FCC TEST REPORT

FCC ID: 2A3ZO-22052

Product	:	**Headphones**
Model Name	:	**EBP-22052, 4SO054A**
Brand	:	**N/A**
Report No.	:	**NCT24010070-1**

Prepared for

Hong Kong Etech Groups Ltd.

16/F, Block C,2nd Phase of Central Avenue, Haihong Industrial Area, Xixiang, Baoan, Shenzhen, China

Prepared by

Shenzhen NCT Testing Technology Co., Ltd.

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1 TEST RESULT CERTIFICATION

Applicant's name	:	Hong Kong Etech Groups Ltd.
Address	:	16/F, Block C,2nd Phase of Central Avenue, Haihong Industrial Area, Xixiang, Baoan, Shenzhen, China
Manufacture's name	:	Hong Kong Etech Groups Ltd.
Address	:	16/F, Block C,2nd Phase of Central Avenue, Haihong Industrial Area, Xixiang, Baoan, Shenzhen, China
Product name	:	Headphones
Model name	:	EBP-22052, 4SO054A
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10-2013 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Date	:	2023-11-21 to 2024-3-12
Date of Issue	:	2024-3-12
Test Result	:	Pass

This device described above has been tested by NCT, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Engineer:

Keven Wu / Engineer

Technical Manager:

Henry Wang / Manager

Contents

2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.209 15.205(a)	PASS
Conduct Emission	15.207	N/A
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Antenna Requirement	15.203	PASS

Remark:

1. “N/A” denotes test is not applicable in this Test Report.

2. Since the EUT power by DC supply, therefore AC power line conducted emissions test is not required.

3 TEST FACILITY

Site Description

EMC Lab. : Accredited by CNAS, 2022-09-27

The certificate is valid until 2028.01.07

The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2017)

The Certificate Registration Number is L8251

Designation Number: CN1347

Test Firm Registration Number: 894804

Accredited by A2LA, June 14, 2023

The Certificate Registration Number is 6837.01

Accredited by Industry Canada, November 09, 2018

The Conformity Assessment Body Identifier is CN0150

Company Number: 30806

Name of Firm : Shenzhen NCT Testing Technology Co., Ltd.

Site Location : A101&2F B2, Fuqiao 6th Area, Xintian Community, Fuhai Street, Baoan District, Shenzhen, People's Republic of China

4 General Information

4.1 General Description of E.U.T.

Product Name	:	Headphones
Model Name	:	EBP-22052
Sample ID	:	24010070E-001#
Sample(s) Status:	:	Engineer sample
Additional model	:	4SO054A
Difference	:	All the models are the same circuit and module, except the model name.
Operating frequency	:	2402-2480MHz
Numbers of Channel	:	79 channels
Antenna Type	:	PCB Antenna
Antenna Gain	:	-0.58 dBi
Type of Modulation	:	GFSK,π/4-DQPSK For DSS
Power supply	:	Input: DC 5V Battery specification:Headset 3.7V/200mAh
Remark: the Antenna gain is provided by customer from Antenna spec. and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.		

4.2 Channel List

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK, π/4-DQPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	-	-

Channel	Frequency(MHz)
0	2402
39	2441
78	2480

4.3 Test Setup Configuration

Conducted Emission

Radiated Emission(30MHz-1GHz)

Radiated Emission(above 1GHz)

Conducted Spurious

4.4 Test Mode

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

FCC Assist 1.0.2.2			
Mode	2402MHz	2441MHz	2480MHz
GFSK	10	10	10
π/4-DQPSK	10	10	10

5 Equipment During Test

5.1 Equipments List

Conducted emission Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
944 Shielded Room	944 Room	/	EMToni	2022/5/31	2025/5/30
EMI Test Receiver	ESPI	101604	Rohde & Schwarz	2023/6/21	2024/6/20
LISN	ENV 216	102796	Rohde & Schwarz	2023/6/21	2024/6/20
LISN	VN1-13S	004023	CRANAGE	2023/6/21	2024/6/20
Cable	RG223-1500MM	NA	RG	2023/6/21	2024/6/20

Radiated emission & Radio Frequency Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
966 Shielded Room	966 Room	/	EMToni	2022/5/31	2025/5/30
EMI Test Receiver	ESCI	101178	Rohde & Schwarz	2023/6/21	2024/6/20
Amplifi（30MHz-1GHz）	BBV 9743 B	00374	SCHNWARZBECK	2023/6/21	2024/6/20
Bilog Antenna（30MHz-1GHz）	VULB9162	00473	SCHNWARZBECK	2023/3/19	2025/3/18
Horn antenna（1GHz-18GHz）	BBHA 9120 D	02622	SCHNWARZBECK	2023/3/19	2025/3/18
Pream plifier（1GHz-18GHz）	BBV 9718D	0024	SCHNWARZBECK	2023/6/21	2024/6/20
Spectrum Analyze（10Hz-40GHz）	FSV 40	100952	Rohde & Schwarz	2023/6/21	2024/6/20
Pream plifier（18GHz-40GHz）	BBV 9721	0056	SCHNWARZBECK	2023/6/21	2024/6/20
Double Ridge Guide Horn Antenna（18GHz-40GHz）	SAS-574	588	A.H.System	2023/3/19	2025/3/18
Loop Antenna (9KHz-30MHz)	FMZB 1513-60	00115	SCHNWARZBECK	2023/6/21	2024/6/20
Amplifier (9KHz-30MHz)	BBV 9745	00109	CHNWARZBECK	2023/6/21	2024/6/20

MXG Signal Analyzer	N9020A	MY50510202	Agilent	2023/6/21	2024/6/20
MXG Vector Signal Generator	N5182A	MY50140020	Agilent	2023/6/21	2024/6/20
MXG Analog Signal Generator	N5181A	MY47420919	Agilent	2023/6/21	2024/6/20
Power Sensor	TR1029-2	512364	Techoy	2023/6/21	2024/6/20
RF Swith	TR1029-1	512364	Techoy	2023/6/21	2024/6/20
Cable	DA800-4000MM	NA	DA	2023/6/21	2024/6/20
Cable	DA800-11000MM	NA	DA	2023/6/21	2024/6/20

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	AUDIX	e3	6.120718
2	EMC radiation test system	AUDIX	e3	6.120718
3	RF test system	TACHOY	RFTest	V1.0.0
4	RF communication test system	TACHOY	RFTest	V1.0.0

5.2 Measurement Uncertainty

Parameter	**Uncertainty**
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(9KHz~30MHz)	±4.51dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB

5.3 Description of Support Units

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

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
/	/	/	/	/	/
/	/	/	/	/	/

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method : ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02

Test Result : PASS

Measurement Distance : 3m

Limit : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))}$ + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))}$ + 40
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)}$ + 40
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

6.1 EUT Operation

Operating Environment :

Temperature : 25 °C

Humidity : 59% RH

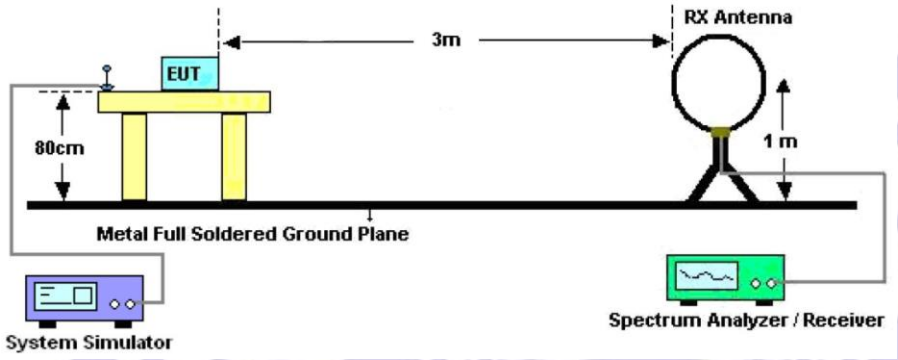
Atmospheric Pressure : 99 kPa

Test Voltage : DC 3.7V

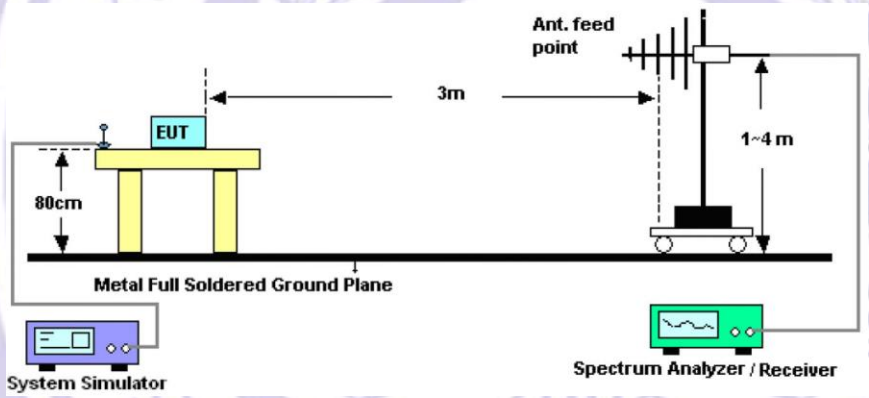
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

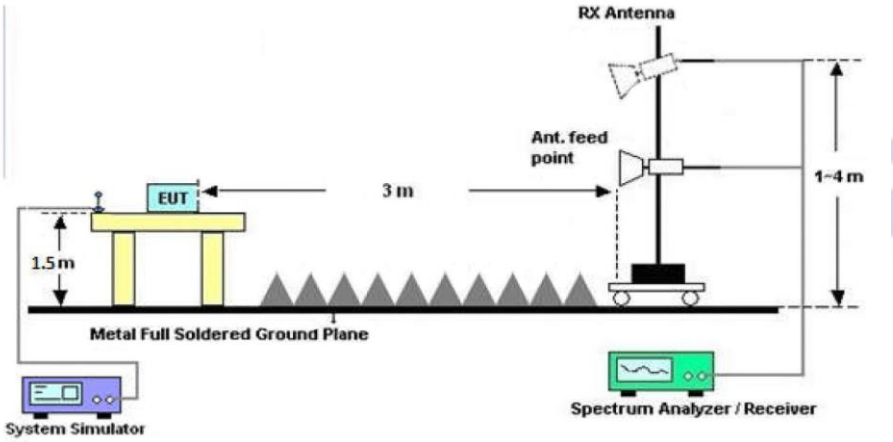
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



6.3 Spectrum Analyzer Setup

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / *10Hz* for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

6.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.

2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

5. Set to the maximum power setting and enable the EUT transmit continuously.

6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.

7. Test Procedure of measurement (For Above 1GHz):

1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).

2) Change the antenna polarization and repeat 1) with vertical polarization.

3) Make a hardcopy of the spectrum.

4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

5) Change the analyser mode to Clear/ Write and found the cone of emission.

6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.

7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.

8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

6.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

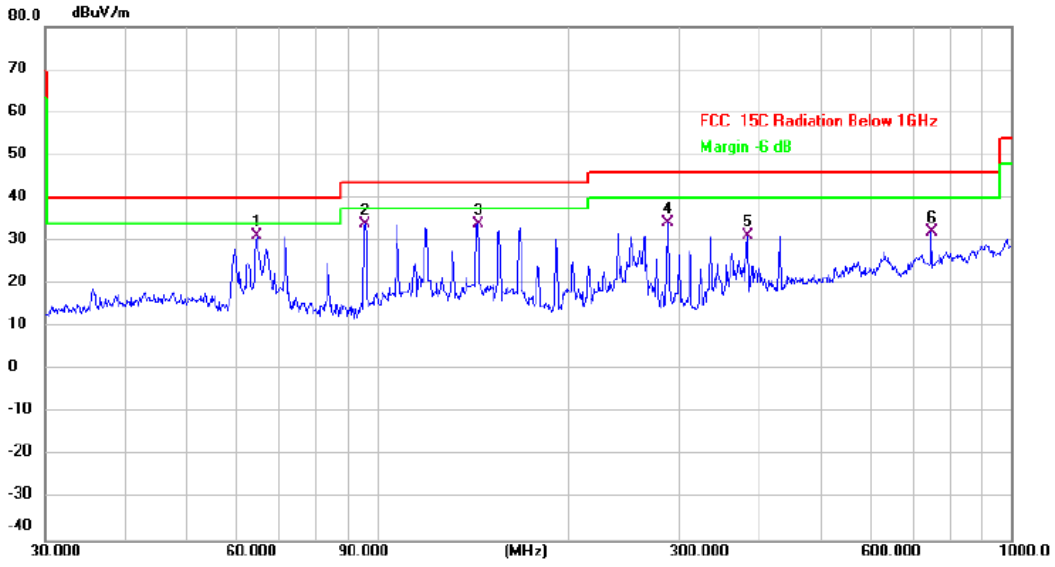
The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots,High Channel (2480MHz) worst case π/4-DQPSK for record:

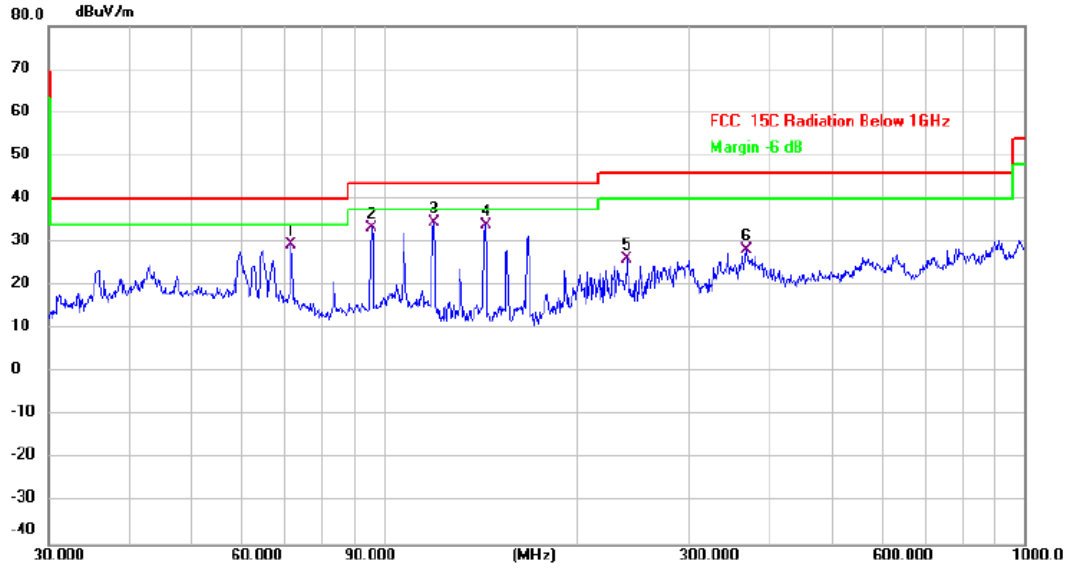
Test plot for Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	64.6594	41.58	-10.39	31.19	40.00	-8.81	QP	
2		95.7622	44.65	-10.60	34.05	43.50	-9.45	QP	
3		143.8294	44.54	-10.56	33.98	43.50	-9.52	QP	
4		287.9904	39.90	-5.60	34.30	46.00	-11.70	QP	
5		383.9318	36.70	-5.47	31.23	46.00	-14.77	QP	
6		747.4824	33.70	-1.43	32.27	46.00	-13.73	QP	

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Test plot for Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		71.8319	40.62	-11.26	29.36	40.00	-10.64	QP	
2		95.7622	43.99	-10.60	33.39	43.50	-10.11	QP	
3	*	119.8555	43.82	-9.22	34.60	43.50	-8.90	QP	
4		143.8294	44.65	-10.56	34.09	43.50	-9.41	QP	
5		239.9873	32.96	-6.89	26.07	46.00	-19.93	QP	
6		368.1116	33.10	-4.94	28.16	46.00	-17.84	QP	

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Note:

The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported. All modes of operation of the EUT were investigated, and only the worst-case results are reported. There were no emissions found below 30MHz within 20dB of the limit.

Test Frequency 1GHz-25GHz

π/4-DQPSK

Polarization: Horizontal / CH00

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4960.000	58.04	-7.20	50.84	74.00	-23.16	peak
2		4960.000	52.47	-7.20	45.27	54.00	-8.73	AVG
3		7440.000	47.11	0.98	48.09	74.00	-25.91	peak
4		7440.000	42.14	0.98	43.12	54.00	-10.88	AVG
5		9920.000	54.43	3.02	57.45	74.00	-16.55	peak
6	*	9920.000	48.94	3.02	51.96	54.00	-2.04	AVG

Polarization: Vertical / CH00

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4960.000	53.43	-7.20	46.23	74.00	-27.77	peak
2		4960.000	48.46	-7.20	41.26	54.00	-12.74	AVG
3		7440.000	46.26	0.98	47.24	74.00	-26.76	peak
4		7440.000	41.16	0.98	42.14	54.00	-11.86	AVG
5		9920.000	54.53	3.02	57.55	74.00	-16.45	peak
6	*	9920.000	48.85	3.02	51.87	54.00	-2.13	AVG

Polarization: Horizontal / CH39

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4882.000	58.24	-7.44	50.80	74.00	-23.20	peak
2		4882.000	52.71	-7.44	45.27	54.00	-8.73	AVG
3		7323.000	45.40	0.79	46.19	74.00	-27.81	peak
4		7323.000	40.47	0.79	41.26	54.00	-12.74	AVG
5		9764.000	52.96	3.14	56.10	74.00	-17.90	peak
6	*	9764.000	48.54	3.14	51.68	54.00	-2.32	AVG

Polarization: Vertical / CH39

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4882.000	55.16	-7.44	47.72	74.00	-26.28	peak
2		4882.000	49.59	-7.44	42.15	54.00	-11.85	AVG
3		7323.000	47.06	0.79	47.85	74.00	-26.15	peak
4		7323.000	41.86	0.79	42.65	54.00	-11.35	AVG
5		9764.000	54.33	3.14	57.47	74.00	-16.53	peak
6	*	9764.000	48.84	3.14	51.98	54.00	-2.02	AVG

Polarization: Horizontal / CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4804.000	58.89	-7.40	51.49	74.00	-22.51	peak
2		4804.000	53.75	-7.40	46.35	54.00	-7.65	AVG
3		7206.000	47.63	0.96	48.59	74.00	-25.41	peak
4		7206.000	42.31	0.96	43.27	54.00	-10.73	AVG
5		9608.000	55.33	2.16	57.49	74.00	-16.51	peak
6	*	9608.000	49.71	2.16	51.87	54.00	-2.13	AVG

Polarization: Vertical / CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4804.000	54.44	-7.40	47.04	74.00	-26.96	peak
2		4804.000	50.07	-7.40	42.67	54.00	-11.33	AVG
3		7206.000	47.78	0.96	48.74	74.00	-25.26	peak
4		7206.000	42.29	0.96	43.25	54.00	-10.75	AVG
5		9608.000	53.49	2.16	55.65	74.00	-18.35	peak
6	*	9608.000	48.49	2.16	50.65	54.00	-3.35	AVG

Note: 1. The testing has been conformed to 10*2480MHz=24800MHz.

2. All other emissions more than 30dB below the limit.

3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Emission Level = Reading + Factor
Margin=Emission Level-Limit

4. All the modes have tested and recorded the worst mode(π /4-DQPSK) in the report. Test frequency are from 1GHz to 25GHz, the amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

π /4-DQPSK

Polarization: Horizontal / CH00

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	46.71	-2.66	44.05	74.00	-29.95	peak
2		2310.000	36.27	-2.66	33.61	54.00	-20.39	AVG
3		2390.000	49.07	-2.03	47.04	74.00	-26.96	peak
4	*	2390.000	38.00	-2.03	35.97	54.00	-18.03	AVG

Polarization: Vertical / CH00

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	45.42	-2.66	42.76	74.00	-31.24	peak
2		2310.000	36.46	-2.66	33.80	54.00	-20.20	AVG
3		2390.000	46.69	-2.03	44.66	74.00	-29.34	peak
4	*	2390.000	37.91	-2.03	35.88	54.00	-18.12	AVG

Polarization: Horizontal /CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.30	-1.91	45.39	74.00	-28.61	peak
2		2483.500	37.36	-1.91	35.45	54.00	-18.55	AVG
3		2500.000	47.64	-1.80	45.84	74.00	-28.16	peak
4	*	2500.000	38.26	-1.80	36.46	54.00	-17.54	AVG

Polarization: Vertical / CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	47.21	-1.91	45.30	74.00	-28.70	peak
2		2483.500	37.46	-1.91	35.55	54.00	-18.45	AVG
3		2500.000	47.00	-1.80	45.20	74.00	-28.80	peak
4	*	2500.000	38.32	-1.80	36.52	54.00	-17.48	AVG

Note:
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

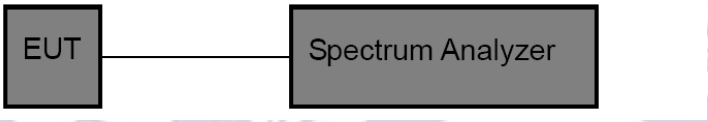
2.The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

7 Maximum Peak Output Power Test

7.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(3)
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.

7.2 Test Setup



7.3 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

7.4 Test Data

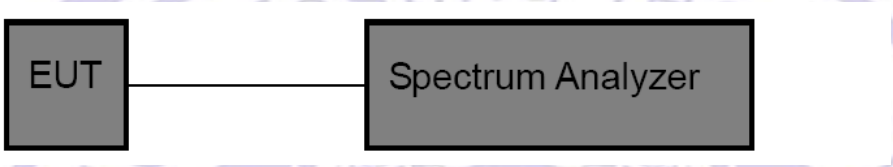
Please see the attachment for data.

8 20DB Occupy Bandwidth Test

8.1 Test Standard

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

8.2 Test Setup



8.3 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 = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

8.4 Test Data

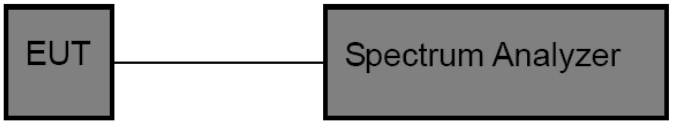
Please see the attachment for data.

9 Carrier Frequency Separation Test

9.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	>25KHz or >two-thirds of the 20 dB bandwidth

9.2 Test Setup



9.3 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 = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

9.4 Test Data

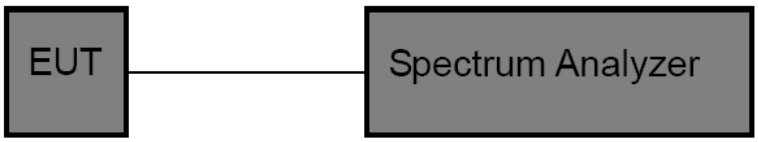
Please see the attachment for data.

10 Number of Hopping Channel Test

10.1 Test Standard and Limit

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

10.2 Test Setup



10.3 Test Procedure

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

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

10.4 Test Data

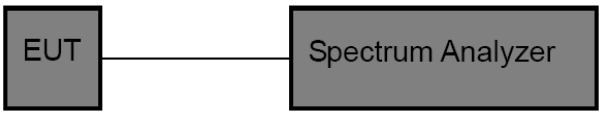
Please see the attachment for data.

12 Dwell Time Test

12.1 Test Standard and Limit

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

12.2 Test Setup



12.3 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 = 1 MHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

12.4 Test Data

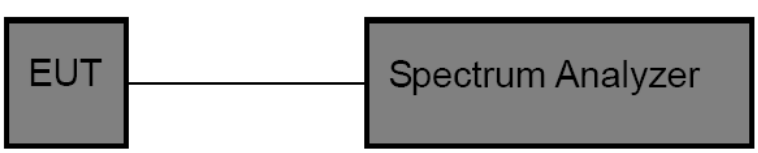
Please see the attachment for data.

13 100kHz Bandwidth of Frequency Band Edge Requirement

13.1 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).

13.2 Test Setup



13.3 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.

13.4 Test Data

Please see the attachment for data.

14 Antenna Requirement

14.1 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.

14.2 Antenna Connected Construction

The antenna is Chip Antenna which permanently attached, and the best case gain of the antenna is 1.24 dBi. It complies with the standard requirement.

15 TEST SETUP & EUT PHOTOGRAPH

Please see the attachment for details.

Appendix

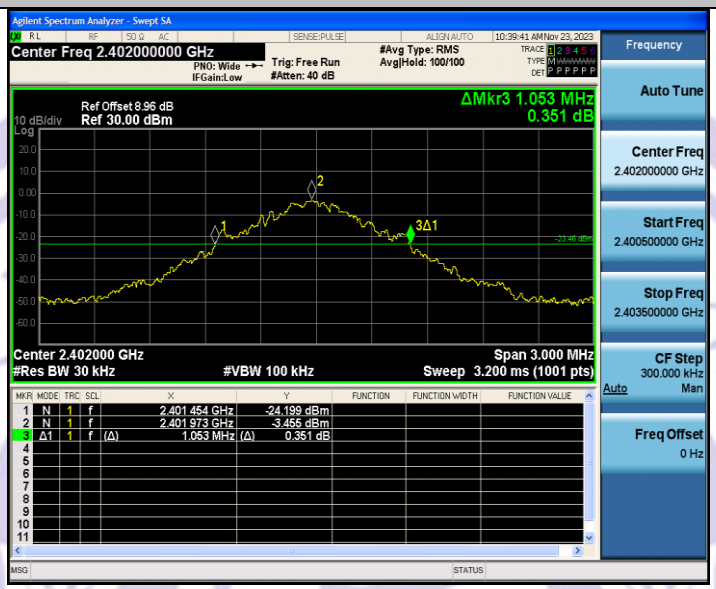
Appendix A: 20dB Emission Bandwidth

Test Result

Test Mode	Antenna	Frequency [MHz]	20db EBW [MHz]
DH5	Ant1	2402	1.053
		2441	1.065
		2480	1.086
2DH5	Ant1	2402	1.338
		2441	1.332
		2480	1.392

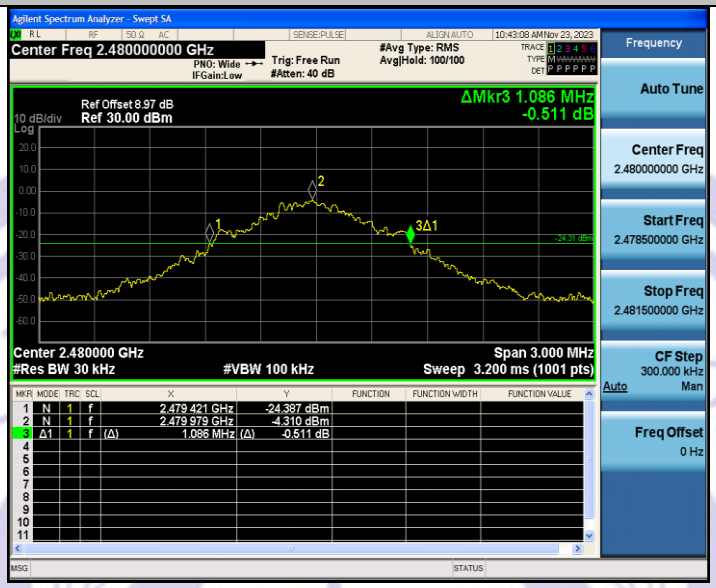
Test Graphs

DH5_Ant1_2402

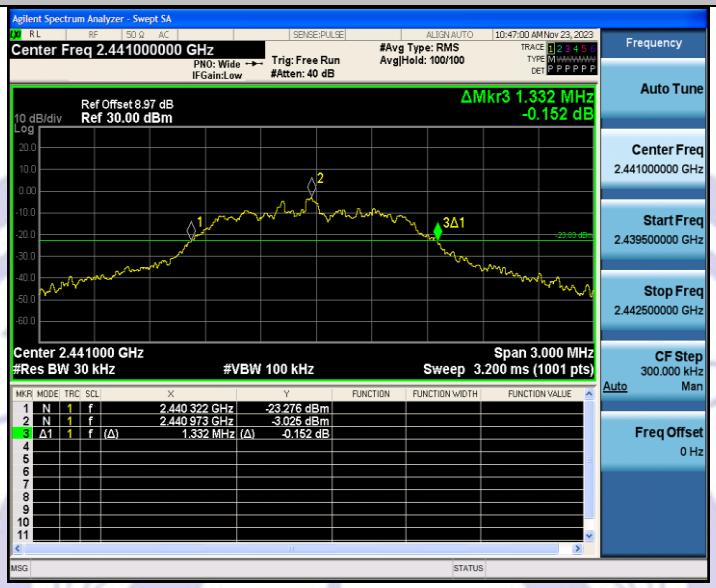
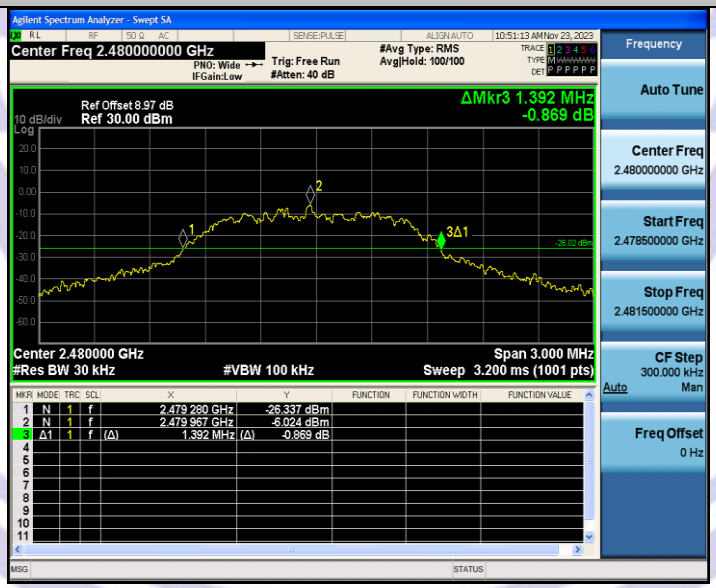


DH5_Ant1_2441

DH5_Ant1_2480



2DH5_Ant1_2402

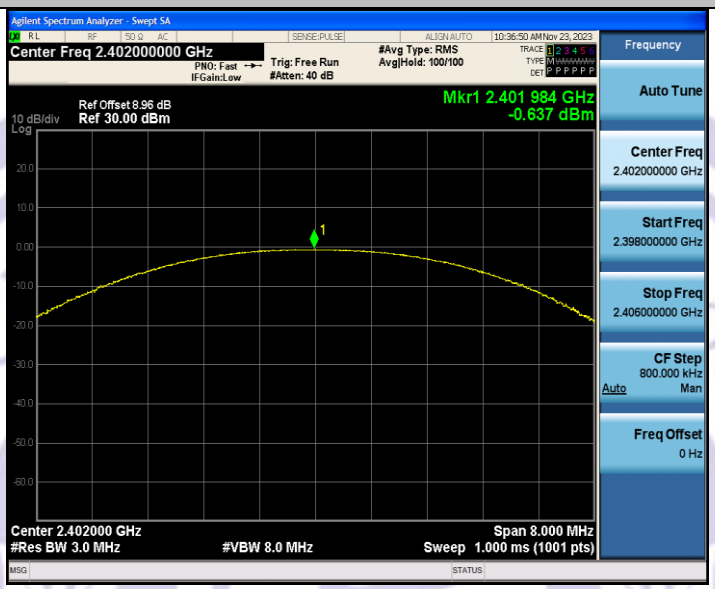
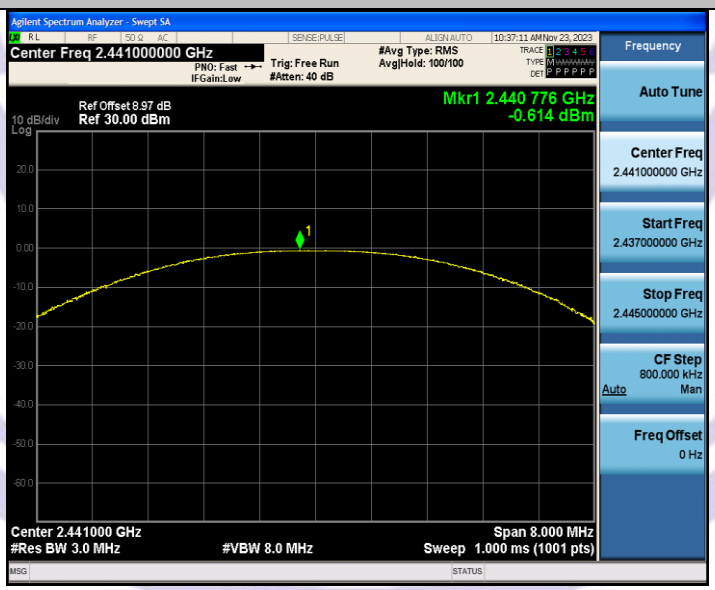
2DH5_Ant1_2441

2DH5_Ant1_2480


Appendix B: Maximum conducted output power

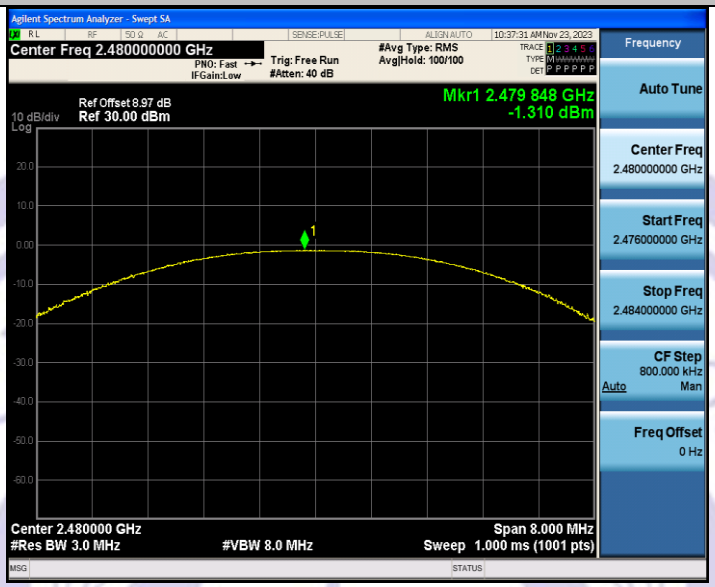
Test Result Peak

Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	-0.64	≤30	PASS
		2441	-0.61	≤30	PASS
		2480	-1.31	≤30	PASS
2DH5	Ant1	2402	0.16	≤20.97	PASS
		2441	0.24	≤20.97	PASS
		2480	-0.55	≤20.97	PASS

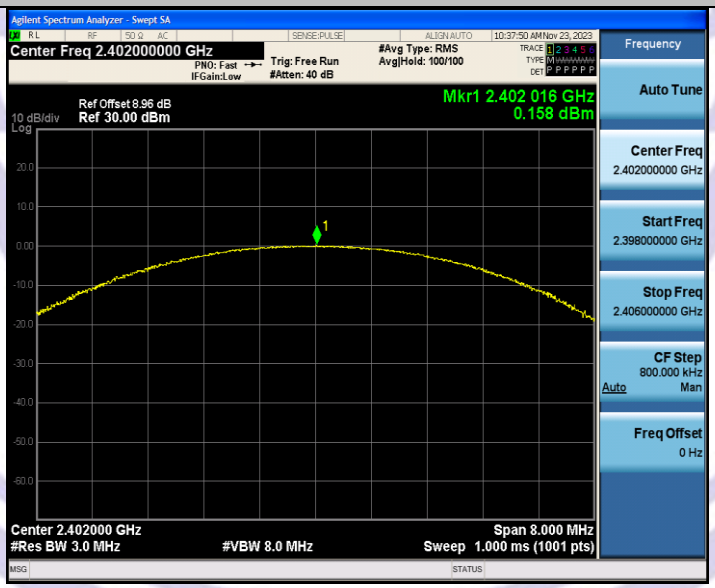
Test Graphs

DH5_Ant1_2402

DH5_Ant1_2441


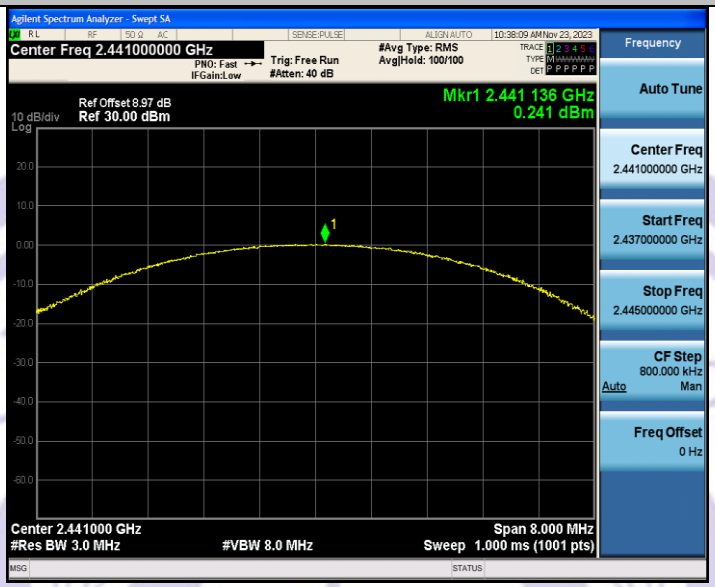
DH5_Ant1_2480



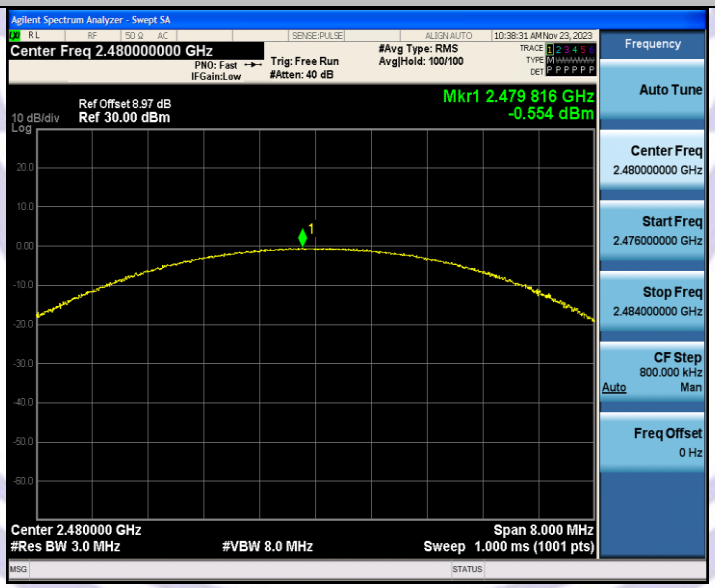
2DH5_Ant1_2402



2DH5_Ant1_2441



2DH5_Ant1_2480



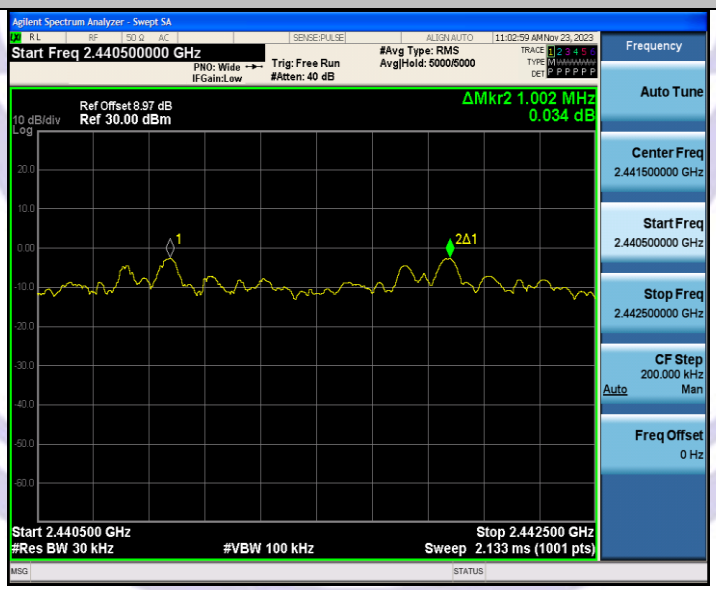
Appendix C: Carrier frequency separation

Test Result

Test Mode	Antenna	Frequency [MHz]	Result [MHz]	Limit [MHz]	Verdict
DH5	Ant1	Hop	0.988	≥0.724	PASS
2DH5	Ant1	Hop	1.002	≥0.928	PASS

Test Graphs

DH5_Ant1_Hop

2DH5_Ant1_Hop


Appendix D: Time of occupancy

Test Result

Test Mode	Antenna	Frequency [MHz]	BurstWidth [ms]	Hops in 31.6s [Num]	Result [s]	Limit [s]	Verdict
DH1	Ant1	Hop	0.381	320	0.122	≤0.4	PASS
DH3	Ant1	Hop	1.638	160	0.262	≤0.4	PASS
DH5	Ant1	Hop	2.885	106.67	0.308	≤0.4	PASS
2DH1	Ant1	Hop	0.390	320	0.125	≤0.4	PASS
2DH3	Ant1	Hop	1.643	160	0.263	≤0.4	PASS
2DH5	Ant1	Hop	2.891	106.67	0.308	≤0.4	PASS

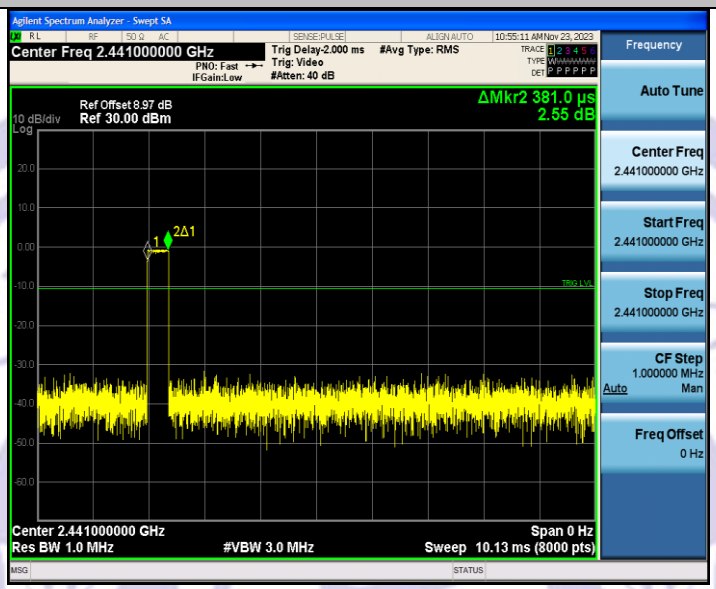
Notes:

1. Period time = 0.4s * 79 = 31.6s

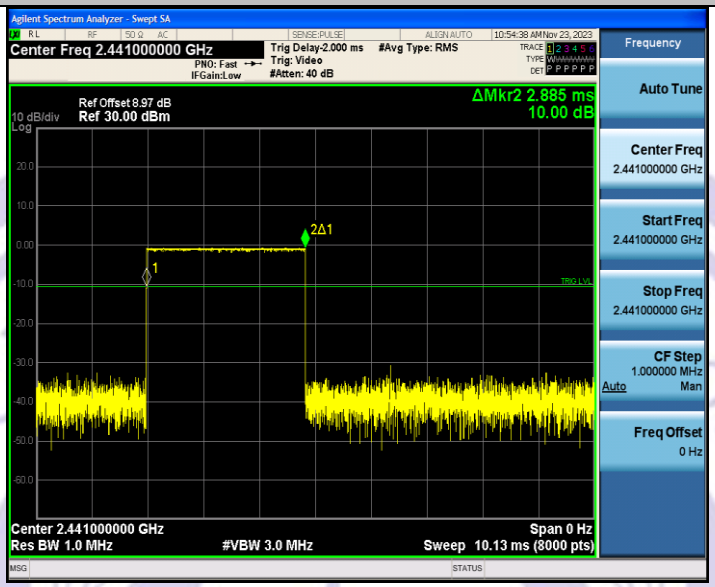
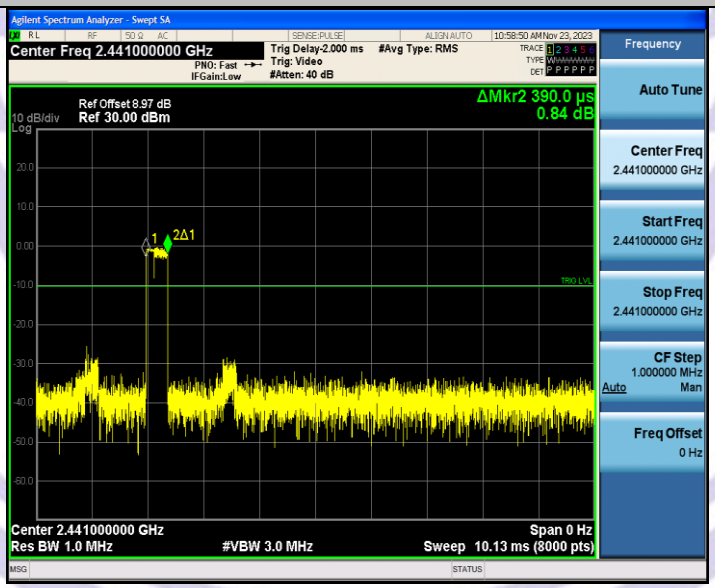
2. Result (Time of occupancy) = BurstWidth[ms] * Hops in 31.6s [Num]

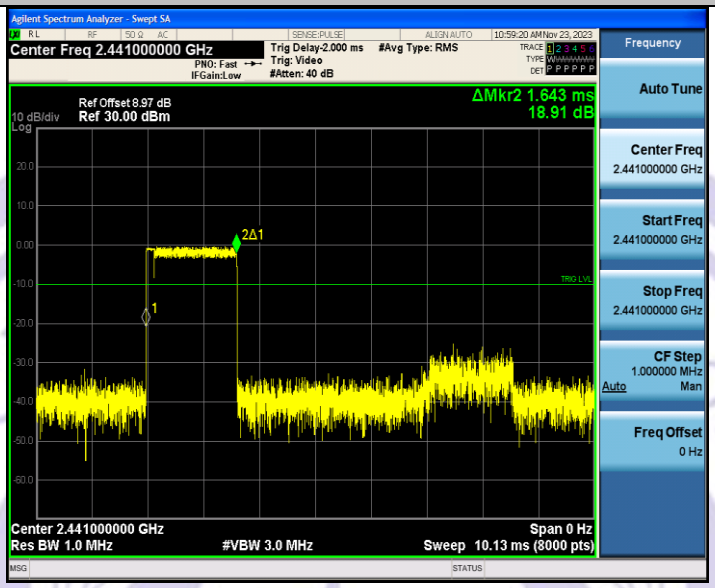
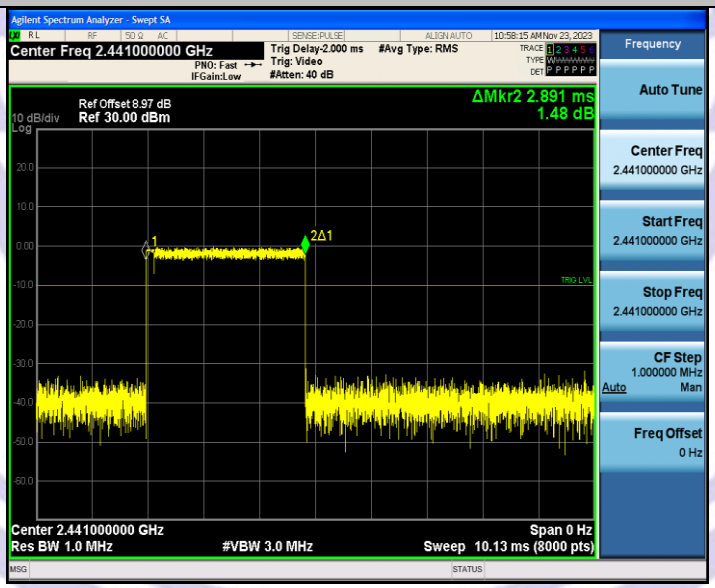
Test Graphs

DH1_Ant1_Hop



DH3_Ant1_Hop

DH5_Ant1_Hop

2DH1_Ant1_Hop


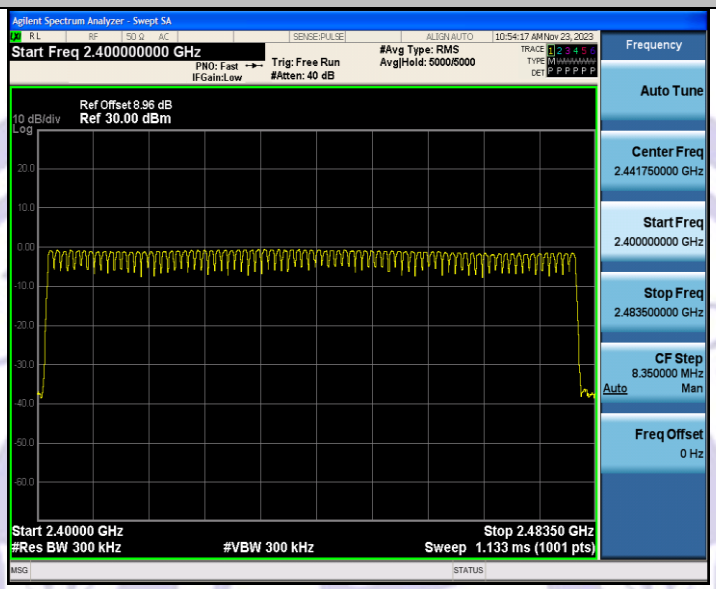
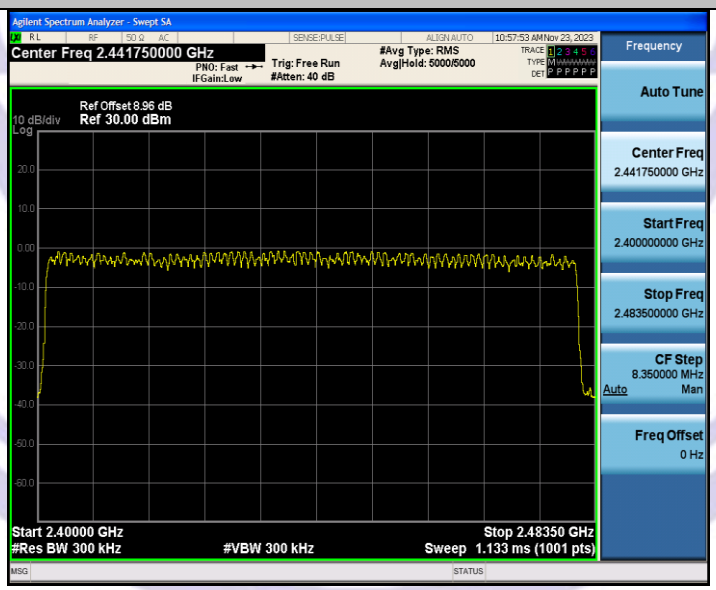
2DH3_Ant1_Hop

2DH5_Ant1_Hop


Appendix E: Number of hopping channels

Test Result

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

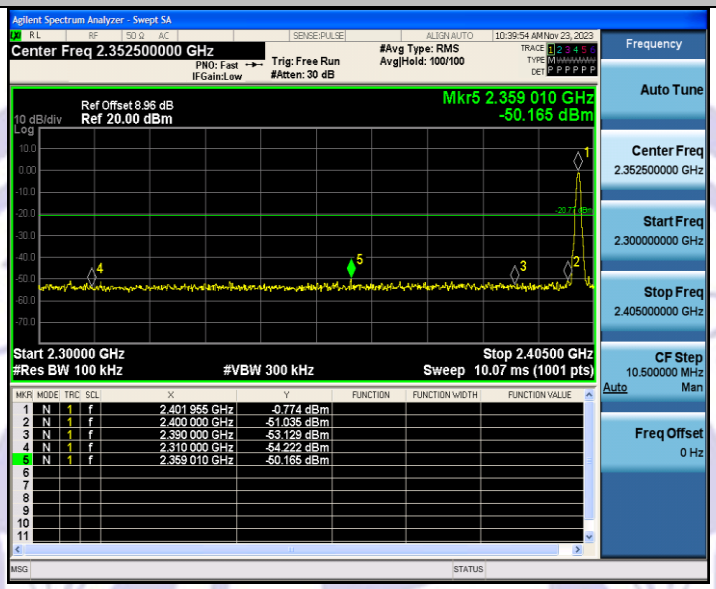
Test Graphs

DH5_Ant1_Hop

2DH5_Ant1_Hop


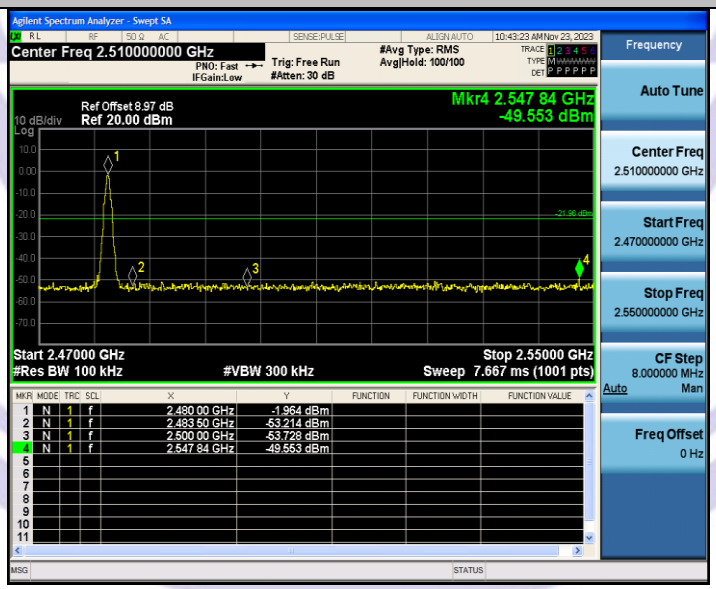
Appendix F: Band edge measurements

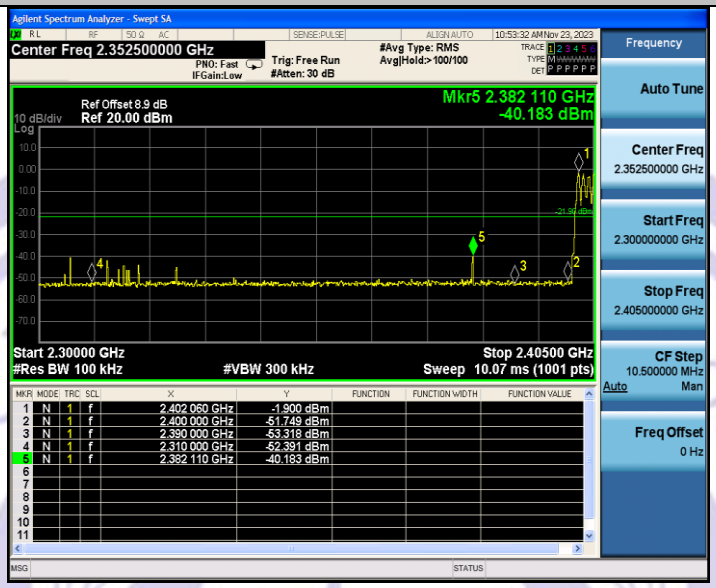
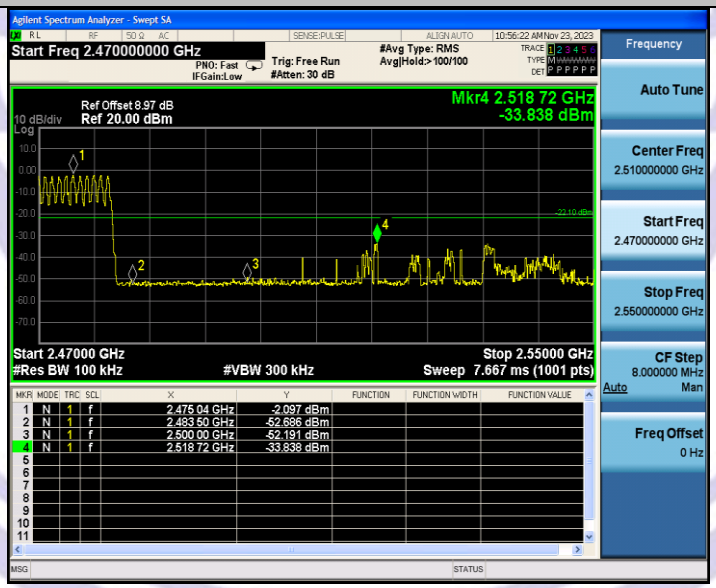
Test Graphs

DH5_Ant1_Low_2402

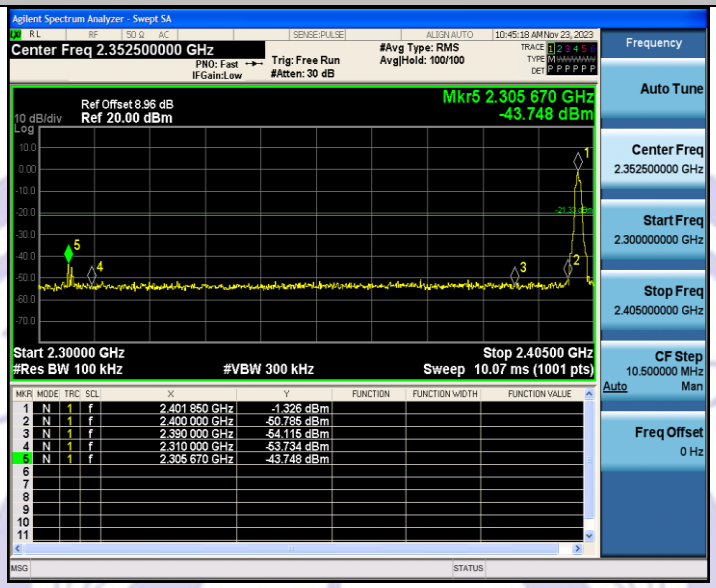


DH5_Ant1_High_2480

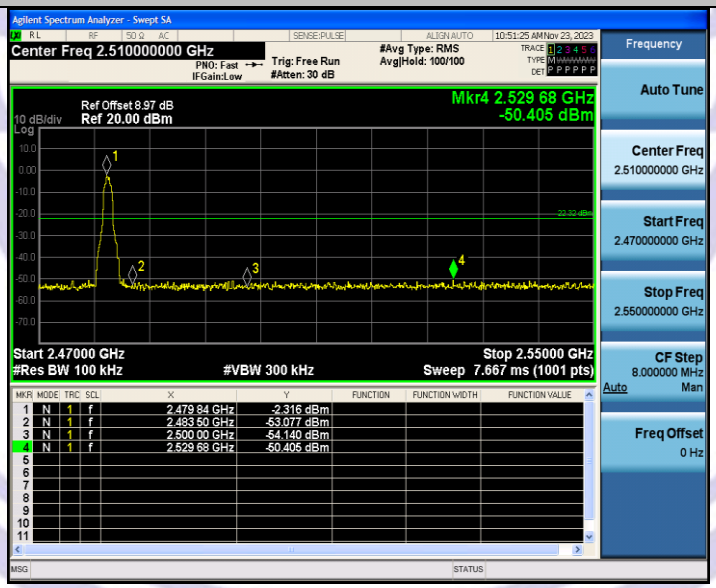


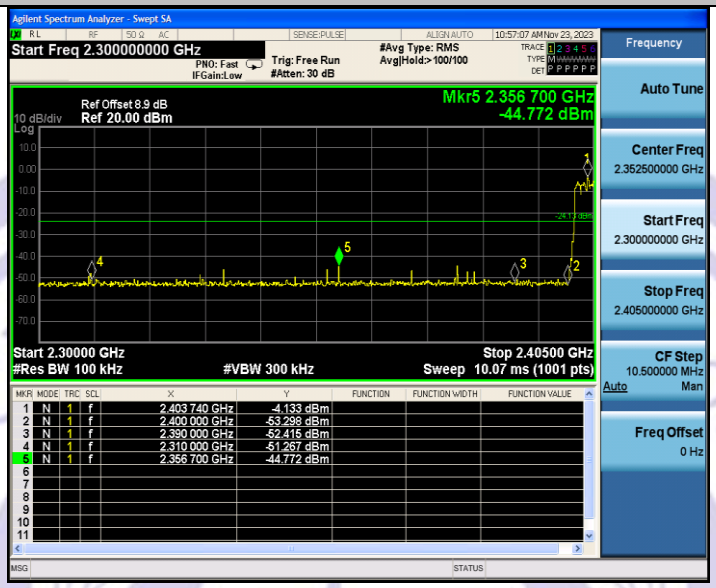
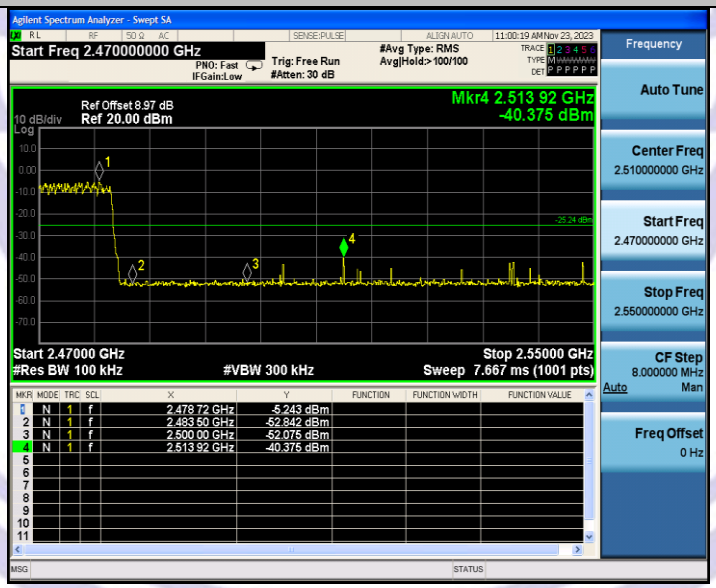
DH5_Ant1_Low_Hop_2402

DH5_Ant1_High_Hop_2480


2DH5_Ant1_Low_2402



2DH5_Ant1_High_2480



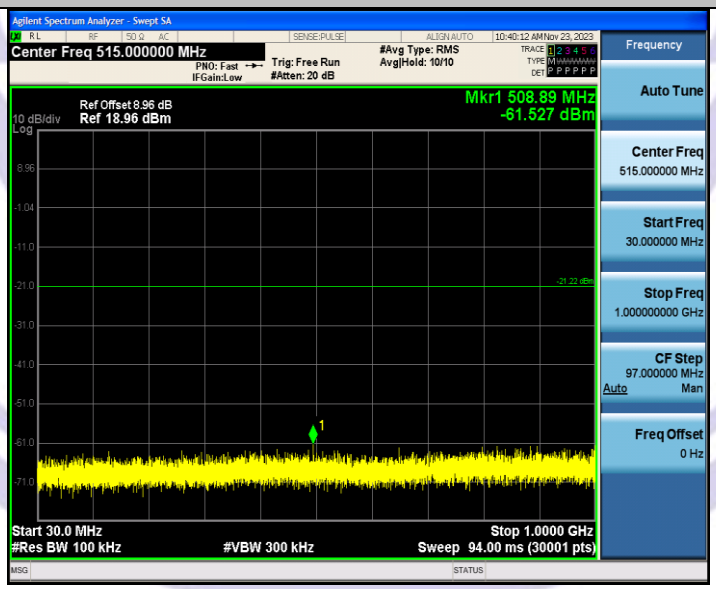
2DH5_Ant1_Low_Hop_2402

2DH5_Ant1_High_Hop_2480


Appendix G: Conducted Spurious Emission

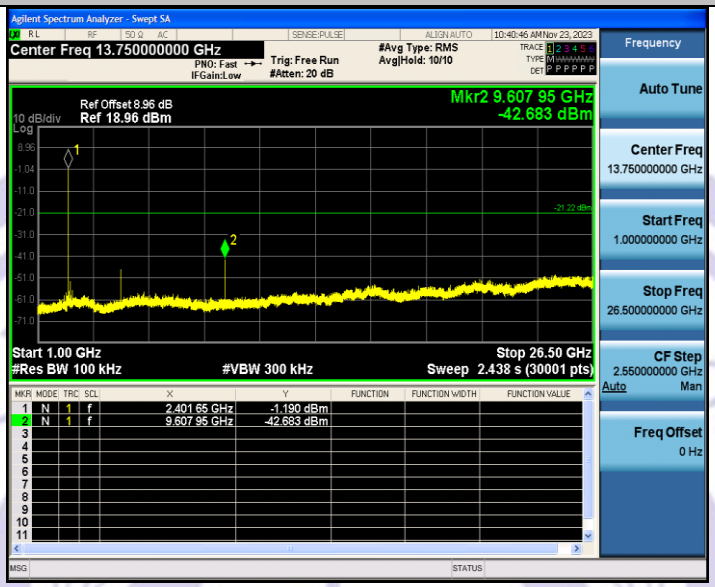
Test Graphs

DH5_Ant1_2402_0~Reference

DH5_Ant1_2402_30~1000

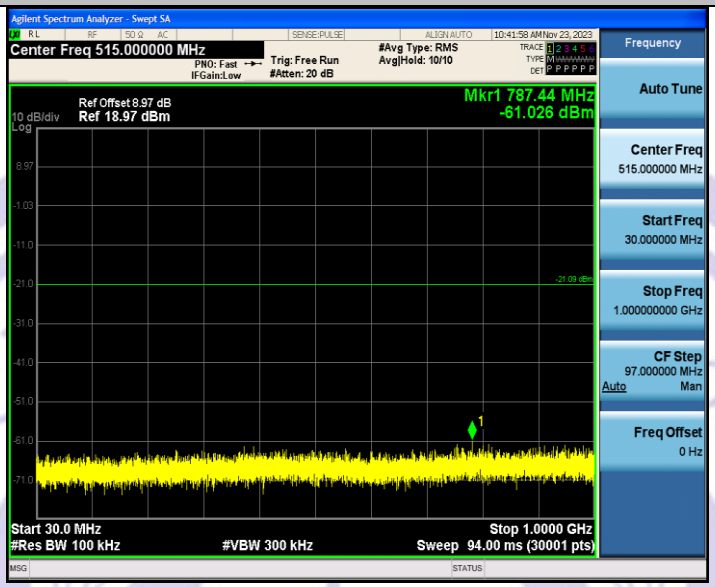


DH5_Ant1_2402_1000~26500

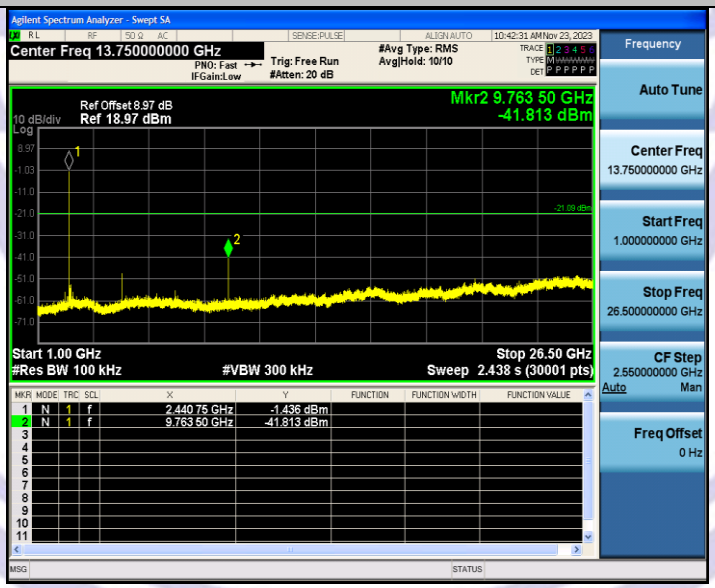


DH5_Ant1_2441_0~Reference

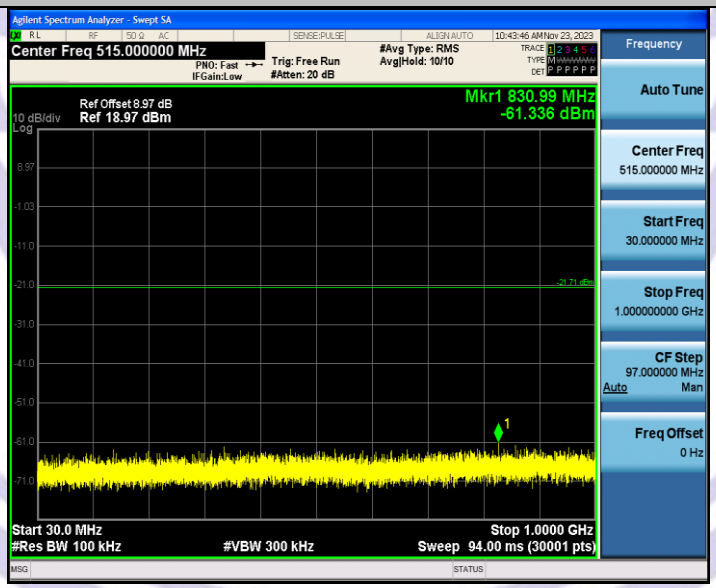
DH5_Ant1_2441_30~1000



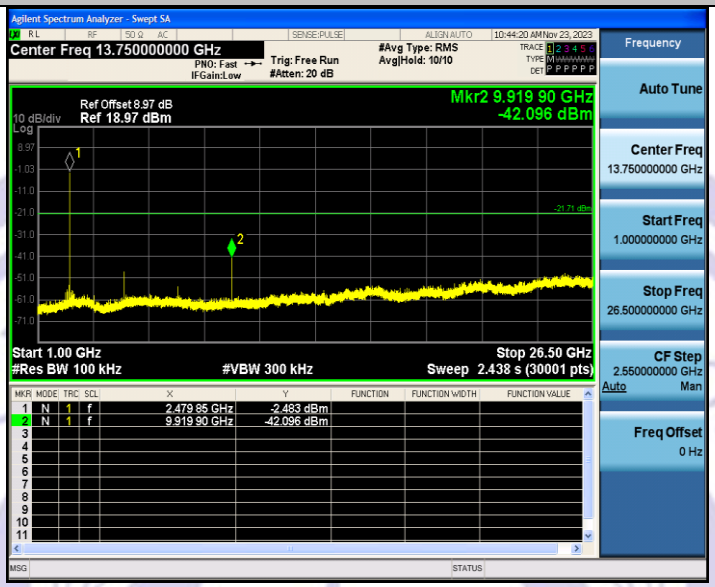
DH5_Ant1_2441_1000~26500



DH5_Ant1_2480_0~Reference

DH5_Ant1_2480_30~1000


DH5_Ant1_2480_1000~26500



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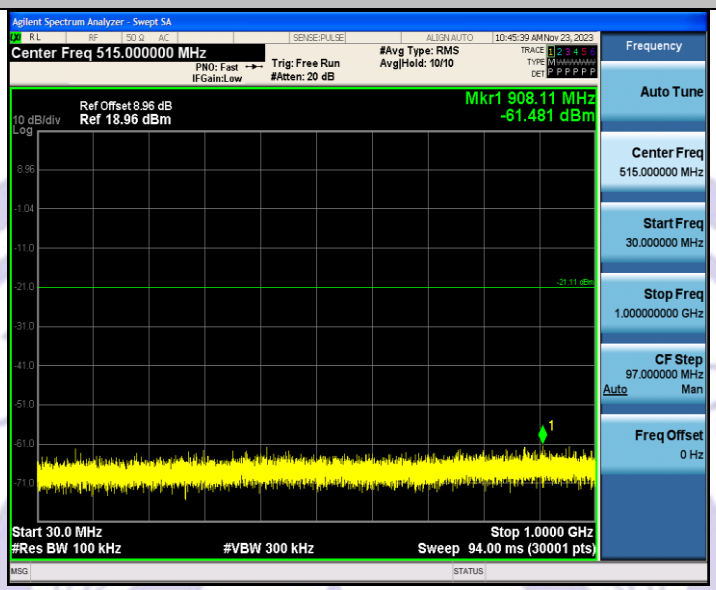
2DH5_Ant1_2402_30~1000

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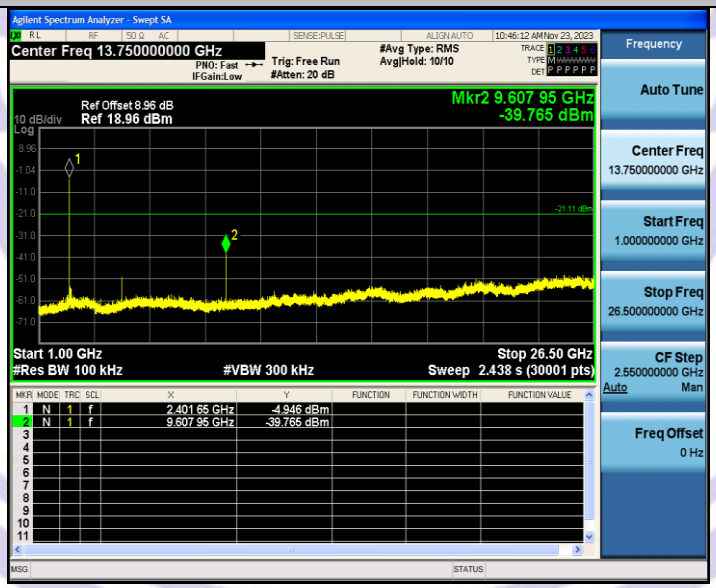

2DH5_Ant1_2441_0~Reference

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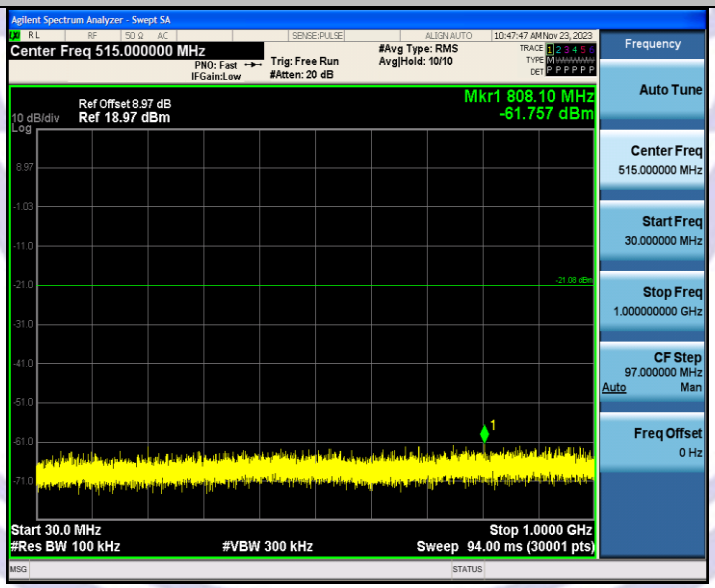

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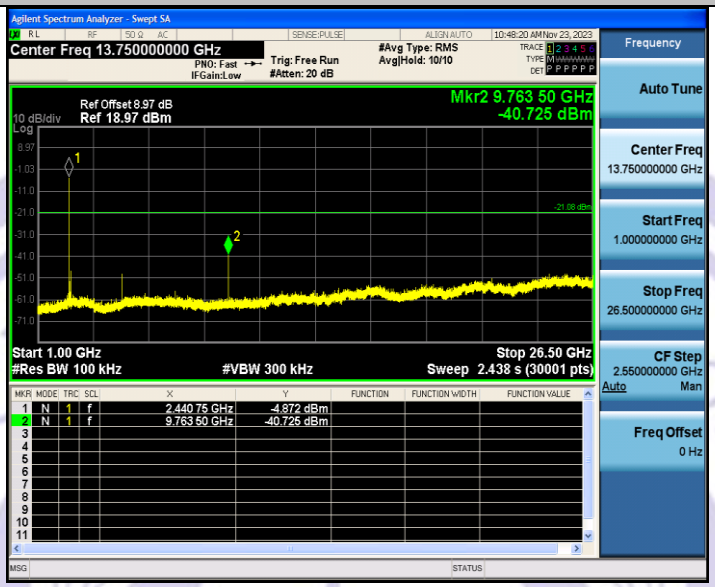

2DH5_Ant1_2480_0~Reference

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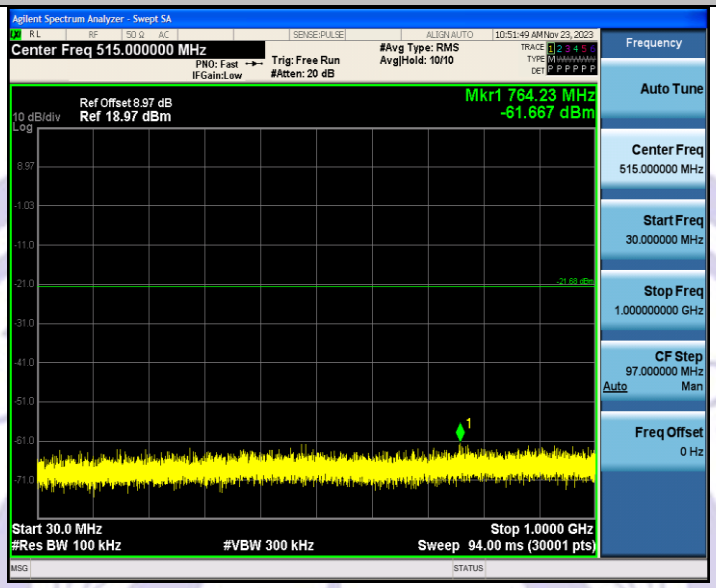
2DH5_Ant1_2480_30~1000



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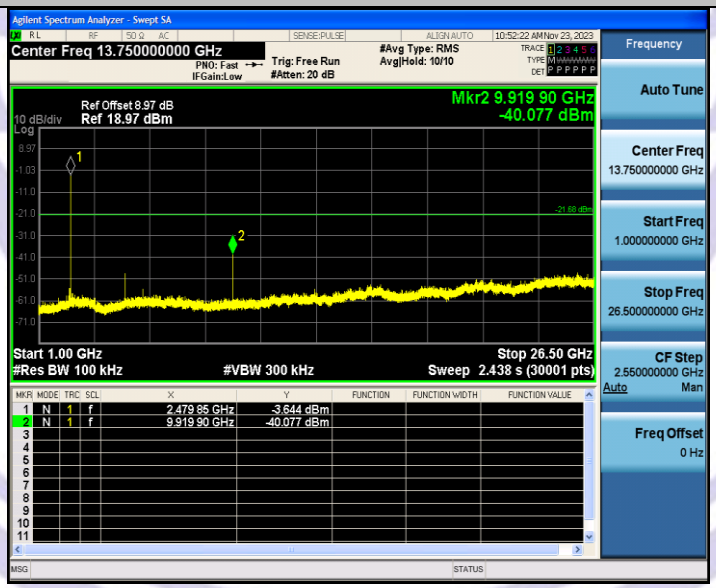

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