FCC TEST REPORT

FCC ID: 2BM5I-CERISE4U

Product	:	CERISE CRMX TRANSMITER
Model Name	:	CERISE 4U PRO WIRED , 1U,- 2U PRO ,- 2U PRO WIRED ,- 4U PRO ,- 4U PRO WIRED
Brand	:	N/A
Report No.	:	PTC24053014001E-FC01

Prepared for

Frame the space

128 rue la Boetie, 75008 PARIS

Prepared by

Precise Testing & Certification Co., Ltd.

Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

1 TEST RESULT CERTIFICATION

Applicant's name	:	Frame the space
Address	:	128 rue la Boetie, 75008 PARIS
Manufacture's name	:	Frame the space
Address	:	128 rue la Boetie, 75008 PARIS
Product name	:	CERISE CRMX TRANSMITER
Model name	:	CERISE 4U PRO WIRED , 1U,- 2U PRO ,- 2U PRO WIRED ,- 4U PRO ,- 4U PRO WIRED
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	Apr. 16, 2024 to Dec. 24, 2024
Date of Issue	:	Dec. 24, 2024
Test Result	:	Pass

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

This report shall not be reproduced except in full, without the written approval of PTC, this document may be altered or revised by PTC, personal only, and shall be noted in the revision of the document.

Test Engineer:

Jack zhou / Engineer

Technical Manager:

Simon Pu / Manager

Contents

Page

1 TEST RESULT CERTIFICATION **2**

2 TEST SUMMARY **5**

3 TEST FACILITY **5**

4 GENERAL INFORMATION **6**

4.1 GENERAL DESCRIPTION OF E.U.T. 6

4.2 TEST MODE 7

5 EQUIPMENT DURING TEST **9**

5.1 EQUIPMENTS LIST 9

5.2 MEASUREMENT UNCERTAINTY 11

5.3 DESCRIPTION OF SUPPORT UNITS 12

6 CONDUCTED EMISSION **13**

6.1 E.U.T. OPERATION 13

6.2 EUT SETUP 13

6.3 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 14

6.4 MEASUREMENT PROCEDURE: 14

6.5 CONDUCTED EMISSION LIMIT 14

6.6 MEASUREMENT DESCRIPTION 14

6.7 CONDUCTED EMISSION TEST RESULT 14

7 RADIATED SPURIOUS EMISSIONS **17**

7.1 EUT OPERATION 17

7.2 TEST SETUP 18

7.3 SPECTRUM ANALYZER SETUP 19

7.4 TEST PROCEDURE 20

7.5 SUMMARY OF TEST RESULTS 21

8 MAXIMUM PEAK OUTPUT POWER TEST **28**

8.1 TEST STANDARD AND LIMIT 28

8.2 TEST SETUP 28

8.3 TEST PROCEDURE 28

8.4 TEST DATA 28

9 20DB OCCUPY BANDWIDTH TEST 49

9.1 TEST STANDARD 49

9.2 TEST SETUP 49

9.3 TEST PROCEDURE 49

9.4 TEST DATA 49

10 CARRIER FREQUENCY SEPARATION TEST 70

10.1 TEST STANDARD AND LIMIT 70

10.2 TEST SETUP 70

10.3 TEST PROCEDURE 70

10.4 TEST DATA 70

11 NUMBER OF HOPPING CHANNEL TEST 78

11.1 TEST STANDARD AND LIMIT 78

11.2 TEST SETUP 78

11.3 TEST PROCEDURE 78

11.4 TEST DATA 79

12 DWELL TIME TEST 86

12.1 TEST STANDARD AND LIMIT 86

12.2 TEST SETUP 86

12.3 TEST PROCEDURE 86

12.4 TEST DATA 87

13 100KHZ BANDWIDTH OF FREQUENCY BAND EDGE REQUIREMENT 107

13.1 TEST STANDARD AND LIMIT 107

13.2 TEST SETUP 107

13.3 TEST PROCEDURE 107

13.4 TEST DATA 108

14 ANTENNA REQUIREMENT 163

14.1 TEST STANDARD AND REQUIREMENT 163

14.2 ANTENNA CONNECTED CONSTRUCTION 163

15 APPENDIX I -- TEST SETUP PHOTOGRAPH 164

16 APPENDIX II -- EUT PHOTOGRAPH 165

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) 15.205(a)	PASS
Conduct Emission	15.207	PASS
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

3 TEST FACILITY

Precise Testing & Certification Co., Ltd.

Address: Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A

FCC Designation Number. CN1219

4 General Information

4.1 General Description of E.U.T.

Product Name	:	CERISE CRMX TRANSMITER
Model Name	:	CERISE 4U PRO WIRED
Additional model	:	1U,- 2U PRO ,- 2U PRO WIRED ,- 4U PRO ,- 4U PRO WIRED
Specification	:	BT 5.1 BDR+EDR
Operation Frequency	:	2402-2480MHz
Number of Channel	:	79 channels for BDR+EDR
Type of Modulation	:	GFSK, Π/4-DQPSK,8DPSK For DSS
Antenna installation	:	External antenna
Antenna Gain	:	2.74 dBi
Rated Power Supply	:	USB 5V 2A PoE 36-57V 10W
Test Power Supply	:	USB 5V 2A PoE 36-57V 10W
Hardware Version	:	N/A
Software Version	:	N/A
Test sample No.	:	PTC24053014001E-1/2,PTC24053014001E-2/2.

4.2 Test Mode

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, 8DPSK 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

5 Equipment During Test

5.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Last Calibration	Calibration Interval
MXG Signal Analyzer	Agilent	N9020A	SER MY5111038	10Hz-26.5GHz	Aug.15, 2024	1 Year
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Aug.15, 2024	1 Year
Power Meter	Anritsu	ML2495A	0949003	300MHz-40GHz	Aug.15, 2024	1 Year
Power Sensor	Anritsu	MA2411B	0917017	300MHz-40GHz	Aug.15, 2024	1 Year
Test S/W	Tonscend	JS1120-3	/	/	/	/

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Last Calibration	Calibration Interval
EMI Test Receiver	Rohde&Schwarz	ESPI7	101671	9KHz-7GHz	Aug.15, 2024	1 Year
Loop Antenna	Schwarzbeck	FMZB 1519	192	9 KHz -30MHz	Aug.15, 2024	1 Year
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Aug.15, 2024	1 Year
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Aug.15, 2024	1 Year
Cable	IMRO	AK-9515E(9m)	Cable-L	9KHz-3GHz	Aug.15, 2024	1 Year
Spectrum Analyzer	Rohde&Schwarz	FSV40	6625-01-588-5515	9KHz-40GHz	Aug.15, 2024	1 Year
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Aug.15, 2024	1 Year

Power Amplifier	ZHINAN	ZN3380C	15002	1GHz-26.5GHz	Aug.15, 2024	1 Year
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-1066	15GHz-40GHz	Jul. 19, 2024	1 Year
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	Jul. 19, 2024	1 Year
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Aug. 15,2024	1 Year
RF Cable	R&S	R204	R21X	1GHz-40GHz	Aug. 15,2024	1 Year
Test S/W	Tonscend	TS+	/	/	/	/

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Date	Calibration Interval
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug. 15,2024	1 Year
Artificial Mains Network	Rohde&Schwarz	ENV216	102453	9KHz-30MHz	Aug. 15,2024	1 Year
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-30MHz	Aug. 15,2024	1 Year
Limiter	R&S	ESH3-Z2	0357.8810.54-102808-NB	0Hz-30MHz	Aug. 15,2024	1 Year
RF Switch	DIAMOND ANTENNA	CX-210	/	0.09MHz-6GHz	Mar. 22,2024	1 Year
Test S/W	Tonscend	JS32-CE	/	/	/	/

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)	±3.15dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB

5.3 Description of Support Units

Equipment	Model No.	Series No.	Parameters
Adapter	KSAS0501800300M2	N/A	N/A

6 Conducted Emission

Test Requirement:	:	FCC CFR 47 Part 15 Section 15.207
Test Method:	:	ANSI C63.10:2013
Test Result:	:	PASS
Frequency Range:	:	150kHz to 30MHz
Class/Severity:	:	Class B
Detector:	:	Peak for pre-scan (9kHz Resolution Bandwidth)

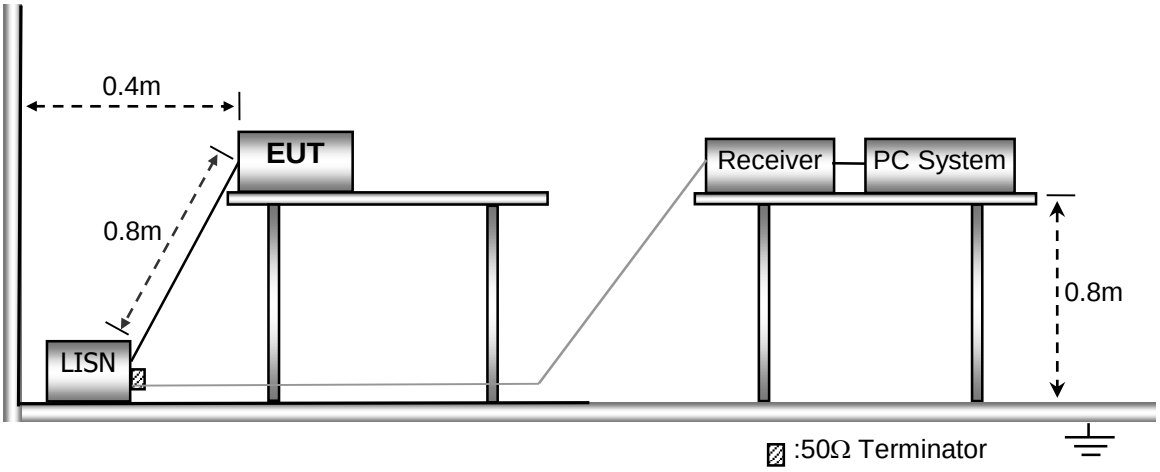
6.1 E.U.T. Operation

Operating Environment **:**

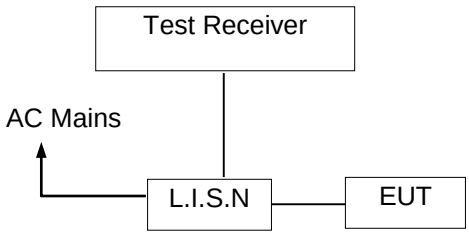
Temperature:	:	23.2°C
Humidity:	:	51 % RH
Atmospheric Pressure:	:	101.12 kPa
Test Voltage	:	AC 120V/60Hz

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10: 2013



6.3 Test SET-UP (Block Diagram of Configuration)



6.4 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

6.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies

2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

6.6 Measurement Description

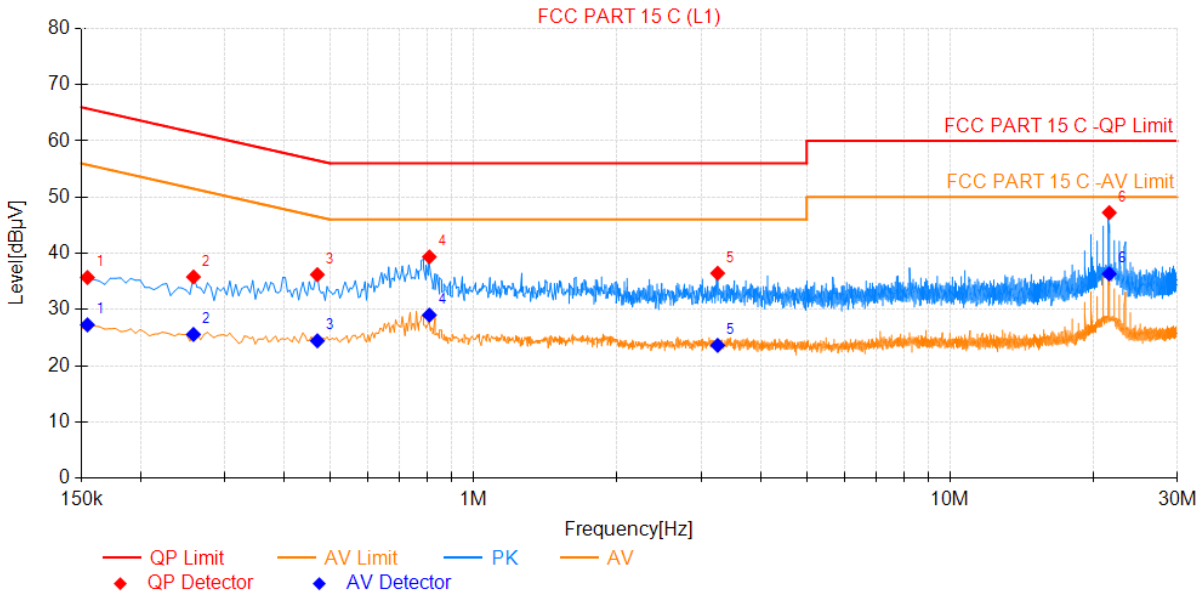
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.7 Conducted Emission Test Result

Pass

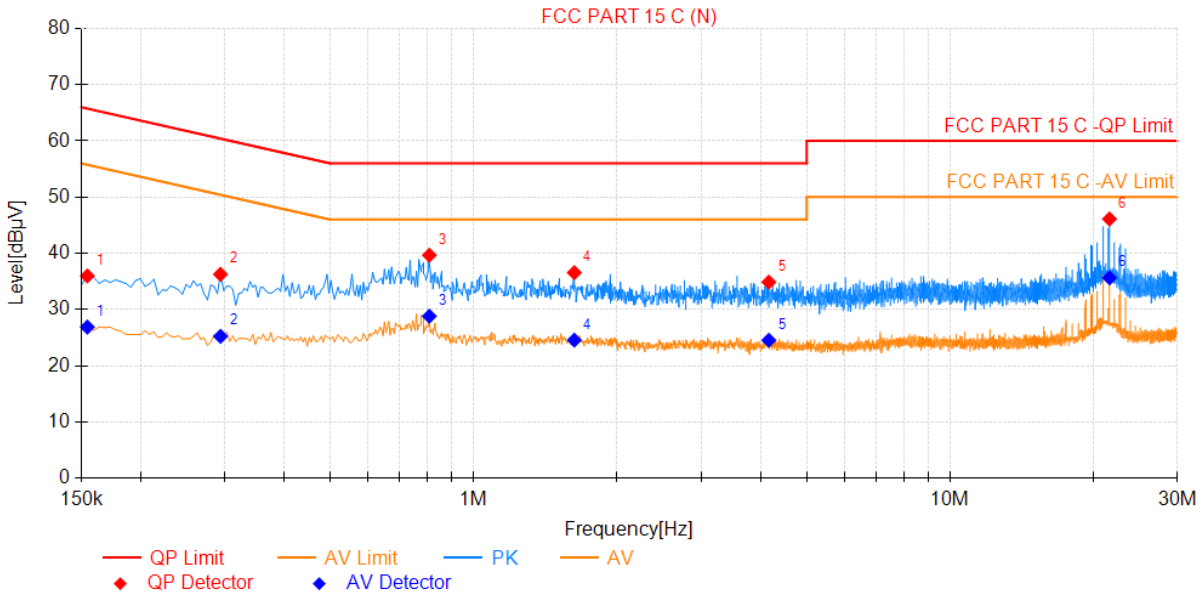
Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (Ant1_GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

Line -120V/60Hz:



Final Data List											
NO.	Freq. [MHz]	QP Reading [dBµV]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.155	16.51	19.18	35.69	65.75	30.06	8.08	27.26	55.75	28.49	PASS
2	0.258	16.68	19.11	35.79	61.50	25.71	6.45	25.56	51.50	25.94	PASS
3	0.470	16.99	19.21	36.20	56.52	20.32	5.21	24.42	46.52	22.10	PASS
4	0.807	20.16	19.21	39.37	56.00	16.63	9.79	29.00	46.00	17.00	PASS
5	3.251	17.22	19.23	36.45	56.00	19.55	4.38	23.61	46.00	22.39	PASS
6	21.588	26.95	20.29	47.24	60.00	12.76	16.05	36.34	50.00	13.66	PASS

Neutral -120V/60Hz:



Final Data List											
NO.	Freq. [MHz]	QP Reading [dBµV]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.155	16.99	18.98	35.97	65.75	29.78	7.89	26.87	55.75	28.88	PASS
2	0.294	17.17	19.09	36.26	60.41	24.15	6.13	25.22	50.41	25.19	PASS
3	0.807	20.47	19.20	39.67	56.00	16.33	9.60	28.80	46.00	17.20	PASS
4	1.626	17.38	19.18	36.56	56.00	19.44	5.37	24.55	46.00	21.45	PASS
5	4.164	15.75	19.13	34.88	56.00	21.12	5.40	24.53	46.00	21.47	PASS
6	21.615	25.90	20.21	46.11	60.00	13.89	15.42	35.63	50.00	14.37	PASS

Note:QP Margin[dB]= QP Limit[dBµV]- QP Value[dBµV], AV Margin[dB]= AV Limit[dBµV]- AV Value[dBµV].

7 Radiated Spurious Emissions

Test Requirement	:	FCC CFR47 Part 15 Section 15.209 & 15.247
Test Method	:	ANSI C63.10:2013
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	$20\log^{(500)}$

7.1 EUT Operation

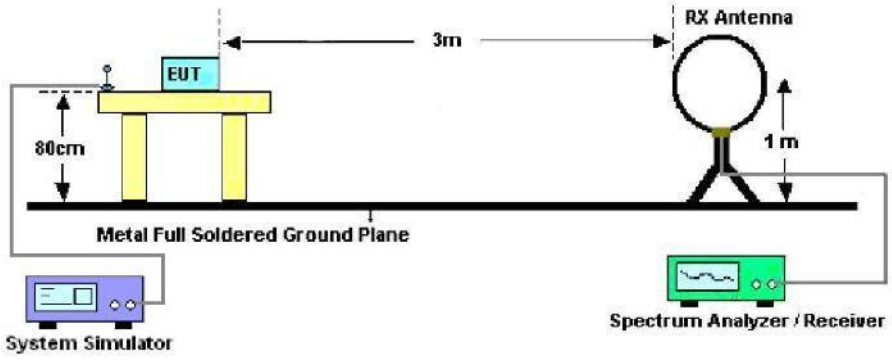
Operating Environment :

Temperature	:	24.5 °C
Humidity	:	55.5% RH
Atmospheric Pressure	:	101.3kPa
Test Voltage	:	AC 120V60Hz

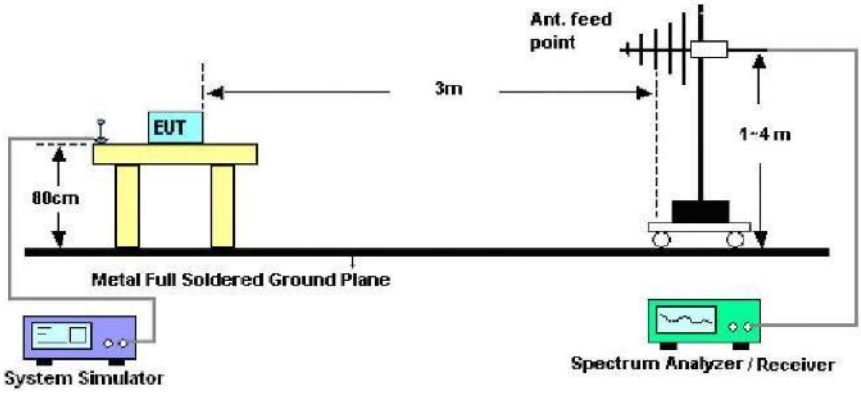
7.2 Test Setup

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

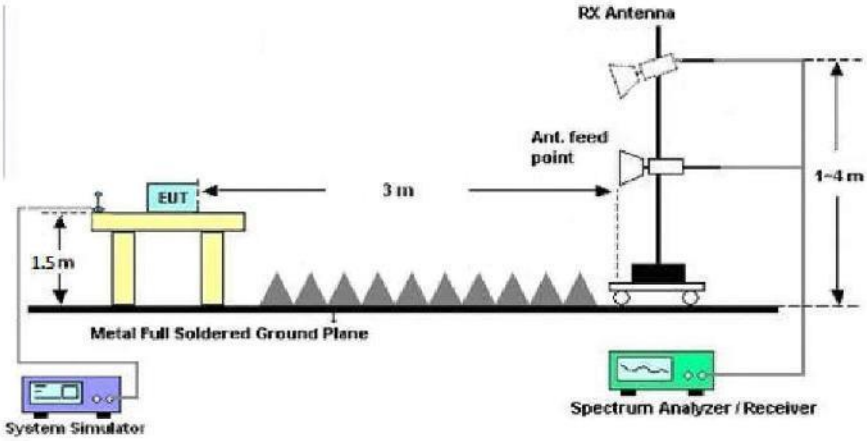
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 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

7.4 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.

7.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

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

Note:

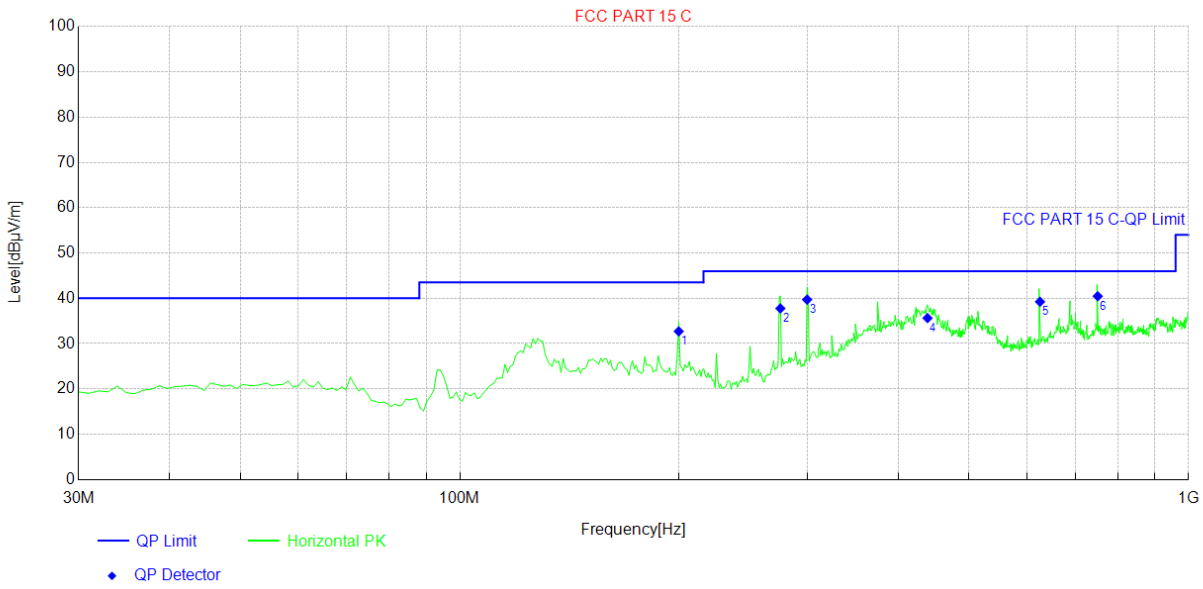
The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

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,Low Channel (2402MHz) Worst case Ant1_GFSK for record:

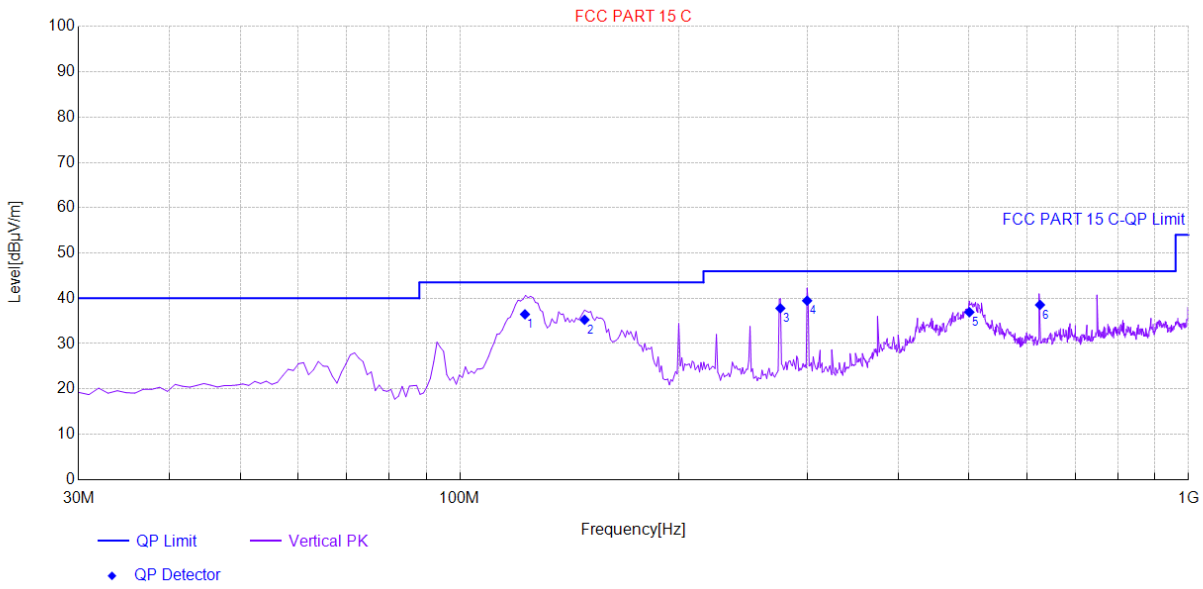
Test plot for Horizontal



Final Data List[QP]								
NO.	Freq. [MHz]	QP Reading [dBµV]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity	Verdict
1	199.75	46.21	-13.50	32.71	43.50	10.79	Horizontal	PASS
2	275.41	48.21	-10.45	37.76	46.00	8.24	Horizontal	PASS
3	299.66	49.42	-9.70	39.72	46.00	6.28	Horizontal	PASS
4	438.37	42.08	-6.44	35.64	46.00	10.36	Horizontal	PASS
5	625.58	41.48	-2.24	39.24	46.00	6.76	Horizontal	PASS
6	750.71	40.40	0.06	40.46	46.00	5.54	Horizontal	PASS

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

Test plot for Vertical



Final Data List[QP]								
NO.	Freq. [MHz]	QP Reading [dBµV]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity	Verdict
1	122.87	48.77	-12.30	36.47	43.50	7.03	Vertical	PASS
2	148.34	45.50	-10.24	35.26	43.50	8.24	Vertical	PASS
3	275.41	48.24	-10.45	37.79	46.00	8.21	Vertical	PASS
4	299.66	49.17	-9.70	39.47	46.00	6.53	Vertical	PASS
5	500.45	41.99	-5.05	36.94	46.00	9.06	Vertical	PASS
6	625.58	40.79	-2.24	38.55	46.00	7.45	Vertical	PASS

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

Test Frequency 1GHz-25GHz

Bluetooth (GFSK, Pi/4-DQPSK, 8DPSK)mode have been tested, and the worst result GFSK mode was report as below:

Test Mode: Ant1_CH00 GFSK					Test channel: Lowest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4804	45.37	34.04	6.58	34.09	51.90	74	-22.10	V
7206	41.82	37.11	7.73	34.5	52.16	74	-21.84	V
9608	37.68	39.31	9.23	34.79	51.43	74	-22.57	V
4804	46.04	34.04	6.58	34.09	52.57	74	-21.43	H
7206	36.07	37.11	7.73	34.5	46.41	74	-27.59	H
9608	39.77	39.31	9.23	34.79	53.52	74	-20.48	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4804	31.52	34.04	6.58	34.09	38.05	54	-15.95	V
7206	28.12	37.11	7.73	34.5	38.46	54	-15.54	V
9608	23.95	39.31	9.23	34.79	37.70	54	-16.30	V
4804	33.90	34.04	6.58	34.09	40.43	54	-13.57	H
7206	27.70	37.11	7.73	34.5	38.04	54	-15.96	H
9608	25.30	39.31	9.23	34.79	39.05	54	-14.95	H

Test Mode: Ant1_CH39 GFSK					Test channel: Middle			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4882	41.59	34.38	6.69	34.09	48.57	74	-25.43	V
7323	38.60	37.22	7.78	34.53	49.07	74	-24.93	V
9764	34.97	39.46	9.35	34.8	48.98	74	-25.02	V
4882	43.09	34.38	6.69	34.09	50.07	74	-23.93	H
7323	37.64	37.22	7.78	34.53	48.11	74	-25.89	H
9764	34.88	39.46	9.35	34.8	48.89	74	-25.11	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4882	32.11	34.38	6.69	34.09	39.09	54	-14.91	V
7323	27.85	37.22	7.78	34.53	38.32	54	-15.68	V
9764	25.17	39.46	9.35	34.8	39.18	54	-14.82	V
4882	34.05	34.38	6.69	34.09	41.03	54	-12.97	H
7323	27.93	37.22	7.78	34.53	38.40	54	-15.60	H
9764	23.70	39.46	9.35	34.8	37.71	54	-16.29	H

Test Mode: Ant1_CH78 GFSK					Test channel: Highest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4960	43.13	34.72	6.79	34.09	50.55	74	-23.45	V
7440	40.23	37.34	7.82	34.57	50.82	74	-23.18	V
9920	34.57	39.62	9.46	34.81	48.84	74	-25.16	V
4960	41.10	34.72	6.79	34.09	48.52	74	-25.48	H
7440	38.27	37.34	7.82	34.57	48.86	74	-25.14	H
9920	37.96	39.62	9.46	34.81	52.23	74	-21.77	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4960	31.88	34.72	6.79	34.09	39.30	54	-14.70	V
7440	28.72	37.34	7.82	34.5	39.38	54	-14.62	V
9920	23.65	39.62	9.46	34.79	37.94	54	-16.06	V
4960	32.40	34.72	6.79	34.09	39.82	54	-14.18	H
7440	28.79	37.34	7.82	34.5	39.45	54	-14.55	H
9920	26.41	39.62	9.46	34.79	40.70	54	-13.30	H

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

   Over Limit =Emission Level-Limit

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

Bluetooth (GFSK, Pi/4-DQPSK, 8DPSK)mode have been tested, and the worst result Ant1_GFSK model was report as below

Test Mode: Ant1_Low Channel 2402MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2390	48.79	29.15	3.41	34.01	47.34	74	-26.66	H	Peak
2400	60.94	29.16	3.43	34.01	59.52	74	-14.48	H	Peak
2390	48.35	29.15	3.41	34.01	46.90	74	-27.10	V	Peak
2400	55.40	29.16	3.43	34.01	53.98	74	-20.02	V	Peak
2390	40.74	29.15	3.41	34.01	39.29	54	-14.71	H	AV
2400	43.62	29.16	3.43	34.01	42.20	54	-11.80	H	AV
2390	39.24	29.15	3.41	34.01	37.79	54	-16.21	V	AV
2400	45.10	29.16	3.43	34.01	43.68	54	-10.32	V	AV

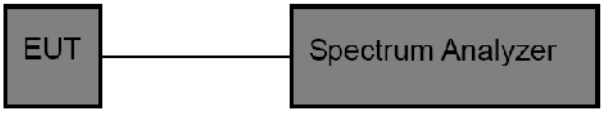
Test Mode: Ant1_High Channel 2480MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2483.5	60.32	29.28	3.53	34.03	59.10	74	-14.90	H	Peak
2500	48.69	29.30	3.56	34.03	47.52	74	-26.48	H	Peak
2483.5	60.83	29.28	3.53	34.03	59.61	74	-14.39	V	Peak
2500	49.94	29.30	3.56	34.03	48.77	74	-25.23	V	Peak
2483.5	41.06	29.28	3.53	34.03	39.84	54	-14.16	H	AV
2500	40.46	29.30	3.56	34.03	39.29	54	-14.71	H	AV
2483.5	43.70	29.28	3.53	34.03	42.48	54	-11.52	V	AV
2500	39.51	29.30	3.56	34.03	38.34	54	-15.66	V	AV

8 Maximum Peak Output Power Test

8.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(3)
Test Limit	125mW

8.2 Test Setup



8.3 Test Procedure

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 D01 15.247 Meas Guidance v05 section 8.3.1.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

8.4 Test Data

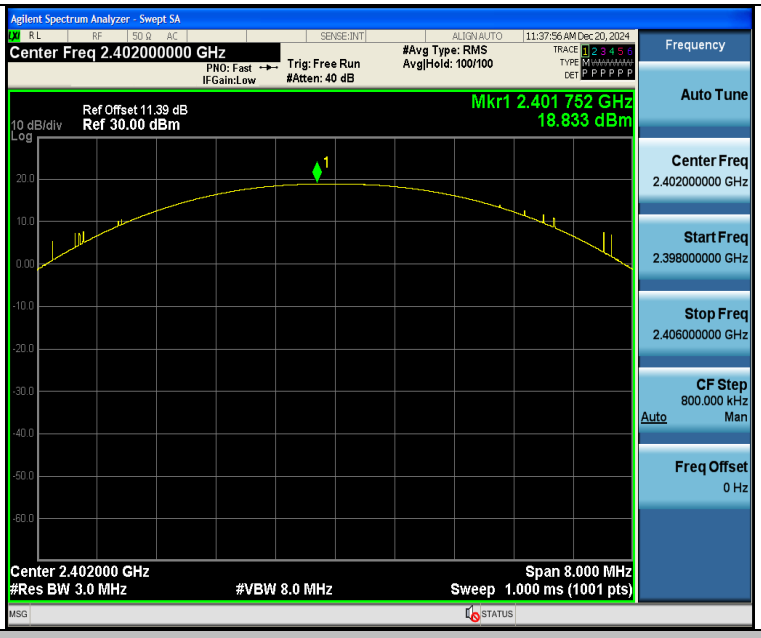
Test Item	:	Max. peak output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	AC 120V	Temperature	:	24.5℃
Test Result	:	PASS	Humidity	:	55%RH

Test	Antenna	Frequency[MHz]	Conducted Peak	Conducted	Verdict

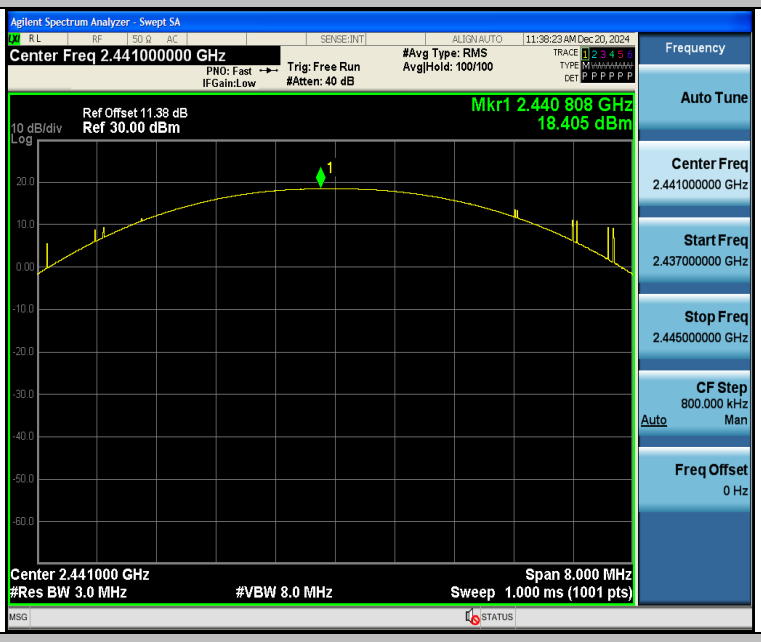
Mode			Powert[dBm]	Limit[dBm]	
DH5	Ant1	2402	18.83	≤20.97	PASS
DH5	Ant1	2441	18.41	≤20.97	PASS
DH5	Ant1	2480	**18.97**	≤20.97	PASS
2DH5	Ant1	2402	18.8	≤20.97	PASS
2DH5	Ant1	2441	18.41	≤20.97	PASS
2DH5	Ant1	2480	18.96	≤20.97	PASS
3DH5	Ant1	2402	18.79	≤20.97	PASS
3DH5	Ant1	2441	18.4	≤20.97	PASS
3DH5	Ant1	2480	18.96	≤20.97	PASS
DH5	Ant2	2402	17.12	≤30	PASS
DH5	Ant2	2441	17.11	≤30	PASS
DH5	Ant2	2480	17.91	≤30	PASS
2DH5	Ant2	2402	17.36	≤20.97	PASS
2DH5	Ant2	2441	17.33	≤20.97	PASS
2DH5	Ant2	2480	18.04	≤20.97	PASS
3DH5	Ant2	2402	17.47	≤20.97	PASS
3DH5	Ant2	2441	17.37	≤20.97	PASS
3DH5	Ant2	2480	**18.07**	≤20.97	PASS
DH5	Ant3	2402	17.56	≤30	PASS
DH5	Ant3	2441	17.58	≤30	PASS
DH5	Ant3	2480	18.29	≤30	PASS
2DH5	Ant3	2402	17.87	≤20.97	PASS
2DH5	Ant3	2441	17.8	≤20.97	PASS
2DH5	Ant3	2480	18.38	≤20.97	PASS
3DH5	Ant3	2402	17.86	≤20.97	PASS
3DH5	Ant3	2441	17.78	≤20.97	PASS
3DH5	Ant3	2480	**18.39**	≤20.97	PASS
DH5	Ant4	2402	17.54	≤30	PASS
DH5	Ant4	2441	17.58	≤30	PASS
DH5	Ant4	2480	18.26	≤30	PASS
2DH5	Ant4	2402	17.85	≤20.97	PASS
2DH5	Ant4	2441	17.77	≤20.97	PASS

2DH5	Ant4	2480	18.36	≤20.97	PASS
3DH5	Ant4	2402	17.9	≤20.97	PASS
3DH5	Ant4	2441	17.78	≤20.97	PASS
3DH5	Ant4	2480	**18.37**	≤20.97	PASS

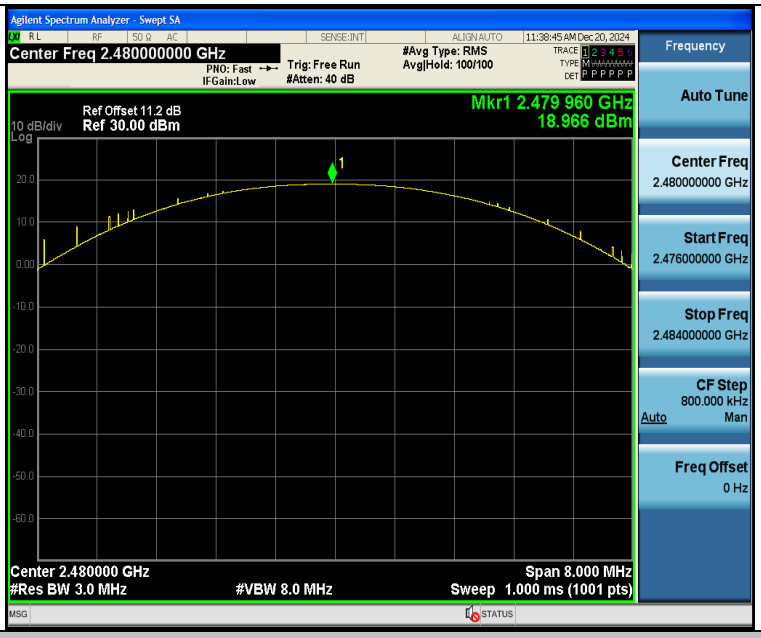
Test Graphs:



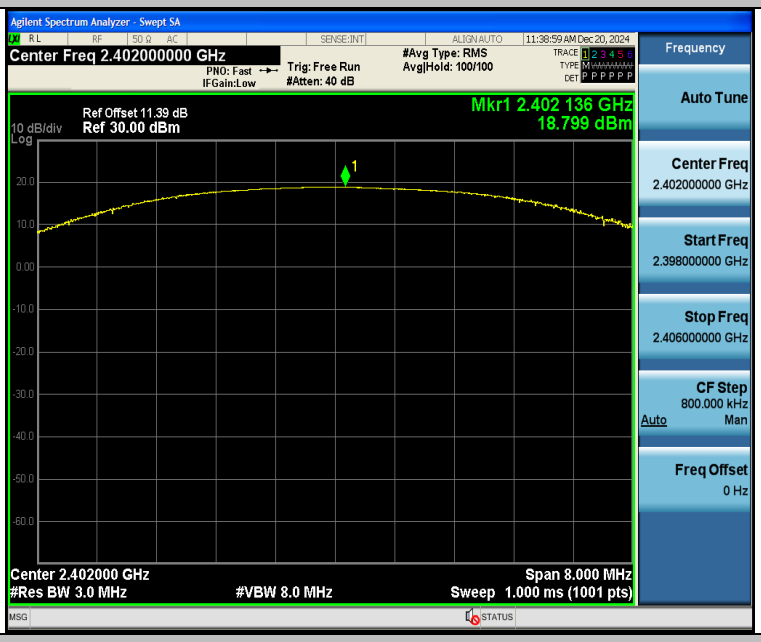
DH5-Ant1-2402-PASS



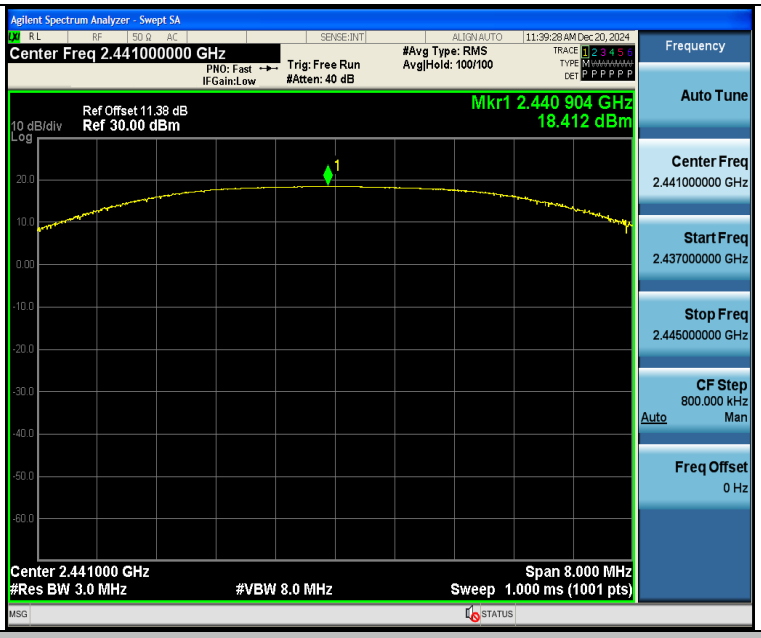
DH5-Ant1-2441-PASS



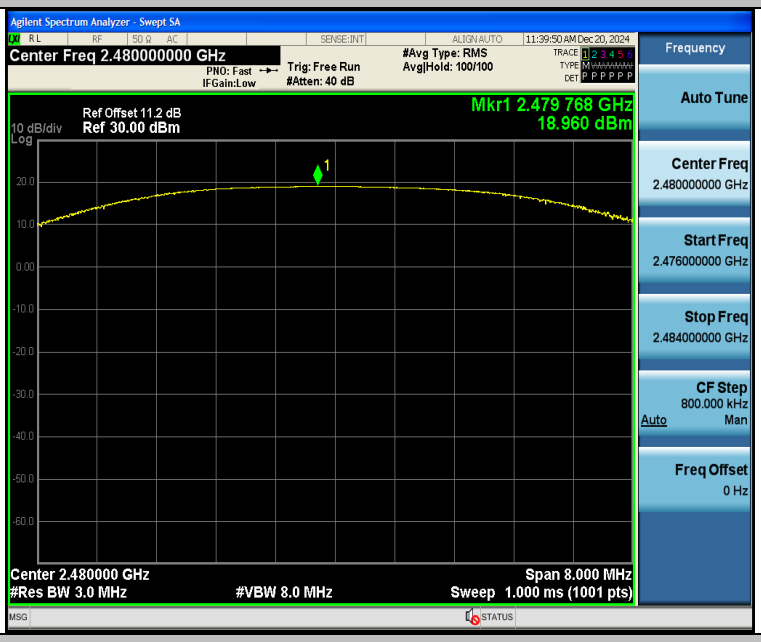
DH5-Ant1-2480-PASS



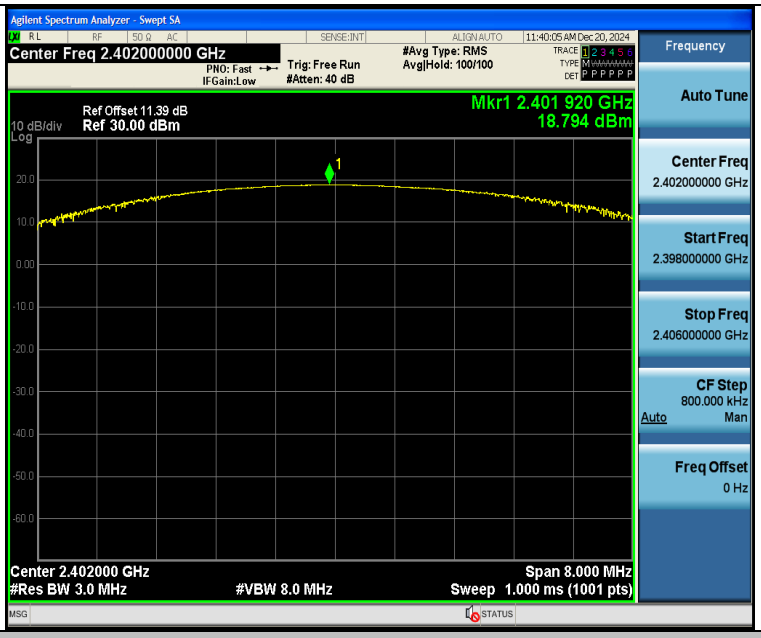
2DH5-Ant1-2402-PASS



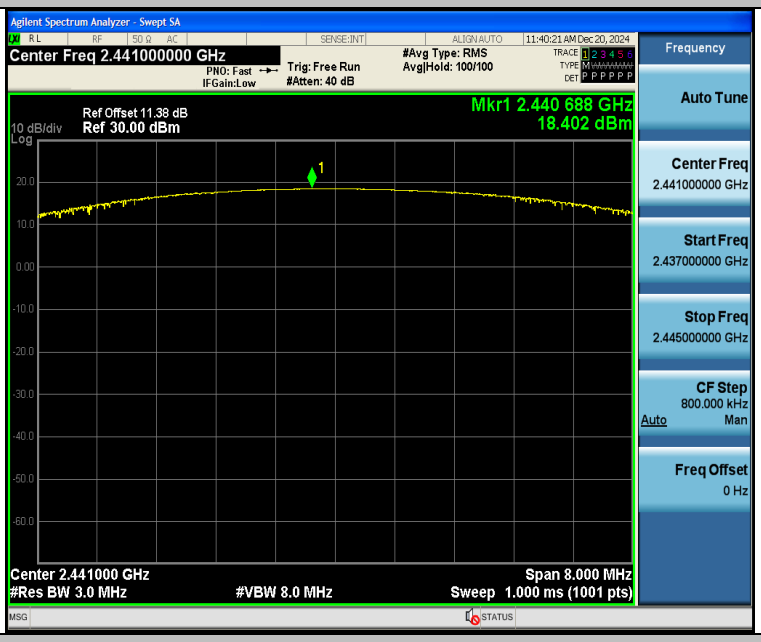
2DH5-Ant1-2441-PASS



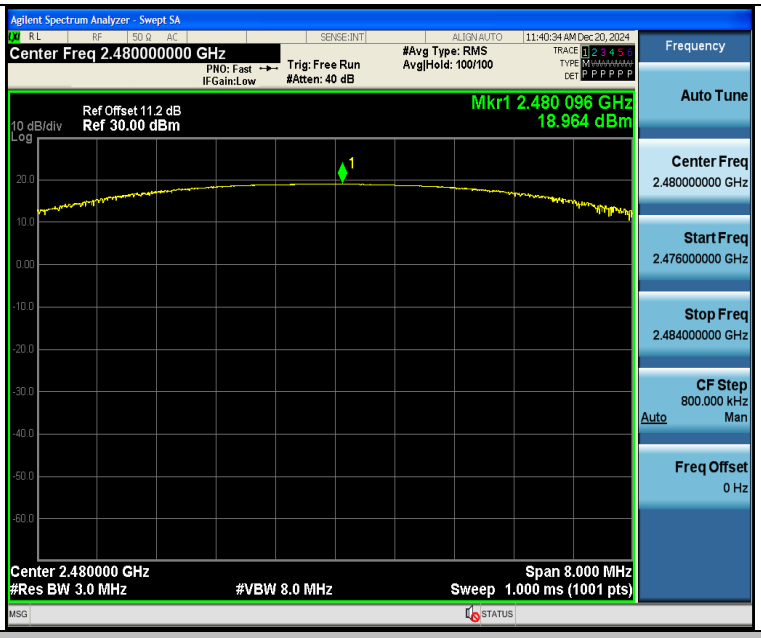
2DH5-Ant1-2480-PASS



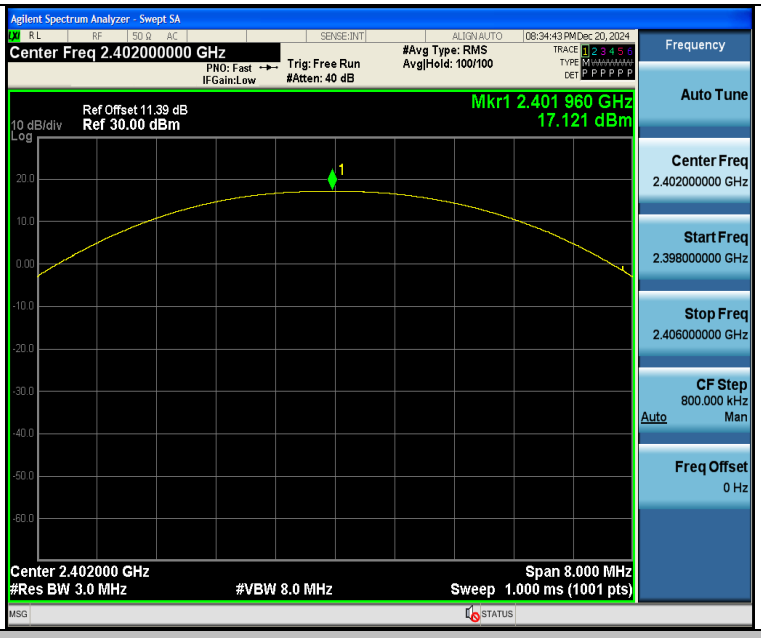
3DH5-Ant1-2402-PASS



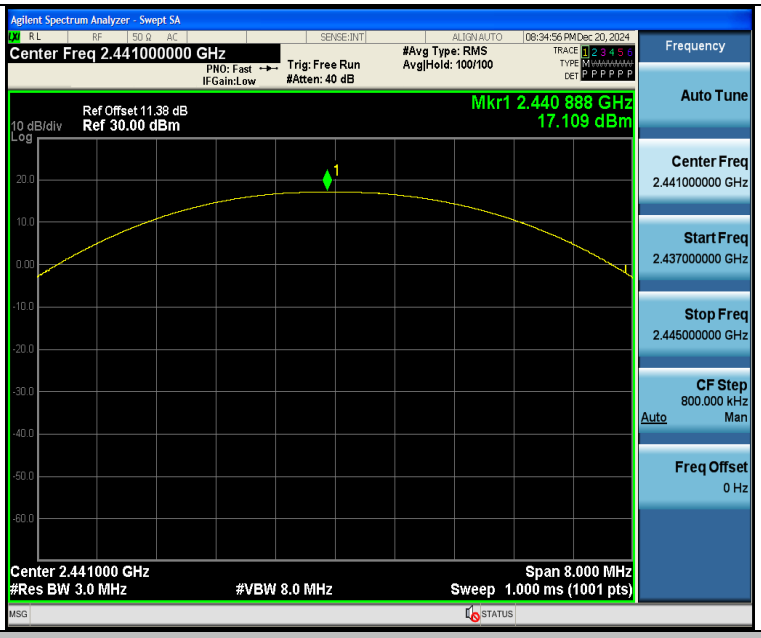
3DH5-Ant1-2441-PASS



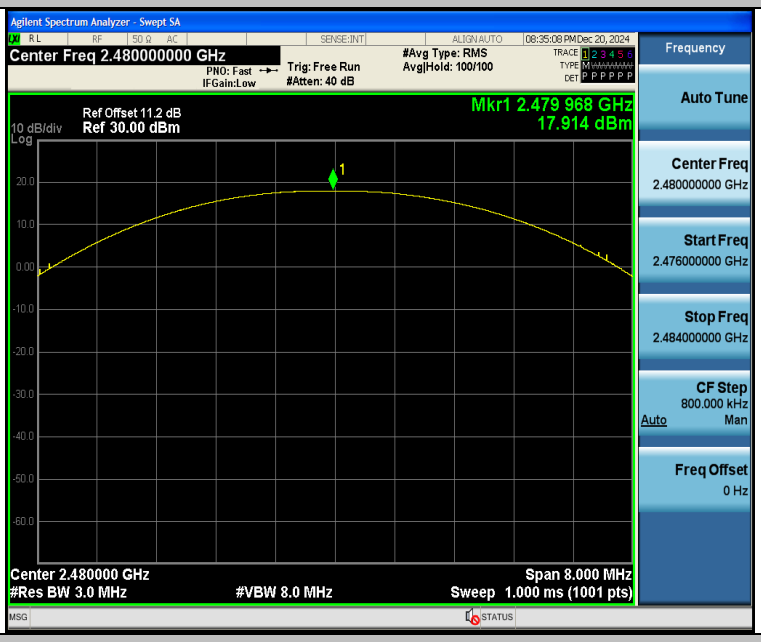
3DH5-Ant1-2480-PASS



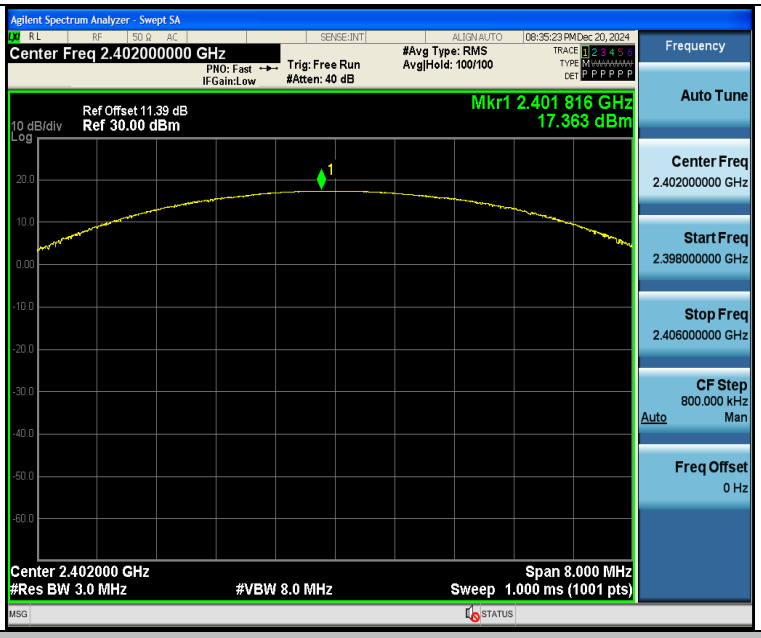
DH5-Ant2-2402-PASS



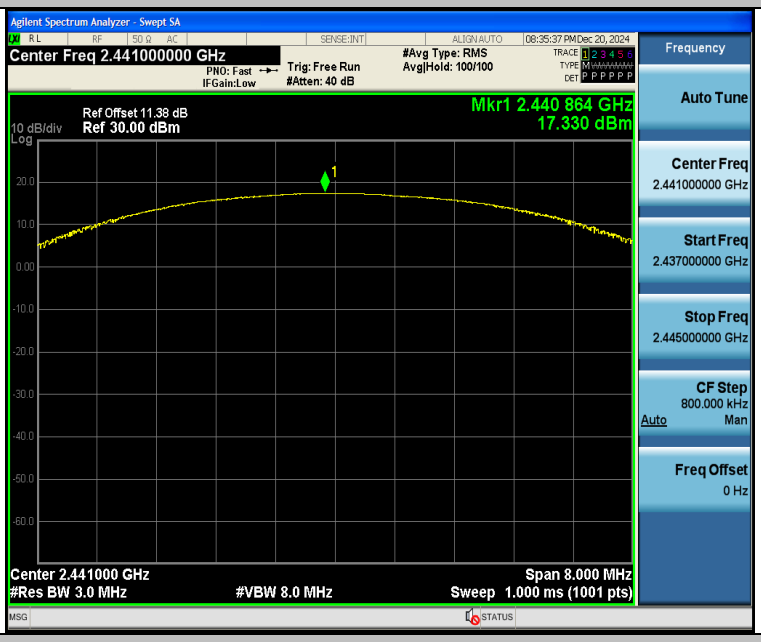
DH5-Ant2-2441-PASS



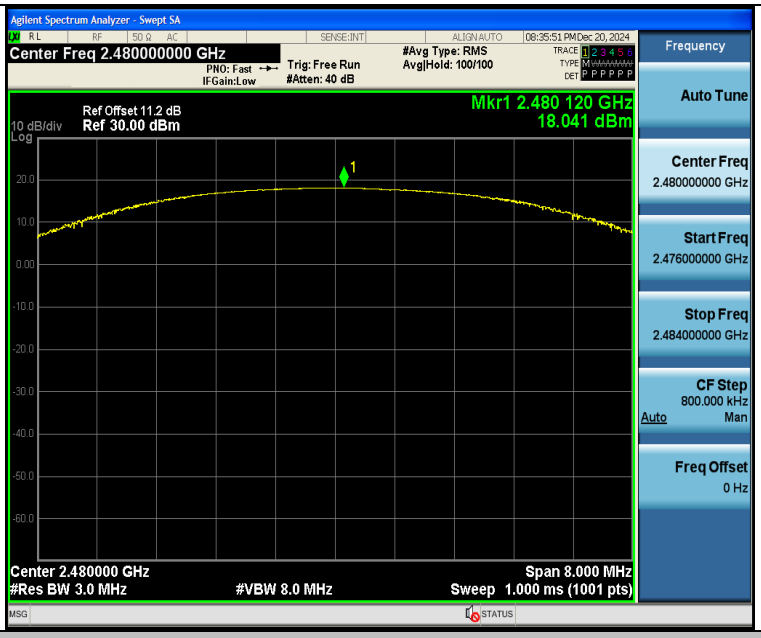
DH5-Ant2-2480-PASS



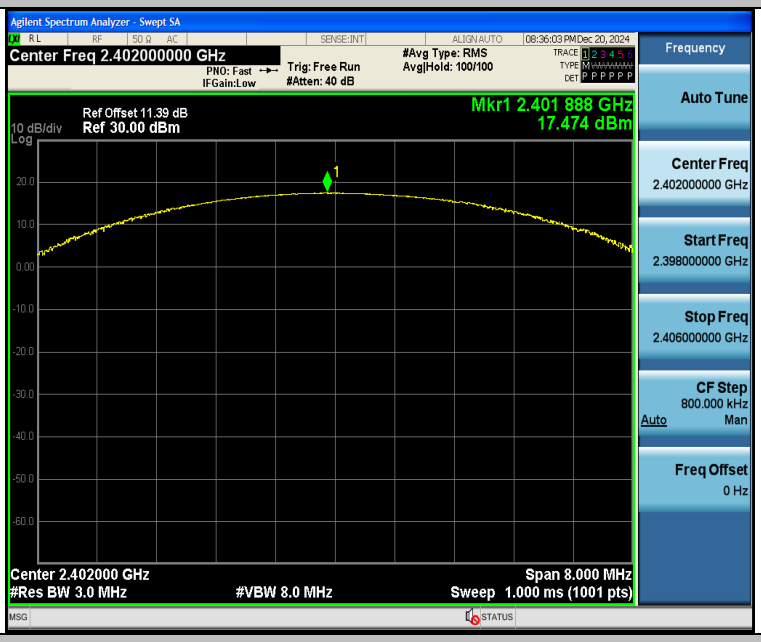
2DH5-Ant2-2402-PASS



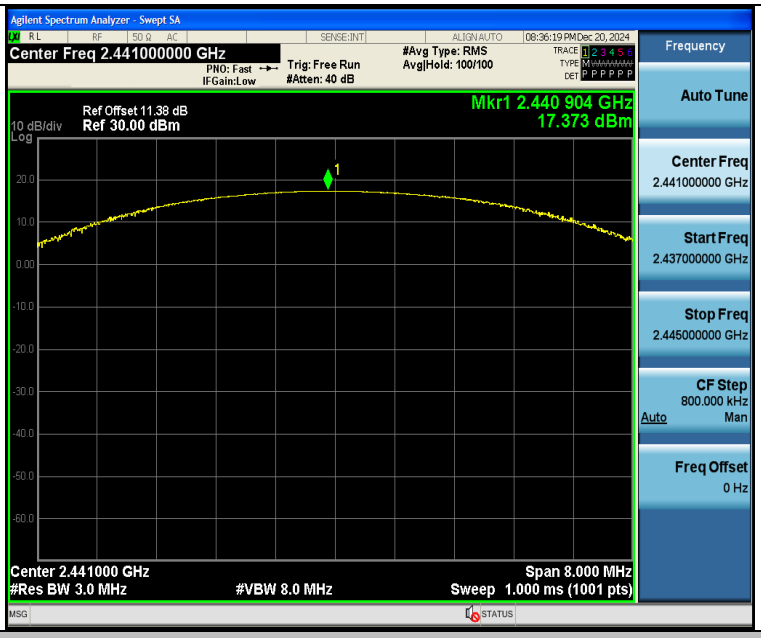
2DH5-Ant2-2441-PASS



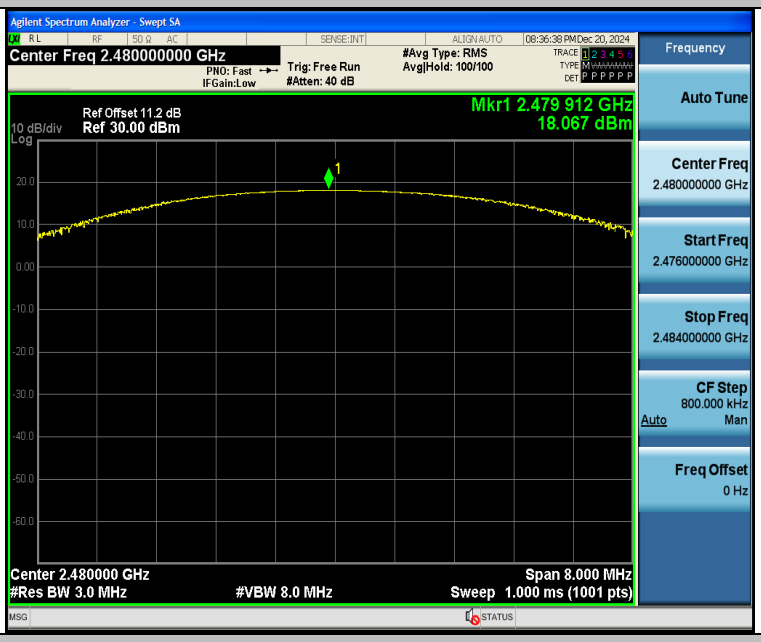
2DH5-Ant2-2480-PASS



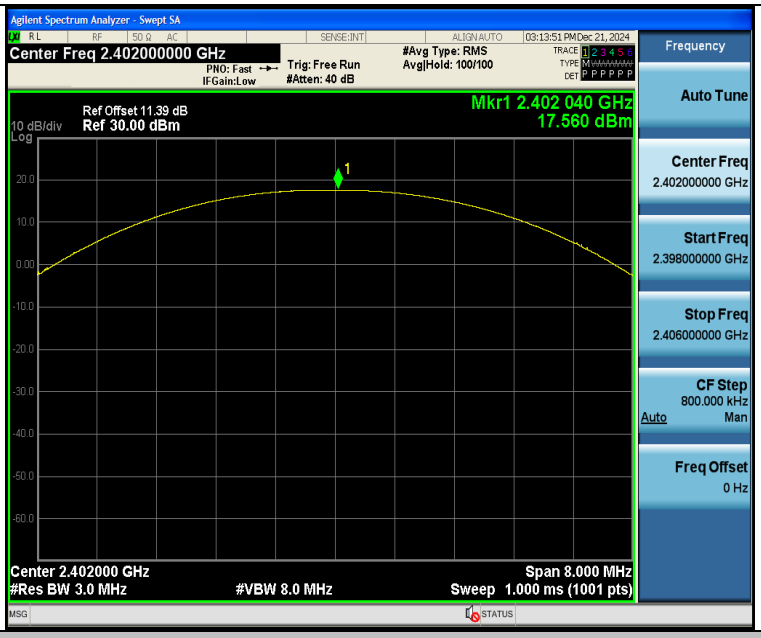
3DH5-Ant2-2402-PASS



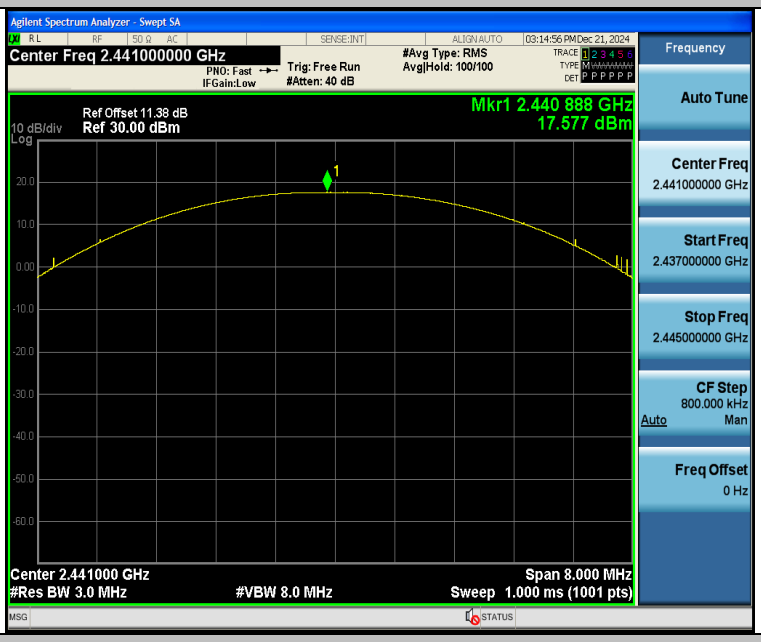
3DH5-Ant2-2441-PASS



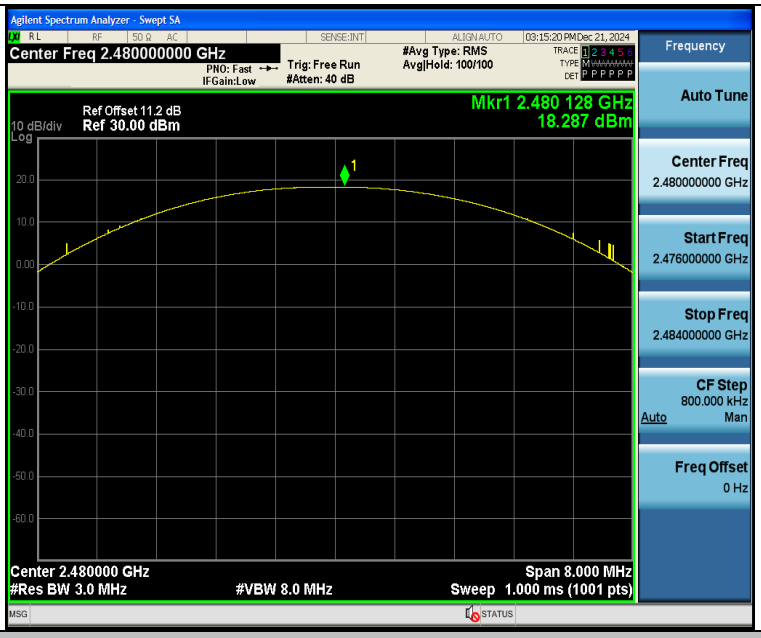
3DH5-Ant2-2480-PASS



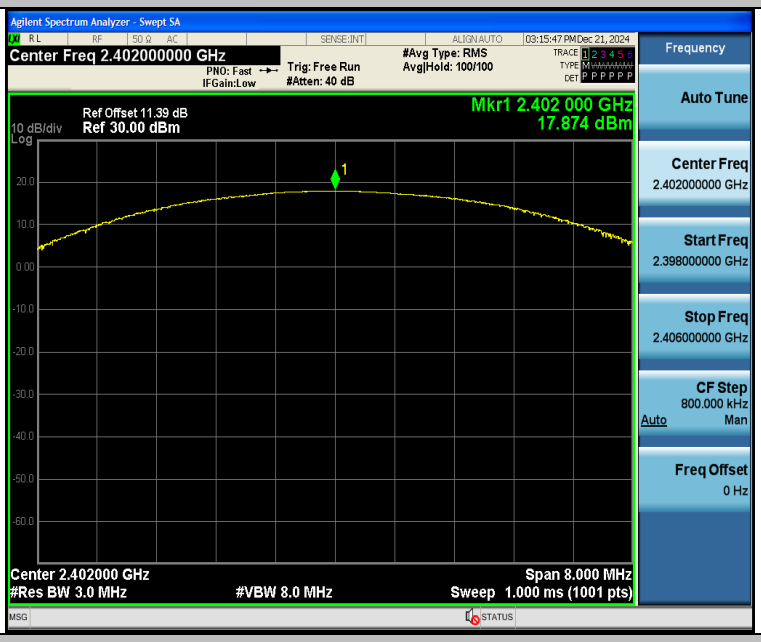
DH5-Ant3-2402-PASS



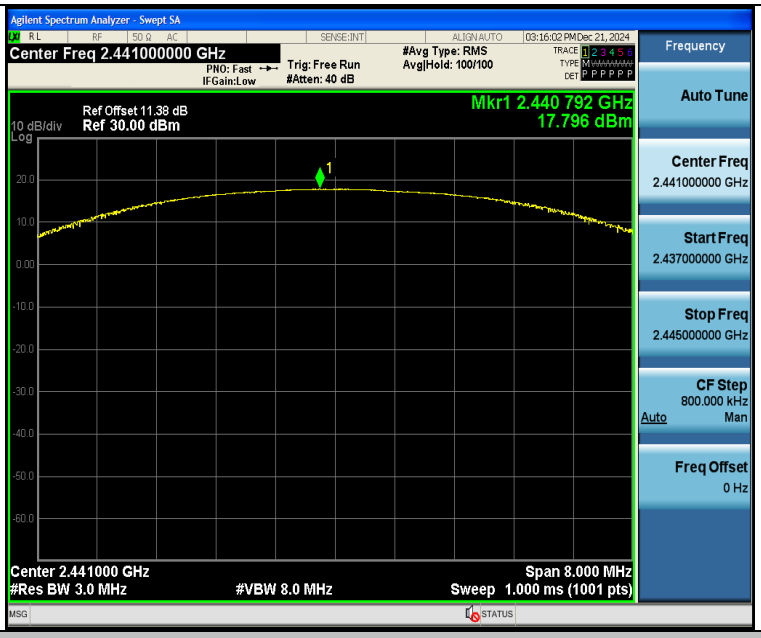
DH5-Ant3-2441-PASS



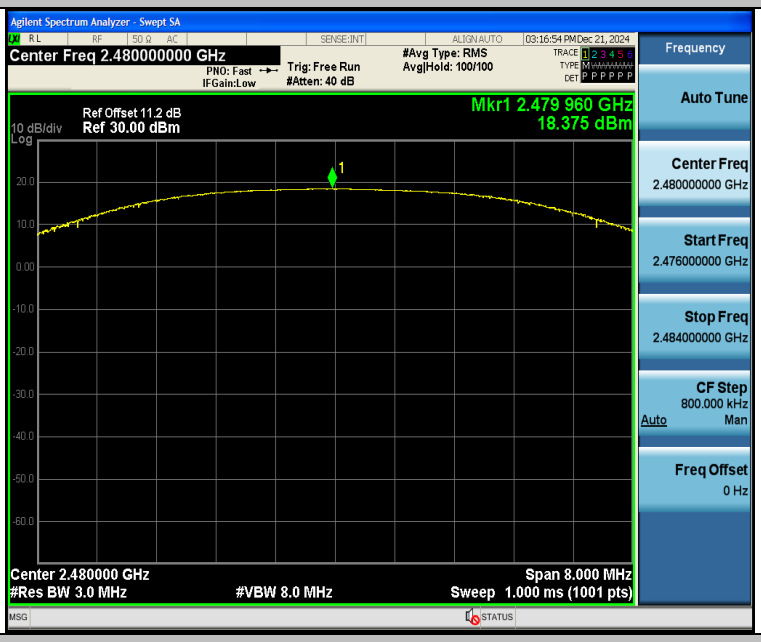
DH5-Ant3-2480-PASS



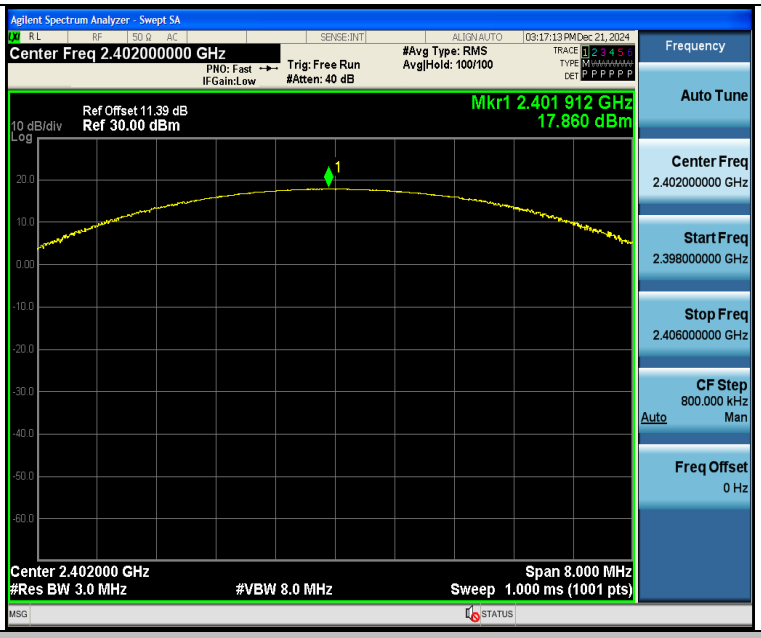
2DH5-Ant3-2402-PASS



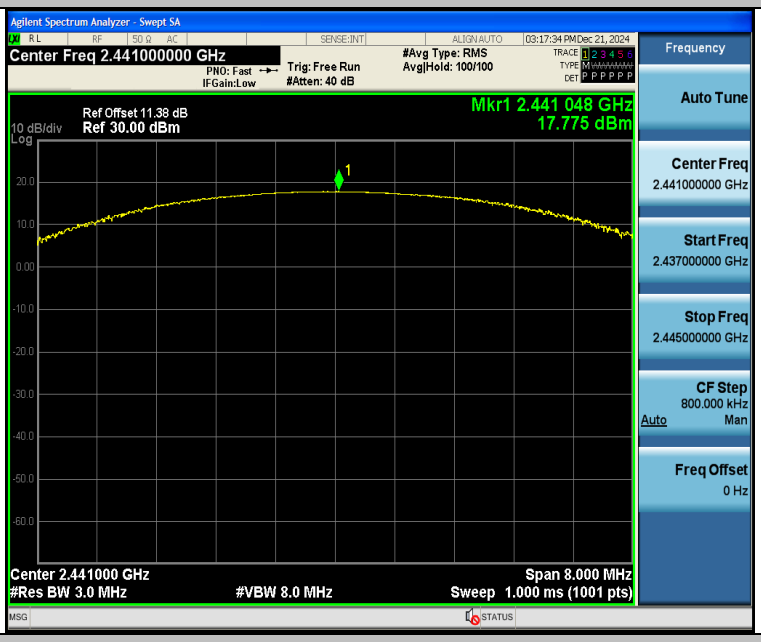
2DH5-Ant3-2441-PASS



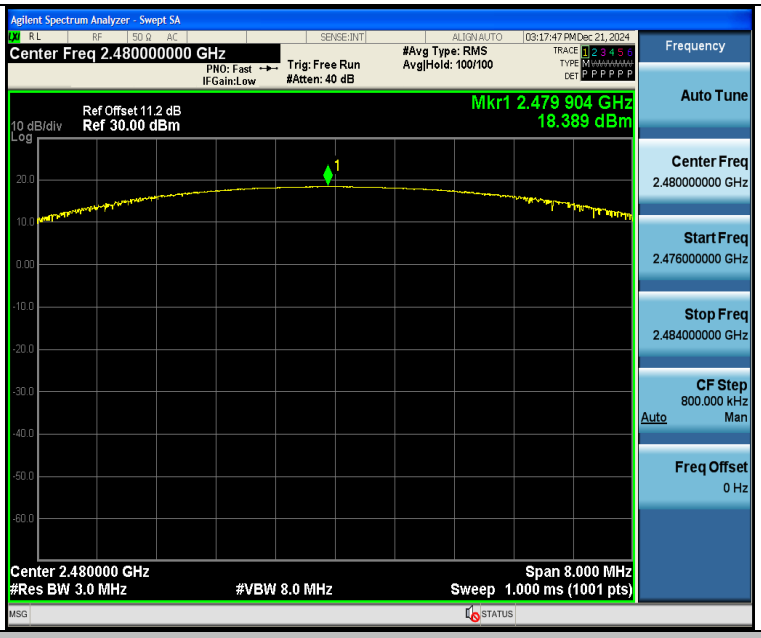
2DH5-Ant3-2480-PASS



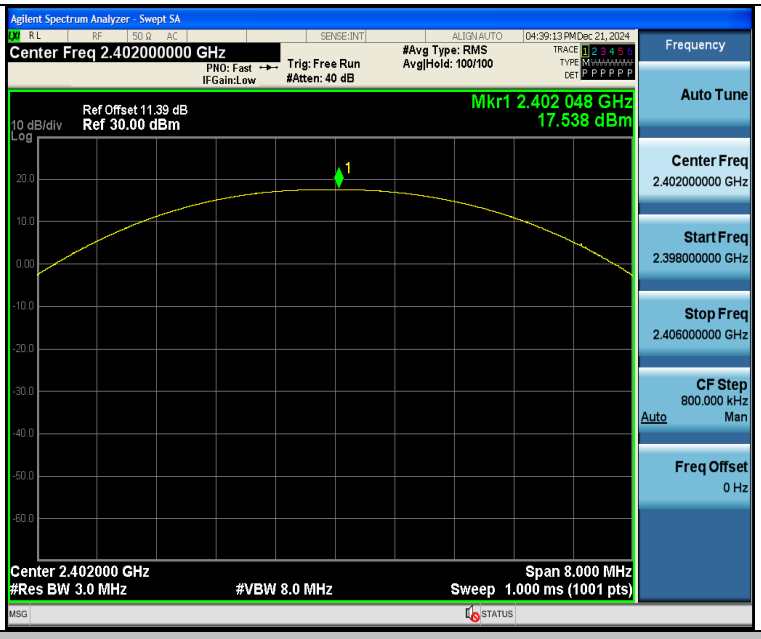
3DH5-Ant3-2402-PASS



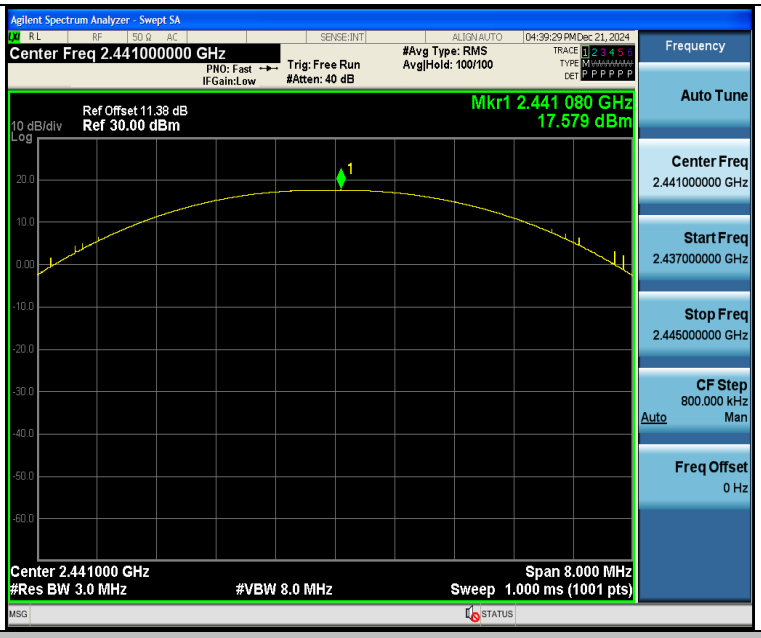
3DH5-Ant3-2441-PASS



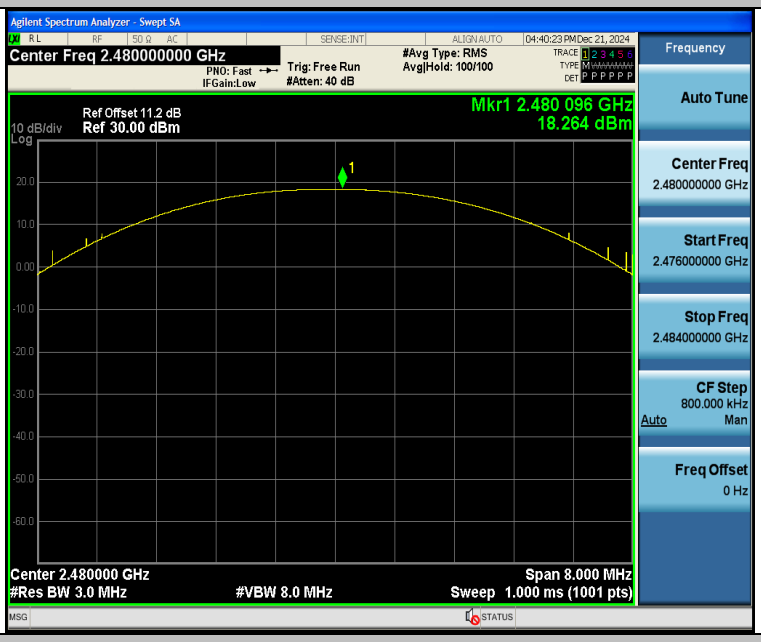
3DH5-Ant3-2480-PASS



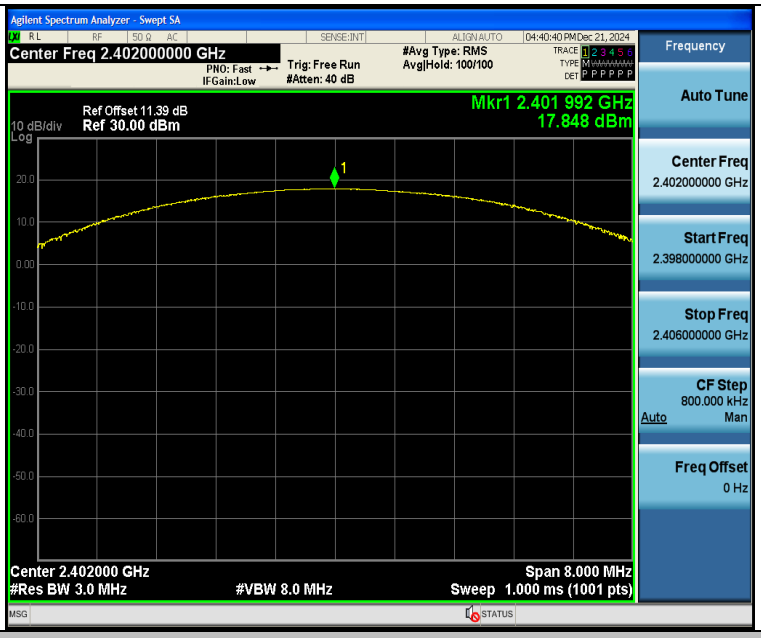
DH5-Ant4-2402-PASS



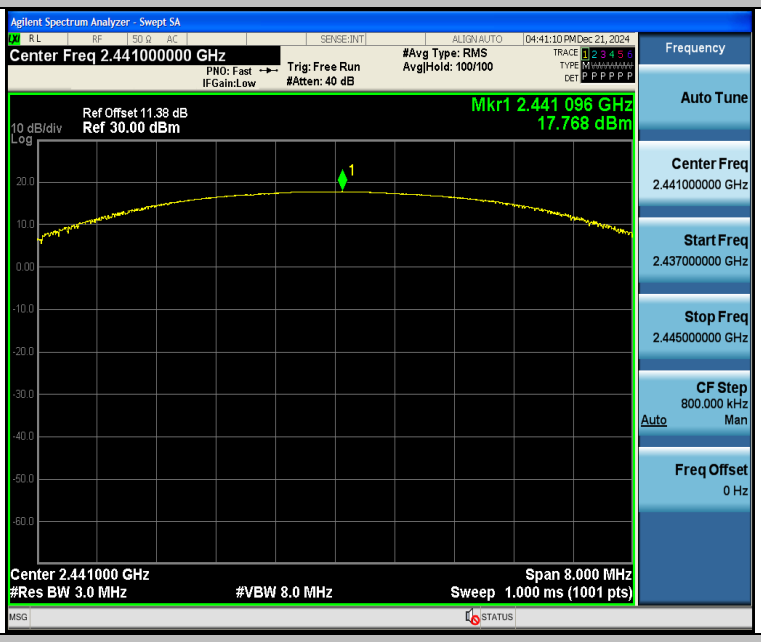
DH5-Ant4-2441-PASS



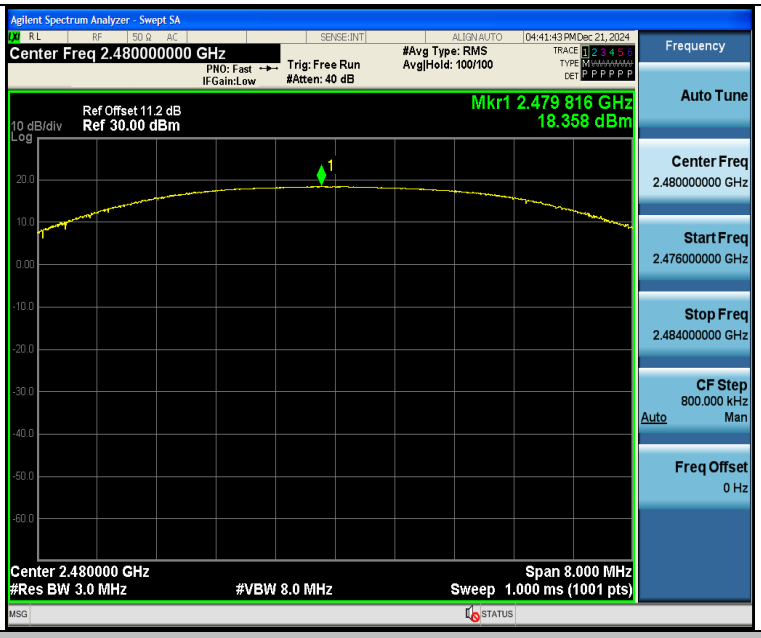
DH5-Ant4-2480-PASS



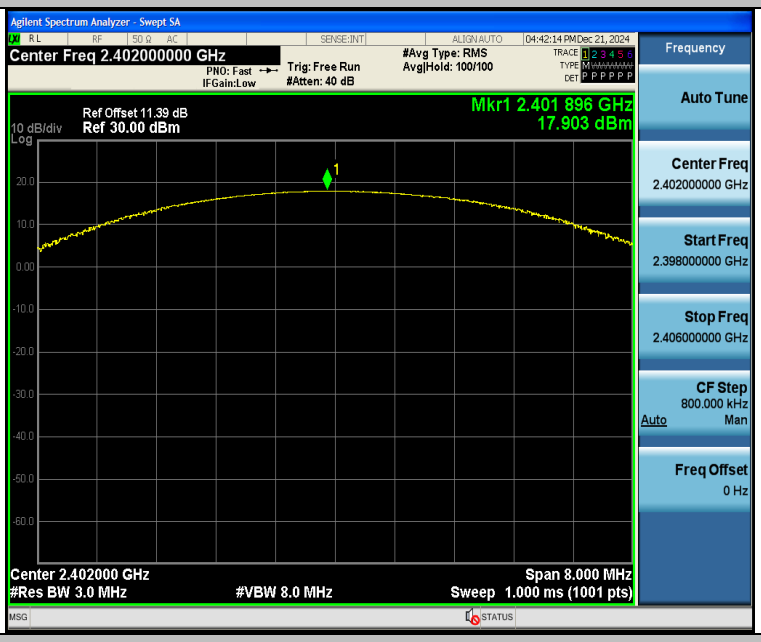
2DH5-Ant4-2402-PASS



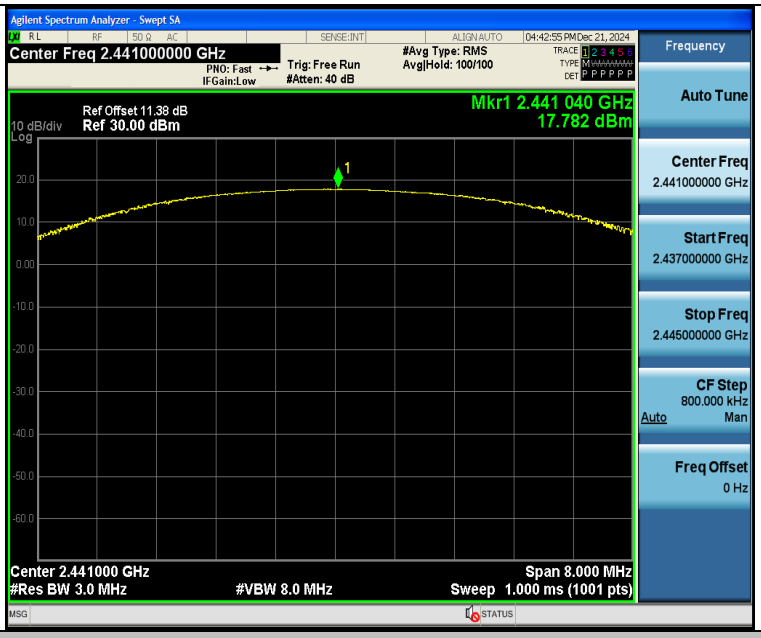
2DH5-Ant4-2441-PASS



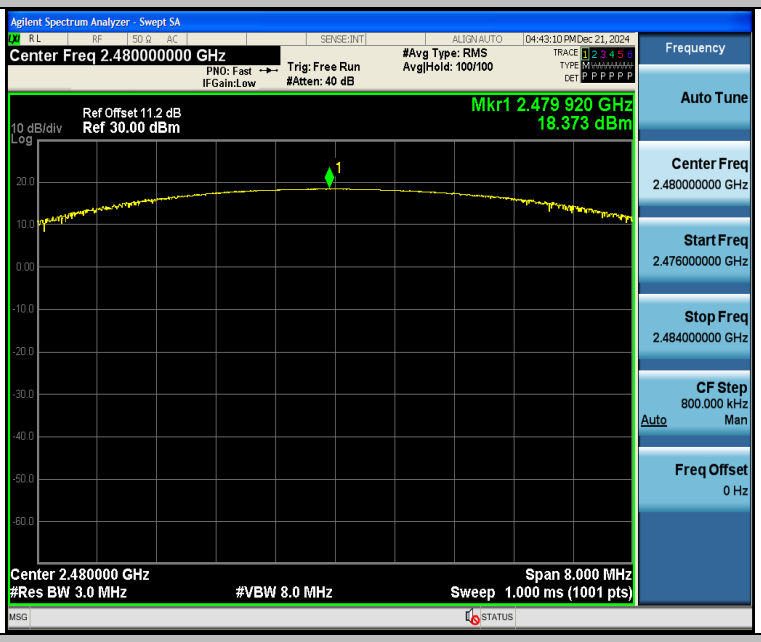
2DH5-Ant4-2480-PASS



3DH5-Ant4-2402-PASS



3DH5-Ant4-2441-PASS



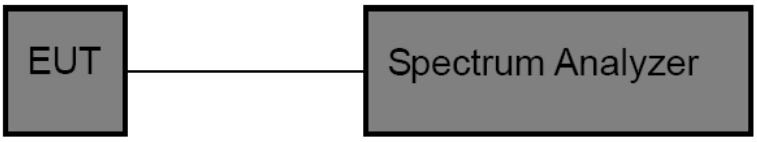
3DH5-Ant4-2480-PASS

9 20DB Occupy Bandwidth Test

9.1 Test Standard

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

9.2 Test Setup



9.3 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.

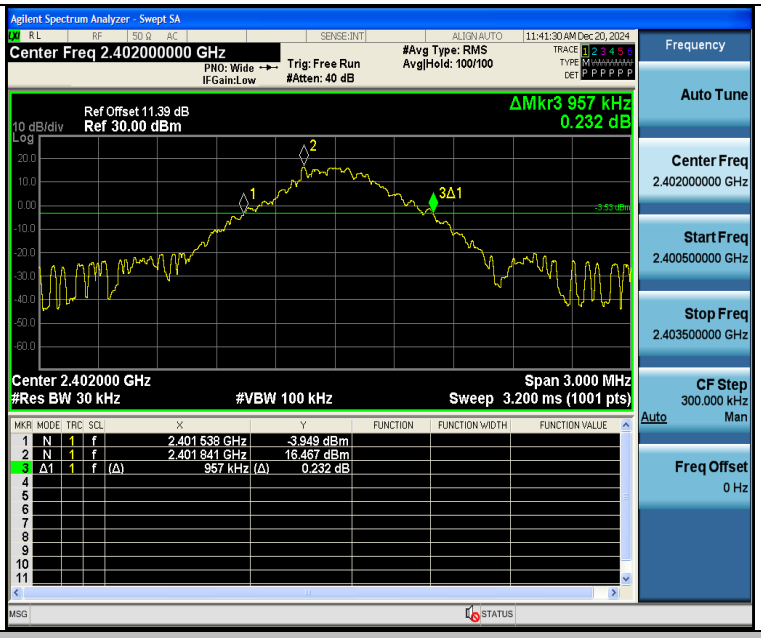
9.4 Test Data

Test Item	:	20dB BW	Test Mode	:	CH Low ~ CH High
Test Voltage	:	AC 120V	Temperature	:	24.5℃
Test Result	:	PASS	Humidity	:	55%RH

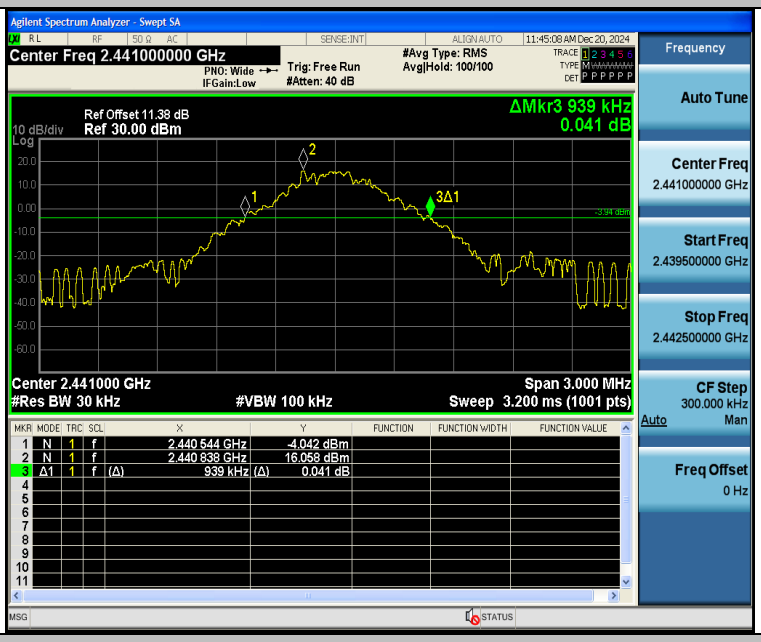
TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.957	2401.538	2402.495	---	---
DH5	Ant1	2441	0.939	2440.544	2441.483	---	---
DH5	Ant1	2480	0.957	2479.541	2480.498	---	---
2DH5	Ant1	2402	1.428	2401.301	2402.729	---	---
2DH5	Ant1	2441	1.401	2440.304	2441.705	---	---
2DH5	Ant1	2480	1.404	2479.304	2480.708	---	---
3DH5	Ant1	2402	1.401	2401.295	2402.696	---	---
3DH5	Ant1	2441	1.398	2440.298	2441.696	---	---
3DH5	Ant1	2480	1.455	2479.277	2480.732	---	---
DH5	Ant2	2402	0.963	2401.538	2402.501	---	---
DH5	Ant2	2441	0.963	2440.538	2441.501	---	---
DH5	Ant2	2480	0.963	2479.538	2480.501	---	---
2DH5	Ant2	2402	1.383	2401.313	2402.696	---	---
2DH5	Ant2	2441	1.395	2440.307	2441.702	---	---
2DH5	Ant2	2480	1.431	2479.298	2480.729	---	---
3DH5	Ant2	2402	1.362	2401.325	2402.687	---	---
3DH5	Ant2	2441	1.377	2440.316	2441.693	---	---
3DH5	Ant2	2480	1.377	2479.316	2480.693	---	---
DH5	Ant3	2402	0.963	2401.535	2402.498	---	---
DH5	Ant3	2441	0.954	2440.535	2441.489	---	---
DH5	Ant3	2480	0.963	2479.535	2480.498	---	---
2DH5	Ant3	2402	1.386	2401.310	2402.696	---	---
2DH5	Ant3	2441	1.524	2440.298	2441.822	---	---
2DH5	Ant3	2480	1.401	2479.304	2480.705	---	---
3DH5	Ant3	2402	1.362	2401.322	2402.684	---	---
3DH5	Ant3	2441	1.380	2440.310	2441.690	---	---
3DH5	Ant3	2480	1.389	2479.301	2480.690	---	---
DH5	Ant4	2402	0.957	2401.535	2402.492	---	---
DH5	Ant4	2441	0.960	2440.535	2441.495	---	---
DH5	Ant4	2480	0.960	2479.538	2480.498	---	---
2DH5	Ant4	2402	1.392	2401.304	2402.696	---	---

2DH5	Ant4	2441	1.413	2440.298	2441.711	---	---
2DH5	Ant4	2480	1.461	2479.292	2480.753	---	---
3DH5	Ant4	2402	1.359	2401.325	2402.684	---	---
3DH5	Ant4	2441	1.383	2440.307	2441.690	---	---
3DH5	Ant4	2480	1.392	2479.301	2480.693	---	---

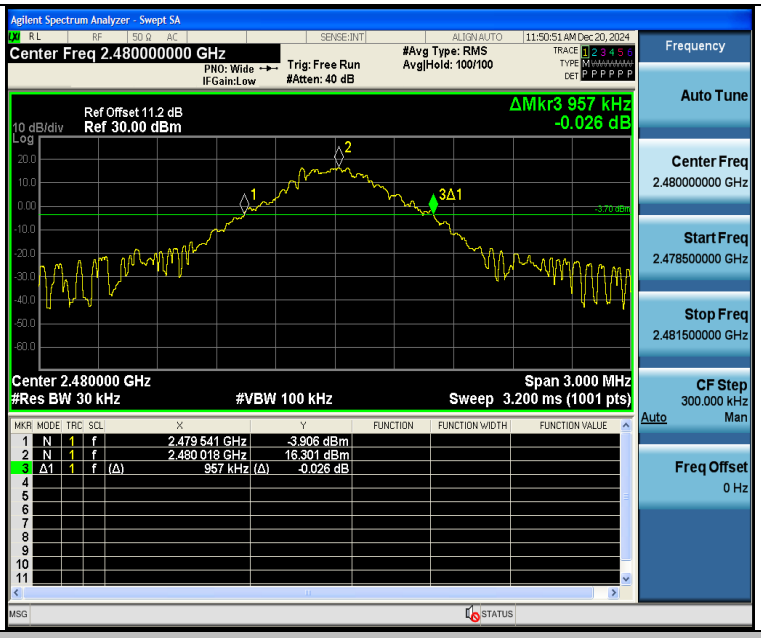
Test Graphs:



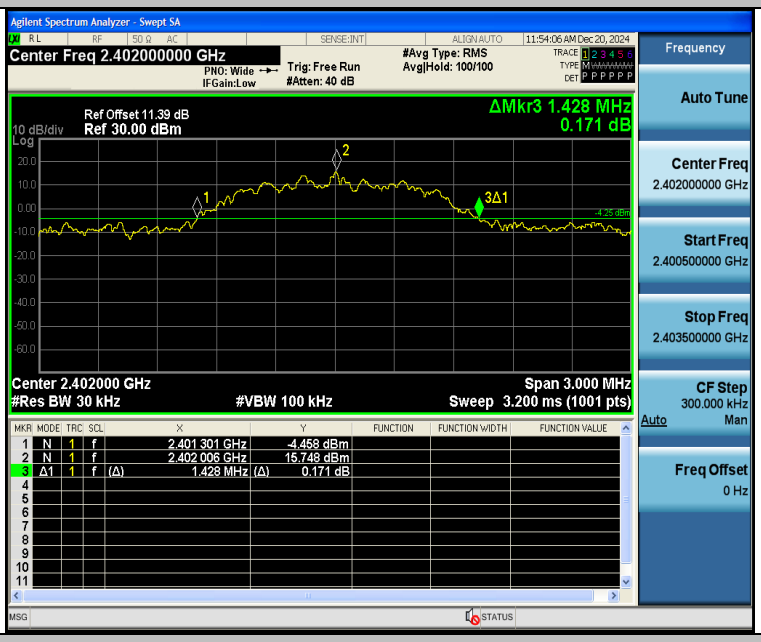
DH5-Ant1-2402



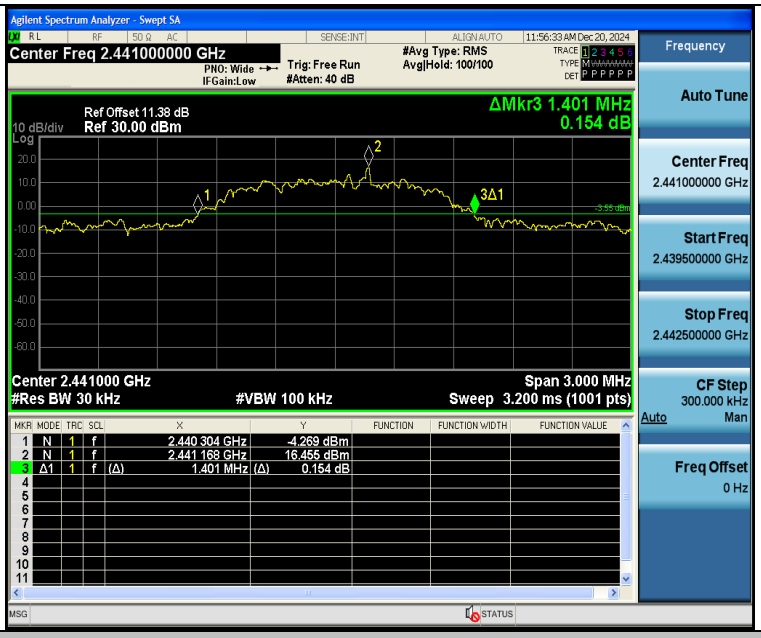
DH5-Ant1-2441



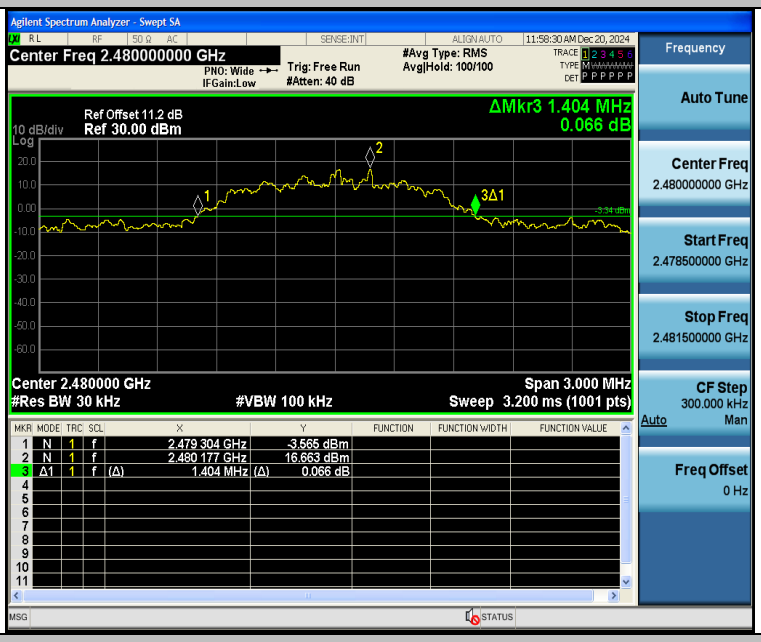
DH5-Ant1-2480



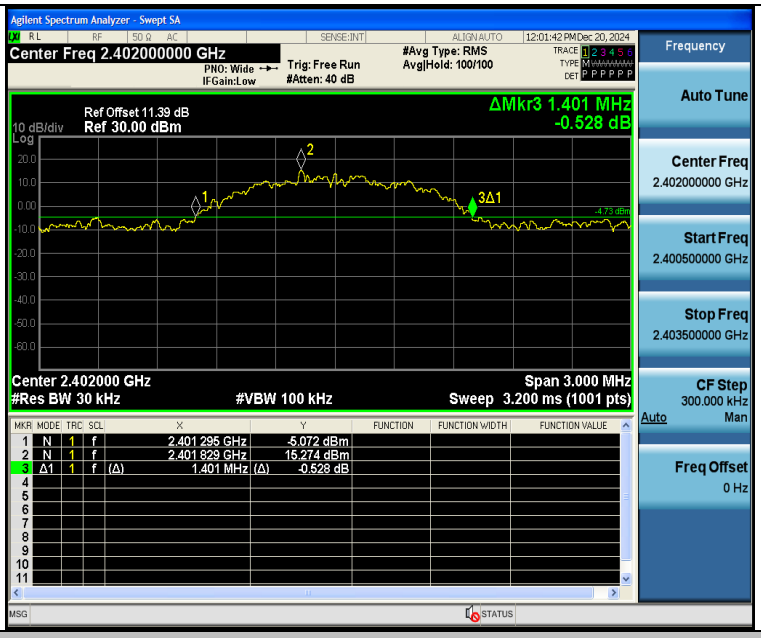
2DH5-Ant1-2402



2DH5-Ant1-2441



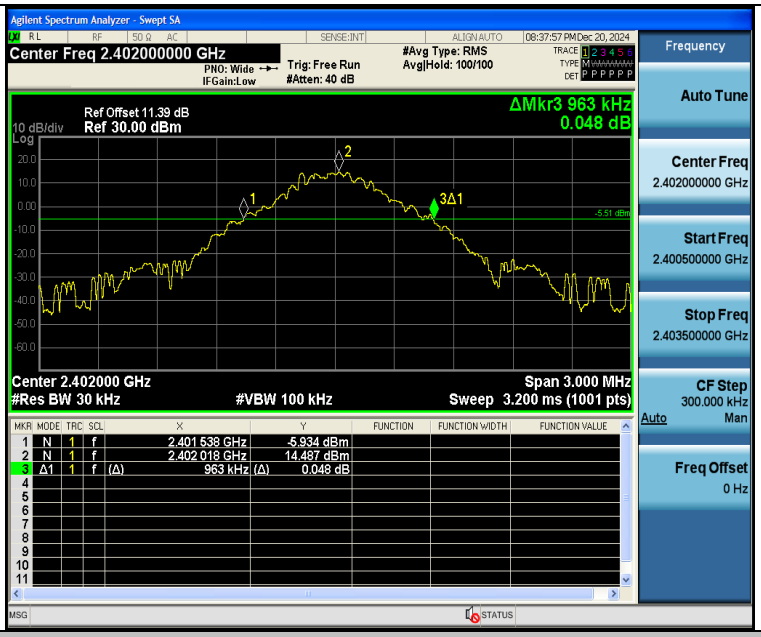
2DH5-Ant1-2480



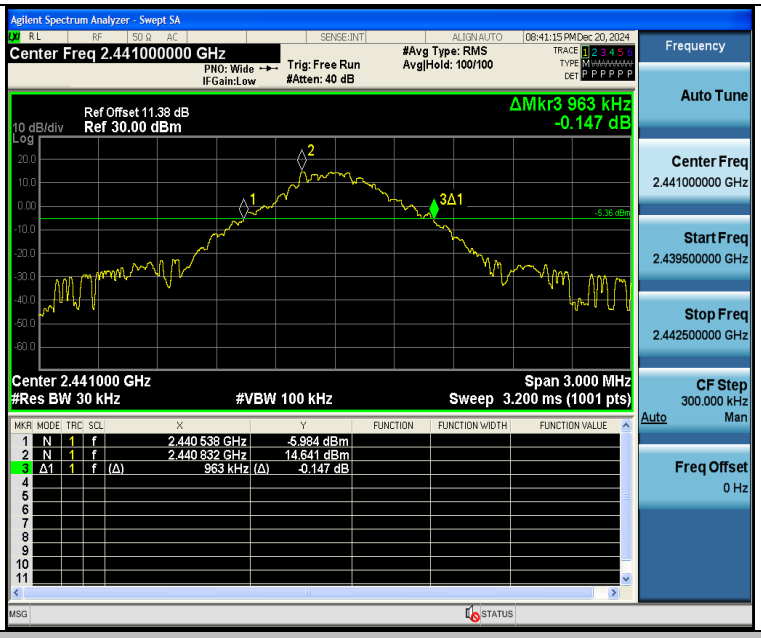
3DH5-Ant1-2402

3DH5-Ant1-2441

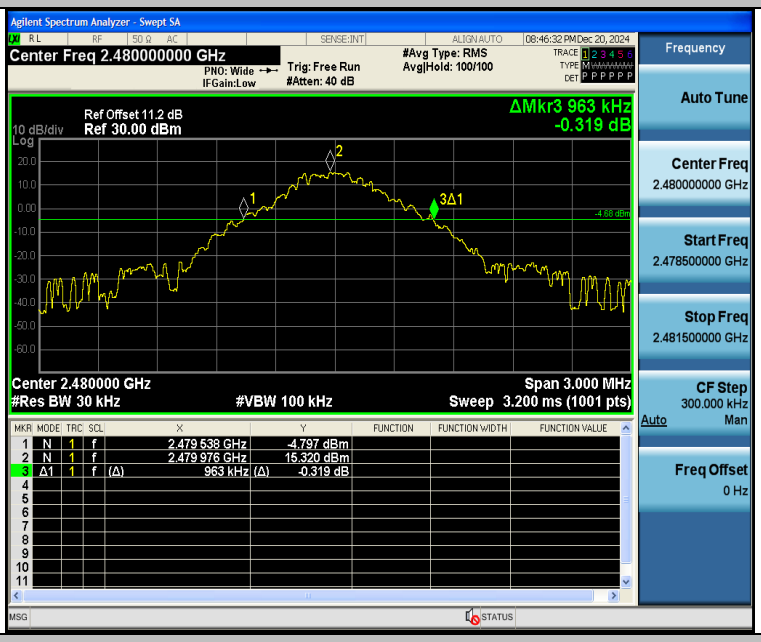
3DH5-Ant1-2480



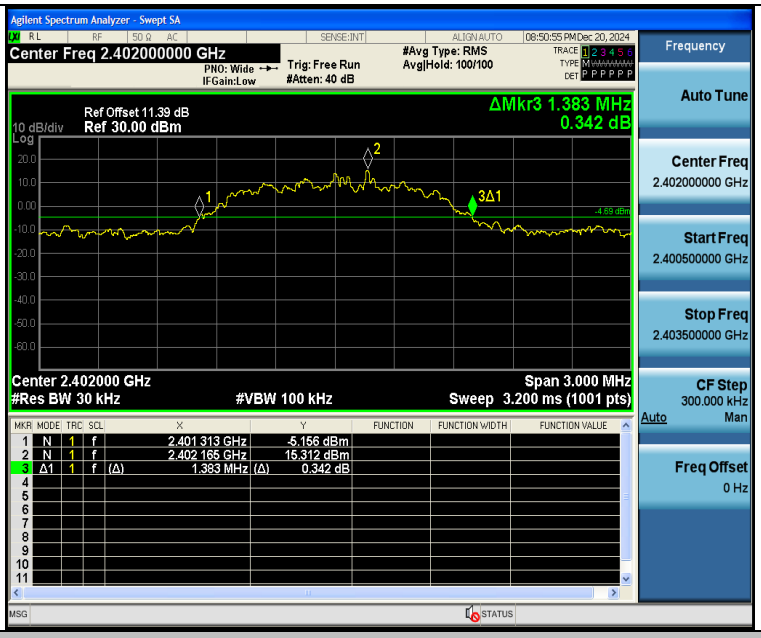
DH5-Ant2-2402



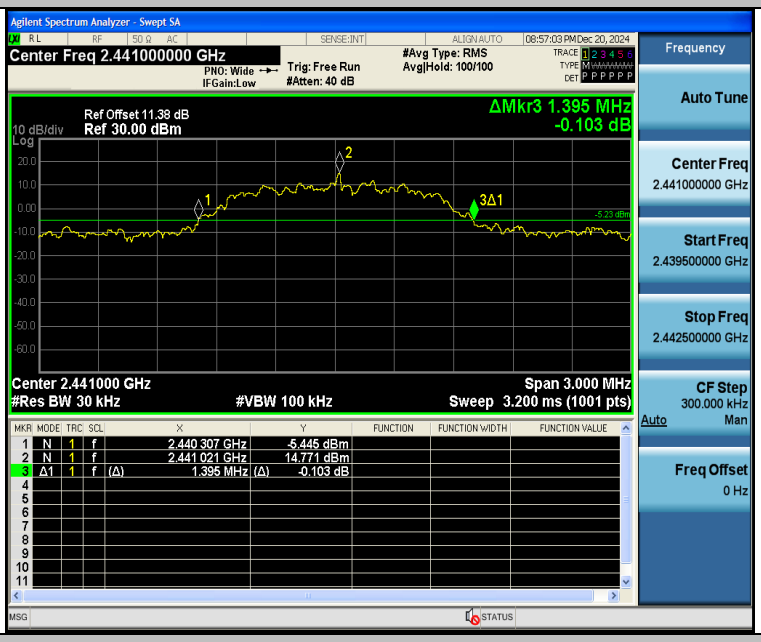
DH5-Ant2-2441



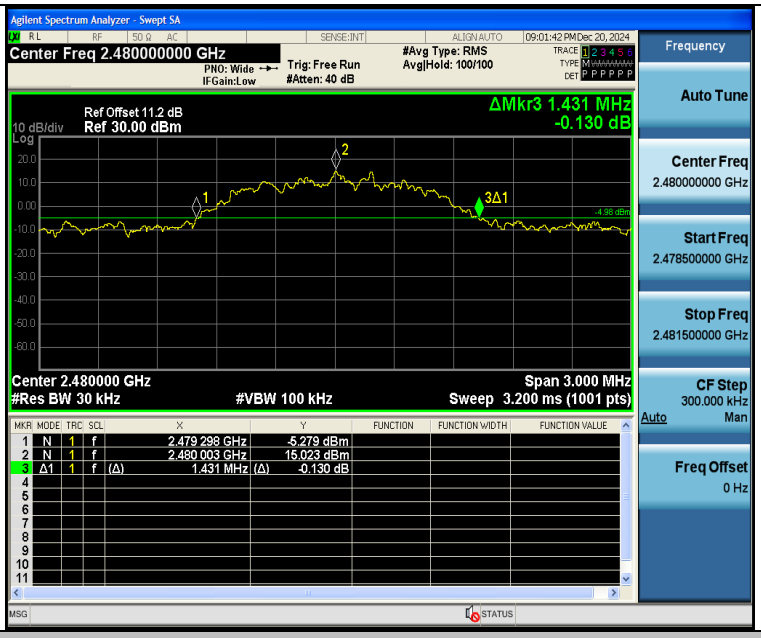
DH5-Ant2-2480



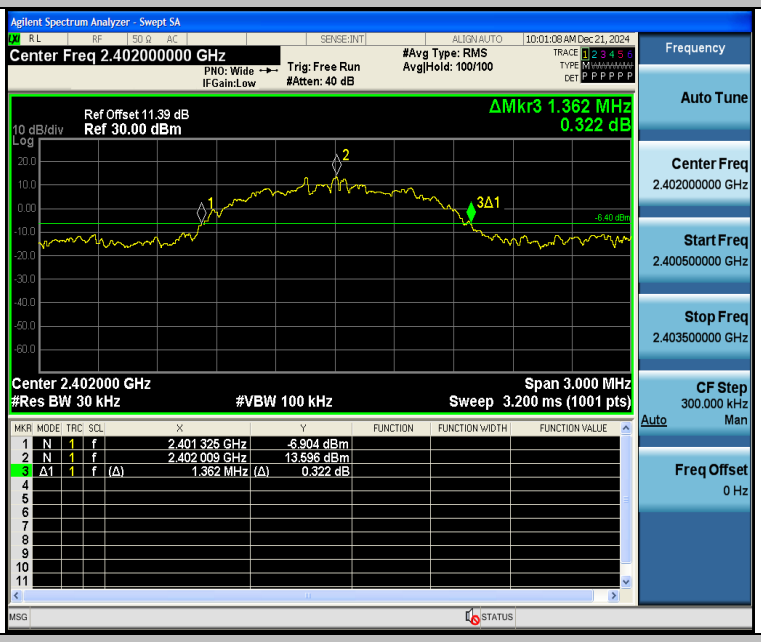
2DH5-Ant2-2402



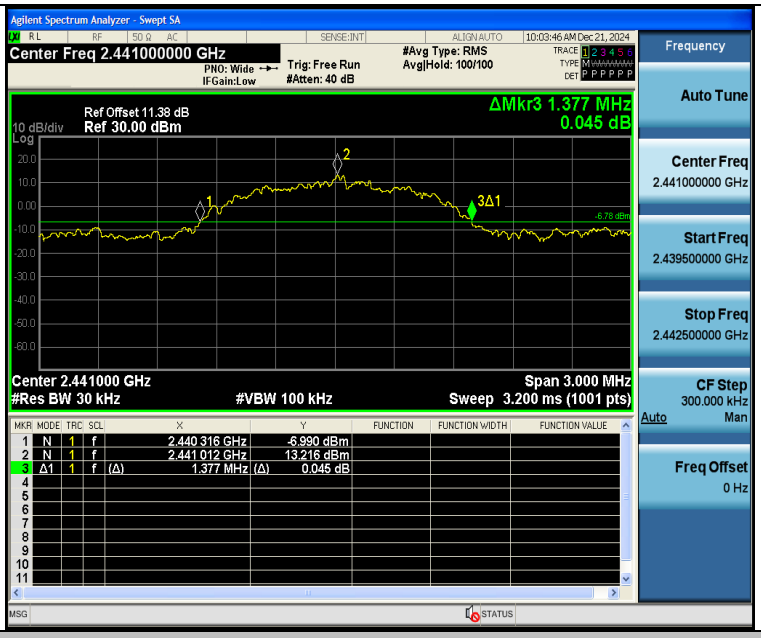
2DH5-Ant2-2441



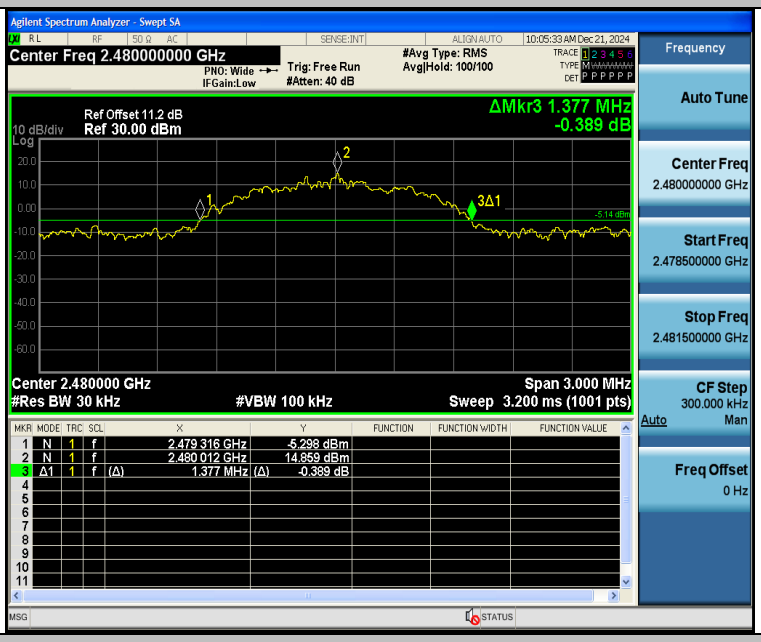
2DH5-Ant2-2480



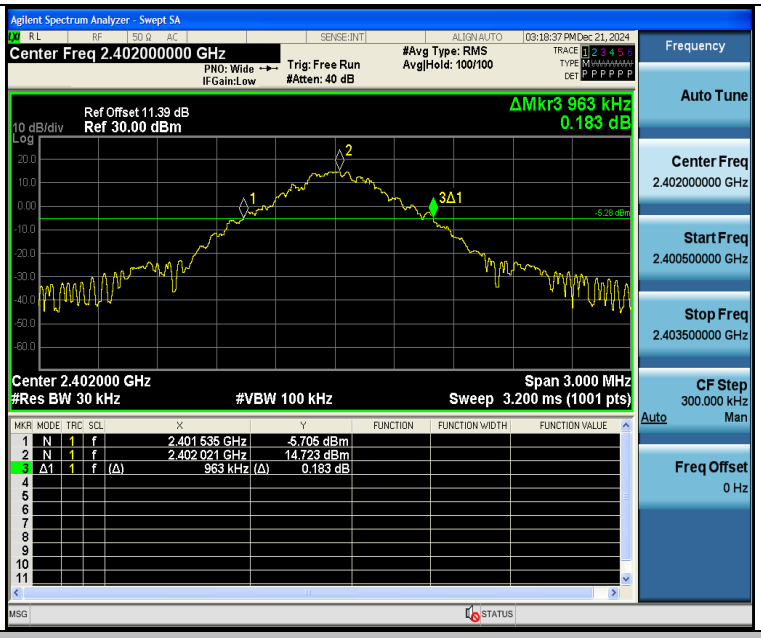
3DH5-Ant2-2402



3DH5-Ant2-2441

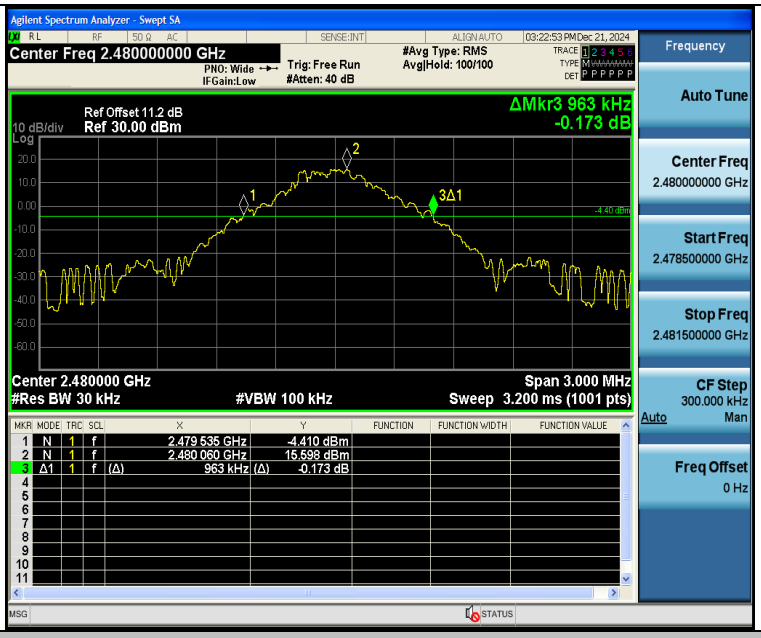


3DH5-Ant2-2480

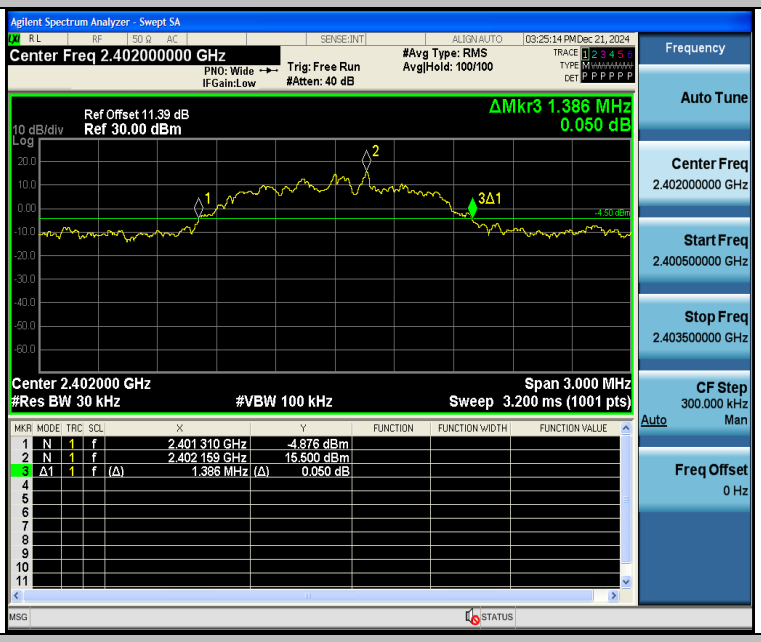


DH5-Ant3-2402

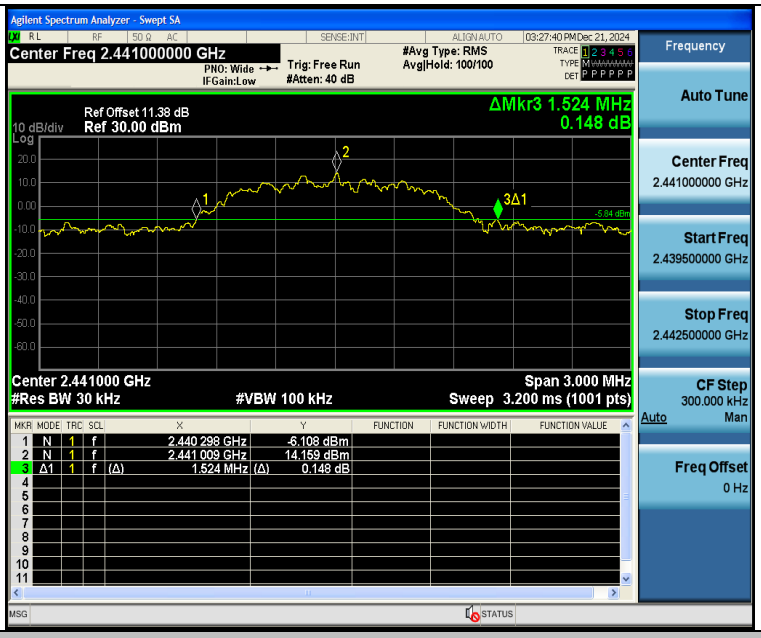
DH5-Ant3-2441



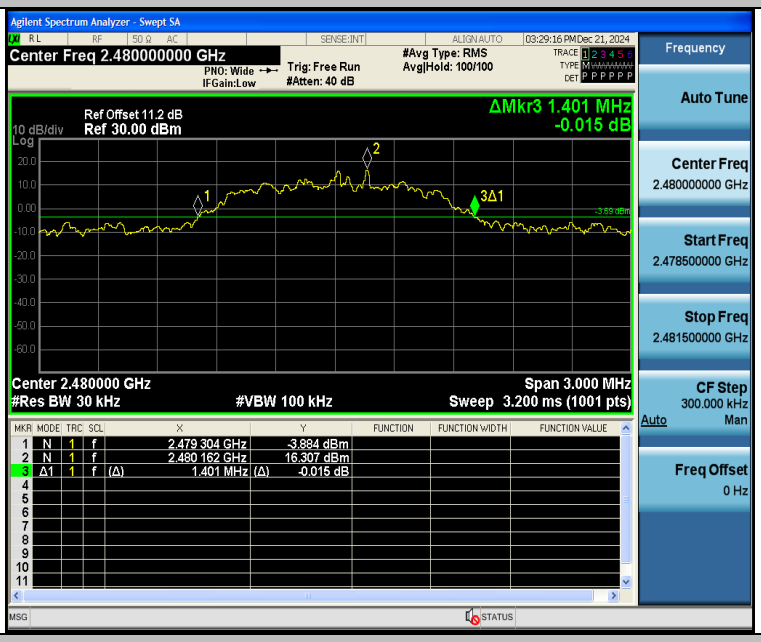
DH5-Ant3-2480



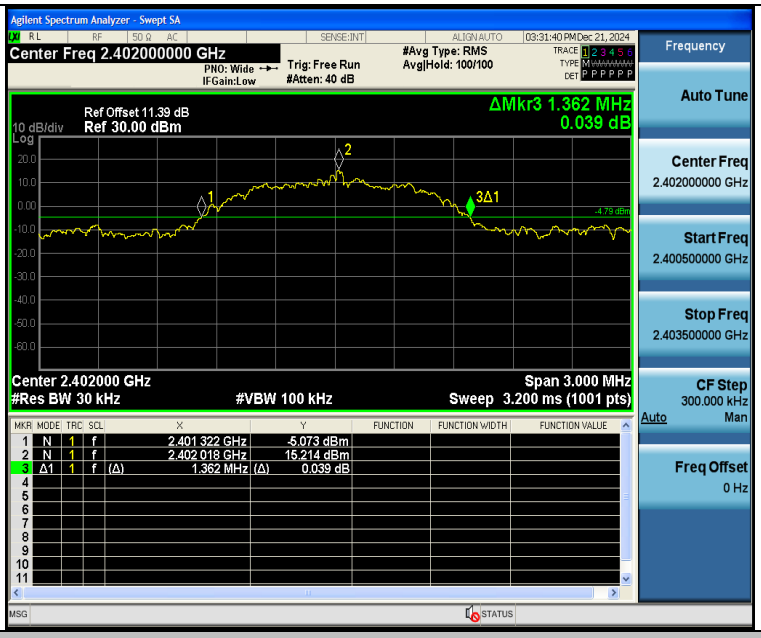
2DH5-Ant3-2402



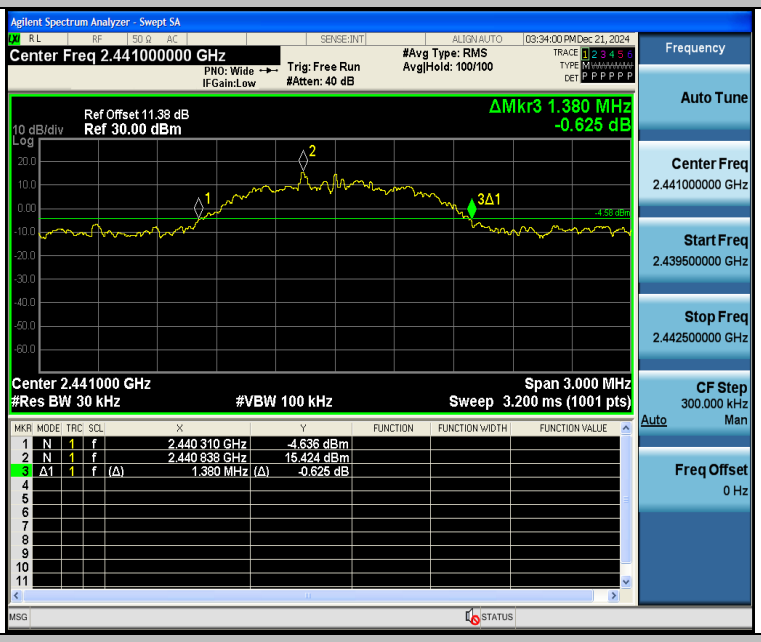
2DH5-Ant3-2441



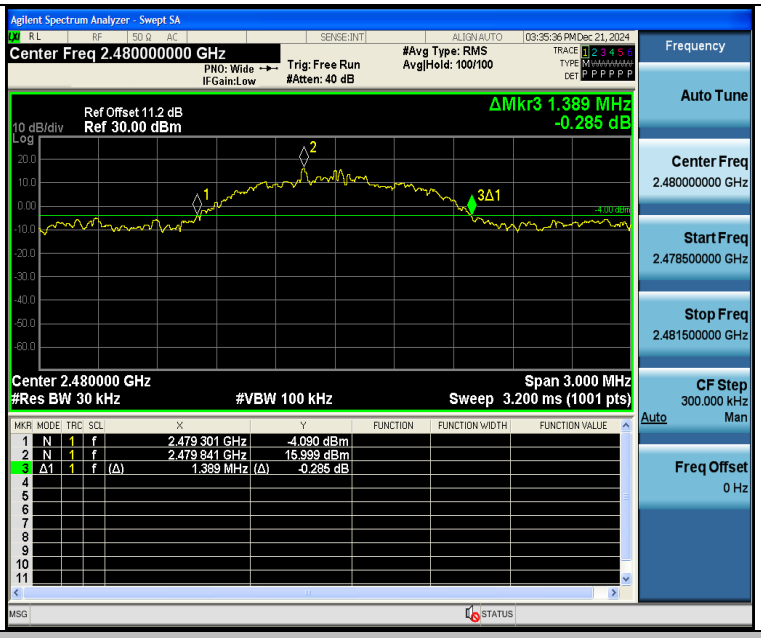
2DH5-Ant3-2480



3DH5-Ant3-2402

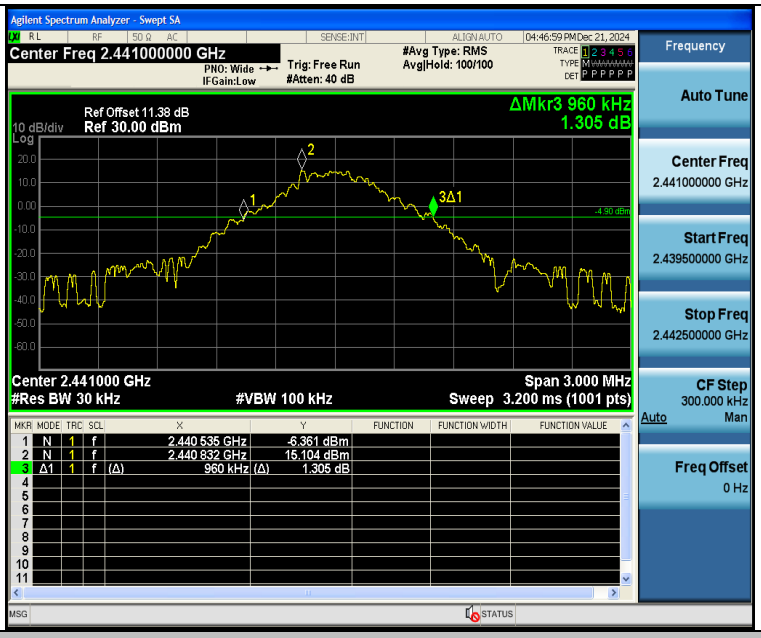


3DH5-Ant3-2441

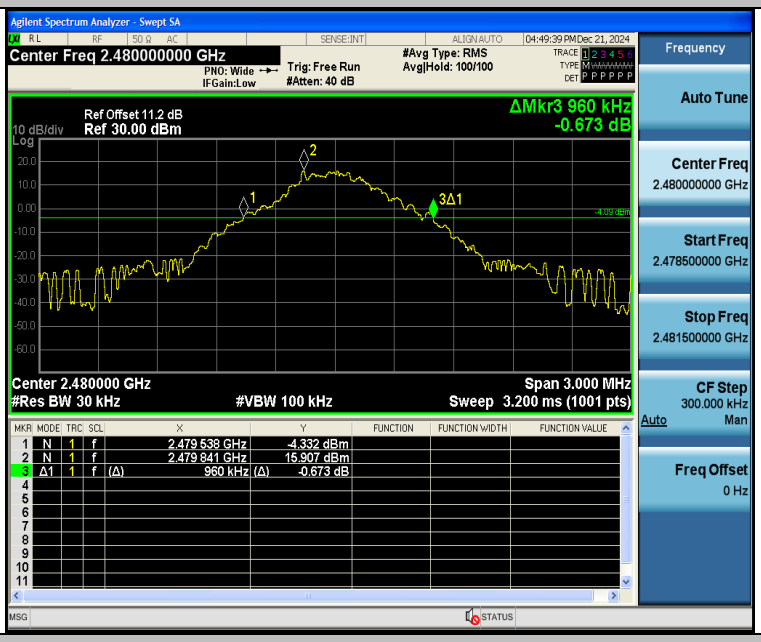


3DH5-Ant3-2480

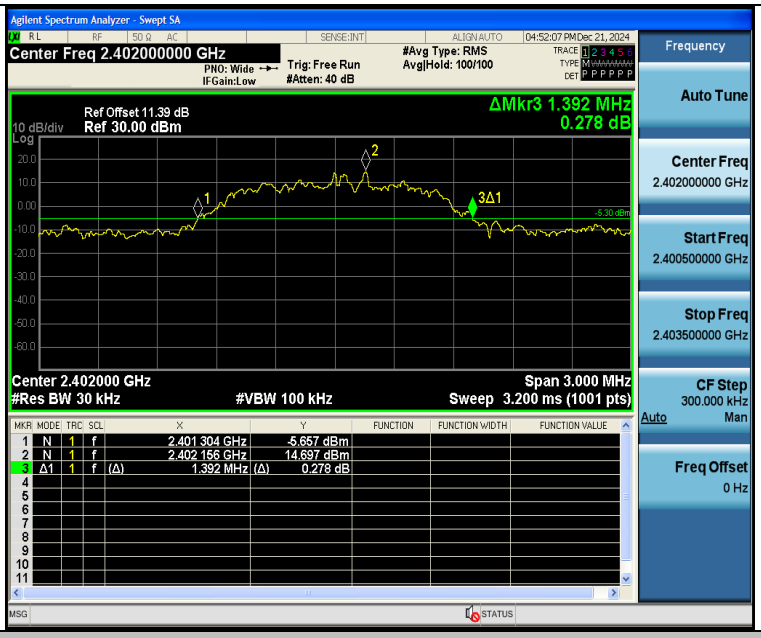
DH5-Ant4-2402



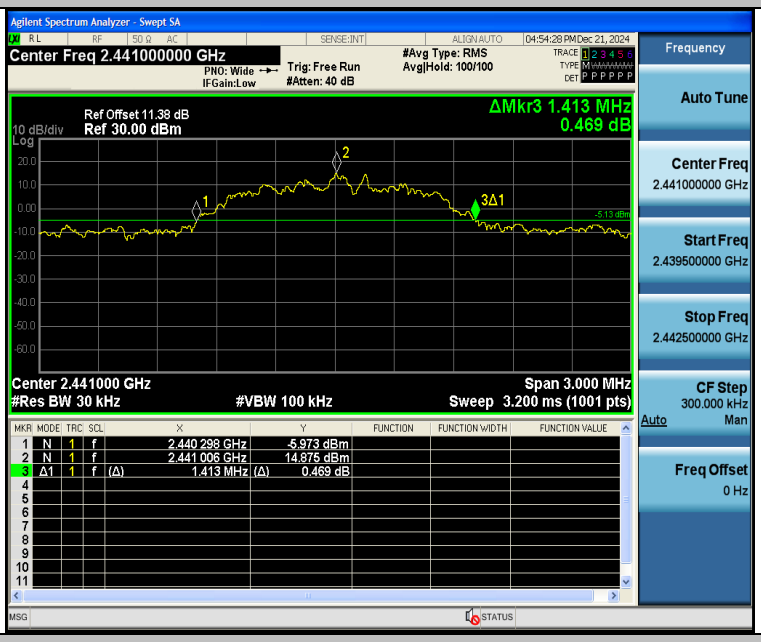
DH5-Ant4-2441



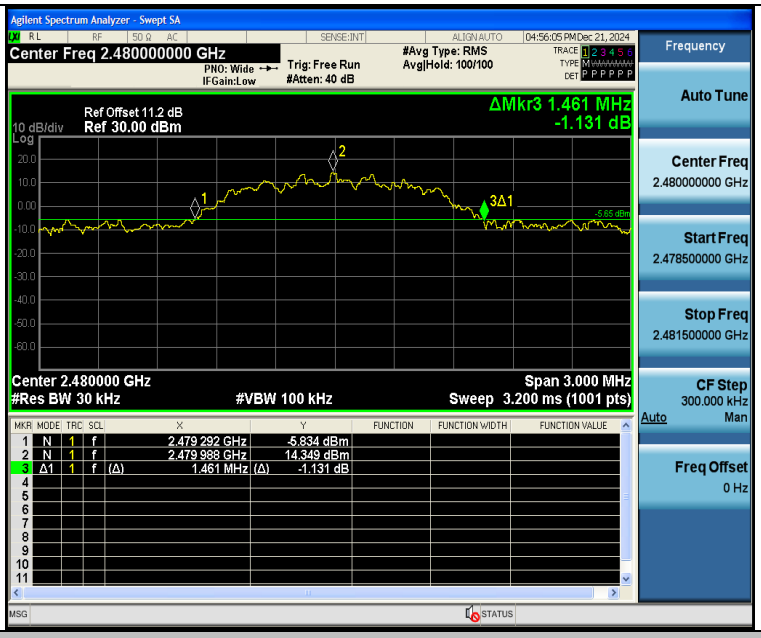
DH5-Ant4-2480



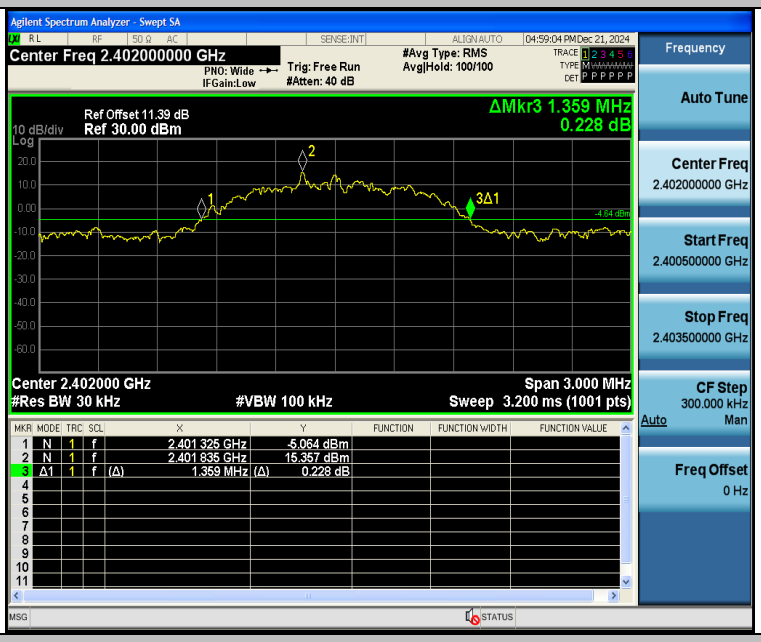
2DH5-Ant4-2402



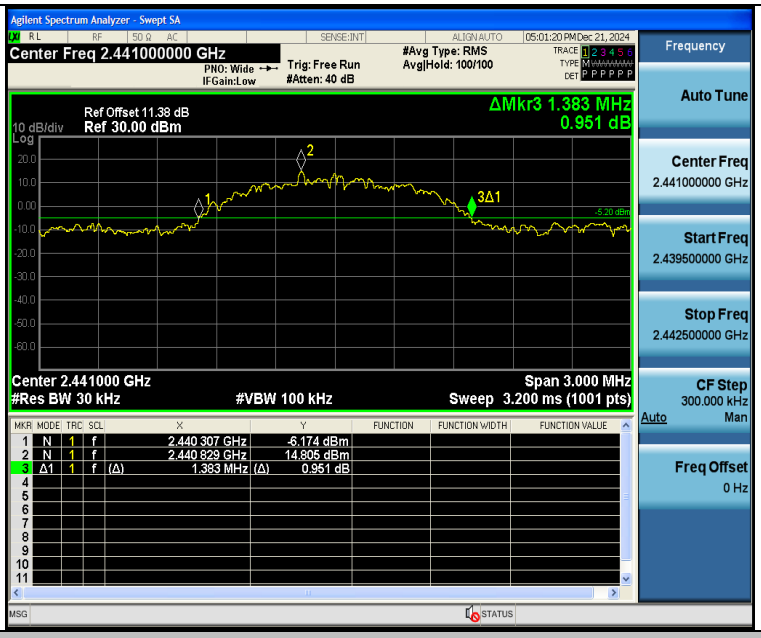
2DH5-Ant4-2441



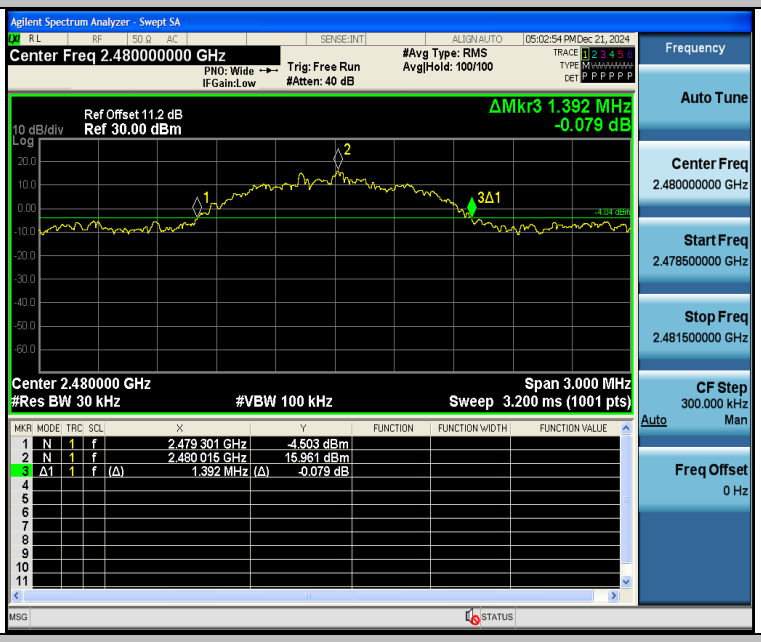
2DH5-Ant4-2480



3DH5-Ant4-2402



3DH5-Ant4-2441



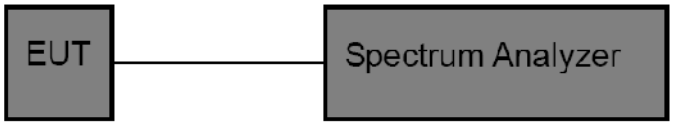
3DH5-Ant4-2480

10 Carrier Frequency Separation Test

10.1 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

10.2 Test Setup



10.3 Test Procedure

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

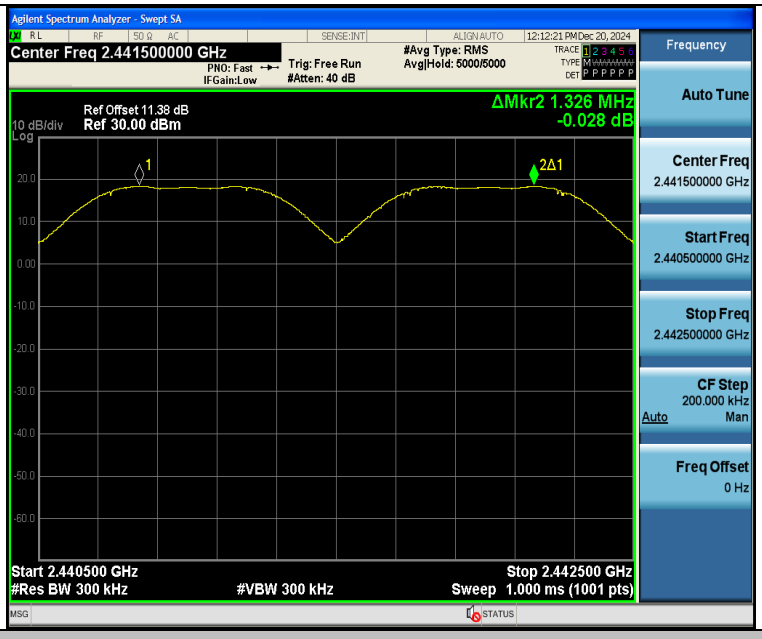
1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 300 kHz.
3. Set the VBW = 300 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

10.4 Test Data

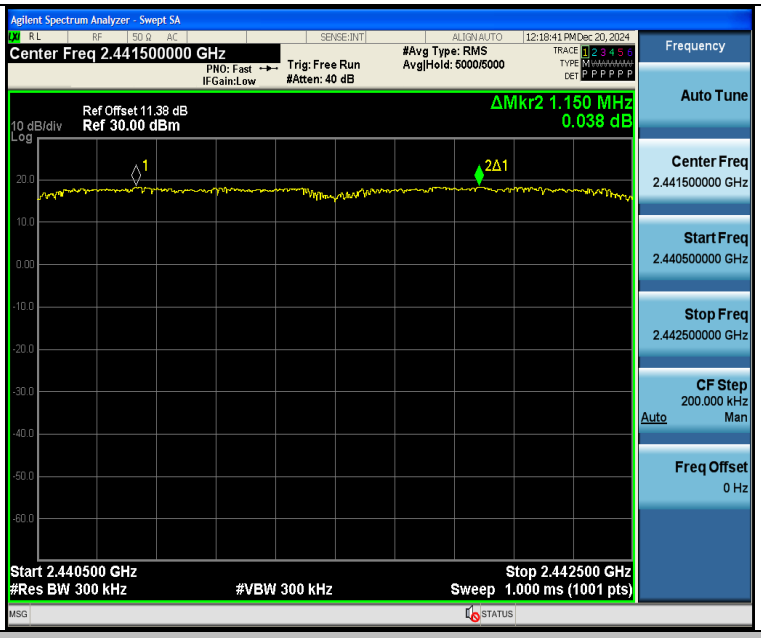
Test Item	:	Frequency Separation	Test Mode	:	CH Low ~ CH High
Test Voltage	:	AC 120V	Temperature	:	24.5℃
Test Result	:	PASS	Humidity	:	55%RH

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	1.326	≥0.957	PASS
2DH5	Ant1	Hop	1.15	≥0.952	PASS
3DH5	Ant1	Hop	0.994	≥0.970	PASS
DH5	Ant2	Hop	0.68	≥0.642	PASS
2DH5	Ant2	Hop	0.982	≥0.954	PASS
3DH5	Ant2	Hop	1.014	≥0.918	PASS
DH5	Ant3	Hop	1.004	≥0.963	PASS
2DH5	Ant3	Hop	1.026	≥1.016	PASS
3DH5	Ant3	Hop	0.998	≥0.926	PASS
DH5	Ant4	Hop	0.99	≥0.960	PASS
2DH5	Ant4	Hop	1.34	≥0.974	PASS
3DH5	Ant4	Hop	0.998	≥0.928	PASS

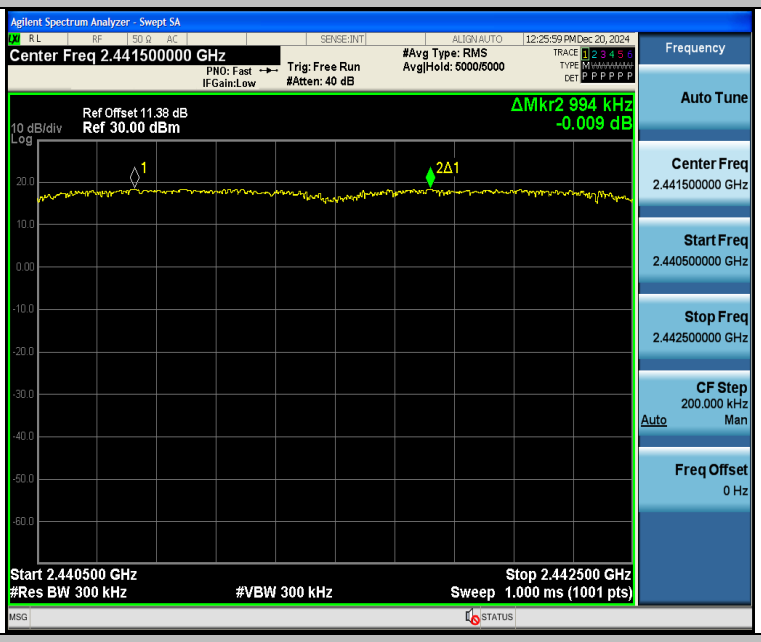
Test Graphs:



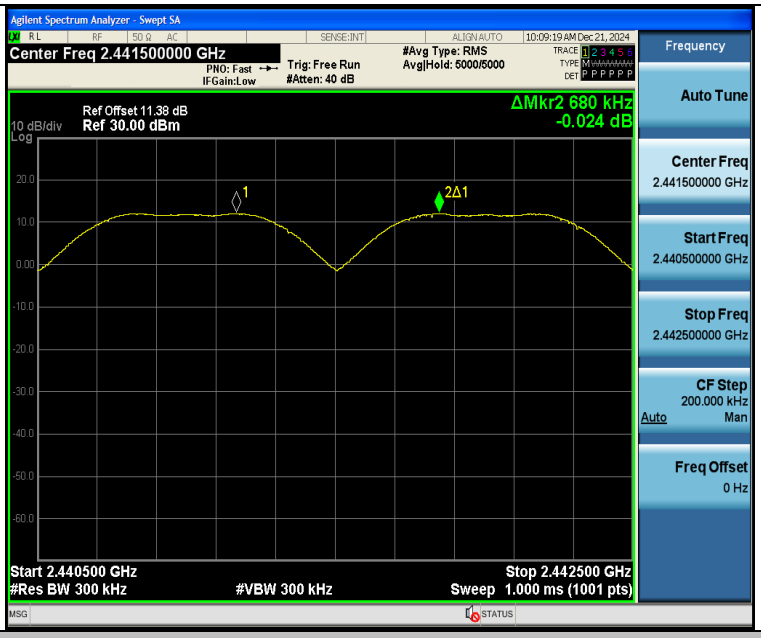
DH5-Ant1-Hop-PASS



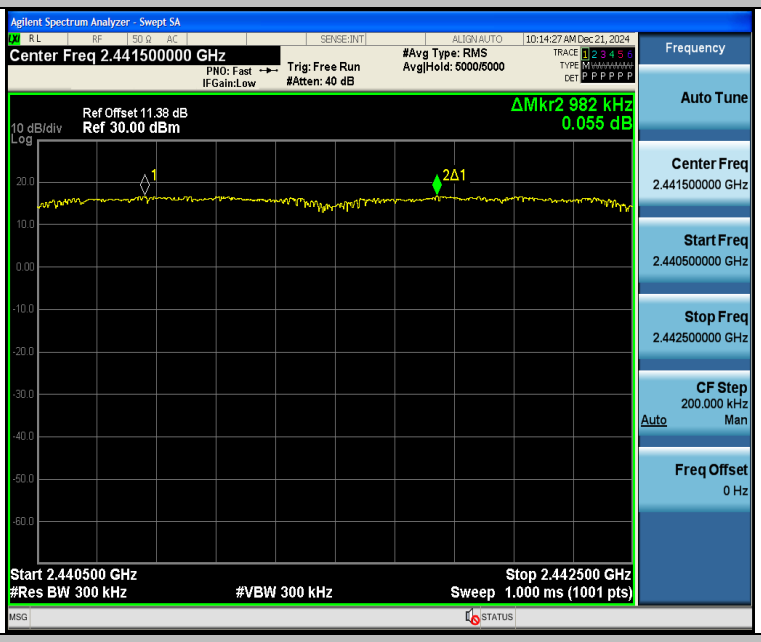
2DH5-Ant1-Hop-PASS



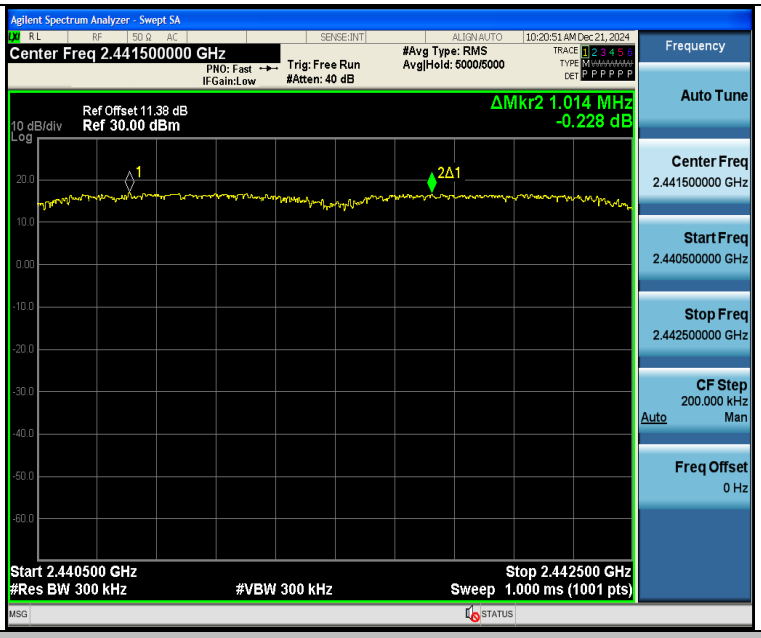
3DH5-Ant1-Hop-PASS



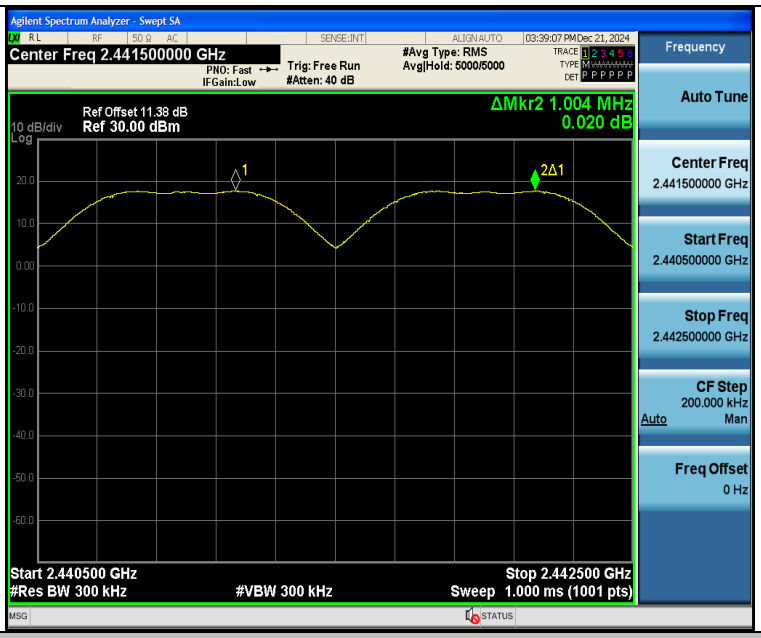
DH5-Ant2-Hop-PASS



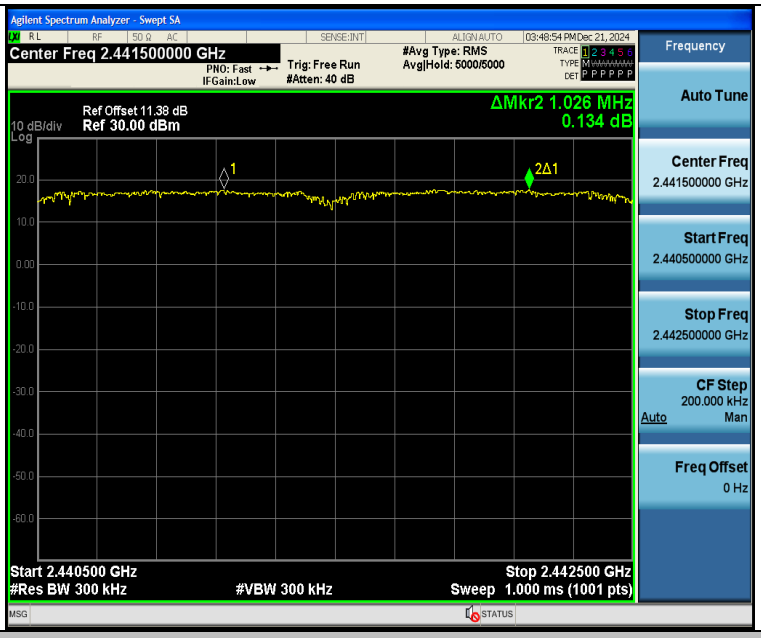
2DH5-Ant2-Hop-PASS



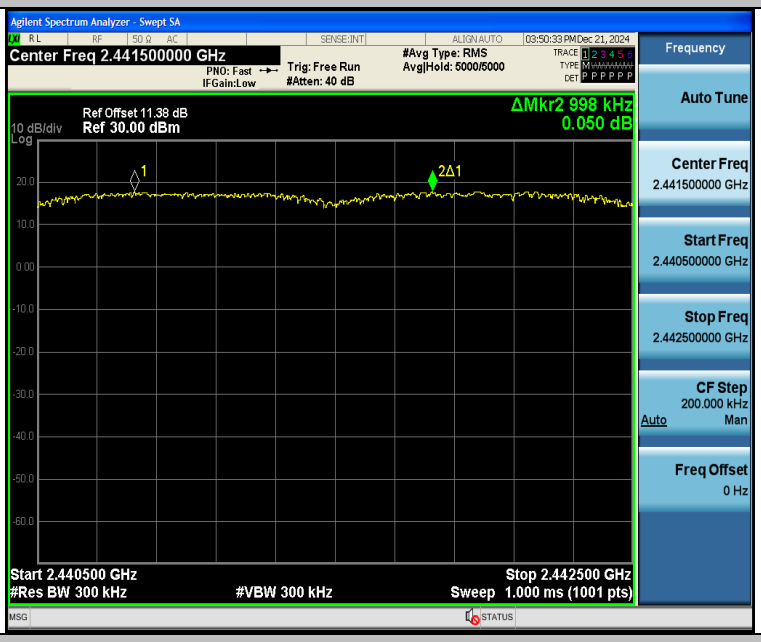
3DH5-Ant2-Hop-PASS



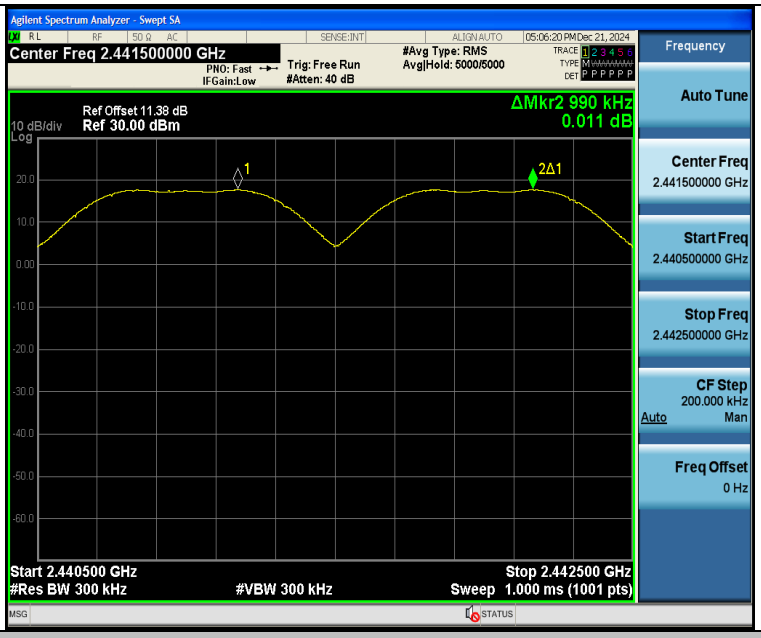
DH5-Ant3-Hop-PASS



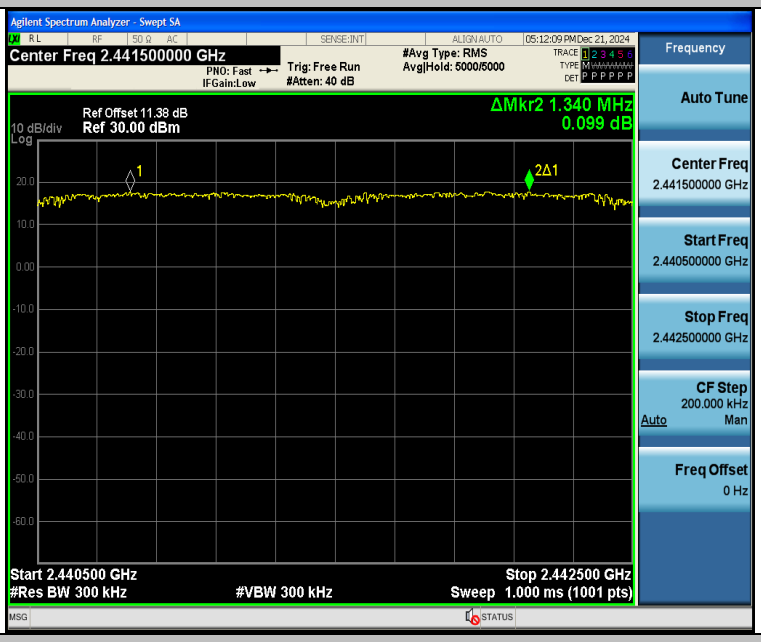
2DH5-Ant3-Hop-PASS



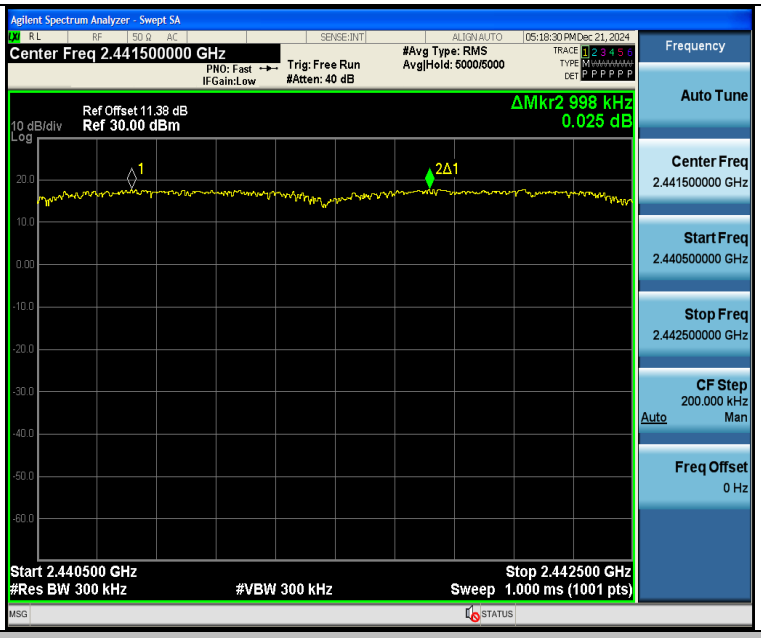
3DH5-Ant3-Hop-PASS



DH5-Ant4-Hop-PASS



2DH5-Ant4-Hop-PASS



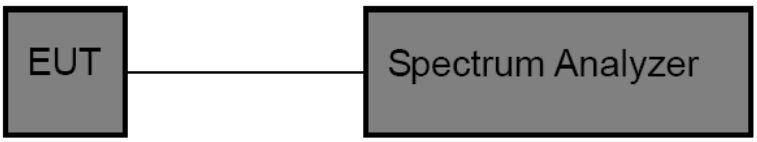
3DH5-Ant4-Hop-PASS

11 Number of Hopping Channel Test

11.1 Test Standard and Limit

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

11.2 Test Setup



11.3 Test Procedure

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

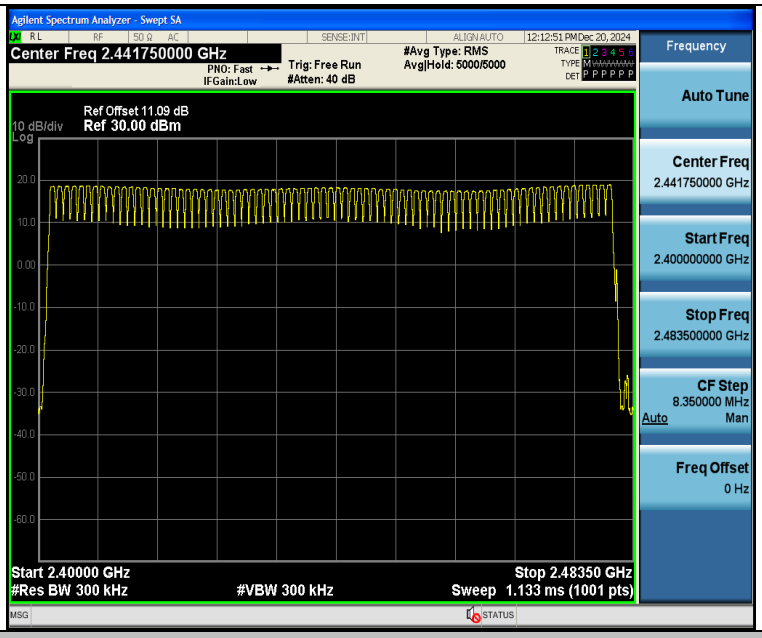
1. Span= the frequency band of operation
2. Set the RBW = 300kHz.
3. Set the VBW = 300kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

11.4 Test Data

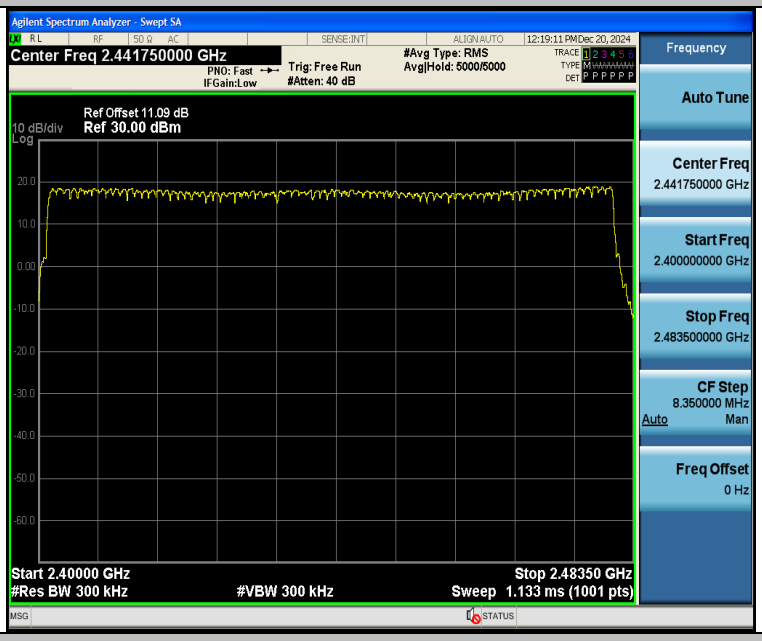
Test Item	:	Number of Hopping Frequency	Test Mode	:	CH Low ~ CH High
Test Voltage	:	AC 120V	Temperature	:	24.5℃
Test Result	:	PASS	Humidity	:	55%RH

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
DH5	Ant2	Hop	79	≥15	PASS
2DH5	Ant2	Hop	79	≥15	PASS
3DH5	Ant2	Hop	79	≥15	PASS
DH5	Ant3	Hop	79	≥15	PASS
2DH5	Ant3	Hop	79	≥15	PASS
3DH5	Ant3	Hop	79	≥15	PASS
DH5	Ant4	Hop	79	≥15	PASS
2DH5	Ant4	Hop	79	≥15	PASS
3DH5	Ant4	Hop	79	≥15	PASS

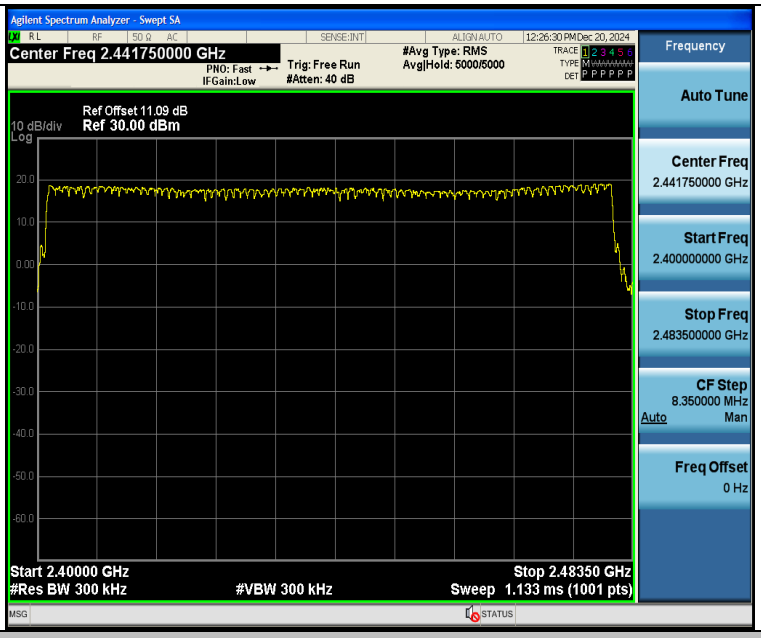
Test Graphs:



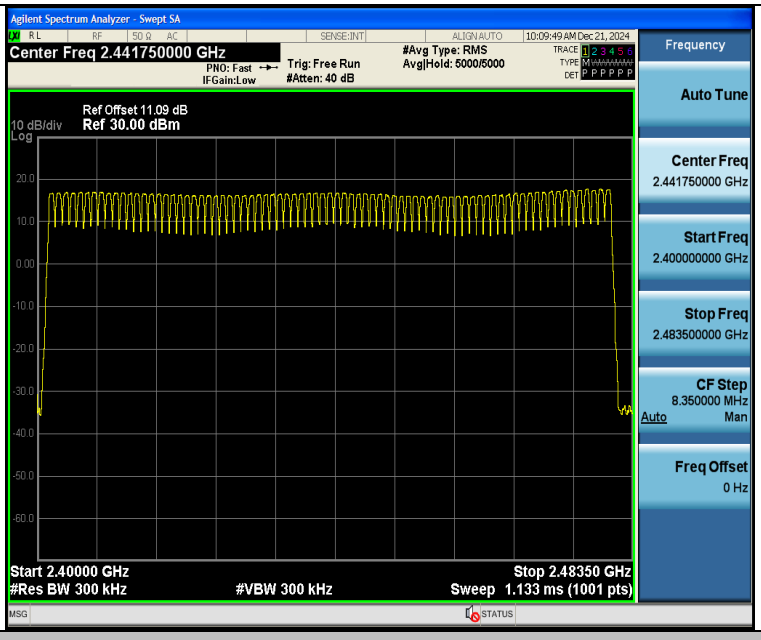
DH5-Ant1-Hop-PASS



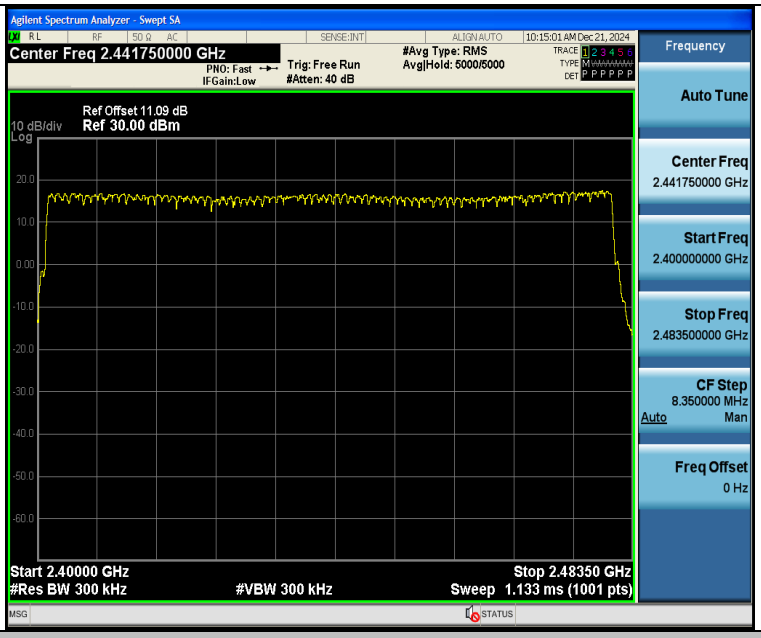
2DH5-Ant1-Hop-PASS



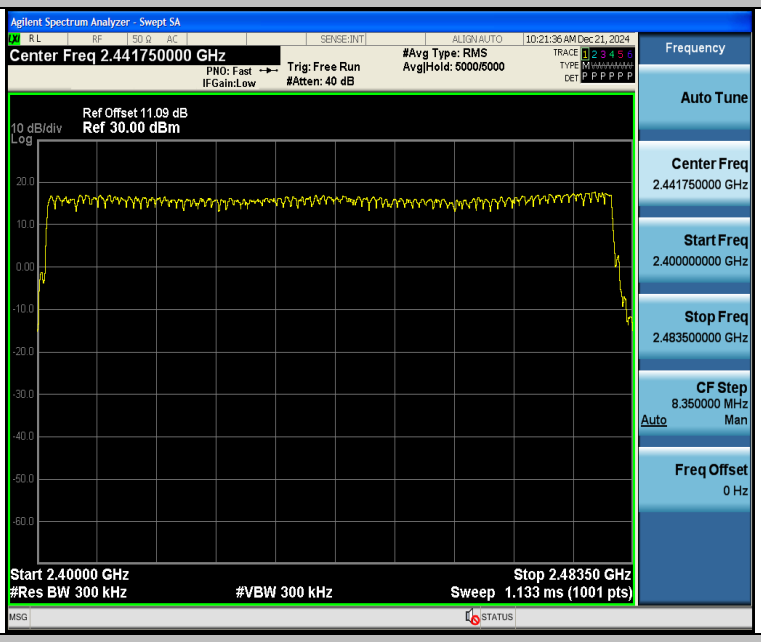
3DH5-Ant1-Hop-PASS



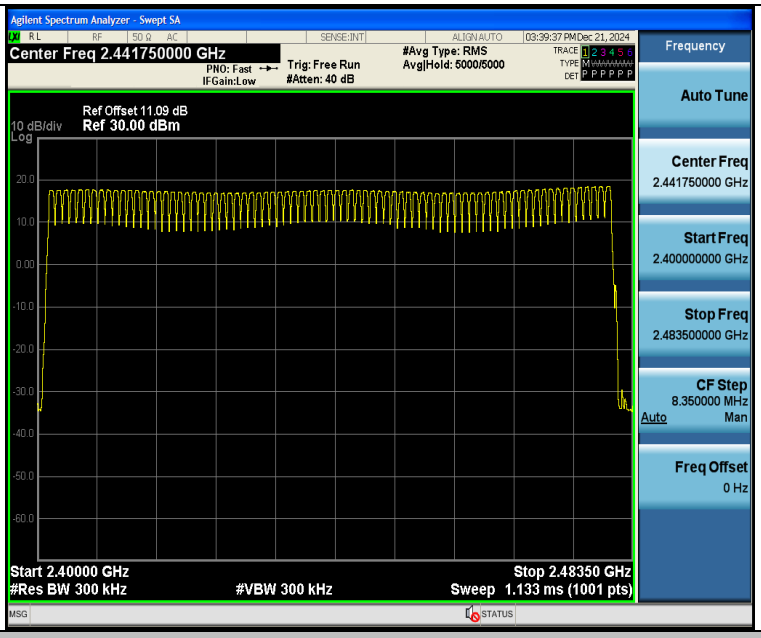
DH5-Ant2-Hop-PASS



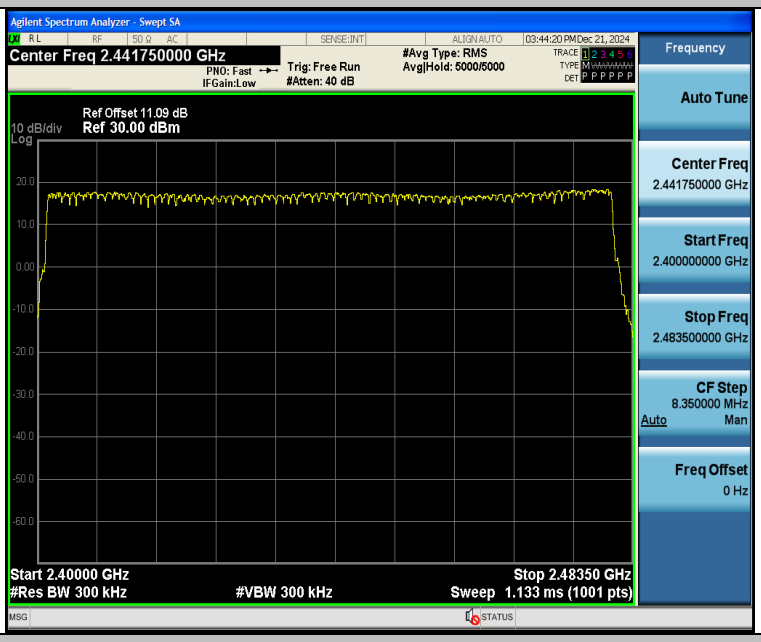
2DH5-Ant2-Hop-PASS



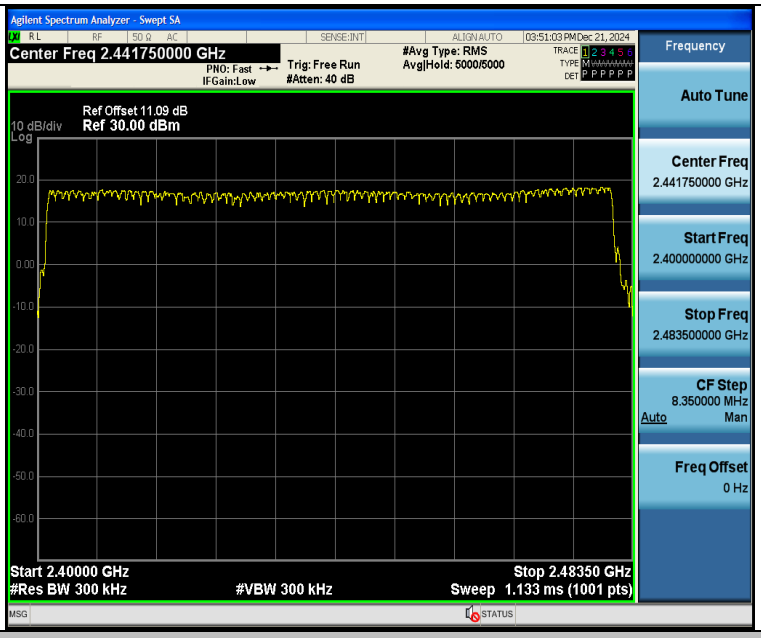
3DH5-Ant2-Hop-PASS



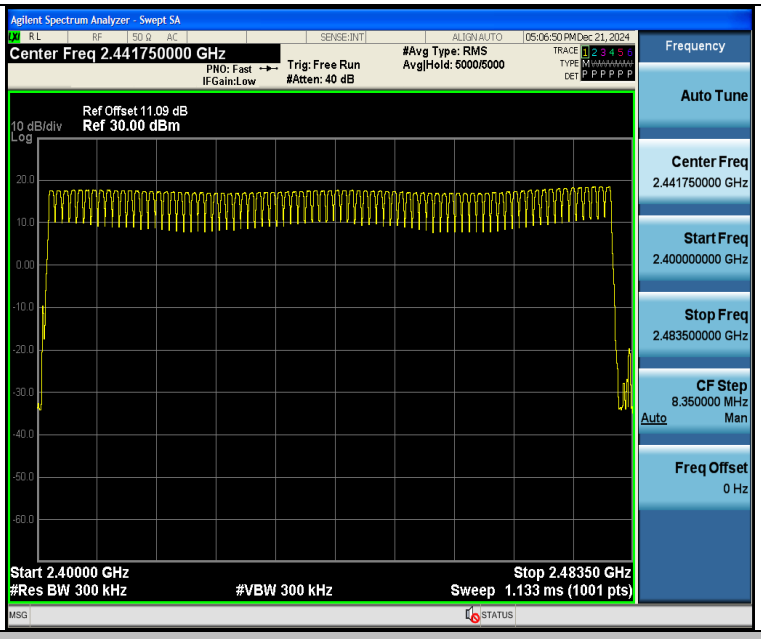
DH5-Ant3-Hop-PASS



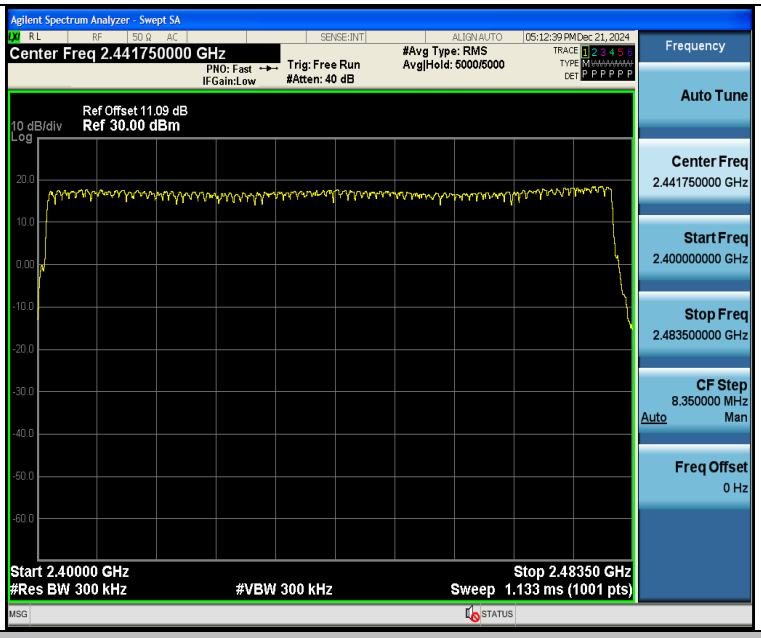
2DH5-Ant3-Hop-PASS



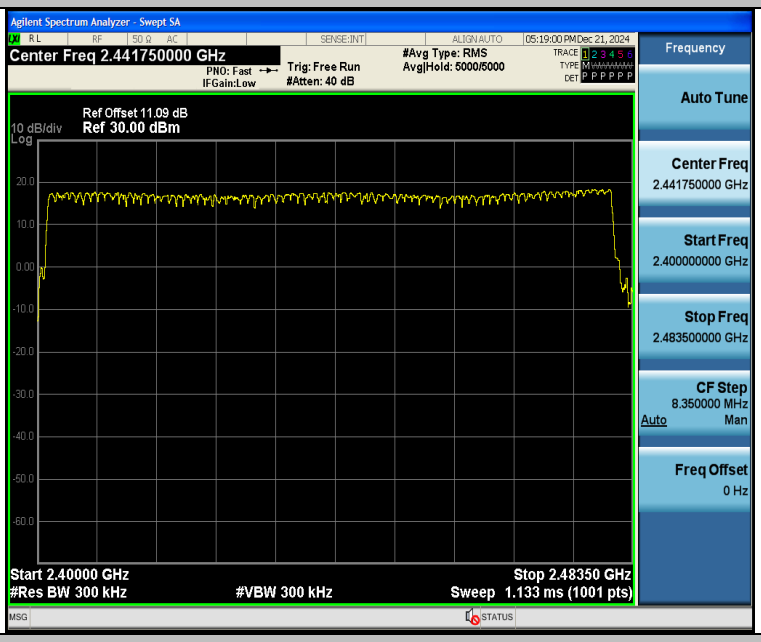
3DH5-Ant3-Hop-PASS



DH5-Ant4-Hop-PASS



2DH5-Ant4-Hop-PASS



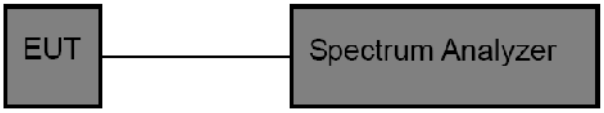
3DH5-Ant4-Hop-PASS

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 = 3 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

Test Item	:	Time of Occupancy	Test Mode	:	CH Low ~ CH High
Test Voltage	:	AC 120V	Temperature	:	24.5℃
Test Result	:	PASS	Humidity	:	55%RH

TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH5	Ant1	Hop	2.893	106.67	0.309	≤0.4	PASS
2DH5	Ant1	Hop	2.899	106.67	0.309	≤0.4	PASS
3DH5	Ant1	Hop	2.902	106.67	0.31	≤0.4	PASS
DH1	Ant1	Hop	0.389	320	0.124	≤0.4	PASS
2DH1	Ant1	Hop	0.399	320	0.128	≤0.4	PASS
3DH1	Ant1	Hop	0.399	320	0.128	≤0.4	PASS
DH3	Ant1	Hop	1.645	160	0.263	≤0.4	PASS
2DH3	Ant1	Hop	1.652	160	0.264	≤0.4	PASS
3DH3	Ant1	Hop	1.650	160	0.264	≤0.4	PASS
DH5	Ant2	Hop	2.885	106.67	0.308	≤0.4	PASS
2DH5	Ant2	Hop	2.891	106.67	0.308	≤0.4	PASS
3DH5	Ant2	Hop	2.893	106.67	0.309	≤0.4	PASS
DH1	Ant2	Hop	0.381	320	0.122	≤0.4	PASS
2DH1	Ant2	Hop	0.390	320	0.125	≤0.4	PASS
3DH1	Ant2	Hop	0.390	320	0.125	≤0.4	PASS
DH3	Ant2	Hop	1.637	160	0.262	≤0.4	PASS
2DH3	Ant2	Hop	1.642	160	0.263	≤0.4	PASS
3DH3	Ant2	Hop	1.642	160	0.263	≤0.4	PASS
DH5	Ant3	Hop	2.880	106.67	0.307	≤0.4	PASS
DH5	Ant3	Hop	2.885	106.67	0.308	≤0.4	PASS
2DH5	Ant3	Hop	2.891	106.67	0.308	≤0.4	PASS
3DH5	Ant3	Hop	2.892	106.67	0.308	≤0.4	PASS
DH1	Ant3	Hop	0.381	320	0.122	≤0.4	PASS
2DH1	Ant3	Hop	0.390	320	0.125	≤0.4	PASS
3DH1	Ant3	Hop	0.391	320	0.125	≤0.4	PASS

DH3	Ant3	Hop	1.637	160	0.262	≤0.4	PASS
2DH3	Ant3	Hop	1.643	160	0.263	≤0.4	PASS
3DH3	Ant3	Hop	1.642	160	0.263	≤0.4	PASS
DH5	Ant4	Hop	-0.864	106.67	-0.092	≤0.4	PASS
2DH5	Ant4	Hop	2.891	106.67	0.308	≤0.4	PASS
3DH5	Ant4	Hop	2.893	106.67	0.309	≤0.4	PASS
DH1	Ant4	Hop	0.381	320	0.122	≤0.4	PASS
2DH1	Ant4	Hop	0.391	320	0.125	≤0.4	PASS
3DH1	Ant4	Hop	0.391	320	0.125	≤0.4	PASS
DH3	Ant4	Hop	1.637	160	0.262	≤0.4	PASS
2DH3	Ant4	Hop	1.643	160	0.263	≤0.4	PASS
3DH3	Ant4	Hop	1.642	160	0.263	≤0.4	PASS

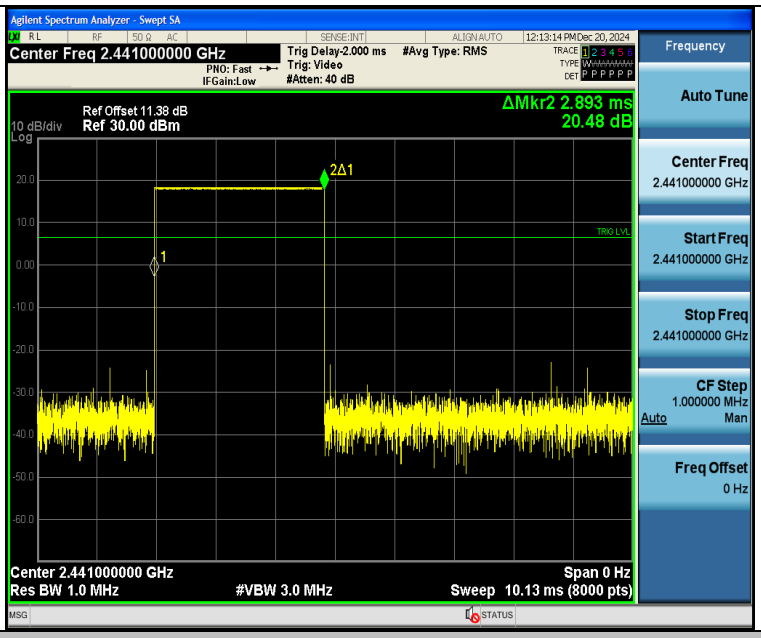
Note:

1.DH1/2DH1 Dwell Time: Reading * (1600/2)*31.6/(channel number).

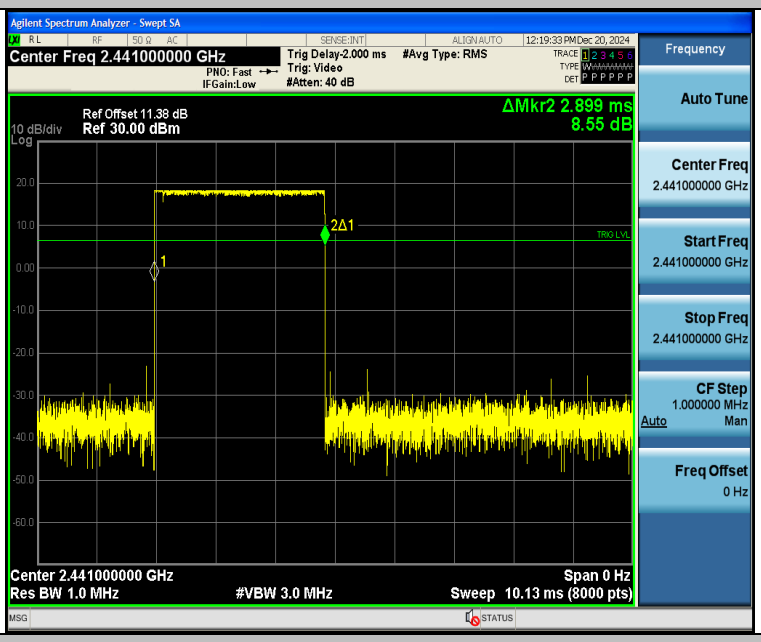
2.DH3/2DH3 Dwell Time: Reading * (1600/4)*31.6/(channel number).

3.DH5/2DH5 Dwell Time: Reading * (1600/6)*31.6/(channel number).

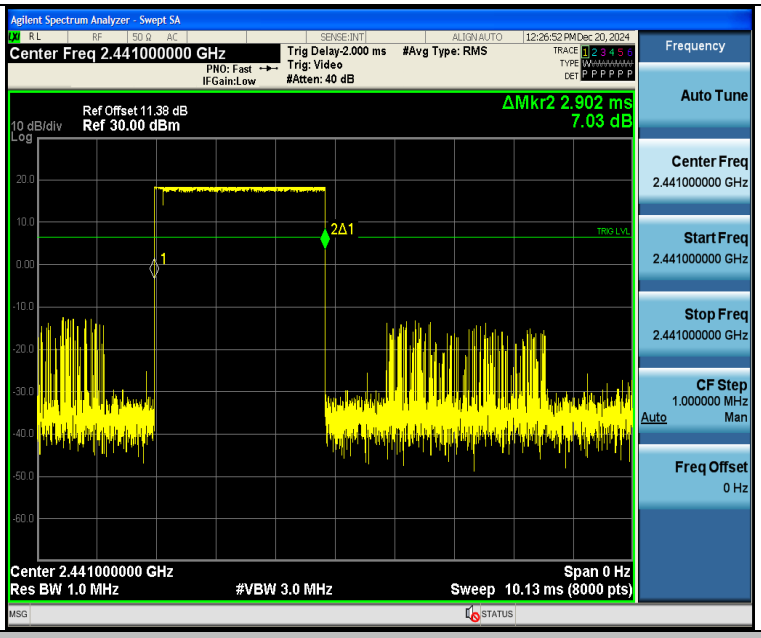
Test Graphs:



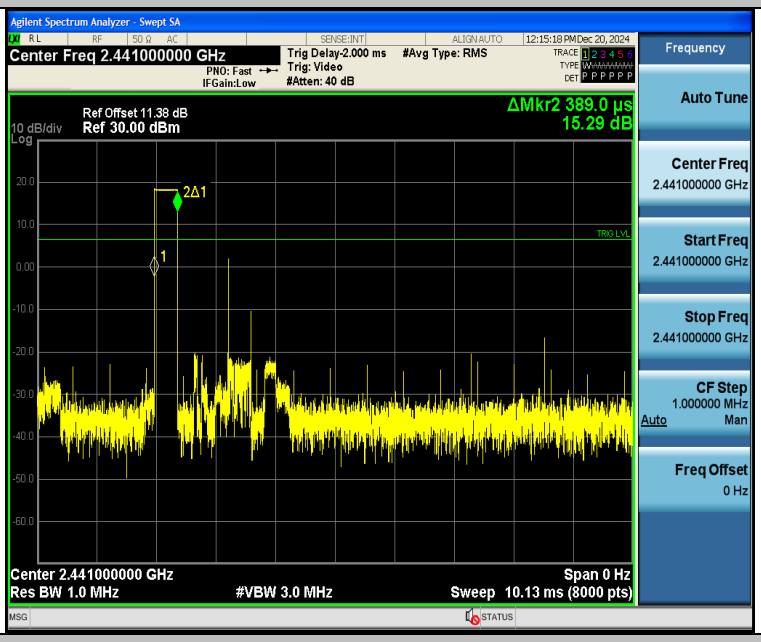
DH5-Ant1-Hop-PASS



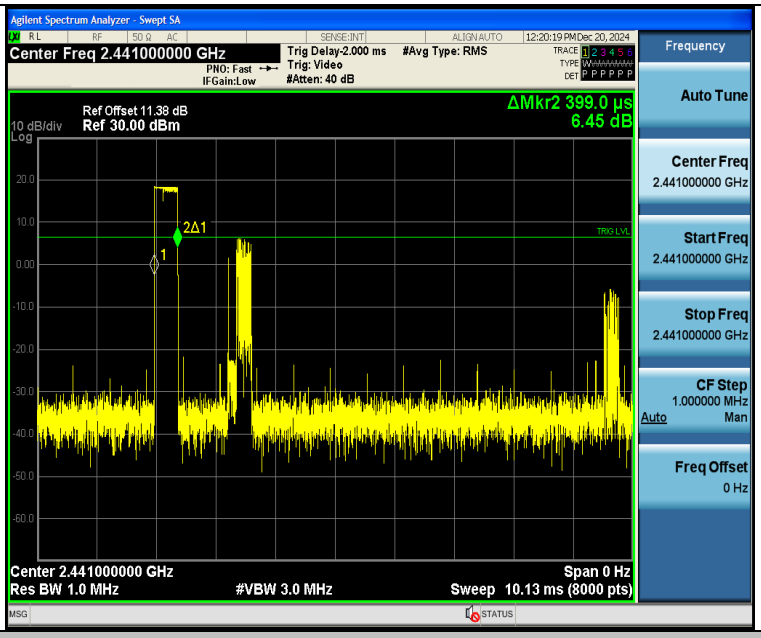
2DH5-Ant1-Hop-PASS



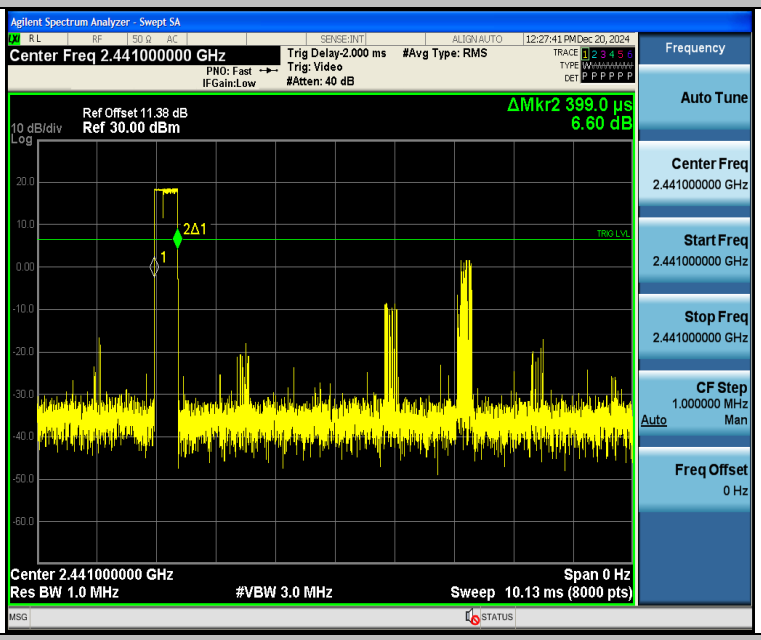
3DH5-Ant1-Hop-PASS



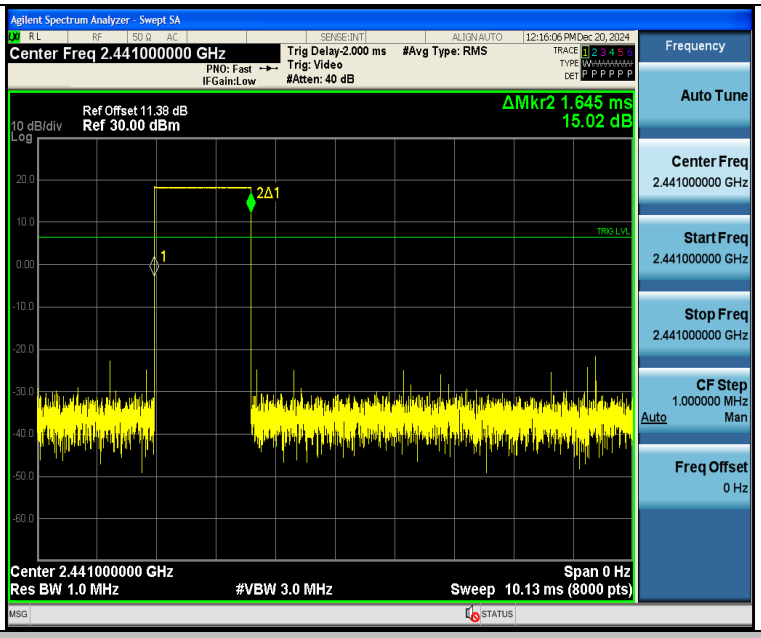
DH1-Ant1-Hop-PASS



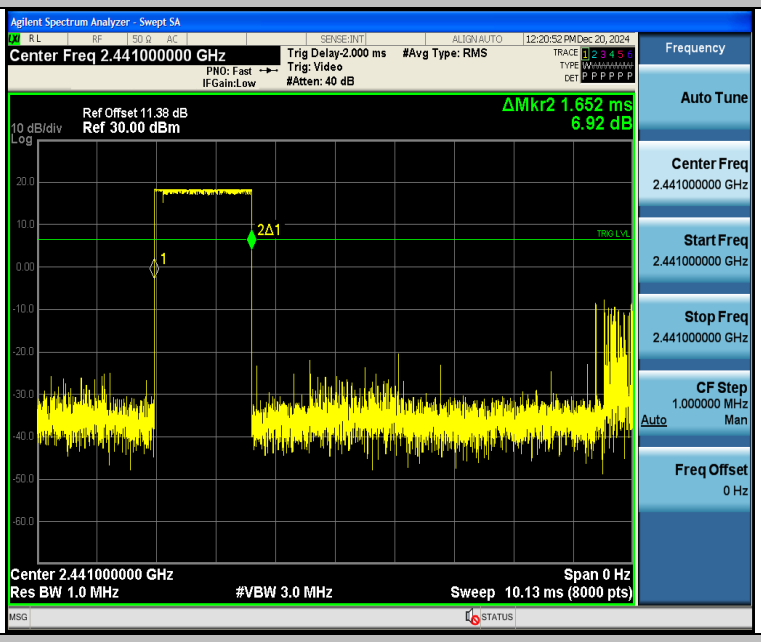
2DH1-Ant1-Hop-PASS



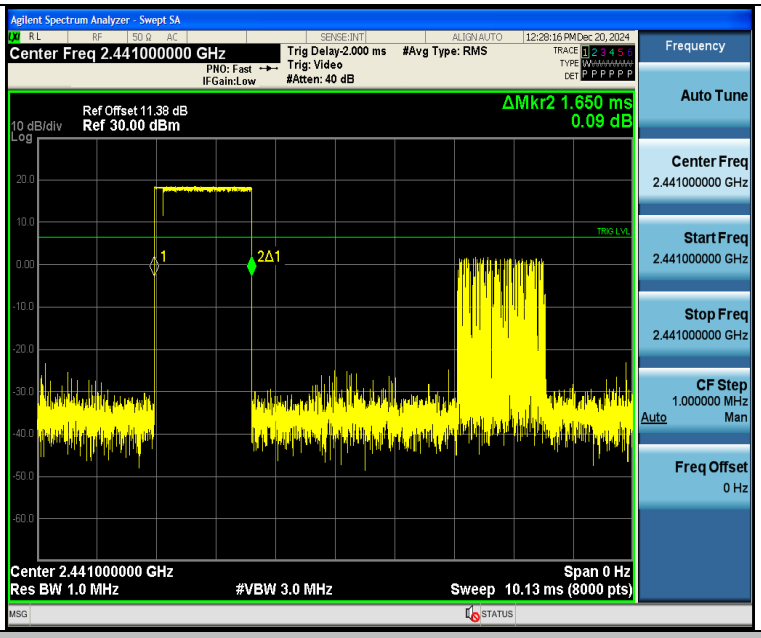
3DH1-Ant1-Hop-PASS



DH3-Ant1-Hop-PASS

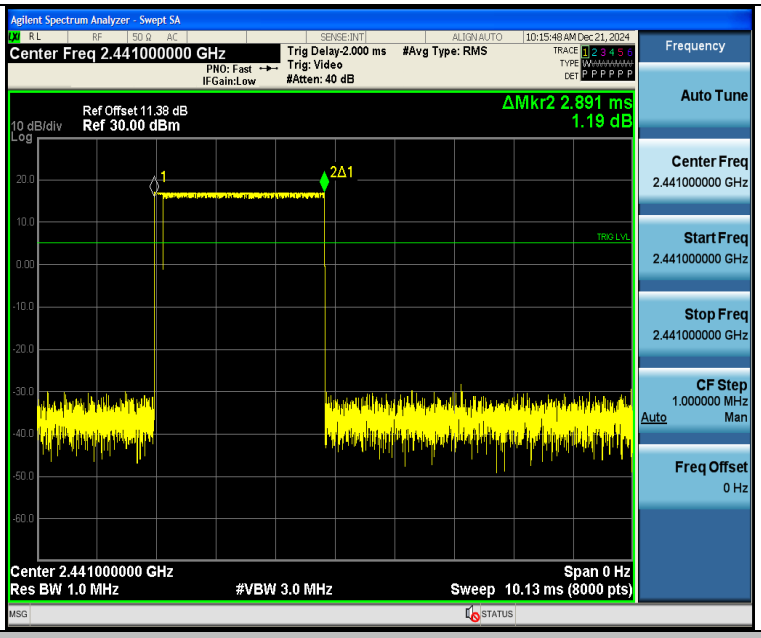


2DH3-Ant1-Hop-PASS

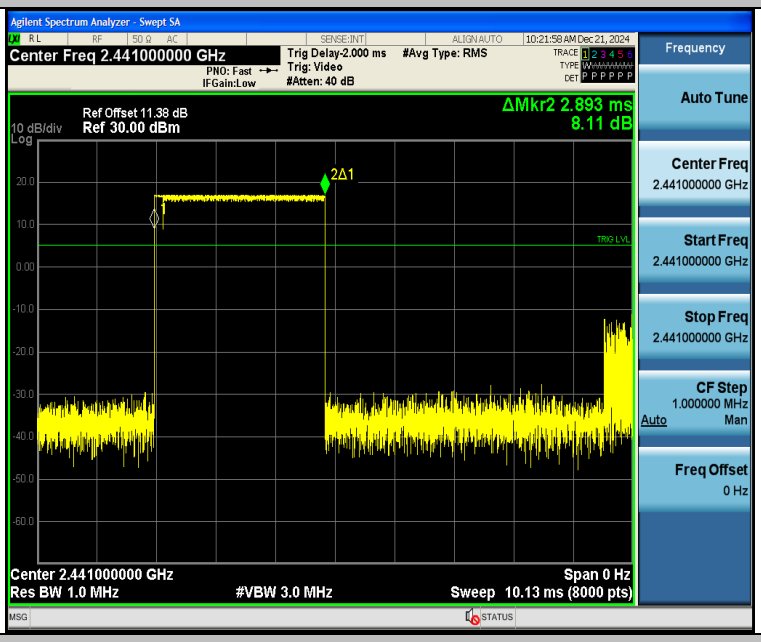


3DH3-Ant1-Hop-PASS

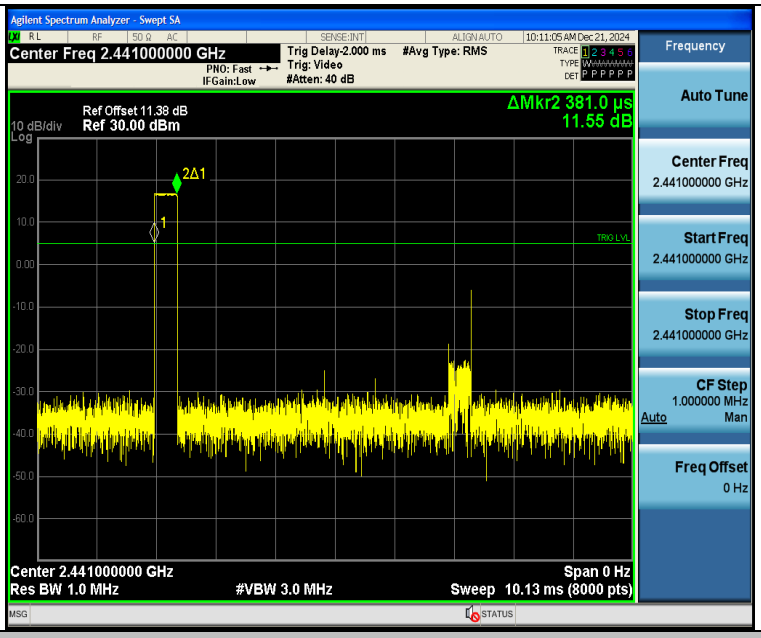
DH5-Ant2-Hop-PASS



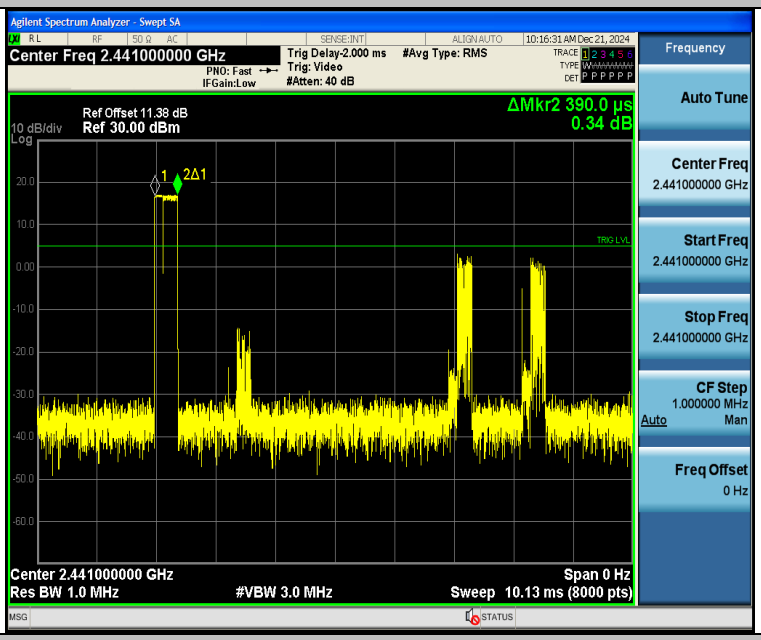
2DH5-Ant2-Hop-PASS



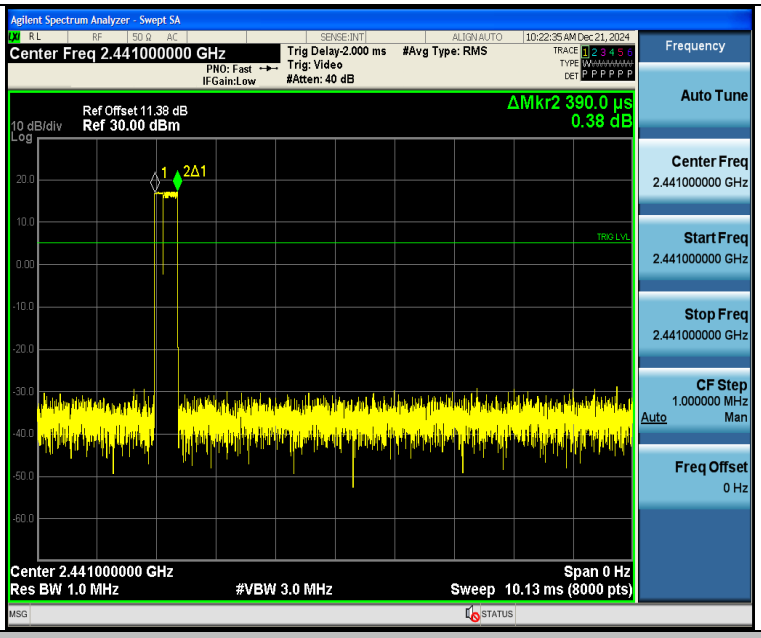
3DH5-Ant2-Hop-PASS



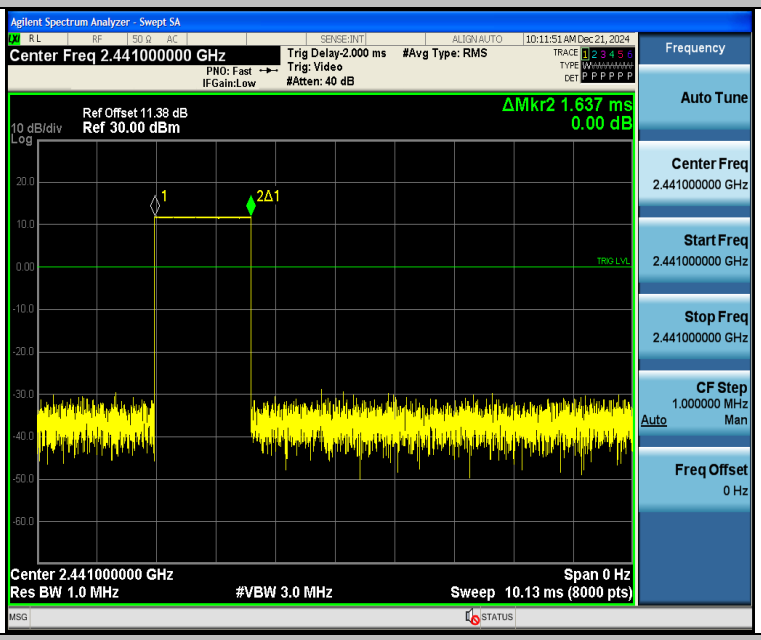
DH1-Ant2-Hop-PASS



2DH1-Ant2-Hop-PASS



3DH1-Ant2-Hop-PASS



DH3-Ant2-Hop-PASS