Appendix: Bluetooth Classic

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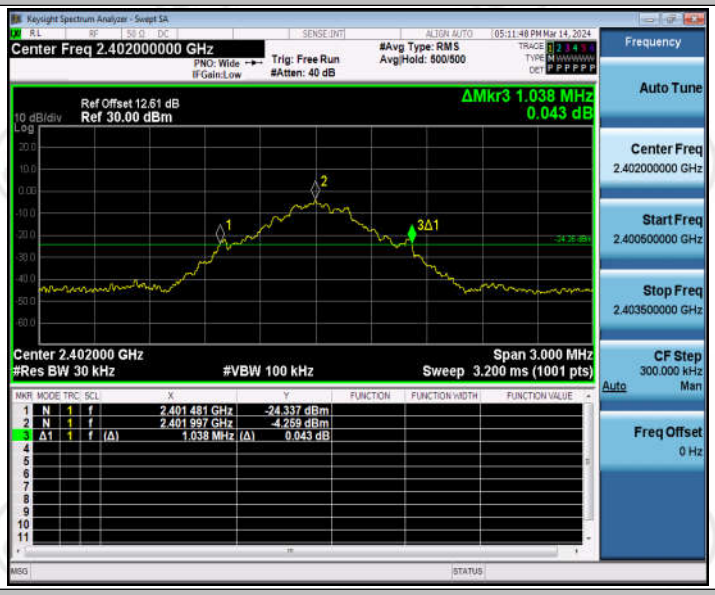
Appendix A: 20dB Emission Bandwidth

Test Result

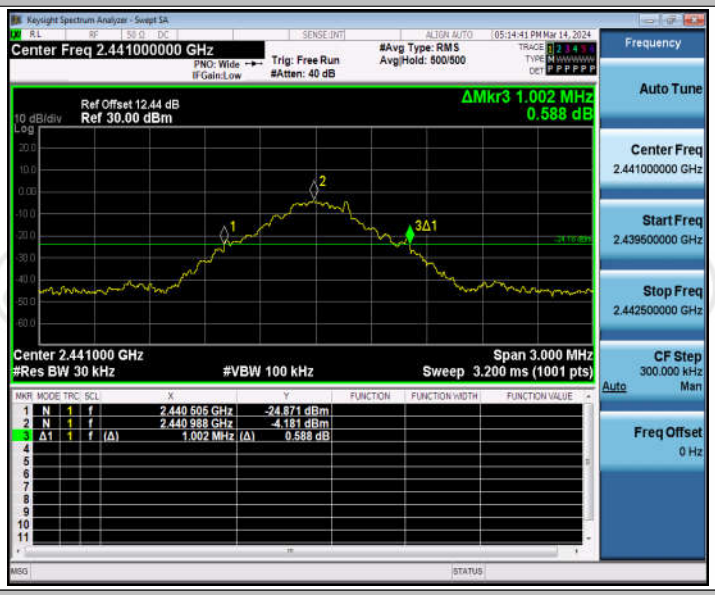
TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	1.038	2401.481	2402.519	---	---
		2441	1.002	2440.505	2441.507	---	---
		2480	1.026	2479.475	2480.501	---	---
2DH5	Ant1	2402	1.278	2401.370	2402.648	---	---
		2441	1.287	2440.367	2441.654	---	---
		2480	1.284	2479.367	2480.651	---	---
3DH5	Ant1	2402	1.293	2401.355	2402.648	---	---
		2441	1.290	2440.355	2441.645	---	---
		2480	1.296	2479.352	2480.648	---	---

Test Graphs

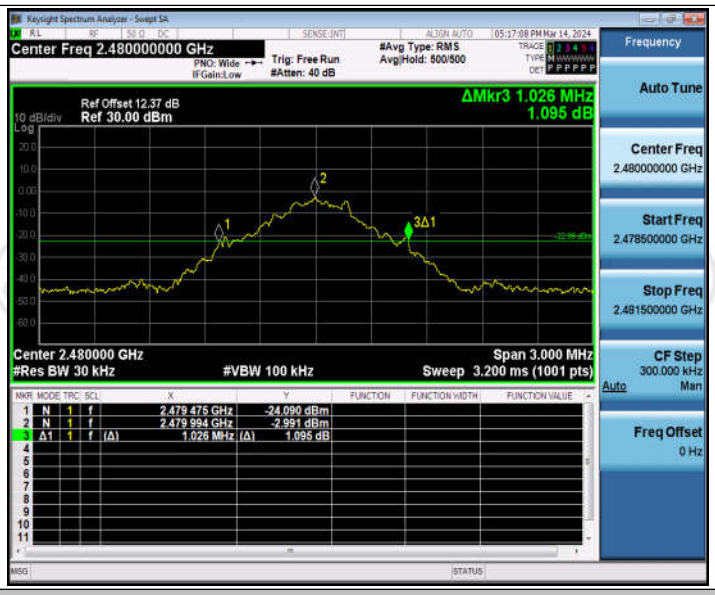
DH5_Ant1_2402



DH5_Ant1_2441

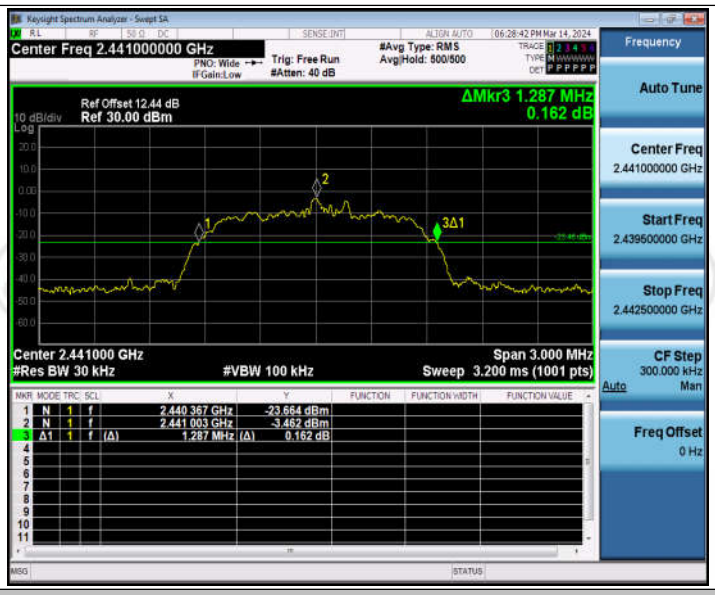


DH5_Ant1_2480

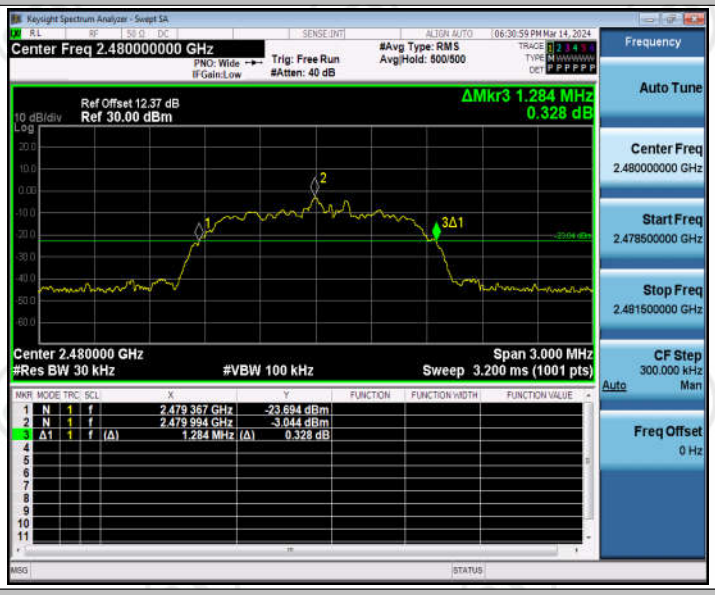


2DH5_Ant1_2402

2DH5_Ant1_2441



2DH5_Ant1_2480



3DH5_Ant1_2402

3DH5_Ant1_2441

3DH5_Ant1_2480

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 500/500
06:38:19 PM Mar 14, 2024
Frequency
Auto Tune
Ref Offset 12.37 dB
10 dB/div
Ref 30.00 dBm
ΔMkr3 1.296 MHz
0.159 dB
Center Freq
2.480000000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.481500000 GHz
Center 2.480000 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
1 N 1 f 2.479 352 GHz -23.503 dBm
2 N 1 f 2.479 997 GHz -2.995 dBm
3 Δ1 1 f (Δ) 1.296 MHz (Δ) 0.159 dB

Appendix B: Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.93333	2401.5262	2402.4596	---	---
		2441	0.89913	2440.5585	2441.4577	---	---
		2480	0.93251	2479.5306	2480.4631	---	---
2DH5	Ant1	2402	1.1722	2401.4112	2402.5834	---	---
		2441	1.1735	2440.4121	2441.5856	---	---
		2480	1.1706	2479.4130	2480.5836	---	---
3DH5	Ant1	2402	1.1873	2401.4079	2402.5952	---	---
		2441	1.1789	2440.4138	2441.5927	---	---
		2480	1.1807	2479.4125	2480.5932	---	---

Test Graphs

DH5_Ant1_2402

DH5_Ant1_2441

DH5_Ant1_2480

2DH5_Ant1_2402

2DH5_Ant1_2441

2DH5_Ant1_2480

3DH5_Ant1_2402

3DH5_Ant1_2441

3DH5_Ant1_2480

Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 500/500
#Atten: 40 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 12.37 dB
10 dB/div
Ref 30.00 dBm
Mkr1 2.479997 GHz
-3.0830 dBm
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
CF Step
300.000 kHz
Auto
Man
Occupied Bandwidth
1.1807 MHz
Total Power
5.90 dBm
Transmit Freq Error
2.889 kHz
OBW Power
99.00 %
x dB Bandwidth
1.361 MHz
x dB
-26.00 dB
Freq Offset
0 Hz

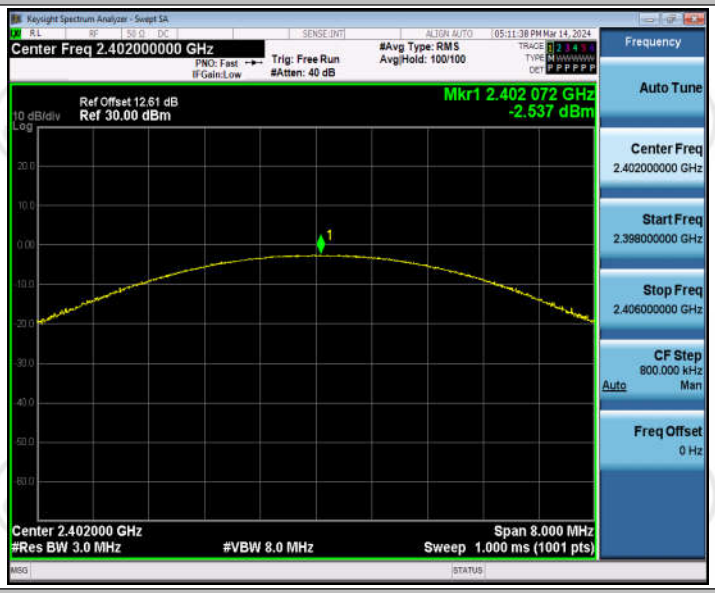
Appendix C: Maximum conducted output power

Test Result Peak

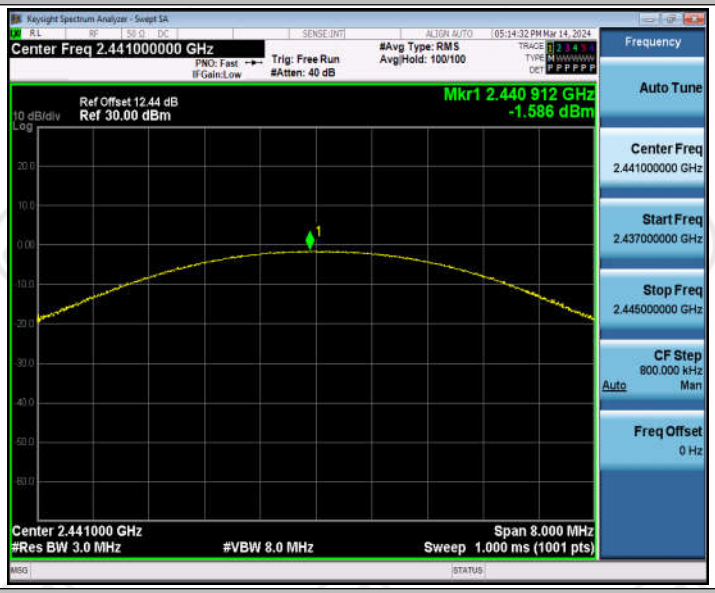
Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	Verdict
DH5	Ant1	2402	-2.54	≤30	PASS
		2441	-1.59	≤20.97	PASS
		2480	-1.44	≤20.97	PASS
2DH5	Ant1	2402	-0.85	≤30	PASS
		2441	0.49	≤20.97	PASS
		2480	0.33	≤20.97	PASS
3DH5	Ant1	2402	-0.17	≤30	PASS
		2441	1.01	≤20.97	PASS
		2480	1.03	≤20.97	PASS

Test Graphs

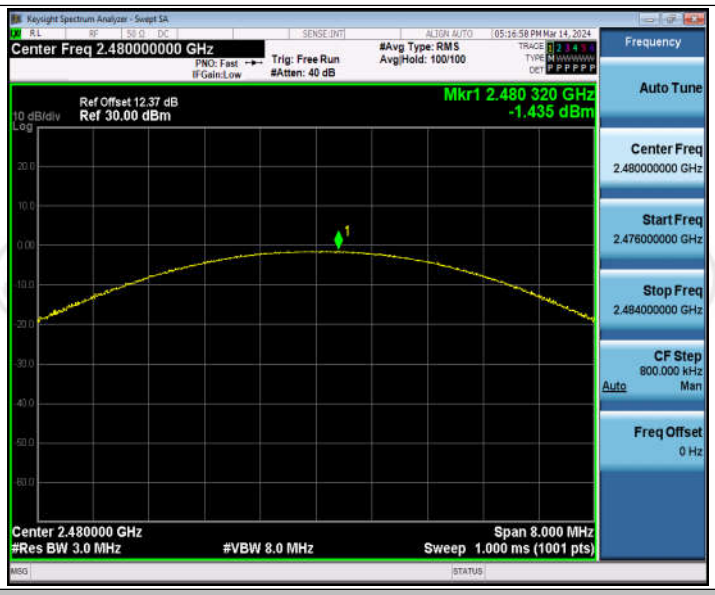
DH5_Ant1_2402



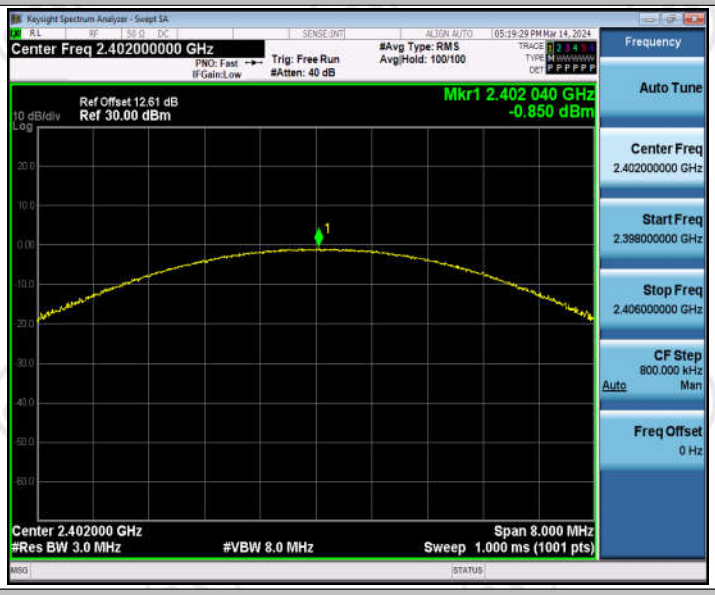
DH5_Ant1_2441



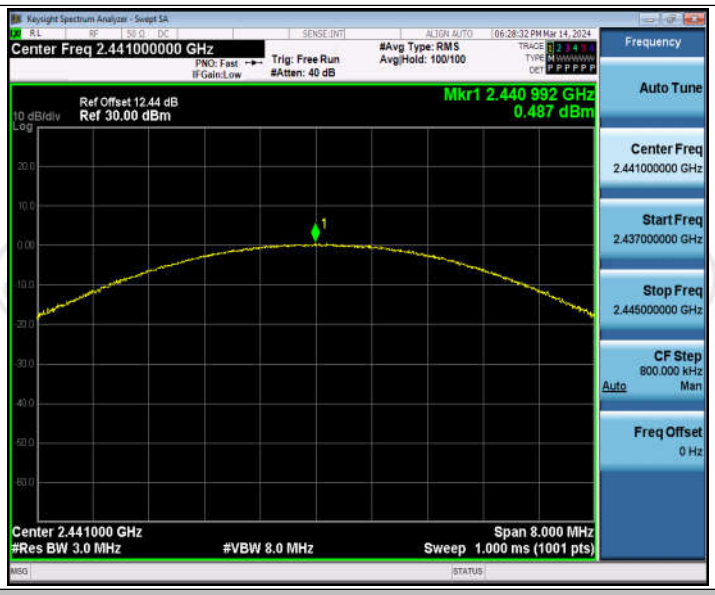
DH5_Ant1_2480



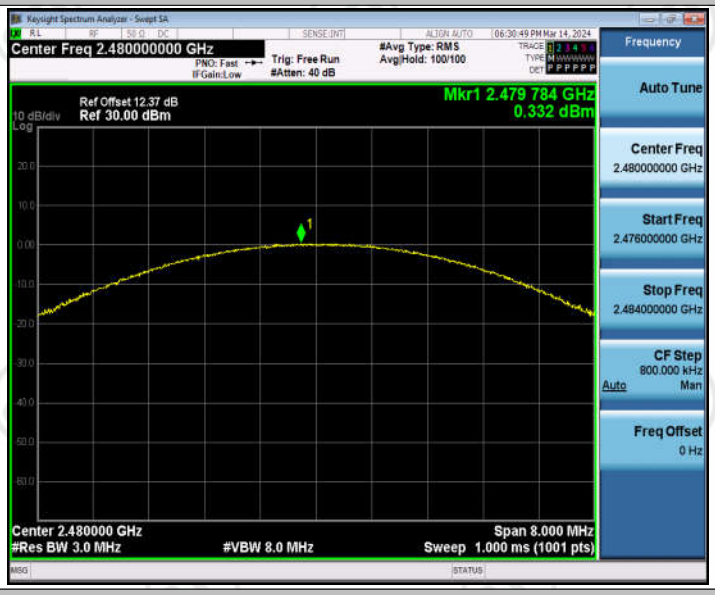
2DH5_Ant1_2402



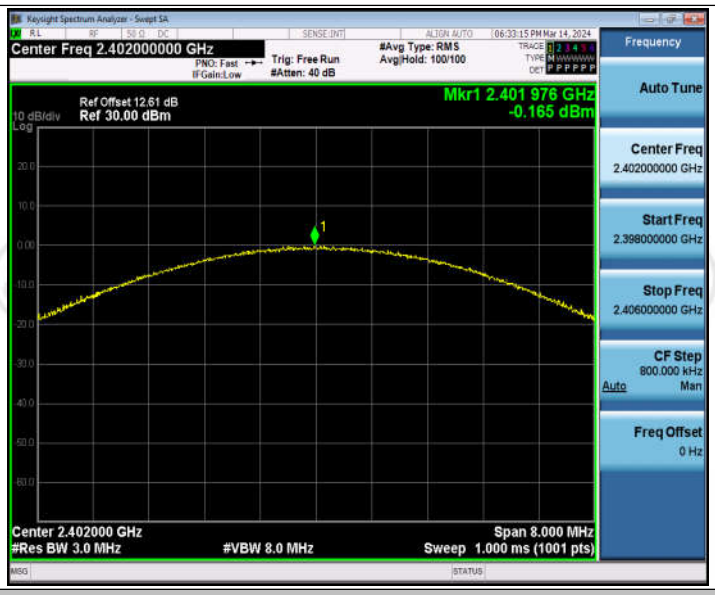
2DH5_Ant1_2441



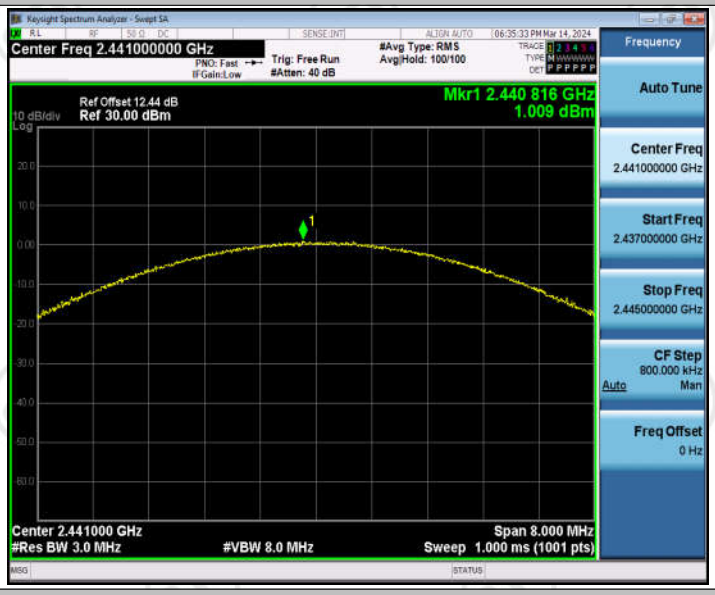
2DH5_Ant1_2480



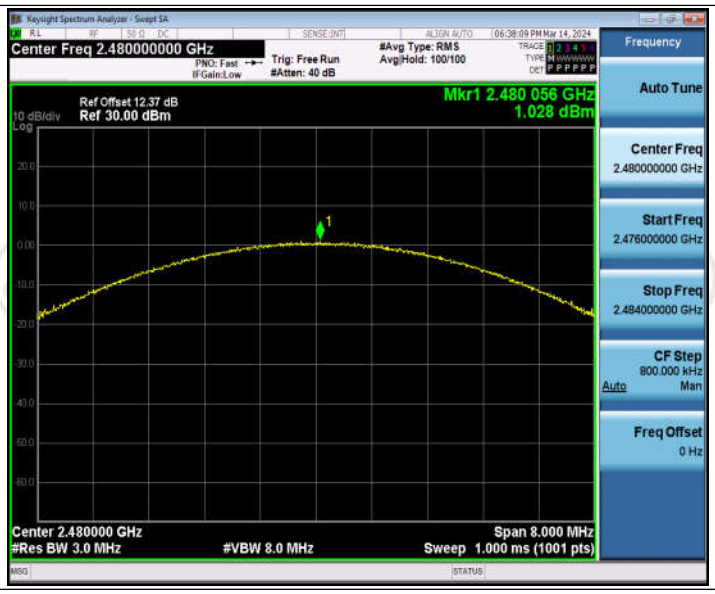
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
06:38:09 PM Mar 14, 2024
Frequency
Auto Tune
Ref Offset 12.37 dB
10 dB/div
Ref 30.00 dBm
Log
Mkr1 2.480 056 GHz
1.028 dBm
Center Freq
2.480000000 GHz
Start Freq
2.476000000 GHz
Stop Freq
2.484000000 GHz
CF Step
800.000 kHz
Auto
Man
Freq Offset
0 Hz
Center 2.480000 GHz
#Res BW 3.0 MHz
#VBW 8.0 MHz
Span 8.000 MHz
Sweep 1.000 ms (1001 pts)

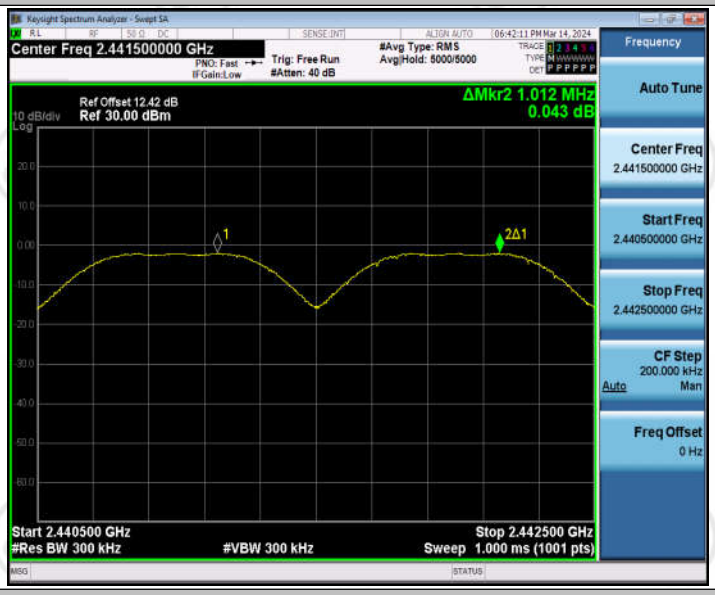
Appendix D: Carrier frequency separation

Test Result

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	1.012	≥0.692	PASS
2DH5	Ant1	Hop	0.936	≥0.858	PASS
3DH5	Ant1	Hop	0.998	≥0.864	PASS

Test Graphs

DH5_Ant1_Hop



2DH5_Ant1_Hop

3DH5_Ant1_Hop

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
06:59:24 PM Mar 14, 2024
Frequency
Auto Tune
Center Freq
2.441500000 GHz
Start Freq
2.440500000 GHz
Stop Freq
2.442500000 GHz
CF Step
200.000 kHz
Auto
Man
Freq Offset
0 Hz
Ref Offset 12.42 dB
10 dB/div
Ref 30.00 dBm
Log
ΔMkr2 998 kHz
-0.043 dB
Start 2.440500 GHz
#Res BW 300 kHz
#VBW 300 kHz
Stop 2.442500 GHz
Sweep 1.000 ms (1001 pts)

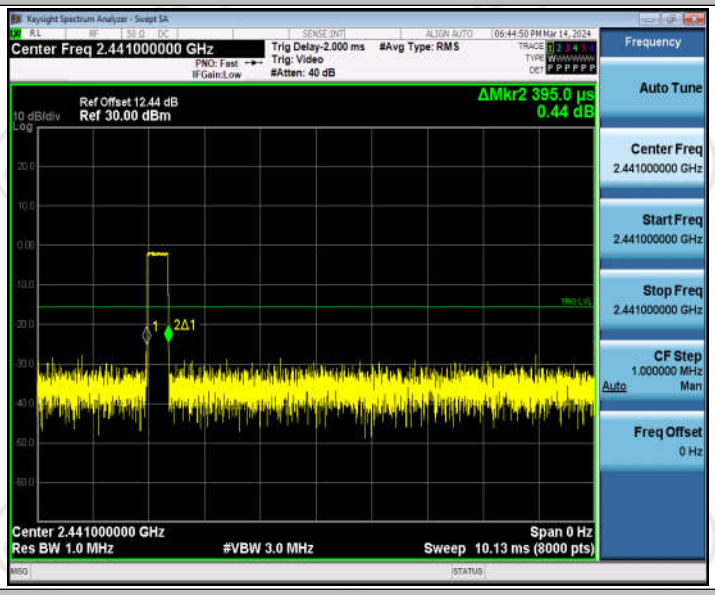
Appendix E: Time of occupancy

Test Result

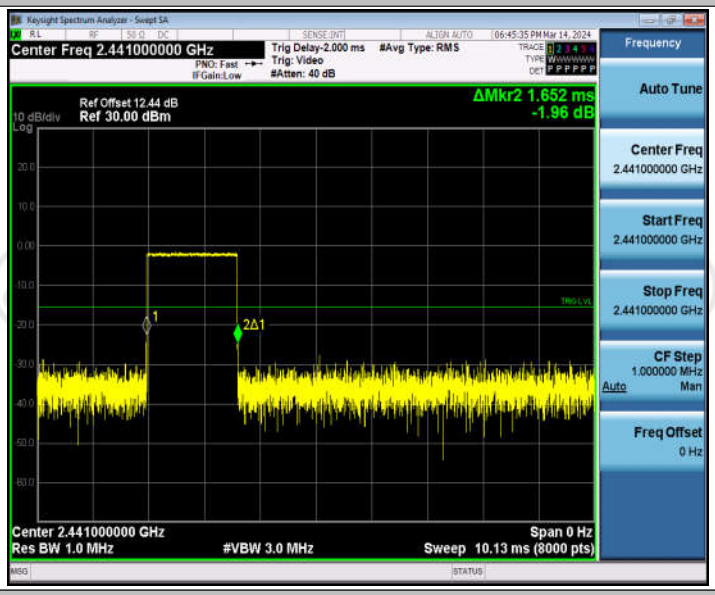
TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.395	320	0.126	≤0.4	PASS
DH3	Ant1	Hop	1.652	160	0.264	≤0.4	PASS
DH5	Ant1	Hop	2.899	106.67	0.309	≤0.4	PASS
2DH1	Ant1	Hop	0.404	320	0.129	≤0.4	PASS
2DH3	Ant1	Hop	1.650	160	0.264	≤0.4	PASS
2DH5	Ant1	Hop	2.897	106.67	0.309	≤0.4	PASS
3DH1	Ant1	Hop	0.394	320	0.126	≤0.4	PASS
3DH3	Ant1	Hop	1.650	160	0.264	≤0.4	PASS
3DH5	Ant1	Hop	2.898	106.67	0.309	≤0.4	PASS

Test Graphs

DH1_Ant1_Hop

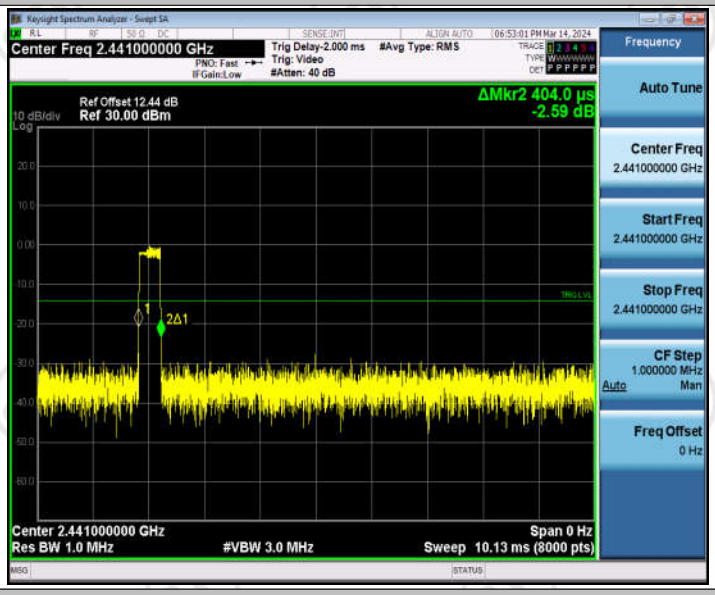


DH3_Ant1_Hop

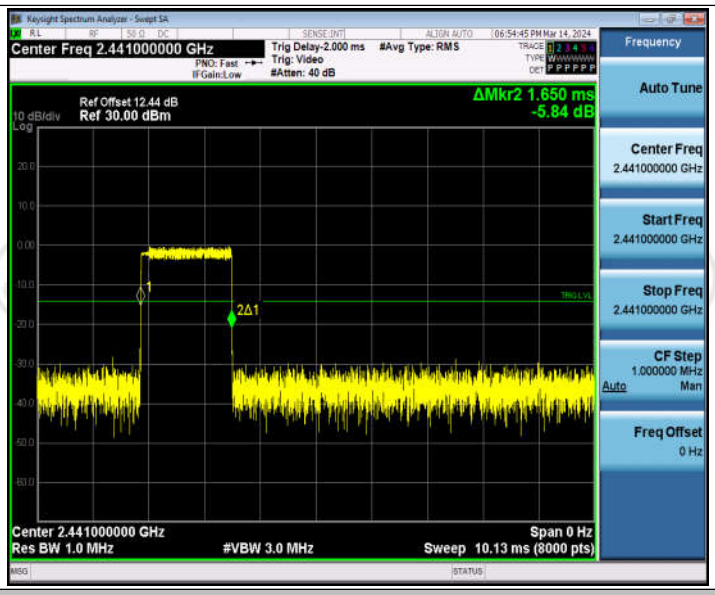


DH5_Ant1_Hop

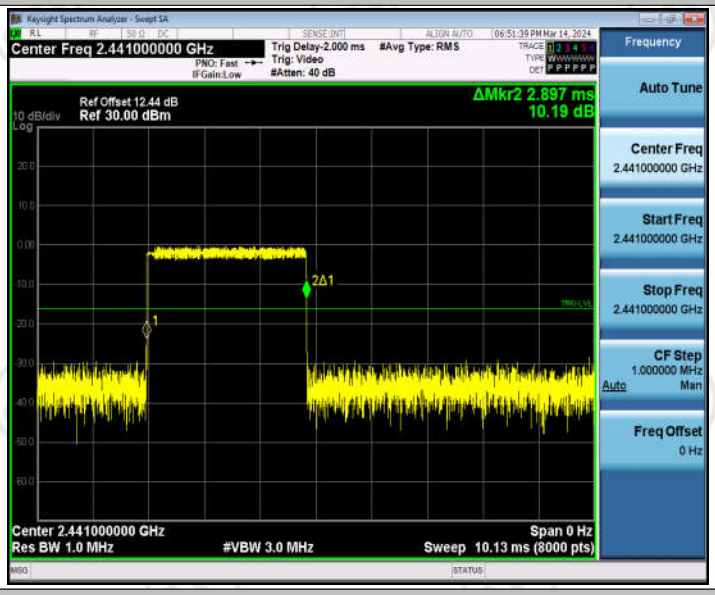
2DH1_Ant1_Hop



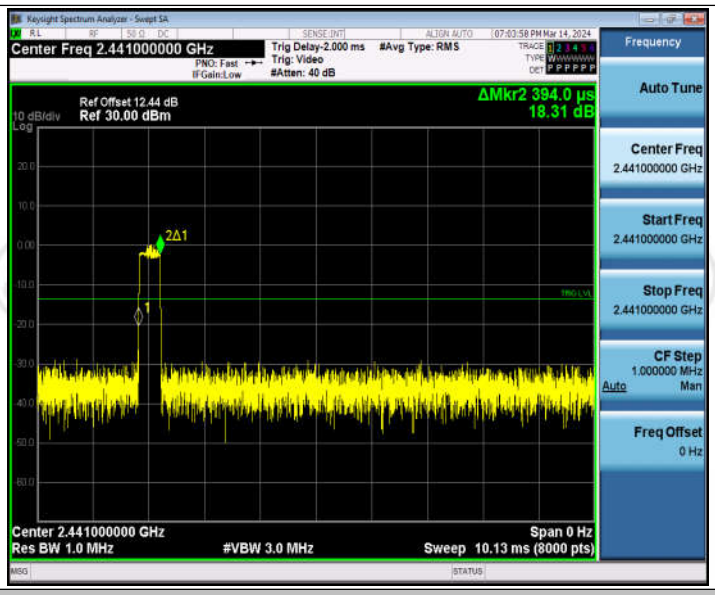
2DH3_Ant1_Hop



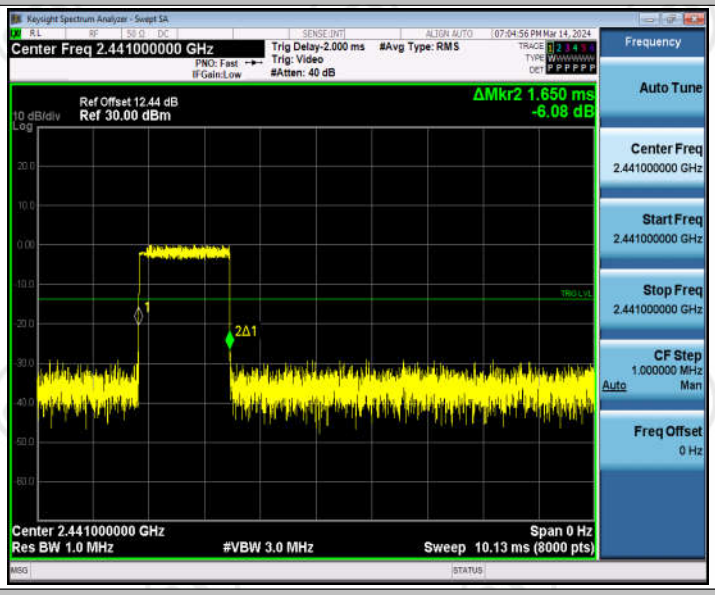
2DH5_Ant1_Hop



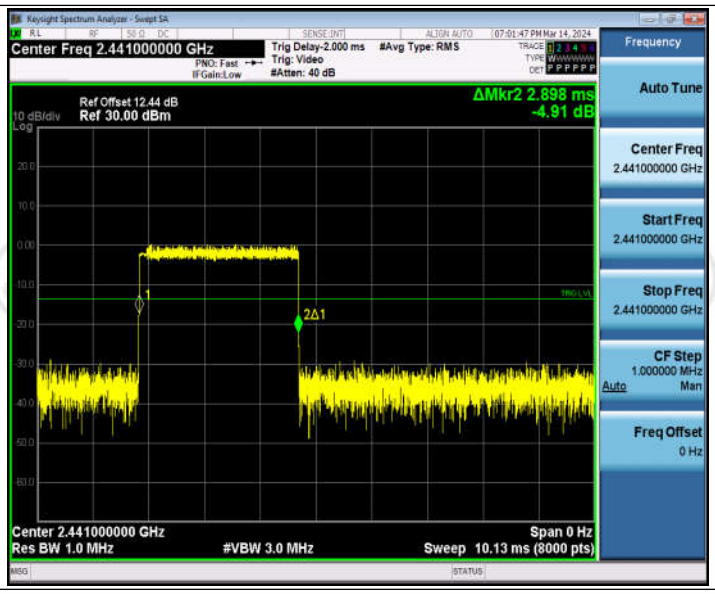
3DH1_Ant1_Hop



3DH3_Ant1_Hop



3DH5_Ant1_Hop


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay-2.000 ms
Trig: Video
#Atten: 40 dB
#Avg Type: RMS
Ref Offset 12.44 dB
10 dB/div
Ref 30.00 dBm
ΔMkr2 2.898 ms
-4.91 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8000 pts)
Frequency
Auto Tune
Center Freq
2.441000000 GHz
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz

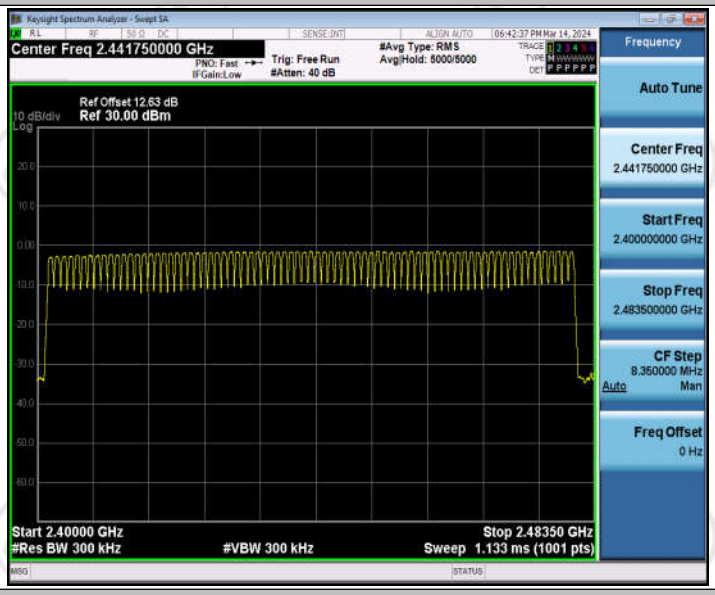
Appendix F: Number of hopping channels

Test Result

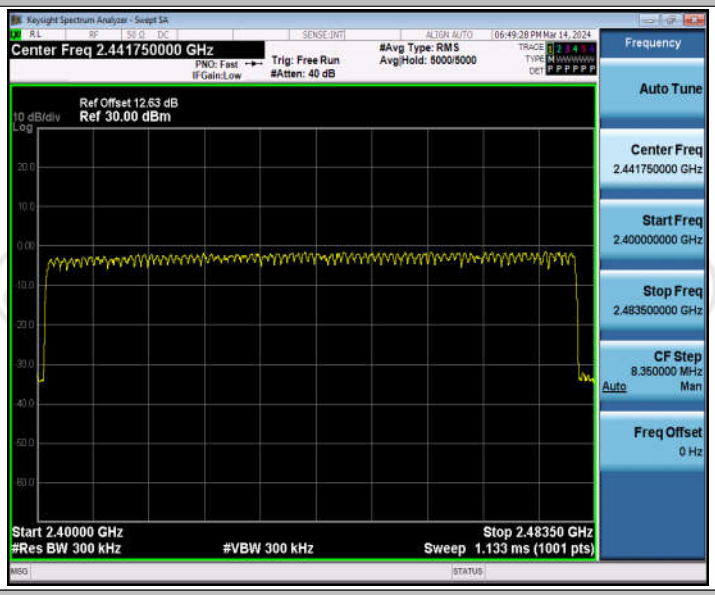
TestMode	Antenna	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

Test Graphs

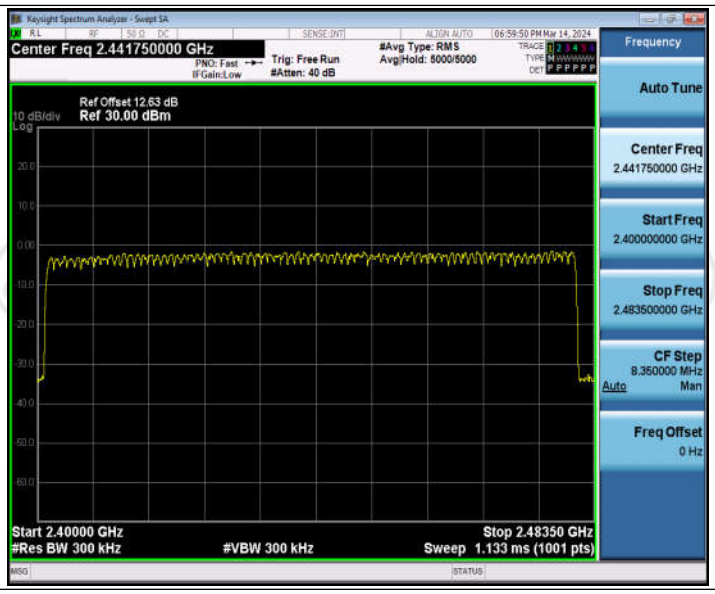
DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
06:59:50 PM Mar 14, 2024
Ref Offset 12.63 dB
10 dB/div
Ref 30.00 dBm
Log
Start 2.40000 GHz
#Res BW 300 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 1.133 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441750000 GHz
Start Freq
2.400000000 GHz
Stop Freq
2.483500000 GHz
CF Step
8.350000 MHz
Auto
Man
Freq Offset
0 Hz

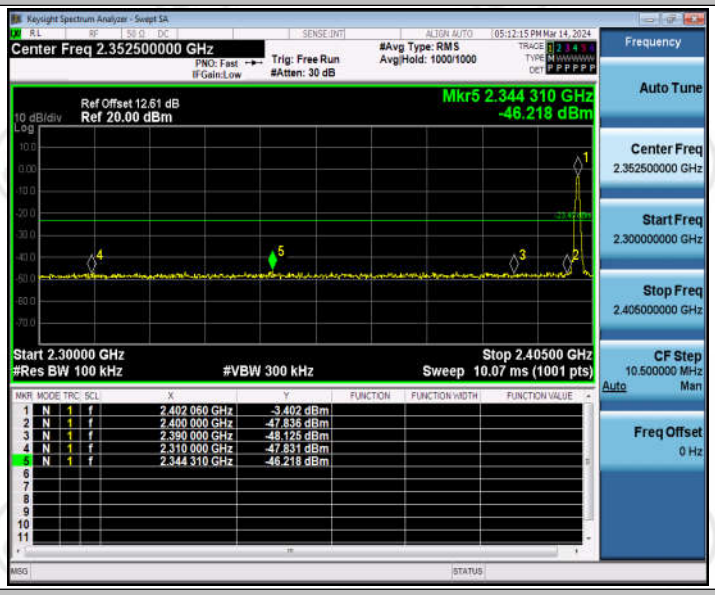
Appendix G: Band edge measurements

Test Result

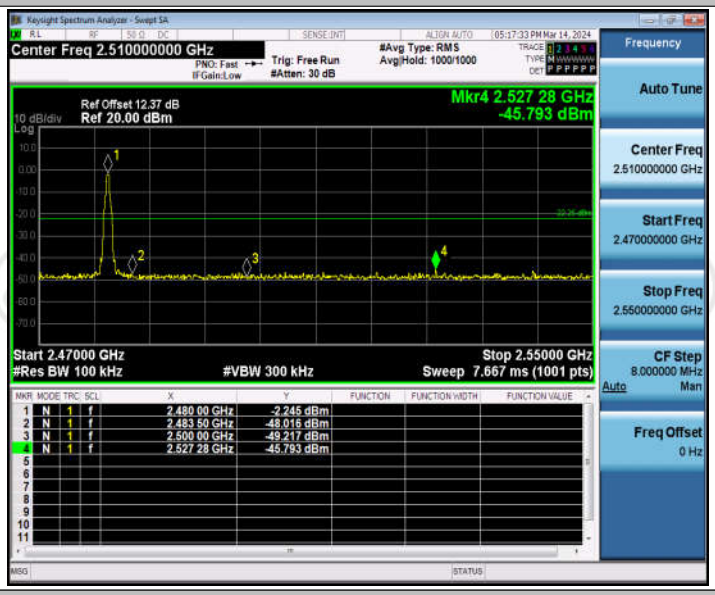
TestMode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	-3.40	-46.22	≤-23.4	PASS
		High	2480	-2.25	-45.79	≤-22.25	PASS
		Low	Hop_2402	-3.42	-46.52	≤-23.42	PASS
		High	Hop_2480	-2.25	-46.22	≤-22.25	PASS
2DH5	Ant1	Low	2402	-3.39	-46.47	≤-23.39	PASS
		High	2480	-2.12	-46.21	≤-22.12	PASS
		Low	Hop_2402	-5.98	-46.66	≤-25.98	PASS
		High	Hop_2480	-2.36	-46.31	≤-22.36	PASS
3DH5	Ant1	Low	2402	-3.28	-46.17	≤-23.28	PASS
		High	2480	-2.09	-43.71	≤-22.09	PASS
		Low	Hop_2402	-5.71	-45.92	≤-25.71	PASS
		High	Hop_2480	-2.19	-41.03	≤-22.19	PASS

Test Graphs

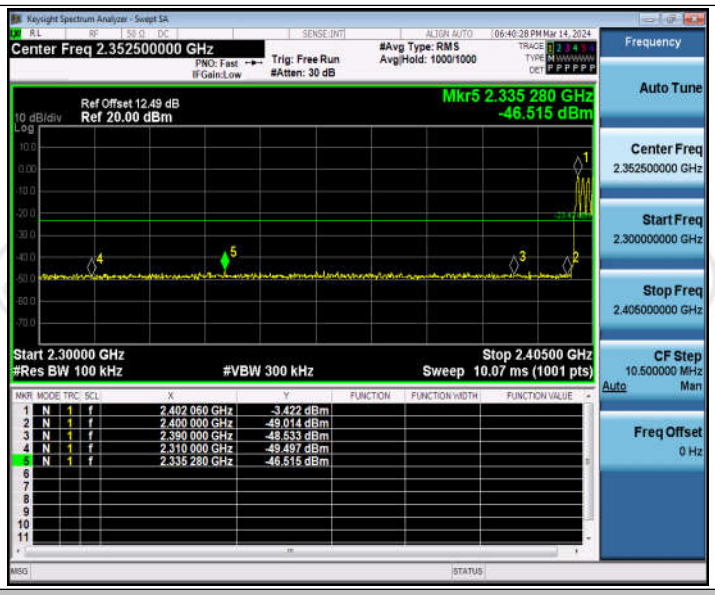
DH5_Ant1_Low_2402



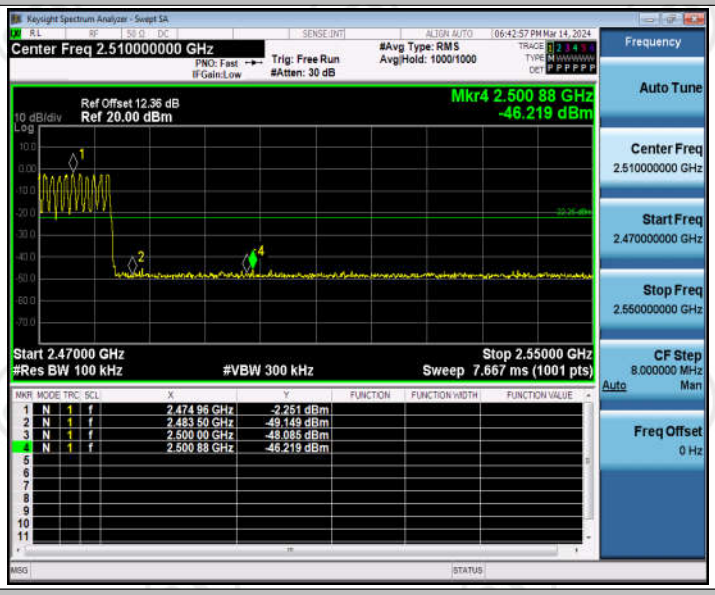
DH5_Ant1_High_2480



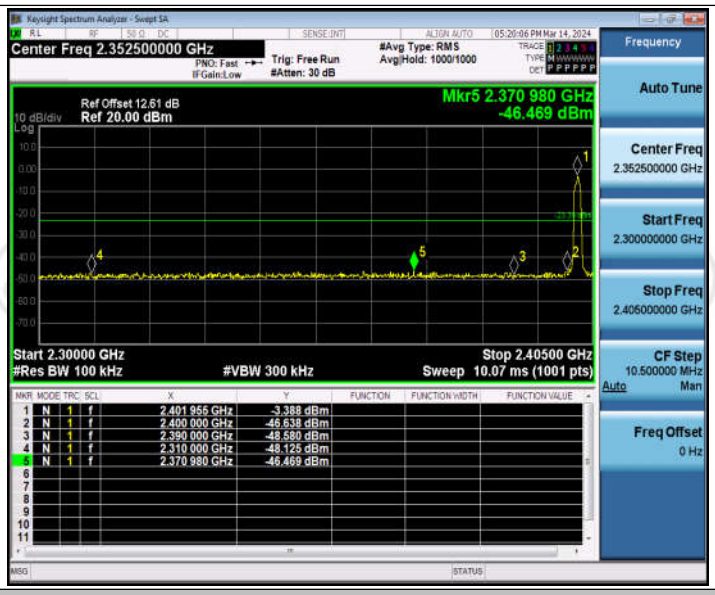
DH5_Ant1_Low_Hop_2402



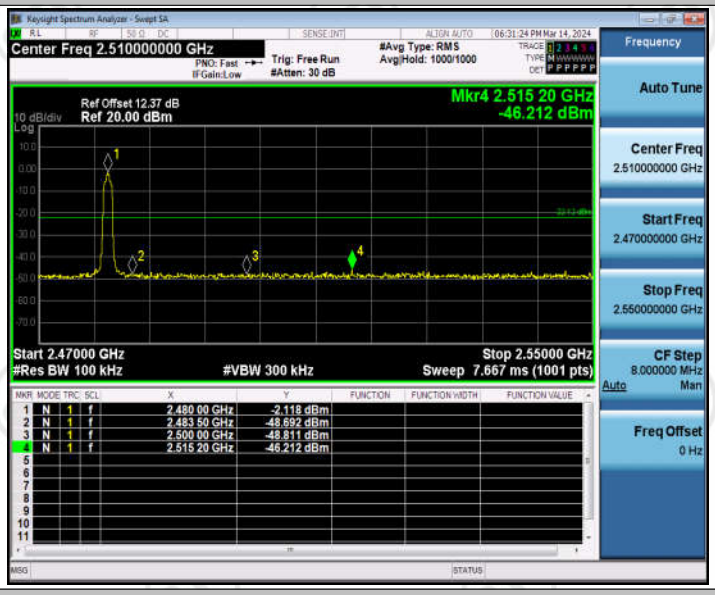
DH5_Ant1_High_Hop_2480



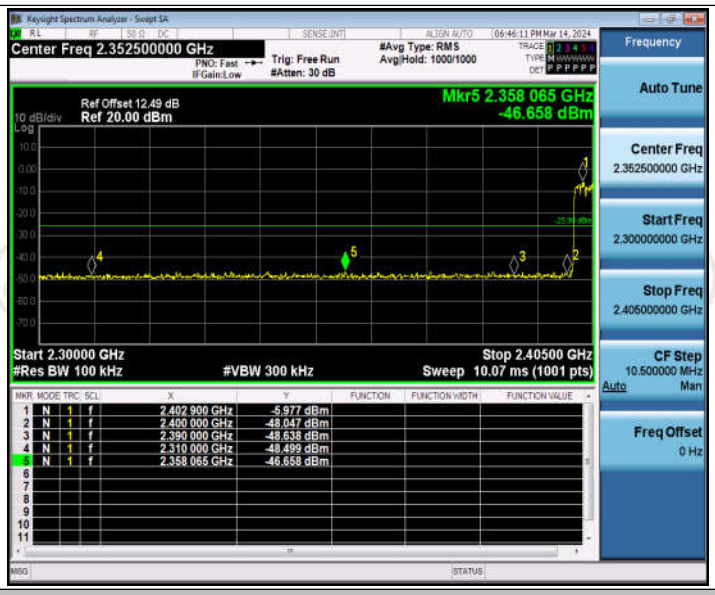
2DH5_Ant1_Low_2402



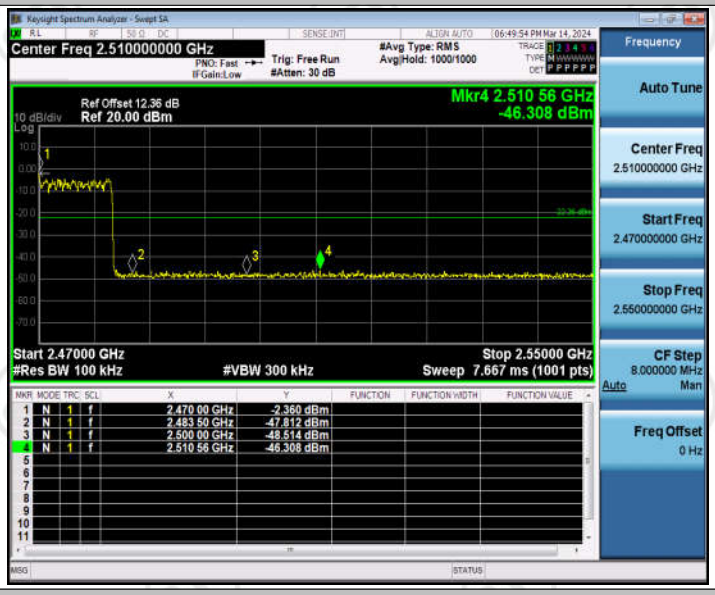
2DH5_Ant1_High_2480



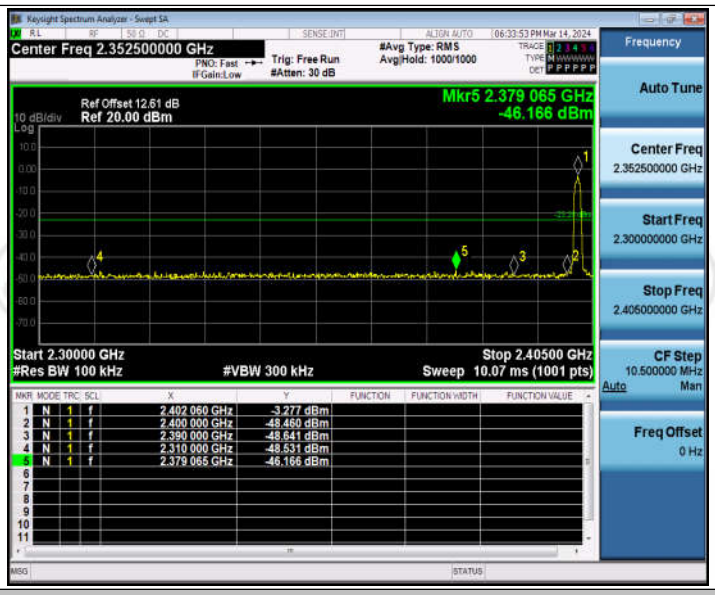
2DH5_Ant1_Low_Hop_2402



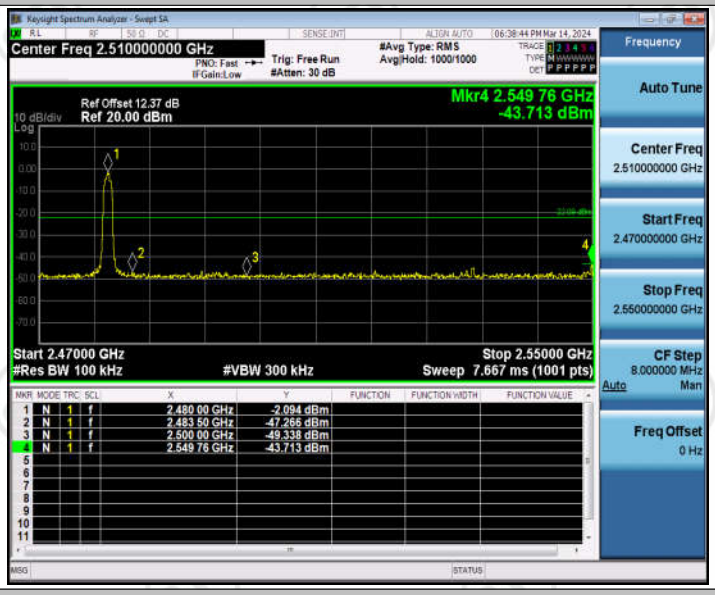
2DH5_Ant1_High_Hop_2480



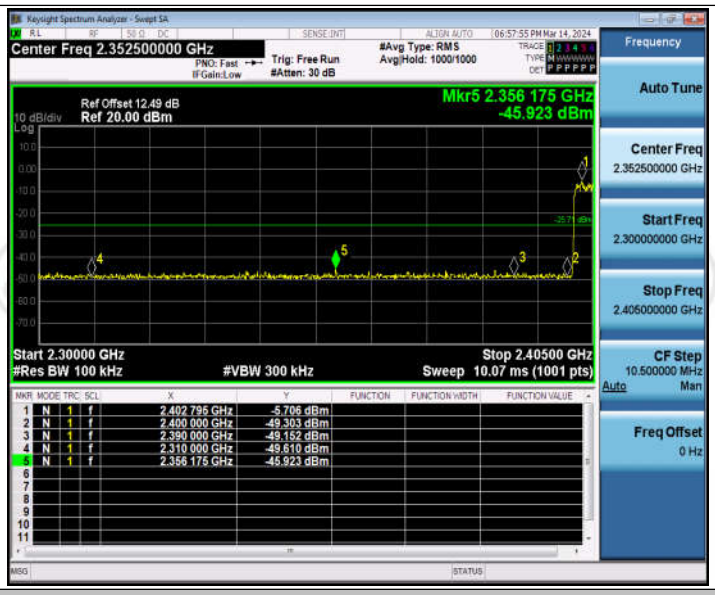
3DH5_Ant1_Low_2402



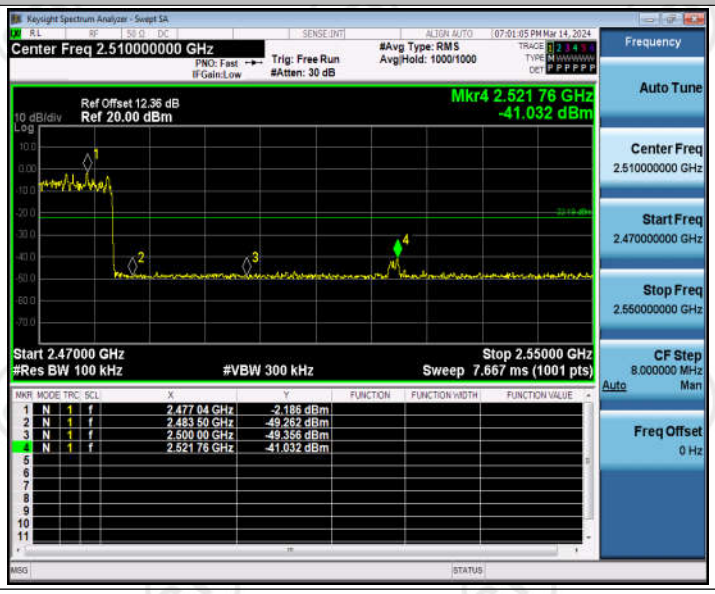
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480



Appendix H: Conducted Spurious Emission

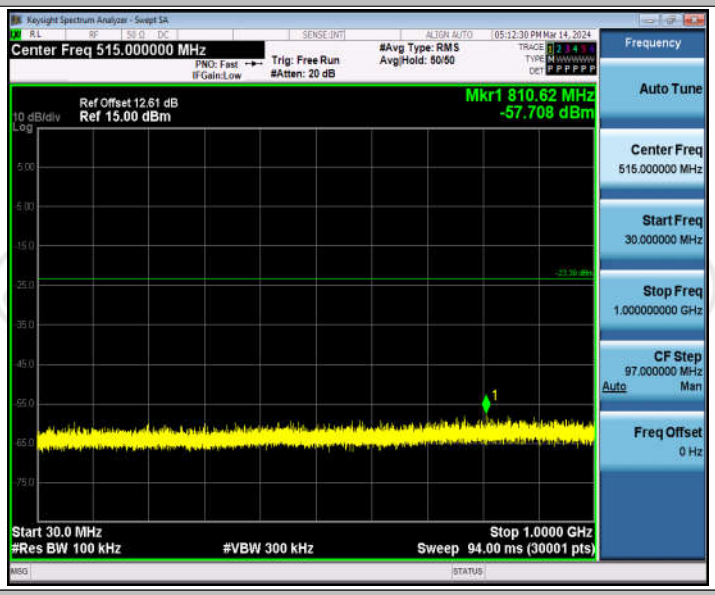
Test Result

TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	-3.39	-3.39	---	PASS
			30~1000	-3.39	-57.71	≤-23.39	PASS
			1000~26500	-3.39	-40.32	≤-23.39	PASS
		2441	Reference	-2.34	-2.34	---	PASS
			30~1000	-2.34	-58.11	≤-22.34	PASS
			1000~26500	-2.34	-40.25	≤-22.34	PASS
		2480	Reference	-2.43	-2.43	---	PASS
			30~1000	-2.43	-57.63	≤-22.43	PASS
			1000~26500	-2.43	-40.22	≤-22.43	PASS
2DH5	Ant1	2402	Reference	-4.09	-4.09	---	PASS
			30~1000	-4.09	-58.24	≤-24.09	PASS
			1000~26500	-4.09	-40.04	≤-24.09	PASS
		2441	Reference	-2.93	-2.93	---	PASS
			30~1000	-2.93	-58.55	≤-22.93	PASS
			1000~26500	-2.93	-40.68	≤-22.93	PASS
		2480	Reference	-2.88	-2.88	---	PASS
			30~1000	-2.88	-58.39	≤-22.88	PASS
			1000~26500	-2.88	-40.3	≤-22.88	PASS
3DH5	Ant1	2402	Reference	-3.32	-3.32	---	PASS
			30~1000	-3.32	-58.14	≤-23.32	PASS
			1000~26500	-3.32	-40.49	≤-23.32	PASS
		2441	Reference	-2.29	-2.29	---	PASS
			30~1000	-2.29	-57.12	≤-22.29	PASS
			1000~26500	-2.29	-40.55	≤-22.29	PASS
		2480	Reference	-2.11	-2.11	---	PASS
			30~1000	-2.11	-56.4	≤-22.11	PASS
			1000~26500	-2.11	-39.92	≤-22.11	PASS

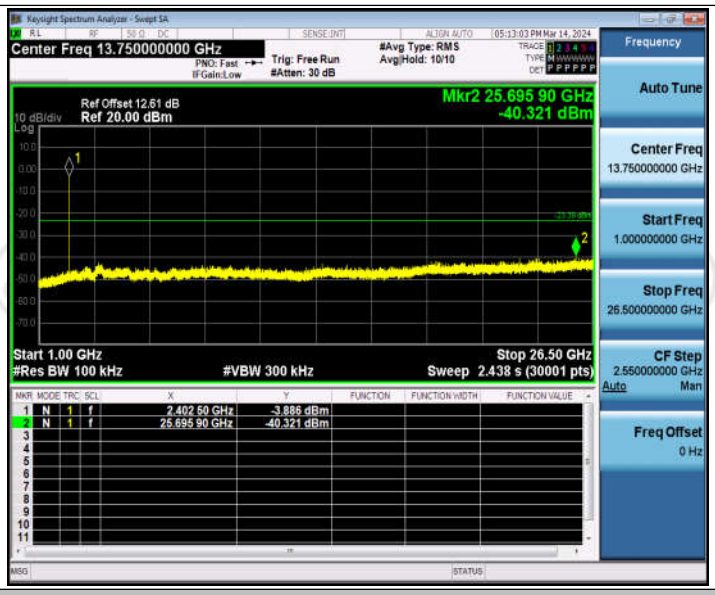
Test Graphs

DH5_Ant1_2402_0~Reference

DH5_Ant1_2402_30~1000

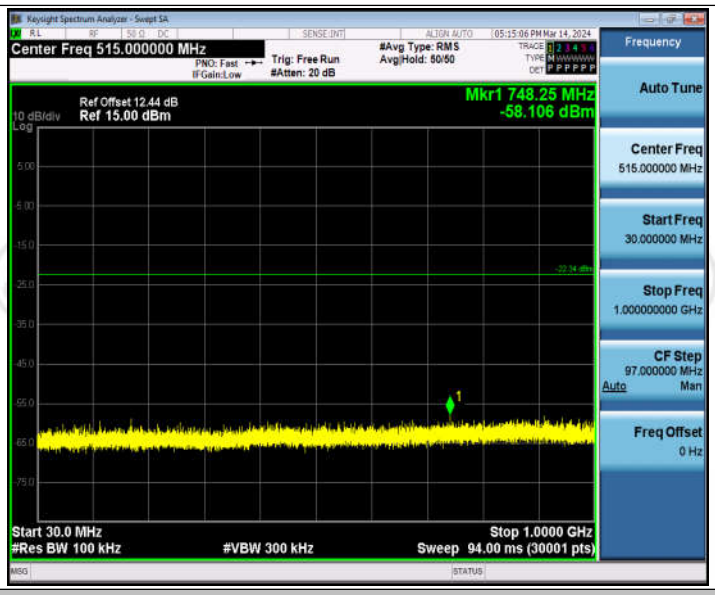


DH5_Ant1_2402_1000~26500

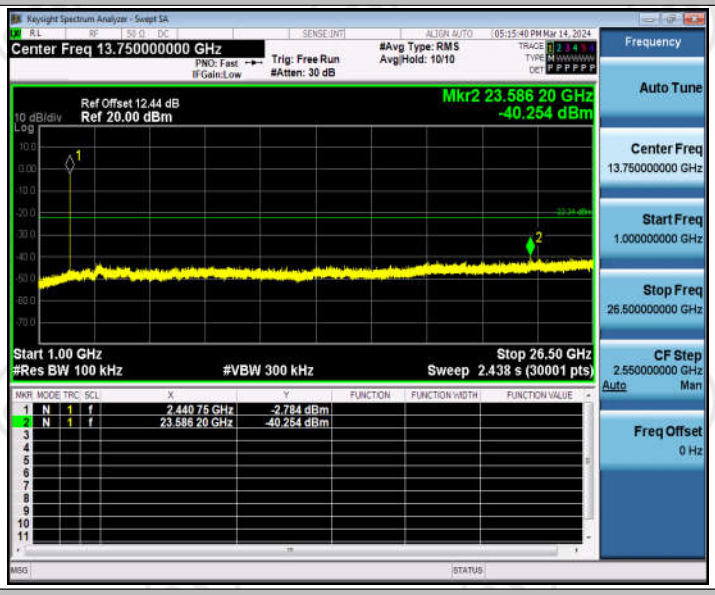


DH5_Ant1_2441_0~Reference

DH5_Ant1_2441_30~1000

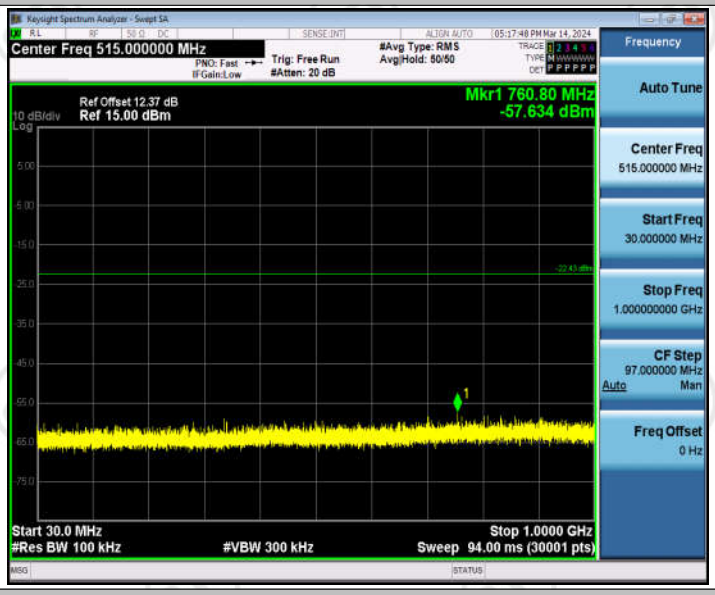


DH5_Ant1_2441_1000~26500

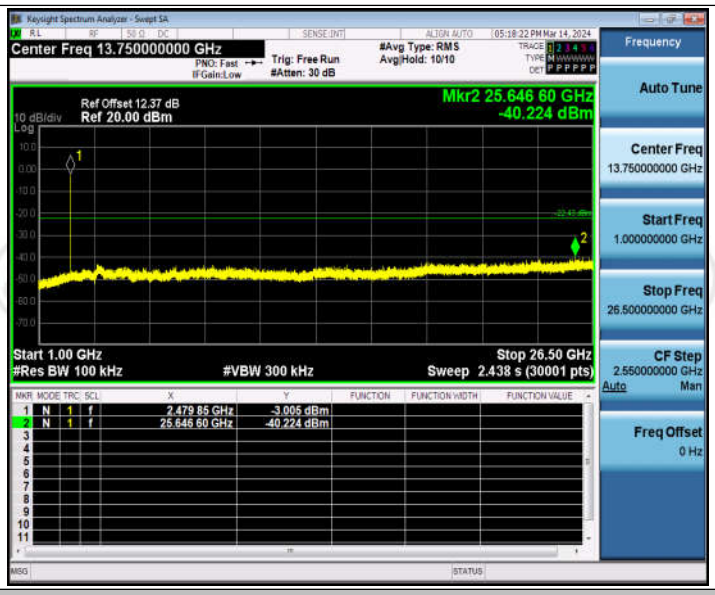


DH5_Ant1_2480_0~Reference

DH5_Ant1_2480_30~1000

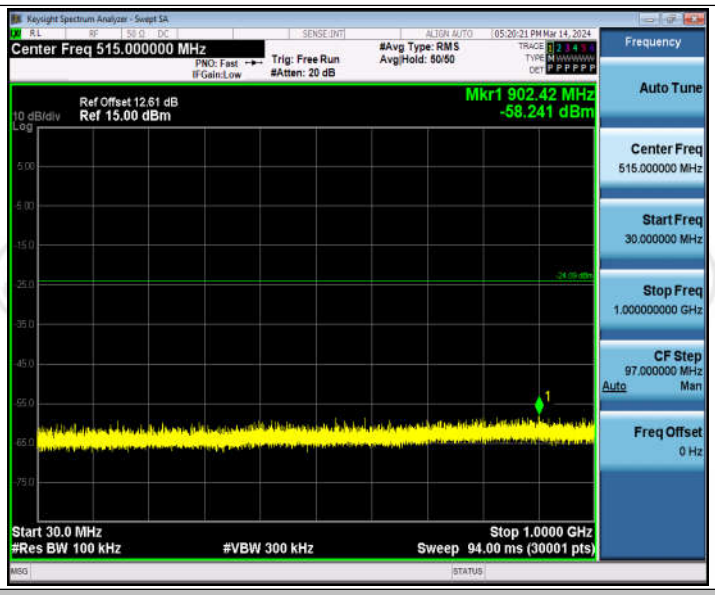


DH5_Ant1_2480_1000~26500

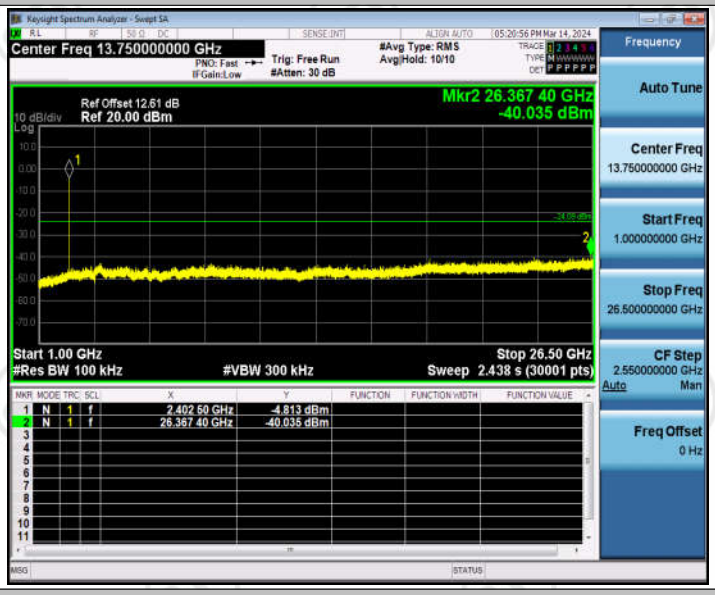


2DH5_Ant1_2402_0~Reference

2DH5_Ant1_2402_30~1000



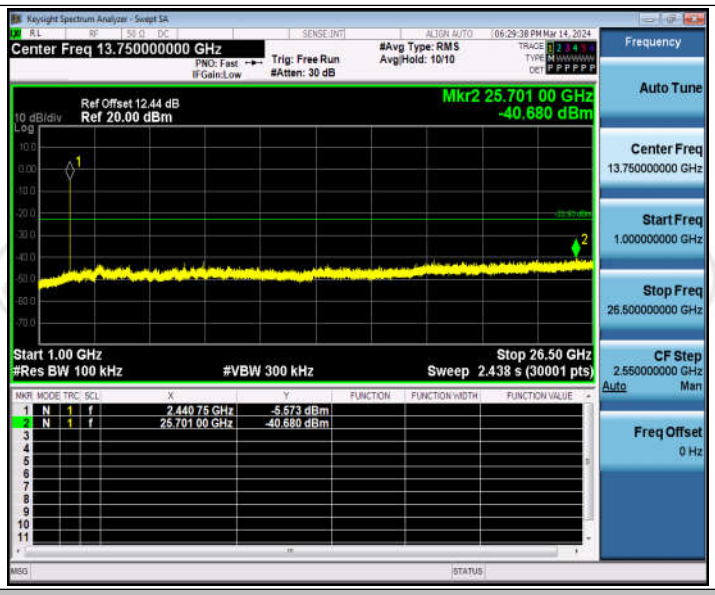
2DH5_Ant1_2402_1000~26500



2DH5_Ant1_2441_0~Reference

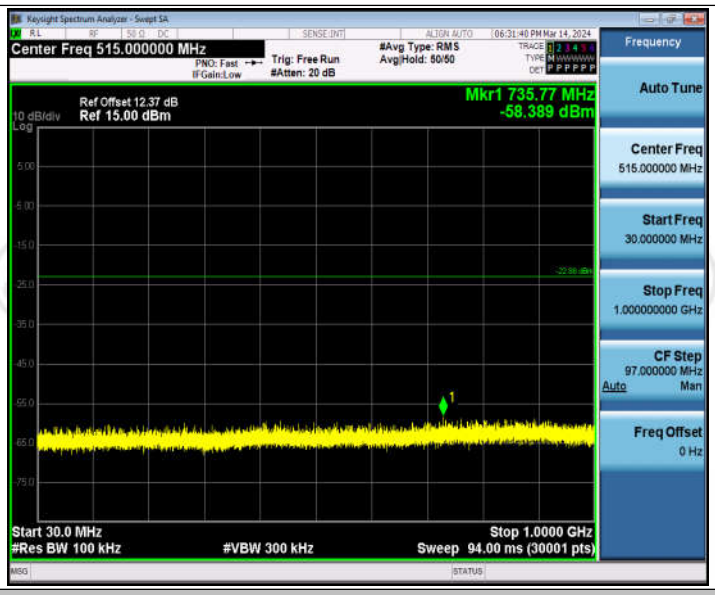
2DH5_Ant1_2441_30~1000

2DH5_Ant1_2441_1000~26500

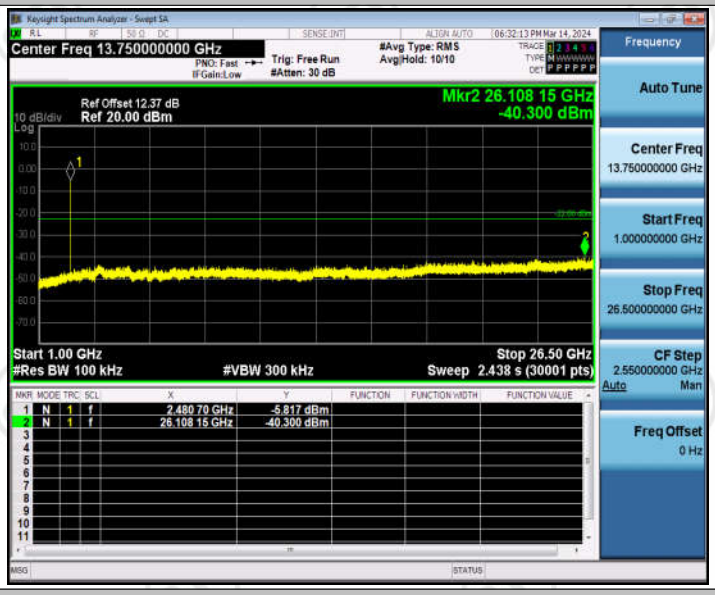


2DH5_Ant1_2480_0~Reference

2DH5_Ant1_2480_30~1000

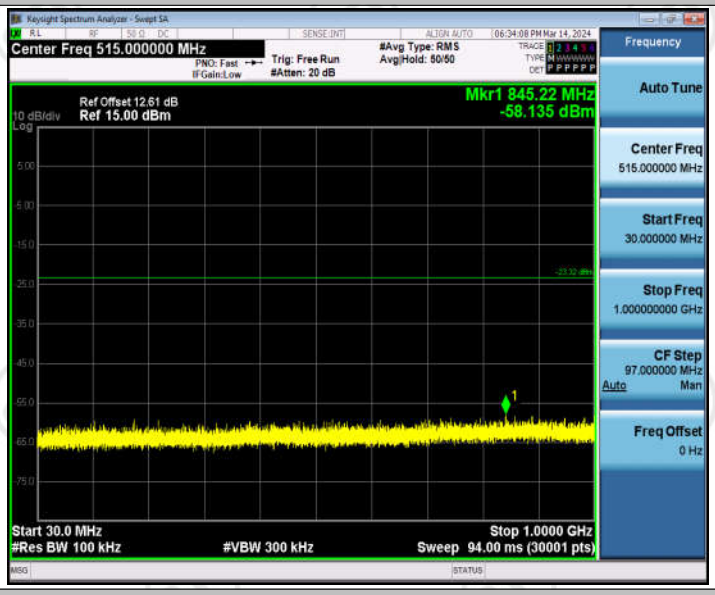


2DH5_Ant1_2480_1000~26500

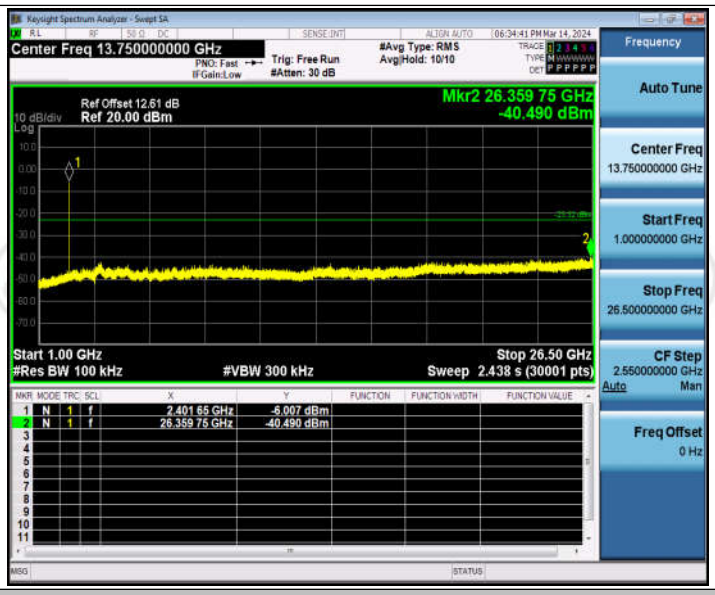


3DH5_Ant1_2402_0~Reference

3DH5_Ant1_2402_30~1000

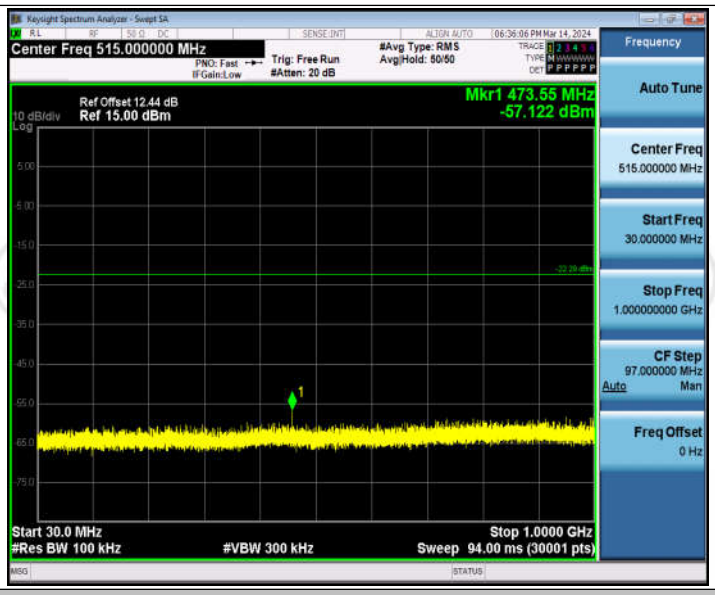


3DH5_Ant1_2402_1000~26500

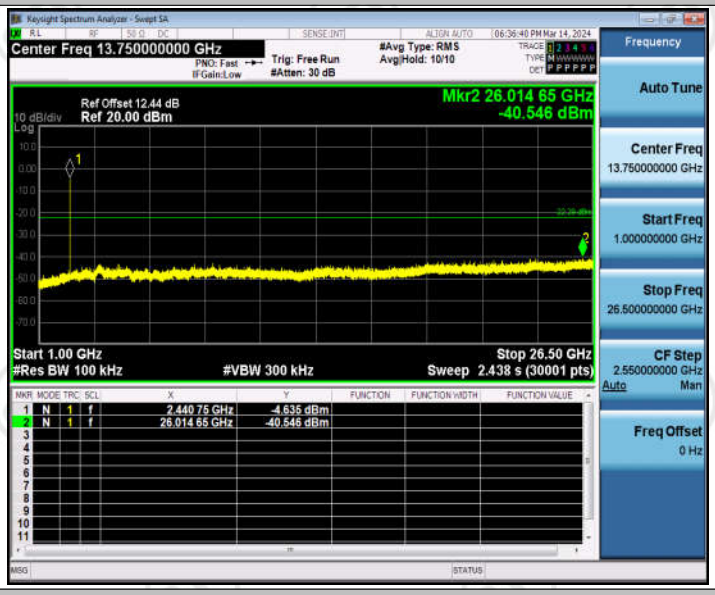


3DH5_Ant1_2441_0~Reference

3DH5_Ant1_2441_30~1000



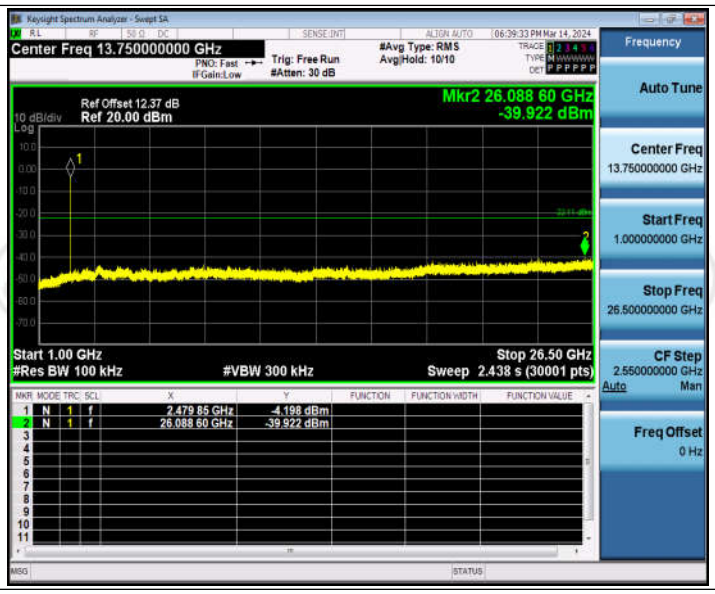
3DH5_Ant1_2441_1000~26500



3DH5_Ant1_2480_0~Reference

3DH5_Ant1_2480_30~1000

3DH5_Ant1_2480_1000~26500


Keysight Spectrum Analyzer - Swept SA
Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 10/10
06:39:33 PM Mar 14, 2024
Ref Offset 12.37 dB
10 dB/div
Ref 20.00 dBm
Mkr2 26.088 60 GHz
-39.922 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
1 N 1 f 2.479 85 GHz -4.198 dBm
2 N 1 f 26.088 60 GHz -39.922 dBm
Frequency
Auto Tune
Center Freq
13.750000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
26.500000000 GHz
CF Step
2.550000000 GHz
Auto
Man
Freq Offset
0 Hz

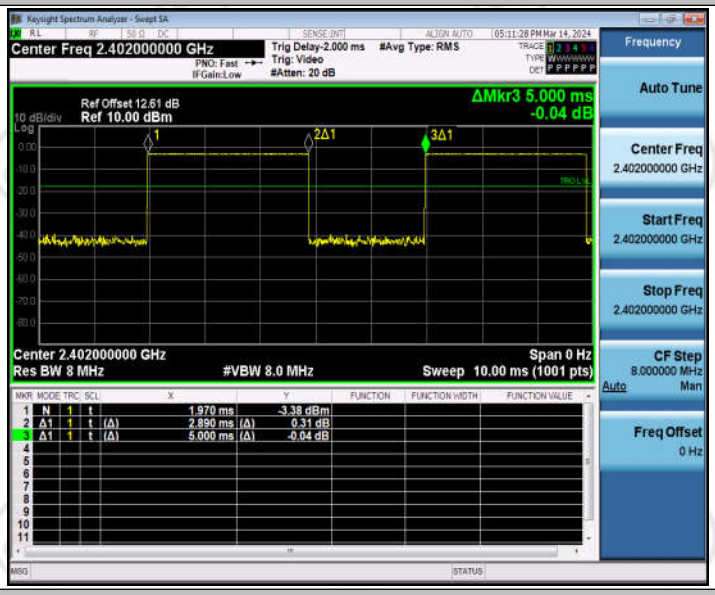
Appendix I: Duty Cycle

Test Result

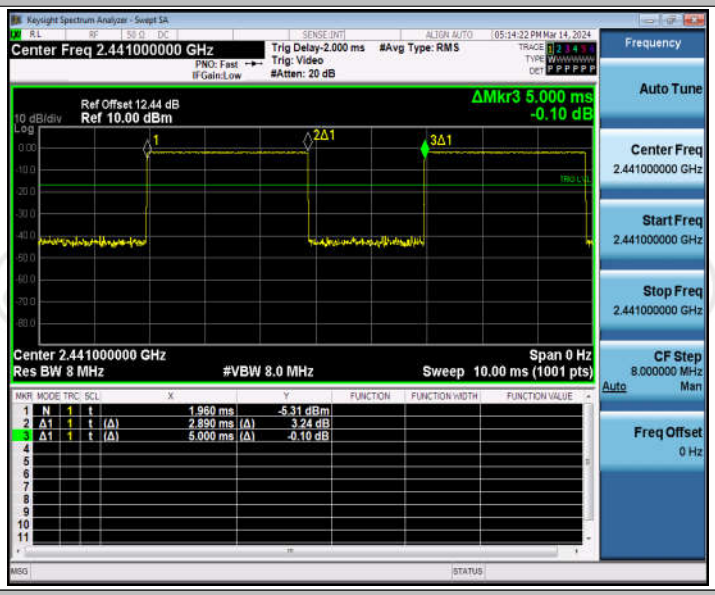
TestMode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
DH5	Ant1	2402	2.89	5.00	57.80	2.38
		2441	2.89	5.00	57.80	2.38
		2480	2.89	5.00	57.80	2.38
2DH5	Ant1	2402	2.90	5.00	58.00	2.37
		2441	2.89	5.00	57.80	2.38
		2480	2.90	5.00	58.00	2.37
3DH5	Ant1	2402	2.89	5.00	57.80	2.38
		2441	2.89	5.00	57.80	2.38
		2480	2.89	5.00	57.80	2.38

Test Graphs

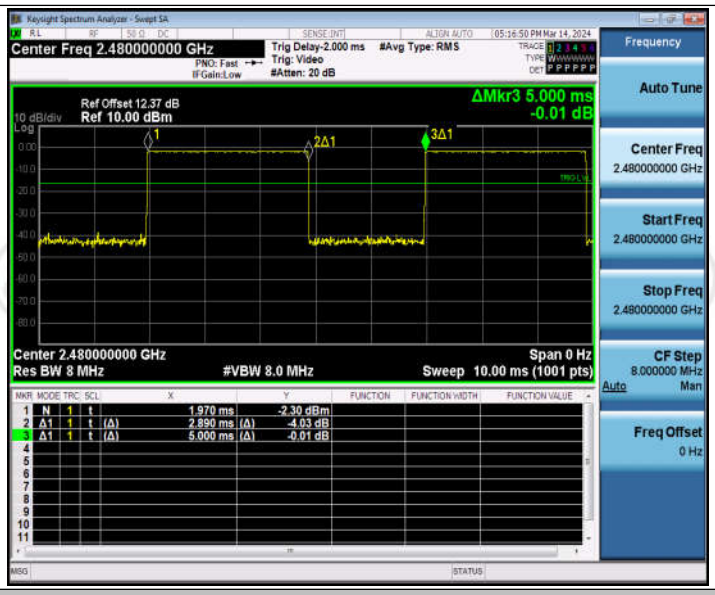
DH5_Ant1_2402



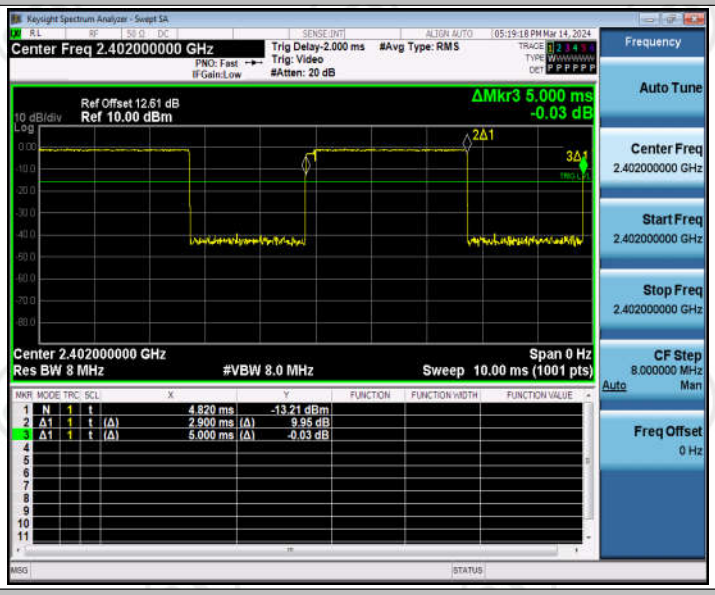
DH5_Ant1_2441



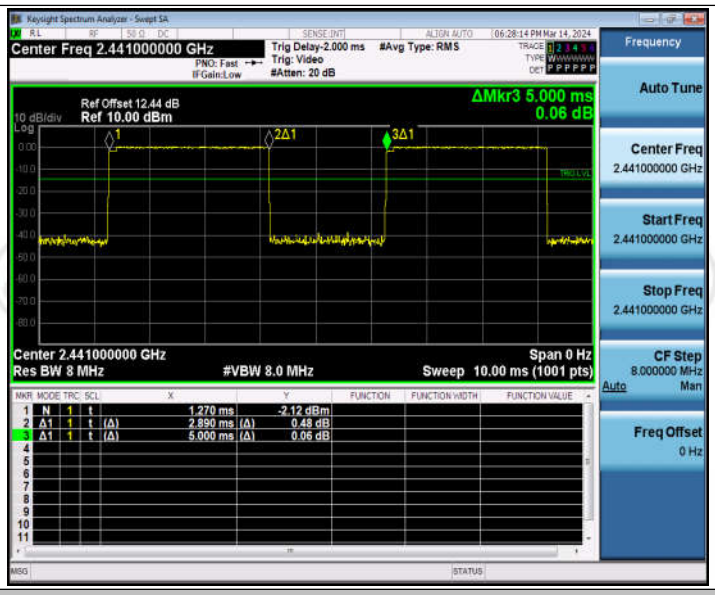
DH5_Ant1_2480



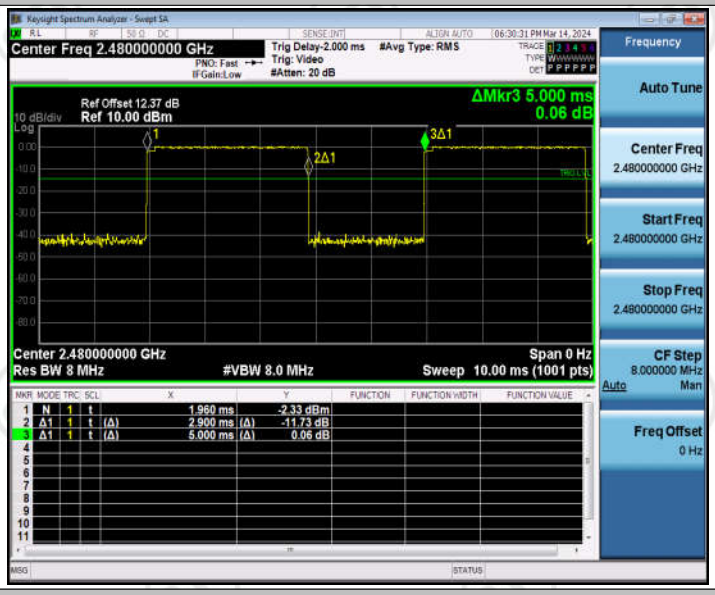
2DH5_Ant1_2402



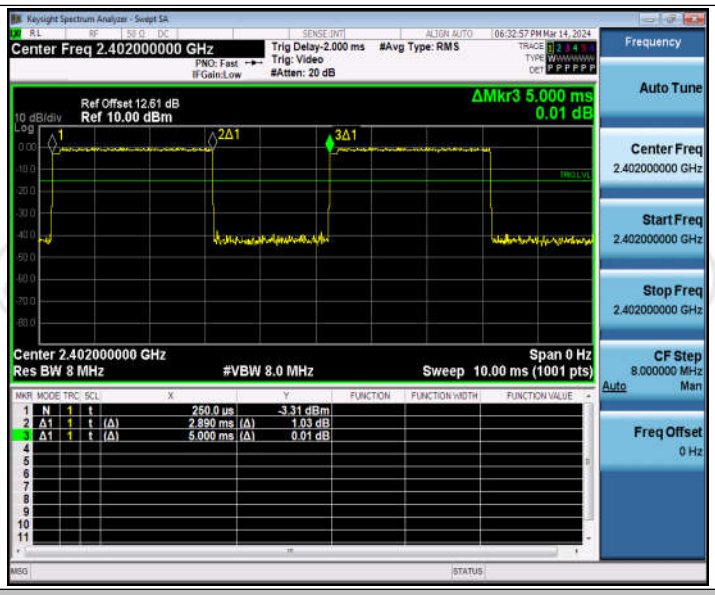
2DH5_Ant1_2441



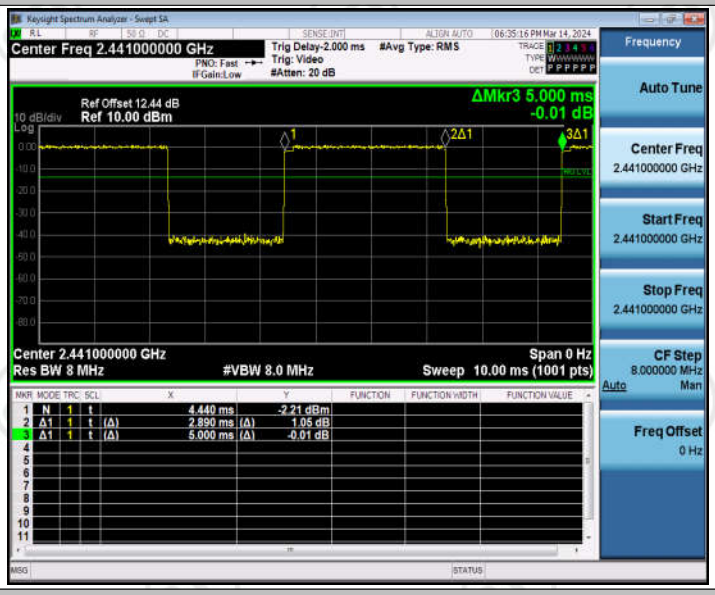
2DH5_Ant1_2480



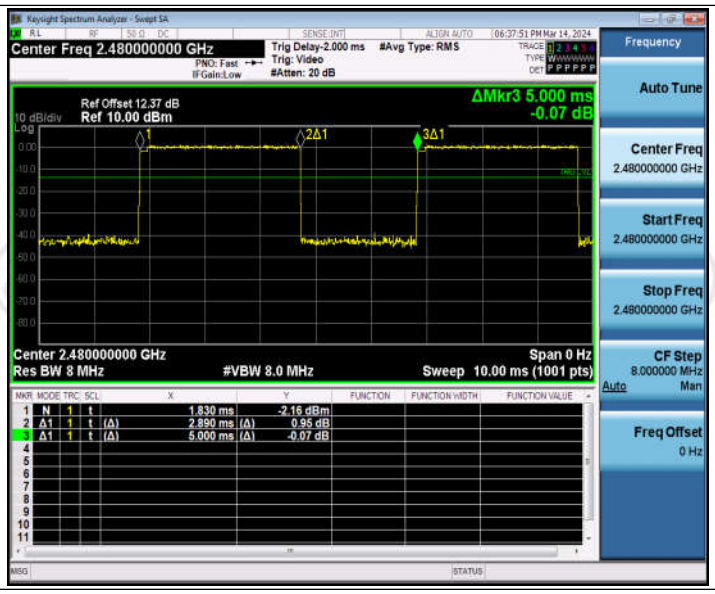
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480



*** End of Report ***