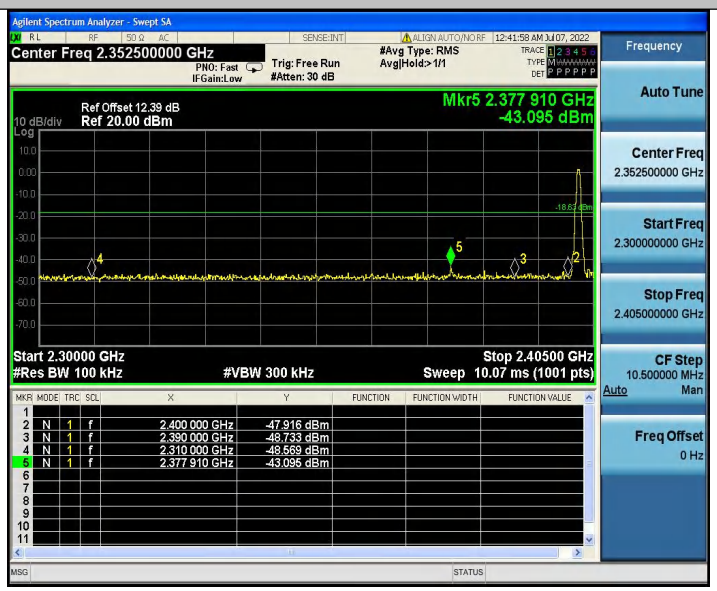
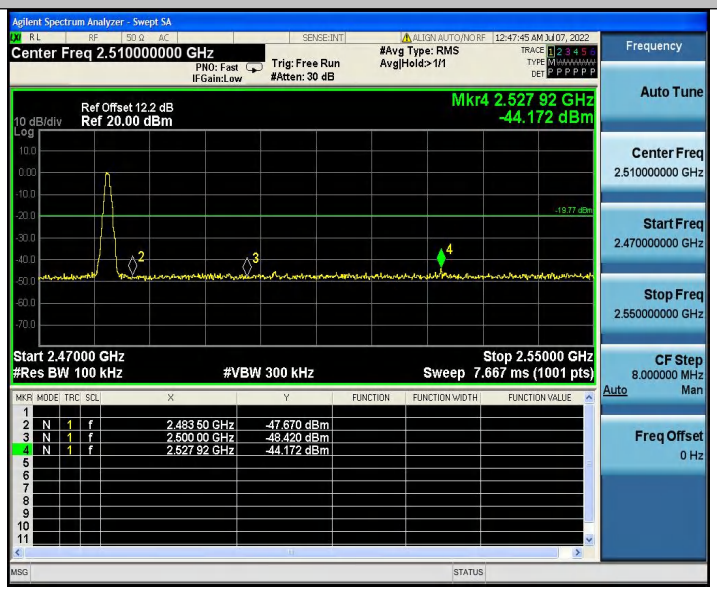
8.3 TEST RESULTS

TestMode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	1.37	-43.1	≤-18.63	PASS
		High	2480	0.23	-44.17	≤-19.77	PASS
		Low	Hop_2402	0.58	-45.91	≤-19.42	PASS
		High	Hop_2480	0.44	-45.02	≤-19.56	PASS
2DH5	Ant1	Low	2402	1.16	-45.5	≤-18.84	PASS
		High	2480	0.04	-44.86	≤-19.96	PASS
		Low	Hop_2402	0.81	-46	≤-19.19	PASS
		High	Hop_2480	0.60	-44.75	≤-19.4	PASS
3DH5	Ant1	Low	2402	1.02	-44.99	≤-18.98	PASS
		High	2480	0.07	-45.59	≤-19.93	PASS
		Low	Hop_2402	-5.93	-46.49	≤-25.93	PASS
		High	Hop_2480	0.42	-45.08	≤-19.58	PASS

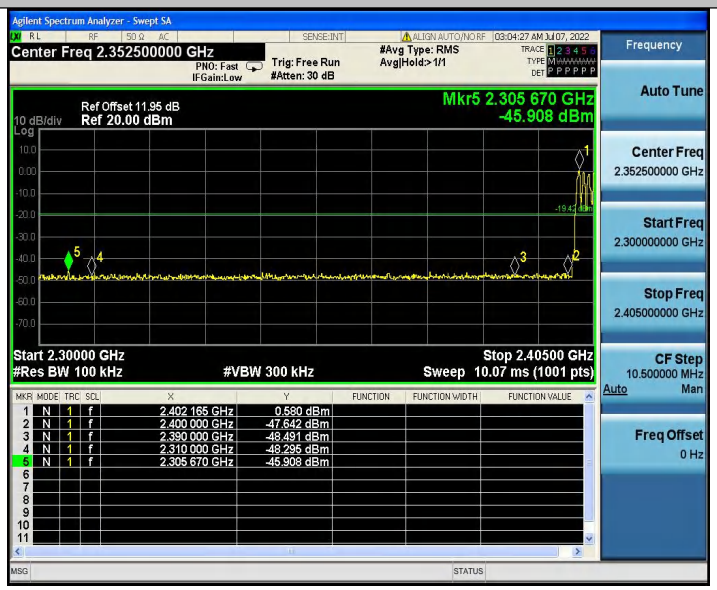
DH5_Ant1_Low_2402



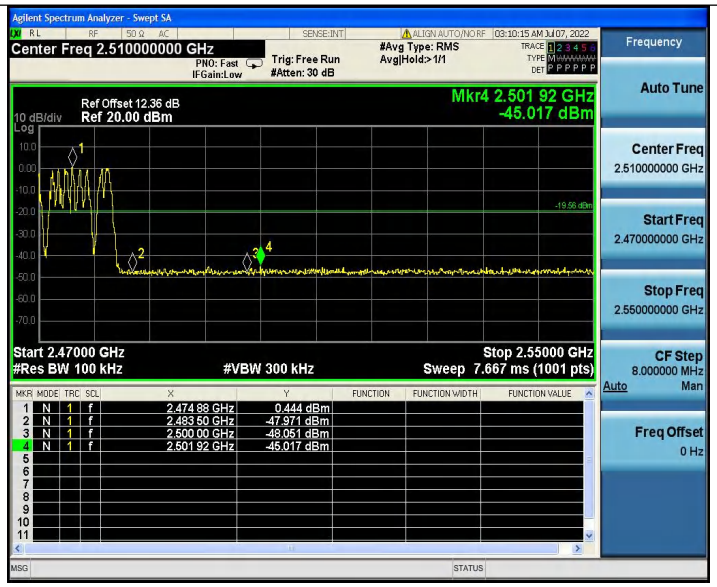
DH5_Ant1_High_2480



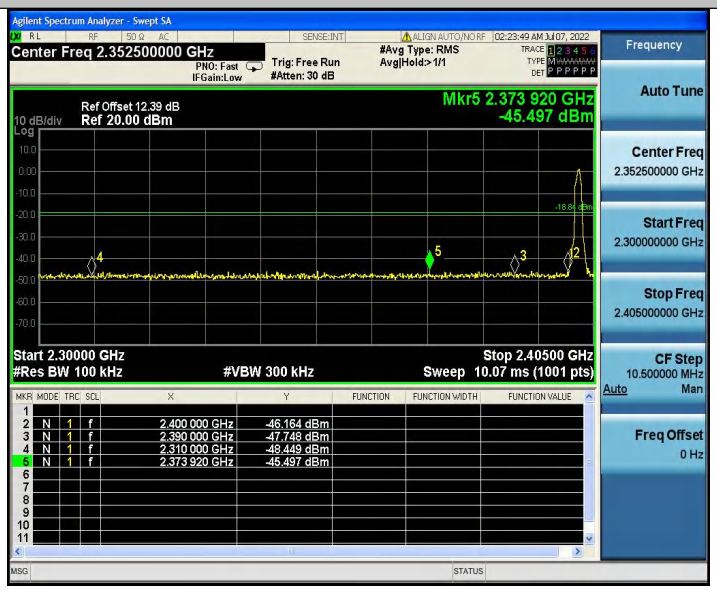
DH5_Ant1_Low_Hop_2402



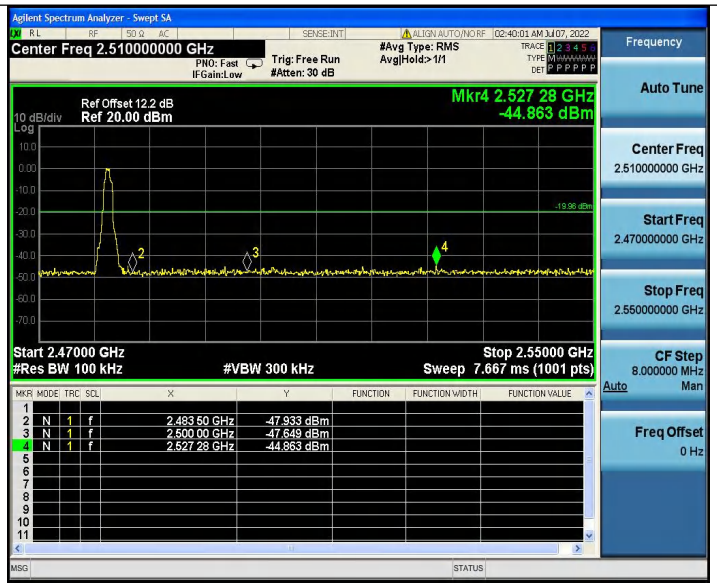
DH5_Ant1_High_Hop_2480



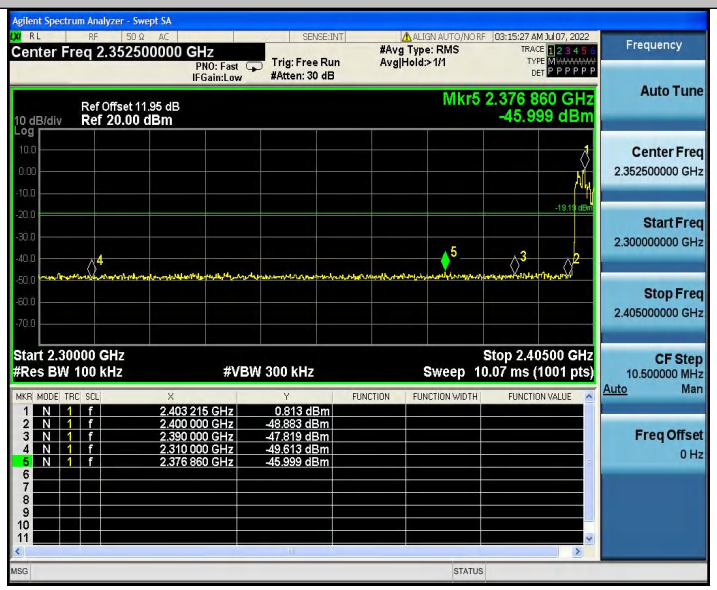
2DH5_Ant1_Low_2402



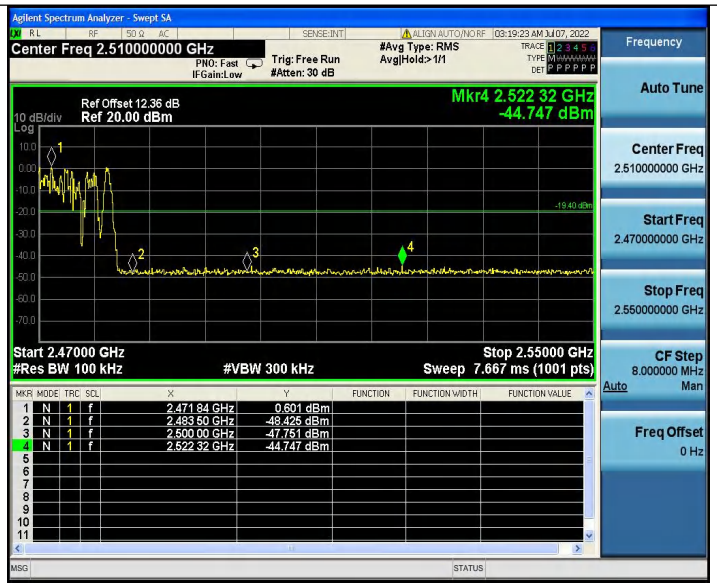
2DH5_Ant1_High_2480



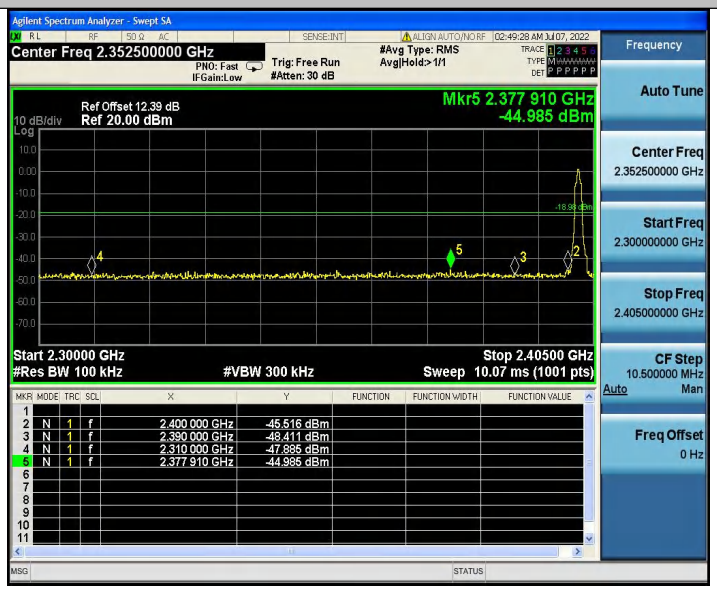
2DH5_Ant1_Low_Hop_2402



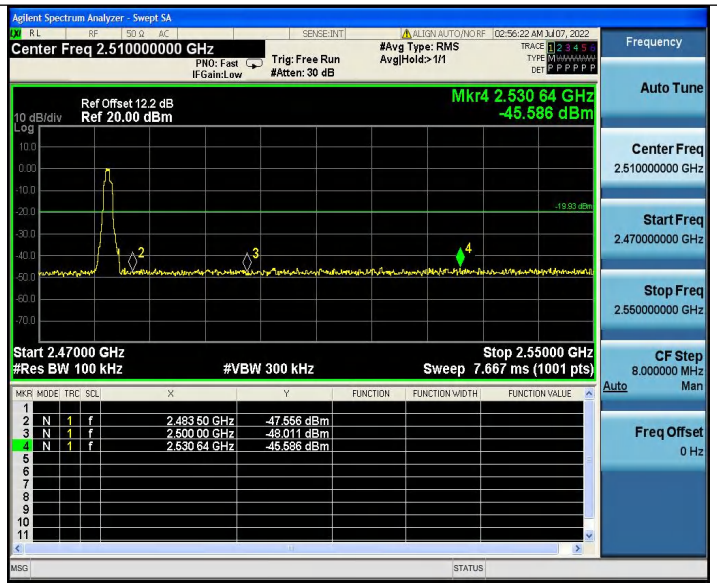
2DH5_Ant1_High_Hop_2480



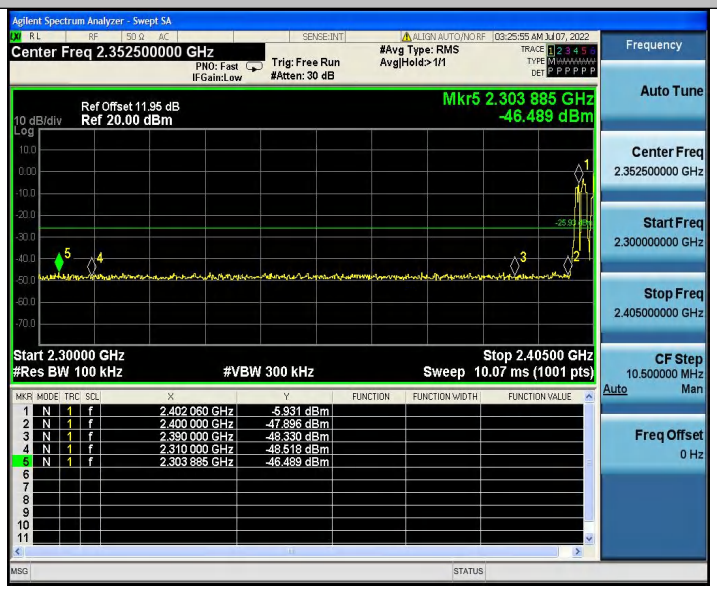
3DH5_Ant1_Low_2402



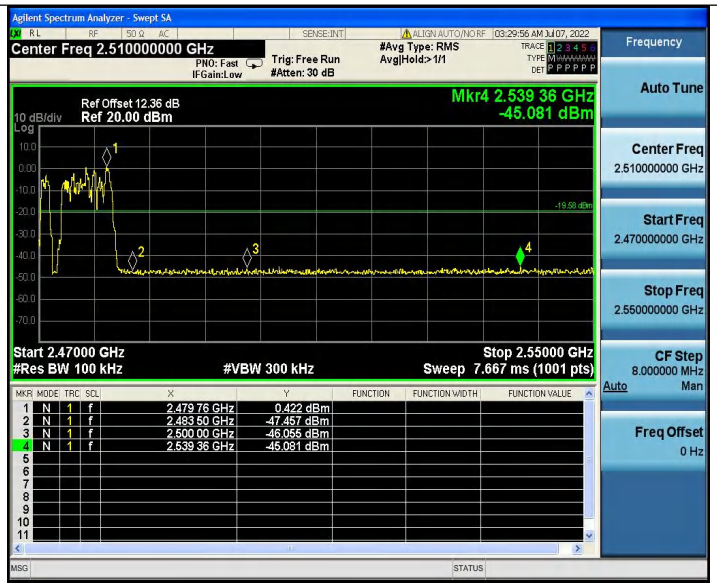
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480

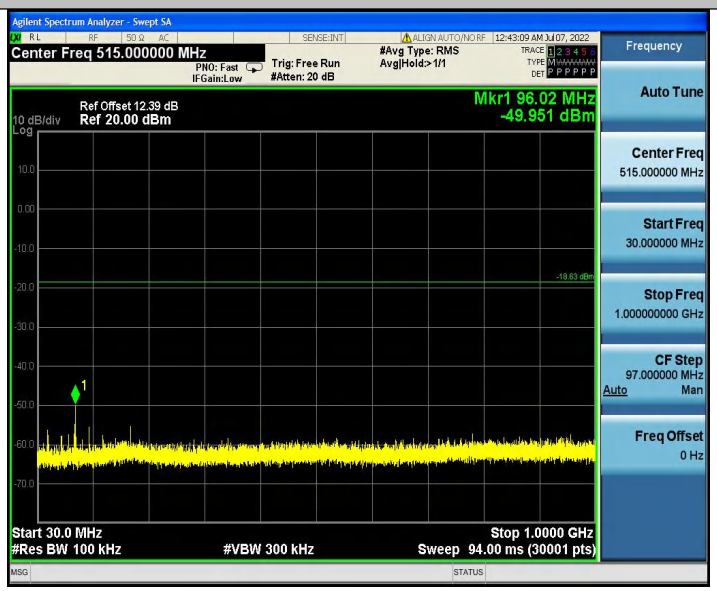


For Conduct spurious emissions

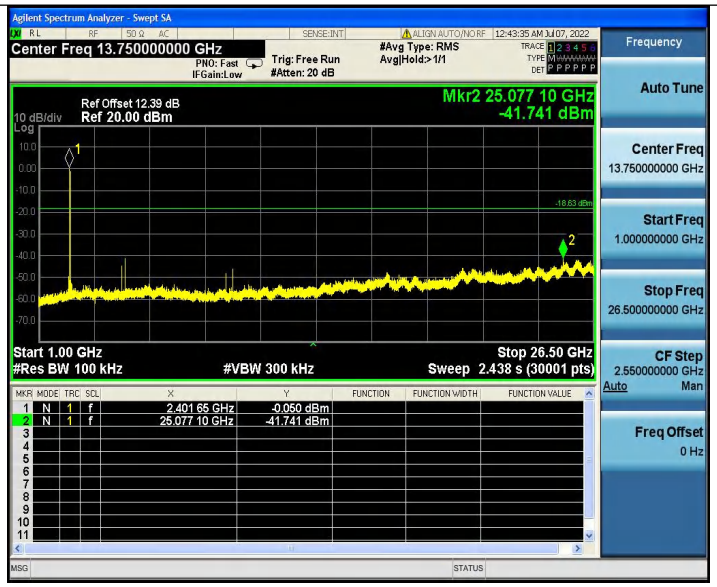
TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	30~1000	1.37	-49.95	≤-18.63	PASS
			1000~26500	1.37	-41.74	≤-18.63	PASS
		2441	30~1000	1.10	-50.43	≤-18.9	PASS
			1000~26500	1.10	-41.32	≤-18.9	PASS
		2480	30~1000	0.23	-48.9	≤-19.77	PASS
			1000~26500	0.23	-41.81	≤-19.77	PASS
2DH5	Ant1	2402	30~1000	1.16	-50.79	≤-18.84	PASS
			1000~26500	1.16	-40.05	≤-18.84	PASS
		2441	30~1000	0.82	-50.21	≤-19.18	PASS
			1000~26500	0.82	-41.76	≤-19.18	PASS
		2480	30~1000	0.04	-50.75	≤-19.96	PASS

			1000~26500	0.04	-40.32	≤-19.96	PASS
3DH5	Ant1	2402	30~1000	1.02	-49.6	≤-18.98	PASS
			1000~26500	1.02	-41.09	≤-18.98	PASS
		2441	30~1000	0.89	-50.65	≤-19.11	PASS
			1000~26500	0.89	-41.78	≤-19.11	PASS
		2480	30~1000	0.07	-49.43	≤-19.93	PASS
			1000~26500	0.07	-41.7	≤-19.93	PASS

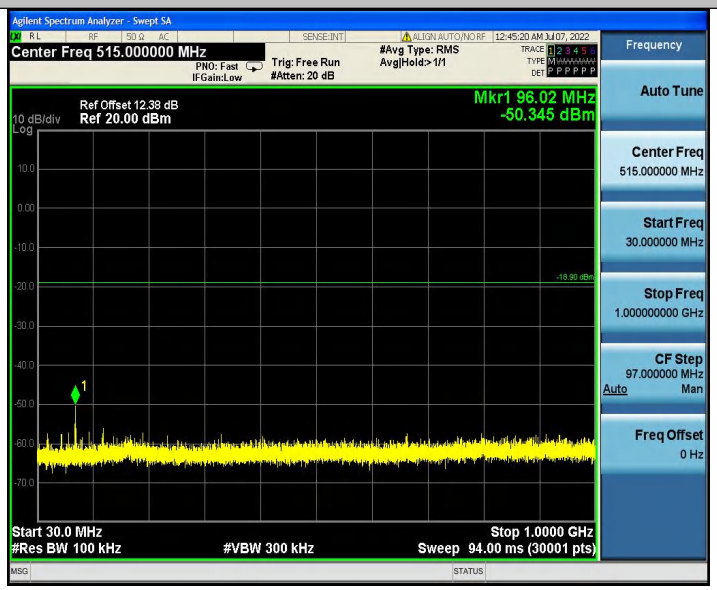
DH5_Ant1_2402_30~1000



DH5_Ant1_2402_1000~26500

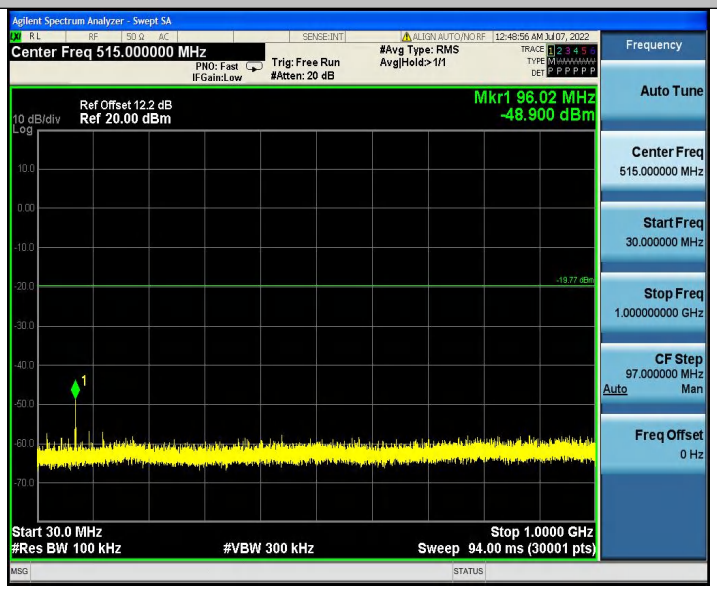


DH5_Ant1_2441_30~1000

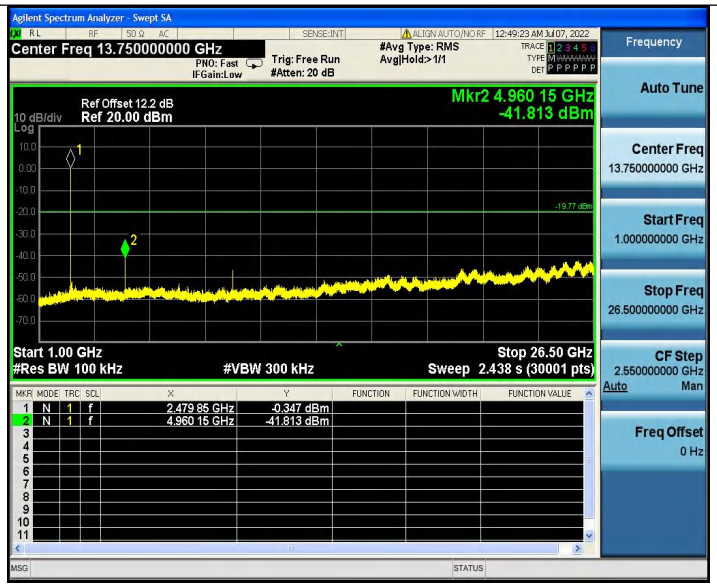


DH5_Ant1_2441_1000~26500

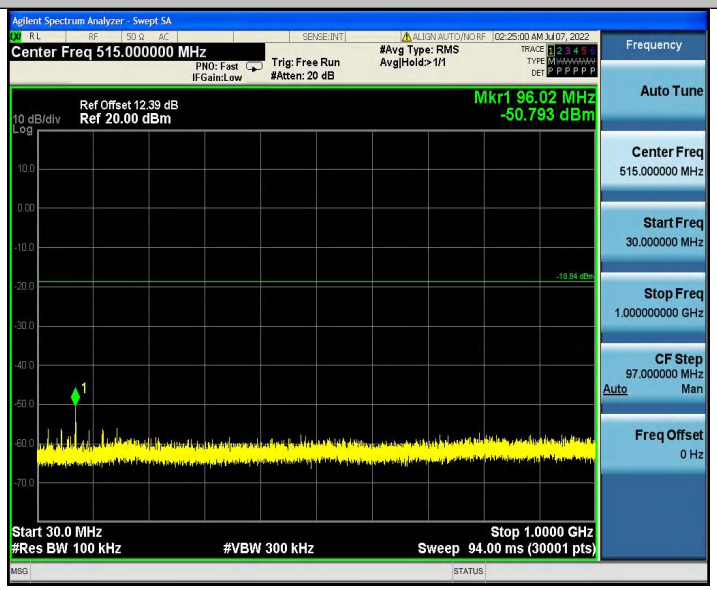
DH5_Ant1_2480_30~1000



DH5_Ant1_2480_1000~26500

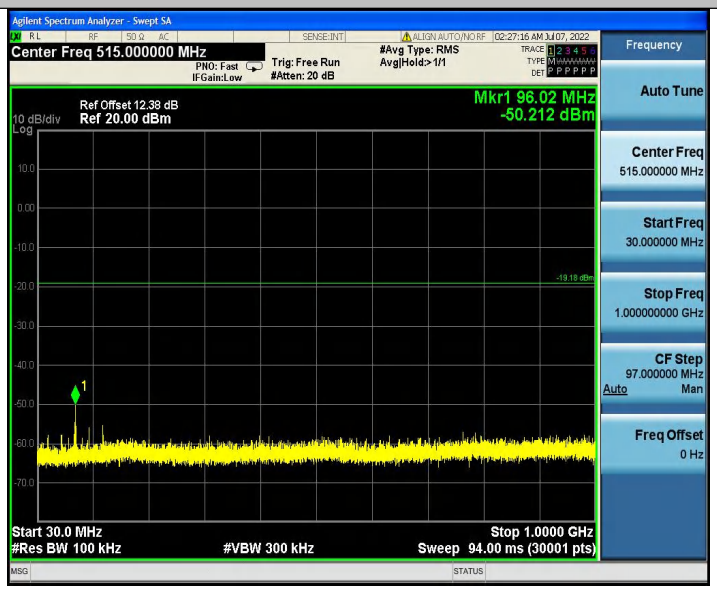


2DH5_Ant1_2402_30~1000



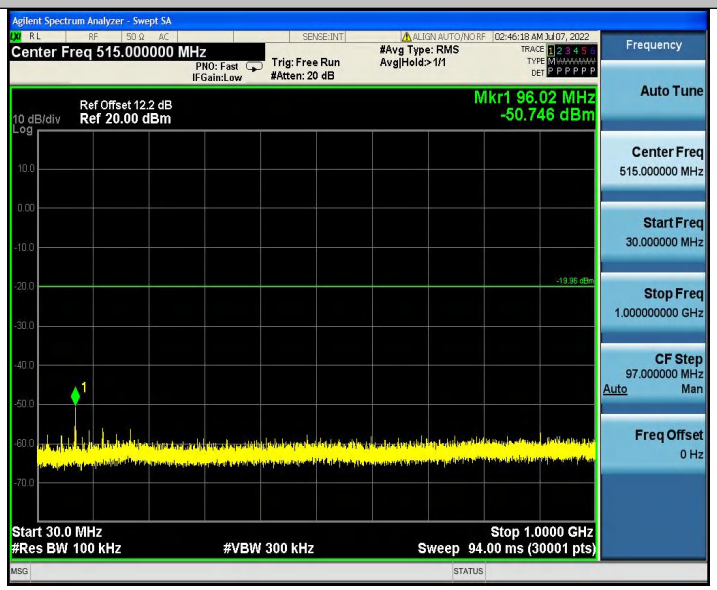
2DH5_Ant1_2402_1000~26500

2DH5_Ant1_2441_30~1000

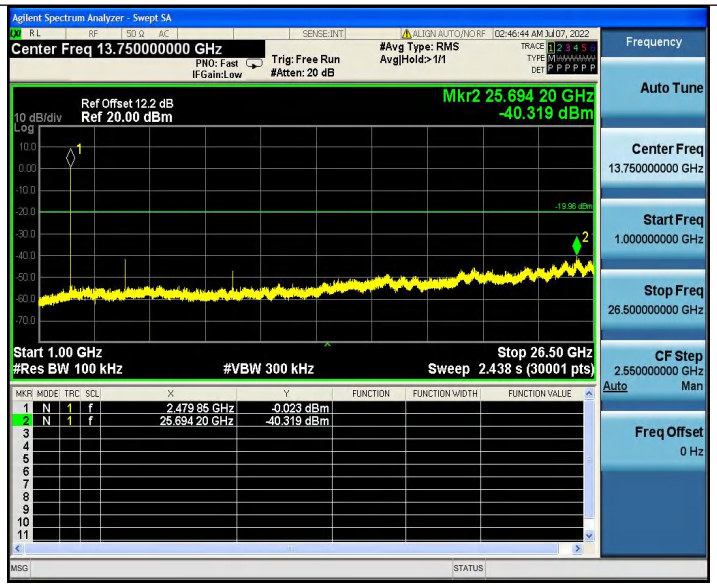


2DH5_Ant1_2441_1000~26500

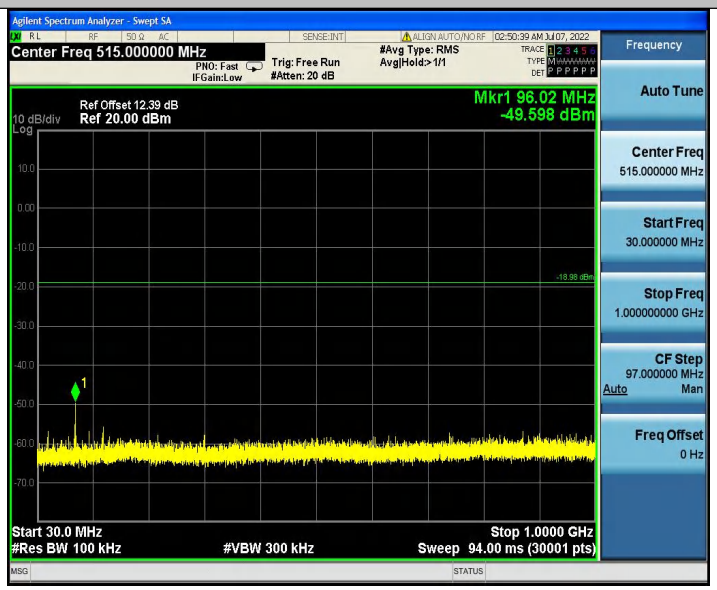
2DH5_Ant1_2480_30~1000



2DH5_Ant1_2480_1000~26500

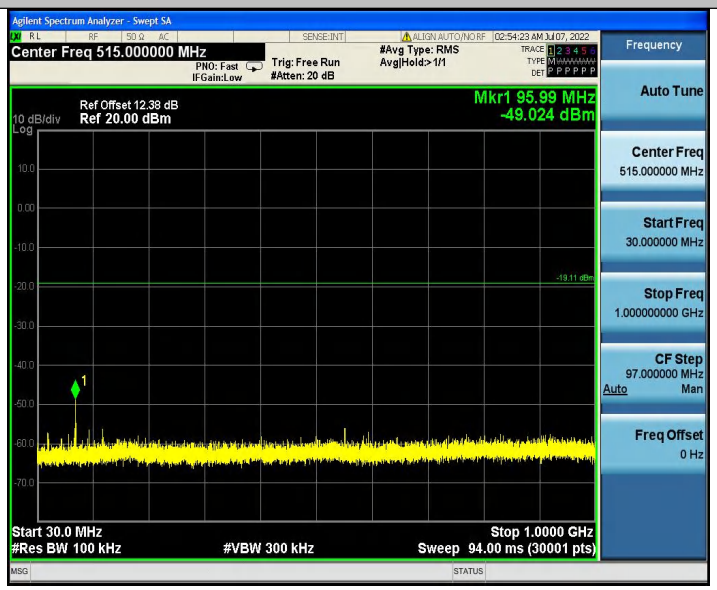


3DH5_Ant1_2402_30~1000



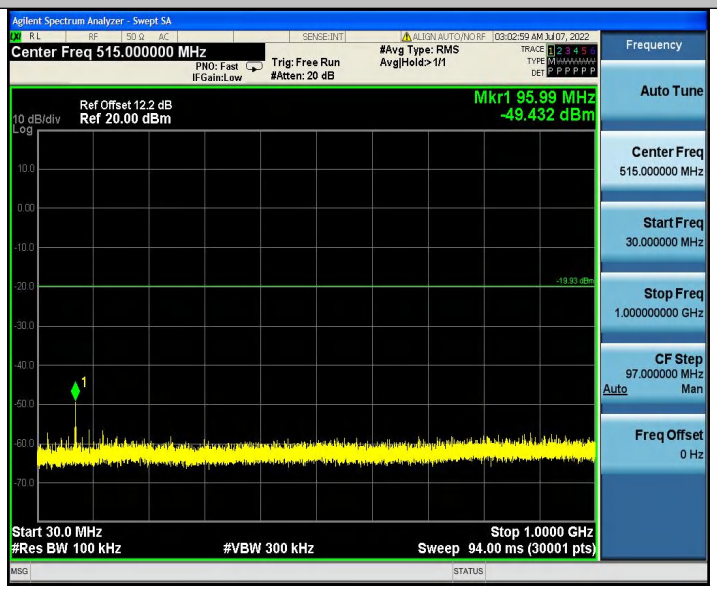
3DH5_Ant1_2402_1000~26500

3DH5_Ant1_2441_30~1000

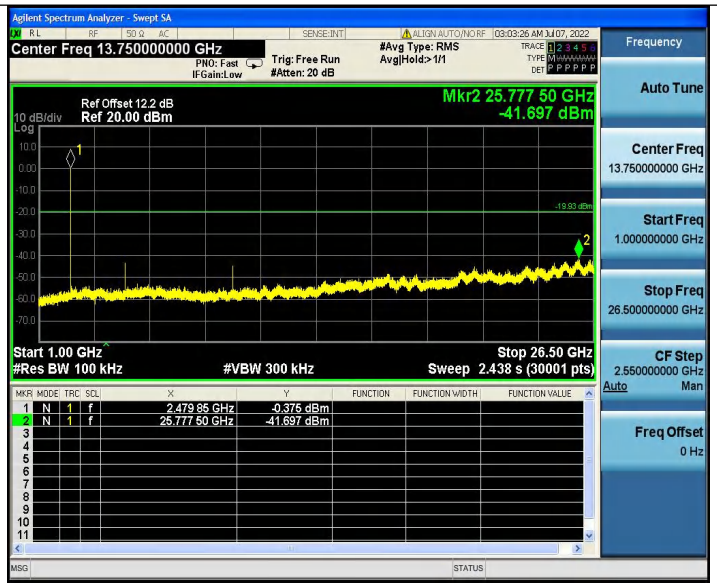


3DH5_Ant1_2441_1000~26500

3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500


Agilent Spectrum Analyzer - Swept SA
Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold:>1/1
03:03:26 AM Jul 07, 2022
Ref Offset 12.2 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr2 25.777 50 GHz
-41.697 dBm
-19.93 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.479 85 GHz -0.375 dBm
2 N 1 f 25.777 50 GHz -41.697 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
MSG
STATUS

9 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer: RBW =30kHz, VBW = 100kHz

9.2 Test Result

Test Mode: CH00 / CH39 / CH78 (GFSK/(1Mbps)Mode)

TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	1.026	2401.487	2402.513	---	---
		2441	1.041	2440.478	2441.519	---	---
		2480	1.104	2479.451	2480.555	---	---
2DH5	Ant1	2402	1.305	2401.358	2402.663	---	---
		2441	1.308	2440.358	2441.666	---	---
		2480	1.305	2479.361	2480.666	---	---
3DH5	Ant1	2402	1.227	2401.415	2402.642	---	---
		2441	1.275	2440.364	2441.639	---	---
		2480	1.281	2479.358	2480.639	---	---

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


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold:>100/100
02:55:54 AM Jul 07, 2022
Ref Offset 12.2 dB
10 dB/div
Ref 30.00 dBm
Log
ΔMkr3 1.281 MHz
-0.225 dB
22.27 dBm
Center 2.480000 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)
1 N 1 f 2.479 358 GHz -22.282 dBm
2 N 1 f 2.479 847 GHz -2.067 dBm
3 Δ1 1 f (Δ) 1.281 MHz (Δ) -0.225 dB
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.481500000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz

10 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

Test Limit : Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band eploying at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Refer to the result “Number of Hopping Frequency” of this document. The 0.125watts (20.97 dBm) limit applies.

10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

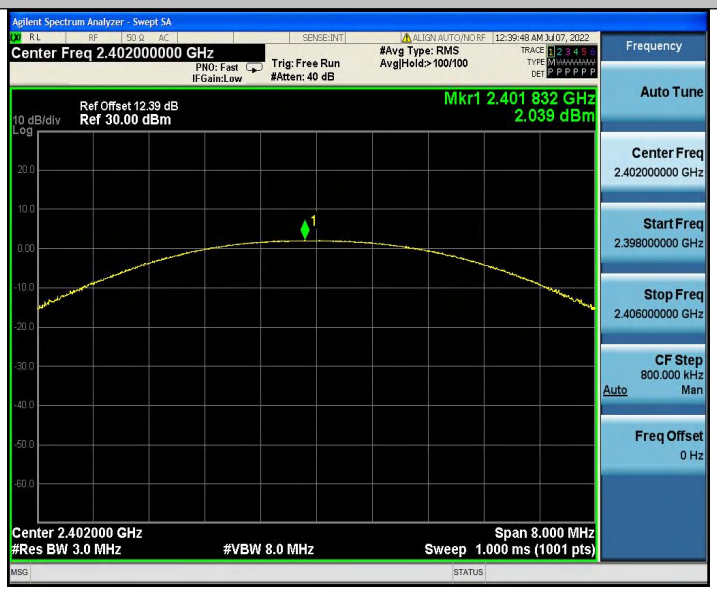
2. Set the spectrum analyser: RBW = 3MHz. VBW =8MHz. Sweep = auto; Detector Function = Peak.

3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

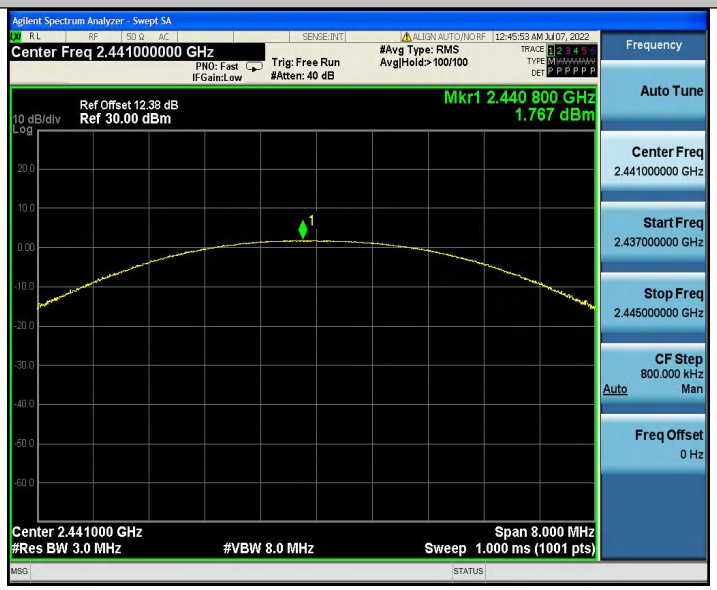
10.2 Test Result

Test Mode	Antenna	Frequency[MHz]	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
DH5	Ant1	2402	2.04	≤20.97	PASS
		2441	1.77	≤20.97	PASS
		2480	0.89	≤20.97	PASS
2DH5	Ant1	2402	2.49	≤20.97	PASS
		2441	2.17	≤20.97	PASS
		2480	1.37	≤20.97	PASS
3DH5	Ant1	2402	2.76	≤20.97	PASS
		2441	2.41	≤20.97	PASS
		2480	1.76	≤20.97	PASS

DH5_Ant1_2402

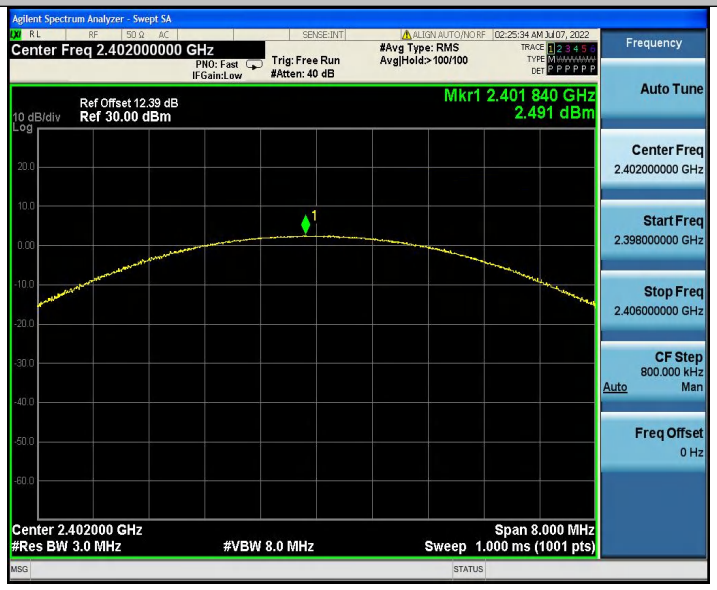


DH5_Ant1_2441



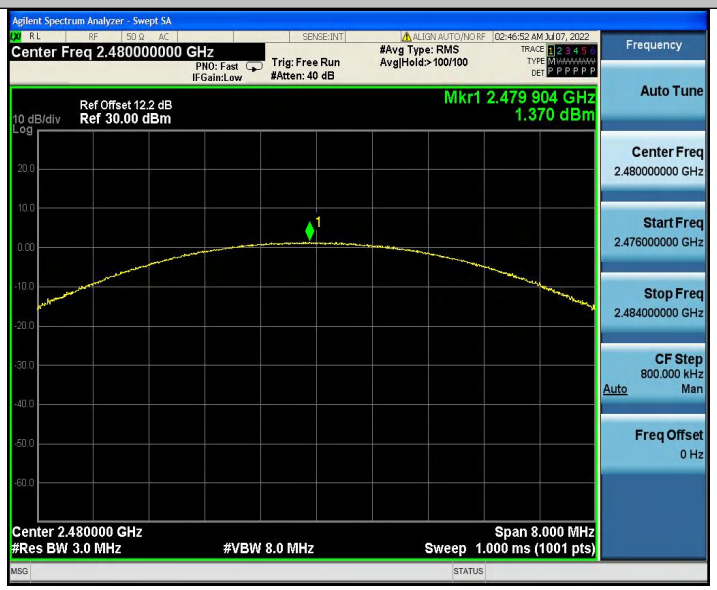
DH5_Ant1_2480

2DH5_Ant1_2402

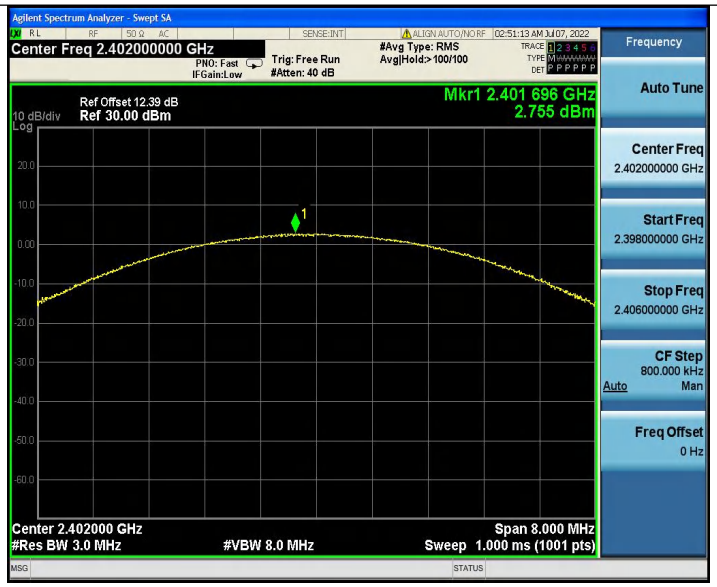


2DH5_Ant1_2441

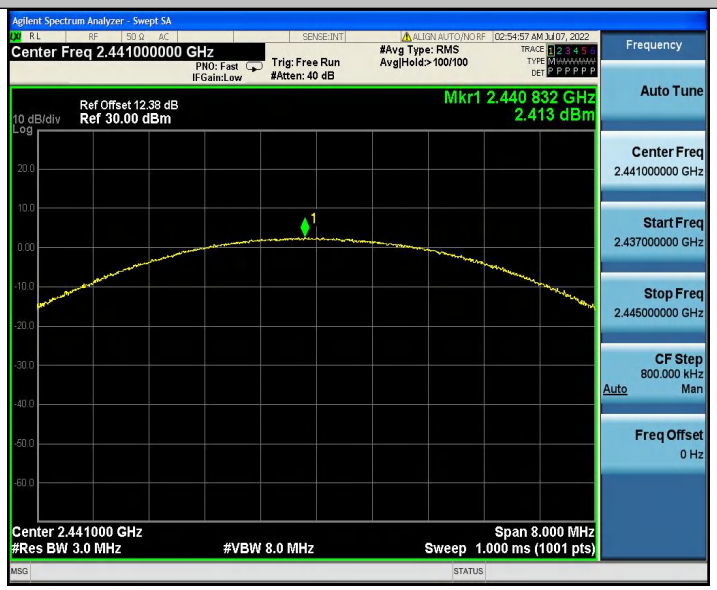
2DH5_Ant1_2480



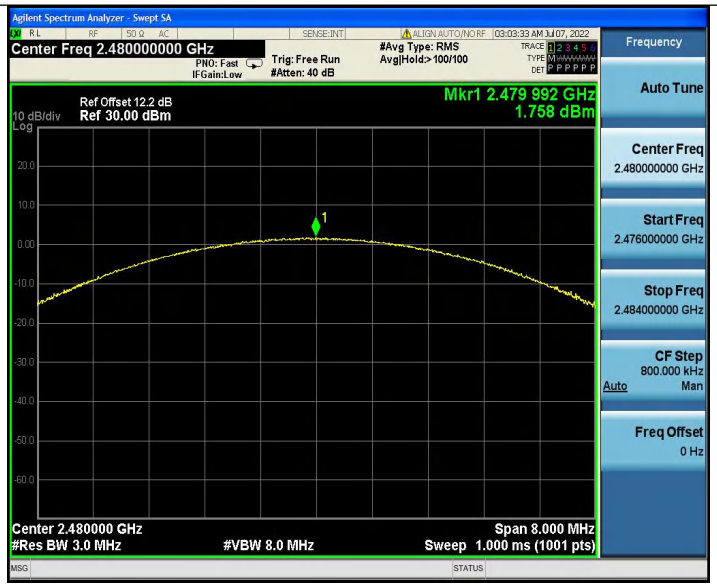
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480


Agilent 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
03:03:33 AM Jul 07, 2022
Ref Offset 12.2 dB
10 dB/div
Ref 30.00 dBm
Log
Mkr1 2.479 992 GHz
1.758 dBm
Center 2.480000 GHz
#Res BW 3.0 MHz
#VBW 8.0 MHz
Span 8.000 MHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.476000000 GHz
Stop Freq
2.484000000 GHz
CF Step
800.000 kHz
Auto
Man
Freq Offset
0 Hz

11 Hopping Channel Separation

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
Test Mode	:	Hopping

11.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 30KHz. VBW =100KHz, Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

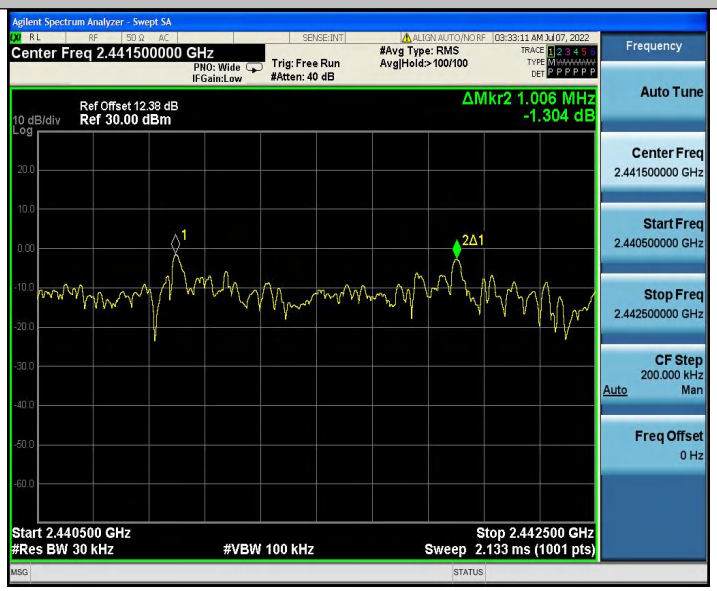
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the sub-paragraphs of this Section Submit this plot.

11.2 Test Result

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	0.99	≥0.736	PASS
2DH5	Ant1	Hop	1.154	≥0.872	PASS
3DH5	Ant1	Hop	1.006	≥0.854	PASS

DH5_Ant1_Hop

2DH5_Ant1_Hop

3DH5_Ant1_Hop


12 Number of Hopping Frequency

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode	:	Hopping(GFSK)

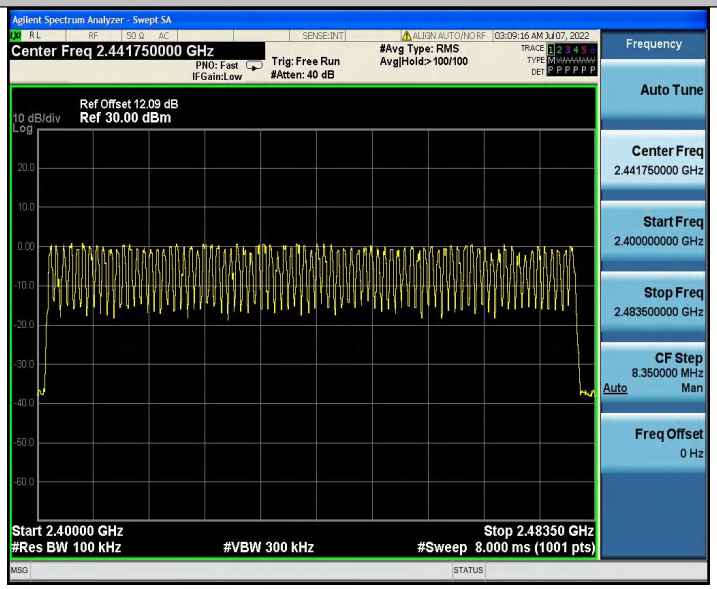
12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW = 300KHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.483GHz. Sweep=auto;

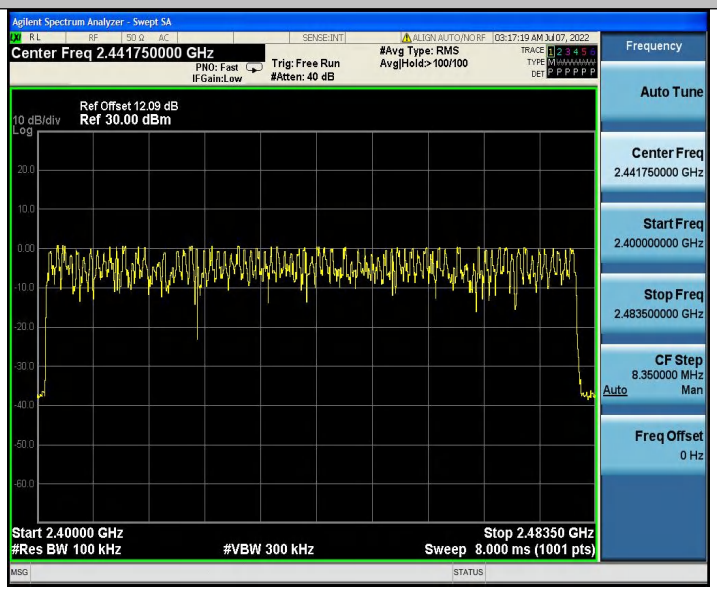
12.2 Test Result

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

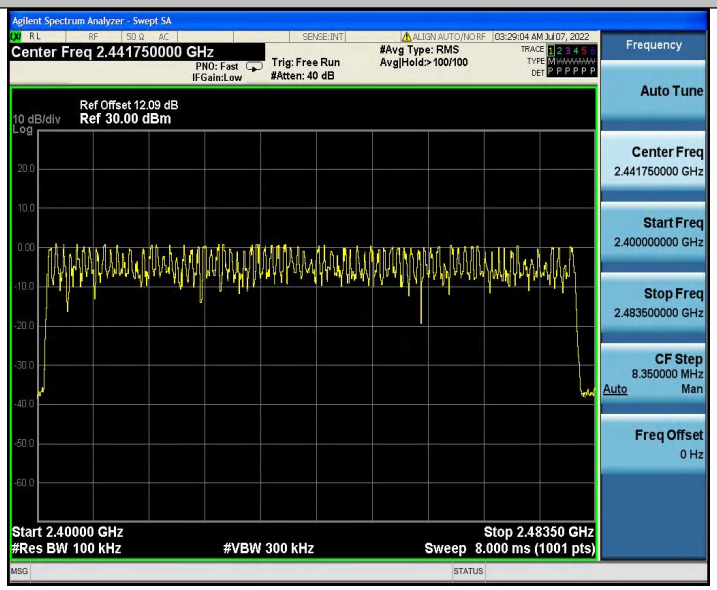
DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop



13 Dwell Time

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
Test Mode	:	The worst case(π/4-DQPSK) was recorded

13.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set spectrum analyzer span = 0. Centred on a hopping channel;

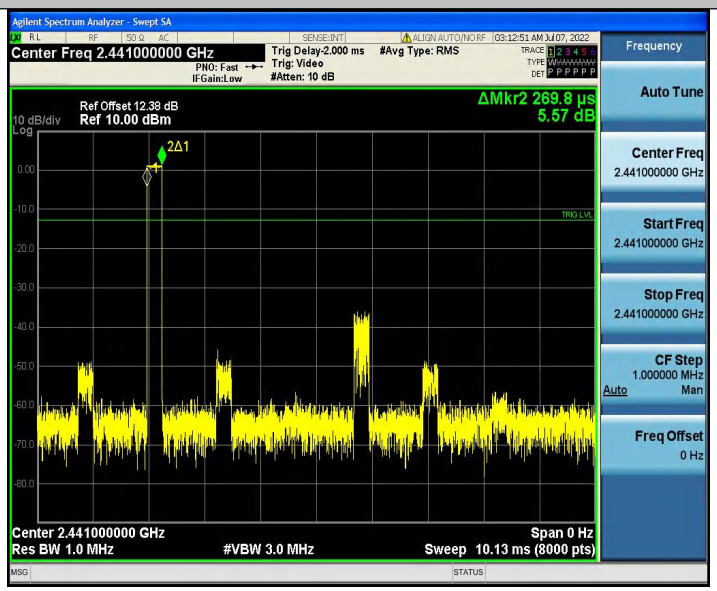
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the sub-paragraphs of this Section. Submit this plot(s).

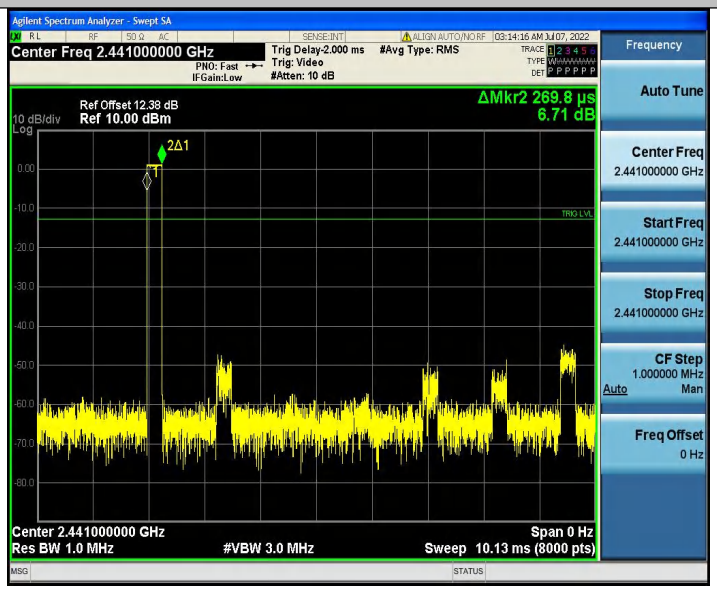
13.2 Test Result

TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.27	320	0.086	≤0.4	PASS
DH3	Ant1	Hop	0.27	160	0.043	≤0.4	PASS
DH5	Ant1	Hop	0.27	106.67	0.029	≤0.4	PASS
2DH1	Ant1	Hop	0.27	320	0.086	≤0.4	PASS
2DH3	Ant1	Hop	0.27	160	0.043	≤0.4	PASS
2DH5	Ant1	Hop	0.27	106.67	0.029	≤0.4	PASS
3DH1	Ant1	Hop	0.27	320	0.086	≤0.4	PASS
3DH3	Ant1	Hop	0.27	160	0.043	≤0.4	PASS
3DH5	Ant1	Hop	0.27	106.67	0.029	≤0.4	PASS

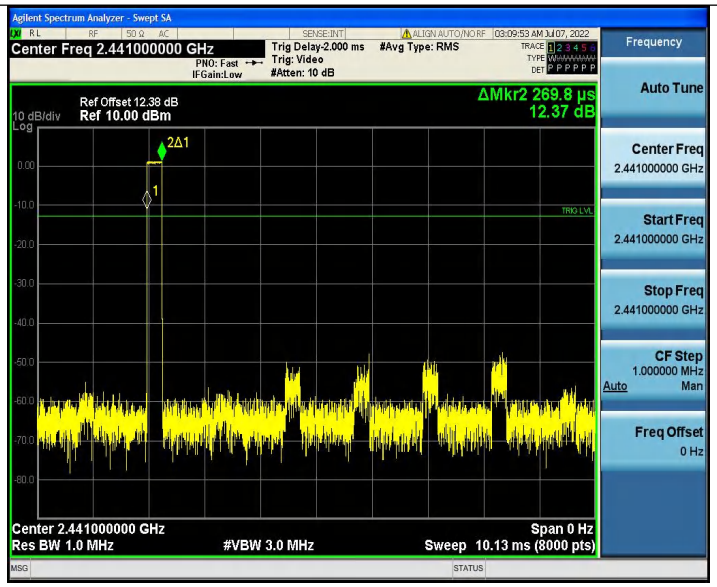
DH1_Ant1_Hop



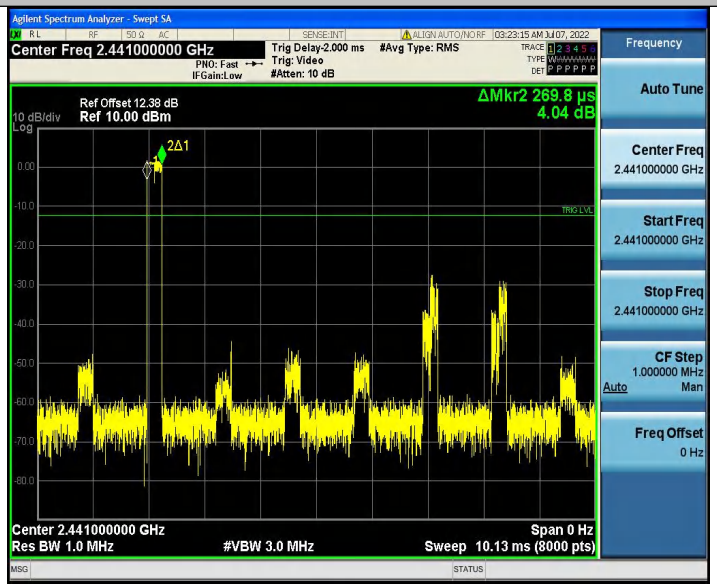
DH3_Ant1_Hop



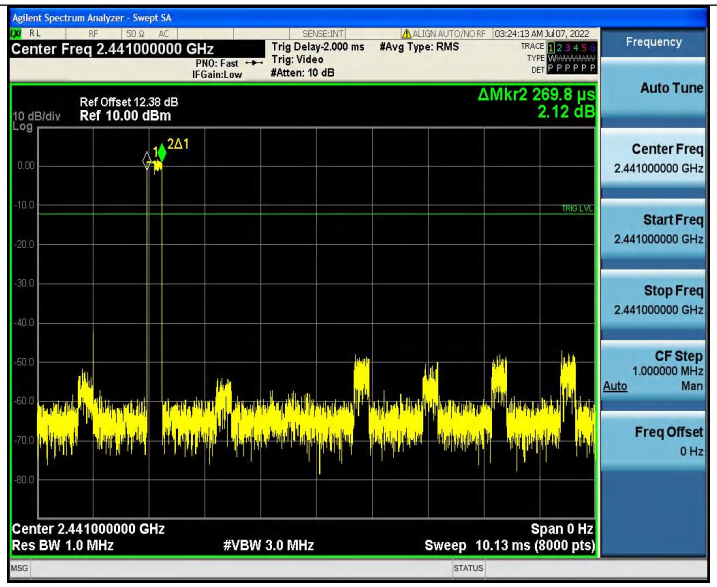
DH5_Ant1_Hop



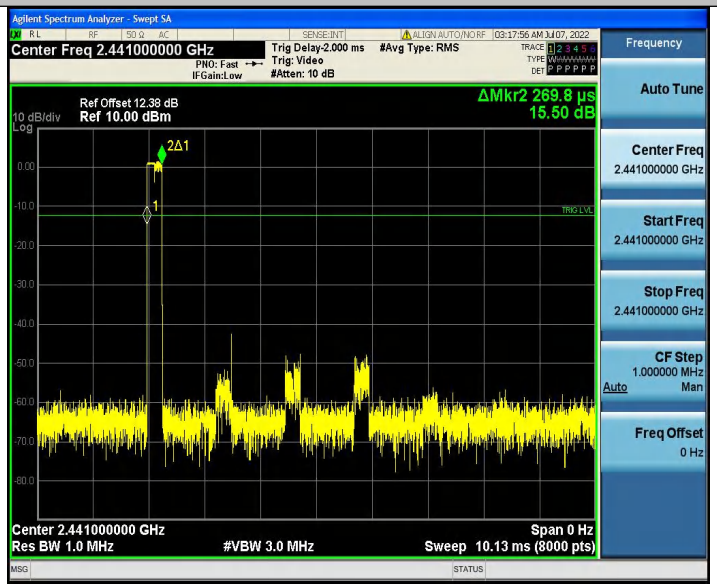
2DH1_Ant1_Hop



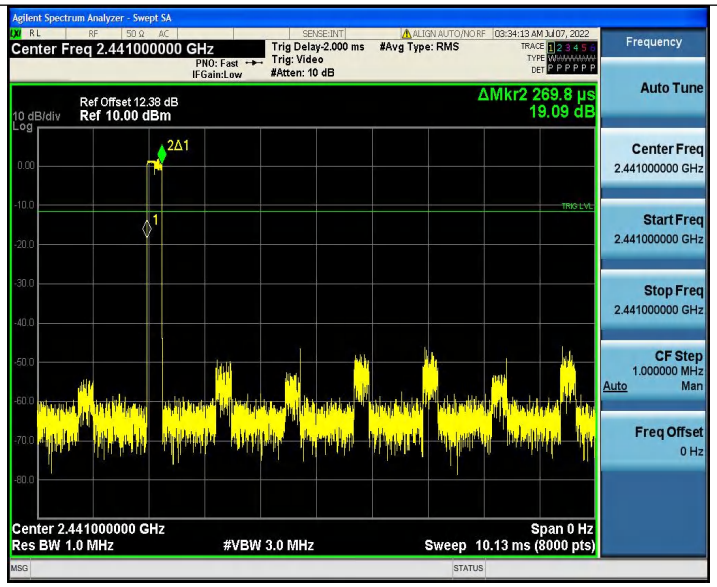
2DH3_Ant1_Hop



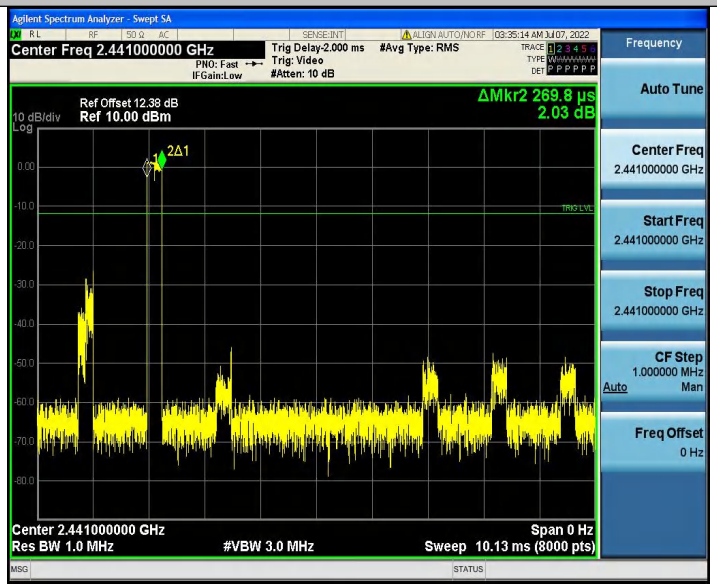
2DH5_Ant1_Hop



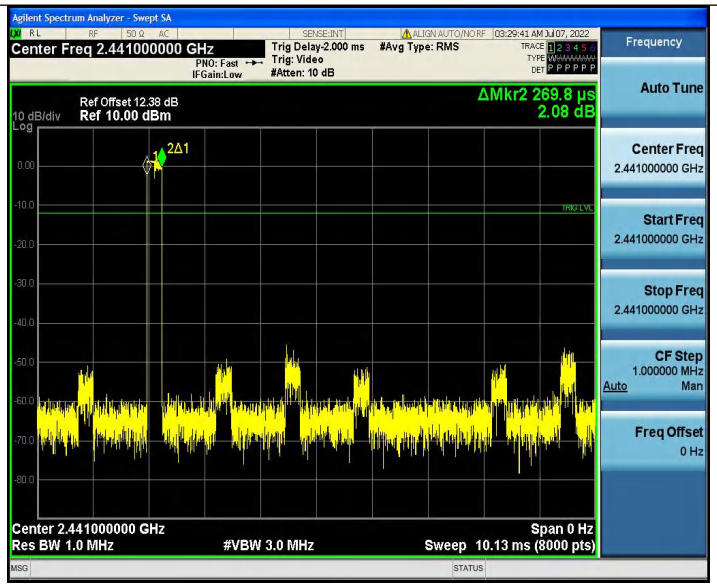
3DH1_Ant1_Hop



3DH3_Ant1_Hop



3DH5_Ant1_Hop


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-2.000 ms
Trig: Video
#Atten: 10 dB
#Avg Type: RMS
03:29:41 AM Jul 07, 2022
Ref Offset 12.38 dB
10 dB/div
Ref 10.00 dBm
Log
ΔMkr2 269.8 µs
2.08 dB
2Δ1
TRIG LVL
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

14 Antenna Requirement

14.1 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

14.2 Result

The EUT'S antenna, permanent attached antenna, is Internal PCB Antenna. The antenna's gain is 0dBi and meets the requirement.

********THE END REPORT********