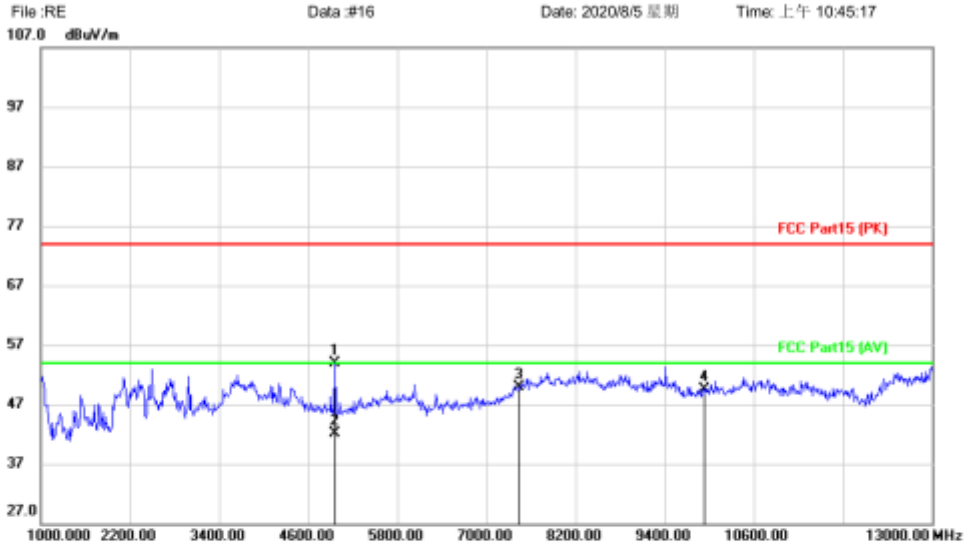
Radiated Emission Measurement



Site
Limit: FCC Part15 (PK)
EUT: Bluetooth Headset
M/N: Truengine 3 SE
Mode: TX-H
Note:

Polarization: ***Horizontal***
Power:
Distance: 3m

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	58.79	-4.84	53.95	74.00	-20.05	peak			
2	*	4960.000	46.87	-4.84	42.03	54.00	-11.97	AVG			
3		7440.000	50.43	-0.56	49.87	74.00	-24.13	peak			
4		9920.000	48.14	1.30	49.44	74.00	-24.56	peak			

Test Result: Pass

RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

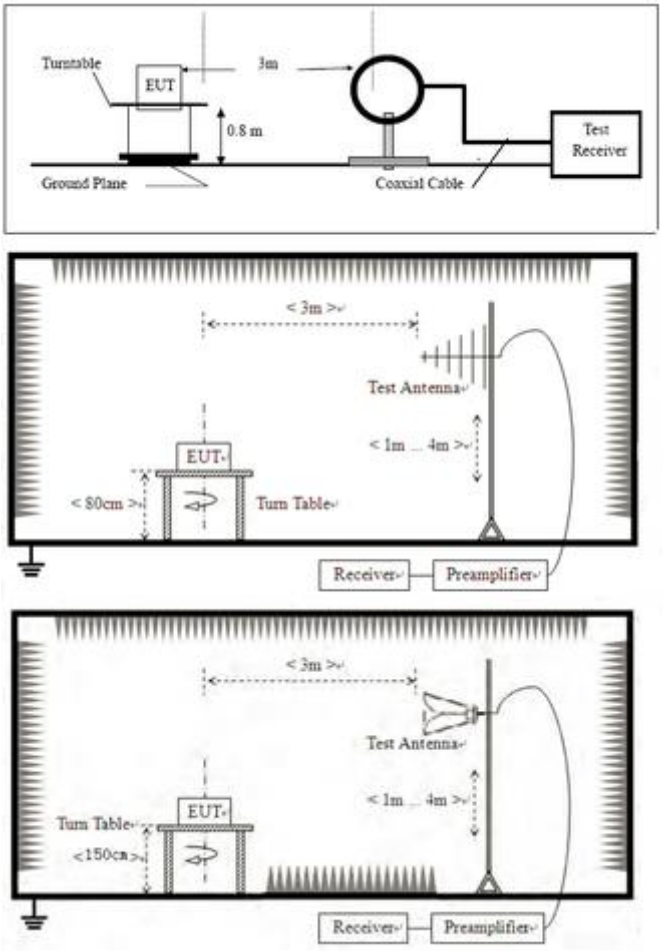
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.10.5
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25℃
Humidity	60%

LIMITS

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

BLOCK DIAGRAM OF TEST SETUP



PROCEDURE

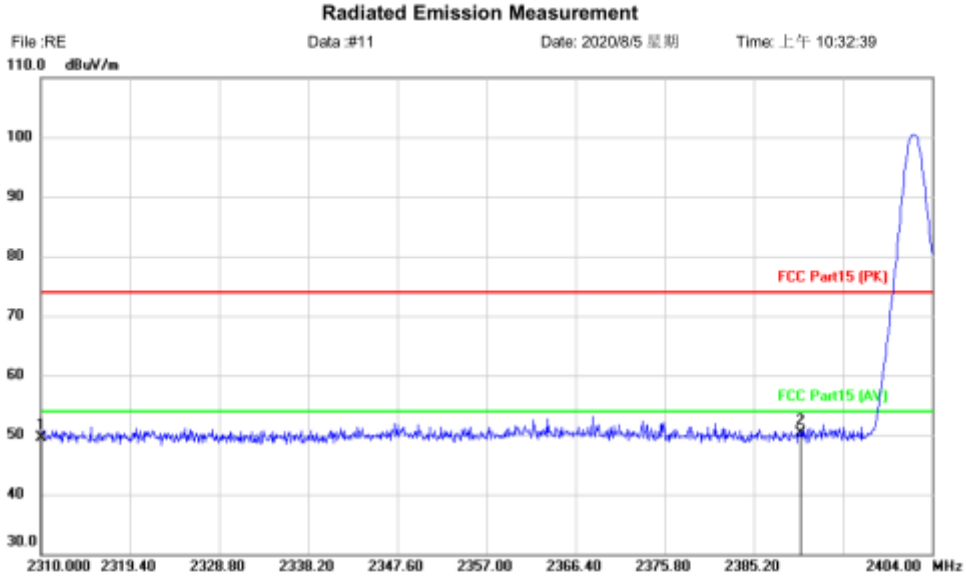
a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
j. Repeat above procedures until all frequencies measured was complete.
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

TEST DATA

Remark: During the test, pre-scan the GFSK, Pi/4QPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.

Lowest channel-Peak Value



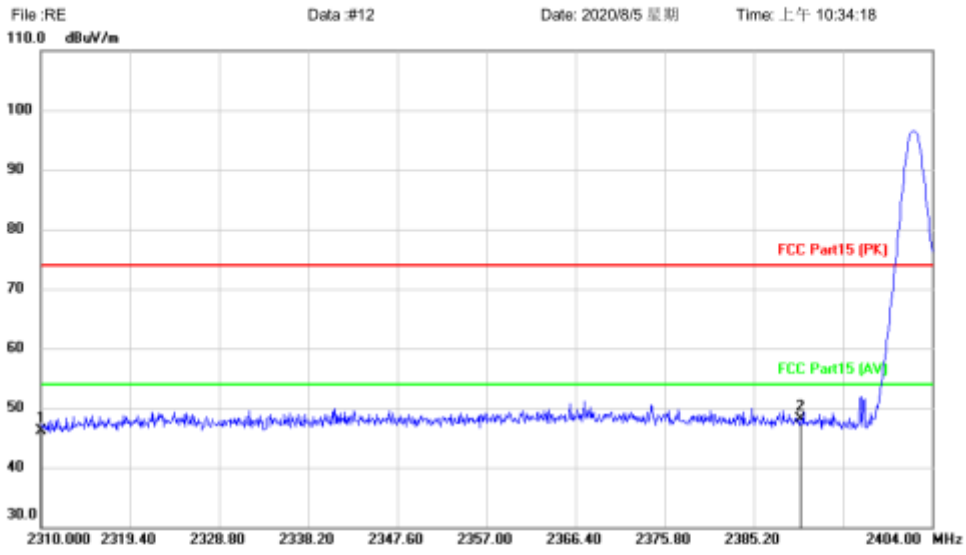
Site
Limit: FCC Part15 (PK)
EUT: Bluetooth Headset
M/N: Truengine 3 SE
Mode: TX-L
Note:

Polarization: *Horizontal*
Power:
Distance: 3m

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	63.53	-14.01	49.52	74.00	-24.48	peak			
2	*	2390.000	63.88	-13.62	50.26	74.00	-23.74	peak			

Radiated Emission Measurement



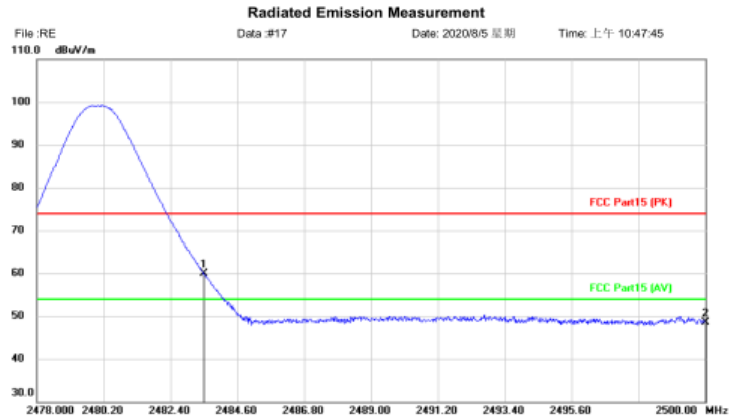
Site
Limit: FCC Part15 (PK)
EUT: Bluetooth Headset
M/N: Truengine 3 SE
Mode: TX-L
Note:

Polarization: *Vertical*
Power:
Distance: 3m

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	60.45	-14.30	46.15	74.00	-27.85	peak			
2	*	2390.000	62.00	-13.95	48.05	74.00	-25.95	peak			

Highest channel-Peak Value

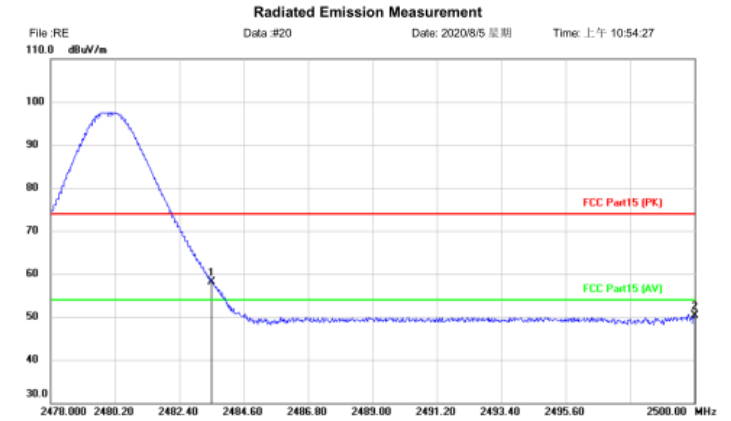


Site
Limit: FCC Part15 (PK)
EUT: Bluetooth Headset
M/N: Truengine 3 SE
Mode: TX-H
Note:

Polarization: *Horizontal*
Power:
Distance: 3m

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2483.500	73.06	-13.11	59.95	74.00	-14.05	peak			
2		2500.000	61.58	-13.02	48.56	74.00	-25.44	peak			



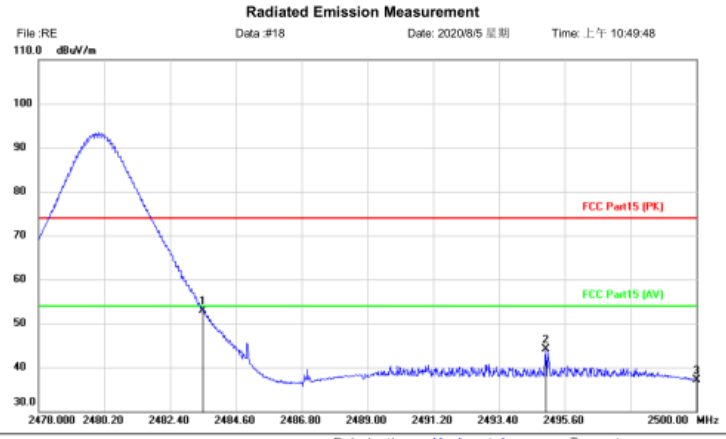
Site
Limit: FCC Part15 (PK)
EUT: Bluetooth Headset
M/N: Truengine 3 SE
Mode: TX-H
Note:

Polarization: *Vertical*
Power:
Distance: 3m

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2483.500	71.65	-13.50	58.15	74.00	-15.85	peak			
2		2500.000	63.67	-13.42	50.25	74.00	-23.75	peak			

AVG Value

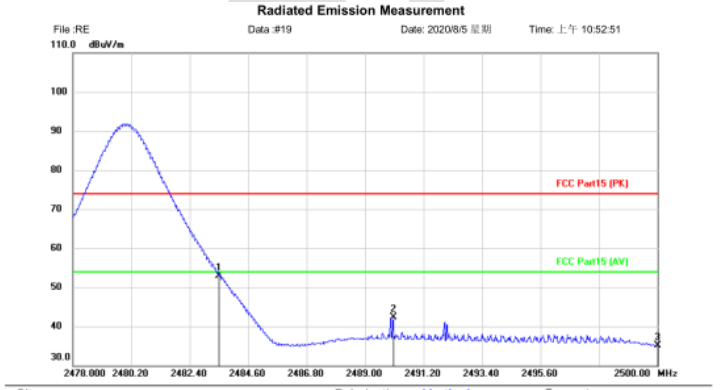


Site
Limit: FCC Part15 (PK)
EUT: Bluetooth Headset
M/N: Truengine 3 SE
Mode: TX-H
Note:

Polarization: *Horizontal*
Power:
Distance: 3m

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2483.500	66.10	-13.11	52.99	54.00	-1.01	AVG			
2		2494.962	57.10	-13.05	44.05	54.00	-9.95	AVG			
3		2500.000	50.12	-13.02	37.10	54.00	-16.90	AVG			



Site
Limit: FCC Part15 (PK)
EUT: Bluetooth Headset
M/N: Truengine 3 SE
Mode: TX-H
Note:

Polarization: *Vertical*
Power:
Distance: 3m

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2483.500	66.50	-13.50	53.00	54.00	-1.00	AVG			
2		2490.056	55.83	-13.47	42.36	54.00	-11.64	AVG			
3		2500.000	48.58	-13.42	35.16	54.00	-18.84	AVG			

Test Result: Pass

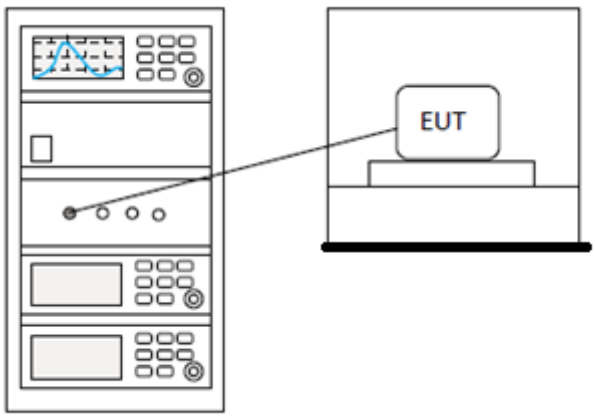
CONDUCTED BAND EDGES MEASUREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25℃
Humidity	60%

LIMITS

Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

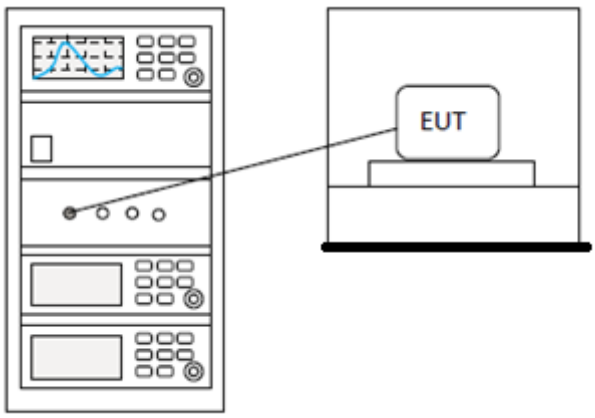
DWELL TIME

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.4
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25℃
Humidity	60%

LIMITS

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

10 APPENDIX

Appendix1

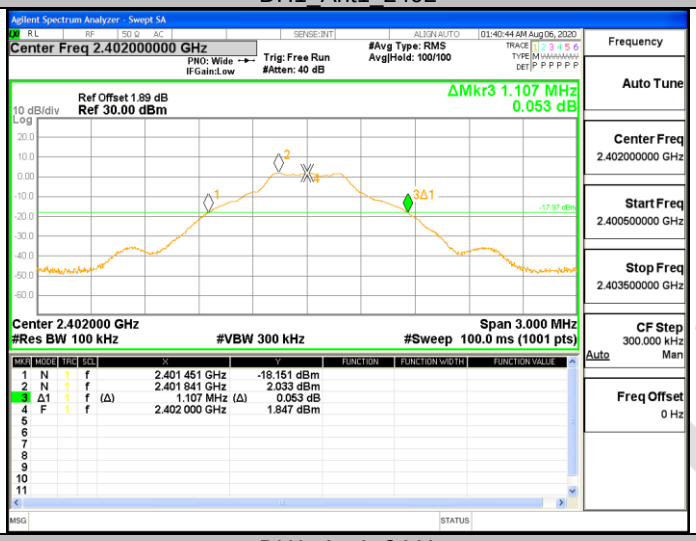
10.1 APPENDIXA: 20DBEMISSION BANDWIDTH

Test Result

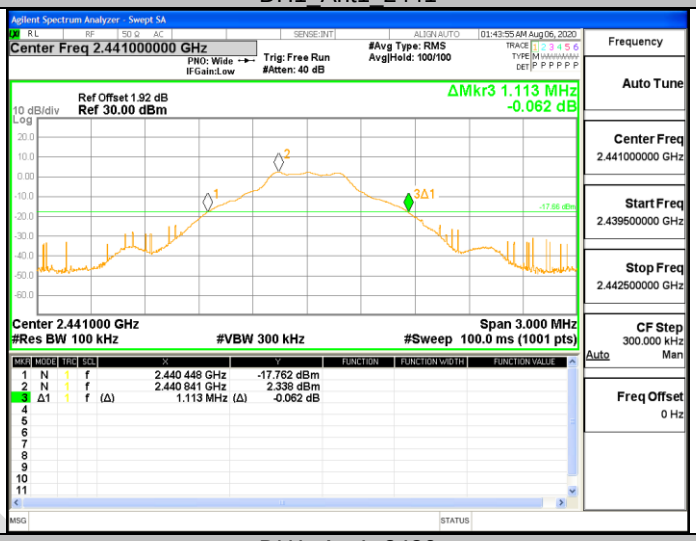
TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	1.107	2401.451	2402.558	---	PASS
		2441	1.113	2440.448	2441.561	---	PASS
		2480	1.101	2479.454	2480.555	---	PASS
2DH1	Ant1	2402	1.395	2401.298	2402.693	---	PASS
		2441	1.395	2440.298	2441.693	---	PASS
		2480	1.395	2479.298	2480.693	---	PASS
3DH1	Ant1	2402	1.365	2401.316	2402.681	---	PASS
		2441	1.362	2440.316	2441.678	---	PASS
		2480	1.362	2479.316	2480.678	---	PASS

Test Graphs

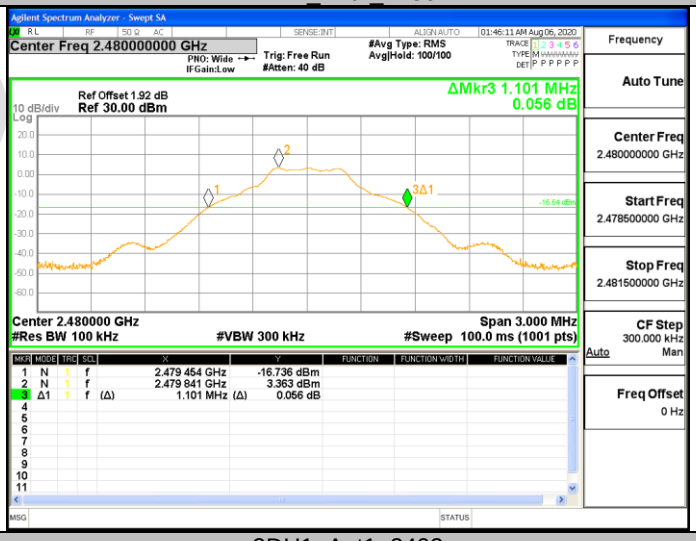
DH1_Ant1_2402



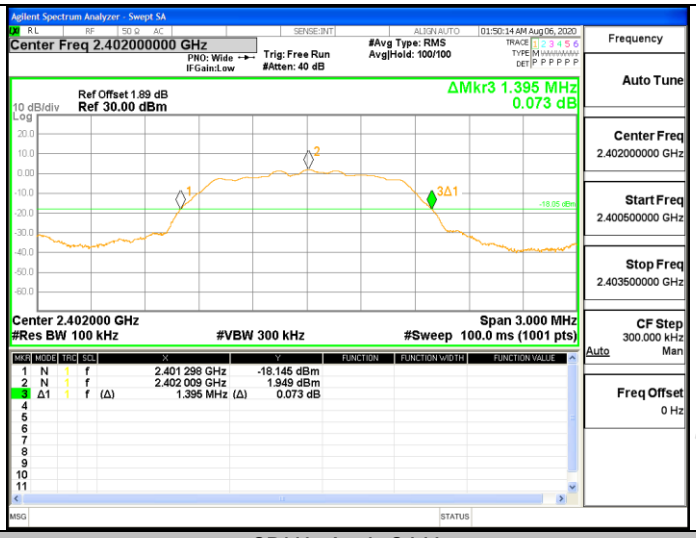
DH1_Ant1_2441



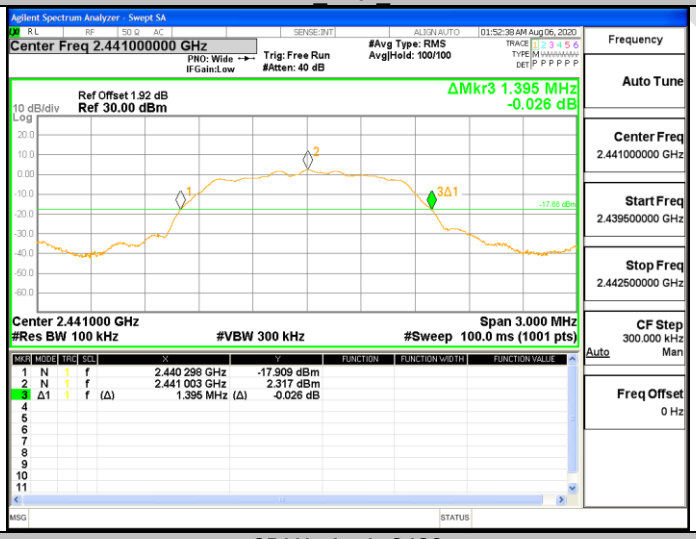
DH1_Ant1_2480



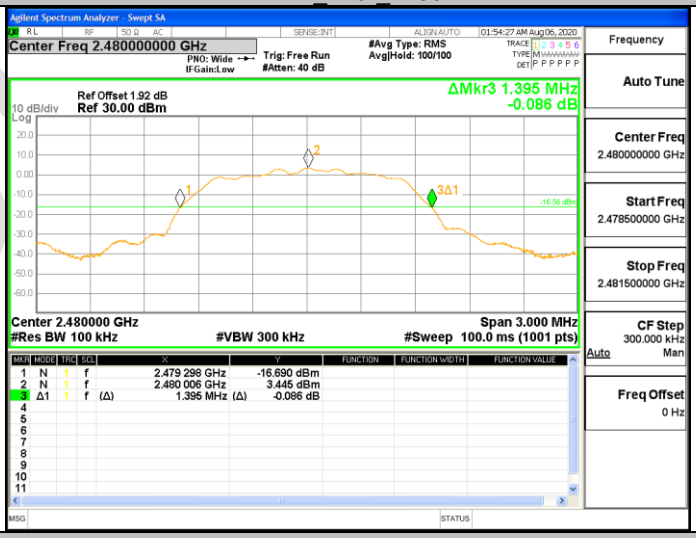
2DH1_Ant1_2402



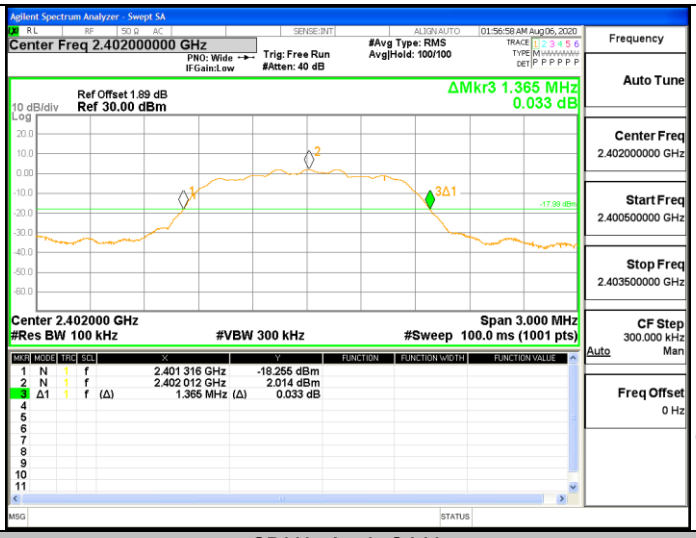
2DH1_Ant1_2441



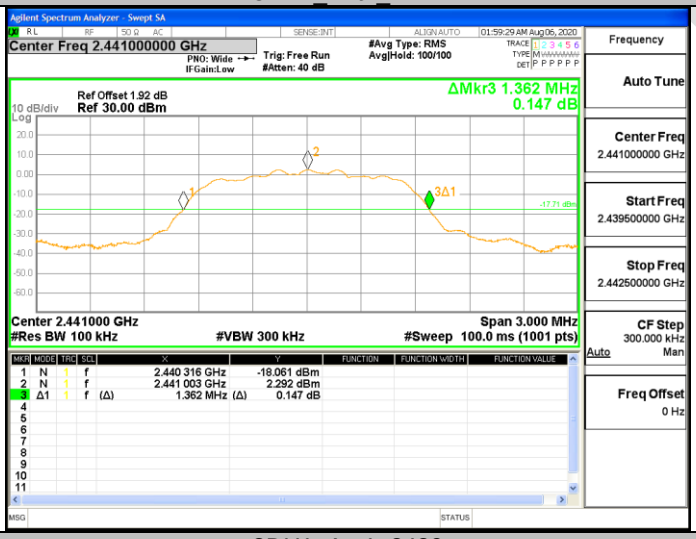
2DH1_Ant1_2480



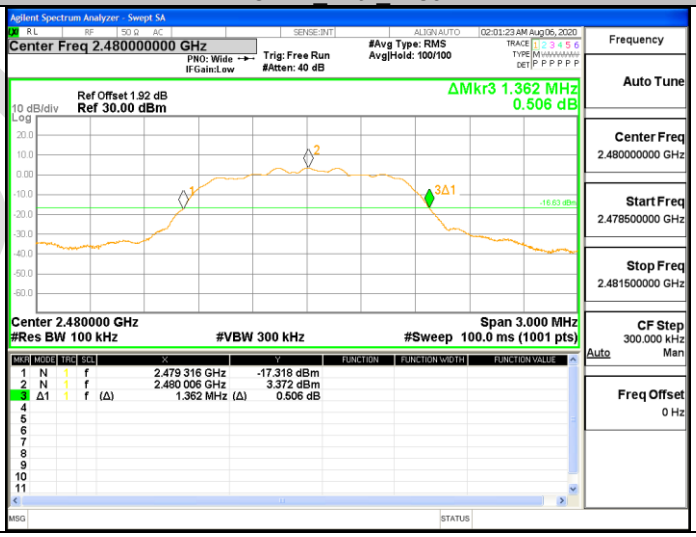
3DH1_Ant1_2402



3DH1_Ant1_2441



3DH1_Ant1_2480



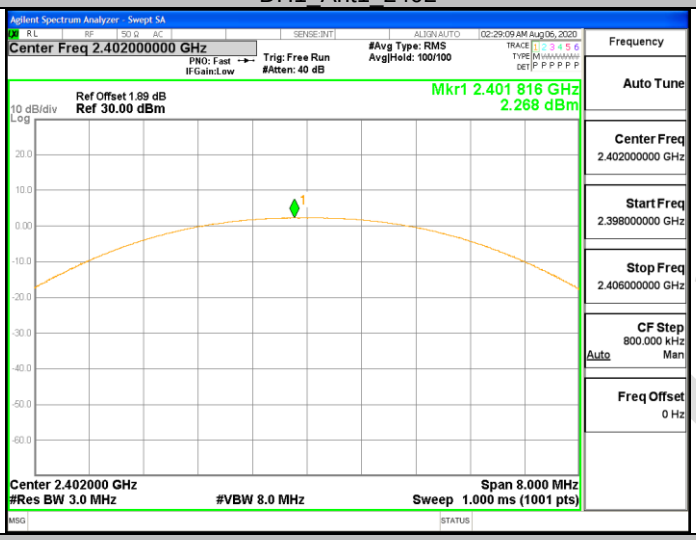
10.2 APPENDIXC: MAXIMUM CONDUCTED OUTPUT POWER

Test Result

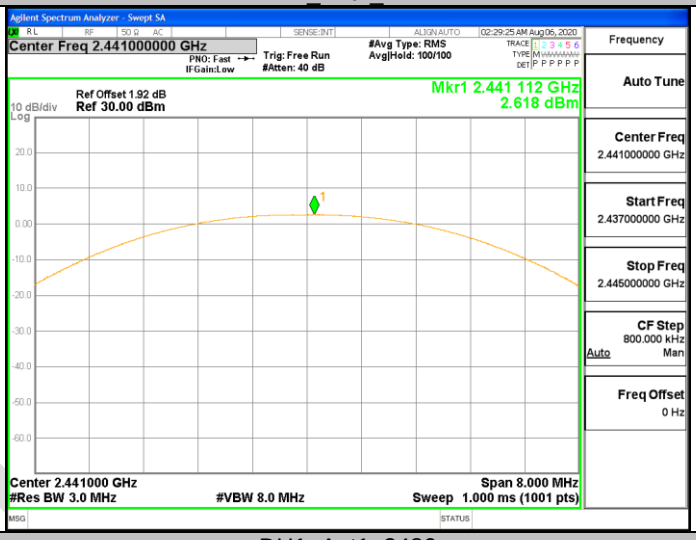
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH1	Ant1	2402	2.27	<=20.97	PASS
		2441	2.62	<=20.97	PASS
		2480	3.73	<=20.97	PASS
2DH1	Ant1	2402	4.74	<=20.97	PASS
		2441	5.08	<=20.97	PASS
		2480	6.07	<=20.97	PASS
3DH1	Ant1	2402	5.39	<=20.97	PASS
		2441	5.79	<=20.97	PASS
		2480	6.79	<=20.97	PASS

Test Graphs

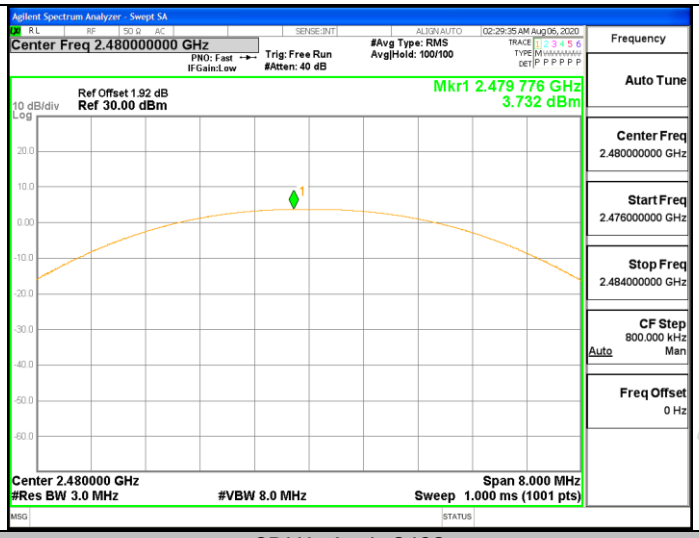
DH1_Ant1_2402



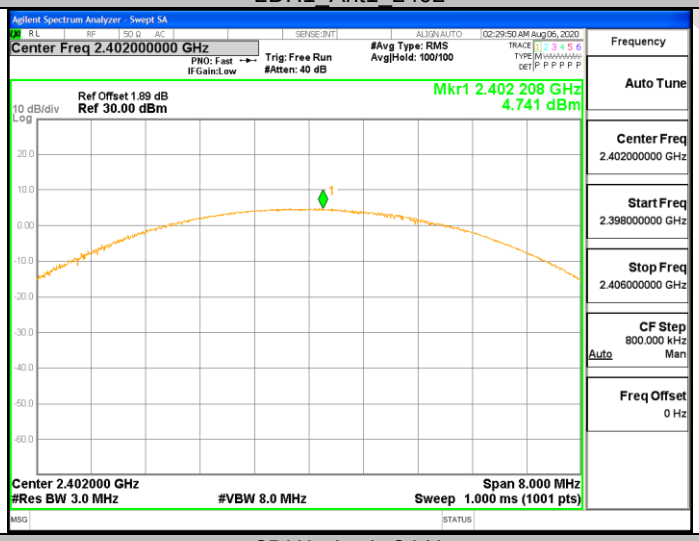
DH1_Ant1_2441



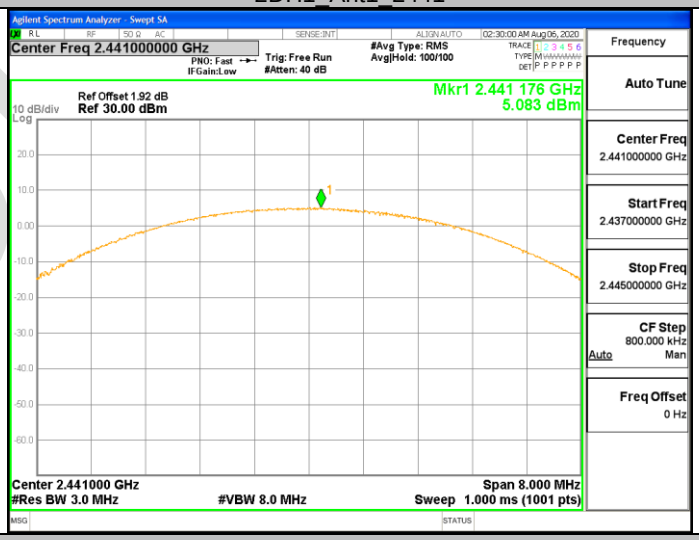
DH1_Ant1_2480



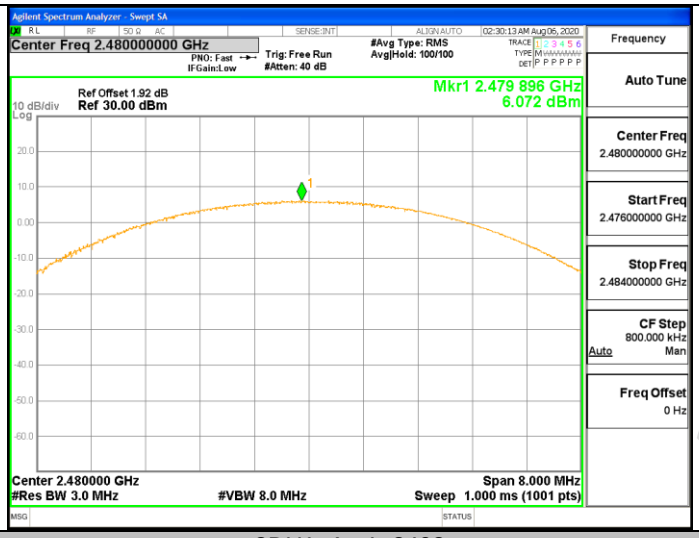
2DH1_Ant1_2402



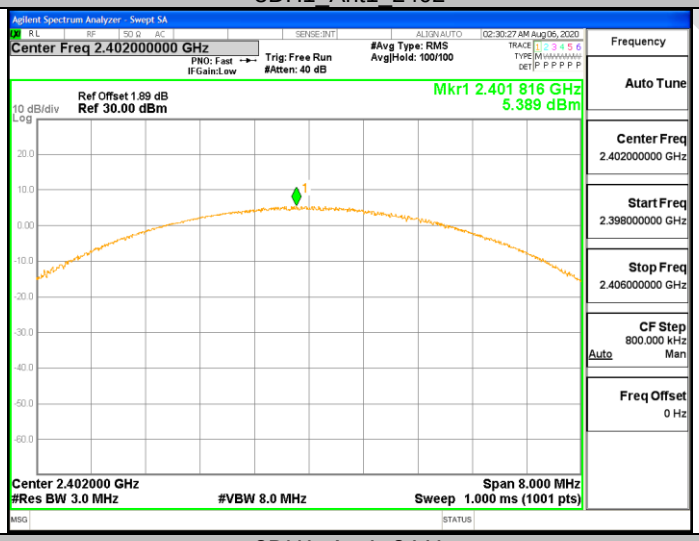
2DH1_Ant1_2441



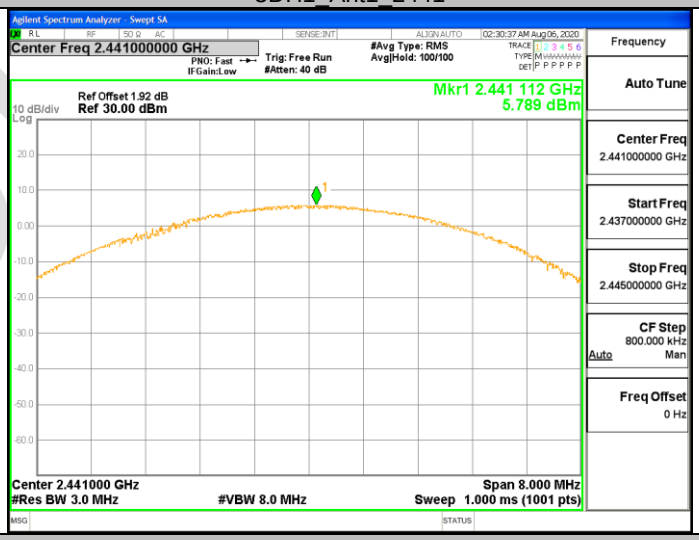
2DH1_Ant1_2480



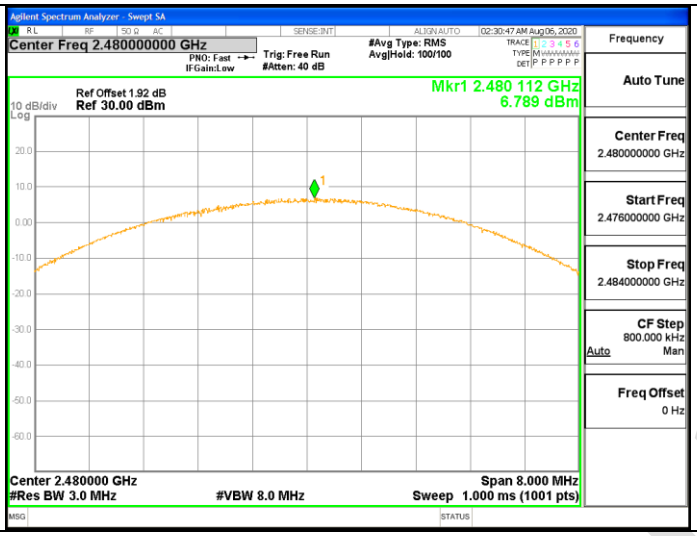
3DH1_Ant1_2402



3DH1_Ant1_2441



3DH1_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
02:30:47 AM Aug 06, 2020
Frequency
Auto Tune
Mkr1 2.480 112 GHz
6.789 dBm
Ref Offset 1.92 dB
10 dB/div
Log
Ref 30.00 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)

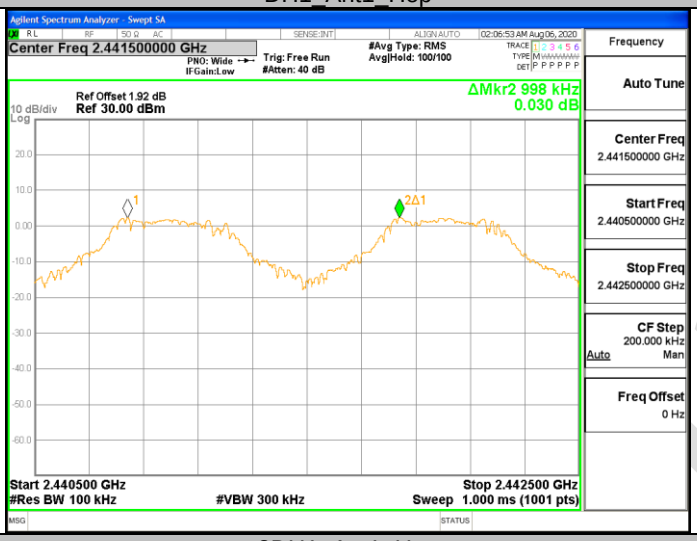
10.3 APPENDIXD: CARRIER FREQUENCY SEPARATION

Test Result

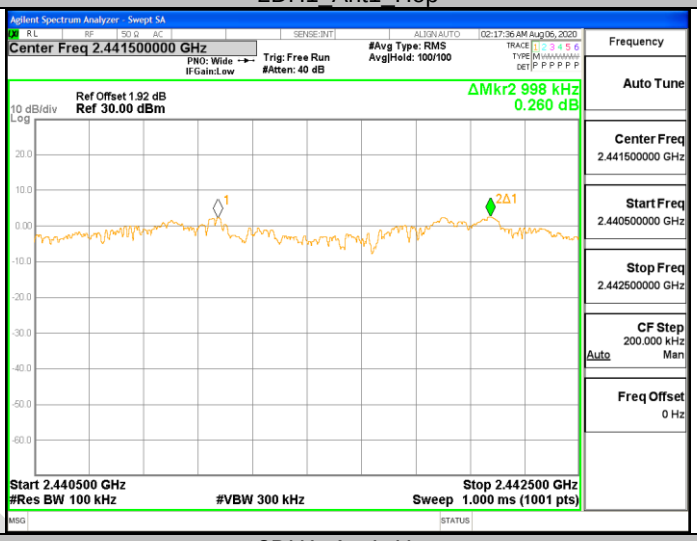
TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH1	Ant1	Hop	0.998	>=0.742	PASS
2DH1	Ant1	Hop	0.998	>=0.930	PASS
3DH1	Ant1	Hop	0.988	>=0.910	PASS

Test Graphs

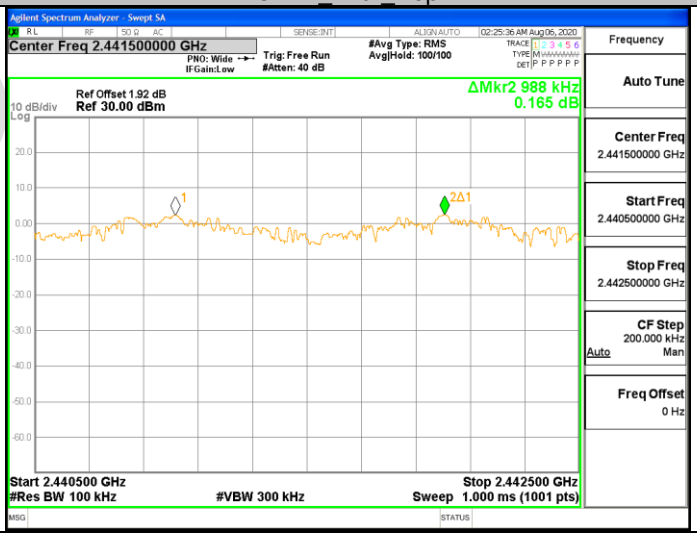
DH1_Ant1_Hop



2DH1_Ant1_Hop



3DH1_Ant1_Hop



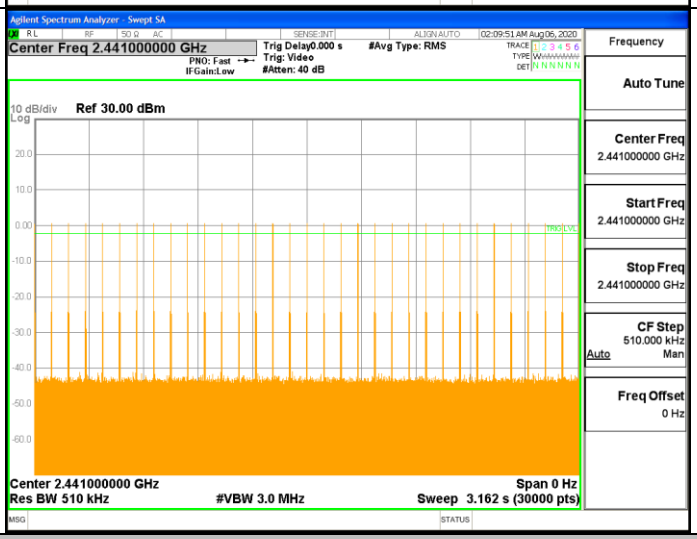
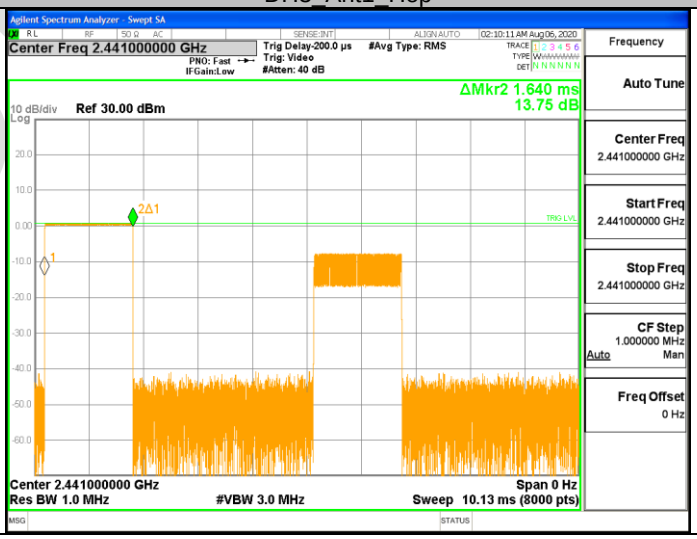
10.4 APPENDIXE: TIME OF OCCUPANCY

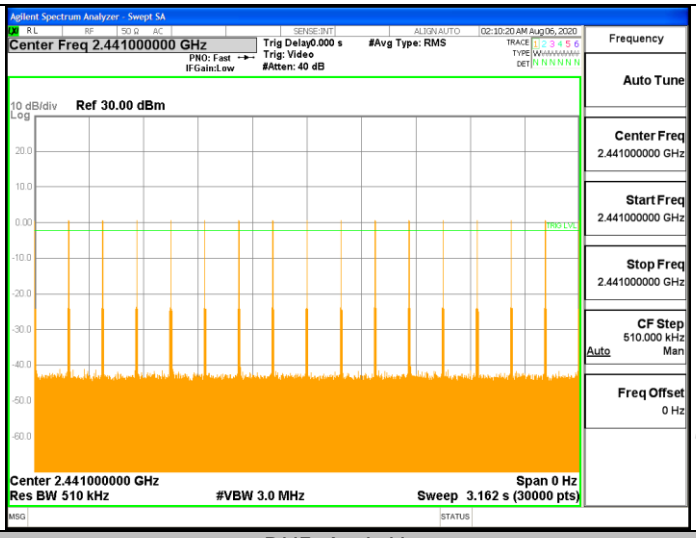
Test Result

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.39	330	0.129	<=0.4	PASS
DH3	Ant1	Hop	1.64	170	0.279	<=0.4	PASS
DH5	Ant1	Hop	2.89	110	0.318	<=0.4	PASS

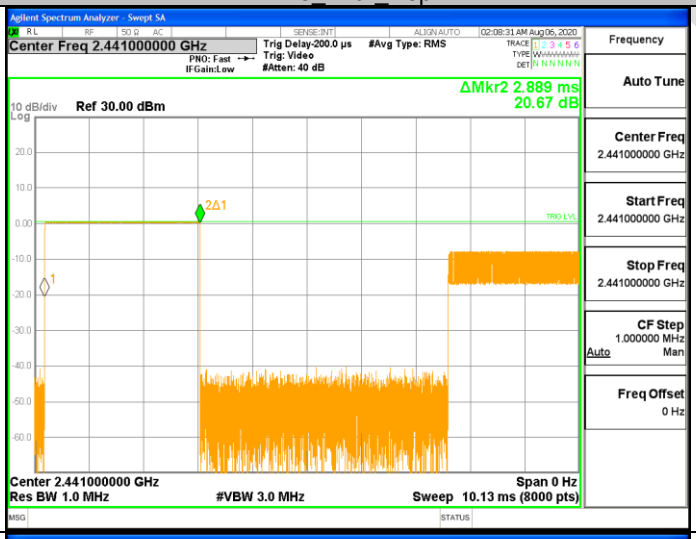
Test Graphs

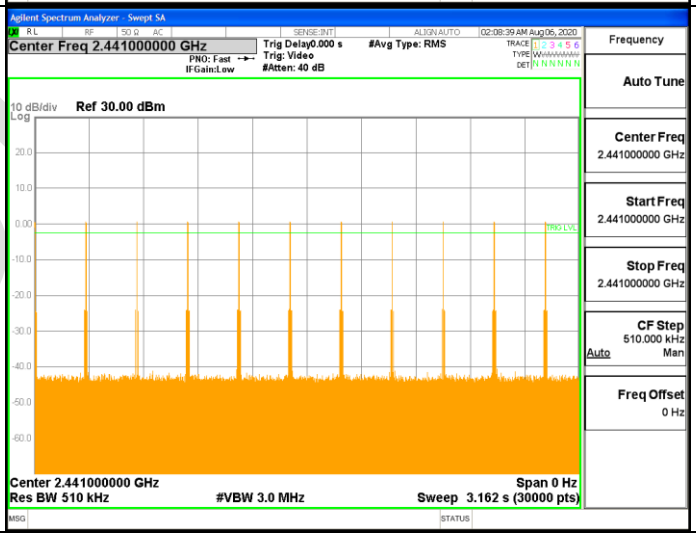
DH1_Ant1_Hop


DH3_Ant1_Hop



Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay0.000 s
Trig: Video
#Atten: 40 dB
#Avg Type: RMS
02:10:20 AM Aug 06, 2020
Frequency
Auto Tune
10 dB/div
Log
Ref 30.00 dBm
Center Freq
2.441000000 GHz
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
CF Step
510.000 kHz
Auto
Man
Freq Offset
0 Hz
Center 2.441000000 GHz
Res BW 510 kHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.162 s (30000 pts)

DH5_Ant1_Hop


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-200.0 µs
Trig: Video
#Atten: 40 dB
#Avg Type: RMS
02:08:31 AM Aug 06, 2020
Frequency
Auto Tune
ΔMkr2 2.889 ms
20.67 dB
10 dB/div
Log
Ref 30.00 dBm
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
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8000 pts)


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay0.000 s
Trig: Video
#Atten: 40 dB
#Avg Type: RMS
02:08:39 AM Aug 06, 2020
Frequency
Auto Tune
10 dB/div
Log
Ref 30.00 dBm
Center Freq
2.441000000 GHz
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
CF Step
510.000 kHz
Auto
Man
Freq Offset
0 Hz
Center 2.441000000 GHz
Res BW 510 kHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 3.162 s (30000 pts)

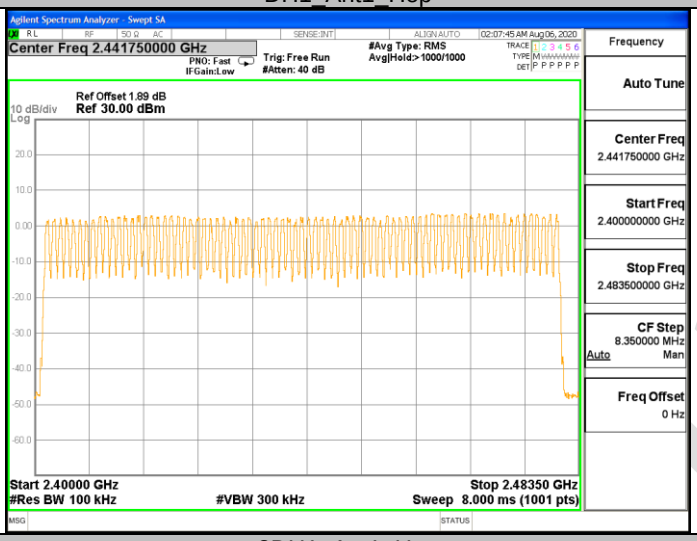
10.5 APPENDIXF: NUMBER OF HOPPING CHANNELS

Test Result

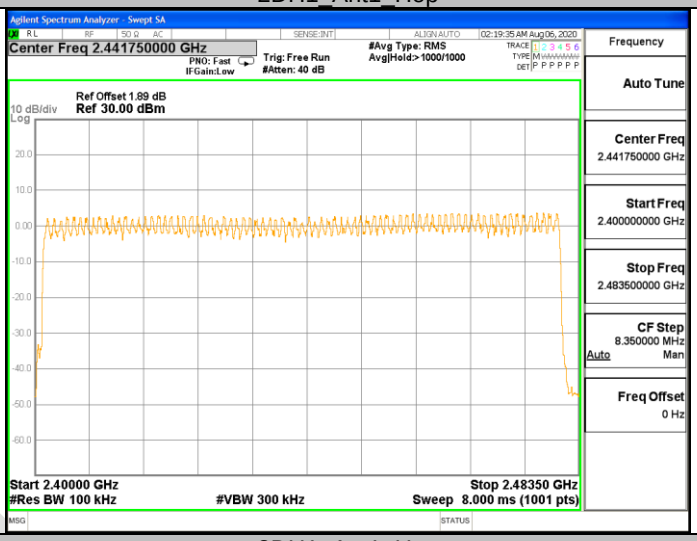
TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH1	Ant1	Hop	79	>=15	PASS
2DH1	Ant1	Hop	79	>=15	PASS
3DH1	Ant1	Hop	79	>=15	PASS

Test Graphs

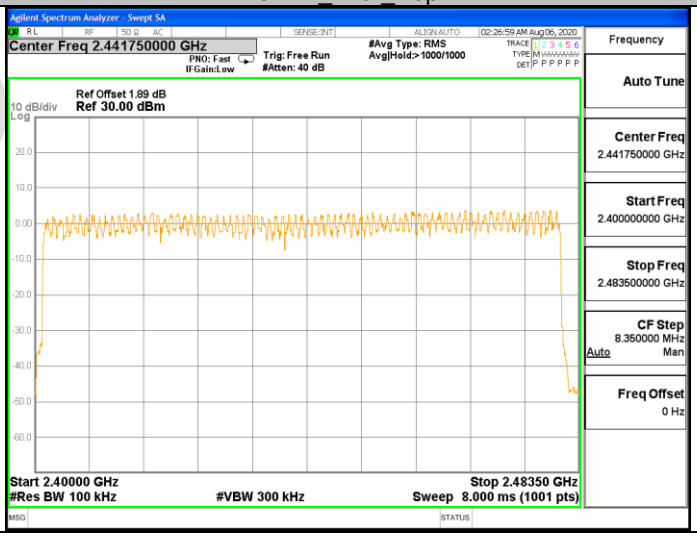
DH1_Ant1_Hop



2DH1_Ant1_Hop



3DH1_Ant1_Hop



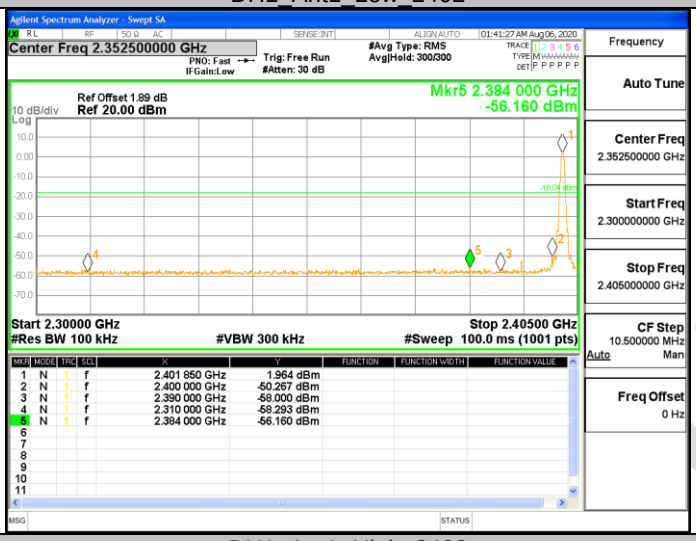
10.6 APPENDIXG:BAND EDGE MEASUREMENTS

Test Result

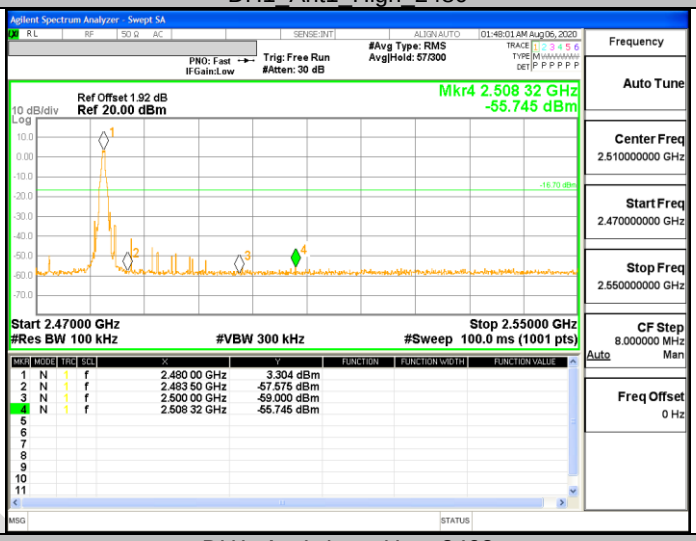
TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH1	Ant1	Low	2402	1.96	-56.16	<=-18.04	PASS
		High	2480	3.30	-55.75	<=-16.7	PASS
		Low	Hop_2402	1.97	-56.1	-18.03	PASS
		High	Hop_2480	3.48	-54.63	-16.52	PASS
2DH1	Ant1	Low	2402	1.92	-56.32	<=-18.08	PASS
		High	2480	3.44	-55.6	<=-16.56	PASS
		Low	Hop_2402	2.09	-55.77	-17.91	PASS
		High	Hop_2480	3.54	-54.73	-16.46	PASS
3DH1	Ant1	Low	2402	1.97	-56.28	<=-18.03	PASS
		High	2480	3.35	-55.41	<=-16.65	PASS
		Low	Hop_2402	2.10	-55.44	-17.9	PASS
		High	Hop_2480	3.44	-55.13	-16.56	PASS

Test Graphs

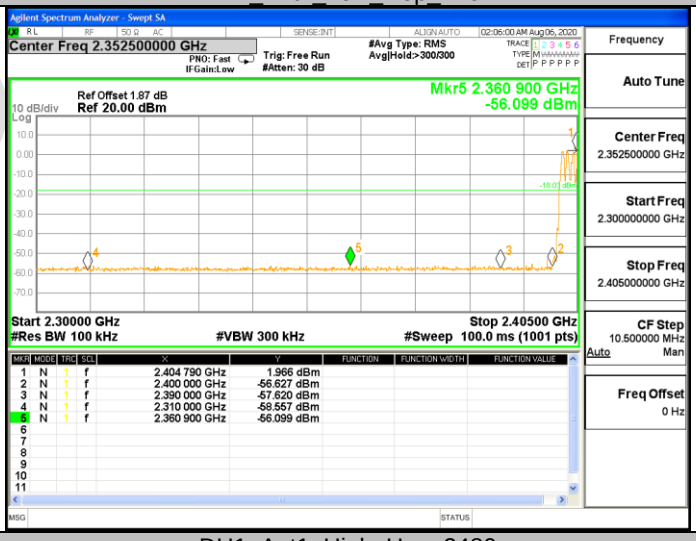
DH1_Ant1_Low_2402



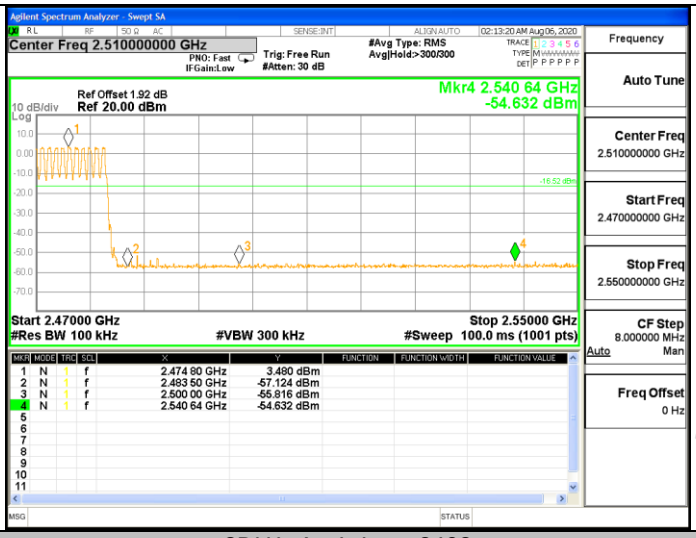
DH1_Ant1_High_2480



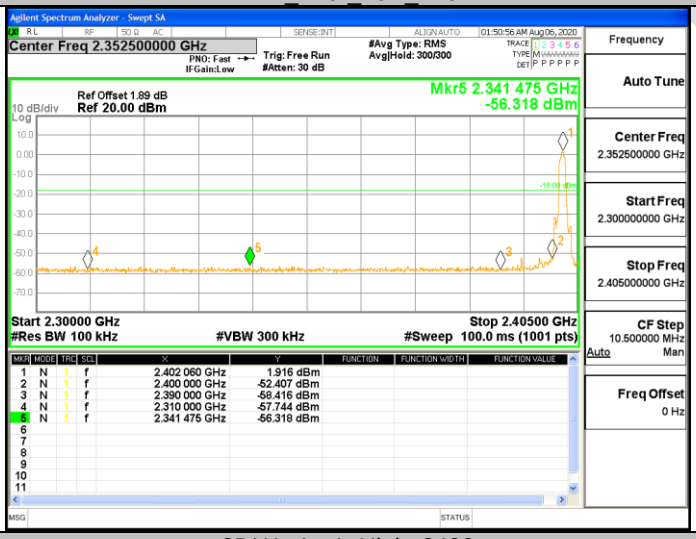
DH1_Ant1_Low_Hop_2402



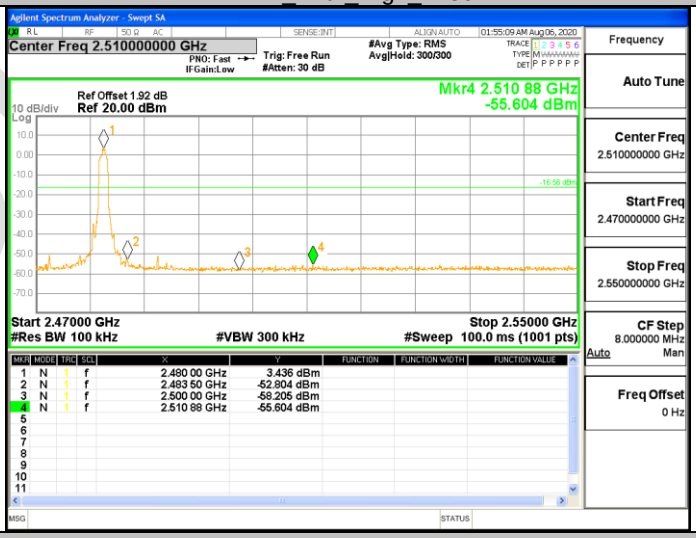
DH1_Ant1_High_Hop_2480



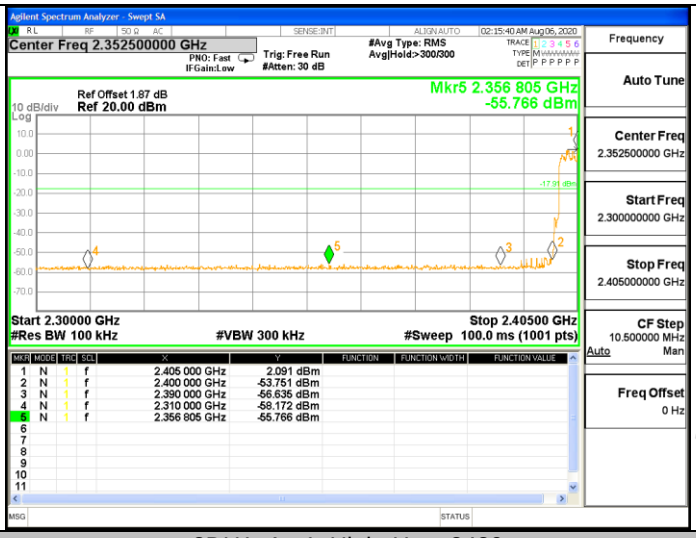
2DH1_Ant1_Low_2402



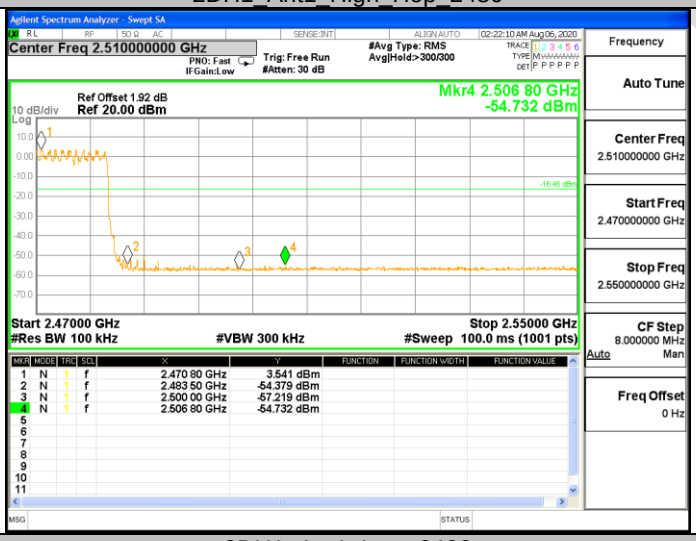
2DH1_Ant1_High_2480



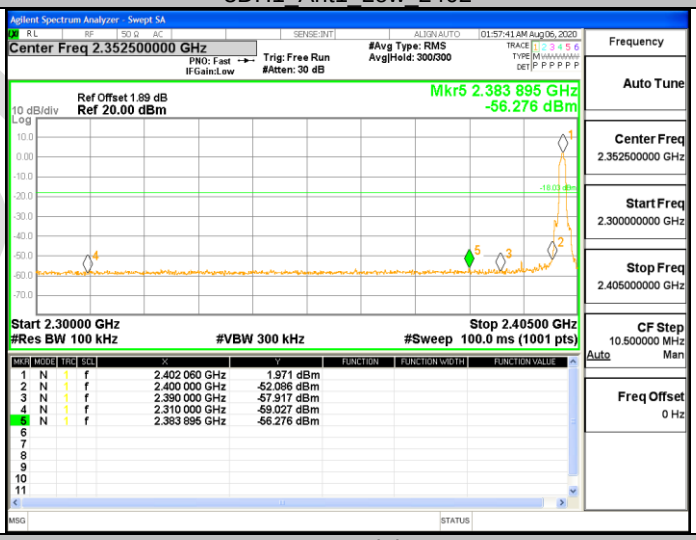
2DH1_Ant1_Low_Hop_2402



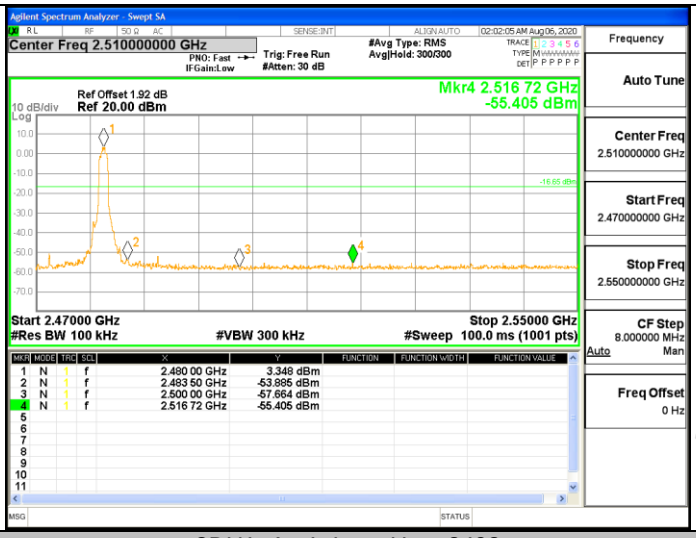
2DH1_Ant1_High_Hop_2480



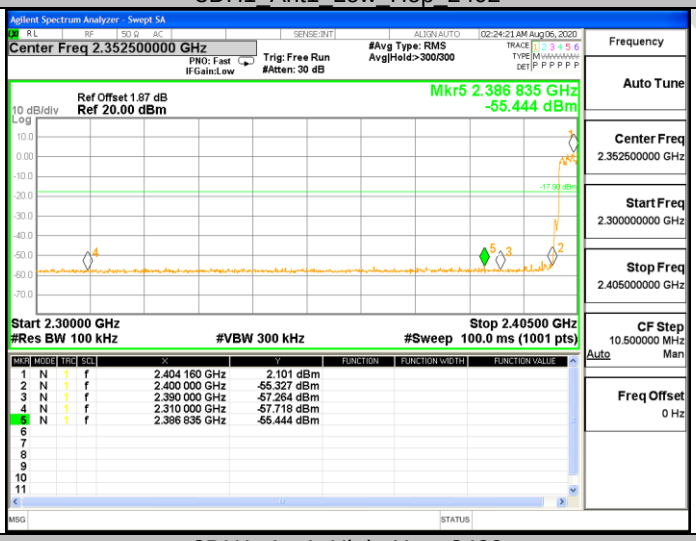
3DH1_Ant1_Low_2402



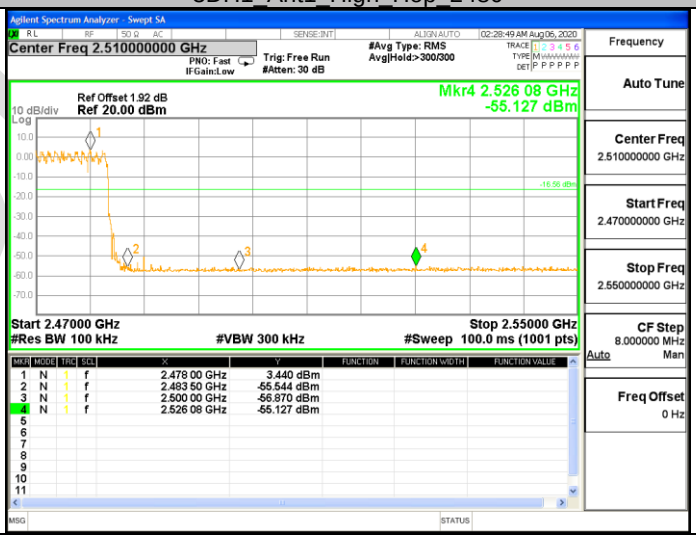
3DH1_Ant1_High_2480



3DH1_Ant1_Low_Hop_2402



3DH1_Ant1_High_Hop_2480



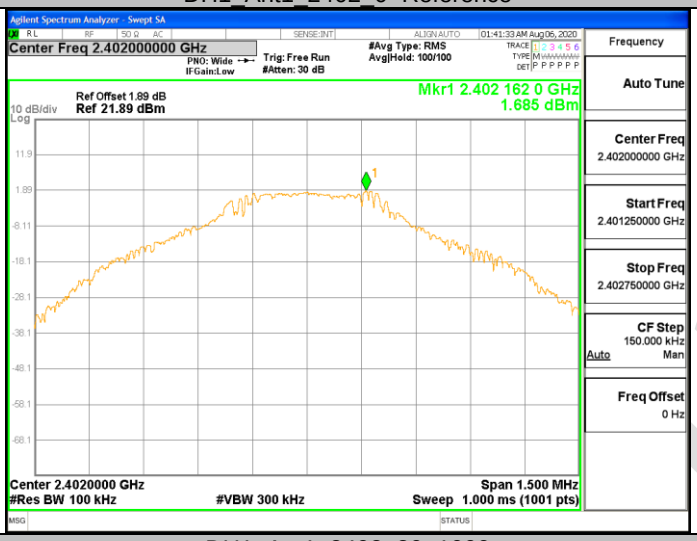
10.7 APPENDIXH:CONDUCTED SPURIOUSEMISSION

Test Result

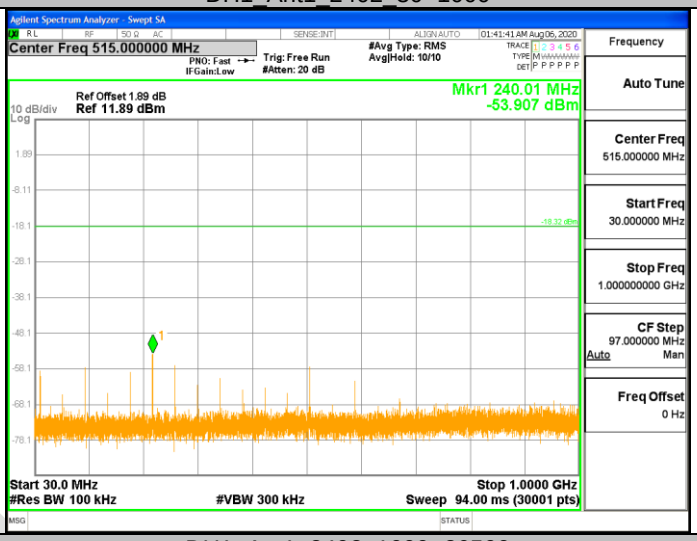
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH1	Ant1	2402	Reference	1.69	1.69	---	PASS
			30~1000	30~1000	-53.907	<=-18.315	PASS
			1000~26500	1000~26500	-53.648	<=-18.315	PASS
		2441	Reference	2.14	2.14	---	PASS
			30~1000	30~1000	-54.974	<=-17.859	PASS
			1000~26500	1000~26500	-53.089	<=-17.859	PASS
		2480	Reference	3.40	3.40	---	PASS
			30~1000	30~1000	-55.731	<=-16.604	PASS
			1000~26500	1000~26500	-52.981	<=-16.604	PASS
2DH1	Ant1	2402	Reference	1.89	1.89	---	PASS
			30~1000	30~1000	-56.017	<=-18.107	PASS
			1000~26500	1000~26500	-53.58	<=-18.107	PASS
		2441	Reference	2.15	2.15	---	PASS
			30~1000	30~1000	-55.639	<=-17.845	PASS
			1000~26500	1000~26500	-52.273	<=-17.845	PASS
		2480	Reference	3.45	3.45	---	PASS
			30~1000	30~1000	-55.753	<=-16.546	PASS
			1000~26500	1000~26500	-51.687	<=-16.546	PASS
3DH1	Ant1	2402	Reference	1.97	1.97	---	PASS
			30~1000	30~1000	-55.268	<=-18.029	PASS
			1000~26500	1000~26500	-52.591	<=-18.029	PASS
		2441	Reference	2.22	2.22	---	PASS
			30~1000	30~1000	-55.371	<=-17.78	PASS
			1000~26500	1000~26500	-51.939	<=-17.78	PASS
		2480	Reference	3.25	3.25	---	PASS
			30~1000	30~1000	-55.625	<=-16.748	PASS
			1000~26500	1000~26500	-52.727	<=-16.748	PASS

Test Graphs

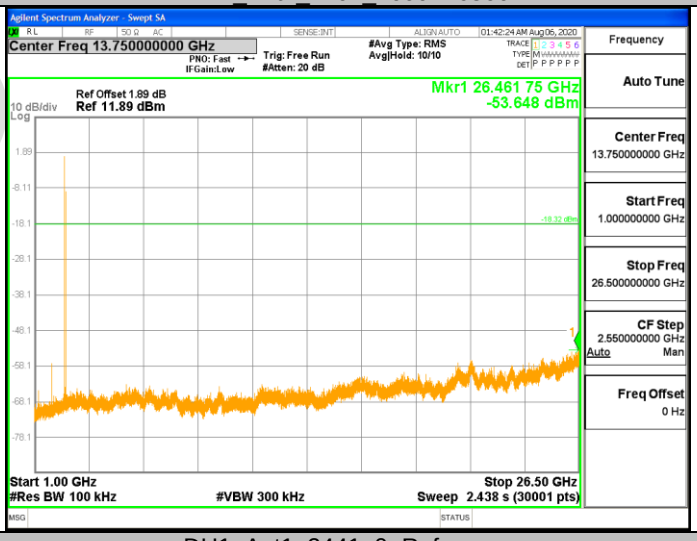
DH1_Ant1_2402_0~Reference



DH1_Ant1_2402_30~1000



DH1_Ant1_2402_1000~26500



DH1_Ant1_2441_0~Reference