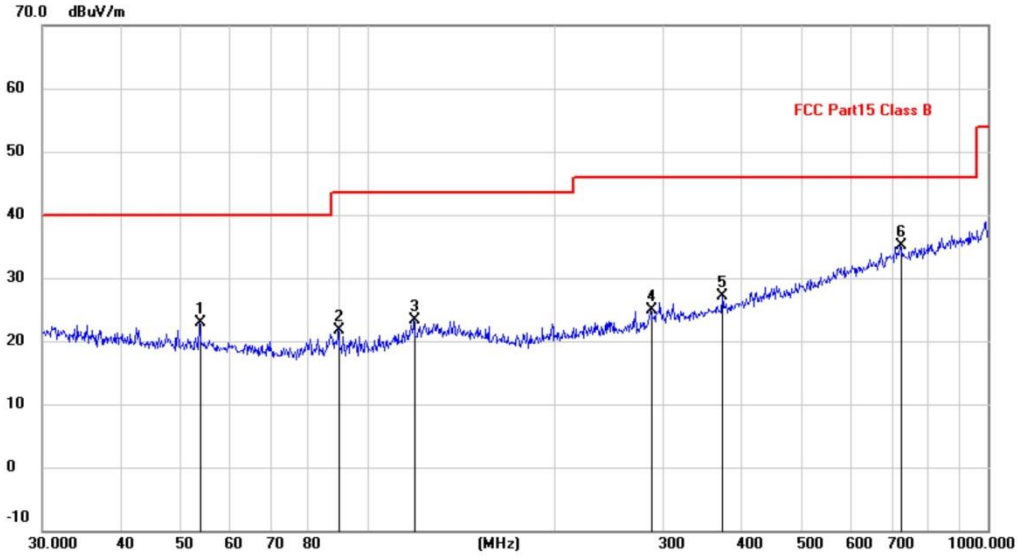
[TestMode: TX mode (SE) below 1G]; [Polarity: Horizontal]

Radiated Emission Measurement

File :RE Data :#22 Date: 2020/5/15 星期 Time: 下午 5:32:13



Site
Limit: FCC Part15 Class B
EUT: TWS Bluetooth earphones
M/N: Haylou-T19
Mode: BT mode
Note:

Polarization: ***Horizontal***
Power:
Distance:

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		53.6932	-1.15	24.08	22.93	40.00	-17.07	QP			
2		89.9047	2.22	19.58	21.80	43.50	-21.70	QP			
3		119.0180	0.79	22.59	23.38	43.50	-20.12	QP			
4		285.9778	1.41	23.44	24.85	46.00	-21.15	QP			
5		373.3112	0.98	26.19	27.17	46.00	-18.83	QP			
6	*	721.7259	1.98	33.07	35.05	46.00	-10.95	QP			

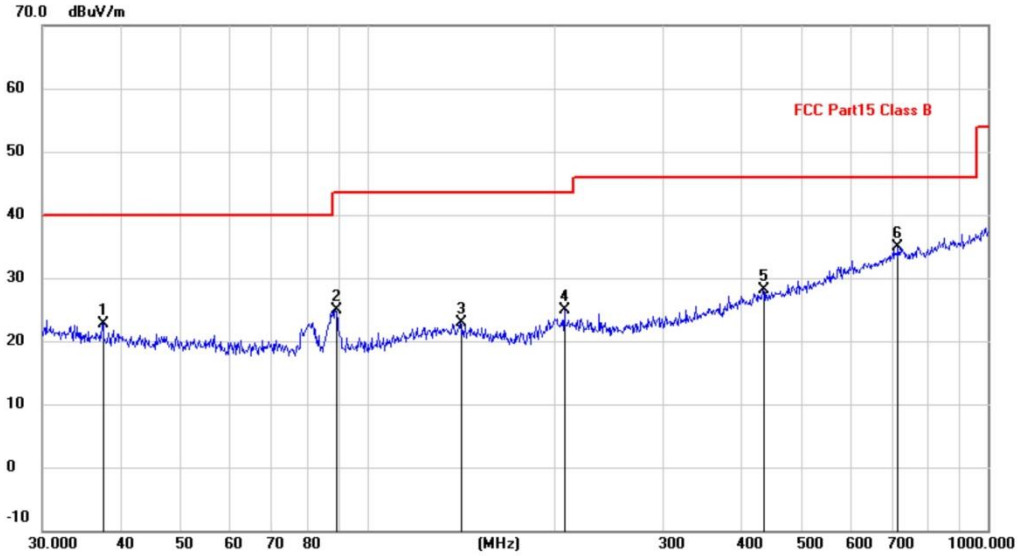
*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX mode (SE) below 1G]; [Polarity: Vertical]

Radiated Emission Measurement

File :RE Data :#23 Date: 2020/5/15 星期 Time: 下午 5:34:11



Site
Limit: FCC Part15 Class B
EUT: TWS Bluetooth earphones
M/N: Haylou-T19
Mode: BT mode
Note:

Polarization: ***Vertical***
Power:
Distance:

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		37.4165	-0.97	23.72	22.75	40.00	-17.25	QP			
2		88.9639	5.35	19.53	24.88	43.50	-18.62	QP			
3		141.3298	-0.40	23.29	22.89	43.50	-20.61	QP			
4		207.8501	4.23	20.62	24.85	43.50	-18.65	QP			
5		434.0651	0.32	27.75	28.07	46.00	-17.93	QP			
6	*	716.6820	2.02	32.98	35.00	46.00	-11.00	QP			

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

9 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	Eason
Temperature	25℃
Humidity	60%

9.1 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.		

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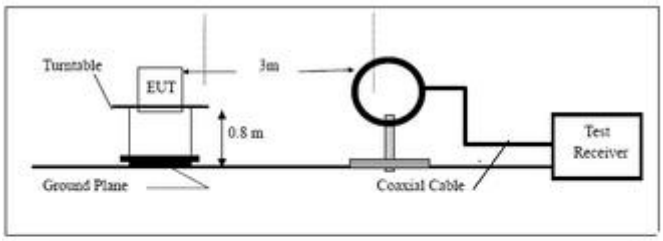
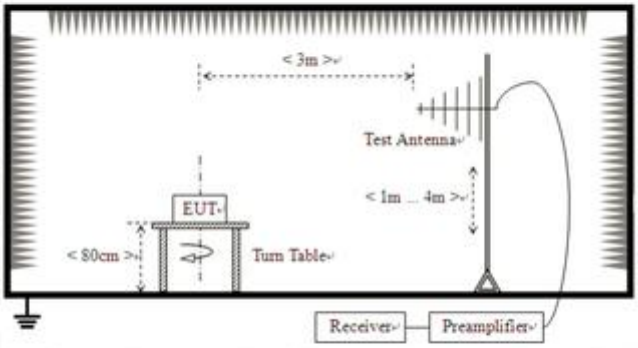
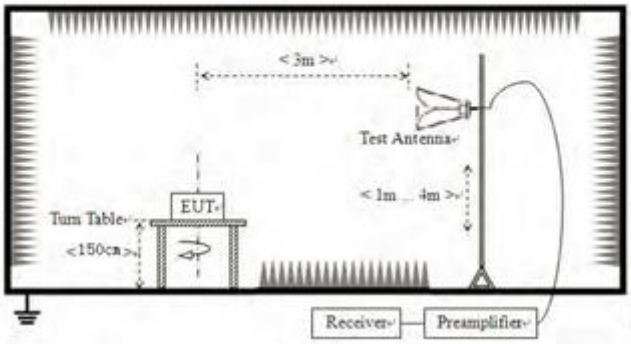
9.2 BLOCK DIAGRAM OF TEST SETUP







9.3 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.

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9.4 TEST DATA

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

[TestMode: TX]						
Test channel:lowest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	57.77	-4.2	53.57	74	-20.43	Horizontal
2390	58.19	-3.88	54.31	74	-19.69	Horizontal
2310	53.9	-4.49	49.41	74	-24.59	Vertical
2390	55.19	-4.21	50.98	74	-23.02	Vertical
Average value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor(dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	46.83	-4.2	42.63	54	-11.37	Horizontal
2390	47.55	-3.88	43.67	54	-10.33	Horizontal
2310	44.24	-4.49	39.75	54	-14.25	Vertical
2390	44.27	-4.21	40.06	54	-13.94	Vertical
Test channel:Highest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	52.58	-3.39	49.19	74	-24.81	Horizontal
2500	73.02	-3.3	69.72	74	-4.28	Horizontal
2483.5	49.73	-3.78	45.95	74	-28.05	Vertical
2500	67.08	-3.7	63.38	74	-10.62	Vertical
Average value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor(dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	40.8	-3.39	37.41	54	-16.59	Horizontal
2500	40.64	-3.3	37.34	54	-16.66	Horizontal
2483.5	37.86	-3.78	34.08	54	-19.92	Vertical
2500	38.02	-3.7	34.32	54	-19.68	Vertical

Test Result: Pass

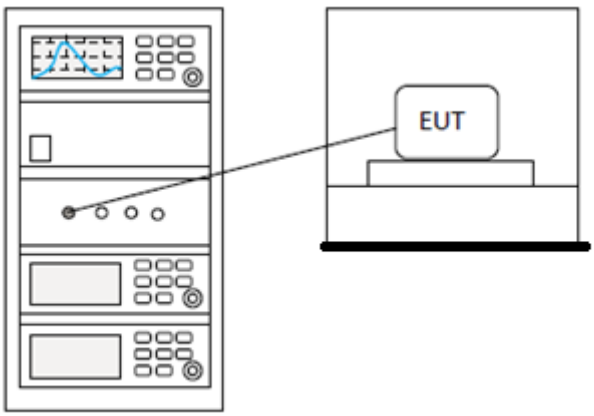
10 CONDUCTED SPURIOUS EMISSIONS

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	25℃
Humidity	60%

10.1 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)).

10.2 BLOCK DIAGRAM OF TEST SETUP



10.3 TEST DATA

Pass: Please Refer To Appendix: For Details

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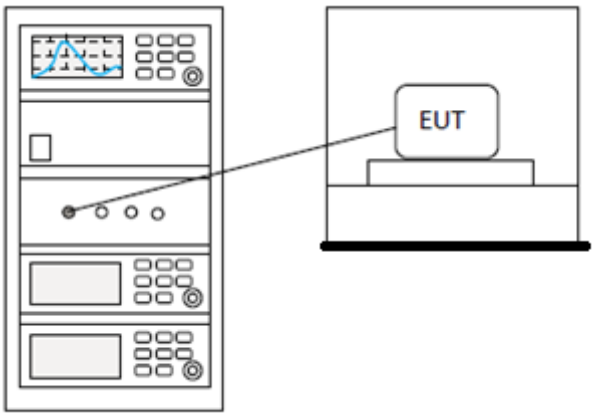
11 CONDUCTED BAND EDGES MEASUREMENT

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	Eason
Temperature	25℃
Humidity	60%

11.1 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)).

11.2 BLOCK DIAGRAM OF TEST SETUP



11.3 TEST DATA

Pass: Please Refer To Appendix: For Details

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12 APPENDIX

12.1 APPENDIX :20DB EMISSION BANDWIDTH

Test Result

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	1.116	2401.436	2402.552	---	PASS
		2441	1.119	2440.433	2441.552	---	PASS
		2480	1.116	2479.436	2480.552	---	PASS
2DH1	Ant1	2402	1.107	2401.442	2402.549	---	PASS
		2441	1.107	2440.439	2441.546	---	PASS
		2480	1.101	2479.445	2480.546	---	PASS
3DH1	Ant1	2402	1.107	2401.442	2402.549	---	PASS
		2441	1.107	2440.442	2441.549	---	PASS
		2480	1.107	2479.442	2480.549	---	PASS

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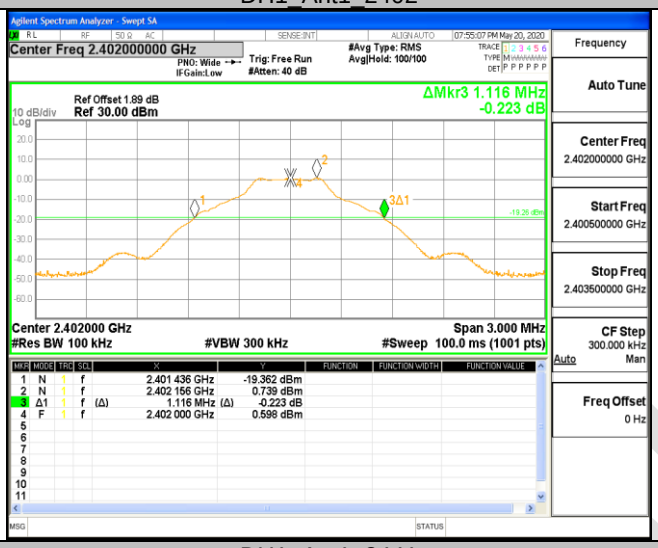
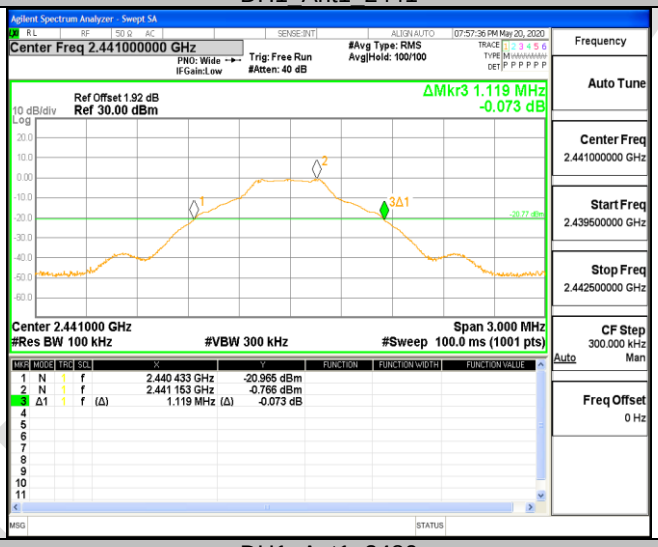
Test Graphs

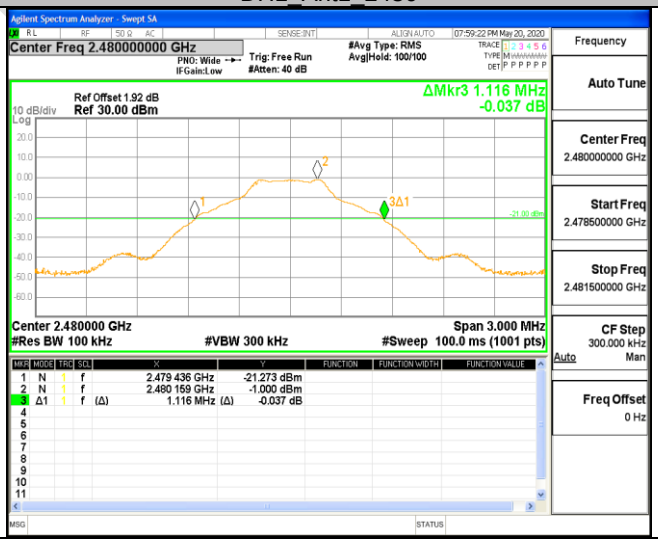
DH1_Ant1_2402



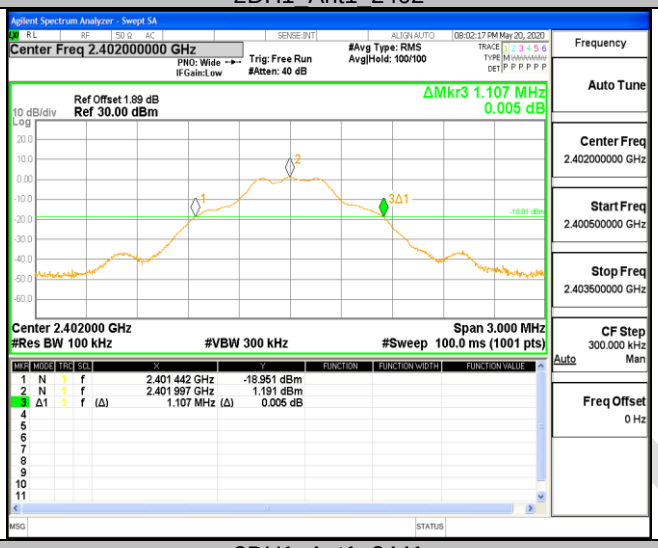
DH1_Ant1_2441



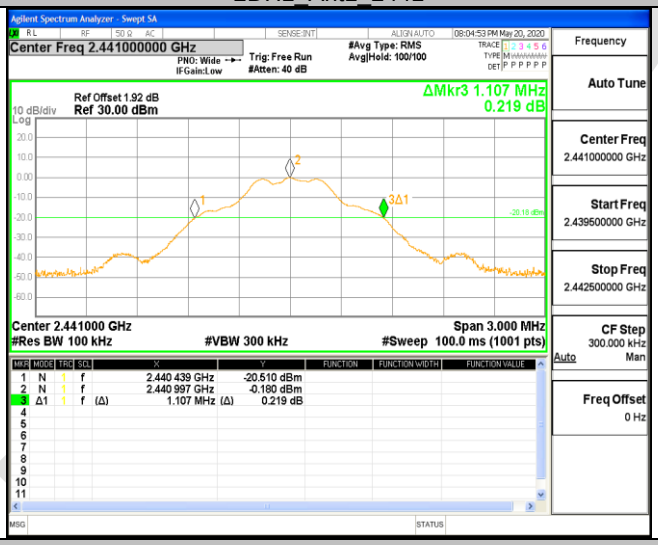
DH1_Ant1_2480



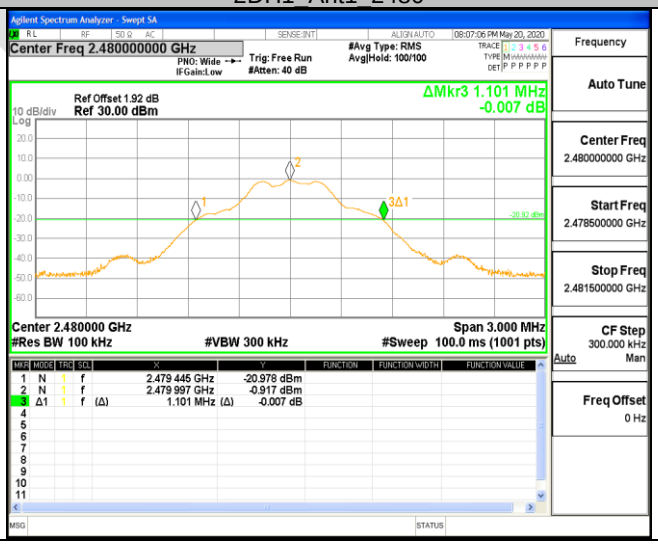
2DH1_Ant1_2402



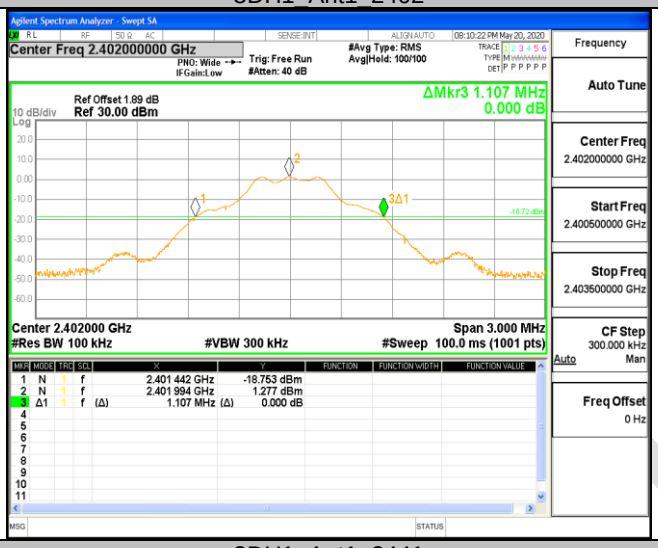
2DH1_Ant1_2441



2DH1_Ant1_2480



3DH1_Ant1_2402



3DH1_Ant1_2441

3DH1_Ant1_2480

12.2 APPENDIX : MAXIMUM CONDUCTED OUTPUT POWER

Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH1	Ant1	2402	1.38	<=20.97	PASS
		2441	0.02	<=20.97	PASS
		2480	-0.76	<=20.97	PASS
2DH1	Ant1	2402	1.35	<=20.97	PASS
		2441	-0.01	<=20.97	PASS
		2480	-0.76	<=20.97	PASS
3DH1	Ant1	2402	1.34	<=20.97	PASS
		2441	-0.02	<=20.97	PASS
		2480	-0.76	<=20.97	PASS

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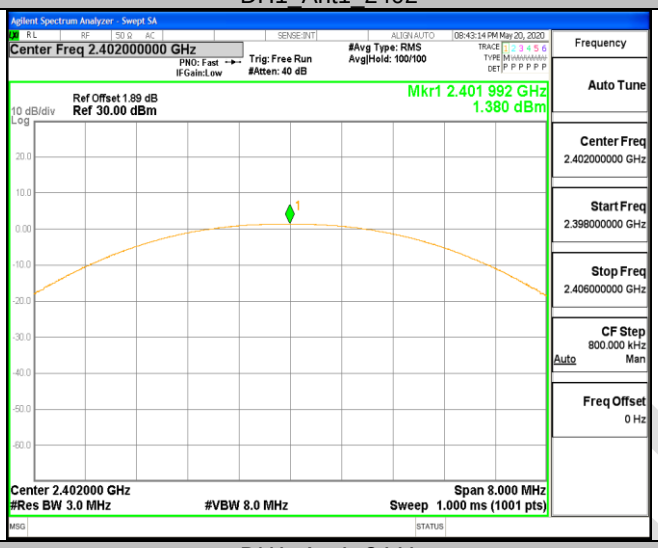
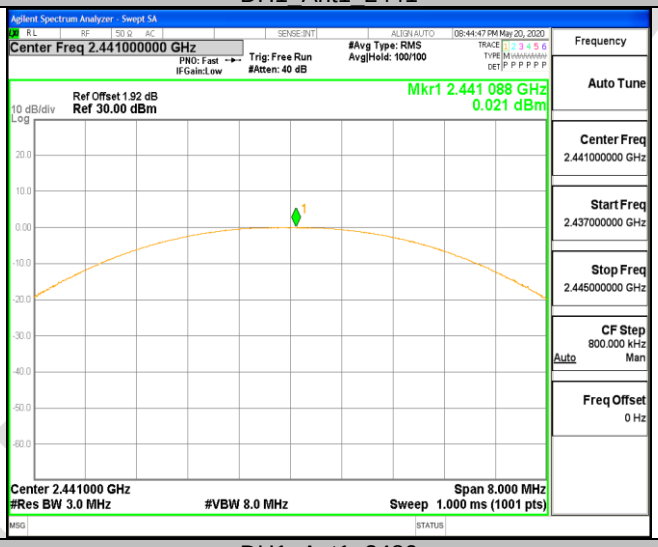
Test Graphs

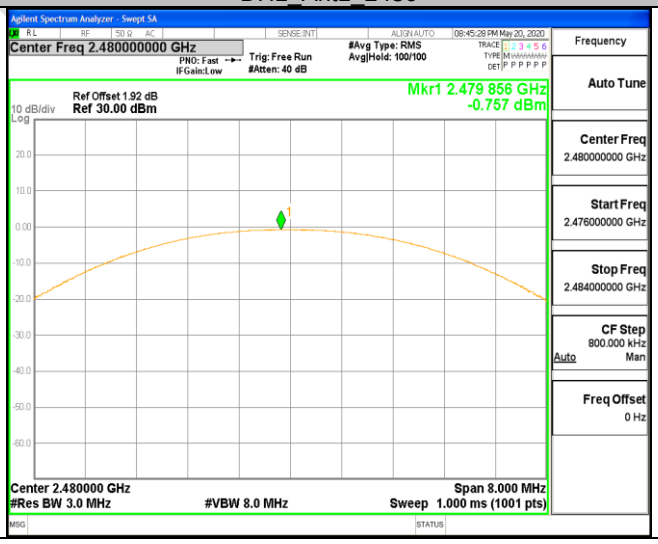
DH1_Ant1_2402



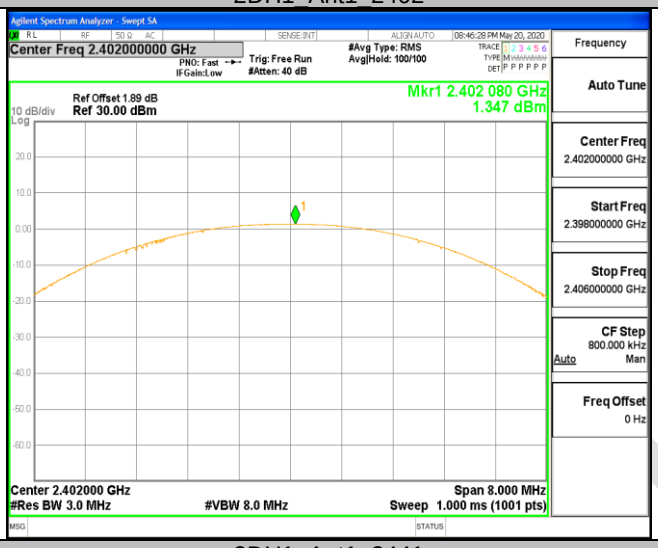
DH1_Ant1_2441



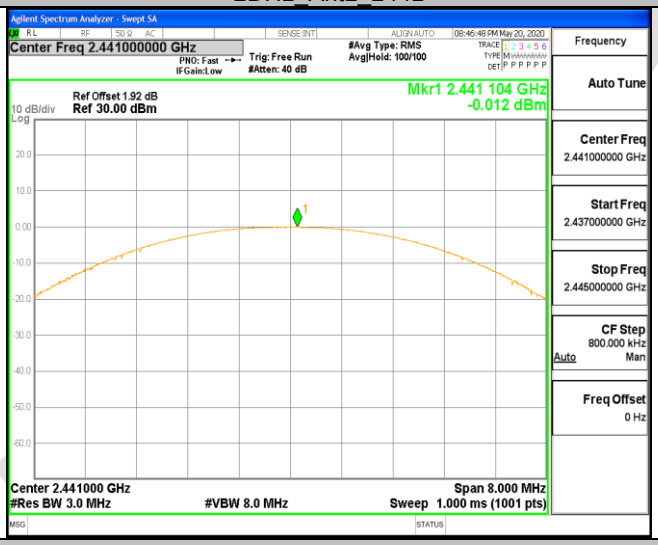
DH1_Ant1_2480



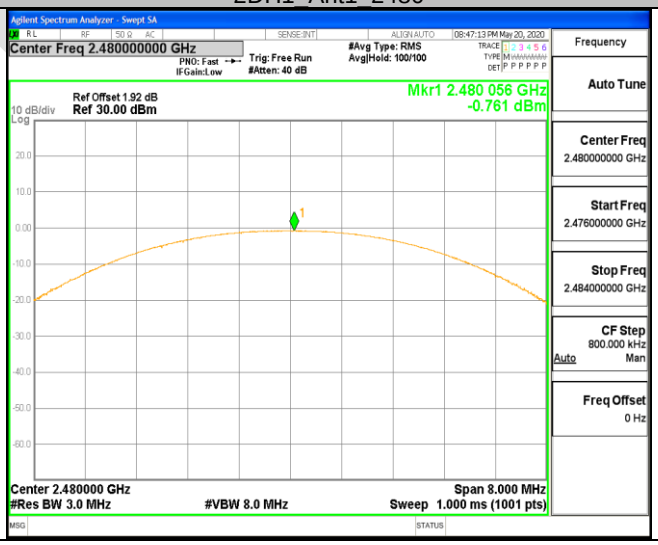
2DH1_Ant1_2402



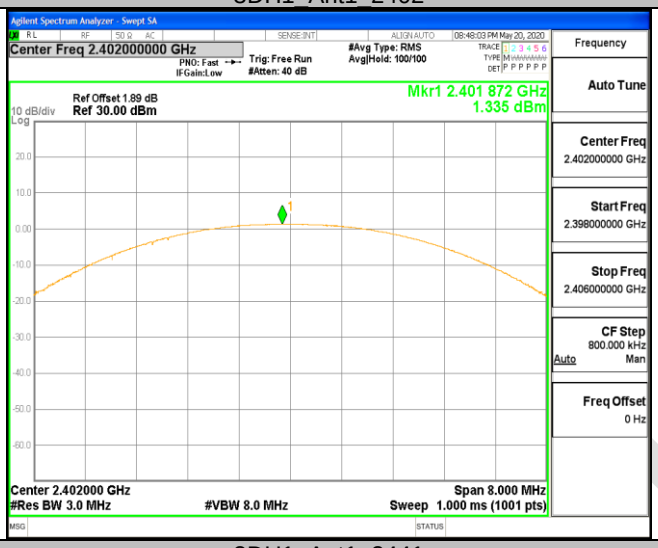
2DH1_Ant1_2441



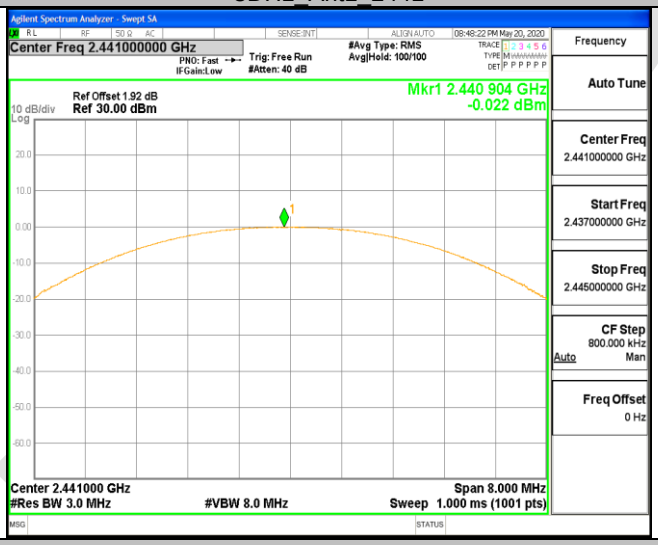
2DH1_Ant1_2480



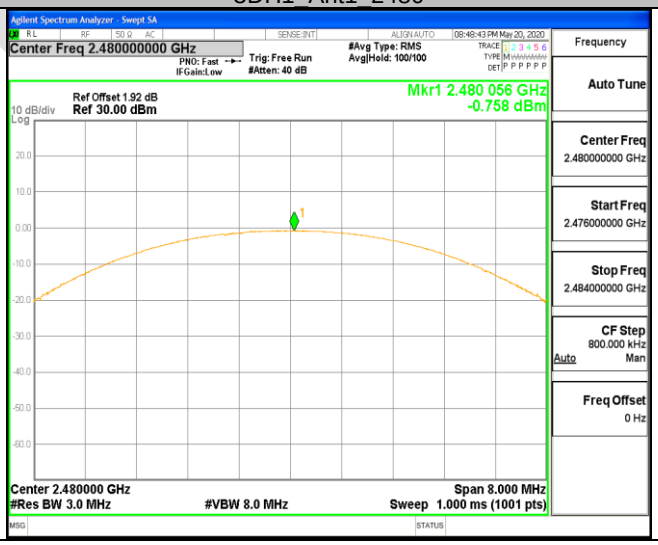
3DH1_Ant1_2402



3DH1_Ant1_2441



3DH1_Ant1_2480



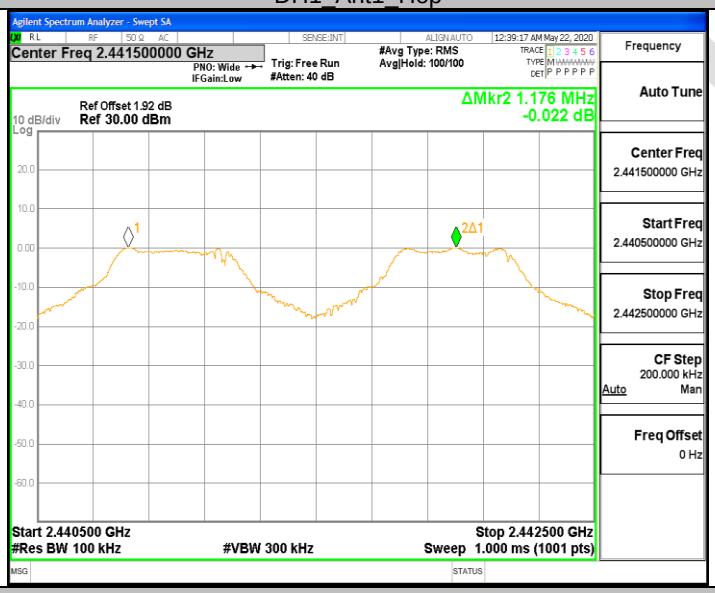
12.3 APPENDIX : CARRIER FREQUENCY SEPARATION

Test Result

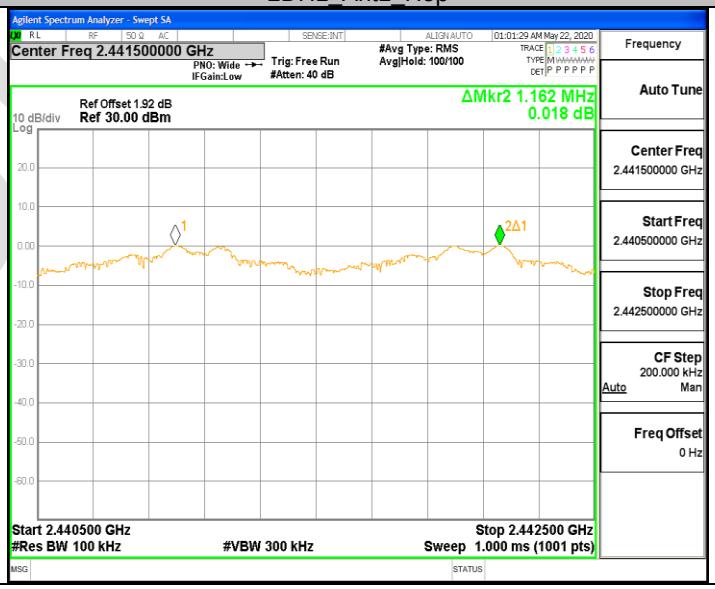
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH1	Ant1	Hop	1.176	>=1.119	PASS
2DH1	Ant1	Hop	1.162	>=1.107	PASS
3DH1	Ant1	Hop	1.002	>=0.738	PASS

Test Graphs

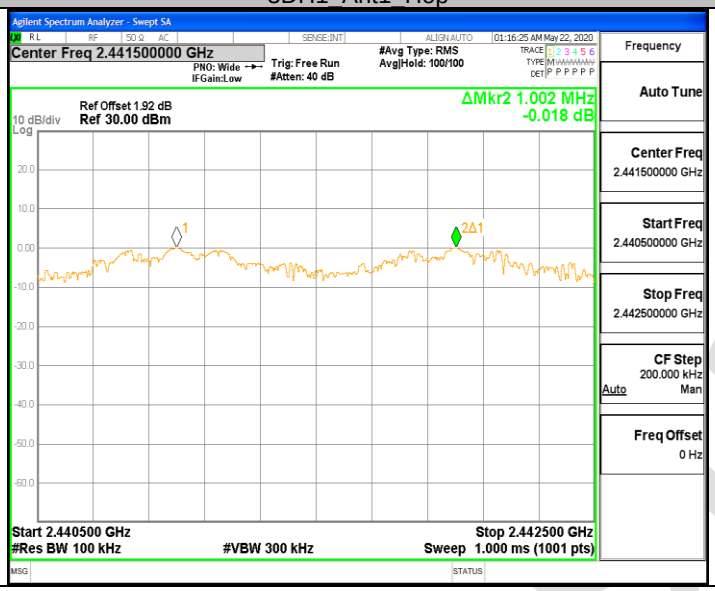
DH1_Ant1_Hop



2DH1_Ant1_Hop



3DH1_Ant1_Hop



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12.4 APPENDIX : TIME OF OCCUPANCY

Test Result

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.38	330	0.126	<=0.4	PASS
DH3	Ant1	Hop	1.28	170	0.217	<=0.4	PASS
DH5	Ant1	Hop	2.89	110	0.317	<=0.4	PASS

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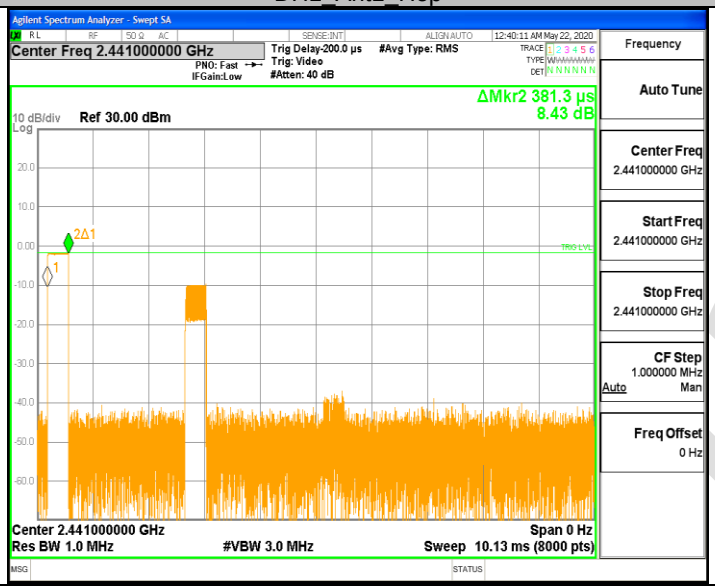
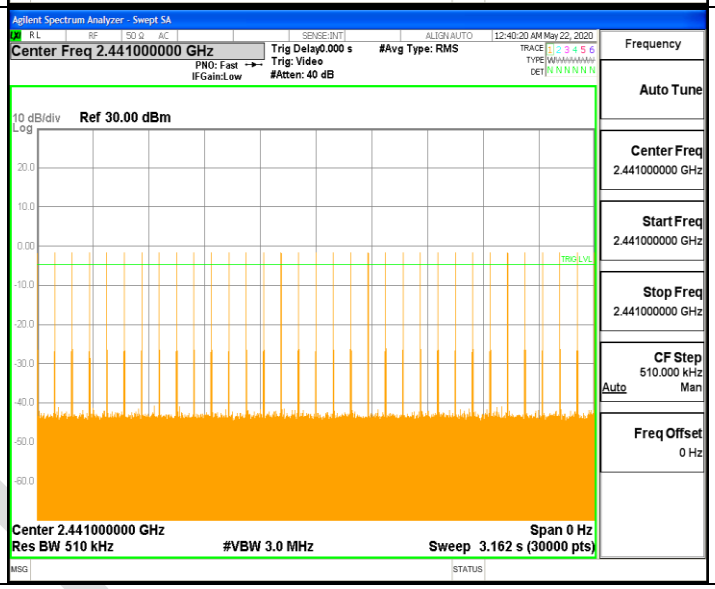
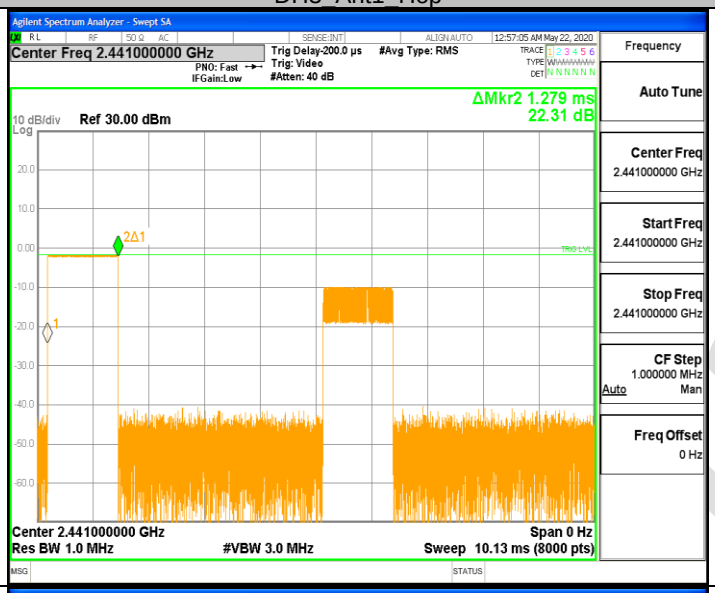
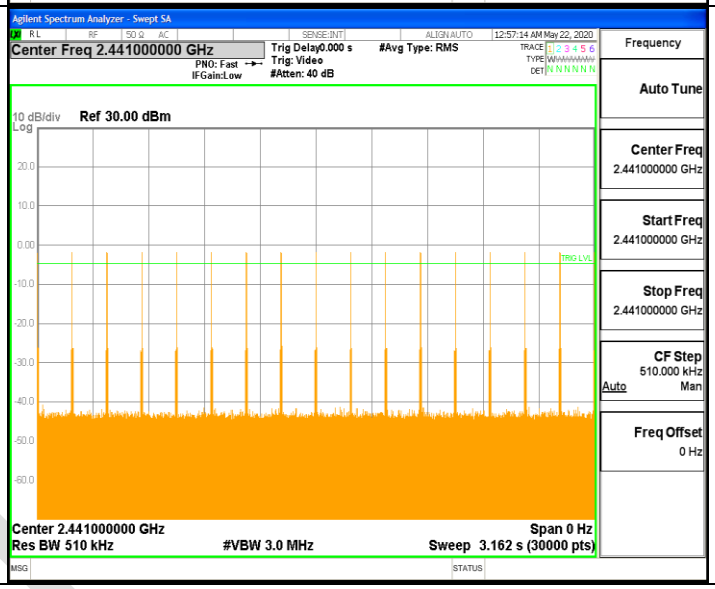
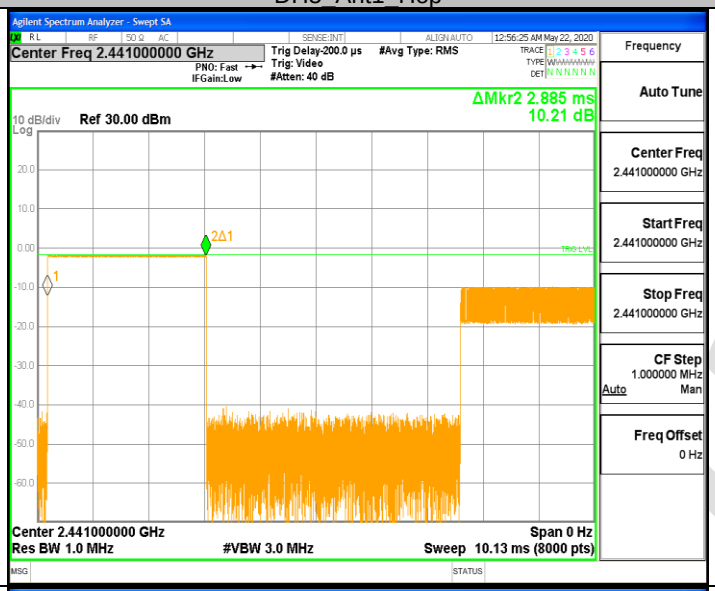
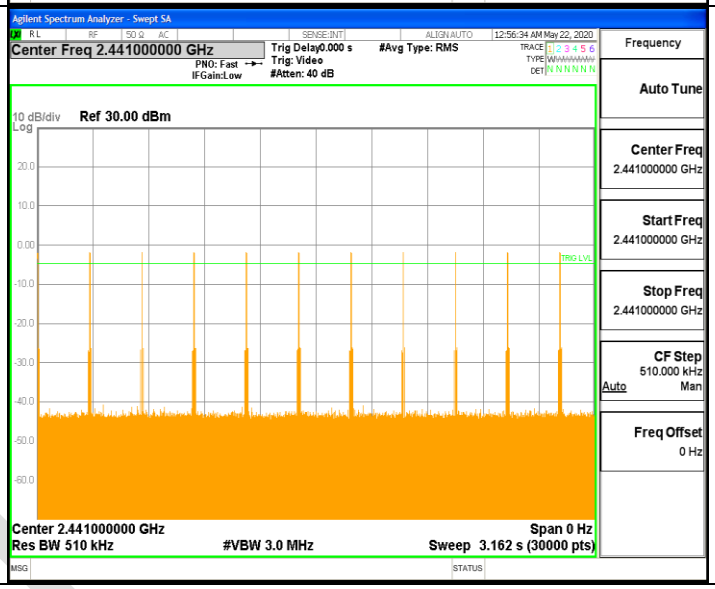
Test Graphs

DH1_Ant1_Hop



DH3_Ant1_Hop		
	 Agilent Spectrum Analyzer - Swept SA Center Freq 2.441000000 GHz Trig Delay-200.0 µs #Avg Type: RMS Trig: Video #Atten: 40 dB PNO: Fast IFGain:Low 12:57:05 AM May 22, 2020 ΔMkr2 1.279 ms 22.31 dB 10 dB/div Ref 30.00 dBm Log 2Δ1 1 Center 2.441000000 GHz Span 0 Hz Res BW 1.0 MHz #VBW 3.0 MHz 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	
	 Agilent Spectrum Analyzer - Swept SA Center Freq 2.441000000 GHz Trig Delay0.000 s #Avg Type: RMS Trig: Video #Atten: 40 dB PNO: Fast IFGain:Low 12:57:14 AM May 22, 2020 10 dB/div Ref 30.00 dBm Log Center 2.441000000 GHz Span 0 Hz Res BW 510 kHz #VBW 3.0 MHz Sweep 3.162 s (30000 pts) Frequency Auto Tune 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	

DH5_Ant1_Hop



Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay-200.0 µs
#Avg Type: RMS
Trig: Video
#Atten: 40 dB
PNO: Fast
IFGain:Low
12:56:25 AM May 22, 2020
ΔMkr2 2.885 ms
10.21 dB
10 dB/div Ref 30.00 dBm
Log
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 3.0 MHz
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

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay0.000 s
#Avg Type: RMS
Trig: Video
#Atten: 40 dB
PNO: Fast
IFGain:Low
12:56:34 AM May 22, 2020
10 dB/div Ref 30.00 dBm
Log
Center 2.441000000 GHz
Span 0 Hz
Res BW 510 kHz
#VBW 3.0 MHz
Sweep 3.162 s (30000 pts)
Frequency
Auto Tune
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

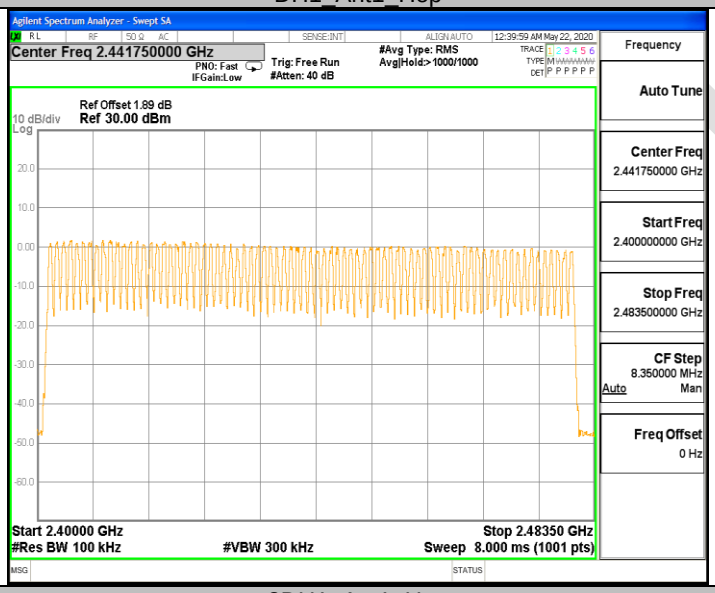
12.5 APPENDIX : NUMBER OF HOPPING CHANNELS

Test Result

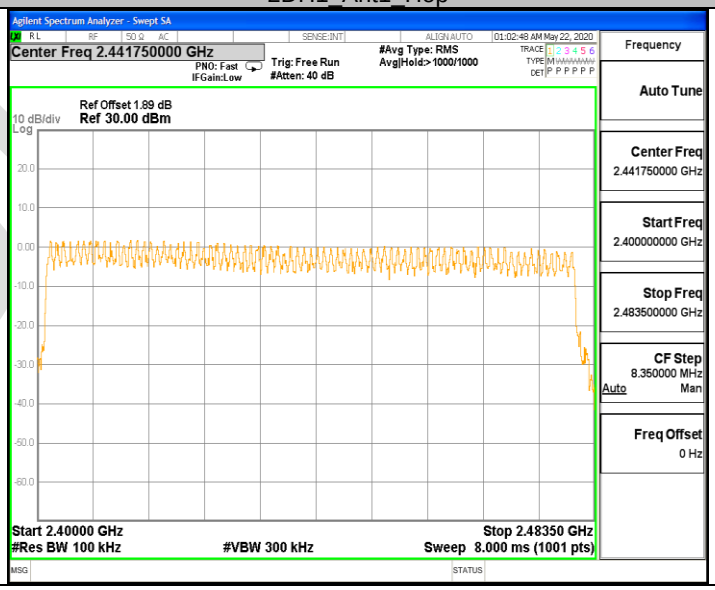
TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH1	Ant1	Hop	79	>=15	PASS
2DH1	Ant1	Hop	79	>=15	PASS
3DH1	Ant1	Hop	79	>=15	PASS

Test Graphs

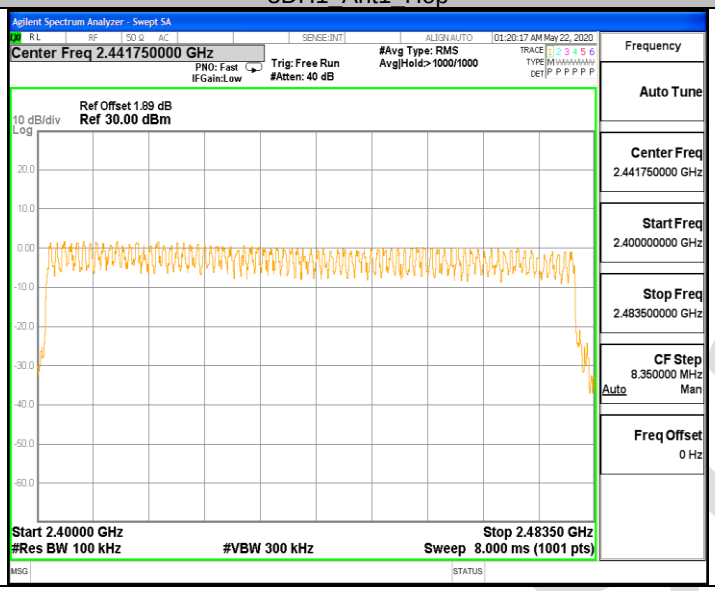
DH1_Ant1_Hop



2DH1_Ant1_Hop



3DH1_Ant1_Hop



BlueAsia

12.6 APPENDIX : BAND EDGE MEASUREMENTS

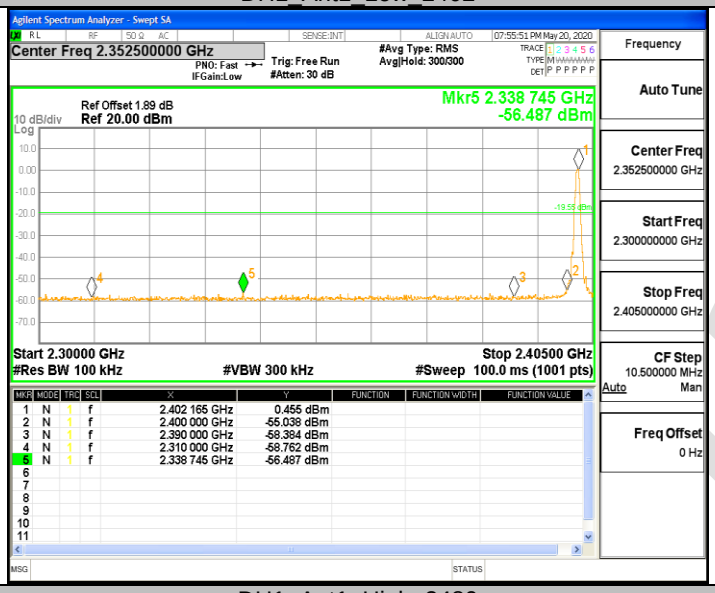
Test Result

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH1	Ant1	Low	2402	0.46	-56.49	<=-19.55	PASS
		High	2480	-1.04	-55.72	<=-21.04	PASS
		Low	Hop_2402	0.61	-56.6	-19.39	PASS
		High	Hop_2480	-0.27	-54.69	-20.27	PASS
2DH1	Ant1	Low	2402	1.10	-56.1	<=-18.9	PASS
		High	2480	-0.92	-55.75	<=-20.92	PASS
		Low	Hop_2402	0.91	-56.33	-19.09	PASS
		High	Hop_2480	-0.54	-55.39	-20.54	PASS
3DH1	Ant1	Low	2402	1.18	-55.92	<=-18.82	PASS
		High	2480	-0.96	-55.12	<=-20.96	PASS
		Low	Hop_2402	1.19	-53.87	-18.82	PASS
		High	Hop_2480	-0.74	-55.53	-20.74	PASS

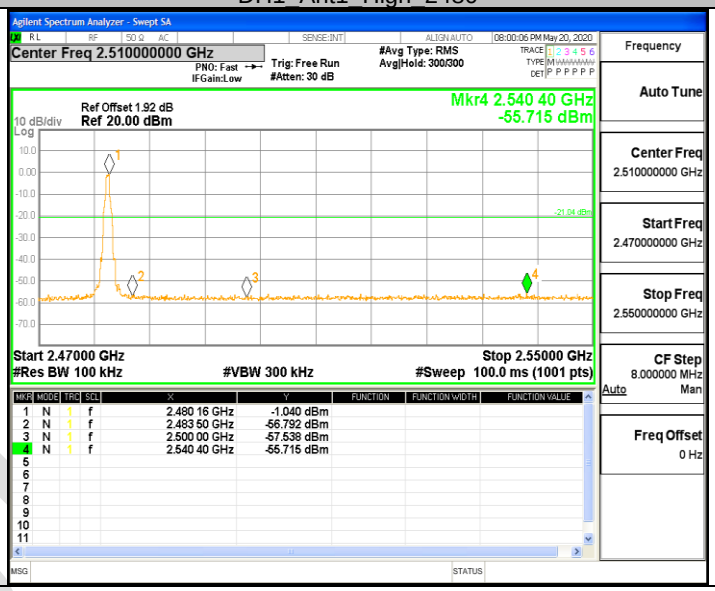
BlueAsia

Test Graphs

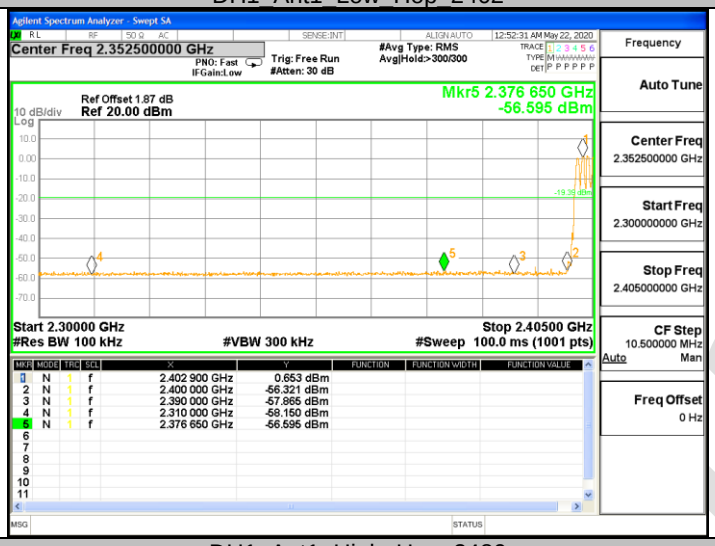
DH1_Ant1_Low_2402



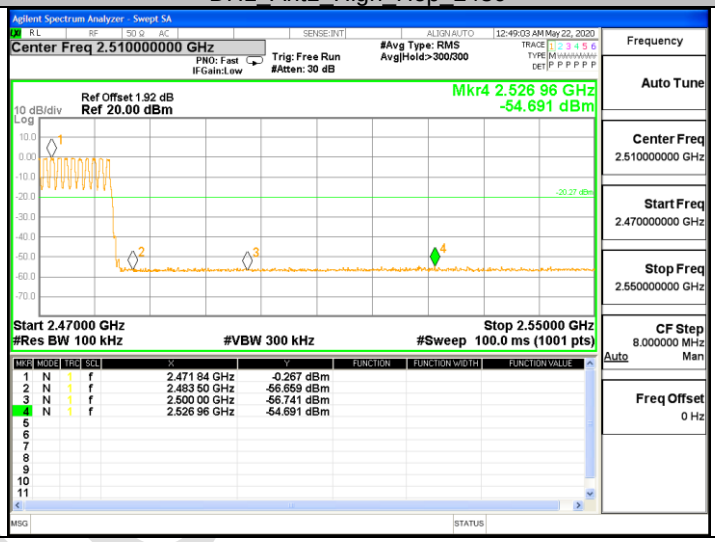
DH1_Ant1_High_2480



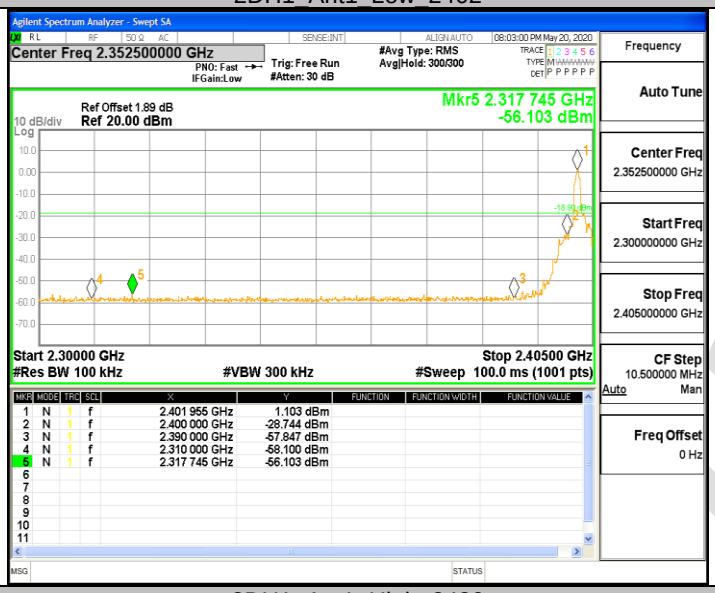
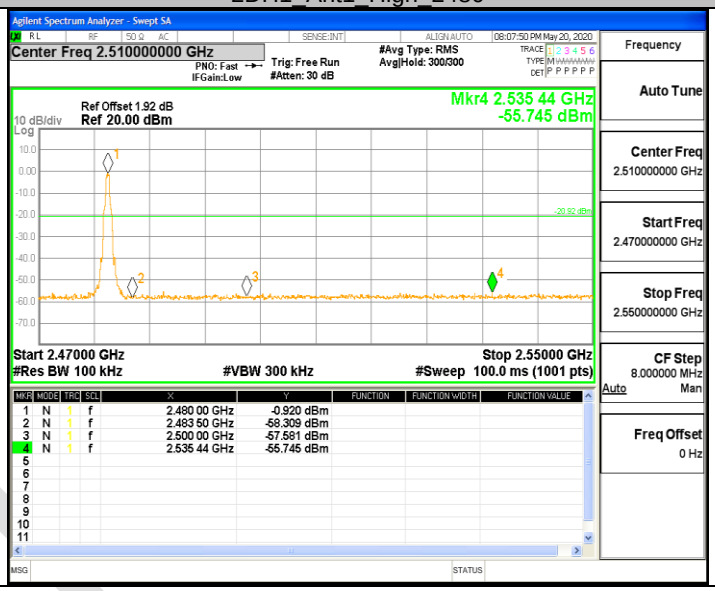
DH1_Ant1_Low_Hop_2402



DH1_Ant1_High_Hop_2480



2DH1_Ant1_Low_2402



2DH1_Ant1_High_2480