9.3 EST DATA

Pass: Please Refer To Appendix: For Details

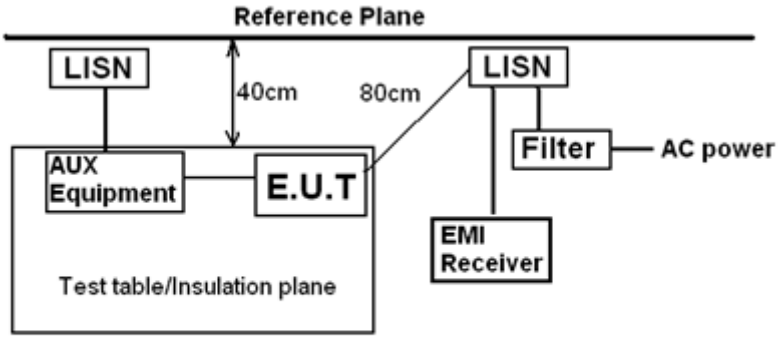
10 CONDUCTED EMISSIONS AT AC POWER LINE (150KHZ-30MHZ)

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	25℃
Humidity	60%

10.1 LIMITS

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		

10.2 BLOCK DIAGRAM OF TEST SETUP



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

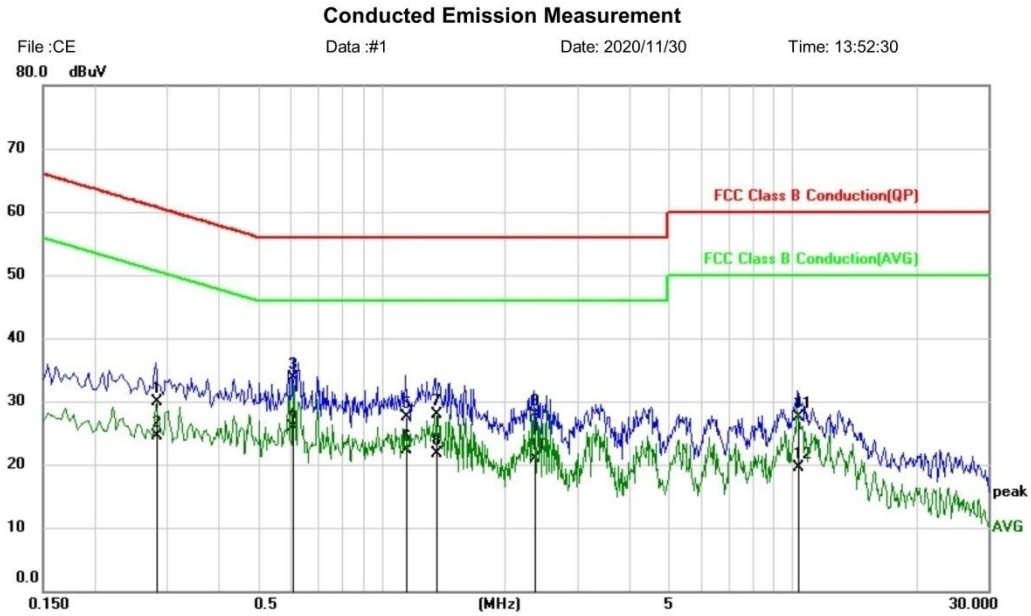
10.3 PROCEDURE

1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50?H + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as

the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.
Remark: LISN=Read Level+ Cable Loss+ LISN Factor

10.4 TEST DATA

[TestMode: TX]; [Line: Line]
Power: AC 120V/60Hz



Site
Limit: FCC Class B Conduction(QP)
EUT: TWS Bluetooth earphones
M/N: In2029A
Mode: BT mode
Note:

Phase: L1
Power:

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2819	20.14	9.76	29.90	60.76	-30.86	QP	
2		0.2819	14.77	9.76	24.53	50.76	-26.23	AVG	
3		0.6100	24.07	9.65	33.72	56.00	-22.28	QP	
4	*	0.6100	16.20	9.65	25.85	46.00	-20.15	AVG	
5		1.1420	17.79	9.72	27.51	56.00	-28.49	QP	
6		1.1420	12.49	9.72	22.21	46.00	-23.79	AVG	
7		1.3540	18.20	9.72	27.92	56.00	-28.08	QP	
8		1.3540	11.96	9.72	21.68	46.00	-24.32	AVG	
9		2.3540	18.19	9.70	27.89	56.00	-28.11	QP	
10		2.3540	11.16	9.70	20.86	46.00	-25.14	AVG	
11		10.3180	17.62	9.80	27.42	60.00	-32.58	QP	
12		10.3180	9.62	9.80	19.42	50.00	-30.58	AVG	

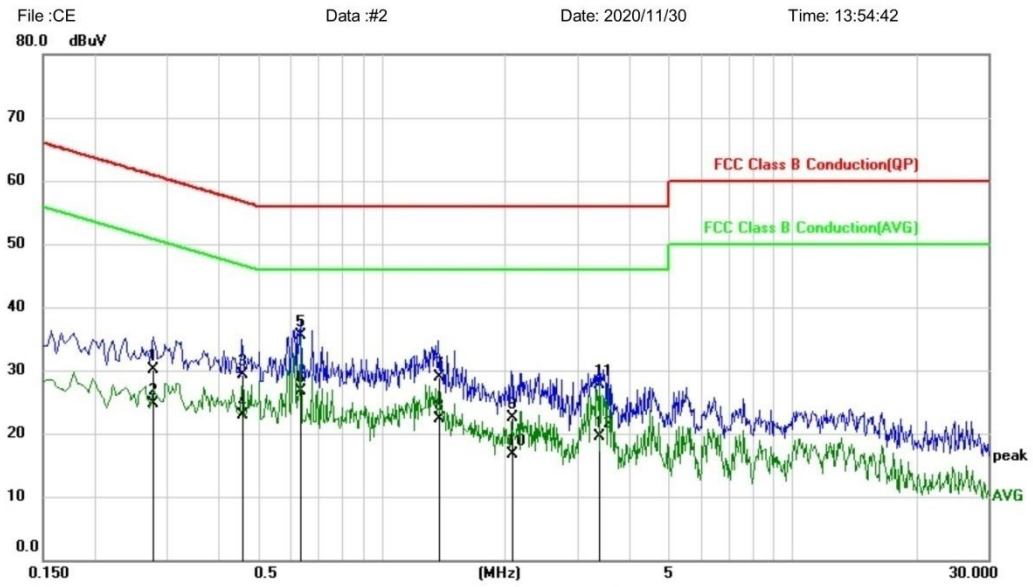
*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX]; [Line: Neutral]

Power: AC 120V/60Hz

Conducted Emission Measurement



Site

Limit: FCC Class B Conduction(QP)

EUT: TWS Bluetooth earphones

M/N: In2029A

Mode: BT mode

Note:

Phase: *N*

Power:

Temperature:

Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2779	20.30	9.74	30.04	60.88	-30.84	QP	
2		0.2779	14.98	9.74	24.72	50.88	-26.16	AVG	
3		0.4580	19.62	9.64	29.26	56.73	-27.47	QP	
4		0.4580	13.30	9.64	22.94	46.73	-23.79	AVG	
5		0.6340	25.85	9.66	35.51	56.00	-20.49	QP	
6	*	0.6340	17.13	9.66	26.79	46.00	-19.21	AVG	
7		1.3740	19.14	9.72	28.86	56.00	-27.14	QP	
8		1.3740	12.55	9.72	22.27	46.00	-23.73	AVG	
9		2.0660	12.80	9.75	22.55	56.00	-33.45	QP	
10		2.0660	6.93	9.75	16.68	46.00	-29.32	AVG	
11		3.3980	17.94	9.75	27.69	56.00	-28.31	QP	
12		3.3980	9.69	9.75	19.44	46.00	-26.56	AVG	

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

Test Result: Pass

11 RADIATED SPURIOUS EMISSIONS

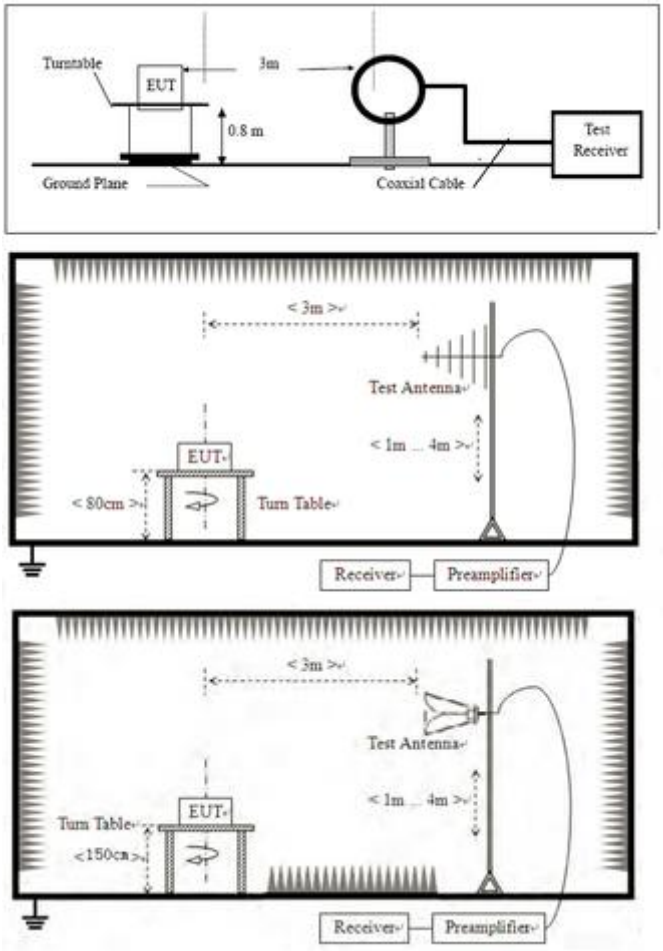
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Test Mode (Pre-Scan)	TX Low channel;TX middle channel;TX high channel
Test Mode (Final Test)	TX Low channel;TX middle channel;TX high channel
Tester	Eason
Temperature	25℃
Humidity	60%

11.1 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.

11.2 BLOCK DIAGRAM OF TEST SETUP



11.3 PROCEDURE

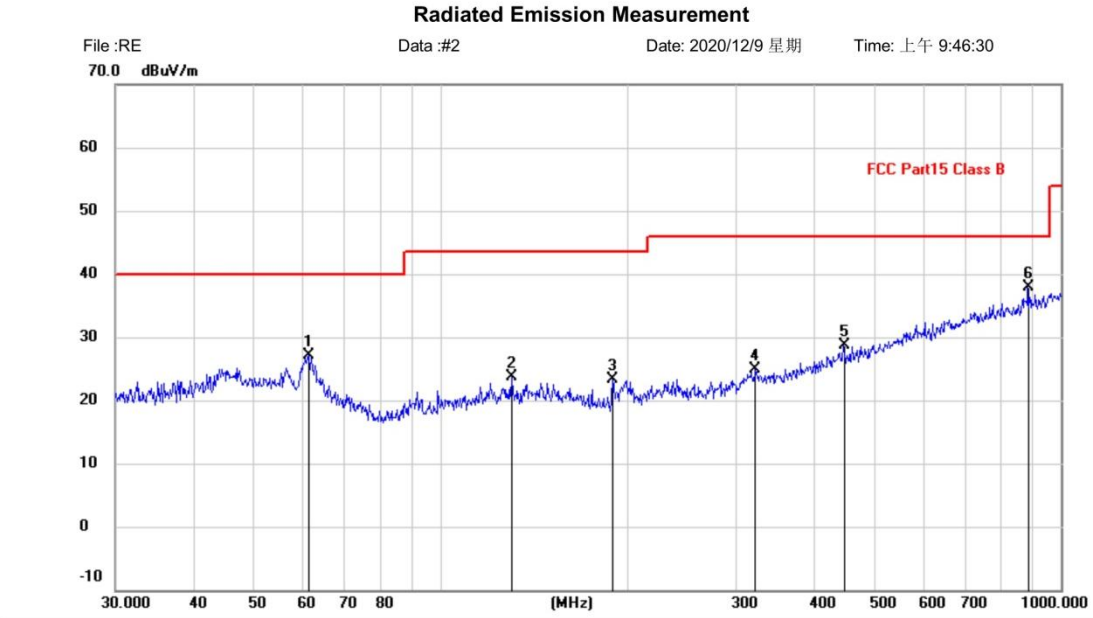
a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters 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) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor ¨C Preamplifier Factor
3) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter ， and only spurious emission is shown.
4) 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.

11.4 TEST DATA

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



Site
Limit: FCC Part15 Class B
EUT: TWS Bluetooth earphones
M/N: In2029A
Mode: BT mode
Note:

Polarization: *Vertical*
Power:
Distance: 3m

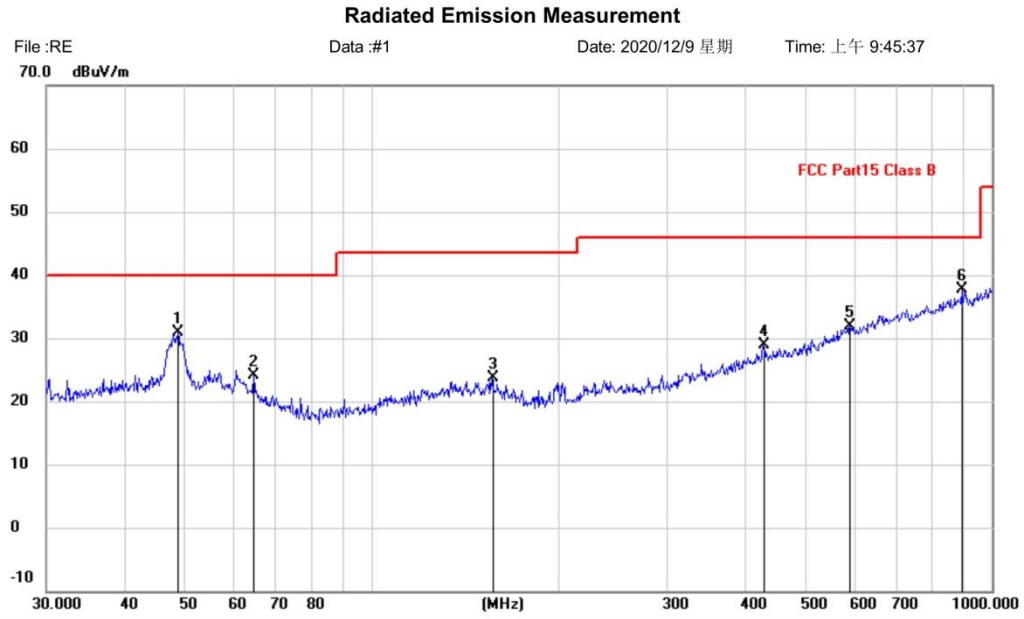
Temperature:
Humidity: %

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		61.5618	4.29	22.82	27.11	40.00	-12.89	QP			
2		130.3789	0.95	22.78	23.73	43.50	-19.77	QP			
3		189.7385	2.91	20.37	23.28	43.50	-20.22	QP			
4		322.1886	0.45	24.38	24.83	46.00	-21.17	QP			
5		446.4141	0.85	27.93	28.78	46.00	-17.22	QP			
6	*	884.5029	2.62	35.33	37.95	46.00	-8.05	QP			

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

Test Result: Pass

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



Site
Limit: FCC Part15 Class B
EUT: TWS Bluetooth earphones
M/N: In2029A
Mode: BT mode
Note:

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

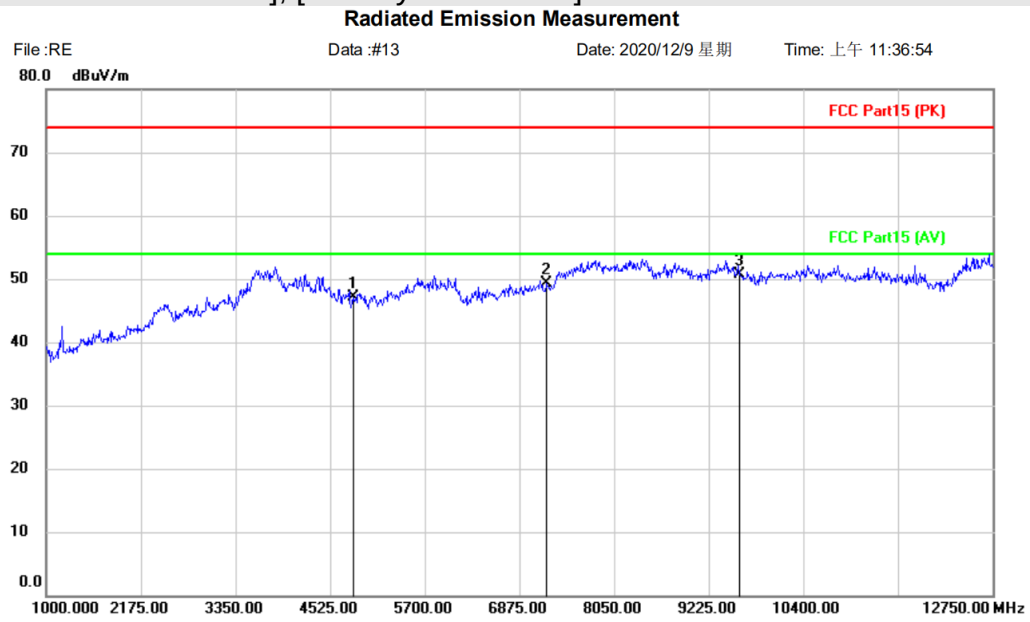
Temperature:
Humidity: %

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		48.8429	6.69	24.25	30.94	40.00	-9.06	QP			
2		64.6594	1.90	22.13	24.03	40.00	-15.97	QP			
3		156.4578	0.76	23.02	23.78	43.50	-19.72	QP			
4		428.0193	1.33	27.59	28.92	46.00	-17.08	QP			
5		590.9737	0.88	31.05	31.93	46.00	-14.07	QP			
6	*	893.8567	2.28	35.46	37.74	46.00	-8.26	QP			

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

Test Result: Pass

[TestMode: TX Low channel]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT: TWS Bluetooth earphones
M/N: In2029A
Mode: TX-L mode
Note:

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

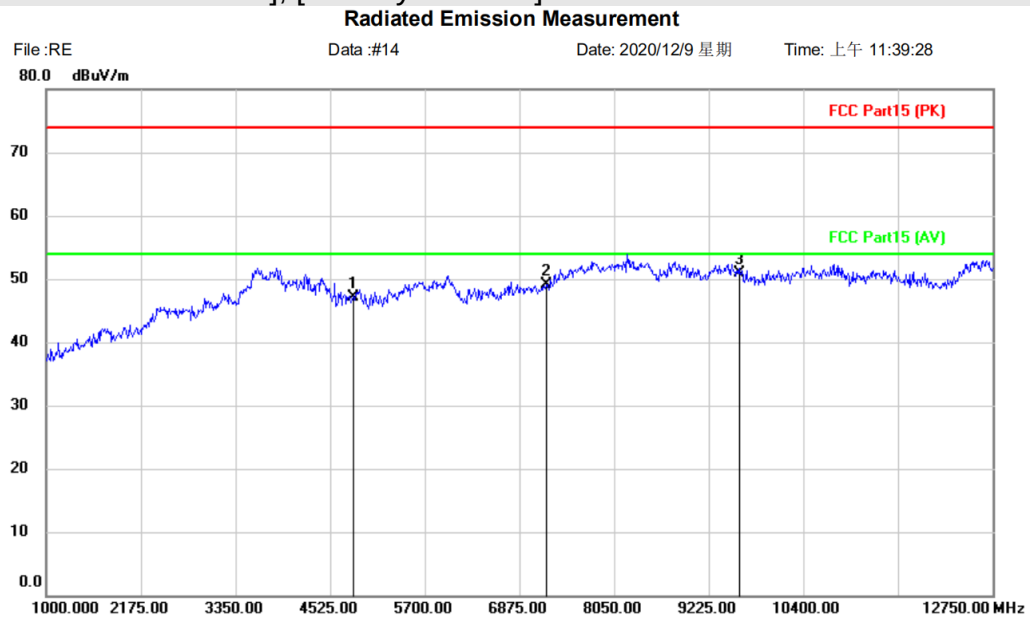
Temperature:
Humidity: %

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		4804.000	51.67	-4.52	47.15	74.00	-26.85	peak			
2		7206.000	51.59	-2.27	49.32	74.00	-24.68	peak			
3	*	9608.000	49.88	0.81	50.69	74.00	-23.31	peak			

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

Test Result: Pass

[TestMode: TX Low channel]; [Polarity: Vertical]



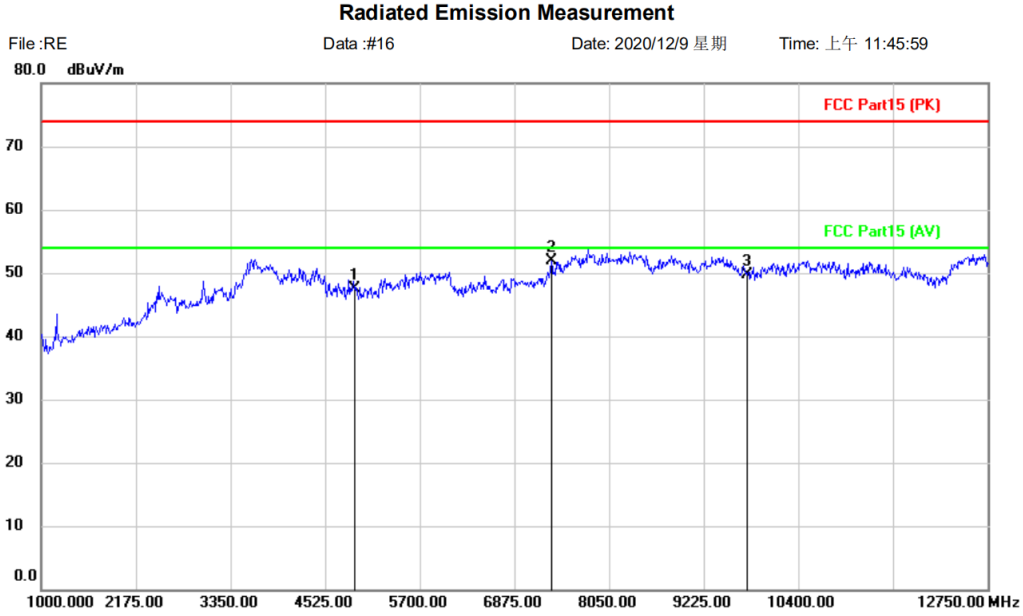
Site	Polarization: ***Vertical***	Temperature:
Limit: FCC Part15 (PK)	Power:	Humidity: %
EUT: TWS Bluetooth earphones	Distance: 3m	
M/N: In2029A		
Mode: TX-L mode		
Note:		

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		4804.000	51.66	-4.52	47.14	74.00	-26.86	peak			
2		7206.000	51.10	-2.02	49.08	74.00	-24.92	peak			
3	*	9608.000	50.35	0.62	50.97	74.00	-23.03	peak			

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

Test Result: Pass

[TestMode: TX middle channel]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT: TWS Bluetooth earphones
M/N: In2029A
Mode: TX-M mode
Note:

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

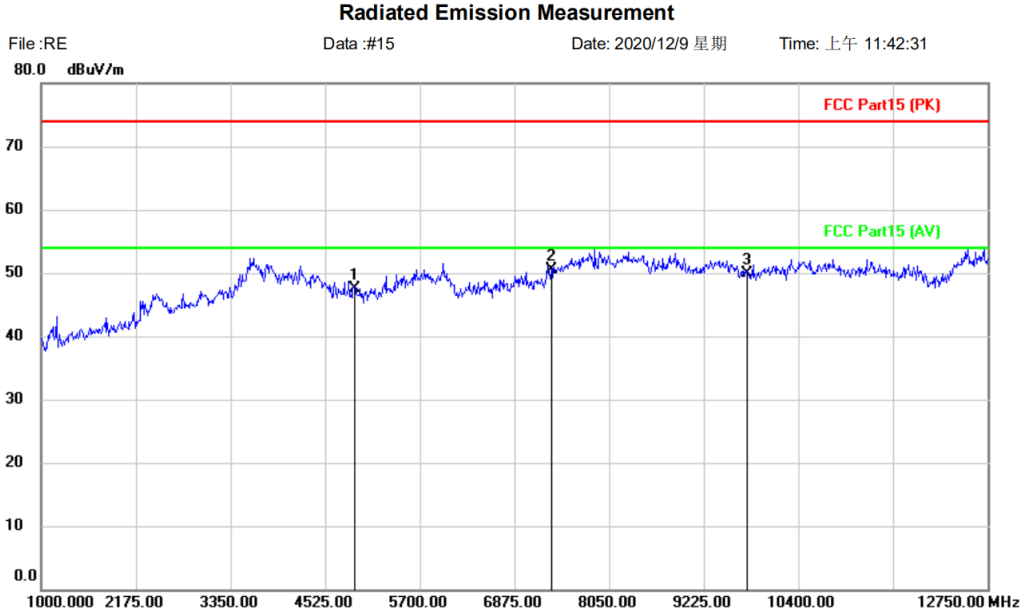
Temperature:
Humidity: %

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		4882.000	52.53	-5.07	47.46	74.00	-26.54	peak			
2	*	7323.000	53.25	-1.34	51.91	74.00	-22.09	peak			
3		9764.000	48.69	0.94	49.63	74.00	-24.37	peak			

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

Test Result: Pass

[TestMode: TX middle channel]; [Polarity: Vertical]



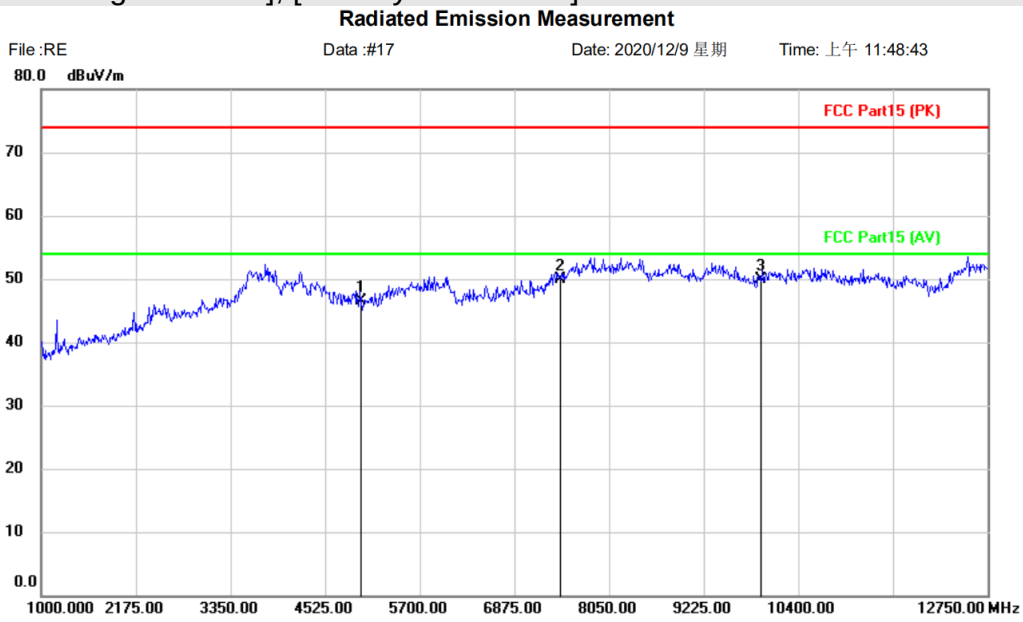
Site	Polarization: ***Vertical***	Temperature:
Limit: FCC Part15 (PK)	Power:	Humidity: %
EUT: TWS Bluetooth earphones	Distance: 3m	
M/N: In2029A		
Mode: TX-M mode		
Note:		

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		4882.000	52.63	-5.07	47.56	74.00	-26.44	peak			
2	*	7323.000	52.00	-1.48	50.52	74.00	-23.48	peak			
3		9764.000	49.00	0.91	49.91	74.00	-24.09	peak			

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

Test Result: Pass

[TestMode: TX high channel]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT: TWS Bluetooth earphones
M/N: In2029A
Mode: TX-H mode
Note:

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

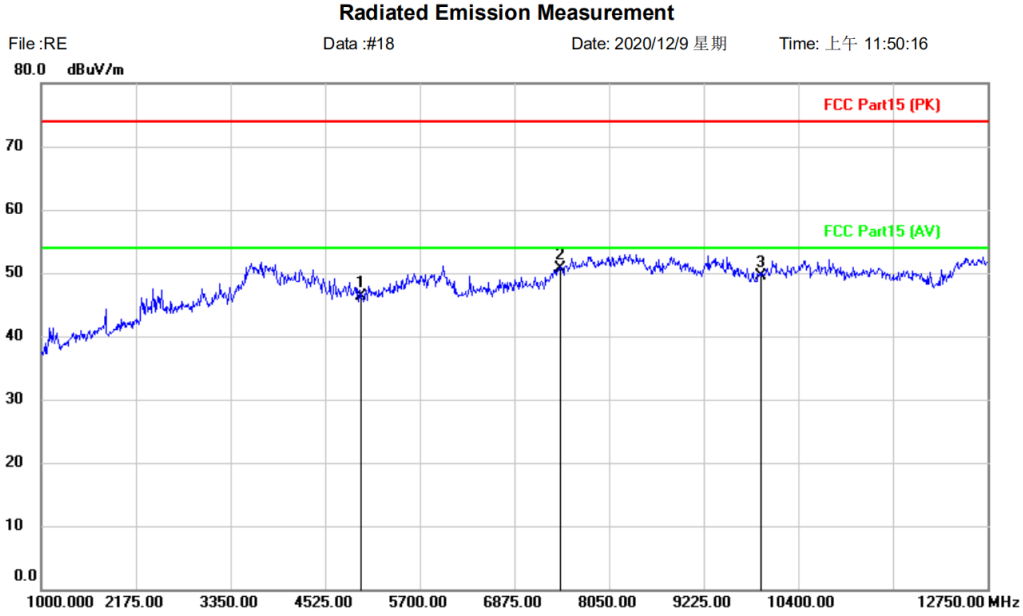
Temperature:
Humidity: %

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	51.40	-4.84	46.56	74.00	-27.44	peak			
2		7440.000	50.42	-0.56	49.86	74.00	-24.14	peak			
3	*	9920.000	48.58	1.30	49.88	74.00	-24.12	peak			

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

Test Result: Pass

[TestMode: TX high channel]; [Polarity: Vertical]



Site	Polarization: ***Vertical***	Temperature:
Limit: FCC Part15 (PK)	Power:	Humidity: %
EUT: TWS Bluetooth earphones	Distance: 3m	
M/N: In2029A		
Mode: TX-H mode		
Note:		

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	51.11	-4.84	46.27	74.00	-27.73	peak			
2	*	7440.000	51.74	-1.07	50.67	74.00	-23.33	peak			
3		9920.000	48.06	1.42	49.48	74.00	-24.52	peak			

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

Test Result: Pass

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

10 APPENDIX

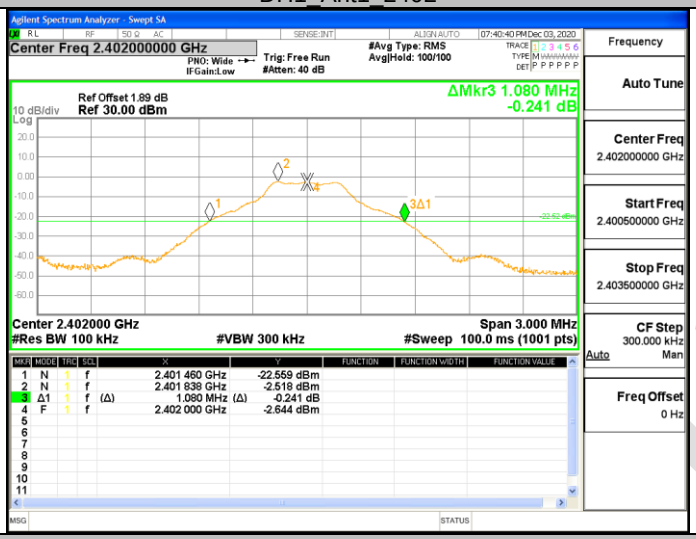
10.1 APPENDIX:20DBEMISSION BANDWIDTH

Test Result

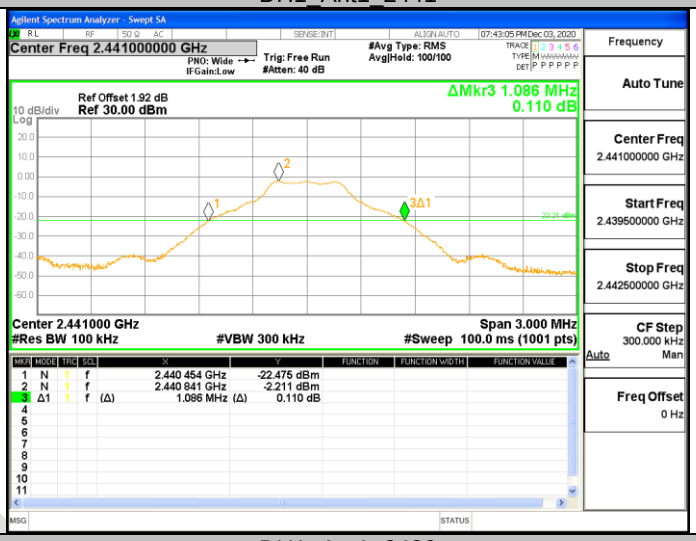
TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	1.080	2401.460	2402.540	---	PASS
		2441	1.086	2440.454	2441.540	---	PASS
		2480	1.086	2479.454	2480.540	---	PASS
2DH1	Ant1	2402	1.368	2401.307	2402.675	---	PASS
		2441	1.371	2440.310	2441.681	---	PASS
		2480	1.371	2479.310	2480.681	---	PASS

Test Graphs

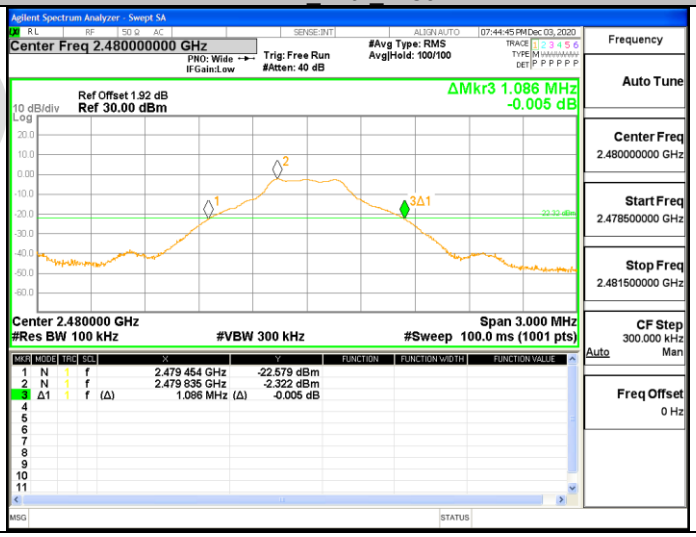
DH1_Ant1_2402



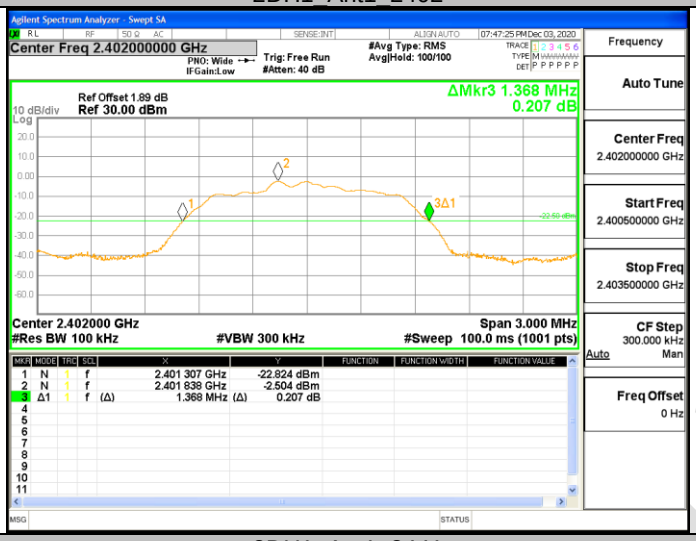
DH1_Ant1_2441



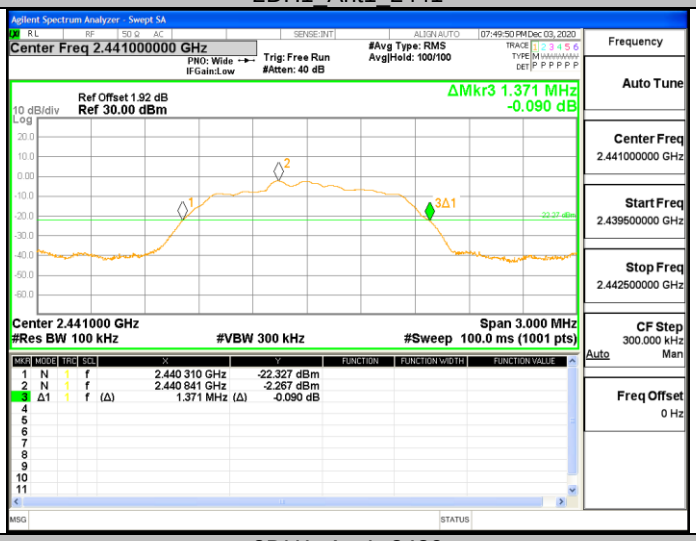
DH1_Ant1_2480



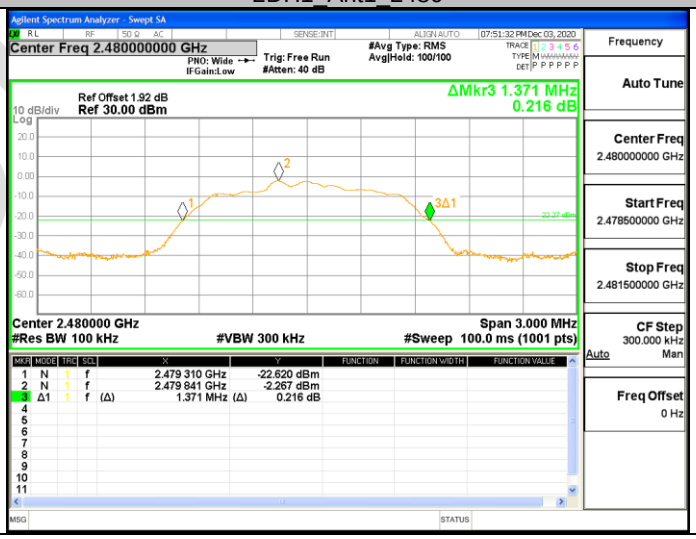
2DH1_Ant1_2402



2DH1_Ant1_2441



2DH1_Ant1_2480



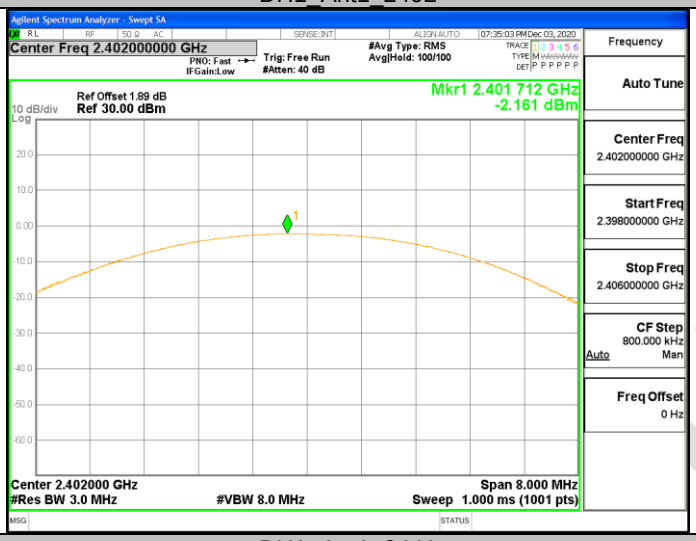
10.2 APPENDIX:MAXIMUM CONDUCTED OUTPUT POWER

Test Result

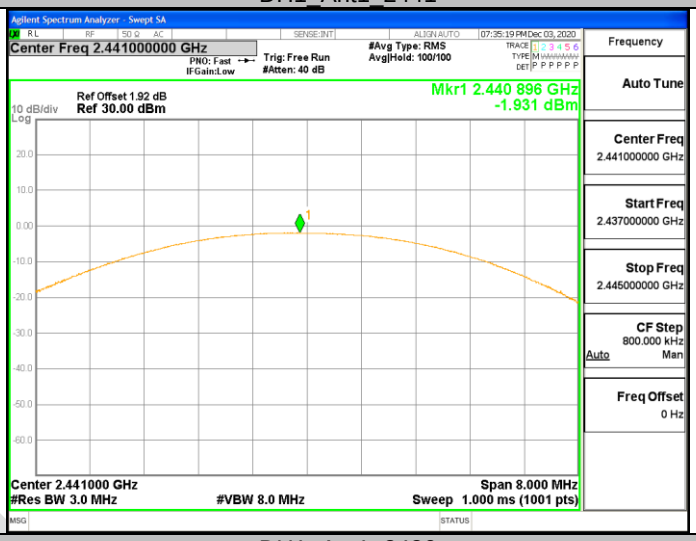
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH1	Ant1	2402	-2.16	<=30	PASS
		2441	-1.93	<=30	PASS
		2480	-2.02	<=30	PASS
2DH1	Ant1	2402	-1.93	<=30	PASS
		2441	-1.58	<=30	PASS
		2480	-1.75	<=30	PASS

Test Graphs

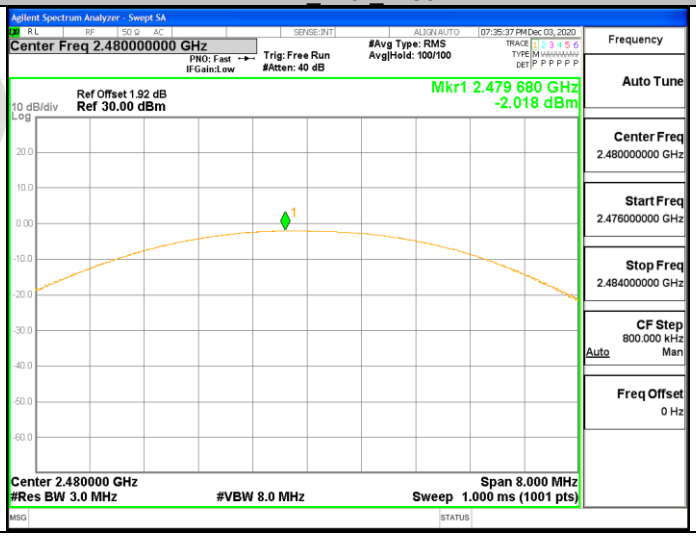
DH1_Ant1_2402



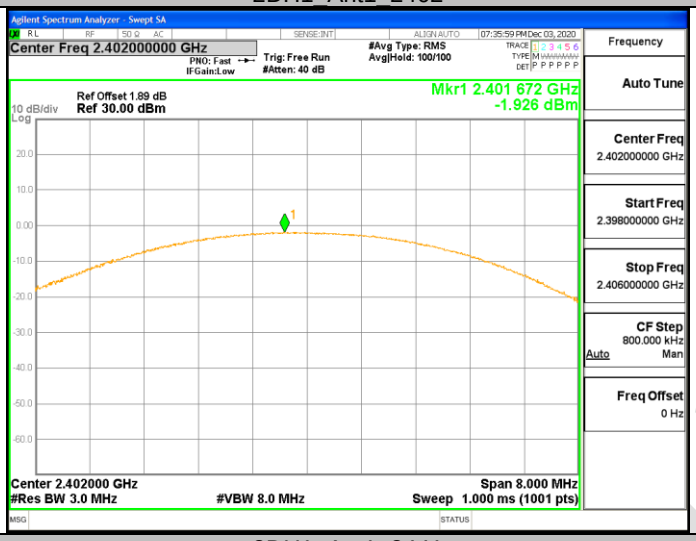
DH1_Ant1_2441



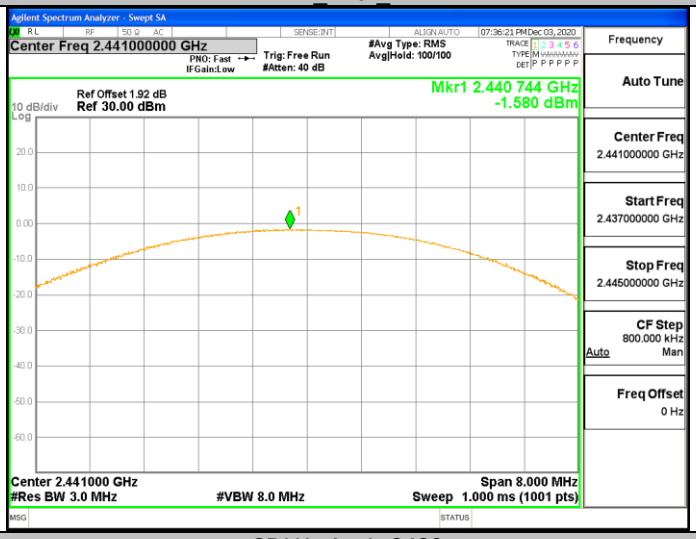
DH1_Ant1_2480



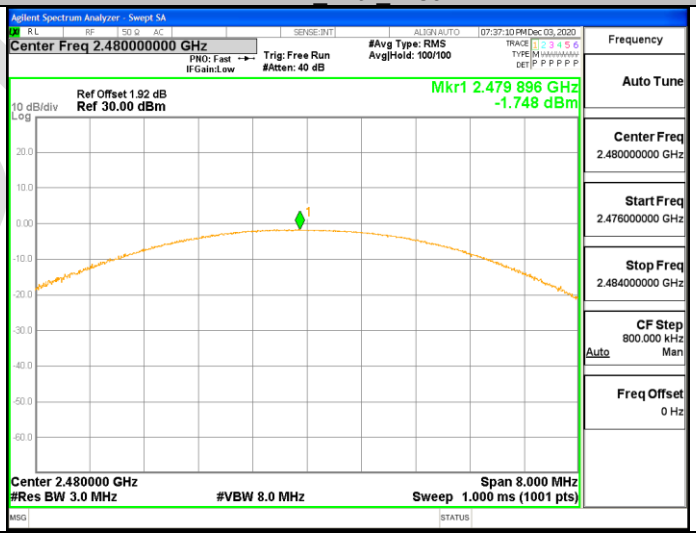
2DH1_Ant1_2402



2DH1_Ant1_2441



2DH1_Ant1_2480



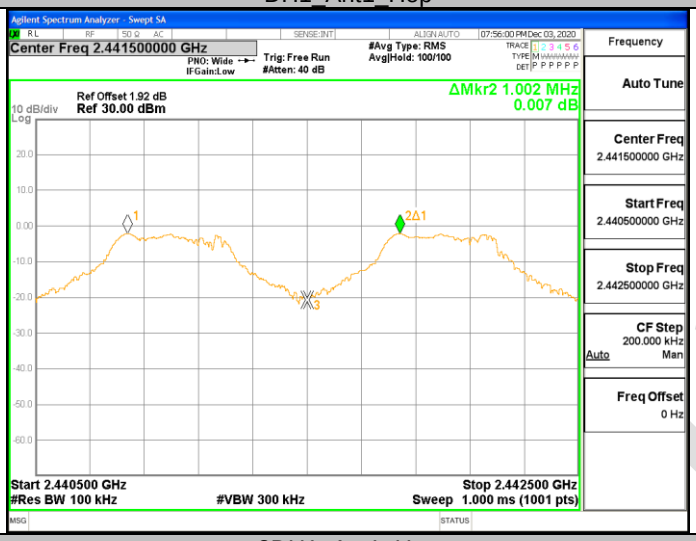
10.3 APPENDIX:CARRIER FREQUENCY SEPARATION

Test Result

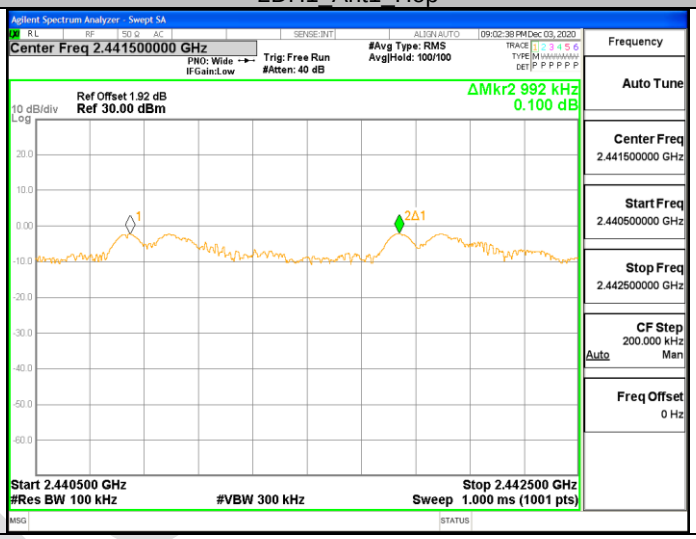
TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH1	Ant1	Hop	1.002	>=0.724	PASS
2DH1	Ant1	Hop	0.992	>=0.914	PASS

Test Graphs

DH1_Ant1_Hop



2DH1_Ant1_Hop

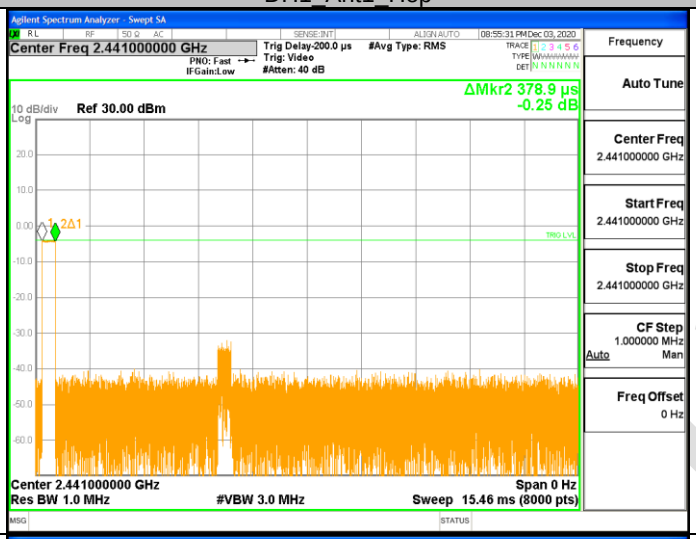
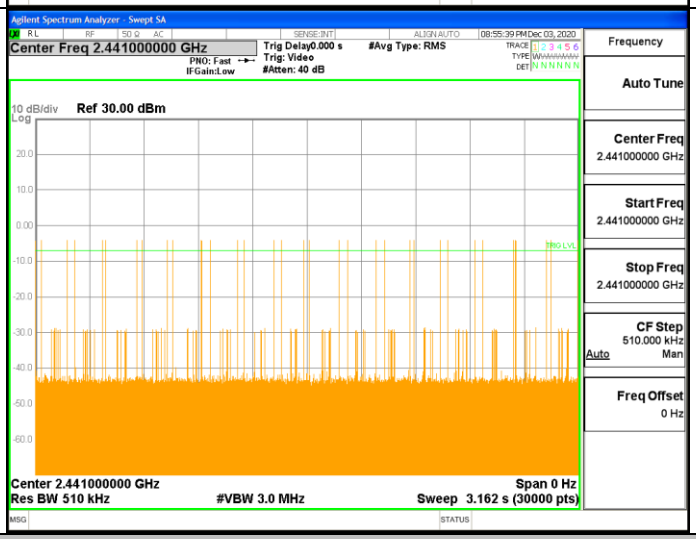
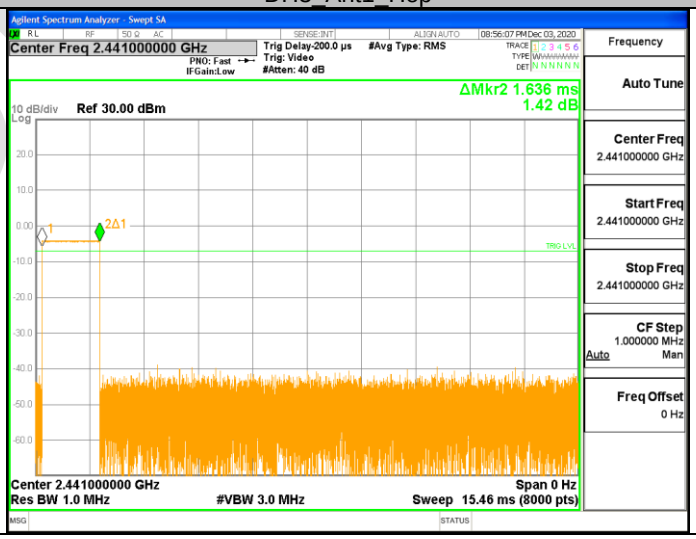


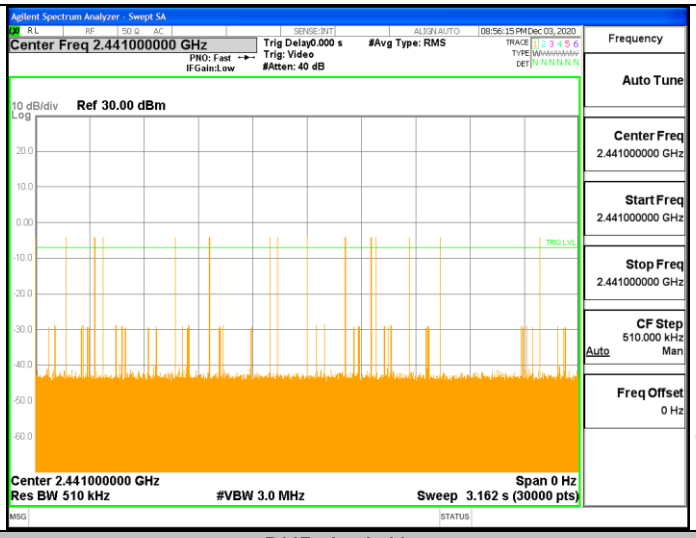
10.4 APPENDIX:TIME OF OCCUPANCY

Test Result

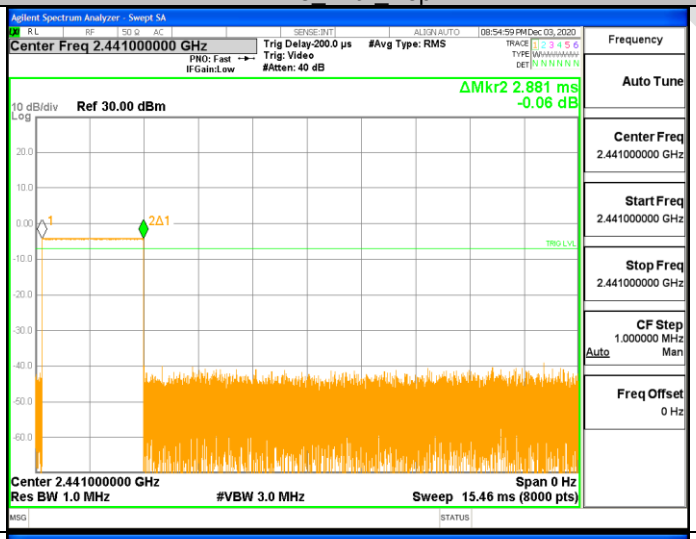
TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.38	330	0.125	<=0.4	PASS
DH3	Ant1	Hop	1.64	150	0.245	<=0.4	PASS
DH5	Ant1	Hop	2.88	90	0.259	<=0.4	PASS

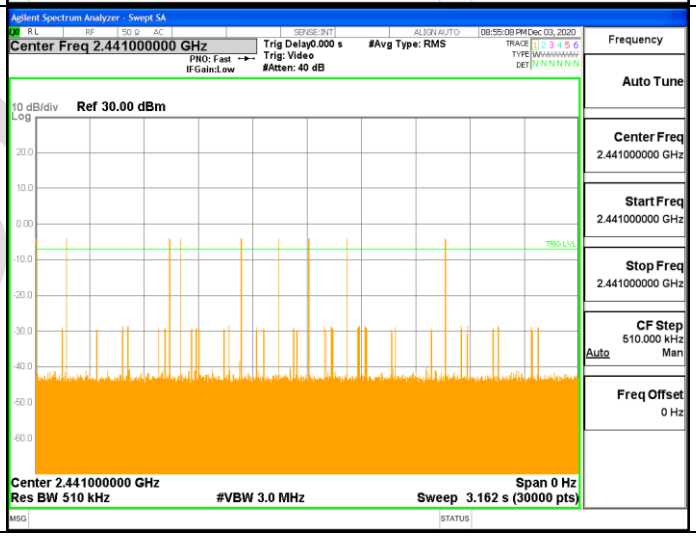
Test Graphs

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
08:56:15 PM Dec 03, 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
08:54:59 PM Dec 03, 2020
Frequency
Auto Tune
ΔMkr2 2.881 ms
-0.06 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 15.46 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
08:55:08 PM Dec 03, 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)

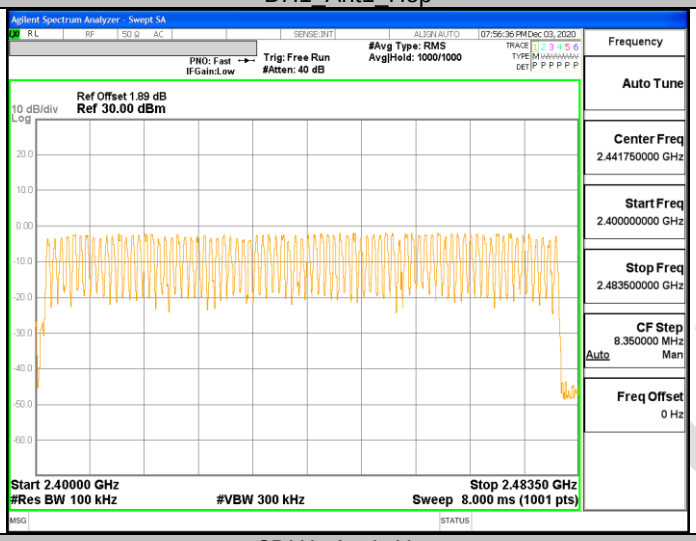
10.5 APPENDIX:NUMBER OF HOPPING CHANNELS

Test Result

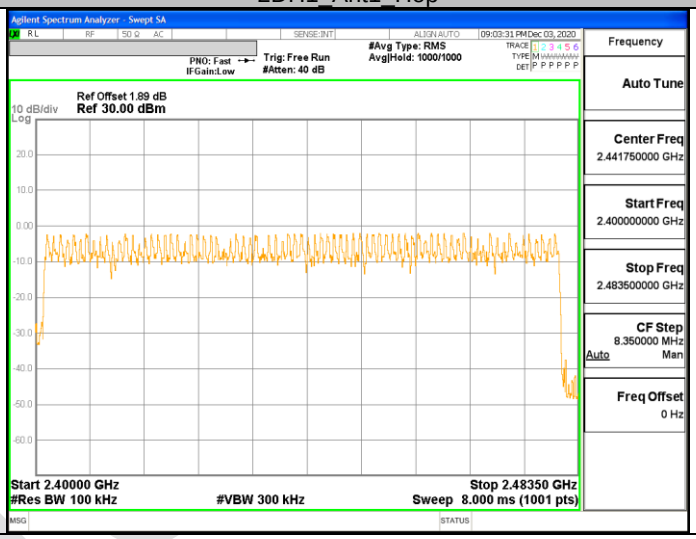
TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH1	Ant1	Hop	79	>=15	PASS
2DH1	Ant1	Hop	79	>=15	PASS

Test Graphs

DH1_Ant1_Hop



2DH1_Ant1_Hop



10.6 APPENDIX:BAND EDGE MEASUREMENTS

Test Result

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH1	Ant1	Low	2402	-2.61	-54.42	<=-22.61	PASS
		High	2480	-2.35	-54.28	<=-22.35	PASS
		Low	Hop_2402	-2.77	-54.13	-22.77	PASS
		High	Hop_2480	-2.38	-54.52	-22.38	PASS
2DH1	Ant1	Low	2402	-2.61	-54.24	<=-22.61	PASS
		High	2480	-2.30	-53.83	<=-22.3	PASS
		Low	Hop_2402	-2.61	-54.87	-22.61	PASS
		High	Hop_2480	-2.32	-55.17	-22.32	PASS