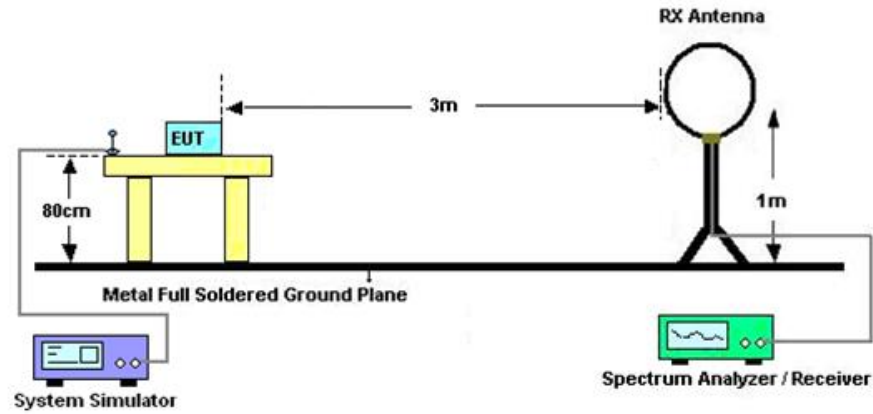
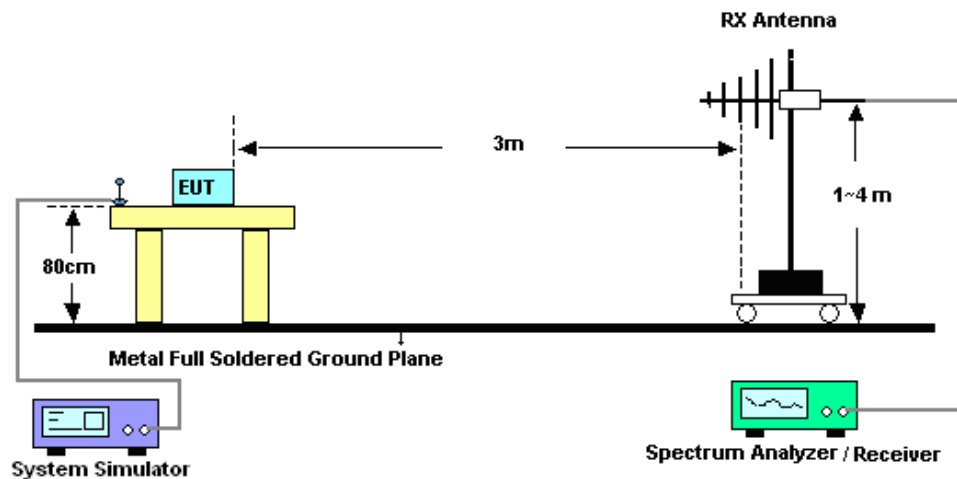


3.8.4 Test Setup

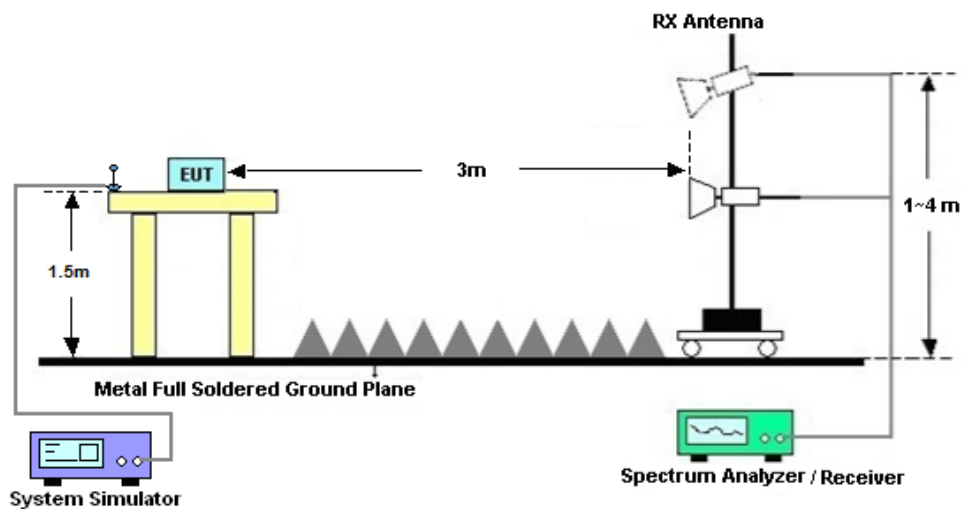
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.8.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.8.8 Duty cycle correction factor for average measurement

Please refer to Appendix D.

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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.

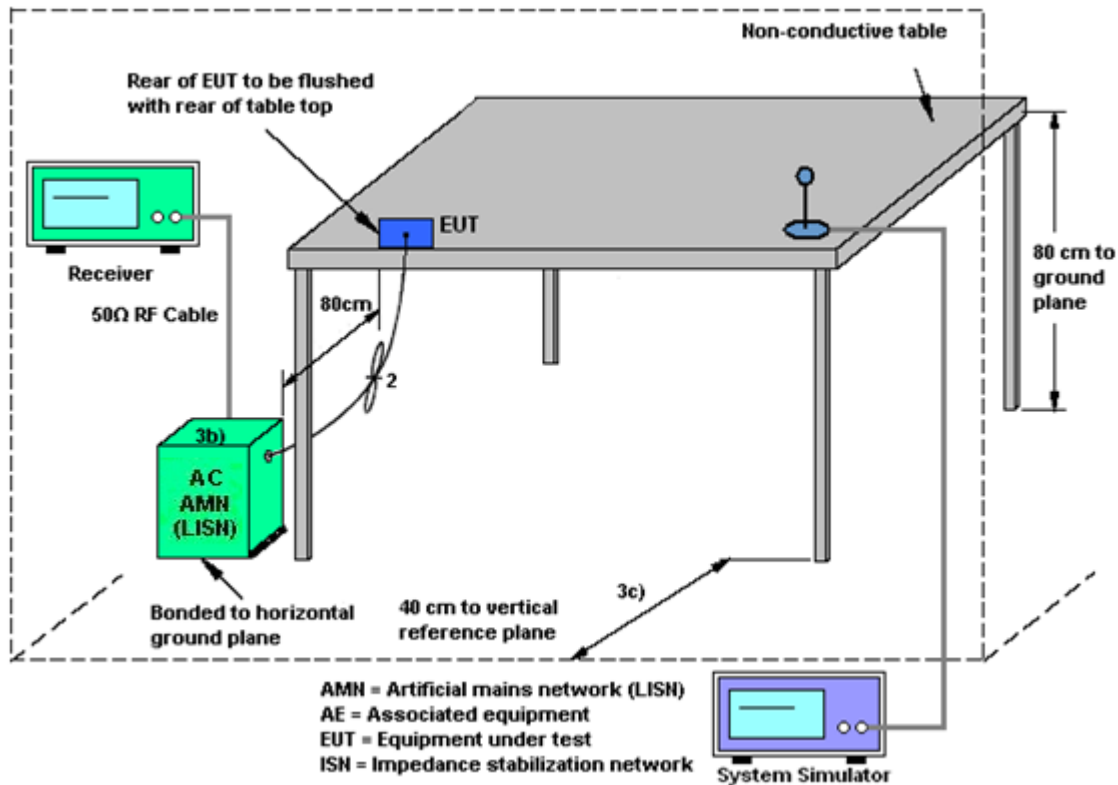
3.9.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.10 Antenna Requirements

3.10.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Mar. 07, 2021	Jun. 07, 2021	Mar. 06, 2022	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2 LISN	00103912	9kHz~30MHz	Dec. 25, 2020	Jun. 07, 2021	Dec. 24, 2021	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 15, 2020	Jun. 07, 2021	Oct. 14, 2021	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 21, 2020	Jun. 07, 2021	Jul. 20, 2021	Conduction (CO01-SZ)
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 08, 2021	May 26, 2021 Jun. 12, 2021	Apr. 07, 2022	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1207253	30MHz~40GHz	Dec. 25, 2020	May 26, 2021 Jun. 12, 2021	Dec. 24, 2021	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec. 25, 2020	May 26, 2021 Jun. 12, 2021	Dec. 24, 2021	Conducted (TH01-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY54450083	20Hz~8.4GHz	Apr. 17, 2021	Jun. 25, 2021	Apr. 16, 2022	Radiation (03CH03-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150246	10Hz~44GHz;	Apr. 17, 2021	Jun. 25, 2021	Apr. 16, 2022	Radiation (03CH03-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jun. 22, 2021	Jun. 25, 2021	Jun. 21, 2022	Radiation (03CH03-SZ)
Bilog Antenna	TESEQ	CBL6112D	23183	25MHz~2GHz	Jan. 07, 2021	Jun. 25, 2021	Jan. 06, 2022	Radiation (03CH03-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1355	1GHz~18GHz	Apr. 25, 2021	Jun. 25, 2021	Apr. 24, 2022	Radiation (03CH03-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Apr. 23, 2021	Jun. 25, 2021	Apr. 22, 2022	Radiation (03CH03-SZ)
Amplifier	Burgeon	BPA-530	102211	0.01Hz~3000MHz	Oct. 17, 2020	Jun. 25, 2021	Oct. 16, 2021	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1943528	1GHz~18GHz	Oct. 16, 2020	Jun. 25, 2021	Oct. 15, 2021	Radiation (03CH03-SZ)
Amplifier	Agilent Technologies	83017A	MY39501302	500MHz~26.5GHz	Dec. 25, 2020	Jun. 25, 2021	Dec. 24, 2021	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 21, 2020	Jun. 25, 2021	Jul. 20, 2021	Radiation (03CH03-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Jun. 25, 2021	NCR	Radiation (03CH03-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Jun. 25, 2021	NCR	Radiation (03CH03-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Jun. 25, 2021	NCR	Radiation (03CH03-SZ)

NCR: No Calibration Required

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage $K=2$ to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.2dB
---	-------

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
---	-------

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.9dB
---	-------

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
---	-------



Appendix A. Conducted Test Results

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Sam Zheng	Temperature:	21~25	°C
Test Date:	2021/5/26~2021/6/12	Relative Humidity:	51~54	%

TEST RESULTS DATA**20dB and 99% Occupied Bandwidth and Hopping Channel Separation**

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.941	0.845	0.999	0.6271	Pass
DH	1Mbps	1	39	2441	0.941	0.842	0.981	0.6271	Pass
DH	1Mbps	1	78	2480	0.941	0.839	1.003	0.6271	Pass
2DH	2Mbps	1	0	2402	1.316	1.181	0.977	0.8770	Pass
2DH	2Mbps	1	39	2441	1.316	1.175	0.990	0.8770	Pass
2DH	2Mbps	1	78	2480	1.316	1.172	0.999	0.8770	Pass
3DH	3Mbps	1	0	2402	1.298	1.178	1.151	0.8654	Pass
3DH	3Mbps	1	39	2441	1.298	1.178	1.003	0.8654	Pass
3DH	3Mbps	1	78	2480	1.298	1.178	0.981	0.8654	Pass

TEST RESULTS DATA**Dwell Time**

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	79	106.67	2.8797	0.31	0.4	Pass
AFH	20	53.33	2.8797	0.15	0.4	Pass

TEST RESULTS DATA**Peak Power Table**

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH5	0	1	11.90	20.97	Pass
	39	1	12.10	20.97	Pass
	78	1	9.10	20.97	Pass
2DH5	0	1	11.90	20.97	Pass
	39	1	12.10	20.97	Pass
	78	1	9.10	20.97	Pass
3DH5	0	1	12.40	20.97	Pass
	39	1	12.60	20.97	Pass
	78	1	9.60	20.97	Pass

TEST RESULTS DATA**Average Power Table****(Reporting Only)**

DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
DH5	0	1	11.30	1.18
	39	1	11.40	1.18
	78	1	8.30	1.18
2DH5	0	1	9.40	1.18
	39	1	9.40	1.18
	78	1	6.40	1.18
3DH5	0	1	9.40	1.16
	39	1	9.50	1.16
	78	1	6.40	1.16

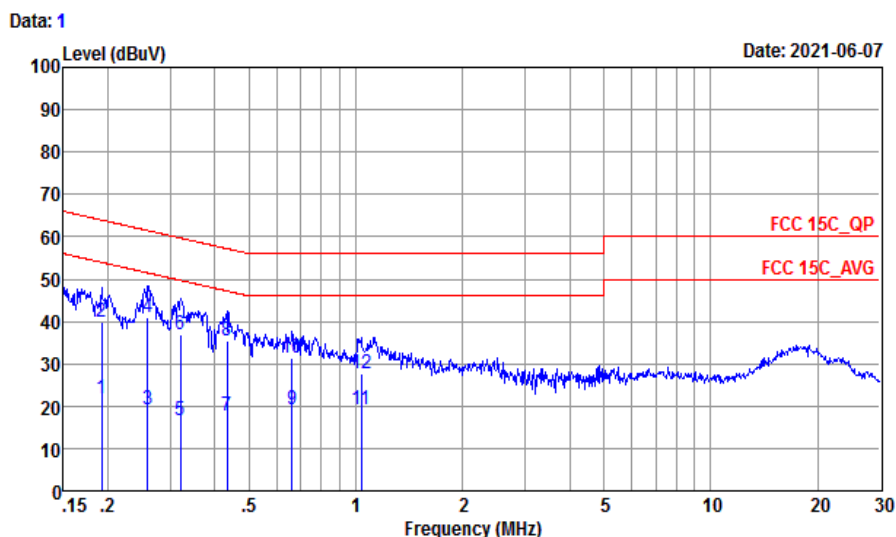
TEST RESULTS DATA**Number of Hopping Frequency**

Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	20	> 15	Pass



Appendix B. AC Conducted Emission Test Results

Test Engineer :	Xie YuQiang	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		

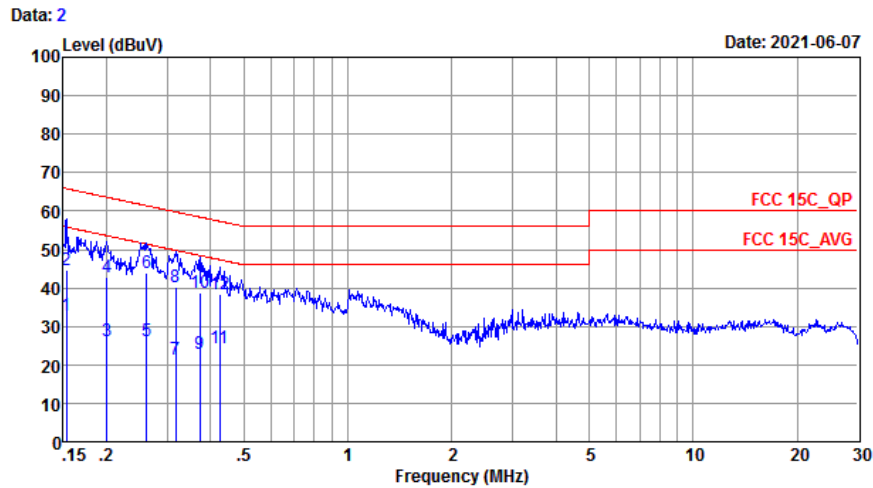


Site : C001-SZ
Condition: FCC 15C_QP LISN_20201030_L LINE

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.19	21.91	-32.02	53.93	11.80	0.08	10.03	Average
2	0.19	39.71	-24.22	63.93	29.60	0.08	10.03	QP
3	0.26	19.17	-32.30	51.47	9.09	0.04	10.04	Average
4 *	0.26	40.87	-20.60	61.47	30.79	0.04	10.04	QP
5	0.32	16.57	-33.14	49.71	6.50	0.03	10.04	Average
6	0.32	36.87	-22.84	59.71	26.80	0.03	10.04	QP
7	0.43	17.73	-29.47	47.20	7.59	0.09	10.05	Average
8	0.43	35.33	-21.87	57.20	25.19	0.09	10.05	QP
9	0.66	19.04	-26.96	46.00	8.90	0.10	10.04	Average
10	0.66	31.54	-24.46	56.00	21.40	0.10	10.04	QP
11	1.04	19.02	-26.98	46.00	8.90	0.10	10.02	Average
12	1.04	27.72	-28.28	56.00	17.60	0.10	10.02	QP



Test Engineer :	Xie YuQiang	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-SZ
Condition: FCC 15C_QP LISN_20201030_N NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15	32.99	-22.83	55.82	22.90	0.08	10.01	Average
2	0.15	44.79	-21.03	65.82	34.70	0.08	10.01	QP
3	0.20	26.11	-27.47	53.58	16.00	0.08	10.03	Average
4	0.20	42.81	-20.77	63.58	32.70	0.08	10.03	QP
5	0.26	26.37	-25.01	51.38	16.30	0.03	10.04	Average
6 *	0.26	43.77	-17.61	61.38	33.70	0.03	10.04	QP
7	0.32	21.56	-28.24	49.80	11.50	0.02	10.04	Average
8	0.32	40.36	-19.44	59.80	30.30	0.02	10.04	QP
9	0.37	23.01	-25.42	48.43	12.91	0.06	10.04	Average
10	0.37	38.81	-19.62	58.43	28.71	0.06	10.04	QP
11	0.43	24.43	-22.90	47.33	14.29	0.09	10.05	Average
12	0.43	38.43	-18.90	57.33	28.29	0.09	10.05	QP

Note:

- Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
- Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)

----- THE END -----



Appendix C. Radiated Spurious Emission

Test Engineer :	Jeff Yao	Temperature :	23~27°C
		Relative Humidity :	41~45%



2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2375.625	41.21	-32.79	74	42.29	27.72	4.88	33.68	287	233	P	H
	*	2375.625	16.42	-37.58	54	-	-	-	-	287	233	A	H
		2402	103.74	-	-	104.79	27.7	4.91	33.66	287	233	P	H
		2402	78.95	-	-	-	-	-	-	287	233	A	H
		2389.905	41.77	-32.23	74	42.82	27.7	4.91	33.66	118	233	P	V
	*	2389.905	16.98	-37.02	54	-	-	-	-	118	233	A	V
		2402	105.22	-	-	106.27	27.7	4.91	33.66	118	233	P	V
		2402	80.43	-	-	-	-	-	-	118	233	A	V
BT CH 39 2441MHz		2363.34	37.82	-36.18	74	41.19	27.85	4.78	36	100	317	P	H
	*	2363.34	13.03	-40.97	54	-	-	-	-	100	317	A	H
		2441	103.15	-	-	104.16	27.66	4.96	33.63	265	232	P	H
		2441	78.36	-	-	-	-	-	-	265	232	A	H
		2496.08	37.8	-36.2	74	41.17	27.63	4.9	35.9	100	317	P	H
		2496.08	13.01	-40.99	54	-	-	-	-	100	317	A	H
		2327.22	38.76	-35.24	74	42.14	27.91	4.75	36.04	111	54	P	V
	*	2327.22	13.97	-40.03	54	-	-	-	-	111	54	A	V
		2441	104.92	-	-	105.93	27.66	4.96	33.63	100	303	P	V
		2441	80.13	-	-	-	-	-	-	100	303	A	V
		2487.19	38.78	-35.22	74	42.14	27.66	4.9	35.92	111	54	P	V
		2487.19	13.99	-40.01	54	-	-	-	-	111	54	A	V



BT CH 78 2480MHz	*	2480	102.47	-	-	103.47	27.63	4.99	33.62	291	296	P	H
		2480	77.68	-	-	-	-	-	-	291	296	A	H
		2483.52	53.91	-20.09	74	54.91	27.63	4.99	33.62	291	296	P	H
		2483.52	29.12	-24.88	54	-	-	-	-	291	296	A	H
	*	2480	106.18	-	-	107.18	27.63	4.99	33.62	100	244	P	V
		2480	81.39	-	-	-	-	-	-	100	244	A	V
		2483.52	57.39	-16.61	74	58.39	27.63	4.99	33.62	100	244	P	V
		2483.52	32.6	-21.4	54	-	-	-	-	100	244	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 00 2402MHz		4804	40.87	-33.13	74	59.53	31.72	7.09	57.47	151	219	P	H
		4804	16.08	-37.92	54					151	219	A	H
		4804	40.13	-33.87	74	58.79	31.72	7.09	57.47	151	219	P	V
		4804	15.34	-38.66	54					151	219	A	V
BT CH 39 2441MHz		4882	40.62	-33.38	74	59.07	31.88	7.19	57.52	159	251	P	H
		4882	15.83	-38.17	54					159	251	A	H
		7323	45.81	-28.19	74	59	36.94	8.8	58.93	188	331	P	H
		7323	21.02	-32.98	54					188	331	A	H
		4882	40.91	-33.09	74	59.36	31.88	7.19	57.52	150	258	P	V
		4882	16.12	-37.88	54					150	258	A	V
		7323	47.03	-26.97	74	60.22	36.94	8.8	58.93	152	309	P	V
		7323	22.24	-31.76	54					152	309	A	V
BT CH 78 2480MHz		4960	41.24	-32.76	74	59.52	32.08	7.22	57.58	118	289	P	H
		4960	16.45	-37.55	54					118	289	A	H
		7440	46.37	-27.63	74	59	37.4	8.95	58.98	158	273	P	H
		7440	21.58	-32.42	54					158	273	A	H
		4960	41.37	-32.63	74	59.65	32.08	7.22	57.58	192	213	P	V
		4960	16.58	-37.42	54					192	213	A	V
		7440	46.53	-27.47	74	59.16	37.4	8.95	58.98	114	202	P	V
		7440	21.74	-32.26	54					114	202	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BT LF		30	25.65	-14.35	40	32.83	24.7	0.52	32.4	100	62	P	H
		56.19	19.59	-20.41	40	38.09	13.18	0.72	32.4			P	H
		104.69	27.7	-15.8	43.5	41.56	17.36	0.98	32.2			P	H
		274.44	22.68	-23.32	46	33.91	18.94	1.58	31.75			P	H
		560.59	27.03	-18.97	46	31.29	24.32	2.27	30.85			P	H
		890.39	28.38	-17.62	46	30.51	26.47	2.88	31.48			P	H
		30	36.55	-3.45	40	43.73	24.7	0.52	32.4	100	230	QP	V
		55.22	36.43	-3.57	40	54.72	13.4	0.71	32.4			P	V
		105.66	31.14	-12.36	43.5	44.95	17.41	0.98	32.2			P	V
		156.1	21.16	-22.34	43.5	35.8	16.35	1.2	32.19			P	V
		610.06	27.68	-18.32	46	31.21	24.82	2.37	30.72			P	V
		998.06	30.08	-23.92	54	30.58	27.48	3.05	31.03			P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

**Note symbol**

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	P eak or A verage
H/V	H orizontal or V ertical



A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

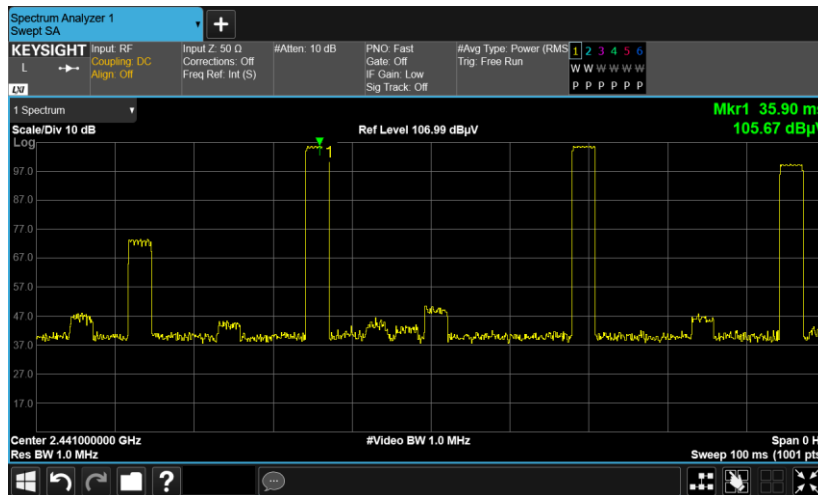
= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

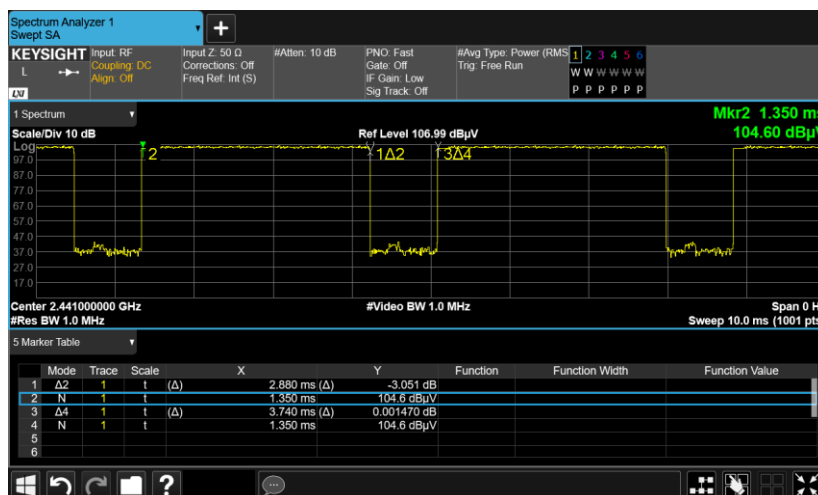
Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Duty Cycle Plots

3DH5 on time (One Pulse) Plot on Channel 39



3DH5 on time (Count Pulses) Plot on Channel 39



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. 3DH5 has the highest duty cycle worst case and is reported.