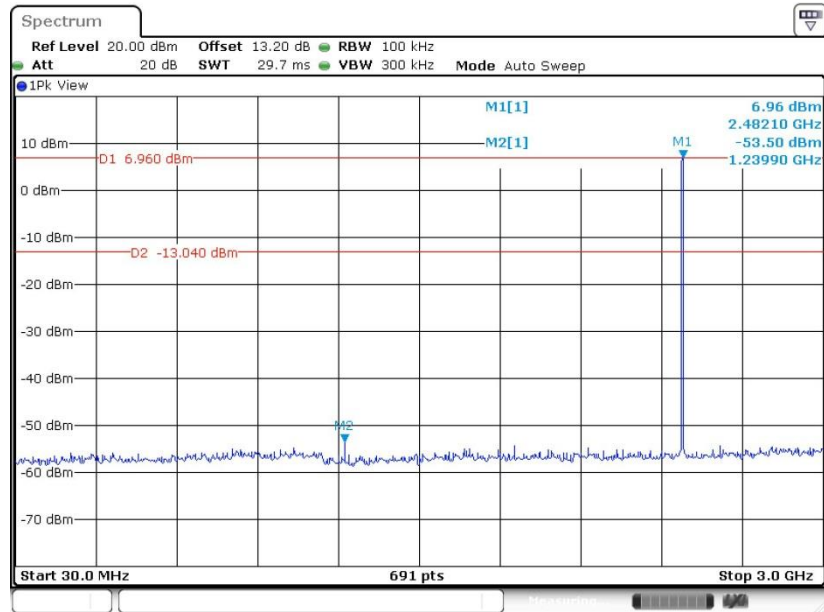
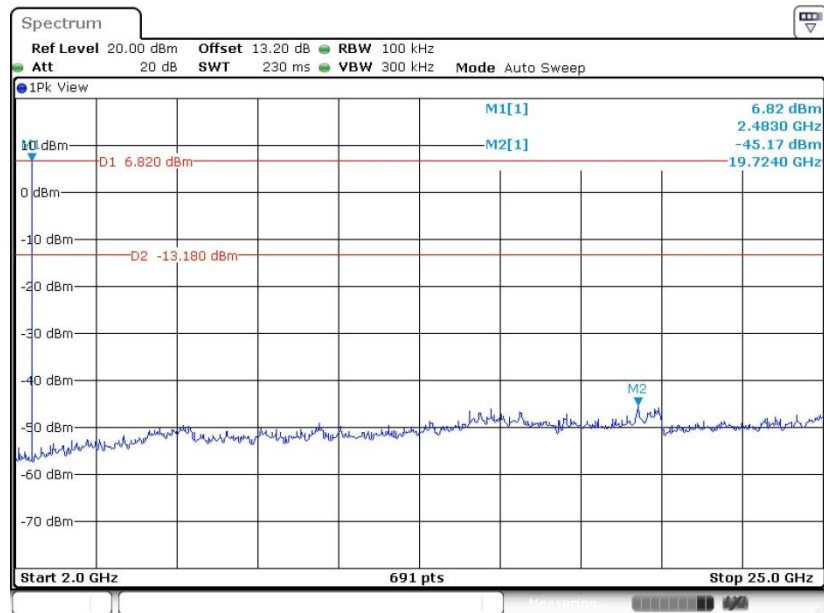


**CSE Plot on Ch 78 between 30MHz ~ 3 GHz**

Date: 12.AUG.2019 11:00:11

CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

Date: 12.AUG.2019 11:00:38

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.8.2 Measuring Instruments

See list of measuring equipment of this test report.

3.8.3 Test Procedures

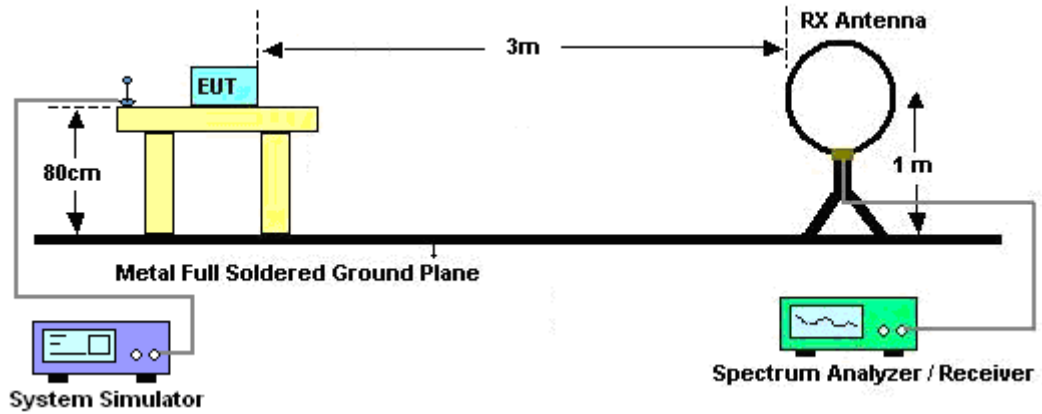
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
$$\text{On time} = N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$$

Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

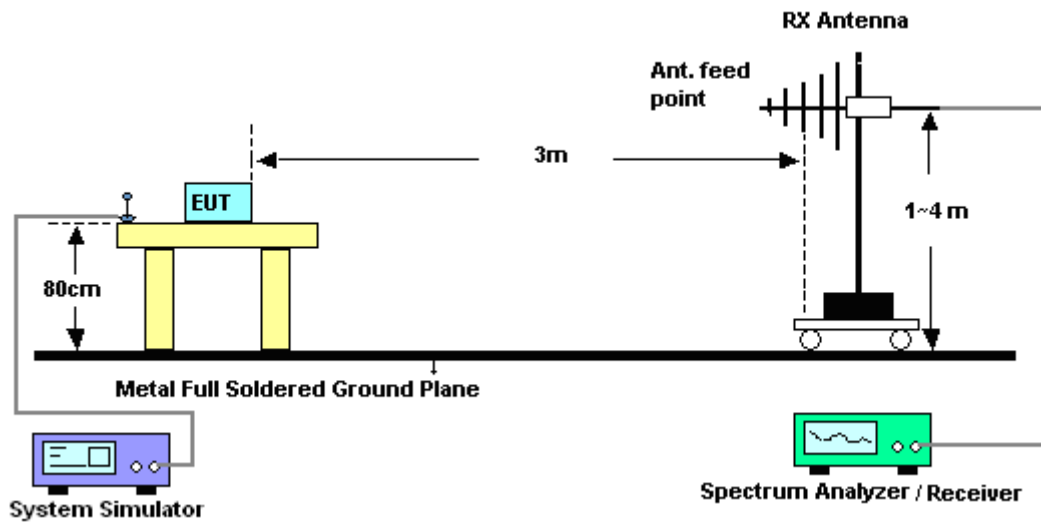
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.8.4 Test Setup

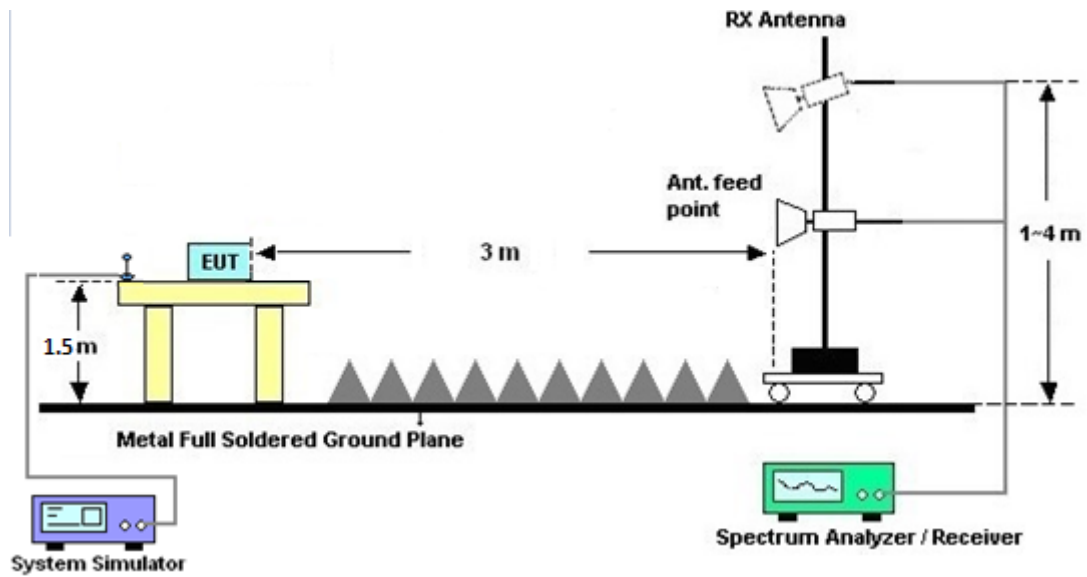
For radiated emissions below 30MHz



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 alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.8.7 Duty Cycle

Please refer to Appendix E.

3.8.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and 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.

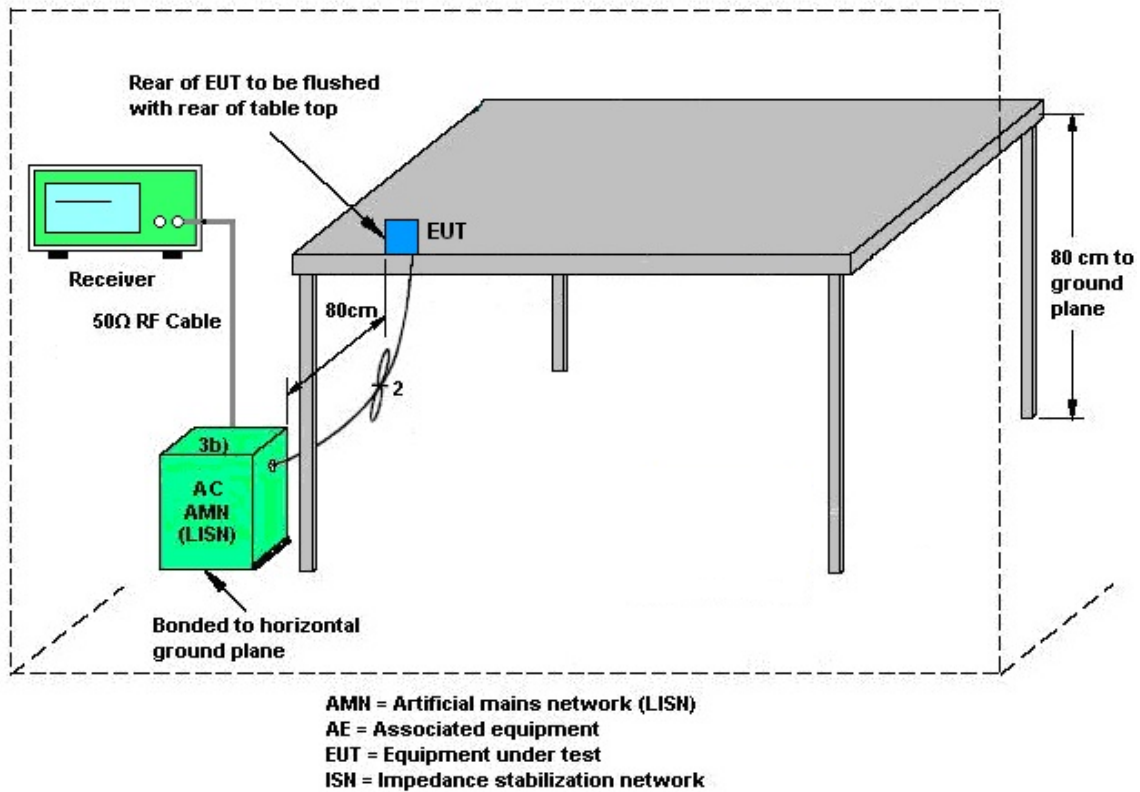
3.9.2 Measuring Instruments

See list of measuring equipment 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
Power Meter	Agilent	E4416A	GB41292344	N/A	Dec. 27, 2018	Jul. 11, 2019~ Aug. 16, 2019	Dec. 26, 2019	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 27, 2018	Jul. 11, 2019~ Aug. 16, 2019	Dec. 26, 2019	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 13, 2018	Jul. 11, 2019~ Aug. 16, 2019	Nov. 12, 2019	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1208382	N/A	Mar. 27, 2019	Jul. 11, 2019~ Aug. 16, 2019	Mar. 26, 2020	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jul. 03, 2019	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 12, 2018	Jul. 03, 2019	Nov. 11, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 14, 2018	Jul. 03, 2019	Nov. 13, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 09, 2018	Jul. 03, 2019	Nov. 08, 2019	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jul. 03, 2019	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Dec. 31, 2018	Jul. 03, 2019	Dec. 30, 2019	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Dec. 31, 2018	Jul. 03, 2019	Dec. 30, 2019	Conduction (CO05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jan. 07, 2019	Jun. 20, 2019~ Jul. 31, 2019	Jan. 06, 2020	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-121 2	1GHz ~ 18GHz	May 14, 2019	Jun. 20, 2019~ Jul. 31, 2019	May 13, 2020	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	37059&01	30MHz~1GHz	Oct. 13, 2018	Jun. 20, 2019~ Jul. 31, 2019	Oct. 12, 2019	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 584	18GHz- 40GHz	Dec. 05, 2018	Jun. 20, 2019~ Jul. 31, 2019	Dec. 04, 2019	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY532701 47	1GHz~26.5GHz	Mar. 15, 2019	Jun. 20, 2019~ Jul. 31, 2019	Mar. 14, 2020	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	1GHz~18GHz	May 20, 2019	Jun. 20, 2019~ Jul. 31, 2019	May 19, 2020	Radiation (03CH13-HY)
Amplifier	Sonoma-Instru ment	310 N	187282	9KHz~1GHz	Dec. 18, 2018	Jun. 20, 2019~ Jul. 31, 2019	Dec. 17, 2019	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 06, 2018	Jun. 20, 2019~ Jul. 31, 2019	Dec. 05, 2019	Radiation (03CH13-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30M-18G	Feb. 13, 2019	Jun. 20, 2019~ Jul. 31, 2019	Feb. 12, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30M-18G	Feb. 13, 2019	Jun. 20, 2019~ Jul. 31, 2019	Feb. 12, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/ 4	30M-18G	Feb. 13, 2019	Jun. 20, 2019~ Jul. 31, 2019	Feb. 12, 2020	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY553705 26	10Hz~44GHz	Mar. 19, 2019	Jun. 20, 2019~ Jul. 31, 2019	Mar. 18, 2020	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jun. 20, 2019~ Jul. 31, 2019	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jun. 20, 2019~ Jul. 31, 2019	N/A	Radiation (03CH13-HY)
Software	AUDIX	E3 6.2009-8-24c	RK-001124	N/A	N/A	Jun. 20, 2019~ Jul. 31, 2019	N/A	Radiation (03CH13-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY541300 85	20Hz ~ 8.4GHz	Nov. 01, 2018	Jun. 20, 2019~ Jul. 31, 2019	Oct. 31, 2019	Radiation (03CH13-HY)
Filter	Wainwright	WLKS1200-8 SS	SN3	1.2G Low Pass	Nov. 02, 2018	Jun. 20, 2019~ Jul. 31, 2019	Nov. 01, 2019	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-280 5-3000-18000 -40ST	SN1	3G High Pass	Nov. 14, 2018	Jun. 20, 2019~ Jul. 31, 2019	Nov. 13, 2019	Radiation (03CH13-HY)

5 Uncertainty of Evaluation

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

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

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.4
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.3
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Howard Lin	Temperature:	21~25	°C
Test Date:	2019/7/11~2019/8/16	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	0.880	0.836	1.003	0.5866	Pass
DH	1Mbps	1	39	2441	0.880	0.834	1.316	0.5866	Pass
DH	1Mbps	1	78	2480	0.880	0.836	1.003	0.5866	Pass
2DH	2Mbps	1	0	2402	1.207	1.135	1.003	0.8046	Pass
2DH	2Mbps	1	39	2441	1.211	1.135	0.999	0.8075	Pass
2DH	2Mbps	1	78	2480	1.211	1.132	0.999	0.8075	Pass
3DH	3Mbps	1	0	2402	1.211	1.123	1.003	0.8075	Pass
3DH	3Mbps	1	39	2441	1.211	1.123	0.999	0.8075	Pass
3DH	3Mbps	1	78	2480	1.211	1.126	0.994	0.8075	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	2.88	0.31	0.4	Pass
AFH	20	53.33	2.88	0.15	0.4	Pass

TEST RESULTS DATA***Peak Power Table***

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH1	0	1	8.25	20.97	Pass
	39	1	8.56	20.97	Pass
	78	1	8.73	20.97	Pass
2DH1	0	1	7.96	20.97	Pass
	39	1	8.27	20.97	Pass
	78	1	8.39	20.97	Pass
3DH1	0	1	8.19	20.97	Pass
	39	1	8.47	20.97	Pass
	78	1	8.54	20.97	Pass

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

DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
DH1	0	1	7.90	8.29
	39	1	8.09	8.29
	78	1	8.26	8.29
2DH1	0	1	6.22	8.22
	39	1	6.36	8.22
	78	1	6.58	8.22
3DH1	0	1	6.04	8.15
	39	1	6.25	8.15
	78	1	6.51	8.15

TEST RESULTS DATA***Number of Hopping Frequency***

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



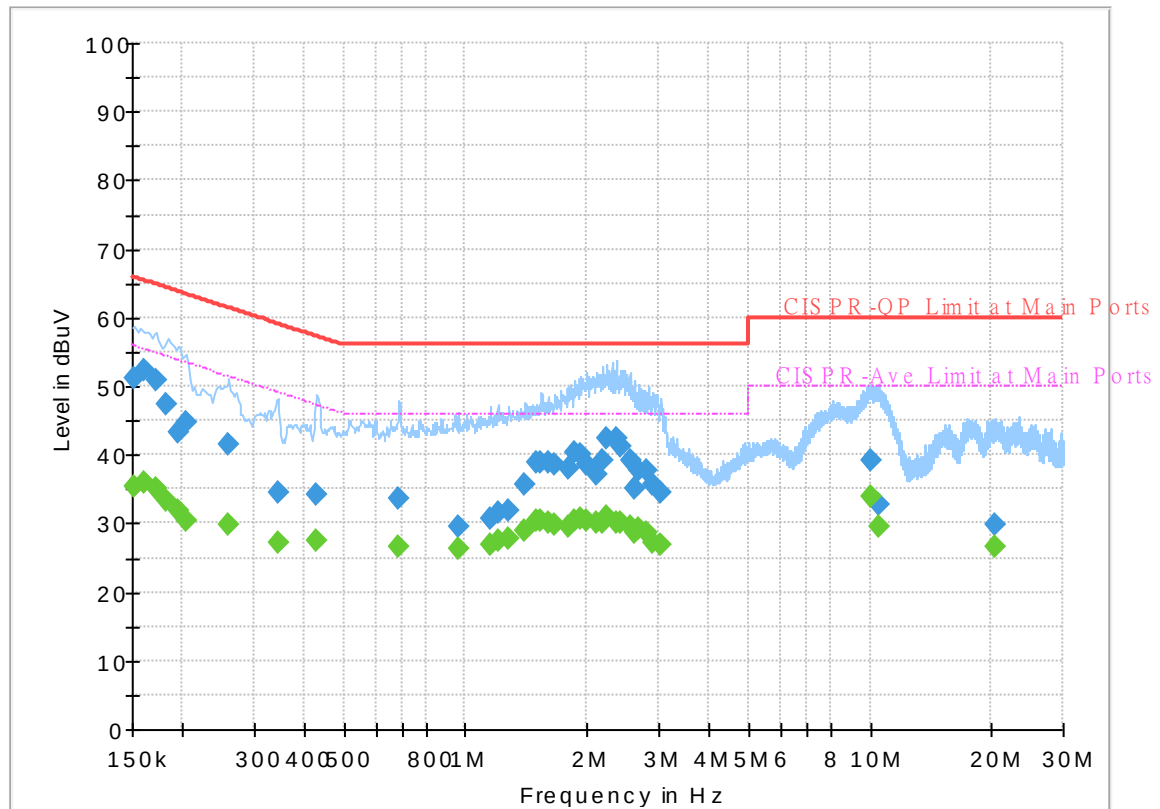
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Jimmy Chang	Temperature :	22~24℃
		Relative Humidity :	52~55%

EUT Information

Report NO : 940344-01
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

Full Spectrum



Final_Result

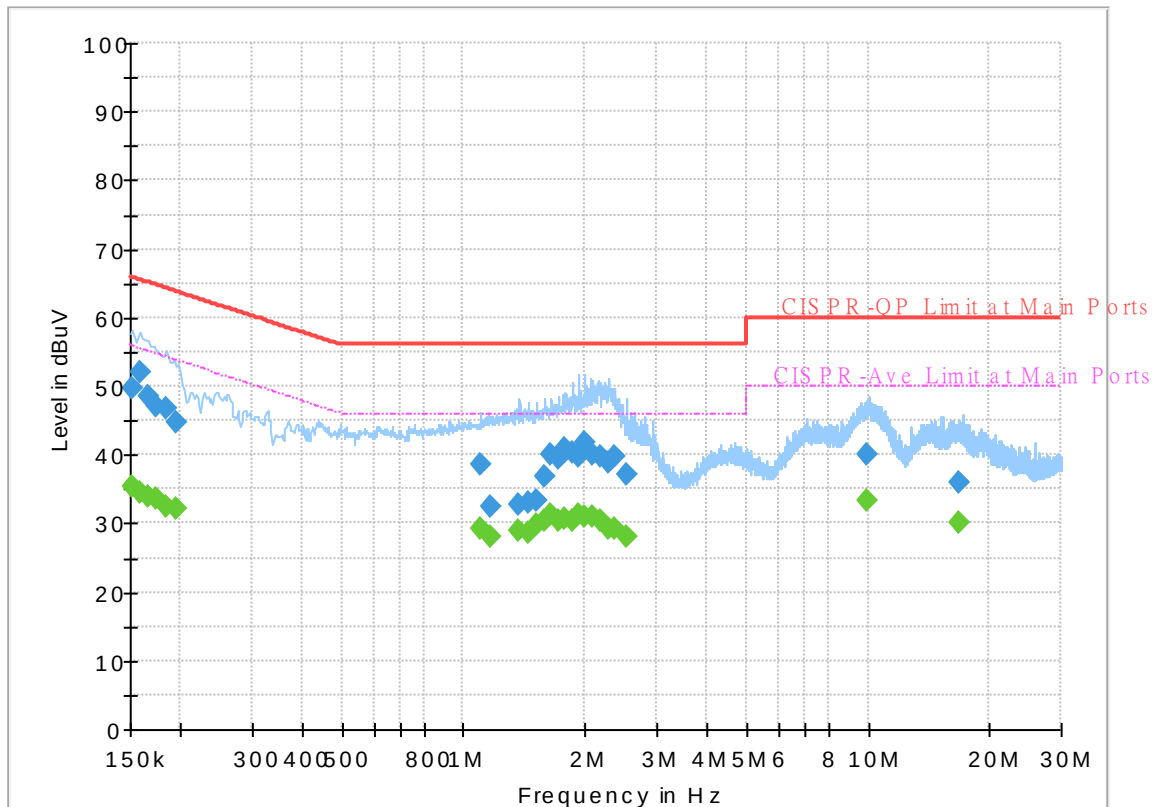
Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	35.40	55.88	20.48	L1	OFF	19.4
0.152250	51.29	---	65.88	14.59	L1	OFF	19.4
0.161250	---	36.01	55.40	19.39	L1	OFF	19.4
0.161250	52.38	---	65.40	13.02	L1	OFF	19.4
0.172500	---	35.02	54.84	19.82	L1	OFF	19.4
0.172500	50.98	---	64.84	13.86	L1	OFF	19.4
0.181500	---	33.19	54.42	21.23	L1	OFF	19.4
0.181500	47.39	---	64.42	17.03	L1	OFF	19.4
0.195000	---	32.01	53.82	21.81	L1	OFF	19.4
0.195000	43.30	---	63.82	20.52	L1	OFF	19.4
0.204000	---	30.37	53.45	23.08	L1	OFF	19.4
0.204000	44.76	---	63.45	18.69	L1	OFF	19.4
0.260250	---	29.96	51.42	21.46	L1	OFF	19.4
0.260250	41.47	---	61.42	19.95	L1	OFF	19.4
0.343500	---	27.33	49.12	21.79	L1	OFF	19.4
0.343500	34.57	---	59.12	24.55	L1	OFF	19.4
0.429000	---	27.45	47.27	19.82	L1	OFF	19.4
0.429000	34.28	---	57.27	22.99	L1	OFF	19.4
0.685500	---	26.70	46.00	19.30	L1	OFF	19.4
0.685500	33.54	---	56.00	22.46	L1	OFF	19.4
0.960000	---	26.34	46.00	19.66	L1	OFF	19.5

0.960000	29.58	---	56.00	26.42	L1	OFF	19.5
1.151250	---	27.01	46.00	18.99	L1	OFF	19.5
1.151250	30.78	---	56.00	25.22	L1	OFF	19.5
1.200750	---	27.62	46.00	18.38	L1	OFF	19.5
1.200750	31.70	---	56.00	24.30	L1	OFF	19.5
1.277250	---	27.77	46.00	18.23	L1	OFF	19.5
1.277250	31.99	---	56.00	24.01	L1	OFF	19.5
1.405500	---	28.99	46.00	17.01	L1	OFF	19.5
1.405500	35.80	---	56.00	20.20	L1	OFF	19.5
1.497750	---	30.35	46.00	15.65	L1	OFF	19.5
1.497750	38.95	---	56.00	17.05	L1	OFF	19.5
1.540500	---	30.46	46.00	15.54	L1	OFF	19.5
1.540500	38.76	---	56.00	17.24	L1	OFF	19.5
1.599000	---	30.09	46.00	15.91	L1	OFF	19.5
1.599000	38.96	---	56.00	17.04	L1	OFF	19.5
1.664250	---	29.89	46.00	16.11	L1	OFF	19.5
1.664250	38.62	---	56.00	17.38	L1	OFF	19.5
1.790250	---	29.62	46.00	16.38	L1	OFF	19.5
1.790250	38.03	---	56.00	17.97	L1	OFF	19.5
1.855500	---	30.41	46.00	15.59	L1	OFF	19.5
1.855500	40.44	---	56.00	15.56	L1	OFF	19.5
1.923000	---	30.73	46.00	15.27	L1	OFF	19.5
1.923000	40.11	---	56.00	15.89	L1	OFF	19.5
1.990500	---	30.30	46.00	15.70	L1	OFF	19.5
1.990500	38.69	---	56.00	17.31	L1	OFF	19.5
2.116500	---	30.15	46.00	15.85	L1	OFF	19.5
2.116500	37.26	---	56.00	18.74	L1	OFF	19.5
2.179500	---	30.01	46.00	15.99	L1	OFF	19.5
2.179500	39.11	---	56.00	16.89	L1	OFF	19.5
2.242500	---	30.88	46.00	15.12	L1	OFF	19.5
2.242500	42.30	---	56.00	13.70	L1	OFF	19.5
2.364000	---	30.17	46.00	15.83	L1	OFF	19.5
2.364000	42.51	---	56.00	13.49	L1	OFF	19.5
2.427000	---	30.05	46.00	15.95	L1	OFF	19.5
2.427000	41.29	---	56.00	14.71	L1	OFF	19.5
2.546250	---	29.61	46.00	16.39	L1	OFF	19.5
2.546250	39.19	---	56.00	16.81	L1	OFF	19.5
2.613750	---	28.60	46.00	17.40	L1	OFF	19.5
2.613750	35.23	---	56.00	20.77	L1	OFF	19.5
2.679000	---	29.17	46.00	16.83	L1	OFF	19.5
2.679000	37.77	---	56.00	18.23	L1	OFF	19.5
2.796000	---	28.60	46.00	17.40	L1	OFF	19.5
2.796000	37.78	---	56.00	18.22	L1	OFF	19.5
2.913000	---	27.27	46.00	18.73	L1	OFF	19.5
2.913000	35.65	---	56.00	20.35	L1	OFF	19.5
3.041250	---	26.89	46.00	19.11	L1	OFF	19.5
3.041250	34.44	---	56.00	21.56	L1	OFF	19.5
10.081500	---	33.96	50.00	16.04	L1	OFF	19.8
10.081500	39.19	---	60.00	20.81	L1	OFF	19.8
10.538250	---	29.65	50.00	20.35	L1	OFF	19.8
10.538250	32.64	---	60.00	27.36	L1	OFF	19.8
20.258250	---	26.75	50.00	23.25	L1	OFF	20.2
20.258250	29.71	---	60.00	30.29	L1	OFF	20.2

EUT Information

Report NO : 940344-01
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Neutral

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	35.30	55.88	20.58	N	OFF	19.5
0.152250	49.62	---	65.88	16.26	N	OFF	19.5
0.159000	---	34.49	55.52	21.03	N	OFF	19.5
0.159000	52.00	---	65.52	13.52	N	OFF	19.5
0.165750	---	33.81	55.17	21.36	N	OFF	19.5
0.165750	48.50	---	65.17	16.67	N	OFF	19.5
0.174750	---	33.49	54.73	21.24	N	OFF	19.5
0.174750	47.04	---	64.73	17.69	N	OFF	19.5
0.183750	---	32.50	54.31	21.81	N	OFF	19.5
0.183750	46.93	---	64.31	17.38	N	OFF	19.5
0.195000	---	32.05	53.82	21.77	N	OFF	19.5
0.195000	44.66	---	63.82	19.16	N	OFF	19.5
1.099500	---	29.36	46.00	16.64	N	OFF	19.5
1.099500	38.48	---	56.00	17.52	N	OFF	19.5
1.164750	---	28.00	46.00	18.00	N	OFF	19.5
1.164750	32.40	---	56.00	23.60	N	OFF	19.5
1.374000	---	28.90	46.00	17.10	N	OFF	19.5
1.374000	32.64	---	56.00	23.36	N	OFF	19.5
1.443750	---	28.62	46.00	17.38	N	OFF	19.5
1.443750	33.12	---	56.00	22.88	N	OFF	19.5
1.513500	---	29.86	46.00	16.14	N	OFF	19.5

1.513500	33.43	---	56.00	22.57	N	OFF	19.5
1.581000	---	30.41	46.00	15.59	N	OFF	19.5
1.581000	36.93	---	56.00	19.07	N	OFF	19.5
1.650750	---	31.25	46.00	14.75	N	OFF	19.6
1.650750	39.93	---	56.00	16.07	N	OFF	19.6
1.718250	---	30.35	46.00	15.65	N	OFF	19.6
1.718250	39.41	---	56.00	16.59	N	OFF	19.6
1.785750	---	30.63	46.00	15.37	N	OFF	19.6
1.785750	40.80	---	56.00	15.20	N	OFF	19.6
1.855500	---	30.45	46.00	15.55	N	OFF	19.6
1.855500	40.27	---	56.00	15.73	N	OFF	19.6
1.925250	---	31.25	46.00	14.75	N	OFF	19.6
1.925250	39.85	---	56.00	16.15	N	OFF	19.6
1.995000	---	31.10	46.00	14.90	N	OFF	19.6
1.995000	41.74	---	56.00	14.26	N	OFF	19.6
2.089500	---	31.05	46.00	14.95	N	OFF	19.6
2.089500	39.98	---	56.00	16.02	N	OFF	19.6
2.170500	---	30.39	46.00	15.61	N	OFF	19.6
2.170500	39.67	---	56.00	16.33	N	OFF	19.6
2.285250	---	29.32	46.00	16.68	N	OFF	19.6
2.285250	39.01	---	56.00	16.99	N	OFF	19.6
2.357250	---	29.34	46.00	16.66	N	OFF	19.6
2.357250	39.79	---	56.00	16.21	N	OFF	19.6
2.521500	---	28.10	46.00	17.90	N	OFF	19.6
2.521500	37.23	---	56.00	18.77	N	OFF	19.6
9.924000	---	33.45	50.00	16.55	N	OFF	19.9
9.924000	39.97	---	60.00	20.03	N	OFF	19.9
16.811250	---	30.21	50.00	19.79	N	OFF	20.1
16.811250	36.06	---	60.00	23.94	N	OFF	20.1



Appendix C. Radiated Spurious Emission

Test Engineer :	Ryan Lin, JC Liang and Wilson Wu	Temperature :	21.5~23.5°C
		Relative Humidity :	46.5~49.5%

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preampl Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2312.625	43.29	-30.71	74	40.95	28	3.93	29.59	376	108	P	H
		2312.625	18.5	-35.5	54	-	-	-	-	-	-	A	H
	*	2402	101.35	-	-	99.33	27.6	4	29.58	376	108	P	H
	*	2402	76.56	-	-	-	-	-	-	-	-	A	H
		2385.495	43.37	-30.63	74	41.33	27.63	3.99	29.58	125	52	P	V
		2385.495	18.58	-35.42	54	-	-	-	-	-	-	A	V
	*	2402	104.39	-	-	102.37	27.6	4	29.58	125	52	P	V
	*	2402	79.6	-	-	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		2389.8	42.85	-31.15	74	40.82	27.62	3.99	29.58	362	123	P	H
		2389.8	18.06	-35.94	54	-	-	-	-	-	-	A	H
	*	2441	102.66	-	-	100.69	27.52	4.03	29.58	362	123	P	H
	*	2441	77.87	-	-	-	-	-	-	-	-	A	H
		2499.93	43.03	-30.97	74	41.02	27.5	4.08	29.57	362	123	P	H
		2499.93	18.24	-35.76	54	-	-	-	-	-	-	A	H
		2313.5	43.29	-30.71	74	40.96	27.99	3.93	29.59	100	53	P	V
		2313.5	18.5	-35.5	54	-	-	-	-	-	-	A	V
	*	2441	103.67	-	-	101.7	27.52	4.03	29.58	100	53	P	V
	*	2441	78.88	-	-	-	-	-	-	-	-	A	V
		2493	43.6	-30.4	74	41.59	27.5	4.08	29.57	100	53	P	V
		2493	18.81	-35.19	54	-	-	-	-	-	-	A	V



BT	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz	*	2480	103.68	-	-	101.68	27.5	4.07	29.57	356	121	P	H
	*	2480	78.89	-	-	-	-	-	-	-	-	A	H
		2485.52	46.2	-27.8	74	44.2	27.5	4.07	29.57	356	121	P	H
		2485.52	21.41	-32.59	54	-	-	-	-	-	-	A	H
	*	2480	104.27	-	-	102.27	27.5	4.07	29.57	122	52	P	V
	*	2480	79.48	-	-	-	-	-	-	-	-	A	V
		2484.64	47.09	-26.91	74	45.09	27.5	4.07	29.57	122	52	P	V
		2484.64	22.3	-31.7	54	-	-	-	-	-	-	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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 00 2402MHz		4804	38.41	-35.59	74	58.34	31.3	6.36	57.59	100	0	P	H
		4804	13.62	-40.38	54	-	-	-	-	-	-	A	H
		4804	39.13	-34.87	74	59.06	31.3	6.36	57.59	100	0	P	V
		4804	14.34	-39.66	54	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		4882	37.94	-36.06	74	57.55	31.24	6.59	57.44	100	0	P	H
		4882	13.15	-40.85	54	-	-	-	-	-	-	A	H
		7323	43.54	-30.46	74	55.94	36.7	8.19	57.29	100	0	P	H
		7323	18.75	-35.25	54	-	-	-	-	-	-	A	H
		4882	37.82	-36.18	74	57.43	31.24	6.59	57.44	100	0	P	V
		4882	13.03	-40.97	54	-	-	-	-	-	-	A	V
		7323	43.72	-30.28	74	56.12	36.7	8.19	57.29	100	0	P	V
		7323	18.93	-35.07	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	38.65	-35.35	74	57.68	31.44	6.81	57.28	100	0	P	H
		4960	13.86	-40.14	54	-	-	-	-	-	-	A	H
		7440	43.83	-30.17	74	56.39	36.68	8.19	57.43	100	0	P	H
		7440	19.04	-34.96	54	-	-	-	-	-	-	A	H
		4960	37.93	-36.07	74	56.96	31.44	6.81	57.28	100	0	P	V
		4960	13.14	-40.86	54	-	-	-	-	-	-	A	V
		7440	43.41	-30.59	74	55.97	36.68	8.19	57.43	100	0	P	V
		7440	18.62	-35.38	54	-	-	-	-	-	-	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	Path	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		125.06	33.7	-9.8	43.5	47.72	17.2	0.97	32.19	100	0	P	H
		221.09	26.51	-19.49	46	42.3	15.07	1.28	32.14	-	-	P	H
		368.53	33.95	-12.05	46	44.05	20.44	1.62	32.16	-	-	P	H
		480.08	29.91	-16.09	46	37.07	23.2	1.81	32.17	-	-	P	H
		832.19	32.59	-13.41	46	33.43	28.34	2.56	31.74	-	-	P	H
		989.33	34.41	-19.59	54	32.2	30.11	2.75	30.65	-	-	P	H
		40.67	29.13	-10.87	40	41.97	18.93	0.52	32.29	100	0	P	V
		119.24	28.96	-14.54	43.5	43.11	17.1	0.95	32.2	-	-	P	V
		399.57	30.78	-15.22	46	39.68	21.49	1.77	32.16	-	-	P	V
		600.36	29.1	-16.9	46	34.01	25.21	2.12	32.24	-	-	P	V
		871.96	32.15	-13.85	46	32.38	28.7	2.61	31.54	-	-	P	V
		980.6	34.78	-19.22	54	32.49	30.29	2.72	30.72	-	-	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:

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	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 CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)
= Antenna Factor(dB/m) + Path 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) + Path 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. Radiated Spurious Emission Plots

Test Engineer :	Ryan Lin, JC Liang and Wilson Wu	Temperature :	21.5~23.5°C
		Relative Humidity :	46.5~49.5%

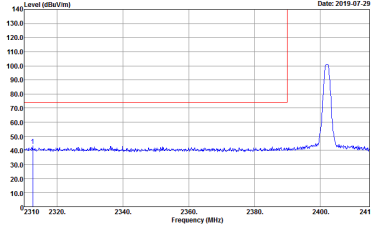
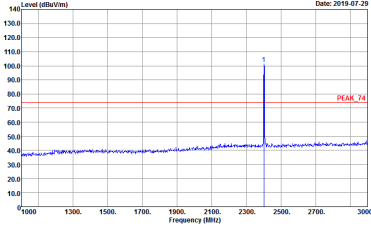
Note symbol

-L	Low channel location
-R	High channel location

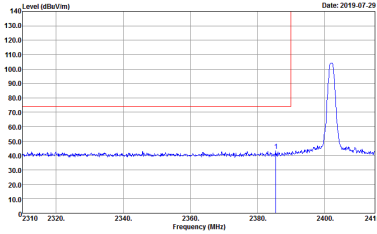
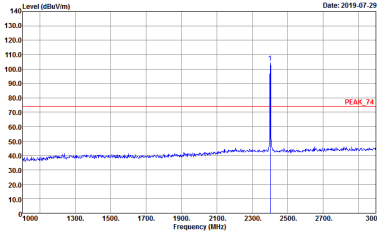


2.4GHz 2400~2483.5MHz

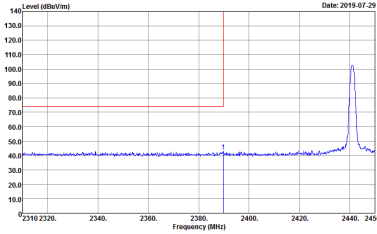
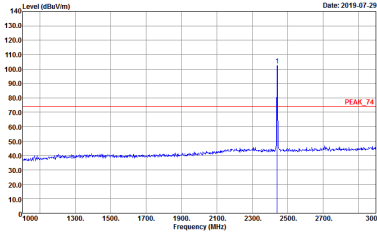
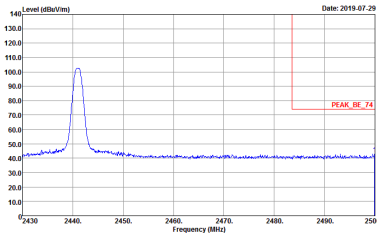
BT (Band Edge @ 3m)

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH13-1FV Condition : PEAK_BE_74 3m HORN_9120D_1212 HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Deflector : Peak Project : 940344-01 Mode : 1	 Site : 03CH13-1FV Condition : PEAK_74 3m HORN_9120D_1212 HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Deflector : Peak Project : 940344-01 Mode : 1

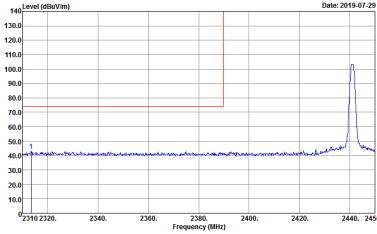
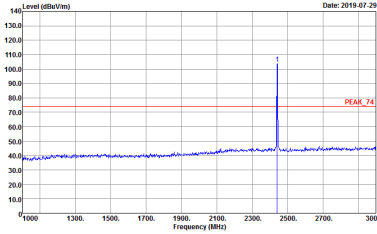
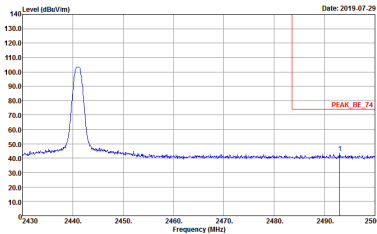


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak	 Site : 03CH13-1V Condition : PEAK_BE_74 3m HORN_91200_1212 VERTICAL Detector : Peak Project : 940344-01 Mode : 1	 Site : 03CH13-1V Condition : PEAK_74 3m HORN_91200_1212 VERTICAL Detector : Peak Project : 940344-01 Mode : 1

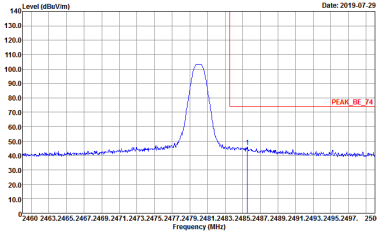
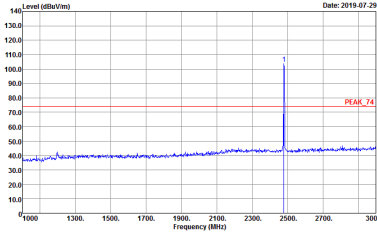


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1212 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 2	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1212 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 2
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1212 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 2	Left blank



BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1212 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 2	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1212 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 2
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1212 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 2	Left blank



BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH13-HV Condition : PEAK_BE_74 3m HORN_91200_1212 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 3	 Site : 03CH13-HV Condition : PEAK_74 3m HORN_91200_1212 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 3

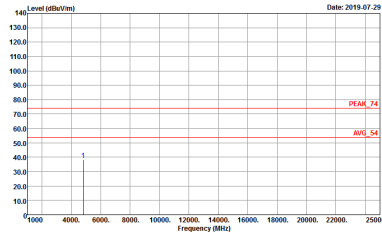
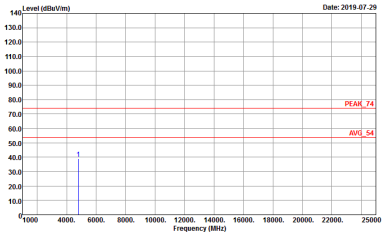


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak	Site : 03CH13-HV Condition : PEAK_BE_74 3m HORN_91200_1212 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 3	Site : 03CH13-HV Condition : PEAK_74 3m HORN_91200_1212 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 940344-01 Mode : 3

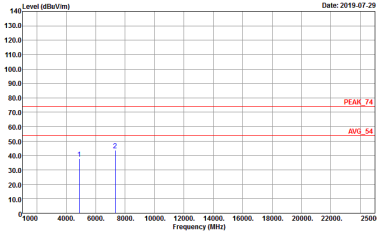
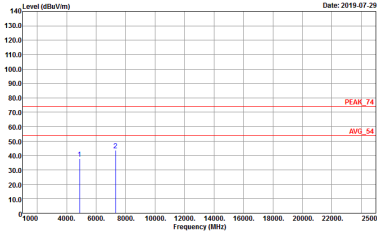


2.4GHz 2400~2483.5MHz

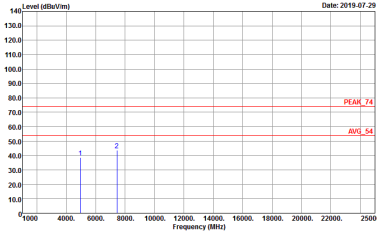
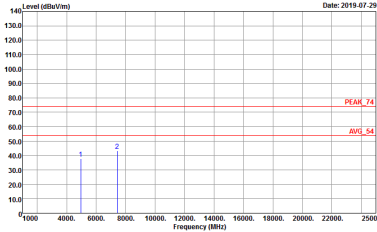
BT (Harmonic @ 3m)

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1212 HORIZONTAL Detector : Peak Project : 940344-01 Mode : 1	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1212 VERTICAL Detector : Peak Project : 940344-01 Mode : 1

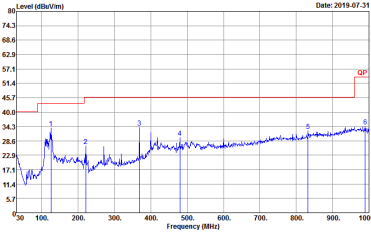
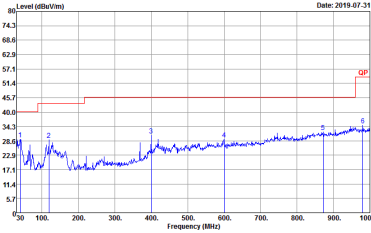


BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH13-4V Condition : PEAK_74 3m HORN_91200_1212 HORIZONTAL Detector : Peak Project : 940344-01 Mode : 2	 Site : 03CH13-4V Condition : PEAK_74 3m HORN_91200_1212 VERTICAL Detector : Peak Project : 940344-01 Mode : 2

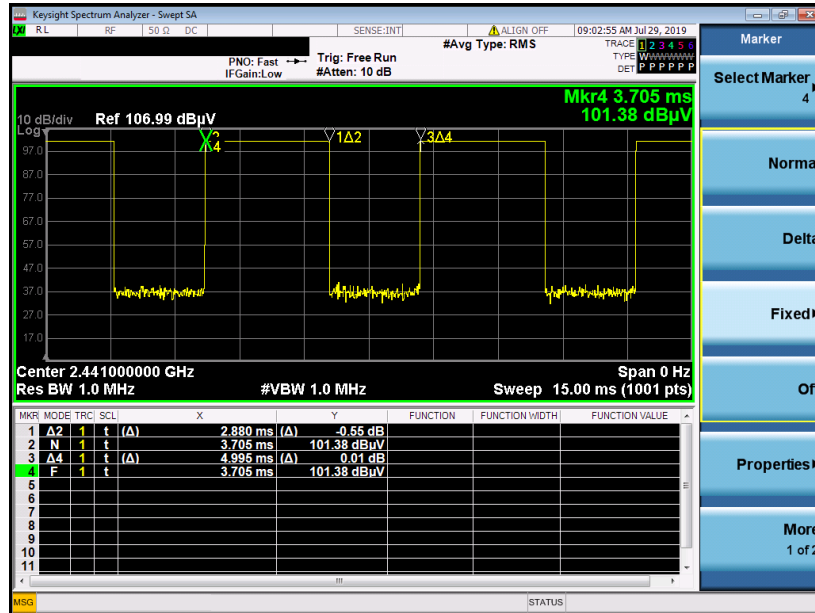
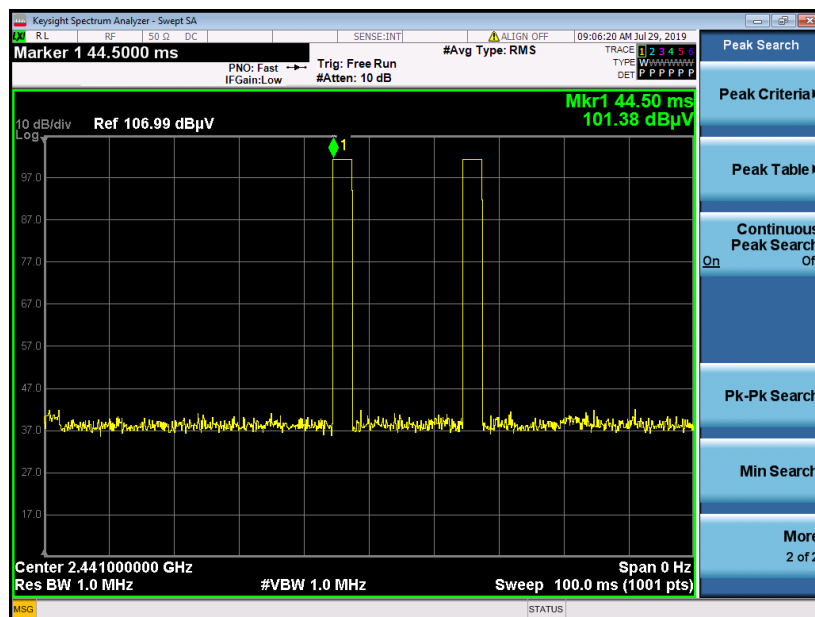


BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH13-4V Condition : PEAK_74 3m HORN_91200_1212 HORIZONTAL Detector : Peak Project : 940344-01 Mode : 3	 Site : 03CH13-4V Condition : PEAK_74 3m HORN_91200_1212 VERTICAL Detector : Peak Project : 940344-01 Mode : 3

Emission below 1GHz
2.4GHz BT (LF)

BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak	 Site : 03CH13-HY Condition : QP 3m BTLOG_40103 HORIZONTAL Detector : Peak Project : 940344-01 Mode : 25	 Site : 03CH13-HY Condition : QP 3m BTLOG_40103 VERTICAL Detector : Peak Project : 940344-01 Mode : 25

Appendix E. Duty Cycle Plots

DH5 on time (One Pulse) Plot on Channel 39

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. **DH5** has the highest duty cycle worst case and is reported.

**Duty Cycle Correction Factor Consideration for AFH mode:**

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100\text{ms} / 57.6\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$

—————THE END—————