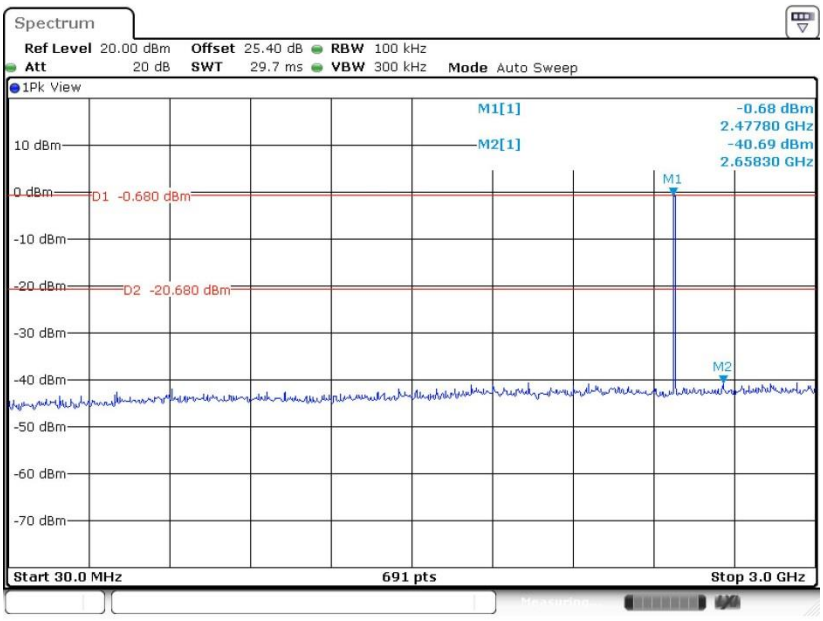
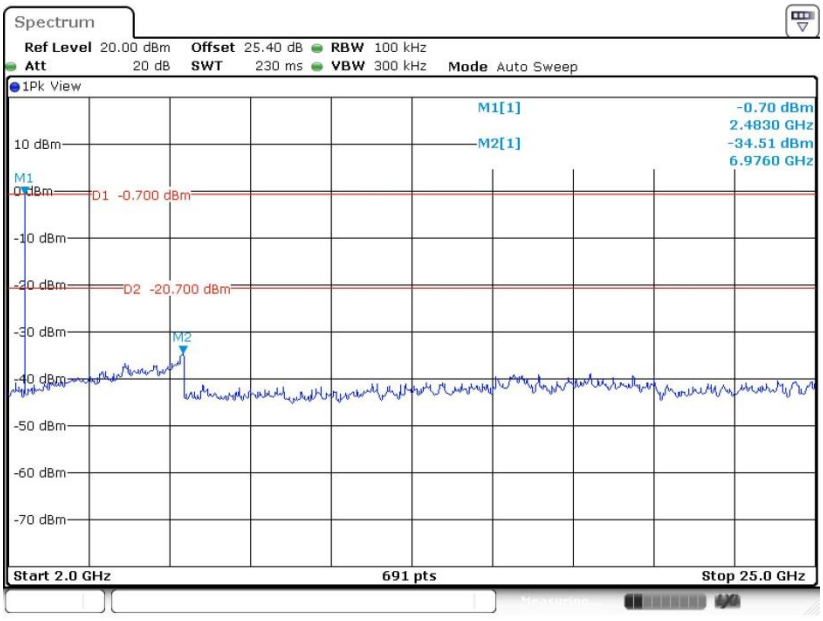
CSE Plot on Ch 78 between 30MHz ~ 3 GHz



Date: 7.MAR.2019 12:12:53

CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



Date: 7.MAR.2019 12:13:23

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.

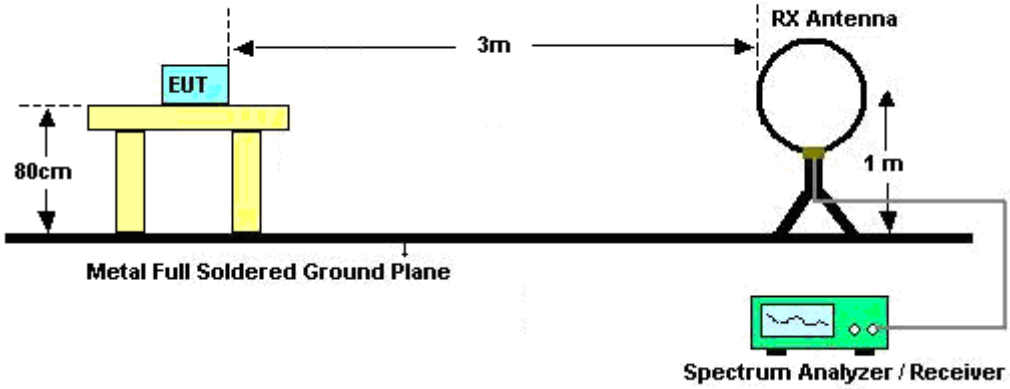
3.8.3 Test Procedures

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>1GHz ; VBW ≥ 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
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   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(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.

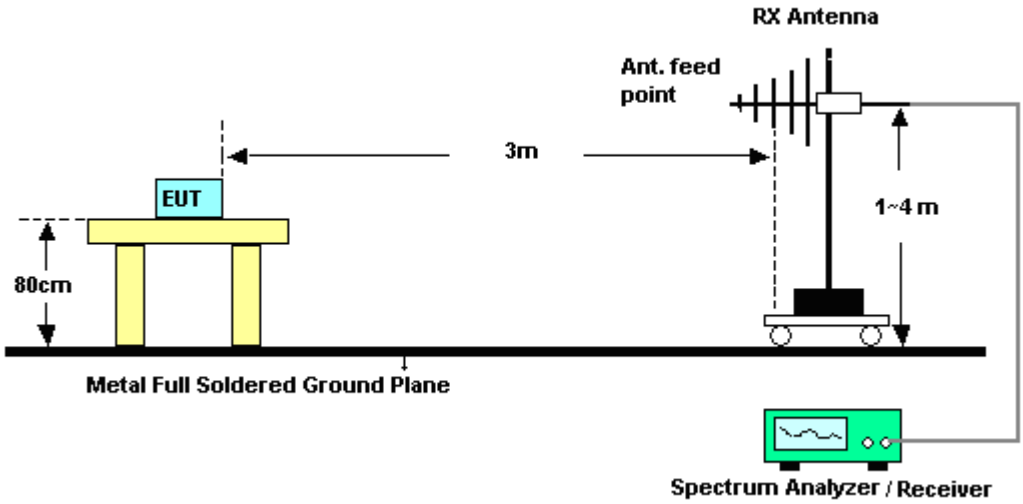
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB for 1Mbps; -24.76dB for 3Mbps) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.8.4 Test Setup

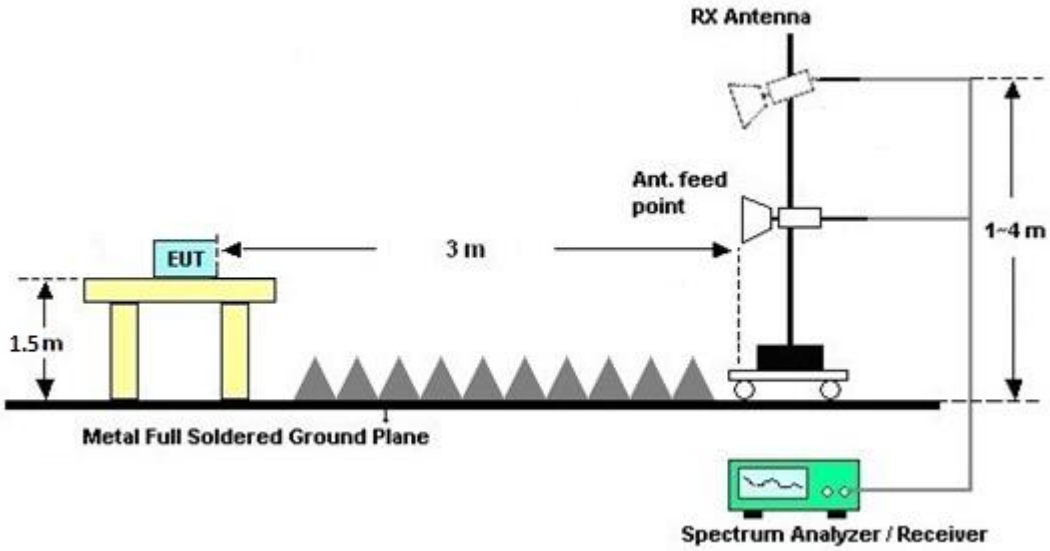
For radiated emissions below 30MHz



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 B and C.

3.8.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.

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 (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.

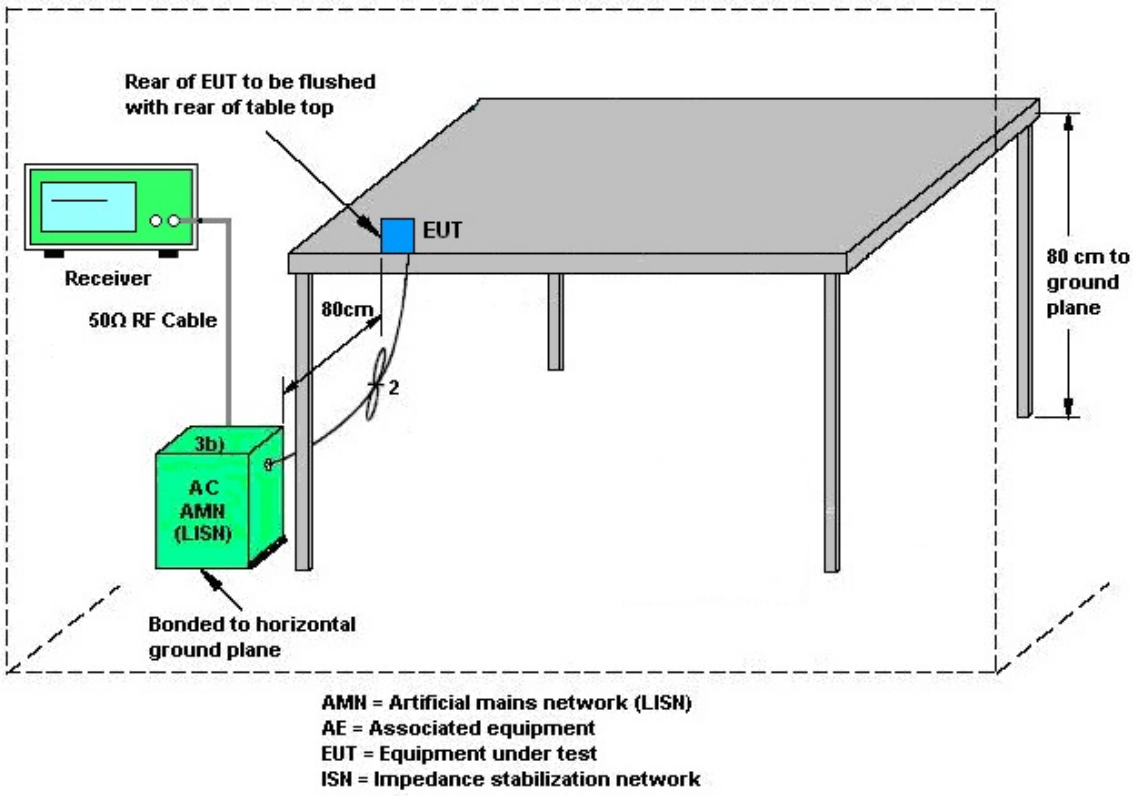
3.9.2 Measuring Instruments

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



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

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	Mar. 05, 2019 ~ Mar. 08, 2019	Dec. 26, 2019	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 27, 2018	Mar. 05, 2019 ~ Mar. 08, 2019	Dec. 26, 2019	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 13, 2018	Mar. 05, 2019 ~ Mar. 08, 2019	Nov. 12, 2019	Conducted (TH05-HY)
BT Base Station (Measure)	Rohde & Schwarz	CBT32	100519	N/A	May 30, 2018	Mar. 05, 2019 ~ Mar. 08, 2019	May 29, 2019	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jan. 07, 2019	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9KHz~3.6GHz	Nov. 12, 2018	Jan. 07, 2019	Nov. 11, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 14, 2018	Jan. 07, 2019	Nov. 13, 2019	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jan. 07, 2019	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2019	Jan. 07, 2019	Jan. 01, 2020	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Nov. 08, 2018	Jan. 07, 2019	Nov. 07, 2019	Conduction (CO05-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Preamplifier	Agilent	8449B	3008A01917	1GHz~26.5GHz	Apr. 23, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	Apr. 22, 2019	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800N1D01N-06	35419&03	30MHz to 1GHz	Dec. 16, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	Dec. 15, 2019	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 02, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	Dec. 03, 2019	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	May 15, 2017	Dec. 25, 2018 ~ Mar. 06, 2019	May 14, 2019	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590075	1GHz ~ 18GHz	Apr. 25, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	Apr. 24, 2019	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	May 21, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	May 20, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4, MY24971/4, MY15682/4	30MHz~1GHz	Feb. 27, 2018	Dec. 25, 2018 ~ Jan. 25, 2019	Feb. 26, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4, MY24971/4, MY15682/4	1GHz~18GHz	Feb. 27, 2018	Dec. 25, 2018 ~ Jan. 25, 2019	Feb. 26, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 27, 2018	Dec. 25, 2018 ~ Jan. 25, 2019	Feb. 26, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 26, 2019	Mar. 06, 2019	Feb. 25, 2020	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Dec. 25, 2018 ~ Mar. 06, 2019	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Dec. 25, 2018 ~ Mar. 06, 2019	N/A	Radiation (03CH07-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 16, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	Jul. 15, 2019	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	RK-001042	N/A	N/A	Dec. 25, 2018 ~ Mar. 06, 2019	N/A	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz- 40GHz	Nov. 20, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	Nov. 19, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SF102/2*11SK252	MY4278/2	9kHz~40GHz	May 17, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	May 16, 2019	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Apr. 17, 2018	Dec. 25, 2018 ~ Mar. 06, 2019	Apr. 16, 2019	Radiation (03CH07-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))	**5.7**

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

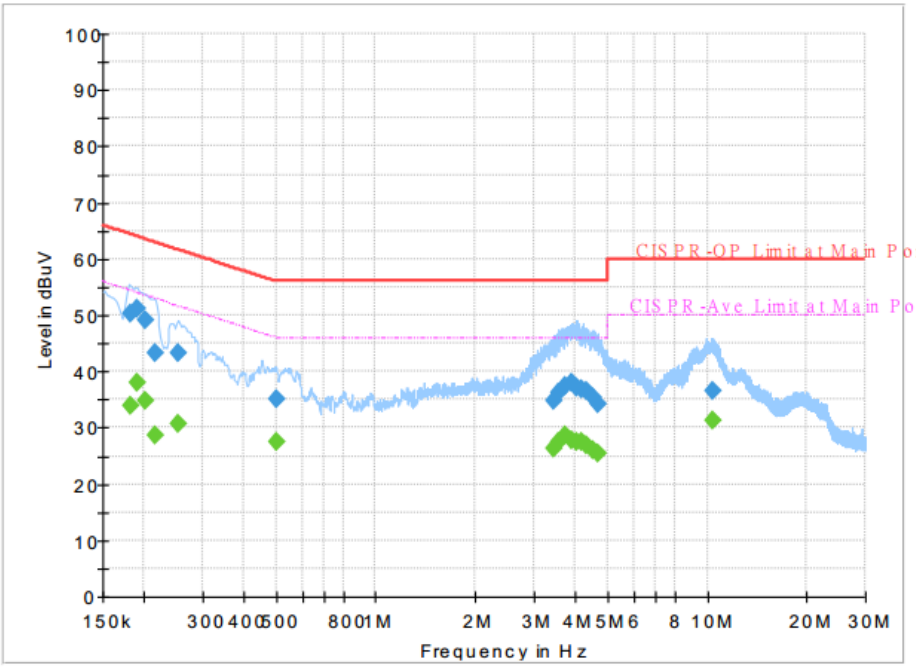
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.5**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.2**

Appendix A. AC Conducted Emission Test Results

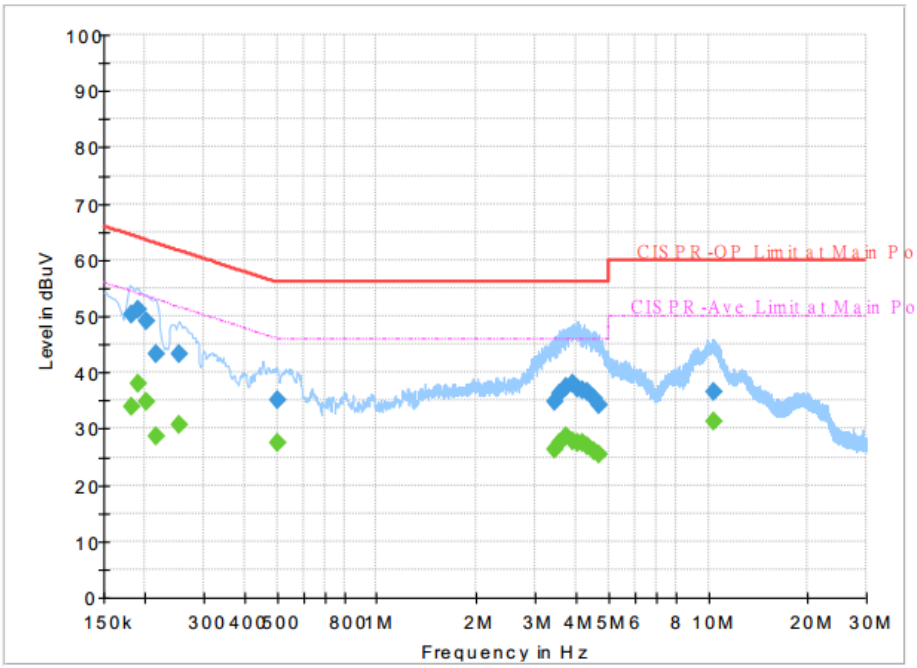
Test Engineer :	Jimmy Chang	Temperature :	24~26℃
		Relative Humidity :	51~53%
Test Voltage :	120Vac / 60Hz	Phase :	Line



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.181500	50.16	---	64.42	14.26	L1	OFF	19.5
0.181500	---	33.78	54.42	20.64	L1	OFF	19.5
0.190500	51.12	---	64.02	12.90	L1	OFF	19.5
0.190500	---	37.88	54.02	16.14	L1	OFF	19.5
0.201750	49.03	---	63.54	14.51	L1	OFF	19.5
0.201750	---	34.66	53.54	18.88	L1	OFF	19.5
0.215250	43.33	---	63.00	19.67	L1	OFF	19.5
0.215250	---	28.74	53.00	24.26	L1	OFF	19.5
0.253500	43.22	---	61.64	18.42	L1	OFF	19.5
0.253500	---	30.70	51.64	20.94	L1	OFF	19.5
0.501000	34.97	---	56.00	21.03	L1	OFF	19.5
0.501000	---	27.45	46.00	18.55	L1	OFF	19.5
3.432750	34.74	---	56.00	21.26	L1	OFF	19.6
3.432750	---	26.44	46.00	19.56	L1	OFF	19.6
3.574500	36.24	---	56.00	19.76	L1	OFF	19.6
3.574500	---	27.43	46.00	18.57	L1	OFF	19.6
3.736500	37.41	---	56.00	18.59	L1	OFF	19.6
3.736500	---	28.57	46.00	17.43	L1	OFF	19.6
3.894000	38.05	---	56.00	17.95	L1	OFF	19.6
3.894000	---	27.81	46.00	18.19	L1	OFF	19.6

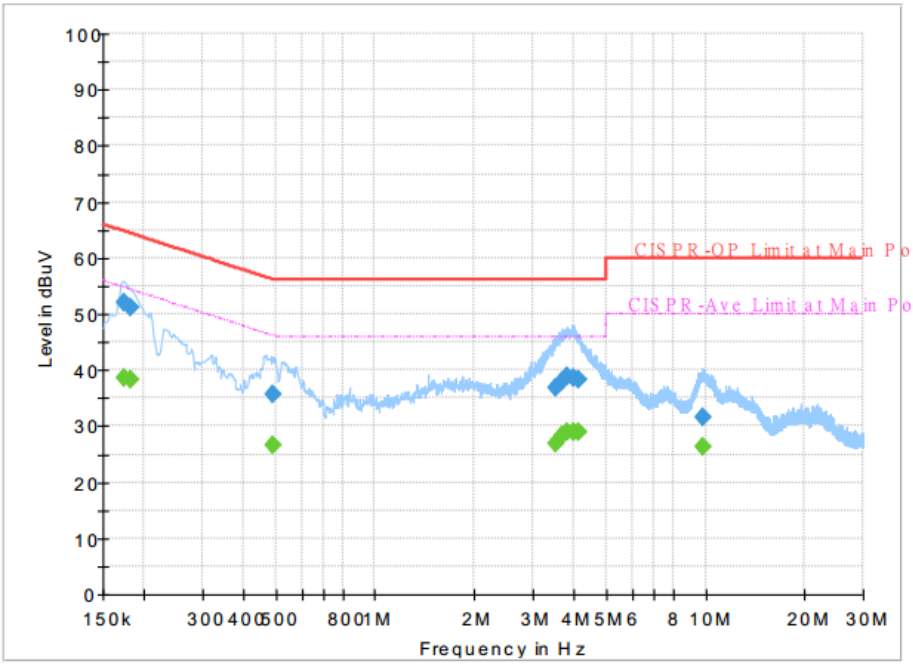
Test Engineer :	Jimmy Chang	Temperature :	24~26℃
		Relative Humidity :	51~53%
Test Voltage :	120Vac / 60Hz	Phase :	Line



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
4.022250	37.23	---	56.00	18.77	L1	OFF	19.6
4.022250	---	27.44	46.00	18.56	L1	OFF	19.6
4.166250	36.87	---	56.00	19.13	L1	OFF	19.6
4.166250	---	27.38	46.00	18.62	L1	OFF	19.6
4.344000	36.57	---	56.00	19.43	L1	OFF	19.6
4.344000	---	27.04	46.00	18.96	L1	OFF	19.6
4.526250	35.26	---	56.00	20.74	L1	OFF	19.6
4.526250	---	25.89	46.00	20.11	L1	OFF	19.6
4.670250	34.27	---	56.00	21.73	L1	OFF	19.6
4.670250	---	25.53	46.00	20.47	L1	OFF	19.6
10.414500	36.55	---	60.00	23.45	L1	OFF	19.7
10.414500	---	31.21	50.00	18.79	L1	OFF	19.7

Test Engineer :	Jimmy Chang	Temperature :	24~26℃
		Relative Humidity :	51~53%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.174750	---	38.55	54.73	16.18	N	OFF	19.5
0.174750	52.14	---	64.73	12.59	N	OFF	19.5
0.181500	---	38.16	54.42	16.26	N	OFF	19.5
0.181500	51.23	---	64.42	13.19	N	OFF	19.5
0.492000	---	26.64	46.13	19.49	N	OFF	19.5
0.492000	35.57	---	56.13	20.56	N	OFF	19.5
3.534000	---	27.01	46.00	18.99	N	OFF	19.6
3.534000	36.71	---	56.00	19.29	N	OFF	19.6
3.702750	---	28.29	46.00	17.71	N	OFF	19.6
3.702750	37.93	---	56.00	18.07	N	OFF	19.6
3.804000	---	28.85	46.00	17.15	N	OFF	19.6
3.804000	38.97	---	56.00	17.03	N	OFF	19.6
3.984000	---	28.98	46.00	17.02	N	OFF	19.6
3.984000	38.74	---	56.00	17.26	N	OFF	19.6
4.139250	---	29.02	46.00	16.98	N	OFF	19.6
4.139250	38.18	---	56.00	17.82	N	OFF	19.6
9.820500	---	26.17	50.00	23.83	N	OFF	19.7
9.820500	31.66	---	60.00	28.34	N	OFF	19.7

Appendix B. Radiated Spurious Emission

Test Engineer :	Jesse Wang, Stan Hsieh, and Troye Hsieh	Temperature :	20~25℃
		Relative Humidity :	55~60%

<1Mbps>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 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 CH00 2402MHz		2389.485	45.39	-28.61	74	40.33	32	7.74	34.68	230	299	P	H
		2389.485	20.6	-33.4	54	-	-	-	-	-	-	A	H
	*	2402	94.88	-	-	89.82	32	7.74	34.68	230	299	P	H
	*	2402	70.09	-	-	-	-	-	-	-	-	A	H
													H
													H
		2373.21	45.4	-28.6	74	40.48	31.93	7.67	34.68	114	118	P	V
		2373.21	20.61	-33.39	54	-	-	-	-	-	-	A	V
	*	2402	99.62	-	-	94.56	32	7.74	34.68	114	118	P	V
	*	2402	74.83	-	-	-	-	-	-	-	-	A	V
													V
													V
BT CH 39 2441MHz		2315.46	45.86	-28.14	74	41.14	31.8	7.6	34.68	224	294	P	H
		2315.46	21.07	-32.93	54	-	-	-	-	-	-	A	H
	*	2441	96.46	-	-	91.15	32.2	7.79	34.68	224	294	P	H
	*	2441	71.67	-	-	-	-	-	-	-	-	A	H
		2485.3	45.29	-28.71	74	39.93	32.2	7.84	34.68	224	294	P	H
		2485.3	20.5	-33.5	54	-	-	-	-	-	-	A	H
		2381.4	45.79	-28.21	74	40.8	31.93	7.74	34.68	102	87	P	V
		2381.4	21	-33	54	-	-	-	-	-	-	A	V
	*	2441	104.16	-	-	98.85	32.2	7.79	34.68	102	87	P	V
	*	2441	79.37	-	-	-	-	-	-	-	-	A	V
		2494.61	45.78	-28.22	74	40.42	32.2	7.84	34.68	102	87	P	V
		2494.61	20.99	-33.01	54	-	-	-	-	-	-	A	V

BT CH 78 2480MHz	*	2480	96.44	-	-	91.08	32.2	7.84	34.68	197	311	P	H
	*	2480	71.65	-	-	-	-	-	-	-	-	A	H
		2488.96	46.5	-27.5	74	41.14	32.2	7.84	34.68	197	311	P	H
		2488.96	21.71	-32.29	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	103.98	-	-	98.62	32.2	7.84	34.68	103	118	P	V
	*	2480	79.19	-	-	-	-	-	-	-	-	A	V
		2483.96	47.19	-26.81	74	41.83	32.2	7.84	34.68	103	118	P	V
		2483.96	22.4	-31.6	54	-	-	-	-	-	-	A	V
													V
													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	43.89	-30.11	74	57.91	34	11.36	59.38	100	0	P	H
		4804	19.1	-34.9	54	-	-	-	-	-	-	A	H
													H
													H
		4804	43.67	-30.33	74	57.69	34	11.36	59.38	100	0	P	V
		4804	18.88	-35.12	54	-	-	-	-	-	-	A	V
													V
													V
BT CH 39 2441MHz		4882	43.66	-30.34	74	57.35	34.13	11.42	59.24	100	0	P	H
		4882	18.87	-35.13	54	-	-	-	-	-	-	A	H
		7323	43.79	-30.21	74	52.35	35.63	13.97	58.16	100	0	P	H
		7323	19	-35	54	-	-	-	-	-	-	A	H
		4882	43.22	-30.78	74	56.91	34.13	10.99	59.24	100	0	P	V
		4882	18.43	-35.57	54	-	-	-	-	-	-	A	V
		7323	44.77	-29.23	74	53.33	35.63	13.5	58.16	100	0	P	V
		7323	19.98	-34.02	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	43.23	-30.77	74	56.69	34.13	11.48	59.07	100	0	P	H
		4960	18.44	-35.56	54	-	-	-	-	-	-	A	H
		7440	44.33	-29.67	74	53.07	35.5	14.09	58.33	100	0	P	H
		7440	19.54	-34.46	54	-	-	-	-	-	-	A	H
		4960	43.12	-30.88	74	56.58	34.13	11.48	59.07	100	0	P	V
		4960	18.33	-35.67	54	-	-	-	-	-	-	A	V
		7440	44.43	-29.57	74	53.17	35.5	14.09	58.33	100	0	P	V
		7440	19.64	-34.36	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		30	23.21	-16.79	40	27.46	24.6	1.33	30.18	-	-	P	H
		146.91	29.4	-14.1	43.5	40.03	17.15	2.24	30.02	-	-	P	H
		233.31	35.67	-10.33	46	46.42	16.57	2.63	29.95	-	-	P	H
		881.7	40.24	-5.76	46	35.45	28.88	4.89	28.98	-	-	P	H
		902	41.59	-4.41	46	36.76	28.76	4.96	28.89	-	-	P	H
		925.1	42.71	-3.29	46	37.14	29.33	4.97	28.73	100	0	P	H
													H
													H
													H
													H
													H
													H
		30.27	32.31	-7.69	40	36.56	24.6	1.33	30.18	-	-	P	V
		39.99	26.59	-13.41	40	36.09	19.33	1.34	30.17	-	-	P	V
		127.74	30.71	-12.79	43.5	41.22	17.53	2.01	30.05	-	-	P	V
		881.7	40.64	-5.36	46	35.85	28.88	4.89	28.98	100	0	P	V
		925.1	40.04	-5.96	46	34.47	29.33	4.97	28.73	-	-	P	V
		968.5	42.02	-11.98	54	34.54	30.86	5.06	28.44	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

<3Mbps>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp 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		2327.745	45.17	-28.83	74	40.45	31.8	7.6	34.68	230	299	P	H
		2327.745	20.41	-33.59	54	-	-	-	-	-	-	A	H
	*	2402	93.07	-	-	88.01	32	7.74	34.68	230	299	P	H
	*	2402	68.31	-	-	-	-	-	-	-	-	A	H
													H
													H
		2351.79	46.68	-27.32	74	41.82	31.87	7.67	34.68	114	118	P	V
		2351.79	21.92	-32.08	54	-	-	-	-	-	-	A	V
	*	2402	97.24	-	-	92.18	32	7.74	34.68	114	118	P	V
	*	2402	72.48	-	-	-	-	-	-	-	-	A	V
													V
													V
BT CH 39 2441MHz		2375.52	45.12	-28.88	74	40.2	31.93	7.67	34.68	224	294	P	H
		2375.52	20.36	-33.64	54	-	-	-	-	-	-	A	H
	*	2441	94.22	-	-	88.91	32.2	7.79	34.68	224	294	P	H
	*	2441	69.46	-	-	-	-	-	-	-	-	A	H
		2491.46	45.27	-28.73	74	39.91	32.2	7.84	34.68	224	294	P	H
		2491.46	20.51	-33.49	54	-	-	-	-	-	-	A	H
		2343.74	45.5	-28.5	74	40.71	31.8	7.67	34.68	102	87	P	V
		2343.74	20.74	-33.26	54	-	-	-	-	-	-	A	V
	*	2441	102.15	-	-	96.84	32.2	7.79	34.68	102	87	P	V
	*	2441	77.39	-	-	-	-	-	-	-	-	A	V
		2493.7	46.15	-27.85	74	40.79	32.2	7.84	34.68	102	87	P	V
		2493.7	21.39	-32.61	54	-	-	-	-	-	-	A	V

BT CH 78 2480MHz	*	2480	94.39	-	-	89.03	32.2	7.84	34.68	197	311	P	H
	*	2480	69.63	-	-	-	-	-	-	-	-	A	H
		2493	46.11	-27.89	74	40.75	32.2	7.84	34.68	197	311	P	H
		2493	21.35	-32.65	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	101.97	-	-	96.61	32.2	7.84	34.68	103	118	P	V
	*	2480	77.21	-	-	-	-	-	-	-	-	A	V
		2483.64	46.51	-27.49	74	41.15	32.2	7.84	34.68	103	118	P	V
		2483.64	21.75	-32.25	54	-	-	-	-	-	-	A	V
													V
													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	43.66	-30.34	74	57.68	34	11.36	59.38	100	0	P	H
		4804	18.9	-35.1	54	-	-	-	-	-	-	A	H
													H
													H
		4804	43.45	-30.55	74	57.47	34	11.36	59.38	100	0	P	V
		4804	18.69	-35.31	54	-	-	-	-	-	-	A	V
													V
													V
BT CH 39 2441MHz		4882	42.93	-31.07	74	56.62	34.13	11.42	59.24	100	0	P	H
		4882	18.17	-35.83	54	-	-	-	-	-	-	A	H
		7323	43.47	-30.53	74	52.03	35.63	13.97	58.16	100	0	P	H
		7323	18.71	-35.29	54	-	-	-	-	-	-	A	H
		4882	43.38	-30.62	74	57.07	34.13	11.42	59.24	100	0	P	V
		4882	18.62	-35.38	54	-	-	-	-	-	-	A	V
		7323	43.63	-30.37	74	52.19	35.63	13.97	58.16	100	0	P	V
		7323	18.87	-35.13	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	43.38	-30.62	74	56.84	34.13	11.48	59.07	100	0	P	H
		4960	18.62	-35.38	54	-	-	-	-	-	-	A	H
		7440	43.78	-30.22	74	52.52	35.5	14.09	58.33	100	0	P	H
		7440	19.02	-34.98	54	-	-	-	-	-	-	A	H
		4960	44.14	-29.86	74	57.6	34.13	11.48	59.07	100	0	P	V
		4960	19.38	-34.62	54	-	-	-	-	-	-	A	V
		7440	45.36	-28.64	74	54.1	35.5	14.09	58.33	100	0	P	V
		7440	20.6	-33.4	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		30	23.35	-16.65	40	27.6	24.6	1.2	30.18	-	-	P	H
		126.12	27.61	-15.89	43.5	38.01	17.64	1.83	30.05	-	-	P	H
		147.72	31.1	-12.4	43.5	41.73	17.15	2.06	30.02	-	-	P	H
		858.6	39.53	-6.47	46	34.89	28.98	4.45	29.08	-	-	P	H
		881	42.07	-3.93	46	37.27	28.89	4.58	28.98	-	-	P	H
		947.5	42.8	-3.2	46	36.1	30.23	4.71	28.58	100	0	P	H
													H
													H
													H
													H
													H
													H
		30	32.4	-7.6	40	36.65	24.6	1.2	30.18	-	-	P	V
		126.93	31.22	-12.28	43.5	41.67	17.59	1.83	30.05	-	-	P	V
		145.56	28.48	-15.02	43.5	39.04	17.23	2.06	30.03	-	-	P	V
		880.3	38.67	-7.33	46	33.88	28.89	4.58	28.99	-	-	P	V
		925.1	39.77	-6.23	46	34.2	29.33	4.64	28.73	100	0	P	V
		969.2	41.76	-12.24	54	34.27	30.86	4.71	28.43	-	-	P	V
													V
													V
													V
													V
													V
													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".

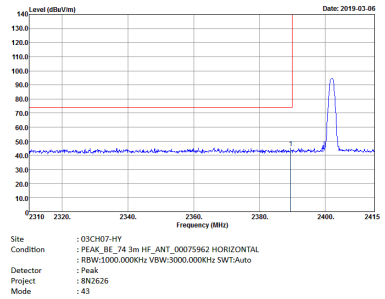
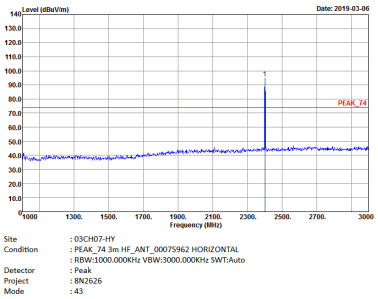
Appendix C. Radiated Spurious Emission Plots

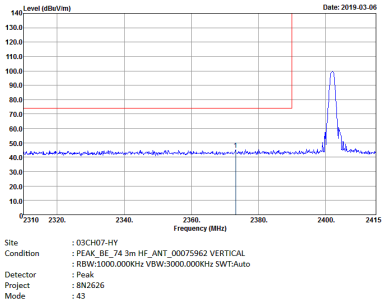
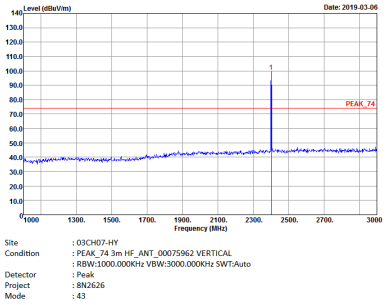
Test Engineer :	Jesse Wang, Stan Hsieh, and Troye Hsieh	Temperature :	20~25℃
		Relative Humidity :	55~60%

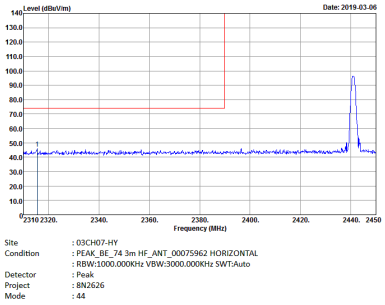
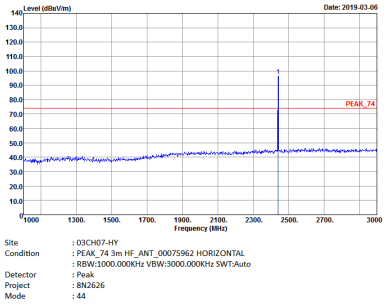
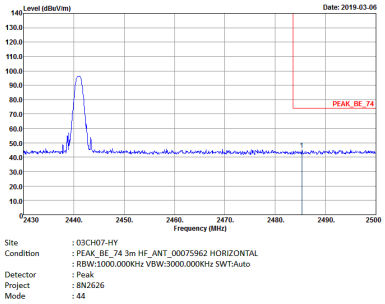
<1Mbps>

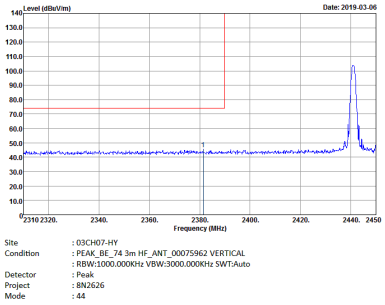
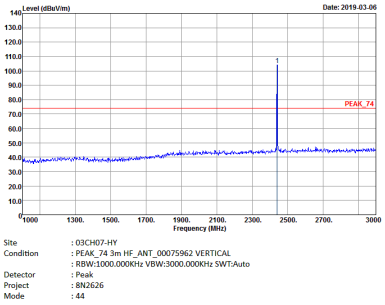
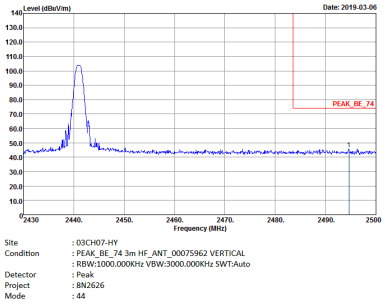
2.4GHz 2400~2483.5MHz

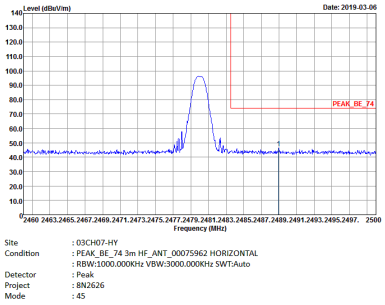
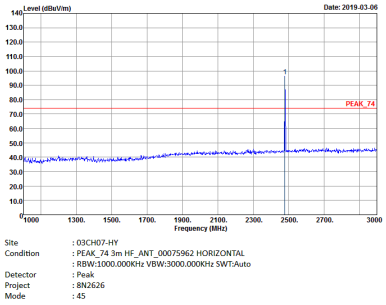
BT (Band Edge @ 3m)

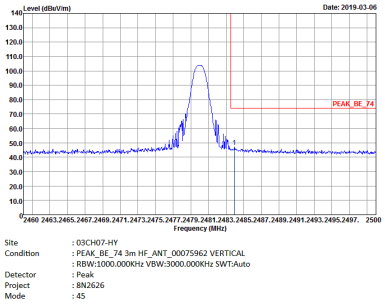
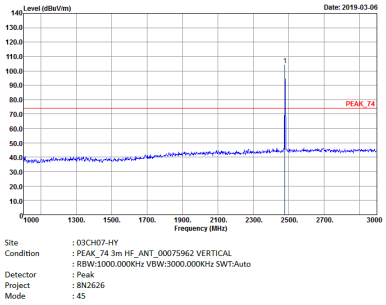
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak		
Peak		Left blank

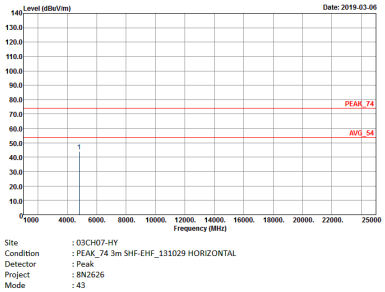
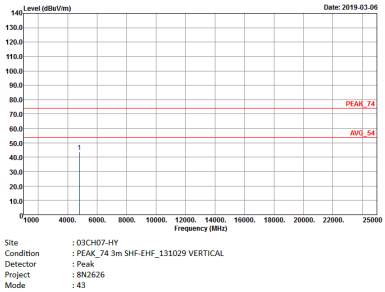
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak	 Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 8N2626 Mode : 44	 Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 8N2626 Mode : 44
Peak	 Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 8N2626 Mode : 44	Left blank

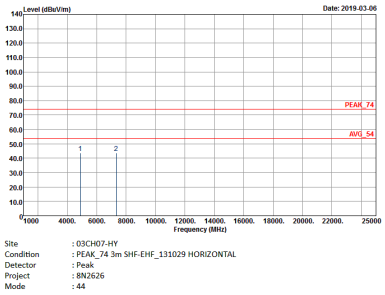
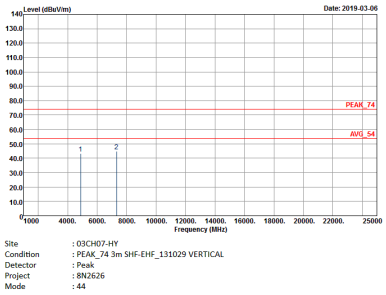
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

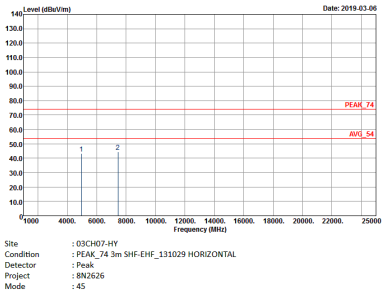
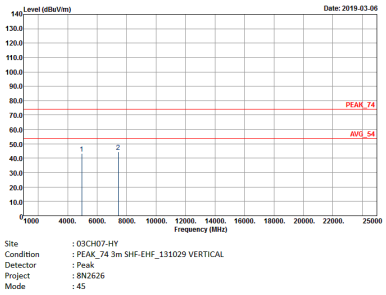
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

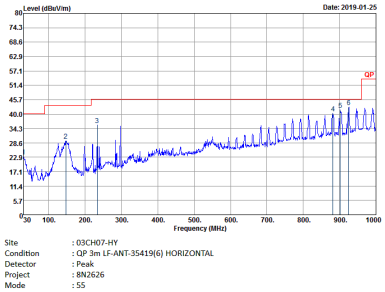
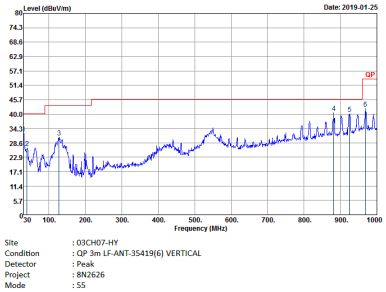
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

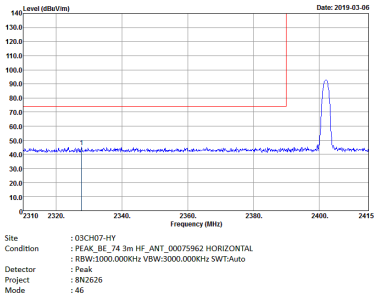
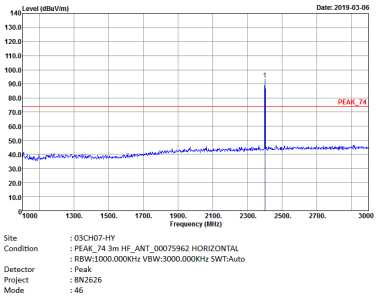
2.4GHz BT (LF)

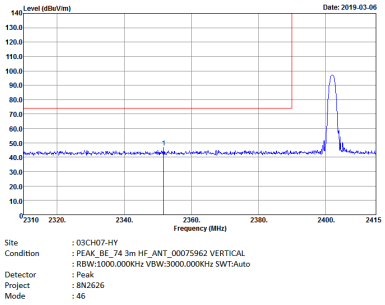
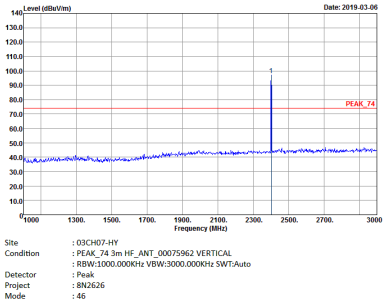
BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak		

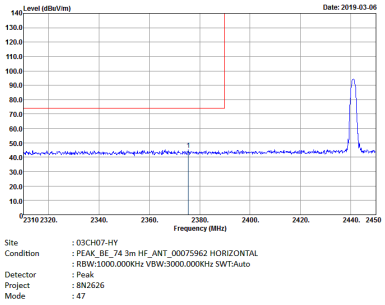
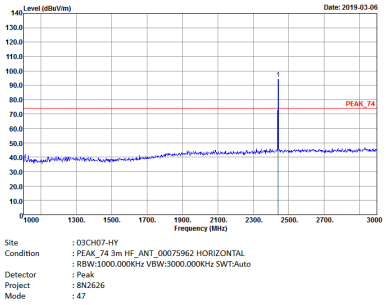
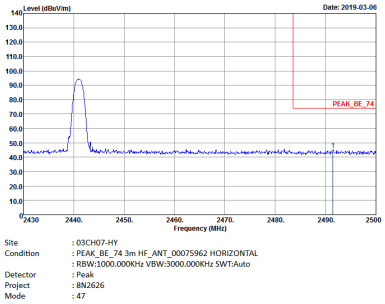
<3Mbps>

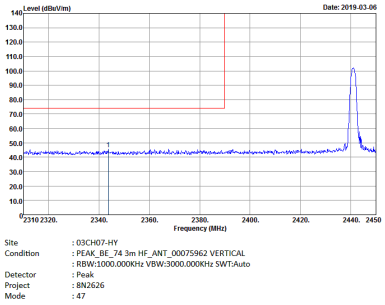
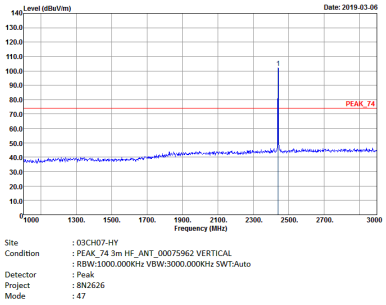
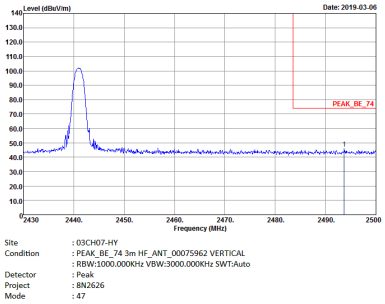
2.4GHz 2400~2483.5MHz

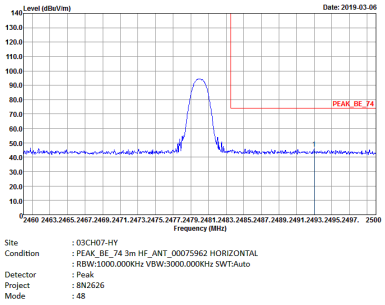
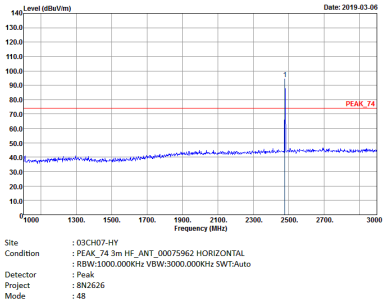
BT (Band Edge @ 3m)

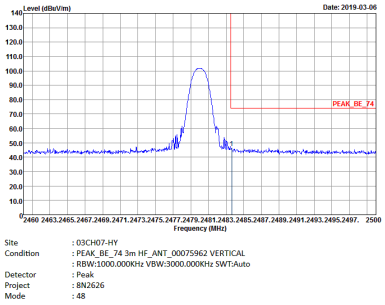
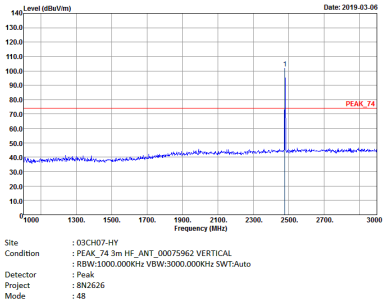
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak		
Peak		Left blank

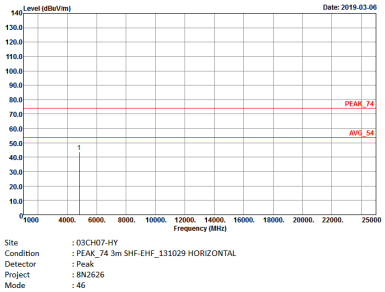
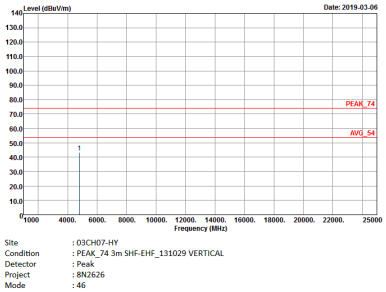
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak		
Peak		Left blank

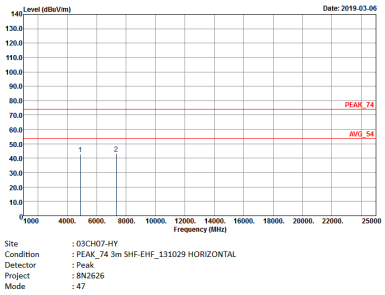
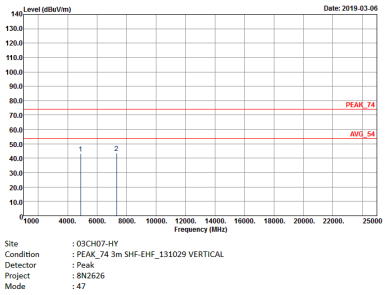
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

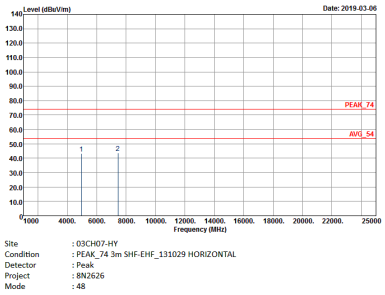
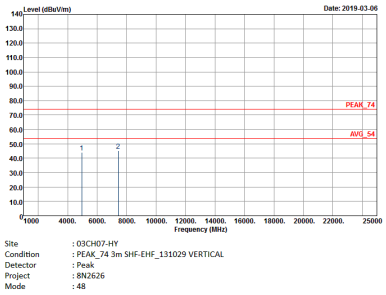
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

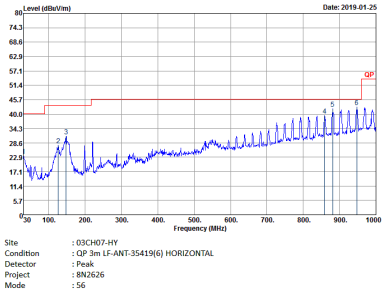
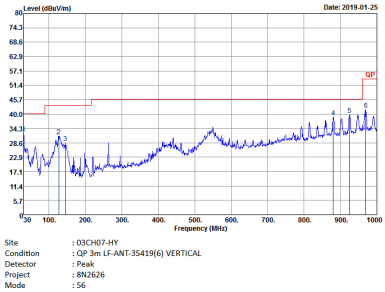
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

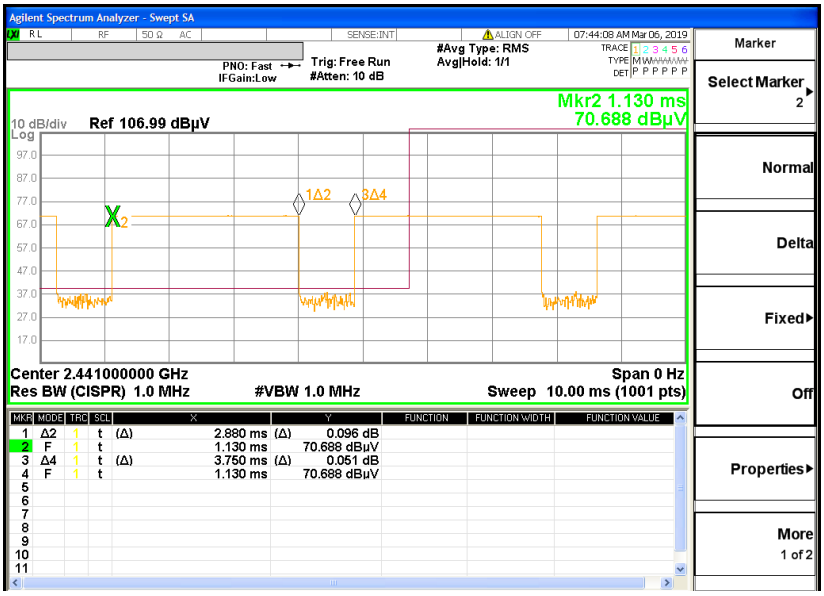
2.4GHz BT (LF)

BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak		

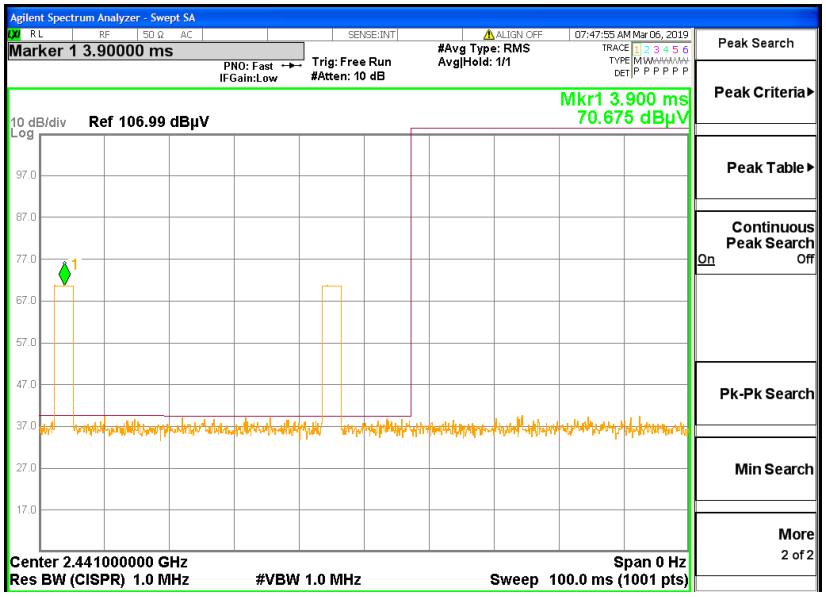
Appendix D. Duty Cycle Plots

<1Mbps>

DH5 on time (One Pulse) Plot on Channel 39



on time (Count Pulses) Plot on Channel 39

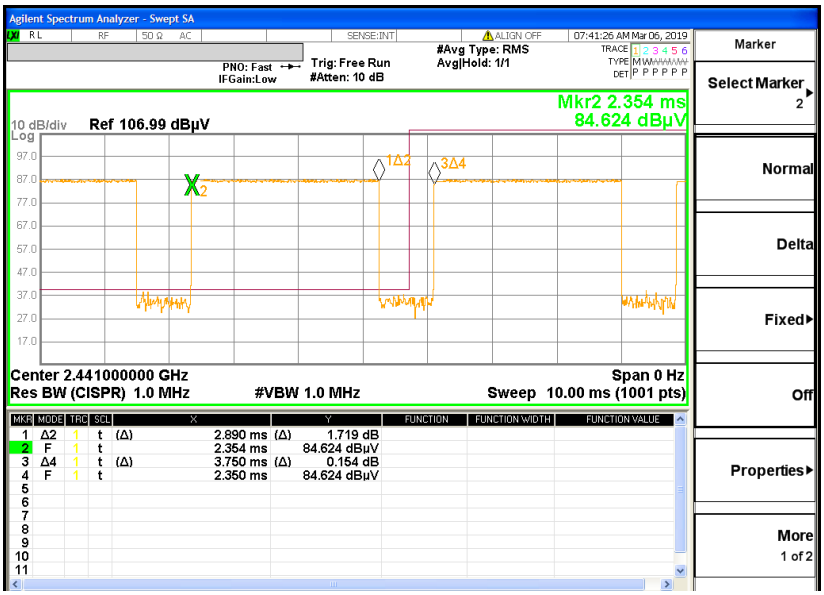


Note:

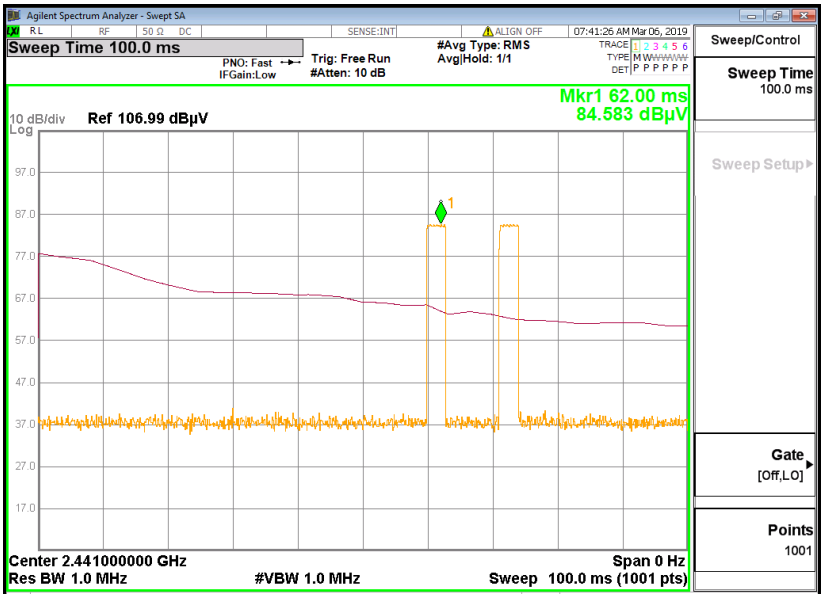
1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.88 / 100 = 5.76 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.79 dB
3. DH5 has the highest duty cycle worst case and is reported.

<3Mbps>

3DH5 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 * 2.89 / 100 = 5.78%
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.76 dB
3. 3DH5 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 ms x 20 channels = 57.6 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. [100ms / 57.6ms] = 2 hops

Thus, the maximum possible ON time:

2.88 ms x 2 = 5.76 ms

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

20 x log(5.76 ms/100ms) = -24.79 dB