FCC RADIO TEST REPORT

FCC ID	:	**PPD-QCNFA344AH**
Equipment	:	**802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card**
Brand Name	:	**Qualcomm Atheros**
Model Name	:	**QCNFA344A**
Applicant	:	**Qualcomm Atheros, Inc. 1700 Technology Drive, San Jose, CA 95110**
Manufacturer	:	**Qualcomm Atheros, Inc. 1700 Technology Drive, San Jose, CA 95110**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Mar. 28, 2018 and testing was started from Mar. 30, 2018 and completed on Apr. 23, 2018. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Jones Tsai

Approved by: Jones Tsai

SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR773112-03B	01	Initial issue of report	Jun. 13, 2018

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(b)(3)	Peak Output Power	Pass	-
3.2	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	Under limit 1.08 dB at 4960.000 MHz
Remark: The reported TX power in EMC report is per actual shipping power setting and measured in this unit. This has considered the actual shipping power during the measurement.				

Reviewed by: Joseph Lin

Report Producer: Maggie Chiang

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, and Wi-Fi 5GHz 802.11a/n/ac

Product Specification subjective to this standard	
Sample 1	EUT with Portable Computer (HONGBO Antenna)
Sample 2	EUT with Portable Computer (ACON Antenna)

Remark: All the tests were performed with Sample 1.

The product was installed into Portable Computer (Brand Name: DELL, Model Name: P87G, P87G001) during test, and the host information was recorded in the following table.

Antenna Information					
Manufacturer	HONGBO		**Manufacturer**	ACON	
Model Name	260-26160		**Model Name**	ANF6Y-200018	
Ant. Type	PIFA		**Ant. Type**	PIFA	
Peak Gain (dBi)	2.4GHz WLAN	Main: -0.59 Aux: -1.18	**Peak Gain (dBi)**	2.4GHz WLAN	Main:-1.38 Aux:-2.70
	5GHz WLAN	Main: -1.07 Aux: -1.64		5GHz WLAN	Main:-1.14 Aux:-1.73

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	TH05-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	03CH12-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

2.2 Test Mode

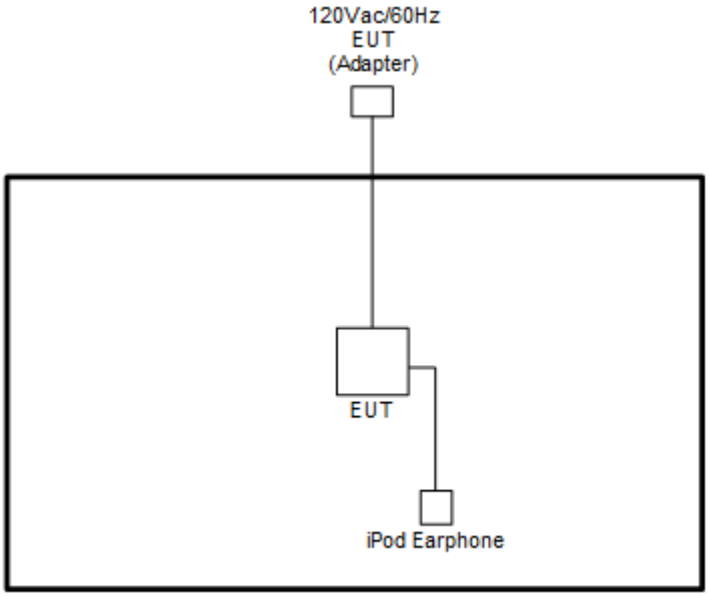
The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
	Bluetooth – LE / GFSK
Radiated Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps

Remark: The Radiated Spurious Emission test has only performed the test cases which chosen from module supplier.

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT” was installed in Portable Computer which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3 Test Result

3.1 Output Power Measurement

3.1.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

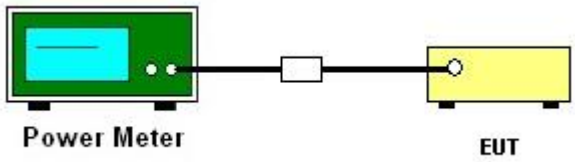
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. For Peak Output Power, the testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.3 PKPM1 Peak power meter method.
2. For Average Output Power, the testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.2.3.2 Method AVGPM-G.
3. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Measure the conducted output power and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.1.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 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. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. 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

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

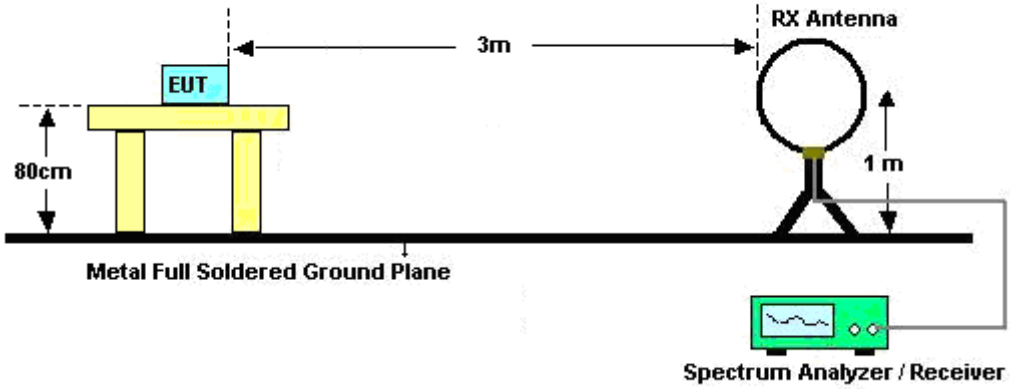
3.2.3 Test Procedures

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04

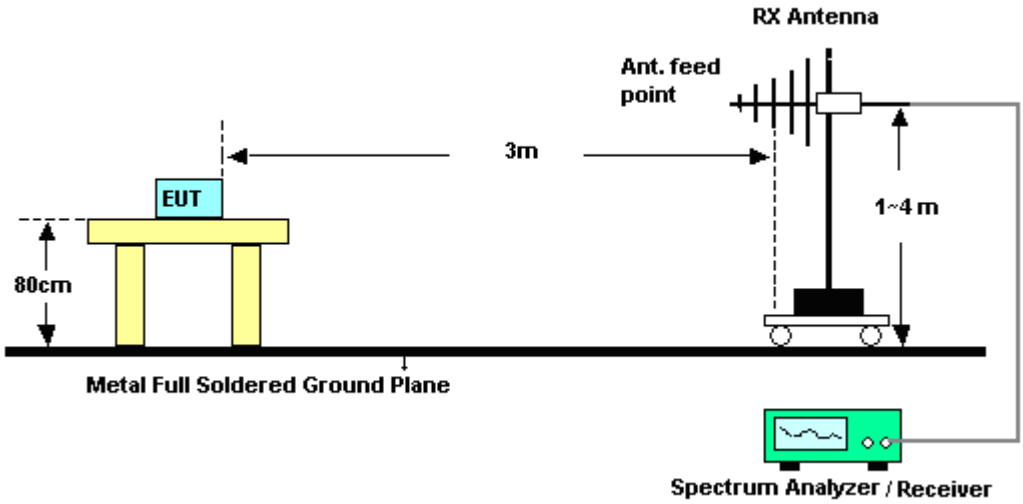
1. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
5. 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.
6. 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.
7. 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; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.2.4 Test Setup

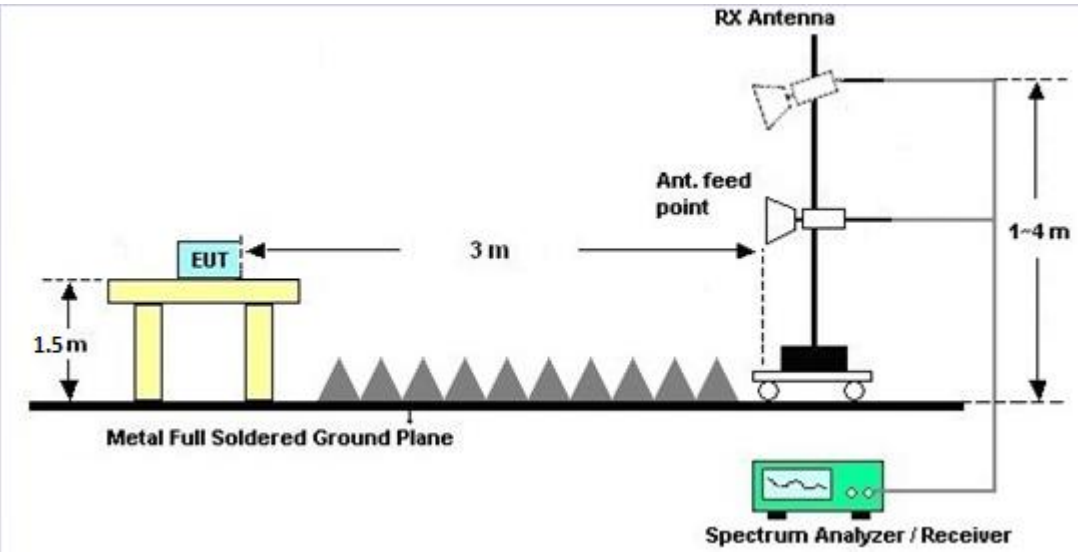
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.2.5 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.

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.2.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.

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. 20, 2017	Mar. 30, 2018~ Apr. 02, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 20, 2017	Mar. 30, 2018~ Apr. 02, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 20, 2017	Mar. 30, 2018~ Apr. 02, 2018	Jun. 19, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1300484	N/A	Mar. 01, 2018	Mar. 30, 2018~ Apr. 02, 2018	Feb. 28, 2019	Conducted (TH05-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	Apr. 03, 2018~ Apr. 23, 2018	Jul. 17, 2018	Radiation (03CH12-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz ~ 44GHz	Oct. 31, 2017	Apr. 03, 2018~ Apr. 23, 2018	Oct. 30, 2018	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 14, 2017	Apr. 03, 2018~ Apr. 23, 2018	Oct. 13, 2018	Radiation (03CH12-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Apr. 03, 2018~ Apr. 23, 2018	Nov. 22, 2018	Radiation (03CH12-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	Dec. 25, 2017	Apr. 03, 2018~ Apr. 23, 2018	Dec. 24, 2018	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Oct. 20, 2017	Apr. 03, 2018~ Apr. 23, 2018	Oct. 19, 2018	Radiation (03CH12-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Jan. 19, 2018	Apr. 03, 2018~ Apr. 23, 2018	Jan. 18, 2020	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY53270148	1GHz~26.5GHz	Jan. 15, 2018	Apr. 03, 2018~ Apr. 23, 2018	Jan. 14, 2019	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN2	3 GHz Highpass	Jul. 17, 2017	Apr. 03, 2018~ Apr. 23, 2018	Jul. 16, 2018	Radiation (03CH12-HY)
Filter	Wainwright	WLKS1200-12SS	SN2	1.2G Low Pass	Jul. 17, 2017	Apr. 03, 2018~ Apr. 23, 2018	Jul. 16, 2018	Radiation (03CH12-HY)
Attenuator	Fairview Microwave	SA18S5W-10	n/a	10db	Jul. 17, 2017	Apr. 03, 2018~ Apr. 23, 2018	Jul. 16, 2018	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Apr. 03, 2018~ Apr. 23, 2018	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Apr. 03, 2018~ Apr. 23, 2018	N/A	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	Apr. 27, 2017	Apr. 03, 2018~ Apr. 23, 2018	Apr. 26, 2018	Radiation (03CH12-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 22, 2017	Apr. 03, 2018~ Apr. 23, 2018	May 21, 2018	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Apr. 03, 2018~ Apr. 23, 2018	N/A	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30M-18G	Mar. 14, 2018	Apr. 03, 2018~ Apr. 23, 2018	Mar. 13, 2019	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15539/4	30M-18G	Mar. 14, 2018	Apr. 03, 2018~ Apr. 23, 2018	Mar. 13, 2019	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY36979/4	30M-18G	Mar. 14, 2018	Apr. 03, 2018~ Apr. 23, 2018	Mar. 13, 2019	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Oct. 17, 2017	Apr. 03, 2018~ Apr. 23, 2018	Oct. 16, 2018	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30M~40GHz	Oct. 17, 2017	Apr. 03, 2018~ Apr. 23, 2018	Oct. 16, 2018	Radiation (03CH12-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1**

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.7**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Lena Lo	Temperature:	21~25	°C
Test Date:	2018/3/30~2018/4/02	Relative Humidity:	51~54	%

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)
BLE	1Mbps	1	0	2402	3.42	30.00
BLE	1Mbps	1	19	2440	3.90	30.00
BLE	1Mbps	1	39	2480	4.20	30.00

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	1.90	3.01
BLE	1Mbps	1	19	2440	1.90	3.53
BLE	1Mbps	1	39	2480	1.90	3.88

Appendix B. Radiated Spurious Emission

Test Engineer :	Watt Tseng, Karl Hou, and Nick Yu	Temperature :	21~23°C
		Relative Humidity :	59~62%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	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)
BLE CH 00 2402MHz		2359.875	53.29	-20.71	74	43.76	27.07	14.04	31.58	386	248	P	H
		2376.885	42.67	-11.33	54	33.08	27.11	14.06	31.58	386	248	A	H
	*	2402	95.31	-	-	85.66	27.15	14.07	31.57	386	248	P	H
	*	2402	94.12	-	-	84.47	27.15	14.07	31.57	386	248	A	H
													H
													H
		2369.22	53.08	-20.92	74	43.51	27.11	14.04	31.58	339	179	P	V
		2386.65	42.83	-11.17	54	33.2	27.15	14.06	31.58	339	179	A	V
	*	2402	102.17	-	-	92.52	27.15	14.07	31.57	339	179	P	V
	*	2402	101.2	-	-	91.55	27.15	14.07	31.57	339	179	A	V
													V
													V
BLE CH 19 2440MHz		2339.82	53.3	-20.7	74	43.82	27.03	14.03	31.58	376	247	P	H
		2386.16	42.68	-11.32	54	33.05	27.15	14.06	31.58	376	247	A	H
	*	2440	95.12	-	-	85.31	27.28	14.1	31.57	376	247	P	H
	*	2440	93.96	-	-	84.15	27.28	14.1	31.57	376	247	A	H
		2489.85	53.45	-20.55	74	43.47	27.4	14.14	31.56	376	247	P	H
		2494.96	42.9	-11.1	54	32.91	27.4	14.14	31.55	376	247	A	H
		2323.72	53.39	-20.61	74	43.98	26.99	14.01	31.59	331	181	P	V
		2386.58	42.76	-11.24	54	33.13	27.15	14.06	31.58	331	181	A	V
	*	2440	102.46	-	-	92.65	27.28	14.1	31.57	331	181	P	V
	*	2440	101.43	-	-	91.62	27.28	14.1	31.57	331	181	A	V
		2497.9	53.07	-20.93	74	43.08	27.4	14.14	31.55	331	181	P	V
		2496.64	43.03	-10.97	54	33.04	27.4	14.14	31.55	331	181	A	V

BLE CH 39 2480MHz	*	2480	93.39	-	-	83.47	27.36	14.12	31.56	361	245	P	H
	*	2480	92.45	-	-	82.53	27.36	14.12	31.56	361	245	A	H
		2494.52	54.15	-19.85	74	44.16	27.4	14.14	31.55	361	245	P	H
		2493.36	43.4	-10.6	54	33.41	27.4	14.14	31.55	361	245	A	H
													H
													H
	*	2480	101.53	-	-	91.61	27.36	14.12	31.56	320	183	P	V
	*	2480	100.58	-	-	90.66	27.36	14.12	31.56	320	183	A	V
		2483.84	56.35	-17.65	74	46.41	27.36	14.14	31.56	320	183	P	V
		2485.92	43.19	-10.81	54	33.25	27.36	14.14	31.56	320	183	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

BLE (Harmonic @ 3m)

BLE	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)
BLE CH 00 2402MHz		4804	43.36	-30.64	74	62.61	31.32	6.7	57.27	100	0	P	H
													H
													H
													H
		4804	47.1	-26.9	74	66.35	31.32	6.7	57.27	100	0	P	V
													V
													V
													V
BLE CH 19 2440MHz		4880	45.82	-28.18	74	64.8	31.46	6.73	57.17	100	0	P	H
		7320	45.21	-28.79	74	58.29	36.15	8.06	57.29	100	0	P	H
													H
													H
		4880	53.01	-20.99	74	71.99	31.46	6.73	57.17	304	138	P	V
		4874	47.47	-6.53	54	66.45	31.46	6.73	57.17	304	138	A	V
		7320	47.5	-26.5	74	60.58	36.15	8.06	57.29	100	0	P	V
													V
BLE CH 39 2480MHz		4960	49.39	-24.61	74	68.06	31.63	6.75	57.05	100	0	P	H
		7440	48.68	-25.32	74	61.58	36.47	8.07	57.44	100	0	P	H
													H
													H
		4960	55.66	-18.34	74	74.33	31.63	6.75	57.05	264	112	P	V
		4960	52.92	-1.08	54	71.59	31.63	6.75	57.05	264	112	A	V
		7440	49.07	-24.93	74	61.97	36.47	8.07	57.44	100	0	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	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 BLE LF		65.37	24.06	-15.94	40	43.86	11.79	0.72	32.31	-	-	P	H
		199.29	38.61	-4.89	43.5	54.74	14.87	1.27	32.27	100	0	P	H
		252.48	33.06	-12.94	46	45.1	18.72	1.44	32.2	-	-	P	H
		330.8	28.15	-17.85	46	39.15	19.59	1.55	32.14	-	-	P	H
		472.9	30.69	-15.31	46	37.7	23.35	1.83	32.19	-	-	P	H
		666.8	37.18	-8.82	46	40.95	26.25	2.16	32.18	-	-	P	H
													H
													H
													H
													H
													H
													H
		31.89	30.53	-9.47	40	39.19	23.24	0.44	32.34	100	0	P	V
		65.64	23.46	-16.54	40	43.22	11.83	0.72	32.31	-	-	P	V
		245.73	31.75	-14.25	46	44.74	17.78	1.44	32.21	-	-	P	V
		450.5	29.85	-16.15	46	37.28	22.99	1.76	32.18	-	-	P	V
		666.8	33.24	-12.76	46	37.01	26.25	2.16	32.18	-	-	P	V
		916.7	32.43	-13.57	46	31.89	29.27	2.63	31.36	-	-	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:

BLE	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)
BLE 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

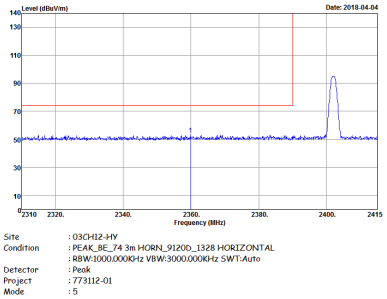
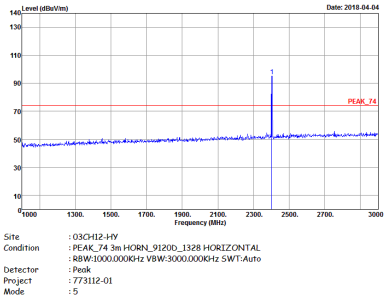
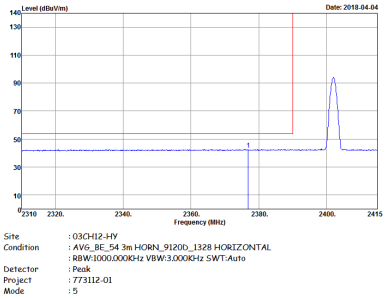
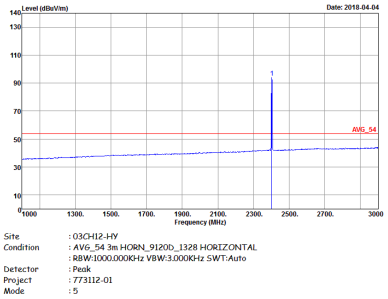
Test Engineer :	Watt Tseng, Karl Hou, and Nick Yu	**Temperature :**	21~23°C
		Relative Humidity :	59~62%

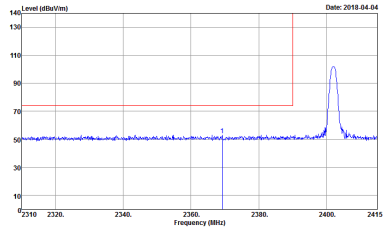
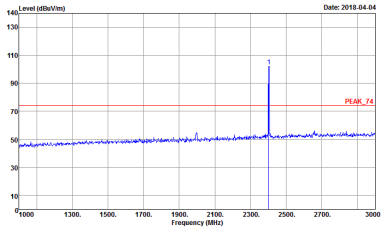
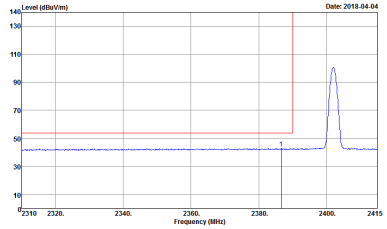
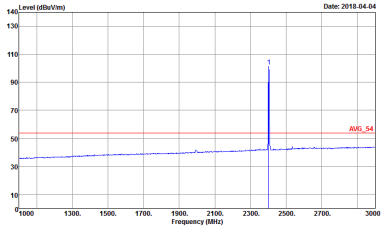
Note symbol

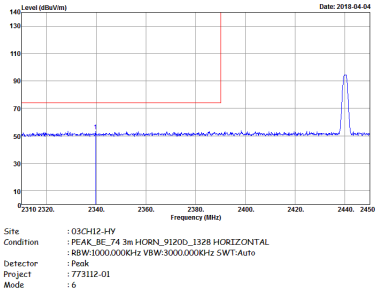
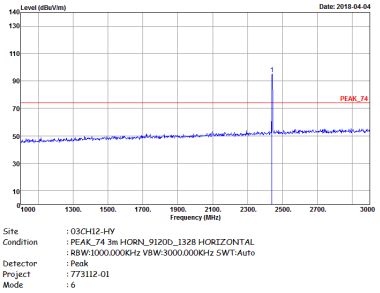
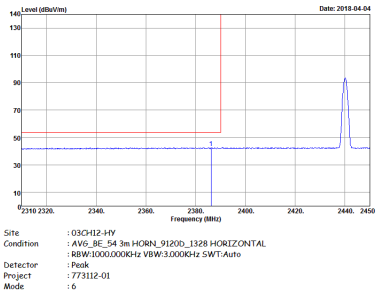
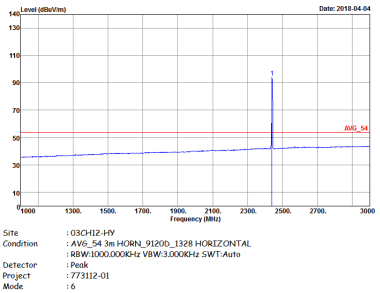
-L	**Low channel location**
-R	**High channel location**

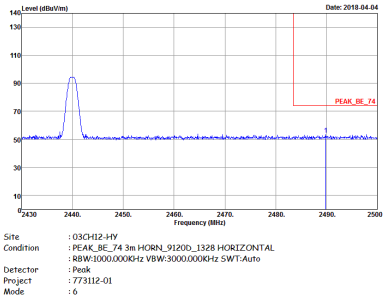
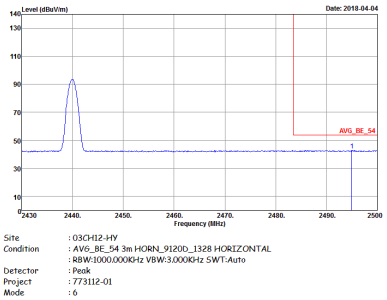
2.4GHz 2400~2483.5MHz

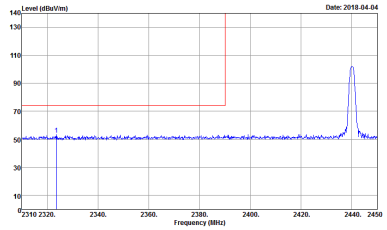
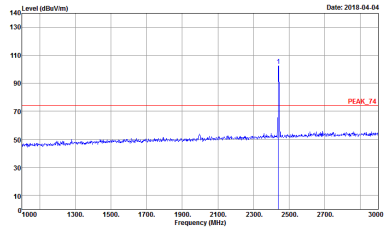
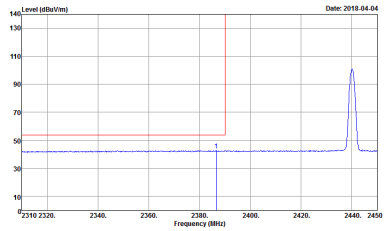
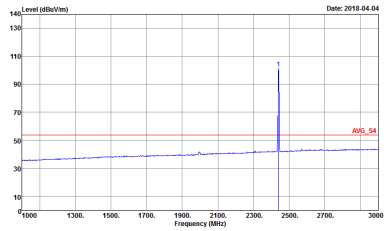
BLE (Band Edge @ 3m)

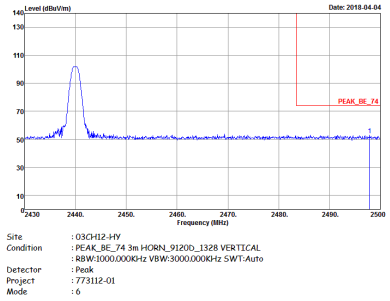
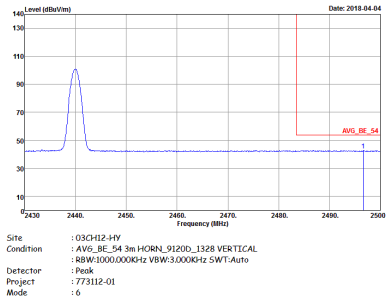
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

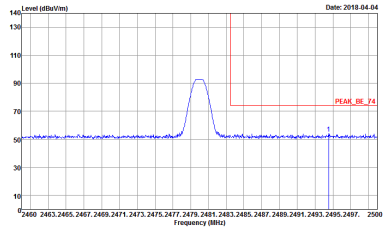
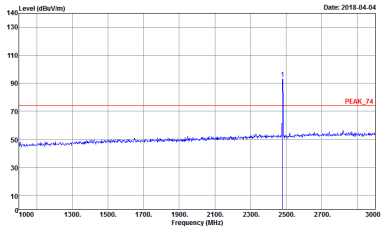
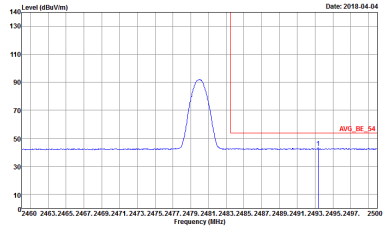
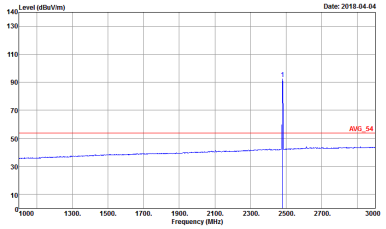
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH12-HY Condition : PEAK_BE_74 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 5	 Site : 03CH12-HY Condition : PEAK_74 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 5
Avg	 Site : 03CH12-HY Condition : AVG_BE_54 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 5	 Site : 03CH12-HY Condition : AVG_54 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 5

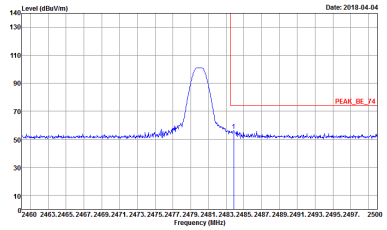
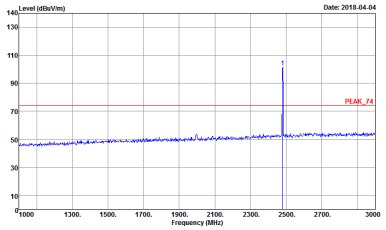
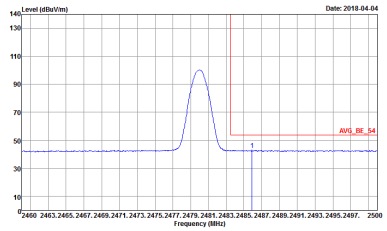
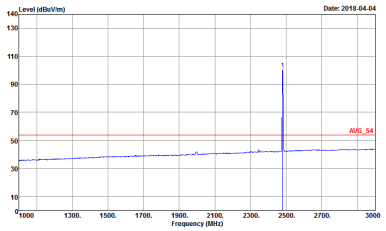
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1	Vertical	Fundamental
Peak	 Site : 03CH12-HY Condition : PEAK_BE_74 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 6	 Site : 03CH12-HY Condition : PEAK_74 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 6
Avg.	 Site : 03CH12-HY Condition : AVG_BE_54 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 6	 Site : 03CH12-HY Condition : AVG_54 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 6

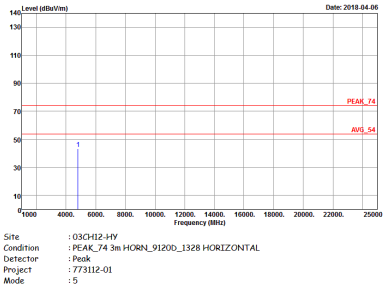
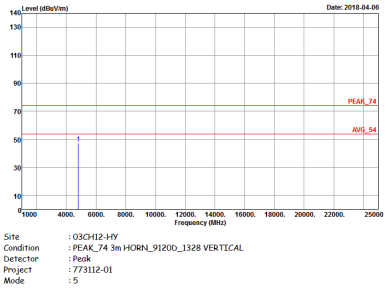
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

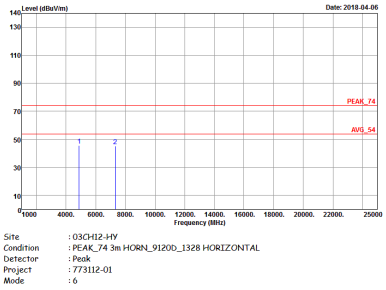
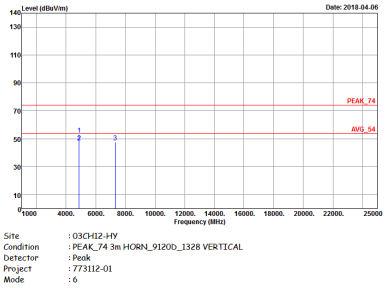
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH12-HY Condition : PEAK_BE_74 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7	 Site : 03CH12-HY Condition : PEAK_74 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7
Avg.	 Site : 03CH12-HY Condition : AV6_BE_54 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7	 Site : 03CH12-HY Condition : AV6_54 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7

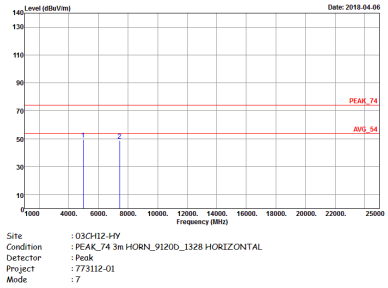
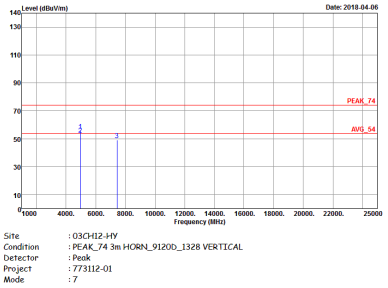
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH12-HY Condition : PEAK_BE_74 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7	 Site : 03CH12-HY Condition : PEAK_74 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7
Avg.	 Site : 03CH12-HY Condition : AV6_BE_54 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7	 Site : 03CH12-HY Condition : AV6_54 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 773112-01 Mode : 7

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

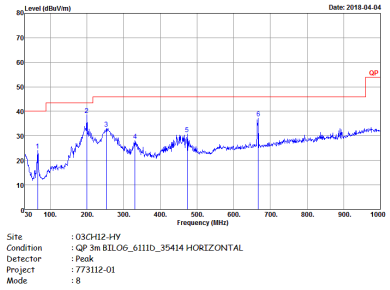
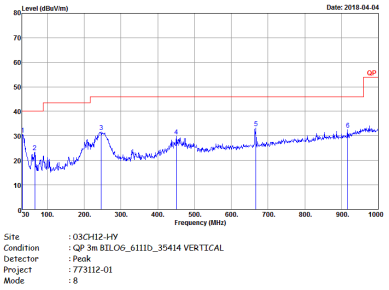
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Vertical
Peak Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH19 2440MHz	
1	Horizontal	Vertical
Peak Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Vertical
Peak		

Emission below 1GHz

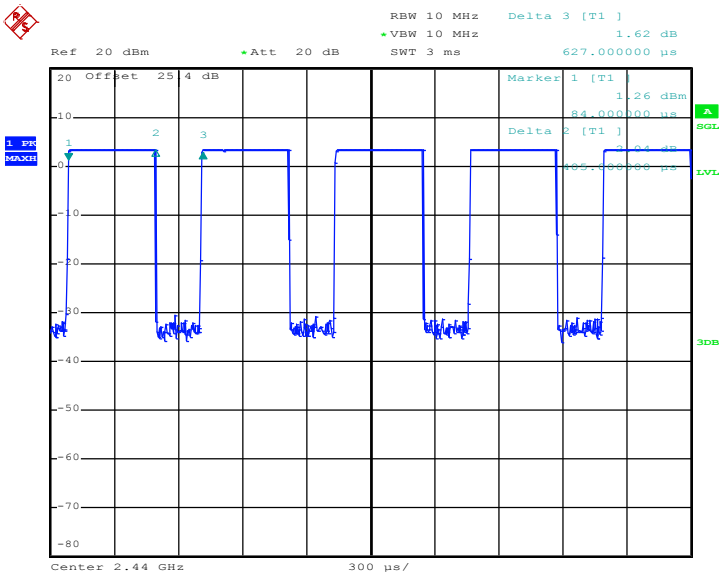
2.4GHz BLE (LF)

BLE	2.4GHz 2400~2483.5MHz	
ANT	BLE LF	
1	Horizontal	Vertical
QP / Peak		

Appendix D. Duty Cycle Plots

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor (dB)
Bluetooth -LE	64.59	405	2.47	3kHz	1.90

Bluetooth - LE



Date: 21.MAR.2018 18:10:53