FCC RF Test Report

APPLICANT	:	Clarinox Technologies
EQUIPMENT	:	Koala Connect
BRAND NAME	:	Koala Connect
MODEL NAME	:	KM-153103
FCC ID	:	2AN5P1531
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

This is a variant report. The product was received on Oct. 20, 2017 and testing was completed on Dec. 22, 2017. 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR7O2010B	Rev. 01	Initial issue of report	Dec. 27, 2017
FR7O2010B	Rev. 02	Revising appendix a	Apr. 17, 2018
FR7O2010B	Rev. 03	Change antenna gain with -1.4 dBi and update appendix a and appendix b	May 17, 2018

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
-	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Not required	-
-	-	99% Bandwidth	-	Not required	-
3.1	15.247(b)(3)	Peak Output Power	≤ 30dBm	Pass	-
-	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Not required	-
-	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Not required	-
3.2	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.48 dB at 48.900 MHz
-	15.207	AC Conducted Emission	15.207(a)	Not required	-
3.3	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

Note:
1. Not required means after assessing, test items are not necessary to carry out.
2. This is a variant report which can be referred Product Equality Declaration. All the test cases were performed on original report which can be referred to Sporton Report Number FR4O2349B. Based on the original report, the conducted power and radiated emission test cases were verified.

1 General Description

1.1 Applicant

Clarinox Technologies
28/296 Bay Rd, Cheltenham, VIC 3192, Australia

1.2 Manufacturer

Jorjin Technologies. Inc.
17F., No.239, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

1.3 Product Feature of Equipment Under Test

Bluetooth and Wi-Fi 2.4GHz 802.11b/g/n

Product Specification subjective to this standard	
Antenna Type	WLAN: Chip Antenna Bluetooth: Chip Antenna

1.4 Modification of EUT

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

1.5 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, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan 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: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH11-HY

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

1.6 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:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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	-	-

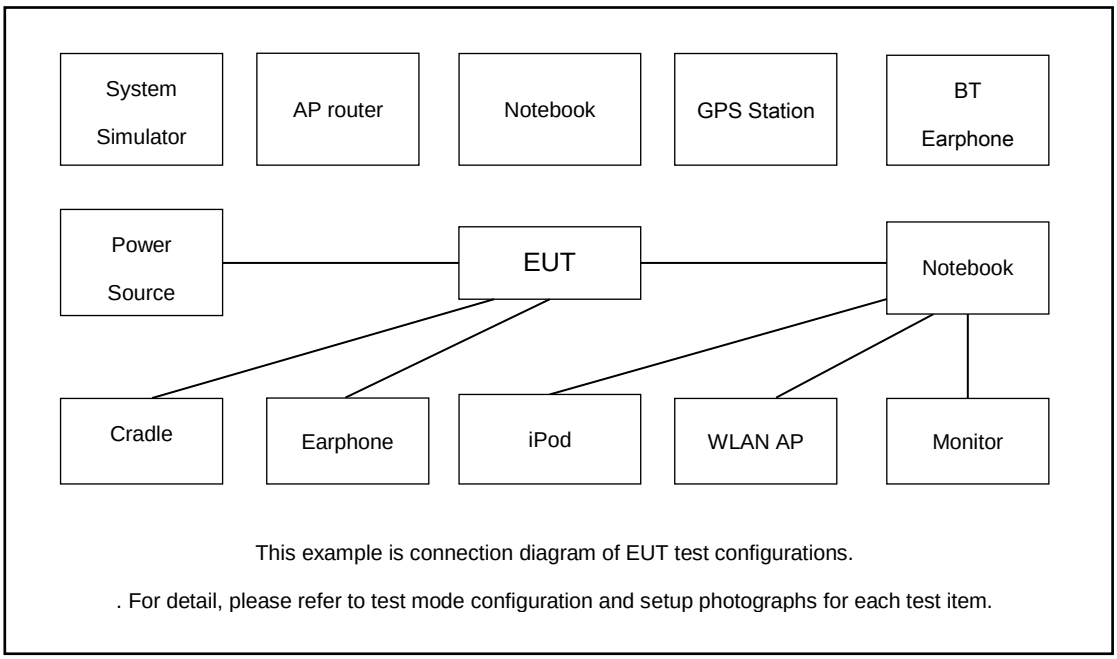
2.2 Test Mode

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	
	Bluetooth – LE / GFSK
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps

2.3 Connection Diagram of Test System



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook-41	Lenovo	G480	N/A	N/A	N/A
2.	Notebook-40	Lenovo	IdeaPad (80O7)	N/A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, programmed RF utility, “HCI_Tester” installed in the notebook make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

3 Test Result

3.1 Peak Output Power Measurement

3.1.1 Limit of Peak 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.

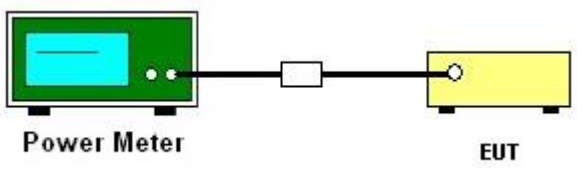
3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.2 PKPM1 Peak power meter method.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. 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

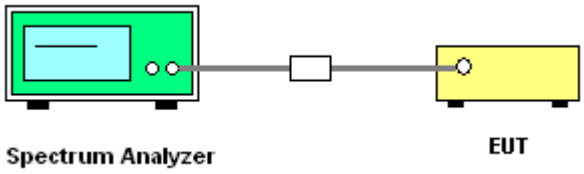
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

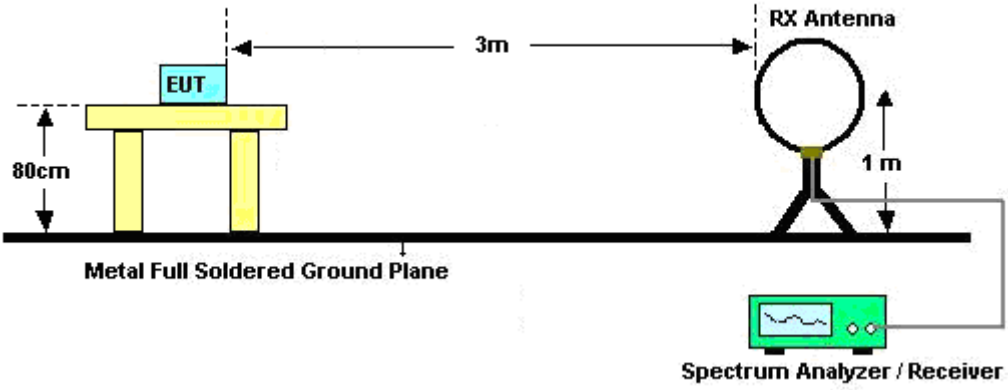
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector 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

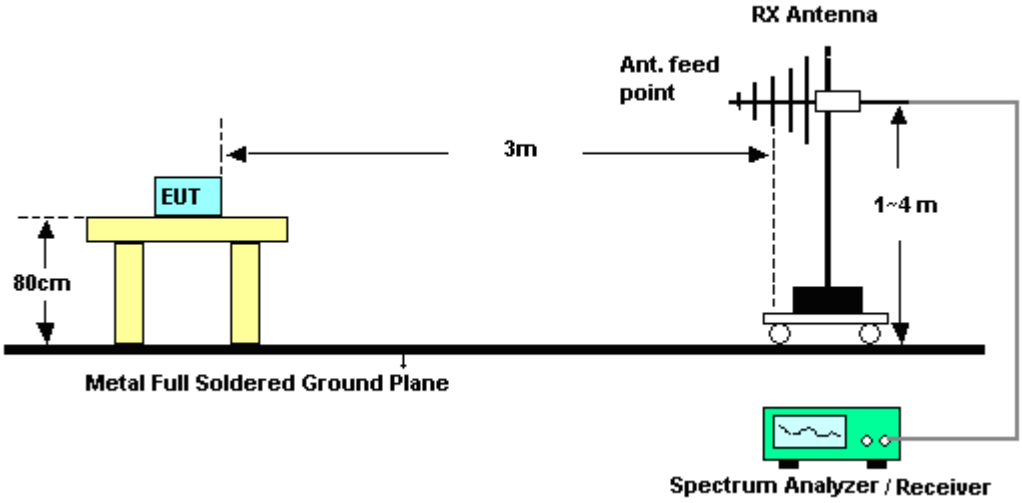
For Conducted Measurement:



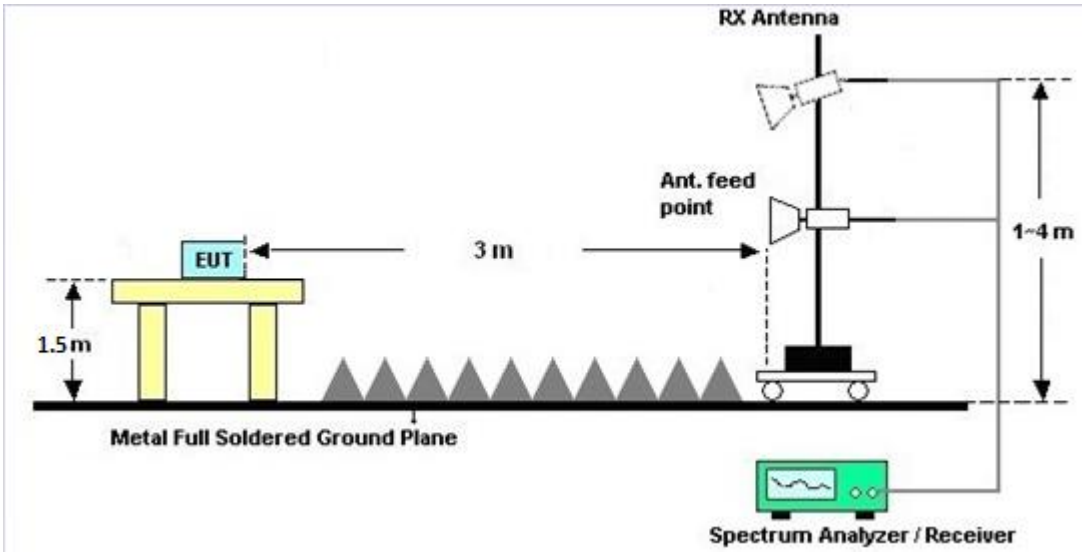
For radiated emissions below 30MHz



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 Conducted Spurious at Band Edges in the Restricted Band

Please refer to Appendix B and C.

3.2.7 Test Result of Conducted Spurious Emission in the Restricted Band

Please refer to Appendix B and C.

3.2.8 Test Result of Cabinet Radiated Spurious at Band Edges

Please refer to Appendix D and E.

3.2.9 Duty Cycle

Please refer to Appendix F.

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

Please refer to Appendix D and E.

3.3 Antenna Requirements

3.3.1 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.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 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. 26, 2016	Dec. 07, 2017~ Dec. 15, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 26, 2016	Dec. 07, 2017~ Dec. 15, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100057	9kHz-40GHz	Nov. 21, 2017	Dec. 07, 2017~ Dec. 15, 2017	Nov. 20, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Aglient	N9030A	MY52350276	3Hz~44GHz	Mar. 23, 2017	Dec. 14, 2017~ Dec. 20, 2017	Mar. 22, 2018	CSE (TH05-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	Dec. 12, 2017~ Dec. 22, 2017	Jul. 17, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Dec. 12, 2017~ Dec. 22, 2017	Nov. 09, 2018	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 14, 2017	Dec. 12, 2017~ Dec. 22, 2017	Oct. 13, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	Dec. 12, 2017~ Dec. 22, 2017	Oct. 15, 2018	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 24, 2017	Dec. 12, 2017~ Dec. 22, 2017	Nov. 23, 2019	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2016	Dec. 12, 2017~ Dec. 22, 2017	Nov. 09, 2018	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800054001	1GHZ~18GHZ	Dec. 07, 2017	Dec. 12, 2017~ Dec. 22, 2017	Dec. 06, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2017	Dec. 12, 2017~ Dec. 22, 2017	Oct. 18, 2018	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Dec. 12, 2017~ Dec. 22, 2017	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Dec. 12, 2017~ Dec. 22, 2017	N/A	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 29, 2017	Dec. 12, 2017~ Dec. 22, 2017	Nov. 28, 2018	Radiation (03CH11-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))	5.20

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.50

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.20

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Kai Liao/Shiming Liu	Temperature:	21~25	°C
Test Date:	2017/12/7~2017/12/16	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)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	5.79	30.00	-1.40	4.39	36.00	Pass
BLE	1Mbps	1	19	2440	5.73	30.00	-1.40	4.33	36.00	Pass
BLE	1Mbps	1	39	2480	5.49	30.00	-1.40	4.09	36.00	Pass

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	0.00	5.53
BLE	1Mbps	1	19	2440	0.00	5.47
BLE	1Mbps	1	39	2480	0.00	5.21

Appendix B. Conducted Spurious Emission

Test Engineer :	Rebecca Lee and Karl Hou	Temperature :	22~24°C
		Relative Humidity :	51~55%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ CSE)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Gain	Cable Loss	Aux Factor	Aux2 Factor	Peak Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
BLE CH 00 2402MHz		2319.45	-47.35	-26.15	-21.2	-51.86	2	2.02	0.49	0	P
		2389.38	-57.58	-16.38	-41.2	-62.14	2	2.06	0.5	0	A
	*	2402	7.15	-	-	2.59	2	2.06	0.5	0	P
	*	2402	6.66	-	-	2.1	2	2.06	0.5	0	A
BLE CH 19 2440MHz		2353.4	-47.93	-26.73	-21.2	-52.46	2	2.04	0.49	0	P
		2388.12	-58.01	-16.81	-41.2	-62.57	2	2.06	0.5	0	A
	*	2440	7.04	-	-	2.46	2	2.08	0.5	0	P
	*	2440	6.4	-	-	1.82	2	2.08	0.5	0	A
		2492.16	-47.23	-26.03	-21.2	-51.84	2	2.11	0.5	0	P
		2484.39	-57.6	-16.4	-41.2	-62.2	2	2.1	0.5	0	A
BLE CH 39 2480MHz	*	2480	6.63	-	-	2.03	2	2.1	0.5	0	P
	*	2480	6.21	-	-	1.61	2	2.1	0.5	0	A
		2486.49	-42.97	-21.77	-21.2	-47.57	2	2.1	0.5	0	P
		2486.72	-52.15	-10.95	-41.2	-56.75	2	2.1	0.5	0	A

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ CSE)

BLE	Note	Frequency (MHz)	Level (dBm)	Over Limit (dB)	Limit Line (dBm)	Read Level (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	Aux Factor (dB)	Aux2 Factor (dB)	Peak Avg. (P/A)
BLE CH 00 2402MHz		4000	-65.04	-43.84	-21.2	-71.09	2	2.72	0.68	0.65	P
		4804	-65.42	-44.22	-21.2	-71.78	2	3.03	0.53	0.8	P
BLE CH 19 2440MHz		4067	-64.49	-43.29	-21.2	-70.61	2	2.75	0.7	0.67	P
		4880	-56.75	-35.55	-21.2	-63.15	2	3.07	0.52	0.81	P
		7320	-63.67	-41.47	-21.2	-70.12	2	4.01	0.45	0.99	P
BLE CH 39 2480MHz		4134	-64.73	-43.53	-21.2	-70.91	2	2.78	0.72	0.68	P
		4960	-59.55	-38.35	-21.2	-65.96	2	3.1	0.5	0.81	P
		7440	-63.55	-41.35	-21.2	-70.09	2	4.07	0.48	0.99	P
		9090	-62.12	-40.92	-21.2	-70.39	2	4.7	0.44	1.13	P
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	Cable	Aux	Aux2	Peak
				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
2.4GHz BLE LF		66.99	-87.42	-32.22	-55.2	-94.54	2	0.34	0.08	4.7	P
		130.98	-87.93	-36.23	-51.7	-95.16	2	0.46	0.07	4.7	P
		182.28	-87.96	-36.26	-51.7	-95.38	2	0.52	0.2	4.7	P
		348.3	-87.28	-38.08	-49.2	-94.76	2	0.7	0.08	4.7	P
		590.5	-86.55	-37.35	-49.2	-94.32	2	0.94	0.13	4.7	P
		737.5	-85.12	-35.92	-49.2	-93.01	2	1.07	0.12	4.7	P

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average 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.
AUX Factor	Connector lose、High/Low pass filter
AUX2 Factor	Grounding factor
P/A	**P**eak or **A**verage

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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Aux	Aux2	Peak
Ant.				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
1		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
802.11b CH 01 2412MHz		2386.545	-39.03	-17.83	-21.2	-44.06	2	2.09	0.94	0	P
		2386.125	-48.1	-6.9	-41.2	-53.13	2	2.09	0.94	0	A

1. Level(dBm) =

Antenna Factor(dB) + Cable Loss(dB) + Read Level(dBm) + Aux Factor(dB) + Aux2 Factor(dB)

2. Over Limit(dB) = Level(dBm) – Limit Line(dBm)

For Peak Limit @ 2386.545MHz:

1. Level(dBm)

= Antenna Factor(dB) + Cable Loss(dB) + Read Level(dBm) + Aux Factor(dB) + Aux2 Factor(dB)

= 2(dB) + 2.09(dB) – 44.06(dBm) + 0.94(dB)

= -39.03(dBm)

2. Over Limit(dB)

= Level(dBm) – Limit Line(dBm)

= -39.03(dBm) + 21.2(dBm)

= -17.83(dB)

For Average Limit @ 2386.125MHz:

1. Level(dBm)

= Antenna Factor(dB) + Cable Loss(dB) + Read Level(dBm) + Aux Factor(dB) + Aux2 Factor(dB)

= 2(dB) + 2.09(dB) – 53.13(dBm) + 0.94(dB)

= -48.1(dBm)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -6.9(dB)

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

Appendix C. Conducted Spurious Emission Plots

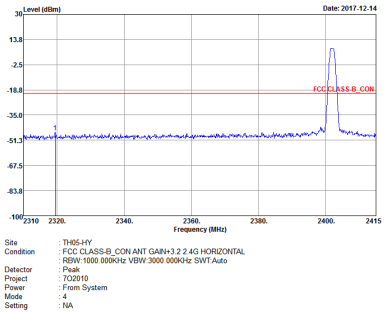
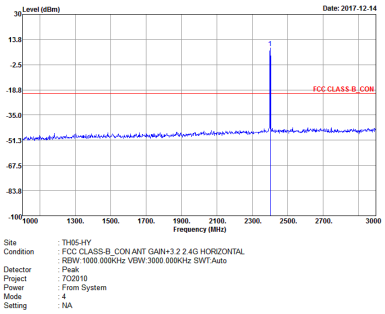
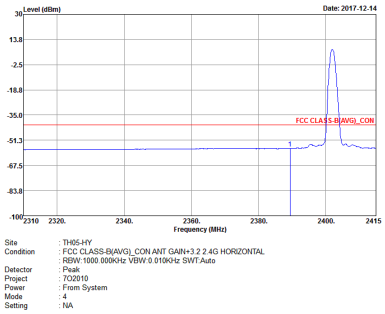
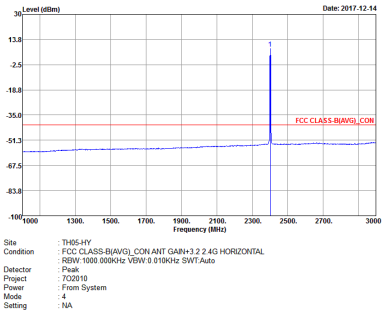
Test Engineer :	Rebecca Lee and Karl Hou	**Temperature :**	22~24°C
		Relative Humidity :	51~55%

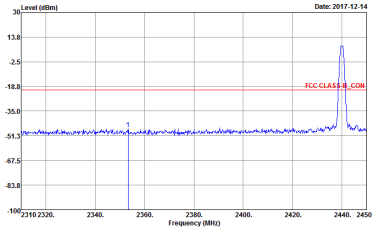
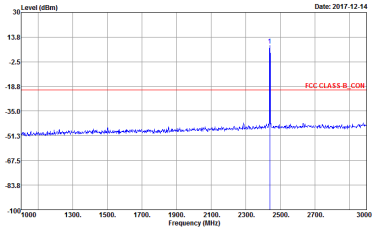
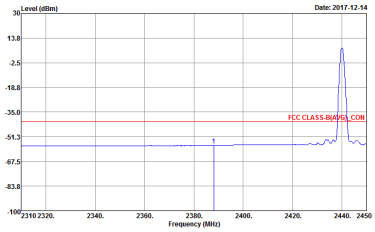
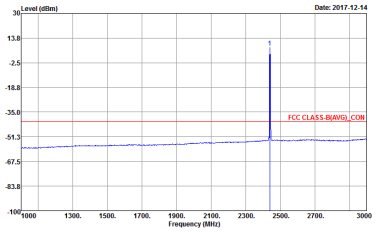
Note symbol

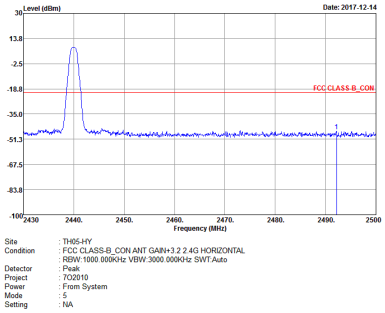
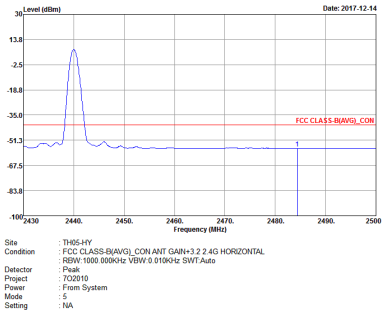
-L	**Low channel location**
-R	**High channel location**

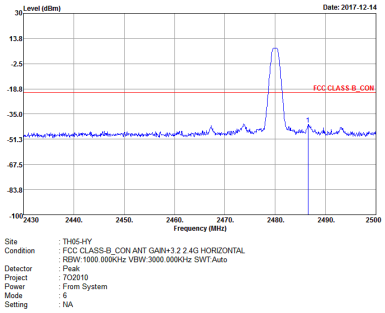
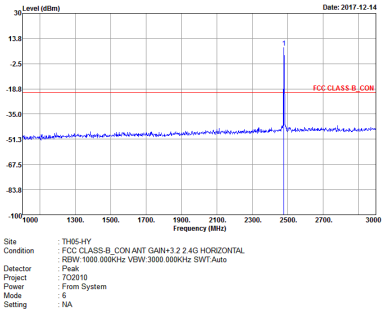
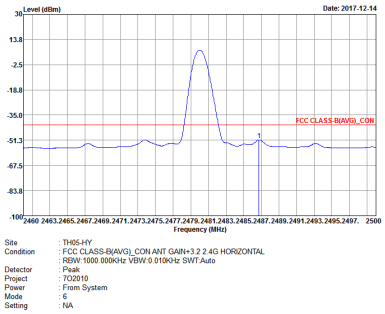
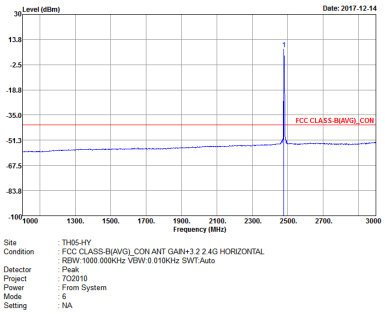
2.4GHz 2400~2483.5MHz

BLE (Band Edge @ Conducted)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ Conducted	
ANT	BLE CH00 2402MHz	
1	Band Edge - L	Fundamental
Peak		
Avg.		

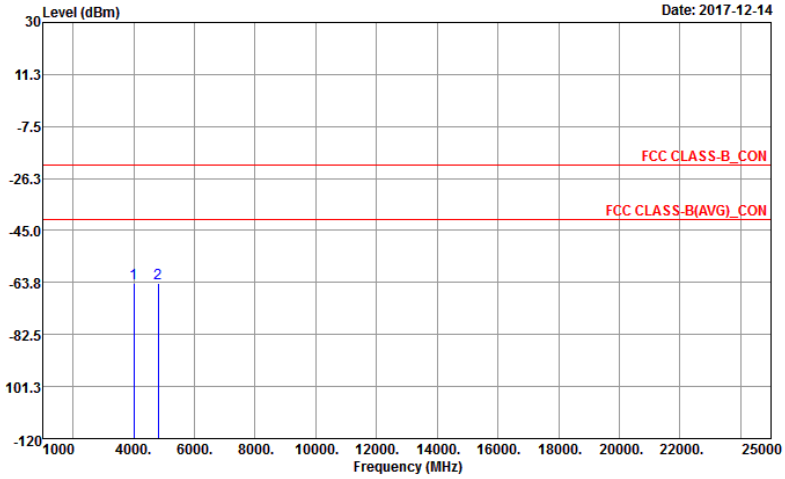
BLE	2.4GHz 2400~2483.5MHz Band Edge @ Conducted	
ANT	BLE CH19 2440MHz	
1	Band Edge - L	Fundamental
Peak	 Site : TH05-HY Condition : FCC CLASS-B_CON ANT GAIN+3.2 2.4G HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7O2010 Power : From System Mode : 5 Setting : NA	 Site : TH05-HY Condition : FCC CLASS-B_CON ANT GAIN+3.2 2.4G HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7O2010 Power : From System Mode : 5 Setting : NA
Avg.	 Site : TH05-HY Condition : FCC CLASS-B(AVG)_CON ANT GAIN+3.2 2.4G HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 7O2010 Power : From System Mode : 5 Setting : NA	 Site : TH05-HY Condition : FCC CLASS-B(AVG)_CON ANT GAIN+3.2 2.4G HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 7O2010 Power : From System Mode : 5 Setting : NA

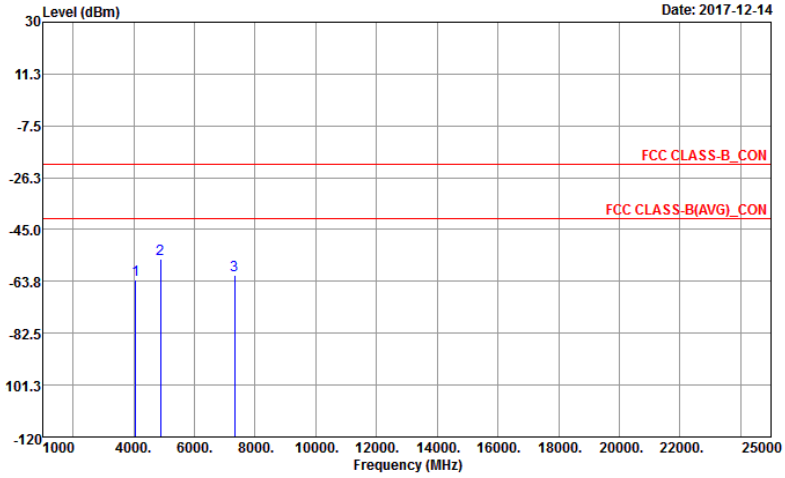
BLE	2.4GHz 2400~2483.5MHz Band Edge @ Conducted	
ANT	BLE CH19 2440MHz - R	
1	Band Edge - R	Fundamental
Peak		Left blank
Avg.		Left blank

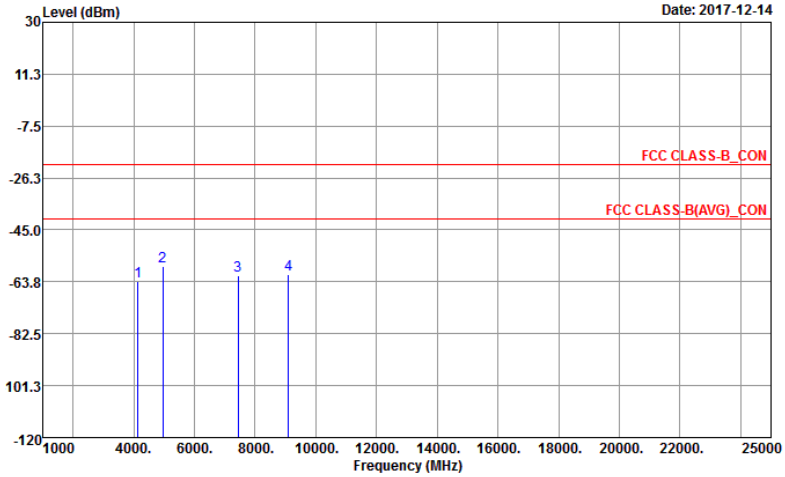
BLE	2.4GHz 2400~2483.5MHz Band Edge @ Conducted	
ANT	BLE CH39 2480MHz	
1	Band Edge - R	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ Conducted)

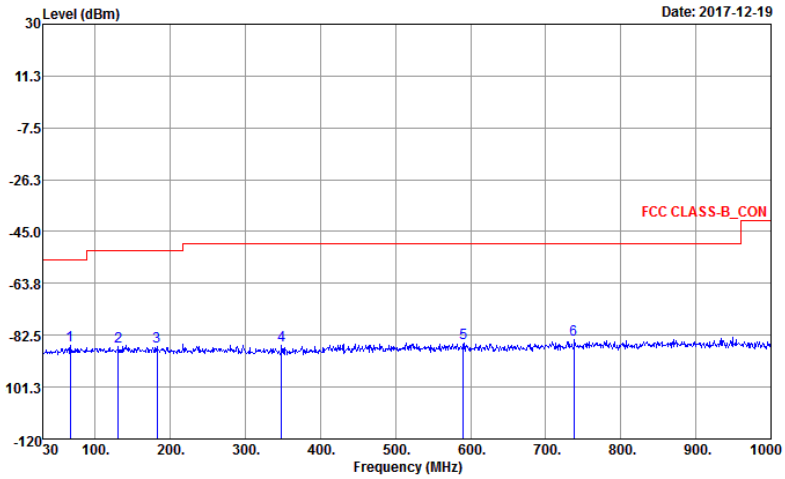
BLE	2.4GHz 2400~2483.5MHz Harmonic @ Conducted
ANT	BLE CH00 2402MHz
1	
Peak Avg.	 Site : TH05-HY Condition : FCC CLASS-B_CON ANT GAIN+3.2 2.4G HORIZONTAL Detector : Peak Project : 7O2010 Power : From System Mode : 4 Setting : NA

BLE	2.4GHz 2400~2483.5MHz Harmonic @ Conducted
ANT	BLE CH19 2440MHz
1	
Peak Avg.	 Site : TH05-HY Condition : FCC CLASS-B_CON ANT GAIN+3.2 2.4G HORIZONTAL Detector : Peak Project : 7O2010 Power : From System Mode : 5 Setting : NA

BLE	2.4GHz 2400~2483.5MHz Harmonic @ Conducted
ANT	BLE CH39 2480MHz
1	
Peak Avg.	 Site : TH05-HY Condition : FCC CLASS-B_CON ANT GAIN+3.2 2.4G HORIZONTAL Detector : Peak Project : 7O2010 Power : From System Mode : 6 Setting : NA

Emission below 1GHz

2.4GHz BLE (LF)

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

Appendix D. Cabinet Radiation Data

Test Engineer :	Hao Hsu, Jacky Hung, and Ken Wu	Temperature :	26~28°C
		Relative Humidity :	52~57%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		2350.11	52.09	-21.91	74	42.54	27	6.22	33.6	114	124	P	H
		2389.17	41.01	-12.99	54	31.19	27.13	6.36	33.6	114	124	A	H
	*	2402	78.07	-	-	68.24	27.13	6.36	33.59	114	124	P	H
	*	2402	77.34	-	-	67.51	27.13	6.36	33.59	114	124	A	H
													H
													H
		2347.905	52.27	-21.73	74	42.72	27	6.22	33.6	104	148	P	V
		2384.55	41	-13	54	31.22	27.09	6.36	33.6	104	148	A	V
	*	2402	76.73	-	-	66.9	27.13	6.36	33.59	104	148	P	V
	*	2402	75.84	-	-	66.01	27.13	6.36	33.59	104	148	A	V
													V
													V
BLE CH 19 2440MHz		2373.68	51.44	-22.56	74	41.73	27.09	6.29	33.6	105	130	P	H
		2386.16	41.04	-12.96	54	31.22	27.13	6.36	33.6	105	130	A	H
	*	2440	77.67	-	-	67.68	27.27	6.38	33.59	105	130	P	H
	*	2440	76.82	-	-	66.83	27.27	6.38	33.59	105	130	A	H
		2487.12	51.83	-22.17	74	41.73	27.36	6.39	33.58	105	130	P	H
		2483.84	41.34	-12.66	54	31.25	27.36	6.38	33.58	105	130	A	H
		2378.16	52.01	-21.99	74	42.3	27.09	6.29	33.6	130	147	P	V
		2386.48	41.01	-12.99	54	31.19	27.13	6.36	33.6	130	147	A	V
	*	2440	74.51	-	-	64.52	27.27	6.38	33.59	130	147	P	V
	*	2440	73.77	-	-	63.78	27.27	6.38	33.59	130	147	A	V
		2489.44	51.85	-22.15	74	41.71	27.4	6.39	33.58	130	147	P	V
		2486.64	41.32	-12.68	54	31.22	27.36	6.39	33.58	130	147	A	V

BLE CH 39 2480MHz	*	2480	76.65	-	-	66.56	27.36	6.38	33.58	118	3	P	H
	*	2480	75.5	-	-	65.41	27.36	6.38	33.58	118	3	A	H
		2490.64	52.16	-21.84	74	42.02	27.4	6.39	33.58	118	3	P	H
		2485.92	41.43	-12.57	54	31.33	27.36	6.39	33.58	118	3	A	H
													H
													H
	*	2480	73.95	-	-	63.86	27.36	6.38	33.58	350	83	P	V
	*	2480	72.28	-	-	62.19	27.36	6.38	33.58	350	83	A	V
		2490.6	52.76	-21.24	74	42.62	27.4	6.39	33.58	350	83	P	V
		2485.48	41.38	-12.62	54	31.28	27.36	6.39	33.58	350	83	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	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable 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		4804	42.49	-31.51	74	59.74	31.26	9.6	58.54	100	0	P	H
													H
													H
													H
		4804	41.42	-32.58	74	58.67	31.26	9.6	58.54	100	0	P	V
													V
													V
													V
BLE CH 19 2440MHz		4880	41.88	-32.12	74	59.03	31.38	9.56	58.52	100	0	P	H
		7320	45.32	-28.68	74	56.17	36.32	11.31	58.94	100	0	P	H
													H
													H
		4880	41.34	-32.66	74	58.49	31.38	9.56	58.52	100	0	P	V
		7320	45.57	-28.43	74	56.42	36.32	11.31	58.94	100	0	P	V
													V
													V
BLE CH 39 2480MHz		4960	43.62	-30.38	74	60.62	31.54	9.53	58.51	100	0	P	H
		7440	47.47	-26.53	74	58	36.59	11.34	58.84	100	0	P	H
													H
													H
		4960	45.12	-28.88	74	62.12	31.54	9.53	58.51	100	0	P	V
		7440	47.05	-26.95	74	57.58	36.59	11.34	58.84	100	0	P	V
													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 (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz BLE LF		169.86	34.68	-8.82	43.5	49.86	15.53	1.61	32.42	100	116	P	H
		201.72	28.82	-14.68	43.5	44.46	14.97	1.72	32.39	-	-	P	H
		250.32	33.41	-12.59	46	45.22	18.55	1.95	32.38	-	-	P	H
		377.7	31.37	-14.63	46	40.21	20.97	2.48	32.34	-	-	P	H
		479.9	32.19	-13.81	46	37.98	23.76	2.77	32.37	-	-	P	H
		958	34.2	-11.8	46	30.11	31.14	3.9	31.13	-	-	P	H
													H
													H
													H
													H
													H
													H
		30.81	34.7	-5.3	40	42.51	23.84	0.82	32.49	-	-	P	V
		48.9	36.52	-3.48	40	53.02	14.96	1.02	32.49	100	82	P	V
		62.67	30.9	-9.1	40	50.58	11.78	1.02	32.49	-	-	P	V
		380.5	30.65	-15.35	46	39.44	21.02	2.48	32.34	-	-	P	V
		477.8	33.19	-12.81	46	39.02	23.72	2.77	32.37	-	-	P	V
		955.9	34.49	-11.51	46	30.5	31.06	3.9	31.14	-	-	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:

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		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. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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

Appendix E. Cabinet Radiation Plots

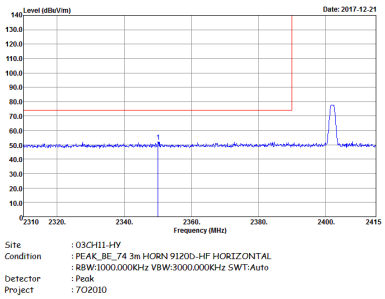
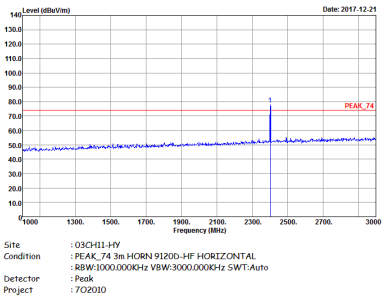
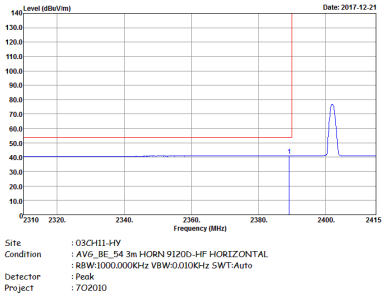
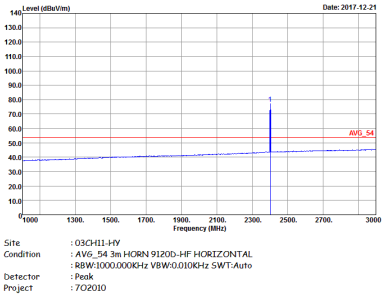
Test Engineer :	Hao Hsu, Jacky Hung, and Ken Wu	**Temperature :**	26~28°C
		Relative Humidity :	52~57%

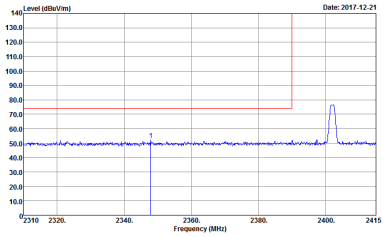
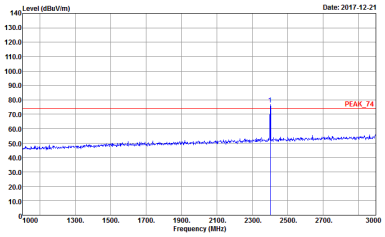
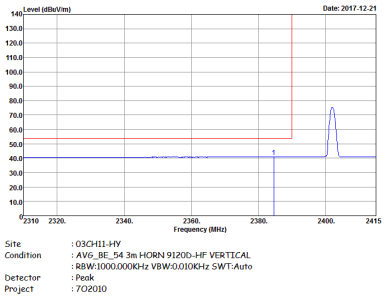
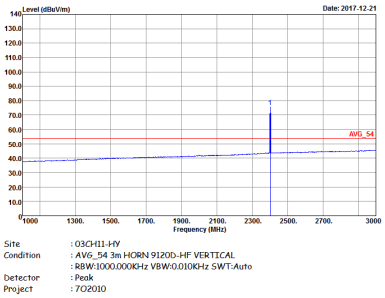
Note symbol

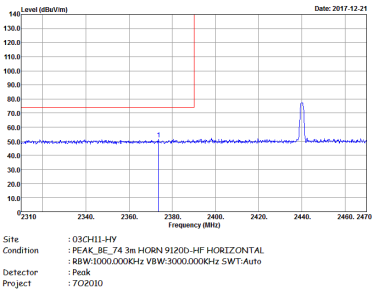
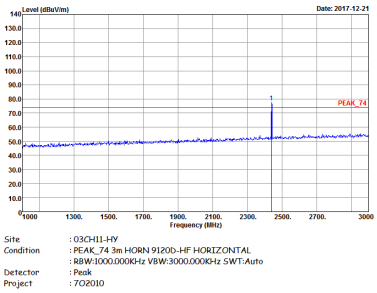
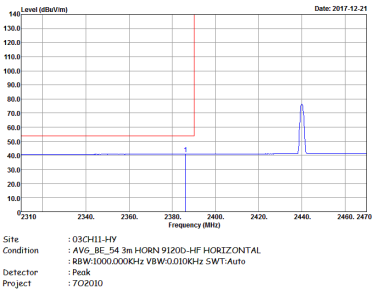
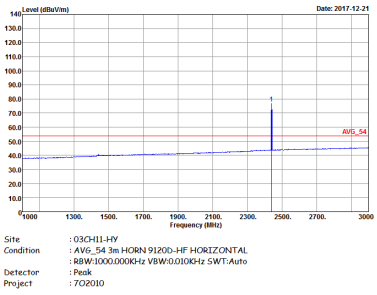
-L	**Low channel location**
-R	**High channel location**

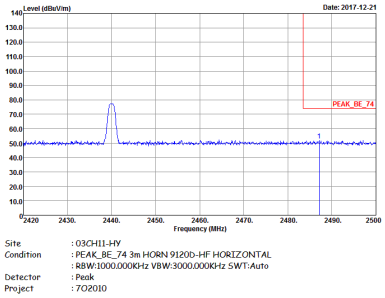
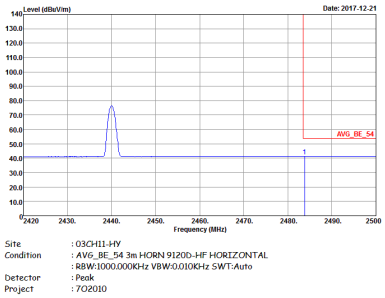
2.4GHz 2400~2483.5MHz

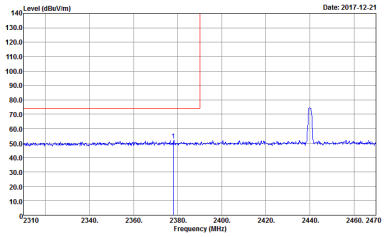
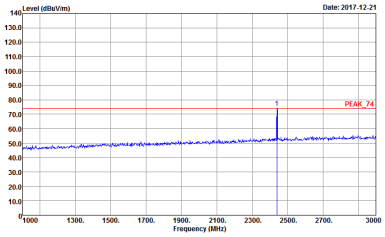
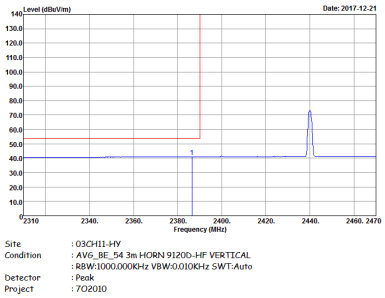
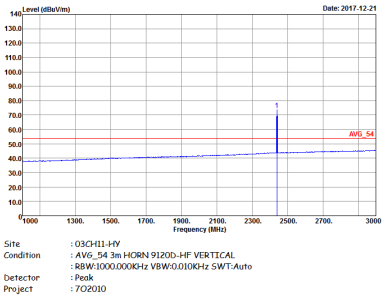
BLE (Band Edge @ 3m)

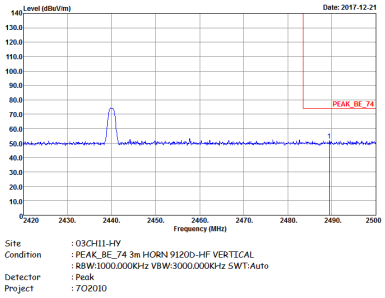
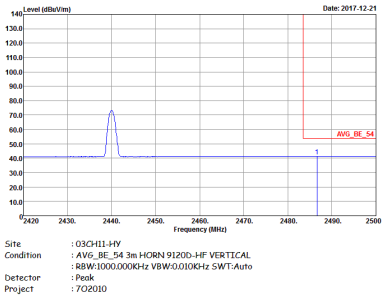
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

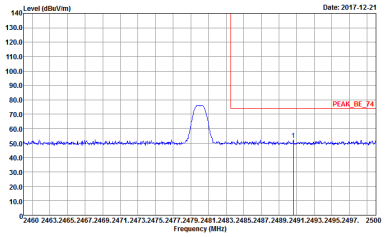
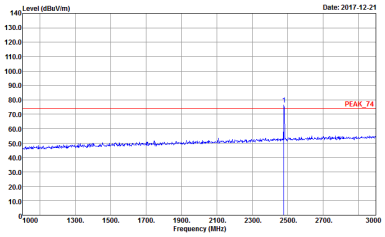
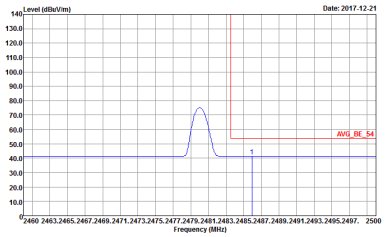
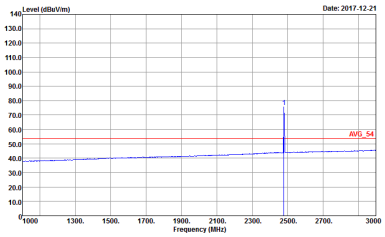
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Vertical	Fundamental
Peak		
Avg		

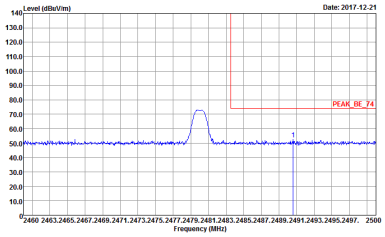
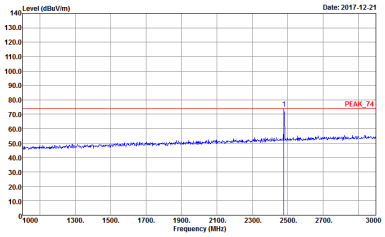
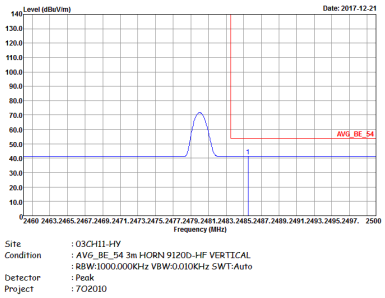
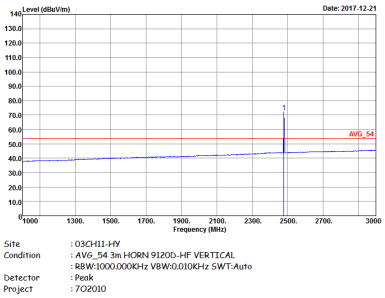
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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		
Avg.		

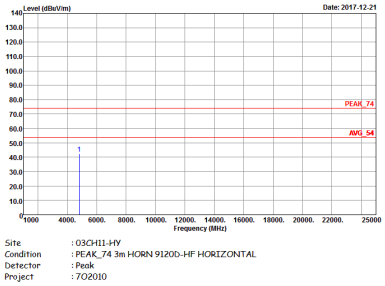
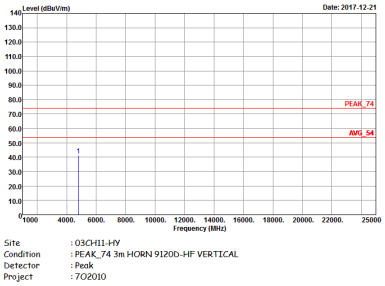
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

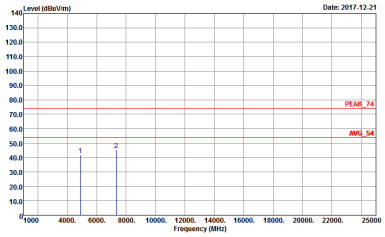
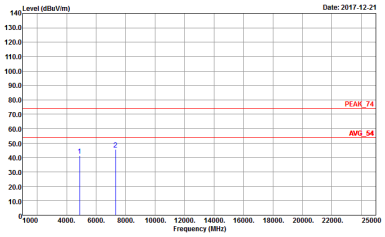
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7O2010	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 7O2010
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 7O2010	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 7O2010

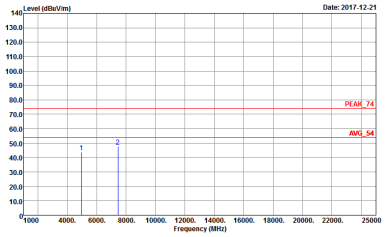
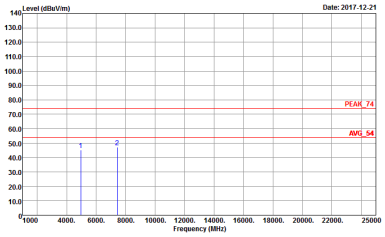
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Vertical	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

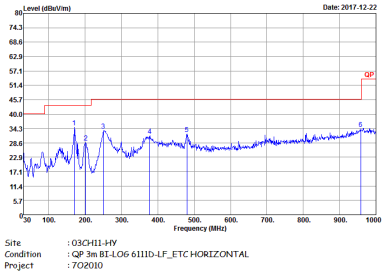
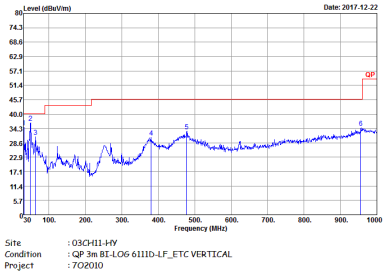
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH00 2402MHz	
1	Horizontal	Vertical
Peak Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH19 2440MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 7O2010	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 7O2010

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Vertical
Peak	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 7O2010	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 7O2010

Emission below 1GHz

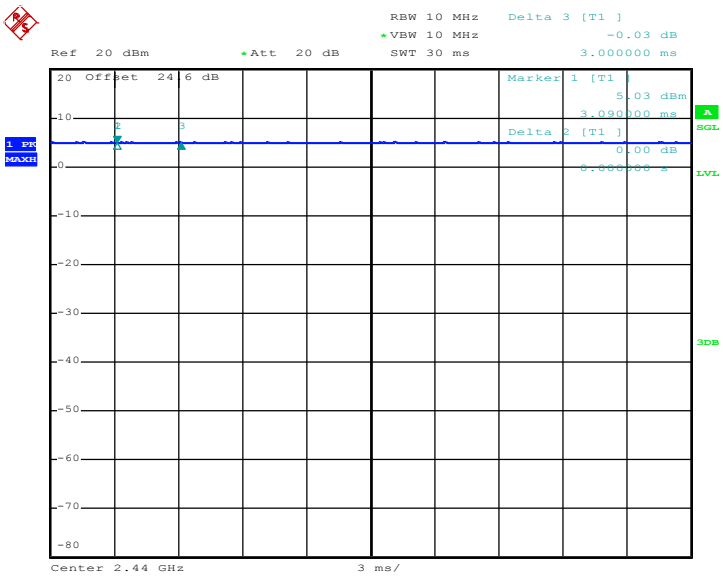
2.4GHz BLE (LF)

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

Appendix F. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth -LE	100	-	-	10Hz

Bluetooth - LE



Date: 7.DEC.2017 22:24:06