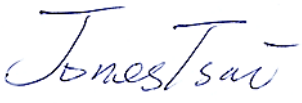
FCC RF Test Report

APPLICANT	:	LC Future Center Limited Taiwan Branch
EQUIPMENT	:	Notebook
BRAND NAME	:	Lenovo
MODEL NAME	:	TP00086A
FCC ID	:	2AJN7-TP00086A
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

This is a partial report which is included the conducted emission and radiated emission test items. The product was received on Nov. 03, 2016 and testing was completed on Dec. 03, 2016. 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

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR6N0822B	Rev. 01	Initial issue of report	Dec. 27, 2016

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.57 dB at 2489.880 MHz
3.2	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 17.45 dB at 4.860 MHz

1 General Description

1.1 Applicant

LC Future Center Limited Taiwan Branch
7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.)

1.2 Manufacturer

LC Future Center Limited Taiwan Branch
7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.)

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook
Brand Name	Lenovo
Model Name	TP00086A
FCC ID	2AJN7-TP00086A
Integrated WLAN Module	Brand Name: Intel Model Name: 8265NGW
Sample 1	EUT with Antenna 1
Sample 2	EUT with Antenna 2
EUT supports Radios application	WCDMA/HSPA/LTE WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Type of Modulation	Bluetooth LE : GFSK

1.5 Modification of EUT

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

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 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.**	
	CO04-HY	03CH07-HY

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

1.7 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 v03r05
- ANSI C63.10-2013

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

2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

a. 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: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

b. AC power line Conducted Emission was tested under maximum output power.

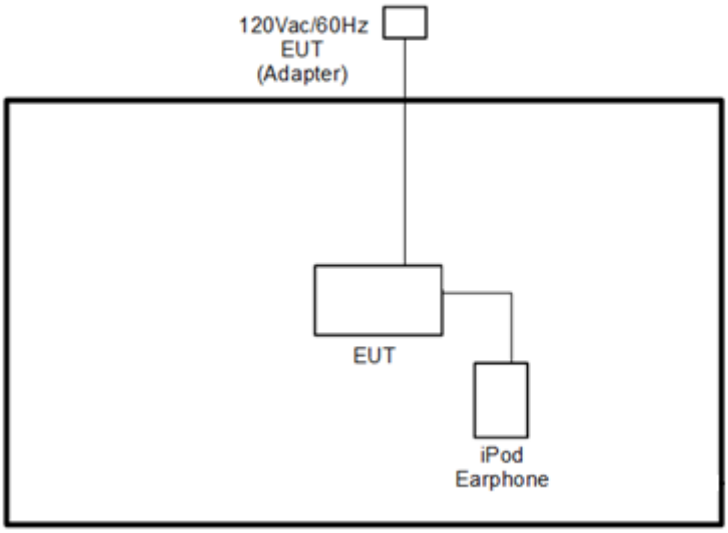
2.2 Test Mode

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

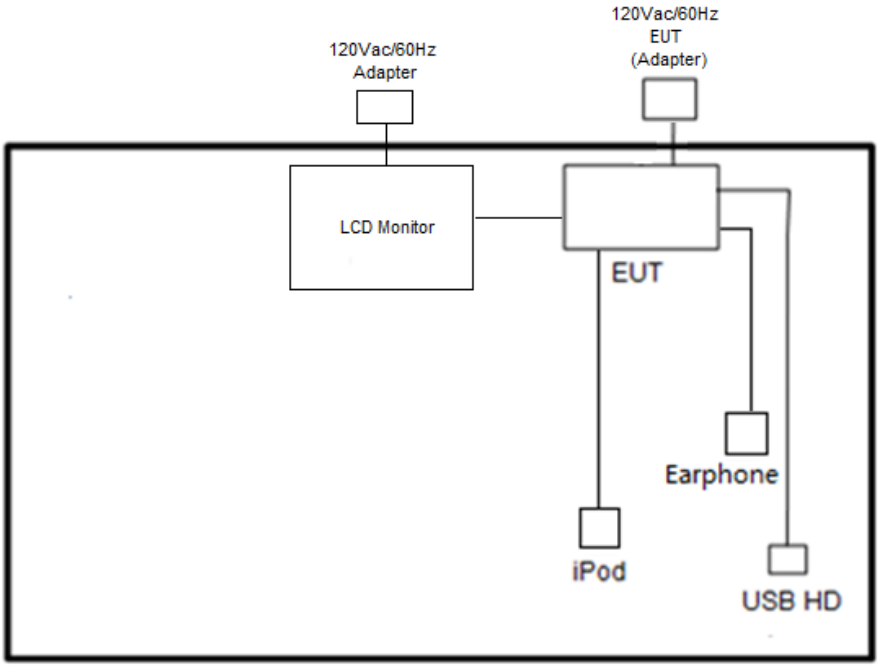
Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
	Bluetooth – LE / GFSK
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1: Bluetooth Link + TF + TC Mode 2: WLAN (2.4GHz) Link + TF + TC
Remark: 1. The worst case of conducted emission is mode 1; only the test data of it was reported. 2. All the radiated test cases were performance with Sample 2. 3. TF stands for Test Function, and consists of MPEG4 and Camera. 4. TC stands for Test Configuration, and consists of Earphone, USB HD, iPod, Adapter, SD Card, and DP Cable.	

2.3 Connection Diagram of Test System

<Bluetooth – LE Tx Mode>



<AC Conducted Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	LCD Monitor	DELL	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
2.	iPod	Apple	A1285	DoC	Shielded, 1.0m	N/A
3.	Earphone	lenovo	TS300-01MS21-8S	FCC DoC	Unshielded,1.2m	N/A
4.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
5.	HD USB	lenovo	F310S	FCC DoC	Shielded, 0.5m	N/A
6.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

For Bluetooth function, programmed RF utility, “DRTU” 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 Radiated Band Edges and Spurious Emission Measurement

3.1.1 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 FCC section 15.209 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

3.1.2 Measuring Instruments

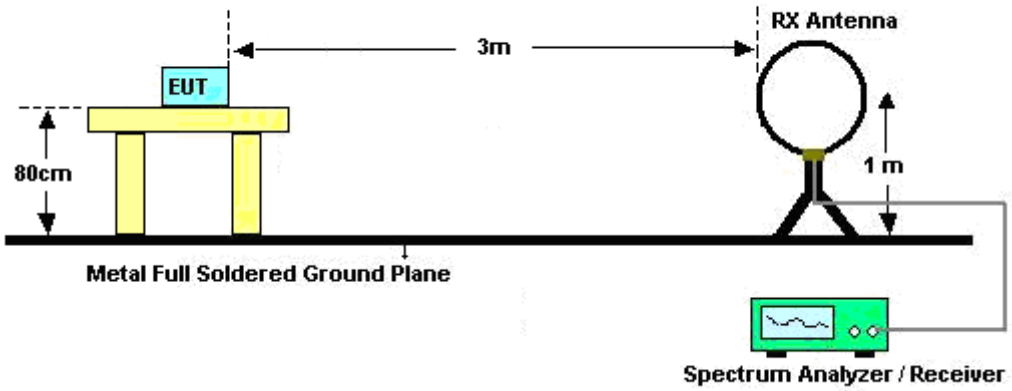
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

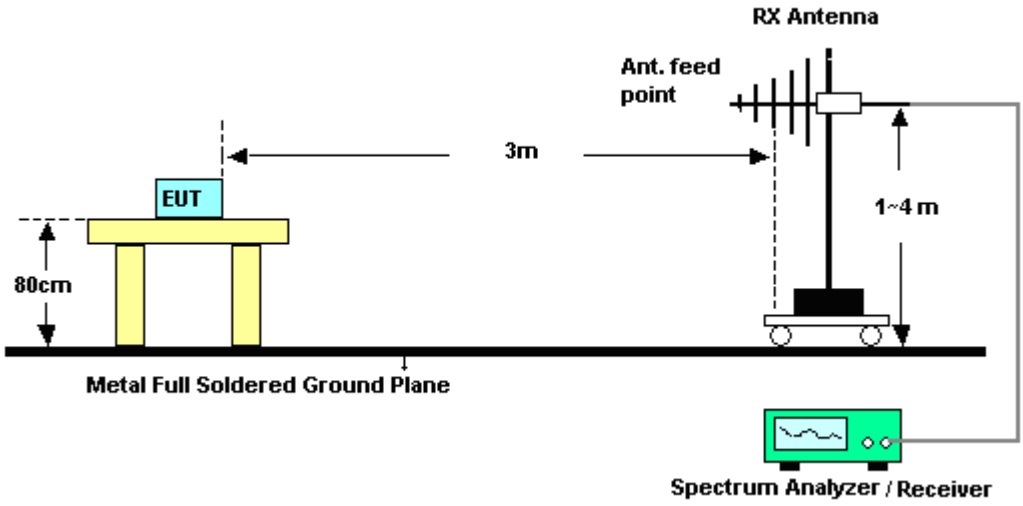
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the 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.

3.1.4 Test Setup

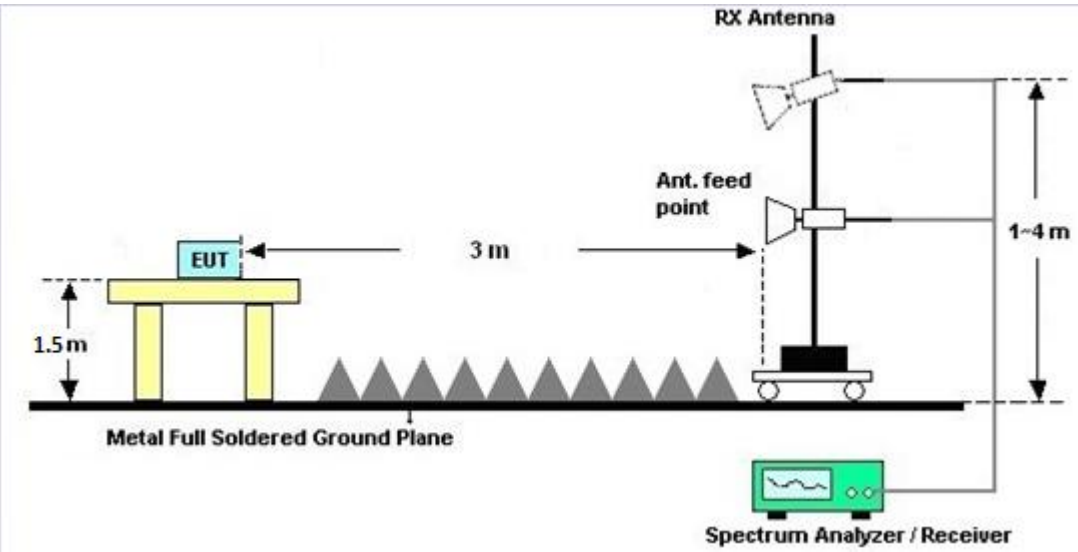
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 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 per 15.31(o) was not reported.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix A and B.

3.2 AC Conducted Emission Measurement

3.2.1 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.

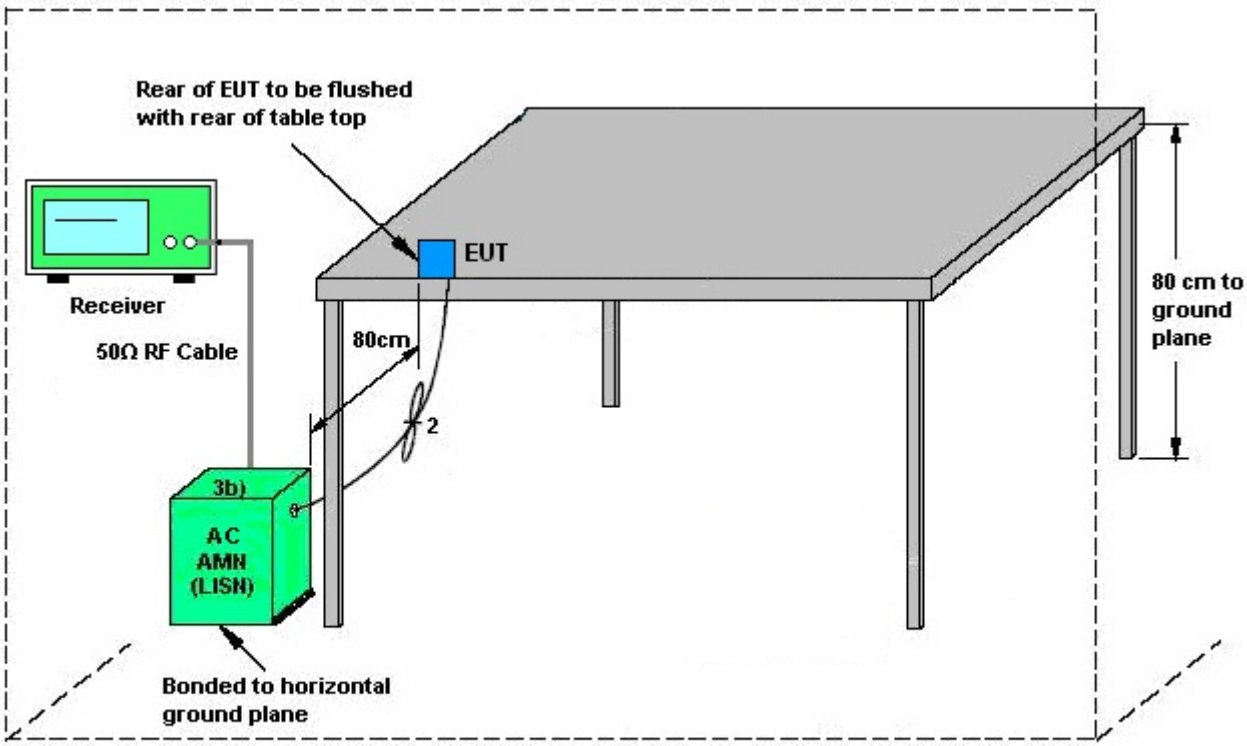
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The 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.

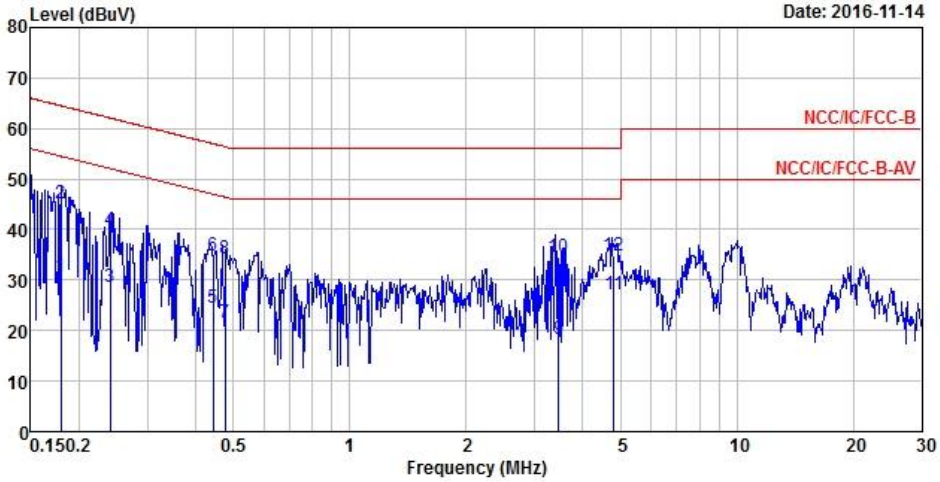
3.2.4 Test Setup



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

3.2.5 Test Result of AC Conducted Emission

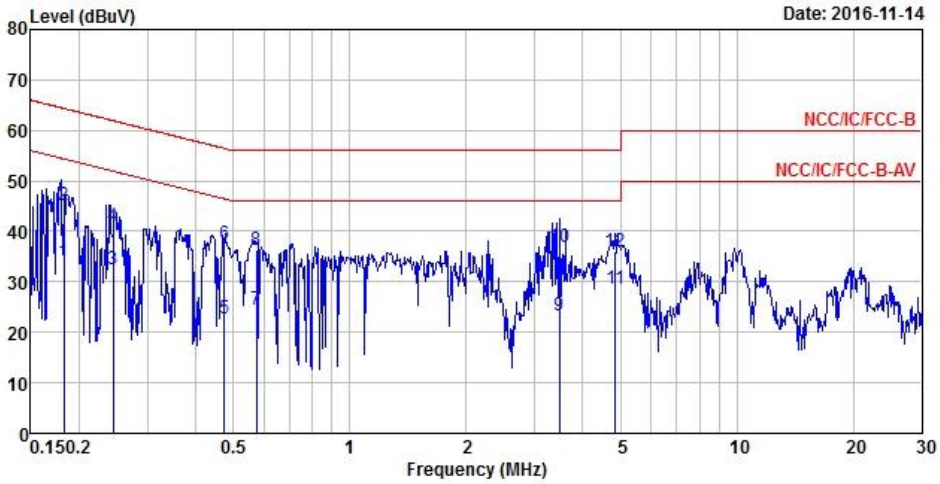
Test Mode :	Mode 1	**Temperature :**	22~24℃
Test Engineer :	James Chiu	**Relative Humidity :**	50~53%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	Bluetooth Link + TF + TC		



Site : CO04-HY
Condition: NCC/IC/FCC-B LISN-NSLK(8127-477) LINE
EUT : NB (Sierra EM7455+Intel 8265NGW) FCC
Model : Yoda
Power : 120V/60Hz

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Aux Factor	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	dB	
1	0.18	30.67	-23.83	54.50	20.42	0.11	0.27	9.87	Average
2	0.18	45.08	-19.42	64.50	34.83	0.11	0.27	9.87	QP
3	0.24	28.50	-23.59	52.09	18.27	0.11	0.25	9.87	Average
4	0.24	39.97	-22.12	62.09	29.74	0.11	0.25	9.87	QP
5	0.44	24.54	-22.43	46.97	14.44	0.12	0.10	9.88	Average
6	0.44	34.76	-22.21	56.97	24.66	0.12	0.10	9.88	QP
7	0.48	21.56	-24.84	46.40	11.46	0.12	0.10	9.88	Average
8	0.48	34.31	-22.09	56.40	24.21	0.12	0.10	9.88	QP
9	3.47	18.20	-27.80	46.00	7.99	0.17	0.14	9.90	Average
10	3.47	34.68	-21.32	56.00	24.47	0.17	0.14	9.90	QP
11 MAX	4.82	27.13	-18.87	46.00	16.92	0.19	0.12	9.90	Average
12	4.82	34.72	-21.28	56.00	24.51	0.19	0.12	9.90	QP

Test Mode :	Mode 1	Temperature :	22~24℃
Test Engineer :	James Chiu	Relative Humidity :	50~53%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + TF + TC		



Site : CO04-HY
Condition: NCC/IC/FCC-B LISN-NSLK(8127-477) NEUTRAL
EUT : NB (Sierra EM7455+Intel 8265NGW) FCC
Model : Yoda
Power : 120V/60Hz

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Aux Factor	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	dB	
1	0.18	34.04	-20.33	54.37	23.79	0.11	0.27	9.87	Average
2	0.18	45.22	-19.15	64.37	34.97	0.11	0.27	9.87	QP
3	0.24	32.53	-19.40	51.93	22.31	0.11	0.24	9.87	Average
4	0.24	41.18	-20.75	61.93	30.96	0.11	0.24	9.87	QP
5	0.47	22.83	-23.61	46.44	12.73	0.12	0.10	9.88	Average
6	0.47	37.35	-19.09	56.44	27.25	0.12	0.10	9.88	QP
7	0.57	24.43	-21.57	46.00	14.33	0.12	0.10	9.88	Average
8	0.57	36.45	-19.55	56.00	26.35	0.12	0.10	9.88	QP
9	3.47	23.26	-22.74	46.00	13.05	0.17	0.14	9.90	Average
10	3.47	36.75	-19.25	56.00	26.54	0.17	0.14	9.90	QP
11 MAX	4.86	28.55	-17.45	46.00	18.33	0.20	0.12	9.90	Average
12	4.86	35.87	-20.13	56.00	25.65	0.20	0.12	9.90	QP

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Nov. 14, 2016	N/A	Conduction (CO04-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	Nov. 14, 2016	Aug. 29, 2017	Conduction (CO04-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 02, 2015	Nov. 14, 2016	Dec. 01, 2016	Conduction (CO04-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 14, 2015	Nov. 14, 2016	Dec. 13, 2016	Conduction (CO04-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	35419&03	30MHz to 1GHz	Jan. 13, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Jan. 12, 2017	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 19, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Aug. 18, 2017	Radiation (03CH07-HY)
EMI Test Receiver	Keysight	N9038A (MXE)	MY54130085	20Hz ~ 8.4GHz	Oct. 26, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Oct. 25, 2017	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Sep. 02, 2015	Nov. 25, 2016 ~ Dec. 03, 2016	Sep. 01, 2017	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590075	1GHz ~ 18GHz	Apr. 15, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Apr. 14, 2017	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	Mar. 18, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Mar. 17, 2017	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Oct. 12, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Oct. 11, 2017	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Feb. 27, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Feb. 26, 2017	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Nov. 25, 2016 ~ Dec. 03, 2016	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Nov. 25, 2016 ~ Dec. 03, 2016	N/A	Radiation (03CH07-HY)
Preamplifier	MITEQ	JS44-18004000-33-8P	1840917	18GHz ~ 40GHz	Jun. 14, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Jun. 13, 2017	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 08, 2016	Nov. 25, 2016 ~ Dec. 03, 2016	Nov. 07, 2017	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))	**2.20**

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. Radiated Spurious Emission

Test Engineer :	Jesse Wang, James Chiu and Daniel Lee	Temperature :	21~23°C
		Relative Humidity :	47~51%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 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		2388.54	55.65	-18.35	74	51.12	32.19	7.31	34.97	364	137	P	H
		2385.075	45.47	-8.53	54	40.99	32.14	7.31	34.97	364	137	A	H
	*	2402	97.54	-	-	93.02	32.19	7.31	34.98	364	137	P	H
	*	2402	97.02	-	-	92.5	32.19	7.31	34.98	364	137	A	H
													H
													H
		2372.895	55.39	-18.61	74	50.98	32.14	7.24	34.97	278	185	P	V
		2322.075	46.42	-7.58	54	42.22	31.98	7.18	34.96	278	185	A	V
	*	2402	101.74	-	-	97.22	32.19	7.31	34.98	278	185	P	V
	*	2402	101.15	-	-	96.63	32.19	7.31	34.98	278	185	A	V
													V
													V
BLE CH 19 2440MHz		2370.9	54.88	-19.12	74	50.47	32.14	7.24	34.97	358	132	P	H
		2374.96	45.21	-8.79	54	40.8	32.14	7.24	34.97	358	132	A	H
	*	2440	96.84	-	-	92.13	32.34	7.36	34.99	358	132	P	H
	*	2440	96.3	-	-	91.59	32.34	7.36	34.99	358	132	A	H
		2486.42	54.85	-19.15	74	50	32.45	7.4	35	358	132	P	H
		2491.46	45.74	-8.26	54	40.84	32.5	7.4	35	358	132	A	H
		2355.5	54.47	-19.53	74	50.11	32.09	7.24	34.97	274	176	P	V
		2359.98	47.6	-6.4	54	43.24	32.09	7.24	34.97	274	176	A	V
	*	2440	101.95	-	-	97.24	32.34	7.36	34.99	274	176	P	V
	*	2440	101.29	-	-	96.58	32.34	7.36	34.99	274	176	A	V
		2484.32	54.43	-19.57	74	49.58	32.45	7.4	35	274	176	P	V
		2496.92	45.64	-8.36	54	40.75	32.5	7.4	35.01	274	176	A	V

BLE CH 39 2480MHz	*	2480	95.61	-	-	90.76	32.45	7.4	35	380	103	P	H
	*	2480	94.92	-	-	90.07	32.45	7.4	35	380	103	A	H
		2490	57.63	-16.37	74	52.73	32.5	7.4	35	380	103	P	H
		2489.88	48.76	-5.24	54	43.86	32.5	7.4	35	380	103	A	H
													H
													H
	*	2480	101.54	-	-	96.69	32.45	7.4	35	269	174	P	V
	*	2480	101.07	-	-	96.22	32.45	7.4	35	269	174	P	V
		2489.96	60.4	-13.6	74	55.5	32.5	7.4	35	269	174	P	V
		2489.88	52.43	-1.57	54	47.53	32.5	7.4	35	269	174	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4804	40.72	-33.28	74	54.29	33.68	11.83	59.08	100	0	P	H
													H
													H
													H
		4804	40.87	-33.13	74	54.44	33.68	11.83	59.08	100	0	P	V
													V
													V
													V
BLE CH 19 2440MHz		4880	39.64	-34.36	74	53.51	33.54	11.53	58.94	100	0	P	H
		7320	39.31	-34.69	74	48.81	34.65	13.81	57.96	100	0	P	H
													H
													H
		4880	40.04	-33.96	74	53.91	33.54	11.53	58.94	100	0	P	V
		7320	39.46	-34.54	74	48.96	34.65	13.81	57.96	100	0	P	V
													V
													V
BLE CH 39 2480MHz		4960	41.11	-32.89	74	55.29	33.37	11.22	58.77	100	0	P	H
		7440	40	-34	74	49.75	34.33	14.05	58.13	100	0	P	H
													H
													H
		4960	39.25	-34.75	74	53.43	33.37	11.22	58.77	100	0	P	V
		7440	40.21	-33.79	74	49.96	34.33	14.05	58.13	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	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		58.35	29.48	-10.52	40	47.38	12.62	1.07	31.59	-	-	P	H
		203.34	33.41	-10.09	43.5	46.9	16.11	1.87	31.47	-	-	P	H
		273.27	31.39	-14.61	46	41.04	19.36	2.32	31.33	-	-	P	H
		324.5	36.26	-9.74	46	44.6	20.5	2.41	31.25	100	0	P	H
		841.8	31.94	-14.06	46	29.87	28.54	4.1	30.57	-	-	P	H
		932.1	33.26	-12.74	46	29.89	29.78	4.12	30.53	-	-	P	H
													H
													H
													H
													H
													H
													H
		59.7	36.93	-3.07	40	55.44	12	1.07	31.58	100	0	P	V
		104.52	29.54	-13.96	43.5	42.66	16.85	1.55	31.52	-	-	P	V
		280.56	33.97	-12.03	46	43.66	19.3	2.32	31.31	-	-	P	V
		764.1	30.86	-15.14	46	30.34	27.34	3.82	30.64	-	-	P	V
		829.9	31.55	-14.45	46	29.72	28.31	4.1	30.58	-	-	P	V
		948.9	32.96	-13.04	46	29.24	30.18	4.07	30.53	-	-	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	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b 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 B. Radiated Spurious Emission Plots

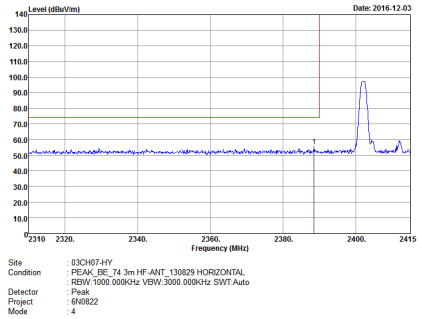
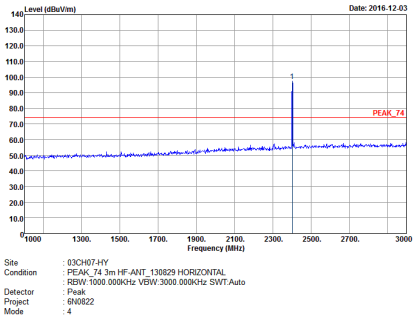
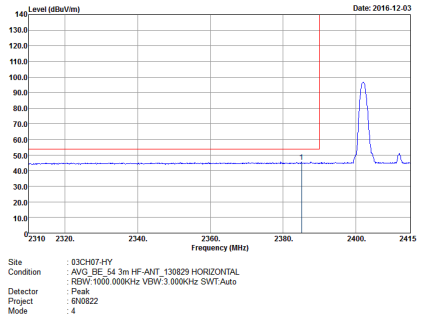
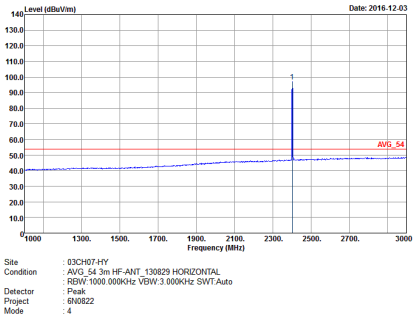
Test Engineer :	Jesse Wang, James Chiu and Daniel Lee	**Temperature :**	21~23°C
		Relative Humidity :	47~51%

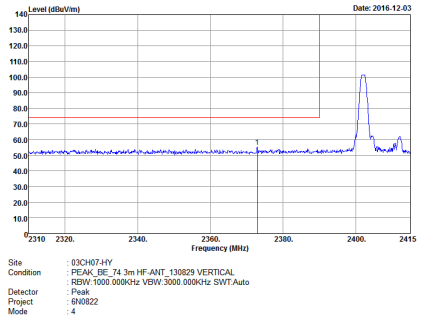
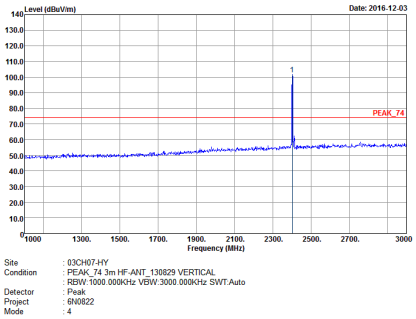
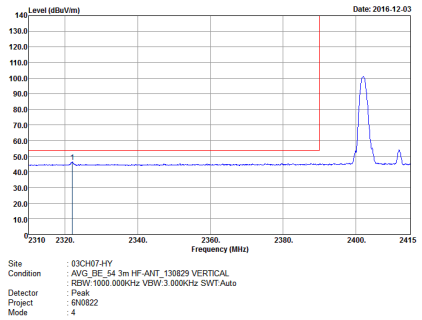
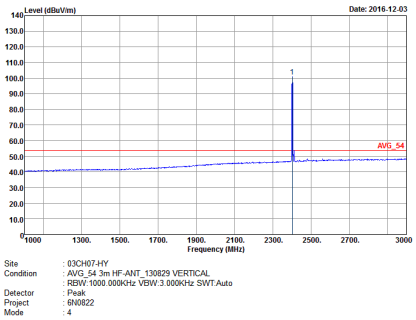
Note symbol

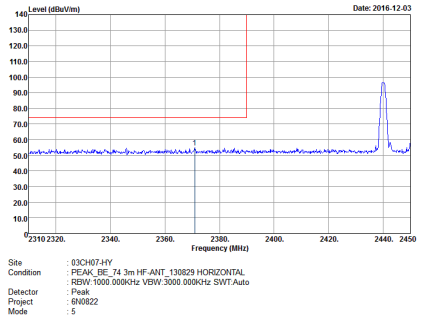
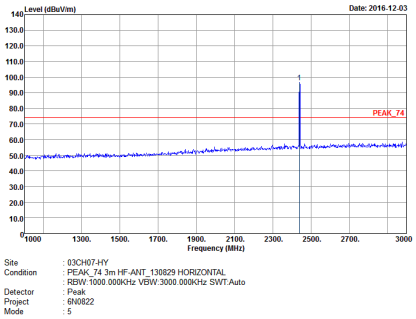
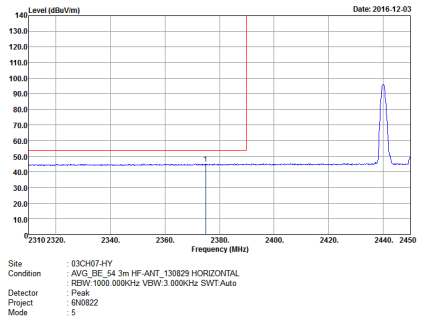
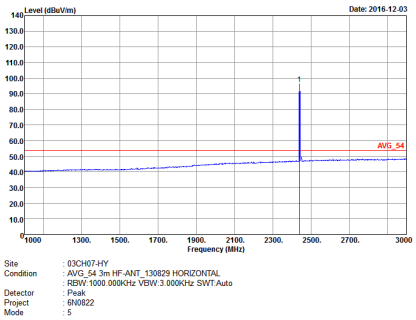
-L	**Low channel location**
-R	**High channel location**

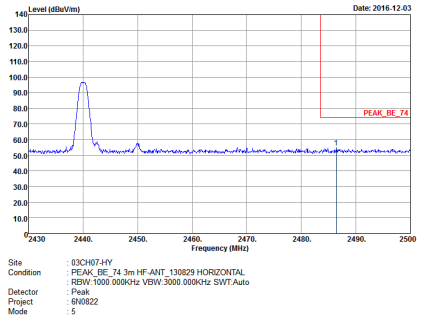
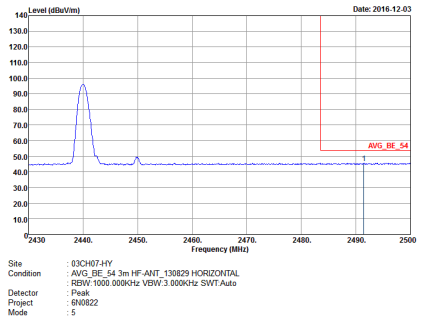
2.4GHz 2400~2483.5MHz

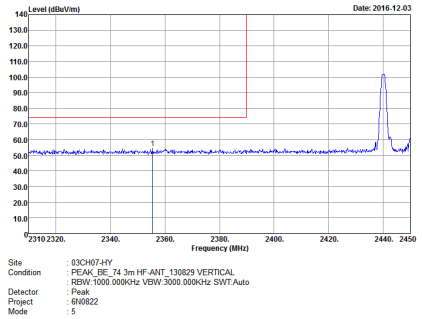
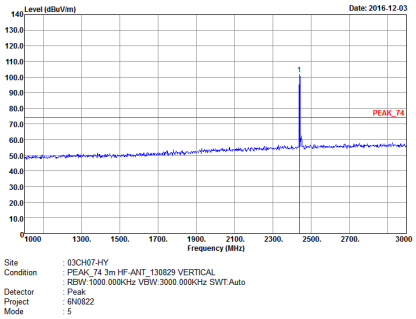
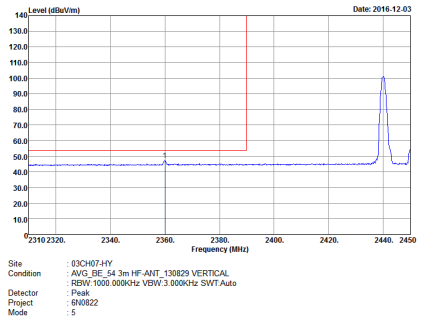
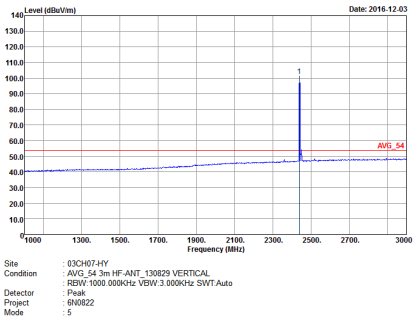
BLE (Band Edge @ 3m)

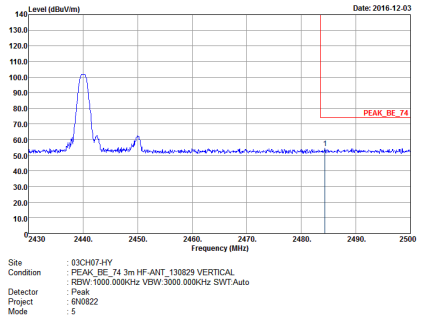
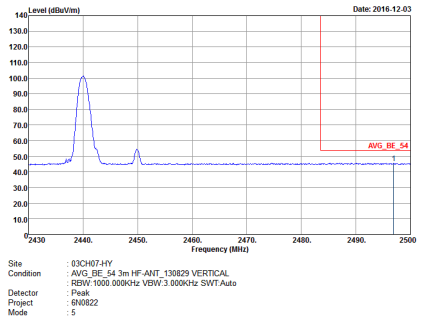
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
2	Horizontal	Fundamental
Peak		
Avg.		

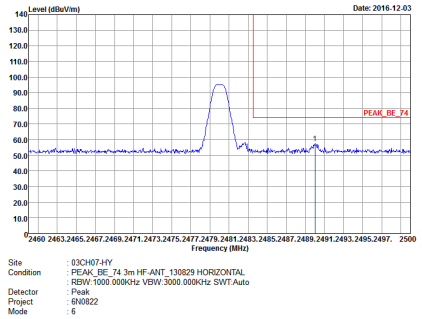
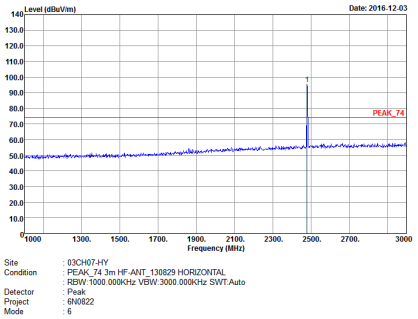
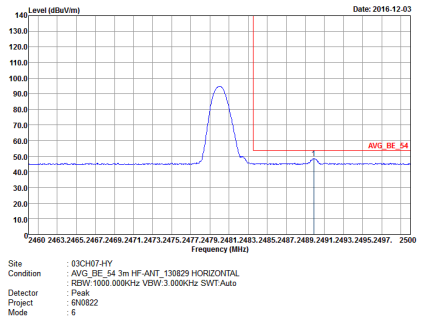
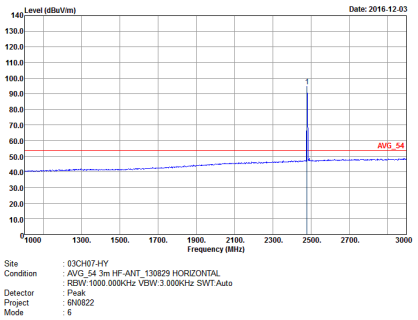
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
2	Vertical	Fundamental
Peak		
Avg		

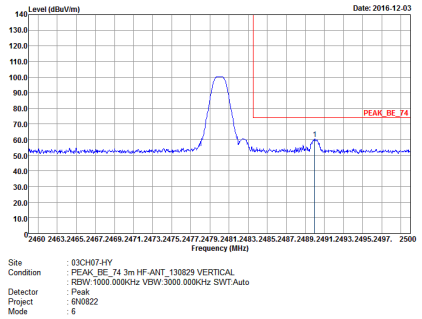
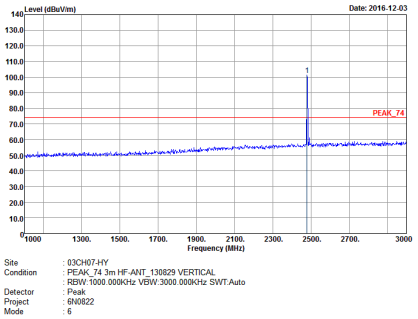
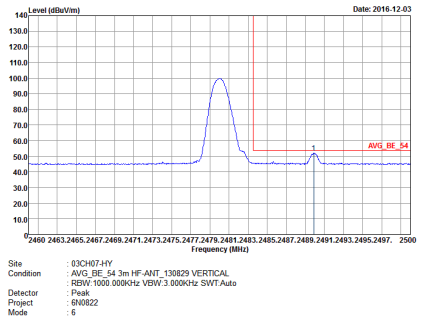
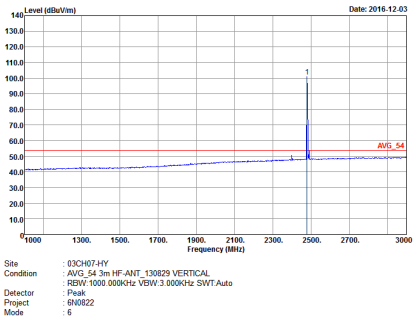
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
2	Horizontal	Fundamental
Peak		
Avg.		

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

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

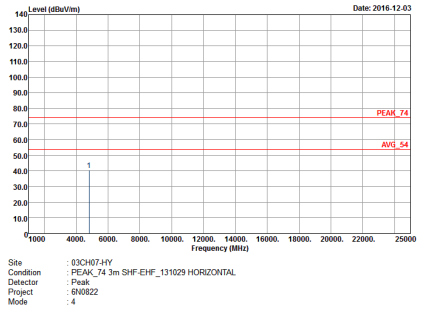
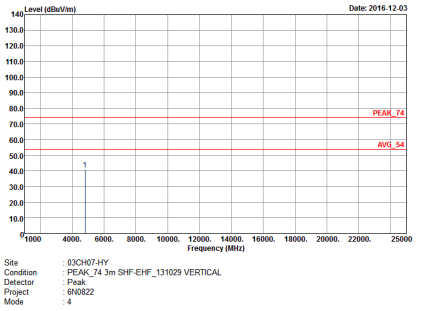
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - R	
2	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

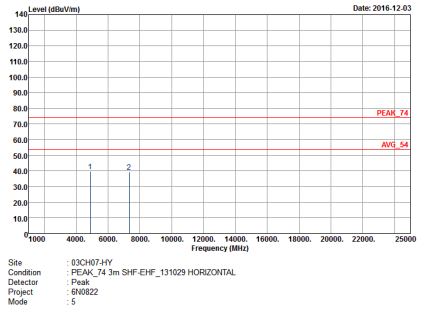
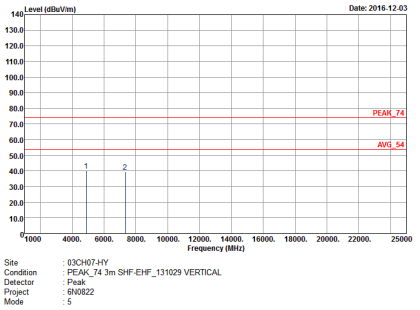
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
2	Horizontal	Fundamental
Peak		
Avg.		

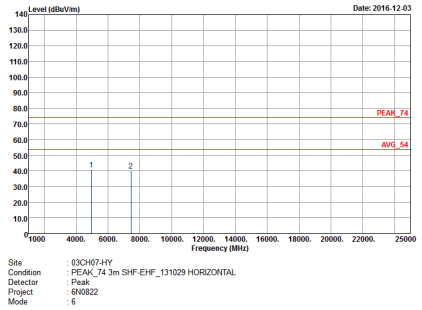
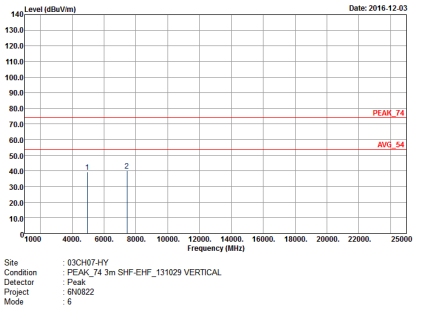
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
2	Vertical	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

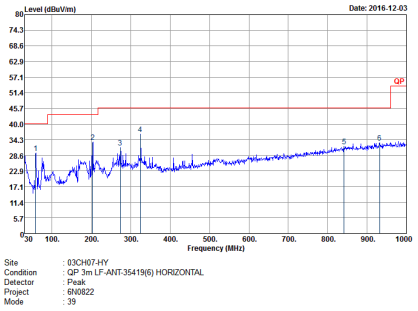
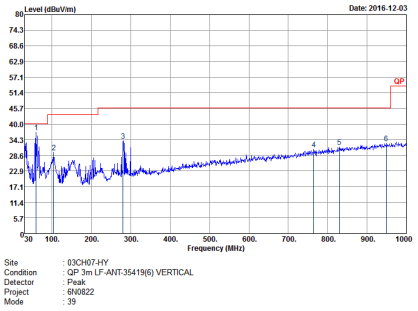
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE CH00 2402MHz	
2	Horizontal	Vertical
Peak Avg.		

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

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

Emission below 1GHz

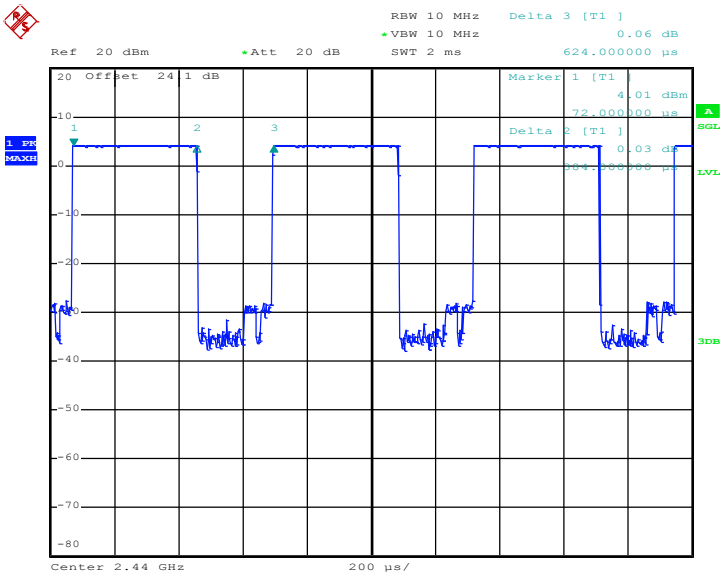
2.4GHz BLE (LF)

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

Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth -LE	61.538	384	2.60	3kHz

Bluetooth -LE



Date: 11.NOV.2016 21:27:02

Appendix E. Antenna Information

Antenna Information			
Antenna 1	Manufacturer	Amphenol	
	Antenna Type	Main: PIFA Antenna	Aux.: PIFA Antenna
	Part number	LX7847-16-000-C	LX7848-16-000-C
	Peak gain	Main Antenna : WLAN(2.4GHz): -6.76 WLAN(5GHz): -1.84	Aux. Antenna : WLAN(2.4GHz): -6.52 Bluetooth : -6.52 WLAN(5GHz): 0.14
Antenna 2	Manufacturer	Speedwire	
	Antenna Type	Main: PIFA Antenna	Aux.: PIFA Antenna
	Part number	F.0G.ZV-0006-003-00	F.0G.ZV-0006-004-00
	Peak gain	Main Antenna : WLAN(2.4GHz): 1.5 WLAN(5GHz): -1.97	Aux. Antenna : WLAN(2.4GHz): 1.68 Bluetooth : 1.68 WLAN(5GHz): -0.3