FCC RF TEST REPORT

47 CFR FCC Part 15 Subpart C § 15.249

Equipment	**:**	**UniFi Security Gateway**
MODEL NAME	**:**	**USG-XG-8**
FCC ID	**:**	**SWX-USGXG**

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
FR781006	Rev. 01	Initial issue of report	Sep. 08, 2017
FR781006	Rev. 02	Add applicable standards in section 2.8 and include ANSI version date in section 3.1.3	Sep. 27, 2017

1. SUMMARY OF THE TEST RESULT

Applied Standard				
Part	**FCC Rule**	**Description of Test**	**Result**	**Remark**
3.1	15.207	AC Power Line Conducted Emissions	Complies	Under limit 23.00 dB at 4.758 MHz
3.2	2.1049	20dB & 99% Occupied Bandwidth	Complies	-
3.3	15.249(a)	Field Strength of Fundamental Emissions	Complies	Max level 82.65 dBμV/m at 2402.000 MHz
3.3	15.249(a)(d)	Radiated Spurious Emissions	Complies	Under limit 4.62 dB at 449.800MHz
3.4	15.203	Antenna Requirements	Complies	-
Note: Not required means after assessing, test items are not necessary to carry out.				

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.70**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.10**

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.70**

2. GENERAL INFORMATION

2.1 Applicant

Ubiquiti Networks, Inc.

685 Third Avenue, 27th Floor New York, New York 10017 USA

2.2 Manufacturer

Ubiquiti Networks, Inc.

685 Third Avenue, 27th Floor New York, New York 10017 USA

2.3 Product Details

Bluetooth

Product Specification subjective to this standard	
Antenna Type	Bluetooth: Internal Antenna

2.4 Modification of EUT

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

2.5 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	-	-

2.6 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 emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

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

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
Conducted 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
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 + SFP+ Link + LAN Link + AC Charging

2.7 Table for Testing Locations

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	CO05-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.**	**FCC Registration No.**
	03CH12-HY	TW0007

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

2.8 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 §15.249
- ANSI C63.10-2013
- ANSI C63.4 2014

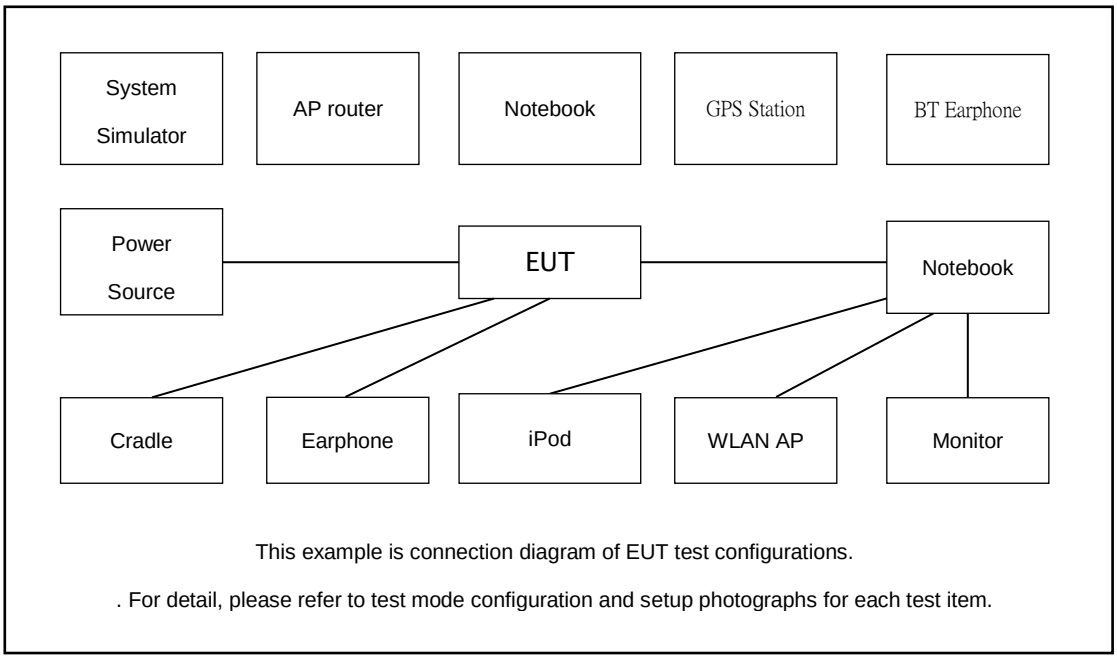
2.9 Table for Supporting Units

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.10 EUT Operation Test Setup

For Bluetooth LE test items, RJ-45 to RS-232 cable and RS-232 to USB cable enabled EUT to connect with the notebook and the programmed RF utility “Putty” installed in the notebook made the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

2.11 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.

3. TEST RESULT

3.1 AC Power Line Conducted Emissions Measurement

3.1.1 Limit

For a Low-power Radio-frequency device which is designed to be connected to the 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 below limits table.

Frequency (MHz)	QP Limit (dBμV)	AV Limit (dBμV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

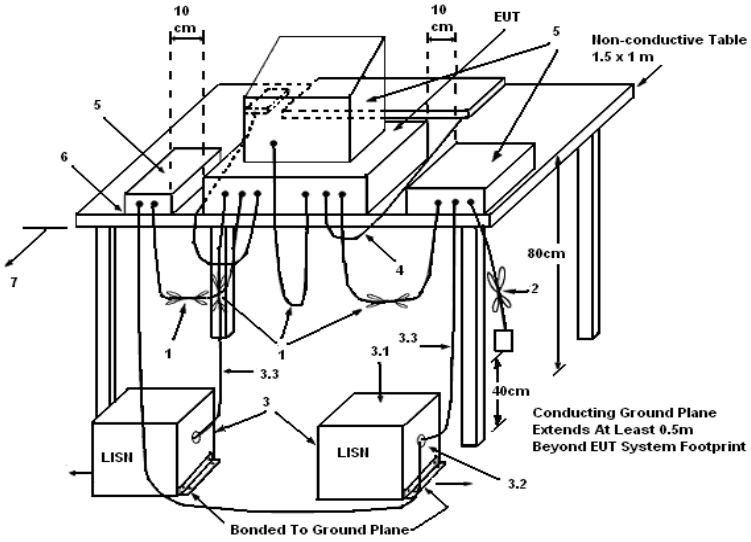
3.1.2 Measuring Instruments

Please refer to section 4 of equipment list in this report.

3.1.3 Test Procedures

1. Configure the EUT according to ANSI C63.4 2014. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

3.1.4 Test Setup Layout



LEGEND:

(1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

(2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

(3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground plane.

(3.1) All other equipment powered from additional LISN(s).

(3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

(3.3) LISN at least 80 cm from nearest part of EUT chassis.

(4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

(5) Non-EUT components of EUT system being tested.

(6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

(7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

3.1.5 Test Deviation

There is no deviation with the original standard.

3.1.6 EUT Operation during Test

The EUT was placed on the test table and programmed in transmitting function.

3.1.7 Results of AC Power Line Conducted Emissions Measurement

Please refer to Appendix A

3.2 20dB and & 99% Occupied Bandwidth

3.2.1 Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band.

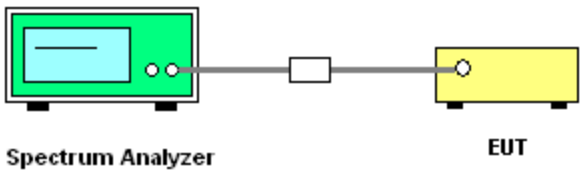
3.2.2 Measuring Instruments

Please refer to section 4 of equipment list in this report.

3.2.3 Test Procedures

1. The transmitter output port was connected to the spectrum analyzer.
2. Measured the spectrum width with highest power setting.

3.2.4 Test Setup Layout



3.2.5 Test Deviation

There is no deviation with the original standard.

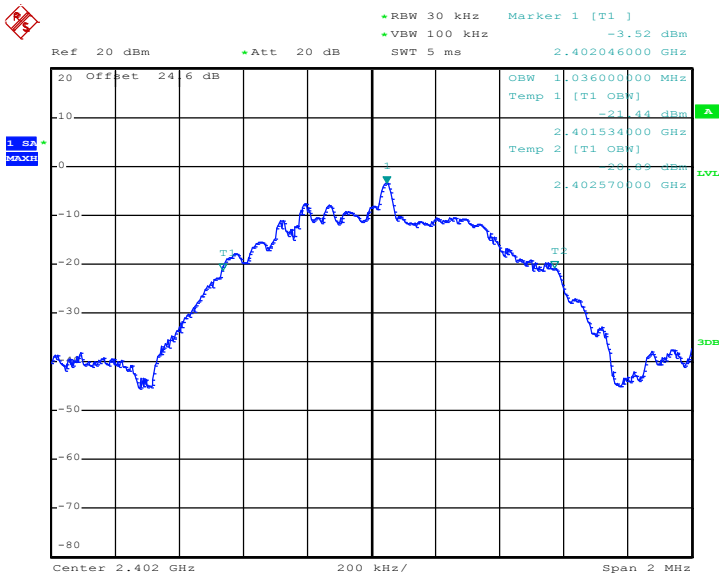
3.2.6 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

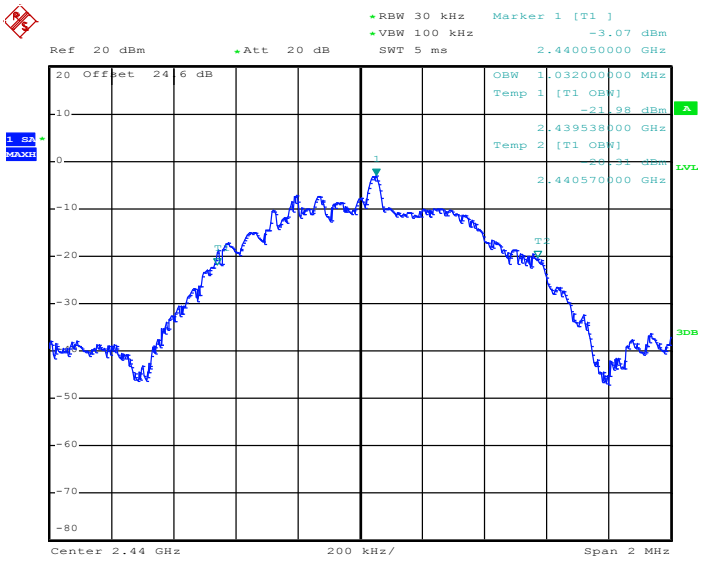
3.2.7 Test Result of 99% Occupied Bandwidth

Final Test Date	Aug. 23, 2017	Test Site No.	TH05-HY
Temperature	21~25°C	Humidity	51~54%
Test Engineer	Derek Hsu		

99% Occupied Bandwidth Plot on Channel 00

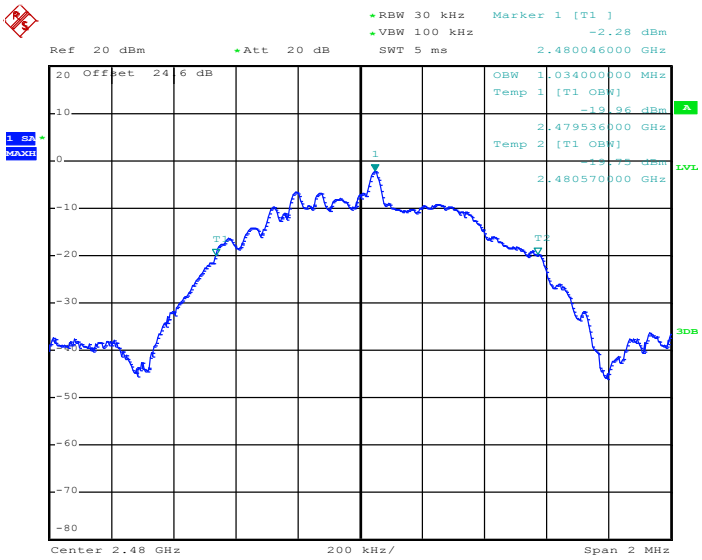


99% Occupied Bandwidth Plot on Channel 19



Date: 23.AUG.2017 09:58:14

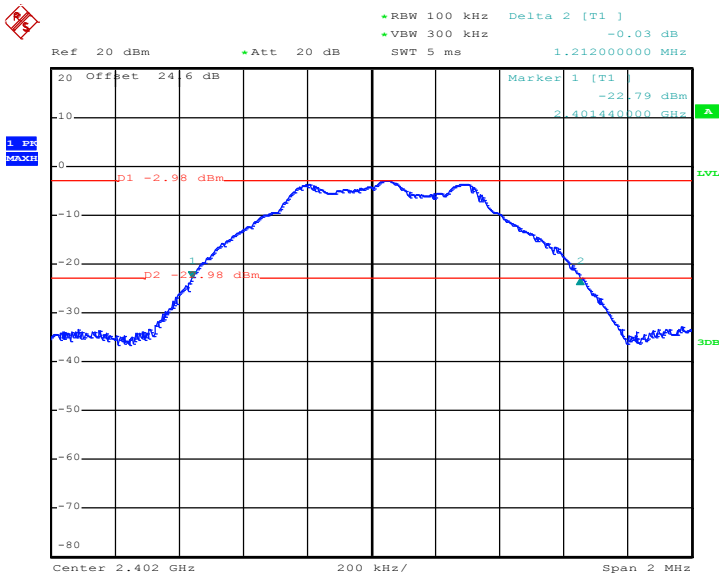
99% Occupied Bandwidth Plot on Channel 39



Date: 23.AUG.2017 09:54:33

3.2.8 Test Result of 20dB Bandwidth

20 dB Bandwidth Plot on Channel 00



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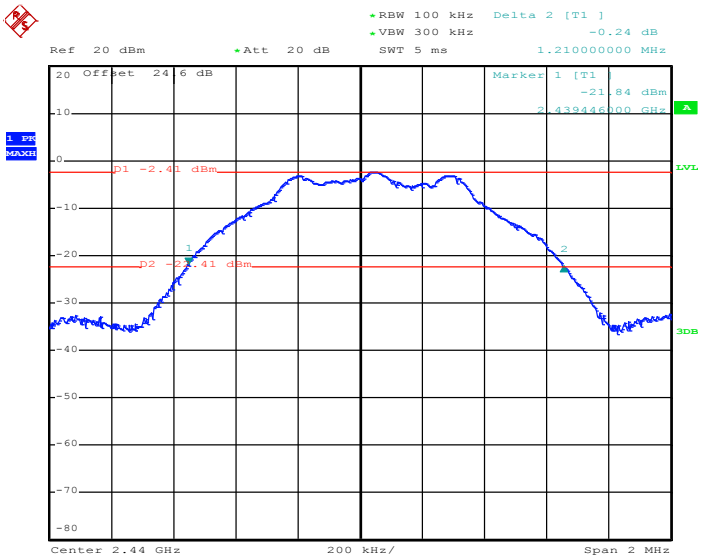
20 dB Bandwidth Plot on Channel 19



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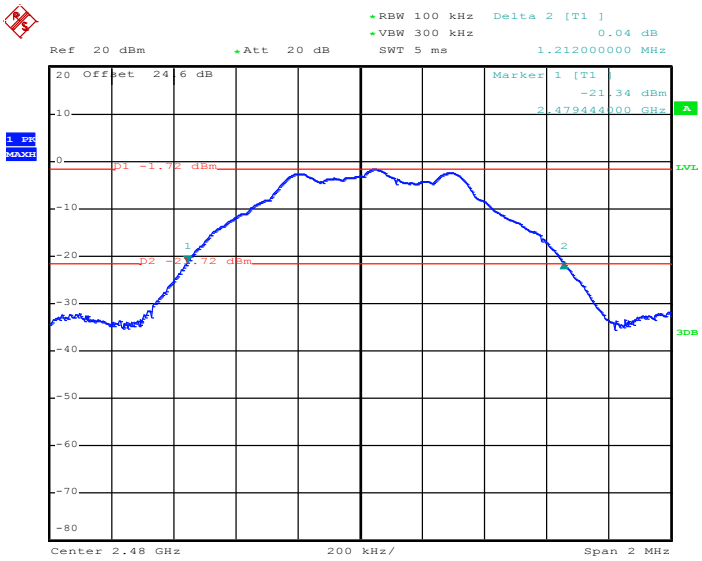
20 dB Bandwidth Plot on Channel 39



Date: 23.AUG.2017 09:55:18

3.3 Field Strength of Fundamental Emissions and Radiated Spurious Emissions

3.3.1 Limit

The field strength measured at 3 meters shall not exceed the limits in the following table:

Fundamental Frequencies(MHz)	Field Strength(millivolts/m)	
	Fundamental	Harmonics
902~928	50	0.5
2400~2483.5	50	0.5
5725~5875	50	0.5

Note: The limits shown in the above table are based on measurements using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using a CISPR quasi-peak detector.

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in 15.209 as below, whichever is less stringent.

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

3.3.2 Measuring Instruments

Please refer to section 4 of equipment list in this report.

3.3.3 Test Procedures

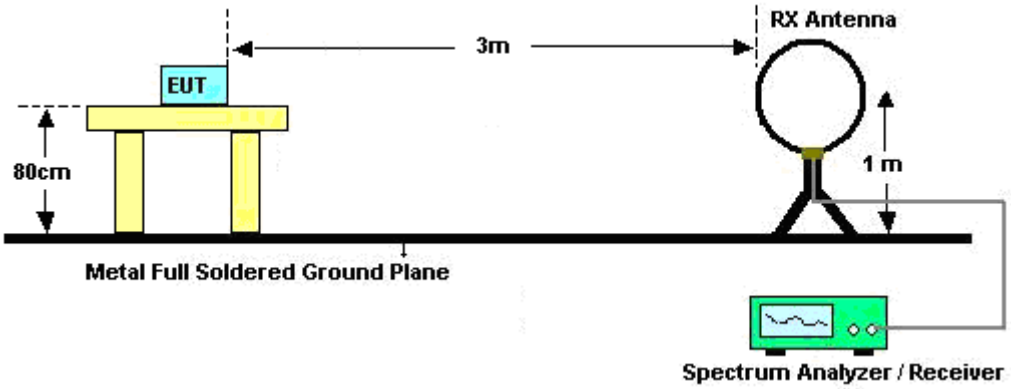
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.

Remark:

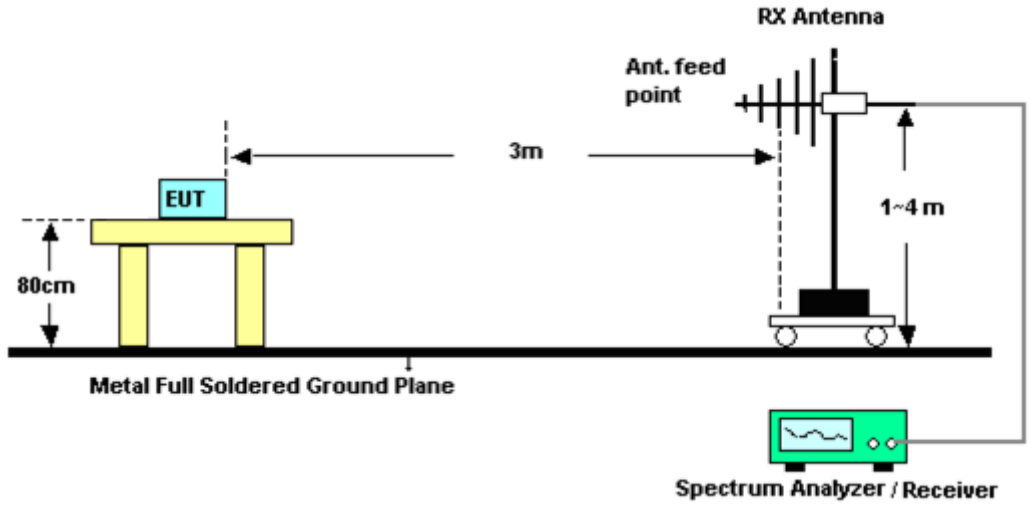
1. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
2. For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = N1*L1+N2*L2+...+Nn-1*LNn-1+Nn*Ln
   Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log(Duty cycle)

3.3.4 Test Setup Layout

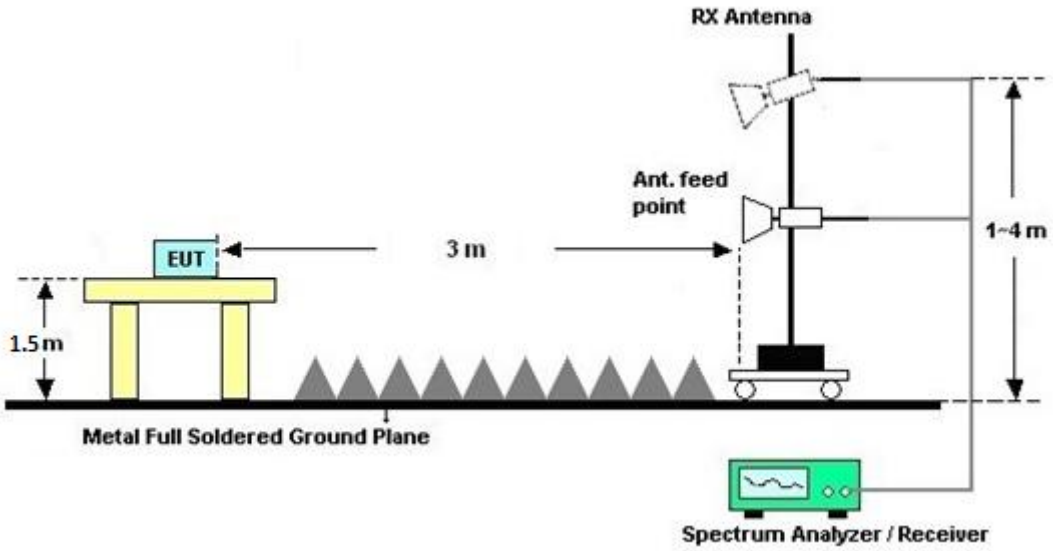
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.3.5 Test Deviation

There is no deviation with the original standard.

3.3.6 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

3.3.7 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.

3.3.8 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.3.9 Duty Cycle

Please refer to Appendix D.

3.3.10 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix B and C

3.4 Antenna Requirements

3.4.1 Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

3.4.2 Antenna Connector Construction

Enbedded in Antenna.

4. LIST OF MEASURING EQUIPMENT

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Agilent	E4416A	GB41292344	NA	Dec. 26, 2016	Aug. 23, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 26, 2016	Aug. 23, 2017	Dec. 25, 2017	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100057	9kHz-40GHz	Nov. 25, 2016	Aug. 23, 2017	Nov. 24, 2017	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Aug. 18, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	Aug. 18, 2017	Aug. 29, 2017	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	May 02, 2017	Aug. 18, 2017	May 01, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Aug. 18, 2017	Nov. 28, 2017	Conduction (CO05-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	Aug. 29, 2017	Jul. 17, 2018	Radiation (03CH12-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Oct. 20, 2016	Aug. 29, 2017	Oct. 19, 2018	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	37059&01	30MHz~1GHz	Oct. 15, 2016	Aug. 29, 2017	Oct. 14, 2017	Radiation (03CH12-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	Dec. 23, 2016	Aug. 29, 2017	Dec. 22, 2017	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Oct. 25, 2016	Aug. 29, 2017	Oct. 24, 2017	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 23, 2017	Aug. 29, 2017	Mar. 22, 2018	Radiation (03CH12-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1815698	1GHz~18GHz	Dec. 01, 2016	Aug. 29, 2017	Nov. 30, 2017	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY53270148	1GHz~26.5GHz	Jan. 12, 2017	Aug. 29, 2017	Jan. 11, 2018	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Aug. 29, 2017	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Aug. 29, 2017	N/A	Radiation (03CH12-HY)
Attenuator	Fairview Microwave	SA18S5W-10	n/a	10db	Mar. 24, 2017	Aug. 29, 2017	Mar. 23, 2018	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	Apr. 27, 2017	Aug. 29, 2017	Apr. 26, 2018	Radiation (03CH12-HY)

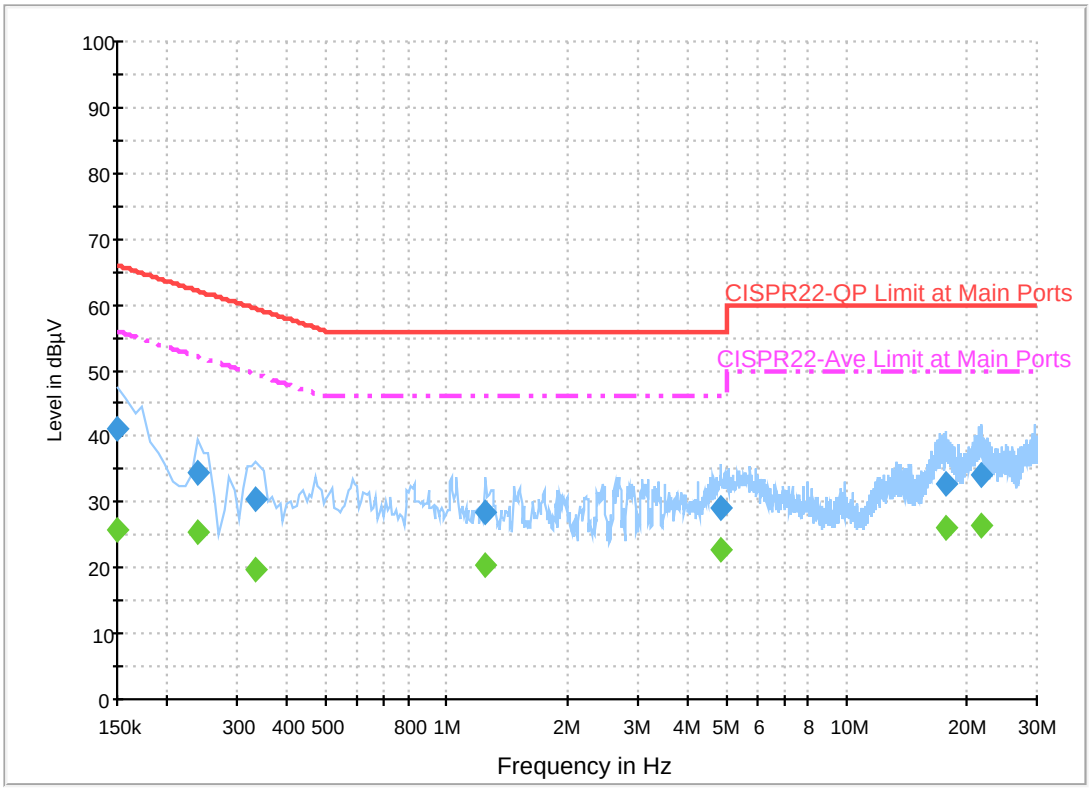
Appendix A. AC Conducted Emission Test Results

Test Engineer :	Kai-Chun Chu	**Temperature :**	26~27℃
		Relative Humidity :	48~49%

EUT Information

Report NO :	781006
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

ENV216 Auto Test-L



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	41.1	Off	L1	19.6	24.9	66.0
0.238000	34.4	Off	L1	19.5	27.8	62.2
0.334000	30.5	Off	L1	19.5	28.9	59.4
1.254000	28.5	Off	L1	19.5	27.5	56.0
4.838000	29.0	Off	L1	19.6	27.0	56.0
17.686000	32.9	Off	L1	19.7	27.1	60.0
21.654000	34.1	Off	L1	19.8	25.9	60.0

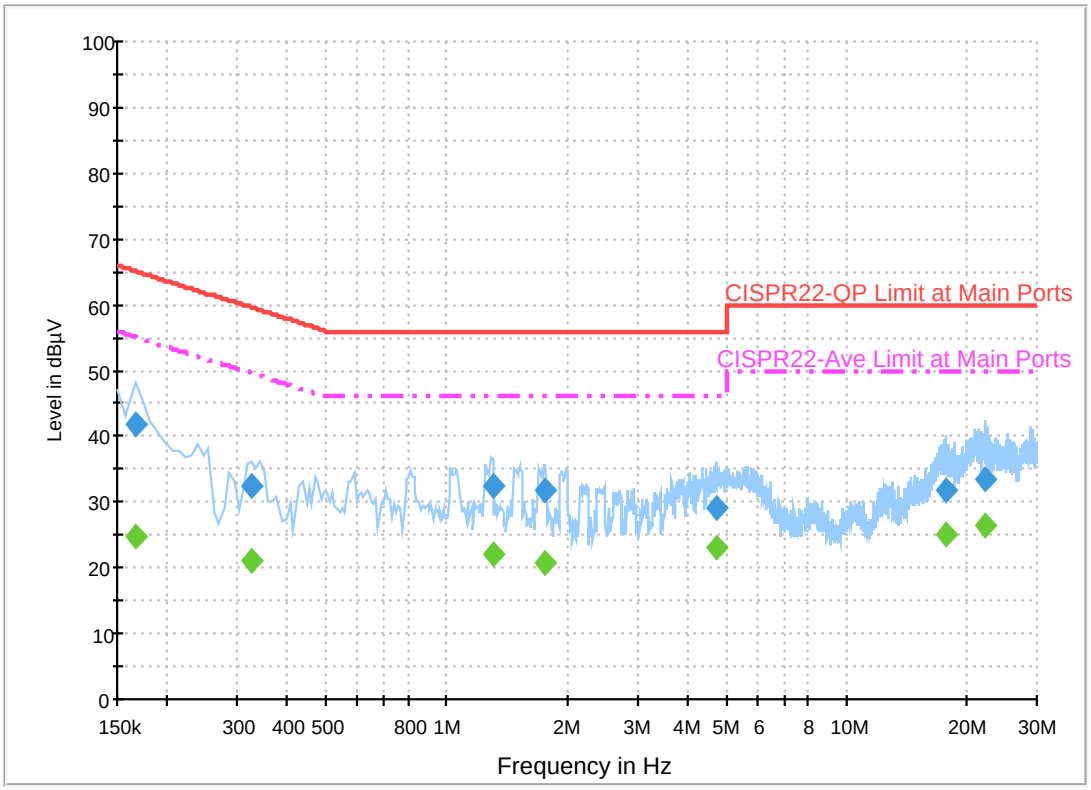
Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	25.8	Off	L1	19.6	30.2	56.0
0.238000	25.4	Off	L1	19.5	26.8	52.2
0.334000	19.6	Off	L1	19.5	29.8	49.4
1.254000	20.3	Off	L1	19.5	25.7	46.0
4.838000	22.9	Off	L1	19.6	23.1	46.0
17.686000	26.0	Off	L1	19.7	24.0	50.0
21.654000	26.4	Off	L1	19.8	23.6	50.0

EUT Information

Report NO :	781006
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral

ENV216 Auto Test-N



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	41.9	Off	N	19.5	23.3	65.2
0.326000	32.4	Off	N	19.5	27.2	59.6
1.302000	32.4	Off	N	19.5	23.6	56.0
1.758000	31.7	Off	N	19.5	24.3	56.0
4.758000	29.1	Off	N	19.6	26.9	56.0
17.862000	31.7	Off	N	19.8	28.3	60.0
22.294000	33.6	Off	N	19.9	26.4	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	24.6	Off	N	19.5	30.6	55.2
0.326000	21.0	Off	N	19.5	28.6	49.6
1.302000	22.2	Off	N	19.5	23.8	46.0
1.758000	20.7	Off	N	19.5	25.3	46.0
4.758000	23.0	Off	N	19.6	23.0	46.0
17.862000	25.2	Off	N	19.8	24.8	50.0
22.294000	26.3	Off	N	19.9	23.7	50.0

Appendix B. Radiated Spurious Emission

Test Engineer :	Nick Yo	Temperature :	24~25℃
		Relative Humidity :	62~64%

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		2398	50.52	-23.48	74	40.85	27.09	4.04	31.49	107	110	P	H
	*	2402	82.65	-31.35	114	72.96	27.11	4.04	31.49	107	110	P	H
		2389.24	40.99	-13.01	54	31.35	27.07	4.03	31.49	107	110	A	H
	*	2402	81.51	-12.49	94	71.82	27.11	4.04	31.49	107	110	A	H
													H
													H
		2383	50.84	-23.16	74	41.22	27.05	4.03	31.49	311	87	P	V
	*	2402	80.13	-33.87	114	70.44	27.11	4.04	31.49	311	87	P	V
		2390.2	40.8	-13.2	54	31.16	27.07	4.03	31.49	311	87	A	V
	*	2402	78.96	-15.04	94	69.27	27.11	4.04	31.49	311	87	A	V
													V
													V
BLE CH 19 2440MHz		2392.24	50.88	-23.12	74	41.23	27.08	4.03	31.49	112	8	P	H
	*	2440	78.47	-35.53	114	68.63	27.22	4.07	31.48	112	8	P	H
		2487.76	52.15	-21.85	74	42.12	27.36	4.11	31.47	112	8	P	H
		2398.96	41.02	-12.98	54	31.34	27.1	4.04	31.49	112	8	A	H
	*	2440	77.42	-16.58	94	67.58	27.22	4.07	31.48	112	8	A	H
		2495.08	41.17	-12.83	54	31.1	27.39	4.11	31.46	112	8	A	H
		2396.68	51.85	-22.15	74	42.18	27.09	4.04	31.49	106	8	P	V
	*	2440	82.2	-31.8	114	72.36	27.22	4.07	31.48	106	8	P	V
		2490.16	51.52	-22.48	74	41.48	27.37	4.11	31.47	106	8	P	V
		2396.32	40.89	-13.11	54	31.22	27.09	4.04	31.49	106	8	A	V
	*	2440	81.15	-12.85	94	71.31	27.22	4.07	31.48	106	8	A	V
		2492.92	41.28	-12.72	54	31.22	27.38	4.11	31.46	106	8	A	V

BLE CH 39 2480MHz	*	2480	77.76	-36.24	114	67.77	27.34	4.09	31.47	100	359	P	H
		2495.8	51.34	-22.66	74	41.27	27.39	4.11	31.46	100	359	P	H
	*	2480.08	76.58	-17.42	94	66.59	27.34	4.09	31.47	100	359	A	H
		2488.36	41.5	-12.5	54	31.46	27.37	4.11	31.47	100	359	A	H
													H
													H
	*	2480	81.3	-32.7	114	71.31	27.34	4.09	31.47	100	0	P	V
		2489.68	51.83	-22.17	74	41.79	27.37	4.11	31.47	100	0	P	V
	*	2480	80.12	-13.88	94	70.13	27.34	4.09	31.47	100	0	A	V
		2485	41.11	-12.89	54	31.09	27.35	4.11	31.47	100	0	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		4005	47.64	-26.36	74	69.97	30.61	5.6	59.18	100	0	P	H
		4804	42.87	-31.13	74	62.35	32.15	6.16	58.33	100	0	P	H
													H
													H
		4005	52.16	-21.84	74	74.49	30.61	5.6	59.18	100	175	P	V
		4005	47.51	-6.49	54	69.84	30.61	5.6	59.18	100	175	A	V
		4804	40.48	-33.52	74	59.96	32.15	6.16	58.33	100	0	P	V
													V
BLE CH 19 2440MHz		4005	47.5	-26.5	74	69.83	30.61	5.6	59.18	100	0	P	H
		4880	46.6	-27.4	74	65.83	32.28	6.21	58.24	100	0	P	H
		7320	45.39	-28.61	74	59.43	37	7.72	59.1	100	0	P	H
													H
		4005	52.11	-21.89	74	74.44	30.61	5.6	59.18	100	175	P	V
		4005	47.42	-6.58	54	69.75	30.61	5.6	59.18	100	175	A	V
		4880	43.05	-30.95	74	62.28	32.28	6.21	58.24	100	0	P	V
		7320	44.73	-29.27	74	58.77	37	7.72	59.1	100	0	P	V
BLE CH 39 2480MHz		4005	48.24	-25.76	74	70.57	30.61	5.6	59.18	100	0	P	H
		4960	46.18	-27.82	74	65.14	32.43	6.26	58.14	100	0	P	H
		7440	45.33	-28.67	74	59.1	37.33	7.75	59.17	100	0	P	H
													H
		4005	52.27	-21.73	74	74.6	30.61	5.6	59.18	100	174	P	V
		4005	47.46	-6.54	54	69.79	30.61	5.6	59.18	100	174	A	V
		4960	43.53	-30.47	74	62.49	32.43	6.26	58.14	100	0	P	V
		7440	44.5	-29.5	74	58.27	37.33	7.75	59.17	100	0	P	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		91.02	32.61	-10.89	43.5	47.24	14.96	0.76	30.41			P	H
		227.37	27.25	-18.75	46	40.09	16.01	1.23	30.23			P	H
		300	31.16	-14.84	46	40.5	19.31	1.39	30.14			P	H
		449.8	41.38	-4.62	46	46.23	23.28	1.7	29.89	100	0	P	H
		672.4	33.03	-12.97	46	33.83	26.57	2.09	29.57			P	H
		746.6	36.55	-9.45	46	35.52	28.16	2.21	29.44			P	H
													H
													H
													H
													H
													H
													H
		50.79	34.34	-5.66	40	49.87	14.3	0.6	30.45	100	0	P	V
		62.4	33.23	-6.77	40	51.08	11.87	0.68	30.44			P	V
		97.23	31.97	-11.53	43.5	45.79	15.72	0.8	30.4			P	V
		449.8	37.64	-8.36	46	42.49	23.28	1.7	29.89			P	V
		672.4	36.41	-9.59	46	37.21	26.57	2.09	29.57			P	V
		729.1	35.47	-10.53	46	35.02	27.65	2.18	29.48			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 C. Radiated Spurious Emission Plots

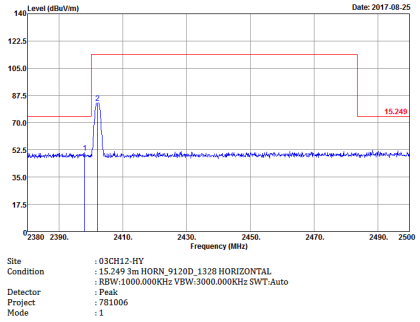
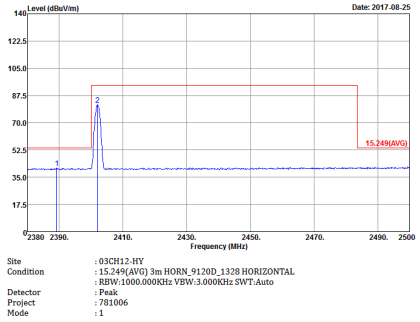
Test Engineer :	Nick Yo	**Temperature :**	24~25℃
		Relative Humidity :	62~64%

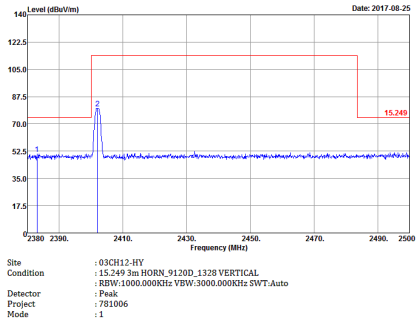
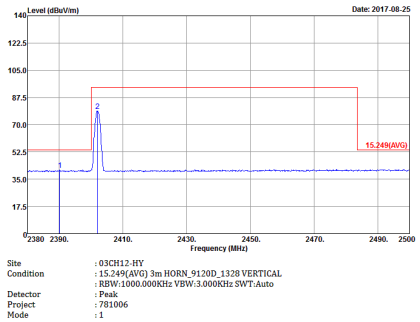
Note symbol

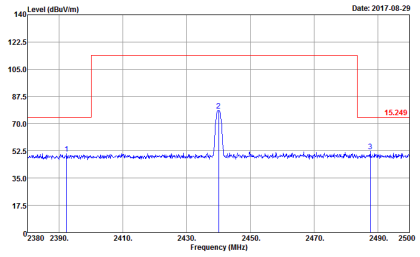
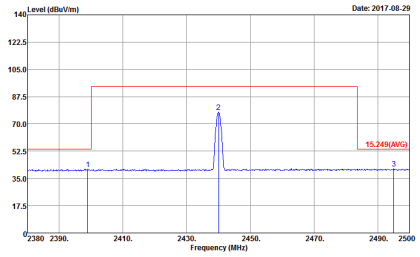
-L	**Low channel location**
-R	**High channel location**

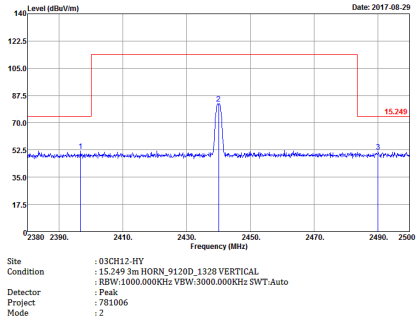
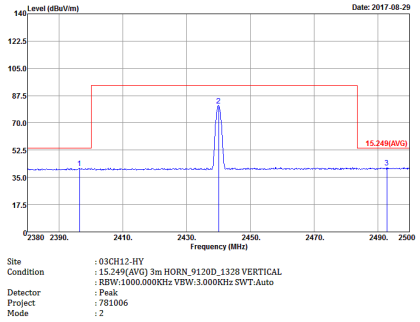
2.4GHz 2400~2483.5MHz

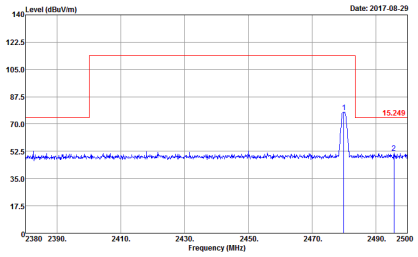
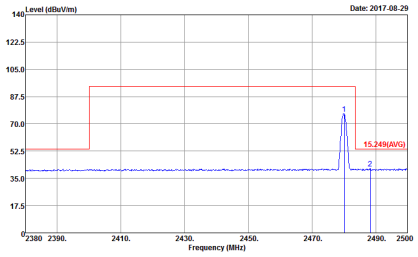
BLE (Band Edge @ 3m)

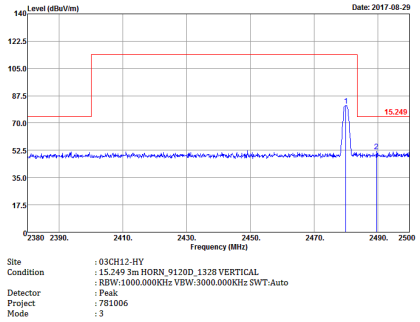
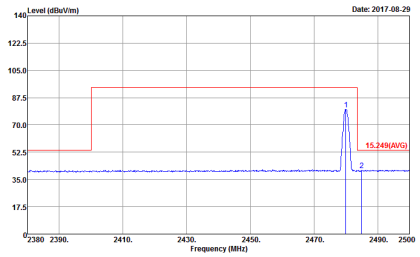
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE 2402MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH12-HY Condition : 15.249 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 1	
Avg.	 Site : 03CH12-HY Condition : 15.249(AVG) 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 1	

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

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE 2440MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH12-HY Condition : 15.249 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 2	
Avg.	 Site : 03CH12-HY Condition : 15.249(AVG) 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 2	

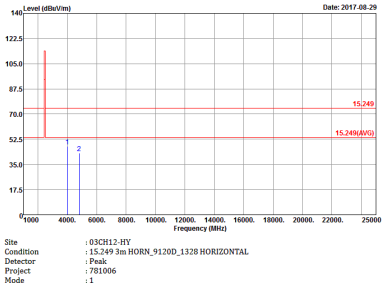
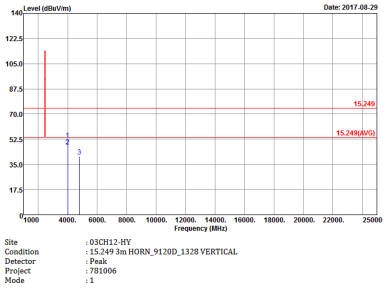
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE 2440MHz	
1	Vertical	Fundamental
Peak		
Avg.		

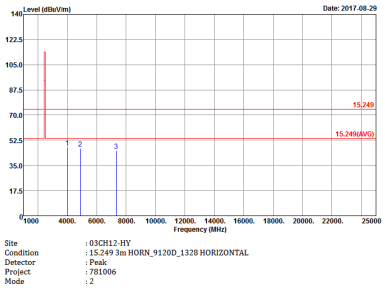
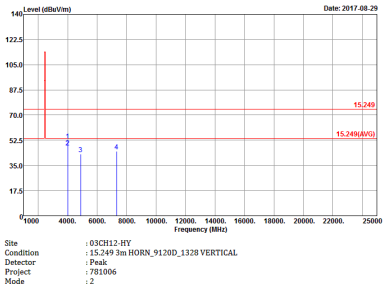
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE 2480MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH12-HY Condition : 15.249 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 3	
Avg.	 Site : 03CH12-HY Condition : 15.249(AVG) 3m HORN_9120D_1328 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 3	

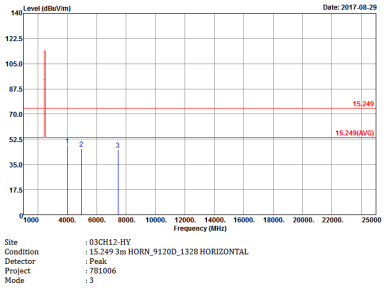
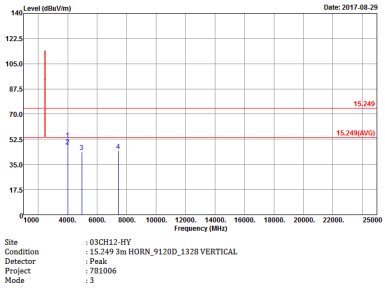
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE 2480MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH12-HY Condition : 15.249 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 3	
Avg.	 Site : 03CH12-HY Condition : 15.249(AVG) 3m HORN_9120D_1328 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 781006 Mode : 3	

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

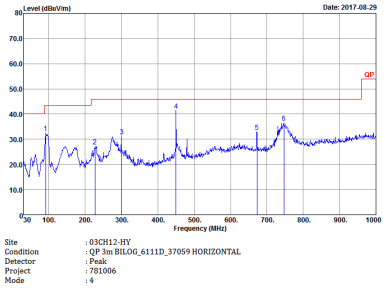
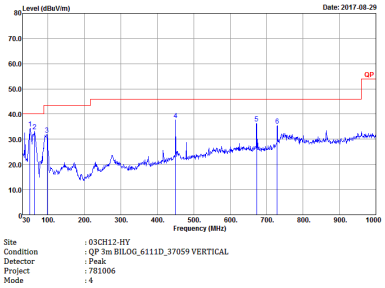
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BLE 2402MHz	
1	Horizontal	Vertical
Peak Avg.		

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

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

Emission below 1GHz

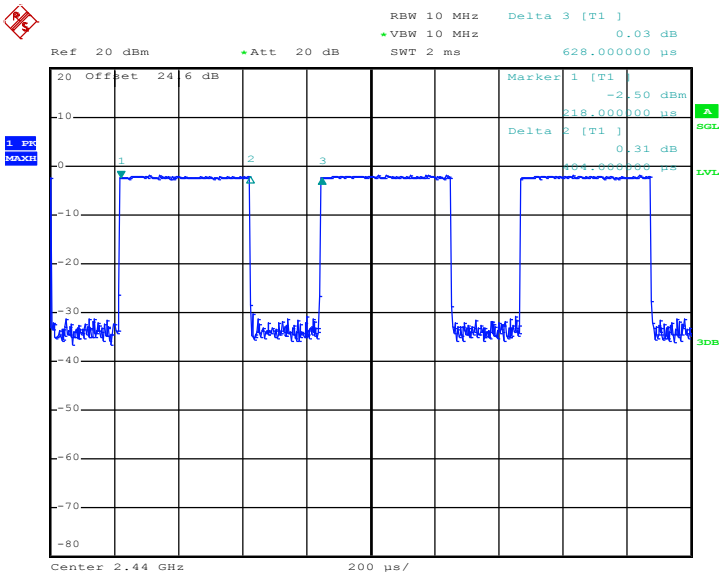
2.4GHz BLE (LF)

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
Bluetooth - LE	64.33	404	2.48	3kHz

Bluetooth - LE



Date: 23.AUG.2017 09:56:35