FCC RF Test Report

APPLICANT	:	Motorola Solutions, Inc.
EQUIPMENT	:	WLAN/BT module
BRAND NAME	:	MOTOROLA
MODEL NAME	:	21-148603-0B
FCC ID	:	UZ7211486030B
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DSS) Spread Spectrum Transmitter

This is a partial report which is included the RF conducted power, radiated spurious emission, and AC conducted emission test items. The product was received on Nov. 06, 2013 and testing was completed on Dec. 20, 2013. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown to be compliant 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.

Louis Wu

Reviewed by: Louis Wu / Manager

Jones Tsai

Approved by: Jones Tsai / Manager

Testing Laboratory 1190

SPORTON INTERNATIONAL INC.
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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3N0602A	Rev. 01	Initial issue of report	Jan. 09, 2014

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(b)(1)	RSS-210 A8.1(b)	Peak Output Power	≤ 125 mW	Pass	-
3.2	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 13.77 dB at 31.890 MHz
3.3	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 19.40 dB at 0.182 MHz
3.4	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Motorola Solutions, Inc.
One Motorola Plaza, Holtsville, NY 11742-1300 USA

1.2 Manufacturer

Motorola Solutions, Inc.
One Motorola Plaza, Holtsville, NY 11742-1300 USA

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	WLAN/BT module
Brand Name	MOTOROLA
Model Name	21-148603-0B
FCC ID	UZ7211486030B
Installed into host	Equipment Name: WORKABOUT PRO 4 Brand Name: MOTOROLA Model Name: 7528X
EUT supports Radios application	WLAN 11a/b/g/n HT20 Bluetooth v2.1 + EDR
Host HW Version	MV
Host SW Version	0.1.36119.1
Host FW Version	X_2.01.0.0.062R
EUT Stage	Identical Prototype

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

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Maximum Output Power to Antenna	Bluetooth BR(1Mbps) : 1.72 dBm (0.0015 W) Bluetooth EDR (2Mbps) : 1.95 dBm (0.0016 W) Bluetooth EDR (3Mbps) : 2.39 dBm (0.0017 W)
Antenna Type	PIFA Antenna type with gain 1.61 dBi
Type of Modulation	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π/4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK

List of Accessory for Host (WORKABOUT PRO 4):

Specification of Accessory		
AC Adapter	**Brand Name**	PHIHONG
	Model Name	PSA15R-050P
Battery	**Brand Name**	Psion
	Model Name	WA3010
Docking	**Brand Name**	Psion
	Model Name	WA4003-G2
USB to RS232 Adapter	**Brand Name**	PSION
	Model Name	WA4015-G1
Pouch Holster	**Model Name**	WA6084
Pistol Holster	**Model Name**	WA6083
Carry Case	**Model Name**	WA6080
USB Cable	**Brand Name**	N/A
	Model Name	N/A
	Power Cord	1.4 meter shielded cable without ferrite core

1.5 Modification of EUT

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

1.6 Testing Site

Test Site	SPORTON INTERNATIONAL INC.			
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978			
Test Site No.	**Sporton Site No.**			**FCC/IC Registration No.**
	TH02-HY	CO05-HY	03CH07-HY	722060/4086B-1

Note: The test site complies with ANSI C63.4 2003 requirement.

1.7 Applied 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 Public Notice DA 00-705
- ANSI C63.4-2003

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

Preliminary tests were performed in different data rates and recorded the RF output power in the following table:

Channel	Frequency	Bluetooth RF Output Power		
		Data Rate / Modulation		
		GFSK	π/4-DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	1.72 dBm	1.95 dBm	**2.39** dBm
Ch39	2441MHz	1.30 dBm	1.63 dBm	2.05 dBm
Ch78	2480MHz	1.50 dBm	1.88 dBm	2.38 dBm

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
2. The data rate was set in 3Mbps for all the test items due to the highest RF output power.

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). Pre-scanned tests, X, Y, Z in three orthogonal panels, and different data rates were conducted to determine the final configuration (X plane as worst plane) from all possible combinations, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.

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

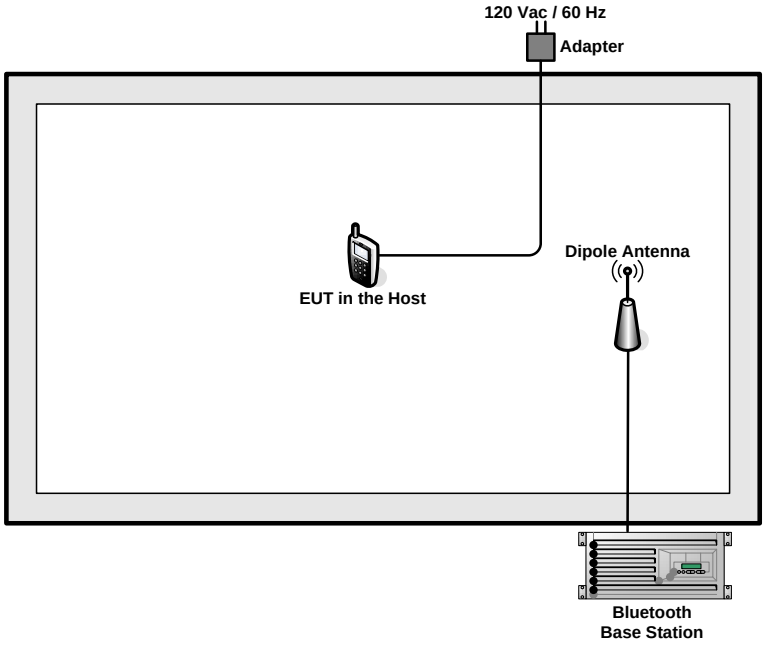
2.2 Test Mode

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

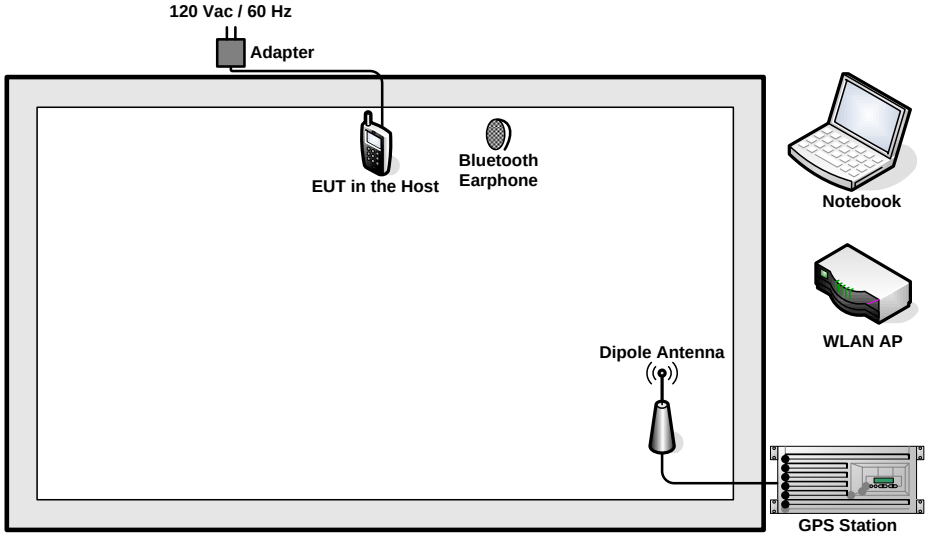
Summary table of Test Cases			
Test Item	**Data Rate / Modulation**		
	Bluetooth BR 1Mbps GFSK	**Bluetooth EDR 2Mbps π/4-DQPSK**	**Bluetooth EDR 3Mbps 8-DPSK**
Conducted Test Cases	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated Test Cases	**Bluetooth EDR 3Mbps 8-DPSK**		
	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz		
AC Conducted Emission	Mode 1 :WLAN (2.4GHz) Link + Bluetooth Link + GPS Rx + MP3 + Adapter		
Remark: For radiated test cases, the worst mode data rate 3Mbps was reported only, because this data rate has the highest RF output power at preliminary tests.			

2.3 Connection Diagram of Test System

<Bluetooth 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.	GPS Station	Pendulum	GSG-54	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Sony Ericsson	MW600	PY70DA2029	N/A	N/A
4.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
5.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
6.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

For Bluetooth function, the RF utility, “MPA3WMBTRegTest tools” was installed in WORKABOUT PRO 4 which was programmed in order to make the EUT get into the engineering modes to contact with Bluetooth base station for continuous transmitting and receiving signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 Peak Output Power Measurement

3.1.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps is 1watt, and for 2Mbps, 3Mbps and AFH are 0.125 watts.

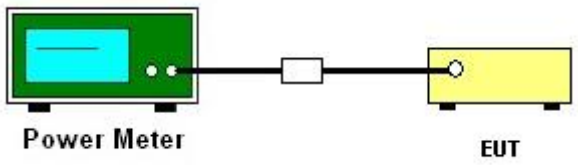
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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 with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Peak Output Power

Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Reece Li	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	1.72	20.97	Pass
39	2441	1.30	20.97	Pass
78	2480	1.50	20.97	Pass

Note: For AFH mode using 20 hopping channels, the maximum output power limit is 20.97dBm.

Test Mode :	2Mbps	Temperature :	24~26℃
Test Engineer :	Reece Li	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		π /4-DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	1.95	20.97	Pass
39	2441	1.63	20.97	Pass
78	2480	1.88	20.97	Pass

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Reece Li	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK	Max. Limits (dBm)	Pass/Fail
		3 Mbps		
00	2402	2.39	20.97	Pass
39	2441	2.05	20.97	Pass
78	2480	2.38	20.97	Pass

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. 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

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

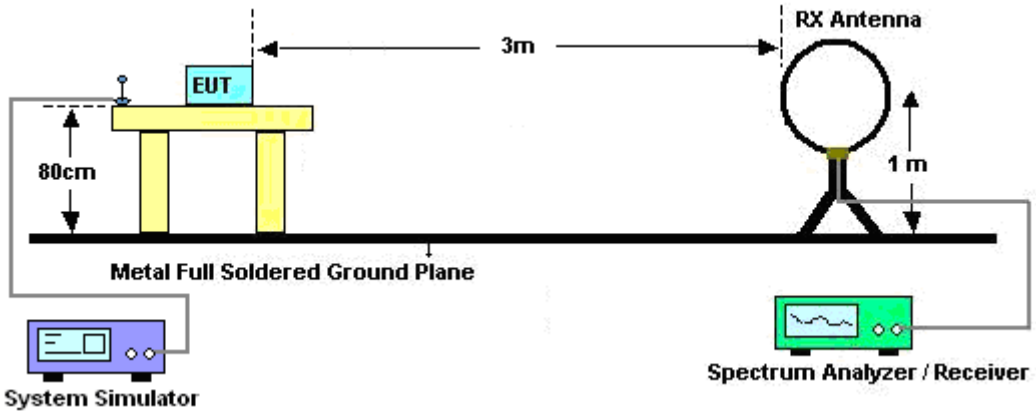
3.2.3 Test Procedures

1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. The EUT was placed on a turntable with 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. 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.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log(Duty cycle)
7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

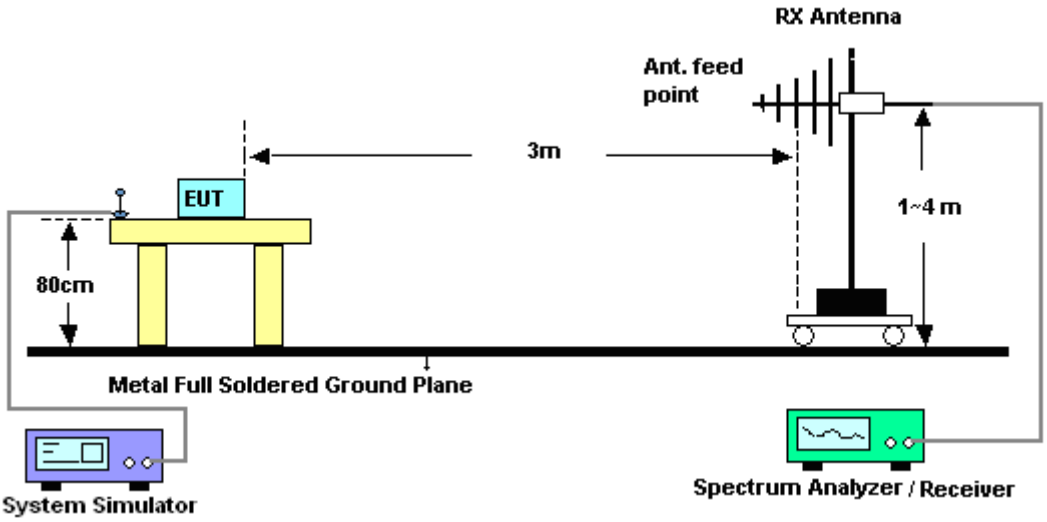
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.73dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.2.4 Test Setup

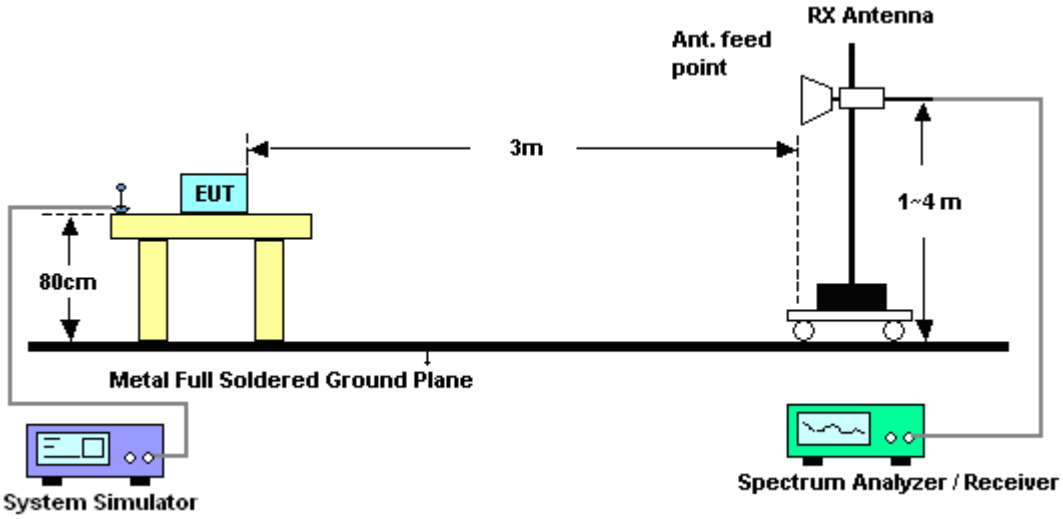
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

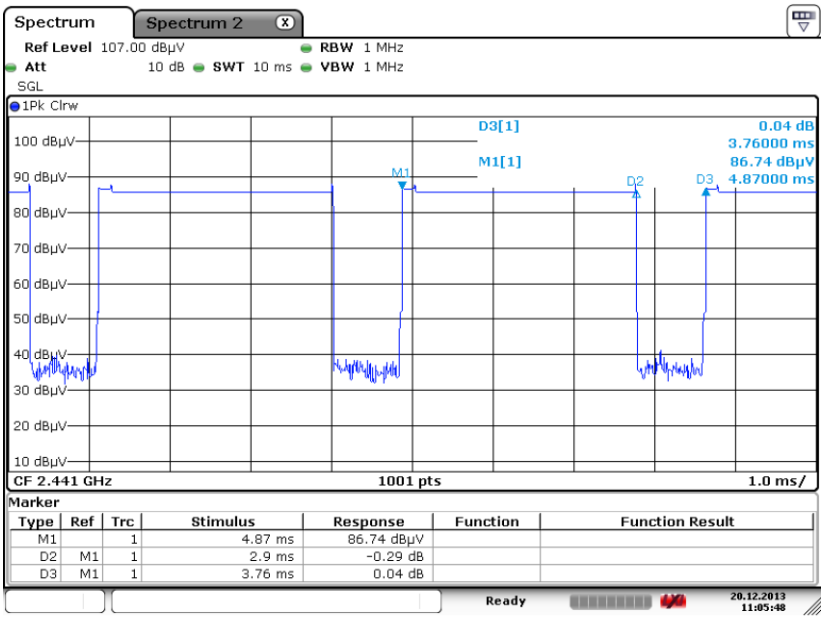


3.2.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

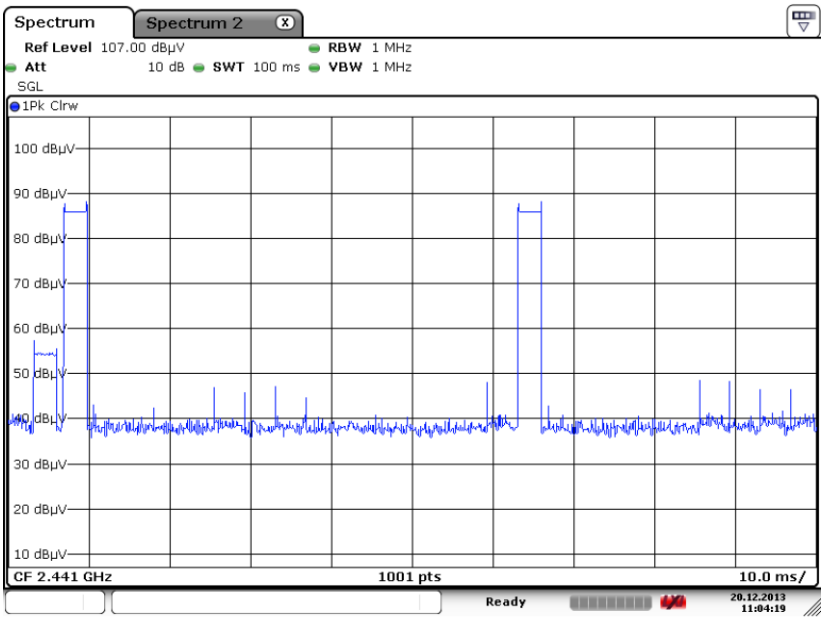
3.2.6 Duty cycle correction factor for average measurement

3DH5 on time (One Pulse) Plot on Channel 39



Date: 20.DEC.2013 11:05:48

3DH5 on time (Count Pulses) Plot on Channel 39



Date: 20.DEC.2013 11:04:18

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.90 / 100 = 5.80 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.73 dB
3. 3DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

2.90 ms x 20 channels = 58.0 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100ms / 57.6ms] = 2 hops

Thus, the maximum possible ON time:

2.90 ms x 2 = 5.80 ms

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

20 x log(5.80 ms/100ms) = -24.73 dB

3.2.7 Test Result of Radiated Spurious at Band Edges

Test Mode :	3Mbps	**Temperature :**	21~24°C
Test Channel :	00	**Relative Humidity :**	51~56%
		Test Engineer :	Stan Hsieh

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	**Level (dBµV/m)**	**Over Limit (dB)**	**Limit Line (dBµV/m)**	**Read Level (dBµV)**	**Antenna Factor (dB)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Ant Pos (cm)**	**Table Pos (deg)**	**Remark**
2373.36	57.99	-16.01	74	53.1	32.28	6.88	34.27	144	241	Peak
2373.36	33.26	-20.74	54	-	-	-	-	-	-	Average
2499.55	46.74	-27.26	74	41.76	32.4	7.06	34.48	144	241	Peak
2499.55	22.01	-31.99	54	-	-	-	-	-	-	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	**Level (dBµV/m)**	**Over Limit (dB)**	**Limit Line (dBµV/m)**	**Read Level (dBµV)**	**Antenna Factor (dB)**	**Cable Loss (dB)**	**Preamp Factor (dB)**	**Ant Pos (cm)**	**Table Pos (deg)**	**Remark**
2386.86	57.69	-16.31	74	52.75	32.3	6.91	34.27	100	271	Peak
2386.86	32.96	-21.04	54	-	-	-	-	-	-	Average
2497.3	46.9	-27.1	74	41.92	32.4	7.06	34.48	100	271	Peak
2497.3	22.17	-31.83	54	-	-	-	-	-	-	Average

Test Mode :	3Mbps	Temperature :	21~24°C
Test Channel :	78	Relative Humidity :	51~56%
		Test Engineer :	Stan Hsieh

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2386.68	54.35	-19.65	74	49.41	32.3	6.91	34.27	108	75	Peak
2386.68	29.62	-24.38	54	-	-	-	-	-	-	Average
2484.37	55.72	-18.28	74	50.71	32.38	7.06	34.43	108	75	Peak
2484.37	30.99	-23.01	54	-	-	-	-	-	-	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2386.77	57.07	-16.93	74	52.13	32.3	6.91	34.27	100	280	Peak
2386.77	32.34	-21.66	54	-	-	-	-	-	-	Average
2484.25	57.23	-16.77	74	52.22	32.38	7.06	34.43	100	280	Peak
2484.25	32.5	-21.5	54	-	-	-	-	-	-	Average

Note: Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73dB)

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

Note: Pre-scanned all test modes and only choose the worst case mode recorded in the test report for radiated spurious emission below 1GHz.

Test Mode :	3Mbps	**Temperature :**	21~24°C
Test Channel :	00	**Relative Humidity :**	51~56%
Test Engineer :	Stan Hsieh	**Polarization :**	Horizontal
Remark :	2402 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
35.67	17.6	-22.4	40	32.53	15.76	0.59	31.28	-	-	Peak
213.33	19.68	-23.82	43.5	40.14	9.23	1.38	31.07	-	-	Peak
258.69	28.66	-17.34	46	44.24	13.84	1.58	31	102	253	Peak
359.5	18.83	-27.17	46	33.17	14.7	2.06	31.1	-	-	Peak
456.1	19.75	-26.25	46	30.86	17.36	2.31	30.78	-	-	Peak
735.4	24.95	-21.05	46	30.23	22.1	3.02	30.4	-	-	Peak
2402	92.68	-	-	87.77	32.3	6.91	34.3	144	241	Peak
2402	67.95	-	-	-	-	-	-	-	-	Average
4803	39.79	-34.21	74	56.02	33.98	8.75	58.96	100	0	Peak
4803	15.06	-38.94	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	21~24°C
Test Channel :	00	Relative Humidity :	51~56%
Test Engineer :	Stan Hsieh	Polarization :	Vertical
Remark :	2402 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
31.89	26.23	-13.77	40	39.34	17.76	0.55	31.42	124	117	Peak
56.46	23.31	-16.69	40	47.47	6.32	0.74	31.22	-	-	Peak
255.99	23.3	-22.7	46	39.37	13.36	1.57	31	-	-	Peak
417.6	17.34	-28.66	46	29.35	16.6	2.2	30.81	-	-	Peak
596.8	22.03	-23.97	46	30.41	19.56	2.68	30.62	-	-	Peak
896.4	26.39	-19.61	46	30.29	23.08	3.33	30.31	-	-	Peak
2402	93.21	-	-	88.3	32.3	6.91	34.3	100	271	Peak
2402	68.48	-	-	-	-	-	-	-	-	Average
4803	40.42	-33.58	74	56.65	33.98	8.75	58.96	100	0	Peak
4803	15.69	-38.31	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	21~24°C
Test Channel :	39	Relative Humidity :	51~56%
Test Engineer :	Stan Hsieh	Polarization :	Horizontal
Remark :	2442 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2442	92.7	-	-	87.75	32.35	6.99	34.39	107	90	Peak
2442	67.97	-	-	-	-	-	-	-	-	Average
4884	41.02	-32.98	74	57.05	33.95	8.85	58.83	100	0	Peak
4884	16.29	-37.71	54	-	-	-	-	-	-	Average
7323	42.28	-31.72	74	53.58	35.53	10.91	57.74	100	0	Peak
7323	17.55	-36.45	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	21~24°C
Test Channel :	39	Relative Humidity :	51~56%
Test Engineer :	Stan Hsieh	Polarization :	Vertical
Remark :	2442 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2442	92.97	-	-	88.02	32.35	6.99	34.39	100	283	Peak
2442	68.24	-	-	-	-	-	-	-	-	Average
4884	40.67	-33.33	74	56.7	33.95	8.85	58.83	100	0	Peak
4884	15.94	-38.06	54	-	-	-	-	-	-	Average
7323	42.83	-31.17	74	54.13	35.53	10.91	57.74	100	0	Peak
7323	18.1	-35.9	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	21~24°C
Test Channel :	78	Relative Humidity :	51~56%
Test Engineer :	Stan Hsieh	Polarization :	Horizontal
Remark :	2480 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2480	91.91	-	-	86.9	32.38	7.06	34.43	108	75	Peak
2480	67.18	-	-	-	-	-	-	-	-	Average
4959	39.72	-34.28	74	55.55	33.91	8.92	58.66	100	0	Peak
4959	14.99	-39.01	54	-	-	-	-	-	-	Average
7440	39.14	-34.86	74	50.44	35.51	11.04	57.85	100	0	Peak
7440	14.41	-39.59	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	21~24°C
Test Channel :	78	Relative Humidity :	51~56%
Test Engineer :	Stan Hsieh	Polarization :	Vertical
Remark :	2480 MHz is fundamental signal which can be ignored.		

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2482	93	-	-	87.99	32.38	7.06	34.43	100	280	Peak
2482	68.27	-	-	-	-	-	-	-	-	Average
4959	39.88	-34.12	74	55.71	33.91	8.92	58.66	100	0	Peak
4959	15.15	-38.85	54	-	-	-	-	-	-	Average
7440	39.73	-34.27	74	51.03	35.51	11.04	57.85	100	0	Peak
7440	15	-39	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

3.3 AC Conducted Emission Measurement

3.3.1 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.

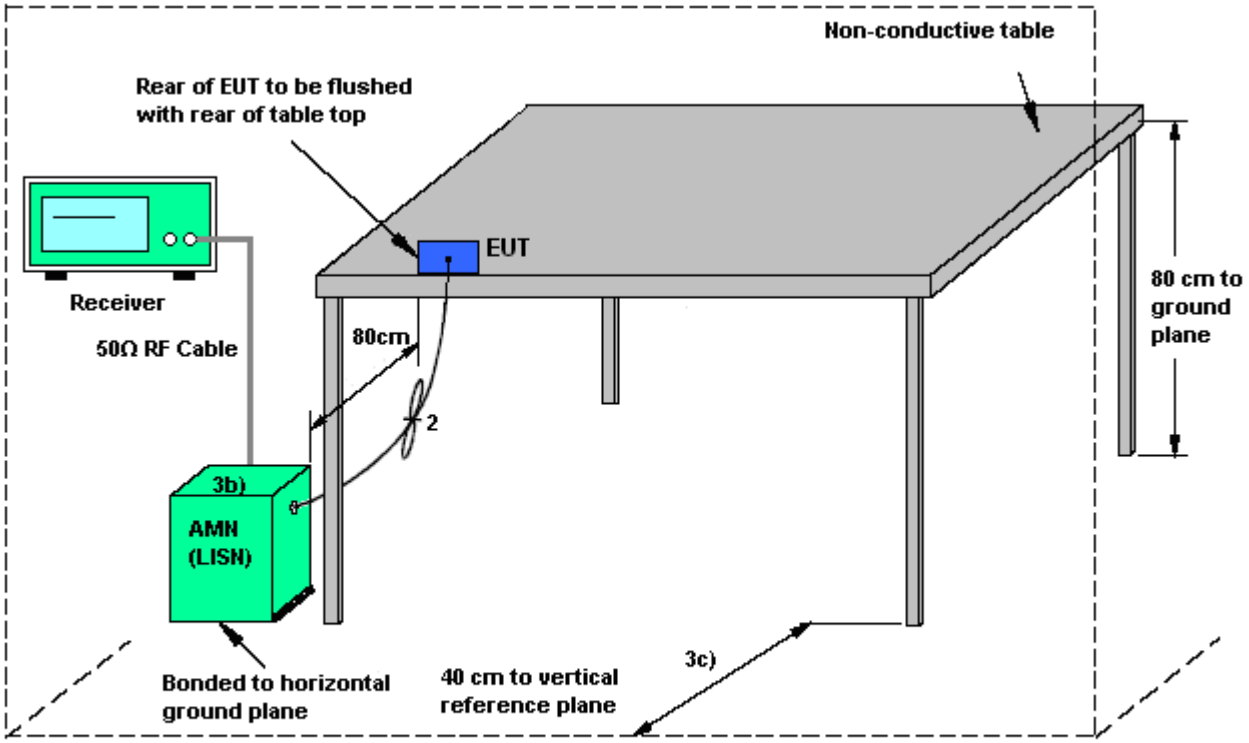
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 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 with Maximum Hold Mode.

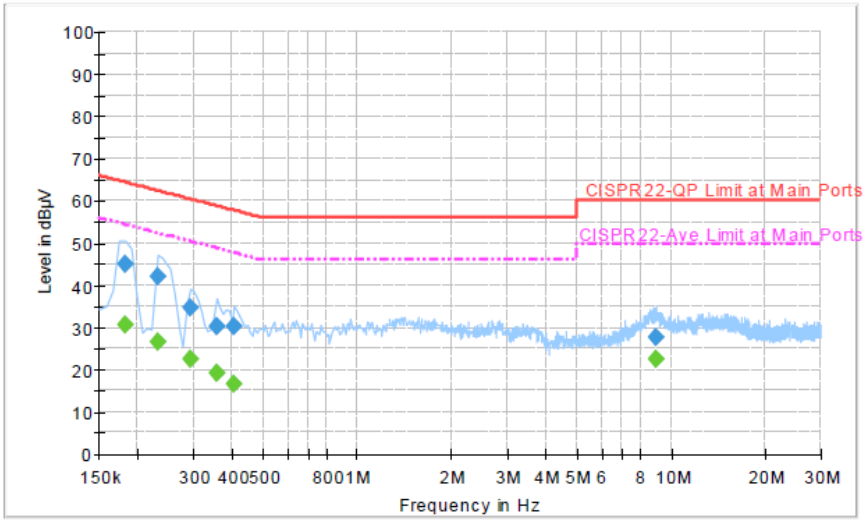
3.3.4 Test Setup



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

3.3.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	WLAN (2.4GHz) Link + Bluetooth Link + GPS Rx + MP3 + Adapter		



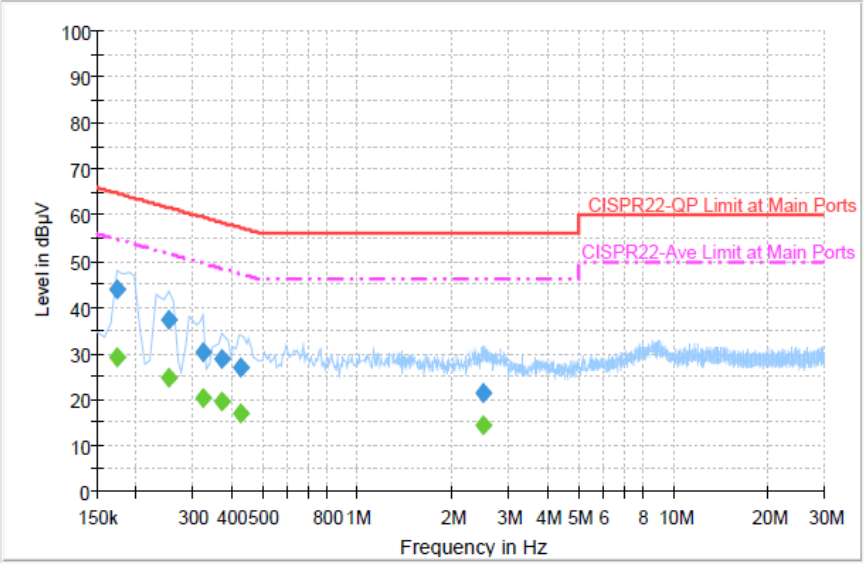
Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.182000	45.0	Off	L1	19.4	19.4	64.4
0.230000	41.9	Off	L1	19.4	20.5	62.4
0.294000	34.9	Off	L1	19.4	25.5	60.4
0.358000	30.3	Off	L1	19.4	28.5	58.8
0.406000	30.2	Off	L1	19.4	27.5	57.7
8.934000	27.6	Off	L1	19.8	32.4	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.182000	30.6	Off	L1	19.4	23.8	54.4
0.230000	26.6	Off	L1	19.4	25.8	52.4
0.294000	22.6	Off	L1	19.4	27.8	50.4
0.358000	19.1	Off	L1	19.4	29.7	48.8
0.406000	16.6	Off	L1	19.4	31.1	47.7
8.934000	22.4	Off	L1	19.8	27.6	50.0

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN (2.4GHz) Link + Bluetooth Link + GPS Rx + MP3 + Adapter		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.174000	43.8	Off	N	19.4	21.0	64.8
0.254000	37.2	Off	N	19.5	24.4	61.6
0.326000	30.2	Off	N	19.4	29.4	59.6
0.374000	28.9	Off	N	19.4	29.5	58.4
0.430000	27.1	Off	N	19.4	30.2	57.3
2.494000	21.5	Off	N	19.6	34.5	56.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.174000	29.2	Off	N	19.4	25.6	54.8
0.254000	24.7	Off	N	19.5	26.9	51.6
0.326000	20.4	Off	N	19.4	29.2	49.6
0.374000	19.6	Off	N	19.4	28.8	48.4
0.430000	16.9	Off	N	19.4	30.4	47.3
2.494000	14.5	Off	N	19.6	31.5	46.0

3.4 Antenna Requirements

3.4.1 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 FCC rule.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 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
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 07, 2013	Nov. 08, 2013 ~ Nov. 16, 2013	Jun. 06, 2014	Conducted (TH02-HY)
Power Meter	Agilent	E4416A	GB41292344	300MHz~40GHz	Feb. 05, 2013	Nov. 08, 2013 ~ Nov. 16, 2013	Feb. 04, 2014	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Feb. 05, 2013	Nov. 08, 2013 ~ Nov. 16, 2013	Feb. 04, 2014	Conducted (TH02-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9 kHz~7 GHz	Sep. 06, 2013	Dec. 20, 2013	Sep. 05, 2014	Radiation (03CH07-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9 kHz ~ 30 GHz	Nov. 20, 2013	Dec. 20, 2013	Nov. 19, 2014	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	860004/0001	9 kHz~30 Mhz	Jul. 03, 2012	Dec. 20, 2013	Jul. 03, 2014	Radiation (03CH07-HY)
Bilog Antenna	Schaffner	CBL6111C	2726	30 MHz ~ 1 GHz	Oct. 10, 2013	Dec. 20, 2013	Oct. 09, 2014	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	75962	1 GHz~18 GHz	Aug. 22, 2013	Dec. 20, 2013	Aug. 21, 2014	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15 GHz- 40 GHz	Oct. 03, 2013	Dec. 20, 2013	Oct. 02, 2014	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	30 MHz~1 GHz	Feb. 26, 2013	Dec. 20, 2013	Feb. 25, 2014	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A01917	1 GHz~26.5 GHz	Aug. 12, 2013	Dec. 20, 2013	Aug. 11, 2014	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	159088	DC~18 G High Gain	Feb. 27, 2013	Dec. 20, 2013	Feb. 26, 2014	Radiation (03CH07-HY)
Turn Table	ChainTek	ChainTek 3000	N/A	0 ~ 360 degree	N/A	Dec. 20, 2013	N/A	Radiation (03CH07-HY)
Antenna Mast	ChainTek	ChainTek 3000	N/A	N/A	N/A	Dec. 20, 2013	N/A	Radiation (03CH07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 15, 2013	Dec. 18, 2013	Nov. 14, 2014	Conduction (CO05-HY)
Two-LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2013	Dec. 18, 2013	Dec. 11, 2014	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 04, 2013	Dec. 18, 2013	Dec. 03, 2014	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Dec. 18, 2013	N/A	Conduction (CO05-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))	**2.26**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.50**