

FCC TEST REPORT

REPORT NO. : FC3D2546-02

MODEL NO. : BCM943162ZP

RECEIVED DATE : Dec. 25, 2013

FINAL TESTED DATE : Apr. 18, 2014

ISSUED DATE : May 05, 2014

**TEST STANDARD : 47 CFR FCC Rules and Regulations Part 15
Subpart B, Class B Digital Device**

Filing Type : Certification

FCC ID : QDS-BRCM1075

APPLICANT : Broadcom Corporation

ADDRESS : 190 Mathilda Place Sunnyvale CA 94086 U.S.A.

Manufacturer : Broadcom Corporation

ADDRESS : 190 Mathilda Place Sunnyvale CA 94086 U.S.A.

ISSUED BY : SPORTON International Inc.

**LAB ADDRESS : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,
Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.**

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- This test report is only applicable to U.S.A..



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History of This Test Report

REPORT NO.	VERSION	ISSUED DATE	Description
FC3D2546-02	Rev.01	Apr. 30, 2014	Initial issue of report
FC3D2546-02	Rev. 02	May 05, 2014	Revising the model name of antenna to “PCA-4077-25GC1-A1” from “PCA-4077-25GC1-A1-RT”.

Certificate No.: CB10304130

CERTIFICATE OF COMPLIANCE

EQUIPMENT NAME : Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0
NGFF2230 Mini Card

BRAND NAME : Broadcom

MODEL NO. : BCM943162ZP

APPLICANT : Broadcom Corporation

ADDRESS : 190 Mathilda Place Sunnyvale CA 94086 U.S.A.

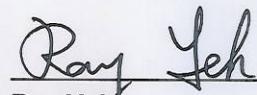
FINAL TESTED DATE : Apr. 18, 2014

TEST STANDARD : 47 CFR FCC Rules and Regulations Part 15
Subpart B, Class B Digital Device

I HEREBY CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 – 2009**.

The above equipment has been tested by **SPORTON International Inc. LAB.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMI characteristics under the conditions specified in this report.



Ray Yeh
SPORTON INTERNATIONAL INC.

1. Summary of Test Results

After estimating all the combination of every test mode, the result shown as below is the worst case.

The EUT has been tested according to the following specifications.

EMISSION			
Test Standard	Test Type	Result	Remarks
47 CFR FCC Rules and Regulations Part 15 Subpart B, Class B Digital Device	Radiated emission test 30 MHz – 1,000 MHz @ 3 m 1,000 MHz – 18,000 MHz @ 3 m 18,000 MHz – 30,000 MHz @ 1 m	PASS	Meet minimum passing margin is -3.06dB at 199.75MHz.

2. General Description of Equipment under Test

Product Detail	
Equipment Name	Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card
Model No.	BCM943162ZP
Brand Name	Broadcom
Power Supply	From host system
Accessories	N/A

2.1. Feature of Equipment under Test

1. Table for class II change

This product is an extension of original one reported under Sporton project number: FC3D2546

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
<ol style="list-style-type: none"> 1. Adding a new antenna (Brand: MAG. LAYERS, Model No.: PCA-4077-25GC1-A1) for this device. 2. The application of this module increases to portable host equipment. The module is limited to use the new antenna (Brand: MAG. LAYERS, Model No.: PCA-4077-25GC1-A1) when it is defined as portable device. 	Radiated Emissions

Note: New antenna and original antenna are the same type, but the gain of new antenna is higher than the original one in 5GHz. Thus, we checked the test items above.

2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.2. Modification of EUT

Please refer to the Photographs of EUT.

3. Test Configuration of Equipment under Test

3.1. Test Mode

Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Radiated Emissions	
Test Mode	Normal Link
1	2.4GHz WLAN function + Bluetooth function
2	5GHz WLAN function + Bluetooth function

For Radiated Emission test below 1GHz:
 Mode 2 generated the worst test result, so it was recorded in this report.
 For Radiated Emission test above 1GHz:
 Mode 2 generated the worst test result for Radiated emission below 1GHz test, thus the measurement for Radiated emission above 1GHz test will follow this same test configuration.

3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Support Unit	Brand	Model	FCC ID
Wireless AP	Planex	GW-AP54SGX	N/A
NB	DELL	E6430	DoC
NB	DELL	E6220	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	SHYARO CHI	MIC-04	N/A
Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card (Device)	Broadcom	BCM943162ZP	QDS-BRCM1075
Test fixture	Broadcom	BCM9NGFF2EC_1	N/A

3.3. EUT Operation Condition

An executive program, EMCTEST.EXE under WIN 7, which generates a complete line of continuously repeating "H" pattern was used as the test software.

The program was executed as follows :

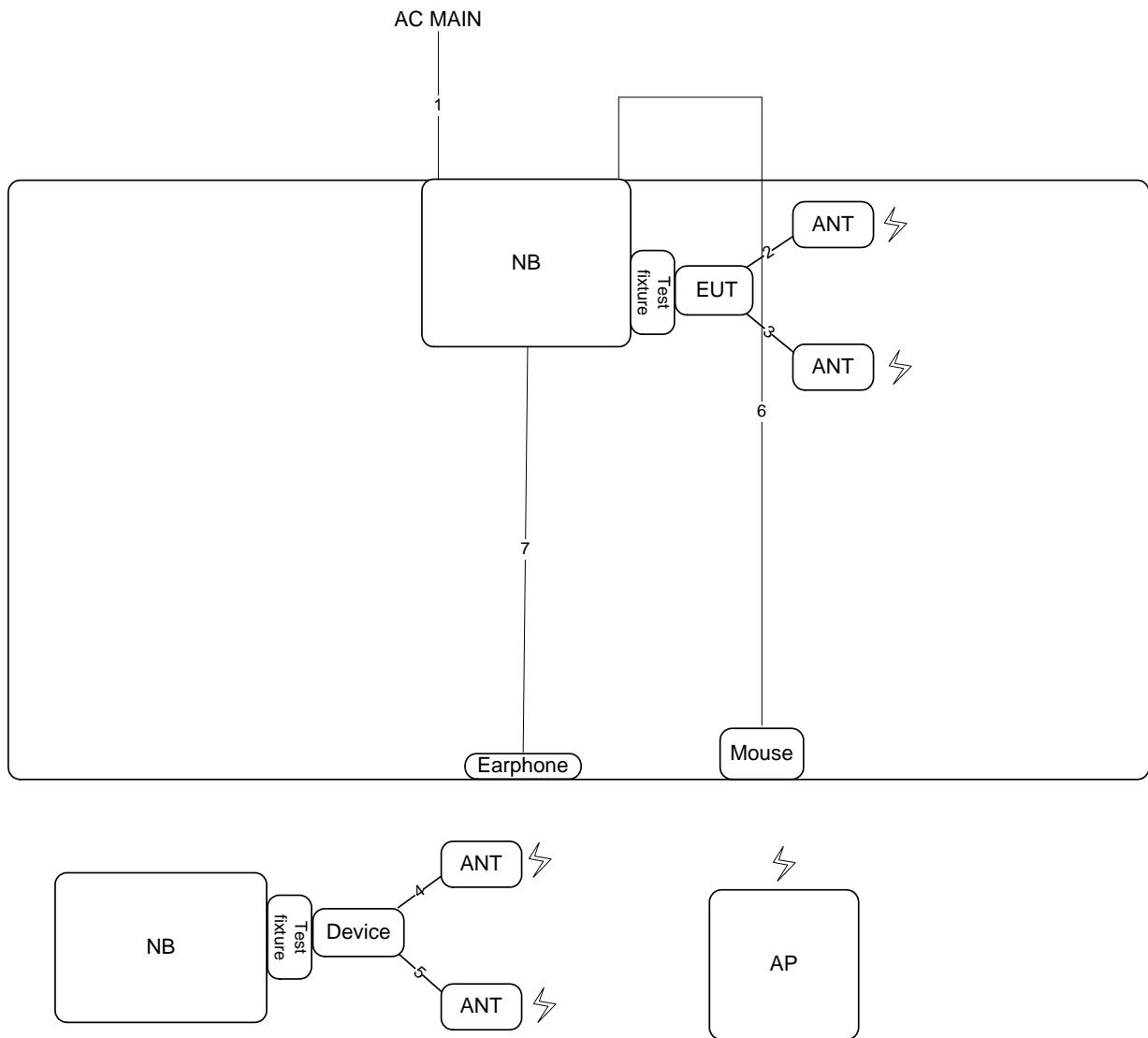
- a. Turn on the power of all equipment.
- b. The NB sends "H" messages to the panel, and the panel displays "H" patterns on the screen.
- c. Repeat the step b.

At the same time, the following programs under WIN 7 were executed:

The remote notebook executed "ping.exe" to link with the EUT to maintain the connection by WLAN.

The remote notebook executed "Bluetool" to link with the EUT to receive and transmit signal by Bluetooth.

3.4. Connection Diagram of Test System



Item	Connection	Shield	Length
1	Power cable	No	2.6m
2	ANT cable	Yes	0.2m
3	ANT cable	Yes	0.2m
4	ANT cable	Yes	0.2m
5	ANT cable	Yes	0.2m
6	USB cable	Yes	1.8m
7	Audio cable	No	1.1m

4. General Information of Test

4.1. Test Facility

Test Site Location : No.8, Lane 724, Bo-ai St., Jhubei City,
Hsinchu County 302, Taiwan, R.O.C.
TEL : 886-3-656-9065
FAX : 886-3-656-9085
Test Site No. : Radiation: 03CH01-CB

4.2. Standard for Methods of Measurement

ANSI C63.4-2009

4.3. Frequency Range Investigated

Test Items	Frequency Range
Radiated emission test	30 MHz to 30,000 MHz

4.4. Test Distance

Test Items	Test Distance
Radiated emission test below 1 GHz (30 MHz to 1,000 MHz)	3 m
Radiated emission test above 1 GHz (1,000 MHz to 18,000 MHz)	3 m
Radiated emission test above 1 GHz (18,000 MHz to 30,000 MHz)	1 m

5. Test of Radiated Emission

5.1. Limit

Radiated Emission below 1 GHz test at 3 m:

Frequency (MHz)	QP (dBuV/m)
30~88	40
88~216	43.5
216~960	46
Above 960	54

Radiated Emission 1~18 GHz test at 3 m:

Frequency (MHz)	PK (dBuV/m)	AV (dBuV/m)
1,000 to 18,000	74	54

Radiated Emission 18~30 GHz test at 1 m:

Frequency (MHz)	PK (dBuV/m)	AV (dBuV/m)
18,000 to 30,000	83.54	63.54

5.2. Description of Major Test Instruments

5.2.1. 30 MHz ~ 1,000 MHz

Receiver Parameter	Setting
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

5.2.2. Above 1 GHz

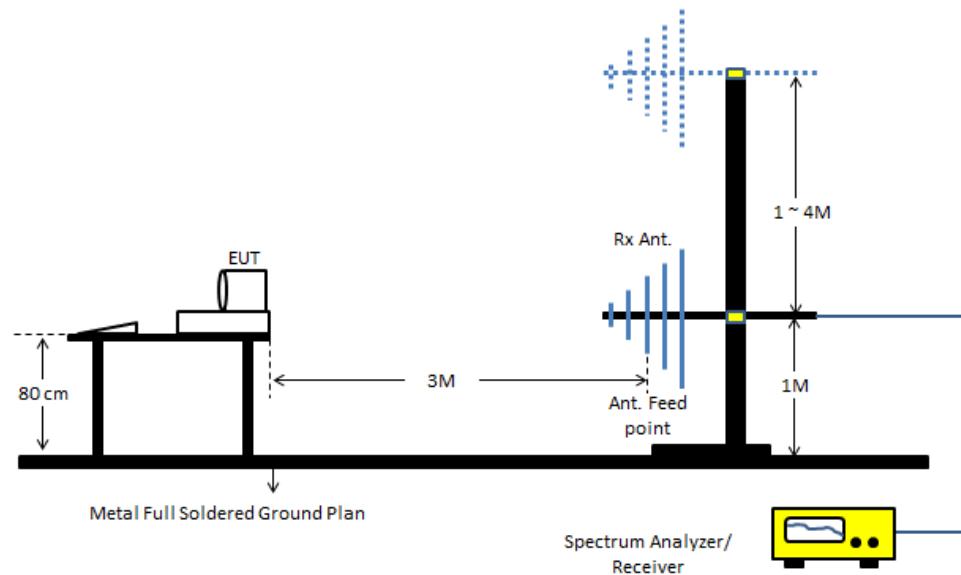
Spectrum Parameter	Setting
Start Frequency	1000 MHz
Stop Frequency	5th harmonic of highest frequency
RBW / VBW	1 MHz / 3MHz for Peak ; 1 MHz / 10Hz for Average

5.3. Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3m meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a half wave dipole and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. 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 turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

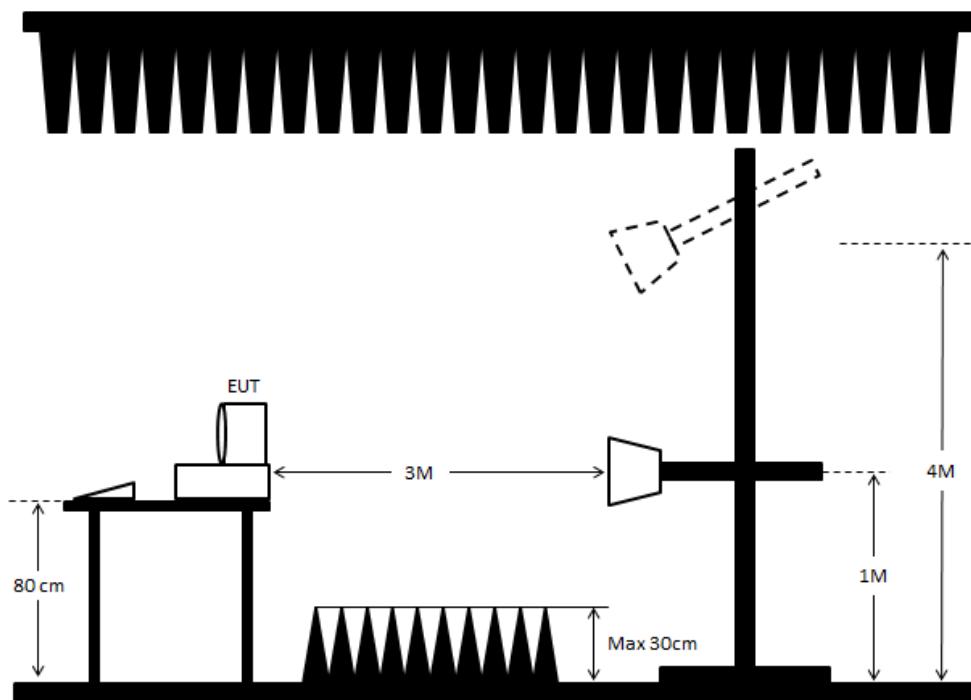
5.4. Typical Test Setup Layout of Radiated Emission

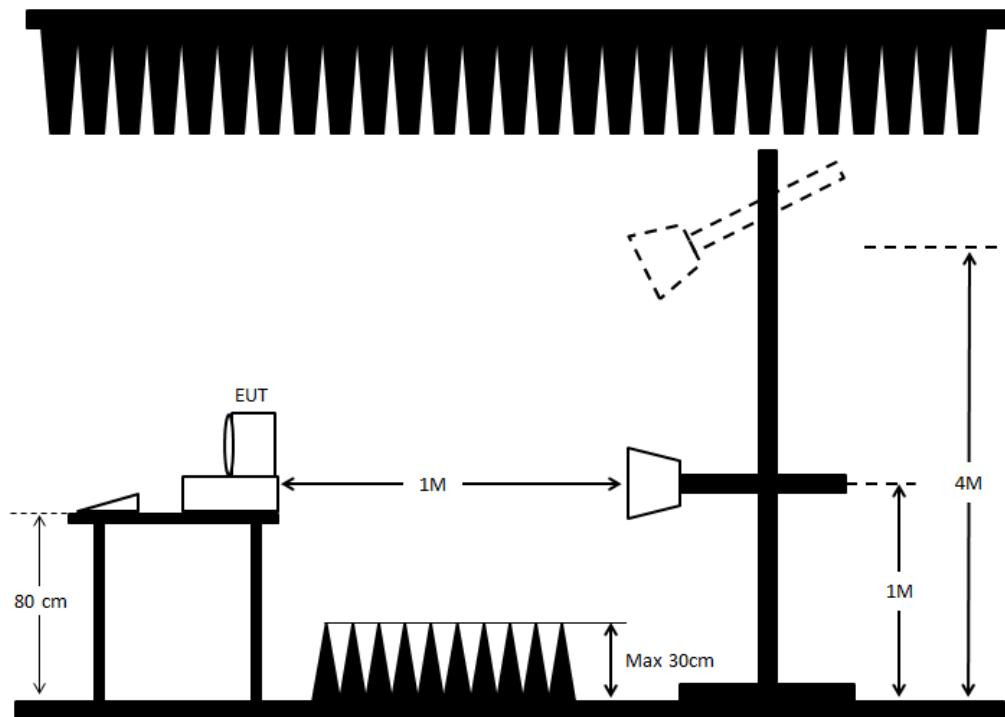
<Below 1 GHz>:



<Above 1 GHz>:

1,000~18,000 MHz

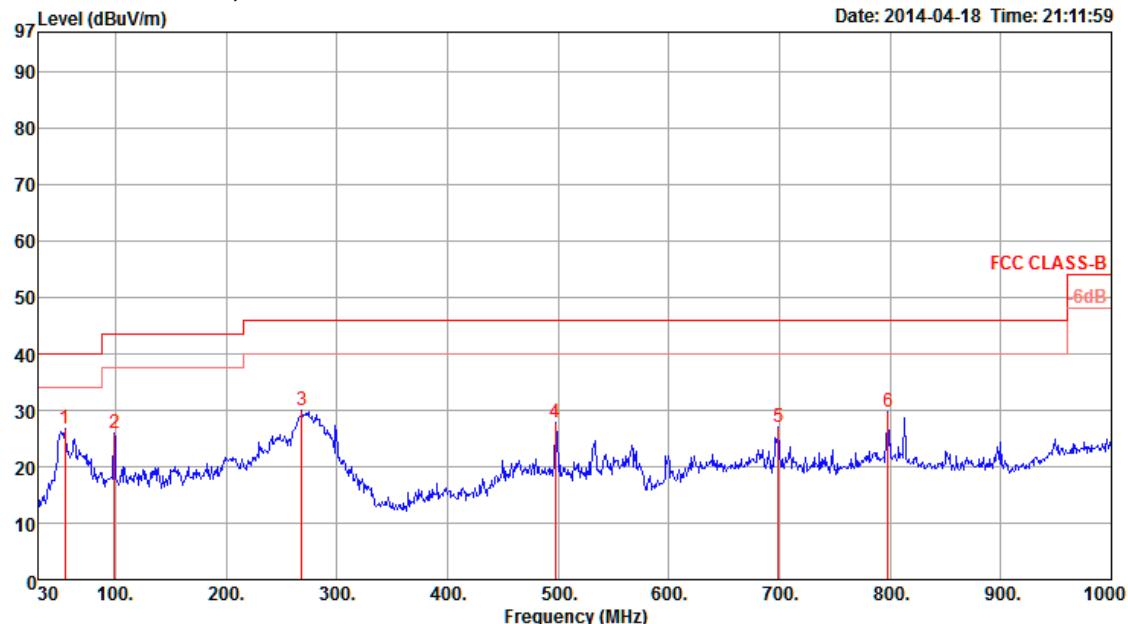


18,000~30,000 MHz

5.5. Test Result of Radiated Emission below 1 GHz

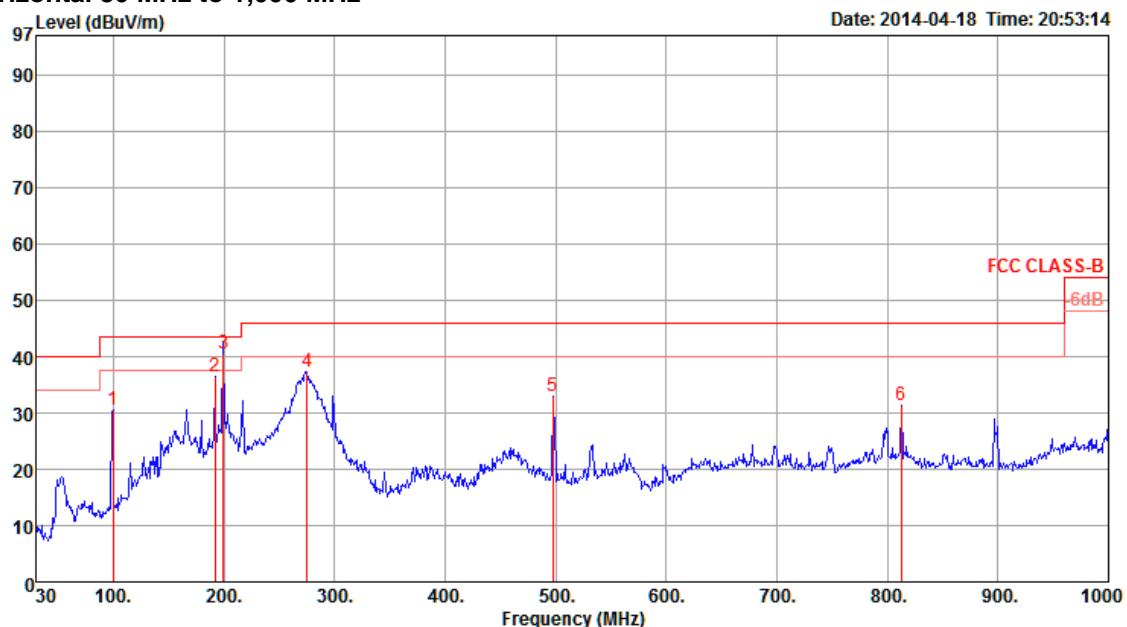
Temperature	21°C	Humidity	61%
Test Engineer	YC Chen	Frequency Range	30 MHz to 1,000 MHz
Test Mode	Mode 2		
<ul style="list-style-type: none"> Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level The test was passed at the minimum margin that marked by the frame in the following test record 			

Vertical 30 MHz to 1,000 MHz



Freq	Level	Limit	Over	Read	Cable			Antenna	Preamp	T/Pos	A/Pos	Pol/Phase
					Line	Limit	dB			deg	cm	
MHz	dBuV/m	dBuV/m										
1	54.25	26.71	40.00	-13.29	52.39	1.12	8.00	27.90	Peak	360	400	VERTICAL
2	98.87	25.84	43.50	-17.66	47.93	1.49	11.20	27.82	Peak	360	400	VERTICAL
3	268.62	30.07	46.00	-15.93	47.03	2.48	13.91	26.90	Peak	360	400	VERTICAL
4	497.54	27.74	46.00	-18.26	41.54	3.37	17.76	27.93	Peak	360	400	VERTICAL
5	699.30	26.99	46.00	-19.01	36.94	4.16	19.90	27.09	Peak	360	400	VERTICAL
6	798.24	29.85	46.00	-16.15	37.42	4.35	21.18	26.90	Peak	360	400	VERTICAL

Horizontal 30 MHz to 1,000 MHz

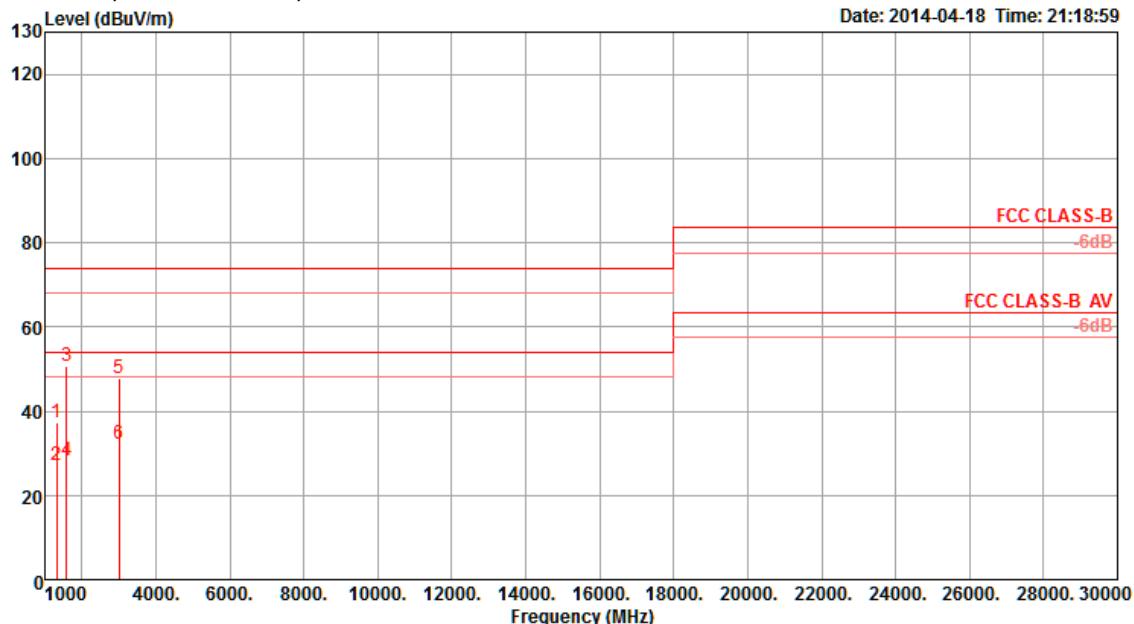


Freq	Level	Limit	Over	Read	Cable Antenna Preamp			T/Pos	A/Pos	Pol/Phase
					Line	Limit	Level			
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm	
1	99.84	30.41	43.50	-13.09	52.27	1.50	11.40	27.82	Peak	0 100 HORIZONTAL
2	191.99	36.38	43.50	-7.12	56.24	2.06	10.08	27.30	Peak	0 100 HORIZONTAL
3	199.75	40.44	43.50	-3.06	58.70	2.09	10.40	27.25	QP	252 100 HORIZONTAL
4	275.41	37.35	46.00	-8.65	54.11	2.51	13.85	26.89	Peak	0 100 HORIZONTAL
5	497.54	33.04	46.00	-12.96	46.84	3.37	17.76	27.93	Peak	0 100 HORIZONTAL
6	812.79	31.35	46.00	-14.65	39.21	4.38	21.30	26.89	Peak	0 100 HORIZONTAL

5.6. Test Result of Radiated Emission above 1 GHz

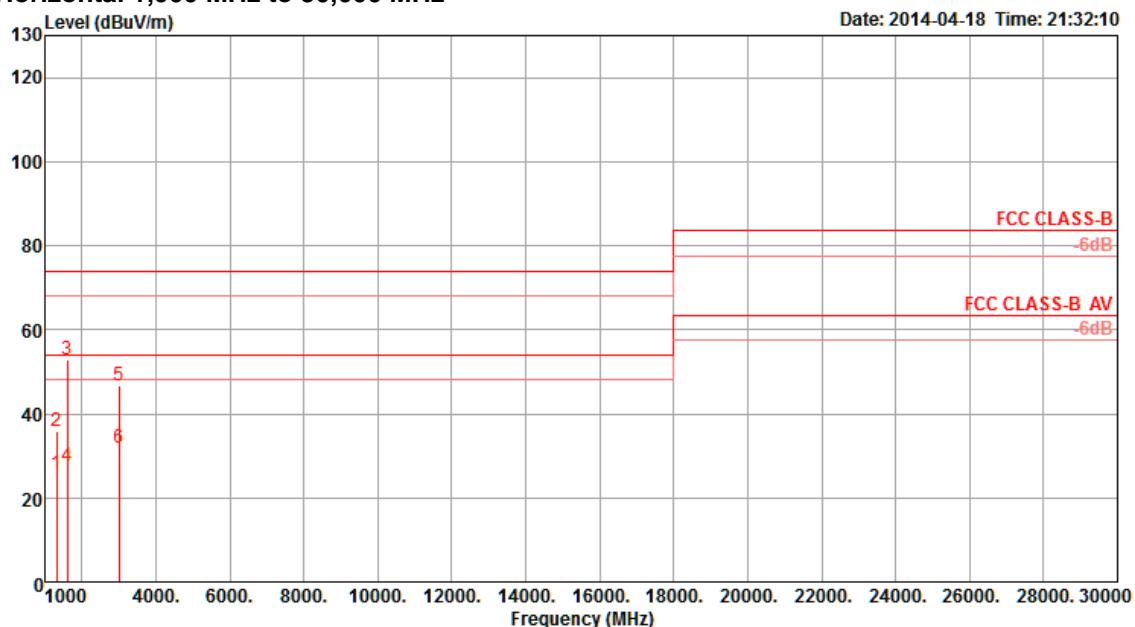
Temperature	21°C	Humidity	61%
Test Engineer	YC Chen	Frequency Range	1,000 MHz to 30,000 MHz
Test Mode	Mode 2		
<ul style="list-style-type: none"> Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level The test was passed at the minimum margin that marked by the frame in the following test record 			

Vertical 1,000 MHz to 30,000 MHz



Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss Factor			Antenna Factor	Preamp Factor	Remark	T/Pos	A/Pos	Pol/Phase
					MHz	dBuV/m	dBuV/m	dB	dB	dB/m	dB		
1	1325.60	37.15	74.00	-36.85	45.52	2.11	24.88	35.36	Peak	79	100	VERTICAL	
2	1325.90	27.33	54.00	-26.67	35.70	2.11	24.88	35.36	Average	79	100	VERTICAL	
3	1594.80	50.70	74.00	-23.30	57.30	2.33	26.08	35.01	Peak	189	100	VERTICAL	
4	1594.80	28.15	54.00	-25.85	34.75	2.33	26.08	35.01	Average	189	100	VERTICAL	
5	2995.70	47.72	74.00	-26.28	50.20	3.25	29.15	34.88	Peak	156	100	VERTICAL	
6	2995.70	32.14	54.00	-21.86	34.62	3.25	29.15	34.88	Average	156	100	VERTICAL	

Horizontal 1,000 MHz to 30,000 MHz



Freq MHz	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Read Level dBuV	Cable Loss dB	Antenna Factor dB/m	Preamp Factor dB	Remark	T/Pos	A/Pos	Pol/Phase
									deg	cm	
1 1322.70	25.85	54.00	-28.15	34.22	2.11	24.88	35.36	Average	342	100	HORIZONTAL
2 1328.50	35.97	74.00	-38.03	44.34	2.11	24.88	35.36	Peak	342	100	HORIZONTAL
3 1597.70	52.72	74.00	-21.28	59.32	2.33	26.08	35.01	Peak	248	100	HORIZONTAL
4 1597.70	27.53	54.00	-26.47	34.13	2.33	26.08	35.01	Average	248	100	HORIZONTAL
5 2995.70	46.83	74.00	-27.17	49.31	3.25	29.15	34.88	Peak	314	100	HORIZONTAL
6 2995.70	31.90	54.00	-22.10	34.38	3.25	29.15	34.88	Average	314	100	HORIZONTAL

6. List of Measuring Equipment Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
BILOG ANTENNA	Schaffner	CBL6112D	2888	20MHz ~ 2GHz	Jan. 15, 2014	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz~18GHz	Nov. 01, 2013	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBEAK	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Dec. 17, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 12, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Dec. 16, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Oct. 23, 2013	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100019	9kHz~40GHz	Dec. 02, 2013	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Dec. 12, 2013	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R.	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO2000	N/A	1 m - 4 m	N.C.R.	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz - 1 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-3	N/A	1 GHz - 40 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-4	N/A	1 GHz - 40 GHz	Nov. 17, 2013	Radiation (03CH01-CB)

※ Calibration Interval of instruments listed above is one year.

N.C.R. means Non-Calibration required.

7. Uncertainty of Test Site

Uncertainty of Radiated Emission Measurement (30MHz ~ 1,000MHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	± 0.173	dB	K=1	0.086
Cable loss	± 0.174	dB	K=2	0.087
Antenna gain	± 0.169	dB	K=2	0.084
Site imperfection	± 0.433	dB	Triangular	0.214
Pre-amplifier gain	± 0.366	dB	K=2	0.183
Transmitter antenna	± 1.200	dB	Rectangular	0.600
Signal generator	± 0.461	dB	Rectangular	0.231
Mismatch	± 0.080	dB	U-shape	0.040
Spectrum analyzer	± 0.500	dB	Rectangular	0.250
Combined standard uncertainty $U_c(y)$				1.778
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				3.555

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	± 0.191	dB	K=1	0.095
Cable loss	± 0.169	dB	K=2	0.084
Antenna gain	± 0.191	dB	K=2	0.096
Site imperfection	± 0.582	dB	Triangular	0.291
Pre-amplifier gain	± 0.304	dB	K=2	0.152
Transmitter antenna	± 1.200	dB	Rectangular	0.600
Signal generator	± 0.461	dB	Rectangular	0.231
Mismatch	± 0.080	dB	U-shape	0.040
Spectrum analyzer	± 0.500	dB	Rectangular	0.250
Combined standard uncertainty $U_c(y)$				1.839
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				3.678

Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	± 0.186	dB	K=1	0.093
Cable loss	± 0.167	dB	K=2	0.083
Antenna gain	± 0.190	dB	K=2	0.095
Site imperfection	± 0.488	dB	Triangular	0.244
Pre-amplifier gain	± 0.269	dB	K=2	0.134
Transmitter antenna	± 1.200	dB	Rectangular	0.600
Signal generator	± 0.461	dB	Rectangular	0.231
Mismatch	± 0.080	dB	U-shape	0.040
Spectrum analyzer	± 0.500	dB	Rectangular	0.250
Combined standard uncertainty $U_c(y)$				1.771
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				3.541