FCC/IC Test Report

APPLICANT	:	Atheros Communications, Inc.
EQUIPMENT	:	802.11a/b/g/n WLAN + Bluetooth Combo module
BRAND NAME	:	Atheros
MODEL NAME	:	ARS42
FCC ID	:	PPD-ARS42
IC	:	4104A-ARS42
STANDARD	:	IC ICES-003 Issue 4 FCC 47 CFR FCC Part 15 Subpart B IC RSS-210 Issue 8

The WiFi + Bluetooth module was tested on extended card inserted to a host laptop PC. The product was received on Feb. 15, 2011 and completely tested on Mar. 21, 2011. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2003 and shown the 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:

Roy Wu / Manager

Testing Laboratory 1190

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

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FD121516	Rev. 01	Initial issue of report	Apr. 07, 2011

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.107	7.2.2	AC Conducted Emission	< 15.107 limits < RSS-Gen table 2 limits	PASS	Under limit 16.4 dB at 0.19 MHz
3.2	15.109	7.2.3.2	Radiated Emission	< 15.109 limits or < RSS-Gen table 1 limits (Section 6)	PASS	Under limit 3.02 dB at 35.94 MHz

1. General Description

1.1. Applicant

Atheros Communications, Inc.
1700 Technology Drive, San Jose, CA 95110, United States

1.2. Manufacturer

Atheros Communications, Inc.
1700 Technology Drive, San Jose, CA 95110, United States

1.3. Test Site Facilities

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: +886-3-327-3456 FAX: +886-3-328-4978		
Test Site No.	**Sporton Site No.**		**FCC/IC Registration No.**
	CO05-HY	03CH07-HY	TW1022/4086B-1

1.4. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC 47 CFR FCC Part 15 Subpart B
- CAN/CSA-CEI/IEC CISPR 22 : 02
- ANSI C63.4-2003
- IC RSS-Gen Issue 3
- IC ICES-003 Issue 4
- IC RSS-210 Issue 8

Remark:

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

2. The test results for FCC compliance, indicating that these results are deemed satisfactory evidence of compliance with **Industry Canada Interference-Causing Equipment Standard ICES-003**.

1.5. Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
2.	Notebook	DELL	Larirude E4300	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	LCD Monitor	Lenovo	6135-AB1	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m

2. Equipment Under Test

2.1. General Information of EUT

Product Feature & Specification	
Equipment	802.11a/b/g/n WLAN + Bluetooth Combo module
Brand Name	Atheros
Model Name	ARS42
FCC ID	PPD-ARS42
IC	4104A-ARS42
Tx/Rx Frequency Range	Bluetooth : 2400 MHz ~ 2483.5 MHz 802.11b/g/n : 2400 MHz ~ 2483.5 MHz 802.11a/n : 5150 MHz ~ 5350 MHz 5470 MHz ~ 5725 MHz 5725 MHz ~ 5850 MHz
Antenna Type	PIFA Antenna
Type of Modulation	Bluetooth (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π/4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK 802.11b : DSSS (BPSK / QPSK / CCK) 802.11a/g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM
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.

2.2. Antenna Information

Brand / Model Name	Type	Frequency Range (MHz)	Antenna Gain (dBi)
Wistron Neweb Corporation / EBJ Aux.	PIFA	2400 ~ 2500	3.62
Wistron Neweb Corporation / ED4 Main	PIFA	5150 ~ 5350	5.56
Wistron Neweb Corporation / ED4 Aux.	PIFA	5470 ~ 5725	5.34
Wistron Neweb Corporation / EBJ Main	PIFA	5725 ~ 5850	4.76

2.3. Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 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 (30MHz to the 5th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

The following tables are showing the test modes as the worst cases and recorded in this report.

Item	EUT Configuration	Test Condition		
		EMI AC	EMI RE<1G	EMI RE≥1G
1.	Operating Mode (EUT with notebook)	☒	☒	☒

Abbreviations:

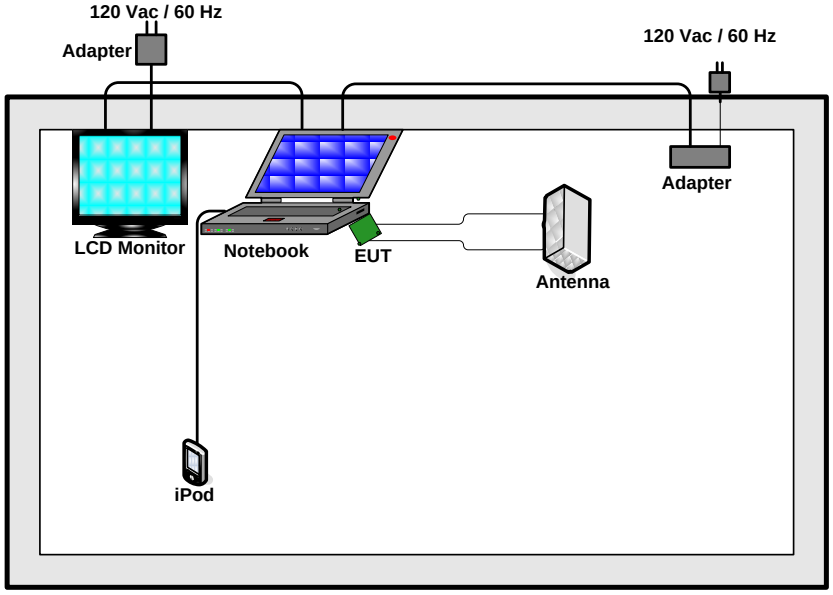
- EMI AC: AC conducted emissions
- EMI RE ≥ 1G: EUT radiated emissions ≥ 1GHz
- EMI RE < 1G: EUT radiated emissions < 1GHz

Test Items	EUT Configure Mode	Function Type
AC Conducted Emission	1	Mode 1 : WLAN On (2.4G) + Bluetooth On Mode 2 : WLAN On (5G) + Bluetooth On
Radiated Emissions < 1GHz	1	Mode 1 : WLAN On (2.4G) + Bluetooth On Mode 2 : WLAN On (5G) + Bluetooth On
Radiated Emissions ≥ 1GHz	1	Mode 1 : WLAN On (2.4G) + Bluetooth On

Remark:

1. The worst case of AC is mode 2; only the test data of this mode was reported.
2. The worst case of RE < 1G is mode 1; only the test data of this mode was reported.

2.4. Connection Diagram of Test System



2.5. Test Software

Turn on Bluetooth and WLAN Function during the test.

3. Test Result

3.1. Test of AC Conducted Emission Measurement

3.1.1 Limits 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 (dBuV)	
	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.

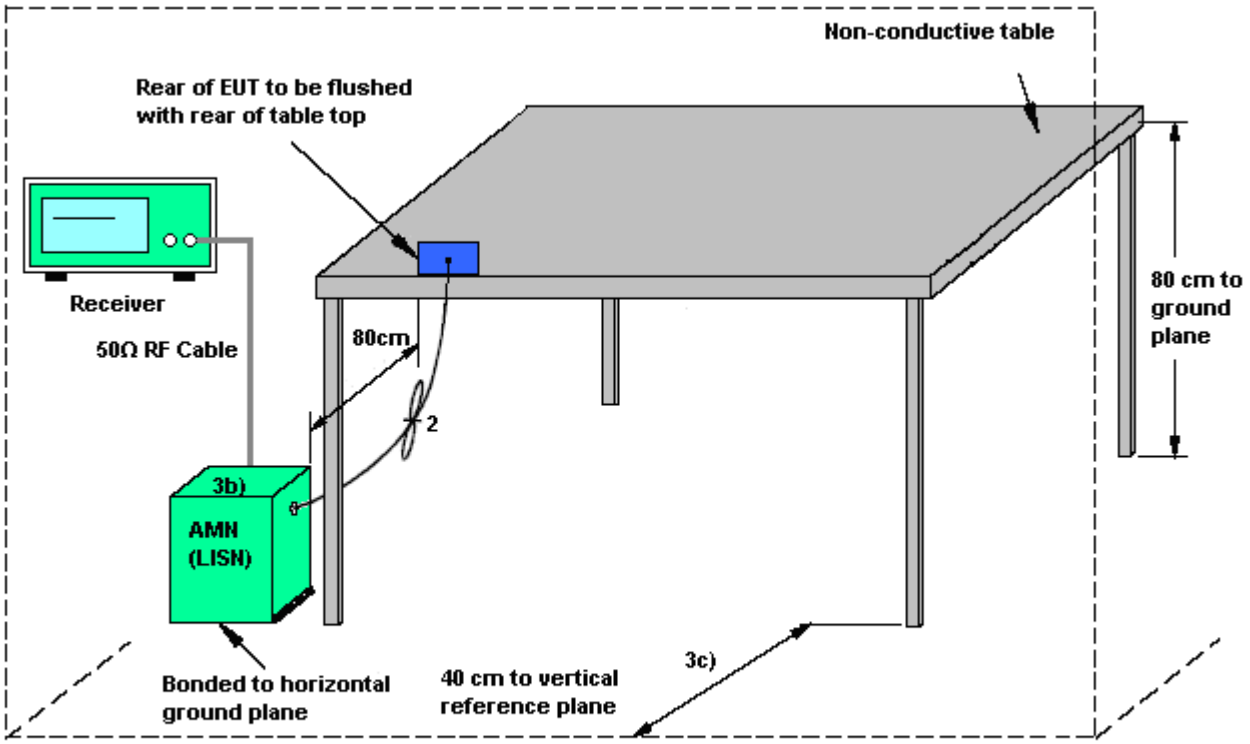
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedure

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.

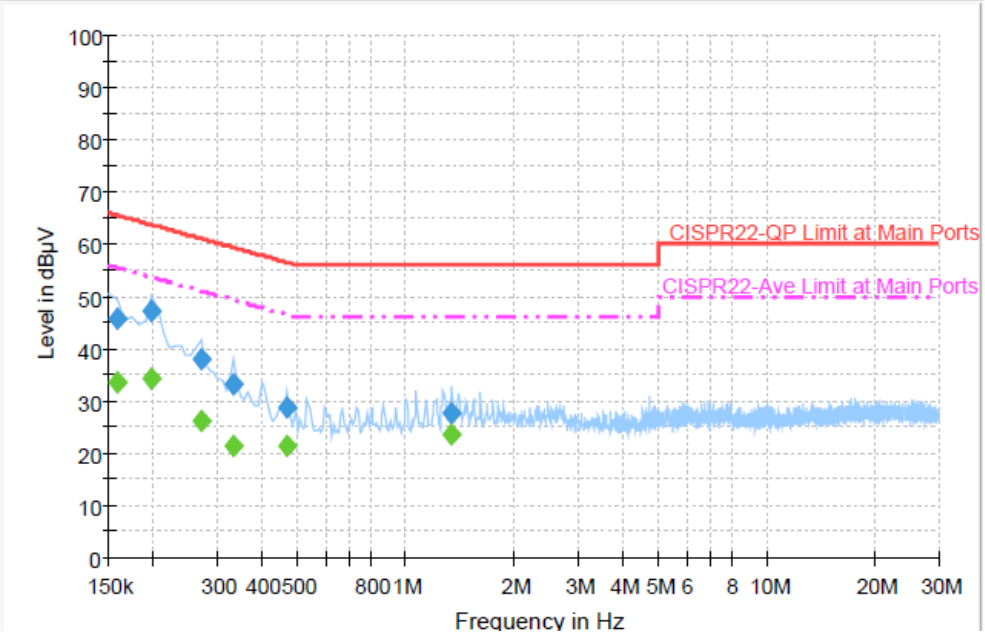
3.1.4 Test Setup



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

3.1.5 Test Result of AC Conducted Emission

Test Mode :	Mode 2	**Temperature :**	20~22℃
Test Engineer :	Cona Huang	**Relative Humidity :**	40~42%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	WLAN On (2.4G) + Bluetooth On		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



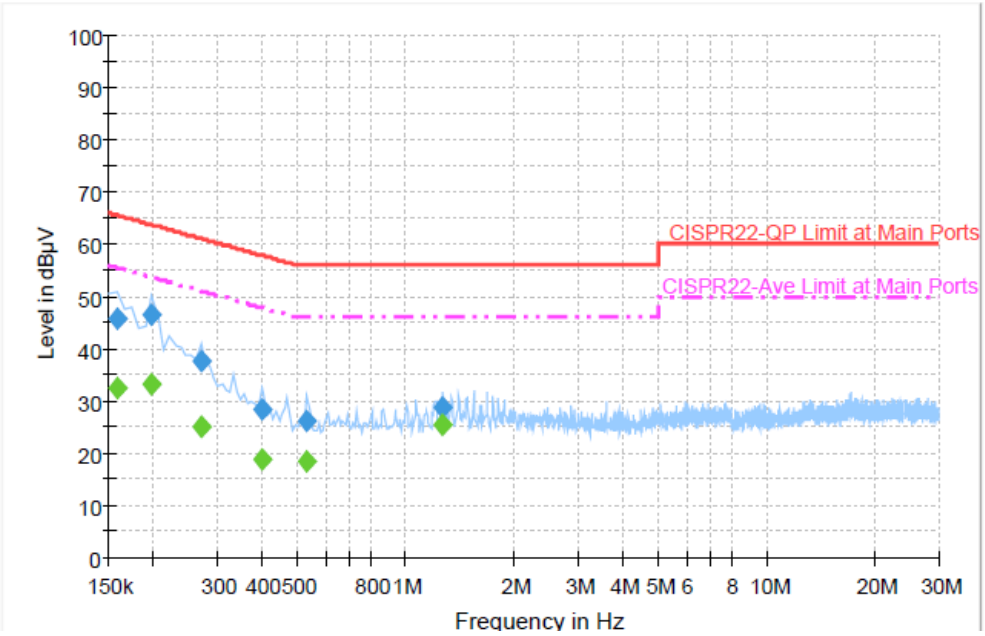
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	45.6	Off	L1	19.3	20.0	65.6
0.198000	47.3	Off	L1	19.3	16.4	63.7
0.270000	38.0	Off	L1	19.3	23.1	61.1
0.334000	33.2	Off	L1	19.3	26.2	59.4
0.470000	28.8	Off	L1	19.4	27.7	56.5
1.342000	27.5	Off	L1	19.4	28.5	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	33.4	Off	L1	19.3	22.2	55.6
0.198000	34.2	Off	L1	19.3	19.5	53.7
0.270000	26.2	Off	L1	19.3	24.9	51.1
0.334000	21.4	Off	L1	19.3	28.0	49.4
0.470000	21.4	Off	L1	19.4	25.1	46.5
1.342000	23.7	Off	L1	19.4	22.3	46.0

Test Mode :	Mode 2	Temperature :	20~22℃
Test Engineer :	Cona Huang	Relative Humidity :	40~42%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN On (2.4G) + Bluetooth On		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	45.9	Off	N	19.4	19.7	65.6
0.198000	46.6	Off	N	19.3	17.1	63.7
0.270000	37.5	Off	N	19.3	23.6	61.1
0.398000	28.3	Off	N	19.4	29.6	57.9
0.534000	26.4	Off	N	19.3	29.6	56.0
1.270000	28.7	Off	N	19.5	27.3	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	32.7	Off	N	19.4	22.9	55.6
0.198000	33.3	Off	N	19.3	20.4	53.7
0.270000	25.1	Off	N	19.3	26.0	51.1
0.398000	18.8	Off	N	19.4	29.1	47.9
0.534000	18.6	Off	N	19.3	27.4	46.0
1.270000	25.5	Off	N	19.5	20.5	46.0

3.2. Test of Radiated Emission Measurement

3.2.1. Limit of Radiated Emission

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

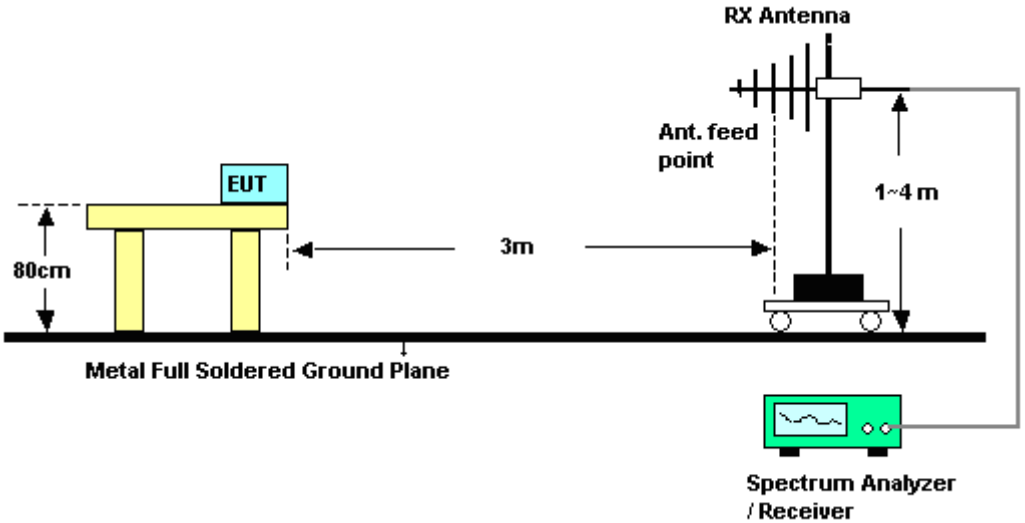
3.2.2. Measuring Instruments

See list of measuring instruments of this test report.

3.2.3. Test Procedures

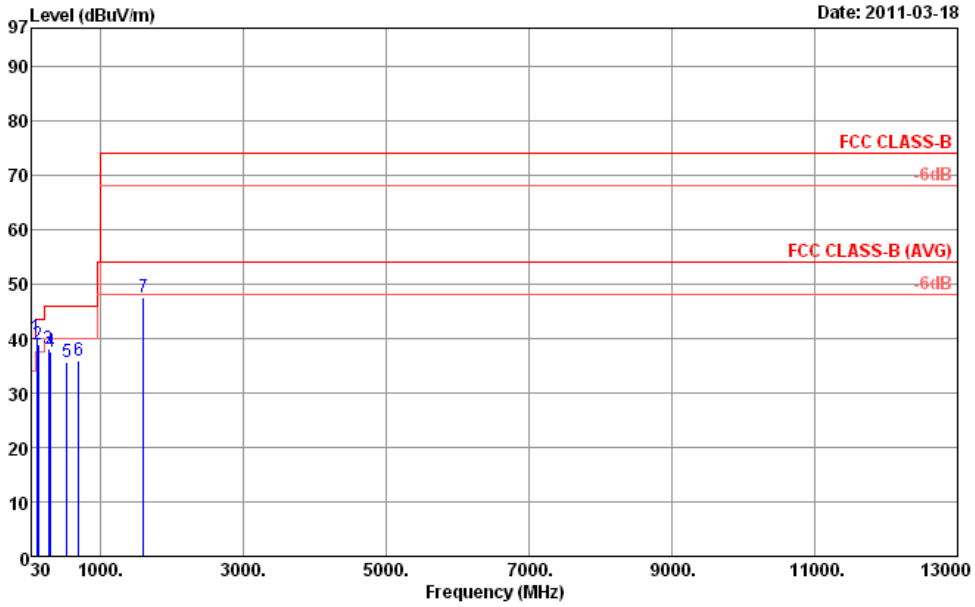
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. 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.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. 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 will be repeated one by one using the quasi-peak method and reported
8. Emission level (dBuV/m) = 20 log Emission level (uV/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.2.4. Test Setup of Radiated Emission



3.2.5. Test Result of Radiated Emission

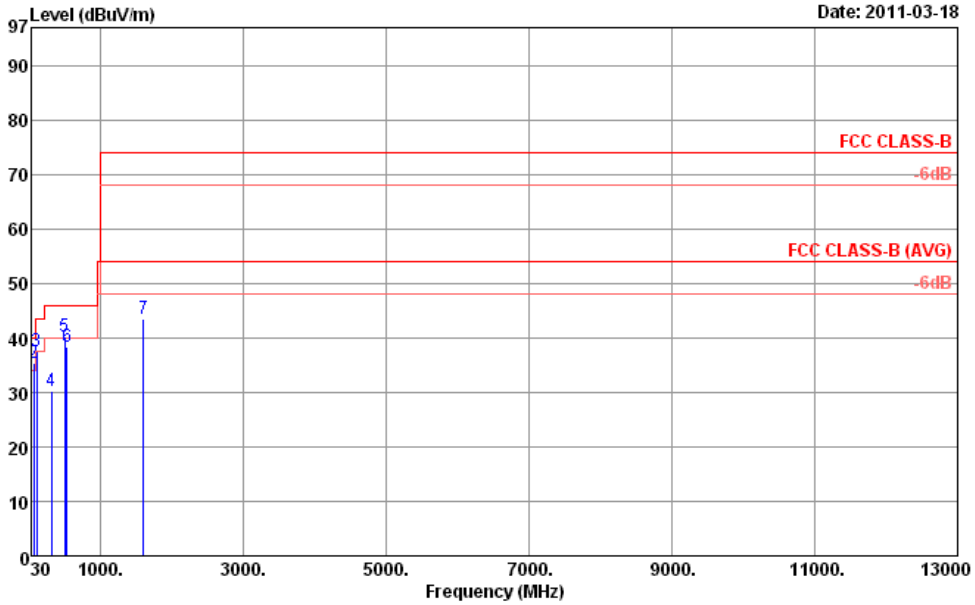
Test Mode :	Mode 1	Temperature :	24~25°C
Test Engineer :	Cona Huang	Relative Humidity :	45~50%
Test Distance :	3m	Polarization :	Horizontal
Function Type :	WLAN On (2.4G) + Bluetooth On		



Site : 03CH07-HY
Condition : FCC CLASS-B HF_ANT_100824 HORIZONTAL
Power : FromSystem
Project : FD 121516
Mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 !	111.00	40.29	-3.21	43.50	60.62	10.24	0.95	31.52	100	157	Peak
2 !	126.93	39.03	-4.47	43.50	58.55	10.93	1.07	31.52	---	---	Peak
3	275.70	38.03	-7.97	46.00	56.03	11.92	1.48	31.40	---	---	Peak
4	301.40	37.51	-8.49	46.00	55.02	12.21	1.55	31.27	---	---	Peak
5	533.10	35.74	-10.26	46.00	47.01	17.62	2.10	30.99	---	---	Peak
6	696.90	35.87	-10.13	46.00	45.06	19.13	2.40	30.72	---	---	Peak
7	1598.00	47.44	-26.56	74.00	73.22	28.66	3.65	58.09	100	0	Peak

Test Mode :	Mode 1	Temperature :	24~25°C
Test Engineer :	Cona Huang	Relative Humidity :	45~50%
Test Distance :	3m	Polarization :	Vertical
Function Type :	WLAN On (2.4G) + Bluetooth On		



Site : 03CH07-HY
Condition : FCC CLASS-B HF_ANT_100824 VERTICAL
Power : FromSystem
Project : FD 121516
Mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 !	35.94	36.98	-3.02	40.00	52.88	15.04	0.58	31.52	100	36	Peak
2 !	69.42	35.33	-4.67	40.00	60.20	5.79	0.84	31.50	---	---	Peak
3 !	108.57	37.52	-5.98	43.50	58.07	10.03	0.95	31.53	---	---	Peak
4	311.90	30.34	-15.66	46.00	47.58	12.49	1.55	31.28	---	---	Peak
5 !	497.40	40.34	-5.66	46.00	52.37	17.01	2.04	31.08	---	---	Peak
6	533.10	38.44	-7.56	46.00	49.71	17.62	2.10	30.99	---	---	Peak
7	1598.00	43.62	-30.38	74.00	69.40	28.66	3.65	58.09	100	0	Peak

4. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Due Date	Remark
EMI Test Receive	R&S	ESCS 30	100356	9KHz – 2.75GHz	Aug. 16, 2010	Aug. 15, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100081	9KHz – 30MHz	Dec. 03, 2010	Dec. 02, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100080	9KHz – 30MHz	Dec. 01, 2010	Nov. 30, 2011	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	N/A	Conduction (CO05-HY)
ISN	Teseq GmbH	ISN T400A	25696	N/A	Jun. 19, 2010	Jun. 18, 2011	Conduction (CO05-HY)
ISN	Teseq GmbH	ISN T800	27134	N/A	Jun. 19, 2010	Jun. 18, 2011	Conduction (CO05-HY)
DC- LISN	R&S	ESH3-26	1000485	0.1MHz~200MHz	Jun. 17, 2010	Jun. 16, 2011	Conduction (CO05-HY)
DC- LISN	R&S	ESH3-26	1000484	0.1MHz~200MHz	Jun. 17, 2010	Jun. 16, 2011	Conduction (CO05-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2726	30MHz ~ 1GHz	Oct. 31, 2010	Oct. 30, 2011	Radiation (03CH07-HY)
Spectrum Analyzer	R&S	FSP	101067	9KHz ~ 30GHz	Dec. 03, 2010	Dec. 02, 2011	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 19, 2010	Aug. 18, 2011	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz- 40GHz	Oct. 18, 2010	Oct. 17, 2011	Radiation (03CH07-HY)
Pre Amplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Dec. 06, 2010	Dec. 05, 2011	Radiation (03CH07-HY)
Pre Amplifier	COM-POWER	PA-103A	161241	10-1000MHz.32 dB.GAIN	Mar. 27, 2010	Mar. 26, 2011	Radiation (03CH07-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz~30 MHz	Jul. 29, 2010	Jul. 28, 2011	Radiation (03CH07-HY)

5. Uncertainty of Evaluation

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

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.10	Normal (k=2)	0.05
Cable Loss	0.10	Normal (k=2)	0.05
AMN Insertion Loss	2.50	Rectangular	0.63
Receiver Specification	1.50	Rectangular	0.43
Site Imperfection	1.39	Rectangular	0.80
Mismatch	+0.34 / -0.35	U-Shape	0.24
Combined Standard Uncertainty Uc(y)	**1.13**		
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**		

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

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.41	Normal (k=2)	0.21
Antenna Factor Calibration	0.83	Normal (k=2)	0.42
Cable Loss Calibration	0.25	Normal (k=2)	0.13
Pre-Amplifier Gain Calibration	0.27	Normal (k=2)	0.14
RCV/SPA Specification	2.50	Rectangular	0.72
Antenna Factor Interpolation for Frequency	1.00	Rectangular	0.29
Site Imperfection	1.43	Rectangular	0.83
Mismatch	+0.39 / -0.41	U-Shape	0.28
Combined Standard Uncertainty Uc(y)	**1.27**		
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.54**		

Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Contribution	Uncertainty of X_i		$u(X_i)$	C_i	$C_i * u(X_i)$
	dB	Probability Distribution			
Receiver Reading	±0.10	Normal (k=2)	0.10	1	0.10
Antenna Factor Calibration	±1.70	Normal (k=2)	0.85	1	0.85
Cable Loss Calibration	±0.50	Normal (k=2)	0.25	1	0.25
Receiver Correction	±2.00	Rectangular	1.15	1	1.15
Antenna Factor Directional	±1.50	Rectangular	0.87	1	0.87
Site Imperfection	±2.80	Triangular	1.14	1	1.14
Mismatch Receiver VSWR Γ1 = 0.197 Antenna VSWR Γ2 = 0.194 Uncertainty = 20Log(1-Γ1*Γ2)	+0.34 / -0.35	U-Shape	0.244	1	0.244
Combined Standard Uncertainty Uc(y)	**2.36**				
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.72**				

Appendix A. Photographs of EUT

Please refer to Sporton report number EP121516 as below.