



FCC 47 CFR PART 15 SUBPART B TEST REPORT

for

802.11n 2x2 PCIe Minicard transceiver

MODEL: AR5B93

Test Report Number:

81203004-D

Issued for

Atheros Communications, Inc.

5480 Great America Parkway Santa Clara CA 95054

Issued By:

Compliance Certification Services Inc.

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	December 23, 2008	Initial Issue	ALL	Jason Chang



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1 TEST RESULT CERTIFICATION

Product:	802.11n 2x2 PCIe Minicard transceiver
Model:	AR5B93
Brand:	Atheros
Applicant:	Atheros Communications, Inc. 5480 Great America Parkway Santa Clara CA 95054
Manufacturer:	Atheros Communications, Inc. 5480 Great America Parkway Santa Clara CA 95054
Tested:	December 03 ~ 22, 2008
Test Voltage:	120VAC/60Hz

EMISSION			
Standard	Item	Result	Remarks
FCC 47 CFR Part 15 Subpart B (May 4, 2007), ICES-003 Issue 4 ANSI C63.4-2003	Conducted	PASS	Meet Class B limit
	Radiated	PASS	Meet Class B limit

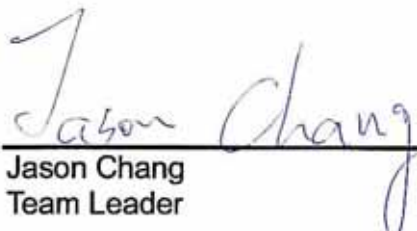
- Note: 1. The test result judgment is decided by the limit of measurement standard
2. The information of measurement uncertainty is available upon the customer's request.

Deviation from Applicable Standard
None

The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Reviewed by:



Jason Chang
Team Leader



Alan Fan
Team Leader



2 EUT DESCRIPTION

Product	802.11n 2x2 PCIe Minicard transceiver
Brand Name	Atheros
Model	AR5B93
Model Discrepancy	N/A
Applicant	Atheros Communications, Inc.
Housing material	Plastic
Serial Number	81203004
Received Date	December 22, 2008
EUT Power Rating	Powered by host device

I/O PORT

I/O PORT TYPES	Q'TY	TESTED WITH
N/A		



3 TEST METHODOLOGY

3.1. DECISION OF FINAL TEST MODE

1. The following test mode was scanned during the preliminary test:

Pre-Test Mode
Mode 1: EUT Transceiving (Operated at normal link function)

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test Mode		
Emission	Conducted Emission	Mode 1
	Radiated Emission	Mode 1

Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.

3.2. EUT SYSTEM OPERATION

1	EUT was connected to Notebook PC via test kit.
2	Install drivers.
3	Run Art program and link the auxiliary AP.
4	Start test.

Note: Test program is self-repeating throughout the test.



4 SETUP OF EQUIPMENT UNDER TEST

4.1. DESCRIPTION OF SUPPORT UNITS

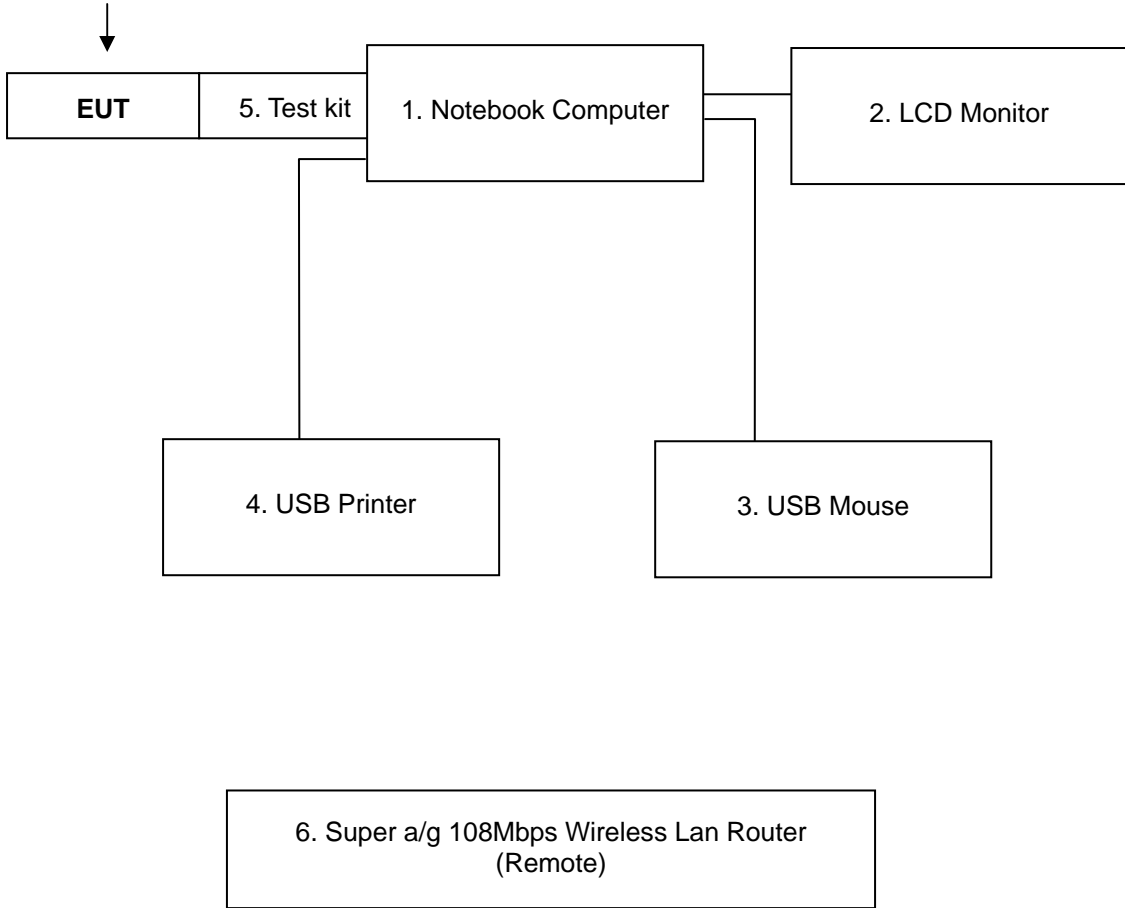
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Manufacturer	Model No.	Serial No.	FCC ID
1	Notebook PC	DELL	Latitude D610	CN-0C4708-48643-625-5565	E2K24BNHM
2	LCD Monitor	ViewSonic	VA1918wm	R18082204614	DoC
3	Mouse	KINYO	KM-770	0804	DoC
4	Printer	HP	C6431D	CN19T6S011	DoC
5	Wireless Router	D-Link	DI-724GU	-----	DoC

Note: Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.2. CONFIGURATION OF SYSTEM UNDER TEST

802.11n 2x2 PCIe Minicard transceiver





5 FACILITIES AND ACCREDITATIONS

5.1. FACILITIES

All measurement facilities used to collect the measurement data are located at:

- Rm.258, Bldg.17, NO.195 , Sec. 4, Chung Hsing Rd., Chu-Tung Chen. Hsin-Chu, Taiwan 310 R.O.C.
- NO. 989-1 Wen Shan Rd., Shang Shan Village, Qionglin Shiang Hsinchu County 30741, Taiwan, R.O.C

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Taiwan	TAF
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The measuring facility of laboratories has been authorized or registered by the following approval agencies.

USA	FCC
Canada	Industry Canada
Japan	VCCI
Taiwan	NCC
	BSMI

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsemc.com>



5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Uncertainty
Conducted emissions	9kHz~30MHz	+/- 2.1 dB
Radiated emissions	30 ~ 1000MHz	+/- 3.2 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Consistent with industry standard (e.g. CISPR 22: 2006, clause 11, Measurement Uncertainty) determining compliance with the limits shall be based on the results of the compliance measurement. Consequently the measured emissions being less than the maximum allowed emission result in this being a compliant test or passing test.

The acceptable measurement uncertainty value without requiring revision of the compliance statement is based on conducted and radiated emissions being less than U_{CISPR} which is 3.6dB and 5.2dB respectively. CCS values (called U_{Lab} in CISPR 16-4-2) is less than U_{CISPR} as shown in the table above. Therefore, MU need not be considered for compliance.



6 CONDUCTED EMISSION MEASUREMENT

6.1. LIMITS OF CONDUCTED EMISSION MEASUREMENT

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

- NOTE:** (1) The lower limit shall apply at the transition frequencies.
(2) The limit decreases in line with the logarithm of the frequency in the range 0.15 to 0.50 MHz.
(3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

6.2. TEST INSTRUMENTS

Powerline Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-465	08/14/2009
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-473	10/13/2009
TEST RECEIVER	R & S	ESHS30	838550/003	01/23/2009
PULSE LIMIT	R & S	ESH3-Z2	100117	09/24/2009
N TYPE COAXIAL CABLE	BELDEN	8268 M17/164	003	09/14/2009

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.



6.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-031)

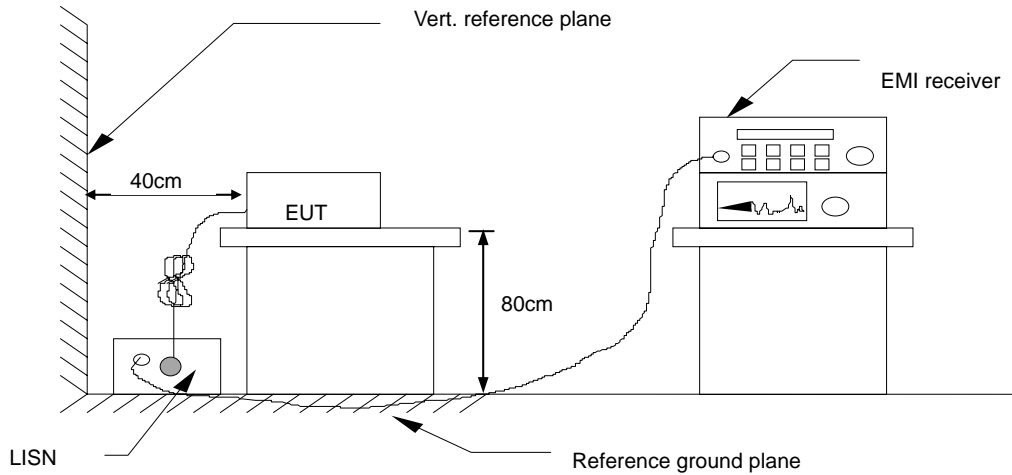
Procedure of Preliminary Test

- The EUT and support equipment, if needed, were set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor standing equipment, it is placed on the ground plane, which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
- The test equipment EUT installed by AC main power, through a Line Impedance Stabilization Network (LISN), which was supplied power source and was grounded to the ground plane.
- All support equipment power by from a second LISN.
- The test program of the EUT was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The Receiver scanned from 150kHz to 30MHz for emissions in each of the test modes.
- During the above scans, the emissions were maximized by cable manipulation.
- The test mode(s) described in Item 3.1 were scanned during the preliminary test.
- After the preliminary scan, we found the test mode described in Item 3.1 producing the highest emission level.
- The worst configuration of EUT and cable of the above highest emission level were recorded for reference of the final test.

Procedure of Final Test

- EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.
- A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.
- The test data of the worst-case condition(s) was recorded.

6.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

6.5. DATA SAMPLE

Frequency (MHz)	Correction factor (dB)	QuasiPeak reading (dBuV)	Average reading (dBuV)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)
x.xx	10.00	43.95	33.00	53.95	43.00	56.00	46.00	-2.05	-3.00

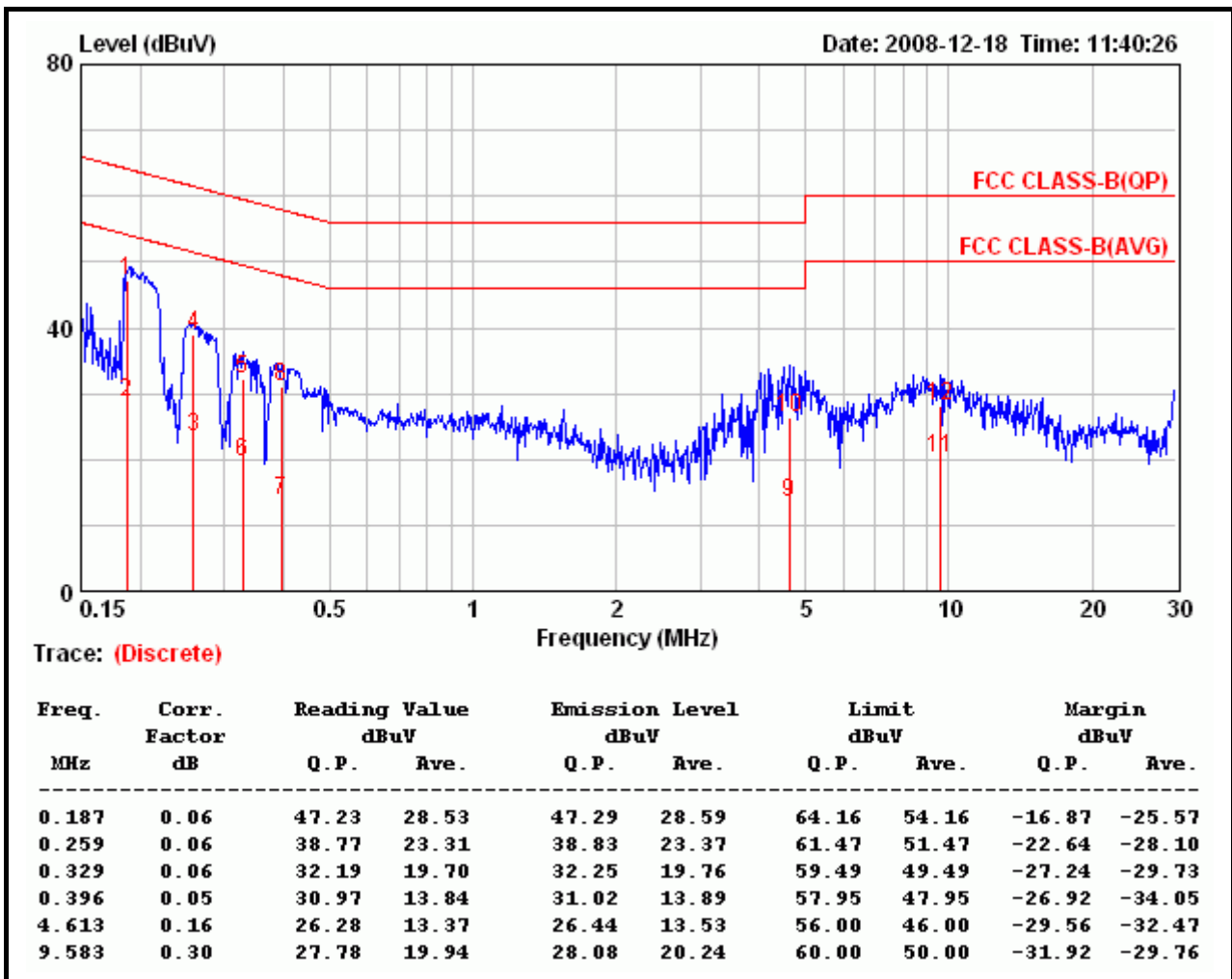
Frequency (MHz) = Emission frequency in MHz
 Reading (dBuV) = Uncorrected Analyzer/Receiver reading + Insertion loss of LISN, if it > 0.5 dB
 Correction Factor (dB) = LISN Factor + Cable loss
 Result (dBuV) = Raw reading converted to dBuV and CF added
 Limit (dBuV) = Limit stated in standard
 Margin (dB) = Result (dBuV) – Limit (dBuV)



6.6. TEST RESULTS

Conduction

Job No.:	81203004	Line:	LINE
Standard:	FCC 15B		
Test Item:	Conduction Emission	Date:	2008/12/18
Temp.(°C)/Hum.(%RH):	22°C / 45%RH	Time:	PM 11:40:26
Company:	Atheros	Tested By:	Rueyyan Lin
Model:	AR5B93	Test Mode:	Mode 1



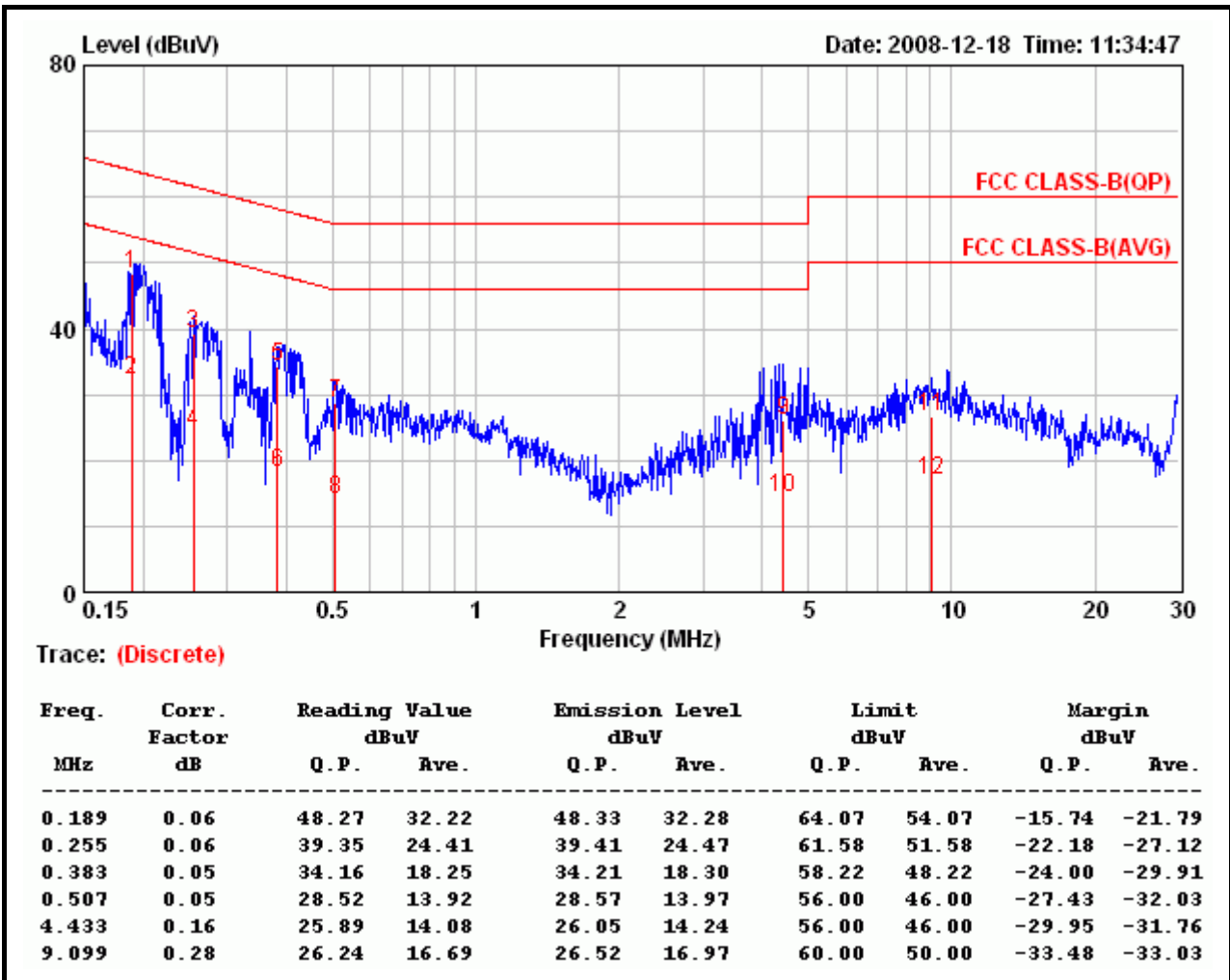
Remark:

1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level – Limit value



Conduction

Job No.:	81203004	Line:	NEUTRAL
Standard:	FCC 15B		
Test Item:	Conduction Emission	Date:	2008/12/18
Temp.(°C)/Hum.(%RH):	22°C / 45%RH	Time:	PM 11:34:47
Company:	Atheros	Tested By:	Rueyyan Lin
Model:	AR5B93	Test Mode:	Mode 1



Remark:

1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level – Limit value



7 RADIATED EMISSION MEASUREMENT

7.1. LIMITS OF RADIATED EMISSION MEASUREMENT

CISPR 22 Limit of Radiated Emission measured at 10 meter

Frequency (MHz)	dBuV/m (At 10m)	
	Class A	Class B
30 ~ 230	40	30
230 ~ 1000	47	37

Frequency (MHz)	Class A (dBuV/m) (At 10m)		Class B (dBuV/m) (At 3m)	
	Average	Peak	Average	Peak
Above 960	59.5	79.5	54	74

NOTE: (1) The lower limit shall apply at the transition frequencies.
 (2) Emission level (dBuV/m) = 20 log Emission level (uV/m).

Maximum permissible level of Radiated Emission measured at 3 meter

Frequency (MHz)	Field Strength (µV/m at 3-meter) Average	Field Strength (dBµV/m at 3-meter) Average
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Frequency (MHz)	Class A (dBuV/m)		Class B (dBuV/m)	
	Average	Peak	Average	Peak
Above 1000	59.3	79.3	54	74

Remark: The lower limit shall apply at the transition frequency.



7.2. TEST INSTRUMENTS

3M Semi Anechoic Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
BILOG ANTENNA	SCHWARZBECK	VNLB	9168	09/18/2009
TEST RECEIVER	R/S	ESCI	100221	05/21/2009
OPEN SITE	-----	-----	No.2	05/07/2009
Spectrum ANALYZER	AGILENT	E4446A	MY46180323	05/21/2009
N TYPE COAXIAL CABLE	MIYAZAKIN	8D-FB	02	05/27/2009
PRE-AMPLIFIER	EM	EM30265	07032612	05/22/2009
Test S/W	LABVIEW (V 6.1)			

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.



7.3. TEST PROCEDURE (please refer to measurement standard or CCS SOP PA-031)

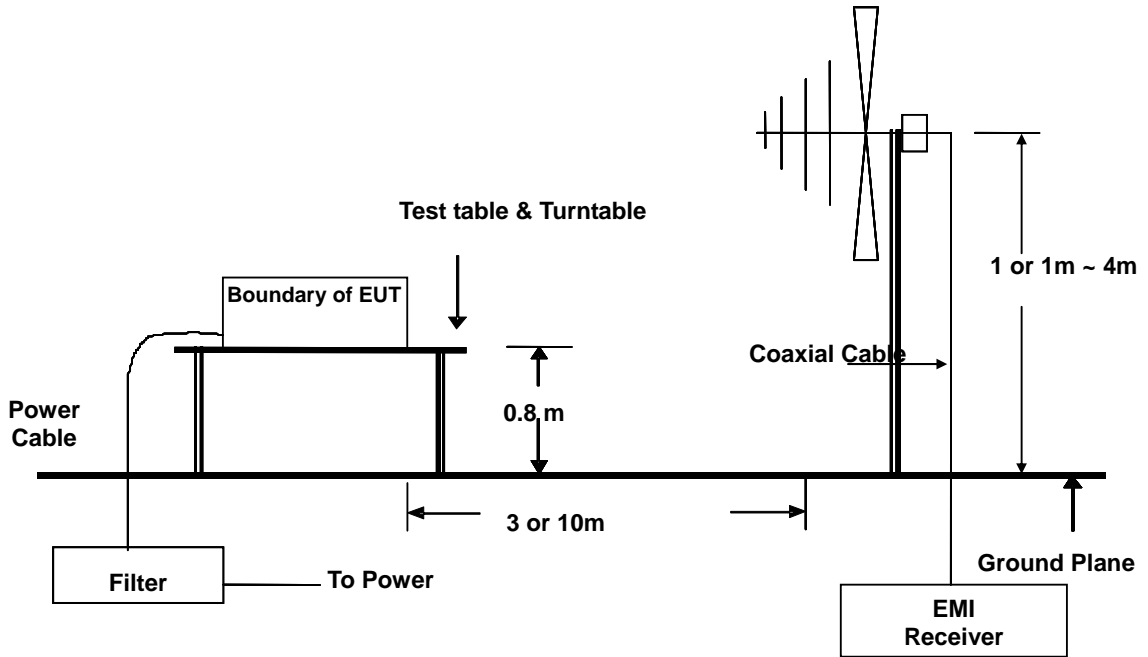
Procedure of Preliminary Test

- The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is a floor standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- Support equipment, if needed, was placed as per ANSI C63.4.
- All I/O cables were positioned to simulate typical usage as per ANSI C63.4.
- The EUT received AC power source from the outlet socket under the turntable. All support equipment power received from another socket under the turntable.
- The antenna was placed at 3 or 10 meter away from the EUT as stated in ANSI C63.4. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.
- The Analyzer / Receiver quickly scanned from 30MHz to 40GHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- The test mode(s) described in Item 3.1 were scanned during the preliminary test:
- After the preliminary scan, we found the test mode described in Item 3.1 producing the highest emission level.
- The worst configuration of EUT and cable of the above highest emission level were recorded for reference of the final test.

Procedure of Final Test

- EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.
- The Analyzer / Receiver scanned from 30MHz to 40GHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 or 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- Recording at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.
- The test data of the worst-case condition(s) was recorded.

7.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

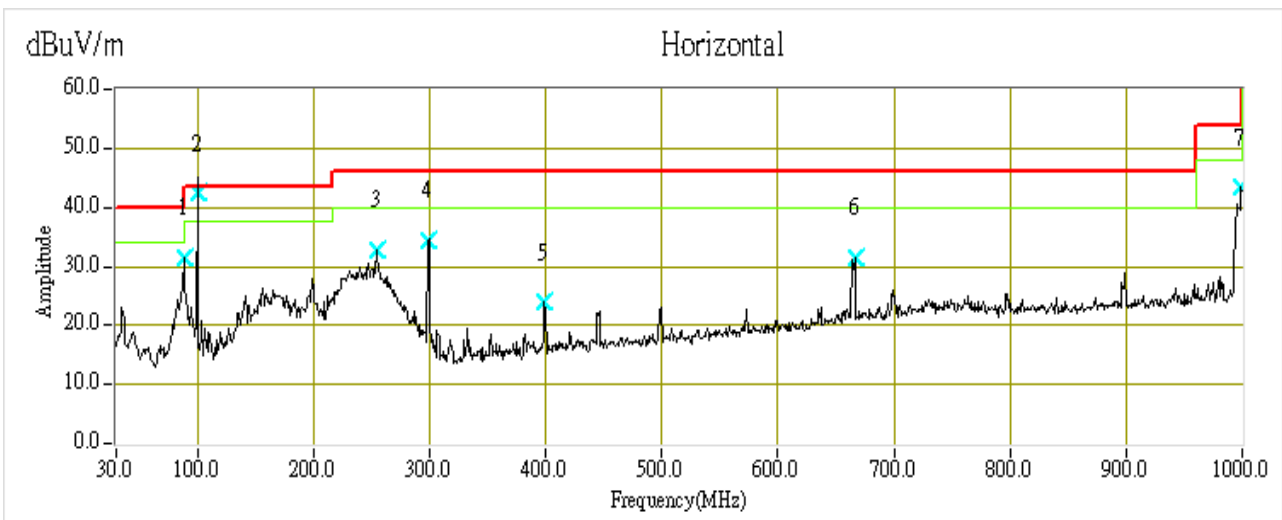
7.5. DATA SAMPLE

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
xx.xx	16.49	9.86	26.35	30.00	-3.65	QP

Frequency (MHz) = Emission frequency in MHz
 Reading (dBuV) = Uncorrected Analyzer / Receiver reading
 Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
 Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
 Limit (dBuV/m) = Limit stated in standard
 Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)
 Q.P. = Quasi-Peak

7.6. TEST RESULTS

Job No.:	81203004	Ant. Polar.:	Horizontal
Standard:	FCC 15B	Tested Distance:	3m
Test Item:	Radiated Emission	Date:	2008/12/19
Temp.(°C)/Hum.(%RH):	22.3°C / 53%RH	Time:	PM 09:22
Company:	Atheros	Tested By:	Rueyyan Lin
Model:	AR5B93	Test Mode:	Mode 1

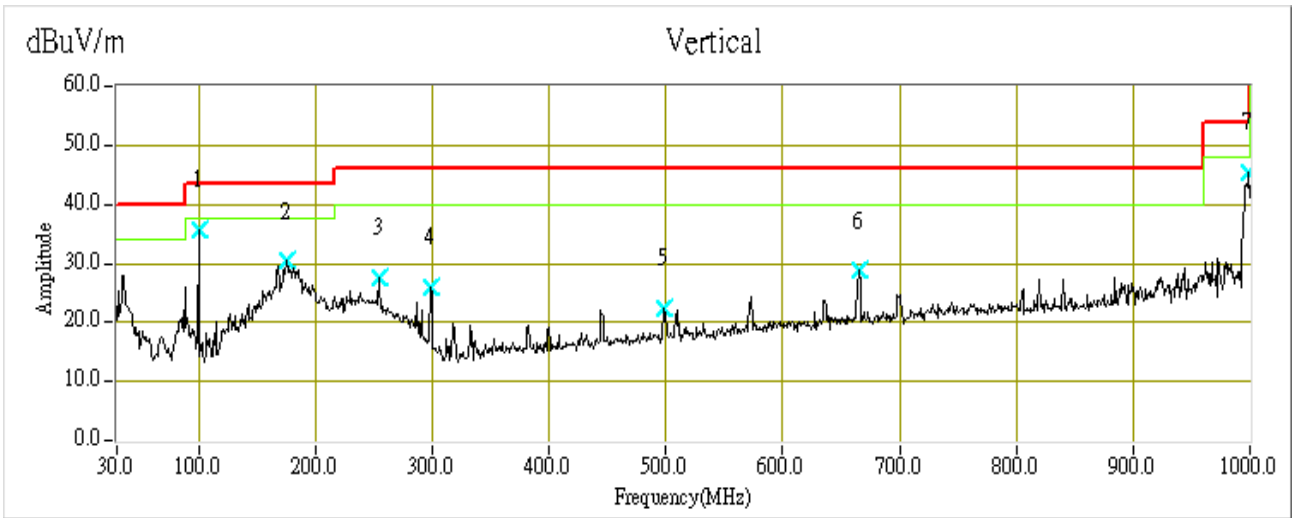


No.	Frequency (MHz)	Reading (dBμV)	Correction Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark
1	88.20	67.96	-36.34	31.61	43.50	-11.89	Peak
2	99.84	78.60	-36.22	42.38	43.50	-1.12	QP
3	254.07	62.81	-30.07	32.74	46.00	-13.26	Peak
4	298.69	62.45	-28.00	34.45	46.00	-11.55	Peak
5	398.60	50.80	-26.96	23.84	46.00	-22.16	Peak
6	666.32	53.98	-22.40	31.58	46.00	-14.42	Peak
7	999.03	61.65	-18.25	43.40	54.00	-10.60	Peak

Remark: The other emission levels were very low against the limit.



Job No.:	81203004	Ant. Polar.:	Vertical
Standard:	FCC 15B	Tested Distance:	3m
Test Item:	Radiated Emission	Date:	2008/12/19
Temp.(°C)/Hum.(%RH):	22.3°C / 53%RH	Time:	PM 09:07
Company:	Atheros	Tested By:	Rueyyan Lin
Model:	AR5B93	Test Mode:	Mode 1



No.	Frequency (MHz)	Reading (dBµV)	Correction Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Remark
1	99.84	71.99	-36.22	35.77	43.50	-7.73	Peak
2	175.50	62.17	-31.80	30.37	43.50	-13.13	Peak
3	254.07	57.78	-30.07	27.71	46.00	-18.29	Peak
4	298.69	53.94	-28.00	25.94	46.00	-20.06	Peak
5	497.54	47.68	-25.21	22.48	46.00	-23.52	Peak
6	665.35	51.19	-22.42	28.77	46.00	-17.23	Peak
7	999.03	63.76	-18.25	45.51	54.00	-8.49	Peak

Remark: The other emission levels were very low against the limit.