



## FCC 47 CFR PART 15 SUBPART B TEST REPORT

for

**802.11n 1x1 PCIe Minicard transceiver**

**MODEL: AR5B95**

Test Report Number:

81029005-D

Issued for

**Atheros Communications, Inc.**

5480 Great America Parkway Santa Clara CA 95054

Issued By:

**Compliance Certification Services Inc.**

Wugu Laboratory

No. 11, Wu-Gong 6<sup>th</sup> Rd., Wugu Industrial Park,  
Taipei Hsien 248, Taiwan (R.O.C.)

TEL: 886-2-2299-9720

FAX: 886-2-2299-9721

E-Mail: [service@tw.ccsemc.com](mailto:service@tw.ccsemc.com)

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**Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	December 9, 2008	Initial Issue	ALL	Eunice Shen

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## 1 TEST RESULT CERTIFICATION

<b>Product:</b>	802.11n 1x1 PCIe Minicard transceiver
<b>Model:</b>	AR5B95
<b>Brand:</b>	Atheros
<b>Applicant:</b>	<b>Atheros Communications, Inc.</b> 5480 Great America Parkway Santa Clara CA 95054
<b>Manufacturer:</b>	<b>Atheros Communications, Inc.</b> 5480 Great America Parkway Santa Clara CA 95054
<b>Tested:</b>	December 12, 2008
<b>Test Voltage:</b>	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 (Main Port)	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:**

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Rex Lai  
Section Manager**Reviewed by:**

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Amanda Wu  
Section Manager



## 2 EUT DESCRIPTION

<b>Product</b>	802.11n 1x1 PCIe Minicard transceiver
<b>Brand Name</b>	Atheros
<b>Model</b>	AR5B95
<b>Model Discrepancy</b>	N/A
<b>Applicant</b>	Atheros Communications, Inc.
<b>Housing material</b>	Plastic
<b>Serial Number</b>	81029005
<b>Received Date</b>	October 29, 2008
<b>EUT Power Rating</b>	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
<b>Mode 1:</b> EUT Transceiving (Operated at normal link function)—Full length board
<b>Mode 2:</b> EUT Transceiving (Operated at normal link function)—Half length board

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.



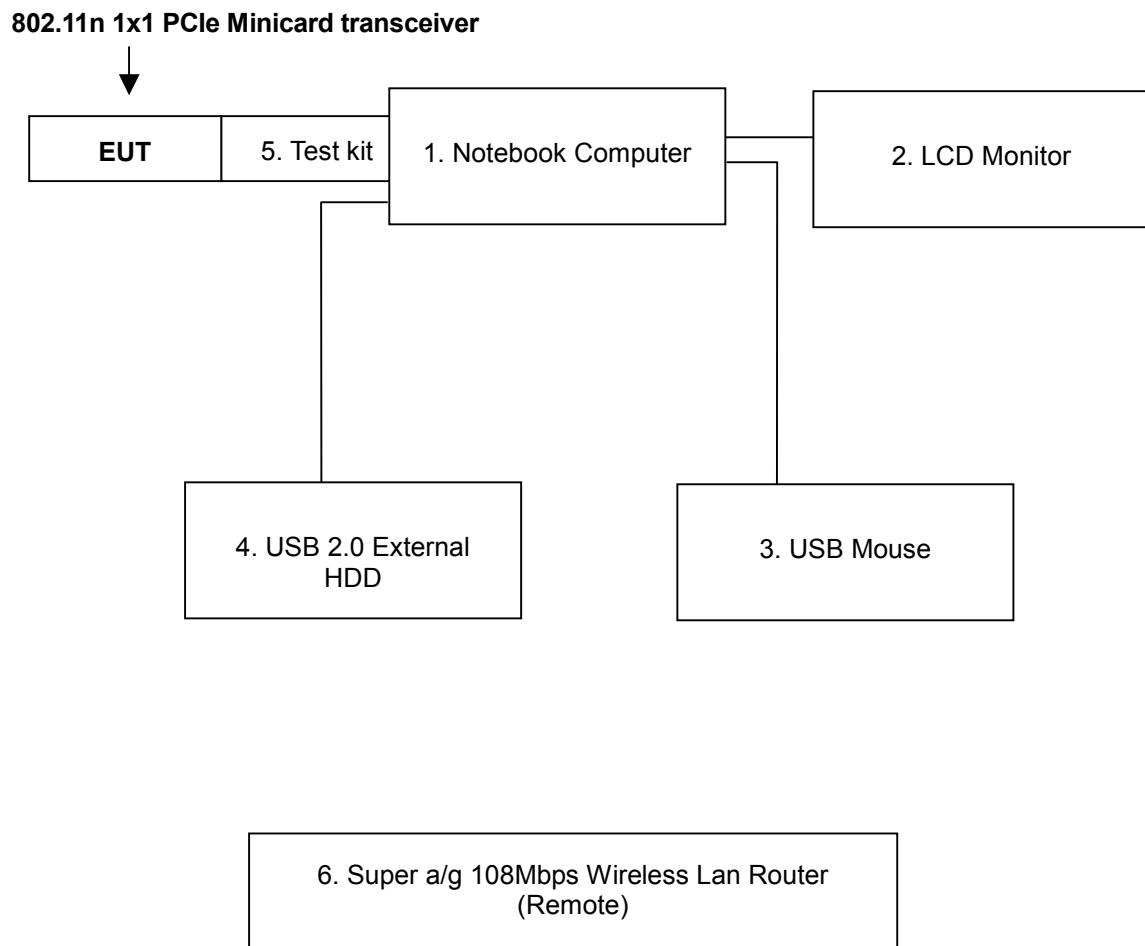
## 4 SETUP OF EQUIPMENT UNDER TEST

### 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.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1	Notebook PC	2672 (X31)	9985H9M	WLAN: ANO20030400LEG Bluetooth: ANO20020100MTN	IBM	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2	LCD Monitor	710V	GS17H9NXA05864E	FCC DoC	710V	Shielded, 1.8m with 2 cores	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
3	USB Mouse	MO19UCA	20440964	FCC DoC	HP	Shielded, 1.8m	N/A
4	USB 2.0 External HDD	F12-U	A0100214-43b0012	FCC DoC	TeraSys	Shielded, 1.8m	N/A
5	Test kit	N/A	N/A	N/A	N/A	N/A	N/A
6	Super a/g 108Mbps Wireless Lan Router (Remote)	BLW-04SAG	40DDA0421	SJ9-BLW54SAG	PLANEX	N/A	Unshielded, 1.8m

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

**4.2. CONFIGURATION OF SYSTEM UNDER TEST**



## **5 FACILITIES AND ACCREDITATIONS**

### **5.1. FACILITIES**

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

No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan  
 No. 81-1, Lane 210, Pa-De 2nd Rd., Luchu Hsiang, Taoyuan Shien, Taiwan.

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4, CISPR 16-1-5.

### **5.2. ACCREDITATIONS**

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

<b>Taiwan</b>	TAF
<b>USA</b>	A2LA

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

<b>USA</b>	FCC
<b>Canada</b>	INDUSTRY CANADA
<b>Taiwan</b>	NCC

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	+/-2.81 dB
Radiated emissions # 966 A	30 ~ 1000MHz	+/- 3.70 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 base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.*

*The acceptable measurement uncertainty value without requiring revision of the compliance statement is base 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
EMI Test Receiver 9kHz-30MHz	Rohde & Schwarz	ESHS30	828144/003	11/25/2009
Two-Line V-Network 9kHz-30MHz	Schaffner	NNB41	03/10013	06/11/2009
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/09/2009
ISN 9kHz-30MHz	FCC	FCC-TLISN-T4	20167	09/20/2009
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.



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

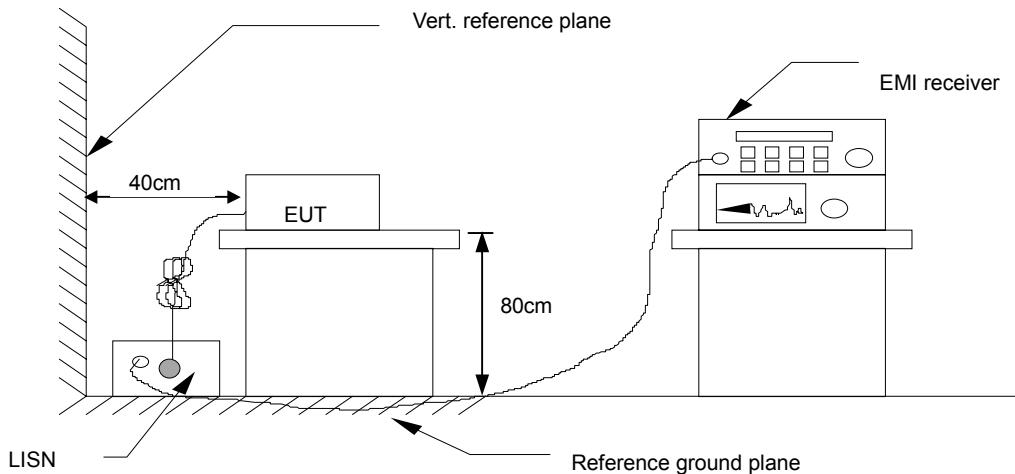
### Procedure of Preliminary Test

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

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)

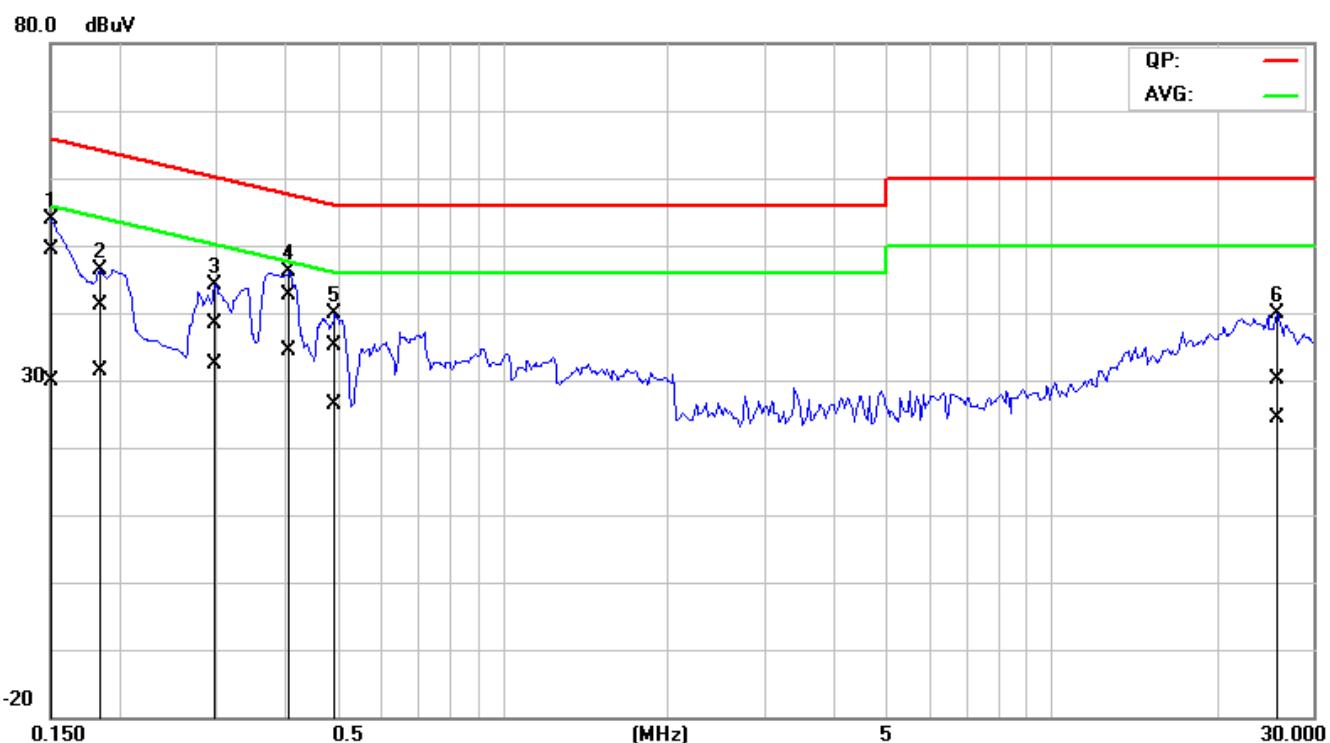
= Result (dBuV) – Limit (dBuV)



## 6.6. TEST RESULTS

### Conduction

Job No.:	81029005	Line:	L1
Standard:	FCC 15B		
Test Item:	Conduction Emission	Date:	2008/12/12
Temp.(°C)/Hum.(%RH):	22°C/45%RH	Time:	PM 03:35:55
Company:	Atheros	Tested By:	Eddy Chung
Model:	AR5B95	Test Mode:	Mode 1



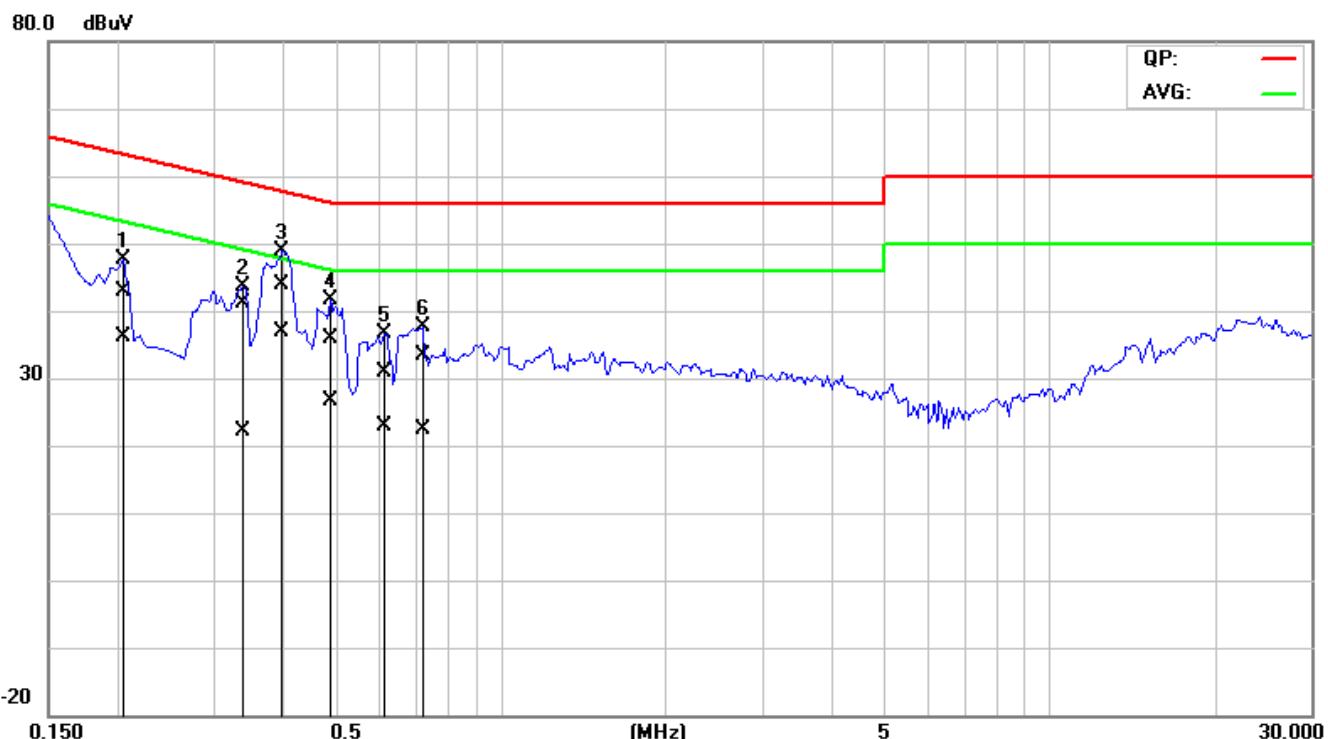
NO.	Frequency (MHz)	Quasi Peak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	Quasi Peak result (dBuV)	Average result (dBuV)	Quasi Peak limit (dBuV)	Average limit (dBuV)	Quasi Peak margin (dB)	Average margin (dB)	Remark
1	0.1500	49.23	29.70	0.20	49.43	29.90	65.99	56.00	-16.56	-26.10	Pass
2	0.1850	41.54	31.07	0.17	41.71	31.24	64.25	54.26	-22.54	-23.02	Pass
3	0.3000	38.25	32.85	0.12	38.37	32.97	60.24	50.24	-21.87	-17.27	Pass
4	0.4100	42.84	34.68	0.07	42.91	34.75	57.65	47.65	-14.74	-12.90	Pass
5	0.4950	35.79	26.51	0.03	35.82	26.54	56.08	46.08	-20.26	-19.54	Pass
6	25.8100	29.46	23.32	0.92	30.38	24.24	60.00	50.00	-29.62	-25.76	Pass

REMARKS: L1 = Line One (Live Line)



## Conduction

Job No.:	81029005	Line:	L2
Standard:	FCC 15B		
Test Item:	Conduction Emission	Date:	2008/12/12
Temp.(°C)/Hum.(%RH):	22°C/45%RH	Time:	PM 03:45:01
Company:	Atheros	Tested By:	Eddy Chung
Model:	AR5B95	Test Mode:	Mode 1



NO.	Frequency (MHz)	Quasi Peak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	Quasi Peak result (dBuV)	Average result (dBuV)	Quasi Peak limit (dBuV)	Average limit (dBuV)	Quasi Peak margin (dB)	Average margin (dB)	Remark
1	0.2050	42.28	36.02	0.15	42.43	36.17	63.40	53.41	-20.97	-17.24	Pass
2	0.3400	41.21	22.13	0.09	41.30	22.22	59.20	49.20	-17.90	-26.98	Pass
3	0.4000	43.97	36.91	0.07	44.04	36.98	57.85	47.85	-13.81	-10.87	Pass
4	0.4900	35.64	26.78	0.03	35.67	26.81	56.17	46.17	-20.50	-19.36	Pass
5	0.6150	30.45	22.97	0.03	30.48	23.00	56.00	46.00	-25.52	-23.00	Pass
6	0.7250	33.46	22.54	0.03	33.49	22.57	56.00	46.00	-22.51	-23.43	Pass

REMARKS: L2 = Line Two (Neutral Line)



## 7 RADIATED EMISSION MEASUREMENT

### 7.1. LIMITS OF RADIATED EMISSION MEASUREMENT

#### CISPR 22 Limit of Radiated Emission measured at 10 meter

Frequency (MHz)	dB <sub>UV</sub> /m (At 10m)	
	Class A	Class B
30 ~ 230	40	30
230 ~ 1000	47	37

Frequency (MHz)	Class A (dB <sub>UV</sub> /m) (At 10m)		Class B (dB <sub>UV</sub> /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 (dB<sub>UV</sub>/m) = 20 log Emission level (uV/m).

#### Maximum permissible level of Radiated Emission measured at 3 meter

Frequency (MHz)	Field Strength ( $\mu$ V/m at 3-meter) Average	Field Strength (dB $\mu$ V/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 (dB <sub>UV</sub> /m)		Class B (dB <sub>UV</sub> /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
Spectrum Analyzer	Agilent	E4446A	US42510252	10/07/2009
Test Receiver	Rohde&Schwarz	ESCI	100064	11/29/2009
Switch Controller	TRC	Switch Controller	SC94050010	05/03/2009
4 Port Switch	TRC	4 Port Switch	SC94050020	05/03/2009
Horn-Antenna	TRC	HA-0502	06	06/04/2009
Horn-Antenna	TRC	HA-0801	04	10/20/2009
Horn-Antenna	TRC	HA-1201A	01	10/14/2009
Horn-Antenna	TRC	HA-1301A	01	10/14/2009
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/28/2009
Turn Table	Max-Full	MFT-120S	T120S940302	N.C.R.
Antenna Tower	Max-Full	MFA-430	A440940302	N.C.R.
Controller	Max-Full	MF-CM886	CC-C-1F-13	N.C.R.
Site NSA	CCS	N/A	FCC MRA: TW1309 IC: IC 2324G-1/-2	10/17/2010 11/04/2010
Test S/W	LABVIEW (V 6.1)			

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. N.C.R = No Calibration Request.



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

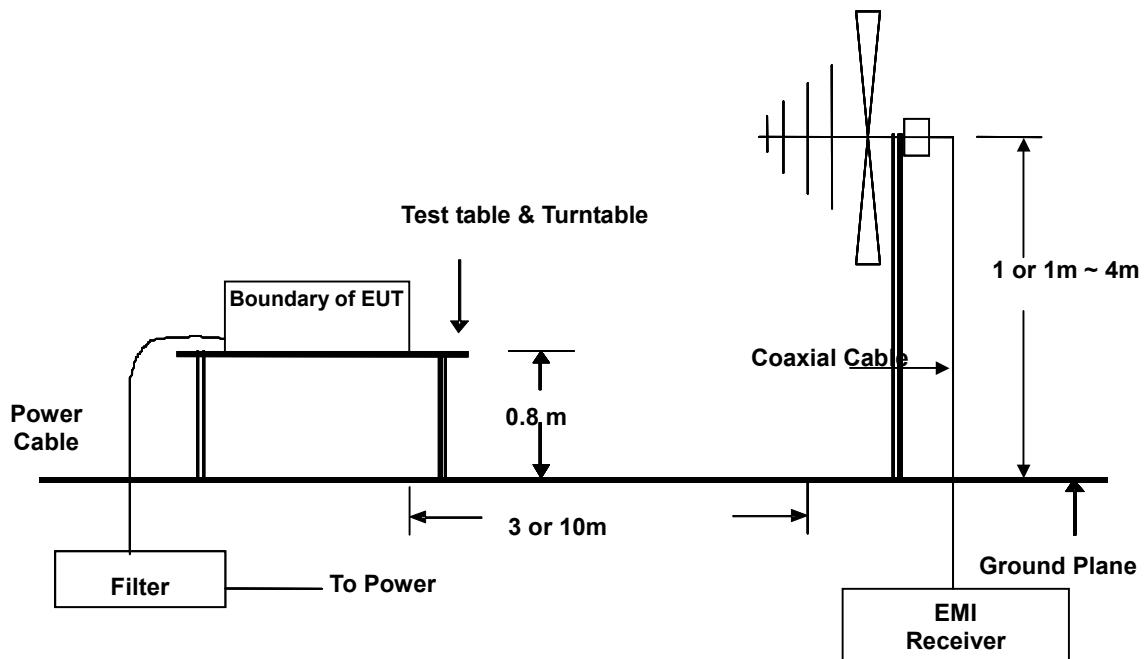
#### Procedure of Preliminary Test

- 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)	Degree (°)	Height (cm)	Remark
xx.xx	16.49	9.86	26.35	30.00	-3.65	116.00	101.00	QP

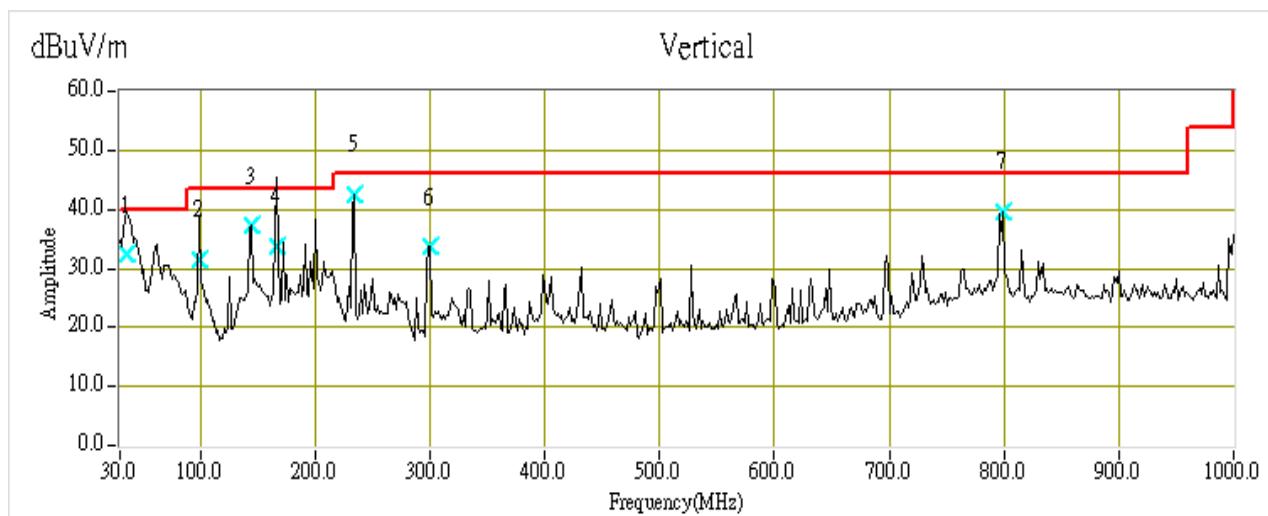
Frequency (MHz) = Emission frequency in MHz  
Reading (dBuV) = Uncorrected Analyzer / Receiver reading  
Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain  
Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)  
Limit (dBuV/m) = Limit stated in standard  
Margin (dB) = Result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



## 7.6. TEST RESULTS

### WUGU 966 Chamber A

Job No.:	81029005	Ant. Polar.:	Ver.
Standard:	FCC 15B	Tested Distance:	10m
Test Item:	Radiated Emission	Date:	2008/12/12
Temp.(°C)/Hum.(%RH):	24°C /50%RH	Time:	PM 11:41
Company:	Atheros	Tested By:	Wolf Huang
Model:	AR5B95	Test Mode:	Mode 1

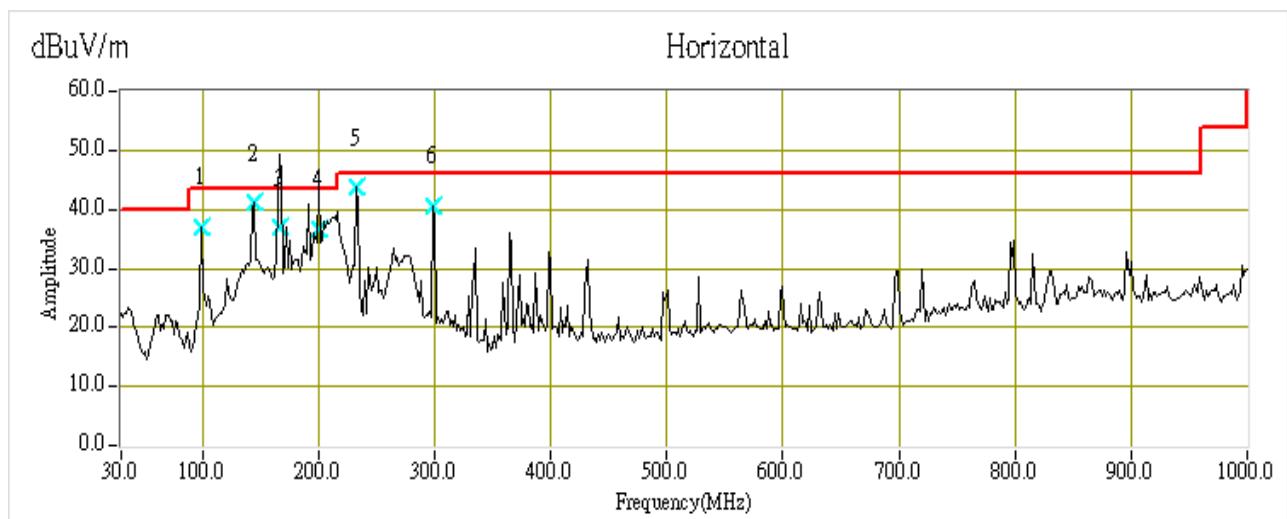


No.	Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	36.29	38.44	-6.33	32.11	40.00	-7.89	QP
2	99.52	44.68	-13.36	31.32	43.50	-12.18	QP
3	144.53	46.10	-9.19	36.91	43.50	-6.59	Peak
4	165.12	43.76	-10.44	33.32	43.50	-10.18	QP
5	234.60	52.62	-9.92	42.70	46.00	-3.30	Peak
6	299.85	41.95	-8.61	33.34	46.00	-12.66	Peak
7	799.71	39.47	0.42	39.05	46.00	-6.95	Peak

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

WUGU 966 Chamber A

<b>Job No.:</b>	81029005	<b>Ant. Polar.:</b>	Hor.
<b>Standard:</b>	FCC 15B	<b>Tested Distance:</b>	10m
<b>Test Item:</b>	Radiated Emission	<b>Date:</b>	2008/12/12
<b>Temp.(°C)/Hum.(%RH):</b>	24°C /50%RH	<b>Time:</b>	PM 11:47
<b>Company:</b>	Atheros	<b>Tested By:</b>	Wolf Huang
<b>Model:</b>	AR5B95	<b>Test Mode:</b>	Mode 1



No.	Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	99.47	49.75	-13.36	36.39	43.50	-7.11	Peak
2	144.61	49.91	-9.19	40.72	43.50	-2.78	Peak
3	166.90	47.66	-10.44	37.22	43.50	-6.28	QP
4	199.67	44.29	-8.13	36.16	43.50	-7.34	QP
5	231.48	53.45	-9.94	43.51	46.00	-2.49	Peak
6	29912	49.18	-8.63	40.55	46.00	-5.45	Peak

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