

FCC TEST REPORT

according to

FCC Rules and Regulations

Part 15 Subpart C

Applicant	American Power Conversion Corporation
Address	85 Rangeway Rd, Building #2, N. Billerica, 01862, USA
Equipment	Wireless Mobile Router
Model No.	WMR1000G
FCC ID	SNSWMR1000G
Trade Name	APC

- The test result refers exclusively to the test presented test model / sample.,
- Without written approval of **Exclusive Certification Corp.** the test report shall not be reproduced except in full.

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CERTIFICATE OF COMPLIANCE

according to

FCC Rules and Regulations

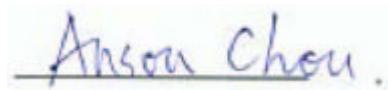
Part 15 Subpart C

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Equipment	Wireless Mobile Router
Model No.	WMR1000G
FCC ID	SNSWMR1000G

I HEREBY CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4**. The equipment was **passed** the test performed according to **FCC Rules and Regulations Part 15 Subpart C (2002)**. The test was carried out on Oct. 24, 2004 at **Exclusive Certification Corp.**

Signature



Anson Chou / Manager

1. Report of Measurements and Examinations

1.1. List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.203	. Antenna Requirement	Pass
15.207	. Conducted Emission	Pass
15.209	. Radiated Emission	Pass
15.247(a)(2)	. 6dB Bandwidth	Pass
15.247(b)	. Maximum Peak Output Power	Pass
15.247(c)	. 100kHz Bandwidth of Frequency Band Edges	Pass
15.247(d)	. Power Spectral Density	Pass
1.1307 1.1310 2.1091 2.1093	. RF Exposure Compliance	Pass

Test by:

Jerry

1.2. Antenna Requirements

1.2.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

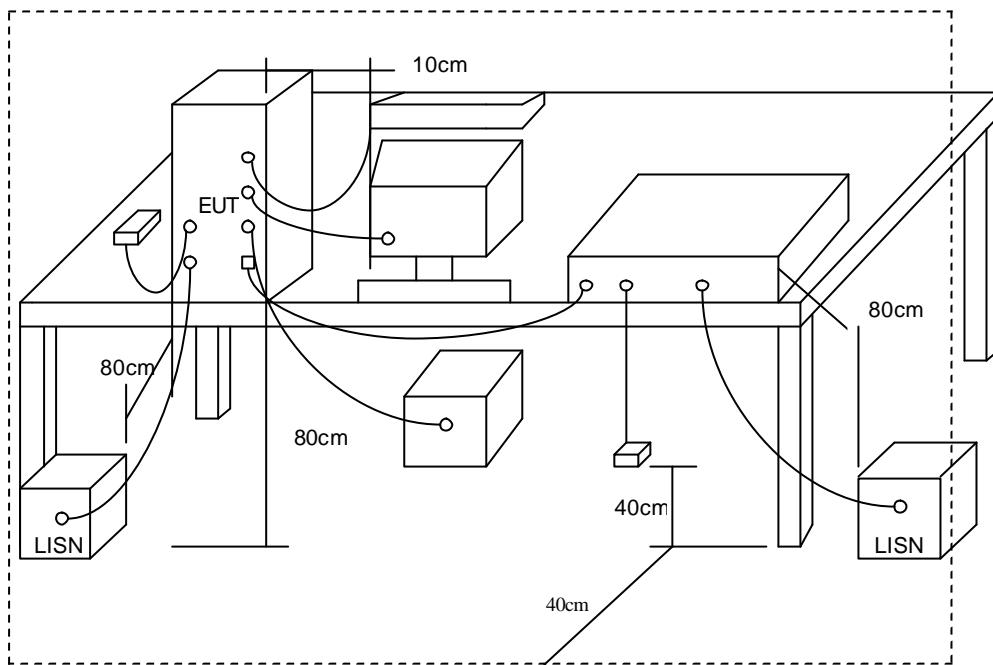
1.3. Test of Conducted Emission

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz on the 115 VAC power and return leads of the EUT according to the methods defined in ANSI C63.4-1992 Section 1.3.2. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane as shown in section 1.3.2. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

1.3.1. Test Procedures

- a. 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.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connecting to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

1.3.2. Typical Test Setup Layout of Conducted Emission



1.3.3. Conducted Emission Requirement

Except for A digital devices, for equipment that is designed to be connected to the public utility (AC) power line on any frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150KHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the Radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

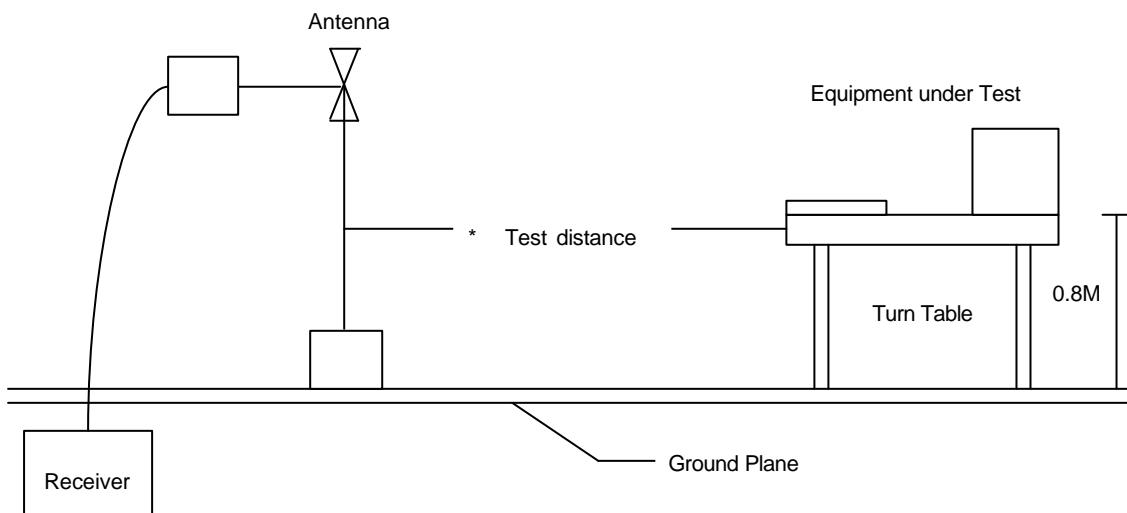
1.4. Test of Radiated Emission

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defined in ANSI C63.4-2001. The EUT was placed, 0.8 meter above the ground plane, as shown in section 1.4.2. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

1.4.1. Test Procedures

1. The EUT was placed on a rotatable table top 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 broadband antenna 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.
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 turn table (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-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 which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
8. 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.

1.4.2. Typical Test Setup Layout of Radiated Emission

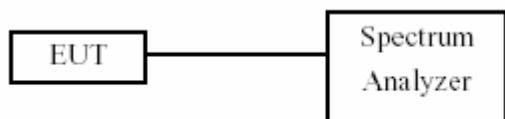


1.5. 6dB Bandwidth

1.5.1. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer.
2. Set RBW of spectrum analyzer to 100 KHz and VBW to 100 KHz.
3. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

1.5.2. Test Setup Layout :

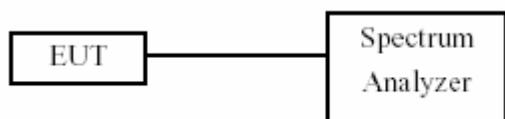


1.6. Maximum Peak Output Power

1.6.1. Test Procedure :

The antenna port (RF output) of the EUT was connected to the input (RF input) of a spectrum analyzer. Power was read directly from the spectrum analyzer and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

1.6.2. Test Setup Layout :



1.7. Band Edges Measurement

1.7.1. Test Procedure :

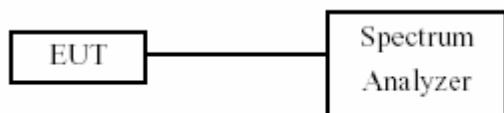
1. The transmitter output was connected to the spectrum analyzer via a low loss cable.
2. Set both RBW and VBW of spectrum analyzer to 100 KHz with convenient frequency span including 100 MHz bandwidth from band edge.
3. The band edges was measured and recorded.

1.8. Power Spectral Density

1.8.1. Test Procedure :

1. The transmitter output was connected to spectrum analyzer.
2. The spectrum analyzer's resolution bandwidth were set at 3KHz RBW and 30KHz VBW as that of the fundamental frequency. Set the sweep time=span/3KHz.
3. The power spectral density was measured and recorded.
4. The Sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

1.8.2. Test Setup Layout :



1.9. Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.250
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

**: Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

1.10. Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1.11. RF Exposure

FCC Rules and Regulations Part 1.1307, 1.1310, 2.1091, 2.1093:

RF Exposure Compliance

1.11.1. Limit For Maximum Permissible Exposure (MPE)

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

F=frequency in MHz

*Plane-wave equivalent power density

1.11.2. MPE Calculations

$$E \text{ (V/m)} = \frac{\sqrt{30 \cdot P \cdot G}}{d} \quad \text{Power Density: } P_d \text{ (mW/cm}^2\text{)} = \frac{E^2}{3770}$$

E = Electric field (V/m)

P = Peak output power (W)

G = Antenna numeric gain (numeric)

d = Separation distance (m)

Because the EUT is belong to General Population/ Uncontrolled Exposure. So the Limit of Power Density is 10 W/m². We can change the formula to:

$$d = \sqrt{\frac{30 \cdot P \cdot G}{3770}}$$

1.11.3. FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation. Proposed RF exposure safety information to include in User's Manual.

2. Test Configuration of Equipment under Test

2.1. Test Mode and Test Software

The following test mode and test software was performed for conduction and radiation test:

- 802.11b (CH LO: 2412MHz) • 802.11b (CH MID: 2437MHz) • 802.11b (CH HI: 2462MHz)
- 802.11g (CH LO: 2412MHz) • 802.11g (CH MID: 2437MHz) • 802.11g (CH HI: 2462MHz)
- An executive programs, "DUTAPIDLL.exe" Application under WIN XP.

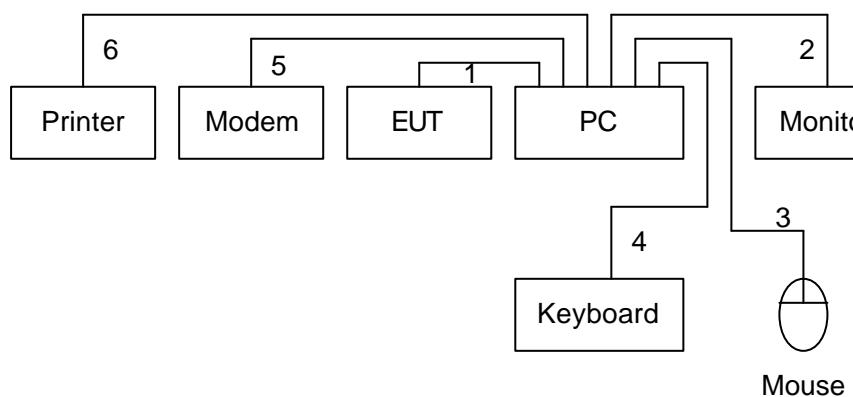
2.2. Description of Test System

Device	Manufacturer	Model No.	Description
PC	IBM	IGV	Power Cable, Unshielding 1.8 m
Monitor	SlimAGE	510A	Power Cable, Adapter Unshielding 1.8 m Data Cable, VGA shielding 1.35 m
Keyboard	IBM	KB-0225	Data Cable, PS2 shielding 1.85 m
Mouse	IBM	MO28VO	Data Cable, USB shielding 1.85 m
Notebook (Remote Site)	IBM	R40(2723-BV1)	Power Cable, Adapter Unshielding 1.8 m
Modem	ACEXX	DM-1414	Power Cable, Adapter Unshielding 1.8 m Data Cable, RSS232 Unshielding 1.35 m
Printer	HP	Desk Jet400	Power Cable, Adapter Unshielding 1.8 m Data Cable, PRINTR shielding 1.6 m

Use Cable:

Cable	Description
RJ-45	Unshielding, 1.8m

2.3. Connection Diagram of Test System



1. The RJ 45 cable is connected from PC to the EUT.
2. The I/O cable is connected from PC to the Monitor.
3. The I/O cable is connected from PC to the Mouse.
4. The I/O cable is connected from PC to the Keyboard.
5. The I/O cable is connected from PC to the Modem.
6. The I/O cable is connected from PC to the Printer.

2.4. Feature of Equipment under Test

- 802.11g wireless networking, with the ability to operate in 802.11g-only, or 802.11b+g modes.
- Easy, web-based setup for installation and management.
- Ethernet connection to an RJ45 wall slot, router, or cable modem.
- Extensive Protocol Support.
- Login capability.
- Front panel LEDs for easy monitoring of status and activity.
- Flash memory for firmware upgrade.

2.5. RF Module Specifications

Radio Data Rates	1, 2, 5.5, 6, 9, 12, 18, 24, 36, 48, and 54 Mbps Auto Rate Sensing	
Frequency	2.4-2.5Ghz	
Data Encoding:	802.11b: Direct Sequence Spread Spectrum (DSSS) 802.11g: Orthogonal Frequency Division Multiplexing (OFDM)	
Maximum Computers Per Wireless Network:	Limited by the amount of wireless network traffic generated by each node. Typically 30-70 nodes.	
Operating Frequency Ranges:	2.412~2.462 GHz (US) 2.412~2.484 GHz (Japan) 2.412~2.472 GHz (Europe ETSI)	2.457~2.462 GHz (Spain) 2.457~2.472 GHz (France)
802.11 Security:	40-bits (also called 64-bits) and 128-bits WEP	

2.6. History of this test report

ORIGINAL.

3. General Information of Test

Test Site:	Exclusive Certification Corp. 4F-2, No. 28, Lane 78, Xing-Ai Rd. Nei-hu, Taipei City 114 Taiwan R.O.C.
Test Site Location (OATS1-SD):	No.68-1, Shihbachongsi, shihding Township, Taipei County 223, Taiwan, R.O.C.
Test Voltage:	AC 110V/ 60Hz
Test in Compliance with:	ANSI C63.4-1992 FCC Part 15 Subpart C
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 24620MHz
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.

4. Test Result and Data

4.1. Antenna Requirement

4.1.1. Antenna Construction and Directional Gain

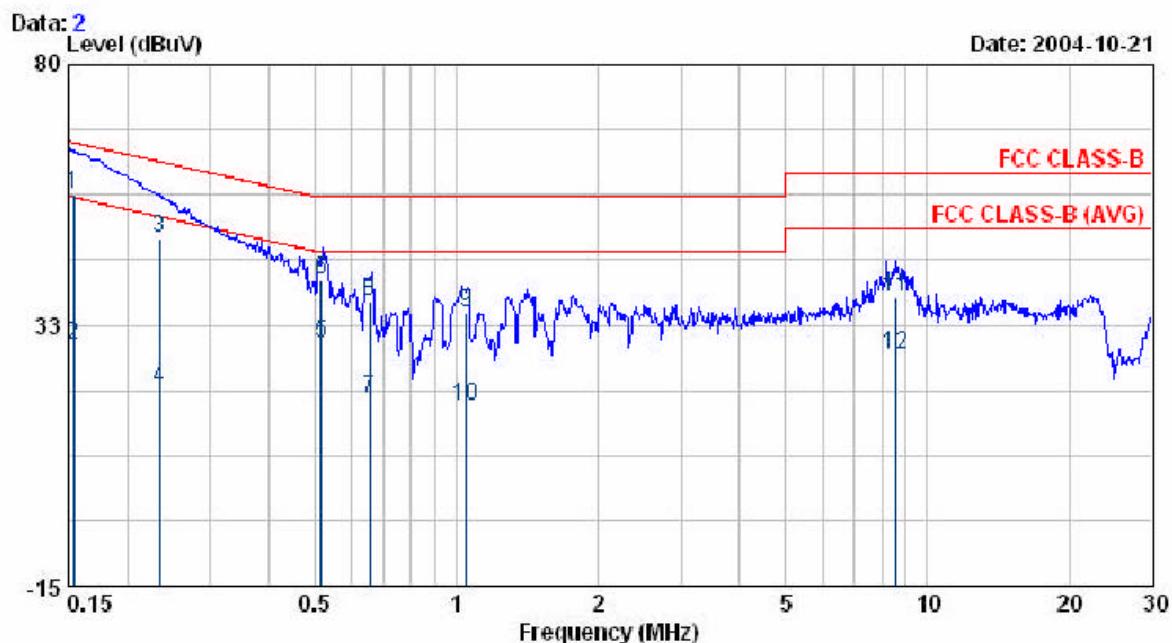
Antenna type: Integral PIFA antenna.

Antenna Gain: 1 dBi.

4.2. Test Result of Conducted Emission

EUT : WMR1000G
Power : 110W 60Hz
Test Mode : 802.11b CH L0
Memo :

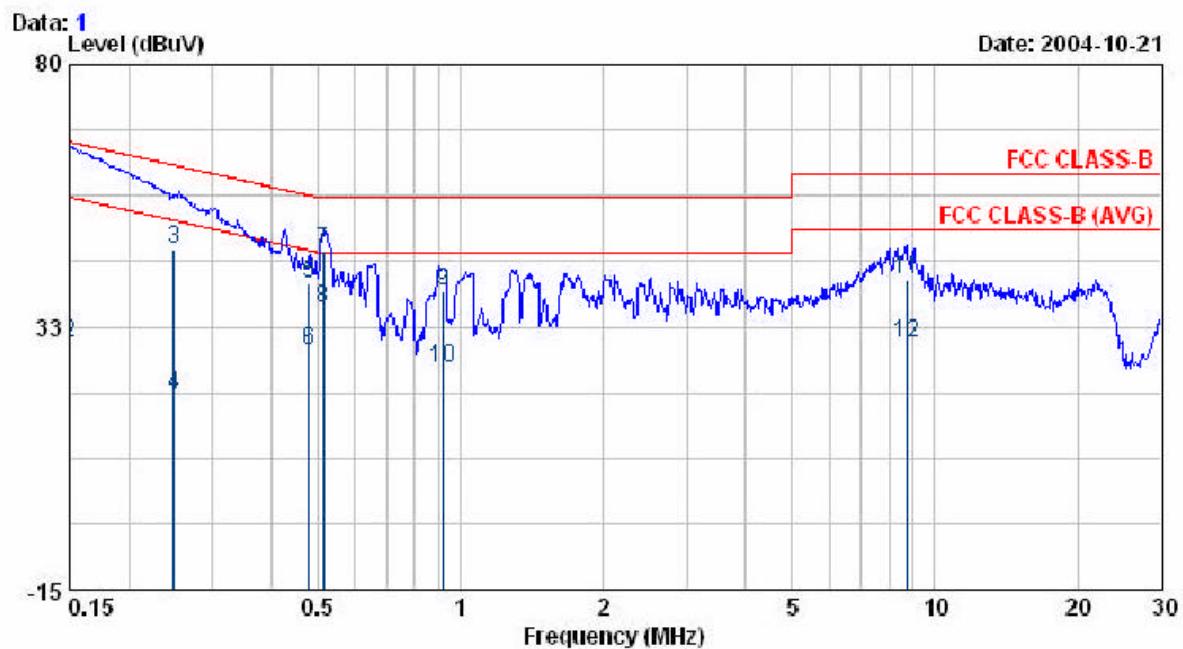
Pol/Phase : NEUTRAL
Temperature : 27 °C
Humidity : 59 %



Freq	Read		Level	Limit	Over Limit	Remark
	Freq	Level				
MHz	dBuV	dB	dBuV	dBuV	dBuV	
0.154	56.08	0.40	56.48	65.78	-9.30	QP
0.154	28.44	0.40	28.84	55.78	-26.94	AVERAGE
0.234	47.75	0.43	48.18	62.30	-14.13	QP
0.234	20.54	0.43	20.97	52.30	-31.34	AVERAGE
0.516	28.84	0.47	29.31	46.00	-16.69	AVERAGE
0.516	40.18	0.47	40.65	56.00	-15.35	QP
0.656	18.62	0.49	19.11	46.00	-26.89	AVERAGE
0.656	36.26	0.49	36.75	56.00	-19.25	QP
1.052	34.22	0.51	34.73	56.00	-21.27	QP
1.052	17.19	0.51	17.70	46.00	-28.30	AVERAGE
8.584	36.73	0.70	37.43	60.00	-22.57	QP
8.584	26.33	0.70	27.03	50.00	-22.97	AVERAGE

EUT : WMR1000G
Power : 110V 60Hz
Test Mode : 802.11b CH L0
Memo :

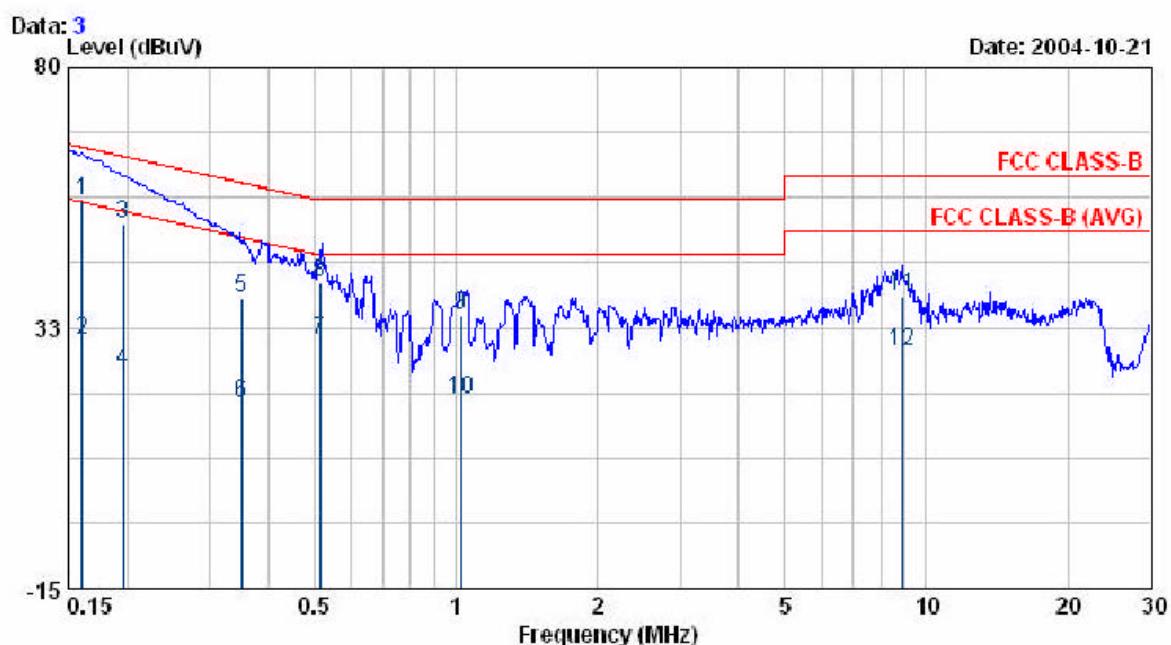
Pol/Phase : LINE
Temperature : 27 °C
Humidity : 59 %



Freq	Read		Level	Limit	Over Limit	Remark
	MHz	dBuV				
0.150	56.77	0.40	57.17	65.98	-8.81	QP
0.150	29.24	0.40	29.64	55.98	-26.34	AVERAGE
0.249	46.14	0.43	46.57	61.80	-15.23	QP
0.249	19.72	0.43	20.15	51.80	-31.65	AVERAGE
0.478	39.72	0.47	40.19	56.37	-16.18	QP
0.478	27.53	0.47	28.00	46.37	-18.37	AVERAGE
0.514	45.65	0.47	46.12	56.00	-9.88	QP
0.514	35.47	0.47	35.94	46.00	-10.06	AVERAGE
0.920	38.56	0.51	39.07	56.00	-16.93	QP
0.920	24.56	0.51	25.07	46.00	-20.93	AVERAGE
8.715	40.51	0.62	41.13	60.00	-18.87	QP
8.715	29.02	0.62	29.64	50.00	-20.36	AVERAGE

EUT : WMR1000G
Power : 110W 60Hz
Test Mode : 802.11b CH MID
Memo :

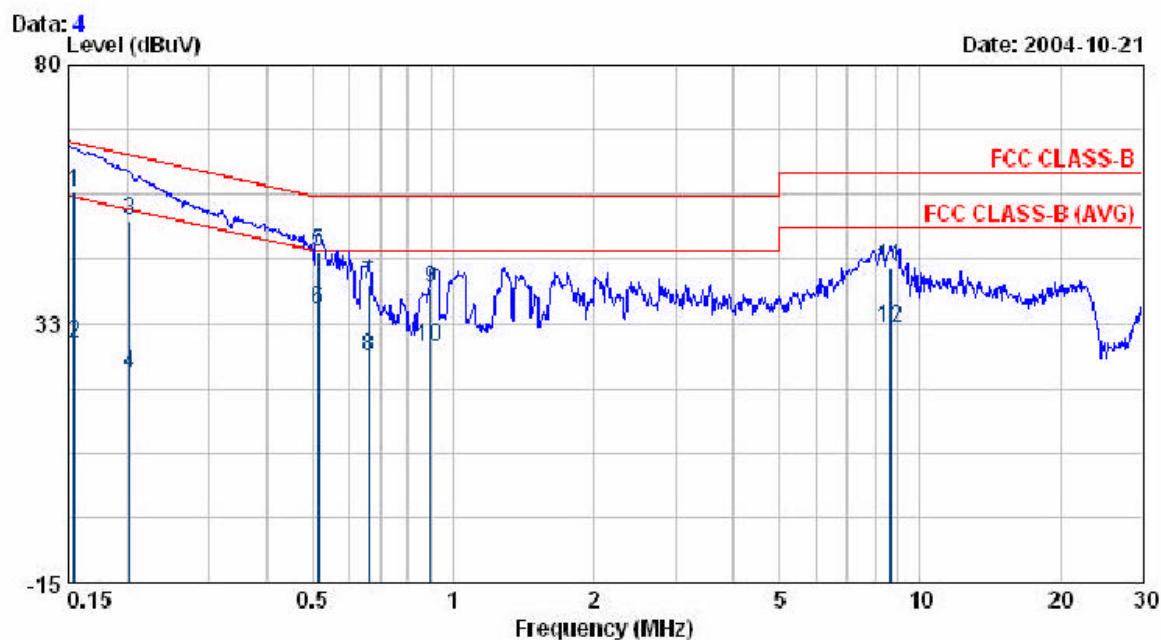
Pol/Phase : NEUTRAL
Temperature : 27 °C
Humidity : 59 %



Freq	Read		Level	Limit	Over	Remark
	MHz	Level	Factor	dBuV	dBuV	dBuV
0.161	55.16	0.40	55.56	65.43	-9.86	QP
0.161	29.98	0.40	30.38	55.43	-25.04	AVERAGE
0.197	51.19	0.42	51.61	63.76	-12.15	QP
0.197	24.17	0.42	24.59	53.76	-29.17	AVERAGE
0.350	37.28	0.45	37.73	58.97	-21.24	QP
0.350	18.30	0.45	18.75	48.97	-30.22	AVERAGE
0.515	29.63	0.47	30.10	46.00	-15.90	AVERAGE
0.515	40.05	0.47	40.52	56.00	-15.48	QP
1.025	34.36	0.51	34.87	56.00	-21.13	QP
1.025	19.05	0.51	19.56	46.00	-26.44	AVERAGE
8.889	37.59	0.70	38.29	60.00	-21.71	QP
8.889	27.28	0.70	27.98	50.00	-22.02	AVERAGE

EUT : WMR1000G
Power : 110V 60Hz
Test Mode : 802.11b CH MID
Memo :

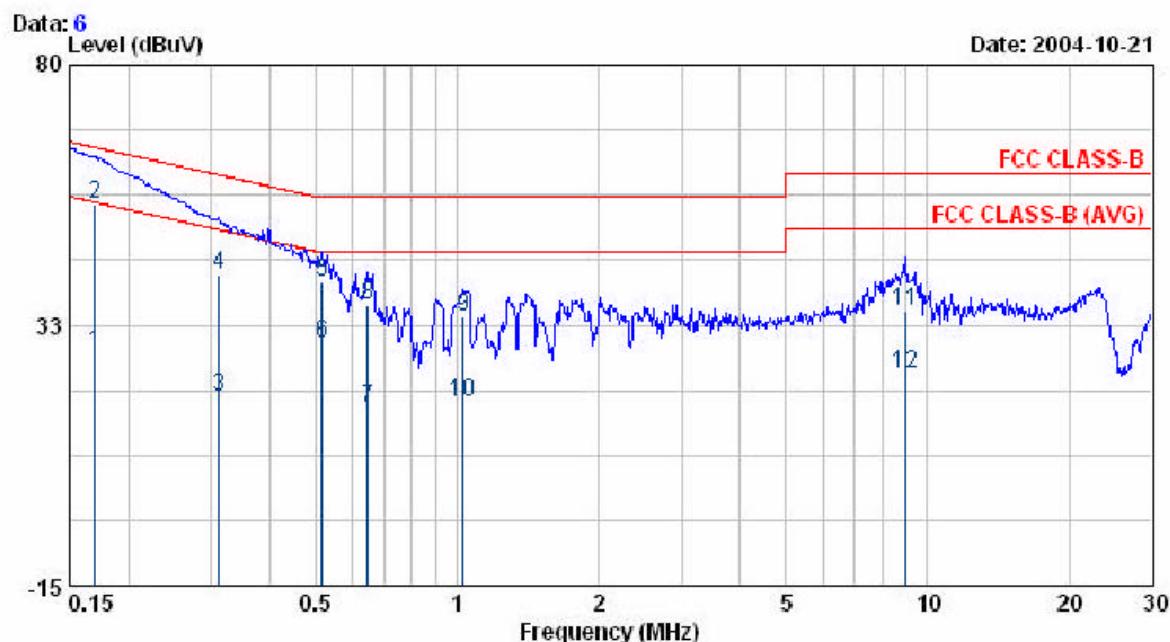
Pol/Phase : LINE
Temperature : 27 °C
Humidity : 59 %



Freq	Read		Level	Limit	Over		Remark
	MHz	dBuV	Factor	dB	dBuV	dBuV	
0.155	56.20	0.40	56.60	65.74	-9.14	QP	
0.155	28.57	0.40	28.97	55.74	-26.77	AVERAGE	
0.203	51.10	0.42	51.52	63.49	-11.97	QP	
0.203	22.73	0.42	23.15	53.49	-30.34	AVERAGE	
0.515	45.23	0.47	45.70	56.00	-10.30	QP	
0.515	34.74	0.47	35.21	46.00	-10.79	AVERAGE	
0.660	39.15	0.49	39.64	56.00	-16.36	QP	
0.660	25.96	0.49	26.45	46.00	-19.55	AVERAGE	
0.896	38.54	0.51	39.05	56.00	-16.95	QP	
0.896	27.52	0.51	28.03	46.00	-17.97	AVERAGE	
8.687	42.00	0.61	42.61	60.00	-17.39	QP	
8.687	30.86	0.61	31.47	50.00	-18.53	AVERAGE	

EUT : WMR1000G
Power : 110V 60Hz
Test Mode : 802.11b CH HI
Memo :

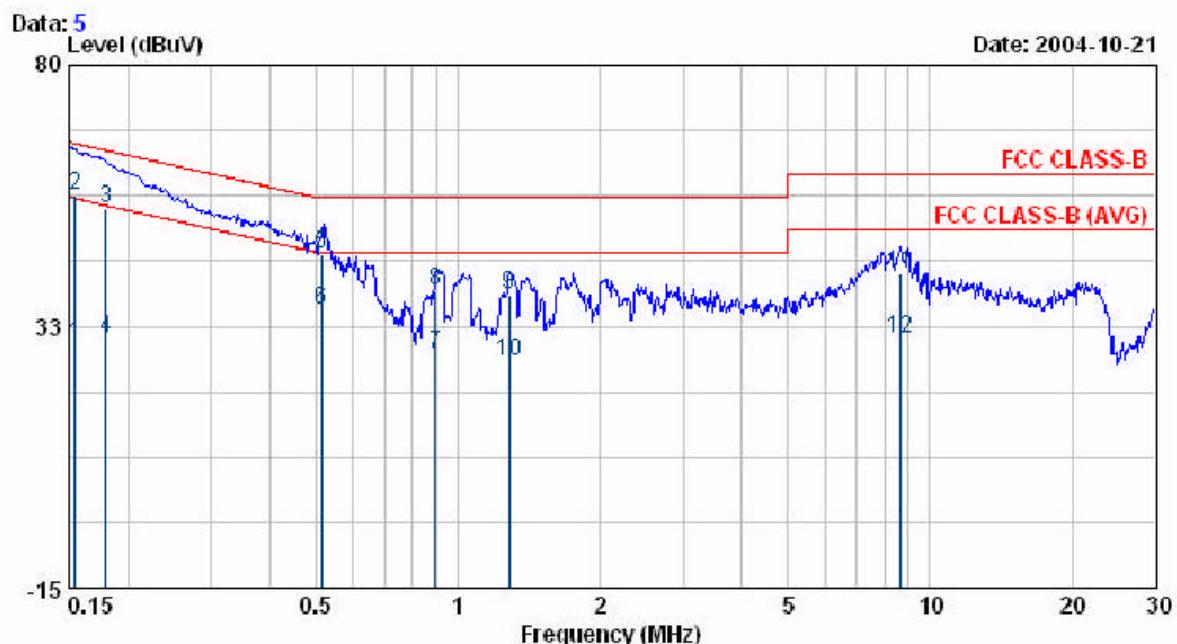
Pol/Phase : NEUTRAL
Temperature : 27 °C
Humidity : 59 %



Freq	Read		Level	Limit	Over Limit	Remark
	MHz	dBuV				
		dB				
0.170	27.10	0.41	27.51	54.96	-27.45	AVERAGE
0.170	54.34	0.41	54.75	64.96	-10.21	QP
0.312	18.89	0.44	19.33	49.93	-30.59	AVERAGE
0.312	41.28	0.44	41.72	59.93	-18.20	QP
0.516	39.94	0.47	40.41	56.00	-15.59	QP
0.516	28.57	0.47	29.04	46.00	-16.96	AVERAGE
0.646	16.93	0.49	17.42	46.00	-28.58	AVERAGE
0.646	35.72	0.49	36.21	56.00	-19.79	QP
1.030	33.50	0.51	34.01	56.00	-21.99	QP
1.030	17.79	0.51	18.30	46.00	-27.70	AVERAGE
8.961	34.33	0.70	35.04	60.00	-24.97	QP
8.961	23.09	0.70	23.80	50.00	-26.21	AVERAGE

EUT : WMR1000G
Power : 110V 60Hz
Test Mode : 802.11b CH HI
Memo :

Pol/Phase : LINE
Temperature : 27 °C
Humidity : 59 %



Freq	Read		Level	Limit	Over Limit	Remark
	MHz	dBuV				
			dB			
0.155	28.79	0.40	29.19	55.74	-26.55	AVERAGE
0.155	55.87	0.40	56.27	65.74	-9.47	QP
0.180	53.37	0.41	53.78	64.50	-10.72	QP
0.180	29.93	0.41	30.34	54.50	-24.16	AVERAGE
0.513	45.11	0.47	45.58	56.00	-10.42	QP
0.513	34.94	0.47	35.41	46.00	-10.59	AVERAGE
0.897	27.04	0.51	27.55	46.00	-18.45	AVERAGE
0.897	38.51	0.51	39.02	56.00	-16.98	QP
1.281	37.65	0.52	38.17	56.00	-17.83	QP
1.281	25.70	0.52	26.22	46.00	-19.78	AVERAGE
8.683	41.49	0.61	42.10	60.00	-17.90	QP
8.683	29.73	0.61	30.34	50.00	-19.66	AVERAGE