



## Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

Versalink 4 port gateway, Model A90-327WXX-06

Radiometrics Document RP-5286



*Product Detail:*

FCC ID: **CH8327WXX-6**

Equipment type: DTS 802.11b/g Wireless ADSL 4 port Ethernet Router

*Test Standards:*

US CFR Title 47, Chapter I, FCC Part 15 Subpart C

FCC Part 15 CFR Title 47: 2002

Industry Canada RSS-210, Issue 5 as required for Category I Equipment

This report concerns: Class II Permissive Change

FCC Part 15.247

*Tests Performed For:*

**Westell, Inc.**

750 North Commons Dr.

Aurora, IL 60504

Phone: (630) 375-4079

*Test Facility:*

**Radiometrics Midwest Corporation**

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*Test Date(s): (Month-Day-Year)*

June 17 thru 19, 2004

Document RP-5286 Revisions:

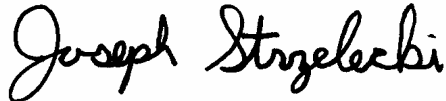
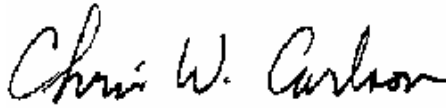
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## 1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Westell, Inc., Versalink 4 port gateway Model: A90-327WXX-06 Serial Number: 04B404762413 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> June 17, 2004	<i>Test Date(s): (Month-Day-Year)</i> June 17 thru 19, 2004
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Guy Cerulli Westell, Inc.
<i>Radiometrics' Personnel Responsible for Test:</i> 	<i>Test Report Approved By</i> 
Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

## 2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Versalink 4 port gateway, Model A90-327WXX-06, manufactured by Westell, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

### Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30 MHz to 24 GHz restricted bands	FCC Part 15.247	Pass

Spurious radiated emissions measurements were performed with both new antennas installed. No other tests were performed, since the transmitter and other electronics have not changed.

## 3 EQUIPMENT UNDER TEST (EUT) DETAILS

### 3.1 EUT Description

The EUT is a Westell Technologies, Inc. VersaLink Wireless Gateway, A90-327WXX-06. The specific unit tested was a production sample, S/N 04B404762413, Software version VER:03.00.50. It is an 802.11b/g Wireless ADSL 4-port Ethernet/USB Router. The EUT was in good working condition during the tests, with no known defects.

#### 3.1.1 FCC Section 15.203 & RSS-210 Section 5.5 Antenna Requirements

The antenna has a unique reverse SMA adaptor. The manufacturer will supply the antennas to the end user.

**3.2 Related Submittals**

Westell, Inc. is not submitting any other products simultaneously for equipment authorization related to the EUT.

**4 TESTED SYSTEM DETAILS**

**4.1 Tested System Configuration**

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply.

Since the EUT is a wireless router that can be located in a separate room from the computers it connects to, it was tested as a remotely located device.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

**Tested System Configuration List**

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	DSL 4 Port Gateway	E	Westell, Inc.	A90-327W15-06	04B404762413
2	MiniPCI card inside modem	E	Abocom Systems	WMG2400	WM43031292
3	Power Adaptor	E	Golden Profit	SY-0901	None
4	Antenna	E	Aztech	061-4713020-000	None
5	Antenna	E	Wieson	Y111E024-002	None
6	Antenna	E	FRE	E421C-2000C1	None
7	Personal Computer	S	Gateway	BATC	5643410
8	Video Monitor	S	Viewsonic	1782	5334513266
9	Notebook PC	S	Dell	Inspiron 3700	007114T-38380-9C2-P0AD
10	Wireless PC Card	S	NetGear	WAG511	WG53135ZC006961
11	4-port Ethernet hub	S	Westell	080-002369	02BS06808946
12	Broadband Test System Note 1	S	Adtech	400120C	149181

\* Type: E = EUT, S = Support Equipment

Note 1: An ATM-25 Module P/N 300310 and an Ethernet Interface Module P/N 401324 were inside the Adtech.

**List of Cables Connected Directly to EUT**

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
4	10	Ethernet Cable RJ 45	#1	No
1	15	DSL cable RJ 15	#1	No
1	2	DC Cable Integral on power adaptor	#1	No

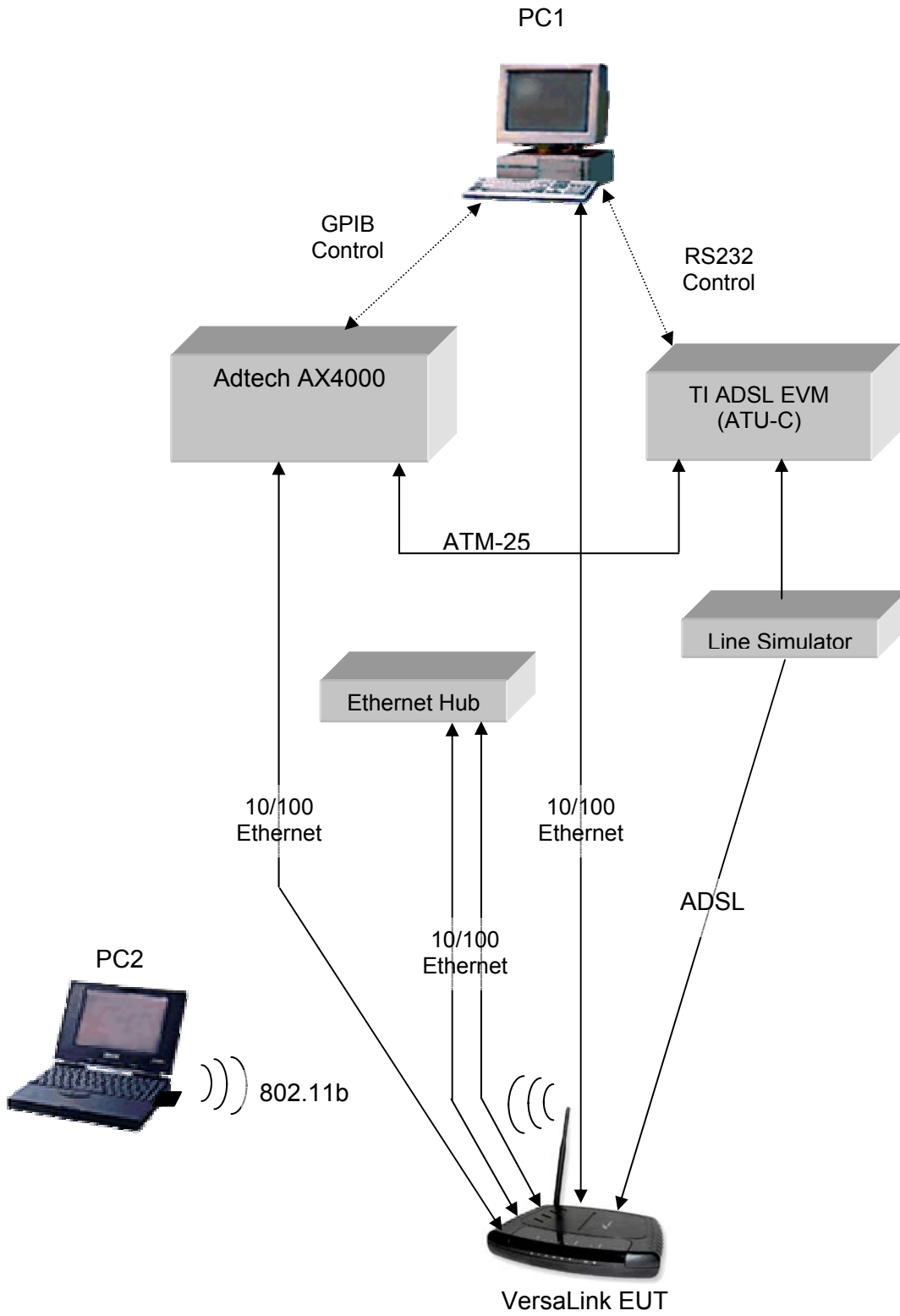
## 4.2 EUT Operation

The EUT was exercised to simulate typical operation. ATM-25 traffic from the Adtech was sent to the ATU-C, where it was then transported via an ADSL line to the EUT. Downstream rate was 8.128 Mbps and upstream was 896 kbps. The traffic then passed out of the EUT to one of the 10/100 Ethernet ports back to the Adtech to complete the round trip. Traffic was also simultaneously sent in the opposite direction.

In addition, the wireless interface of the EUT was exercised by sending data from PC1 over wired 10/100 Ethernet to the EUT, then to PC2 via the wireless 802.11b/g link. The EUT mode and channel were set for each test using the EUT's configuration web screens. The EUT wireless transmitter was exercised using a utility called "Qcheck" from Ixia. It is able, among other things, to send streaming UDP traffic from one endpoint to another. A streaming path was sent from PC1 to PC2 via the EUT's wireless interface. The transmitter was set at three frequencies

Finally, the other 2 Ethernet ports were terminated with a hub.

Figure 1. EUT Setup Drawing



### 4.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

### 4.4 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

## 5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2002	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2001	2001	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

The test procedures used are in accordance with the ANSI document C63.4-2001, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

## 6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site ([www.radiomet.com](http://www.radiomet.com)). Radiometrics accreditation status can be verified at A2LA's web site ([www.a2la2.net](http://www.a2la2.net)).

The following is a list of shielded enclosures located in Romeoville, Illinois:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles in the located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 24' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 20' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber D: Is a fully anechoic chamber that measures 22' L X 10' W X 10' H. The walls, ceiling and floor are fully lined with ferrite absorber tiles. Braden Shielding Systems of Tulsa, Oklahoma manufactured the chamber.

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Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number 31040/SIT 1300F2. The FCC test site Registration Number is 90897. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

### 7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

### 8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

### 9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	11/27/03
AMP-12	MITEQ	Pre-amplifier	AM-1431	530935	0.01-1000MHz	12 Mo.	12/31/03
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18 GHz	12 Mo.	12/03/03
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	09/30/02
ANT-25	ARA	Super Log Antenna	LPB-2520/A	1116	20-2000MHz	24 Mo.	01/06/04
ANT-42	RMC	Std. Gain Horn	HW2020	1001	18-26GHz	24 Mo.	05/19/04
MIX-01	H-P	Harmonic Mixer	11970K	3003A02337	18-26.5GHz	12 Mo.	05/19/04
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	06/07/03
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	10/21/03
REC-08	Hewlett Packard	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	12 Mo.	05/26/04
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	12 Mo.	01/28/04

Note: All calibrated equipment is subject to periodic checks.

NCR – No Calibration Required. Device monitored by calibrated equipment. N/A: Not Applicable.



## 10 RADIATED RF EMISSIONS MEASUREMENTS

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. For tests above 1 GHz, the video bandwidth was set to 1 MHz for peak and 100 Hz for average.

A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. From 30 to 1000 MHz an Anritsu Spectrum analyzer and a MITEQ AM-1431 amplifier with a 10 dB attenuator connected to the input. For tests from 1 to 25 GHz, an HP8566B spectrum analyzer with an external mixer was used with a Celeritek uWave amplifier with an attenuator on the input. The fundamental emission, out of band emissions and the ambient emissions were below the level of input overload.

Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. Measurements were performed using the peak or quasi-peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab. Radiated emission measurements are performed with linearly polarized broadband antennas.

The restricted band frequency ranges were slowly scanned with particular attention paid to those frequency ranges which appeared high in the preliminary emission scan. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

### 10.1.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG + PKA$$

Where: FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

PKA = Peak to Average Factor (This is zero for non-average measurements)

The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is  $20 * \text{Log}(\text{Duty cycle}/100)$ .

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**10.1.2 Radiated Emissions Test Results**

Test Date	06-17-2004
Test Distance	3 Meters
Specification	FCC Part 15.247
Abbreviations	Pol = Antenna Polarization

Antenna on EUT	Test Mode	Tx Freq MHz	Ant Pol.	Detector Function	Emission Freq. MHz	dBuV/m	Limit	Margin under limit
Wieson	802.11b	2412	Vert	Peak	4824	66.5	74.0	7.5
Wieson	802.11b	2412	Vert	Ave	4824	47.6	54.0	6.4
Wieson	802.11b	2412	Horz	Peak	4824	56.7	74.0	17.3
Wieson	802.11b	2412	Horz	Ave	4824	38.4	54.0	15.6
Wieson	802.11b	2412	Vert	Peak	2389	55.3	74.0	18.7
Wieson	802.11b	2412	Vert	Ave	2389	36.7	54.0	17.3
Wieson	802.11b	2437	Vert	Peak	4874	65.6	74.0	8.4
Wieson	802.11b	2437	Vert	Ave	4874	46.8	54.0	7.2
Wieson	802.11b	2437	Horz	Peak	4874	57.1	74.0	16.9
Wieson	802.11b	2437	Horz	Ave	4874	38.2	54.0	15.8
Wieson	802.11b	2437	Vert	Ave	1235	27.0	54.0	27.0
Wieson	802.11b	2437	Horz	Ave	1235	27.5	54.0	26.5
Wieson	802.11b	2462	Vert	Peak	4924	65.8	74.0	8.2
Wieson	802.11b	2462	Vert	Ave	4924	46.9	54.0	7.1
Wieson	802.11b	2462	Horz	Peak	4924	55.4	74.0	18.6
Wieson	802.11b	2462	Horz	Ave	4924	37.1	54.0	16.9
Wieson	802.11g	2412	Vert	Peak	4824	61.7	74.0	12.3
Wieson	802.11g	2412	Vert	Ave	4824	42.7	54.0	11.3
Wieson	802.11g	2412	Horz	Peak	4824	56.5	74.0	17.5
Wieson	802.11g	2412	Horz	Ave	4824	37.7	54.0	16.3
Wieson	802.11g	2412	Vert	Peak	2389	60.9	74.0	13.1
Wieson	802.11g	2412	Vert	Ave	2389	39.4	54.0	14.6
Wieson	802.11g	2437	Vert	Peak	4874	64.8	74.0	9.2
Wieson	802.11g	2437	Vert	Ave	4874	46.1	54.0	7.9
Wieson	802.11g	2437	Horz	Peak	4874	56.3	74.0	17.7
Wieson	802.11g	2437	Horz	Ave	4874	38.2	54.0	15.8
Wieson	802.11g	2462	Vert	Peak	4924	64.2	74.0	9.8
Wieson	802.11g	2462	Vert	Ave	4924	45.8	54.0	8.2
Wieson	802.11g	2462	Horz	Peak	4924	55.4	74.0	18.6
Wieson	802.11g	2462	Horz	Ave	4924	36.7	54.0	17.3
FRE	802.11b	2412	Vert	Peak	2389	54.1	74.0	19.9
FRE	802.11b	2412	Vert	Ave	2389	36.1	54.0	17.9
FRE	802.11b	2412	Vert	Peak	4824	65.4	74.0	8.6
FRE	802.11b	2412	Vert	Ave	4824	46.4	54.0	7.6
FRE	802.11b	2412	Horz	Peak	4824	55.9	74.0	18.1
FRE	802.11b	2412	Horz	Ave	4824	37.2	54.0	16.8
FRE	802.11b	2437	Vert	Peak	4874	63.3	74.0	10.7
FRE	802.11b	2437	Vert	Ave	4874	44.4	54.0	9.6
FRE	802.11b	2437	Horz	Peak	4874	57.2	74.0	16.8

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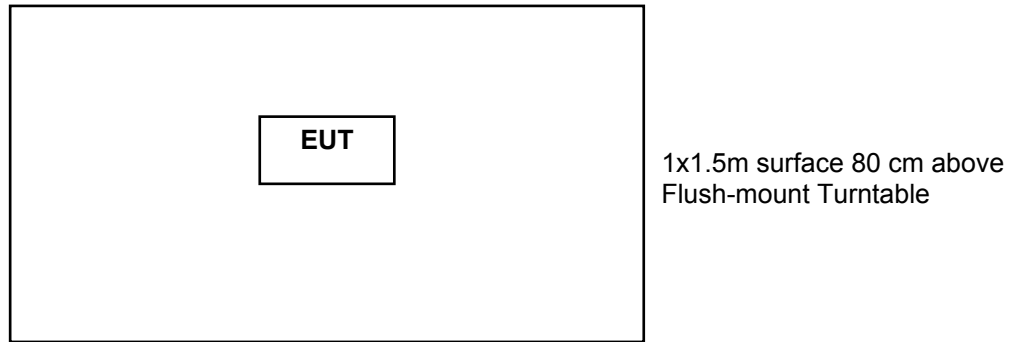
Antenna on EUT	Test Mode	Tx Freq MHz	Ant Pol.	Detector Function	Emission Freq. MHz	dBuV/m	Limit	Margin under limit
FRE	802.11b	2437	Horz	Ave	4874	39.0	54.0	15.0
FRE	802.11b	2462	Vert	Peak	4924	62.6	74.0	11.4
FRE	802.11b	2462	Vert	Ave	4924	43.8	54.0	10.2
FRE	802.11b	2462	Horz	Peak	4924	56.4	74.0	17.6
FRE	802.11b	2462	Horz	Ave	4924	38.1	54.0	15.9
FRE	802.11g	2412	Vert	Peak	4824	67.1	74.0	6.9
FRE	802.11g	2412	Vert	Ave	4824	48.2	54.0	5.8
FRE	802.11g	2412	Horz	Peak	4824	55.2	74.0	18.8
FRE	802.11g	2412	Horz	Ave	4824	36.4	54.0	17.6
FRE	802.11g	2437	Vert	Peak	4874	64.3	74.0	9.7
FRE	802.11g	2437	Vert	Ave	4874	46.2	54.0	7.8
FRE	802.11g	2437	Horz	Peak	4874	57.9	74.0	16.1
FRE	802.11g	2437	Horz	Ave	4874	39.6	54.0	14.4
FRE	802.11g	2462	Vert	Peak	4924	60.6	74.0	13.4
FRE	802.11g	2462	Vert	Ave	4924	42.3	54.0	11.7
FRE	802.11g	2462	Horz	Peak	4924	56.0	74.0	18.0
FRE	802.11g	2462	Horz	Ave	4924	37.9	54.0	16.1
Aztech	802.11b	2412	Vert	Peak	2389	62.5	74.0	11.5
Aztech	802.11b	2412	Vert	Ave	2389	43.9	54.0	10.1
Aztech	802.11b	2412	Vert	Peak	4824	71.4	74.0	2.6
Aztech	802.11b	2412	Vert	Ave	4824	50.6	54.0	3.4
Aztech	802.11b	2412	Horz	Peak	4824	55.0	74.0	19.0
Aztech	802.11b	2412	Horz	Ave	4824	36.8	54.0	17.2
Aztech	802.11b	2437	Vert	Peak	4874	69.5	74.0	4.5
Aztech	802.11b	2437	Vert	Ave	4874	50.3	54.0	3.7
Aztech	802.11b	2437	Horz	Peak	4874	56.1	74.0	17.9
Aztech	802.11b	2437	Horz	Ave	4874	37.4	54.0	16.6
Aztech	802.11b	2462	Vert	Peak	4924	67.9	74.0	6.1
Aztech	802.11b	2462	Vert	Ave	4924	49.8	54.0	4.2
Aztech	802.11b	2462	Horz	Peak	4924	55.9	74.0	18.1
Aztech	802.11b	2462	Horz	Ave	4924	37.1	54.0	16.9
Aztech	802.11g	2412	Vert	Peak	4824	70.4	74.0	3.6
Aztech	802.11g	2412	Vert	Ave	4824	50.4	54.0	3.6
Aztech	802.11g	2412	Horz	Peak	4824	55.6	74.0	18.4
Aztech	802.11g	2412	Horz	Ave	4824	37.0	54.0	17.0
Aztech	802.11g	2437	Vert	Peak	4874	68.7	74.0	5.3
Aztech	802.11g	2437	Vert	Ave	4874	49.8	54.0	4.2
Aztech	802.11g	2437	Horz	Peak	4874	55.4	74.0	18.6
Aztech	802.11g	2437	Horz	Ave	4874	36.4	54.0	17.6
Aztech	802.11g	2462	Vert	Peak	4924	67.8	74.0	6.2
Aztech	802.11g	2462	Vert	Ave	4924	49.6	54.0	4.4
Aztech	802.11g	2462	Horz	Peak	4924	55.4	74.0	18.6
Aztech	802.11g	2462	Horz	Ave	4924	36.7	54.0	17.3

Judgment: Passed by dB

No other Emissions were detected within 10 dB of the limits.

For tests above 1 GHz, the video bandwidth was set to 1 MHz for peak and 100 Hz for average.

Figure 2. Drawing of Radiated Emissions Setup



**Notes:**

- EUT tested as a remotely located device
- Support Equipment out side of test area
- AC outlet with low-pass filter at the base of the turntable
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale

