Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

Gateway Router Model D90-327W30-06

Radiometrics Document RP-5745

ACCREDITED
Certification # 1495.01

Test Standards:
CENELEC EN 55022: 2003
FCC Part 15 CFR Title 47: 2004
ICES-003: 2004 Digital Apparatus (Industry Canada)
ANSI C63.4-2003

Tests Performed For:	*Test Facility:*
Westell, Inc. 750 N. Commons Rd. Aurora, IL 60504	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446

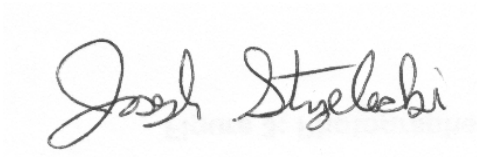
Test Date(s): (Month-Day-Year)
January 9 and 12, 2006

RP-5745 Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	February 7, 2006		
1	February 9, 2006	All	Josh Stylecki

Table of Contents

1 ADMINISTRATIVE DATA

Equipment Under Test: A Westell, Inc., Gateway Router Model: D90-327W30-06 Serial Number: 22247 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) January 9, 2006	*Test Date(s): (Month-Day-Year)* January 9 and 12, 2006
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* Steve Hawkins Westell, Inc.
Radiometrics' Personnel Responsible for Test:  02-07-06 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*EUT Checked By:* Steve Hawkins Westell, Inc.

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Westell, Inc. Gateway Router Model D90-327W30-06. 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 Level	Test Result
Conducted Emissions, AC Mains	0.15-30 MHz	EN 55022	Class B	Pass
RF Radiated Emissions	30-2000 MHz	EN 55022	Class B	Pass

Since the FCC allows the use of the EN55022 limits in place of the FCC part 15 subpart B limits, the Radiated RF and AC Conducted emissions test shows compliance for both the CE and the US market. The test results also conform to ICES-003: 2004 Digital Apparatus (Industry Canada).

This test covers the unintentional Radiator portion of the EUT only. This report does not address the emissions from the wireless portion of the EUT above 2 GHz. However the wireless card was transmitting and fully functional during the tests.

3 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
CENELEC EN 55022	2003	Limits and methods of measurement of radio disturbance characteristics of information technology equipment

Document	Date	Title
FCC CFR Title 47	2004	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2003	2003	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IEC CISPR 16-1 CISPR 16-2	2005	Specification for radio disturbance and immunity measuring apparatus and methods; Methods of measurement of disturbance and immunity; Part 1 and Part 2

4 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 testing and calibration laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the "basic standards" listed herein. A full list of Radiometrics capabilities can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la.org).

The following is a list of facilities used during the tests.

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.

Test Station F: Is an area that measures approximately 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

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.

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).

5 EQUIPMENT UNDER TEST (EUT) DETAILS

5.1 EUT Description

The EUT is a Gateway Router. The EUT is a DSL Modem, Ethernet router and a wireless 802.11b/g LAN. The EUT was in good working condition during the test, with no known defects.

5.2 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. Support and simulation equipment were remotely located during testing. Support equipment was not subjected to the test requirements.

Test Setup Configuration List

Item	Description	Type*	Company	Model Number	Serial Number
1	Versalink Wireless Gateway Router	E	Westell, Inc.	D90-327W30-06	22247
2	120V to 12 VDC power Supply	E	Westell, Inc.	085-200037	None
3	802.11b/g High power VLINK WLAN card	E	Abocom Systems	WMTO583	None
4	Laptop PC	S	HP	Ze4115	TW23729448
5	Laptop PC	S	MPC	T2000	G34891AWA00510
6	Hub (4 modems)	S	Westell, Inc.	B90-610014-06	N/A
7	CO	S	Texas Instrument	AC5 EVM	B089337
8	Wireless Client	S	Westell, Inc.	A90-200WG-01	04GS10010996

* Type: E = EUT, S = Support Equipment (not part of tested system); P = Peripherals or Host (part of the tested system)

The following cables were connected to the EUT or support equipment during the tests. Refer to configuration list for item specifics.

List of Cables Connected to EUT

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	DC Cord	#1 Power input	No
1	28.0	DSL Cable	#1 and #3	No
4	7.5	Ethernet Cable	#1 and #4	No

5.3 Operating Conditions of EUT

The EUT was in a normal operating mode during the tests. There were continuous pings between router and wireless client during all tests. All circuits were activated during the tests. Power was supplied at 120 VAC, 60 Hz single-phase.

5.4 EUT Modifications

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

6 DEVIATIONS FROM THE TEST SPECIFICATIONS

There were no deviations from the test specifications.

7 EXCLUSIONS FROM THE TEST SPECIFICATIONS

This test covers the unintentional Radiator portion of the EUT only. This report does not address the emissions from the wireless portion of the EUT above 2 GHz.

8 TEST PROCEDURES

8.1 RF Emissions Measurement Procedures

The test procedures used are in accordance with the ANSI document C63.4-2003 and the IEC document CISPR 16.

The emission measurements were performed with a spectrum analyzer. The bandwidth of the spectrum analyzer from 150 kHz to 30 MHz is 9 kHz, and the bandwidth from 30 to 1000 MHz is 120 kHz. Above 1 GHz a 1 MHz bandwidth is used.

8.1.1 Radiated Emission Measurement Procedures

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 2000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak or the quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector function as required by the specification for final determination of compliance.

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 field strength is calculated by adding the antenna factor, distance correction factor, cable loss, and subtracting the amplifier gain from the measured reading. Each antenna, cable and amplifier has individual factors across its usable frequency range. The antenna factor converts the voltage reading in dBuV to field strength in dBuV/meter. The distance correction is an inverse proportionality factor of 20 dB per decade of distance. The distance correction factor for a ten-meter specification distance to a three-meter test distance is calculated as follows: Distance Correction Factor = 20 * Log (3/10) = -10.5 dB.

EN55022 Radiated Emissions Limits

Frequency Range (MHz)	Test Distance (meters)	Field Strength QP (dBuV/m)	
		Class A	Class B
30 – 230	10	40	30
230 – 1000	10	47	37

8.1.2 Conducted Emission Measurement Procedures

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter.

The conducted emissions must conform to both the quasi-peak and the average limits. The measurements are first performed using the peak detector function. If the peak detector data exceeds or is marginally close the limits, the measurements are repeated using an average and/or quasi-peak detector function for final determination of compliance. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

8.1.2.1 Power Line Conducted Emissions Procedures

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. This is referred to as an Artificial Mains Network (AMN) in CE documents. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

Conducted Emissions Limits

Frequency Range (MHz)	Class A Limits (dBuV)		Class B Limits (dBuV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.150 - 0.50*	79	66	66 - 56	56 - 46
0.5 – 5.0	73	60	56	46
5.0 - 30	73	60	60	50
* The limit decreases linearly with the logarithm of the frequency in these ranges.				

9 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.

10 TEST EQUIPMENT TABLE

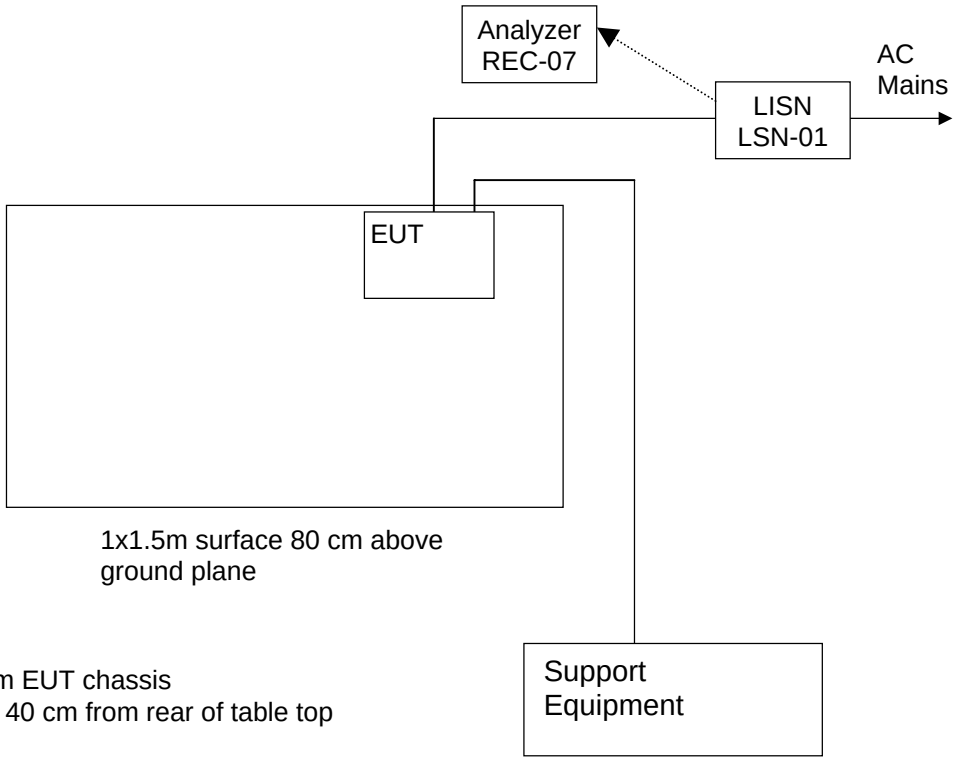
RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/21/05
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/22/05
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	06/15/04
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	04/20/05
LSN-01	Electrometrics	LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	04/25/05
LSN-02	Electrometrics	LISN	LISN 25/3	1063	0.01-30MHz	24 Mo.	04/25/05
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	01/04/05
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 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.

11 TEST SETUP DOCUMENTATION

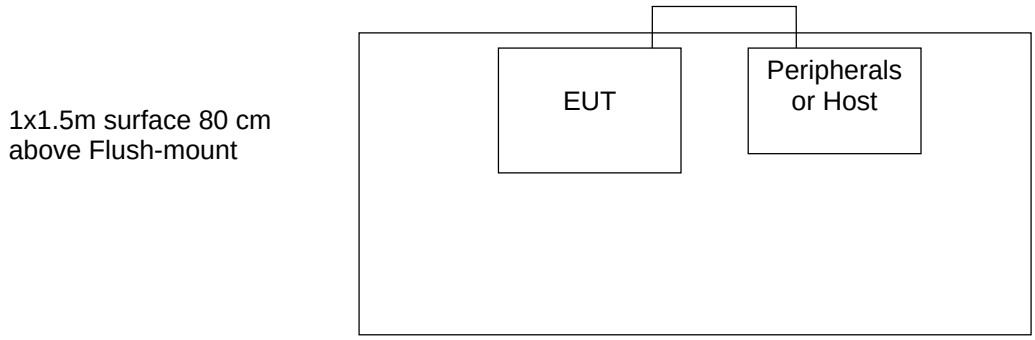
This section includes photographs of the actual test setup and drawings indicating the general test setup components. The drawings show the test equipment setup for each test. For the detailed EUT setup see the photographs and the “equipment under test (EUT) Details” in this report.

Figure 1. Drawing of Conducted Emissions Test Setup



Notes:
- Not to Scale
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled

Figure 2. Drawing of Radiated Emissions Test Setup



Notes:
- Not to Scale
- Antenna height varied 1-4 meters
- Distance from antenna to tested system is 3 meters
- AC cords not shown. They are connected to AC outlet with low-pass filter on turntable

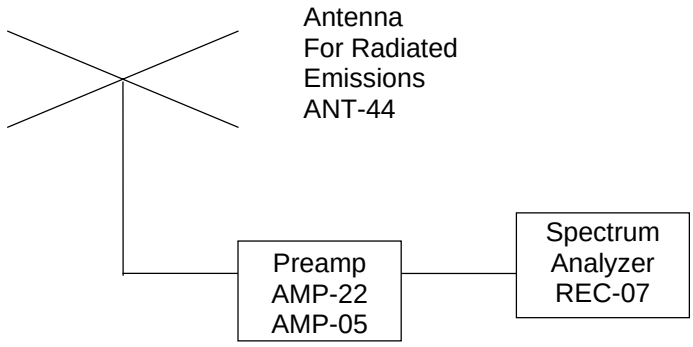
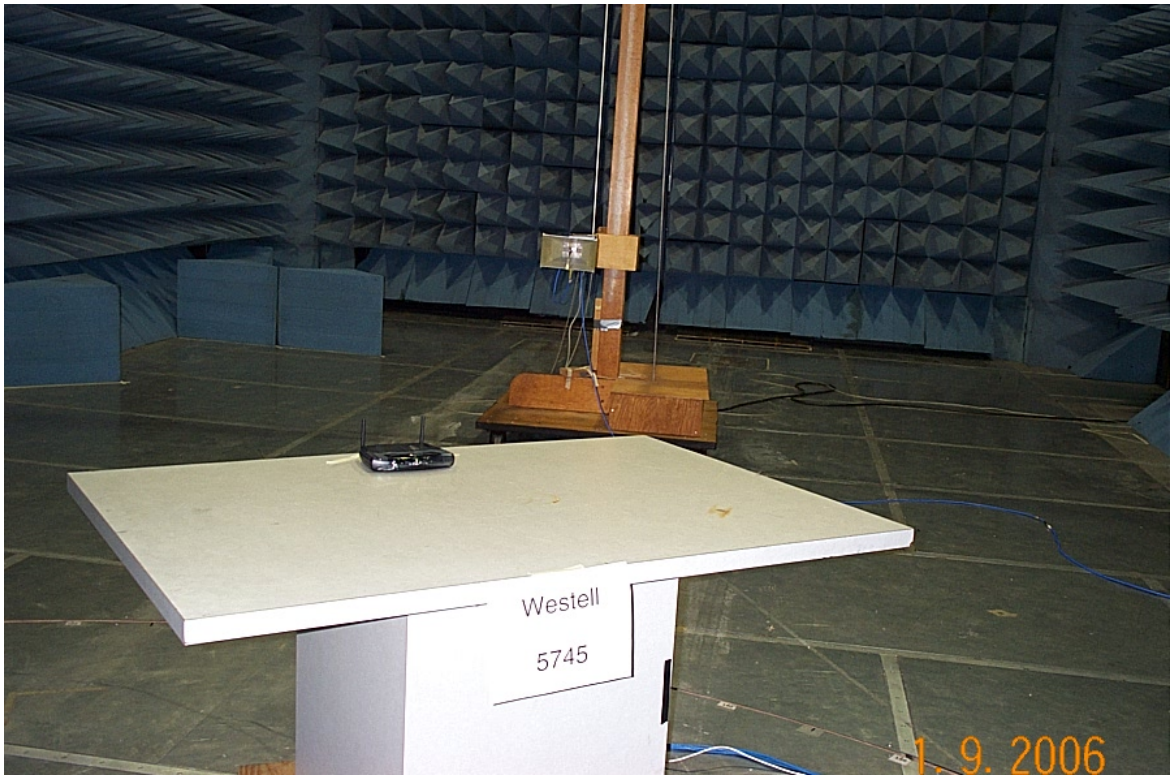
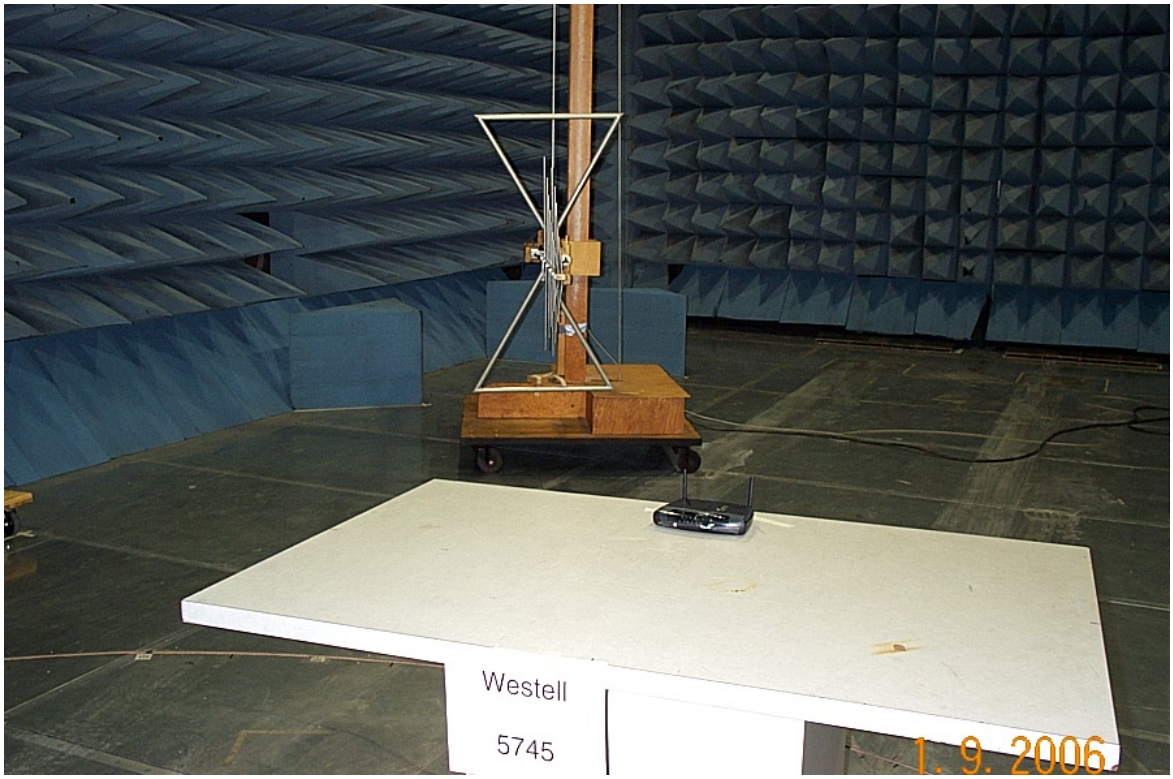


Figure 3. Photographs of Radiated Emissions Test Setup





Photograph of Radiated Emissions Test Setup

Figure 4. Photographs of Conducted Emissions Test Setup

12 DETAILED TEST RESULTS

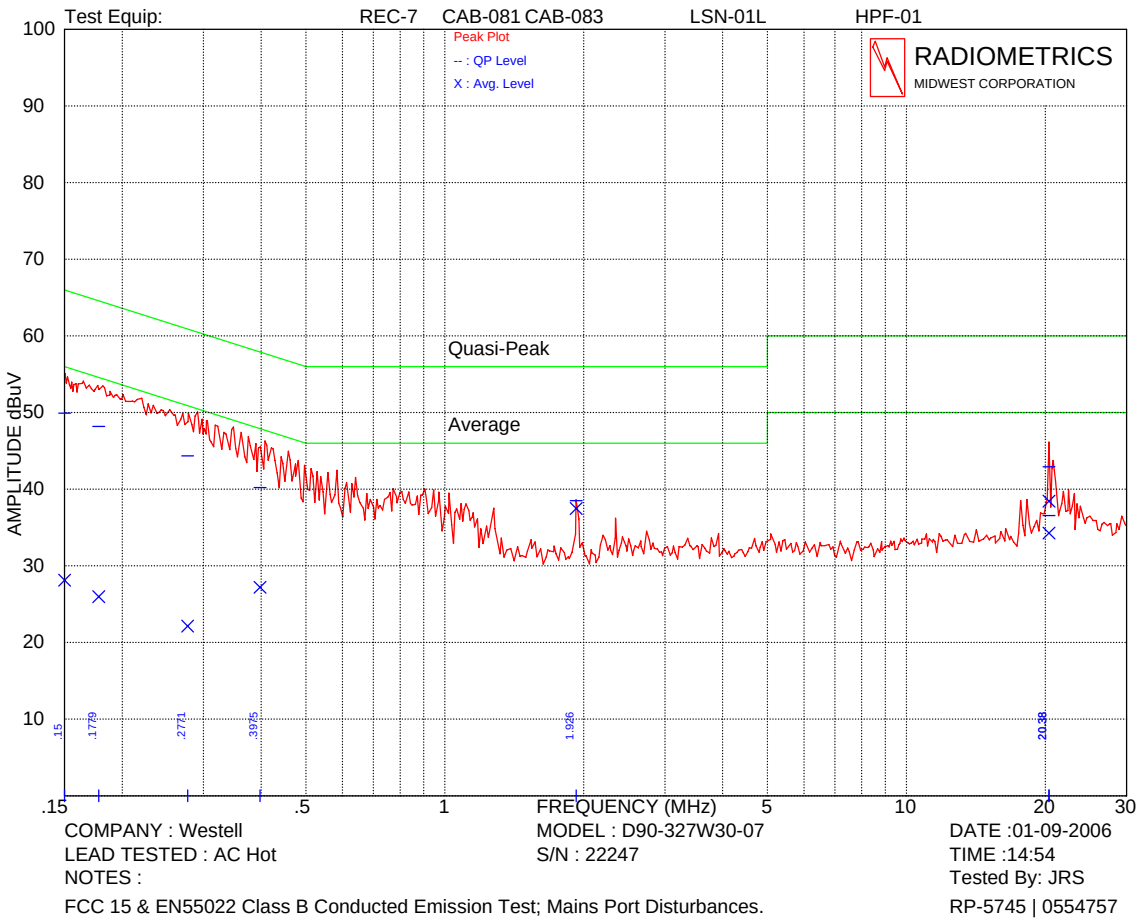
12.1 Radiated Emissions Test Results

Company	Westell	Specification	FCC Part 15; Subpart B; Class B
Model	D90-327W30-06	Test Date	01/09/2006
Serial Number	22247	Test Distance	3 Meters
Test Personnel	Joseph Strzelecki	Test Location	Chamber E
Notes	Corr. Factors = cable loss - preamp gain - distance factor.		
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical; LP = Log-Periodic; BL = Bilog; P = peak; Q = QP		

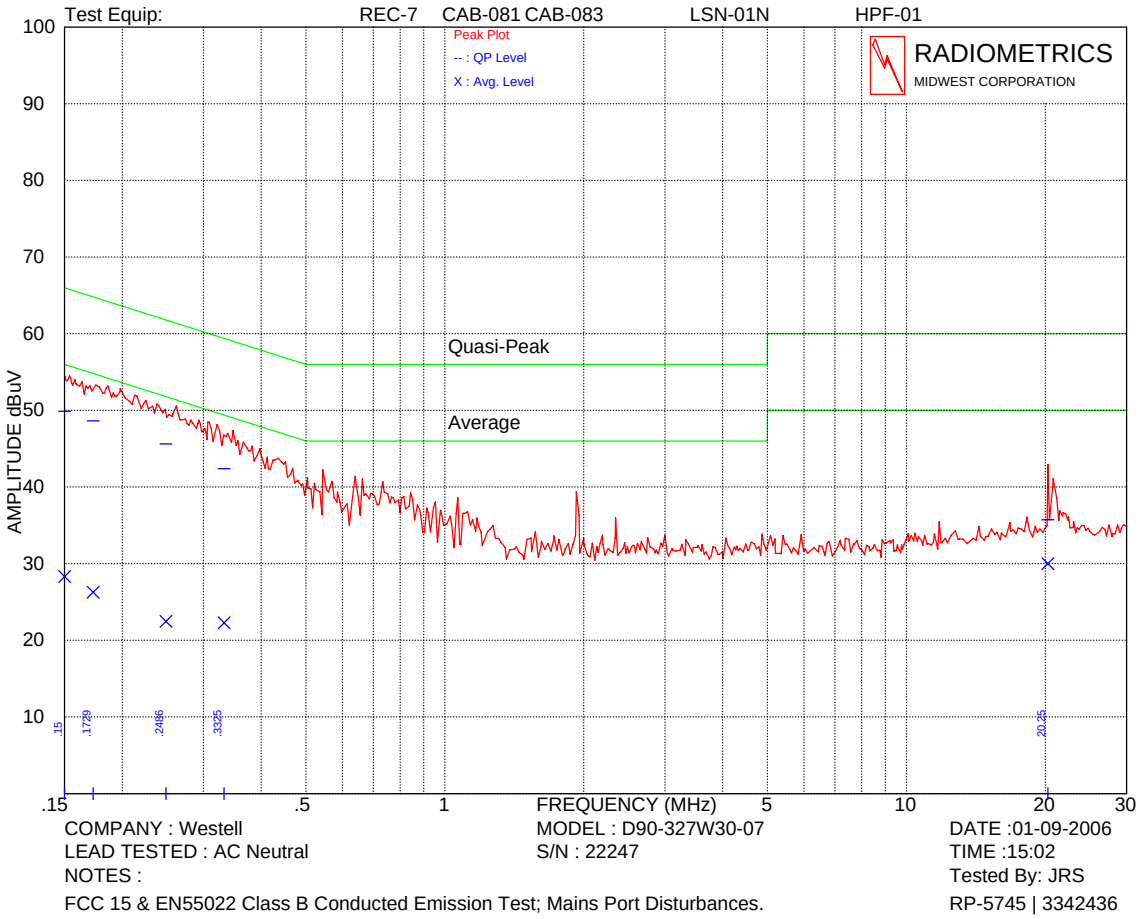
Freq. MHz	Meter Reading dBuV	Antenna Factor dB	Antenna Pol/ ANT ID	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
36.4	30.5 P	17.0	H/44	-17.6	29.8	40.0	10.2
74.2	28.9 P	6.6	H/44	-17.0	18.6	40.0	21.4
101.9	29.1 P	10.9	H/44	-16.6	23.4	43.5	20.1
145.6	31.4 P	10.5	H/44	-16.2	25.7	43.5	17.8
181.4	33.3 P	9.4	H/44	-15.9	26.8	43.5	16.7
199.9	36.5 P	10.2	H/44	-15.7	30.9	43.5	12.6
216.0	34.9 P	11.1	H/44	-15.6	30.4	43.5	13.1
239.7	41.9 P	12.2	H/44	-15.4	38.7	46.0	7.3
249.5	40.2 P	12.4	H/44	-15.3	37.3	46.0	8.7
250.3	32.9 P	12.4	H/44	-15.3	30.0	46.0	16.0
264.4	32.3 P	13.0	H/44	-15.2	30.1	46.0	15.9
375.3	37.8 P	16.4	H/44	-14.6	39.6	46.0	6.4
400.2	34.5 P	16.2	H/44	-14.5	36.2	46.0	9.8
720.4	32.4 P	20.6	H/44	-12.0	41.0	46.0	5.0
750.4	31.2 P	20.9	H/44	-11.7	40.4	46.0	5.6
800.4	32.0 P	21.4	H/44	-11.3	42.2	46.0	3.8
870.0	30.5 P	21.7	H/44	-10.9	41.2	46.0	4.8
880.0	30.3 Q	21.9	H/44	-10.8	41.4	46.0	4.6
880.3	32.2 P	21.9	H/44	-10.8	43.3	46.0	2.7
37.0	38.3 Q	15.5	V/44	-17.6	36.2	40.0	3.8
50.7	38.4 P	13.7	V/44	-17.4	34.7	40.0	5.3
62.3	36.7 P	11.4	V/44	-17.1	31.0	40.0	9.0
62.9	43.1 P	11.2	V/44	-17.1	37.1	40.0	2.9
63.0	37.9 P	11.1	V/44	-17.1	31.8	40.0	8.2
65.2	35.8 P	10.1	V/44	-17.1	28.8	40.0	11.2
68.7	36.1 P	8.4	V/44	-17.1	27.5	40.0	12.5
81.5	35.1 P	6.7	V/44	-16.9	24.9	40.0	15.1
81.7	39.6 P	6.7	V/44	-16.9	29.4	40.0	10.6
90.9	37.4 P	8.8	V/44	-16.8	29.4	43.5	14.1
92.5	40.7 P	9.4	V/44	-16.7	33.4	43.5	10.1
93.6	37.5 P	9.9	V/44	-16.7	30.7	43.5	12.8
101.9	39.8 P	12.4	V/44	-16.6	35.5	43.5	8.0
103.3	38.1 P	12.5	V/44	-16.6	34.0	43.5	9.5
124.8	33.7 P	15.2	V/44	-16.4	32.5	43.5	11.0
250.3	41.5 P	12.9	V/44	-15.3	39.1	46.0	6.9

Freq. MHz	Meter Reading dBuV	Antenna Factor dB	Antenna Pol/ ANT ID	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
257.8	40.9 P	13.0	V/44	-15.3	38.6	46.0	7.4
267.3	33.9 P	13.3	V/44	-15.2	32.0	46.0	14.0
276.7	32.9 P	13.2	V/44	-15.2	30.9	46.0	15.1
333.7	34.9 P	16.2	V/44	-14.8	36.3	46.0	9.7
343.2	32.1 P	16.7	V/44	-14.8	34.0	46.0	12.0
375.4	35.1 P	16.5	V/44	-14.6	36.9	46.0	9.1
419.6	31.9 P	16.5	V/44	-14.4	34.0	46.0	12.0
500.2	31.3 P	18.1	V/44	-13.8	35.6	46.0	10.4
661.8	29.0 P	19.4	V/44	-12.5	35.9	46.0	10.1
675.4	29.2 P	19.5	V/44	-12.4	36.3	46.0	9.7
693.7	29.2 P	19.8	V/44	-12.3	36.7	46.0	9.3
880.0	33.2 P	21.5	V/44	-10.8	43.8	46.0	2.2
880.0	31.0 Q	21.5	V/44	-10.8	41.7	46.0	4.3
1040.1	28.4 P	22.6	V/44	-9.3	41.7	54.0	12.3
1039.0	41.0	24.3	V/13	-26.5	38.8	54.0	15.2
1519.0	38.7	25.3	V/13	-26.0	38.0	54.0	16.0

12.1.1 Conducted Emissions Data



Freq. MHz	Quasi Peak		Average	
	Amplitude dBuV	Limit dBuV	Amplitude dBuV	Limit dBuV
0.15	49.92	66.00	28.12	56.00
0.18	48.18	64.58	25.99	54.58
0.28	44.36	60.90	22.14	50.90
0.40	40.22	57.90	27.20	47.90
1.93	38.50	56.00	37.48	46.00
20.38	42.93	60.00	38.45	50.00
20.38	36.55	60.00	34.27	50.00



Freq. MHz	Quasi Peak		Average	
	Amplitude dBuV	Limit dBuV	Amplitude dBuV	Limit dBuV
0.15	49.87	66.00	28.33	56.00
0.17	48.63	64.82	26.27	54.82
0.25	45.61	61.80	22.47	51.80
0.33	42.38	59.39	22.27	49.39
20.26	35.73	60.00	30.00	50.00