



Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

4Port Wireless Gateway Router

Versalink, Model C90-327W10-07

Radiometrics Document RP-5507



Product Detail:

FCC ID: CH8C90327WXX-06

Equipment type: 2.4 GHz Digitally Modulated Transmitter.

Test Standards:

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

FCC Part 15 CFR Title 47: 2004

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

This report concerns: Original Grant for Certification

FCC Part 15.247

Tests Performed For:

Westell, Inc.

750 N. Commons Dr.

Aurora, IL 60504

Test Facility:

Radiometrics Midwest Corporation

12 East Devonwood Ave.

Romeoville, IL 60446

e-mail: info@radiomet.com

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

March 21 to May 11, 2005

Document RP-5507 Revisions:

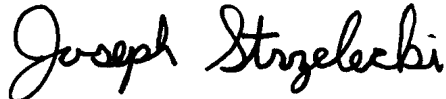
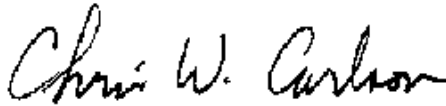
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0	May 31, 2005		
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1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Westell, Inc., 4Port Wireless Gateway Router Model: Versalink, Serial Number: none This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> March 21, 2005	<i>Test Date(s): (Month-Day-Year)</i> March 21 to May 11, 2005
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Barak Balkuv 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 4Port Wireless Gateway Router, Versalink Model C90-327WXX-07, 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 25 GHz	RSS-210 & FCC Part 15	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	RSS-210 & FCC Part 15	Pass

Spread Spectrum Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS-210 Section	Test Result
6 dB Bandwidth Test	2400 to 2483 MHz	15.247 a	6.2.2 (o) (a)	Pass
Peak Output Power	2400 to 2483 MHz	15.247 b	6.2.2 (o) (a)	Pass
Band-edge Compliance of RF Conducted Emissions	2400 to 2483 MHz	15.247 c	6.2.2 (o) (e)	Pass
Spurious RF Conducted Emissions	30 MHz to 25 GHz	15.247 c	6.2.2 (o) (e1)	Pass
Spurious Radiated Emissions	30 MHz to 25 GHz	15.247 c	6.2.2 (o) (a)	Pass
Power Spectral Density	2400 to 2483 MHz	15.247 d	6.2.2 (o) (b)	Pass

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a 4-Port Wireless Gateway Router, Model Versalink, manufactured by Westell, Inc. The EUT was in good working condition during the tests, with no known defects. This device has an integrated DSL modem and 802.11 WiFi router (to support connectivity to WiFi enabled devices throughout the home).

For wireless gateway the radio used is an Abocom WMG2400V with FCC ID# of MQ4WMG2400.

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

The 2.4 GHz antenna has a reverse polarity SMA connector on it.

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.

The EUT was tested with a personal computer. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply. 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	4Port Wireless Gateway Router	E	Westell, Inc.	C90-327WXX-07	None
2	Power Supply	E	Westell, Inc.	AA-151-ABN	None
3	Desktop PC	P	Gateway	MFATXPNTMDPE4100	0032924227
4	Monitor	P	Viewsonic	1782	5334513266
5	Keyboard	P	Gateway	2196003-00-004	54210247
6	Mouse	P	Gateway	X04-81538	7002409
7	Laptop PC	S	Gateway	SOLO 9100	BC397290560
8	Wireless Bridge	S	Linksys	WET54G	BDY003902803
9	CO	S	Texas Instrument	EUMII 400L PQT	B087268
10	Ethernet Switch	S	Westell, Inc.	A90-240010-04	02B506808945

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

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List of EUT Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	AC Cord	#1 and #2	No
1	21	DSL Cable	#1 and #3	No
1	1.8	USB Cable	#1 and #9	Yes
4	15.2	Ethernet Cable	#1 and #10	No

4.2 Special Accessories

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

4.3 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	2004	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
IC RSS-210 Issue 5	2001	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
IC RSS-212 Issue 1	1998	Test Methods For Radio Equipment
FCC 558074	2004	New Guidance on Measurements for Digital Transmission Systems in Section 15.247

The test procedures used are in accordance with 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). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.net).

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. 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.

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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.	12/07/04
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo.	12/07/04
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/07/04
AMP-29	HP / Agilent	Amplifier	11975A	2304A00158	2-8 GHz	12 Mo.	07/21/04
AMP-29	HP / Agilent	Amplifier for 18-26 GHz Mixer	11975A	2304A00158	2-8 GHz	12 Mo.	07/21/04
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/13/04
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26 GHz	12 Mo.	10/13/04
ANT-42	EMCO	Bicon Antenna	3104C	9512-4713	25-300MHz	12 Mo.	12/02/04
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.	12/31/03
HPF-03	Mini-Circuits	High Pass Filter	VHP-39	HPF-03	3-10 GHz	12 Mo.	08/03/04
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	04/08/03
MXR-01	HP / Agilent	Harmonic Mixer	11970K	3003A02243	18.6-26.5GHz	12 Mo.	01/06/05
PRE-01	HP / Agilent	Preselector	85685A	2510A00143	20 Hz-2GHz	12 Mo.	01/20/05
REC-01	HP / Agilent	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	08/17/04
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.

10 TEST SECTIONS

10.1 AC Conducted Emissions; Section 15.207

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. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. 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.

Broadband conducted emissions may exceed the following limits by no more than 13 dB. An emission is defined as broadband if the average detector amplitude is 6 dB or more under the quasi-peak detector amplitude.

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FCC Limits of Conducted Emissions at the AC Mains Ports

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

The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from power cord, after testing all modes of operation.

Test Date : May 11, 2005

The Amplitude is the final corrected value with cable and LISN Loss.

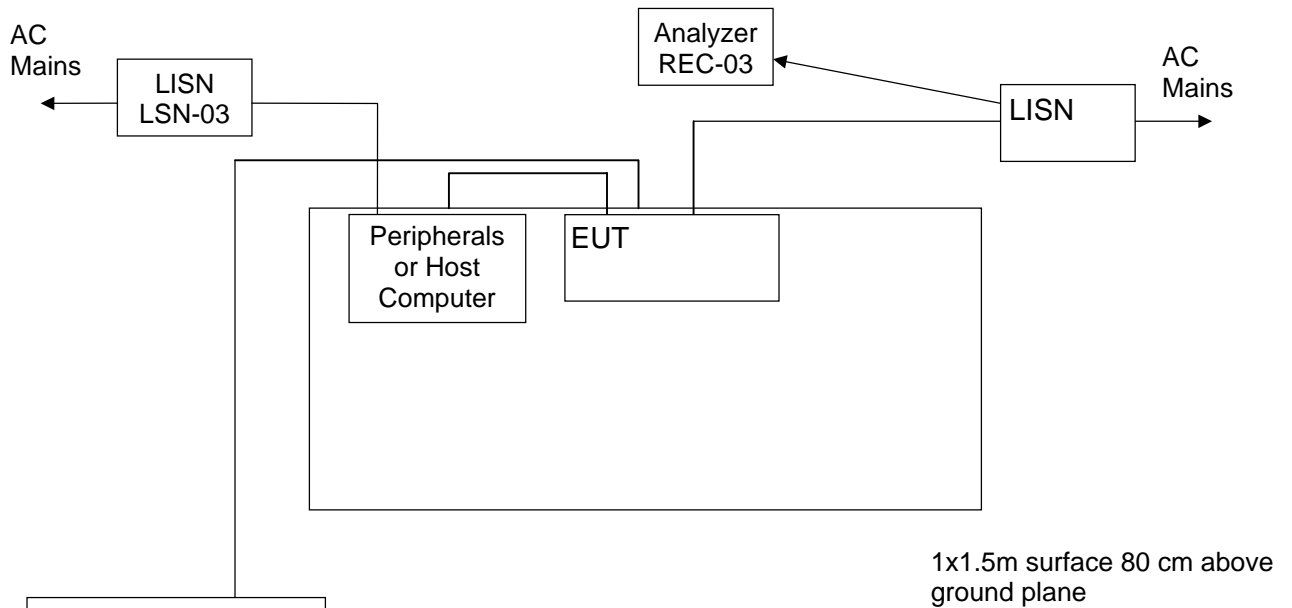
Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Hot	0.28	45.47	60.95	25.99	50.95
AC Hot	0.33	44.17	59.39	24.88	49.39
AC Hot	0.45	41.79	56.79	22.98	46.79
AC Hot	3.52	40.75	56.00	39.45	46.00
AC Hot	3.91	37.82	56.00	35.86	46.00
AC Hot	26.55	39.55	60.00	35.80	50.00
AC Neutral	0.17	46.48	64.77	28.60	54.77
AC Neutral	0.26	43.61	61.56	25.92	51.56
AC Neutral	0.46	37.63	56.78	21.67	46.78
AC Neutral	3.52	39.21	56.00	37.71	46.00
AC Neutral	3.91	36.67	56.00	34.86	46.00
AC Neutral	18.24	38.14	60.00	31.49	50.00

The above are the worst case results with three frequencies test for each EUT

* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

Judgment: Passed by at least 6.5 dB

Figure 1. 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

10.2 Occupied Bandwidth (6 dB)

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

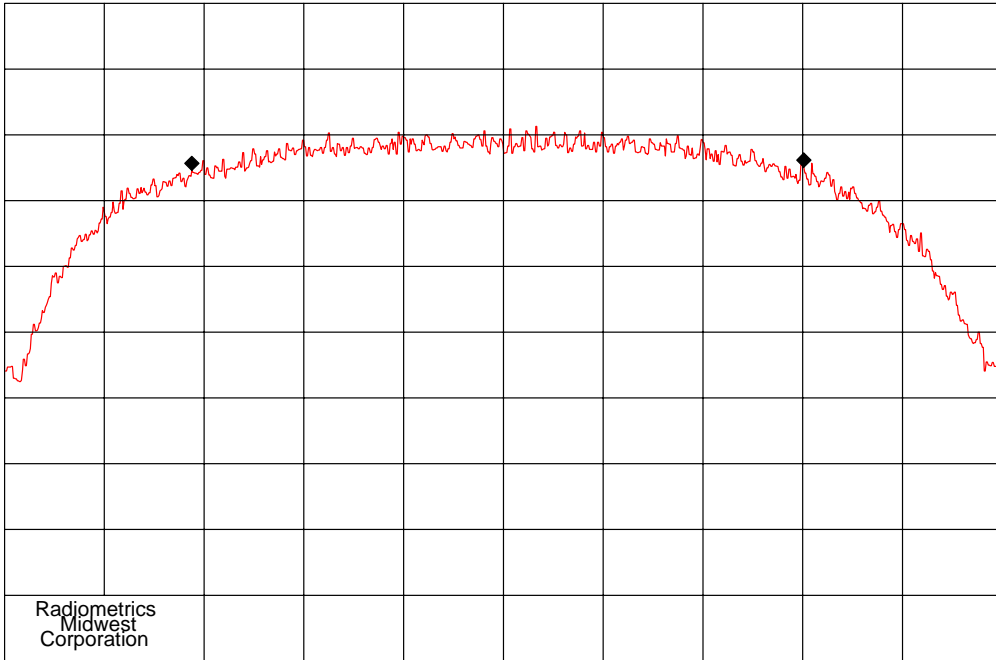
The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 6 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

Channel	802.11b	802.11g
	EBW MHz	EBW MHz
1	12.3	13.0
6	13.1	15.3
11	12.9	12.1

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MKR Delta 12.28 MHz 0.50 dB



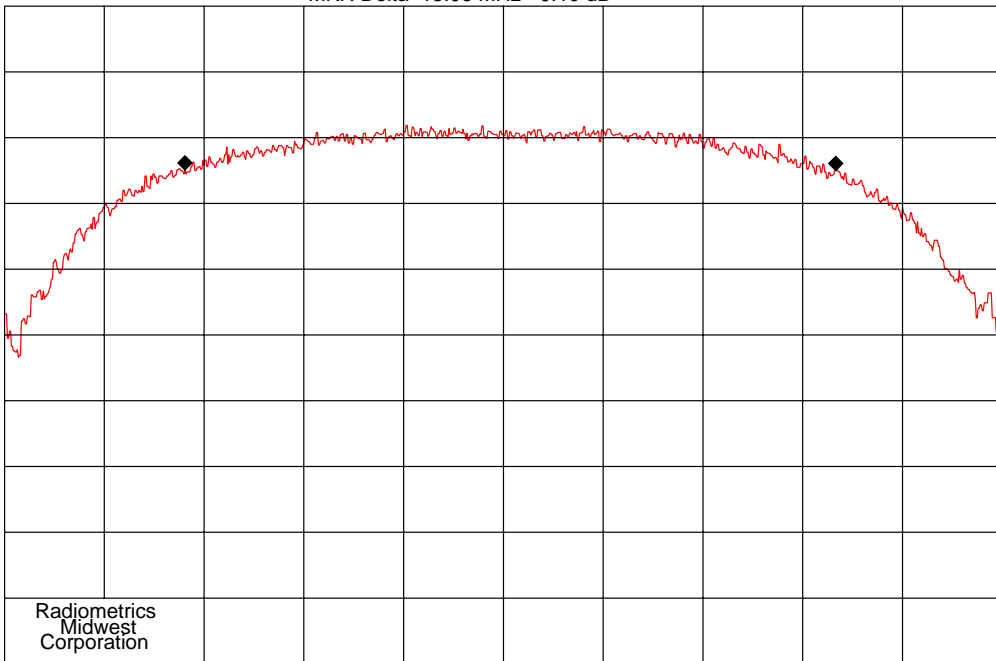
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COMPANY : Westell
CENTER 2.412 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Bandwidth Test, Chan 1; 802.11b

ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 13:03

DATE : 05-11-2005
SPAN 20.0 MHz
ATTEN 40 dB
SWP 20.0 msec

MKR Delta 13.06 MHz -0.10 dB



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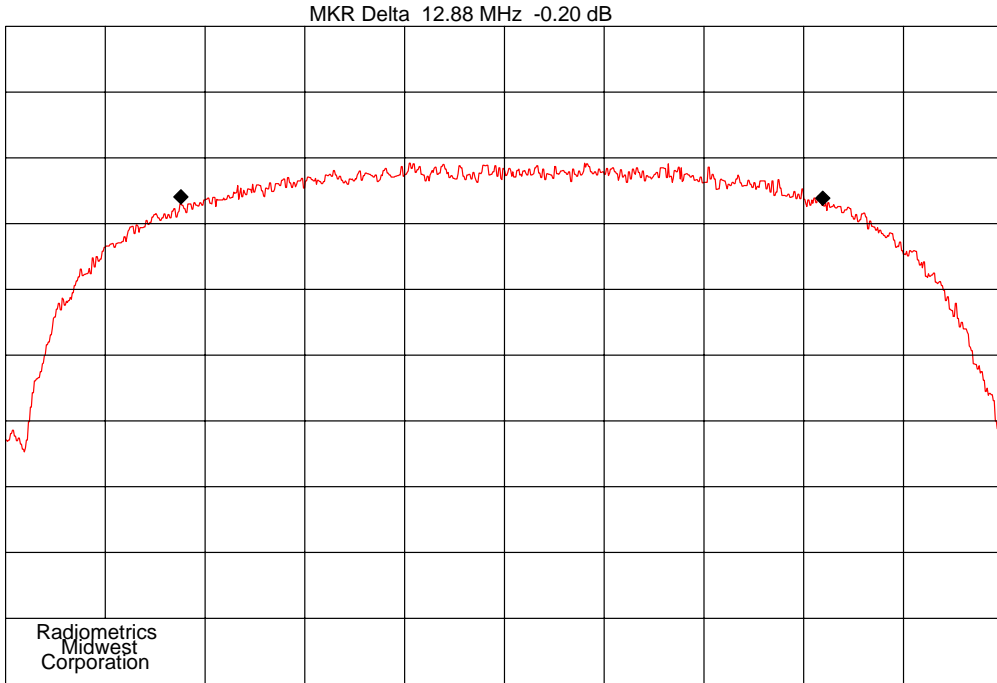
COMPANY : Westell
CENTER 2.437 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Bandwidth Test, Chan 6; 802.11b

ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 13:06

DATE : 05-11-2005
SPAN 20.0 MHz
ATTEN 40 dB
SWP 20.0 msec

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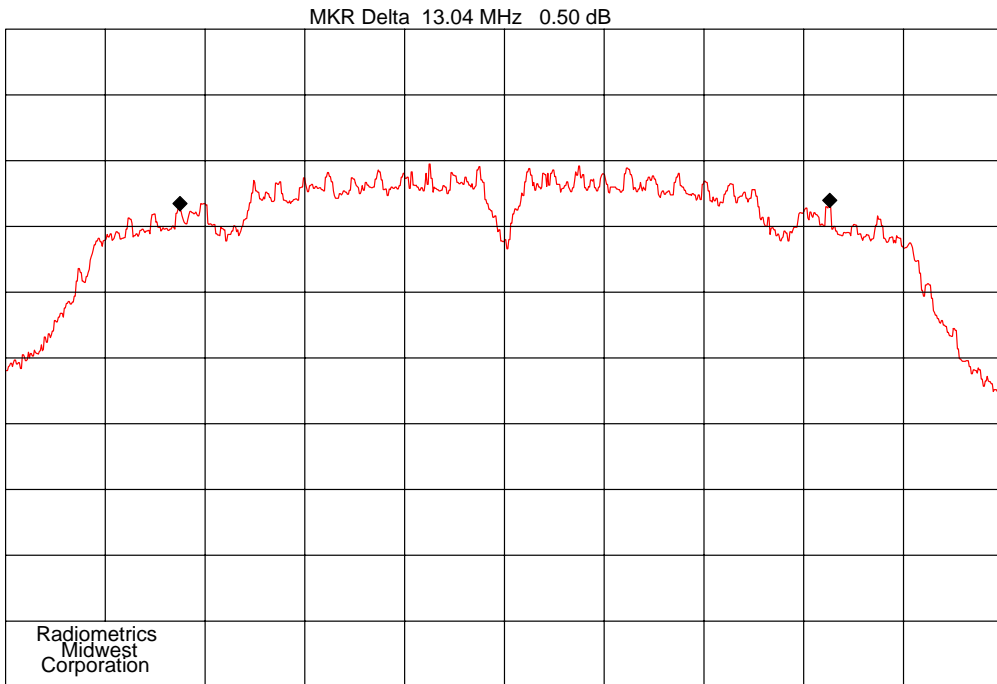


COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/

ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 12:46

DATE : 05-11-2005
SPAN 20.0 MHz
ATTEN 40 dB
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 11; 802.11b



COMPANY : Westell
CENTER 2.412 0 GHz
RES BW 100 kHz
10 dB/

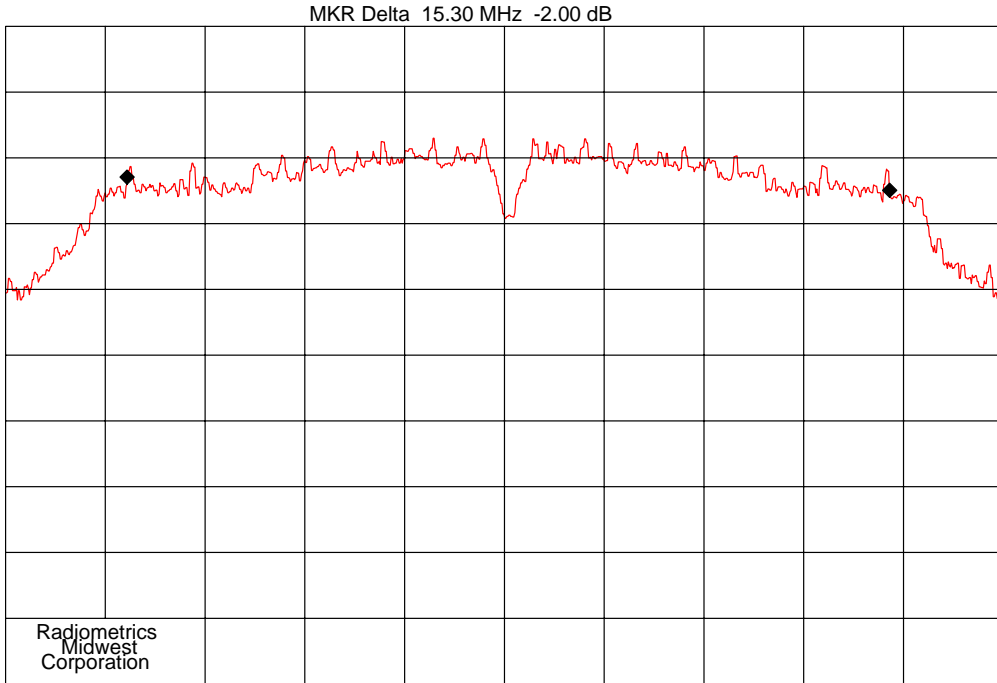
ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 12:59

DATE : 05-11-2005
SPAN 20.0 MHz
ATTEN 40 dB
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 1; 802.11g

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

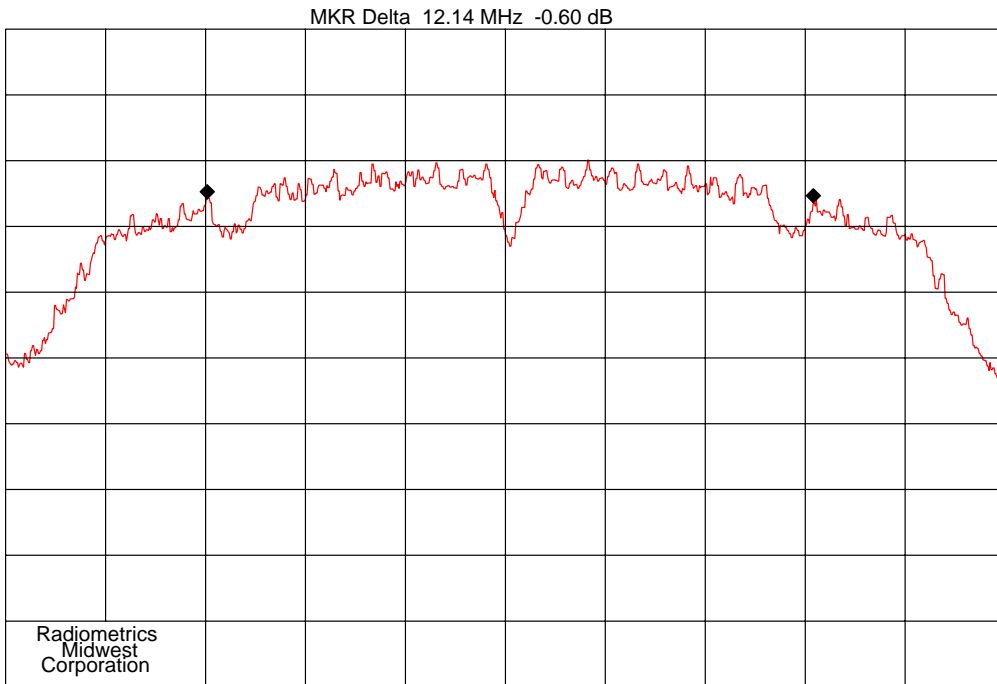
Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router



COMPANY : Westell
CENTER 2.437 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Bandwidth Test, Chan 6; 802.11g

ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 12:55

DATE : 05-11-2005
SPAN 20.0 MHz
ATTEN 40 dB
SWP 20.0 msec



COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Bandwidth Test, Chan 11; 802.11g

ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 12:52

DATE : 05-11-2005
SPAN 20.0 MHz
ATTEN 40 dB
SWP 20.0 msec

Judgement: Pass

10.3 Peak Output Power

The power output option 1; using a Peak power meter from FCC rules 558074 was used for this test.

The indicated level is the peak output power. Note 30 dBm = 1 watt. Since the gain of the antenna is always less than 6dB, the limit is not reduced.

Mode	Freq. (MHz)	Total Power (dBm)		Limit (dBm)
		dBm	Watts	
802.11b	2412	22.3	0.170	30.0
802.11b	2437	24.8	0.302	30.0
802.11b	2462	22.4	0.174	30.0
802.11g	2412	22.3	0.170	30.0
802.11g	2437	24.9	0.309	30.0
802.11g	2462	22.6	0.182	30.0

10.4 Power Spectral Density

PSD option 1 was used for this test. No external attenuator was used. The spectrum analyzer was set to the following settings:

- Span = 500 kHz
- RBW = 3 kHz
- VBW = 10 kHz
- Sweep = 167 seconds
- Detector function = Peak

Mode	Frequency (MHz)	Reading dBm	Cable Loss (dB)	3 kHz Spectral Density (dBm)	Limit (dBm)
802.11b	2412	-3.9	0.2	-3.7	8.0
802.11b	2437	-1	0.2	-0.8	8.0
802.11b	2462	-4	0.2	-3.8	8.0
802.11g	2412	-5.3	0.2	-5.1	8.0
802.11g	2437	-2.4	0.2	-2.2	8.0
802.11g	2462	-6.9	0.2	-6.7	8.0

Judgement: Pass by 8.8 dB

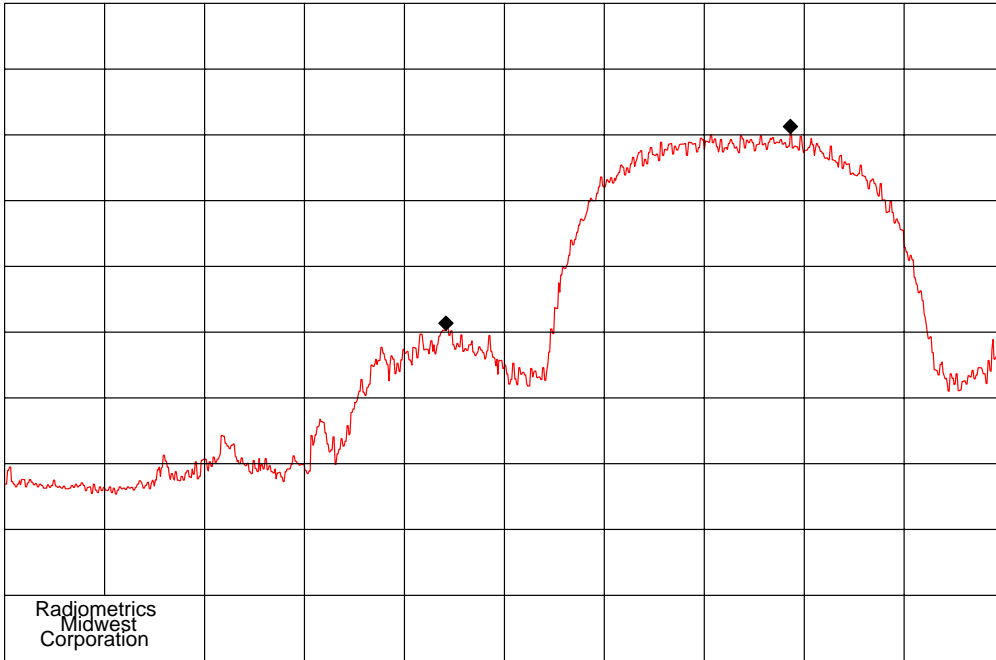
10.5 Band-edge Compliance of RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize.

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MKR Delta -17.25 MHz -29.90 dB

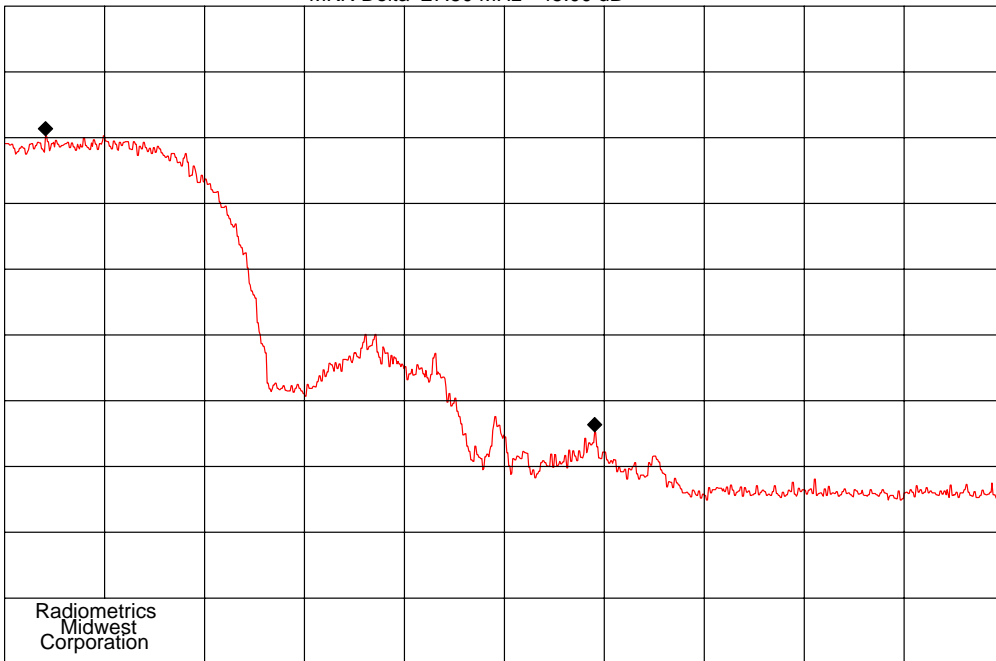


COMPANY : Westell
 CENTER 2.400 0 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Band edge, Ch 1; 802.11b

ITEM : C90-327W30
 REF 30.0 dBm
 VBW 300 kHz
 TIME : 13:09

DATE : 05-11-2005
 SPAN 50.0 MHz
 ATTEN 40 dB
 SWP 20.0 msec

MKR Delta 27.50 MHz -45.00 dB



COMPANY : Westell
 CENTER 2.483 5 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Band edge, Ch 11; 802.11b

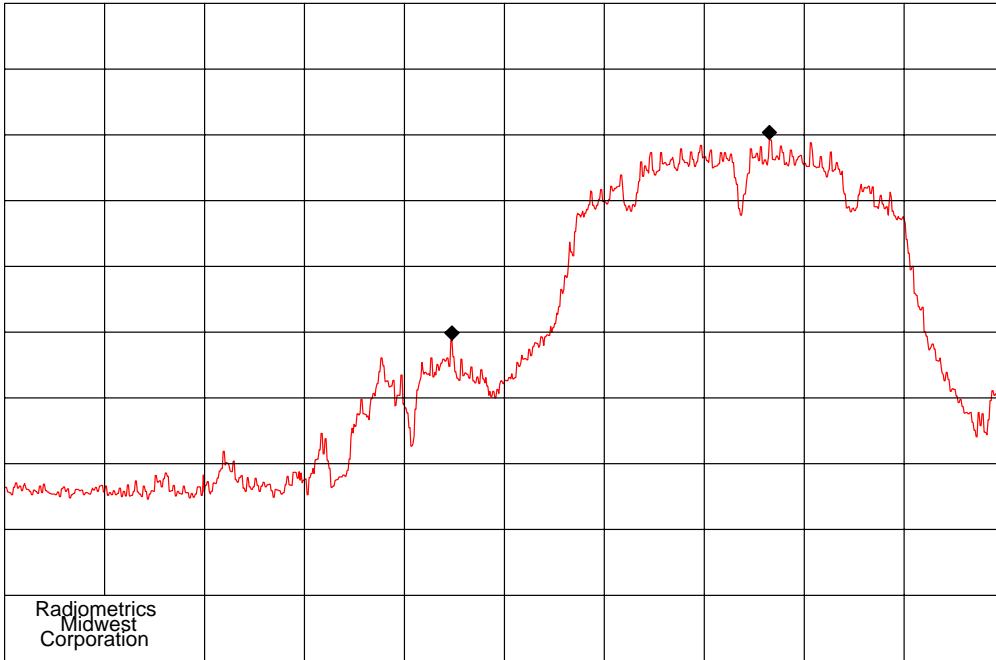
ITEM : C90-327W30
 REF 30.0 dBm
 VBW 300 kHz
 TIME : 13:11

DATE : 05-11-2005
 SPAN 50.0 MHz
 ATTEN 40 dB
 SWP 20.0 msec

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MKR Delta -15.90 MHz -30.50 dB



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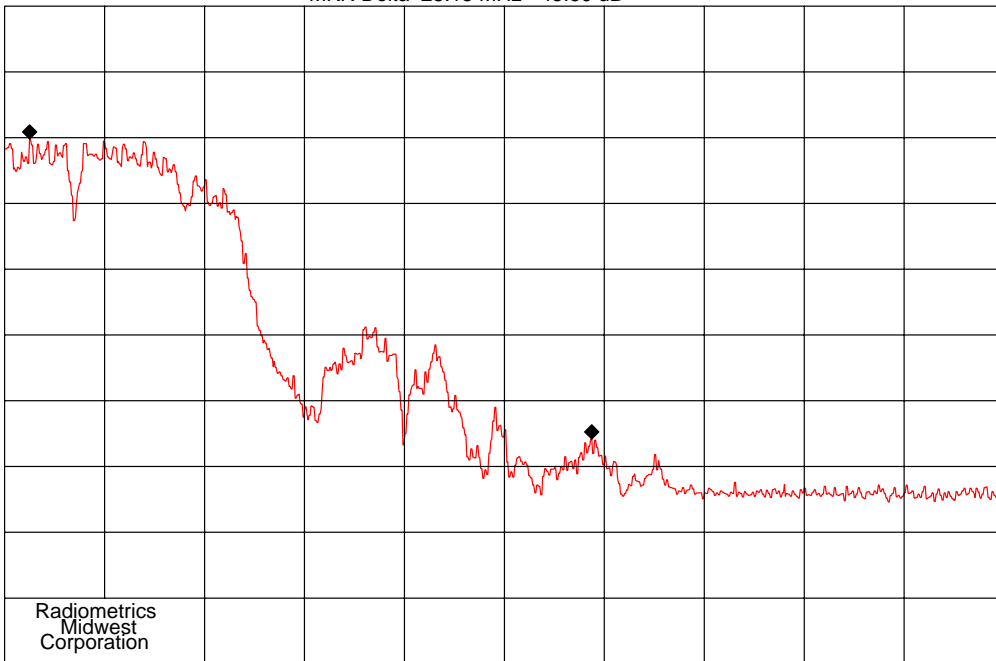
COMPANY : Westell
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/

ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 13:15

DATE : 05-11-2005
SPAN 50.0 MHz
ATTEN 40 dB
SWP 20.0 msec

NOTES : Band edge, Ch 1; 802.11g

MKR Delta 28.15 MHz -45.60 dB



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COMPANY : Westell
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/

ITEM : C90-327W30
REF 30.0 dBm
VBW 300 kHz
TIME : 13:13

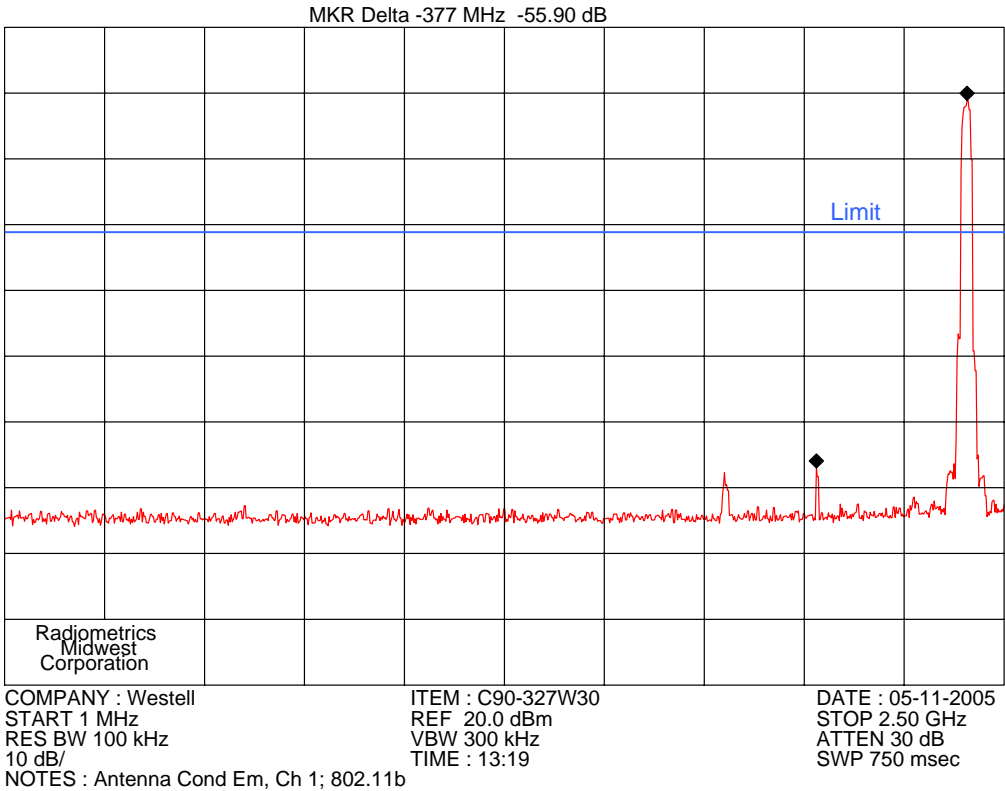
DATE : 05-11-2005
SPAN 50.0 MHz
ATTEN 40 dB
SWP 20.0 msec

NOTES : Band edge, Ch 11; 802.11g

Judgement: Pass by 9.9 dB

10.6 Spurious RF Conducted Emissions

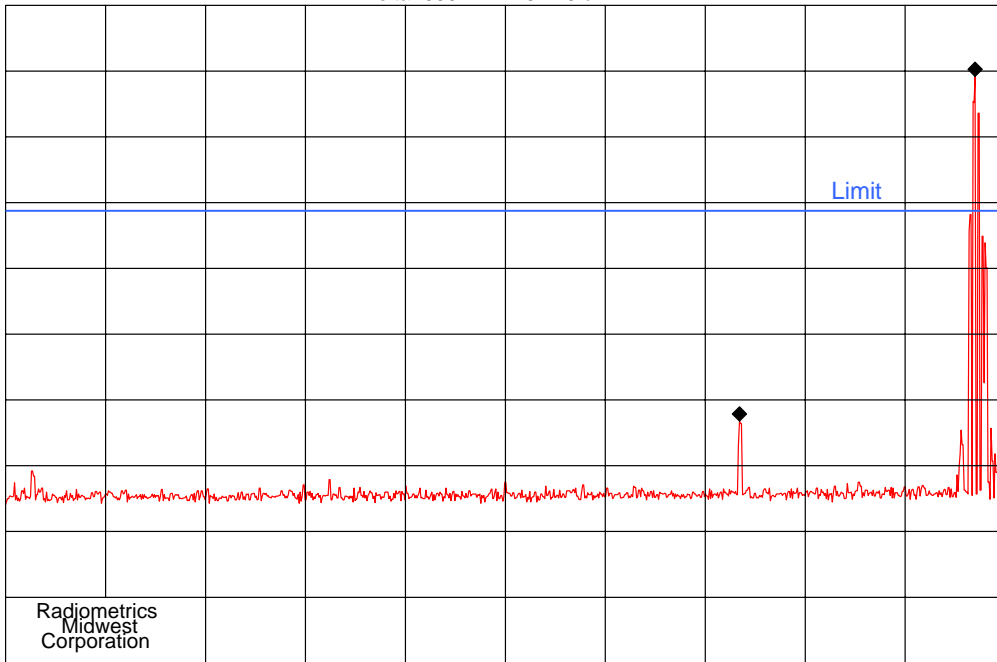
The spectrum analyzer was set to the MAX HOLD mode to record all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. The trace was allowed to stabilize. The first two plots were made while stepping through three frequencies (Low middle and high). Each frequency was on for 30 seconds. The last two plots were made with hopping enabled.



RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

MKR Delta -590 MHz -52.40 dB

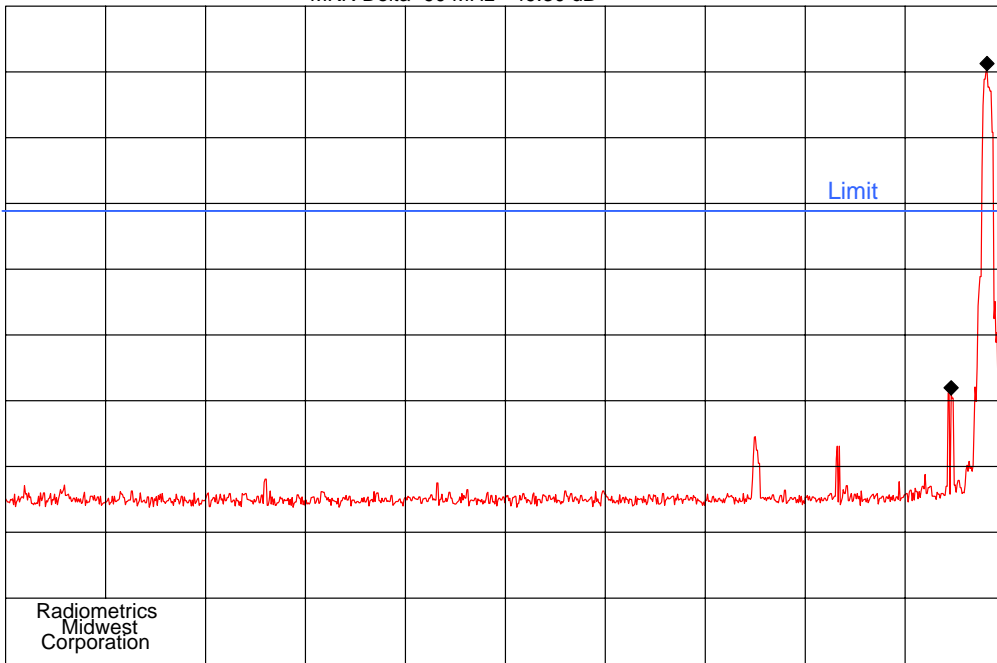


COMPANY : Westell
 START 1 MHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 6; 802.11b

ITEM : C90-327W30
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:20

DATE : 05-11-2005
 STOP 2.50 GHz
 ATTEN 30 dB
 SWP 750 msec

MKR Delta -90 MHz -49.30 dB



COMPANY : Westell
 START 1 MHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 11; 802.11b

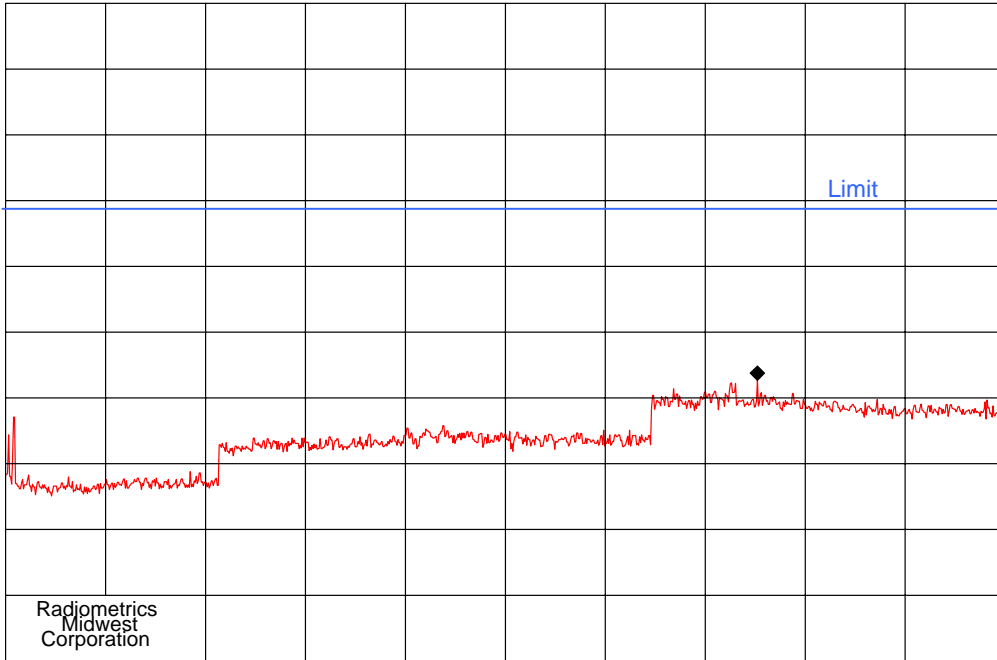
ITEM : C90-327W30
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:22

DATE : 05-11-2005
 STOP 2.50 GHz
 ATTEN 30 dB
 SWP 750 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

MKR 14.16 GHz -37.30 dBm

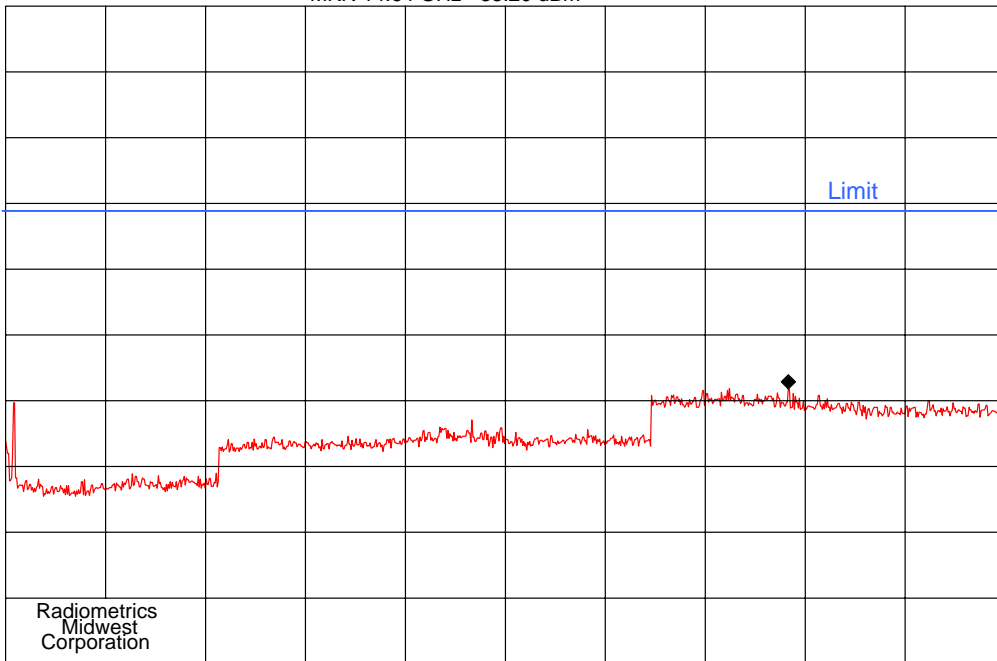


COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Antenna Cond Em, Ch 1; 802.11b

ITEM : C90-327W30
REF 20.0 dBm
VBW 1 MHz
TIME : 13:37

DATE : 05-11-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec

MKR 14.64 GHz -38.20 dBm



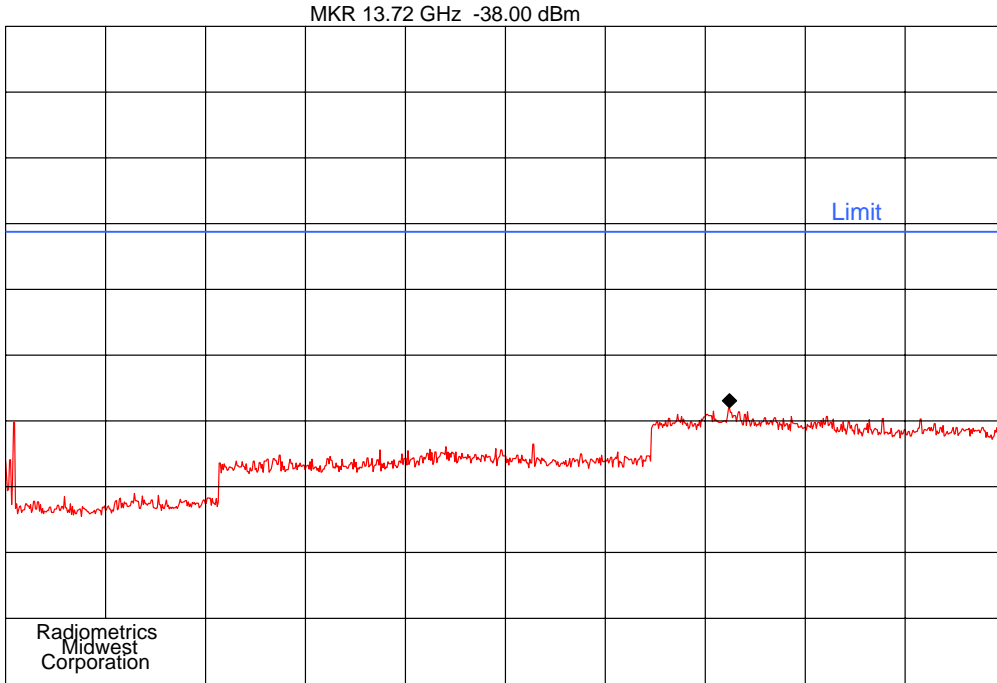
COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Antenna Cond Em, Ch 6; 802.11b

ITEM : C90-327W30
REF 20.0 dBm
VBW 1 MHz
TIME : 13:36

DATE : 05-11-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

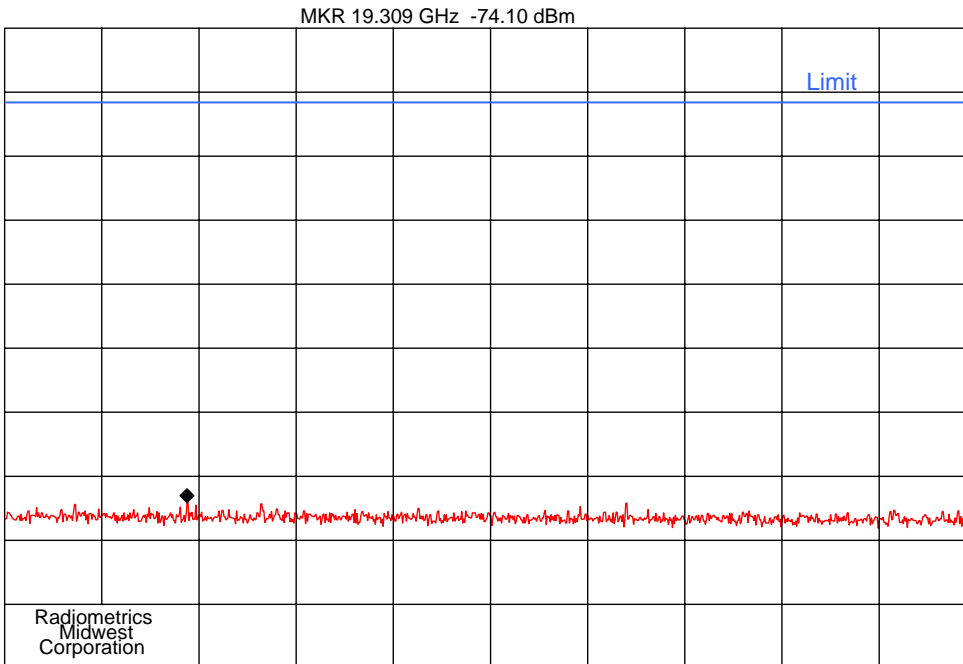
Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router



COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Antenna Cond Em, Ch 11; 802.11b

ITEM : C90-327W30
REF 20.0 dBm
VBW 1 MHz
TIME : 13:34

DATE : 05-11-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec



COMPANY : Westell
START 18.00 GHz
RES BW 300 kHz
10 dB/
NOTES : Antenna Cond Em, Ch 1; 802.11b

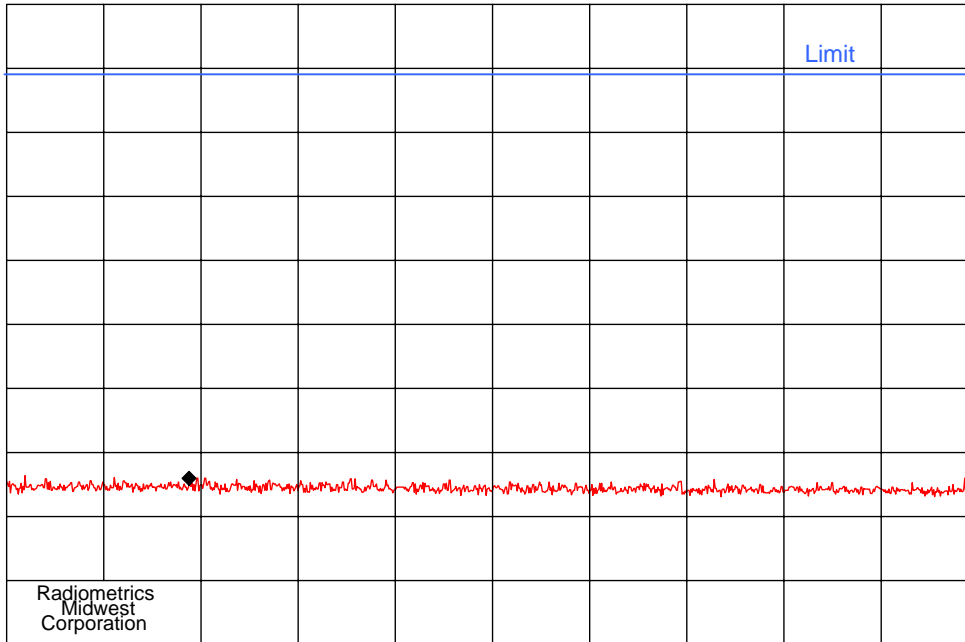
ITEM : C90-327W30
REF 0.0 dBm
VBW 1 MHz
TIME : 14:55

DATE : 05-11-2005
STOP 25.00 GHz
HARMONIC 6
SWP 210 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

MKR 19.309 GHz -75.10 dBm



Radiometrics
Midwest
Corporation

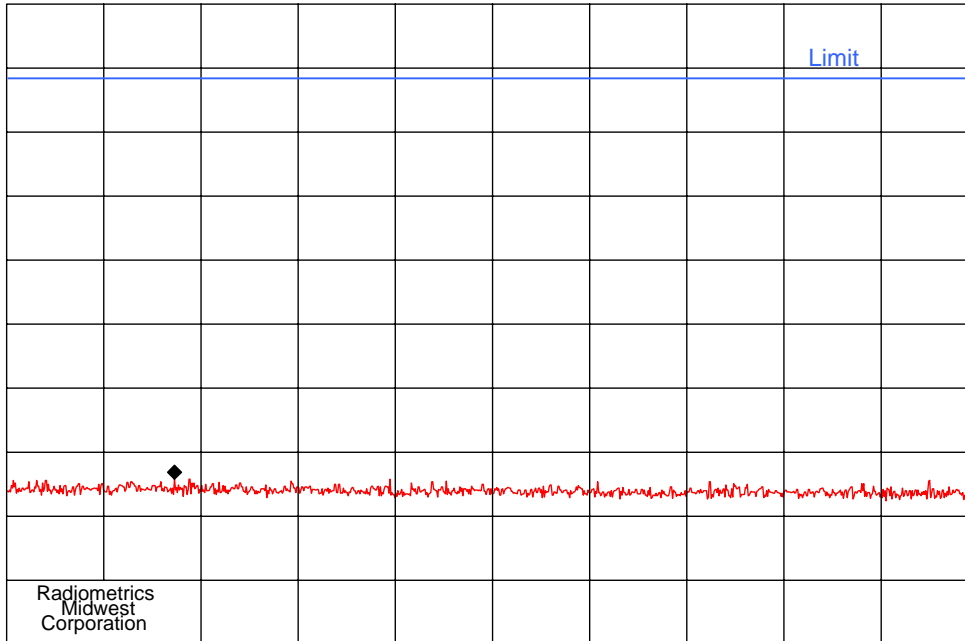
COMPANY : Westell
START 18.00 GHz
RES BW 300 kHz
10 dB/

ITEM : C90-327W30
REF 0.0 dBm
VBW 1 MHz
TIME : 14:56

DATE : 05-11-2005
STOP 25.00 GHz
HARMONIC 6
SWP 210 msec

NOTES : Antenna Cond Em, Ch 6; 802.11b

MKR 19.204 GHz -74.20 dBm



Radiometrics
Midwest
Corporation

COMPANY : Westell
START 18.00 GHz
RES BW 300 kHz
10 dB/

ITEM : C90-327W30
REF 0.0 dBm
VBW 1 MHz
TIME : 14:57

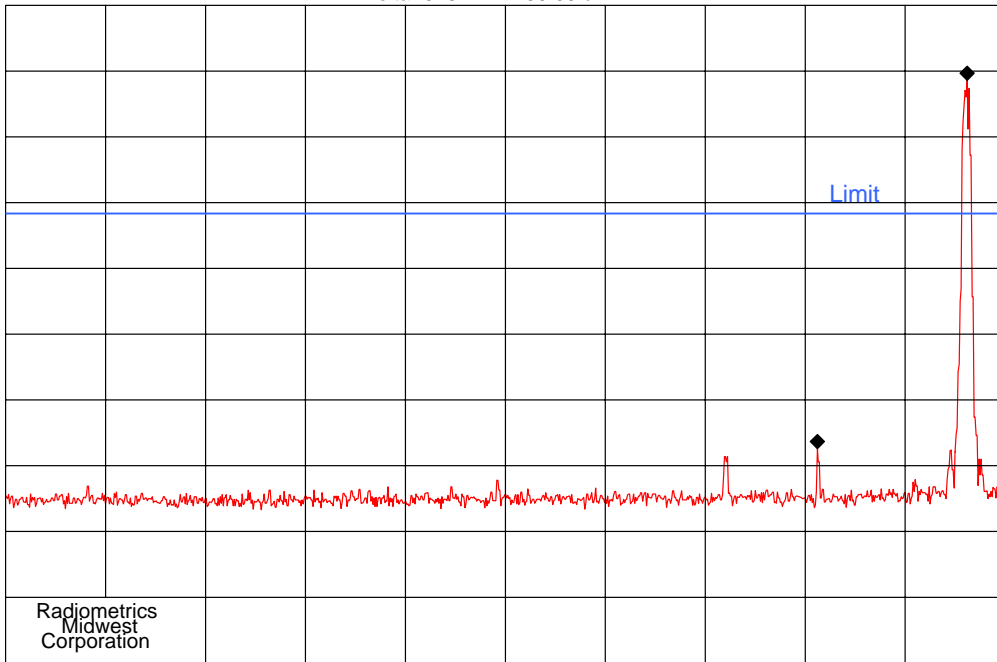
DATE : 05-11-2005
STOP 25.00 GHz
HARMONIC 6
SWP 210 msec

NOTES : Antenna Cond Em, Ch 11; 802.11b

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

MKR Delta -375 MHz -56.00 dB



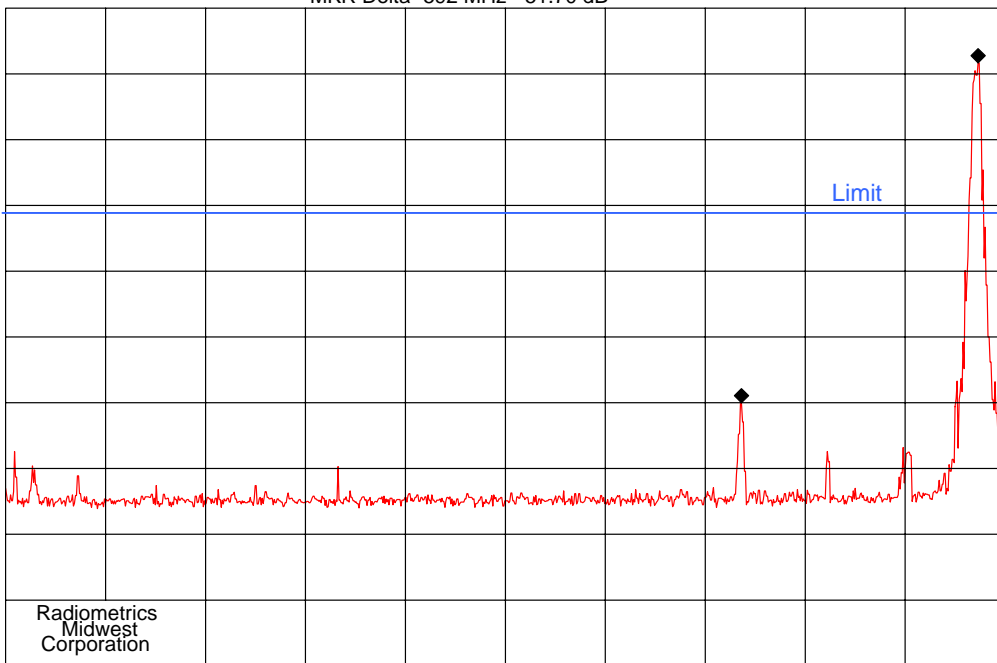
COMPANY : Westell
 START 1 MHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 1; 802.11g

ITEM : C90-327W30
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:28

DATE : 05-11-2005
 STOP 2.50 GHz
 ATTEN 30 dB
 SWP 750 msec

Radiometrics
 Midwest
 Corporation

MKR Delta -592 MHz -51.70 dB



COMPANY : Westell
 START 1 MHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 6; 802.11g

ITEM : C90-327W30
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:29

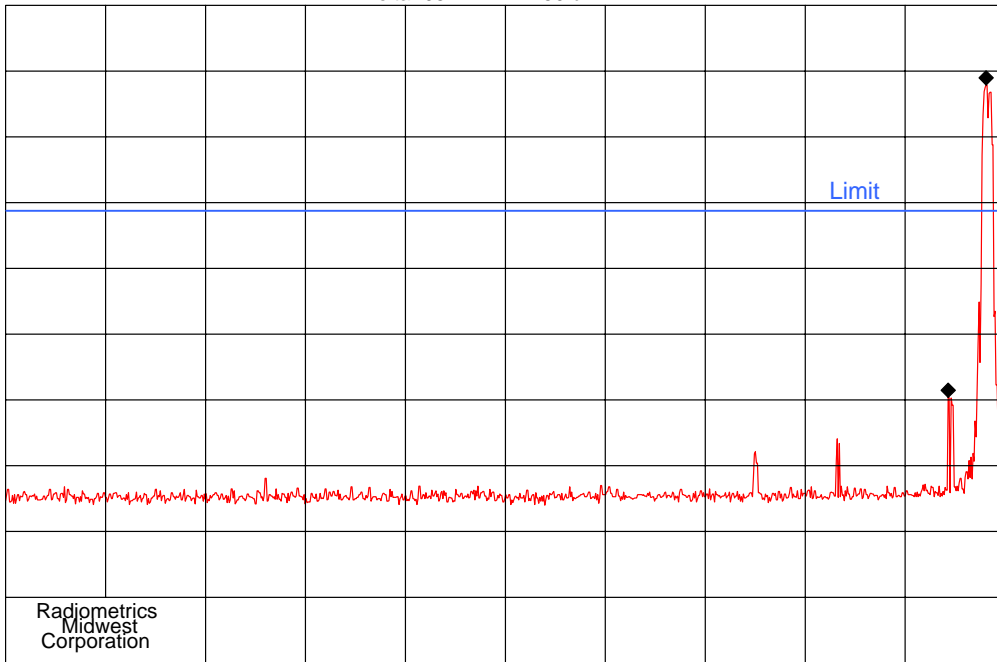
DATE : 05-11-2005
 STOP 2.50 GHz
 ATTEN 30 dB
 SWP 750 msec

Radiometrics
 Midwest
 Corporation

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

MKR Delta -95 MHz -47.50 dB

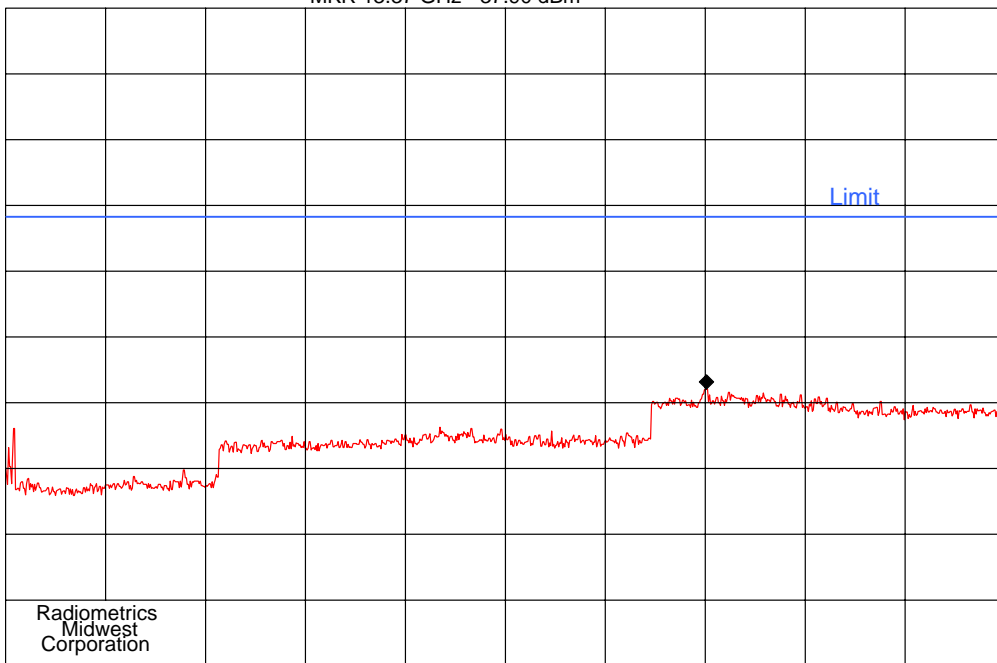


COMPANY : Westell
 START 1 MHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 11; 802.11g

ITEM : C90-327W30
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:25

DATE : 05-11-2005
 STOP 2.50 GHz
 ATTEN 30 dB
 SWP 750 msec

MKR 13.37 GHz -37.90 dBm



COMPANY : Westell
 START 2.5 GHz
 RES BW 300 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 1; 802.11g

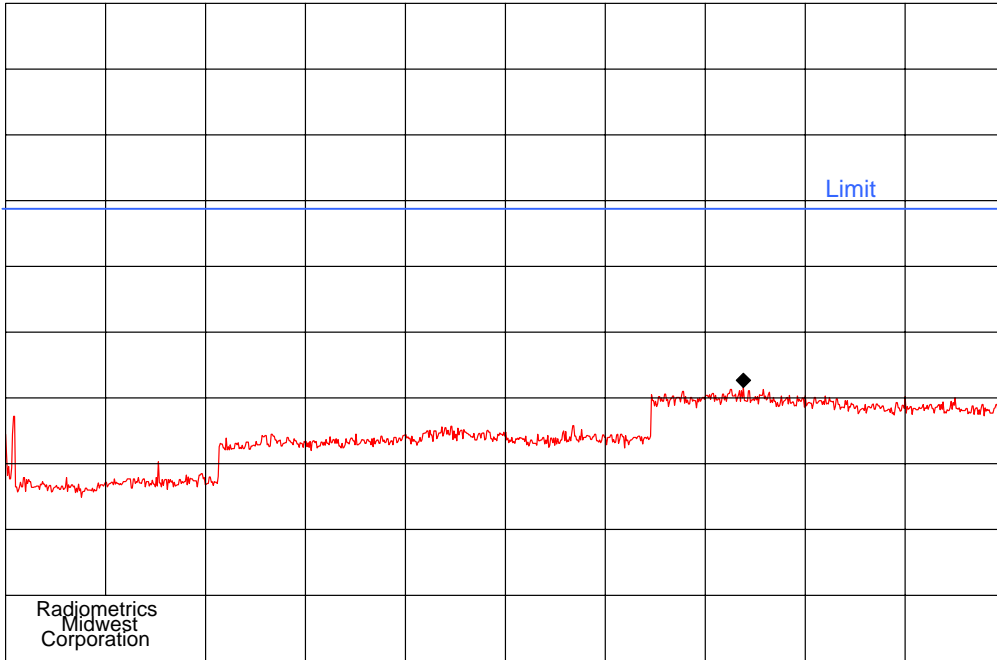
ITEM : C90-327W30
 REF 20.0 dBm
 VBW 1 MHz
 TIME : 13:31

DATE : 05-11-2005
 STOP 18.0 GHz
 ATTEN 30 dB
 SWP 465 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

MKR 13.94 GHz -38.40 dBm

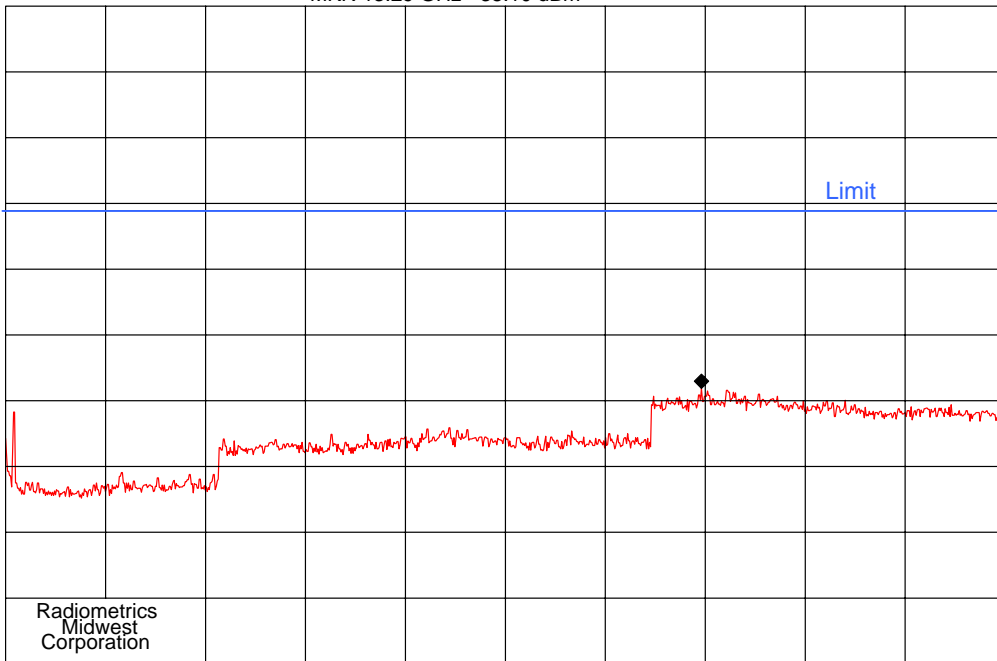


COMPANY : Westell
 START 2.5 GHz
 RES BW 300 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 6; 802.11g

ITEM : C90-327W30
 REF 20.0 dBm
 VBW 1 MHz
 TIME : 13:33

DATE : 05-11-2005
 STOP 18.0 GHz
 ATTEN 30 dB
 SWP 465 msec

MKR 13.29 GHz -38.10 dBm

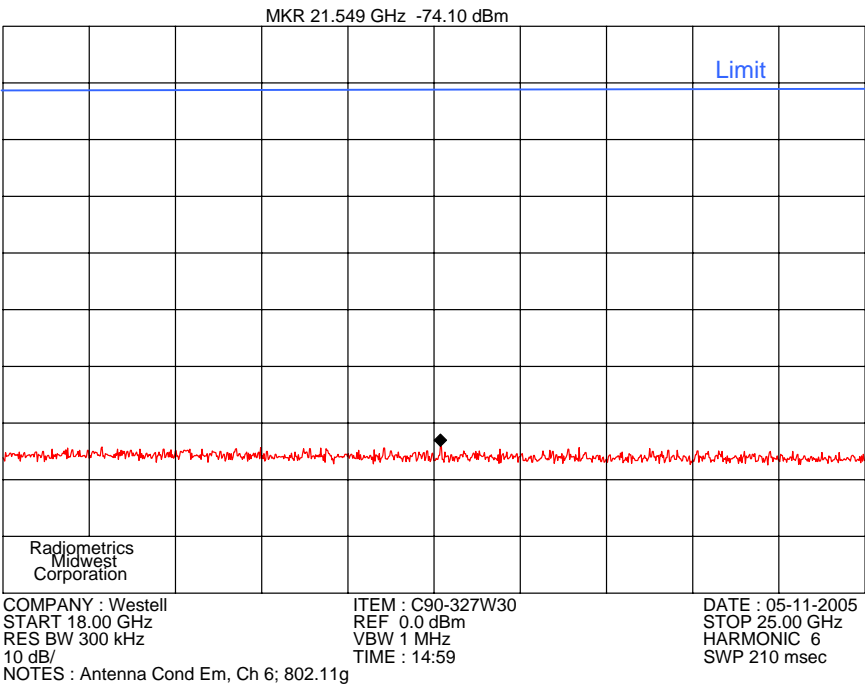
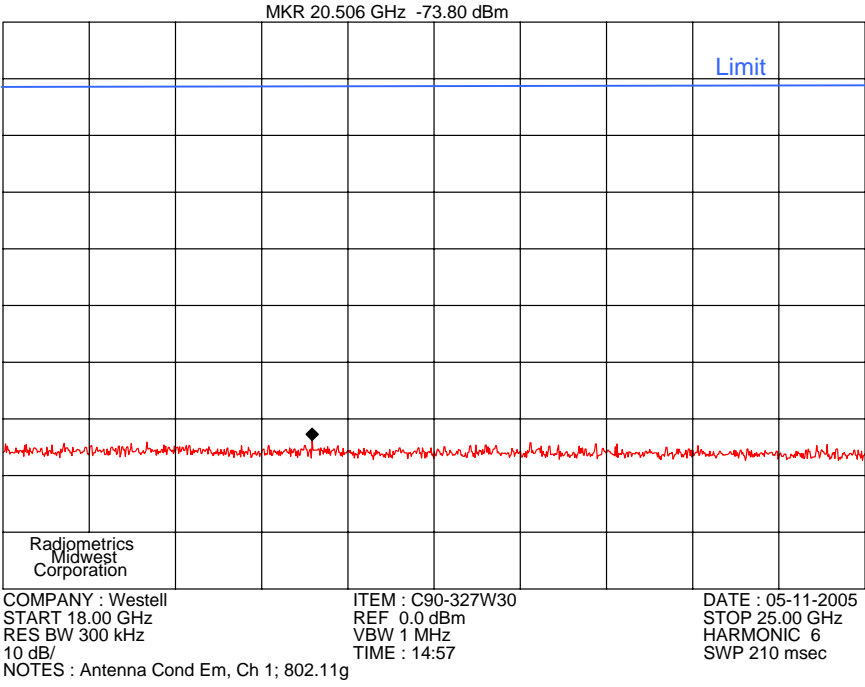


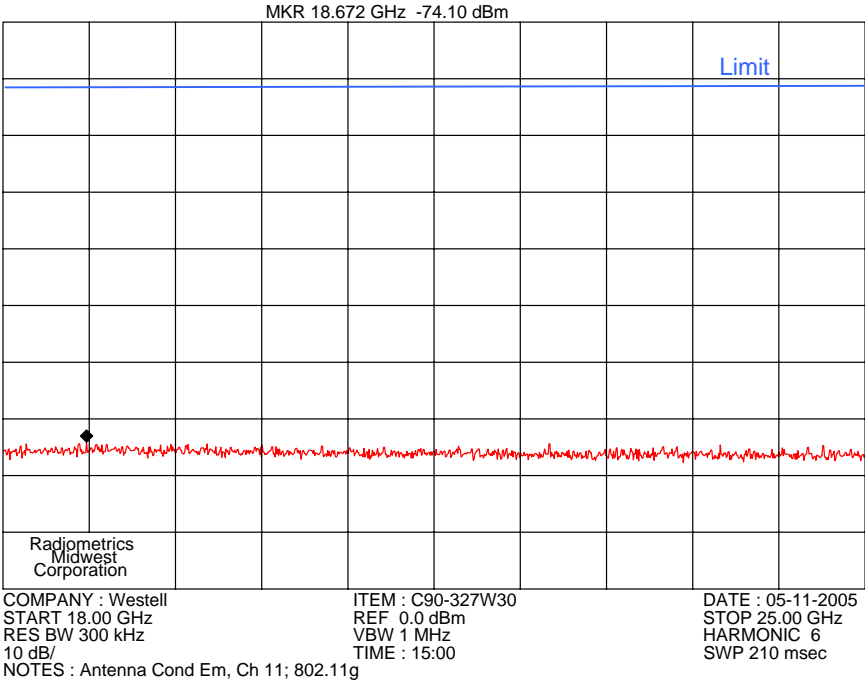
COMPANY : Westell
 START 2.5 GHz
 RES BW 300 kHz
 10 dB/
 NOTES : Antenna Cond Em, Ch 11; 802.11g

ITEM : C90-327W30
 REF 20.0 dBm
 VBW 1 MHz
 TIME : 13:34

DATE : 05-11-2005
 STOP 18.0 GHz
 ATTEN 30 dB
 SWP 465 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router





10.7 Spurious Radiated Emissions (Restricted Band)

Radiated emission measurements in the Restricted bands 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. 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 preamplifier were used. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 25 GHz, an HP8566A spectrum analyzer was used with a preamplifier. A harmonic mixer was used from 20 to 25 GHz. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

Radiated emission measurements are performed with linearly polarized broadband antennas. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

Final radiated emissions measurements were performed in Chamber E at a test distance of 3 meters. The entire frequency range from 30 MHz to 25 GHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the 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 anechoic test chamber has a metal ground screen.

10.7.1 Radiated Emissions Field Strength Sample 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 is as follows:

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

Where: FS = Field Strength

RA = Receiver Amplitude

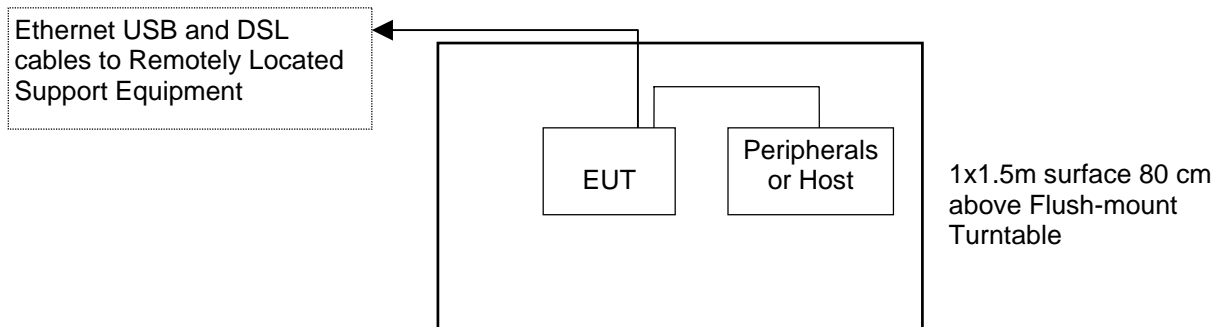
AF = Antenna Factor

CF = Cable Attenuation Factor

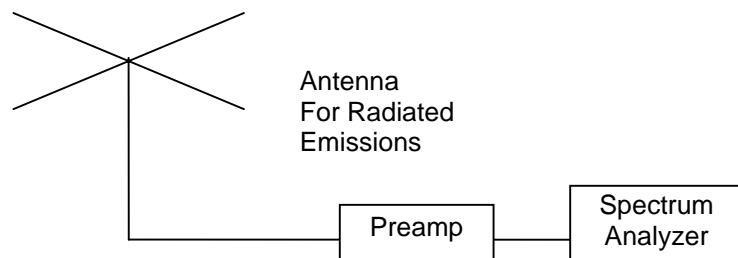
AG = Amplifier Gain

HPF = High pass Filter Loss

Figure 2. Drawing of Radiated Emissions Setup



- Notes:**
- 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



10.7.2 Spurious Radiated Emissions Test Results (Restricted Band)

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured

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Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

A Video Bandwidth of 10 Hz was used for Average measurements above 1 GHz.

The peak emissions did not exceed the average limit by more than 20 dB.

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	Versalink	Test Date	
Serial Number	none	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal;; Bilog (ANT-6); HN = Horn (ANT-13) used above 1 GHz P = peak; Q = QP		

Emissions Above 1 GHz

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	dBuV/m	Limit dBuV/m	Margin under limit
802.11b	2412	H	Ave	4824.0	41.0	54.0	13.0
802.11b	2412	H	Peak	4824.0	46.7	74.0	27.3
802.11b	2412	V	Ave	4824.0	49.4	54.0	4.6
802.11b	2412	V	Peak	4824.0	53.8	74.0	20.2
802.11b	2412	V	Ave	2038.0	46.7	54.0	7.3
802.11b	2412	V	Peak	2038.0	51.3	74.0	22.7
802.11b	2412	H	Ave	2038.0	44.4	54.0	9.6
802.11b	2412	H	Peak	2038.0	45.6	74.0	28.4
802.11b	2412	H	Ave	2390.0	48.2	54.0	5.8
802.11b	2412	H	Peak	2390.0	61.1	74.0	12.9
802.11b	2412	V	Ave	2390.0	44.1	54.0	9.9
802.11b	2412	V	Peak	2390.0	56.1	74.0	17.9
802.11b	2412	H	Ave	7236.0	42.0	54.0	12.0
802.11b	2412	H	Peak	7236.0	52.0	74.0	22.0
802.11b	2412	V	Ave	7236.0	42.0	54.0	12.0
802.11b	2412	V	Peak	7236.0	52.0	74.0	22.0
802.11b	2412	H	Peak	9648.0	51.5	74.0	22.5
802.11b	2412	V	Peak	9648.0	53.0	74.0	21.0
802.11b	2412	H	Peak	12060.0	47.7	74.0	26.3
802.11b	2412	V	Peak	12060.0	47.7	74.0	26.3
802.11b	2412	H	Peak	14472.0	55.1	74.0	18.9
802.11b	2412	V	Peak	14472.0	55.1	74.0	18.9
802.11b	2412	H	Peak	16884.0	49.6	74.0	24.4
802.11b	2412	V	Peak	16884.0	49.6	74.0	24.4
802.11b	2437	V	Peak	2437.0	115.0	125.0	10.0
802.11b	2437	H	Peak	2437.0	107.5	125.0	17.5

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Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	dBuV/m	Limit dBuV/m	Margin under limit
802.11b	2437	V	Ave	4874.0	52.0	54.0	2.0
802.11b	2437	V	Peak	4874.0	59.0	74.0	15.0
802.11b	2437	H	Ave	4874.0	45.3	54.0	8.7
802.11b	2437	H	Peak	4874.0	55.5	74.0	18.5
802.11b	2437	V	Ave	7311.0	42.1	54.0	11.9
802.11b	2437	V	Peak	7311.0	52.1	74.0	21.9
802.11b	2437	H	Ave	7311.0	42.1	54.0	11.9
802.11b	2437	H	Peak	7311.0	52.1	74.0	21.9
802.11b	2437	V	Ave	9748.0	51.6	54.0	2.4
802.11b	2437	V	Peak	9748.0	57.7	74.0	16.3
802.11b	2437	H	Ave	9748.0	49.6	54.0	4.4
802.11b	2437	H	Peak	9748.0	56.1	74.0	17.9
802.11b	2462	V	Ave	4924.0	51.0	54.0	3.0
802.11b	2462	V	Peak	4924.0	59.4	74.0	14.6
802.11b	2462	H	Ave	4924.0	49.4	54.0	4.6
802.11b	2462	H	Peak	4924.0	56.3	74.0	17.7
802.11b	2462	H	Ave	7386.0	46.5	54.0	7.5
802.11b	2462	H	Peak	7386.0	54.5	74.0	19.5
802.11b	2462	V	Ave	7386.0	47.5	54.0	6.5
802.11b	2462	V	Peak	7386.0	56.7	74.0	17.3
802.11b	2462	V	Peak	9848.0	54.6	74.0	19.4
802.11b	2462	H	Peak	9848.0	47.5	74.0	26.5
802.11b	2462	V	Peak	12310.0	47.7	74.0	26.3
802.11b	2462	H	Peak	12310.0	47.7	74.0	26.3
802.11b	2462	V	Peak	14772.0	55.1	74.0	18.9
802.11b	2462	H	Peak	14772.0	55.1	74.0	18.9
802.11b	2462	V	Peak	17234.0	49.6	74.0	24.4
802.11b	2462	H	Peak	17234.0	49.6	74.0	24.4
802.11g	2412	H	Ave	4824.0	40.0	54.0	14.0
802.11g	2412	H	Peak	4824.0	46.7	74.0	27.3
802.11g	2412	V	Ave	4824.0	41.4	54.0	12.6
802.11g	2412	V	Peak	4824.0	54.0	74.0	20.0
802.11g	2412	V	Ave	2038.0	46.7	54.0	7.3
802.11g	2412	V	Peak	2038.0	51.0	74.0	23.0
802.11g	2412	H	Ave	2390.0	46.5	54.0	7.5
802.11g	2412	H	Peak	2390.0	55.6	74.0	18.4
802.11g	2412	V	Ave	2390.0	47.5	54.0	6.5
802.11g	2412	V	Peak	2390.0	59.2	74.0	14.8
802.11g	2412	H	Ave	7236.0	42.0	54.0	12.0
802.11g	2412	H	Peak	7236.0	52.0	74.0	22.0
802.11g	2412	V	Ave	7236.0	42.0	54.0	12.0
802.11g	2412	V	Peak	7236.0	52.0	74.0	22.0

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Testing of the Westell, Inc., Versalink Model C90-327WXX-07, 4Port Wireless Gateway Router

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	dBuV/m	Limit dBuV/m	Margin under limit
802.11g	2412	H	Peak	9648.0	47.5	74.0	26.5
802.11g	2412	V	Peak	9648.0	42.0	74.0	32.0
802.11g	2412	H	Peak	12060.0	47.7	74.0	26.3
802.11g	2412	V	Peak	12060.0	47.7	74.0	26.3
802.11g	2412	H	Peak	14472.0	55.1	74.0	18.9
802.11g	2412	V	Peak	14472.0	55.1	74.0	18.9
802.11g	2412	H	Peak	16884.0	49.6	74.0	24.4
802.11g	2412	V	Peak	16884.0	49.6	74.0	24.4
802.11g	2437	V	Peak	2437.0	112.8	125.0	12.2
802.11g	2437	H	Peak	2437.0	106.9	125.0	18.1
802.11g	2437	V	Ave	4874.0	42.0	54.0	12.0
802.11g	2437	V	Peak	4874.0	59.4	74.0	14.6
802.11g	2437	H	Ave	4874.0	45.3	54.0	8.7
802.11g	2437	H	Peak	4874.0	55.5	74.0	18.5
802.11g	2437	V	Ave	7311.0	42.1	54.0	11.9
802.11g	2437	V	Peak	7311.0	52.1	74.0	21.9
802.11g	2437	H	Ave	7311.0	42.1	54.0	11.9
802.11g	2437	H	Peak	7312.8	52.1	74.0	21.9
802.11g	2437	V	Ave	9748.0	39.6	54.0	14.4
802.11g	2437	V	Peak	9748.0	58.6	74.0	15.4
802.11g	2437	H	Ave	9748.0	39.6	54.0	14.4
802.11g	2437	H	Peak	9748.0	57.1	74.0	16.9
802.11g	2462	V	Ave	4924.0	43.1	54.0	10.9
802.11g	2462	V	Peak	4924.0	59.0	74.0	15.0
802.11g	2462	H	Ave	4924.0	40.5	54.0	13.5
802.11g	2462	H	Peak	4924.0	57.1	74.0	16.9
802.11g	2462	H	Ave	7386.0	42.5	54.0	11.5
802.11g	2462	H	Peak	7386.0	54.4	74.0	19.6
802.11g	2462	V	Ave	7386.0	42.5	54.0	11.5
802.11g	2462	V	Peak	7386.0	46.0	74.0	28.0

Judgment: Passed by 2.0 dB
 No other emissions were detected in the restricted bands.

Emissions Below 1 GHz

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/Type		EUT	Limit	
53.7	48.8 P	14.6	H/44	-37.8	25.6	30.0	4.4
94.0	50.1 P	9.1	H/44	-37.2	22.0	30.0	8.0
109.0	43.0 P	11.5	H/44	-37.0	17.4	30.0	12.6

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Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
155.6	44.2 P	8.9	H/44	-36.6	16.6	30.0	13.4
199.6	50.4 P	10.6	H/44	-36.2	24.8	30.0	5.2
224.7	45.4 P	11.8	H/44	-36.0	21.2	30.0	8.8
250.0	45.8 P	12.9	H/44	-35.8	22.9	37.0	14.1
274.0	44.8 P	13.6	H/44	-35.7	22.7	37.0	14.3
373.6	43.7 P	15.7	H/44	-35.1	24.3	37.0	12.7
374.0	42.1 P	15.8	H/44	-35.1	22.8	37.0	14.2
500.8	45.0 P	18.1	H/44	-34.1	29.0	37.0	8.0
575.2	38.3 P	18.4	H/44	-33.6	23.1	37.0	13.9
614.8	45.7 P	19.3	H/44	-33.3	31.7	37.0	5.3
625.6	40.5 P	19.4	H/44	-33.2	26.6	37.0	10.4
686.8	39.2 P	20.5	H/44	-33.1	26.6	37.0	10.4
746.8	38.2 P	21.0	H/44	-32.5	26.7	37.0	10.3
54.1	52.8 Q	11.7	V/44	-37.8	26.7	30.0	3.3
54.5	53.7 P	11.6	V/44	-37.8	27.5	30.0	2.5
55.3	51.4 P	11.6	V/44	-37.8	25.2	30.0	4.8
69.8	47.7 P	8.0	V/44	-37.5	18.1	30.0	11.9
70.1	51.7 P	8.0	V/44	-37.5	22.2	30.0	7.8
78.6	51.1 P	7.2	V/44	-37.4	20.9	30.0	9.1
94.6	54.2 P	9.0	V/44	-37.2	26.0	30.0	4.0
95.2	52.3 Q	9.2	V/44	-37.2	24.3	30.0	5.7
96.3	53.9 Q	9.8	V/44	-37.2	26.5	30.0	3.5
98.4	52.7 Q	10.7	V/44	-37.2	26.2	30.0	3.8
111.6	48.8 P	12.4	V/44	-37.0	24.2	30.0	5.8
124.9	43.4 P	10.5	V/44	-36.8	17.1	30.0	12.9
141.2	46.3 P	7.7	V/44	-36.7	17.3	30.0	12.7
149.7	49.8 P	7.3	V/44	-36.6	20.5	30.0	9.5
500.8	43.6 P	17.2	V/44	-34.1	26.7	37.0	10.3
625.6	40.0 P	19.2	V/44	-33.2	26.0	37.0	11.0
937.6	33.6 P	22.4	V/44	-30.6	25.4	37.0	11.6

Judgment: Passed by 2.5 dB