



Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

VersaLink Wireless Gateway Router, Model D90327W15-06

Radiometrics Document RP-5671



Product Detail:

FCC ID: CH8D90327WXXX-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
 Romeoville, IL 60446
 Phone: (815) 293-0772
 e-mail: info@radiomet.com

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

September 21 to October 7, 2005

Document RP-5671 Revisions:

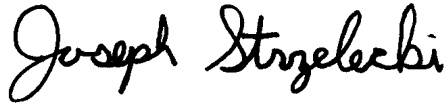
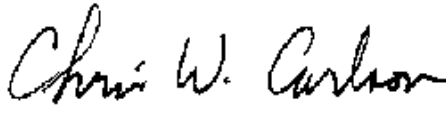
Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	November 22, 2005			

Table of Contents

1 ADMINISTRATIVE DATA	3
2 TEST SUMMARY AND RESULTS	3
3 EQUIPMENT UNDER TEST (EUT) DETAILS	4
3.1 EUT Description	4
3.1.1 FCC Section 15.203 & RSS-210 Section 5.5 Antenna Requirements	4
3.2 Related Submittals	4
4 TESTED SYSTEM DETAILS	4
4.1 Tested System Configuration	4
4.2 Special Accessories	5
4.3 Equipment Modifications	5
5 TEST SPECIFICATIONS AND RELATED DOCUMENTS	5
6 RADIOMETRICS' TEST FACILITIES	5
7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS	6
8 CERTIFICATION	6
9 TEST EQUIPMENT TABLE	7
10 TEST SECTIONS	7
10.1 AC Conducted Emissions; Section 15.207	7
Figure 1. Conducted Emissions Test Setup	9
10.2 Occupied Bandwidth	9
10.3 Peak Output Power	15
10.4 Power Spectral Density	16
10.5 Band-edge Compliance of RF Conducted Emissions	16
10.6 Spurious RF Conducted Emissions	20
10.7 Spurious Radiated Emissions (Restricted Band)	30
10.7.1 Radiated Emissions Field Strength Sample Calculation	30
Figure 2. Drawing of Radiated Emissions Setup	31
10.7.2 Spurious Radiated Emissions Test Results (Restricted Band)	31

Notice: This report must not be reproduced (except in full) without the written approval of Radiometrics Midwest Corporation.

1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Westell, Inc., VersaLink Wireless Gateway Router Model: D90327W15-06 Serial Number: 6881 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> September 21, 2005	<i>Test Date(s): (Month-Day-Year)</i> September 21 thru October 7, 2005
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Timothy Lim 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 Wireless Gateway Router, Model D90327W15-06, 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 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 VersaLink Wireless Gateway Router, Model D90327W15-06, 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 an 802.11 WiFi router (to support connectivity to WiFi enabled devices throughout the home).

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. The testing was performed in two configurations: 105 and 125 MHz clock rates. Wiring was consistent with manufacturer's recommendations.

The EUT was tested as a remotely located device. 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 as follows:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	VersaLink Wireless Gateway Router	E	Westell, Inc.	D90-327W15-06	6881
2	Laptop PC	S	Gateway	450ROG	N/A
3	Hub (4 modems)	S	Westell, Inc.	B90-610014-06	N/A
4	CO	S	Texas Instrument	AC5 EVM	B089337
5	WiFi Card	S	Abocom Systems	WCM520T	N/A

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

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

List of EUT Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	AC Cord	#1 input power	No
1	21	DSL Cable	#1 and #4	No
4	15.2	Ethernet Cable	#1 and #3	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.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

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 located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

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.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

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	Hewlett-Packard	Amplifier for 18-26 GHz Mixer	11975A	2304A00158	2-8 GHz	12 Mo.	08/19/05
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	24 Mo.	08/03/04
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	04/25/05
MXR-01	H P	Harmonic Mixer	11970K	3003A02243	18.6-26.5GHz	12 Mo.	01/06/05
PRE-01	Hewlett Packard	Preselector	85685A	2510A00143	20 Hz-2GHz	12 Mo.	01/20/05
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	08/19/05
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.

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.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

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 : October 7, 2005

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

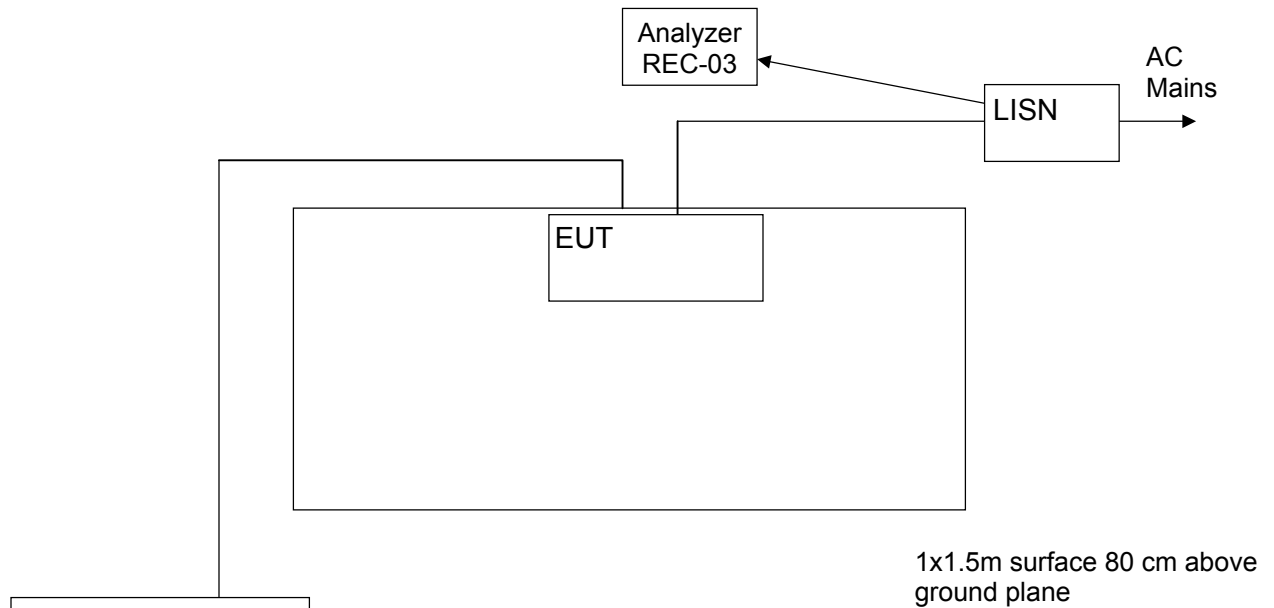
Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Neutral	0.15	47.53	65.97	36.45	55.97
AC Neutral	0.19	N/A	64.08	34.56	54.08
AC Neutral	0.30	N/A	60.20	32.34	50.20
AC Neutral	0.50	38.77	56.02	29.57	46.02
AC Neutral	1.96	N/A	56.00	36.74	46.00
AC Neutral	2.35	N/A	56.00	38.96	46.00
AC Neutral	17.70	N/A	60.00	38.93	50.00
AC Neutral	19.71	42.35	60.00	36.60	50.00
AC Hot	0.15	48.57	66.00	37.09	56.00
AC Hot	0.33	N/A	59.53	32.84	49.53
AC Hot	0.43	40.50	57.27	30.24	47.27
AC Hot	1.00	N/A	56.00	30.01	46.00
AC Hot	2.35	43.00	56.00	40.44	46.00
AC Hot	10.55	N/A	60.00	30.71	50.00
AC Hot	17.69	39.82	60.00	33.55	50.00
AC Hot	20.33	N/A	60.00	31.27	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 5.56 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

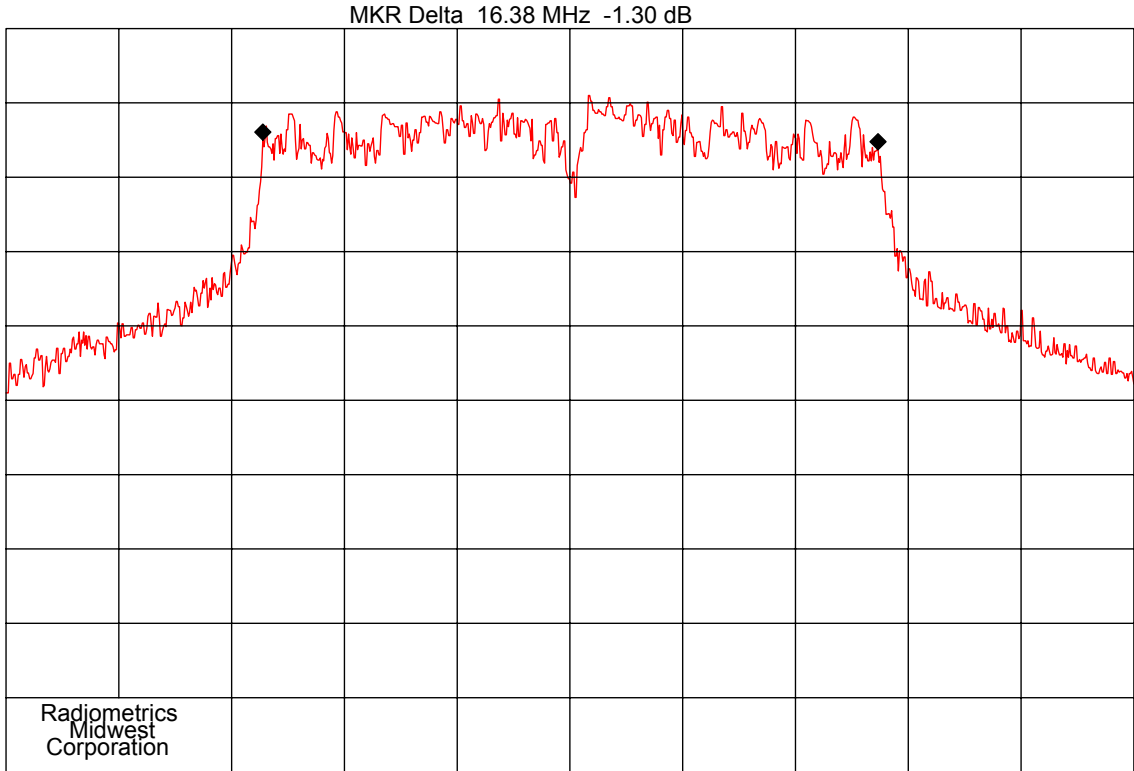
10.2 Occupied Bandwidth

This test is a direct connection from the RF output to the spectrum analyzer. 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
	6 dB EBW MHz	6 dB EBW MHz
1	13.2	16.5
6	13.1	16.3
11	13.1	16.4

The minimum bandwidth as per 15.247 is 0.5 MHz

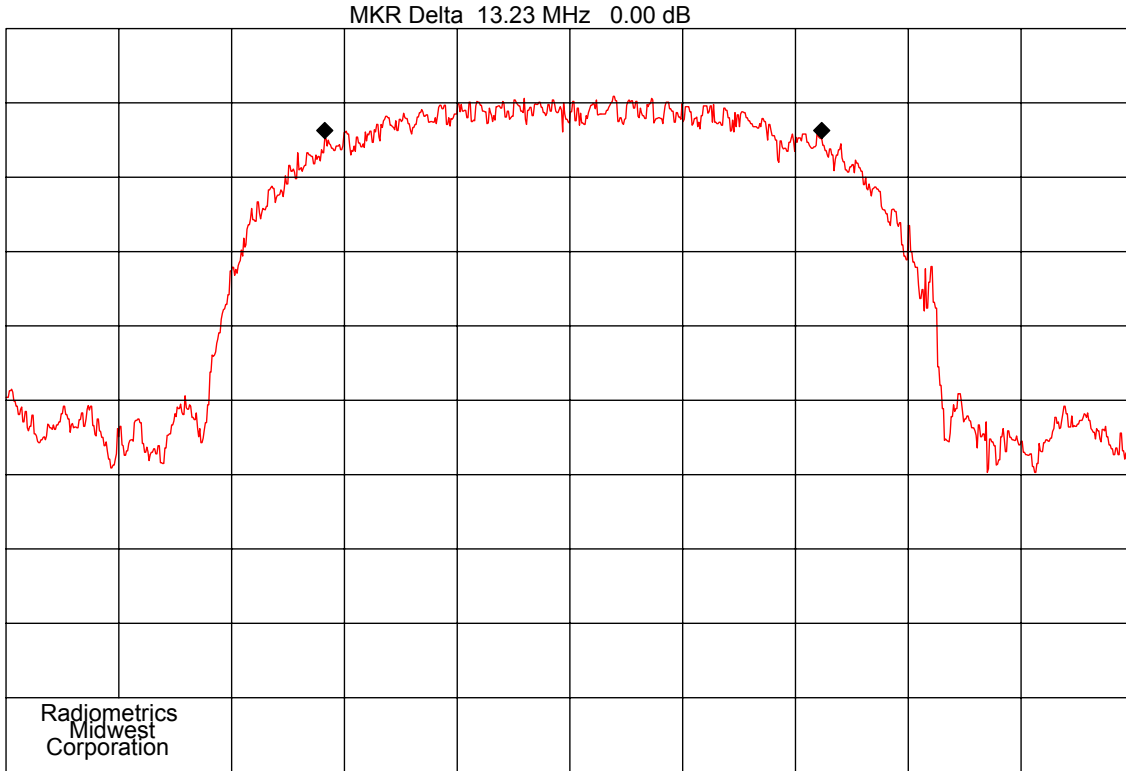
RADIOMETRICS MIDWEST CORPORATION - EMC Test Report Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router
--



COMPANY : Westell CENTER 2.462 0 GHz RES BW 100 kHz 10 dB/ NOTES : Bandwidth Test, 802.11g; Ch 11	ITEM : D90-327W15-06 REF 20.0 dBm VBW 300 kHz TIME : 14:07	DATE : 09-26-2005 SPAN 30.0 MHz ATTEN 30 dB SWP 20.0 msec
---	---	--

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router



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

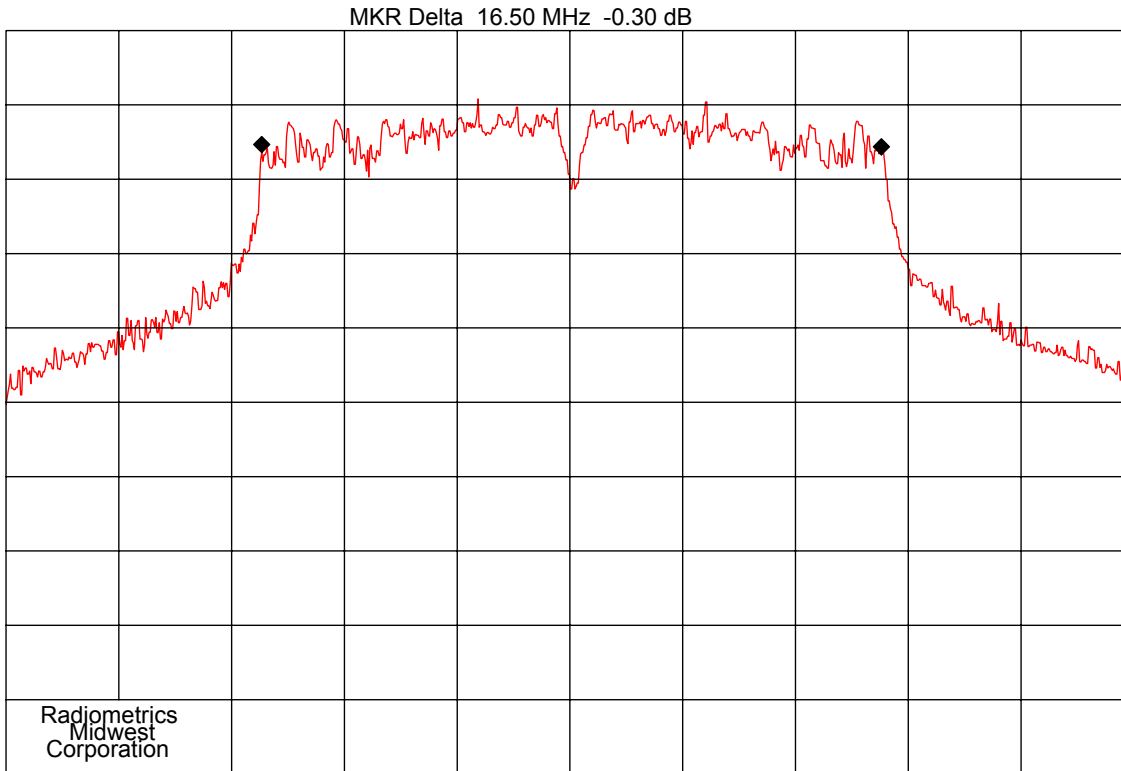
ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 14:28

DATE : 09-26-2005
SPAN 30.0 MHz
ATTEN 30 dB
SWP 20.0 msec

NOTES : Bandwidth Test, 802.11b; Ch 1

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router



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

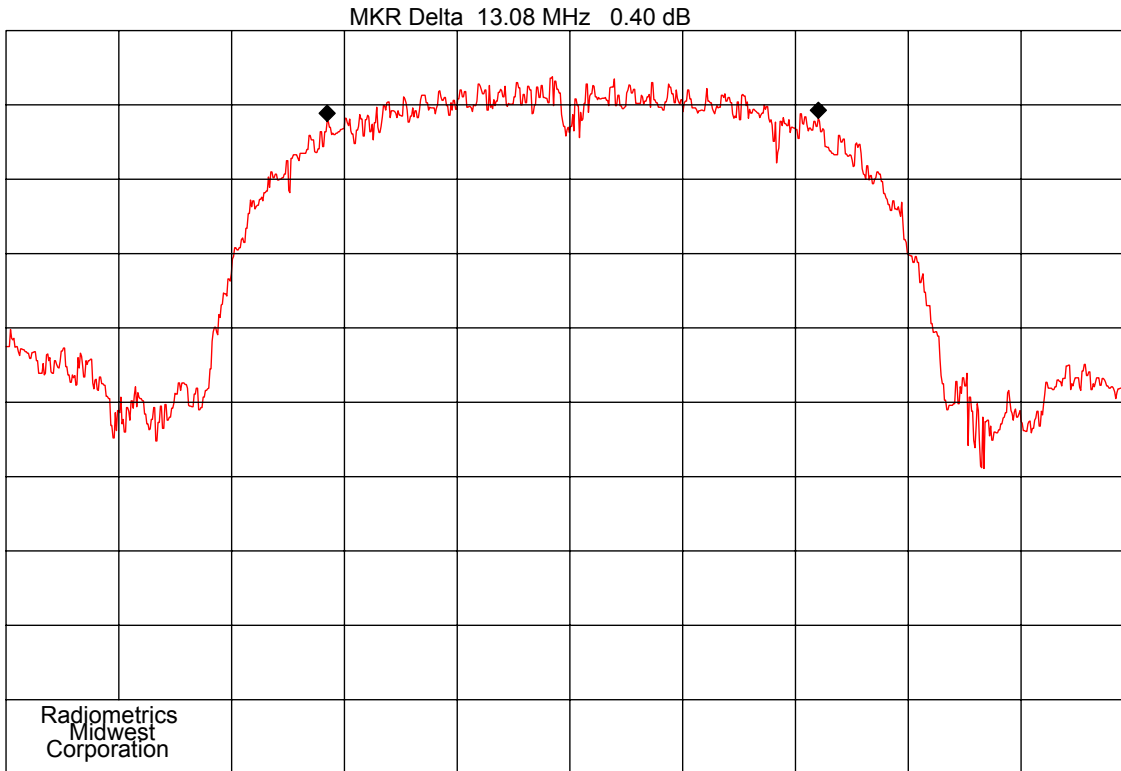
ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 14:26

DATE : 09-26-2005
SPAN 30.0 MHz
ATTEN 30 dB
SWP 20.0 msec

NOTES : Bandwidth Test, 802.11g; Ch 1

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router



COMPANY : Westell
CENTER 2.437 0 GHz
RES BW 100 kHz
10 dB/

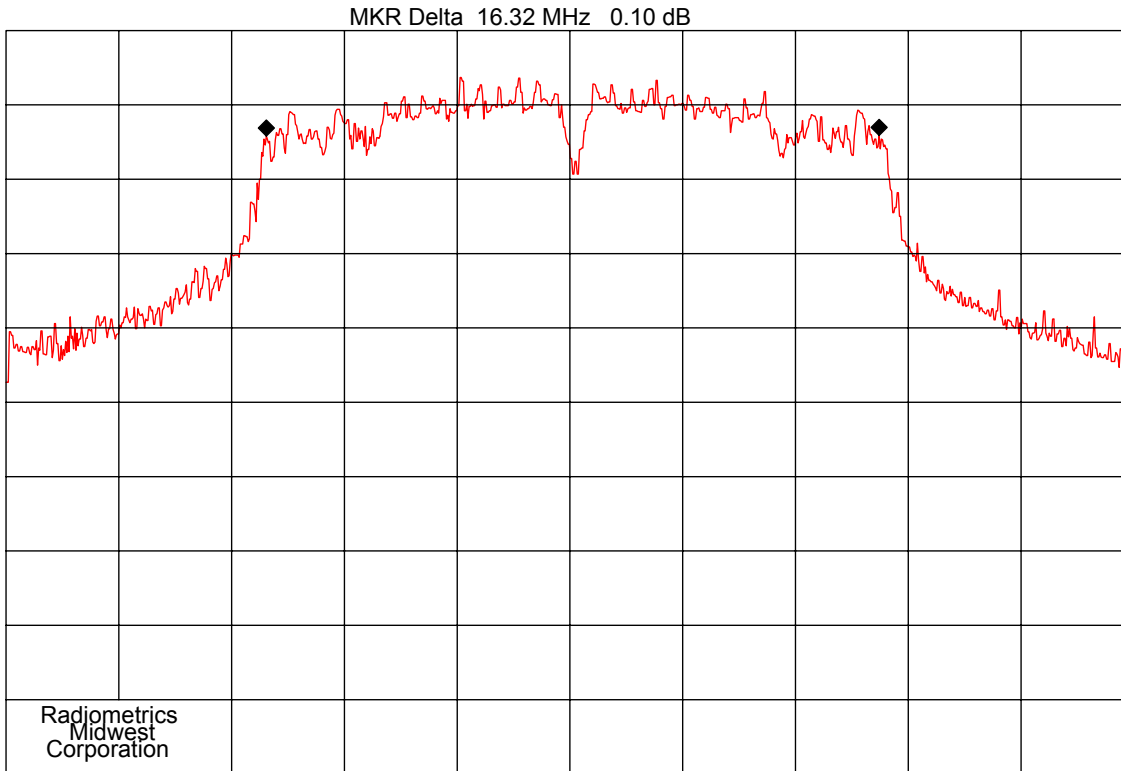
ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 14:20

DATE : 09-26-2005
SPAN 30.0 MHz
ATTEN 30 dB
SWP 20.0 msec

NOTES : Bandwidth Test, 802.11b; Ch 6

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

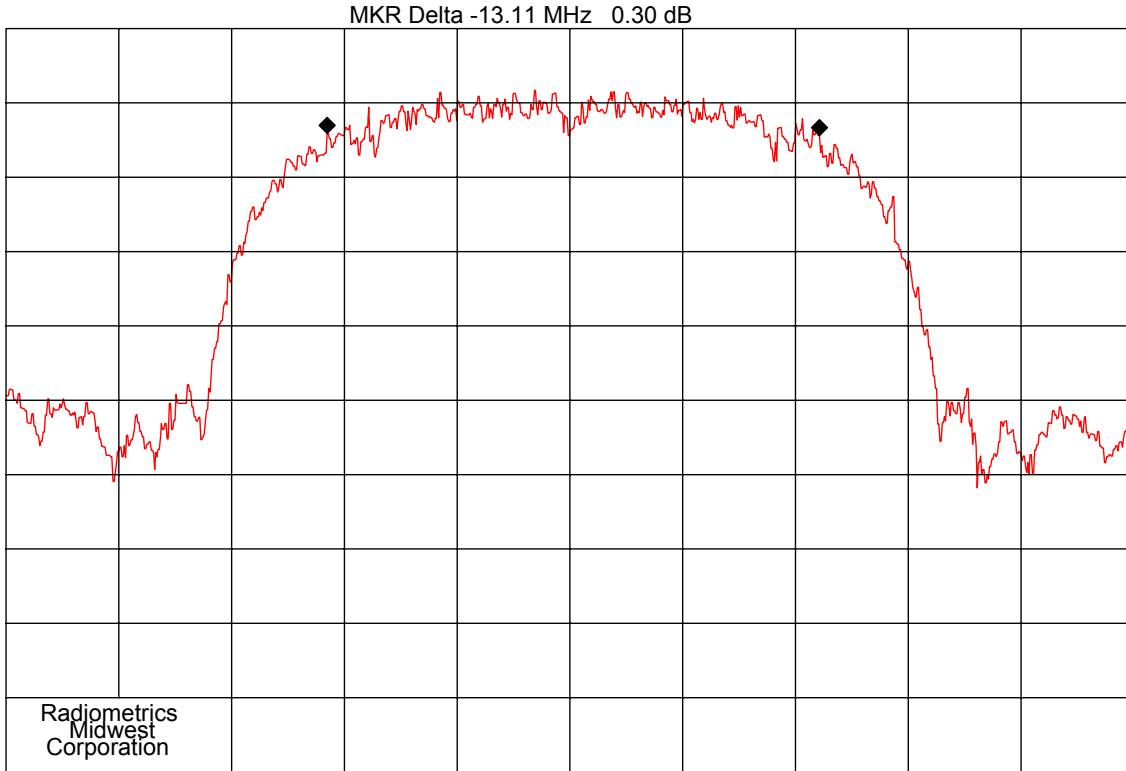


COMPANY : Westell
 CENTER 2.437 0 GHz
 RES BW 100 kHz
 10 dB/

ITEM : D90-327W15-06
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 14:23

DATE : 09-26-2005
 SPAN 30.0 MHz
 ATTEN 30 dB
 SWP 20.0 msec

NOTES : Bandwidth Test, 802.11g; Ch 6



COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
CENTER 2.462 0 GHz	REF 20.0 dBm	SPAN 30.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 14:33	SWP 20.0 msec
NOTES : Bandwidth Test, 802.11b; Ch 11		

Judgement: Pass

10.3 Peak Output Power

The power output option 2; Method #3 from FCC rules 558074 was used for this test. The spectrum analyzer was set to the following settings:

- Span = 2 MHz
- RBW = 1 MHz
- VBW = 3 MHz
- Sweep = auto
- Detector function = peak
- Trace = max hold

The trace was allowed to stabilize. The marker-to-peak function was used to measure the peak of the emission. 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.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

Mode	Freq. (MHz)	Reading (dBm)	BW Corr Factor (dB)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
					dBm	Watts	
802.11b	2412	14.2	11.2	0.3	25.7	0.369	30
802.11b	2437	16.7	11.2	0.3	28.2	0.657	30
802.11b	2462	14.8	11.2	0.3	26.3	0.427	30
802.11g	2412	12.7	12.2	0.3	25.2	0.329	30
802.11g	2437	14.5	12.1	0.3	26.9	0.492	30
802.11g	2462	14	12.1	0.3	26.4	0.441	30

Judgement: Pass

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	-6.9	0.3	-6.6	8.0
802.11b	2437	-5.2	0.3	-4.9	8.0
802.11b	2462	-6.5	0.3	-6.2	8.0
802.11g	2412	-7.6	0.3	-7.3	8.0
802.11g	2437	-5.9	0.3	-5.6	8.0
802.11g	2462	-7.1	0.3	-6.8	8.0

Judgement: Pass

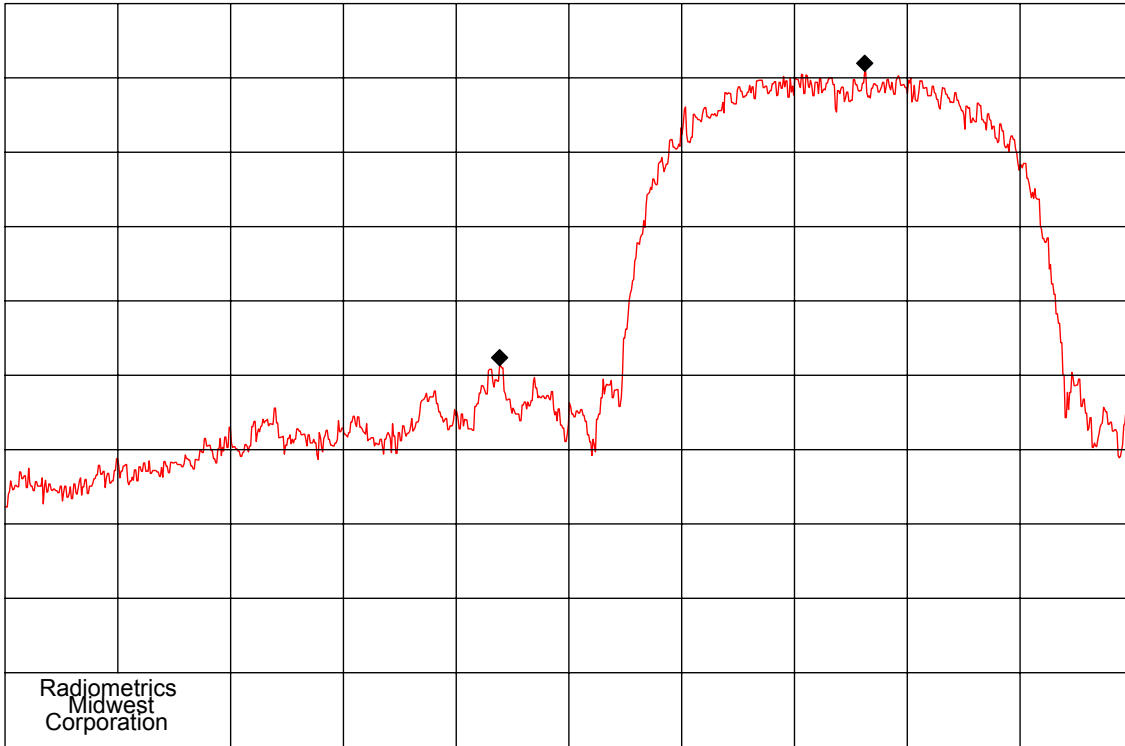
10.5 Band-edge Compliance of RF Conducted Emissions

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. This test is a direct connection from the RF output to the spectrum analyzer. The trace was allowed to stabilize.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

MKR Delta -16.20 MHz -39.60 dB



Radiometrics
Midwest
Corporation

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

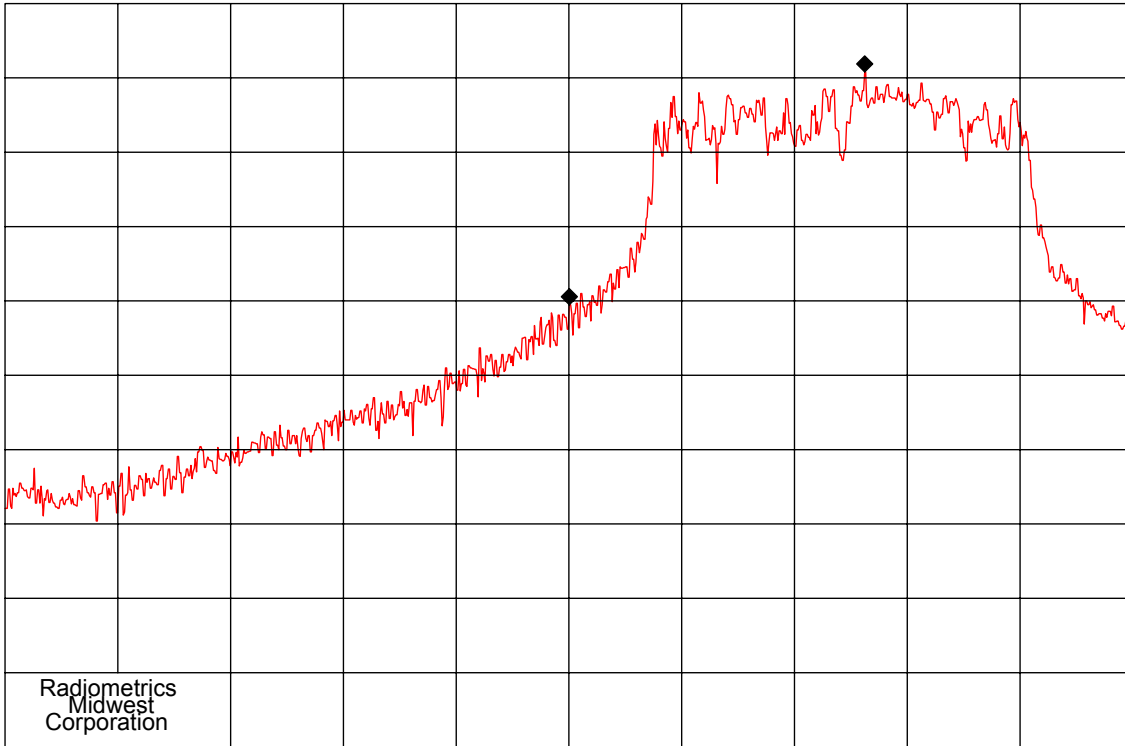
ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 14:43

DATE : 09-26-2005
SPAN 50.0 MHz
ATTEN 30 dB
SWP 20.0 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

MKR Delta -13.10 MHz -31.30 dB



Radiometrics
Midwest
Corporation

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

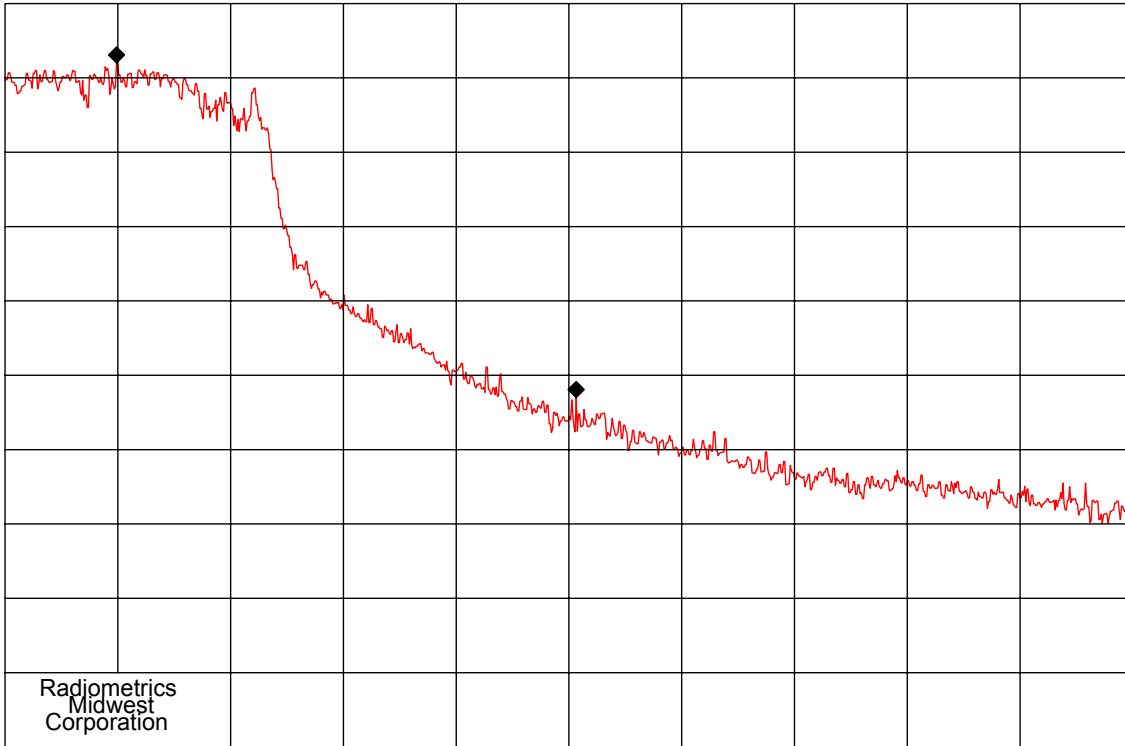
ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 14:42

DATE : 09-26-2005
SPAN 50.0 MHz
ATTEN 30 dB
SWP 20.0 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

MKR Delta 20.40 MHz -45.00 dB



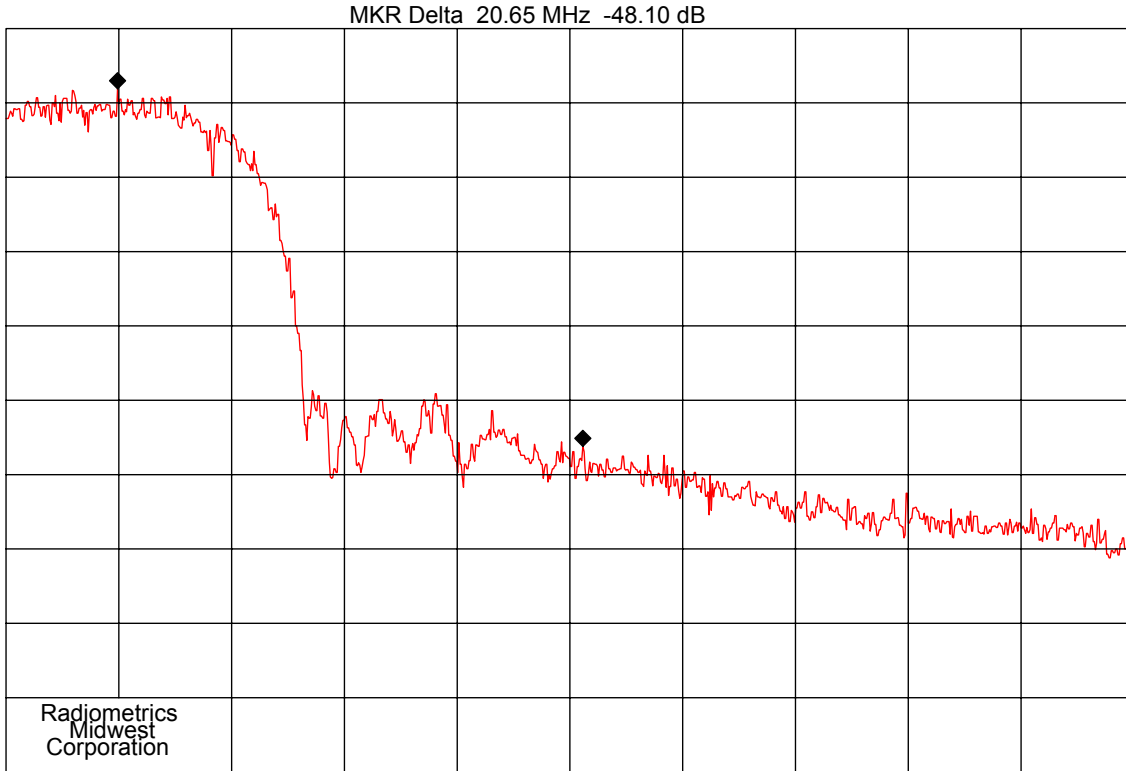
Radiometrics
Midwest
Corporation

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

ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 14:39

DATE : 09-26-2005
SPAN 50.0 MHz
ATTEN 30 dB
SWP 20.0 msec

NOTES : Band Edge, 802.11g; Ch 11



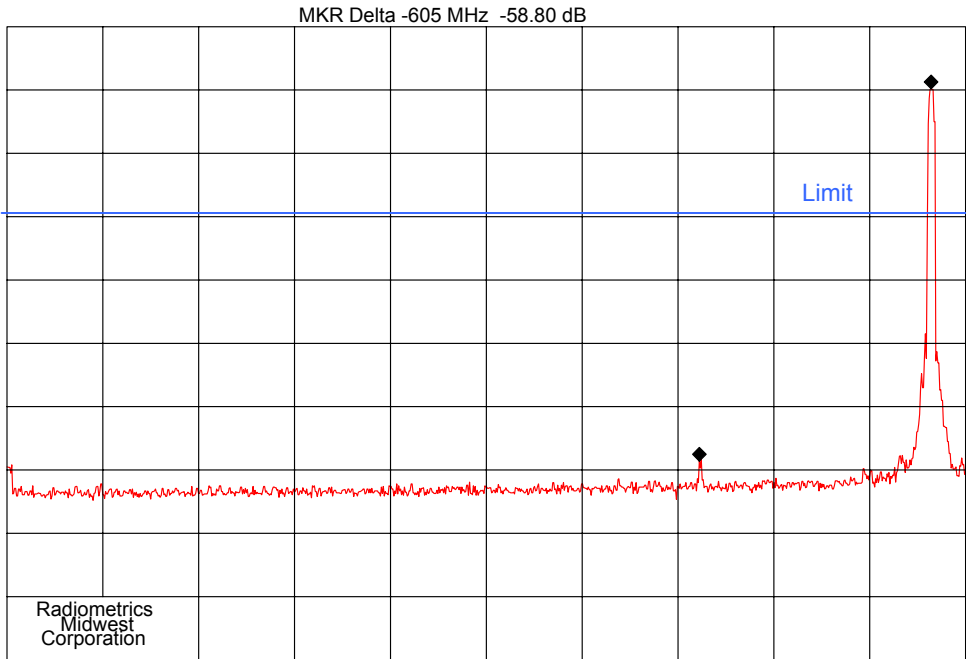
COMPANY : Westell CENTER 2.483 5 GHz RES BW 100 kHz 10 dB/ NOTES : Band Edge, 802.11b; Ch 11	ITEM : D90-327W15-06 REF 20.0 dBm VBW 300 kHz TIME : 14:36	DATE : 09-26-2005 SPAN 50.0 MHz ATTEN 30 dB SWP 20.0 msec
--	---	--

Judgement: Pass; All band edge emissions at least 20 dB below level of Carrier.

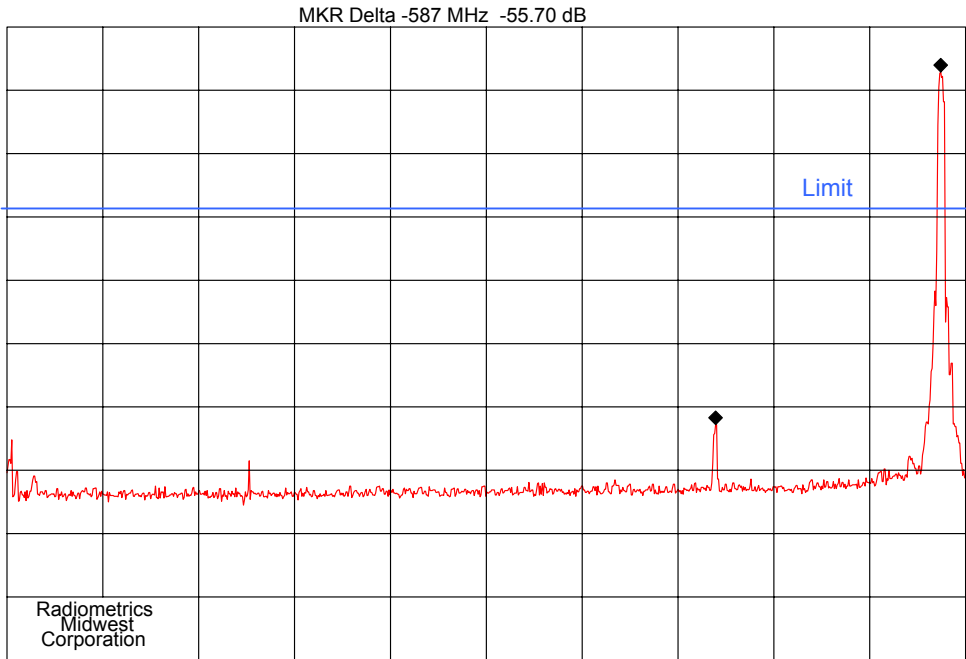
10.6 Spurious RF Conducted Emissions

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.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

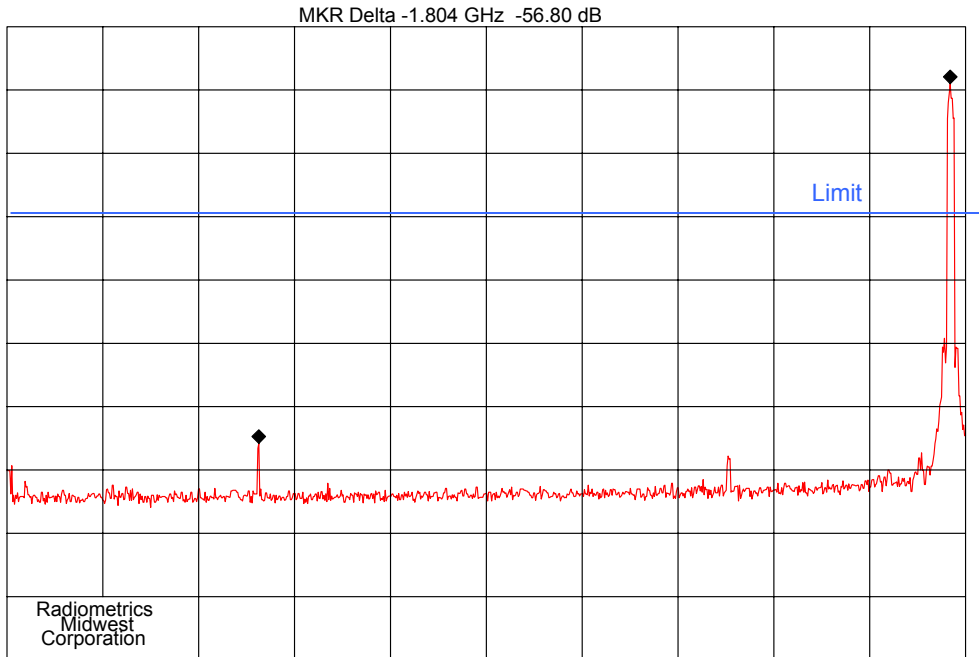


COMPANY : Westell START 1 MHz RES BW 100 kHz 10 dB/ NOTES : Antenna Cond Em, 802.11b; Ch 1	ITEM : D90-327W15-06 REF 20.0 dBm VBW 300 kHz TIME : 15:07	DATE : 09-26-2005 STOP 2.50 GHz ATTEN 30 dB SWP 750 msec
--	---	---

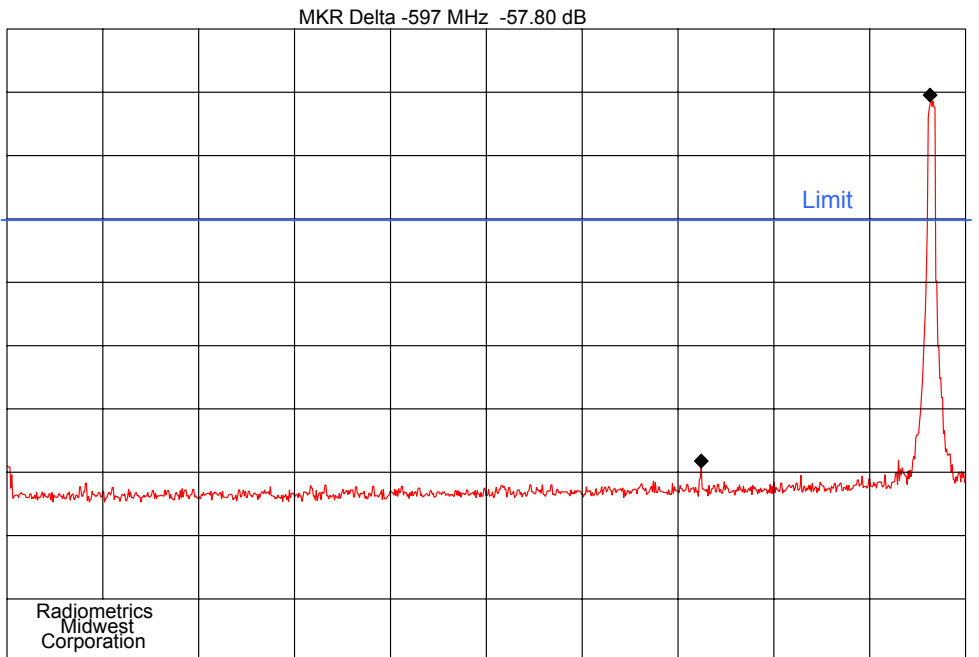


COMPANY : Westell START 1 MHz RES BW 100 kHz 10 dB/ NOTES : Antenna Cond Em, 802.11b; Ch 6	ITEM : D90-327W15-06 REF 20.0 dBm VBW 300 kHz TIME : 15:15	DATE : 09-26-2005 STOP 2.50 GHz ATTEN 30 dB SWP 750 msec
--	---	---

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

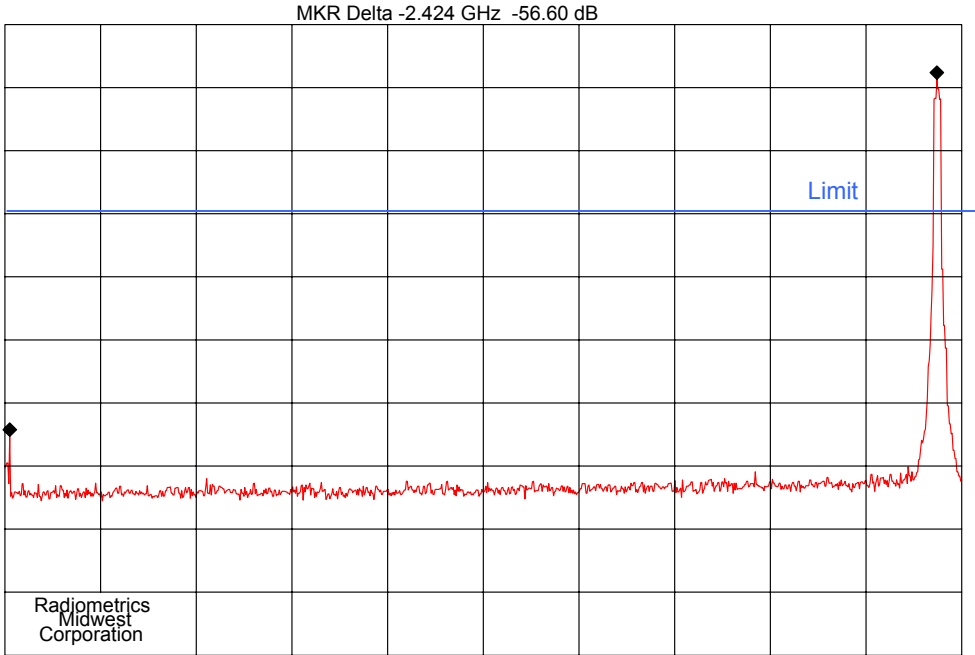


COMPANY : Westell	ITEM : D90327W15-06	DATE : 09-26-2005
START 1 MHz	REF 20.0 dBm	STOP 2.50 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 15:48	SWP 750 msec
NOTES : Ant cond Em, 802.11b Ch 11		

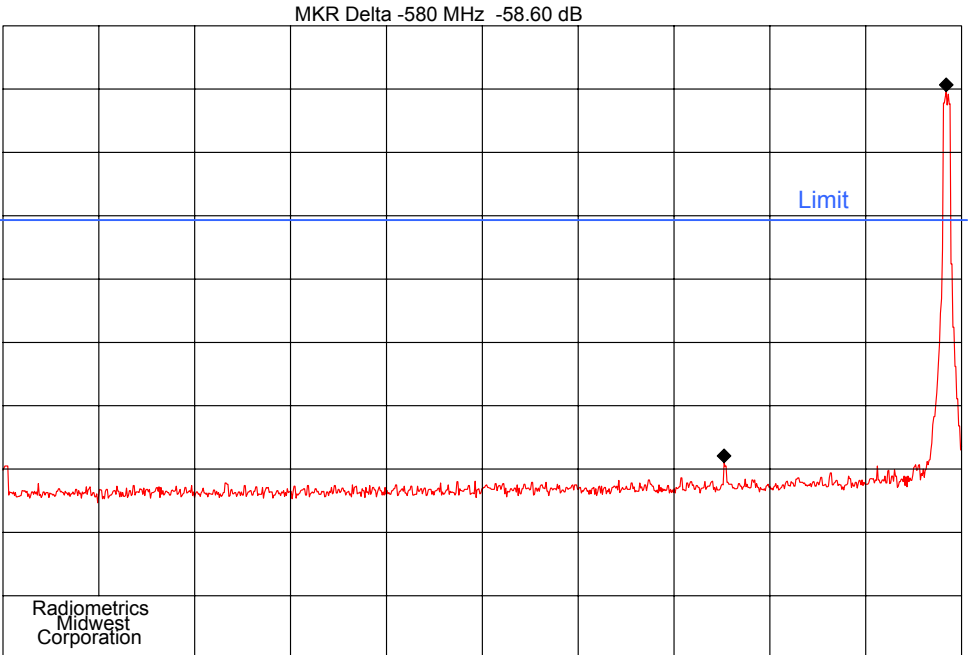


COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
START 1 MHz	REF 20.0 dBm	STOP 2.50 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 15:11	SWP 750 msec
NOTES : Antenna Cond Em, 802.11g; Ch 1		

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router
--



COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
START 1 MHz	REF 20.0 dBm	STOP 2.50 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 15:14	SWP 750 msec
NOTES : Antenna Cond Em, 802.11g; Ch 6		

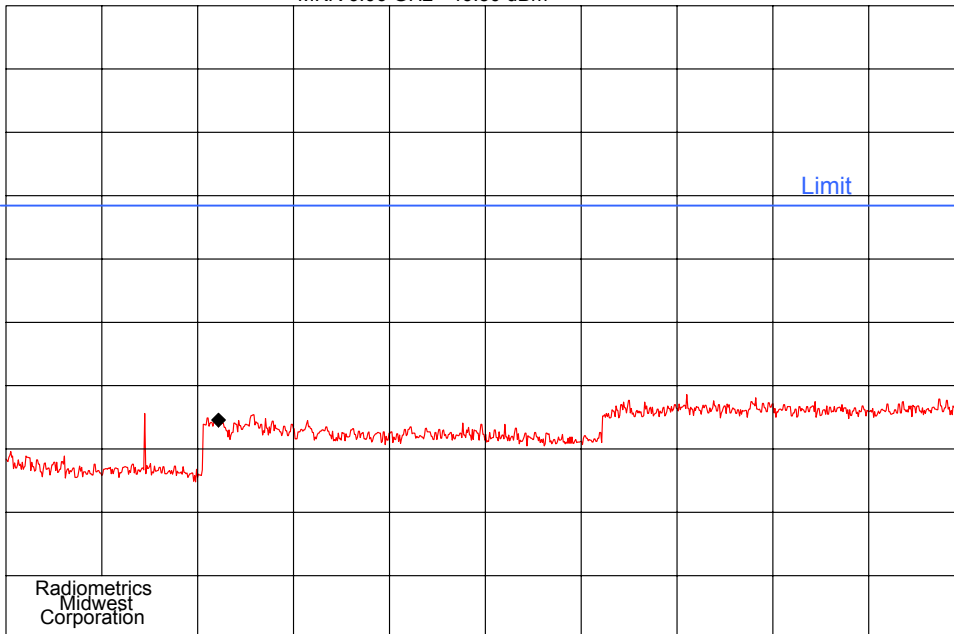


COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
START 1 MHz	REF 20.0 dBm	STOP 2.50 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 15:55	SWP 750 msec
NOTES : Ant cond Em, 802.11g Ch 11		

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

MKR 6.06 GHz -46.50 dBm



Radiometrics
Midwest
Corporation

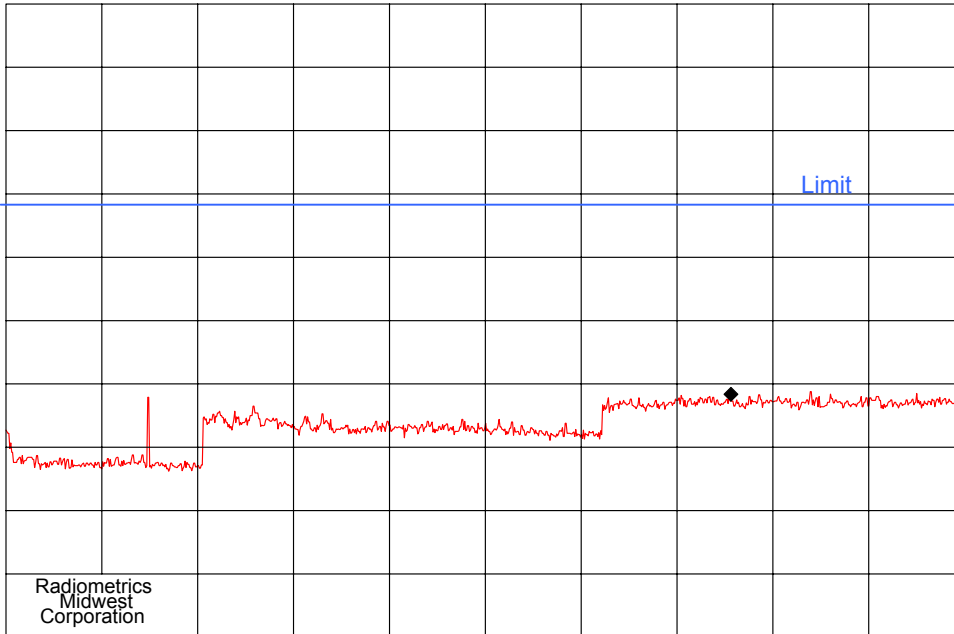
COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/

ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 16:07

DATE : 09-26-2005
STOP 18.6 GHz
ATTEN 30 dB
SWP 4.83 sec

NOTES : Ant cond Em, 802.11b Ch 1

MKR 14.67 GHz -42.70 dBm



Radiometrics
Midwest
Corporation

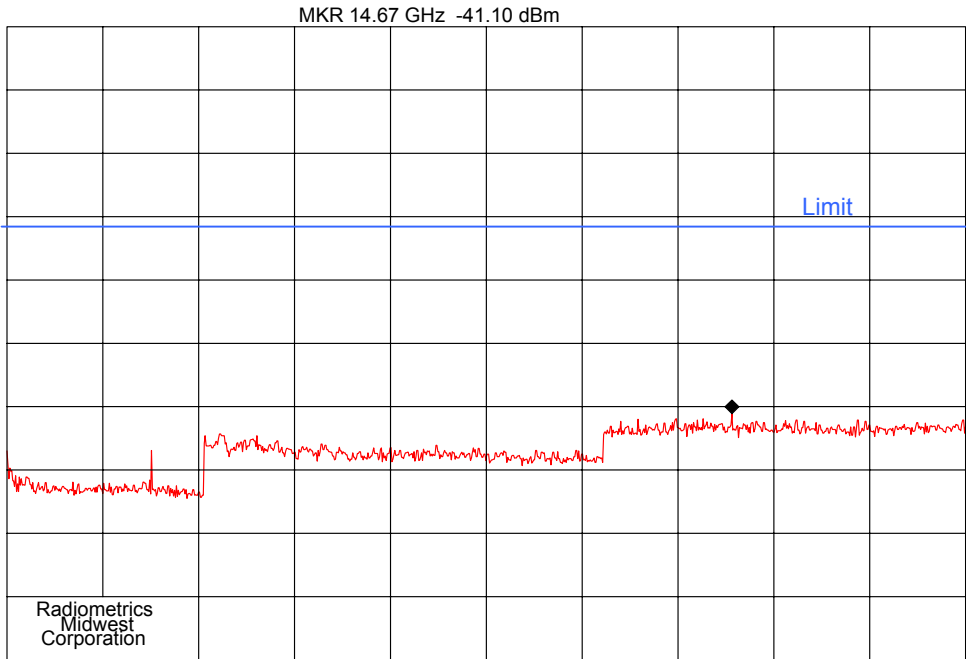
COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/

ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 16:00

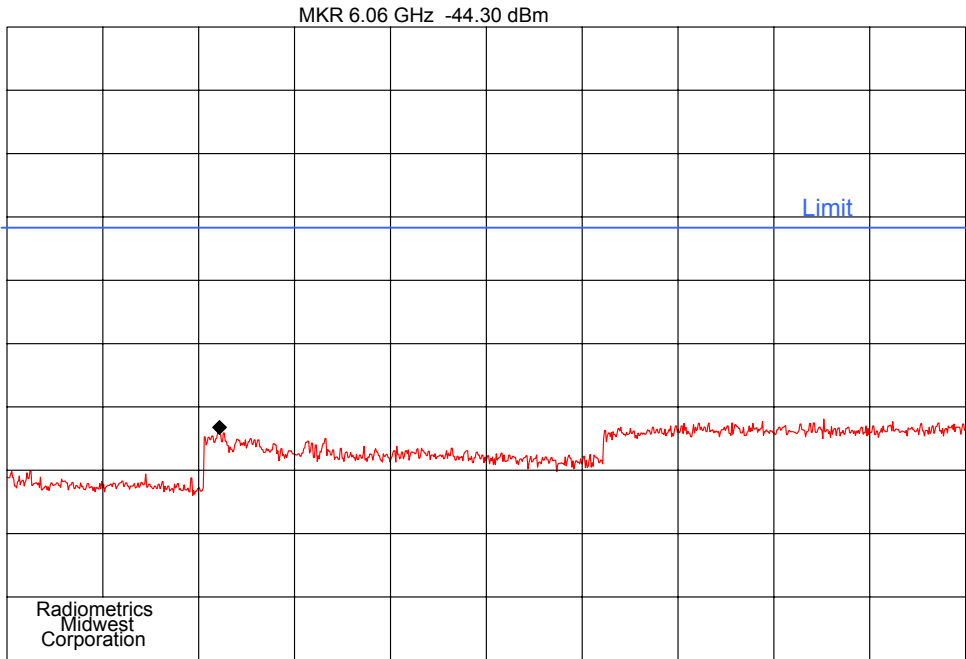
DATE : 09-26-2005
STOP 18.6 GHz
ATTEN 30 dB
SWP 4.83 sec

NOTES : Ant cond Em, 802.11b Ch 6

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router
--



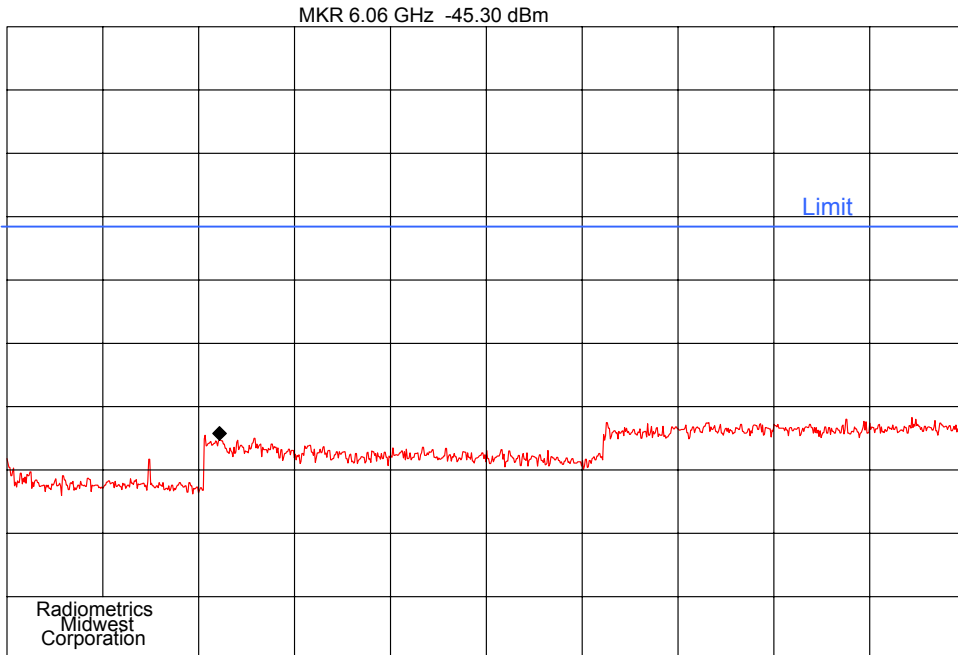
COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
START 2.5 GHz	REF 20.0 dBm	STOP 18.6 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 15:58	SWP 4.83 sec
NOTES : Ant cond Em, 802.11b Ch 11		



COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
START 2.5 GHz	REF 20.0 dBm	STOP 18.6 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 16:05	SWP 4.83 sec
NOTES : Ant cond Em, 802.11g Ch 1		

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

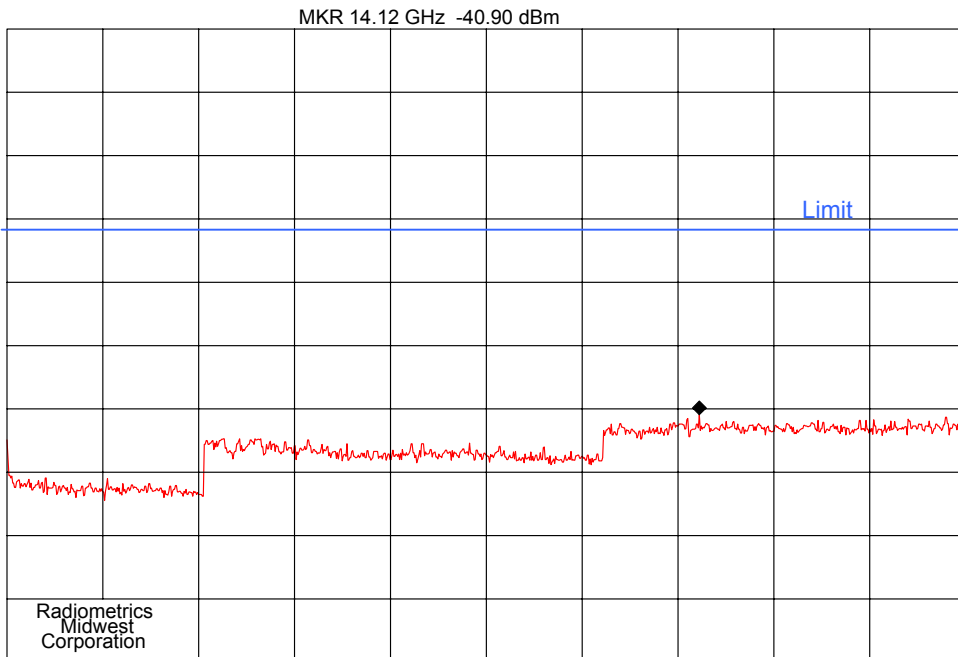


COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/

ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 16:03

DATE : 09-26-2005
STOP 18.6 GHz
ATTEN 30 dB
SWP 4.83 sec

NOTES : Ant cond Em, 802.11g Ch 6



COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/

ITEM : D90-327W15-06
REF 20.0 dBm
VBW 300 kHz
TIME : 15:57

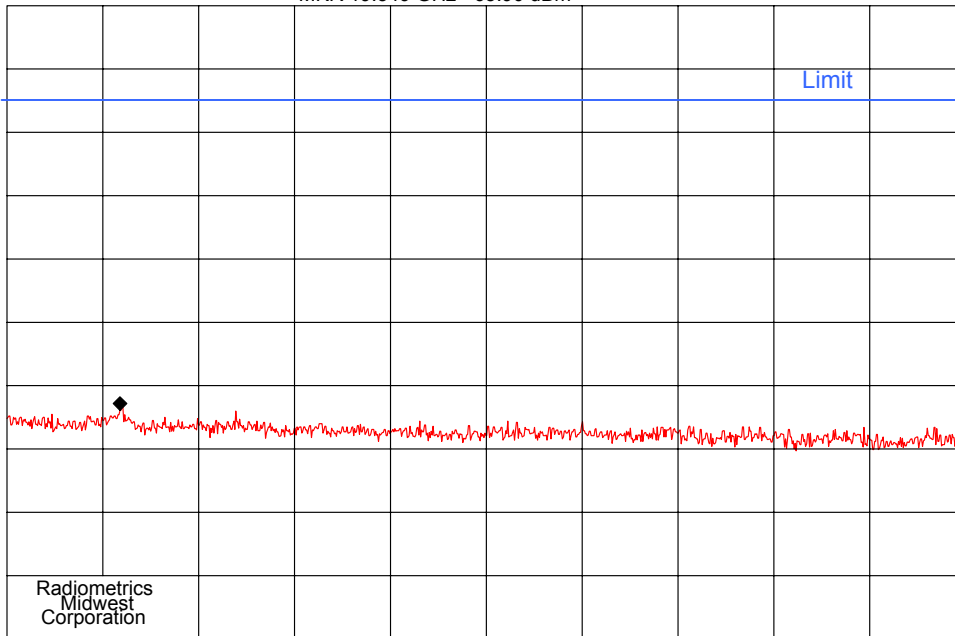
DATE : 09-26-2005
STOP 18.6 GHz
ATTEN 30 dB
SWP 4.83 sec

NOTES : Ant cond Em, 802.11g Ch 11

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

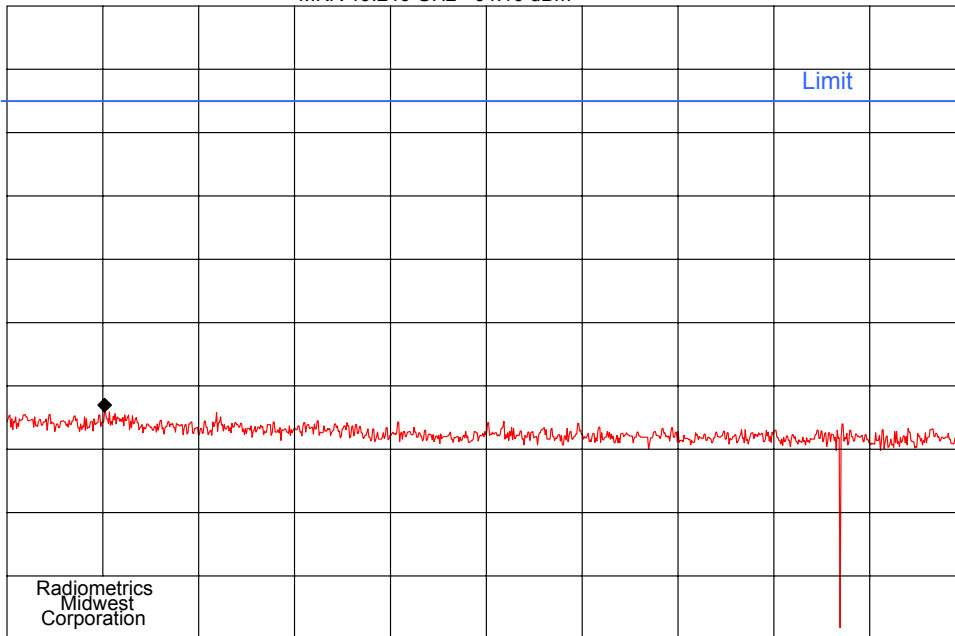
MKR 19.349 GHz -63.90 dBm



COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
START 18.60 GHz	REF 0.0 dBm	STOP 25.00 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 10 dB
10 dB/	TIME : 16:37	SWP 1.92 sec

NOTES : Ant cond Em, 802.11b Ch 1

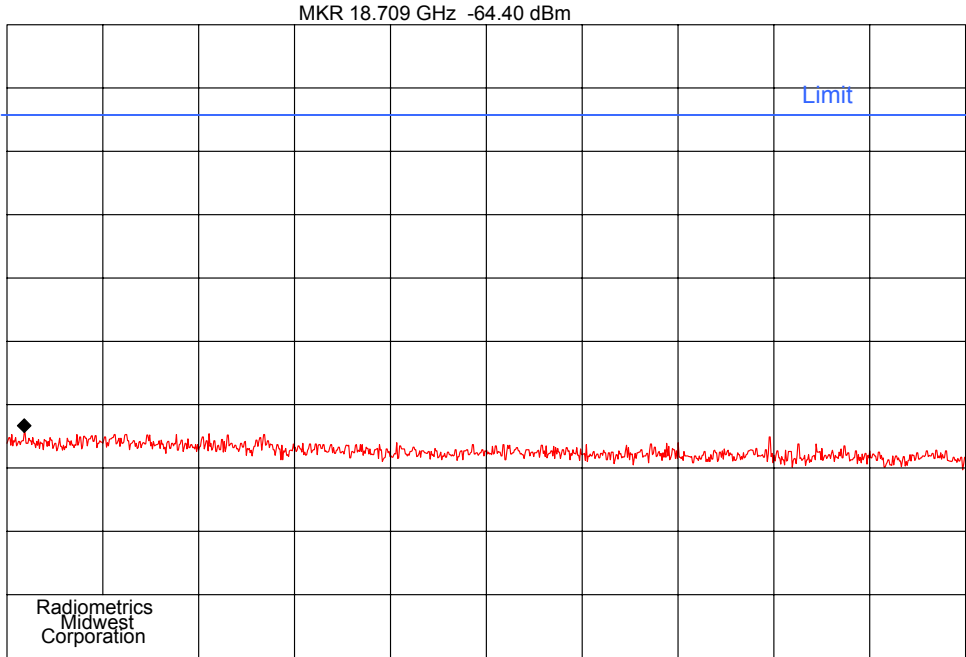
MKR 19.246 GHz -64.10 dBm



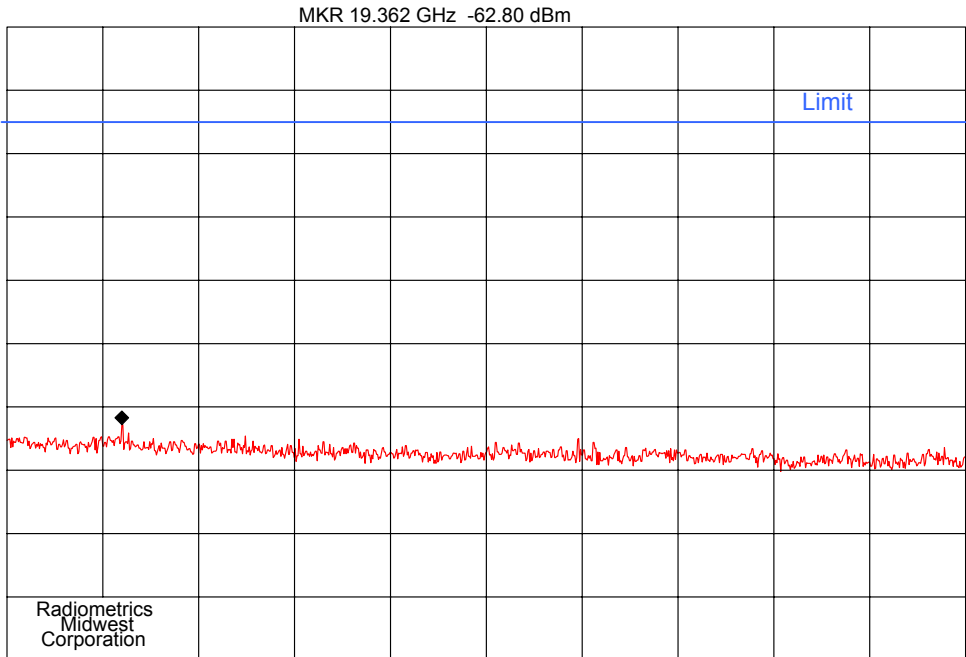
COMPANY : Westell	ITEM : D90-327W15-06	DATE : 09-26-2005
START 18.60 GHz	REF 0.0 dBm	STOP 25.00 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 10 dB
10 dB/	TIME : 16:38	SWP 1.92 sec

NOTES : Ant cond Em, 802.11b Ch 6

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router
--

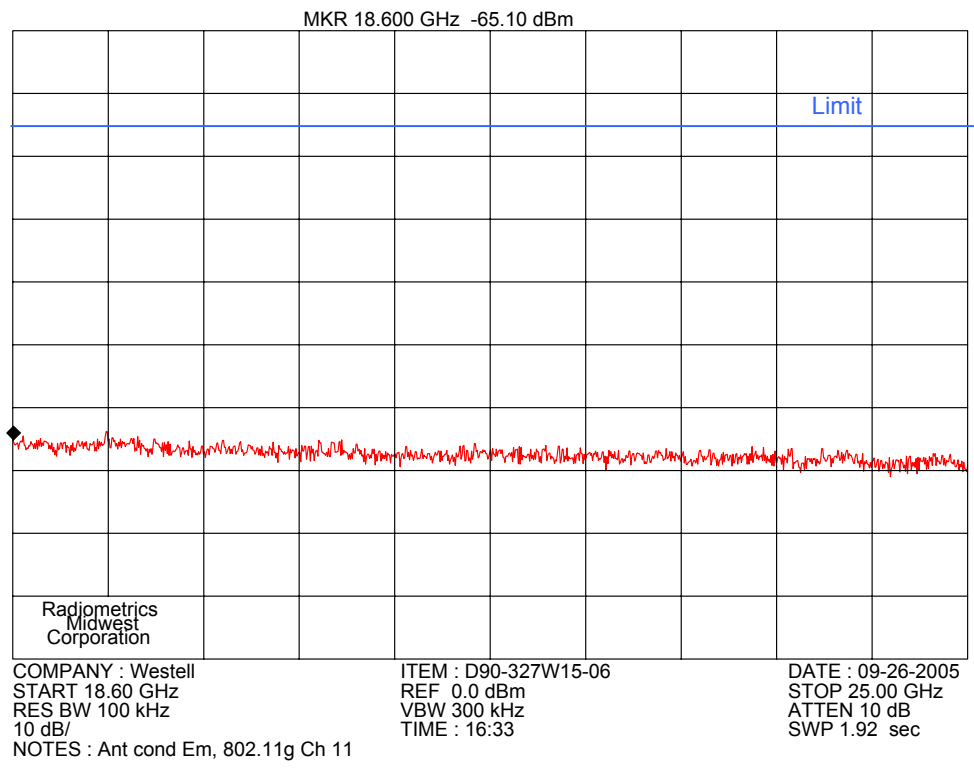
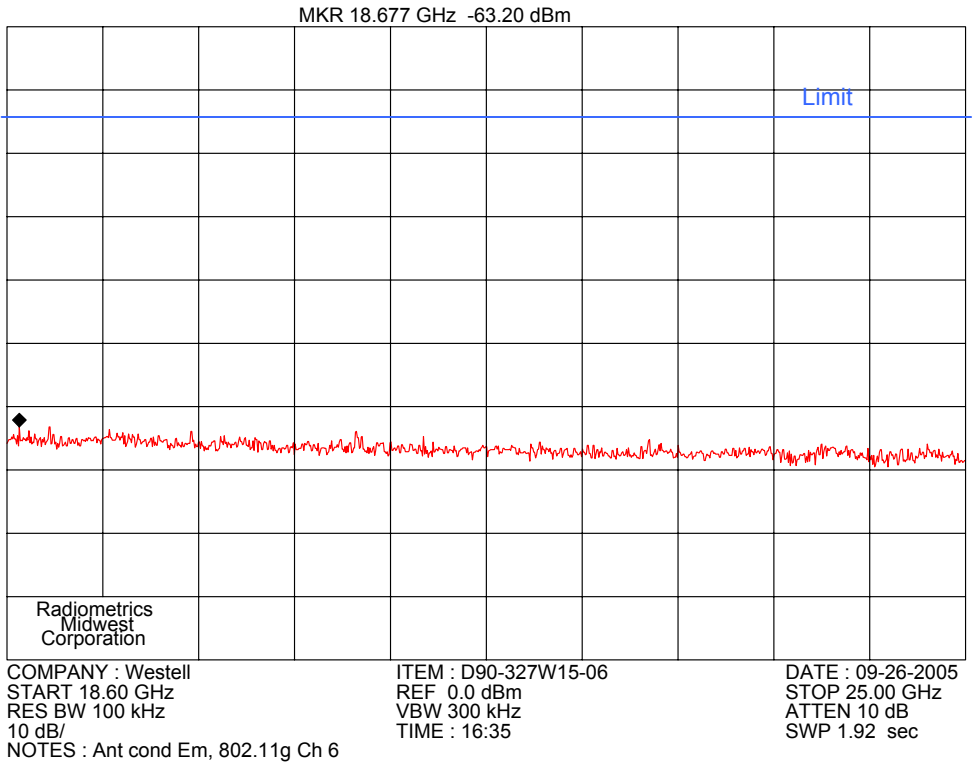


COMPANY : Westell START 18.60 GHz RES BW 100 kHz 10 dB/ NOTES : Ant cond Em, 802.11b Ch 11	ITEM : D90-327W15-06 REF 0.0 dBm VBW 300 kHz TIME : 16:40	DATE : 09-26-2005 STOP 25.00 GHz ATTEN 10 dB SWP 1.92 sec
--	--	--



COMPANY : Westell START 18.60 GHz RES BW 100 kHz 10 dB/ NOTES : Ant cond Em, 802.11g Ch 1	ITEM : D90-327W15-06 REF 0.0 dBm VBW 300 kHz TIME : 16:37	DATE : 09-26-2005 STOP 25.00 GHz ATTEN 10 dB SWP 1.92 sec
---	--	--

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router
--



Judgement: Pass; All band edge emissions at least 20 dB below level of Carrier.

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 the open area test site 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 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.

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

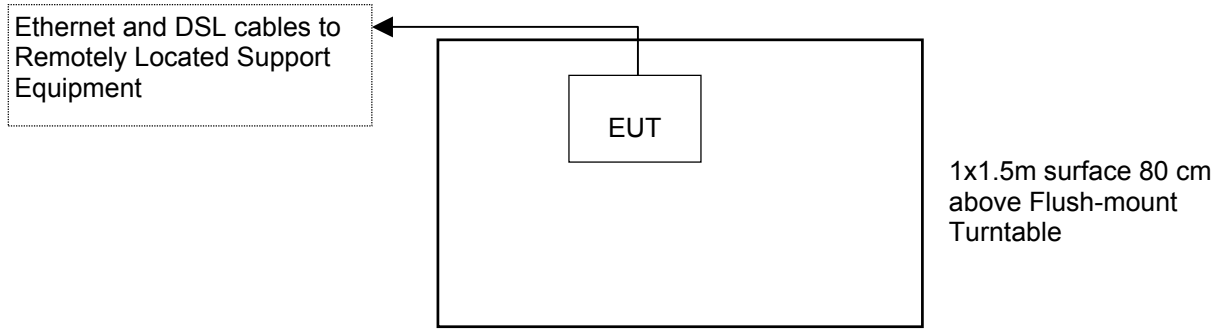
AF = Antenna Factor

CF = Cable Attenuation Factor

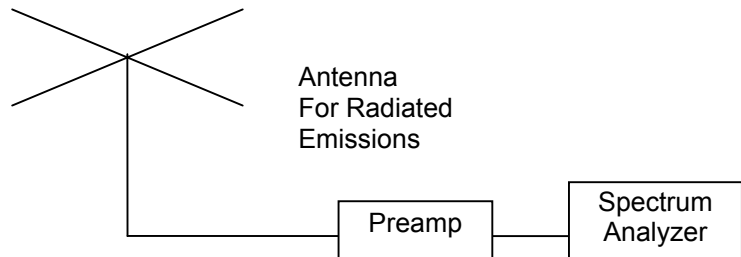
AG = Amplifier Gain

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

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.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

Manufacturer	Westell, Inc.	Specification	FCC 15.247
Model	D90327W15-06	Test Date	October 7, 2005
Serial Number	6881	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	EUT FS dBuV/m	Limit dBuV/m	Margin under limit
802.11b	2412	V	Ave.	1520	46.4	54.0	7.6
802.11b	2412	H	Ave.	1520	44.3	54.0	9.7
802.11b	2412	V	Ave.	2390	51.2	54.0	2.8
802.11b	2412	H	Ave.	2390	46.3	54.0	7.7
802.11b	2412	V	Ave	4824	48.3	54.0	5.7
802.11b	2412	H	Ave.	4824	44.7	54.0	9.3
802.11b	2412	V	Ave.	7236	44.1	54.0	9.9
802.11b	2412	H	Ave.	7236	46.8	54.0	7.2
802.11b	2437	V	Ave.	4874	52.4	54.0	1.6
802.11b	2437	H	Ave.	4874	47.7	54.0	6.3
802.11b	2437	V	Ave.	7311	44.3	54.0	9.7
802.11b	2437	H	Ave.	7311	44.3	54.0	9.7
802.11b	2462	V	Ave.	2483.5	50.7	54.0	3.3
802.11b	2462	H	Ave.	2483.5	48.7	54.0	5.3
802.11b	2462	V	Ave.	4924	50.4	54.0	3.6
802.11b	2462	H	Ave.	4924	46.3	54.0	7.7
802.11b	2462	V	Ave.	7386	46.5	54.0	7.5
802.11b	2462	H	Ave.	7386	46.3	54.0	7.7
802.11b	2412	V	Peak	1520	52.4	74.0	21.6
802.11b	2412	H	Peak	1520	48.0	74.0	26.0
802.11b	2412	V	Peak	2390	70.7	74.0	3.3
802.11b	2412	H	Peak	2390	62.4	74.0	11.6
802.11b	2412	V	Peak	4824	61.2	74.0	12.8
802.11b	2412	H	Peak	4824	58.2	74.0	15.8
802.11b	2412	V	Peak	7236	56.6	74.0	17.4
802.11b	2412	H	Peak	7236	55.9	74.0	18.1
802.11b	2437	V	Peak	4874	63.5	74.0	10.5
802.11b	2437	H	Peak	4874	60.3	74.0	13.7
802.11b	2437	V	Peak	7311	56.3	74.0	17.7
802.11b	2437	H	Peak	7311	56.1	74.0	17.9
802.11b	2462	V	Peak	2483.5	69.6	74.0	4.4
802.11b	2462	H	Peak	2483.5	62.8	74.0	11.2
802.11b	2462	V	Peak	4924	63.1	74.0	10.9
802.11b	2462	H	Peak	4924	57.8	74.0	16.2
802.11b	2462	V	Peak	7386	57.5	74.0	16.5
802.11b	2462	H	Peak	7386	57.2	74.0	16.8

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	EUT FS dBuV/m	Limit dBuV/m	Margin under limit
802.11a	2412	V	Ave.	4824	50.5	54.0	3.5
802.11g	2412	H	Ave.	4824	44.7	54.0	9.3
802.11g	2412	V	Ave.	7236	44.9	54.0	9.1
802.11g	2412	H	Ave.	7236	45.1	54.0	8.9
802.11g	2437	V	Ave.	4874	51.9	54.0	2.1
802.11g	2437	H	Ave.	4874	49.7	54.0	4.3
802.11g	2437	V	Ave.	7311	44.8	54.0	9.2
802.11g	2437	H	Ave.	7311	44.1	54.0	9.9
802.11g	2462	V	Ave.	2483.5	52.9	54.0	1.1
802.11g	2462	H	Ave.	2483.5	48.7	54.0	5.3
802.11g	2462	V	Ave.	4924	49.8	54.0	4.2
802.11g	2462	H	Ave.	4924	45.3	54.0	8.7
802.11g	2462	V	Ave.	7386	43.1	54.0	10.9
802.11g	2462	H	Ave.	7386	44.5	54.0	9.5
802.11g	2412	V	Peak	2390	73.0	74.0	1.0
802.11g	2412	H	Peak	2390	64.2	74.0	9.8
802.11g	2412	V	Peak	4824	61.1	74.0	12.9
802.11g	2412	H	Peak	4824	59.2	74.0	14.8
802.11g	2412	V	Peak	7236	57.4	74.0	16.6
802.11g	2412	H	Peak	7236	56.7	74.0	17.3
802.11g	2437	V	Peak	4874	62.9	74.0	11.1
802.11g	2437	H	Peak	4874	59.7	74.0	14.3
802.11g	2437	V	Peak	7311	54.3	74.0	19.7
802.11g	2437	H	Peak	7311	54.3	74.0	19.7
802.11g	2462	V	Peak	2483.5	73.1	74.0	0.9
802.11g	2462	H	Peak	2483.5	63.2	74.0	10.8
802.11g	2462	V	Peak	4924	61.0	74.0	13.0
802.11g	2462	H	Peak	4924	58.5	74.0	15.5
802.11g	2462	V	Peak	7386	57.6	74.0	16.4
802.11g	2462	H	Peak	7386	57.0	74.0	17.0

Judgment: Passed by 0.9 dB

No other emissions were detected in the restricted bands.

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model D90327W15-06, VersaLink Wireless Gateway Router

Emissions Below 1 GHz

Test Date : 10-07-2005

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
62.8	35.1 P	10.2	H/44	-17.1	28.2	40.0	11.8
92.4	35.4 P	8.8	H/44	-16.7	27.5	43.5	16.0
150.0	39.2 P	12.1	H/44	-16.1	35.2	43.5	8.3
162.0	38.8 P	8.7	H/44	-16.0	31.5	43.5	12.0
210.8	41.8 P	10.8	H/44	-15.6	37.0	43.5	6.5
249.2	41.5 P	12.9	H/44	-15.3	39.1	46.0	6.9
316.4	35.8 P	13.8	H/44	-14.9	34.8	46.0	11.2
373.2	32.7 P	15.7	H/44	-14.6	33.8	46.0	12.2
424.0	31.6 P	17.4	H/44	-14.3	34.7	46.0	11.3
530.2	34.3 P	17.9	H/44	-13.4	38.8	46.0	7.2
544.0	33.4 P	17.9	H/44	-13.3	38.0	46.0	8.0
616.7	31.9 P	19.3	H/44	-12.7	38.5	46.0	7.5
635.9	34.0 Q	19.4	H/44	-12.6	40.8	46.0	5.2
674.8	32.6 P	20.5	H/44	-12.3	40.8	46.0	5.2
37.7	34.5 P	15.6	V/44	-17.6	32.5	40.0	7.5
62.2	43.2 Q	10.8	V/44	-17.1	36.9	40.0	3.1
63.7	39.9 P	10.3	V/44	-17.1	33.1	40.0	6.9
72.9	39.2 P	7.5	V/44	-17.0	29.7	40.0	10.3
82.1	44.2 P	7.0	V/44	-16.8	34.3	40.0	5.7
94.4	44.3 Q	9.0	V/44	-16.7	36.7	43.5	6.8
101.7	42.4 P	11.7	V/44	-16.6	37.5	43.5	6.0
104.2	42.7 Q	11.9	V/44	-16.6	38.0	43.5	5.5
114.0	40.8 P	12.4	V/44	-16.5	36.7	43.5	6.8
125.2	40.0 P	10.5	V/44	-16.3	34.1	43.5	9.4
177.2	39.2 P	10.3	V/44	-15.9	33.6	43.5	9.9
211.6	39.8 P	11.1	V/44	-15.6	35.3	43.5	8.2
212.0	43.5 P	11.2	V/44	-15.6	39.1	43.5	4.4
250.0	42.2 P	12.8	V/44	-15.3	39.7	46.0	6.3
299.6	34.6 P	13.3	V/44	-15.0	32.9	46.0	13.1
317.2	35.0 P	14.2	V/44	-14.9	34.3	46.0	11.7
375.0	36.1 P	15.9	V/44	-14.6	37.4	46.0	8.6
482.8	33.1 P	17.3	V/44	-13.8	36.6	46.0	9.4
500.0	33.5 P	17.2	V/44	-13.7	37.1	46.0	8.9
530.8	34.8 P	18.3	V/44	-13.4	39.7	46.0	6.3
625.0	29.7 P	19.2	V/44	-12.7	36.2	46.0	9.8
635.2	30.8 P	19.6	V/44	-12.6	37.9	46.0	8.1
798.4	30.0 P	20.8	V/44	-11.3	39.6	46.0	6.4

Judgment: Passed by 3.1 dB

All detected frequencies below 1 GHz were listed herein, not just the restricted bands.