



Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

ULS3 w/Ikanos Gateway with WIFI, Model A90-9100VM15-10

Radiometrics Document RP-5986B



Product Detail:

FCC ID: CH89100VMXX-10

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: 2007

Industry Canada RSS-210, Issue 7: 2007 as required for Category I Equipment

This report concerns: Measurement and Test Data for Original Filing
FCC Part 15.247

Tests Performed For:

Westell, Inc.

750 West Commons Dr.
Aurora, IL 60504

Test Facility:

Radiometrics Midwest Corporation

12 East Devonwood
Romeoville, IL 60446

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

Feb 26, 27 and 28, 2007

Document RP-5986B Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	November 30, 2007		

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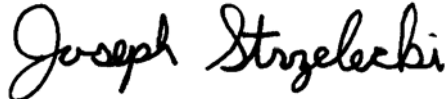
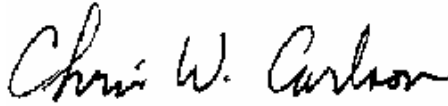
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Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Westell, Inc., ULS3 w/Ikanos VDSL2 Gateway Model: A90-9100VM15-10 Serial Number: 07BS02540641 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> Feb. 26, 2007	<i>Test Date(s): (Month-Day-Year)</i> Feb 26, 27 and 28, 2007
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Robert Tarasewicz Westell, Inc.
<i>Radiometrics' Personnel Responsible for Test:</i>  <hr/> Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	<i>Test Report Approved By</i>  <hr/> Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a ULS3 w/Ikanos VDSL2 Gateway, Model A90-9100VM15-10, 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	FCC Part 15	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	FCC Part 15	Pass

Spread Spectrum Transmitter Requirements

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

2.1 RF Exposure Compliance Requirements

Since The peak power output is 280 mW, The EUT meets the FCC requirement for RF exposure. There are no power level adjustments and the antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a ULS3 w/Ikanos VDSL2 Gateway, Model A90-9100VM15-10 with a Rev C PCB, manufactured by Westell, Inc. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 Antenna Requirements

The antenna uses a reverse polarity SMA Connector. The connector is not readily available to public. Therefore it meets the 15.203 Requirement.

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 as a remotely located device. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply. The identifications 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	ULS3 w/Ikanos VDSL2 Gateway	E	Westell, Inc.	A90-9100VM15-10	07BS05628762
2	Ikanos ULS3 Gateway (MoCA LAN)	S	Westell, Inc	A90-9100VM15-10	4027
3	Four Wirespeed dual connect routers	S	Westell, Inc.	B90-610014-06 B90-610010-06 B90-610010-06 B90-610010-06	04B401594590 04BS2052816 04B410939898 00001
4	Notebook Computer (Ethernet port)	S	Compaq	Presario 1688	1456VQLIN
5	Notebook Computer (WiFi client)	S	Dell	Inspiron 7000	0009795D
6	Power Supply	E	Amigo	AM1201500D	None

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

List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	AC Cord	#7	No
5	15.2	Ethernet Cable	#1 to #4 and #5	No
1	20.0	75 Ohm Coax cable	#1 and #2	Yes
1	15.0	RJ11 Twisted Pair Cable	#1 to #3	No

4.2 Special Accessories

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

4.3 Equipment Modifications

The following 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	2007	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
IC RSS-210 Issue 7	2007	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 2	2007	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)
FCC DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
FCC 558074	2005	Measurement of Digital Transmission Systems Operating under Section 15.247

The test procedures used are in accordance with the FCC DA 00-705, <or> FCC 558074, Industry Canada RSS-212 and ANSI document C63.4-2003, "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.org).

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

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

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

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

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

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 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 US1065. The FCC test site Registration Number is 732175. 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.	12/27/06
AMP-12	MITEQ	Pre-amplifier	AM-1431	530935	0.01-1000MHz	12 Mo.	12/27/06
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo.	12/27/06
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/29/06
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/24/06
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/12/05
HPF-03	Mini-Circuits	High Pass Filter	VHP-39	HPF-03	3-10 GHz	12 Mo.	02/08/07
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	05/03/07
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	05/03/07
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	06/20/06
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	02/07/07
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	01/17/07
REC-08	Hewlett Packard	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	12 Mo.	07/05/06
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 Mo.	03/31/06

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

10.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 7.2.2.

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.

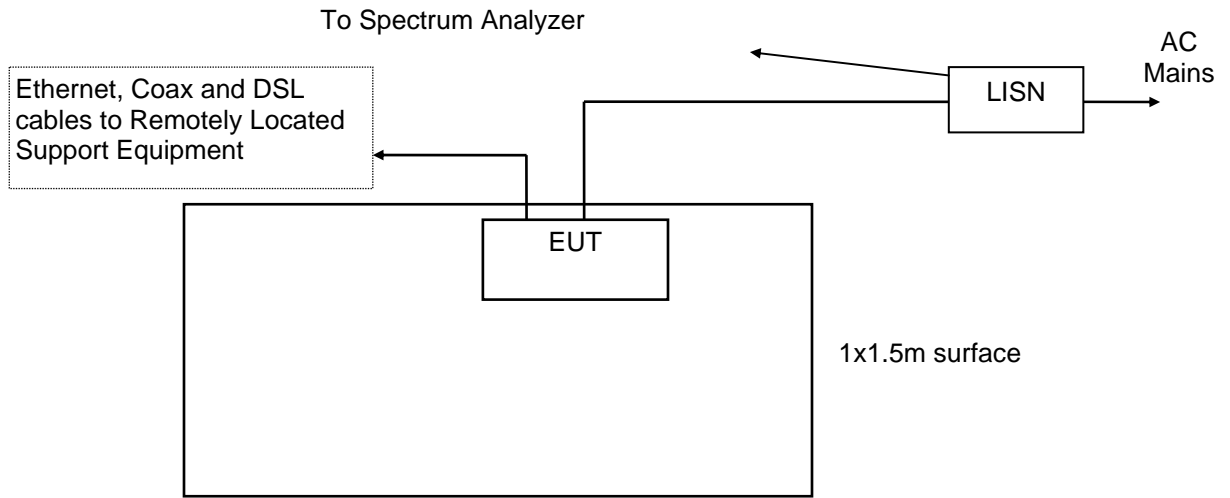
The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from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

Test Date: February 28, 2007

Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Neutral	0.15	54.67	66.00	30.43	56.00
AC Neutral	0.20	52.99	63.77	27.07	53.77
AC Neutral	0.26	52.65	61.58	24.89	51.58
AC Neutral	0.35	52.18	59.02	22.23	49.02
AC Neutral	0.37	51.91	58.46	23.57	48.46
AC Neutral	0.46	45.11	56.73	20.53	46.73
AC Neutral	6.07	37.43	60.00	34.58	50.00
AC Neutral	17.69	36.63	60.00	29.99	50.00
AC Neutral	21.66	41.43	60.00	36.95	50.00
AC Hot	0.15	54.67	66.00	30.43	56.00
AC Hot	0.20	52.99	63.77	27.07	53.77
AC Hot	0.26	53.28	61.58	24.89	51.58
AC Hot	0.35	53.04	59.02	22.23	49.02
AC Hot	0.37	53.21	58.46	23.57	48.46
AC Hot	0.46	45.11	56.73	20.53	46.73
AC Hot	6.07	37.43	60.00	34.58	50.00
AC Hot	17.69	36.63	60.00	29.99	50.00
AC Hot	21.66	41.43	60.00	36.95	50.00

The Amplitude is the final corrected value with cable and LISN Loss.
 Judgment: Passed by 5.25 dB

Figure 1. Conducted Emissions Test Setup



Notes:

- 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.

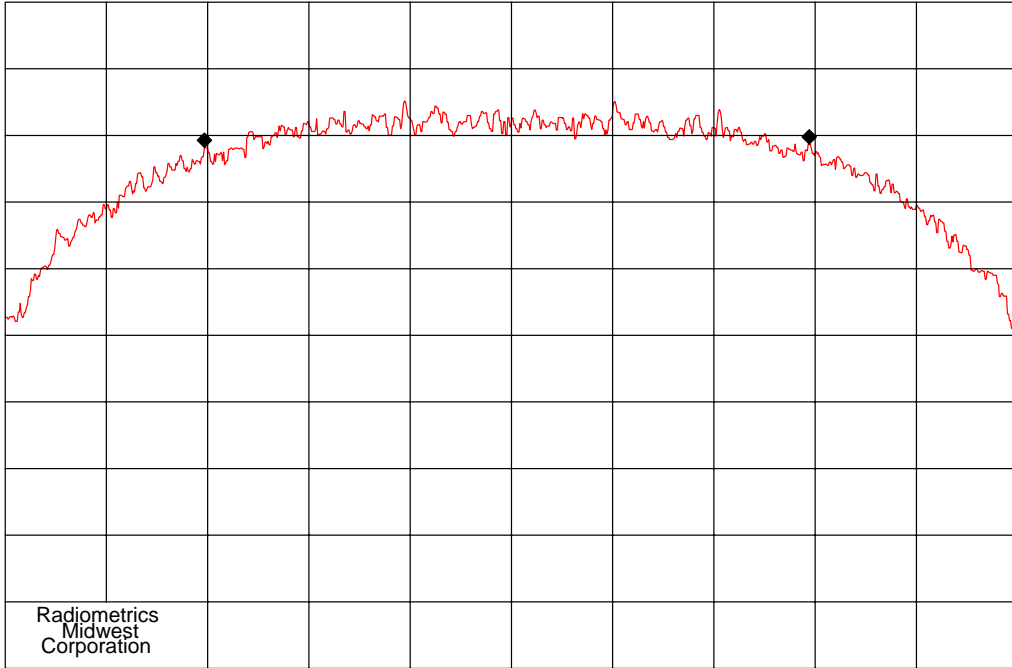
The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 6 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission. The Bandwidth is required to be at least 500 kHz. As can be seen, the lowest bandwidth is 12.0 MHz.

Channel	802.11b	802.11g
	6 dB EBW MHz	6 dB EBW MHz
1	12.0	16.5
6	12.2	16.6
11	12.5	16.7

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MKR Delta -11.96 MHz -0.50 dB



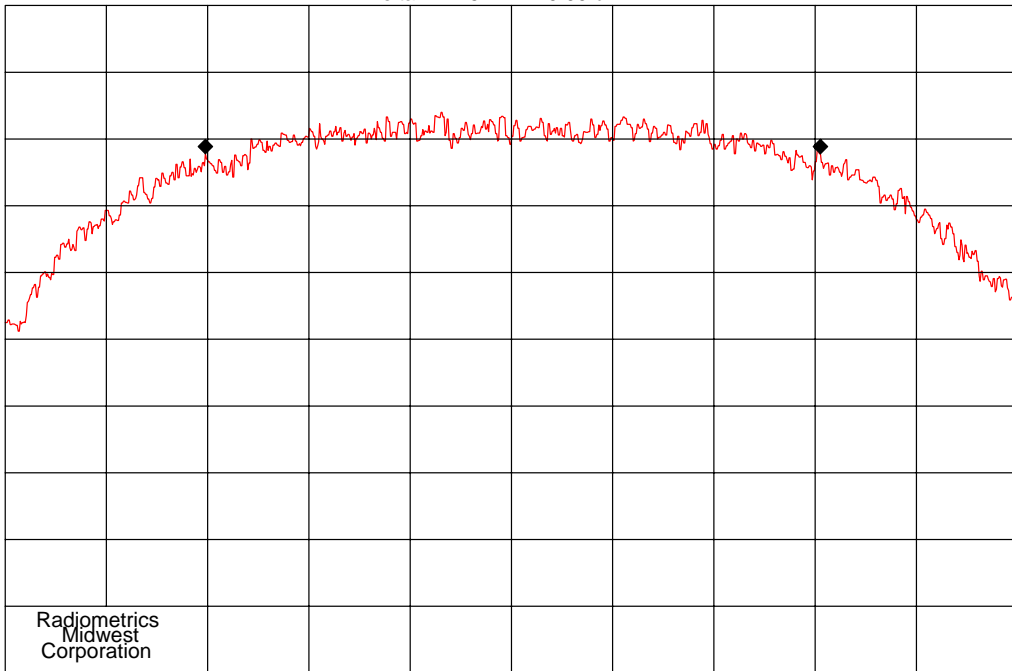
COMPANY : Westell
 CENTER 2.412 0 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : 6 dB Bandwidth, 802.11b; Ch 1

ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 09:49

DATE : 02-26-2007
 SPAN 20.0 MHz
 ATTEN 30 dB
 SWP 20.0 msec

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MKR Delta 12.16 MHz 0.00 dB



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

ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 09:51

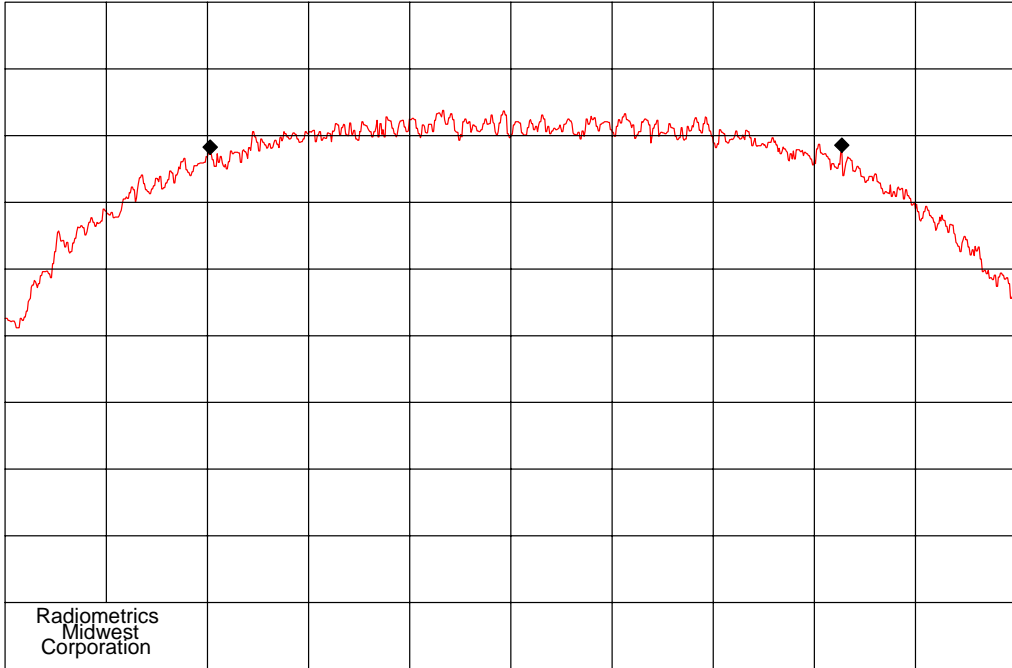
DATE : 02-26-2007
 SPAN 20.0 MHz
 ATTEN 30 dB
 SWP 20.0 msec

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MKR Delta -12.50 MHz -0.30 dB



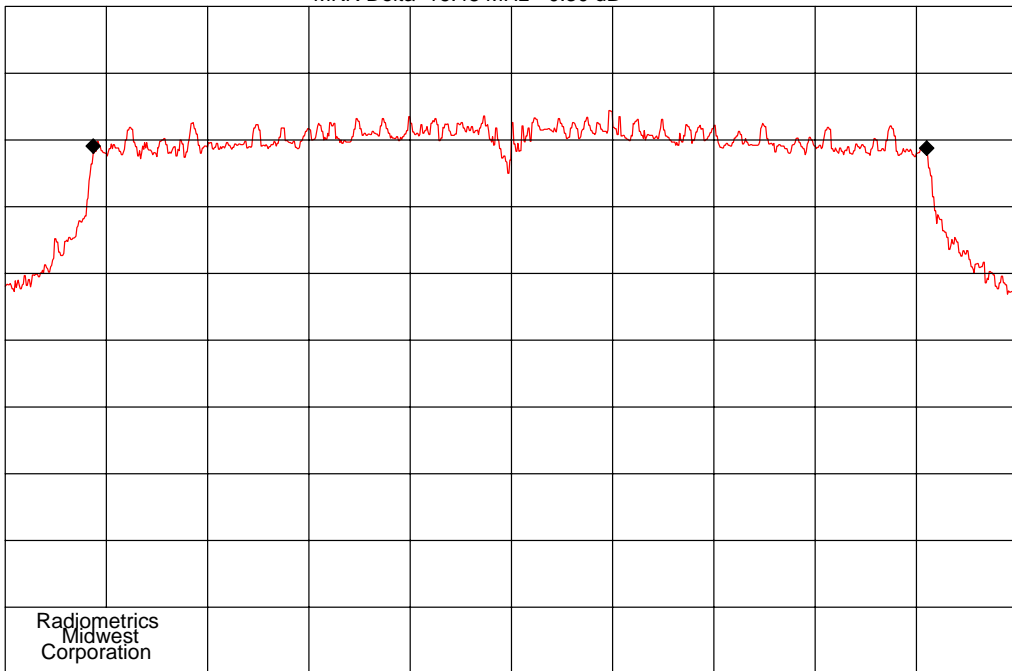
COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, 802.11b; Ch 11

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 09:57

DATE : 02-26-2007
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

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MKR Delta 16.48 MHz -0.30 dB



COMPANY : Westell
CENTER 2.412 0 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, 802.11g; Ch 1

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 09:45

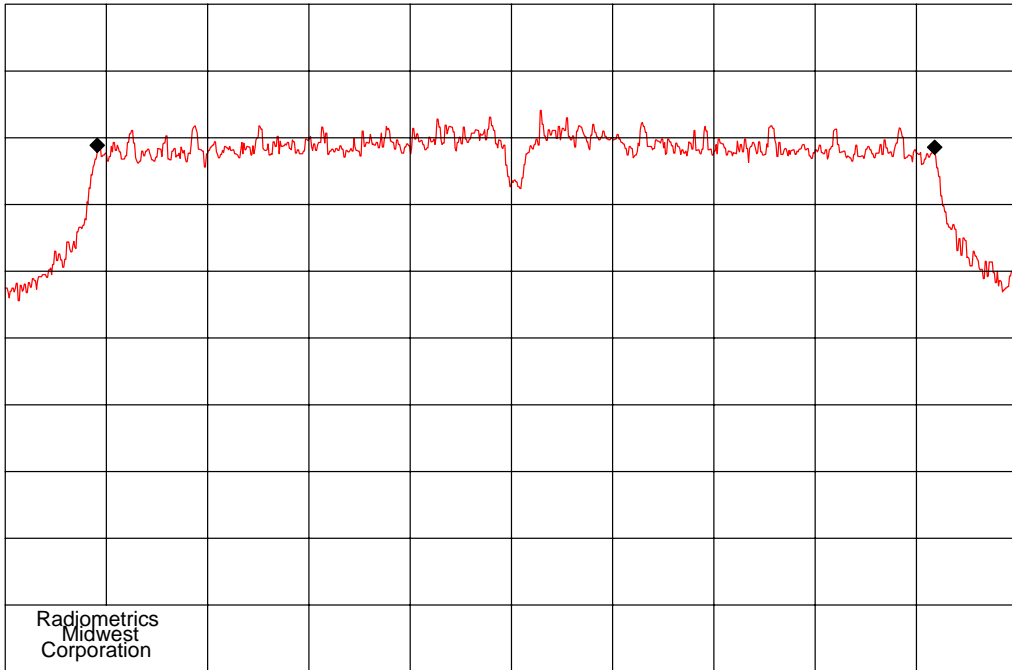
DATE : 02-26-2007
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

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MKR Delta 16.56 MHz -0.30 dB

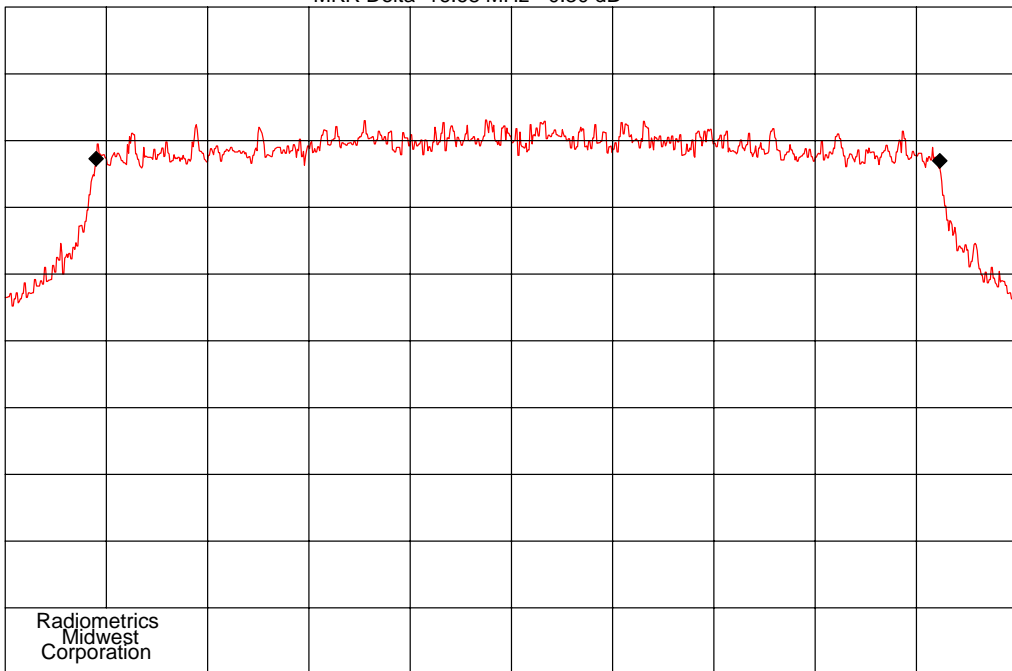


COMPANY : Westell
CENTER 2.437 0 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, 802.11g; Ch 6

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 09:53

DATE : 02-26-2007
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

MKR Delta 16.68 MHz -0.30 dB



COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, 802.11g; Ch 11

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 09:55

DATE : 02-26-2007
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

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10.3 Peak Output Power

The EUT antenna port was connected to the spectrum analyzer Via a low loss coaxial cable. 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 = 20 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. The BW correction factor is $10 \cdot \log(BW)$. Note 30 dBm = 1 watt. Since the gain of the antenna is always less than 6 dB, the limit is not reduced.

Mode	Freq. (MHz)	Reading (dBm)	BW Corr Factor (dB)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
					dBm	Watts	
802.11b	2412	11.8	10.8	0.3	22.9	0.194	30
802.11b	2437	11.6	10.8	0.3	22.7	0.188	30
802.11b	2462	11.5	11.0	0.3	22.8	0.189	30
802.11g	2412	12.1	12.2	0.3	24.6	0.286	30
802.11g	2437	11.9	12.2	0.3	24.4	0.275	30
802.11g	2462	11.7	12.2	0.3	24.2	0.264	30

Judgement: Pass by 5.4 dB

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	-9.4	0.3	-9.1	8.0
802.11b	2437	-9.4	0.3	-9.1	8.0
802.11b	2462	-9.6	0.3	-9.3	8.0
802.11g	2412	-10.4	0.3	-10.1	8.0
802.11g	2437	-10.6	0.3	-10.3	8.0
802.11g	2462	-10.8	0.3	-10.5	8.0

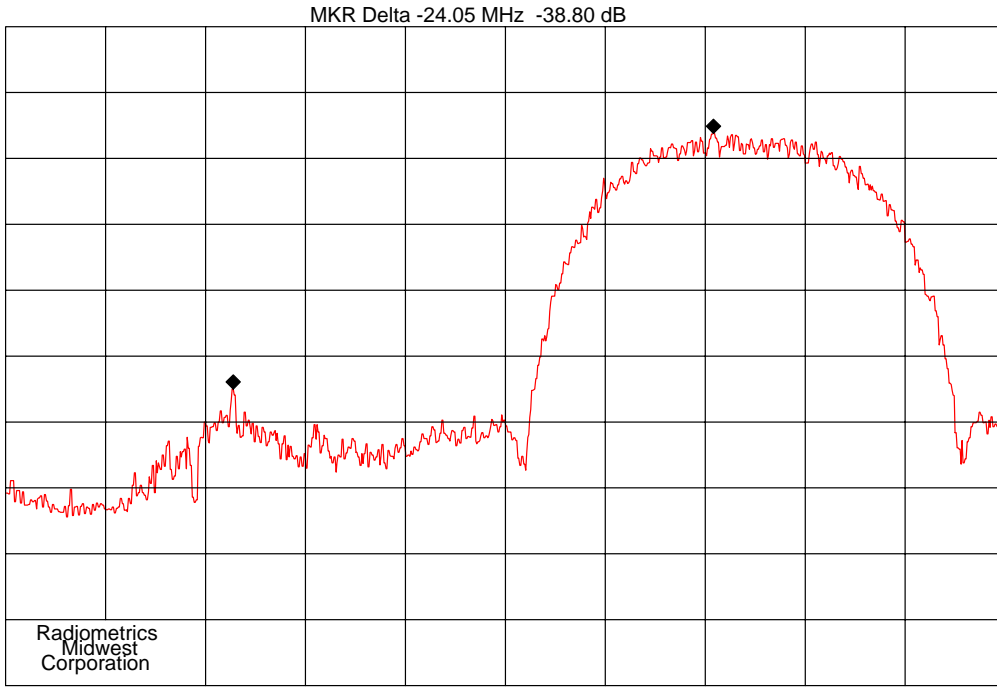
Judgement: Pass by 17.1 dB

10.5 Band-edge Compliance of RF Conducted Emissions

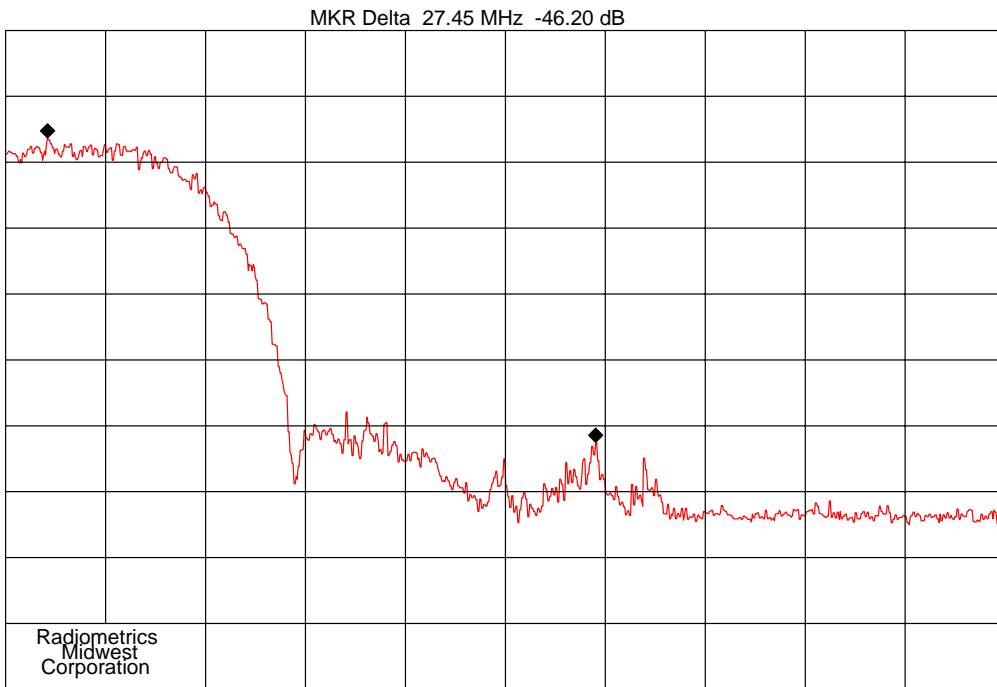
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize.

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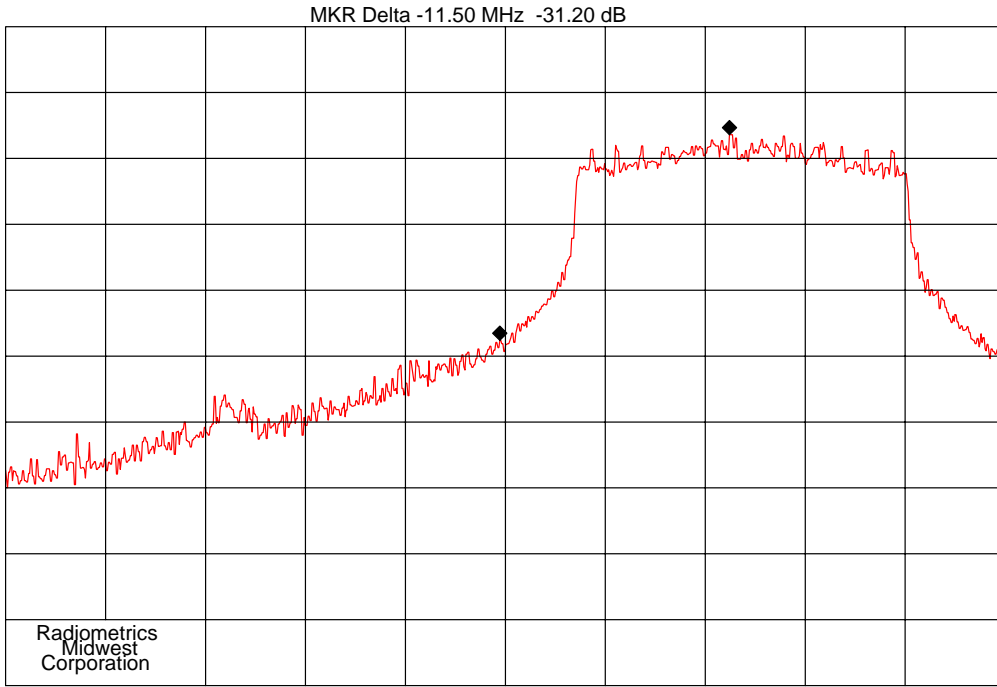
COMPANY : Westell	ITEM : A90-9100VM15-10	DATE : 02-26-2007
CENTER 2.400 0 GHz	REF 20.0 dBm	SPAN 50.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 10:47	SWP 20.0 msec
NOTES : Band Edge, 802.11b; Ch 1		



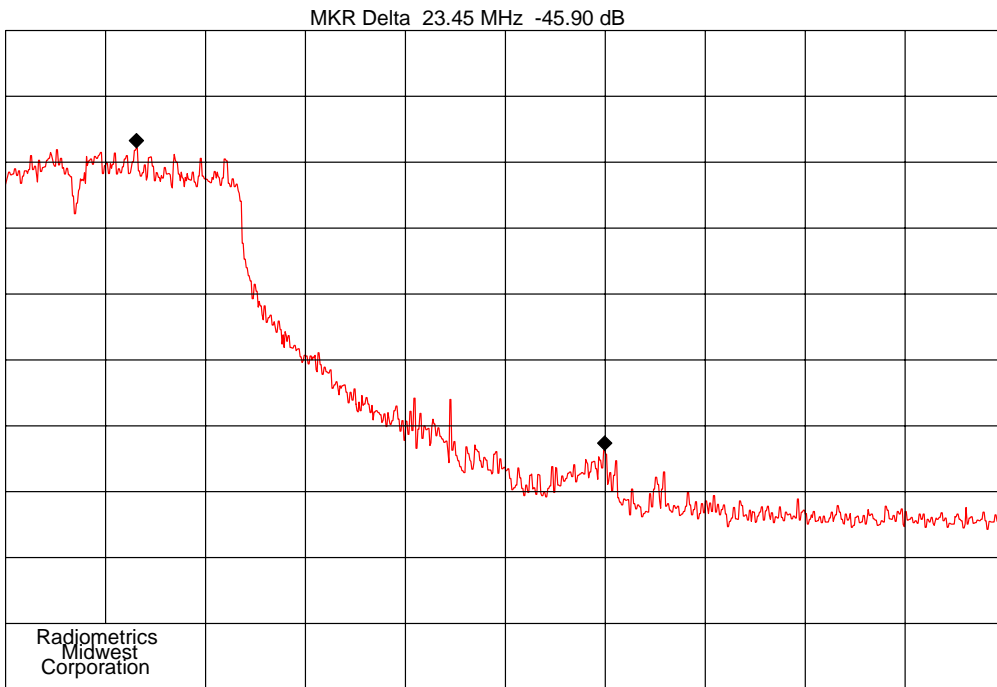
COMPANY : Westell	ITEM : A90-9100VM15-10	DATE : 02-26-2007
CENTER 2.483 5 GHz	REF 20.0 dBm	SPAN 50.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 10:41	SWP 20.0 msec
NOTES : Band Edge, 802.11b; Ch 11		

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway



COMPANY : Westell CENTER 2.400 0 GHz RES BW 100 kHz 10 dB/ NOTES : Band Edge, 802.11g; Ch 1	ITEM : A90-9100VM15-10 REF 20.0 dBm VBW 300 kHz TIME : 10:45	DATE : 02-26-2007 SPAN 50.0 MHz ATTEN 30 dB SWP 20.0 msec
---	---	--

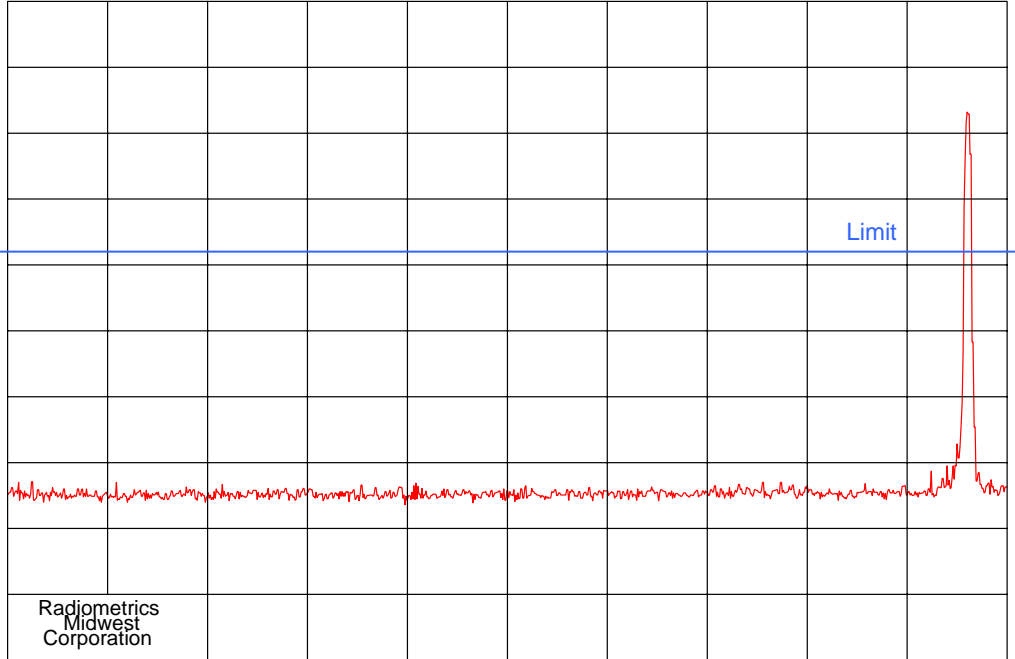


COMPANY : Westell CENTER 2.483 5 GHz RES BW 100 kHz 10 dB/ NOTES : Band Edge, 802.11g; Ch 11	ITEM : A90-9100VM15-10 REF 20.0 dBm VBW 300 kHz TIME : 10:43	DATE : 02-26-2007 SPAN 50.0 MHz ATTEN 30 dB SWP 20.0 msec
--	---	--

Judgement: Pass by 18.8 dB (the Delta should be at least 20 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.



Radiometrics
Midwest
Corporation

COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/

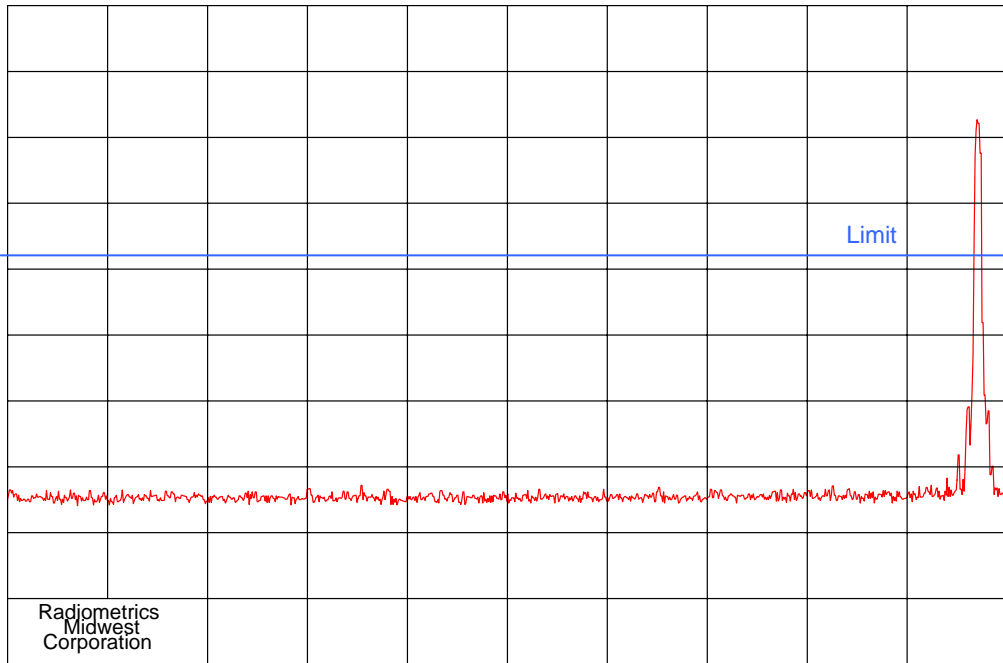
ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 13:37

DATE : 02-26-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec

NOTES : Antenna Cond Em, 802.11b; Ch 1

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

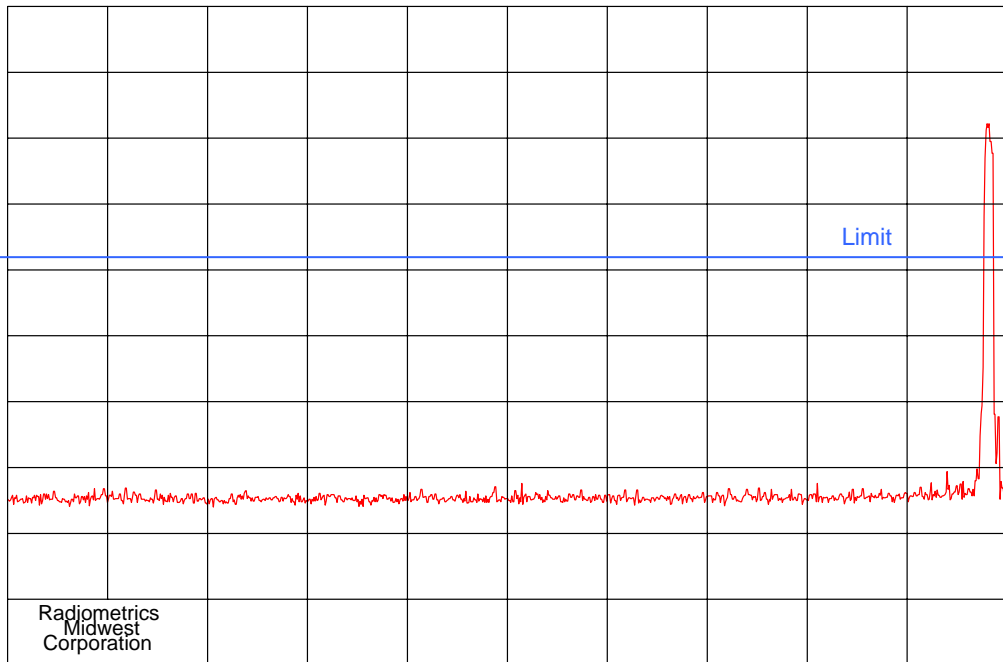
Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway



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

ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:39

DATE : 02-26-2007
 STOP 2.50 GHz
 ATTEN 30 dB
 SWP 750 msec



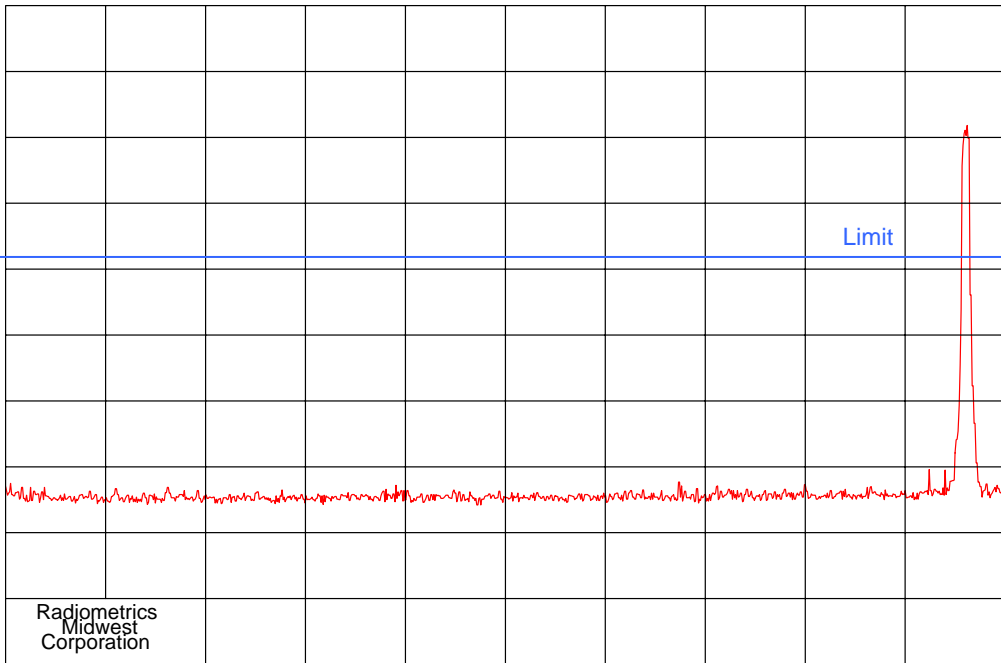
COMPANY : Westell
 START 1 MHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, 802.11b; Ch 11

ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:40

DATE : 02-26-2007
 STOP 2.50 GHz
 ATTEN 30 dB
 SWP 750 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

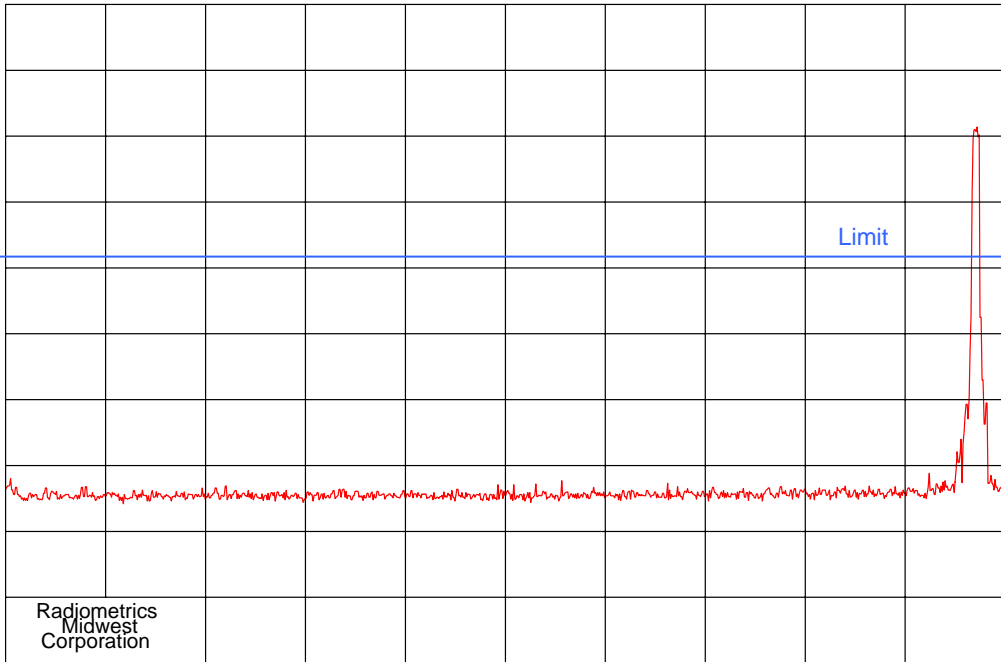
Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway



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

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 13:42

DATE : 02-26-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



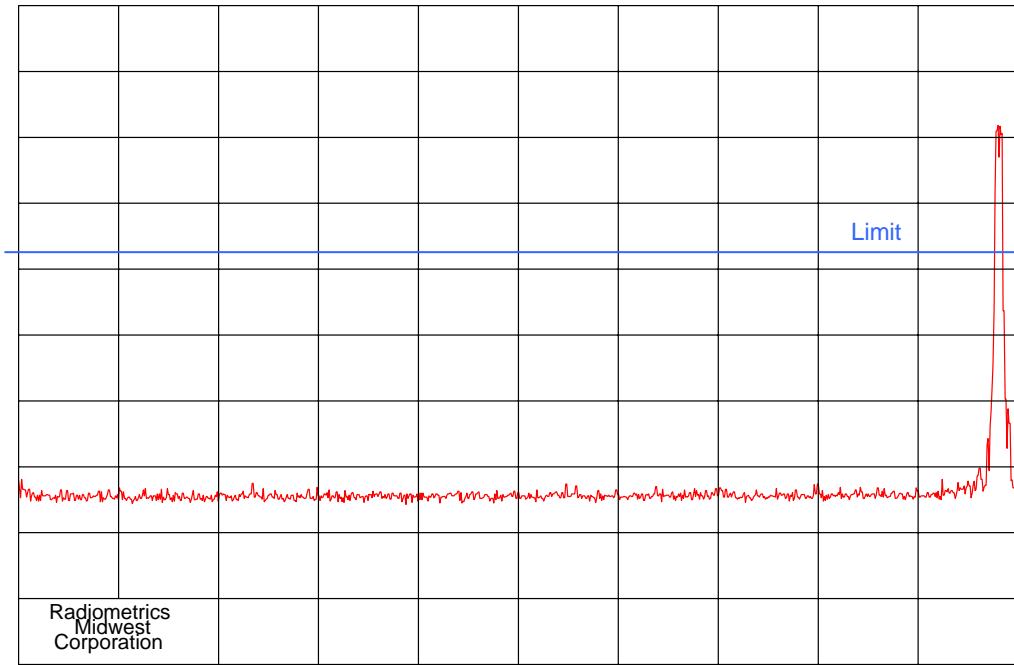
COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Cond Em, 802.11g; Ch 6

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 13:44

DATE : 02-26-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

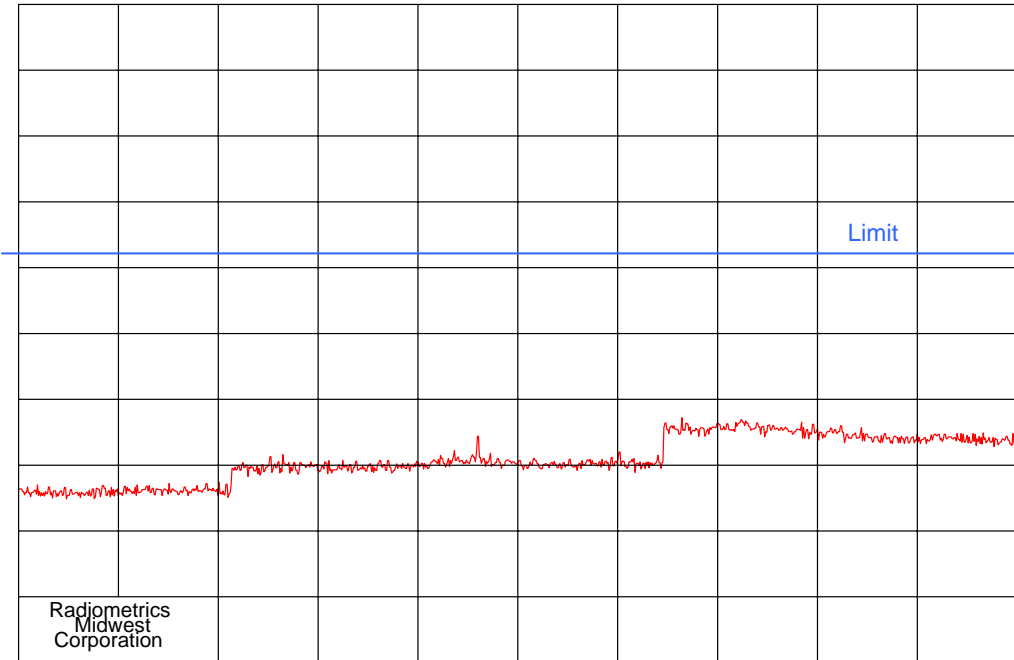


Radiometrics
Midwest
Corporation

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

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 13:46

DATE : 02-26-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



Radiometrics
Midwest
Corporation

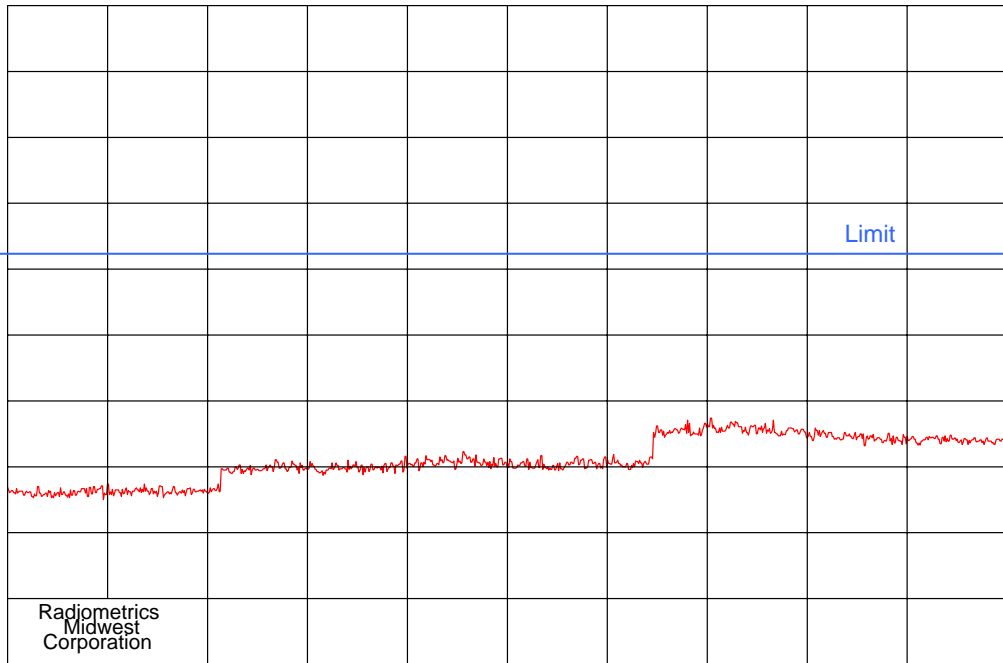
COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Cond Em, 802.11b; Ch 1

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 13:21

DATE : 02-26-2007
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

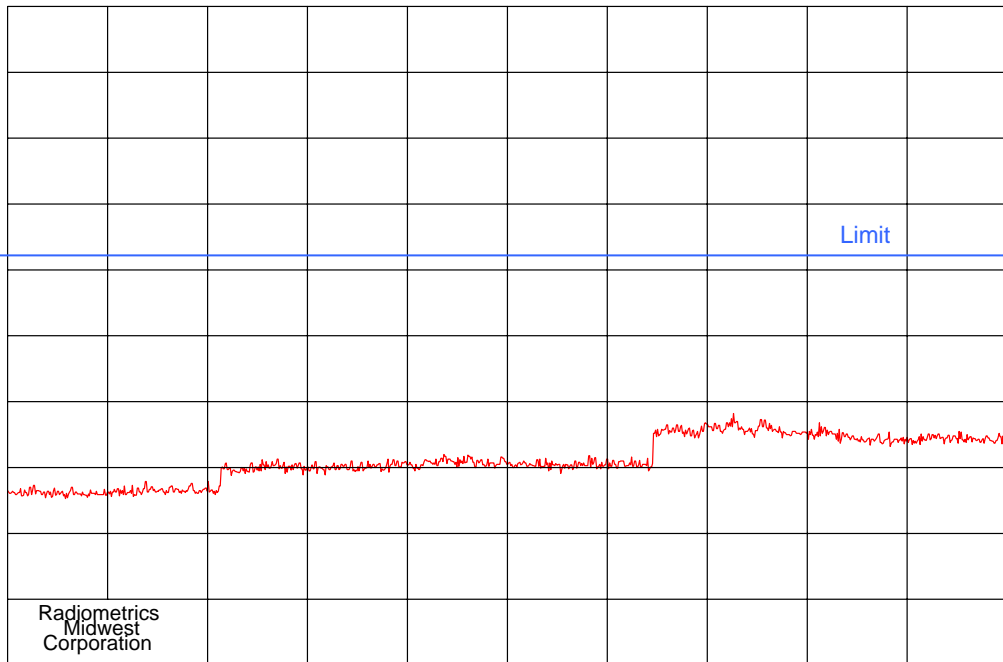


COMPANY : Westell
 START 2.5 GHz
 RES BW 100 kHz
 10 dB/

ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:24

DATE : 02-26-2007
 STOP 18.0 GHz
 ATTEN 30 dB
 SWP 4.65 sec

NOTES : Antenna Cond Em, 802.11b; Ch 6



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

ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:27

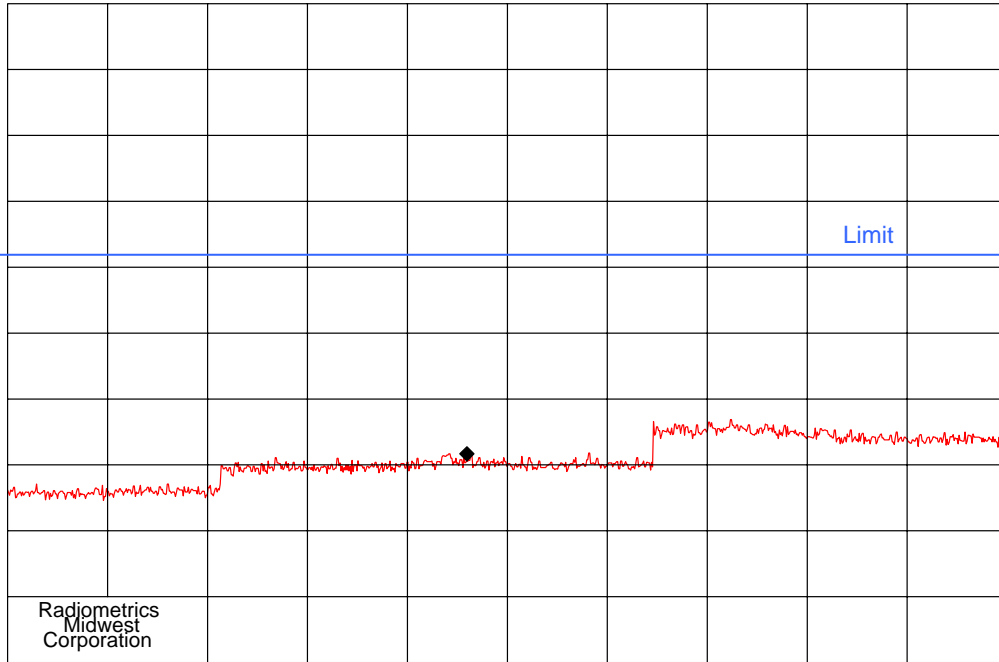
DATE : 02-26-2007
 STOP 18.0 GHz
 ATTEN 30 dB
 SWP 4.65 sec

NOTES : Antenna Cond Em, 802.11b; Ch 11

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

MKR 9.61 GHz -49.40 dBm



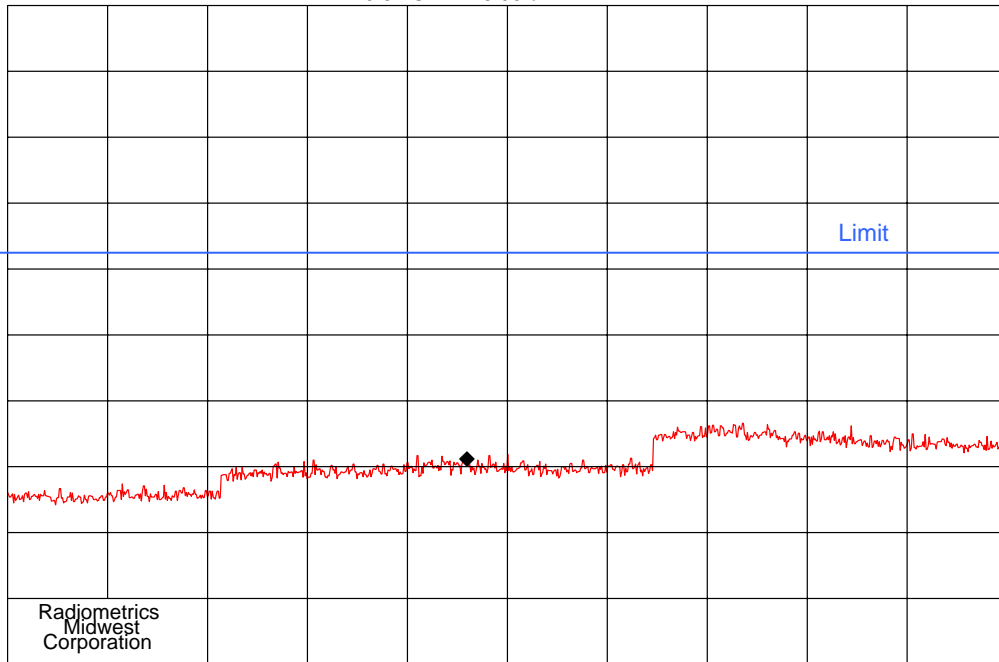
COMPANY : Westell
 START 2.5 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, 802.11g; Ch 1

ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:33

DATE : 02-26-2007
 STOP 18.0 GHz
 ATTEN 30 dB
 SWP 4.65 sec

Radiometrics
 Midwest
 Corporation

MKR 9.61 GHz -49.90 dBm



COMPANY : Westell
 START 2.5 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, 802.11g; Ch 6

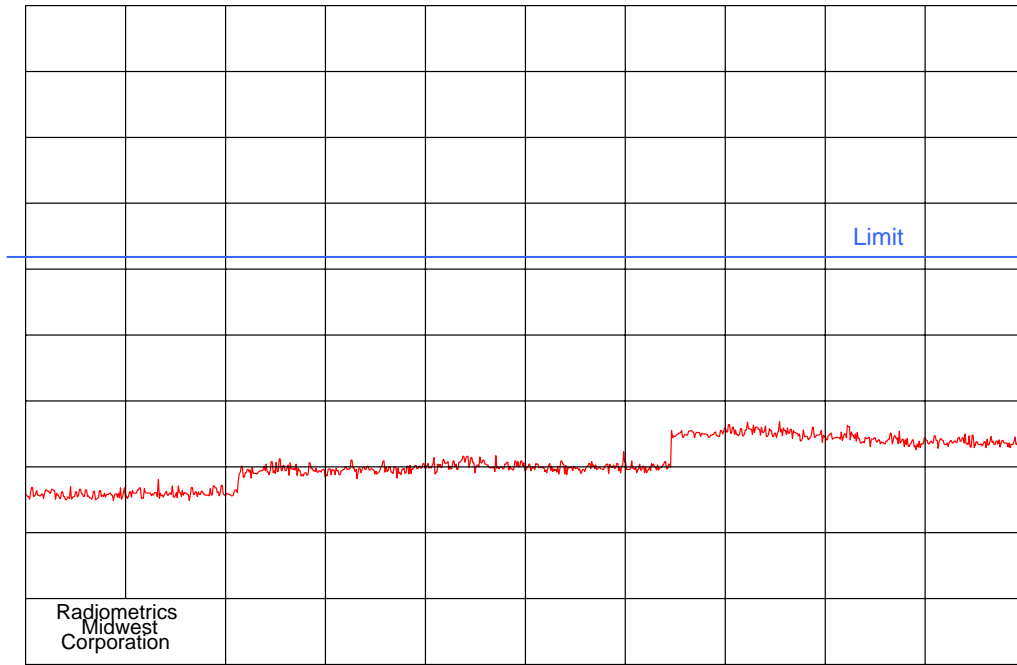
ITEM : A90-9100VM15-10
 REF 20.0 dBm
 VBW 300 kHz
 TIME : 13:34

DATE : 02-26-2007
 STOP 18.0 GHz
 ATTEN 30 dB
 SWP 4.65 sec

Radiometrics
 Midwest
 Corporation

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

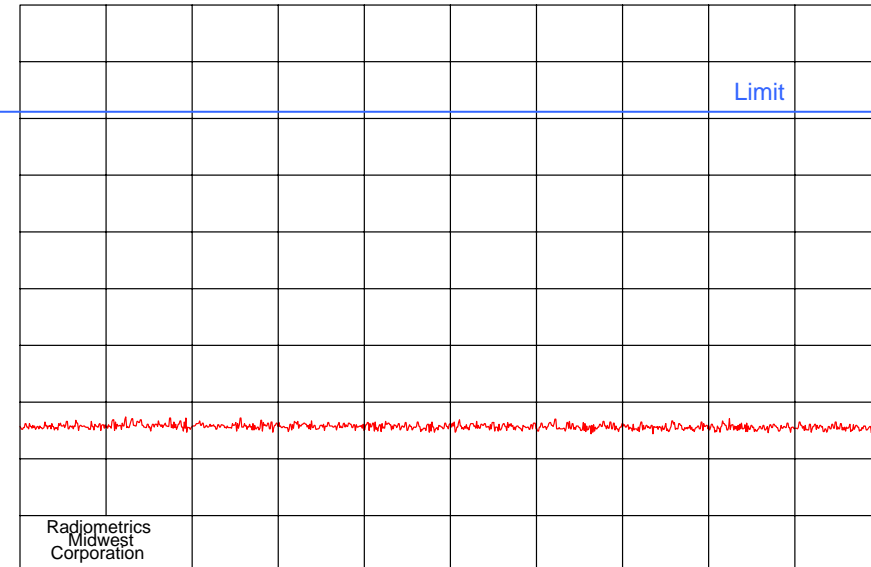


Radiometrics
Midwest
Corporation

COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Cond Em, 802.11g; Ch 11

ITEM : A90-9100VM15-10
REF 20.0 dBm
VBW 300 kHz
TIME : 13:35

DATE : 02-26-2007
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



Radiometrics
Midwest
Corporation

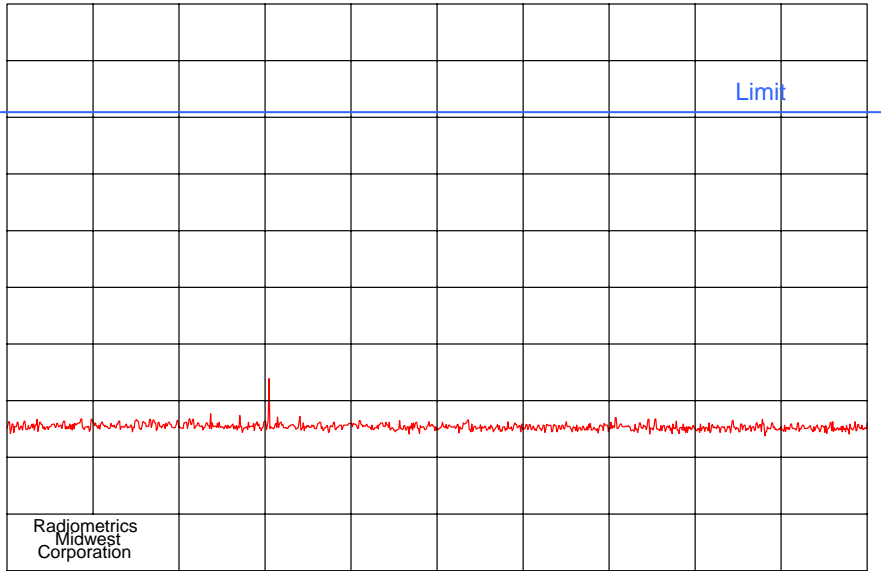
COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Cond Em, 802.11b; Ch 1

ITEM : A90-9100VM15-10
REF 0.0 dBm
VBW 300 kHz
TIME : 14:51

DATE : 02-26-2007
STOP 25.00 GHz
HARMONIC 6L
SWP 2.10 sec

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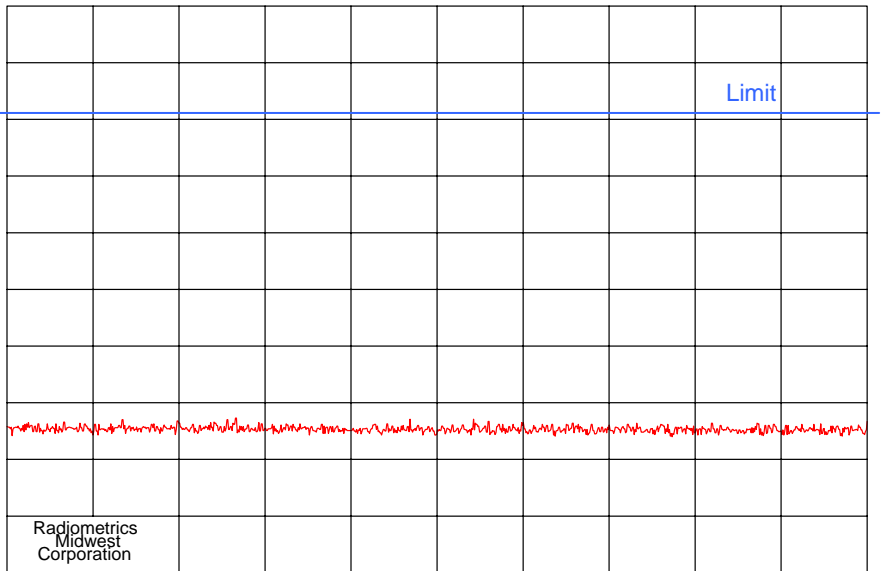
Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway



COMPANY : Westell
 START 18.00 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, 802.11b; Ch 6

ITEM : A90-9100VM15-10
 REF 0.0 dBm
 VBW 300 kHz
 TIME : 14:40

DATE : 02-26-2007
 STOP 25.00 GHz
 HARMONIC 6L
 SWP 2.10 sec



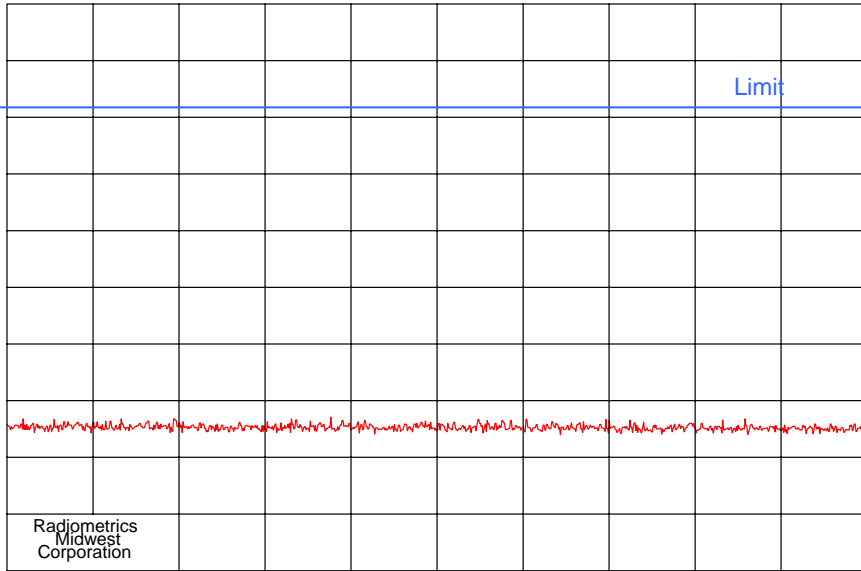
COMPANY : Westell
 START 18.00 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, 802.11b; Ch 11

ITEM : A90-9100VM15-10
 REF 0.0 dBm
 VBW 300 kHz
 TIME : 14:42

DATE : 02-26-2007
 STOP 25.00 GHz
 HARMONIC 6L
 SWP 2.10 sec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

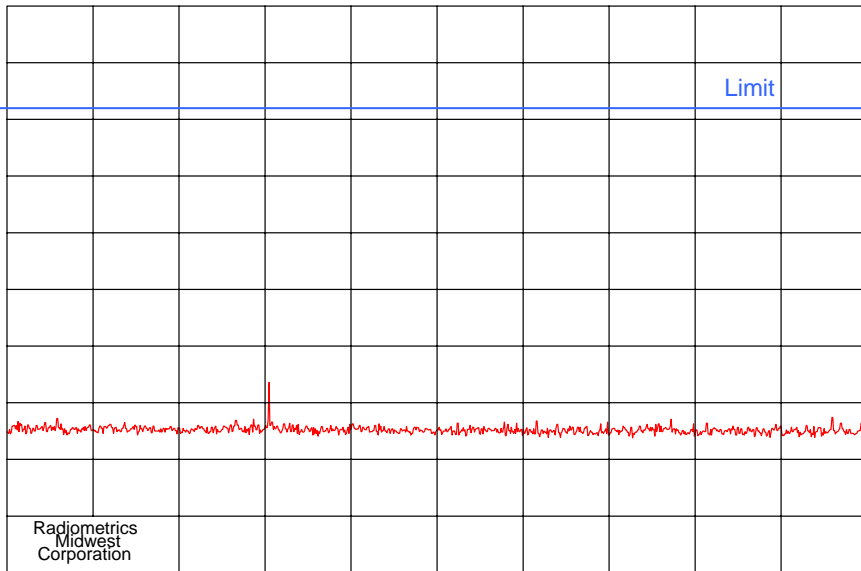
Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway



COMPANY : Westell
 START 18.00 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, 802.11g; Ch 1

ITEM : A90-9100VM15-10
 REF 0.0 dBm
 VBW 300 kHz
 TIME : 14:43

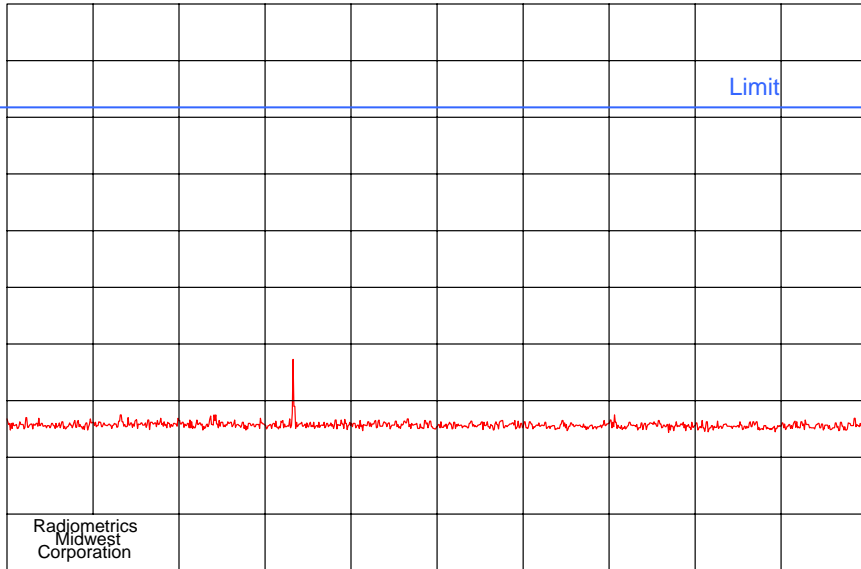
DATE : 02-26-2007
 STOP 25.00 GHz
 HARMONIC 6L
 SWP 2.10 sec



COMPANY : Westell
 START 18.00 GHz
 RES BW 100 kHz
 10 dB/
 NOTES : Antenna Cond Em, 802.11g; Ch 6

ITEM : A90-9100VM15-10
 REF 0.0 dBm
 VBW 300 kHz
 TIME : 14:44

DATE : 02-26-2007
 STOP 25.00 GHz
 HARMONIC 6L
 SWP 2.10 sec



Radiometrics
Midwest
Corporation

COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Cond Em, 802.11g; Ch 11

ITEM : A90-9100VM15-10
REF 0.0 dBm
VBW 300 kHz
TIME : 14:46

DATE : 02-26-2007
STOP 25.00 GHz
HARMONIC 6L
SWP 2.10 sec

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

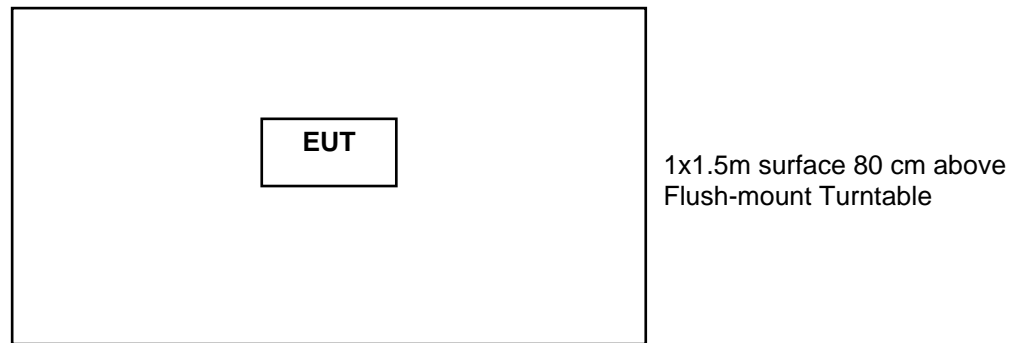
AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

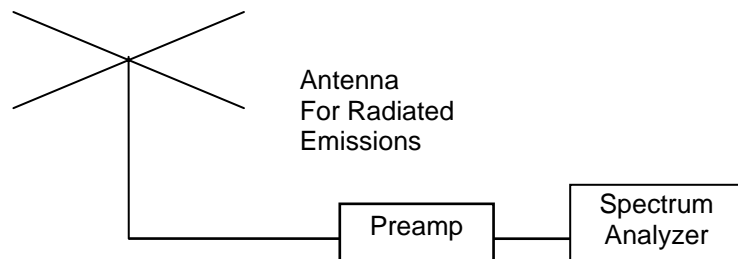
HPF = High pass Filter Loss

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 (2 to 25 GHz)

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 A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	A90-9100VM15-10	Test Date	2/27/2007
Serial Number	07B402910504	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain – Duty Cycle Factor + HP Filter Loss		

hrm #	Tx Freq	Ant Pol.	802.11b		802.11g		Corr . Fact. dB	EUT Emission Freq MHz	Field Strength from EUT		Field Strength Limit		Margin Under Limit dB
			Peak Analyzer	Ave RDG	Peak dBuV	Ave dBuV			Peak dBuV/m	Ave dBuV/m	Peak dBuV/m	Ave dBuV/m	
be	2412	V	59.5	35.9	61.2	40.3	9.4	2389	70.6	49.7	74	54	3.4
be	2412	H	50.3	33.0	56.3	32.0	9.4	2390	65.7	42.4	74	54	8.3
2	2412	V	48.5	33.8	38.9	30.1	10.3	4824	58.8	44.1	74	54	9.9
2	2412	H	38.2	29.0	37.8	29.5	10.3	4824	48.5	39.8	74	54	14.2
3	2412	V	45.2	31.6	44.6	31.5	16.3	7236	61.5	47.9	74	54	6.1
3	2412	H	42.4	30.2	42.4	30.7	16.3	7236	58.7	47	74	54	7
2	2437	V	43.1	32.6	42.7	31.2	10.4	4874	53.5	43	74	54	11
2	2437	H	41.9	30.0	41.8	30.0	10.4	4874	52.3	40.4	74	54	13.6
3	2437	V	44.5	29.5	47.0	31.9	16.5	7311	63.5	48.4	74	54	5.6
3	2437	H	41.0	28.3	43.8	31.0	16.5	7311	60.3	47.5	74	54	6.5
be	2462	V	54.9	32.0	60.3	35.0	9.9	2483.5	70.2	44.9	74	54	3.8
be	2462	V	51.6	30.0	57.3	33.6	9.9	2484	67.2	43.5	74	54	6.8
2	2462	V	50.1	36.7	49.6	34.5	10.5	4924	60.6	47.2	74	54	6.8
2	2462	H	46.8	33.1	45.6	32.8	10.5	4924	57.3	43.6	74	54	10.4
3	2462	V	45.1	32.0	44.6	32.6	16.8	7386	61.9	49.4	74	54	4.6
3	2462	H	42.2	30.6	43.1	30.2	16.8	7386	59.9	47.4	74	54	6.6

- Notes: 1. hrm = Harmonic; BE = Band Edge emissions; V = Vertical; H = Horizontal
 2. The margin (last column) is the worst case margin under the peak or average limits for that row. It is also the worst case margin for the 802.11b and 802.11g modes.
 3. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor

No other emissions were detected in the restricted bands from 2 to 25 GHz.

Note there is no radiated limit for the fundamental emission, just conducted emissions limit.

Judgment: Passed by 3.4 dB

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

10.7.3 Radiated Emissions Below 2 GHz

Company	Westell, Inc.	Specification	FCC Part 15; Subpart B; Class B
Model	A90-9100VM15-10	Test Date	2/26/2007
Serial Number	07B402910504	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		
Notes	Rev C PCB; Globtek Power Supply		

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
176.6	55.8 Q	15.6	H/BC	-33.7	37.7	43.5	5.8
858.8	56.1 Q	10.4	H/BC	-35.0	31.5	40.0	8.5
1050.3	31.4 P	21.9	H/BL	-18.5	34.8	54.0	19.2
1141.5	35.8 P	22.5	H/BL	-18.5	39.9	54.0	14.1
1199.6	33.1 P	23.0	H/BL	-18.5	37.6	54.0	16.4
247.3	60.2 Q	12.3	H/LP	-32.3	40.2	46.0	5.8
282.6	55.8 P	14.0	H/LP	-31.4	38.5	46.0	7.5
317.9	59.2 P	15.0	H/LP	-30.6	43.7	46.0	2.3
353.3	57.1 P	15.3	H/LP	-29.7	42.7	46.0	3.3
388.6	55.7 P	16.0	H/LP	-29.6	42.1	46.0	3.9
423.9	53.0 P	16.6	H/LP	-29.8	39.8	46.0	6.2
459.3	52.7 P	17.0	H/LP	-29.7	40.0	46.0	6.0
494.6	52.6 P	18.2	H/LP	-29.5	41.3	46.0	4.7
529.9	54.7 P	18.5	H/LP	-29.2	44.0	46.0	2.0
777.2	45.5 P	22.2	H/LP	-27.7	40.0	46.0	6.0
999.9	40.0 P	24.5	H/LP	-27.1	37.4	54.0	16.6
38.4	49.7 P	10.4	V/BC	-35.7	24.5	40.0	15.5
41.4	52.6 P	10.8	V/BC	-35.7	27.7	40.0	12.3
45.2	53.6 P	11.2	V/BC	-35.7	29.1	40.0	10.9
46.9	59.1 Q	11.2	V/BC	-35.6	34.7	40.0	5.3
50.0	61.0 Q	11.1	V/BC	-35.5	36.6	40.0	3.4
50.2	61.1 Q	11.1	V/BC	-35.4	36.8	40.0	3.2
54.1	60.3 Q	10.6	V/BC	-35.2	35.6	40.0	4.4
58.5	60.9 Q	9.6	V/BC	-35.0	35.5	40.0	4.5
66.2	61.0 Q	7.9	V/BC	-34.8	34.1	40.0	5.9
66.3	59.2 P	7.9	V/BC	-34.8	32.4	40.0	7.6
70.5	62.5 P	7.1	V/BC	-34.8	34.8	40.0	5.2
72.6	60.1 P	6.8	V/BC	-34.9	32.1	40.0	7.9
76.0	57.7 P	7.0	V/BC	-34.9	29.8	40.0	10.2
86.1	54.1 P	8.2	V/BC	-34.8	27.5	40.0	12.5
130.9	46.7 P	12.4	V/BC	-34.3	24.7	43.5	18.8
176.6	55.0 P	16.4	V/BC	-33.7	37.7	43.5	5.8
176.6	52.3 P	16.4	V/BC	-33.7	35.0	43.5	8.5
200.0	53.4 P	17.3	V/BC	-33.0	37.7	43.5	5.8

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-9100VM15-10, ULS3 w/Ikanos VDSL2 Gateway

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
247.3	50.4 P	16.6	V/BC	-32.3	34.8	46.0	11.2
1050.4	32.2 P	21.9	V/BL	-18.5	35.6	54.0	18.4
1141.4	33.3 P	22.5	V/BL	-18.5	37.4	54.0	16.6
1150.4	27.4 P	22.6	V/BL	-18.5	31.5	54.0	22.5
1175.0	31.6 P	22.8	V/BL	-18.5	35.9	54.0	18.1
247.3	55.3 P	12.5	V/LP	-32.3	35.6	46.0	10.4
282.6	46.7 P	13.6	V/LP	-31.4	28.9	46.0	17.1
318.0	50.2 P	14.9	V/LP	-30.6	34.6	46.0	11.4
318.0	42.6 P	14.9	V/LP	-30.6	26.9	46.0	19.1
353.3	46.7 P	15.2	V/LP	-29.7	32.2	46.0	13.8
388.6	49.3 P	15.9	V/LP	-29.6	35.6	46.0	10.4
423.9	49.8 P	16.5	V/LP	-29.8	36.5	46.0	9.5
423.9	49.4 P	16.5	V/LP	-29.8	36.1	46.0	9.9
459.3	51.6 P	17.1	V/LP	-29.7	39.1	46.0	6.9
494.6	52.2 P	18.4	V/LP	-29.5	41.1	46.0	4.9
494.6	49.0 P	18.4	V/LP	-29.5	37.8	46.0	8.2
529.9	53.1 P	17.8	V/LP	-29.2	41.7	46.0	4.3
777.2	41.2 P	21.5	V/LP	-27.7	35.0	46.0	11.0
847.8	46.1 P	21.9	V/LP	-27.5	40.5	46.0	5.5
953.8	36.2 P	23.3	V/LP	-27.1	32.5	46.0	13.5
989.2	37.6 P	23.7	V/LP	-27.1	34.2	54.0	19.8
1000.0	50.0 P	24.0	V/LP	-27.1	46.9	54.0	7.1

Judgment: Passed by 2.0 dB