



Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

Ultraline Iiv VDSL2 Gateway, Model A90-826010-07

Radiometrics Document RP-5839



Product Detail:

FCC ID: **CH8A908260XX**

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: 2006

This report concerns: Original Grant for Certification
 FCC Part 15.247

Tests Performed For:

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Test Facility:

Radiometrics Midwest Corporation

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

May 25 and 26, 2006

Document RP-5839 Revisions:

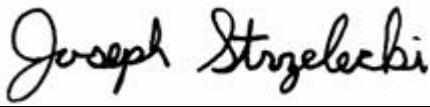
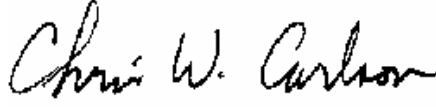
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1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Westell, Inc., Ultraline IIv VDSL2 Gateway Model: A90-826010-07 Serial Number: None This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> May 25, 2006	<i>Test Date(s): (Month-Day-Year)</i> May 25 and 26, 2006
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Guy Cerulli Westell, Inc.
<i>Radiometrics' Personnel Responsible for Test:</i> 	<i>Test Report Approved By:</i> 
Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is an Ultraline IIv VDSL2 Gateway, Model A90-826010-07, manufactured by Westell, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results. This report pertains to the 802.11 section and the unintentional radiator section of the Ultraline IIv VDSL2 Gateway.

The EUT has two antennas for diversity. The RF can be routed to only one of the antenna ports at a time. In this report, the antenna ports are designated as main and auxiliary. Unless otherwise noted, all tests were performed the RF routed to the main antenna. This was found to have the highest RF power.

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

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is an Ultraline IIv VDSL2 Gateway, Model A90-826010-07, manufactured by Westell, Inc. The EUT was in good working condition during the tests, with no known defects. The EUT has two antennas for diversity. In this report, the antenna ports are designated as main and auxiliary.

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.

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 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	Ultraline IIv VDSL2 Gateway	E	Westell, Inc.	A90-826010-07	C1-21
2	MiniPCI 802.11b/g WIFI card	E	Gemtek	00-90-4B-04-25-14 (MAC address)	
3	VDSL2 CO Line	S	Broadcom	BCM96348M	10034741 Rev A.12.7
4	Four Wirespeed dual connect routers	S	Westell, Inc.	B90-610014-06 B90-610010-06 B90-610010-06 B90-610010-06	04B401594590 04BS2052816 04B410939898 00001
5	Notebook Computer	S	Medion	MD5275	9142X010112270038 1K000
6	Notebook Computer	S	Micron	TransPort GX3	NBK001737-04 A08591AW101010

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

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List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	AC Cord	#1	No
4	15.2	Ethernet Cable	#1 and #4	No
1	21	Phone 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	2006	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
FCC 558074	2005	Measurement of Digital Transmission Systems Operating under Section 15.247

The test procedures used are in accordance with the 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 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.

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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/NCSS Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

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

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/22/05
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo.	12/22/05
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/21/05
AMP-29	HP / Agilent	Amplifier	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-17	RMC	Std. Gain Horn	HW1002	1001	12.4-18GHz	12 Mo.	08/19/05
ANT-44	Imp Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/12/05
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	04/20/05
HPF-03	Mini-Circuits	High Pass Filter	VHP-39	HPF-03	3-10 GHz	12 Mo.	02/08/06
HPF-04	Mini-Circuits	High Pass Filter	VHP-36	HPF-04	2.6-10 GHz	12 Mo.	02/08/06
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	04/25/05
PRE-01	HP / Agilent	Preselector	85685A	2510A00143	20 Hz-2GHz	12 Mo.	07/05/06
PSA-01	HP / Agilent	AC Power/ Analyzer	6813B	US38390181	DC-5kHz	12 Mo.	04/21/06
PWM-01	Boonton	Power Meter	4230	22503	50kHz-18GHz	24 Mo.	06/21/05
REC-01	HP / Agilent	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	08/19/05

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RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	12/07/05
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	02/07/06
REC-08	HP / Agilent	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; 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.

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 EUT power cord, after testing all modes of operation.

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Test Date : May 26, 2006

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

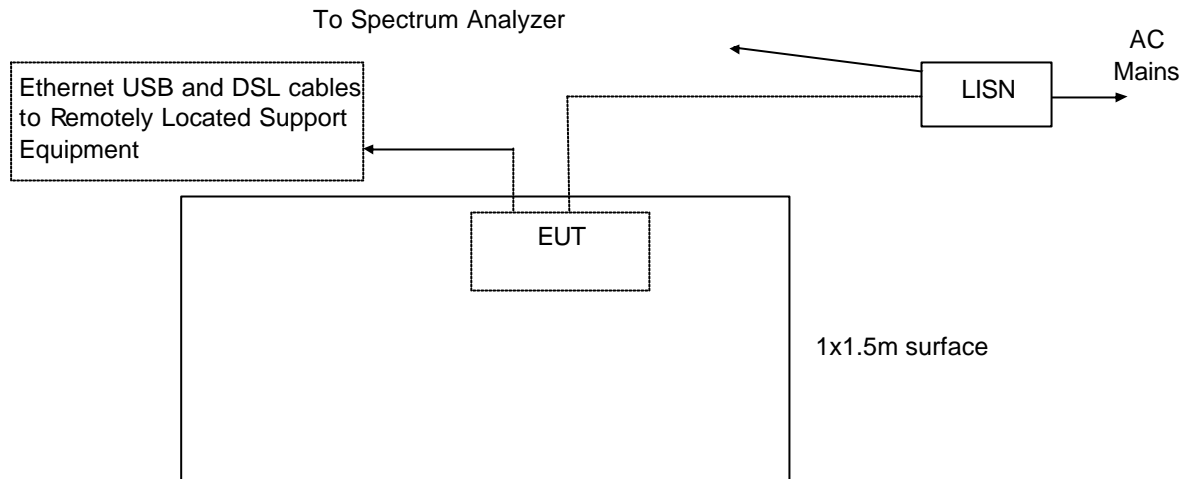
Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Neutral	0.15	57.45	66.00	37.79	56.00
AC Neutral	0.18	56.31	64.45	37.54	54.45
AC Neutral	0.30	51.70	60.16	32.34	50.16
AC Neutral	0.43	47.90	57.35	29.56	47.35
AC Neutral	0.57	44.24	56.00	29.51	46.00
AC Neutral	0.67	41.26	56.00	29.51	46.00
AC Neutral	9.16	45.41	60.00	40.04	50.00
AC Neutral	10.08	47.22	60.00	42.22	50.00
AC Neutral	10.64	49.05	60.00	44.10	50.00
AC Neutral	11.36	51.91	60.00	46.41	50.00
AC Neutral	11.76	50.86	60.00	45.52	50.00
AC Neutral	21.11	39.08	60.00	33.28	50.00
AC Hot	0.15	58.28	66.00	39.59	56.00
AC Hot	0.19	56.43	64.02	38.09	54.02
AC Hot	0.26	53.29	61.32	34.85	51.32
AC Hot	0.36	49.49	58.71	32.80	48.71
AC Hot	0.47	45.64	56.44	30.19	46.44
AC Hot	10.97	47.80	60.00	42.66	50.00
AC Hot	11.46	49.77	60.00	44.50	50.00
AC Hot	11.80	48.63	60.00	43.28	50.00
AC Hot	21.66	44.90	60.00	40.03	50.00
AC Hot	17.66	36.52	60.00	31.05	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 3.59 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)

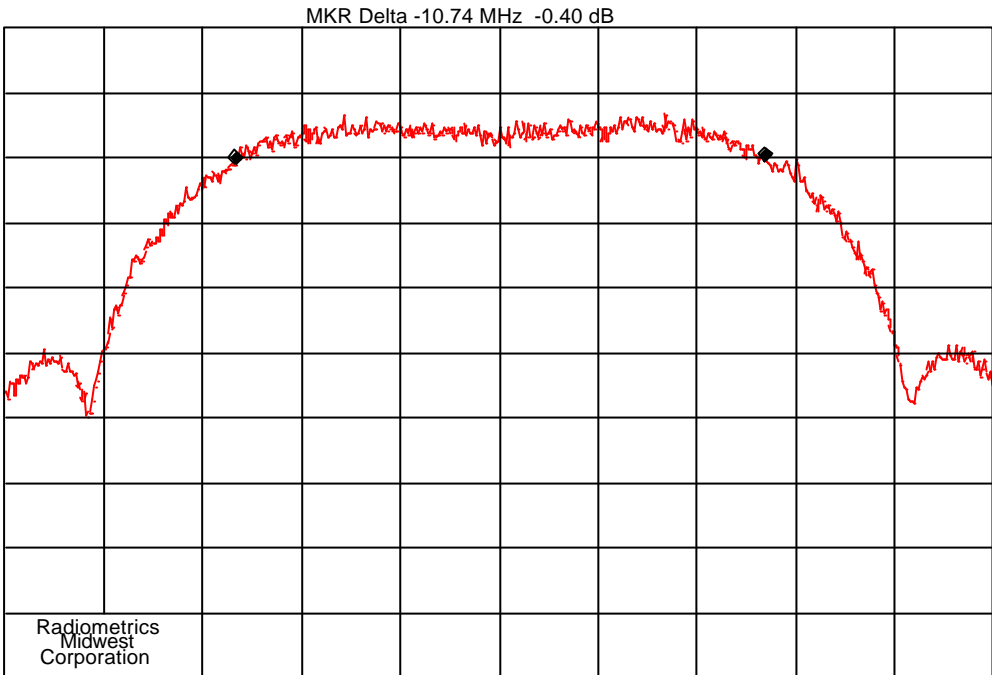
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

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.

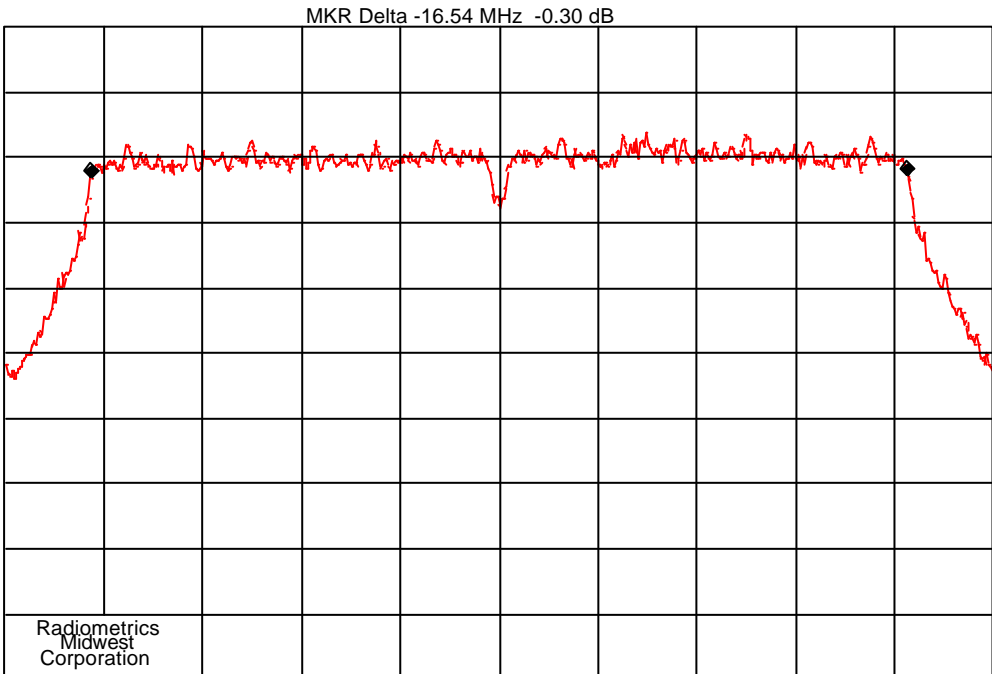
Channel	802.11b	802.11g
	6 dB EBW MHz	6 dB EBW MHz
1	10.7	16.5
6	11.2	16.7
11	11.1	16.5

Judgement: Pass

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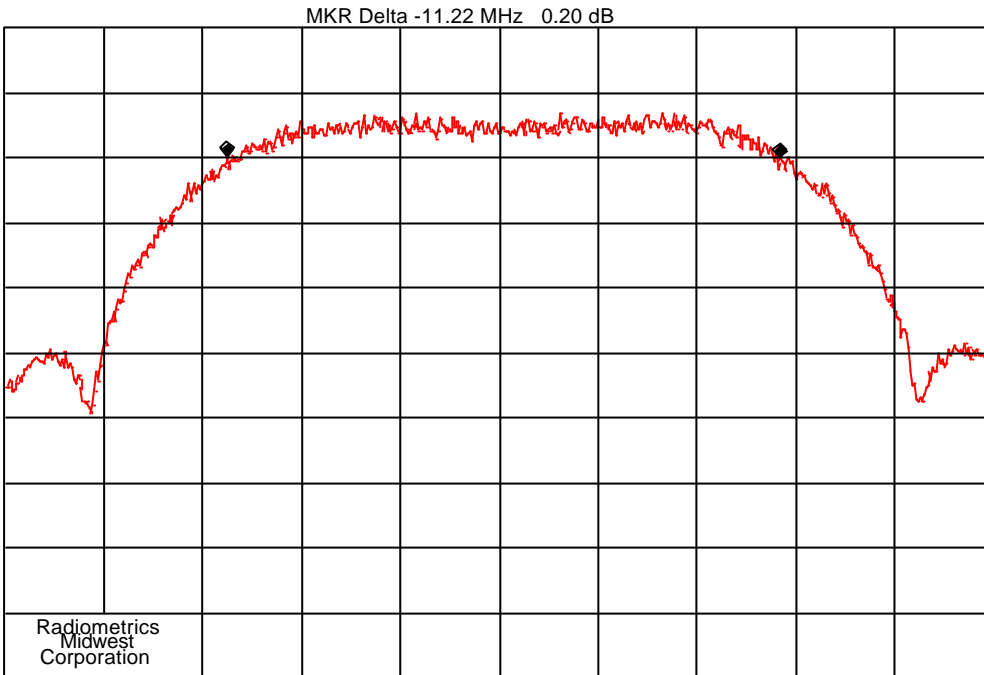


COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
CENTER 2.412 0 GHz	REF 20.0 dBm	SPAN 20.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 11:39	SWP 20.0 msec
NOTES : 6 dB Bandwidth, 802.11b Ch 1		

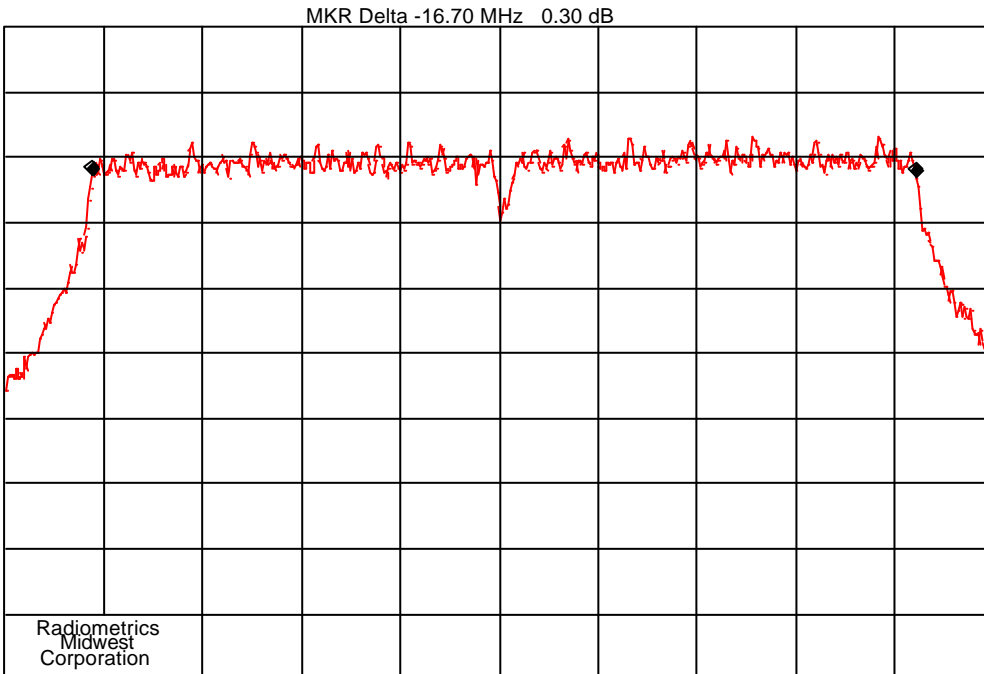


COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
CENTER 2.412 0 GHz	REF 20.0 dBm	SPAN 20.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 11:31	SWP 20.0 msec
NOTES : 6 dB Bandwidth, 802.11g Ch 1		

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COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
CENTER 2.437 0 GHz	REF 20.0 dBm	SPAN 20.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 11:41	SWP 20.0 msec
NOTES : 6 dB Bandwidth, 802.11b Ch 6		

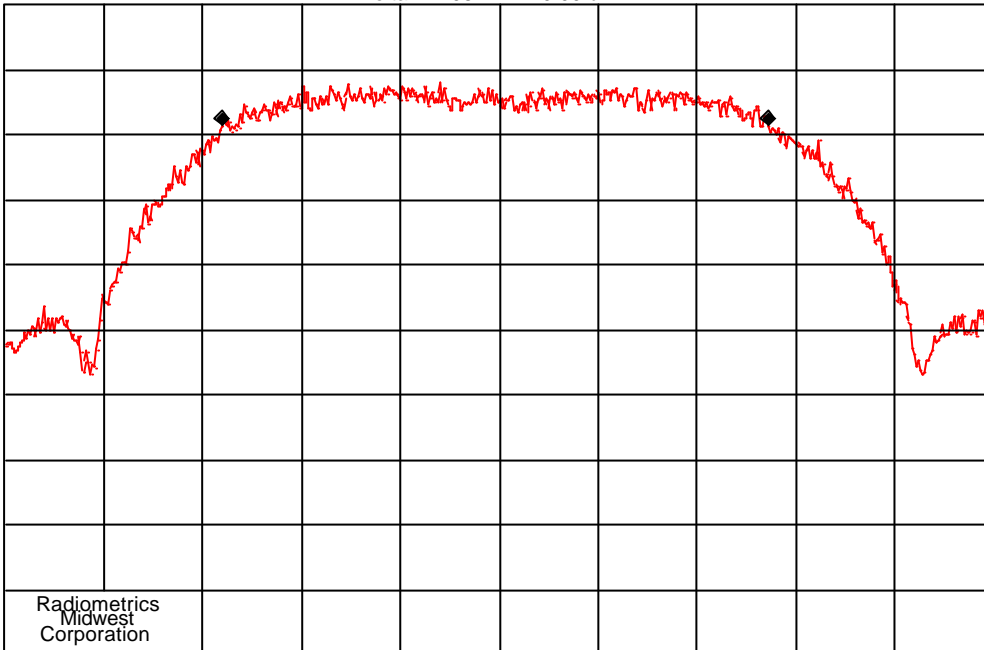


COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
CENTER 2.437 0 GHz	REF 20.0 dBm	SPAN 20.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 11:46	SWP 20.0 msec
NOTES : 6 dB Bandwidth, 802.11g Ch 6		

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MKR Delta -11.08 MHz 0.00 dB



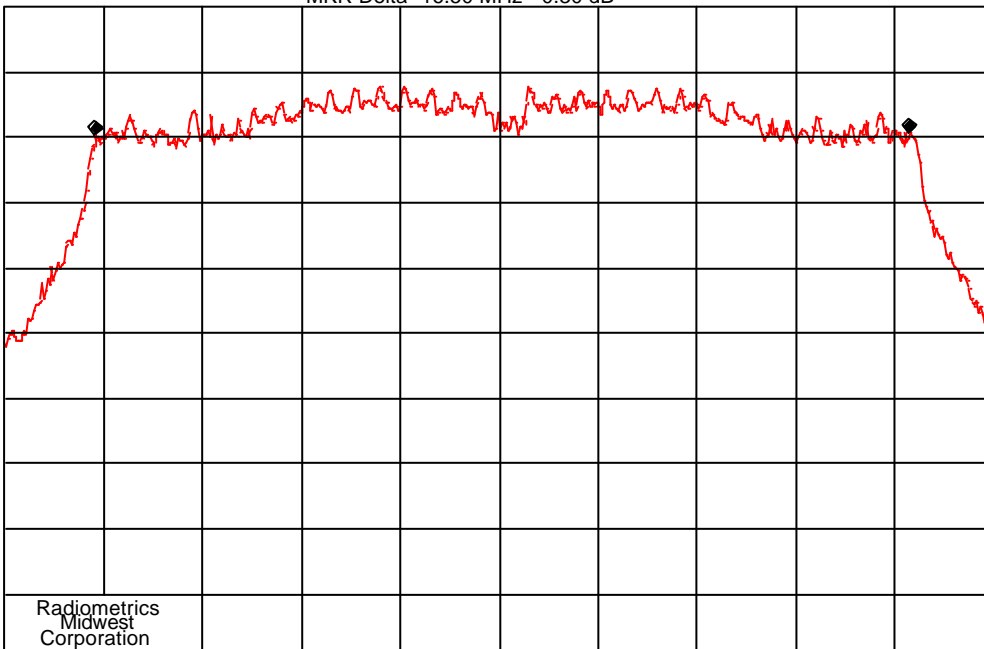
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COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, 802.11b Ch 11

ITEM : A90-826010-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:53

DATE : 05-26-2006
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

MKR Delta -16.50 MHz -0.30 dB



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

ITEM : A90-826010-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:48

DATE : 05-26-2006
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

10.3 Peak Output Power

The spectrum analyzer was set to the following settings:

Span = 2 MHz (approximately 5 times the 20 dB bandwidth, centered on a hopping channel)

RBW = 3 MHz (> the 20 dB bandwidth of the emission being measured)

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.

Main RF Connector

Mode	Freq. (MHz)	Reading (dBm)	BW Corr Factor (dB)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
					dBm	Watts	
802.11b	2412	14.9	10.3	0.3	25.5	0.354	30
802.11b	2437	15.4	10.5	0.3	26.2	0.416	30
802.11b	2462	16.1	10.5	0.3	26.9	0.485	30
802.11g	2412	15.6	12.2	0.3	28.1	0.642	30
802.11g	2437	16	12.2	0.3	28.5	0.712	30
802.11g	2462	15.8	12.2	0.3	28.3	0.672	30

Auxiliary RF Connector

Mode	Freq. (MHz)	Reading (dBm)	BW Corr Factor (dB)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
					dBm	Watts	
802.11b	2412	14.7	10.3	0.3	25.3	0.338	30
802.11b	2437	15.2	10.5	0.3	26.0	0.397	30
802.11b	2462	15.2	10.5	0.3	26.0	0.394	30
802.11g	2412	15.2	12.2	0.3	27.7	0.585	30
802.11g	2437	14.1	12.2	0.3	26.6	0.460	30
802.11g	2462	15.2	12.2	0.3	27.7	0.585	30

Judgement: Pass

10.4 Power Spectral Density

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

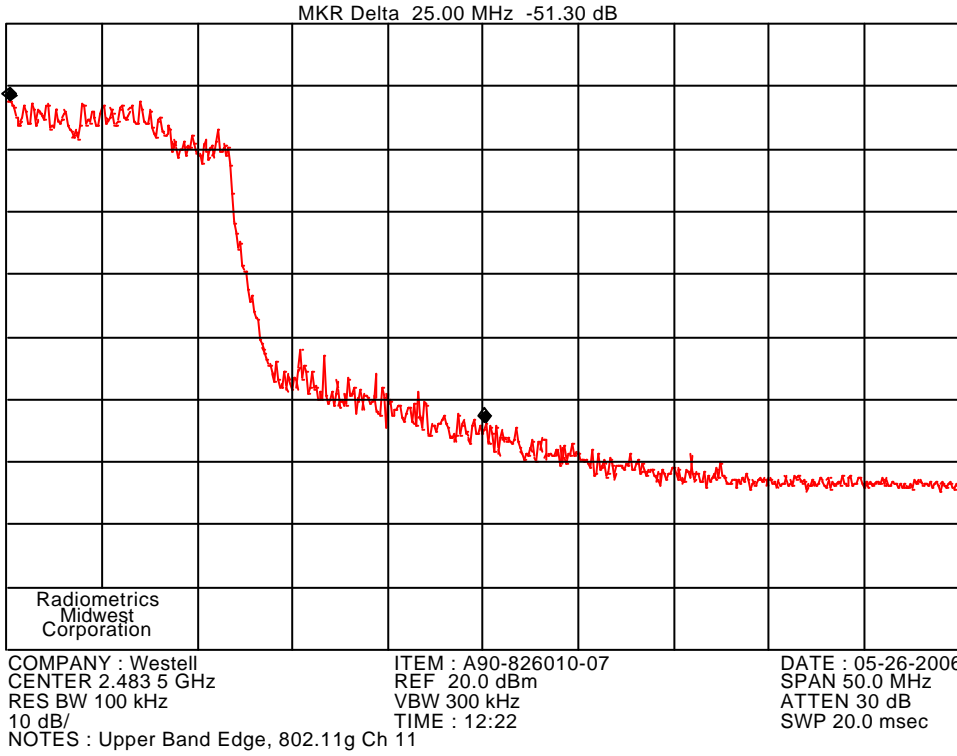
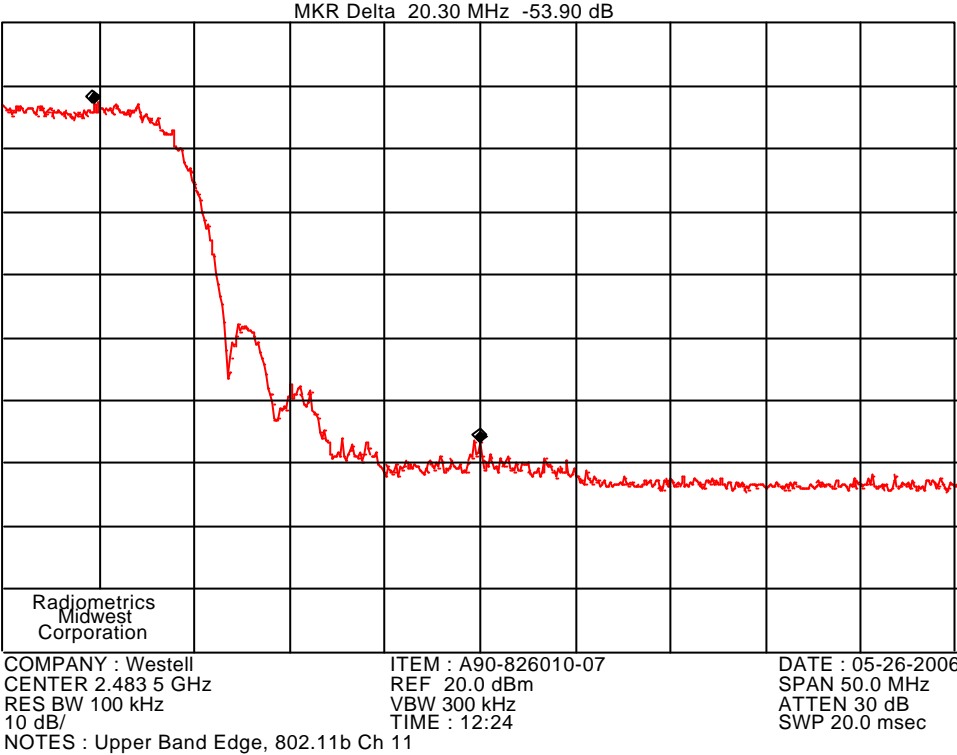
The trace was allowed to stabilize. The marker-to-peak function was used to measure the peak of the emission. The indicated level is the peak output power. Note 30 dBm = 1 watt. Since the gain of the antenna is always less than 6dB, the limit is not reduced.

Port Tested	Mode	Frequency (MHz)	Reading dBm	Cable Loss (dB)	3 kHz Spectral Density (dBm)	Limit (dBm)
Main	802.11b	2412	-7.1	0.3	-6.8	8.0
Main	802.11b	2437	-8.0	0.3	-7.7	8.0
Main	802.11b	2462	-7.3	0.3	-7.0	8.0
Main	802.11g	2412	-7.8	0.3	-7.5	8.0
Main	802.11g	2437	-7.7	0.3	-7.4	8.0
Main	802.11g	2462	-8.4	0.3	-8.1	8.0
Aux	802.11b	2412	-8.0	0.3	-7.7	8.0
Aux	802.11b	2437	-7.7	0.3	-7.4	8.0
Aux	802.11b	2462	-6.6	0.3	-6.3	8.0
Aux	802.11g	2412	-7.9	0.3	-7.6	8.0
Aux	802.11g	2437	-8.1	0.3	-7.8	8.0
Aux	802.11g	2462	-7.1	0.3	-6.8	8.0

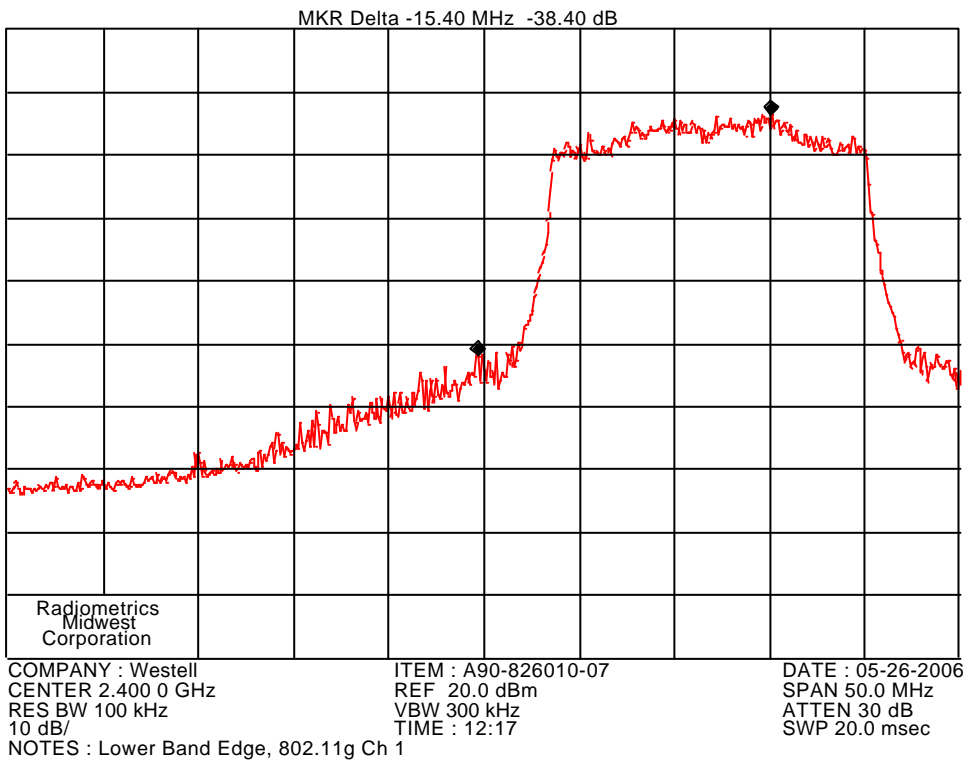
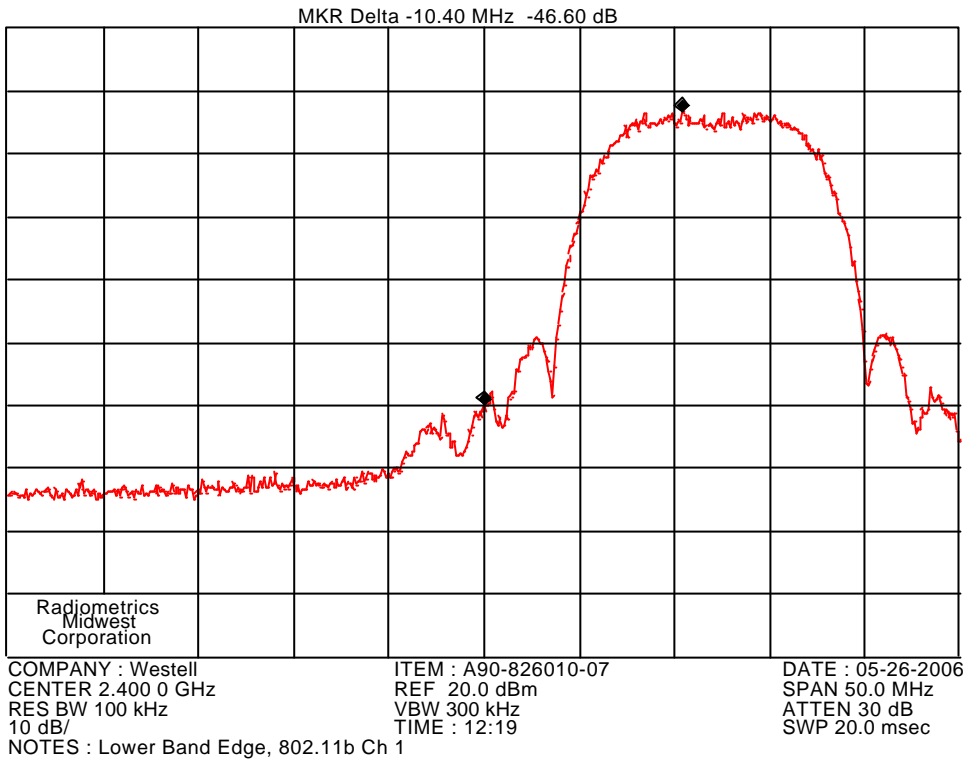
10.5 Band-edge Compliance of RF Conducted Emissions

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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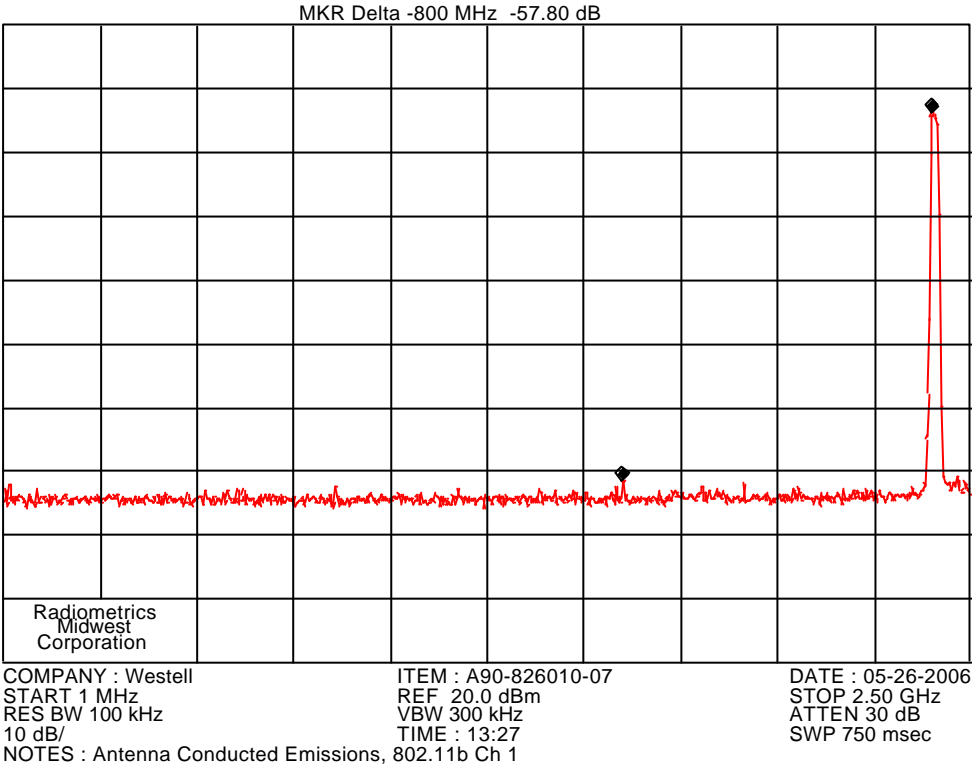
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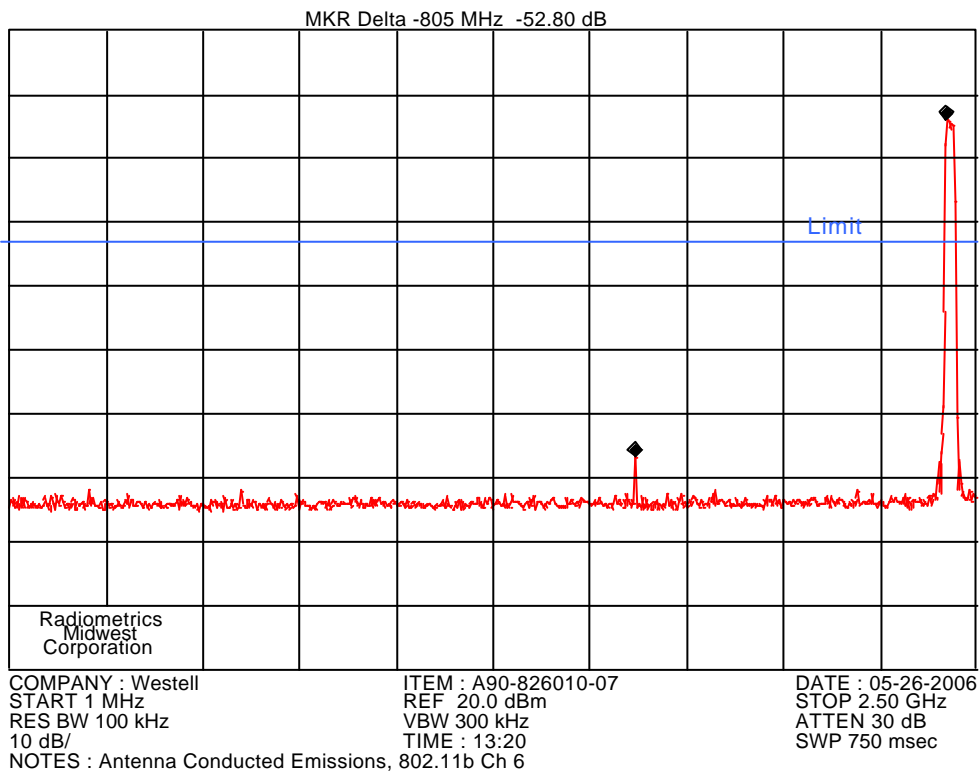
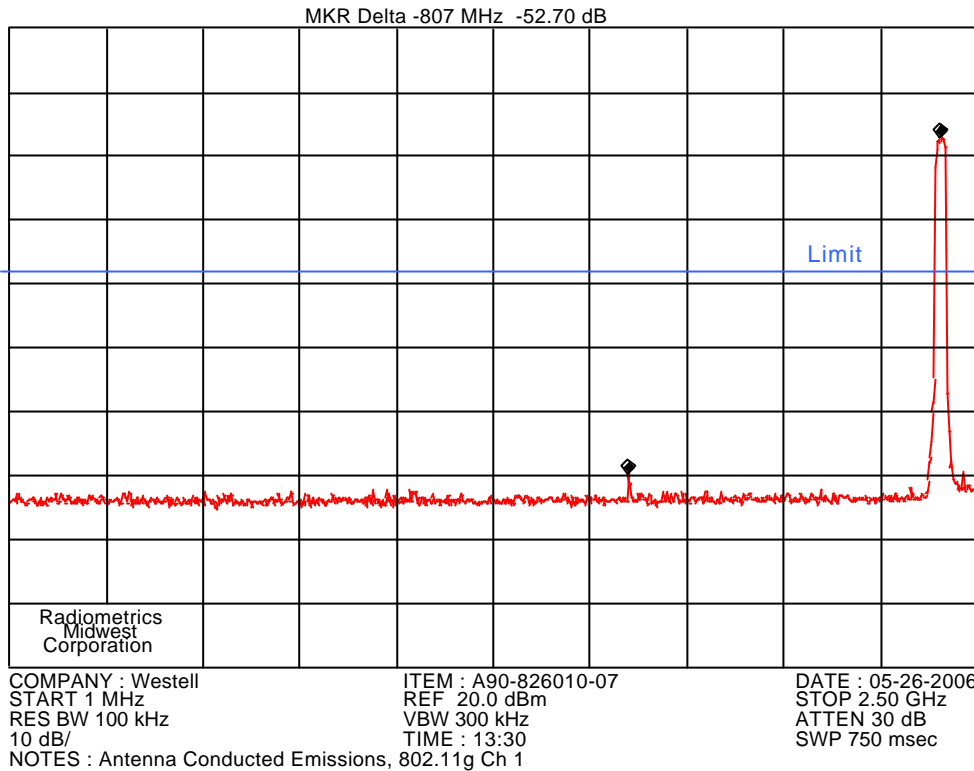
Judgement: Pass

10.6 Spurious RF Conducted Emissions

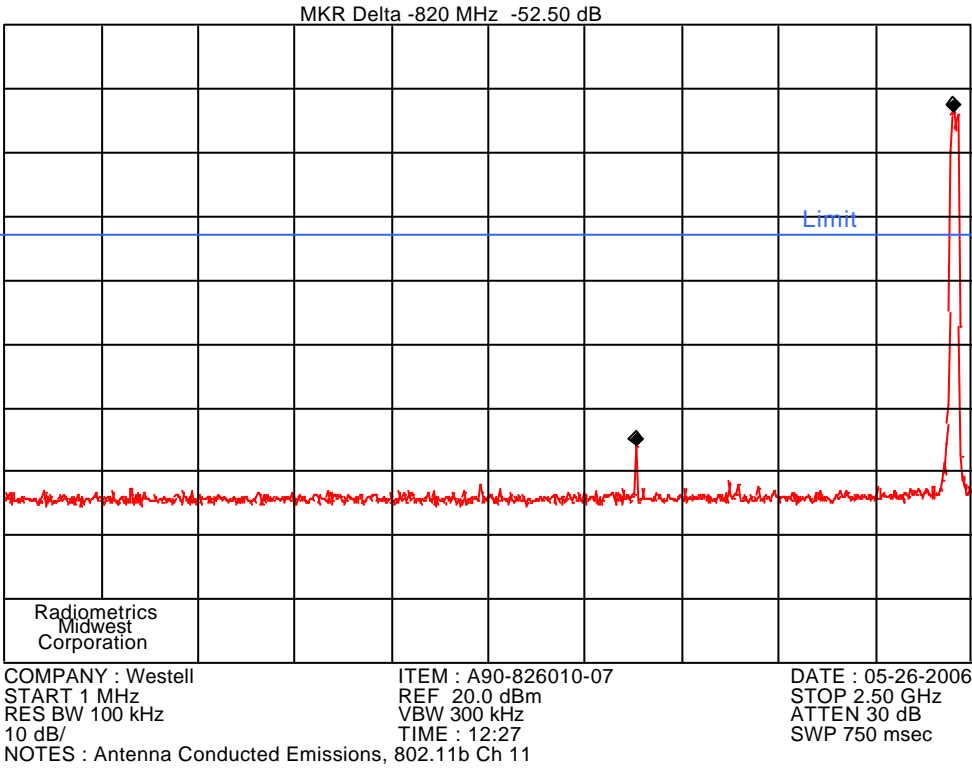
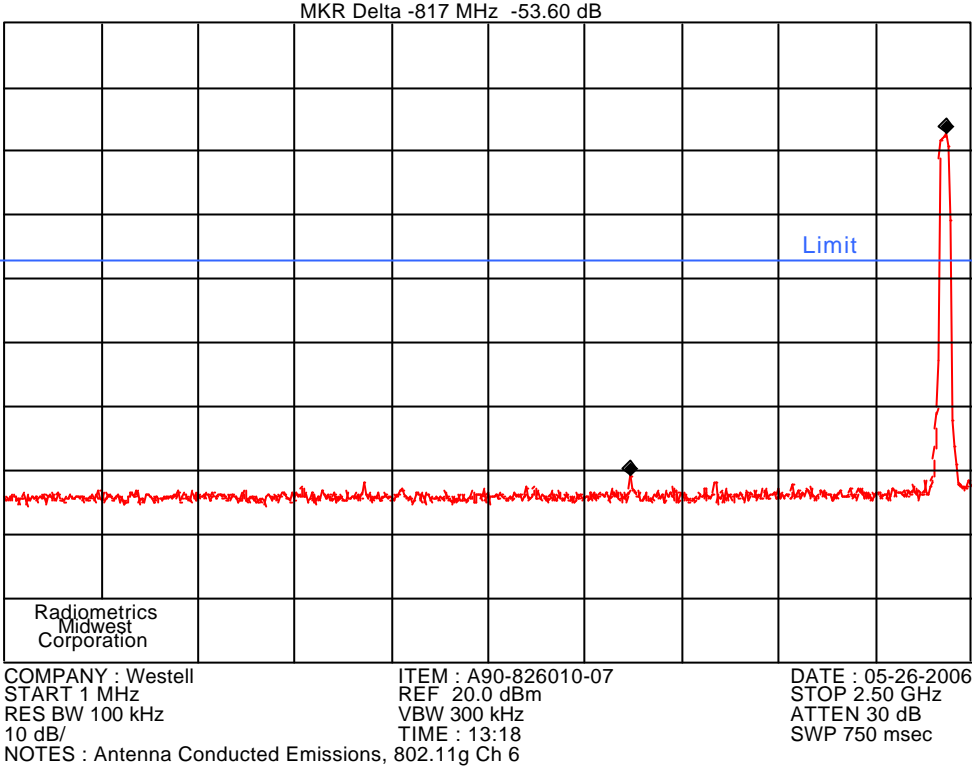
The spectrum analyzer was set to the MAX HOLD mode to measure all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. The trace was allowed to stabilize.



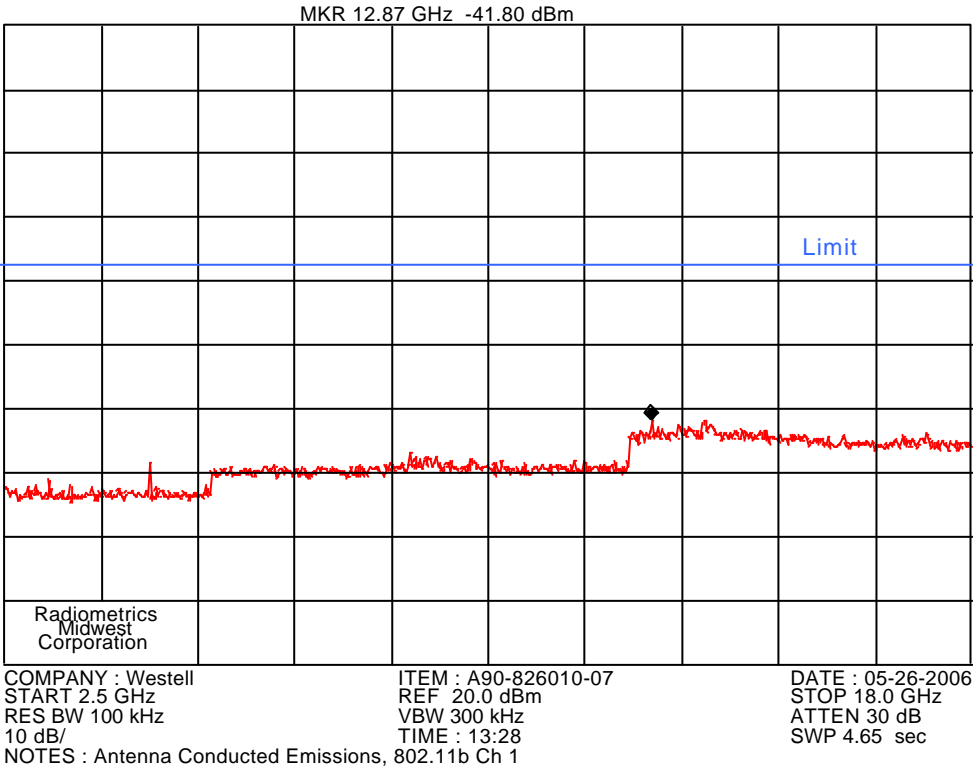
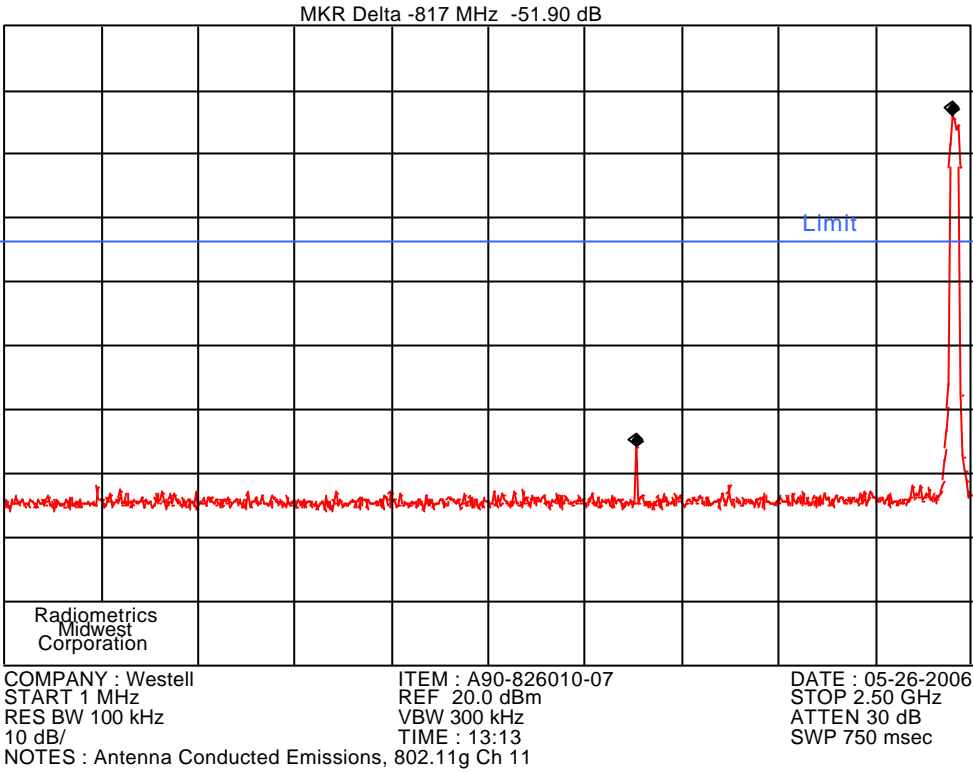
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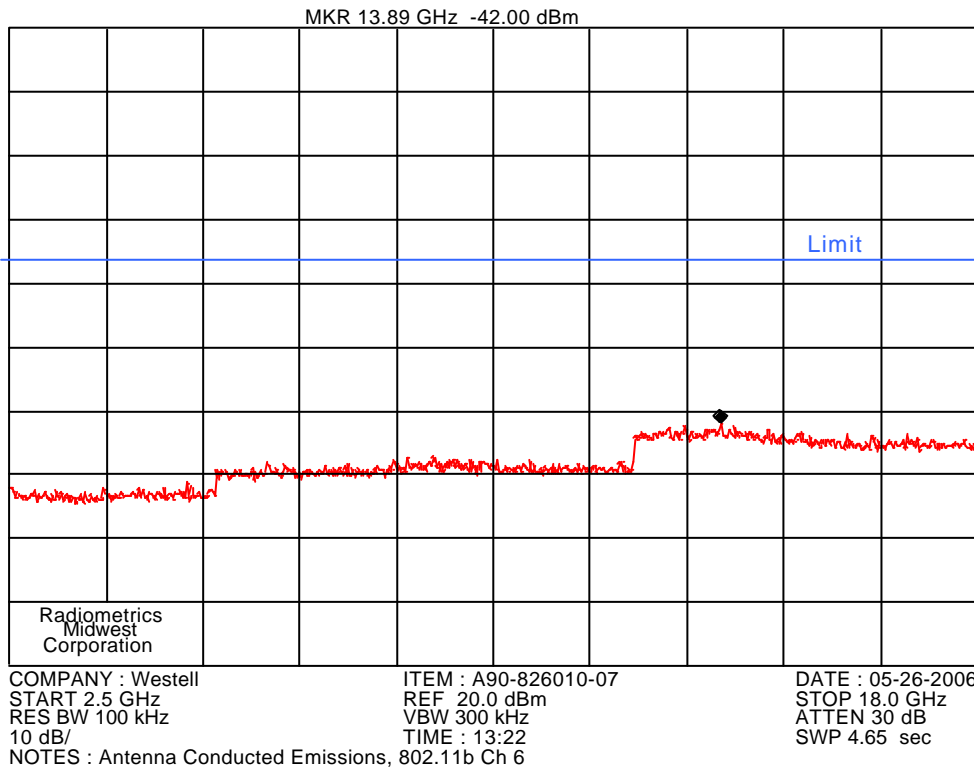
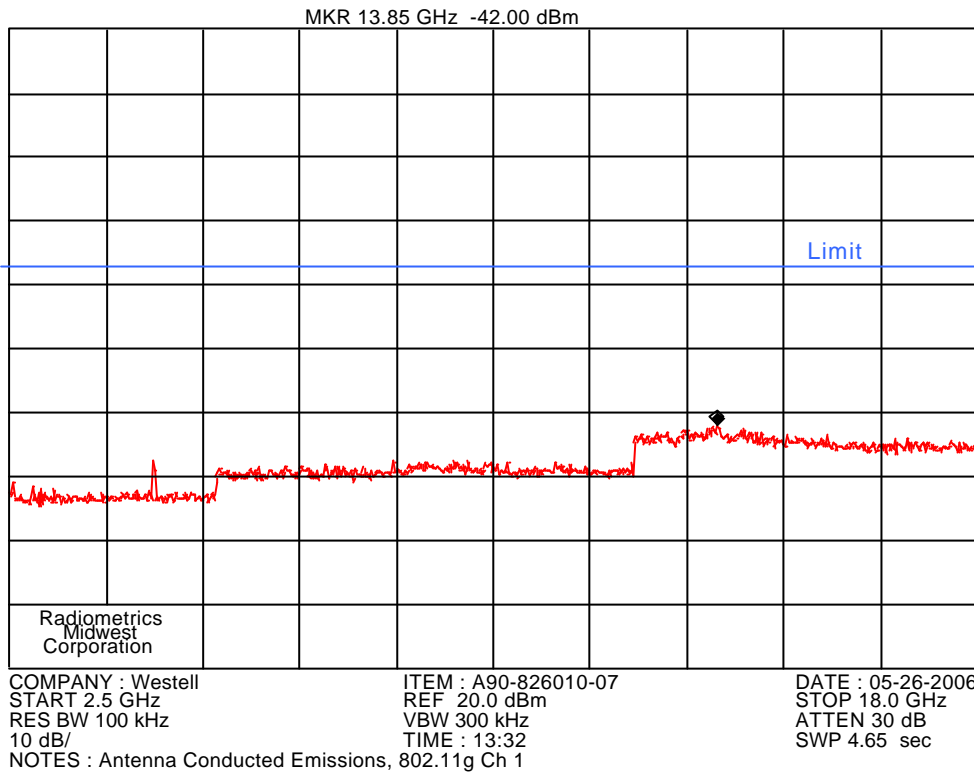
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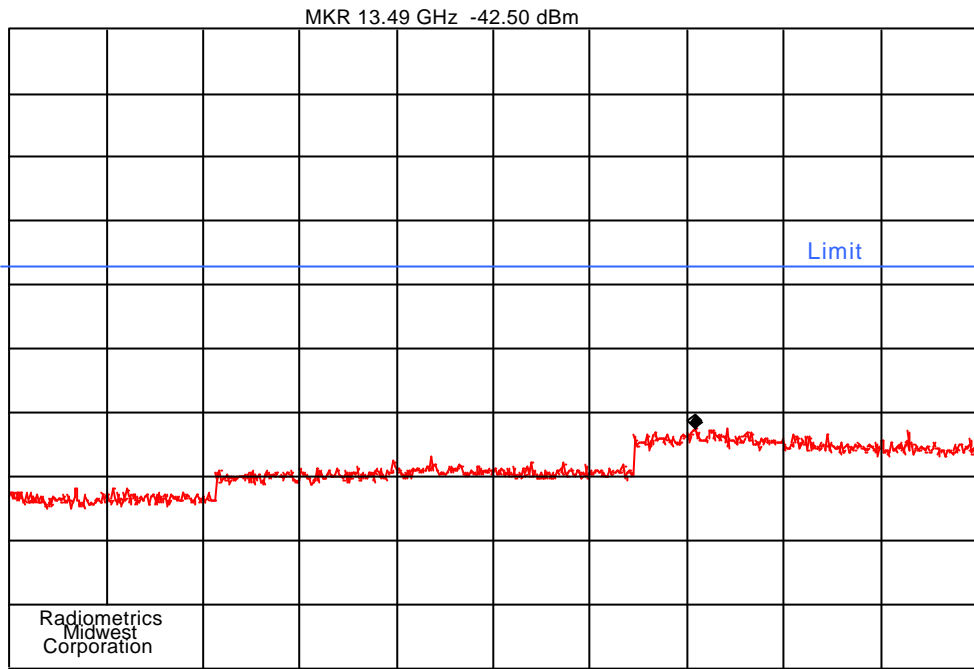
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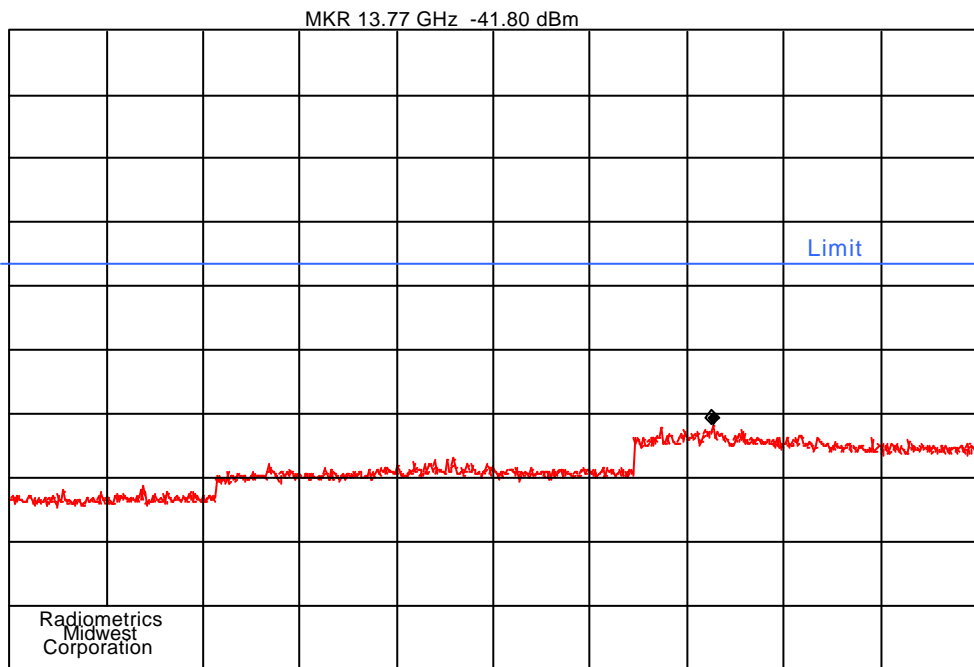
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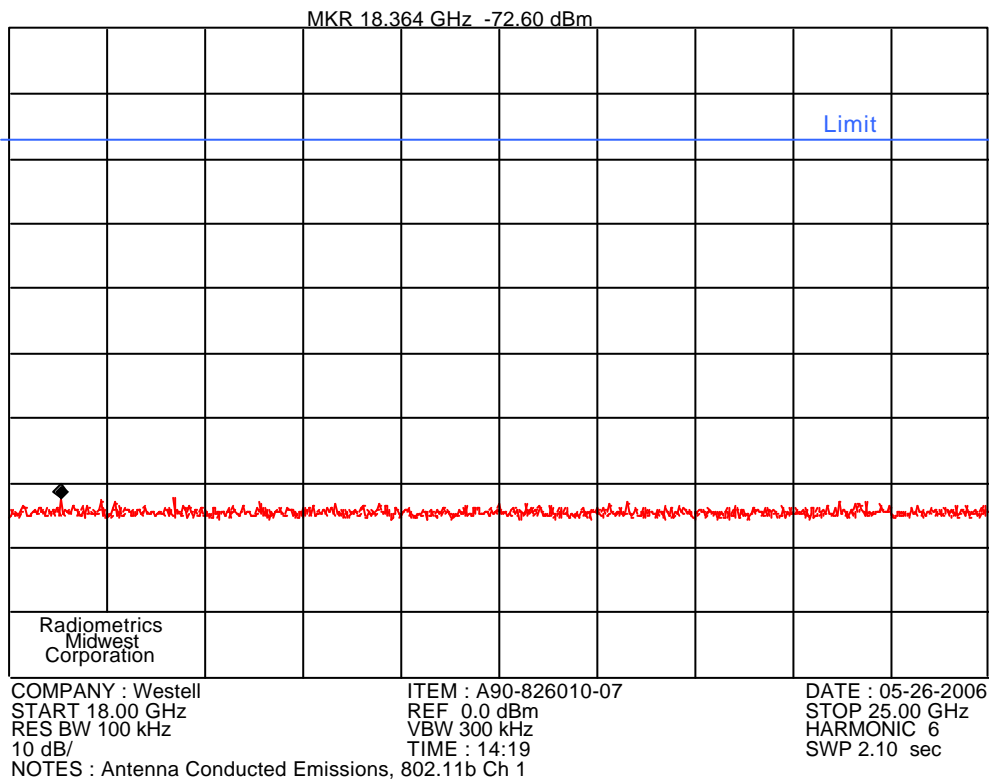
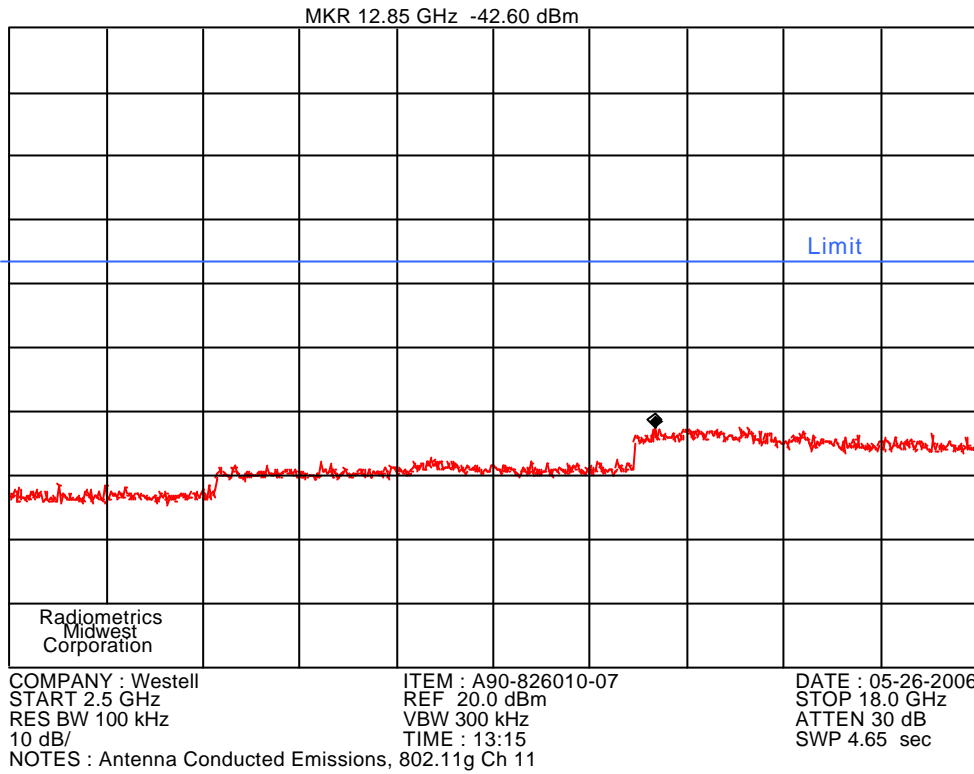


COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
START 2.5 GHz	REF 20.0 dBm	STOP 18.0 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 13:19	SWP 4.65 sec
NOTES : Antenna Conducted Emissions, 802.11g Ch 6		

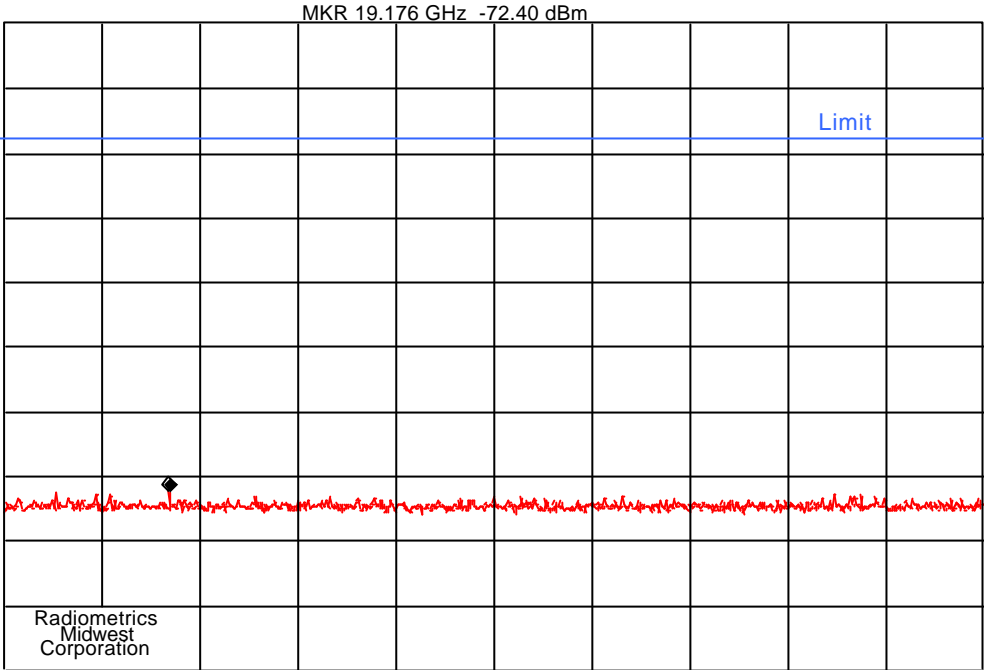


COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
START 2.5 GHz	REF 20.0 dBm	STOP 18.0 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 12:30	SWP 4.65 sec
NOTES : Antenna Conducted Emissions, 802.11b Ch 11		

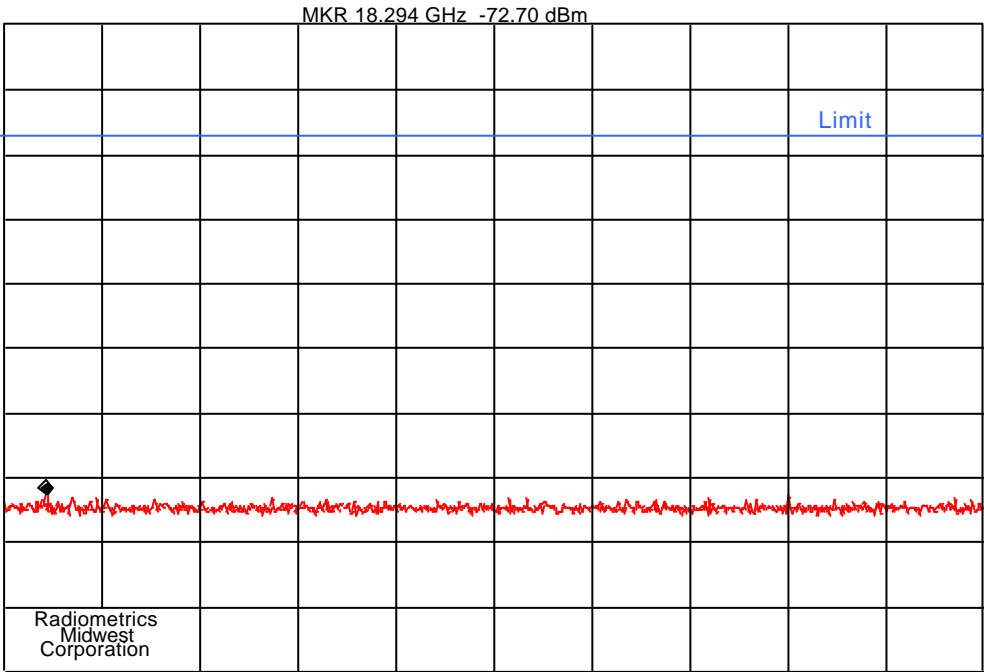
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RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
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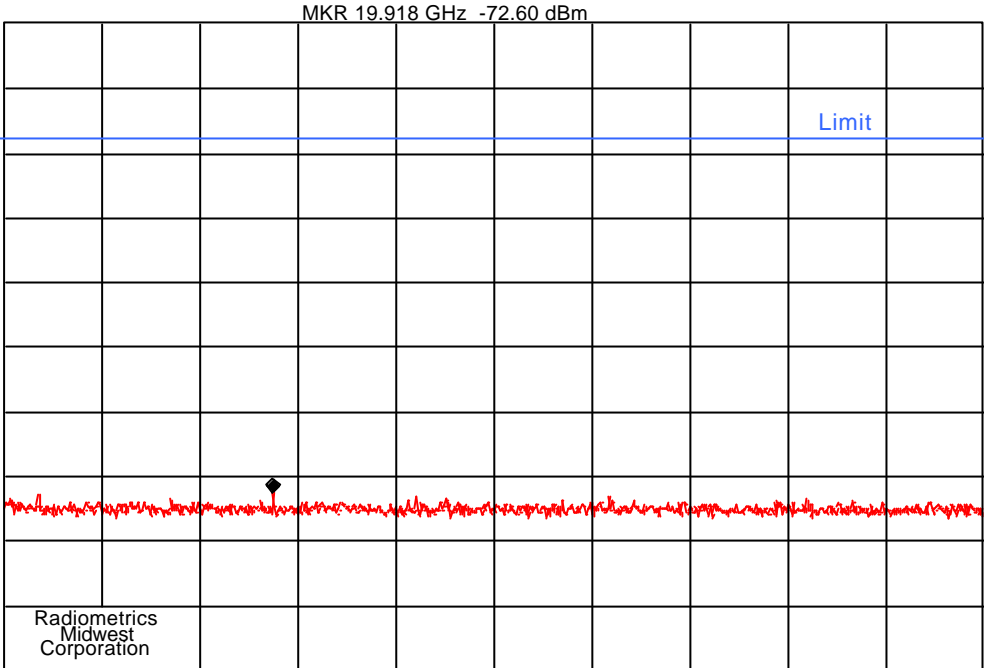


COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
START 18.00 GHz	REF 0.0 dBm	STOP 25.00 GHz
RES BW 100 kHz	VBW 300 kHz	HARMONIC 6
10 dB/	TIME : 14:20	SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11g Ch 1		

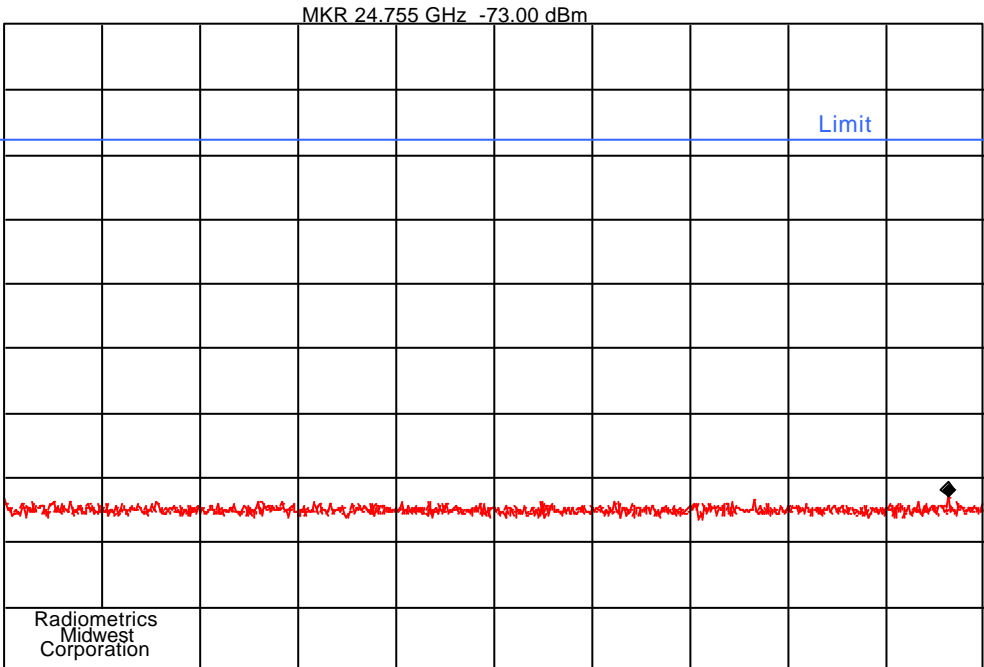


COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
START 18.00 GHz	REF 0.0 dBm	STOP 25.00 GHz
RES BW 100 kHz	VBW 300 kHz	HARMONIC 6
10 dB/	TIME : 14:22	SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11b Ch 6		

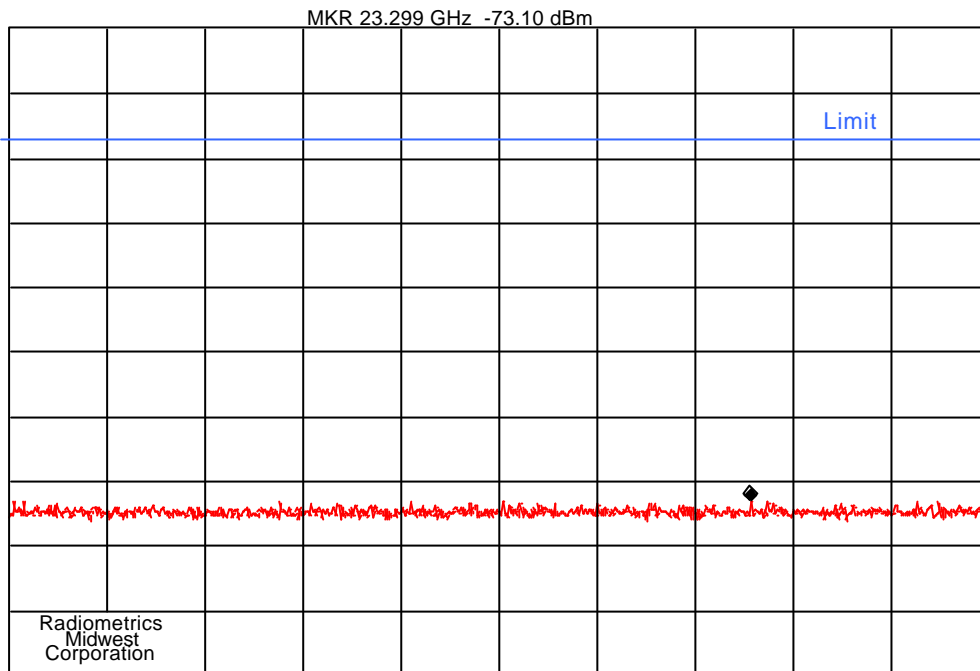
RADIOMETRICS MIDWEST CORPORATION - EMC Test Report
Testing of the Westell, Inc., Ultraline IIv VDSL2 Gateway, Model A90-826010-07



COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
START 18.00 GHz	REF 0.0 dBm	STOP 25.00 GHz
RES BW 100 kHz	VBW 300 kHz	HARMONIC 6
10 dB/	TIME : 14:21	SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11g Ch 6		



COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
START 18.00 GHz	REF 0.0 dBm	STOP 25.00 GHz
RES BW 100 kHz	VBW 300 kHz	HARMONIC 6
10 dB/	TIME : 14:22	SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11b Ch 11		



COMPANY : Westell	ITEM : A90-826010-07	DATE : 05-26-2006
START 18.00 GHz	REF 0.0 dBm	STOP 25.00 GHz
RES BW 100 kHz	VBW 300 kHz	HARMONIC 6
10 dB/	TIME : 14:23	SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11g Ch 11		

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:

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

Where: FS = Field Strength

RA = Receiver Amplitude

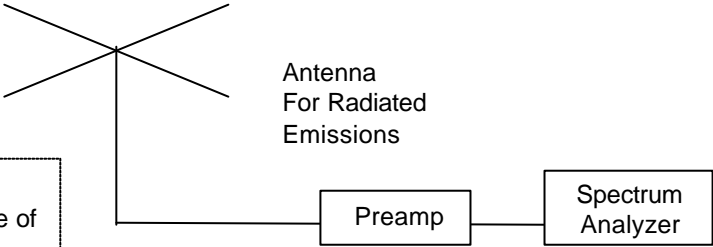
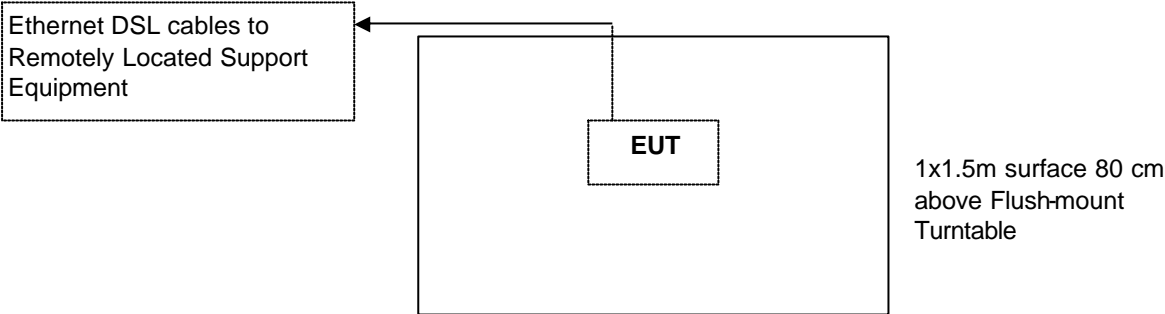
AF = Antenna Factor

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.

hrm #	Tx Freq	Ant Pol.	802.11b Analyzer		802.11g RDG		Corr. Fact. dB	EUT Emission Freq MHz	Field Strength from EUT		Field Strength Limit		Margin Under Limit dB
			Peak	Ave	Peak	Ave			Peak	Ave	Peak	Ave	
1	2412	V	104.2	80.0	103.6	75.4	10.5	2412	114.1	85.9	125	105	10.9
1	2412	H	89.2	69.0	90.4	65.3	10.5	2412	100.9	75.8	125	105	24.1
be	2412	V	51.2	35.4	58.0	38.1	10.5	2389	68.5	48.6	74	54	5.4
be	2412	H	35.0	25.3	45.0	24.6	10.5	2390	55.5	35.8	74	54	18.2
2	2412	V	48.7	29.0	50.2	27.0	13.6	4824	63.8	42.6	74	54	10.2
2	2412	H	39.0	26.3	42.6	25.5	13.6	4824	56.2	39.9	74	54	14.1
3	2412	V	39.2	24.0	40.5	24.0	19.5	7236	60	43.5	74	54	10.5
3	2412	H	38.6	24.0	40.1	24.0	19.5	7236	59.6	43.5	74	54	10.5
1	2437	V	104.5	75.3	105.1	80.3	10.6	2437	115.7	90.9	125	105	9.3
1	2437	H	90.1	65.4	90.7	65.2	10.6	2437	101.3	76	125	105	23.7
2	2437	V	47.4	25.7	50.0	26.3	13.6	4874	63.6	39.9	74	54	10.4
2	2437	H	40.1	24.6	41.2	25.1	13.6	4874	54.8	38.7	74	54	15.3
3	2437	V	42.3	24.0	42.7	24.0	19.8	7311	62.5	43.8	74	54	10.2
3	2437	H	42.1	24.0	42.7	24.0	19.8	7311	62.5	43.8	74	54	10.2
1	2462	V	102.9	80.0	103.1	74.8	10.9	2462	114	90.9	125	105	11
1	2462	H	90.6	70.2	89.7	66.4	10.9	2462	101.5	81.1	125	105	23.5
be	2462	V	51.1	34.0	57.7	36.9	10.9	2483.5	68.6	47.8	74	54	5.4
be	2462	V	51.0	37.6	58.9	36.9	10.9	2484	69.8	48.5	74	54	4.2
be	2462	H	44.0	25.0	45.0	25.3	10.9	2483.5	55.9	36.2	74	54	17.8
2	2462	V	42.3	27.0	48.5	25.6	13.9	4924	62.4	40.9	74	54	11.6
2	2462	H	39.5	26.3	38.5	25.1	13.9	4924	53.4	40.2	74	54	13.8
3	2462	V	39.0	24.0	40.5	24.0	20.2	7386	60.7	44.2	74	54	9.8
3	2462	H	39.5	24.0	40.2	24.0	20.2	7386	60.4	44.2	74	54	9.8

* Noise Floor of analyzer; No detectable emission

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

Judgment: Passed by 4.2 dB

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

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Ultraline IIv VDSL2 Gateway, Model A90-826010-07

Radiated Emissions below 2 GHz including unrestricted bands

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	A90-826010-07	Test Date	05-25-2006
Serial Number	None	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; A = Average		
Notes	Corr. Factors = Cable Loss – Preamp Gain		

The following is the worst case emissions from EUT below 2 GHz. The results include intentional and unintentional emissions.

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/Type		EUT	Limit	
50.7	30.7 P	15.3	H/44	-17.4	28.7	40.0	11.3
90.5	33.0 P	8.1	H/44	-16.8	24.4	43.5	19.1
103.5	32.9 P	11.2	H/44	-16.6	27.4	43.5	16.1
125.5	31.0 P	14.8	H/44	-16.4	29.4	43.5	14.1
133.4	32.0 P	13.3	H/44	-16.3	28.9	43.5	14.6
134.3	34.1 P	12.9	H/44	-16.3	30.7	43.5	12.8
160.3	36.0 P	10.0	H/44	-16.1	29.9	43.5	13.6
175.3	35.5 P	9.3	H/44	-16.0	28.8	43.5	14.7
176.8	36.1 P	9.3	H/44	-15.9	29.5	43.5	14.0
192.2	38.0 P	10.3	H/44	-15.8	32.5	43.5	11.0
197.3	33.7 P	10.4	H/44	-15.7	28.4	43.5	15.1
208.7	33.7 P	10.6	H/44	-15.6	28.7	43.5	14.8
250.0	38.8 Q	12.4	H/44	-15.3	35.8	46.0	10.2
256.0	43.1 Q	12.6	H/44	-15.3	40.4	46.0	5.6
384.0	40.4 Q	16.4	H/44	-14.6	42.3	46.0	3.7
420.0	39.5 Q	16.2	H/44	-14.4	41.3	46.0	4.7
42.5	30.7 P	14.8	V/44	-17.6	27.9	40.0	12.1
44.1	31.9 P	14.9	V/44	-17.5	29.3	40.0	10.7
50.9	34.2 P	13.7	V/44	-17.4	30.5	40.0	9.5
62.2	41.6 Q	11.5	V/44	-17.2	35.9	40.0	4.1
63.0	35.9 P	11.1	V/44	-17.1	29.9	40.0	10.1
64.0	42.6 Q	10.7	V/44	-17.1	36.1	40.0	3.9
83.4	41.4 Q	6.9	V/44	-16.8	31.5	40.0	8.5
92.5	38.5 P	9.4	V/44	-16.7	31.1	43.5	12.4
113.2	34.3 P	13.8	V/44	-16.5	31.5	43.5	12.0
127.9	39.7 P	15.0	V/44	-16.4	38.4	43.5	5.1
134.3	36.9 P	13.4	V/44	-16.3	34.0	43.5	9.5
140.5	38.3 P	12.2	V/44	-16.2	34.3	43.5	9.2
143.1	38.5 P	11.7	V/44	-16.2	34.0	43.5	9.5
145.6	40.3 P	11.4	V/44	-16.2	35.5	43.5	8.0
152.8	37.3 P	10.6	V/44	-16.2	31.8	43.5	11.7
160.3	40.2 P	11.0	V/44	-16.1	35.1	43.5	8.4
162.7	40.0 P	11.1	V/44	-16.1	35.1	43.5	8.4
176.8	42.0 P	10.0	V/44	-15.9	36.1	43.5	7.4
181.4	36.6 P	9.8	V/44	-15.9	30.5	43.5	13.0
190.9	35.4 P	10.3	V/44	-15.8	29.9	43.5	13.6
192.2	37.1 P	10.3	V/44	-15.8	31.6	43.5	11.9

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Testing of the Westell, Inc., Ultraline IIv VDSL2 Gateway, Model A90-826010-07

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
256.5	34.7 P	12.9	V/44	-15.3	32.3	46.0	13.7
420.0	39.0 Q	16.5	V/44	-14.4	41.1	46.0	4.9
500.4	30.1 P	18.1	V/44	-13.8	34.4	46.0	11.6
1000.4	31.7 P	22.9	H/44	-20.2	34.4	54.0	19.6
1125.0	27.9 P	23.9	H/44	-19.7	32.1	54.0	21.9
1259.0	28.8 P	24.6	H/44	-19.0	34.4	54.0	19.6
1279.0	29.9 P	24.7	H/44	-18.9	35.7	54.0	18.3
1398.0	35.1 P	25.4	H/44	-18.3	42.2	54.0	11.8
1624.0	39.4 P	26.9	H/44	-17.3	49.0	54.0	5.0
1624.4	39.2 P	26.9	H/44	-17.3	48.9	54.0	5.1
1624.7	39.8 A	26.9	H/44	-17.3	49.4	54.0	4.6

Judgment: Passed by 3.7 dB