



Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

Versalink Wifi Device, Model A90-750015-07

Radiometrics Document RP-6051



Product Detail:

FCC ID: CH87500XX-07

Equipment type: Digital Transmission System

Test Standards:

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

FCC Part 15 CFR Title 47: 2006

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

This report concerns: Original Grant for Certification

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)

May 4 thru 8, 2007

Document RP-6051 Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	December 06, 2007		

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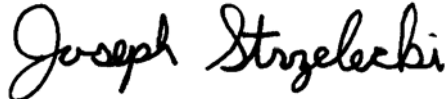
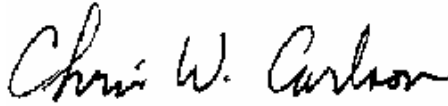
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RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-750015-07, Versalink

1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Westell, Inc., Versalink Model: A90-750015-07 Serial Number: 641 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> May 4, 2007	<i>Test Date(s): (Month-Day-Year)</i> May 4 thru 8, 2007
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Bryan Bella 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 Versalink, Model A90-750015-07, manufactured by Westell, Inc.. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30 MHz to 25 GHz	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 670 mW, The EUT meets the FCC requirement for RF exposure. 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 Versalink, Model A90-750015-07, 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 & RSS-GEN Antenna Requirements

The antenna is permanently attached to the PCB internal to the EUT. 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:

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Versalink	E	Westell, Inc.	A90-750015-07	641
2	Four Wirespeed dual connect routers	S	Westell, Inc.	B90-610014-06 B90-610010-06 B90-610010-06 B90-610010-06	04B401594590 04BS2052816 04B410939898 00001
3	Notebook Computer (Ethernet port)	S	Compaq	Presario 1688	1456VQLIN
4	Notebook Computer (WiFi client)	S	Dell	Inspiron 7000	0009795D
5	Power Supply	E	Leader	MT12-41120-AROF	0001

* 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 Power input	No
1	1.8	AC Cord	#8	No
4	15.2	Ethernet Cable	#1 to #2	No
1	1.8	Y Cable (Ethernet or USB)	PC USB or NAT router	No

4.2 Special Accessories

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

4.3 Equipment Modifications

A 2.2 uF capacitor was added across the hot and return of the low voltage power input at the power connector.

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
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 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-210 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:

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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.

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-16	MITEQ	Pre-amplifier	AM-1300	608852	0.01-1000MHz	12 Mo.	12/27/06
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	12/27/06

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RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/29/06
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; 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.		

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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 and the three tested channels.

Test Date : May 8, 2007

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

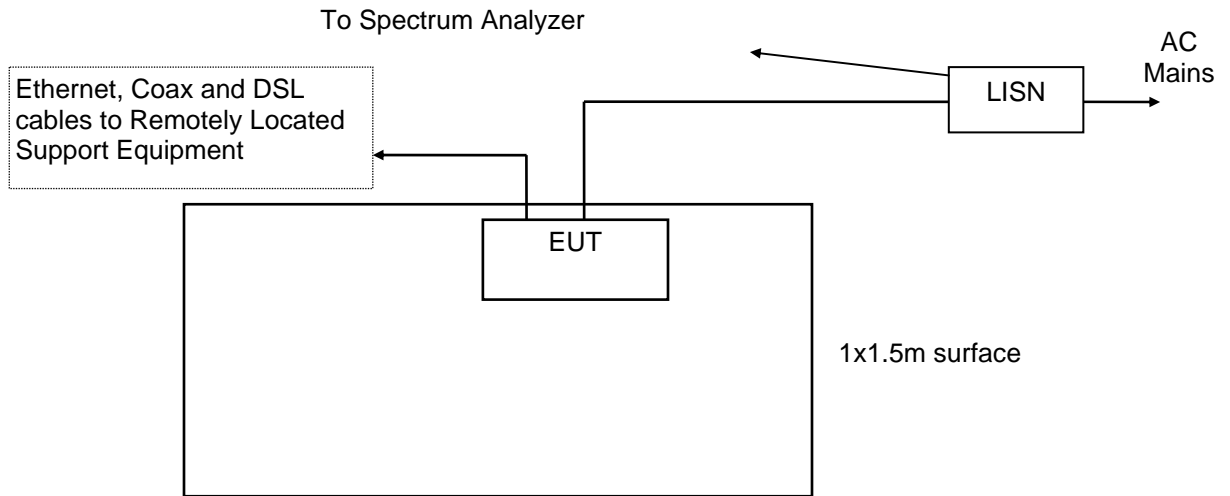
EUT Mode	Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
Ethernet	AC Neutral	0.29	50.2	60.6	40.3	50.6
Ethernet	AC Neutral	1.19	46.5	56.0	36.2	46.0
Ethernet	AC Neutral	2.09	47.9	56.0	37.2	46.0
Ethernet	AC Neutral	27.47	53.5	60.0	45.4	50.0
Ethernet	AC Hot	0.40	46.7	57.8	39.6	47.8
Ethernet	AC Hot	0.49	45.1	56.2	35.8	46.2
Ethernet	AC Hot	1.19	47.1	56.0	39.7	46.0
Ethernet	AC Hot	2.09	48.7	56.0	39.1	46.0
Ethernet	AC Hot	3.21	50.1	56.0	41.4	46.0
Ethernet	AC Hot	27.44	54.8	60.0	45.7	50.0
USB	AC Neutral	0.29	51.0	60.6	40.1	50.6
USB	AC Neutral	0.79	45.3	56.0	34.8	46.0
USB	AC Neutral	3.35	50.2	56.0	40.0	46.0
USB	AC Neutral	3.81	52.1	56.0	41.5	46.0
USB	AC Neutral	4.11	54.5	56.0	44.1	46.0
USB	AC Neutral	5.12	51.6	60.0	43.6	50.0
USB	AC Neutral	27.49	49.6	60.0	45.7	50.0
USB	AC Hot	0.38	48.9	58.2	40.3	48.2
USB	AC Hot	0.48	43.6	56.3	40.9	46.3
USB	AC Hot	1.19	47.9	56.0	38.3	46.0
USB	AC Hot	3.81	54.2	56.0	44.5	46.0
USB	AC Hot	4.38	50.3	56.0	42.5	46.0
USB	AC Hot	5.17	50.8	60.0	44.3	50.0
USB	AC Hot	8.45	51.2	60.0	42.6	50.0
USB	AC Hot	27.51	54.8	60.0	46.2	50.0

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 1.5 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)

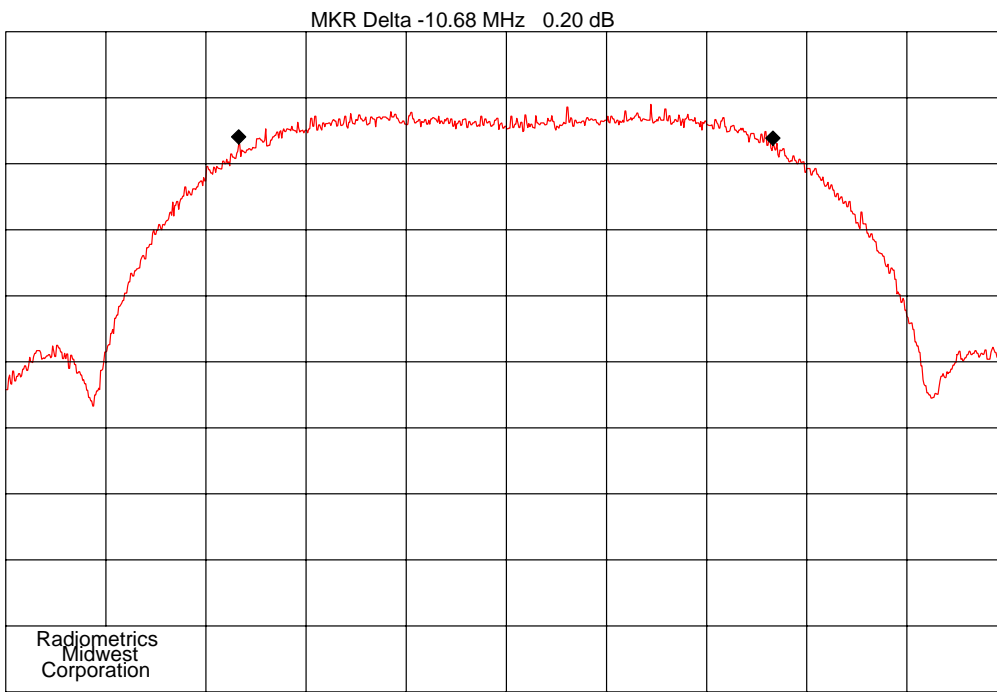
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

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 minimum occupied is required to be 0.5 MHz.

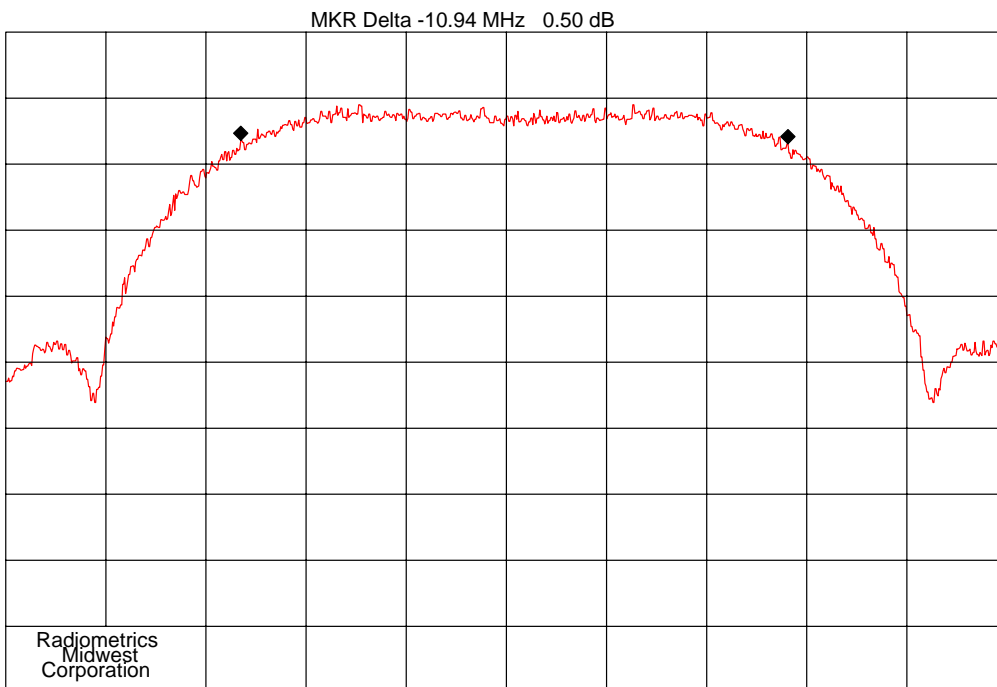
Channel	802.11b	802.11g
	6 dB EBW MHz	6 dB EBW MHz
1	10.68	16.62
6	10.94	16.46
11	10.86	16.28

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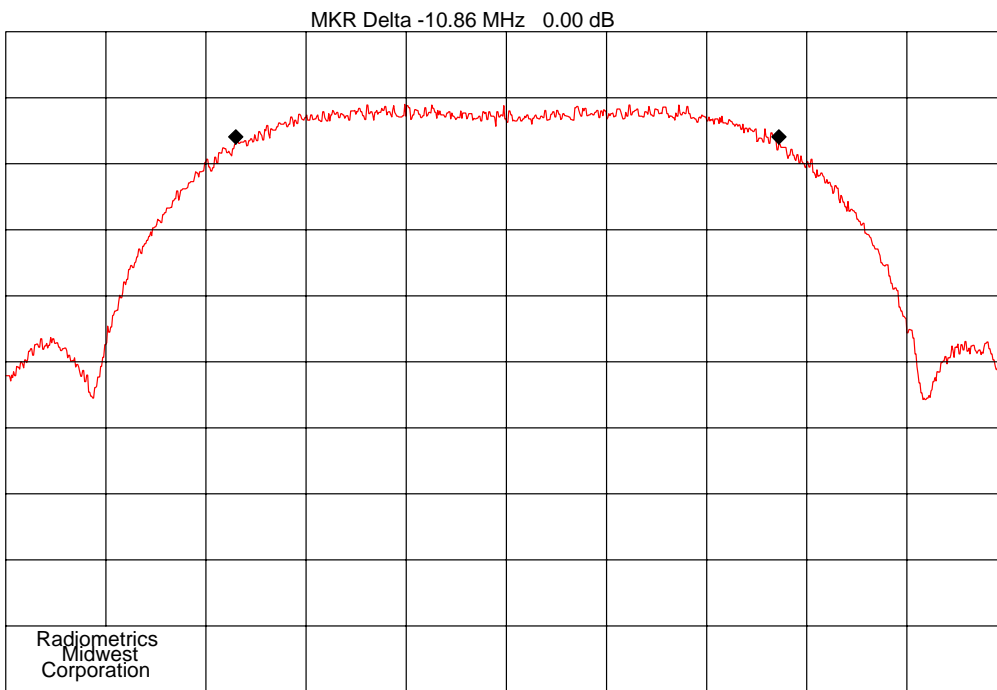
COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
CENTER 2.412 0 GHz	REF 20.0 dBm	SPAN 20.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 12:22	SWP 20.0 msec
NOTES : 6 dB Bandwidth, 802.11b; Ch 1		



COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
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 : 12:26	SWP 20.0 msec
NOTES : 6 dB Bandwidth, 802.11b; Ch 6		

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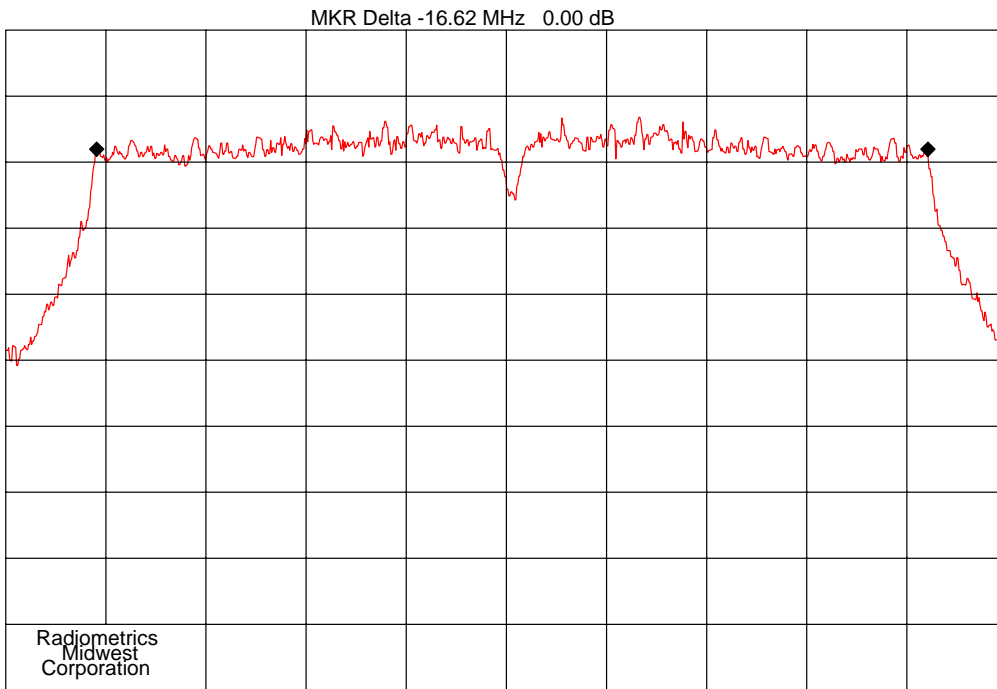


COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 12:29

DATE : 05-08-2007
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

NOTES : 6 dB Bandwidth, 802.11b; Ch 11



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

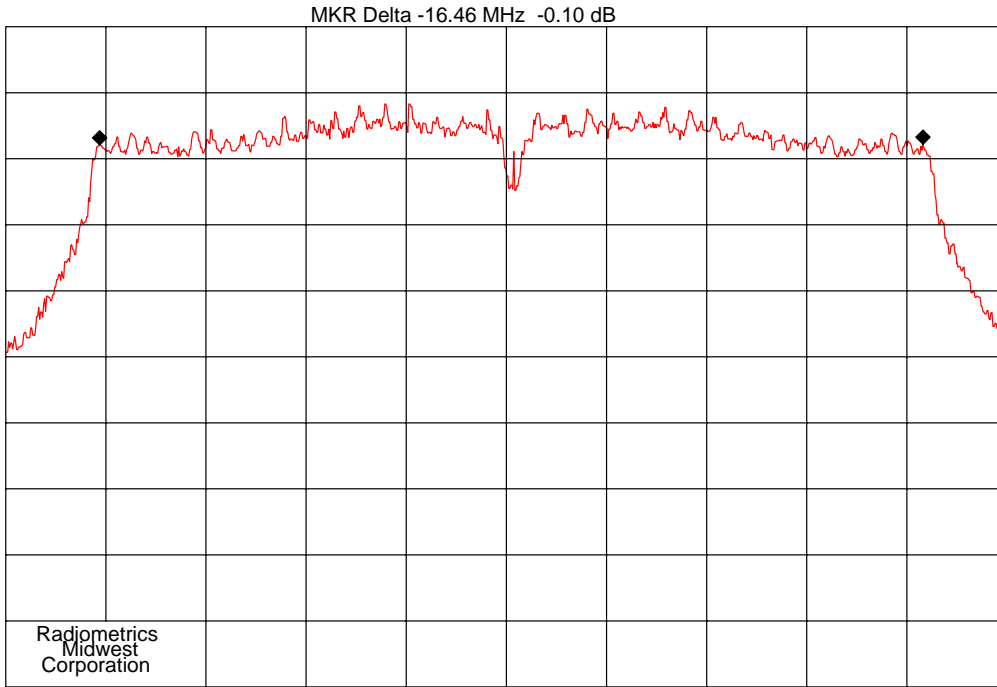
ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:43

DATE : 05-08-2007
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

NOTES : 6 dB Bandwidth, 802.11g; Ch 1

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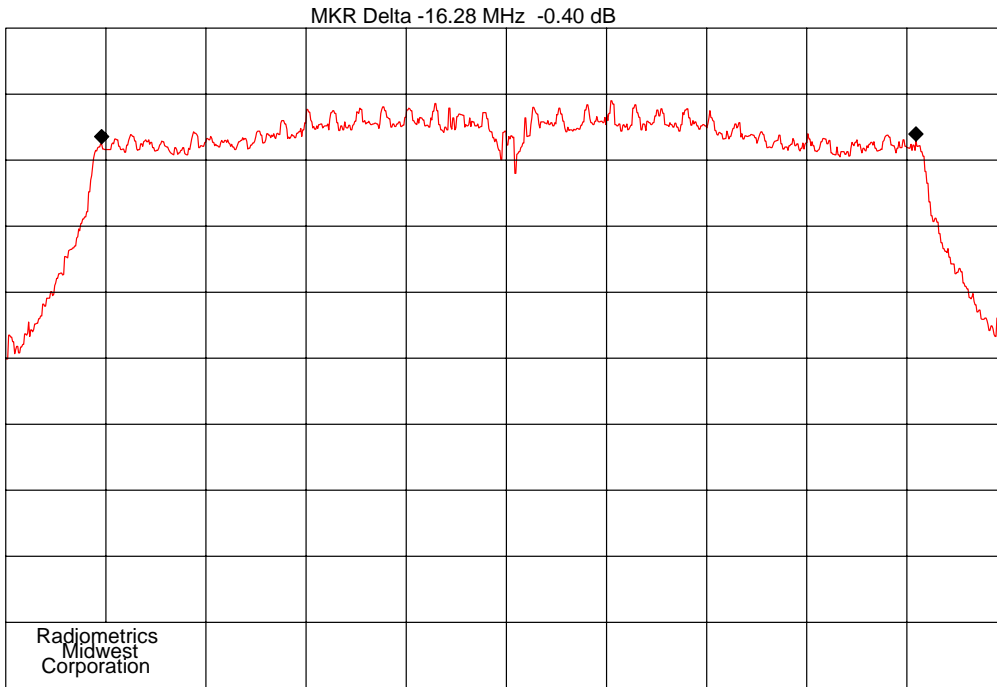
Testing of the Westell, Inc., Model A90-750015-07, Versalink



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

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:55

DATE : 05-08-2007
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec



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

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:16

DATE : 05-08-2007
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 = 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. 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	16.2	10.3	0.3	26.8	0.477	30
802.11b	2437	15.9	10.4	0.3	26.6	0.456	30
802.11b	2462	16.2	10.4	0.3	26.9	0.485	30
802.11g	2412	15.1	12.2	0.3	27.6	0.576	30
802.11g	2437	15.8	12.2	0.3	28.3	0.670	30
802.11g	2462	14.9	12.1	0.3	27.3	0.539	30

Judgement pass by 1.7 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	-5.2	0.3	-4.9	8.0
802.11b	2437	-6.1	0.3	-5.8	8.0
802.11b	2462	-6.2	0.3	-5.9	8.0
802.11g	2412	-7.6	0.3	-7.3	8.0
802.11g	2437	-6.4	0.3	-6.1	8.0
802.11g	2462	-6.8	0.3	-6.5	8.0

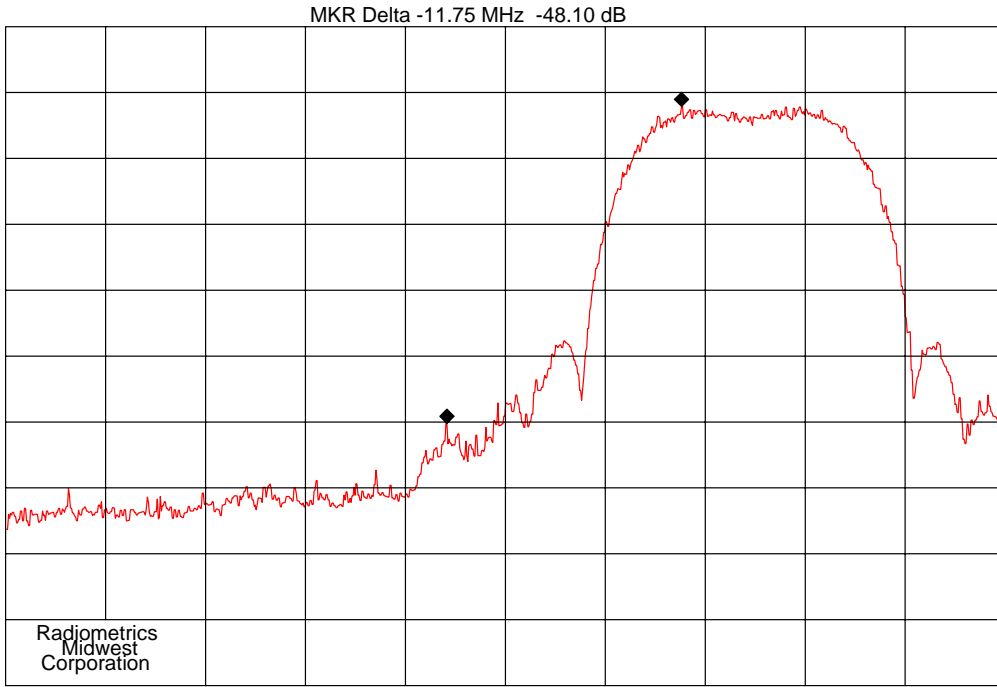
Judgement pass by 12.9 dB

10.5 Band-edge Compliance of RF Conducted Emissions

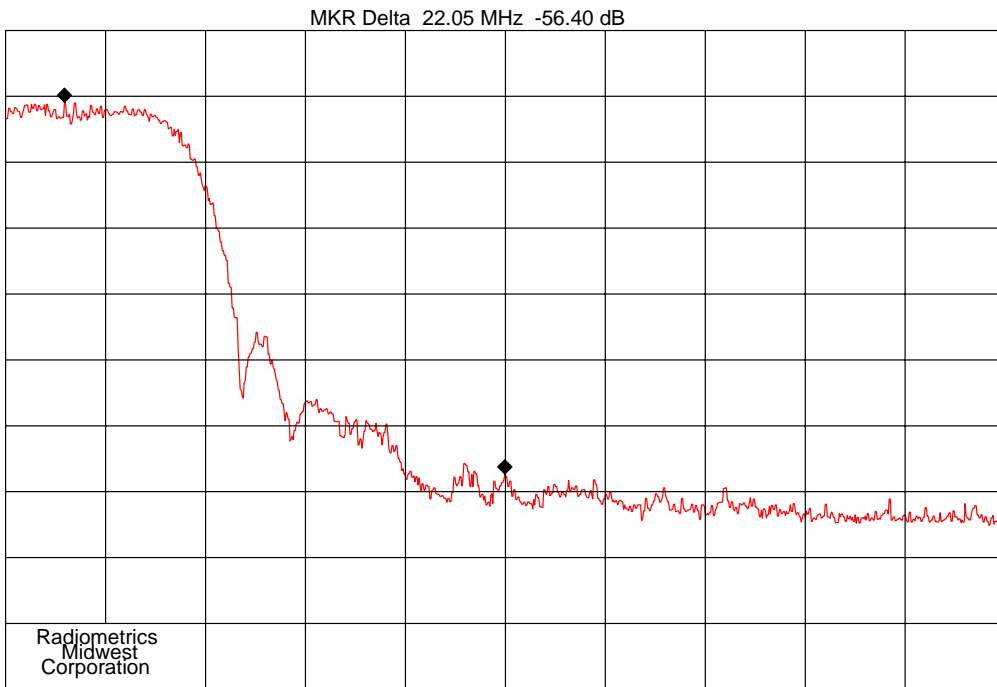
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize. The delta is required to be at least 20 dB.

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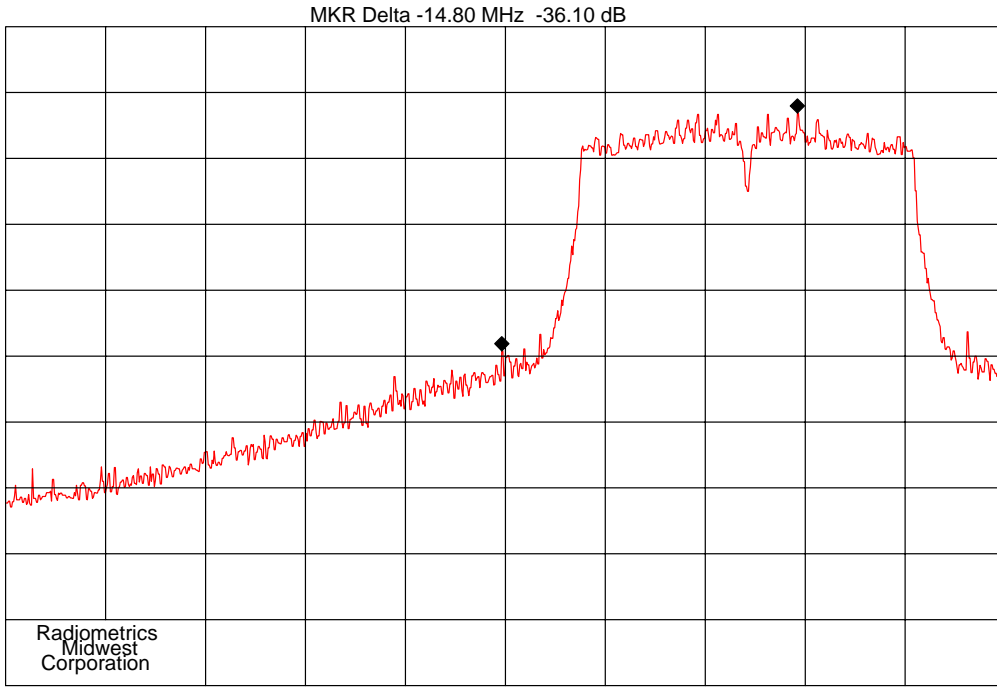
COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
CENTER 2.399 6 GHz	REF 20.0 dBm	SPAN 50.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 13:15	SWP 20.0 msec
NOTES : Lower Band Edge, 802.11b; Ch 1		



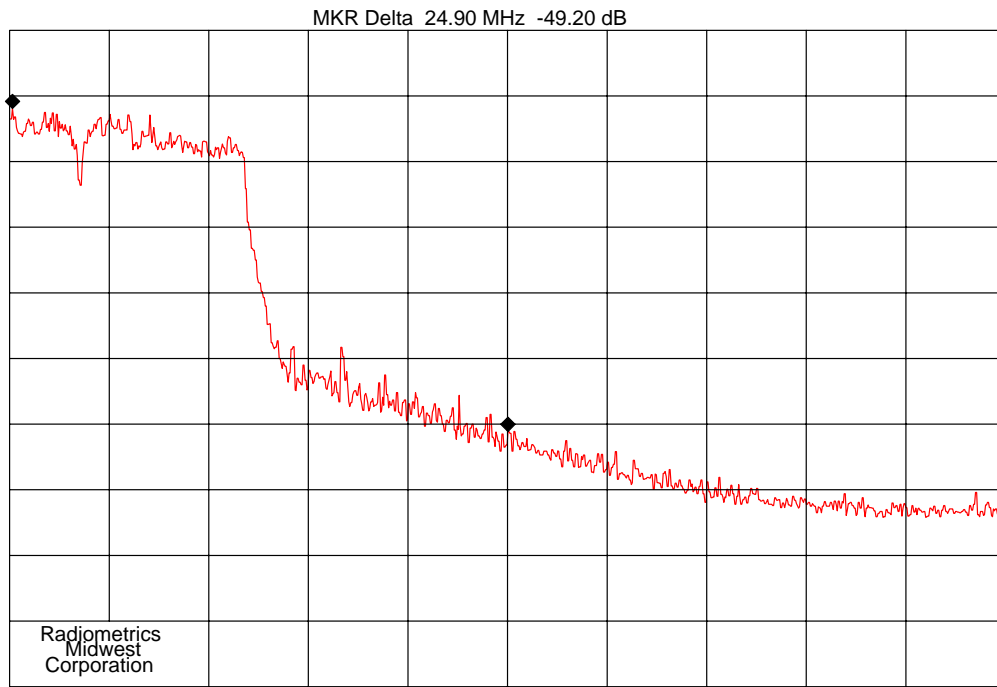
COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
CENTER 2.483 5 GHz	REF 20.0 dBm	SPAN 50.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 13:13	SWP 20.0 msec
NOTES : Upper Band Edge, 802.11b; Ch 11		

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-750015-07, Versalink



COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
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 : 11:51	SWP 20.0 msec
NOTES : Lower Band Edge, 802.11g; Ch 1		

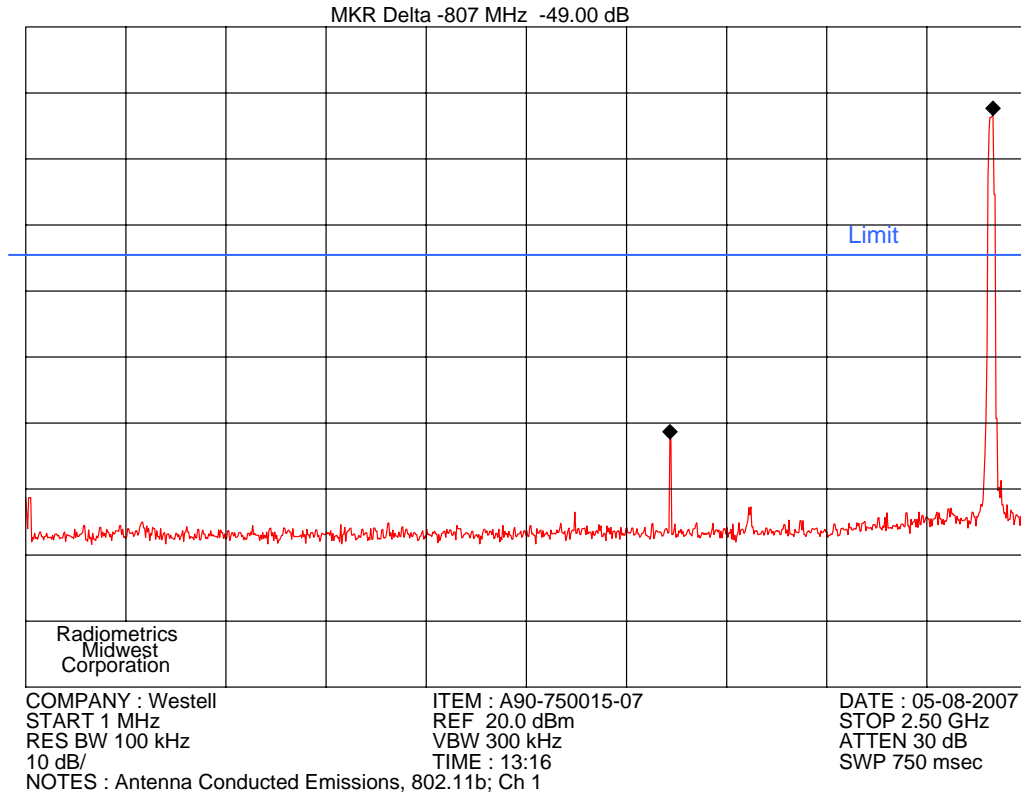


COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
CENTER 2.483 5 GHz	REF 20.0 dBm	SPAN 50.0 MHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 11:25	SWP 20.0 msec
NOTES : Upper Band Edge, 802.11g; Ch 11		

Judgement: pass by 16.1 dB

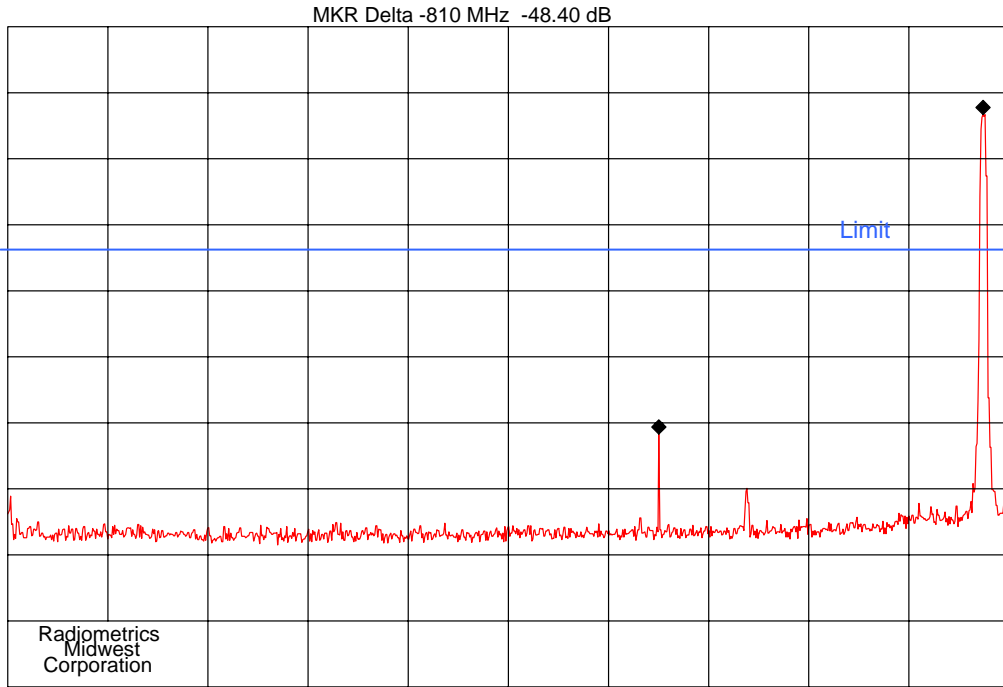
10.6 Spurious RF Conducted Emissions

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.



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Testing of the Westell, Inc., Model A90-750015-07, Versalink

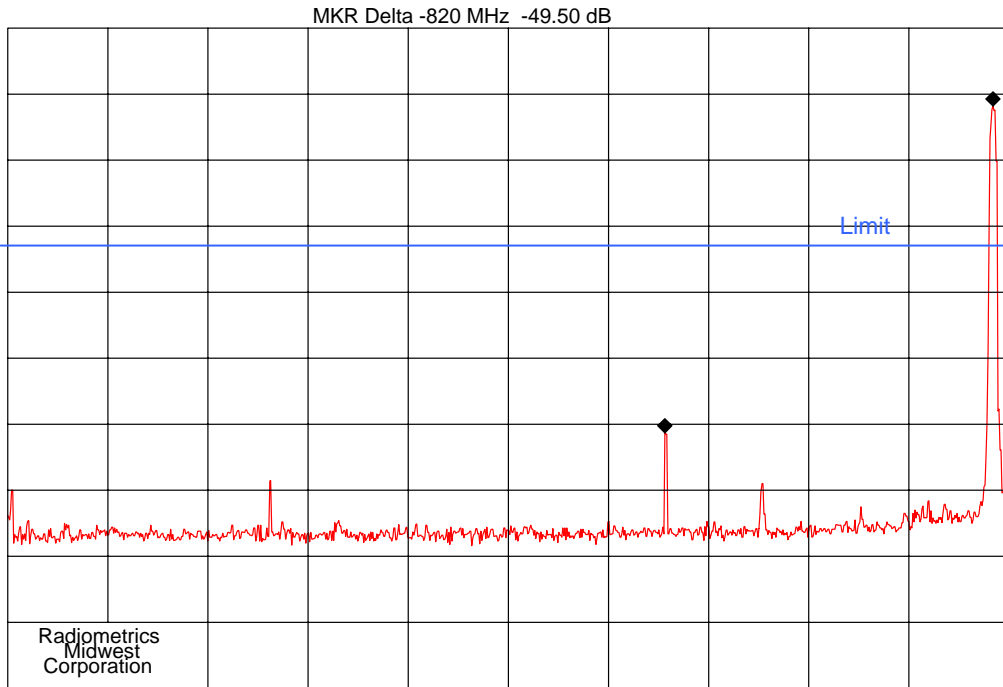


Radometrics
Midwest
Corporation

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

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:20

DATE : 05-08-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



Radometrics
Midwest
Corporation

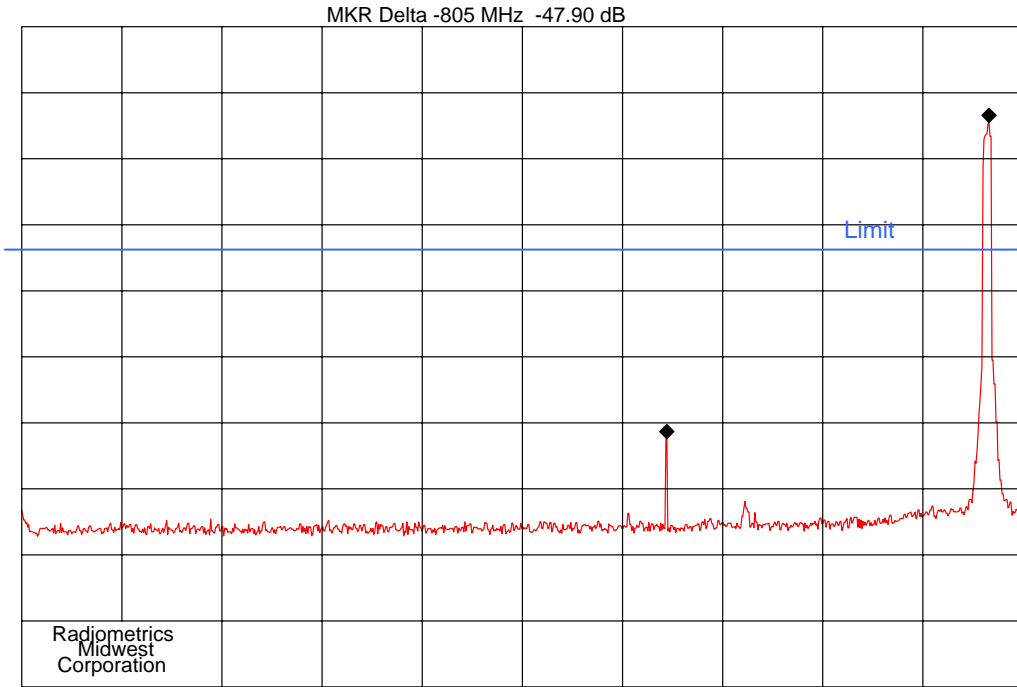
COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, 802.11b; Ch 11

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:22

DATE : 05-08-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

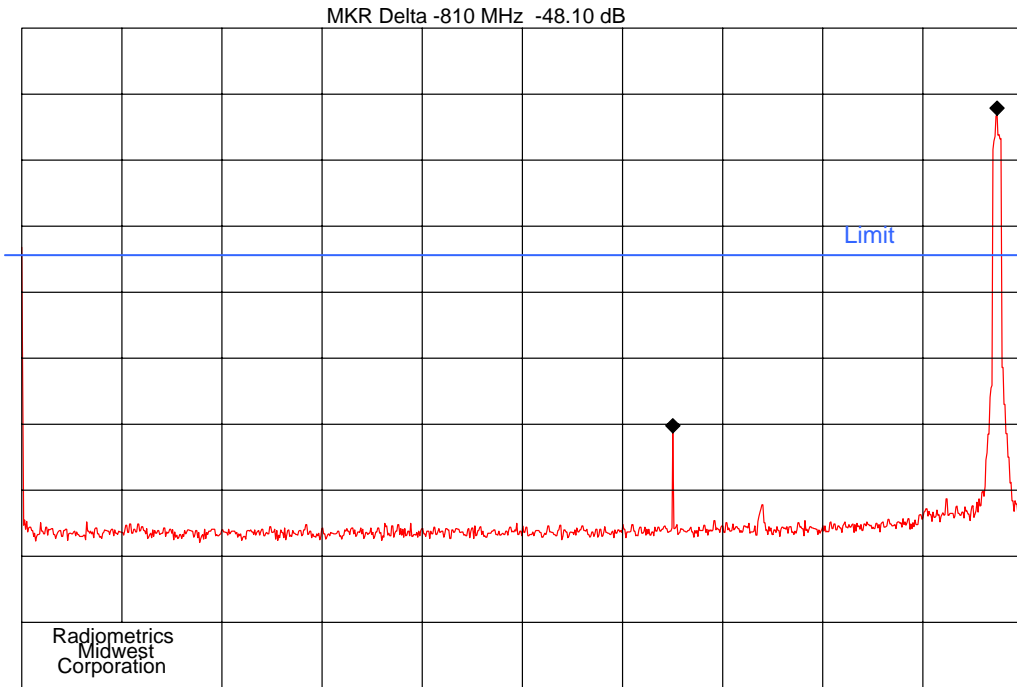
Testing of the Westell, Inc., Model A90-750015-07, Versalink



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

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:38

DATE : 05-08-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



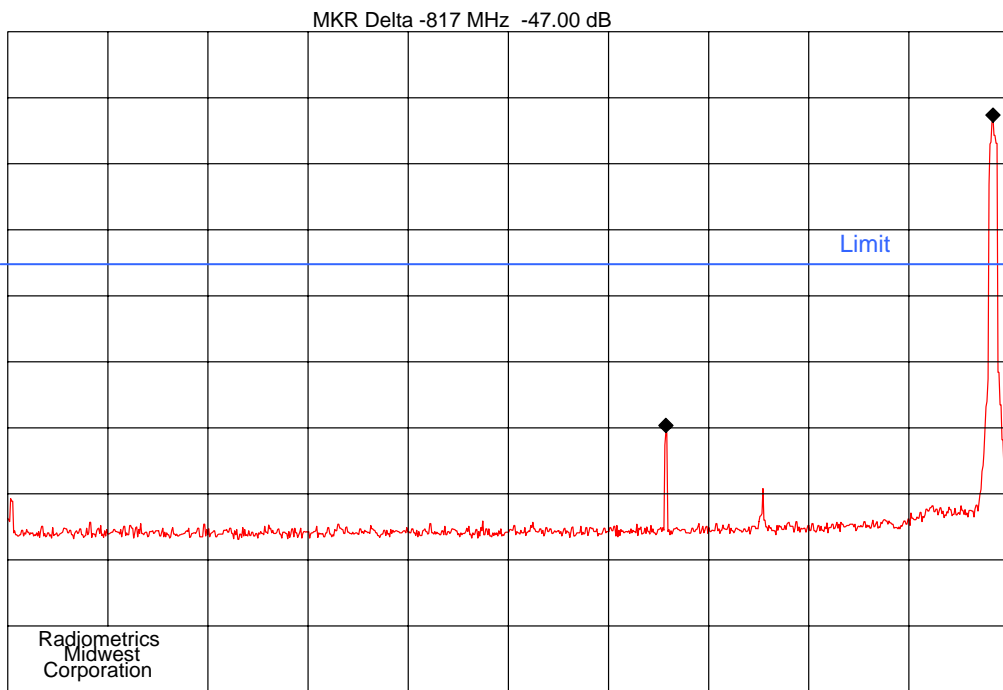
COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, 802.11g; Ch 6

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:34

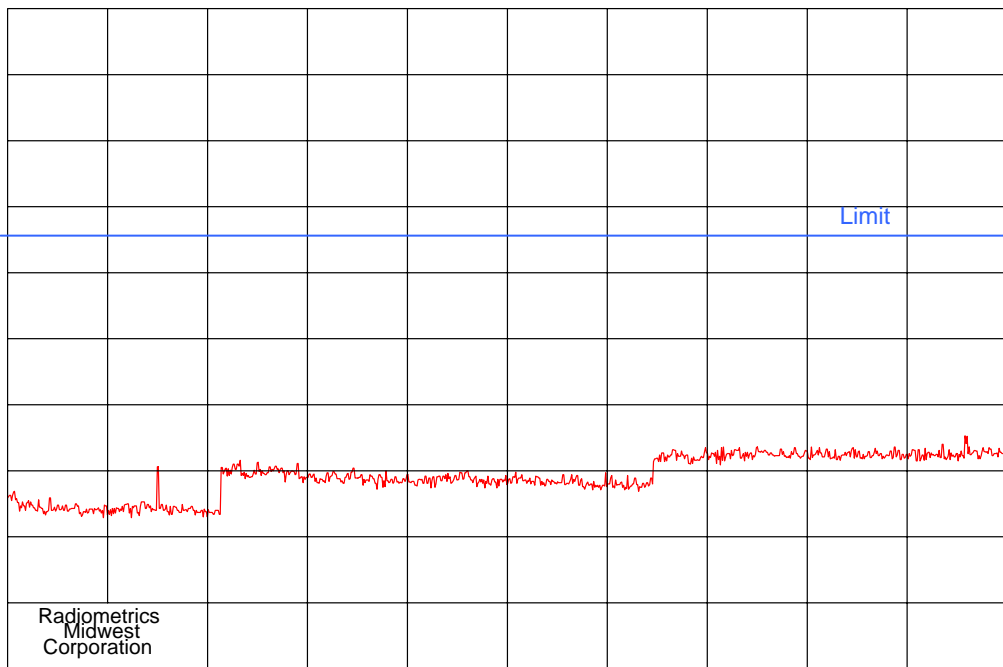
DATE : 05-08-2007
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-750015-07, Versalink



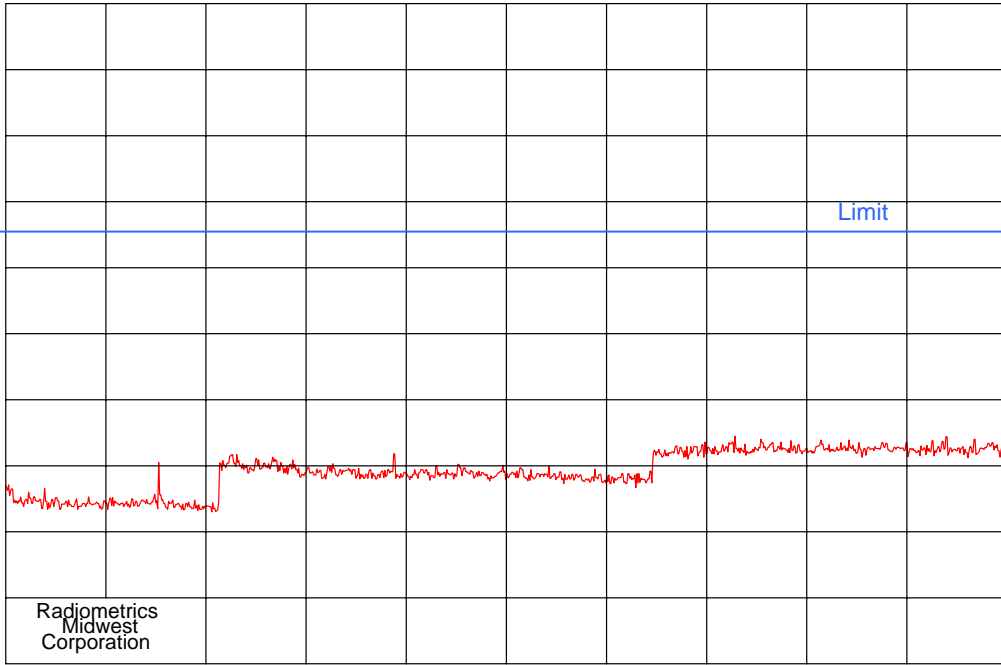
COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
START 1 MHz	REF 20.0 dBm	STOP 2.50 GHz
RES BW 100 kHz	VBW 300 kHz	ATTEN 30 dB
10 dB/	TIME : 11:29	SWP 750 msec
NOTES : Antenna Conducted Emissions, 802.11g; Ch 11		



COMPANY : Westell	ITEM : A90-750015-07	DATE : 05-08-2007
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 : 13:17	SWP 4.65 sec
NOTES : Antenna Conducted Emissions, 802.11b; Ch 1		

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-750015-07, Versalink

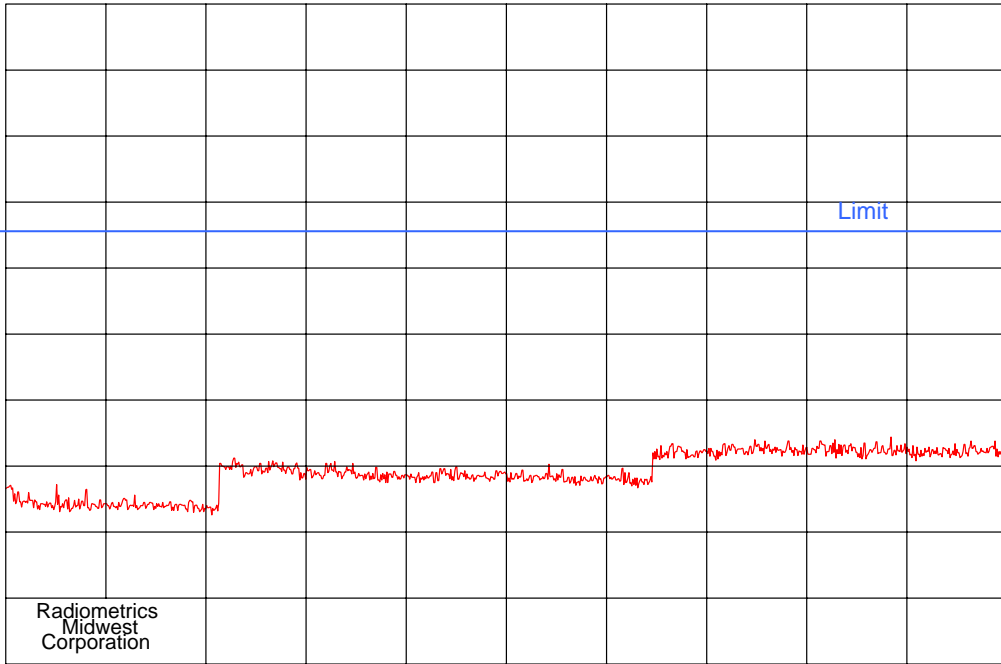


Radiometrics
Midwest
Corporation

COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, 802.11b; Ch 6

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:19

DATE : 05-08-2007
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



Radiometrics
Midwest
Corporation

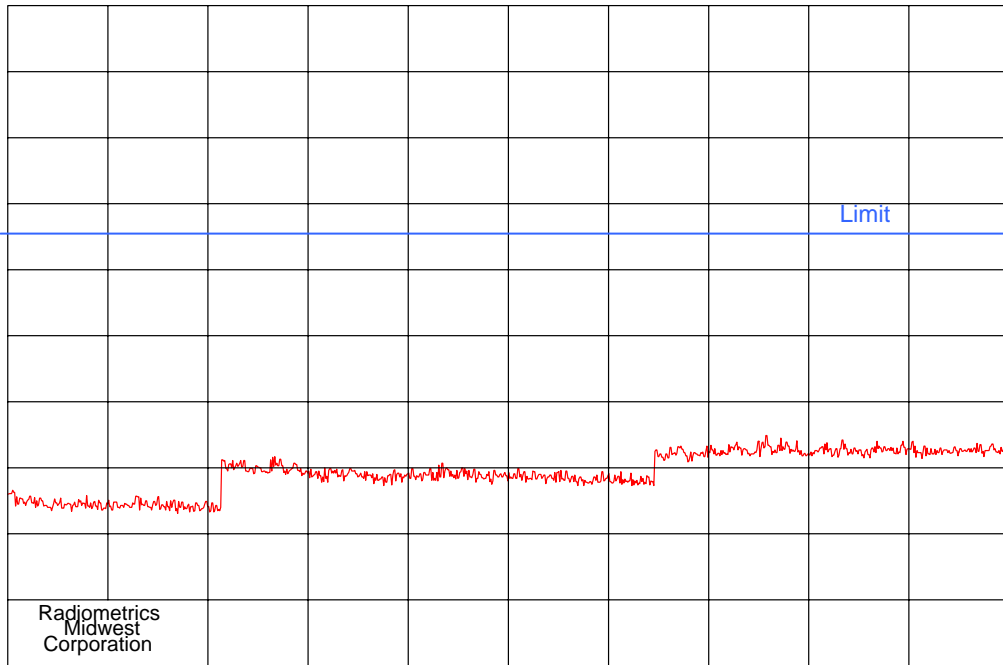
COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, 802.11b; Ch 11

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:22

DATE : 05-08-2007
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-750015-07, Versalink



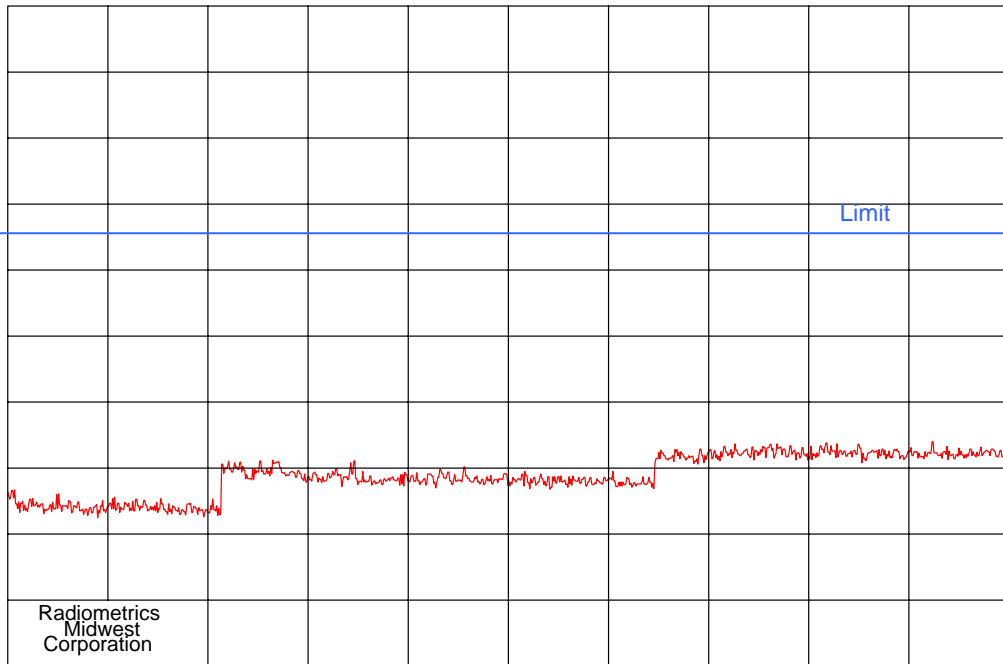
Radiometrics
Midwest
Corporation

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

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:40

DATE : 05-08-2007
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec

NOTES : Antenna Conducted Emissions, 802.11g; Ch 1



Radiometrics
Midwest
Corporation

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

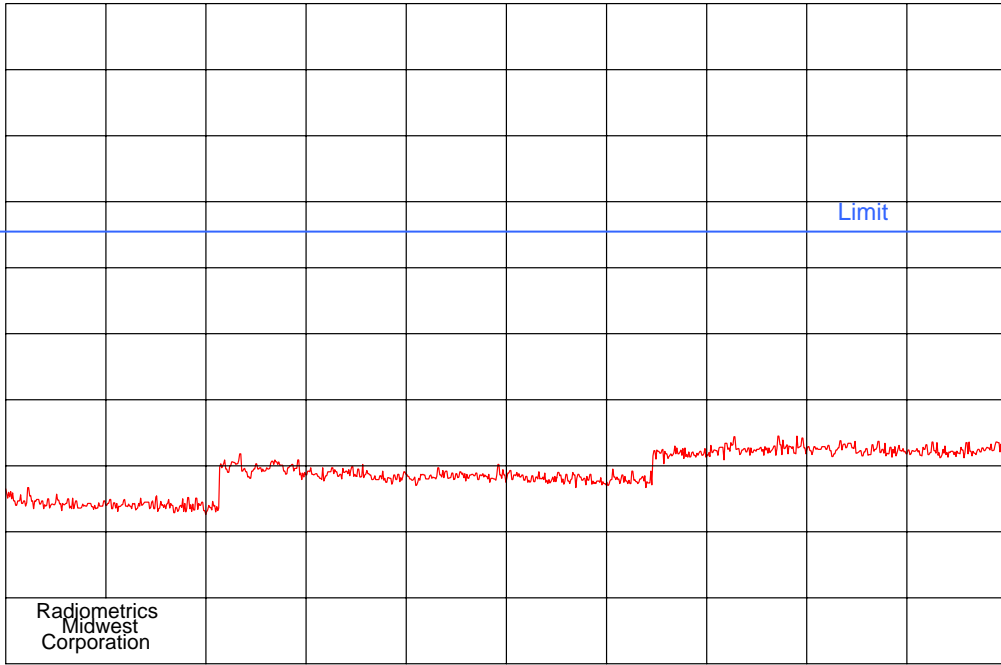
ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:32

DATE : 05-08-2007
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec

NOTES : Antenna Conducted Emissions, 802.11g; Ch 6

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Testing of the Westell, Inc., Model A90-750015-07, Versalink

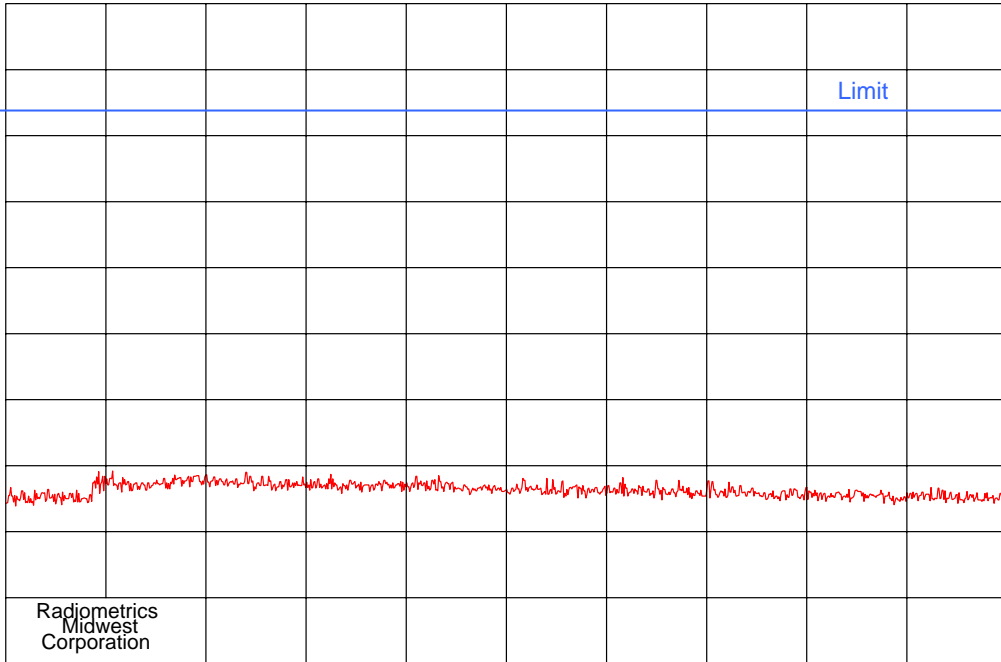


Radiometrics
Midwest
Corporation

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

ITEM : A90-750015-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:30

DATE : 05-08-2007
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



Radiometrics
Midwest
Corporation

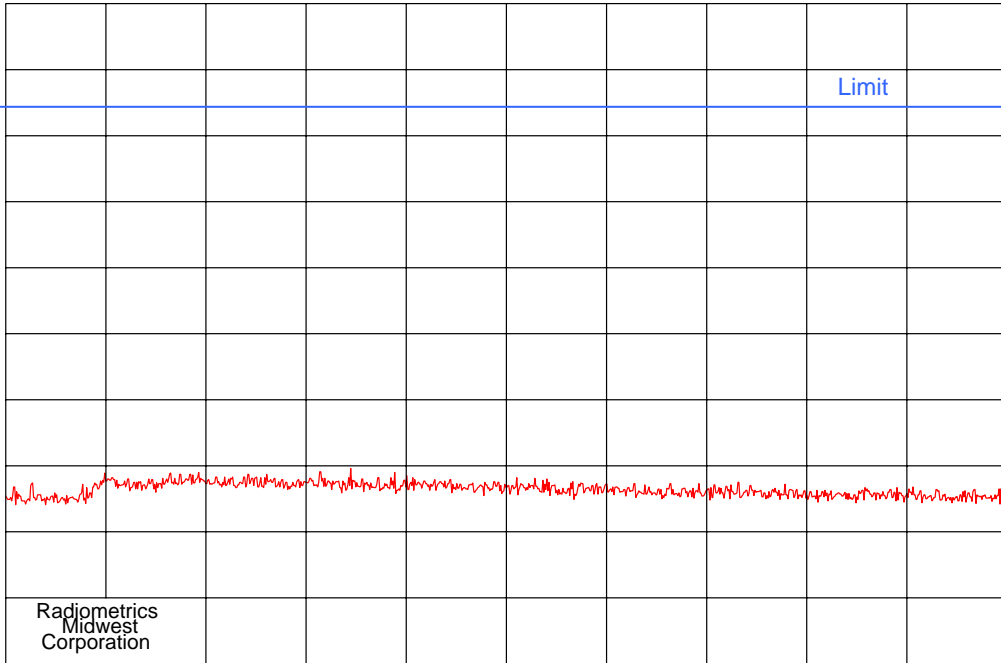
COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, 802.11b; Ch 1

ITEM : A90-750015-07
REF 0.0 dBm
VBW 300 kHz
TIME : 13:34

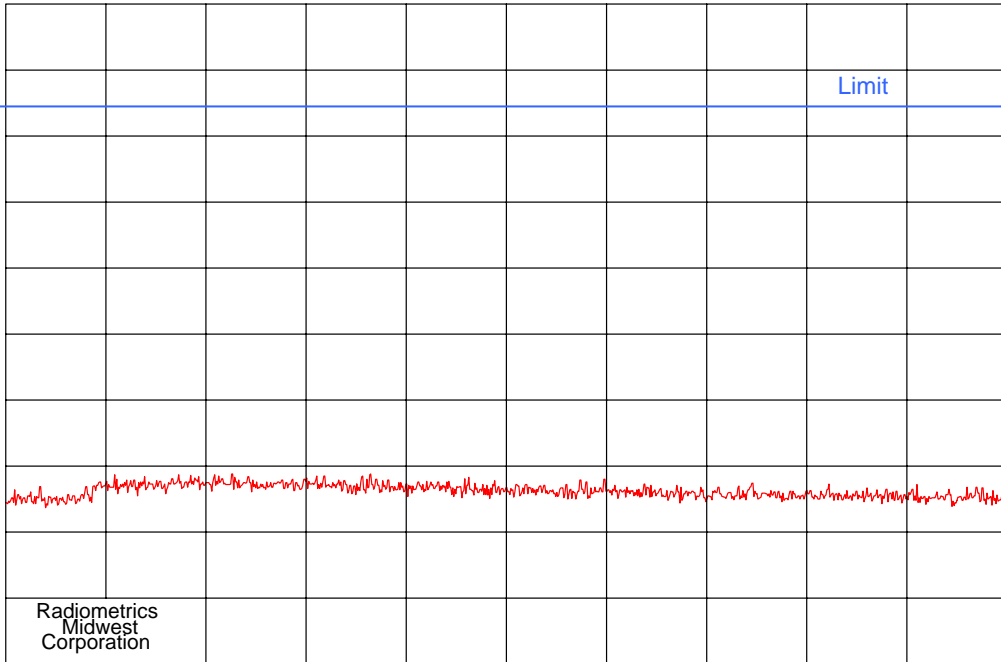
DATE : 05-08-2007
STOP 25.00 GHz
ATTEN 10 dB
SWP 2.10 sec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model A90-750015-07, Versalink



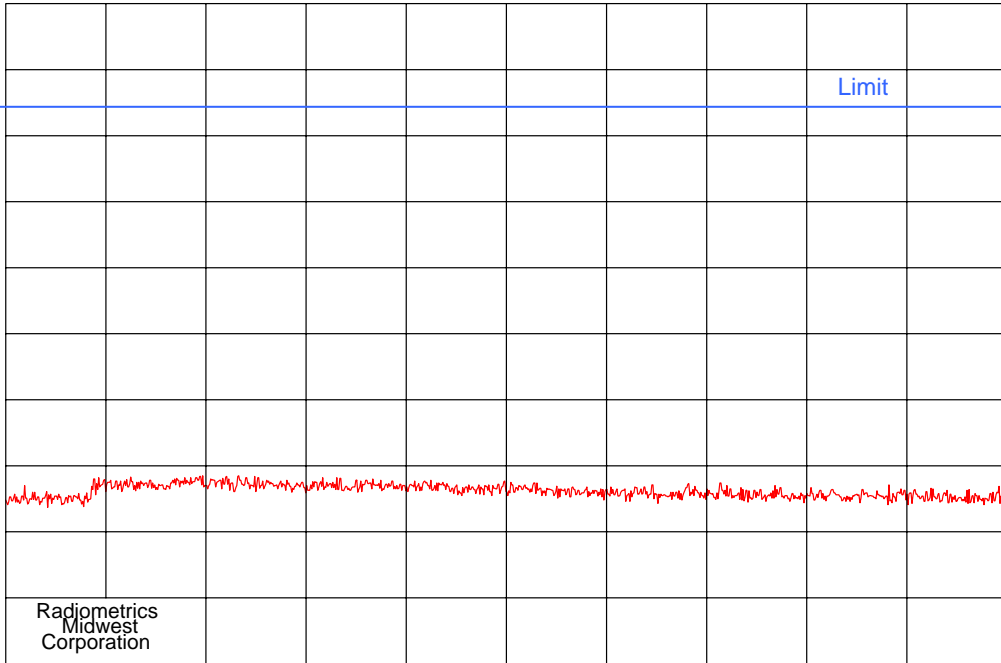
COMPANY : Westell START 18.00 GHz RES BW 100 kHz 10 dB/	ITEM : A90-750015-07 REF 0.0 dBm VBW 300 kHz TIME : 13:35	DATE : 05-08-2007 STOP 25.00 GHz ATTEN 10 dB SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11b; Ch 6		



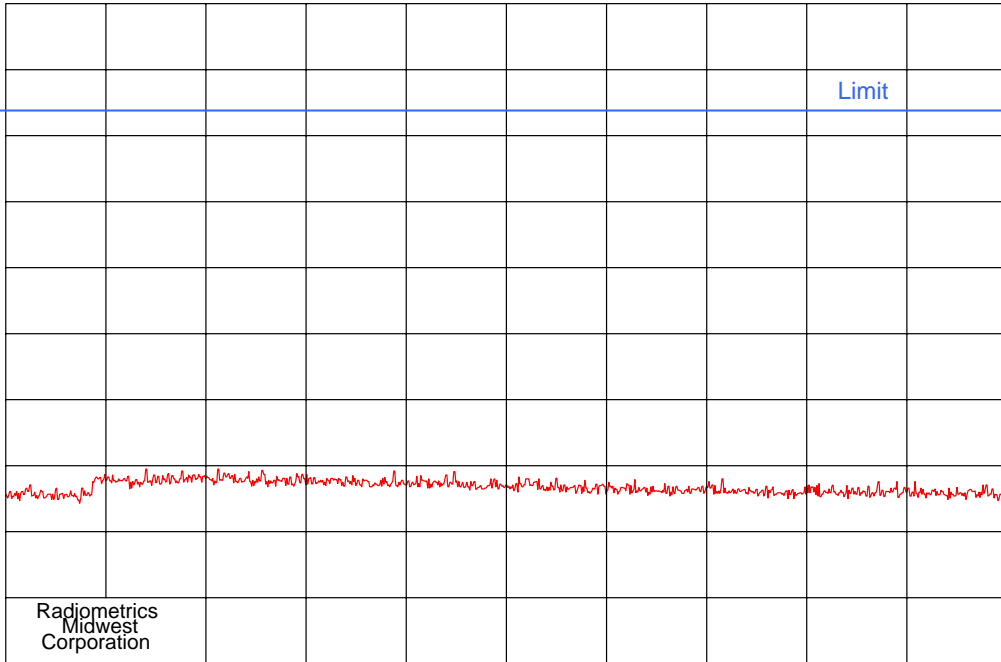
COMPANY : Westell START 18.00 GHz RES BW 100 kHz 10 dB/	ITEM : A90-750015-07 REF 0.0 dBm VBW 300 kHz TIME : 13:36	DATE : 05-08-2007 STOP 25.00 GHz ATTEN 10 dB SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11b; Ch 11		

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

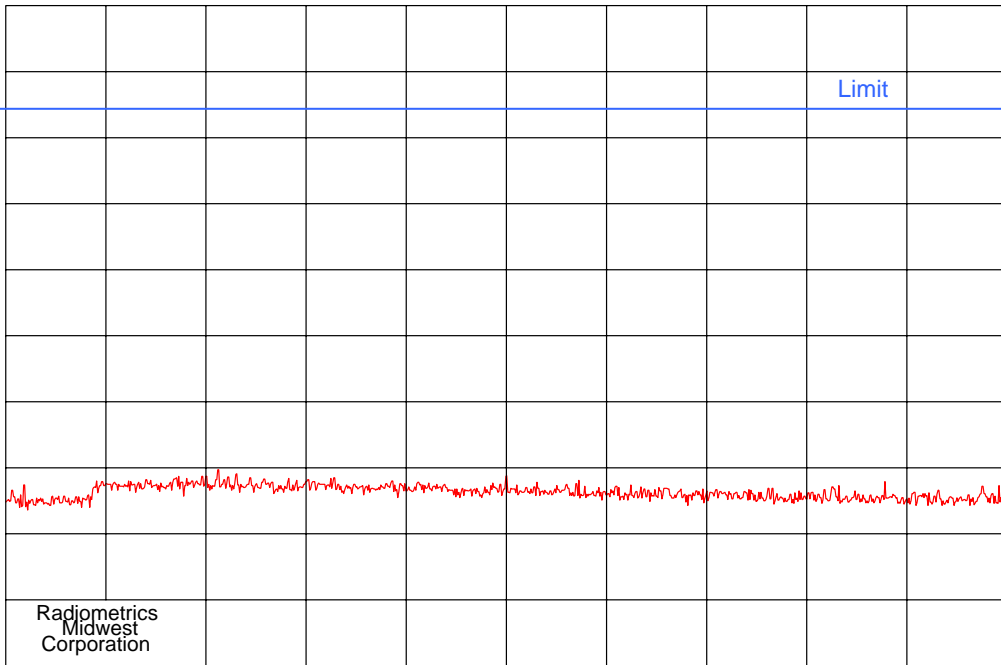
Testing of the Westell, Inc., Model A90-750015-07, Versalink



COMPANY : Westell START 18.00 GHz RES BW 100 kHz 10 dB/	ITEM : A90-750015-07 REF 0.0 dBm VBW 300 kHz TIME : 13:40	DATE : 05-08-2007 STOP 25.00 GHz ATTEN 10 dB SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11g; Ch 1		



COMPANY : Westell START 18.00 GHz RES BW 100 kHz 10 dB/	ITEM : A90-750015-07 REF 0.0 dBm VBW 300 kHz TIME : 13:38	DATE : 05-08-2007 STOP 25.00 GHz ATTEN 10 dB SWP 2.10 sec
NOTES : Antenna Conducted Emissions, 802.11g; Ch 6		



Radiometrics
Midwest
Corporation

COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/

ITEM : A90-750015-07
REF 0.0 dBm
VBW 300 kHz
TIME : 13:36

DATE : 05-08-2007
STOP 25.00 GHz
ATTEN 10 dB
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. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

From 30 to 1000 MHz, an Anritsu spectrum analyzer and a preamplifier with a 10 dB attenuator connected to the input 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 HP8566 spectrum analyzer was used with a preamplifier. 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.

Preliminary radiated emission tests were performed inside of an anechoic chamber. The frequency range from 30 to 25000 MHz was scanned and plotted using the peak detector function. The results of the preliminary scans were only used to identify the frequencies being emitted from the EUT and were not used to determine compliance with the test specification. Radiated emission measurements are performed with linearly polarized broadband antennas.

Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. 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

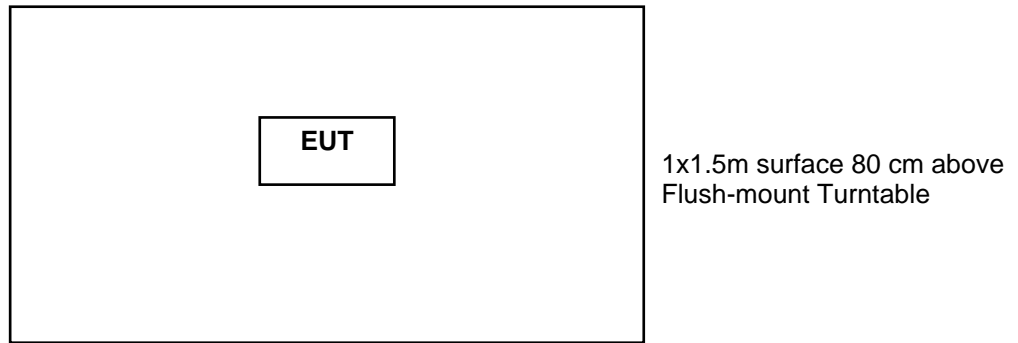
AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

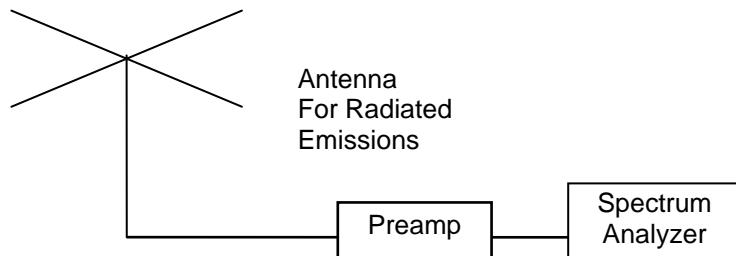
HPF = High pass Filter Loss

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



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Testing of the Westell, Inc., Model A90-750015-07, Versalink

10.7.2 Spurious Radiated Emissions Test Results (1 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.

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	A90-750015-07	Test Date	5/8/2007
Serial Number	641	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		

Emissions above 1 GHz (ANT-2)

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	Ave			Peak	Ave	Peak	Ave	
be	2412	V	27.7	17.5	36.1	21.9	30.6	2388	67.2	52.5	74	54	2.0
be	2412	H	21.7	12.5	35.7	18.9	30.6	2388	66.3	49.5	74	54	4.5
2	2412	V	51.2	35.7	52.0	33.5	10.8	4824	62.8	46.5	74	54	7.5
2	2412	H	45.7	33.4	43.2	29.5	10.8	4824	56.5	44.2	74	54	9.8
3	2412	V	37.0	28.0	37.0	26.0	16.8	7236	53.8	44.8	74	54	9.2
3	2412	H	36.0	26.0	36.0	26.0	16.8	7236	52.8	42.8	74	54	11.2
2	2437	V	50.6	40.0	51.2	32.2	10.9	4874	62.1	50.9	74	54	3.1
2	2437	H	45.9	35.6	45.2	29.9	10.9	4874	56.8	46.5	74	54	7.5
3	2437	V	36.0	26.0	37.0	26.0	17.0	7311	54	43.0	74	54	11.0
3	2437	H	36.0	26.0	36.0	26.0	17.0	7311	53	43.0	74	54	11.0
be	2462	V	26.6	18.0	33.1	18.4	31.0	2485.5	64.1	49.4	74	54	4.6
be	2462	H	21.9	14.5	31.7	16.4	31.0	2485.5	62.7	47.4	74	54	6.6
2	2462	V	52.4	38.2	52.6	33.7	11.0	4924	63.6	49.2	74	54	4.8
2	2462	H	46.5	34.2	45.1	29.5	11.0	4924	57.5	45.2	74	54	8.8
3	2462	V	37.0	27.3	37.0	26.0	17.5	7386	54.5	44.8	74	54	9.2
3	2462	H	36.5	26.0	36.0	26.0	17.5	7386	54	43.5	74	54	10.5

Emissions above 1 GHz (ANT-1)

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	Ave			Peak	Ave	Peak	Ave	
be	2412	V	26.3	17.3	41.2	16.3	30.6	2388	71.8	47.9	74	54	2.2
be	2412	H	22.7	12.4	38.4	11.7	30.6	2388	69	43	74	54	5.0
2	2412	V	50.9	34.9	52.3	34.2	10.8	4824	63.1	45.7	74	54	8.3

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2	2412	H	45.8	33.4	44.6	30.4	10.8	4824	56.6	44.2	74	54	9.8
3	2412	V	37	28	37.3	26	16.8	7236	54.1	44.8	74	54	9.2
3	2412	H	36	26	36	26	16.8	7236	52.8	42.8	74	54	11.2
2	2437	V	50.2	38.4	51.5	33.4	10.9	4874	62.4	49.3	74	54	4.7
2	2437	H	45.6	33.9	46.3	31.5	10.9	4874	57.2	44.8	74	54	9.2
3	2437	V	36	26	37.4	26	17.0	7311	54.4	43	74	54	11
3	2437	H	36	26	36	26	17.0	7311	53	43	74	54	11
be	2462	V	28.3	19.7	39.9	16	31.0	2485.5	70.9	50.7	74	54	3.1
be	2462	H	25.6	15.9	36.5	16.2	31.0	2485.5	67.5	47.2	74	54	6.5
2	2462	V	48.5	37.9	52.1	32.7	11.0	4924	63.1	48.9	74	54	5.1
2	2462	H	43.7	31.4	44.8	30.4	11.0	4924	55.8	42.4	74	54	11.6
3	2462	V	37	27.3	37.2	26	17.5	7386	54.7	44.8	74	54	9.2
3	2462	H	36.5	26	36	26	17.5	7386	54	43.5	74	54	10.5

No other emissions were detected in the restricted bands above 1 GHz.

- 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 2.0 dB

10.7.3 Radiated Emissions Below 1 GHz

Company	Westell, Inc.	Specification	FCC Part 15; Subpart B; Class B
Model		Test Date	
Serial Number		Test Distance	3 Meters
Test Personnel	Joseph Strzelecki	Test Location	Open Area Test Site 8625 Helmar Road
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	This is the worst case emissions from the USB and Ethernet modes		

All restricted bands emissions Below 1 GHz. Emissions within 1 MHz of the restricted bands were also included.

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ID#		EUT	Limit	
38.5	41.8 P	11.4	H/BC	-24.7	28.4	40.0	11.6
109.0	39.7 P	11.8	H/BC	-22.9	28.6	43.5	14.9
113.1	36.7 P	12.1	H/BC	-23.0	25.8	43.5	17.7
149.1	39.9 P	11.8	H/BC	-22.6	29.1	43.5	14.4

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Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ID#		EUT	Limit	
233.4	34.1 P	15.1	H/BC	-21.2	28.0	46.0	18.0
250.0	44.2 P	12.5	H/LP	-20.8	35.9	46.0	10.1
400.0	36.0 P	16.5	H/LP	-18.6	33.9	46.0	12.1
72.5	53.0 P	6.8	V/BC	-23.9	35.9	40.0	4.1
73.8	46.9 P	6.8	V/BC	-23.9	29.8	40.0	10.2
74.1	49.5 P	6.8	V/BC	-23.9	32.4	40.0	7.6
109.2	44.4 P	12.8	V/BC	-22.9	34.3	43.5	9.2
110.8	49.2 P	12.8	V/BC	-22.9	39.1	43.5	4.4
111.6	49.6 P	12.9	V/BC	-22.9	39.5	43.5	4.0
112.8	45.3 P	12.9	V/BC	-23.0	35.2	43.5	8.3
120.0	38.5 P	12.9	V/BC	-23.1	28.3	43.5	15.2
240.1	42.9 P	16.0	V/BC	-20.9	38.0	46.0	8.0
250.2	43.6 P	12.6	V/LP	-20.8	35.4	46.0	10.6
323.2	41.6 P	14.7	V/LP	-19.1	37.2	46.0	8.8
337.7	39.5 P	14.7	V/LP	-19.1	35.1	46.0	10.9
399.8	37.6 P	16.0	V/LP	-18.6	35.0	46.0	11.0

Judgment: Passed by 4.0 dB

No other emissions were detected in the restricted bands.