Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

4Port Wireless Gateway Router, Model Versalink

Radiometrics Document RP-5422

ACCREDITED
Certification # 1495.01

Product Detail:
FCC ID: CH8A90328XX-07
Equipment type: 2.4 GHz Digitally Modulated Transmitter.

Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C
FCC Part 15 CFR Title 47: 2004
Industry Canada RSS-210, Issue 5 as required for Category I Equipment

This report concerns: Original Grant for Certification
FCC Part 15.247

Tests Performed For:	*Test Facility:*
Westell, Inc. 750 N. Commons Dr. Aurora, IL 60504	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772 e-mail: info@radiomet.com

Test Date(s): (Month-Day-Year)
January 25 to 28, 2005

Document RP-5422 Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	March 24, 2005			

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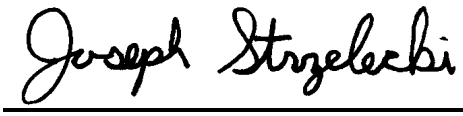
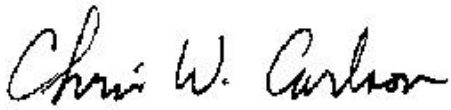
1 ADMINISTRATIVE DATA

Equipment Under Test: A Westell, Inc., 4Port Wireless Gateway Router Model: versalink Serial Number: none This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) November 11, 2004	*Test Date(s): (Month-Day-Year)* January 25 to 28, 2005
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* Dan Wood Westell, Inc.
Radiometrics' Personnel Responsible for Test:  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*Test Report Approved By*  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a 4Port Wireless Gateway Router, Model Versalink, manufactured by Westell, Inc.. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30 MHz to 25 GHz	RSS-210 & FCC Part 15	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	RSS-210 & FCC Part 15	Pass

Spread Spectrum Transmitter Requirements

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

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

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

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

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

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

3.2 Related Submittals

Westell, Inc. is not submitting any other products simultaneously for equipment authorization related to the EUT.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations.

The EUT was tested with a personal computer. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply. The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description Type*		Manufacturer	Model Number	Serial Number
1	4Port Wireless Gateway Router	E	Westell, Inc.	A90-328W10-07	5
2	Power Supply	E	Westell, Inc.	AA-151-ABN	None
3	Desktop PC	P	Gateway	MFATXPNTMDPE4100	0032924227
4	Monitor	P	Viewsonic	1782	5334513266
5	Keyboard	P	Gateway	2196003-00-004	54210247
6	Mouse	P	Gateway	X04-81538	7002409
7	Laptop PC	S	Gateway	SOLO 9100	BC397290560
8	Wireless Bridge	S	Linksys	WET54G	BDY003902803
9	CO	S	Texas Instrument	EUMII 400L PQT	B087268
10	Ethernet Switch	S	Westell, Inc.	A90-240010-04	02B506808945

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

List of EUT Cables

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

4.2 Special Accessories

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

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2004	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2001	2001	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 5	2001	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
IC RSS-212 Issue 1	1998	Test Methods For Radio Equipment
FCC 558074	2004	New Guidance on Measurements for Digital Transmission Systems in

		Section 15.247

The test procedures used are in accordance with ANSI document C63.4-2001, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.net).

The following is a list of facilities used during the tests.

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

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number 31040/SIT 1300F2. The FCC test site Registration Number is 90897. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

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

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/07/04
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	12/07/04
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/07/04
AMP-29	HP / Agilent	Amplifier	11975A	2304A00158	2-8 GHz	12 Mo.	07/21/04
AMP-29	HP / Agilent	Amplifier for 18-26 GHz Mixer	11975A	2304A00158	2-8 GHz	12 Mo.	07/21/04
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/13/04
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26 GHz	12 Mo.	10/13/04
ANT-42	EMCO	Bicon Antenna	3104C	9512-4713	25-300MHz	12 Mo.	12/02/04
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	06/15/04
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	12/31/03
HPF-03	Mini-Circuits	High Pass Filter	VHP-39	HPF-03	3-10 GHz	12 Mo.	08/03/04
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	04/08/03
MXR-01	HP / Agilent	Harmonic Mixer	11970K	3003A02243	18.6-26.5GHz	12 Mo.	01/06/05
PRE-01	HP / Agilent	Preselector	85685A	2510A00143	20 Hz-2GHz	12 Mo.	01/20/05
REC-01	HP / Agilent	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	08/17/04
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	01/04/05
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 Mo.	01/28/04

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

10.1 AC Conducted Emissions; Section 15.207

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

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

FCC Limits of Conducted Emissions at the AC Mains Ports

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

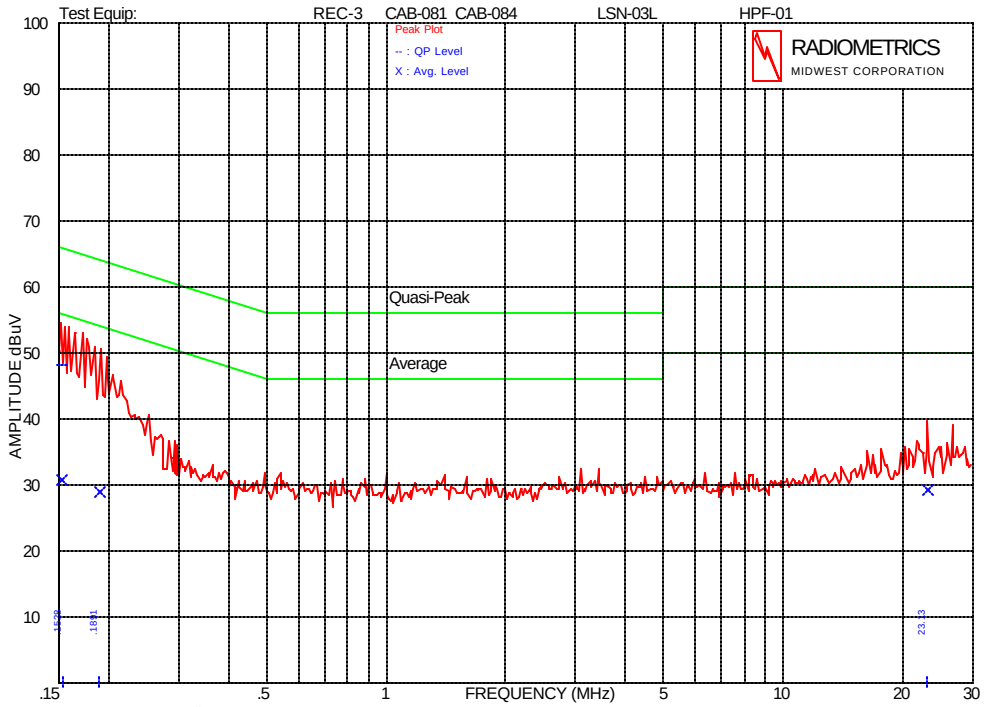
The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from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

Test Date : January 25, 2005
The Amplitude is the final corrected value with cable and LISN Loss.

Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Neutral	0.15	47.90	65.85	30.95	55.85
AC Neutral	23.13	N/A	60.00	33.30	50.00
AC Neutral	0.18	N/A	64.44	29.11	54.44
AC Hot	0.15	48.19	65.84	30.65	55.84
AC Hot	0.19	N/A	64.08	29.03	54.08
AC Hot	23.13	N/A	60.00	29.13	50.00

The above are the worst case results with three frequencies test for each EUT
* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

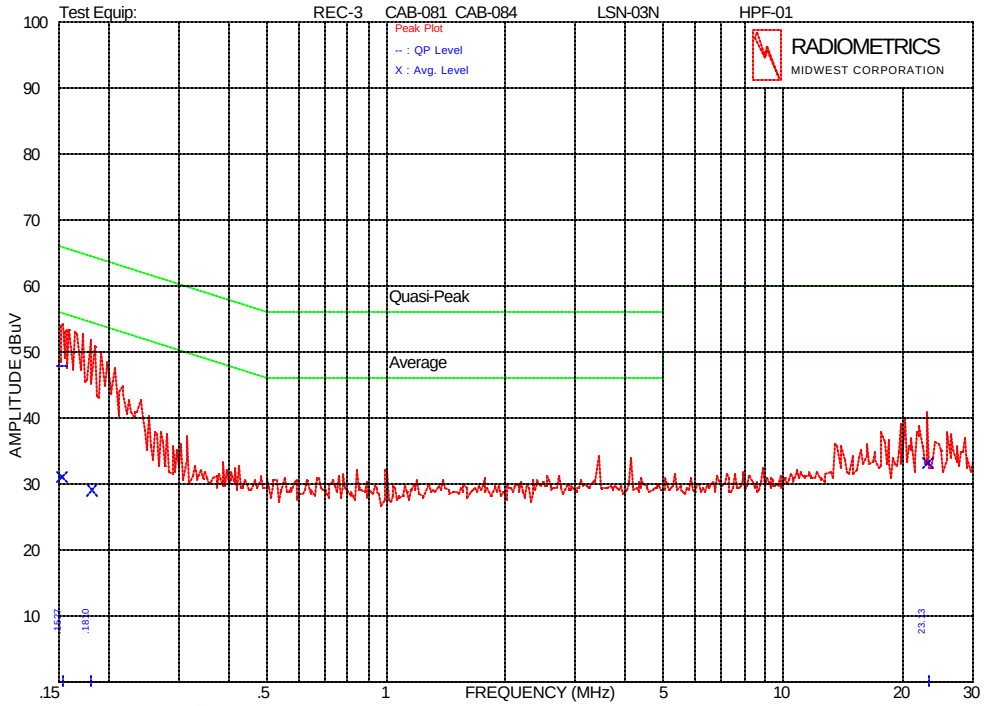
Judgment: Passed by at least 10 dB



COMPANY : Westell
LEAD TESTED : AC Hot
NOTES : OEM AA-151A 120 VAC Power Supply
FCC 15 & EN55022 Class B Conducted Emission Test; Mains Port Disturbances.

MODEL : A90-328W10-07
S/N : 5

DATE :01-25-2005
TIME :13:23
Tested By: JRS
RP-5422 | 120-H

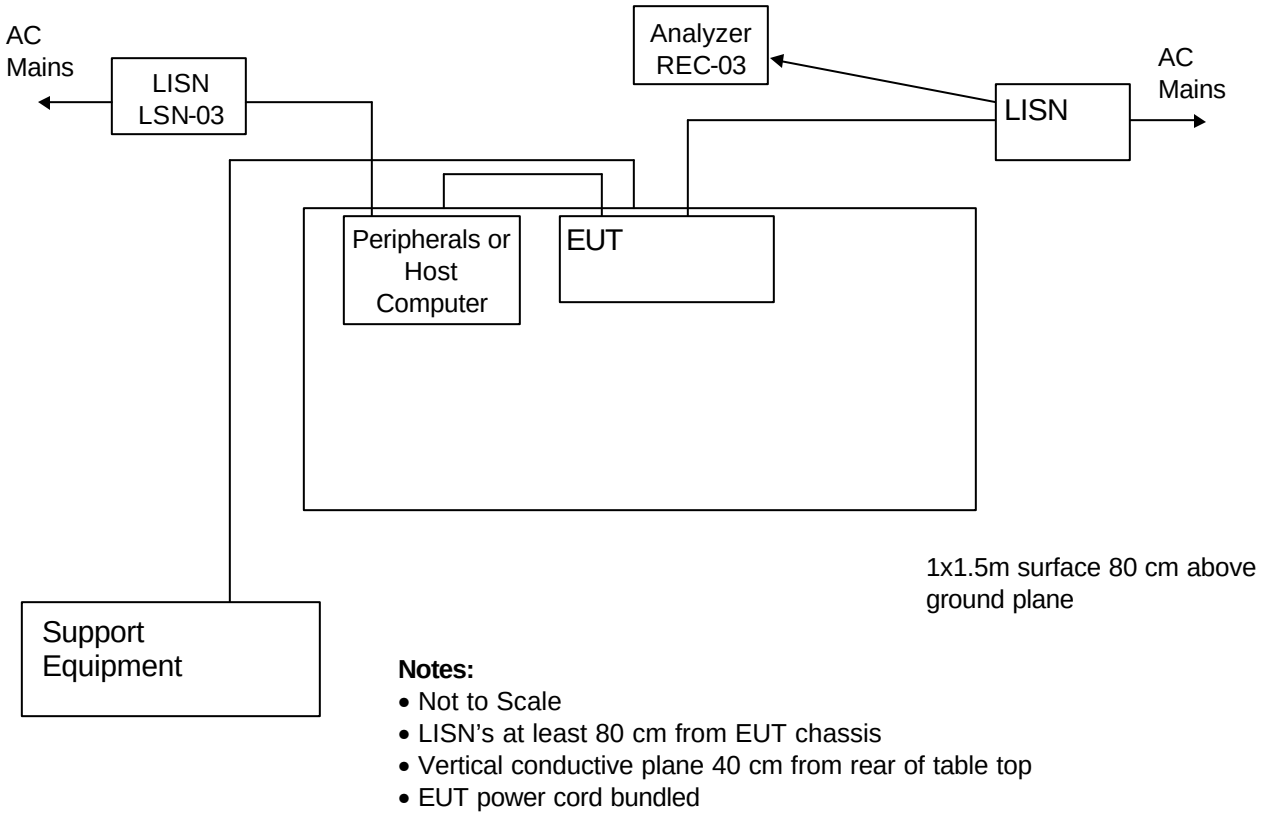


COMPANY : Westell
LEAD TESTED : AC Neutral
NOTES : OEM AA-151A 120 VAC Power Supply
FCC 15 & EN55022 Class B Conducted Emission Test; Mains Port Disturbances.

MODEL : A90-328W10-07
S/N : 5

DATE :01-25-2005
TIME :13:28
Tested By: JRS
RP-5422 | 120V-n

Figure 1. Conducted Emissions Test Setup



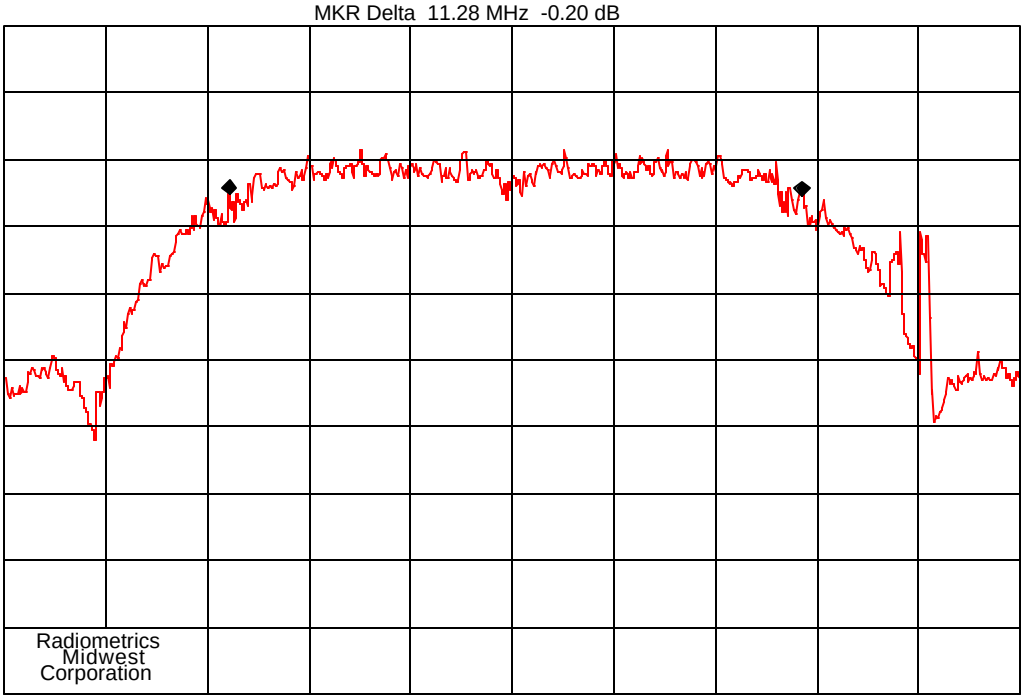
10.2 Occupied Bandwidth (6 dB)

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.

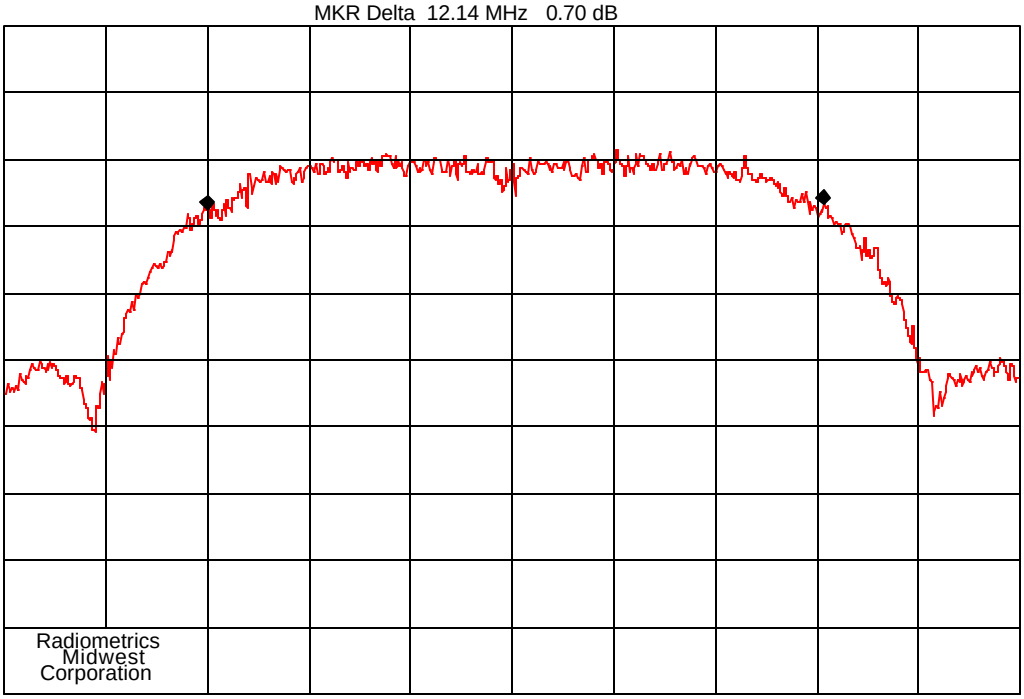
	802.11b	802.11g
Channel	EBW MHz	EBW MHz
1	11.3	16.7
6	12.2	16.6
11	11	16.5

MKR Delta 11.28 MHz -0.20 dB

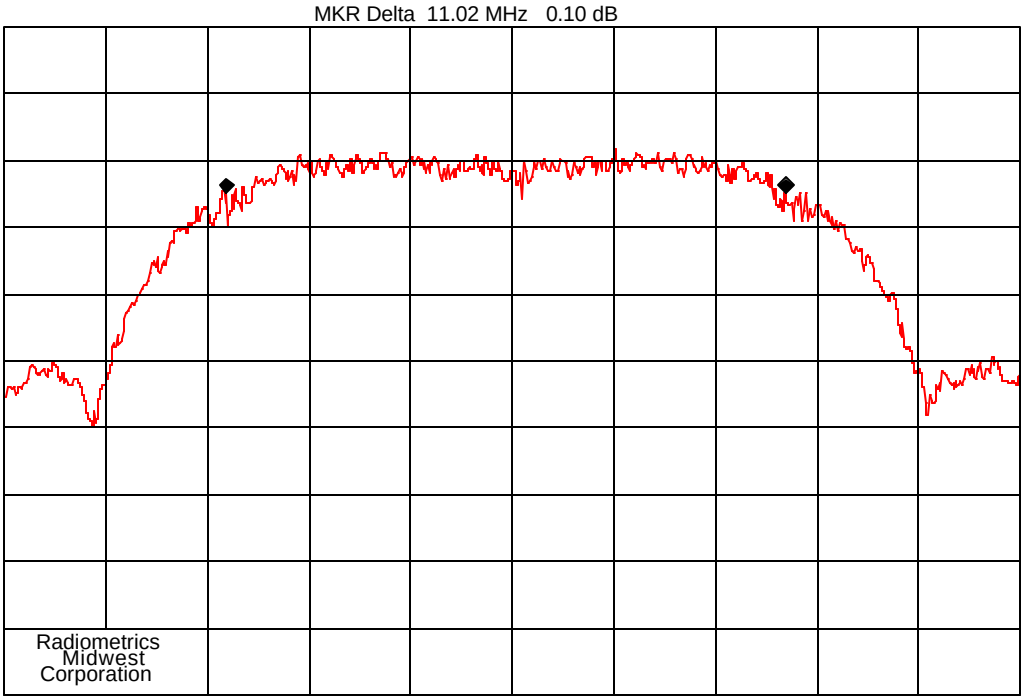


COMPANY : Westell
CENTER 2.412 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:35
DATE : 01-27-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec
NOTES : 15.247(a)(2) Bandwidth, 802.11b; Chan 1

MKR Delta 12.14 MHz 0.70 dB



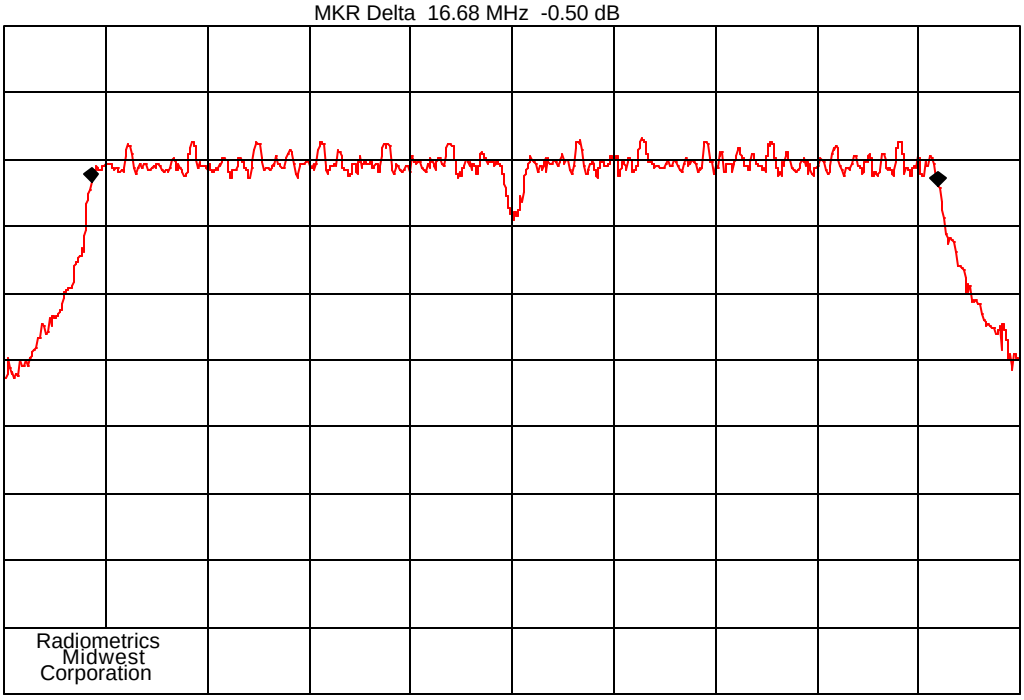
COMPANY : Westell
CENTER 2.437 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:32
DATE : 01-27-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec
NOTES : 15.247(a)(2) Bandwidth, 802.11b; Chan 6



COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
NOTES : 15.247(a)(2) Bandwidth, 802.11b; Chan 11

ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:38

DATE : 01-27-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

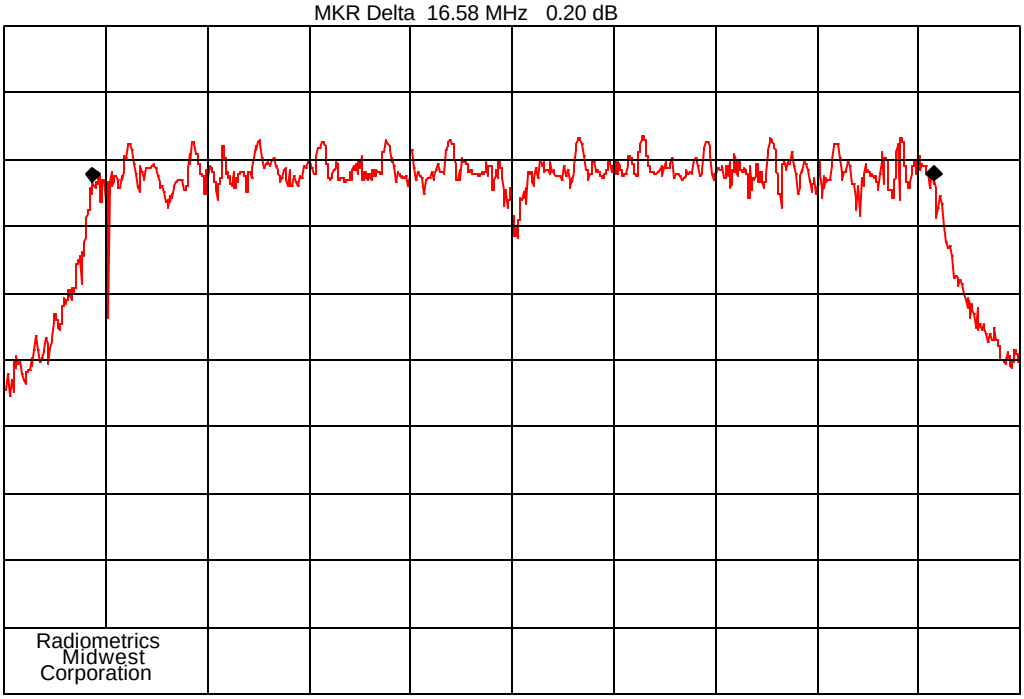


COMPANY : Westell
CENTER 2.412 0 GHz
RES BW 100 kHz
10 dB/
NOTES : 15.247(a)(2) Bandwidth, 802.11g; Chan 1

ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:17

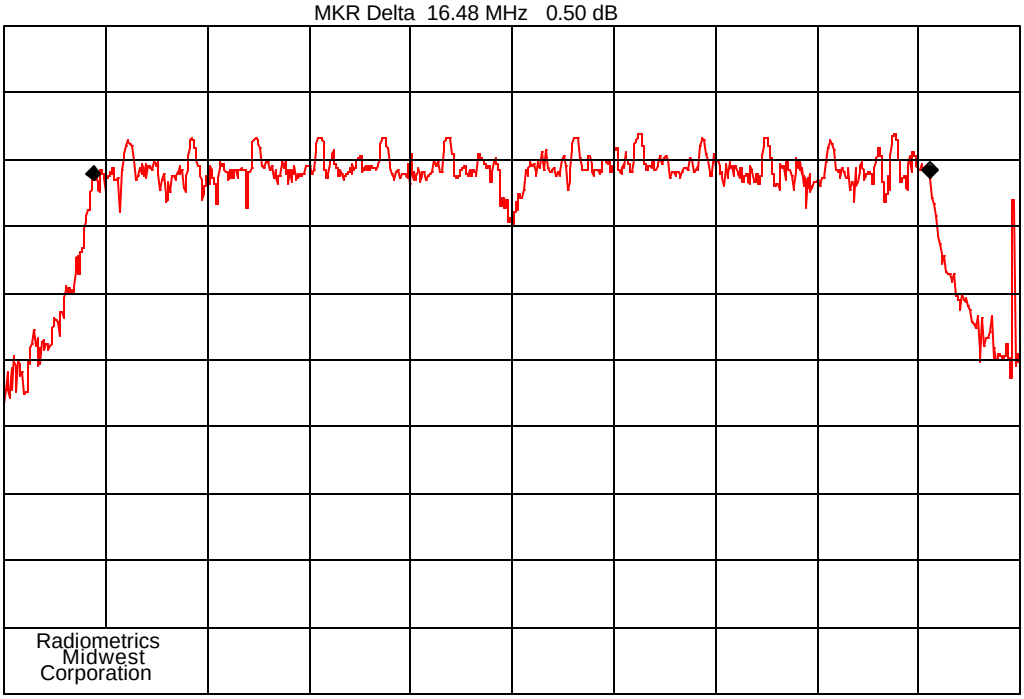
DATE : 01-27-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec

MKR Delta 16.58 MHz 0.20 dB



COMPANY : Westell
CENTER 2.437 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:27
DATE : 01-27-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec
NOTES : 15.247(a)(2) Bandwidth, 802.11g; Chan 6

MKR Delta 16.48 MHz 0.50 dB



COMPANY : Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:45
DATE : 01-27-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec
NOTES : 15.247(a)(2) Bandwidth, 802.11g; Chan 11

10.3 Peak Output Power

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

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

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

Mode	Freq. (MHz)	Reading (dBm)	BW Corr Factor (dB)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
					dBm	Watts	
802.11b	2412	8.0	11.3	0.3	19.6	0.0912	30
802.11b	2437	8.7	12.2	0.3	21.2	0.1318	30
802.11b	2462	8.9	11.0	0.3	20.2	0.1047	30
802.11g	2412	9.2	16.7	0.3	26.2	0.4169	30
802.11g	2437	9.9	16.6	0.3	26.8	0.4786	30
802.11g	2462	10.1	16.5	0.3	26.9	0.4898	30

10.4 Power Spectral Density

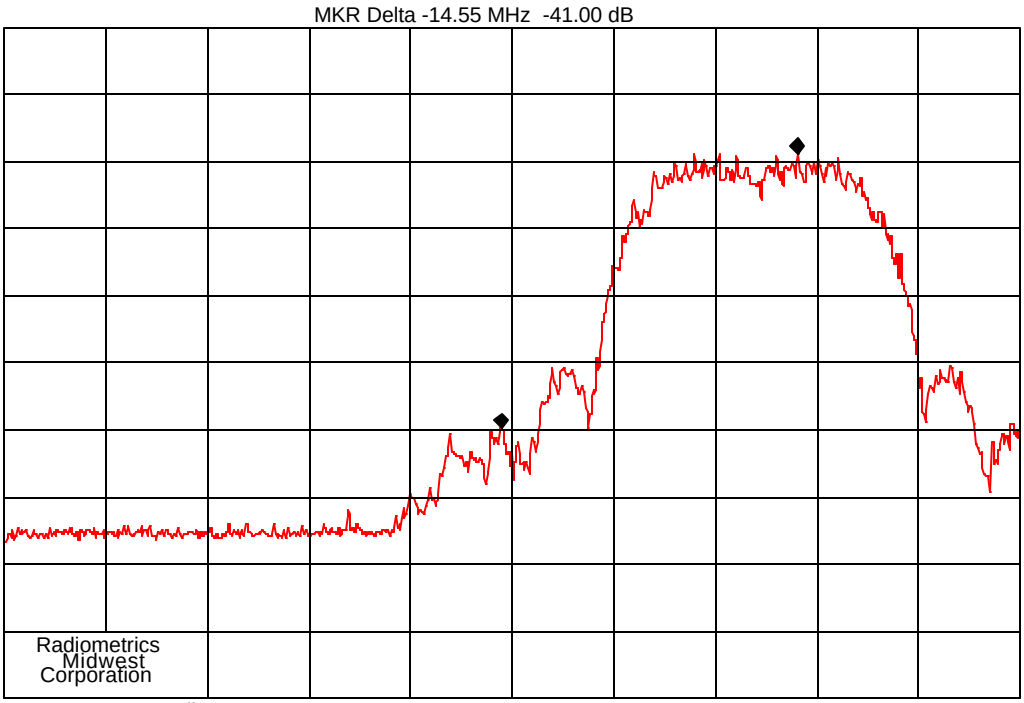
PSD option 1 was used for this test. No external attenuator was used. The spectrum analyzer was set to the following settings:

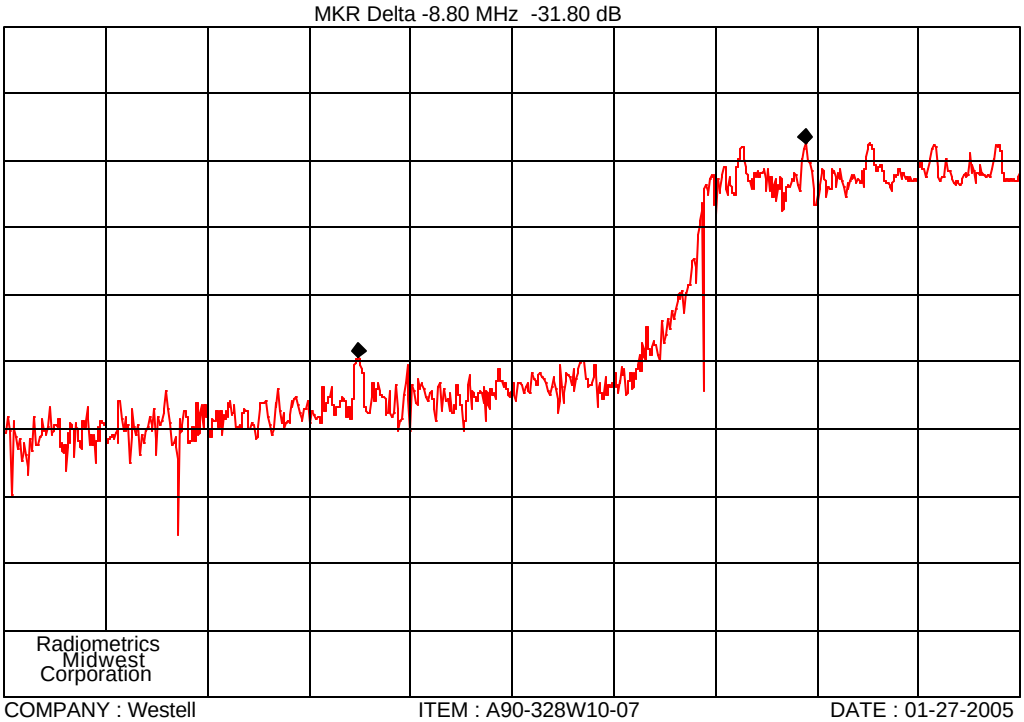
Span = 500 kHz
RBW = 3 kHz
VBW = 10 kHz
Sweep = 167 seconds
Detector function = Peak

Mode	Frequency (MHz)	Reading dBm	Cable Loss (dB)	3 kHz Spectral Density (dBm)	Limit (dBm)
802.11b	2412	-8.6	0.3	-8.3	8.0
802.11b	2437	-8.9	0.3	-8.6	8.0
802.11b	2462	-9.5	0.3	-9.2	8.0
802.11g	2412	-10.5	0.3	-10.2	8.0
802.11g	2437	-10.3	0.3	-10.1	8.0
802.11g	2462	-11.4	0.3	-11.1	8.0

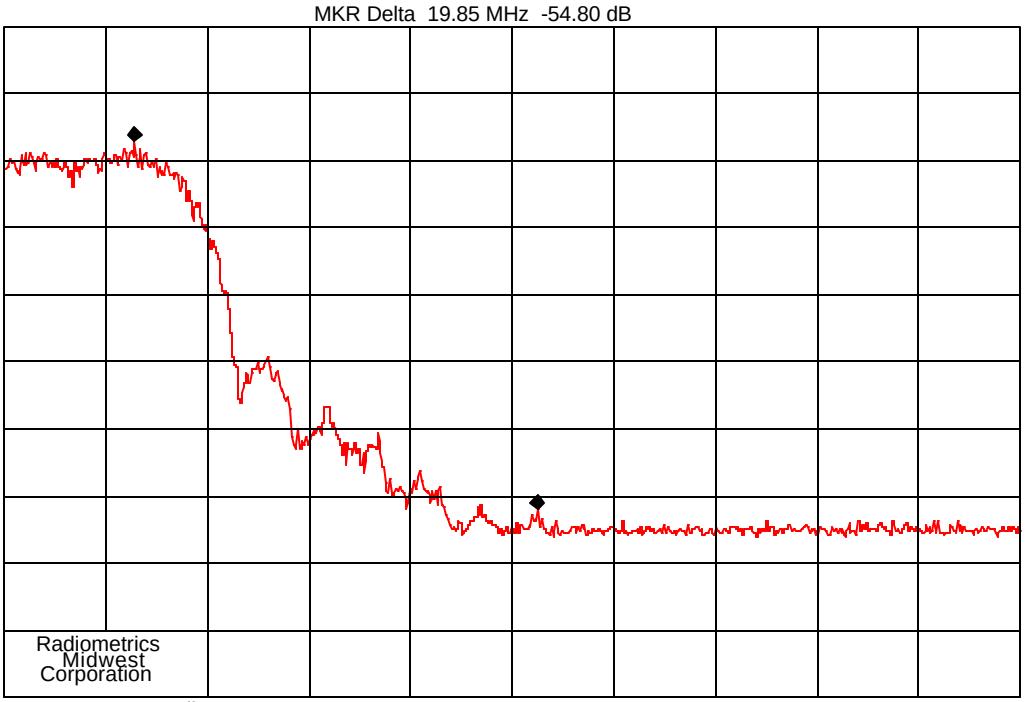
10.5 Band-edge Compliance of RF Conducted Emissions

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.

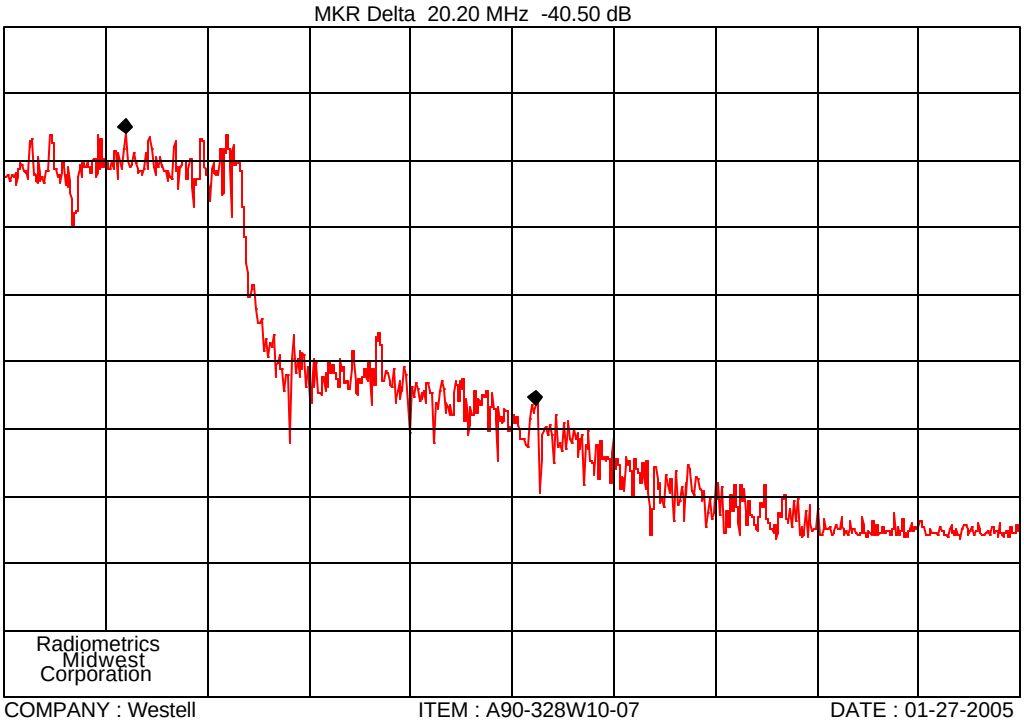




COMPANY : Westell
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 12:10
DATE : 01-27-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec
NOTES : 15.247(c) Band edge, 802.11g; Chan 1



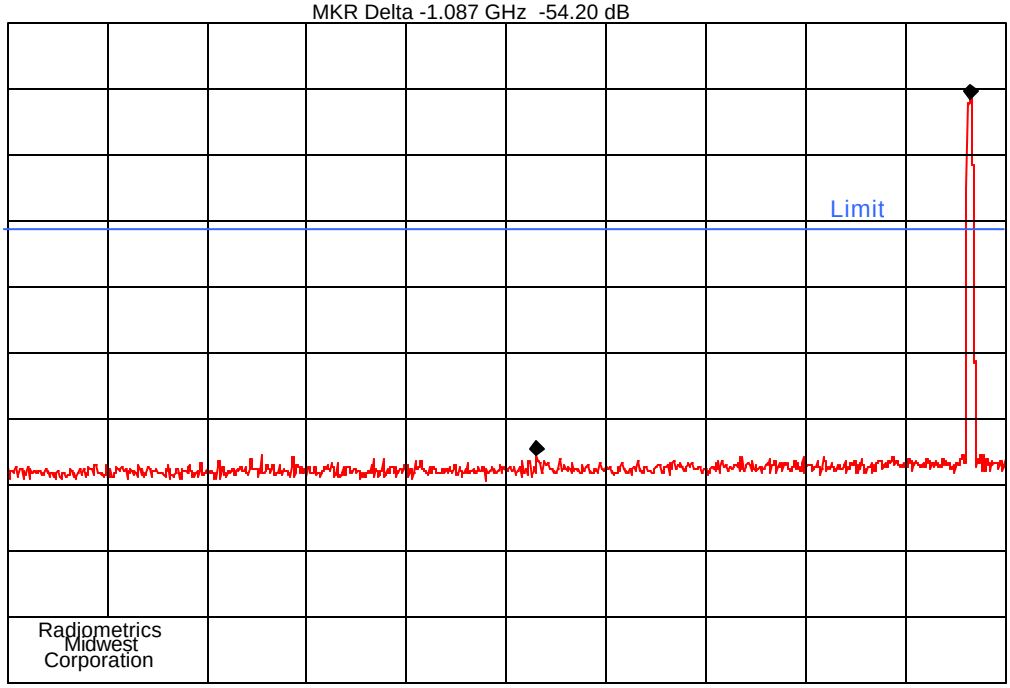
COMPANY : Westell
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-328W10-07
REF 20.0 dBm
VBW 300 kHz
TIME : 12:17
DATE : 01-27-2005
SPAN 50.0 MHz
ATTEN 30 dB
SWP 20.0 msec
NOTES : 15.247(c) Band Edge, 802.11b; Chan 11



10.6 Spurious RF Conducted Emissions

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

MKR Delta -1.087 GHz -54.20 dB

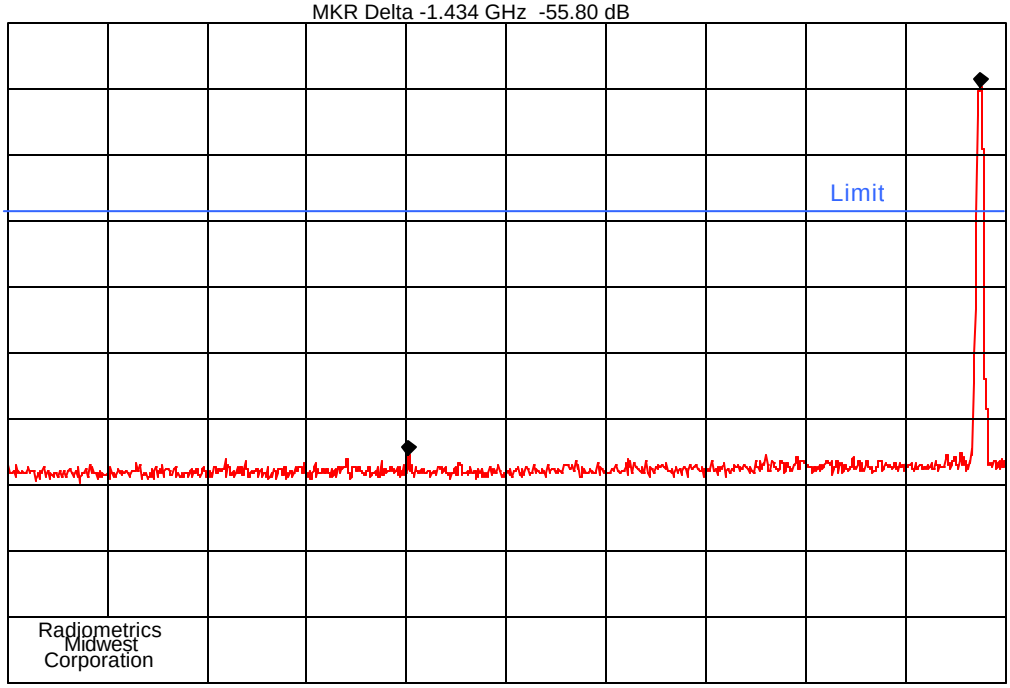


COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 1

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:34

DATE : 01-27-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec

MKR Delta -1.434 GHz -55.80 dB

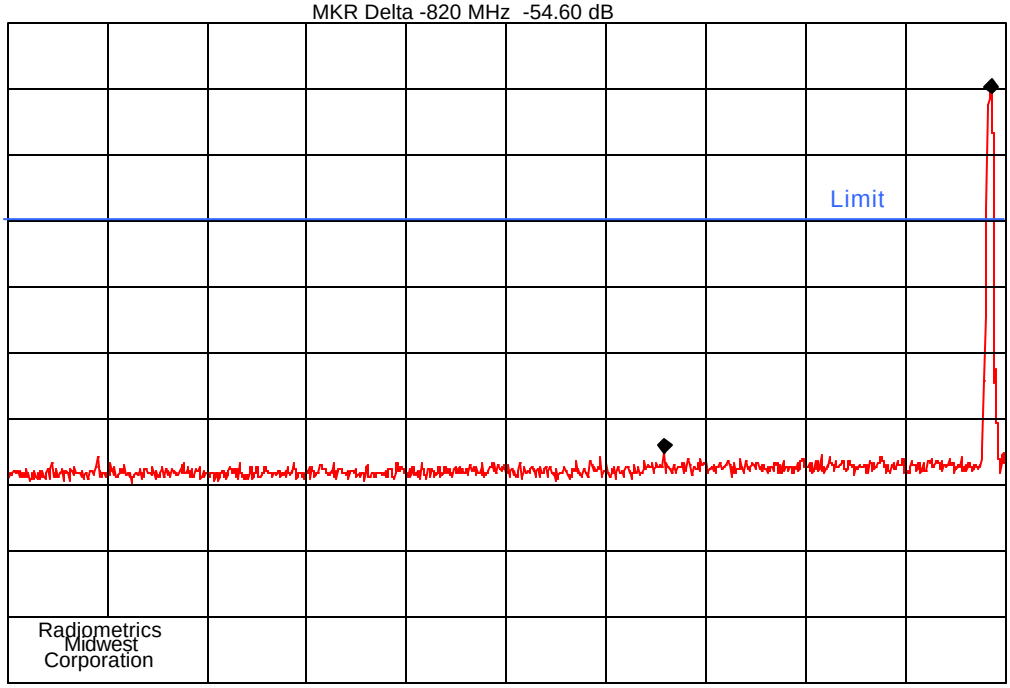


COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 6

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:42

DATE : 01-27-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec

MKR Delta -820 MHz -54.60 dB

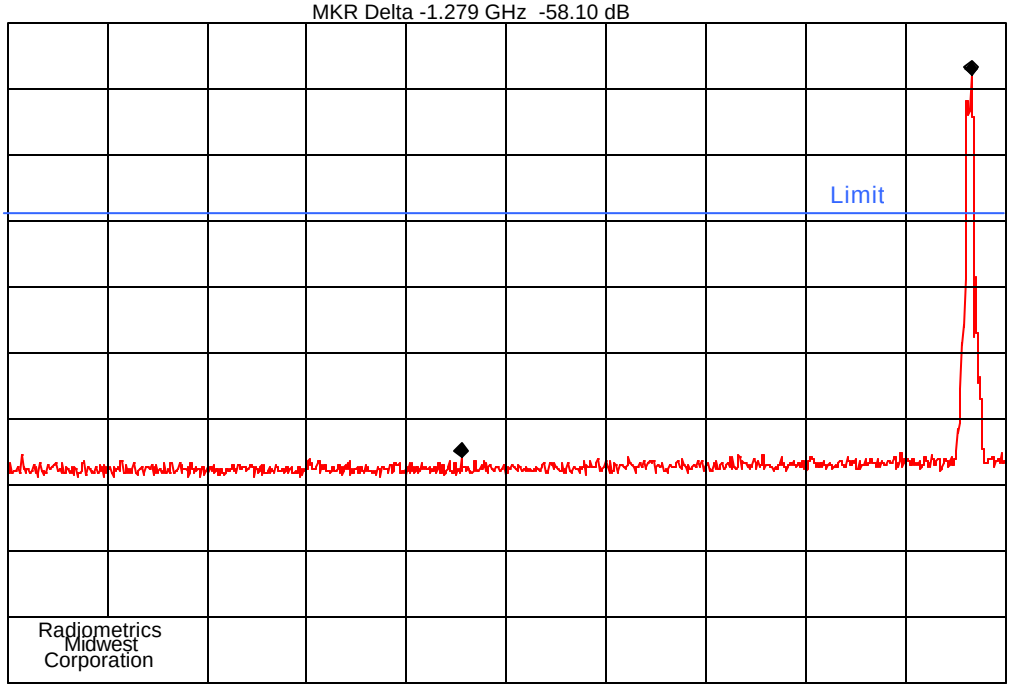


COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 11

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:46

DATE : 01-27-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec

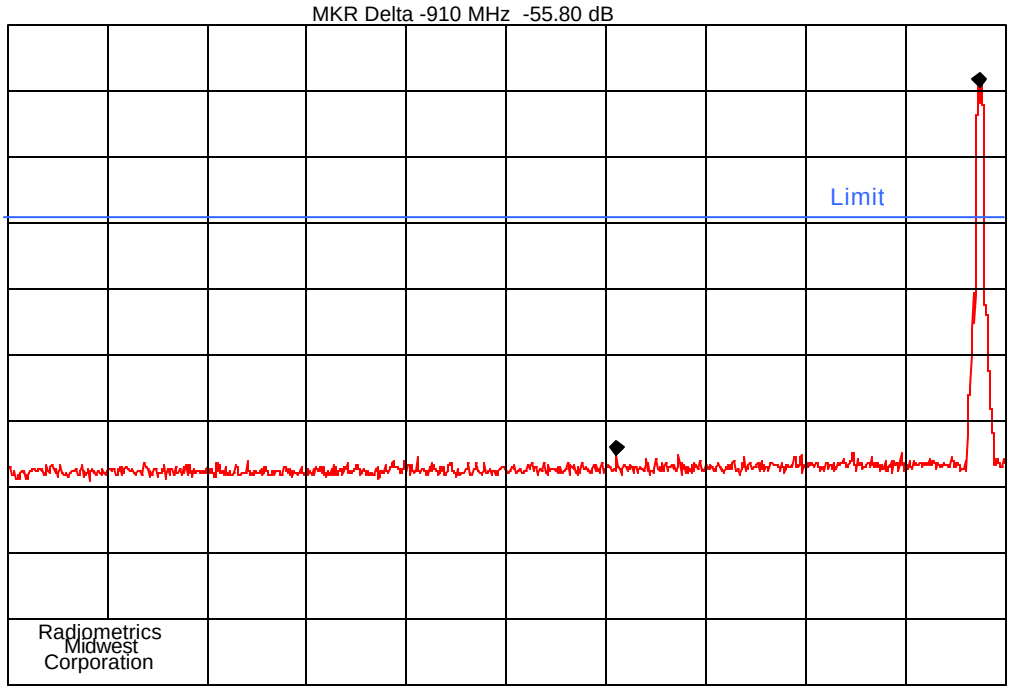
MKR Delta -1.279 GHz -58.10 dB



COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 1

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:27

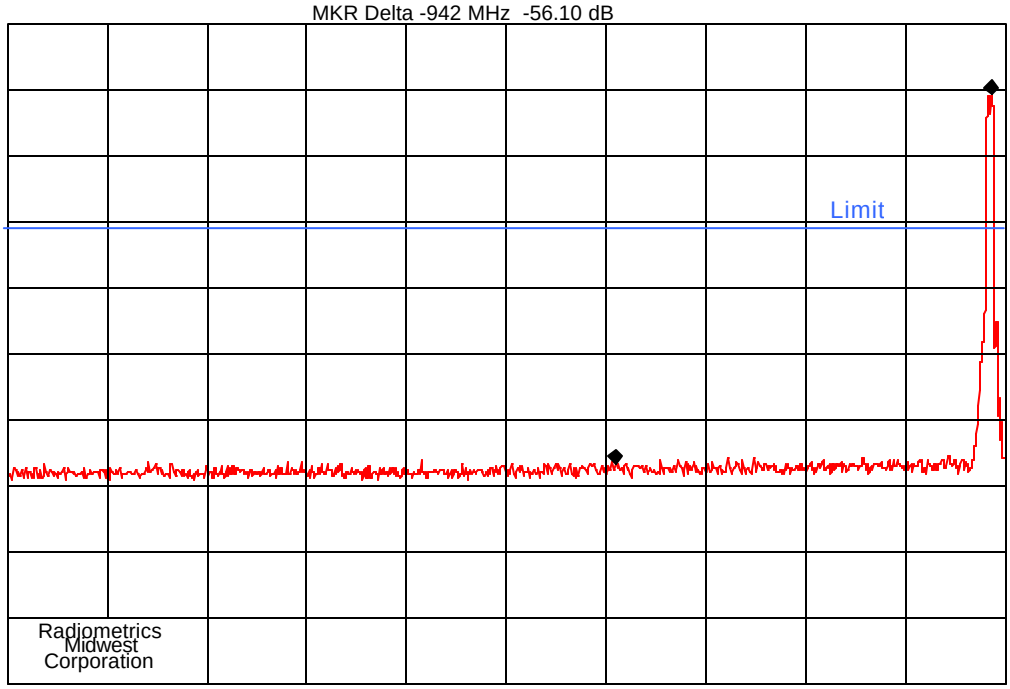
DATE : 01-27-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 6

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:18

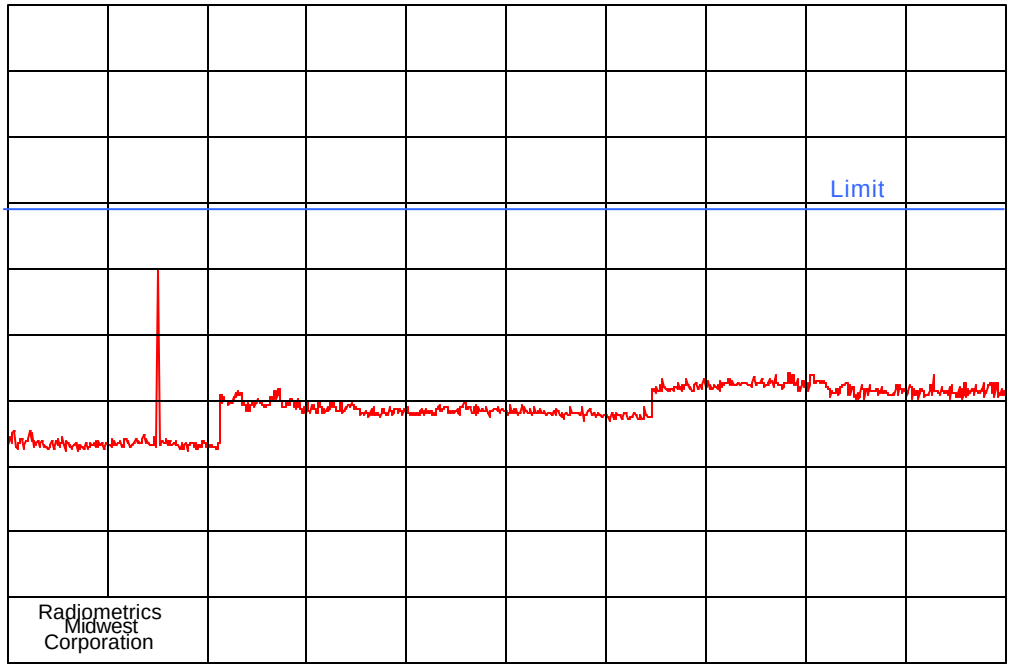
DATE : 01-27-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 11

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:05

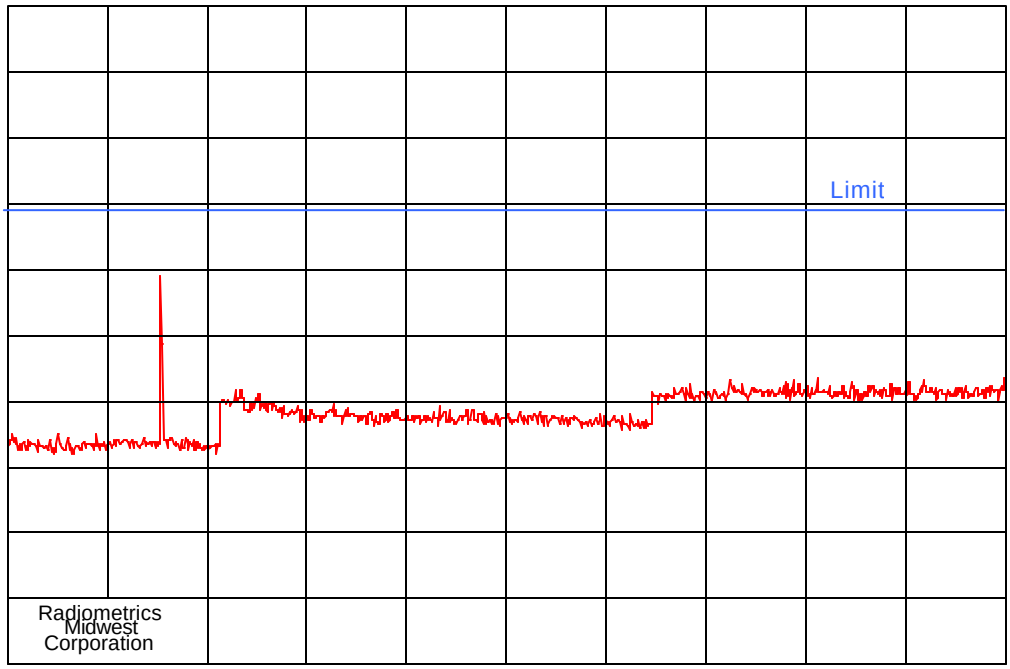
DATE : 01-27-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 1

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:38

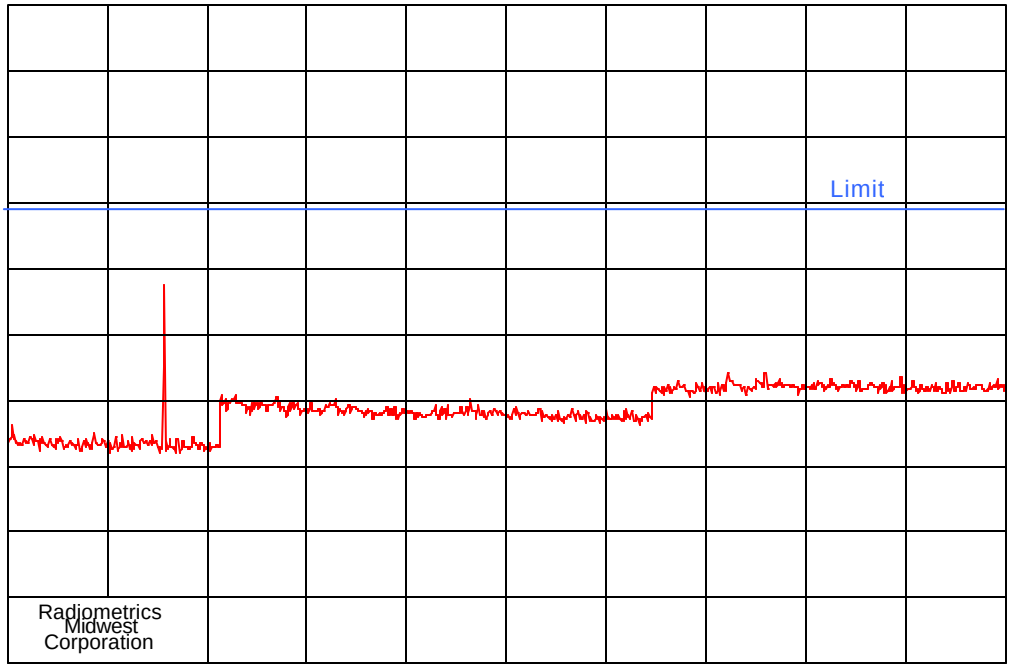
DATE : 01-27-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 6

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:45

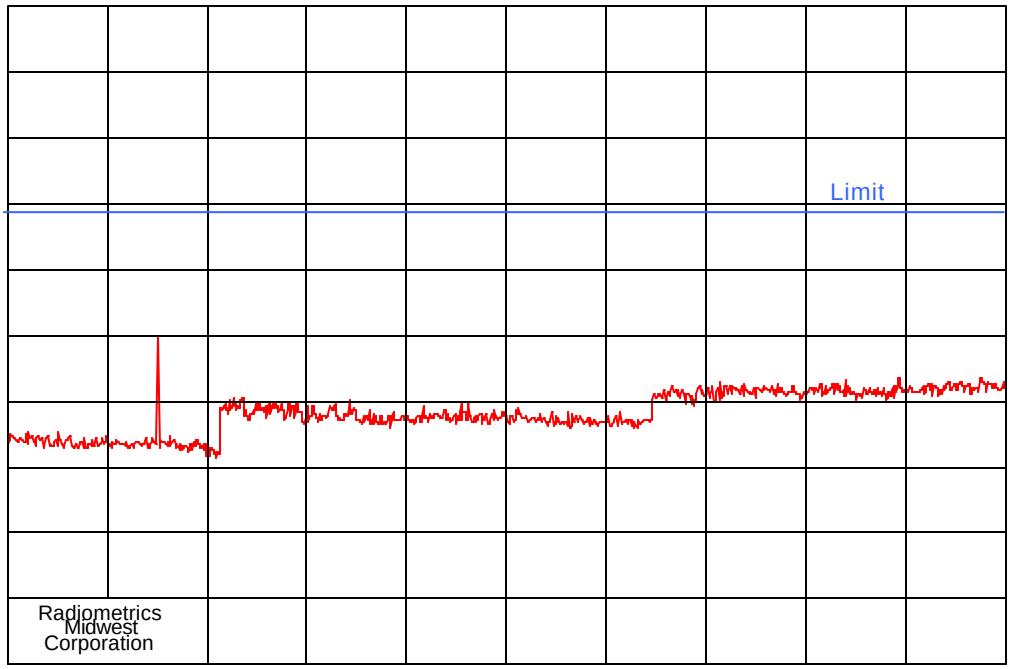
DATE : 01-27-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 11

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:47

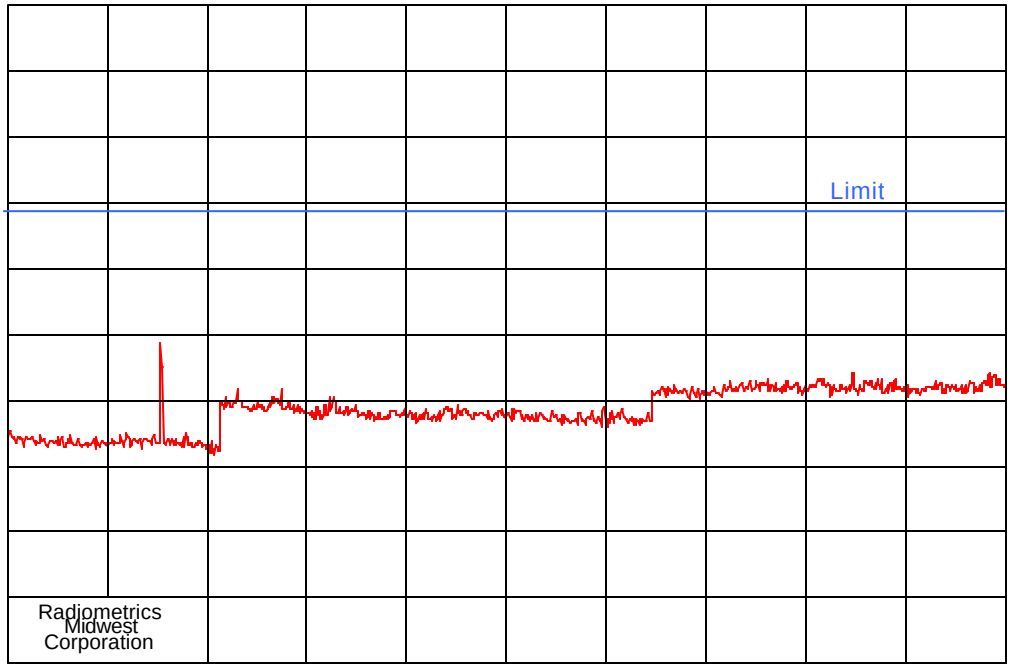
DATE : 01-27-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 1

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:29

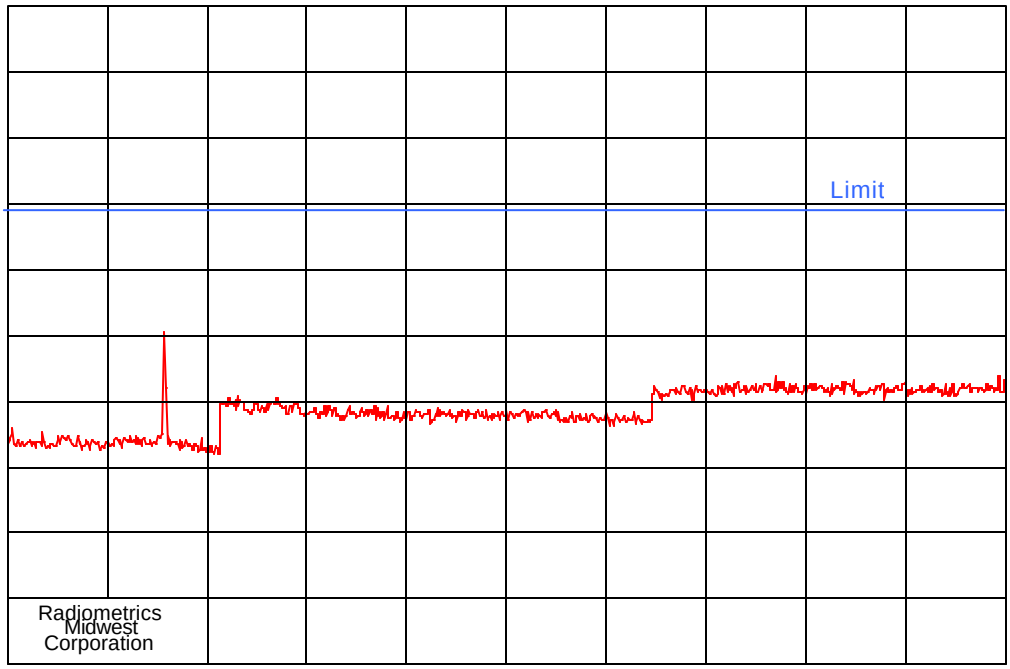
DATE : 01-27-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 6

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:20

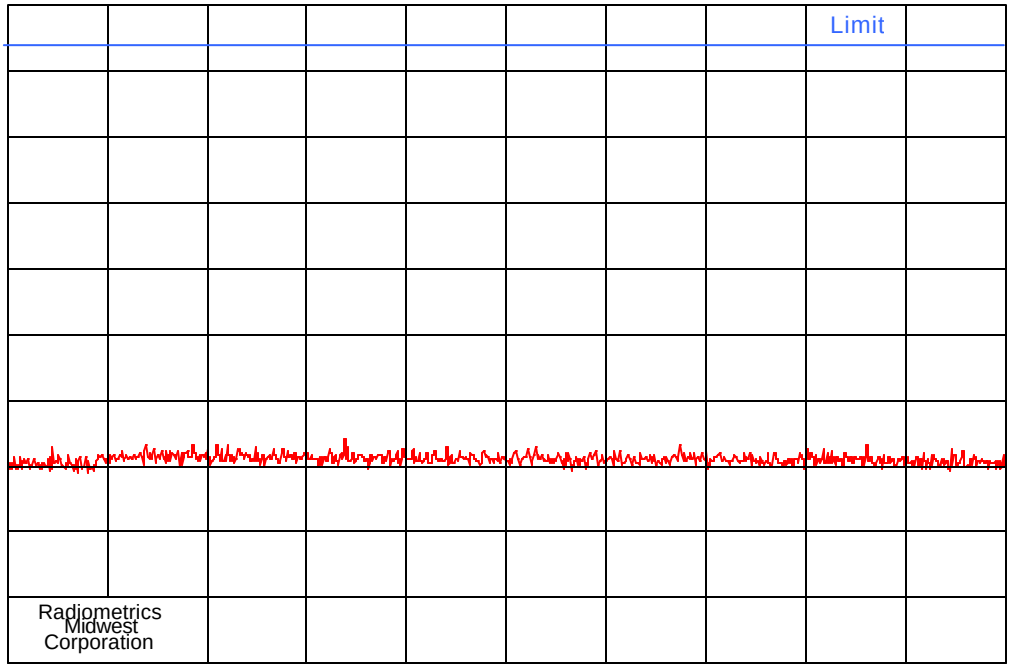
DATE : 01-27-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



COMPANY : Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 11

ITEM : A90-328W10-07
REF 10.0 dBm
VBW 300 kHz
TIME : 14:12

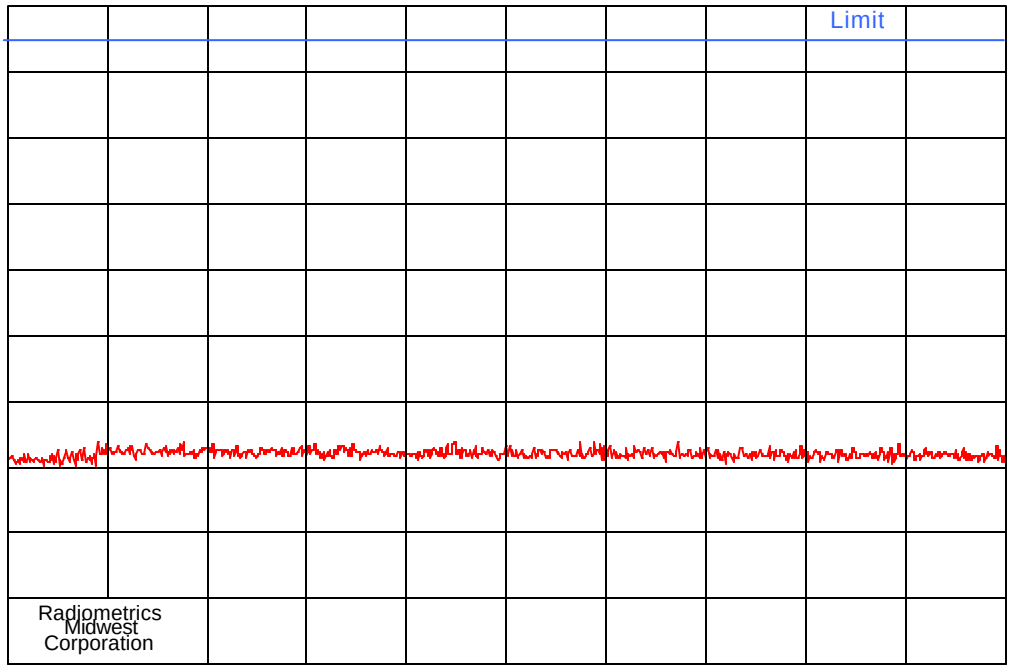
DATE : 01-27-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 1

ITEM : A90-328W10-07
REF -14.0 dBm
VBW 300 kHz
TIME : 15:22

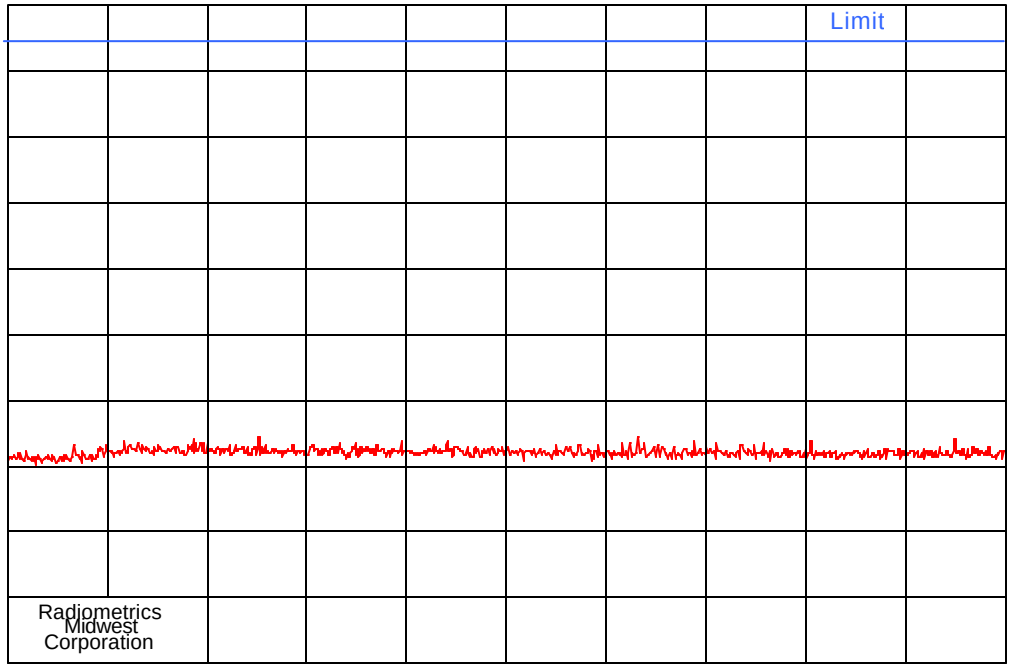
DATE : 01-27-2005
STOP 24.85 GHz
ATTEN 10 dB
SWP 2.06 sec



COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 6

ITEM : A90-328W10-07
REF -14.0 dBm
VBW 300 kHz
TIME : 15:18

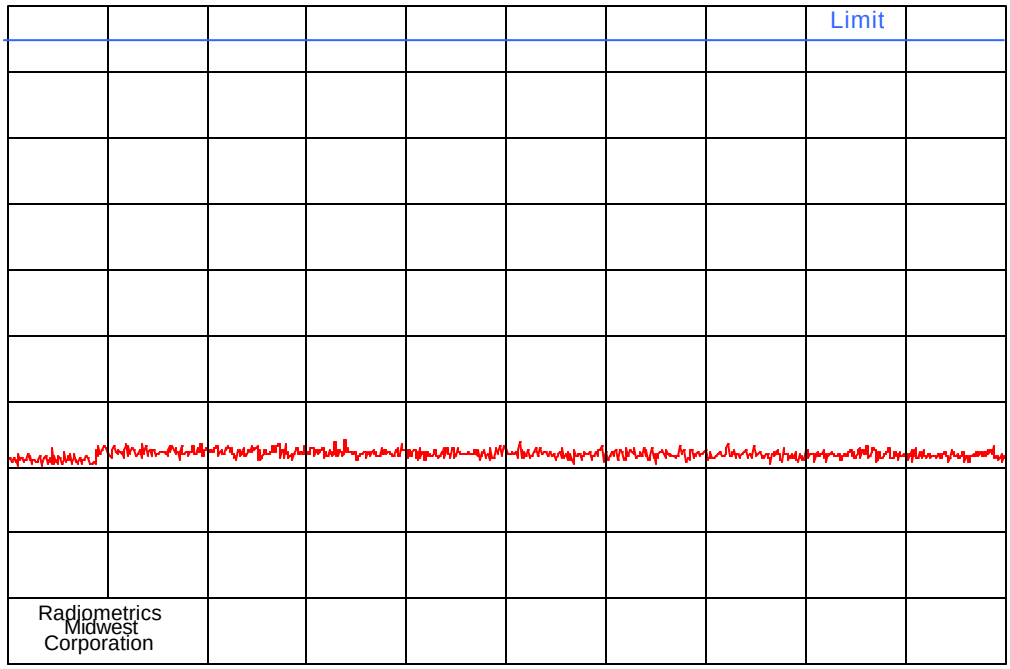
DATE : 01-27-2005
STOP 24.85 GHz
ATTEN 10 dB
SWP 2.06 sec



COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11b; Chan 11

ITEM : A90-328W10-07
REF -14.0 dBm
VBW 300 kHz
TIME : 15:20

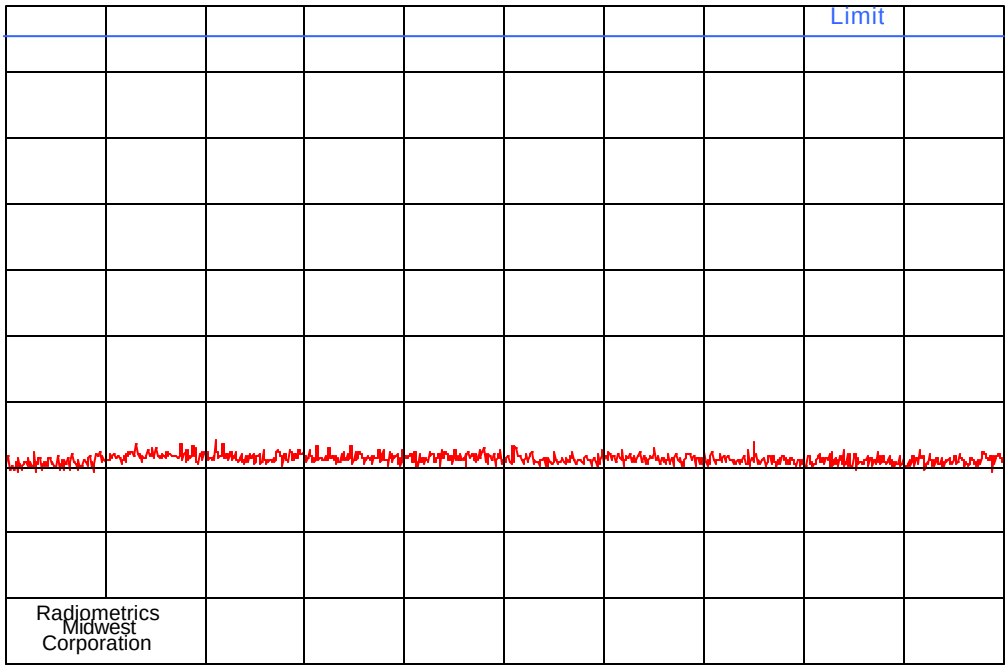
DATE : 01-27-2005
STOP 24.85 GHz
ATTEN 10 dB
SWP 2.06 sec



COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 1

ITEM : A90-328W10-07
REF -14.0 dBm
VBW 300 kHz
TIME : 15:23

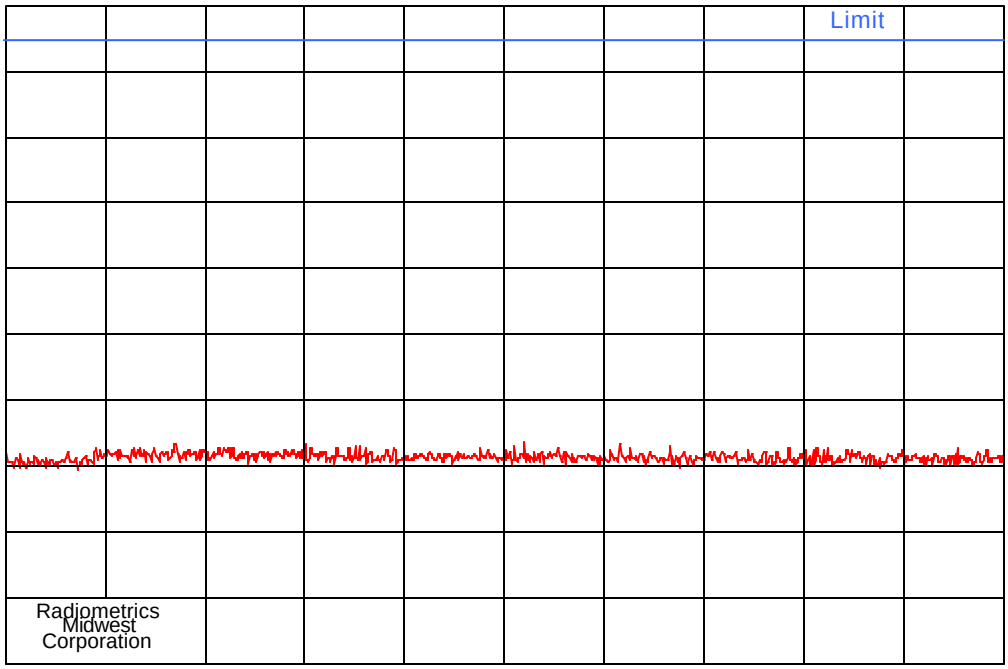
DATE : 01-27-2005
STOP 24.85 GHz
ATTEN 10 dB
SWP 2.06 sec



COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 6

ITEM : A90-328W10-07
REF -14.0 dBm
VBW 300 kHz
TIME : 15:37

DATE : 01-27-2005
STOP 24.85 GHz
ATTEN 10 dB
SWP 2.06 sec



COMPANY : Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
NOTES : Ant Cond Emissions, 802.11g; Chan 11

ITEM : A90-328W10-07
REF -14.0 dBm
VBW 300 kHz
TIME : 15:38

DATE : 01-27-2005
STOP 24.85 GHz
ATTEN 10 dB
SWP 2.06 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.

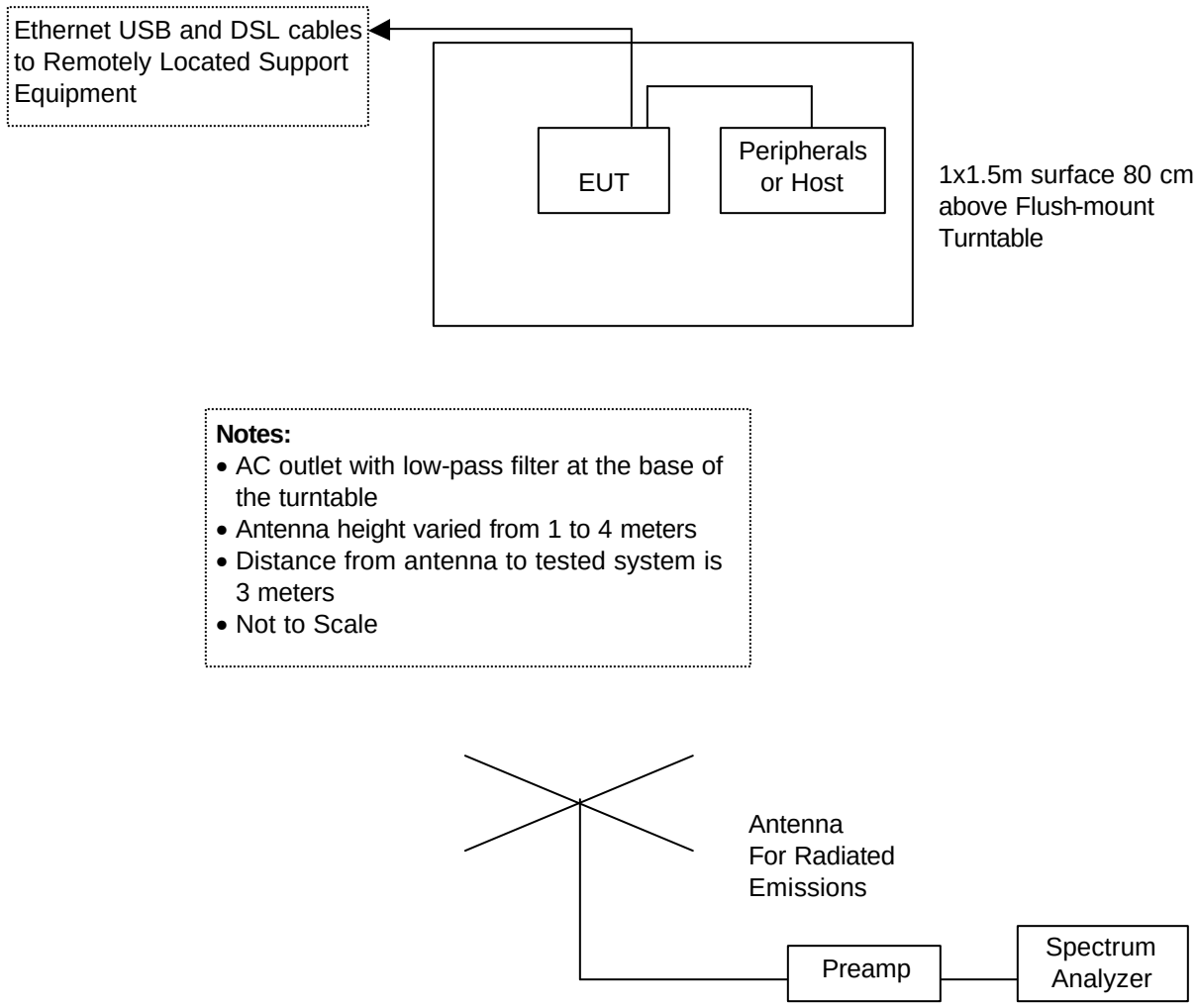
Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. The entire frequency range from 30 MHz to 25 GHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

10.7.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF - AG
Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
HPF = High pass Filter Loss

Figure 2. Drawing of Radiated Emissions Setup



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 ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

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

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

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	Versalink	Test Date	12/8/2004
Serial Number	none	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal;; Bilog (ANT-6); HN = Horn (ANT-13) used above 1 GHz P = peak; Q = QP		

Emissions Above 1 GHz

EUT Mode	Tx Freq MHz	Ant Pol.	Detector Function	Emission Freq. MHz	EUT Field dBuV/m	Limit dBuV/m	Margin under limit dB
802.11b	2412	H	Ave	4825.6	38.2	54.0	15.8
802.11b	2412	H	Peak	4825.3	50.4	74.0	23.6
802.11b	2412	H	Ave	12060.7	41.7	54.0	12.3
802.11b	2412	H	Peak	12061.8	50.7	74.0	23.3
802.11b	2412	V	Ave	4824.6	41.7	54.0	12.3
802.11b	2412	V	Peak	4824.7	61.0	74.0	13.0
802.11b	2412	V	Ave	12061.6	41.7	54.0	12.3
802.11b	2412	V	Peak	12060.6	50.7	74.0	23.3
802.11b	2437	H	Ave	4874.0	37.8	54.0	16.2
802.11b	2437	H	Peak	4874.8	49.8	74.0	24.2
802.11b	2437	H	Ave	7311.2	42.1	54.0	11.9
802.11b	2437	H	Peak	7312.3	51.1	74.0	22.9
802.11b	2437	H	Ave	12185.3	41.7	54.0	12.3
802.11b	2437	H	Peak	12185.6	50.7	74.0	23.3
802.11b	2437	V	Ave	4876.0	41.8	54.0	12.2
802.11b	2437	V	Peak	4875.1	60.8	74.0	13.2
802.11b	2437	V	Ave	7312.4	42.1	54.0	11.9
802.11b	2437	V	Peak	7311.1	51.1	74.0	22.9
802.11b	2437	V	Ave	12185.6	41.7	54.0	12.3
802.11b	2437	V	Peak	12186.7	50.7	74.0	23.3
802.11b	2462	H	Ave	4925.2	39.4	54.0	14.6
802.11b	2462	H	Peak	4925.3	51.4	74.0	22.6
802.11b	2462	H	Ave	7386.9	42.5	54.0	11.5
802.11b	2462	H	Peak	7387.7	51.5	74.0	22.5
802.11b	2462	H	Ave	12312.0	41.7	54.0	12.3
802.11b	2462	H	Peak	12310.9	50.7	74.0	23.3
802.11b	2462	V	Ave	4924.9	42.5	54.0	11.5
802.11b	2462	V	Peak	4925.5	56.7	74.0	17.3
802.11b	2462	V	Ave	7386.6	42.5	54.0	11.5
802.11b	2462	V	Peak	7387.1	51.5	74.0	22.5
802.11b	2462	V	Ave	12310.3	41.7	54.0	12.3
802.11b	2462	V	Peak	12310.8	50.7	74.0	23.3

EUT Mode	Tx Freq MHz	Ant Pol.	Detector Function	Emission Freq. MHz	EUT Field dBuV/m	Limit dBuV/m	Margin under limit dB
802.11g	2412	H	Ave	4824.3	37.7	54.0	16.3
802.11g	2412	H	Peak	4824.0	49.5	74.0	24.5
802.11g	2412	H	Ave	12061.7	41.7	54.0	12.3
802.11g	2412	H	Peak	12061.2	50.7	74.0	23.3
802.11g	2412	V	Ave	4824.9	41.4	54.0	12.6
802.11g	2412	V	Peak	4824.1	60.8	74.0	13.2
802.11g	2412	V	Ave	12060.6	41.7	54.0	12.3
802.11g	2412	V	Peak	12061.5	50.7	74.0	23.3
802.11g	2437	H	Ave	4875.0	37.1	54.0	16.9
802.11g	2437	H	Peak	4874.2	51.5	74.0	22.5
802.11g	2437	H	Ave	7312.6	42.1	54.0	11.9
802.11g	2437	H	Peak	7311.9	51.1	74.0	22.9
802.11g	2437	H	Ave	12185.3	41.7	54.0	12.3
802.11g	2437	H	Peak	12186.8	50.7	74.0	23.3
802.11g	2437	V	Ave	4874.4	42.1	54.0	11.9
802.11g	2437	V	Peak	4874.1	61.7	74.0	12.3
802.11g	2437	V	Ave	7312.3	42.1	54.0	11.9
802.11g	2437	V	Peak	7311.6	51.1	74.0	22.9
802.11g	2437	V	Ave	12186.4	41.7	54.0	12.3
802.11g	2437	V	Peak	12185.9	50.7	74.0	23.3
802.11g	2462	H	Ave	4924.5	40.4	54.0	13.6
802.11g	2462	H	Peak	4925.8	52.0	74.0	22.0
802.11g	2462	H	Ave	7386.5	42.5	54.0	11.5
802.11g	2462	H	Peak	7386.9	51.5	74.0	22.5
802.11g	2462	H	Ave	12310.4	41.7	54.0	12.3
802.11g	2462	H	Peak	12311.3	50.7	74.0	23.3
802.11g	2462	V	Ave	4925.8	41.7	54.0	12.3
802.11g	2462	V	Peak	4926.0	62.4	74.0	11.6
802.11g	2462	V	Ave	7386.3	42.5	54.0	11.5
802.11g	2462	V	Peak	7387.8	51.5	74.0	22.5
802.11g	2462	V	Ave	12311.5	41.7	54.0	12.3
802.11g	2462	V	Peak	12311.6	50.7	74.0	23.3

Judgment: Passed by 11.5 dB
No other emissions were detected in the restricted bands.

Emissions Below 1 GHz

Notes	Versalink and Host computer; Corr. Factors = Cable Loss – Preamp Gain

Freq. MHz	Meter Reading dBuV	Antenna Factor dB	Antenna Pol/ Type	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
56.4	35.5 P	13.6	H/44	-27.7	21.4	30.0	8.6
66.5	41.5 P	8.6	H/44	-27.5	22.6	30.0	7.4
80.2	38.9 P	6.9	H/44	-27.3	18.5	30.0	11.5
82.0	39.6 P	7.0	H/44	-27.3	19.3	30.0	10.7
98.7	39.0 P	10.3	H/44	-27.1	22.2	30.0	7.8
106.8	38.4 P	11.4	H/44	-27.0	22.8	30.0	7.2
124.9	36.4 P	10.7	H/44	-26.8	20.3	30.0	9.7
155.8	38.1 P	8.8	H/44	-26.5	20.4	30.0	9.6
165.4	37.4 P	9.6	H/44	-26.4	20.5	30.0	9.5
173.1	37.5 P	9.0	H/44	-26.4	20.1	30.0	9.9
250.0	44.2 P	12.9	H/44	-25.8	31.3	37.0	5.7
384.0	35.6 P	16.3	H/44	-25.0	26.9	37.0	10.1
511.0	33.8 P	18.0	H/44	-24.0	27.8	37.0	9.2
521.1	34.9 P	17.8	H/44	-23.9	28.8	37.0	8.2
42.3	35.3 P	16.4	V/44	-28.0	23.7	30.0	6.3
56.1	34.7 Q	11.6	V/44	-27.7	18.6	30.0	11.4
62.8	38.9 P	10.6	V/44	-27.6	22.0	30.0	8.0
68.2	44.7 Q	8.7	V/44	-27.5	25.9	30.0	4.1
69.0	44.4 Q	8.4	V/44	-27.5	25.3	30.0	4.7
75.6	44.3 P	7.2	V/44	-27.4	24.1	30.0	5.9
81.2	41.2 Q	7.0	V/44	-27.3	20.9	30.0	9.1
86.2	40.6 Q	7.0	V/44	-27.2	20.4	30.0	9.6
87.6	42.1 P	7.3	V/44	-27.2	22.1	30.0	7.9
94.5	41.2 P	9.0	V/44	-27.1	23.0	30.0	7.0
98.5	40.3 Q	10.8	V/44	-27.1	24.0	30.0	6.0
100.2	38.8 P	11.5	V/44	-27.1	23.2	30.0	6.8
125.2	42.6 P	10.5	V/44	-26.8	26.4	30.0	3.6
128.1	35.8 P	10.3	V/44	-26.7	19.4	30.0	10.6
183.8	31.9 P	9.8	V/44	-26.3	15.5	30.0	14.5
250.0	42.1 P	12.8	V/44	-25.8	29.1	37.0	7.9
254.8	36.6 P	12.8	V/44	-25.7	23.6	37.0	13.4
382.8	36.5 P	15.9	V/44	-25.0	27.4	37.0	9.6
384.0	33.5 Q	15.9	V/44	-25.0	24.3	37.0	12.7
500.8	32.3 P	17.2	V/44	-24.1	25.4	37.0	11.6
521.2	33.2 P	18.1	V/44	-23.9	27.3	37.0	9.7
529.6	33.6 P	18.3	V/44	-23.9	28.1	37.0	8.9

Judgment: Passed by 3.6 dB