



# Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

Wireless Gateway & Cordless Phone, Model VZ1

Radiometrics Document RP-5394



*Product Detail:*

FCC ID: CH8A90VZ10XX06  
 Equipment type: 2.4 GHz Digitally Modulated Transmitter.

*Test Standards:*

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

This report concerns: Original Grant for Certification  
 FCC Part 15.247

*Tests Performed For:*

**Westell, Inc.**  
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 Aurora, IL 60504

*Test Facility:*

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

November 11 thru December 14, 2004

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Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
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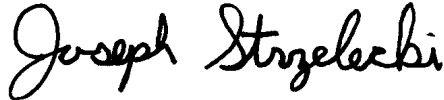
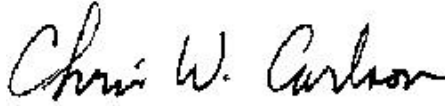
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**RADIOMETRICS MIDWEST CORPORATION - EMC Test Report**

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone

**1 ADMINISTRATIVE DATA**

<i>Equipment Under Test:</i> A Westell, Inc., Wireless Gateway & Cordless Phone Model: VZ1 Serial Number: none This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> November 11, 2004	<i>Test Date(s): (Month-Day-Year)</i> November 11 thru December 14, 2004
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> Dan Wood Westell, Inc.
<i>Radiometrics' Personnel Responsible for Test:</i>  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	<i>Test Report Approved By</i>  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

**2 TEST SUMMARY AND RESULTS**

The EUT (Equipment Under Test) is a Wireless Gateway & Cordless Phone, Model VZ1, 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 unintentional radiator section of the VZ1.

**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 Wireless Gateway & Cordless Phone, Model VZ1, manufactured by Westell, Inc. The EUT was in good working condition during the tests, with no known defects. This device has a Cordless Handset operating in the 5.8 GHz range, CID display, speakerphone, as well as an LCD display, and 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 and the 5.8 GHz antennas are internal to the case of the EUT. They are not accessible to the end user.

#### **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 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	Wireless Gateway & Cordless Phone	E	Westell, Inc.	A90-VZ1015-06	04B411000127
2	Power Supply	E	Westell, Inc.	085-200042	None
3	Desktop PC	S	Gateway	Gateway LC	0023262910
4	Monitor	S	Viewsonic	1782	5334513266
5	Keyboard	S	Gateway	2196003-00-004	54210247
6	Mouse	S	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 System 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	6	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](http://www.radiomet.com)). Radiometrics accreditation status can be verified at A2LA's web site ([www.a2la2.net](http://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.

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**9 TEST EQUIPMENT TABLE**

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/07/04
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo.	12/07/04
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/07/04
AMP-29	Hewlett-Packard	Amplifier	11975A	2304A00158	2-8 GHz	12 Mo.	07/21/04
AMP-29	Hewlett-Packard	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	H P	Harmonic Mixer	11970K	3003A02243	18.6-26.5GHz	12 Mo.	01/06/05
REC-01	Hewlett Packard	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.

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**FCC Limits of Conducted Emissions at the AC Mains Ports**

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

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

Test Date : November 11, 2004

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	2.88	42.34	56.00	33.12	46.00
AC Neutral	22.86	38.06	60.00	29.73	50.00
AC Neutral	3.13	41.19	56.00	35.94	46.00
AC Neutral	0.17	46.48	65.03	26.82	55.03
AC Hot	3.13	45.59	56.00	40.15	46.00
AC Hot	2.74	N/A	56.00	35.93	46.00
AC Hot	22.43	39.03	60.00	31.84	50.00
AC Hot	2.61	38.47	56.00	28.54	46.00

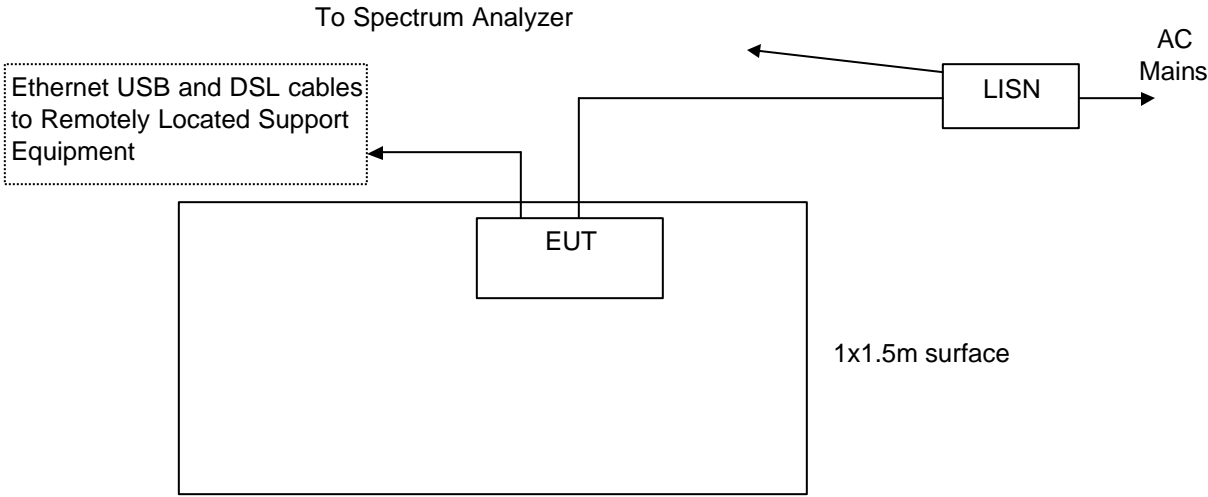
The above are the worst case results with three frequencies test for each EUT

\* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

Judgment: Passed by 5.8 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)**

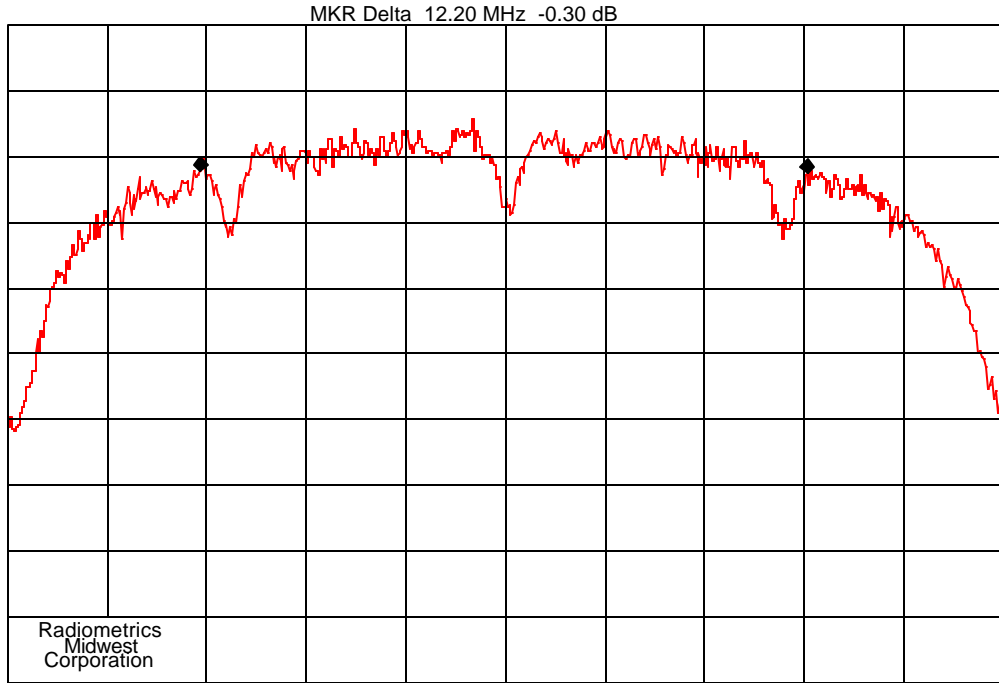
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

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
	EBW MHz	EBW MHz
1	12.2	12.4
6	12.2	12.2
11	12.3	12.2

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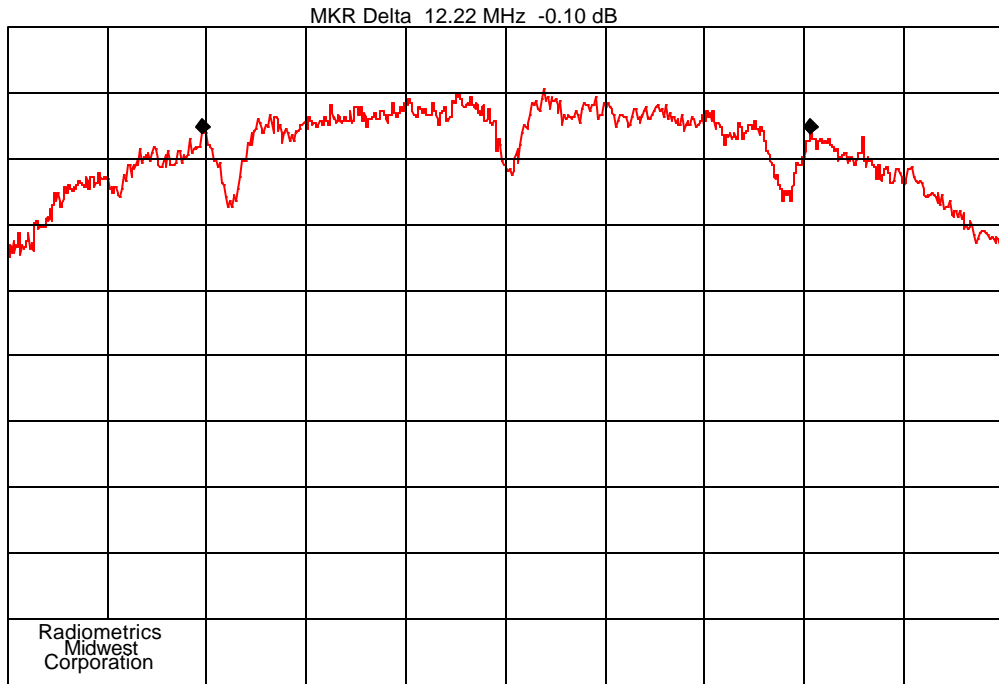


COMPANY : Westell  
CENTER 2.412 0 GHz  
RES BW 100 kHz  
10 dB/

ITEM : VZ1 Base 802.11  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 11:44

DATE : 11-12-2004  
SPAN 20.0 MHz  
ATTEN 30 dB  
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 1; 802.11b



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

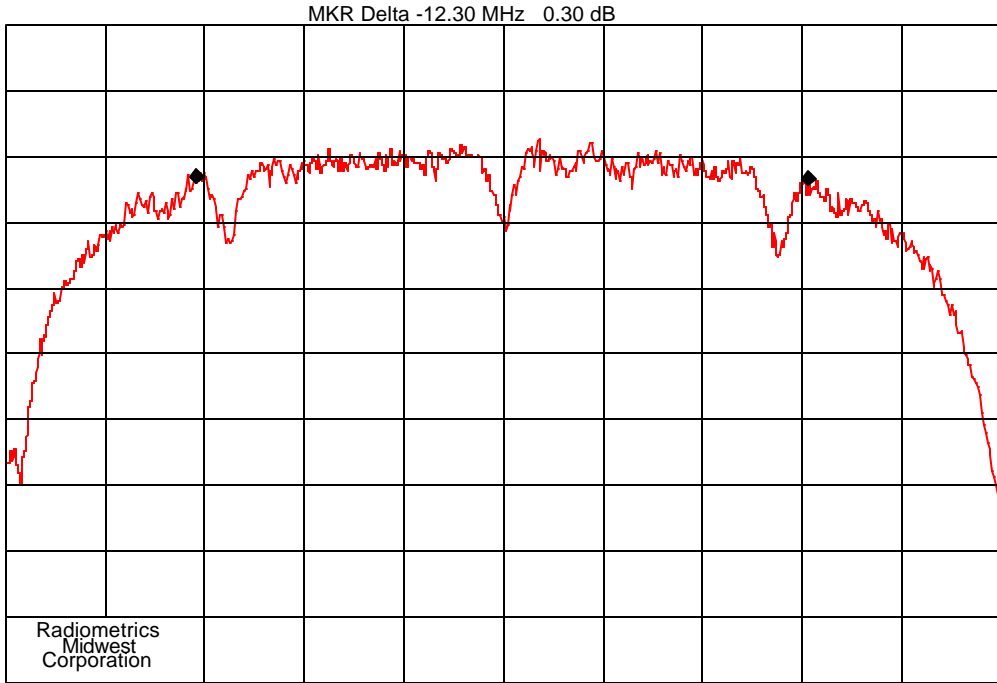
ITEM : VZ1 Base 802.11  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 09:58

DATE : 11-12-2004  
SPAN 20.0 MHz  
ATTEN 30 dB  
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 6; 802.11b

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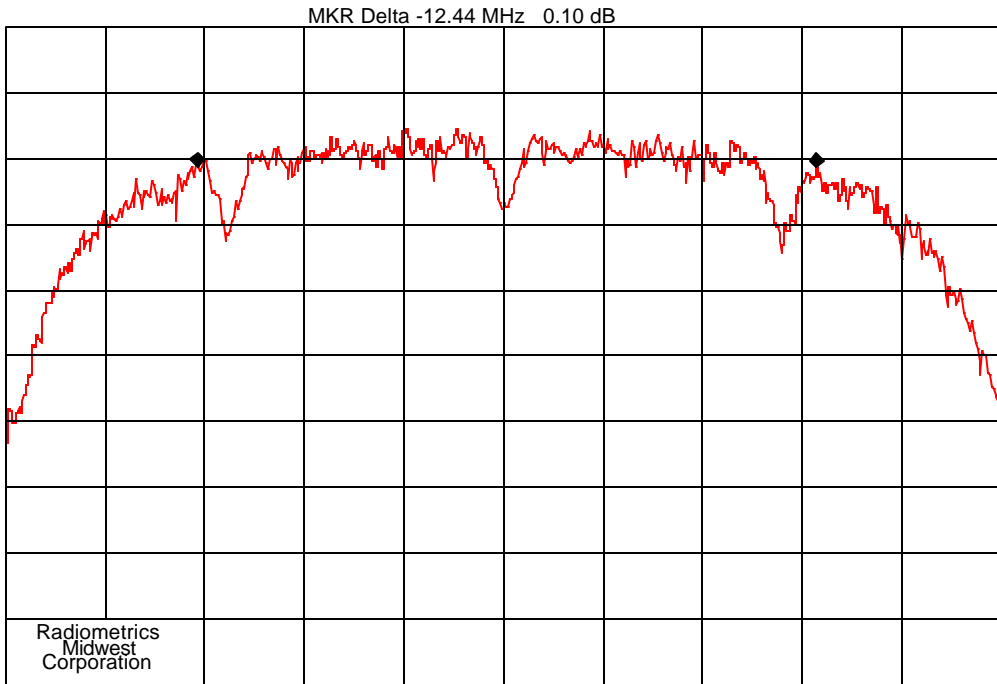


COMPANY : Westell  
CENTER 2.462 0 GHz  
RES BW 100 kHz  
10 dB/

ITEM : VZ1 Base 802.11  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 11:34

DATE : 11-12-2004  
SPAN 20.0 MHz  
ATTEN 30 dB  
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 11; 802.11b



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

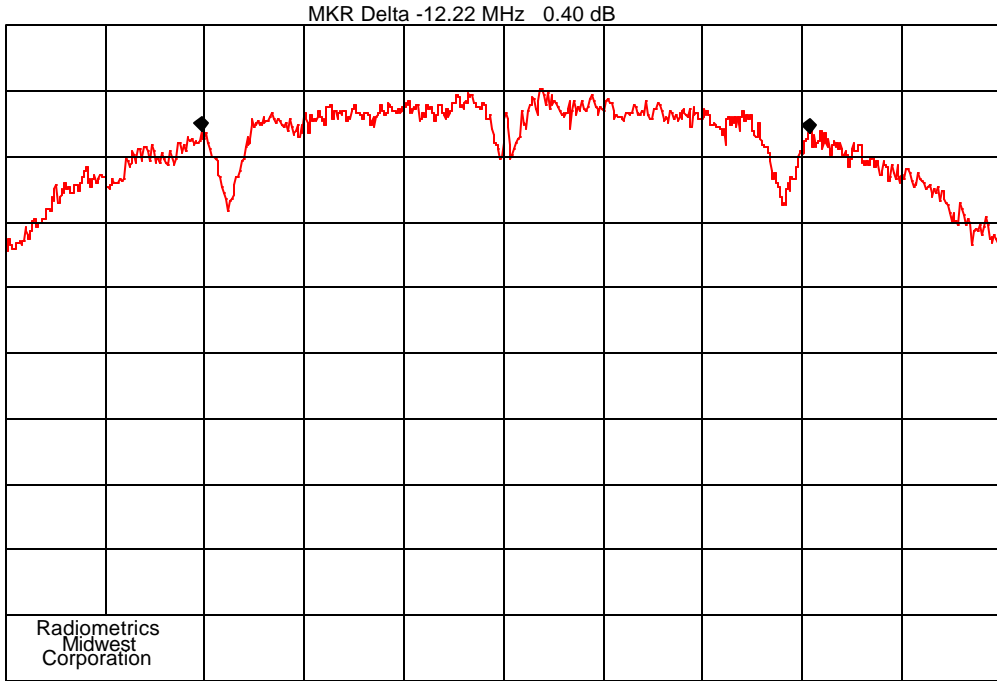
ITEM : VZ1 Base 802.11  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 11:41

DATE : 11-12-2004  
SPAN 20.0 MHz  
ATTEN 30 dB  
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 1; 802.11g

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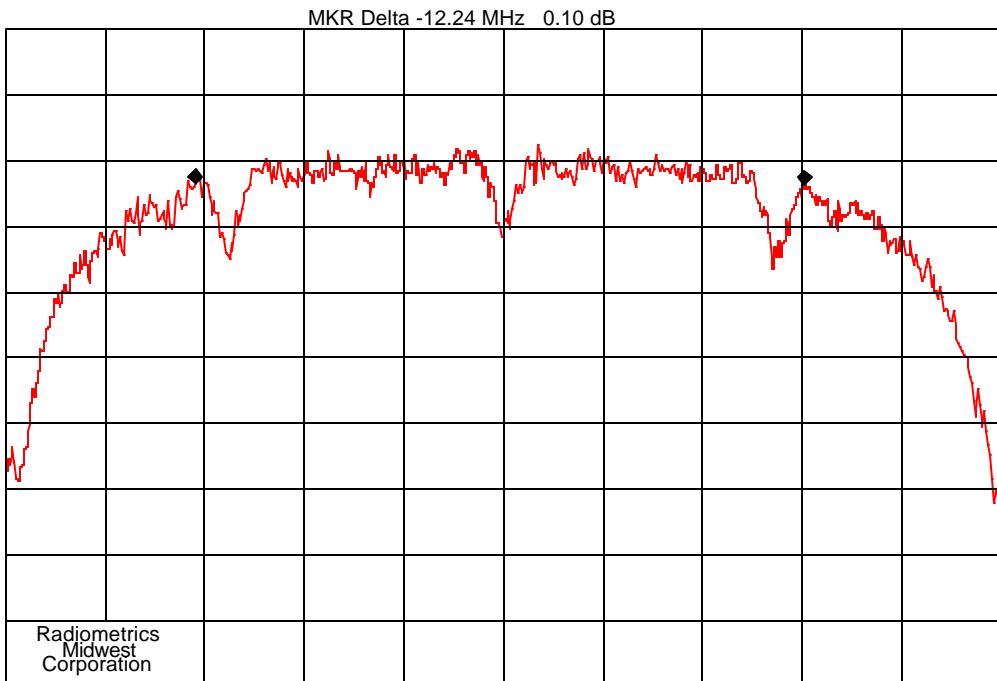


COMPANY : Westell  
CENTER 2.437 0 GHz  
RES BW 100 kHz  
10 dB/

ITEM : VZ1 Base 802.11  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 10:27

DATE : 11-12-2004  
SPAN 20.0 MHz  
ATTEN 30 dB  
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 6; 802.11g



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

ITEM : VZ1 Base 802.11  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 11:37

DATE : 11-12-2004  
SPAN 20.0 MHz  
ATTEN 30 dB  
SWP 20.0 msec

NOTES : Bandwidth Test, Chan 11; 802.11g

### 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	13.5	10.9	0.2	24.6	0.288	30
802.11b	2437	15.5	10.9	0.2	26.6	0.457	30
802.11b	2462	15.5	10.9	0.2	26.6	0.457	30
802.11g	2412	14.5	10.9	0.2	25.6	0.363	30
802.11g	2437	15.4	10.9	0.2	26.5	0.447	30
802.11g	2462	15.1	10.9	0.2	26.2	0.417	30

### 10.4 Power Spectral Density

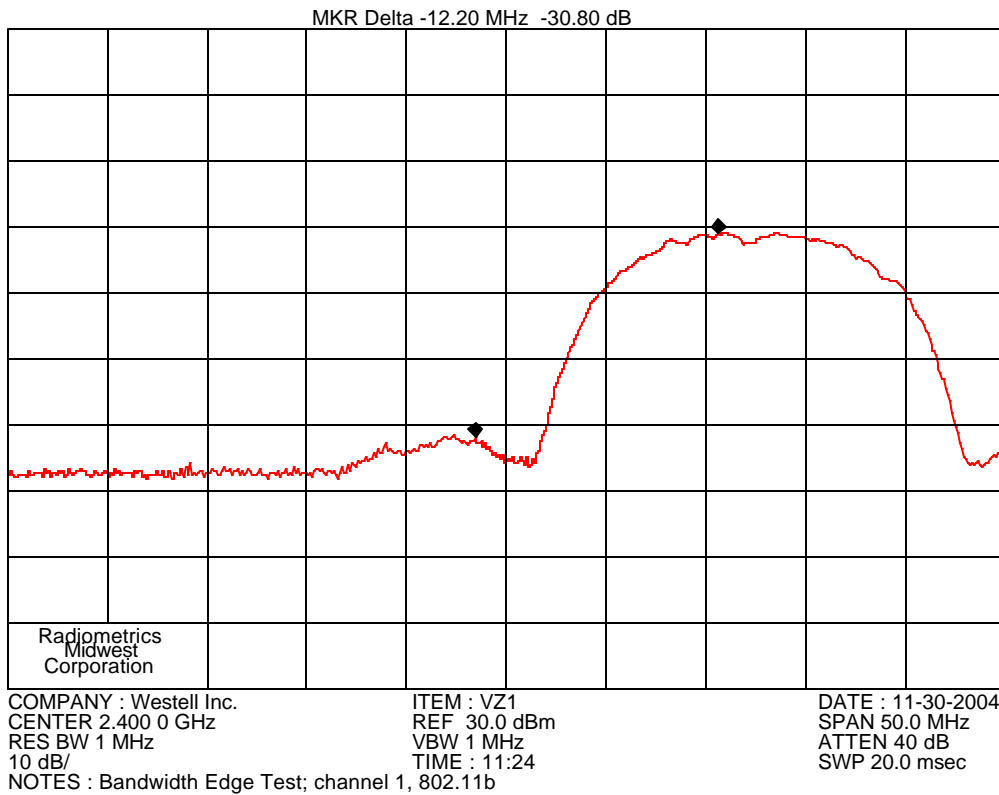
PSD option 1 was used for this test. No external attenuator was used. The spectrum analyzer was set to the following settings:

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	-9.5	0.9	-8.6	8.0
802.11b	2437	-10.8	0.9	-9.9	8.0
802.11b	2462	-13.1	0.9	-12.2	8.0
802.11g	2412	-15.9	0.9	-15.0	8.0
802.11g	2437	-16.0	0.9	-15.1	8.0
802.11g	2462	-16.1	0.9	-15.2	8.0

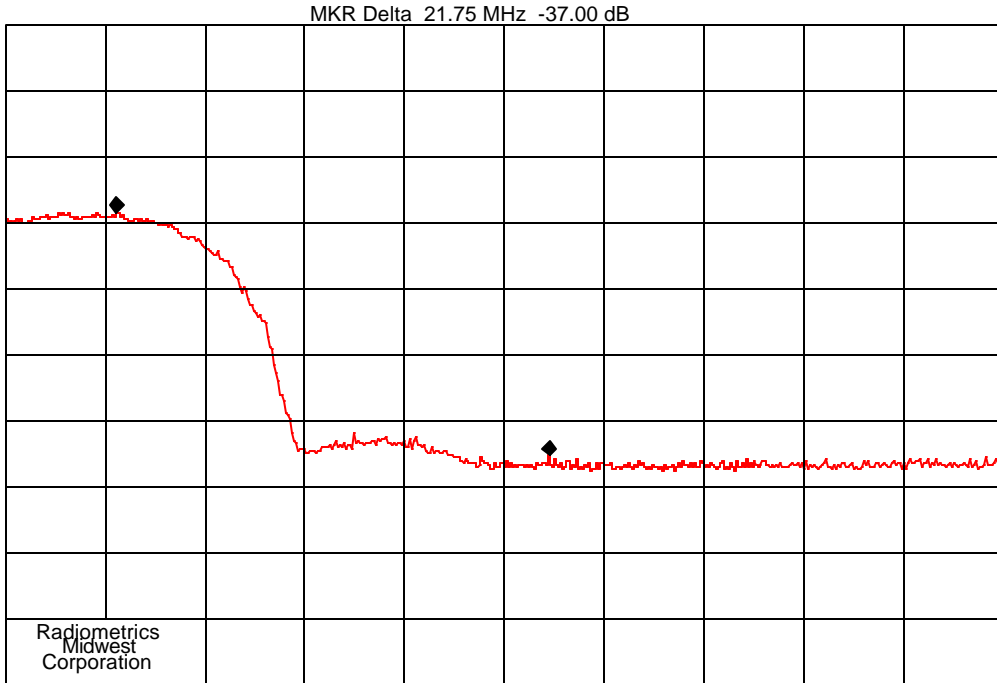
### 10.5 Band-edge Compliance of RF Conducted Emissions

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.

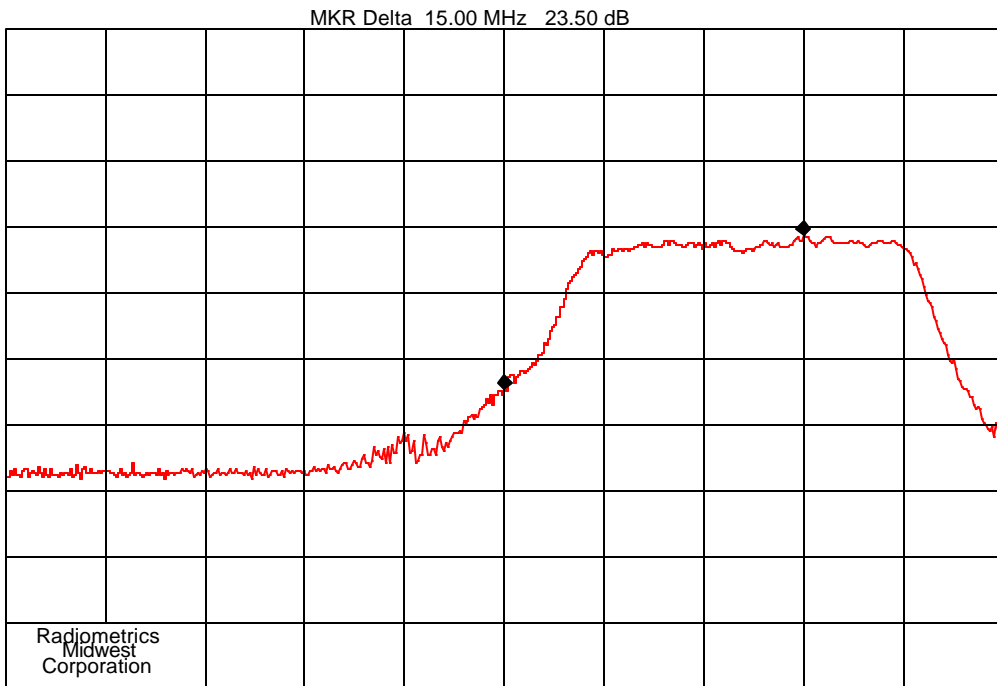


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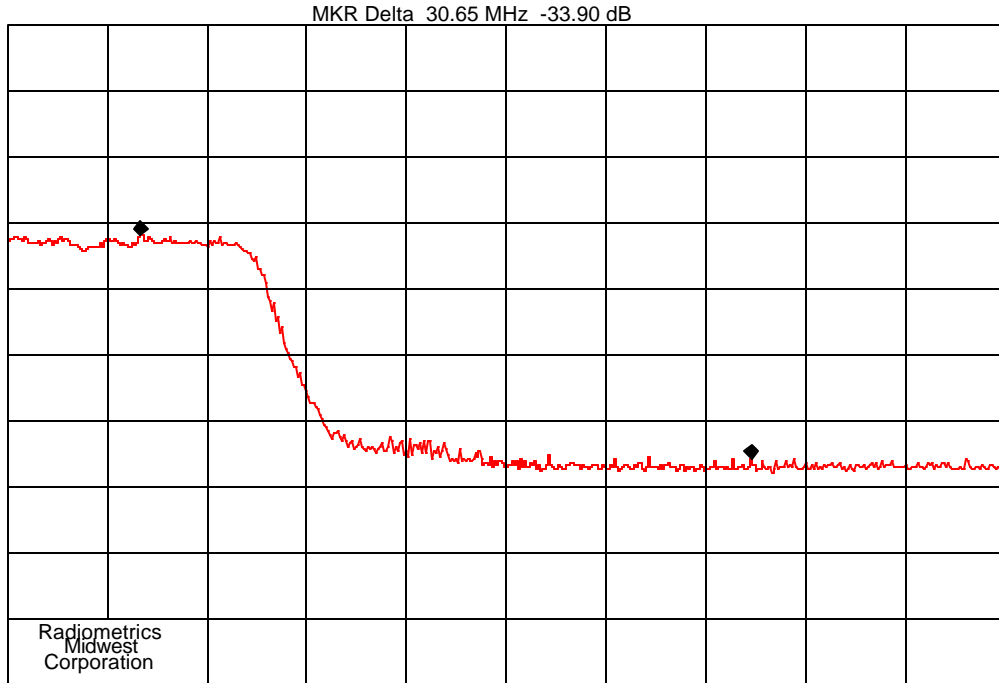
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COMPANY : Westell Inc.	ITEM : VZ1	DATE : 11-30-2004
CENTER 2.483 0 GHz	REF 30.0 dBm	SPAN 50.0 MHz
RES BW 1 MHz	VBW 1 MHz	ATTEN 40 dB
10 dB/	TIME : 11:33	SWP 20.0 msec
NOTES : Bandwidth Edge Test; channel 11, 802.11b		



COMPANY : Westell Inc.	ITEM : VZ1	DATE : 11-30-2004
CENTER 2.400 0 GHz	REF 30.0 dBm	SPAN 50.0 MHz
RES BW 1 MHz	VBW 1 MHz	ATTEN 40 dB
10 dB/	TIME : 11:46	SWP 20.0 msec
NOTES : Bandwidth Edge Test; Channel 1, 802.11g		



COMPANY : Westell Inc.  
CENTER 2.483 0 GHz  
RES BW 1 MHz  
10 dB/  
NOTES : Bandwidth Edge Test; Channel 11, 802.11g

ITEM : VZ1  
REF 30.0 dBm  
VBW 1 MHz  
TIME : 11:37

DATE : 11-30-2004  
SPAN 50.0 MHz  
ATTEN 40 dB  
SWP 20.0 msec

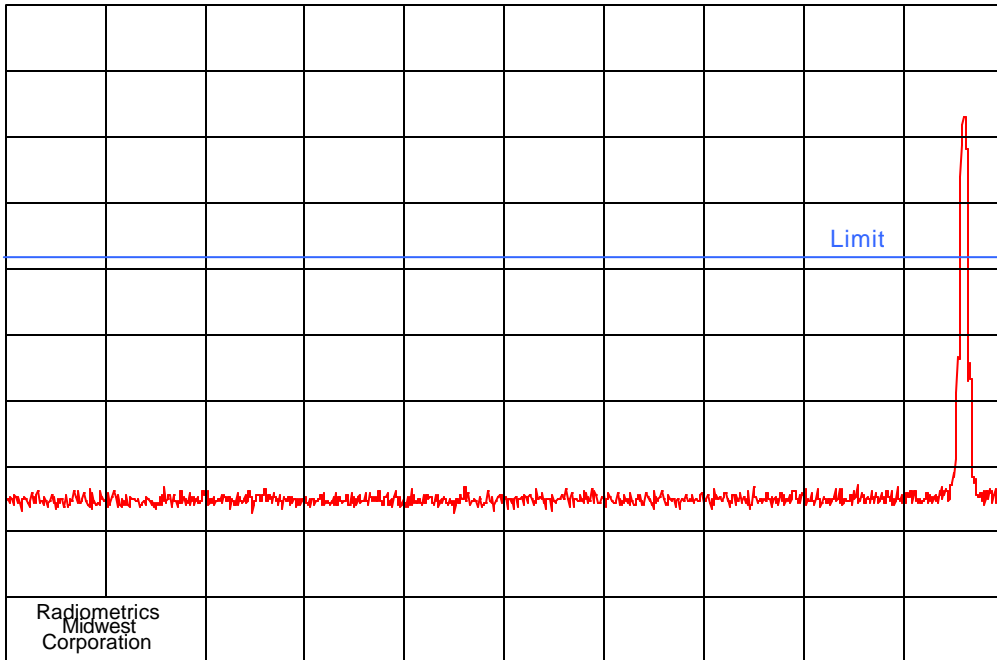
### 10.6 Spurious RF Conducted Emissions

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 10<sup>th</sup> 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.



RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



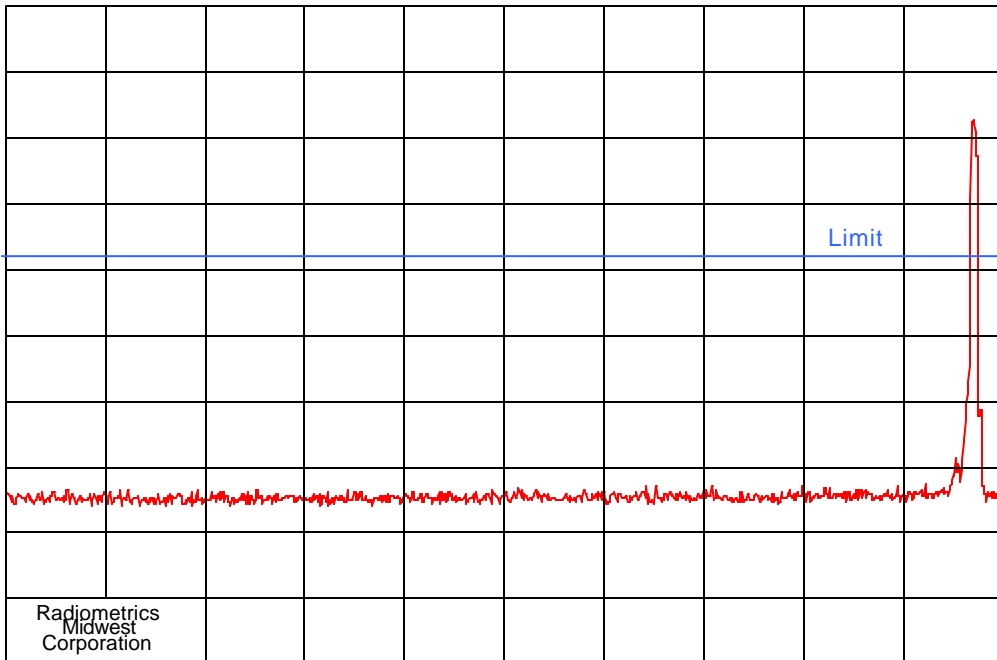
COMPANY : Westell Inc.

START 1 MHz  
RES BW 100 kHz  
10 dB/

NOTES : RF Conducted emissions, 802.11b; Channel 1

ITEM : VZ1  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 16:15

DATE : 11-30-2004  
STOP 2.50 GHz  
ATTEN 30 dB  
SWP 750 msec



COMPANY : Westell Inc.

START 1 MHz  
RES BW 100 kHz  
10 dB/

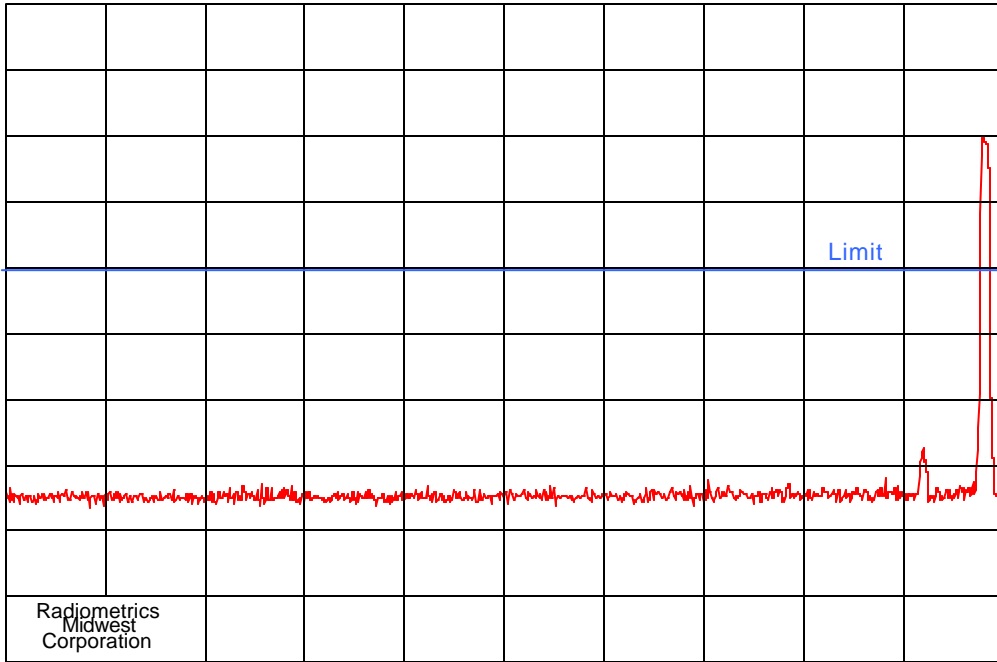
NOTES : RF Conducted emissions, 802.11b; Channel 6

ITEM : VZ1  
REF 20.0 dBm  
VBW 300 kHz  
TIME : 16:18

DATE : 11-30-2004  
STOP 2.50 GHz  
ATTEN 30 dB  
SWP 750 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

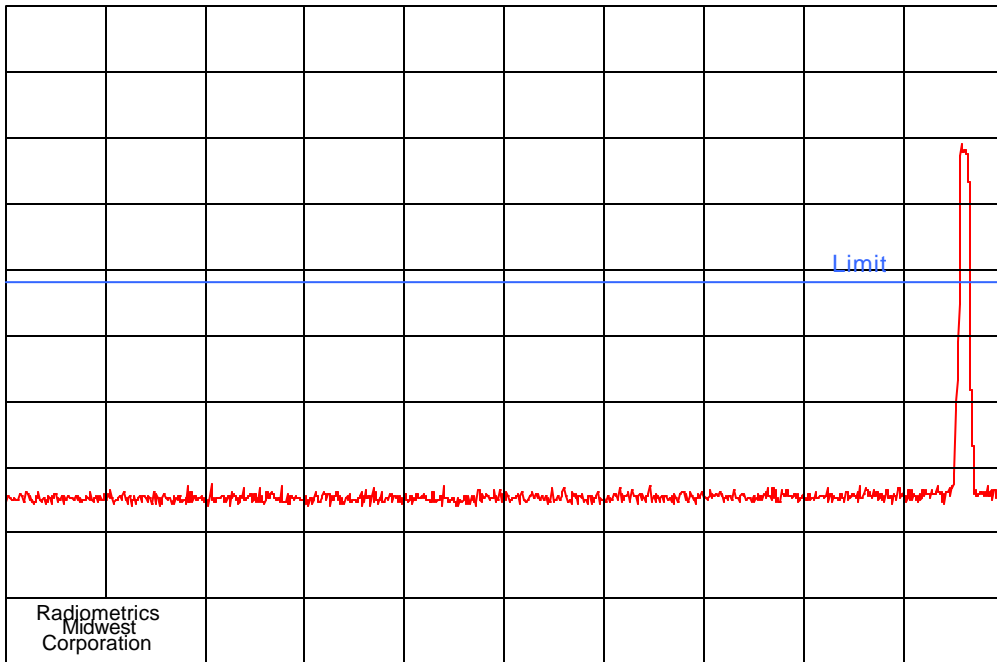
Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.  
 START 1 MHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11b; Channel 11

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 16:19

DATE : 11-30-2004  
 STOP 2.50 GHz  
 ATTEN 30 dB  
 SWP 750 msec



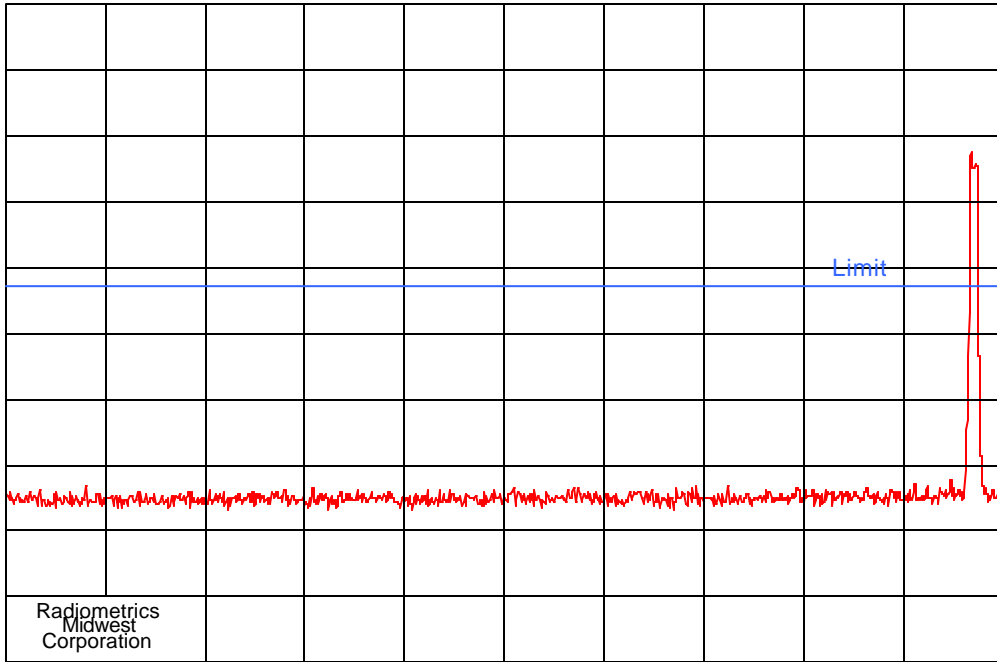
COMPANY : Westell Inc.  
 START 1 MHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11g; Channel 1

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 16:23

DATE : 11-30-2004  
 STOP 2.50 GHz  
 ATTEN 30 dB  
 SWP 750 msec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.

ITEM : VZ1

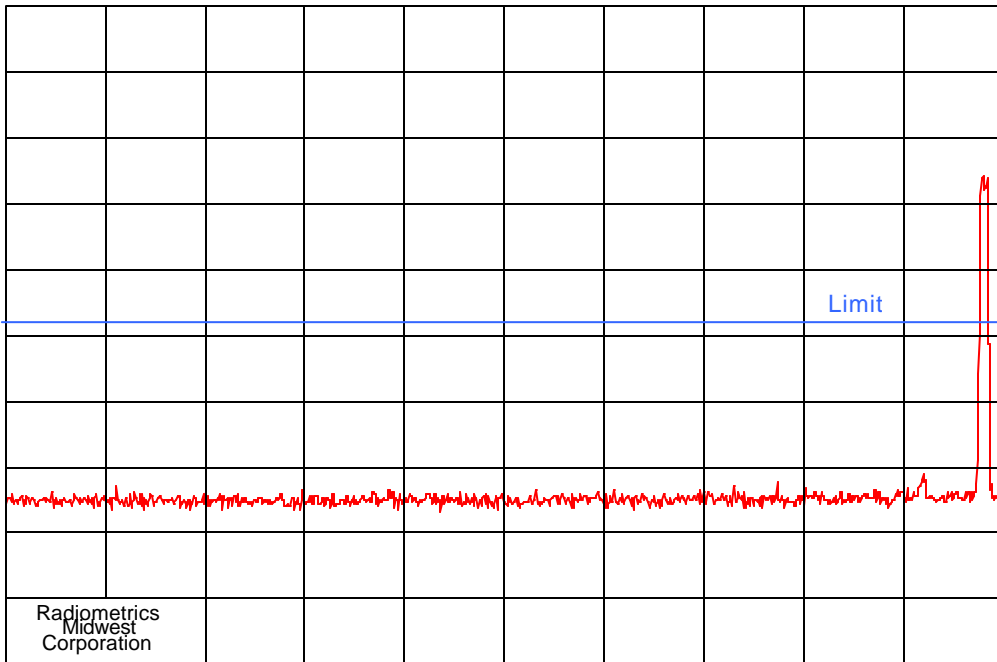
DATE : 11-30-2004

START 1 MHz  
RES BW 100 kHz  
10 dB/

REF 20.0 dBm  
VBW 300 kHz  
TIME : 16:41

STOP 2.50 GHz  
ATTEN 30 dB  
SWP 750 msec

NOTES : RF Conducted Emissions, 802.11g; Channel 6



COMPANY : Westell Inc.

ITEM : VZ1

DATE : 11-30-2004

START 1 MHz  
RES BW 100 kHz  
10 dB/

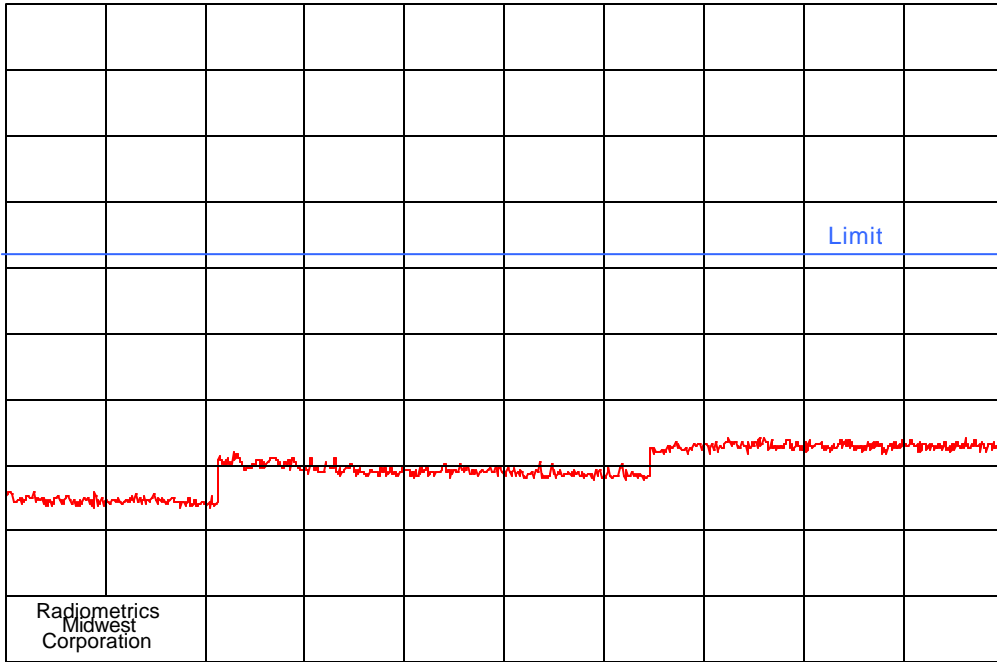
REF 20.0 dBm  
VBW 300 kHz  
TIME : 16:21

STOP 2.50 GHz  
ATTEN 30 dB  
SWP 750 msec

NOTES : RF Conducted emissions, 802.11g; Channel 11

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

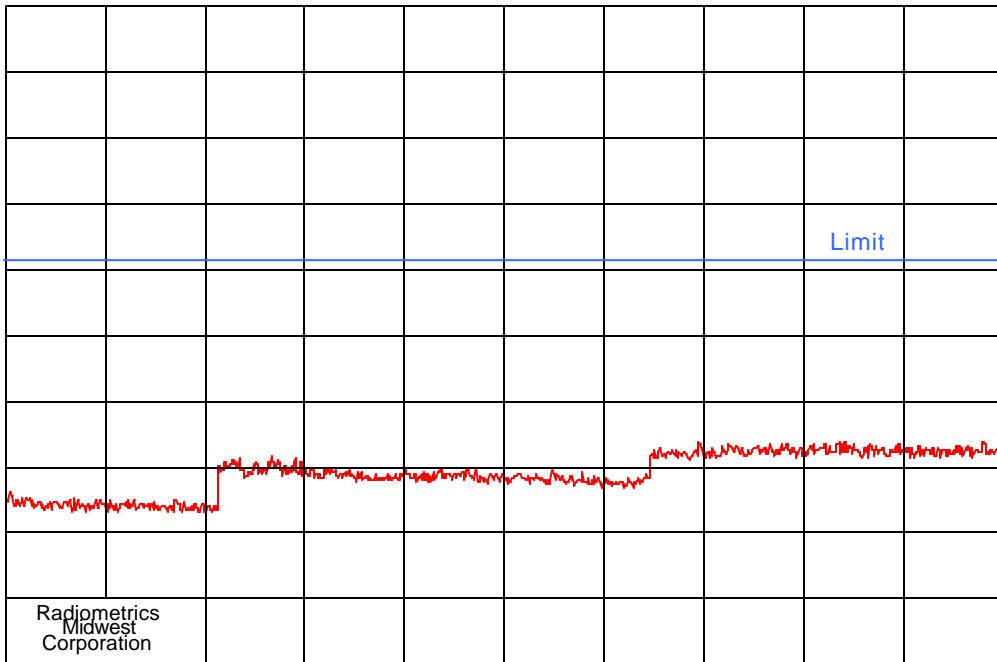
Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.  
 START 2.5 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF conducted emissions, channel 1; 802.b

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 13:12

DATE : 11-30-2004  
 STOP 18.0 GHz  
 ATTEN 30 dB  
 SWP 4.65 sec



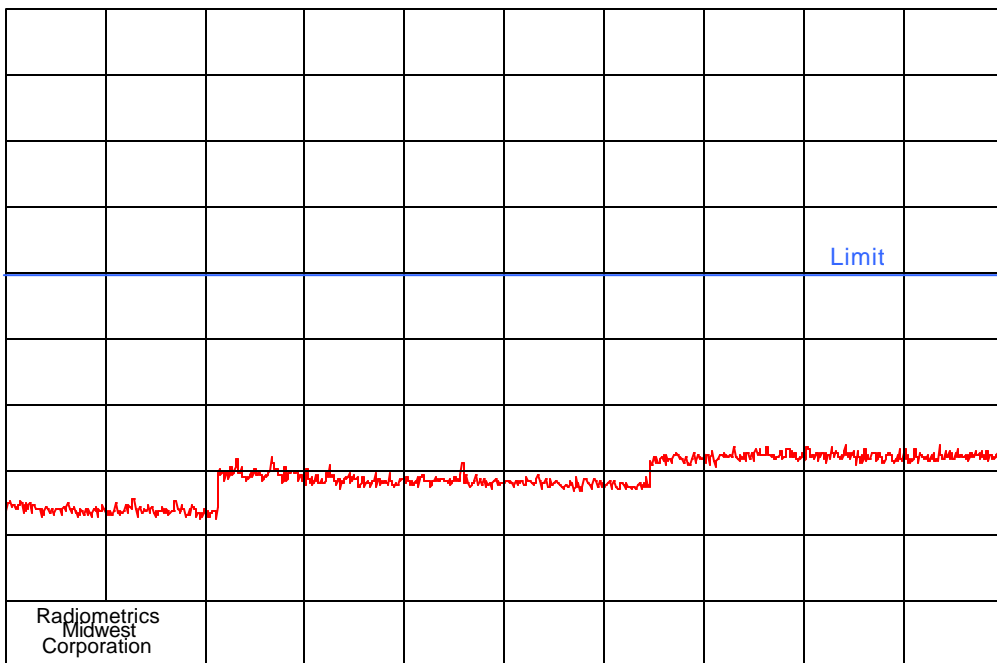
COMPANY : Westell Inc.  
 START 2.5 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF conducted emissions, channel 6; 802.1b

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 13:31

DATE : 11-30-2004  
 STOP 18.0 GHz  
 ATTEN 30 dB  
 SWP 4.65 sec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

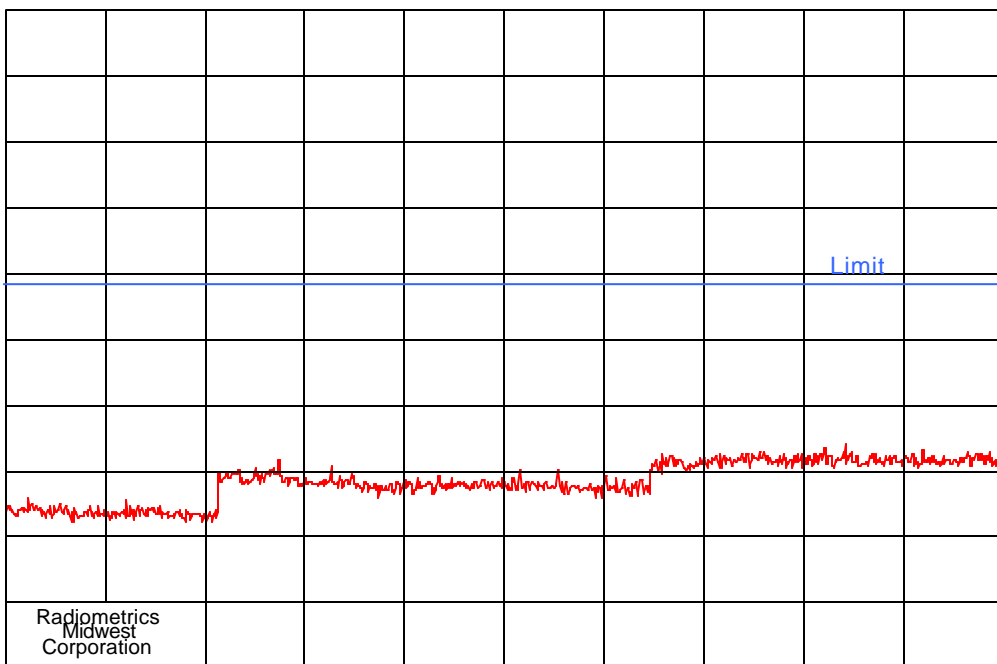
Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.  
 START 2.5 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11b; channel 11

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 13:56

DATE : 11-30-2004  
 STOP 18.0 GHz  
 ATTEN 30 dB  
 SWP 4.65 sec



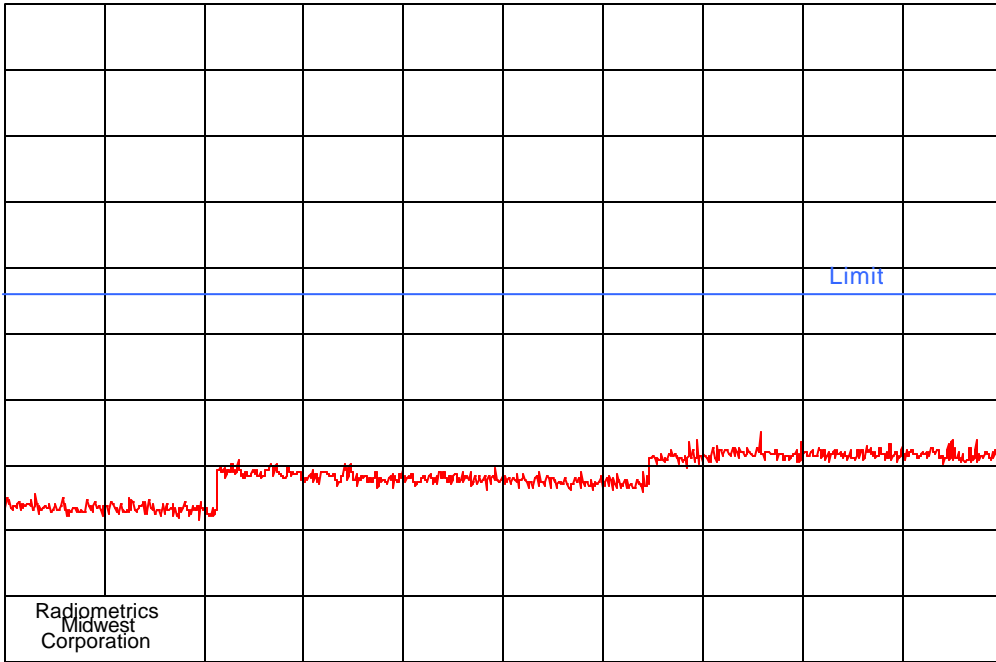
COMPANY : Westell Inc.  
 START 2.5 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11g; channel 1

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 14:07

DATE : 11-30-2004  
 STOP 18.0 GHz  
 ATTEN 30 dB  
 SWP 4.65 sec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.

ITEM : VZ1

DATE : 11-30-2004

START 2.5 GHz

REF 20.0 dBm

STOP 18.0 GHz

RES BW 100 kHz

VBW 300 kHz

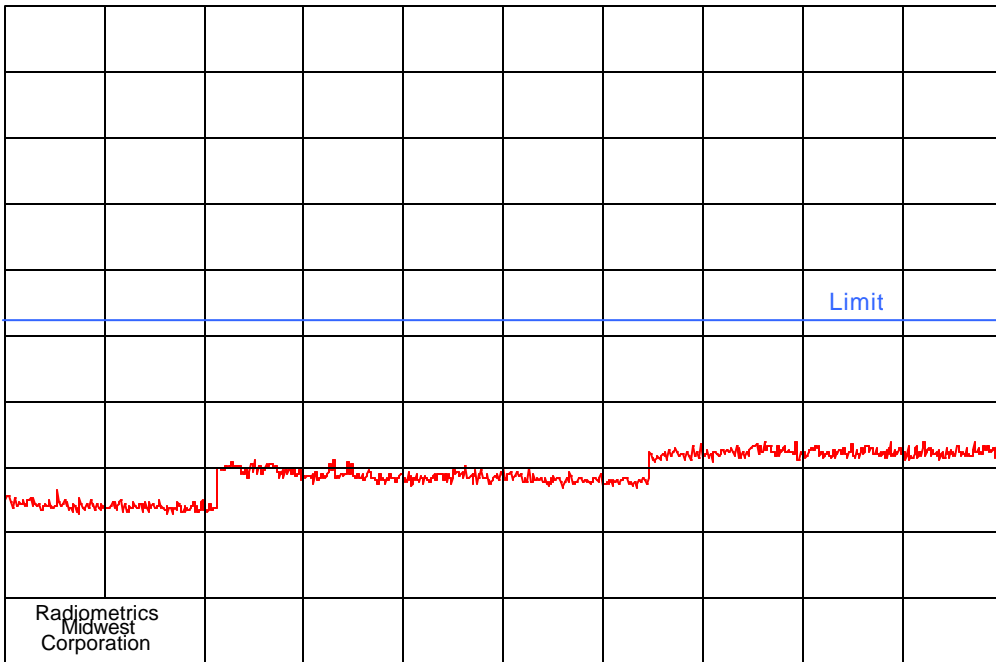
ATTEN 30 dB

10 dB/

TIME : 14:15

SWP 4.65 sec

NOTES : RF Conducted emissions, 802.11g; channel 6



COMPANY : Westell Inc.

ITEM : VZ1

DATE : 11-30-2004

START 2.5 GHz

REF 20.0 dBm

STOP 18.0 GHz

RES BW 100 kHz

VBW 300 kHz

ATTEN 30 dB

10 dB/

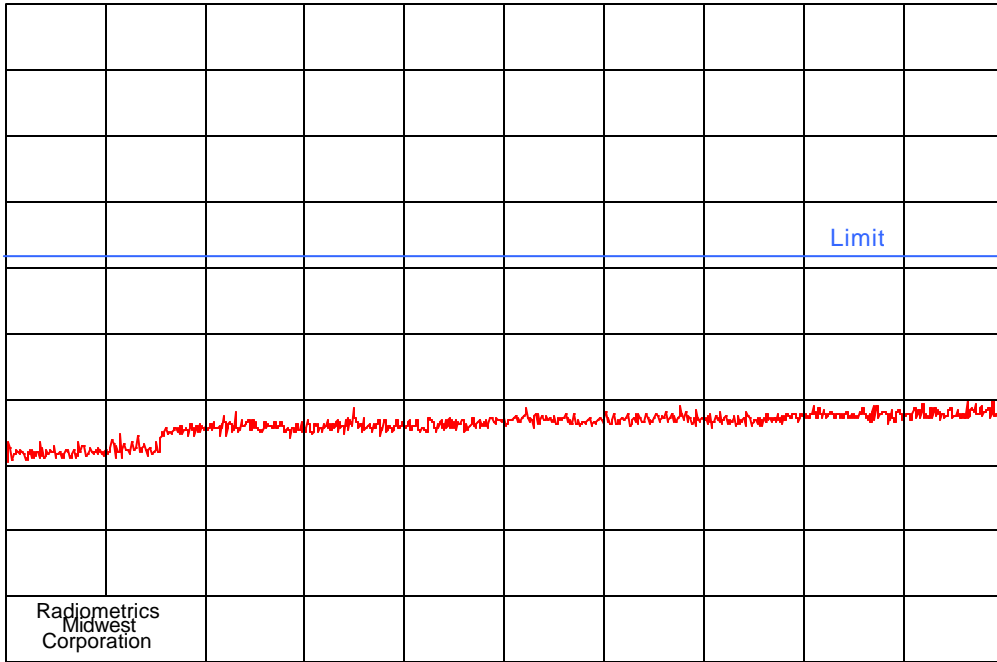
TIME : 14:21

SWP 4.65 sec

NOTES : RF Conducted emissions, 802.11g; channel 11

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

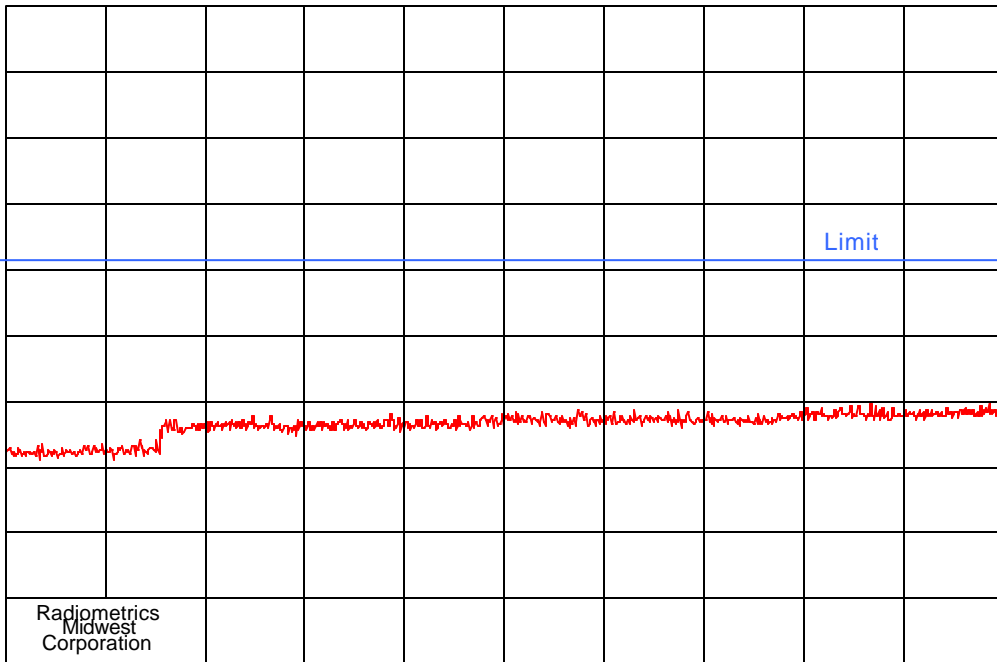
Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.  
 START 17.99 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11b; channel 1

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 13:47

DATE : 11-30-2004  
 STOP 25.00 GHz  
 ATTEN 30 dB  
 SWP 2.00 sec



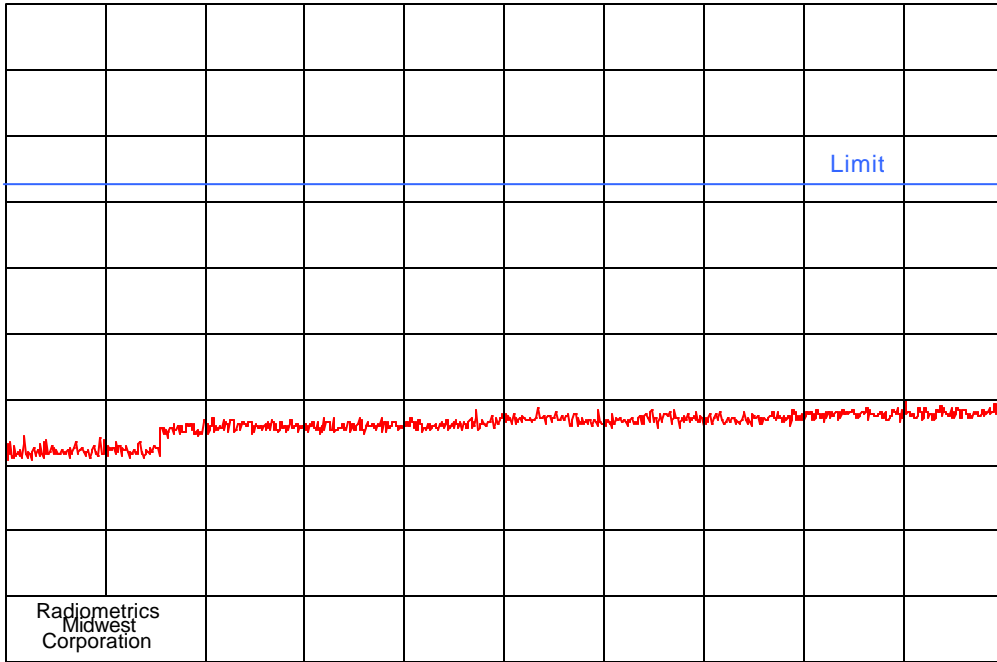
COMPANY : Westell Inc.  
 START 17.99 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11b; channel 6

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 13:42

DATE : 11-30-2004  
 STOP 25.00 GHz  
 ATTEN 30 dB  
 SWP 2.00 sec

RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

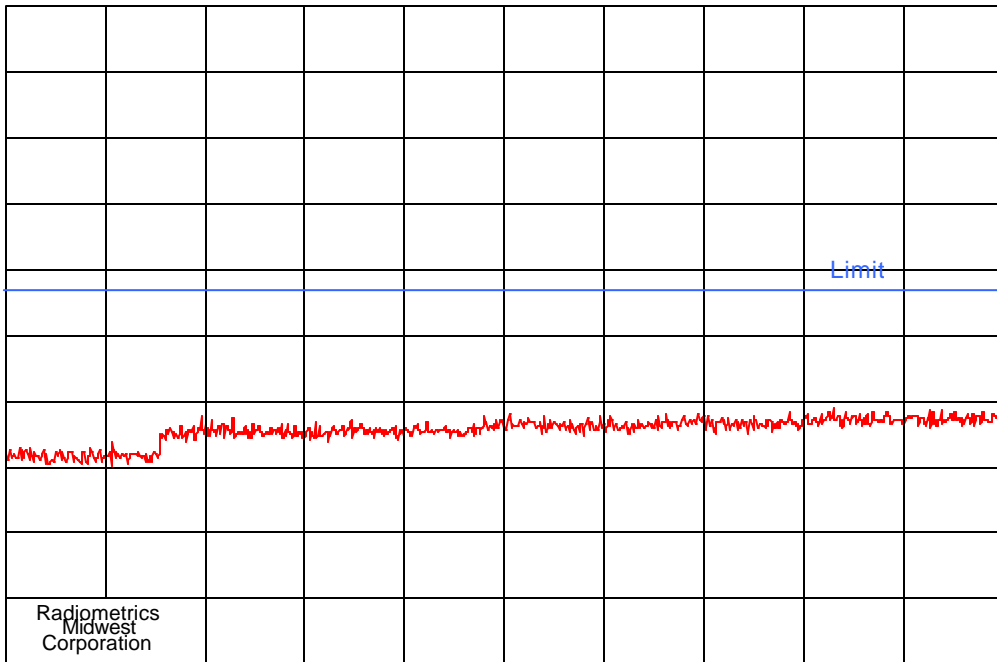
Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.  
 START 17.99 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11b; channel 11

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 13:56

DATE : 11-30-2004  
 STOP 25.00 GHz  
 ATTEN 30 dB  
 SWP 2.00 sec



COMPANY : Westell Inc.  
 START 17.99 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11g; channel 1

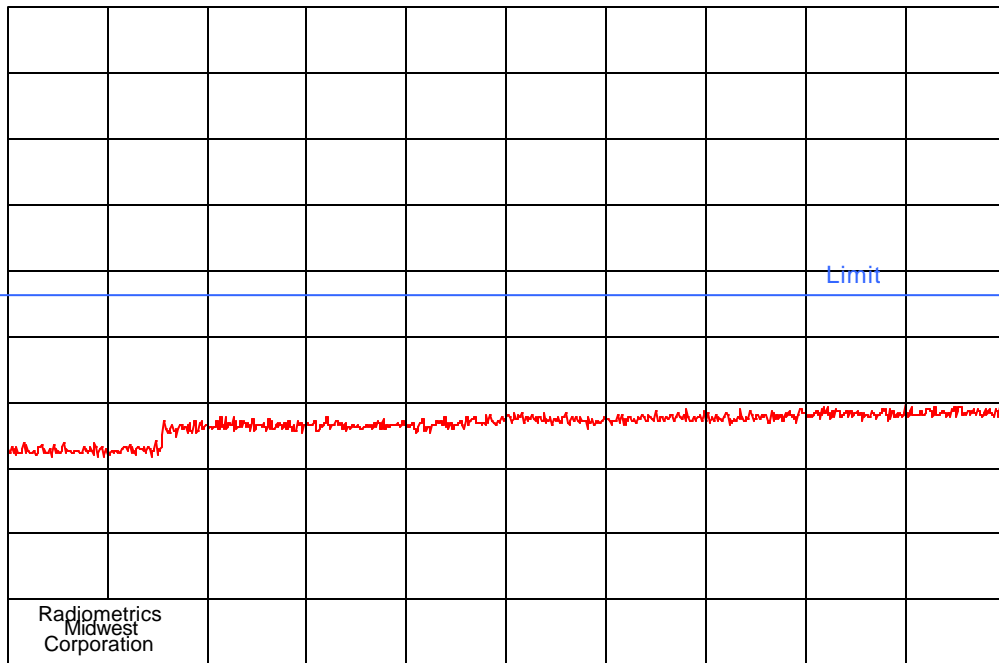
ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 14:10

DATE : 11-30-2004  
 STOP 25.00 GHz  
 ATTEN 30 dB  
 SWP 2.00 sec



RADIOMETRICS MIDWEST CORPORATION - EMC Test Report

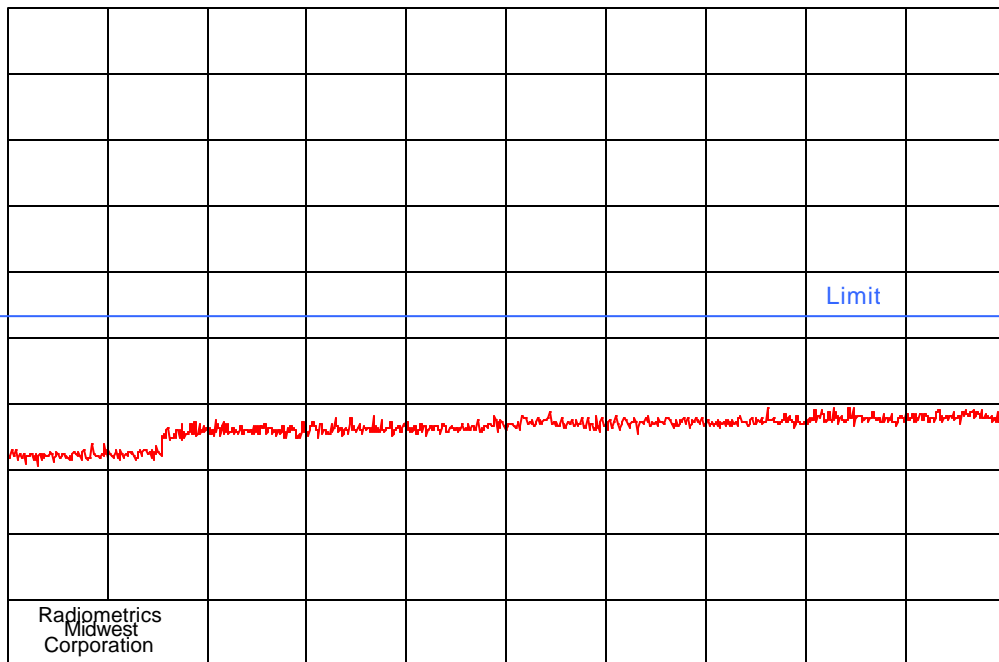
Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone



COMPANY : Westell Inc.  
 START 17.99 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11g; channel 6

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 14:18

DATE : 11-30-2004  
 STOP 25.00 GHz  
 ATTEN 30 dB  
 SWP 2.00 sec



COMPANY : Westell Inc.  
 START 17.99 GHz  
 RES BW 100 kHz  
 10 dB/  
 NOTES : RF Conducted emissions, 802.11g; channel 11

ITEM : VZ1  
 REF 20.0 dBm  
 VBW 300 kHz  
 TIME : 14:21

DATE : 11-30-2004  
 STOP 25.00 GHz  
 ATTEN 30 dB  
 SWP 2.00 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

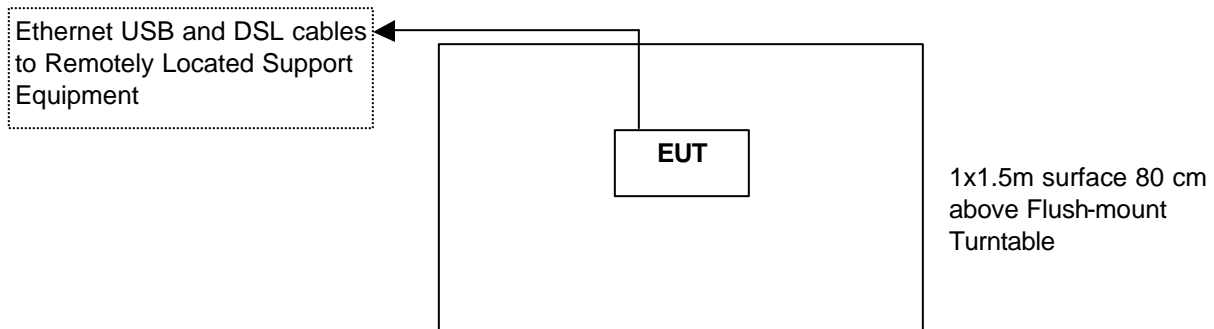
AF = Antenna Factor

CF = Cable Attenuation Factor

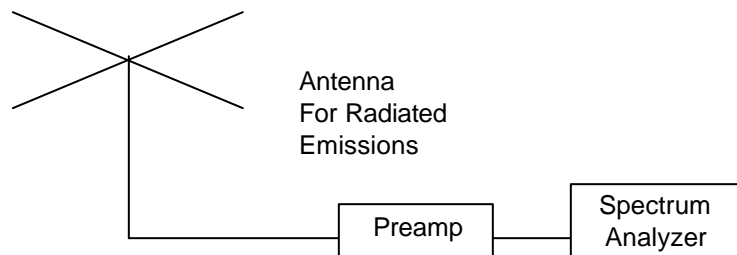
AG = Amplifier Gain

HPF = High pass Filter Loss

Figure 2. Drawing of Radiated Emissions Setup

**Notes:**

- AC outlet with low-pass filter at the base of the turntable
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale

**10.7.2 Spurious Radiated Emissions Test Results (Restricted Band)**

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

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

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

**RADIOMETRICS MIDWEST CORPORATION - EMC Test Report**

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	VZ1	Test Date	12/8/2004
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		
Notes	Corr. Factors = Cable Loss – Preamp Gain + HP Filter Loss		

**Emissions Above 1 GHz**

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	dBuV/m	Limit	Margin under limit
802.11b	2412	V	Peak	4823.8	46.6	74.0	27.4
802.11b	2412	V	Ave	4823.6	34.7	54.0	19.3
802.11b	2437	V	Peak	4873.9	49.6	74.0	24.4
802.11b	2437	V	Peak	7309.7	55.6	74.0	18.4
802.11b	2437	V	Ave	4924.8	43.0	54.0	11.0
802.11b	2437	V	Ave	7309.0	47.4	54.0	6.6
802.11b	2462	V	Ave	7388.3	47.2	54.0	6.8
802.11b	2437	V	Peak	4924.9	59.0	74.0	15.0
802.11b	2412	H	Peak	4823.6	47.9	74.0	26.1
802.11b	2462	H	Peak	7237.5	58.1	74.0	15.9
802.11b	2437	H	Peak	7310.2	55.1	74.0	18.9
802.11b	2412	V	Peak	4824.0	47.9	74.0	26.1
802.11b	2412	V	Peak	4825.4	54.6	74.0	19.4
802.11b	2437	H	Ave	7308.9	45.1	54.0	8.9
802.11g	2412	V	Peak	4822.5	48.0	74.0	26.0
802.11g	2412	V	Ave	4826.5	48.2	54.0	5.8
802.11b	2412	H	Ave	4822.4	46.5	54.0	7.5
802.11b	2412	H	Ave	4826.0	46.9	54.0	7.1
802.11b	2437	H	Ave	4875.4	49.5	54.0	4.5
802.11b	2437	V	Ave	4873.7	49.9	54.0	4.1
802.11g	2437	H	Ave	4873.0	48.8	54.0	5.2
802.11g	2437	V	Ave	4875.4	47.2	54.0	6.8
802.11g	2437	V	Peak	7308.8	56.1	74.0	17.9
802.11g	2437	V	Ave	7309.5	44.6	54.0	9.4
802.11g	2437	H	Peak	7311.6	56.2	74.0	17.8
802.11g	2437	H	Ave	7310.5	44.7	54.0	9.3
802.11b	2437	H	Peak	7311.8	56.2	74.0	17.8
802.11b	2437	H	Ave	7309.6	44.6	54.0	9.4
802.11b	2437	V	Peak	7308.7	56.5	74.0	17.5
802.11b	2437	V	Ave	7309.5	45.4	54.0	8.6
802.11b	2462	V	Peak	4926.1	58.4	74.0	15.6
802.11b	2462	V	Peak	7384.1	56.7	74.0	17.3
802.11b	2462	V	Ave	4924.2	39.8	54.0	14.2
802.11b	2462	V	Ave	7384.9	45.3	54.0	8.7

**RADIOMETRICS MIDWEST CORPORATION - EMC Test Report**

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	dBuV/m	Limit	Margin under limit
802.11b	2462	H	Peak	4924.8	63.9	74.0	10.1
802.11b	2462	H	Peak	7386.3	56.7	74.0	17.3
802.11b	2462	H	Ave	4924.6	39.1	54.0	14.9
802.11b	2462	H	Ave	7383.7	44.2	54.0	9.8
802.11g	2462	H	Peak	4924.8	62.1	74.0	11.9
802.11g	2462	H	Peak	7385.3	56.7	74.0	17.3
802.11g	2462	H	Ave	4924.6	39.4	54.0	14.6
802.11g	2462	H	Ave	7385.4	48.4	54.0	5.6
802.11g	2462	V	Peak	4926.4	60.1	74.0	13.9
802.11g	2462	V	Peak	7387.9	57.1	74.0	16.9
802.11g	2462	V	Ave	4923.5	40.7	54.0	13.3
802.11g	2462	V	Ave	7383.6	44.4	54.0	9.6
802.11b	2462	V	Peak	12311.5	57.0	74.0	17.0
802.11b	2462	V	Ave	12309.6	44.5	54.0	9.5
802.11b	2462	H	Peak	12311.0	56.9	74.0	17.1
802.11b	2462	H	Ave	12307.6	44.5	54.0	9.5
802.11g	2462	H	Peak	12309.1	56.9	74.0	17.1
802.11g	2462	H	Ave	12307.6	44.5	54.0	9.5
802.11g	2462	V	Peak	12312.1	56.8	74.0	17.2
802.11g	2462	V	Ave	12308.9	44.5	54.0	9.5
802.11g	2437	V	Peak	12186.8	57.1	74.0	16.9
802.11g	2437	V	Ave	12182.6	44.8	54.0	9.2
802.11g	2437	H	Peak	12185.0	58.1	74.0	15.9
802.11g	2437	H	Ave	12186.8	45.1	54.0	8.9
802.11b	2437	H	Peak	12183.9	57.0	74.0	17.0
802.11b	2437	H	Ave	12187.0	45.1	54.0	8.9
802.11b	2437	V	Peak	12184.3	57.0	74.0	17.0
802.11b	2437	V	Ave	12182.6	45.0	54.0	9.0
802.11b	2412	V	Peak	12059.6	57.6	74.0	16.4
802.11b	2412	V	Ave	12057.8	45.1	54.0	8.9
802.11b	2412	H	Peak	12058.0	57.2	74.0	16.8
802.11b	2412	H	Ave	12059.0	45.3	54.0	8.7
802.11g	2412	H	Peak	12059.5	58.0	74.0	16.0
802.11g	2412	H	Ave	12057.6	45.1	54.0	8.9
802.11g	2412	V	Peak	12060.4	57.1	74.0	16.9
802.11g	2412	V	Ave	12058.0	45.1	54.0	8.9

Judgment: Passed by 4.1 dB

No other emissions were detected in the restricted bands.

**RADIOMETRICS MIDWEST CORPORATION - EMC Test Report**

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone

**Emissions Below 1 GHz**

Notes † Base unit

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
101.2	35.9 P	10.8	H/44	-16.8	29.9	43.5	13.6
186.8	43.8 P	10.0	H/44	-16.0	37.8	43.5	5.7
214.8	44.5 P	11.1	H/44	-15.9	39.8	43.5	3.7
250.0	47.0 P	12.9	H/44	-15.6	44.3	46.0	1.7
299.8	42.7 P	14.2	H/44	-15.3	41.7	46.0	4.3
349.9	35.7 P	15.0	H/44	-15.0	35.7	46.0	10.3
373.2	37.0 P	15.7	H/44	-14.9	37.8	46.0	8.2
480.4	32.2 P	17.1	H/44	-14.3	35.0	46.0	11.0
560.8	31.5 P	18.1	H/44	-13.6	36.0	46.0	10.0
600.4	32.6 P	18.6	H/44	-13.2	38.0	46.0	8.0
624.9	32.7 P	19.4	H/44	-13.0	39.1	46.0	6.9
649.6	31.6 P	19.5	H/44	-12.8	38.4	46.0	7.6
699.8	30.0 P	20.7	H/44	-12.5	38.2	46.0	7.8
799.6	30.4 P	21.6	H/44	-11.6	40.3	46.0	5.7
41.0	39.1 Q	15.8	V/44	-17.7	37.2	40.0	2.8
63.6	42.2 Q	10.4	V/44	-17.3	35.3	40.0	4.7
71.1	43.4 P	7.8	V/44	-17.1	34.1	40.0	5.9
84.6	41.6 P	6.7	V/44	-17.0	31.3	40.0	8.7
85.4	46.3 P	6.8	V/44	-16.9	36.1	40.0	3.9
111.4	38.5 P	12.3	V/44	-16.7	34.1	43.5	9.4
175.0	39.3 P	10.5	V/44	-16.1	33.7	43.5	9.8
187.6	39.9 P	9.9	V/44	-16.0	33.8	43.5	9.7
199.9	41.4 P	10.5	V/44	-16.0	35.9	43.5	7.6
215.7	41.7 P	11.5	V/44	-15.9	37.3	43.5	6.2
239.7	32.2 P	13.1	V/44	-15.7	29.6	46.0	16.4
250.0	43.3 P	12.8	V/44	-15.6	40.5	46.0	5.5
275.4	38.0 P	13.0	V/44	-15.4	35.7	46.0	10.3
288.4	36.7 P	12.9	V/44	-15.3	34.3	46.0	11.7
300.3	37.5 P	13.4	V/44	-15.3	35.6	46.0	10.4
375.4	34.7 P	15.9	V/44	-14.9	35.7	46.0	10.3
401.2	36.3 P	15.7	V/44	-14.8	37.2	46.0	8.8
500.0	34.5 P	17.2	V/44	-14.1	37.5	46.0	8.5
560.0	38.4 P	18.6	V/44	-13.6	43.4	46.0	2.6
560.5	37.6 P	18.6	V/44	-13.6	42.6	46.0	3.4
624.4	33.0 P	19.2	V/44	-13.0	39.2	46.0	6.8
749.2	33.0 P	20.8	V/44	-12.0	41.8	46.0	4.2
799.6	32.6 P	20.8	V/44	-11.6	41.7	46.0	4.3
874.0	32.5 P	21.7	V/44	-11.3	42.9	46.0	3.1
978.4	29.7 P	22.5	V/44	-10.3	41.8	54.0	12.2

**RADIOMETRICS MIDWEST CORPORATION - EMC Test Report**

Testing of the Westell, Inc., Model VZ1, Wireless Gateway & Cordless Phone

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
Notes	Just Handset						
36.4	35.8 P	17.7	H/44	-27.7	25.8	40.0	14.2
84.4	35.9 P	7.0	H/44	-27.0	15.8	40.0	24.2
172.4	34.0 P	9.0	H/44	-26.1	16.9	43.5	26.6
249.2	33.0 P	12.9	H/44	-25.5	20.4	46.0	25.6
438.4	30.5 P	16.9	H/44	-24.3	23.1	46.0	22.9
560.8	30.5 P	18.1	H/44	-23.6	25.0	46.0	21.0
36.6	31.4 P	15.7	V/44	-17.7	29.3	40.0	10.7
41.2	39.5 P	15.9	V/44	-27.7	27.7	40.0	12.3
50.2	29.9 P	12.4	V/44	-17.5	24.8	40.0	15.2
62.8	37.5 P	10.6	V/44	-27.3	20.8	40.0	19.2
79.9	41.2 P	7.1	V/44	-27.1	21.2	40.0	18.8
84.6	39.2 P	6.7	V/44	-27.0	18.8	40.0	21.2
187.6	35.5 P	9.9	V/44	-26.0	19.3	43.5	24.2
239.7	33.3 P	13.1	V/44	-25.6	20.8	46.0	25.2
250.1	37.1 P	12.8	V/44	-25.5	24.4	46.0	21.6
300.3	33.5 P	13.4	V/44	-25.3	21.6	46.0	24.4
373.2	31.6 P	15.9	V/44	-24.9	22.6	46.0	23.4
560.8	31.6 P	18.7	V/44	-23.6	26.7	46.0	19.3
799.6	30.4 P	20.8	V/44	-21.7	29.5	46.0	16.5

Judgment: Passed by 1.7 dB

No other emissions were detected in the restricted bands.