Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

Wireless Gateway Router

Ultraline IIB Bonded ADSL Gateway, Model A90-816030-07

Radiometrics Document RP-5645

ACCREDITED
Certification # 1495.01

Product Detail:
FCC ID: **CH8A9081XXYY-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 Ave. Romeoville, IL 60446 e-mail: info@radiomet.com

Test Date(s): (Month-Day-Year)
August 23 to September 12, 2005

Document RP-5645 Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	October 13, 2005		
1	October 20, 2005	35, 36	Joseph Strzelecki

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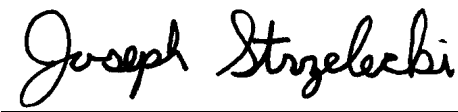
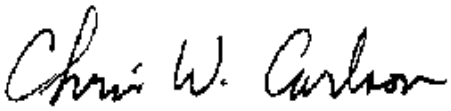
1 ADMINISTRATIVE DATA

Equipment Under Test: A Westell, Inc., Wireless Gateway Router Model: Ultraline IIB Bonded ADSL Gateway A90-816030-07 Serial Number: 05BS09231879 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) July 12, 2005	*Test Date(s): (Month-Day-Year)* July 12 thru September 9, 2005
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* Burak Balkuv 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 Wireless Gateway Router, Ultraline IIB Bonded ADSL Gateway Model A90-816030-07, 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	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 UltraLine IIb is a high-performance router product designed to meet the needs of the service providers deploying broadband video solutions.

The RF section of the EUT is a digitally modulated Spread Spectrum transceiver for use as an 802.11b or 802.11g wireless LAN. It operates in the 2400 to 2483.5 MHz Frequency Band. The wireless section is a miniPCI card inside the modem. It is a Gemtek Model 990-300-0001L.

The 2.4 GHz antenna has a reverse polarity SMA connector on it. The antenna used is a 2 dBi monopole.

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 exercised to simulate typical operation. Both ADSL lines were in sync between the EUT and the ATU-C at 8.128 Mbps downstream and 896 kbps upstream.

In addition, the wireless interface of the EUT was exercised by sending data from PC1 over wired 10/100 Ethernet to the EUT, and then to PC2 via the wireless 802.11b/g link. The EUT mode and channel were set for each test using the EUT’s configuration web screens. The EUT wireless transmitter was exercised using a utility called “Qcheck” from Ixia. It is able, among other things, to send streaming UDP traffic from one endpoint to another. A streaming path was sent from PC1 to PC2 via the EUT’s wireless interface.

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

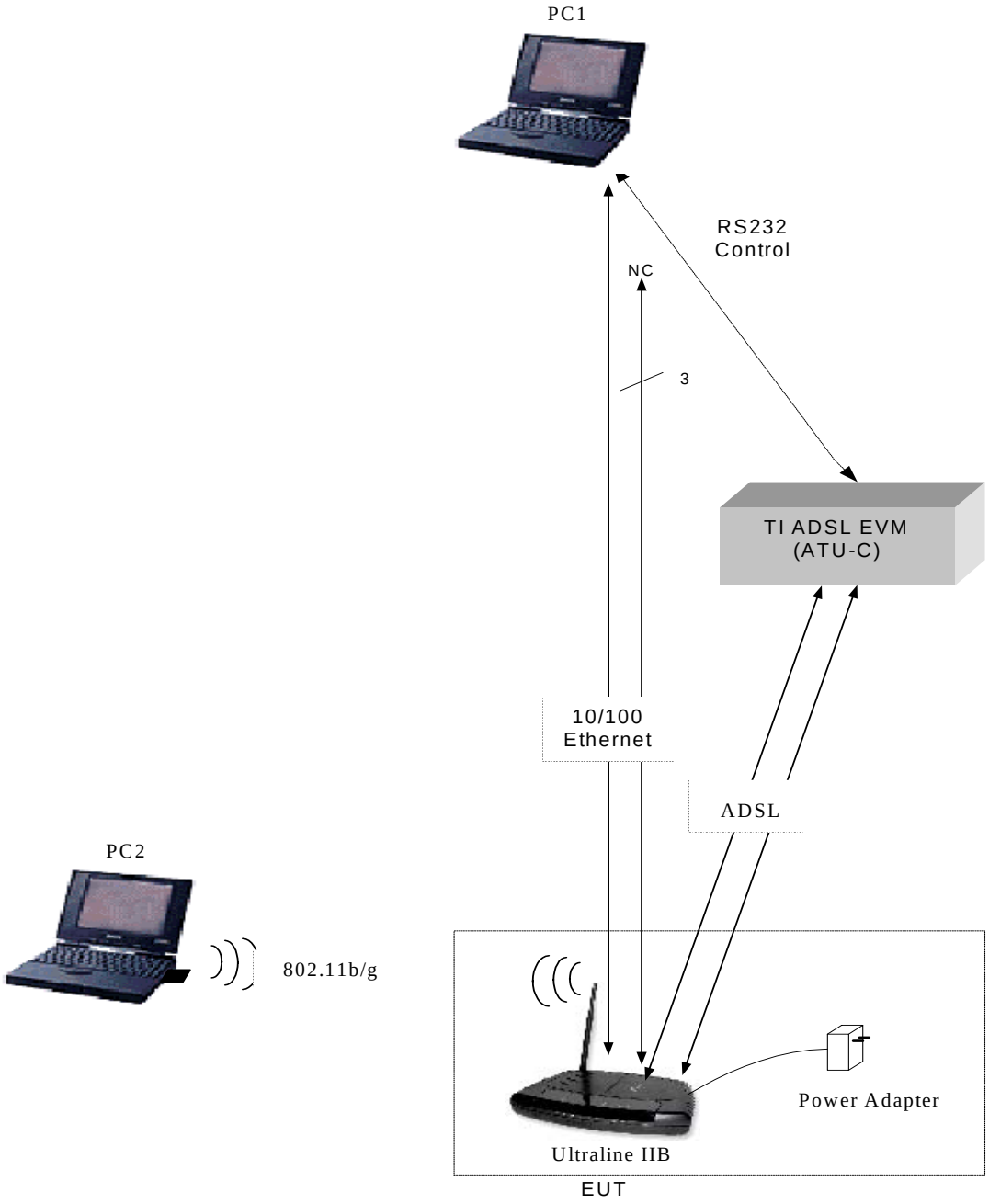
Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Ultraline IIB Bonded ADSL Gateway	E	Westell, Inc.	A90-816030-07	05BS09231879
2	MiniPCI card inside modem	E	Gemtek	990-300-0001L	(MAC Addr) 00:14:A5:0A:AE:2B
3	Power Adapter	E	Anoma Na Corp	AEC-T5712A	None
4	Antenna	E	Wieson Technologies	Y111E024-002	None
5	Notebook PC	S	Dell	Inspiron 3700	007114T-38380-9C2-P0AD
6	Notebook PC	S	Medion	MD5275	9142X0101122700381K000
7	Wireless PC Card	S	Microsoft	MN-720	(MAC Addr) 00:0D:3A:22:53:46
8	ADSL ATU-C	S	Texas Instruments	AC5 EVM	None

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

List of EUT Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
4	10	Ethernet Cable RJ 45	#1 and #5	No
2	15	DSL Cable RJ 15	#1 and #8	No
1	2	DC Cable Integral On Power Adaptor	#1	No

Figure 1. EUT Setup diagram



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 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 approximately 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 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.	08/19/05
AMP-29	HP / Agilent	Amplifier for 18-26 GHz Mixer	11975A	2304A00158	2-8 GHz	12 Mo.	08/19/05
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/13/04
ANT-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
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26 GHz	12 Mo.	10/13/04
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	24 Mo.	08/03/04
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	04/25/05
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.	08/19/05
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	11/11/04
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	01/04/05
REC-08	HP / Agilent	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	12 Mo.	06/14/05
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.

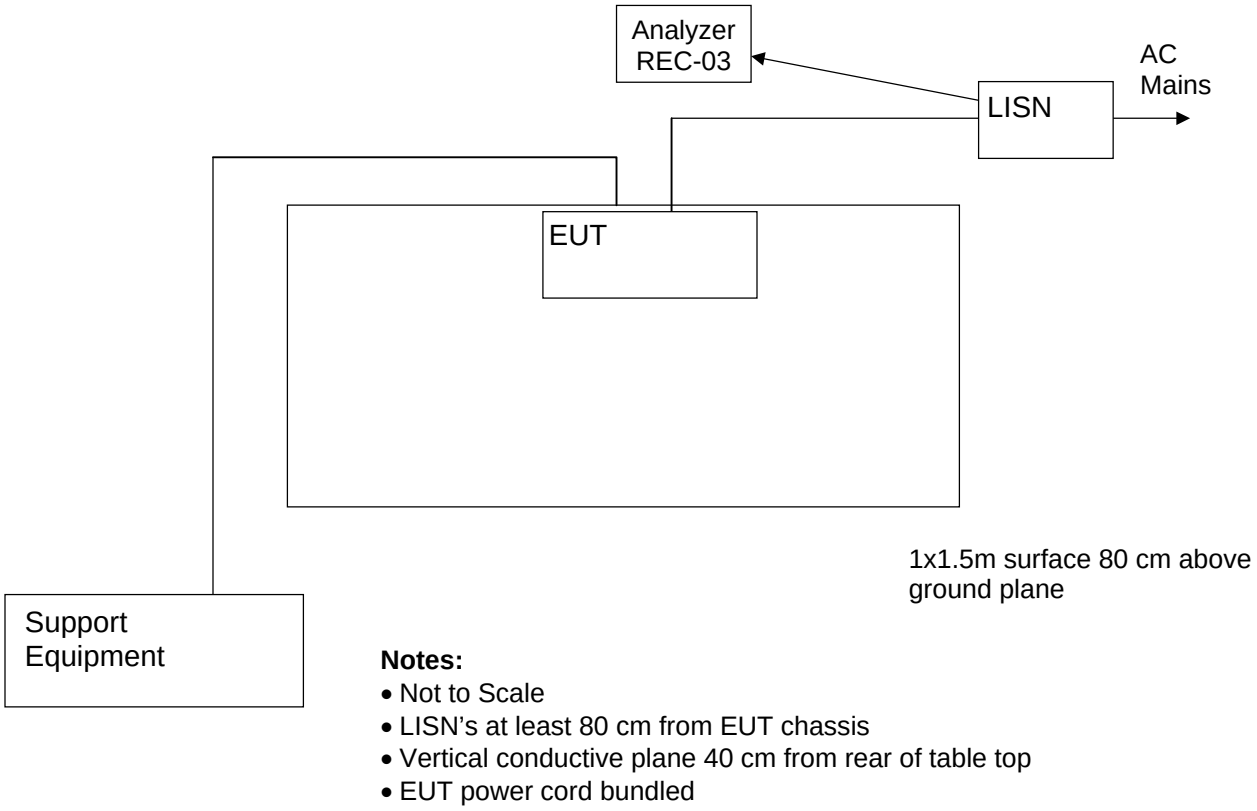
Test Date : September 12, 2005
The Amplitude is the final corrected value with cable and LISN Loss.

Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Neutral	0.15	55.37	66.00	37.79	56.00
AC Neutral	0.22	52.20	62.73	35.94	52.73
AC Neutral	0.36	47.88	58.63	32.20	48.63
AC Neutral	0.53	N/A	56.00	29.60	46.00
AC Neutral	26.62	N/A	60.00	33.55	50.00
AC Hot	0.15	55.84	66.00	38.43	56.00
AC Hot	0.25	51.83	61.92	34.97	51.92
AC Hot	0.36	N/A	58.81	32.80	48.81
AC Hot	0.50	N/A	56.00	30.17	46.00
AC Hot	20.53	N/A	60.00	33.77	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 10.1 dB

Figure 2. Conducted Emissions Test Setup



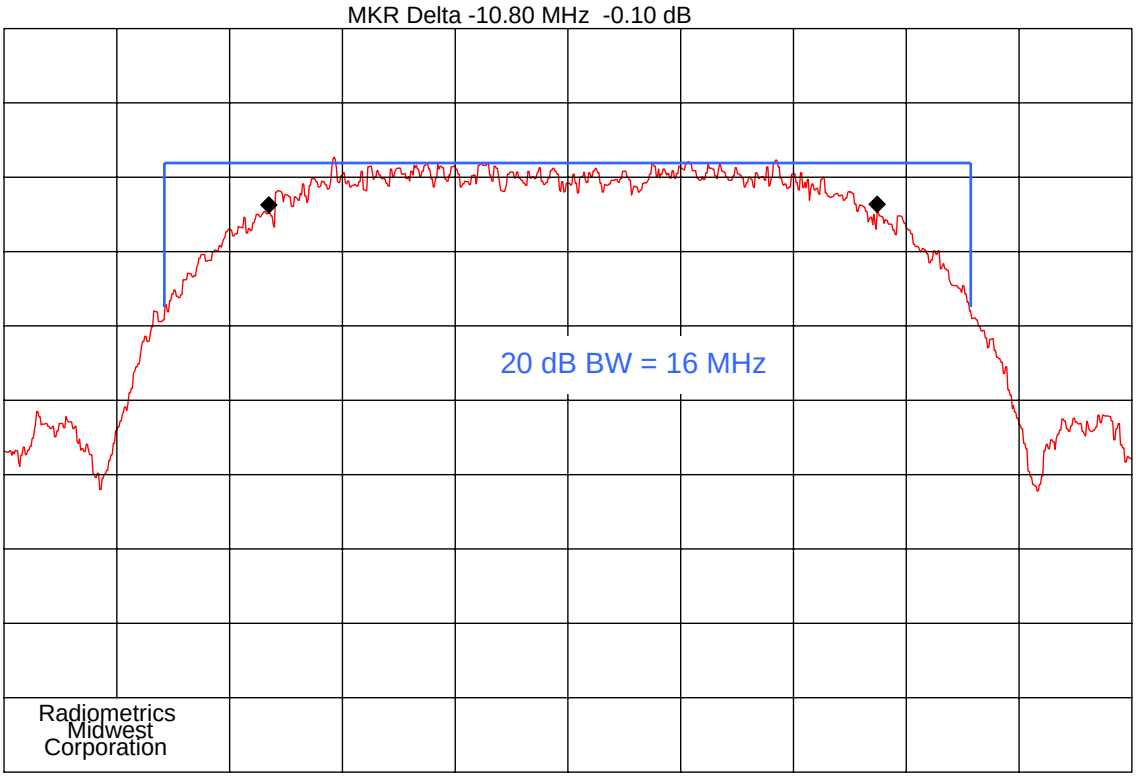
10.2 Occupied Bandwidth (6 dB)

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.

For canadian requirements, a 99% emission bandwidth was also determined using the same procedures, except that the marker-delta reading is the 20 dB bandwidth down on each side of the emission.

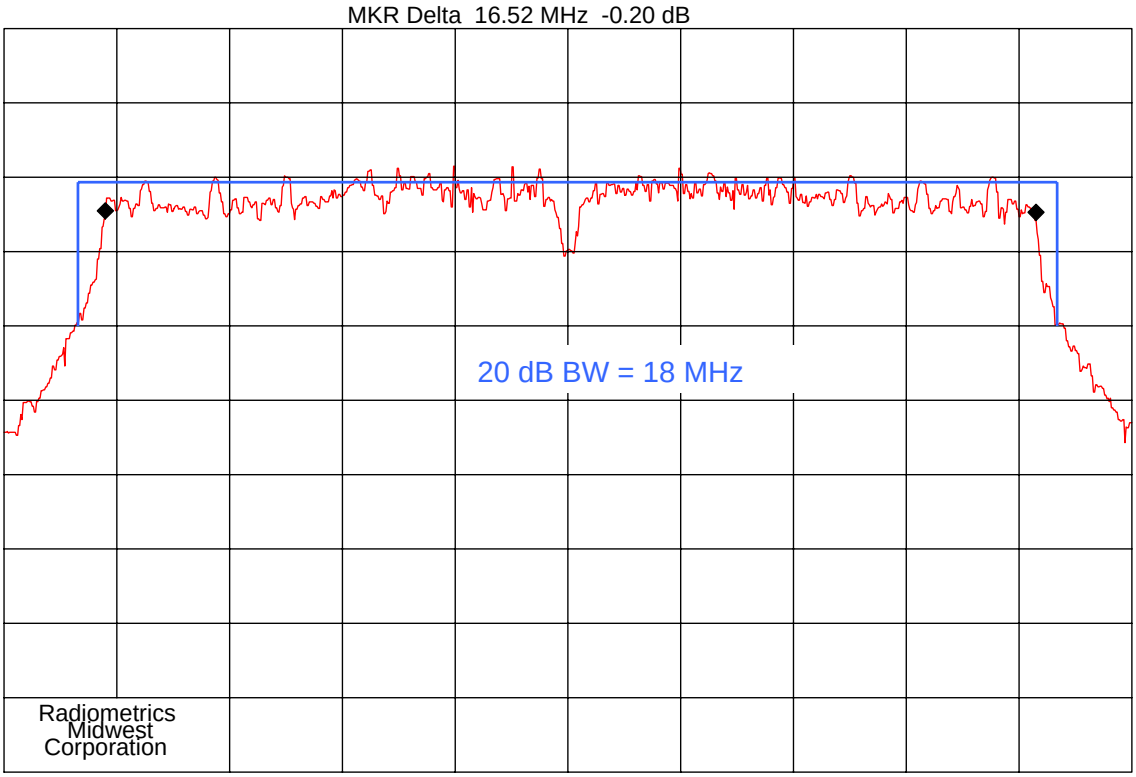
	802.11b	802.11g	802.11b	802.11g
Channel	6 dB EBW MHz	6 dB EBW MHz	20 dB EBW MHz	20 dB EBW MHz
1	10.8	16.5	16	18
6	11.0	16.7	16	18
11	10.6	16.6	16	18



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:24

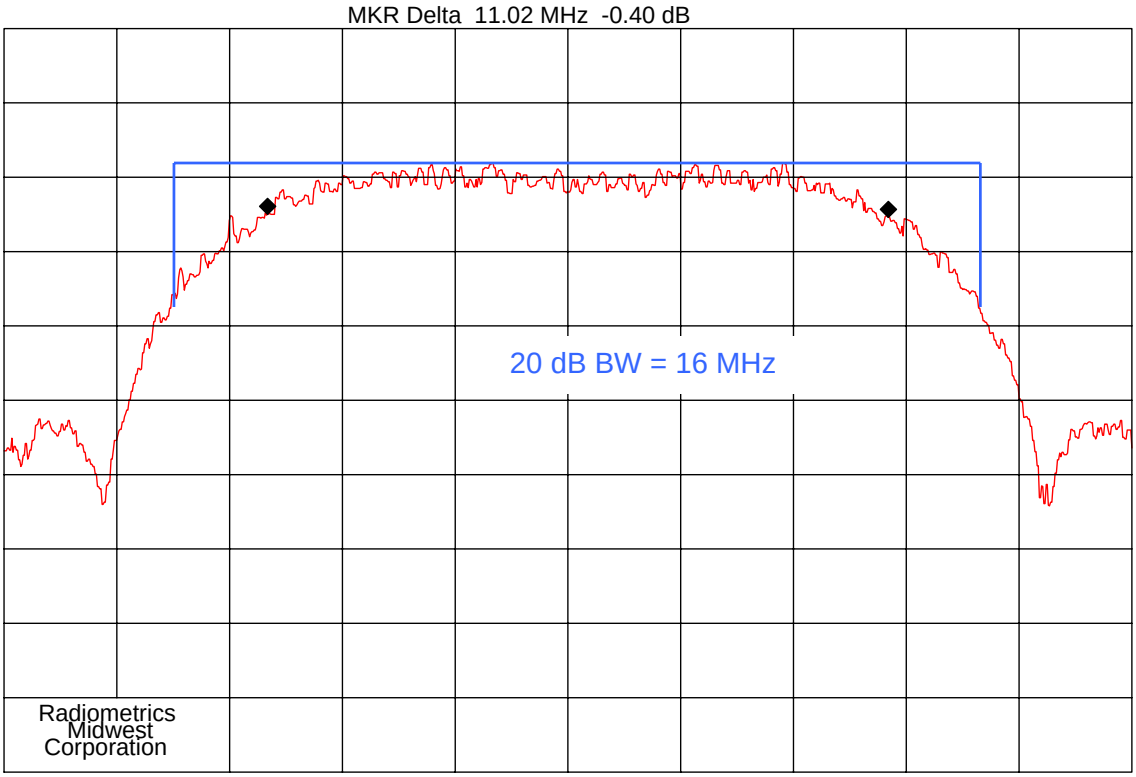
DATE : 05-12-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:28

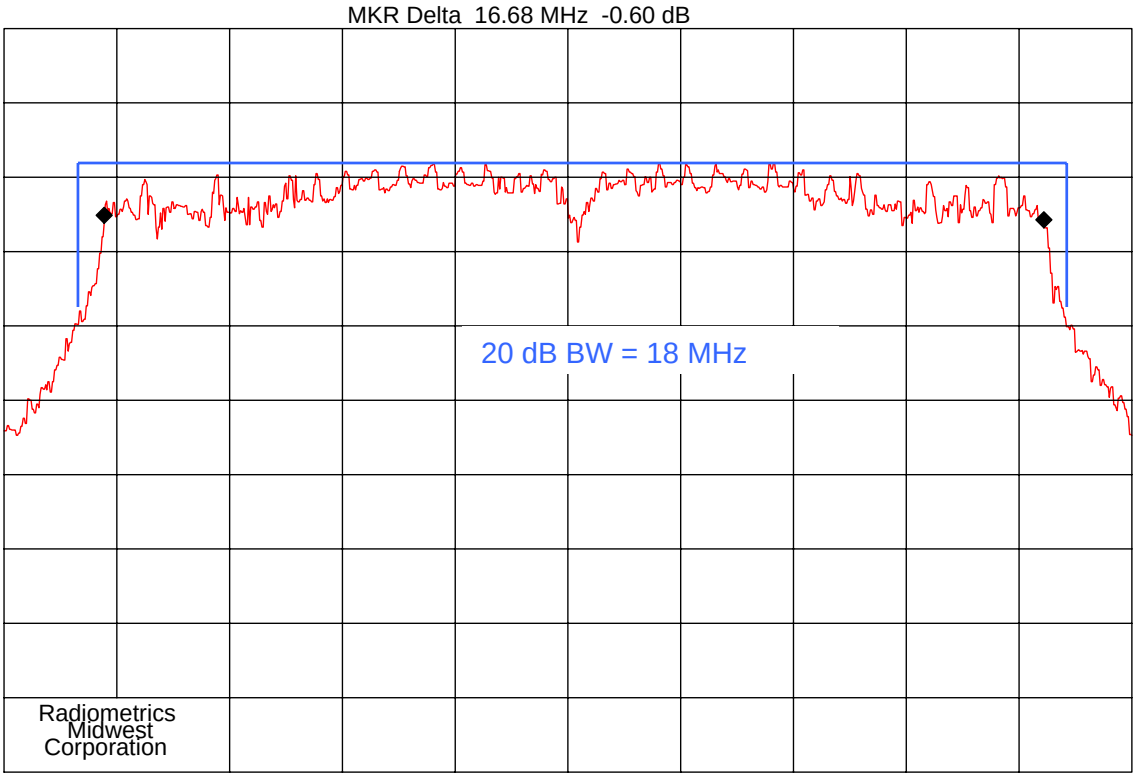
DATE : 05-12-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:32

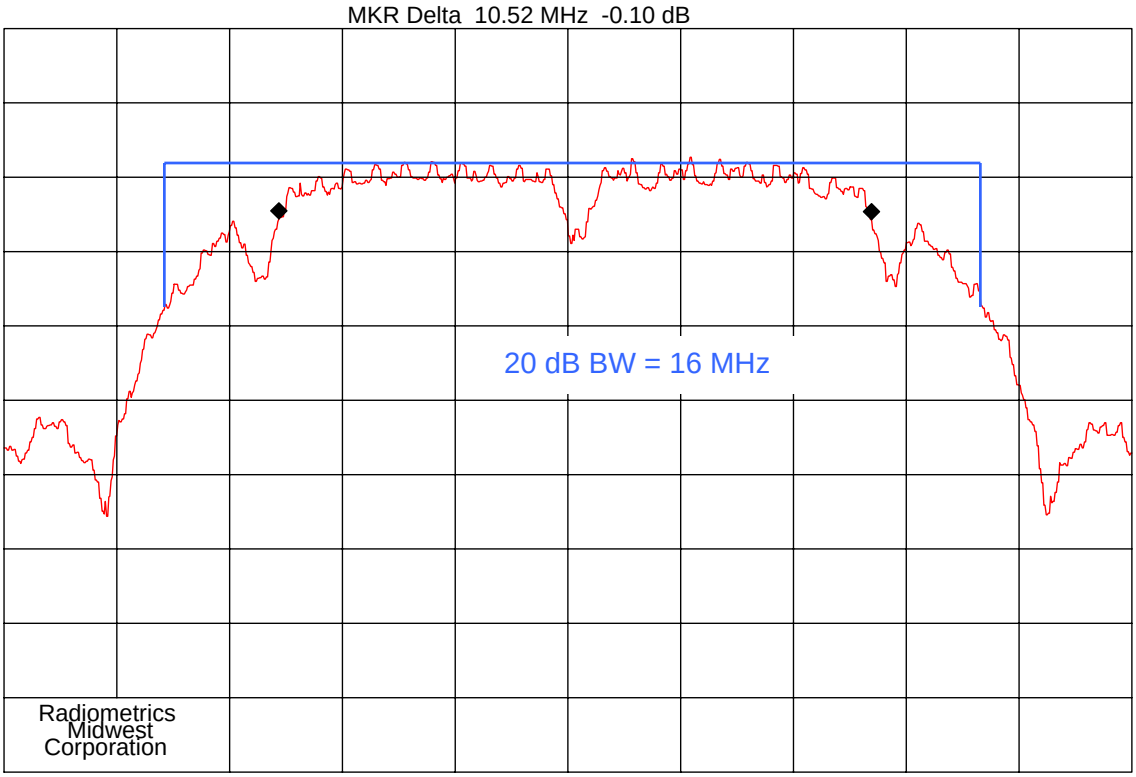
DATE : 05-12-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:30

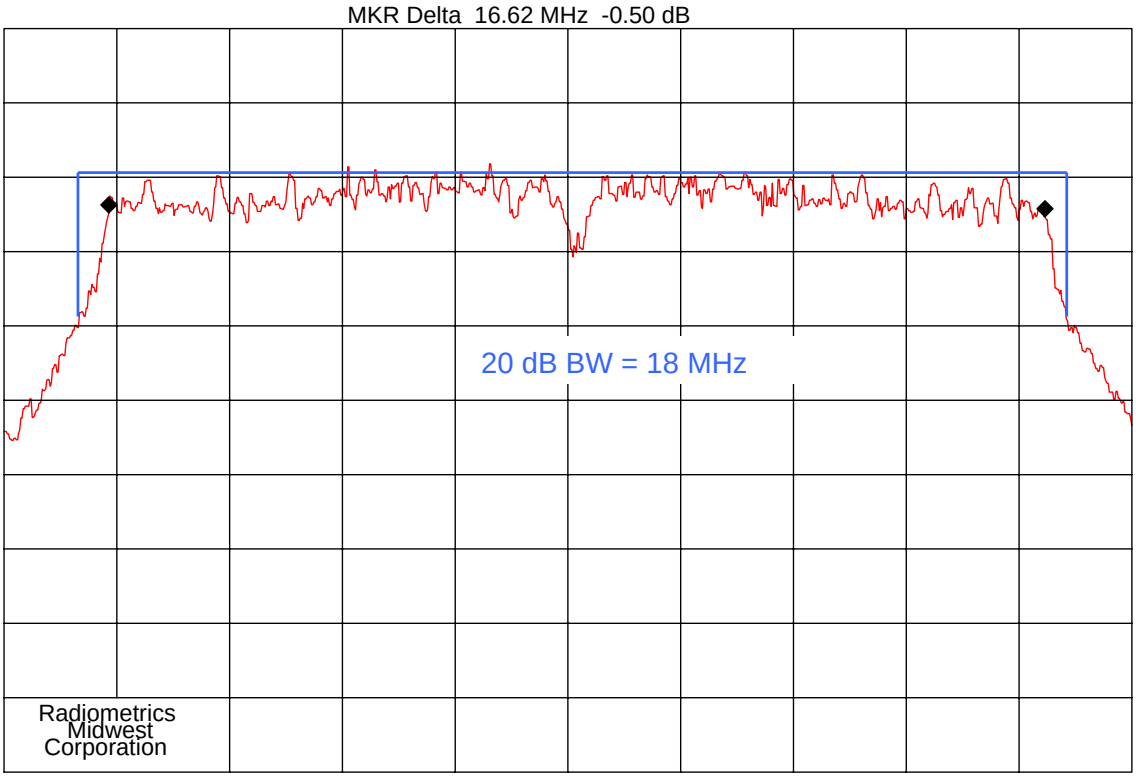
DATE : 05-12-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 11:33

DATE : 05-12-2005
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec



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. The BW correction factor is 10*Log(BW). 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	7.0	10.3	0.3	17.6	0.058	30
802.11b	2437	9.6	10.4	0.3	20.3	0.107	30
802.11b	2462	9.3	10.3	0.3	19.9	0.097	30
802.11g	2412	7.7	12.2	0.3	20.2	0.104	30
802.11g	2437	10.2	12.2	0.3	22.7	0.187	30
802.11g	2462	10.8	12.2	0.3	23.3	0.214	30

10.4 Power Spectral Density

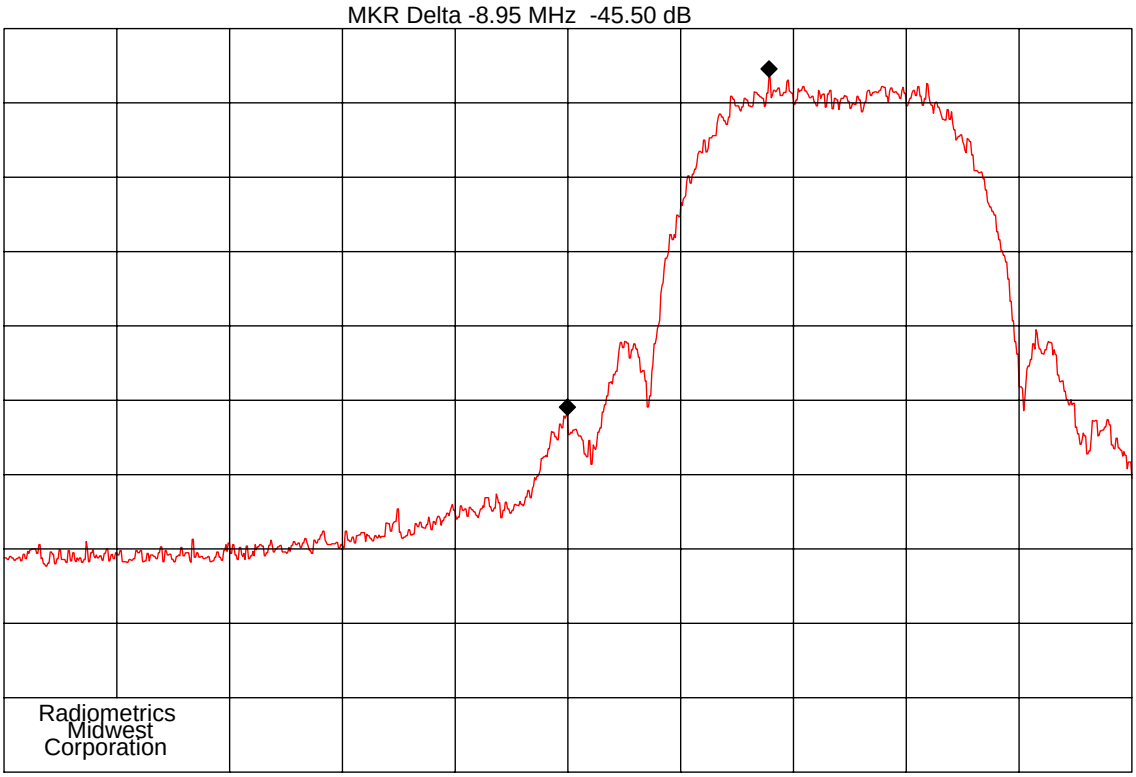
PSD option 1 was used for this test. No external attenuator was used. The spectrum analyzer was set to the following settings:

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	-6.4	0.3	-6.1	8.0
802.11b	2437	-6.5	0.3	-6.2	8.0
802.11b	2462	-6.7	0.3	-6.4	8.0
802.11g	2412	-8	0.3	-7.7	8.0
802.11g	2437	-7.6	0.3	-7.3	8.0
802.11g	2462	-8.9	0.3	-8.6	8.0

10.5 Band-edge Compliance of RF Conducted Emissions

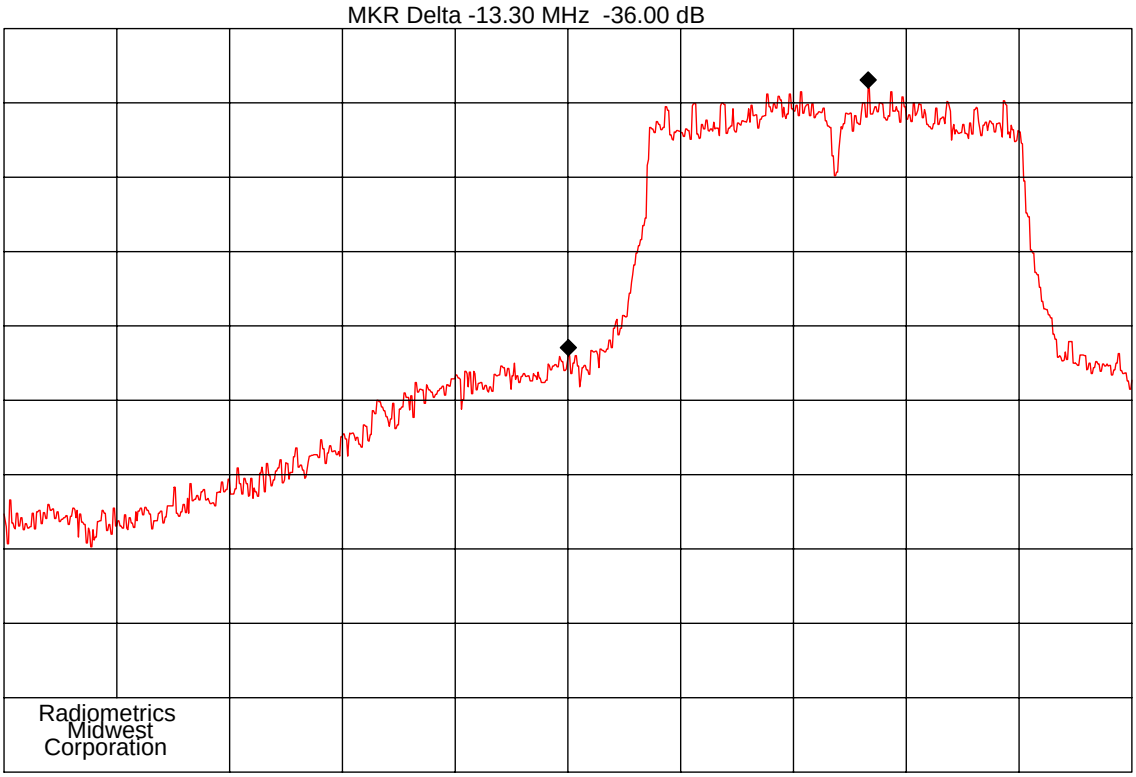
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize.



COMPANY : Westell
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge, 802.11b Ch 1

ITEM : A90-4272V-07
REF 10.0 dBm
VBW 300 kHz
TIME : 12:48

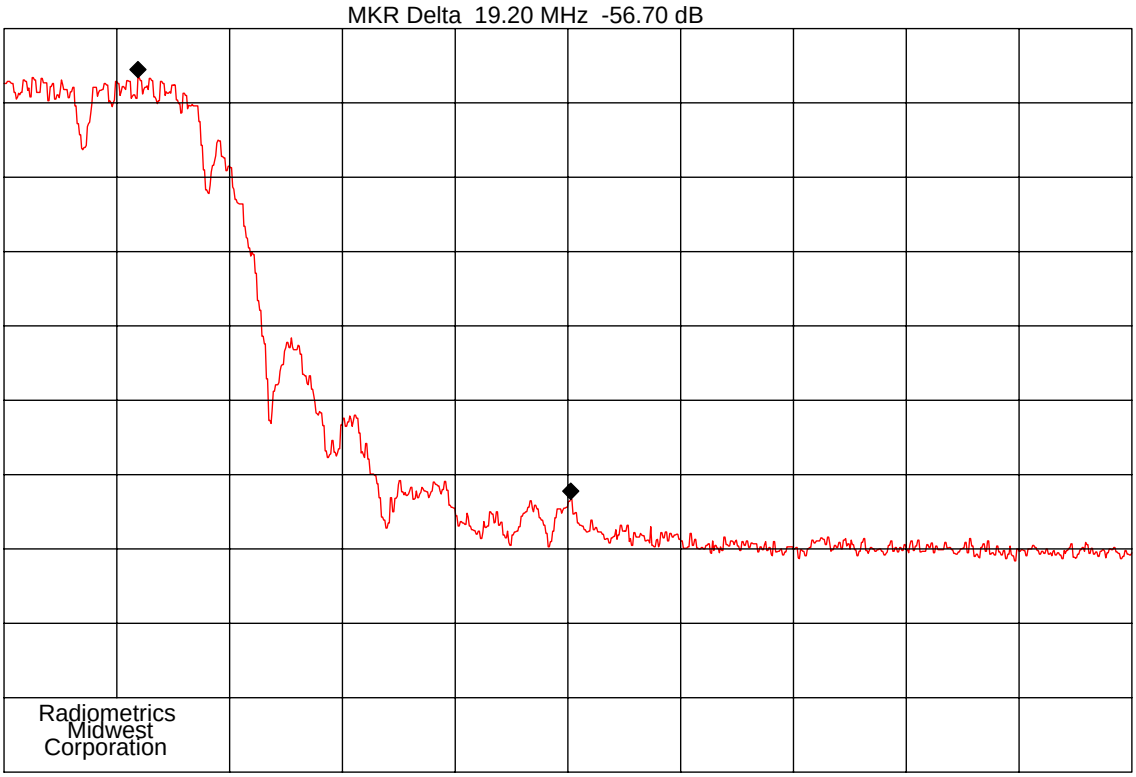
DATE : 05-12-2005
SPAN 50.0 MHz
ATTEN 20 dB
SWP 20.0 msec



COMPANY : Westell
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge, 802.11g Ch 1

ITEM : A90-4272V-07
REF 10.0 dBm
VBW 300 kHz
TIME : 12:50

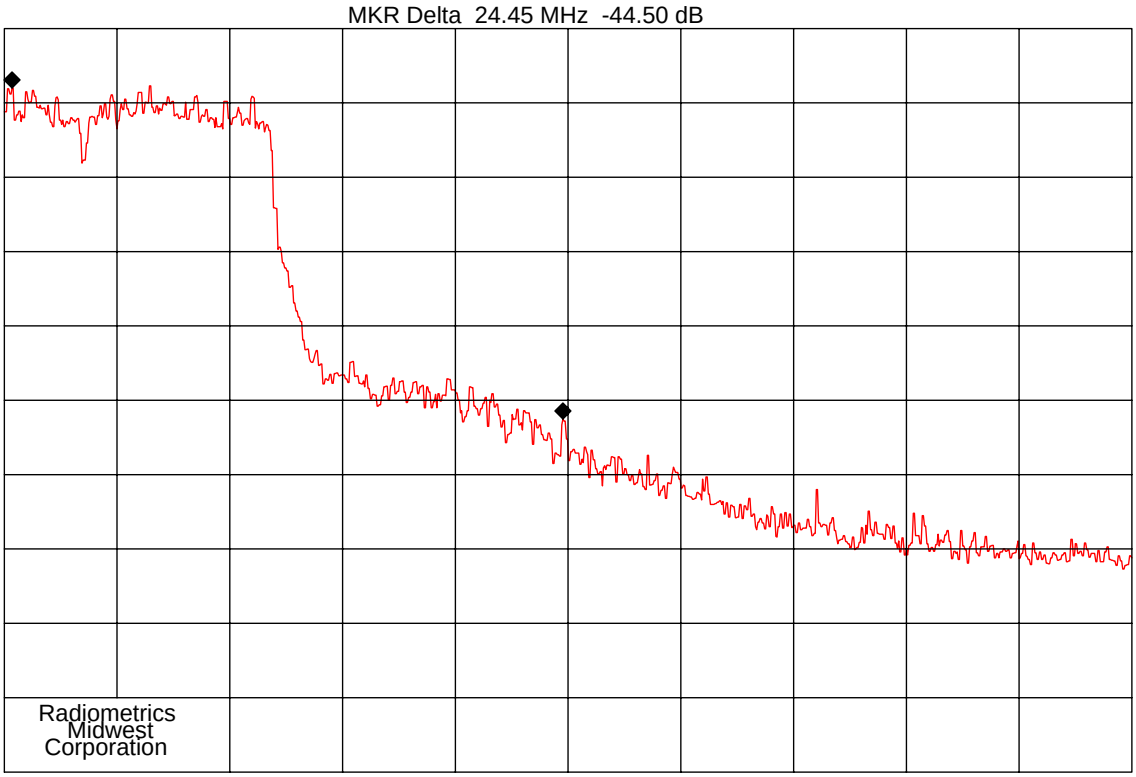
DATE : 05-12-2005
SPAN 50.0 MHz
ATTEN 20 dB
SWP 20.0 msec



COMPANY : Westell
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge, 802.11b Ch 11

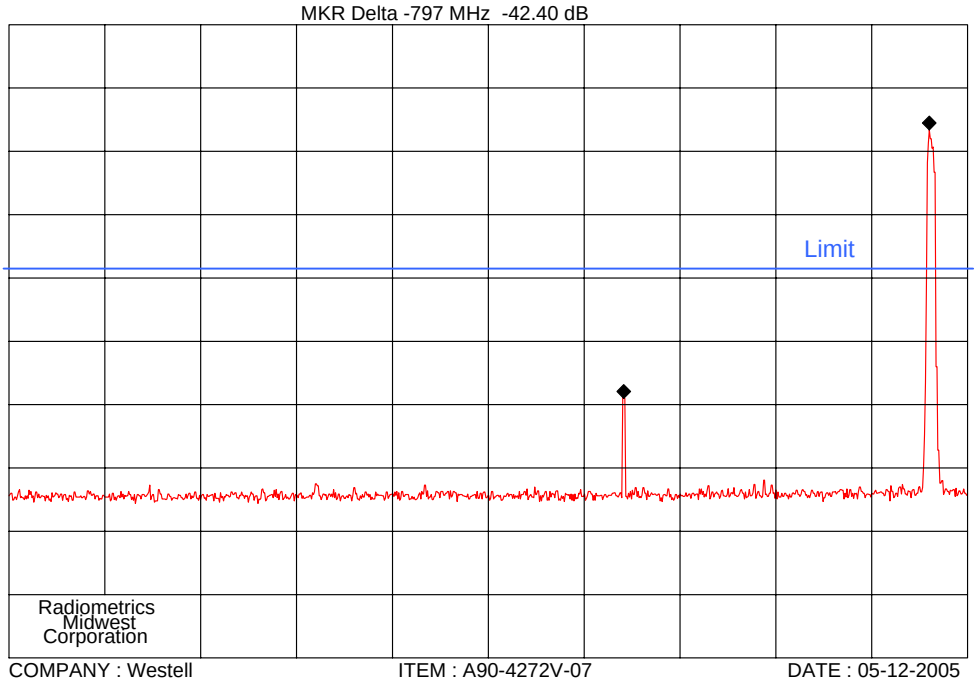
ITEM : A90-4272V-07
REF 10.0 dBm
VBW 300 kHz
TIME : 12:53

DATE : 05-12-2005
SPAN 50.0 MHz
ATTEN 20 dB
SWP 20.0 msec



10.6 Spurious RF Conducted Emissions

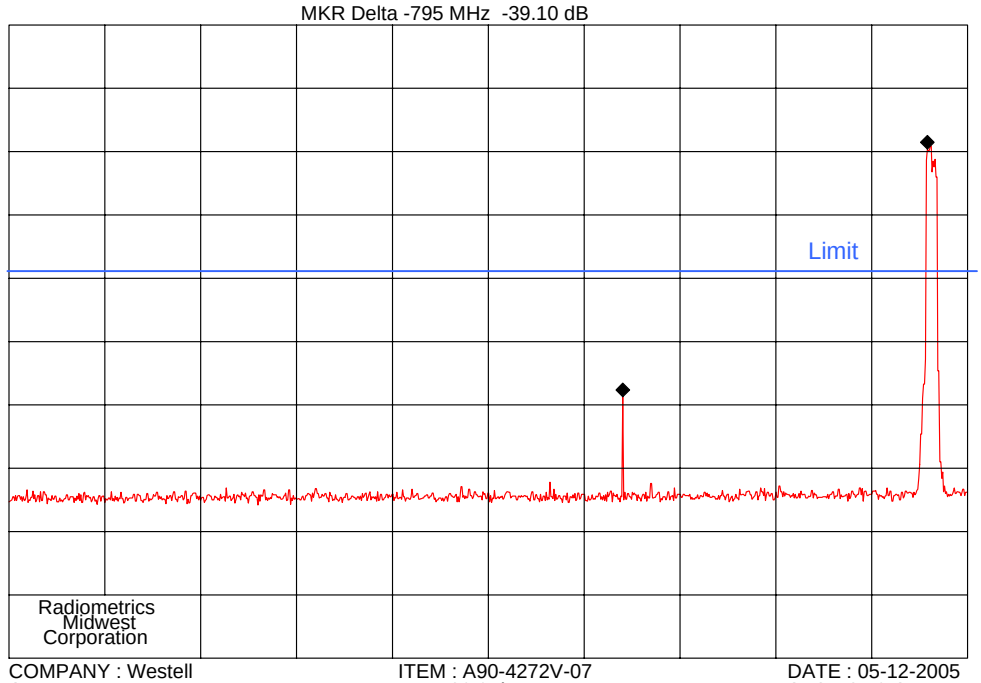
The spectrum analyzer was set to the MAX HOLD mode to record all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. The trace was allowed to stabilize. The first two plots were made while stepping through three frequencies (Low middle and high). Each frequency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



COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant cond Em, 802.11b Ch 1

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:13

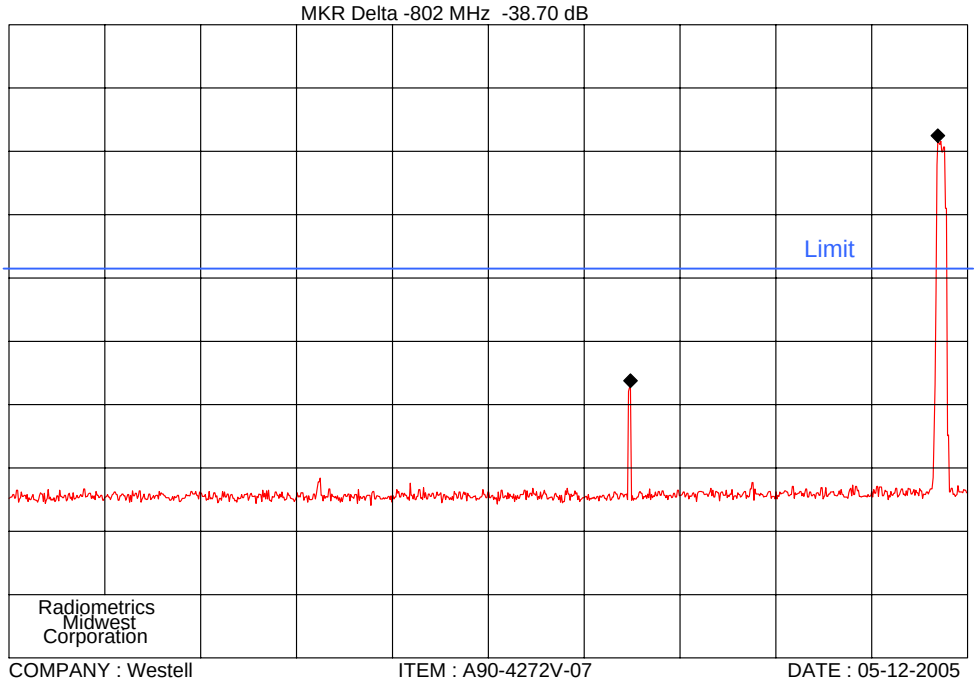
DATE : 05-12-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Westell
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Ant cond Em, 802.11g Ch 1

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:23

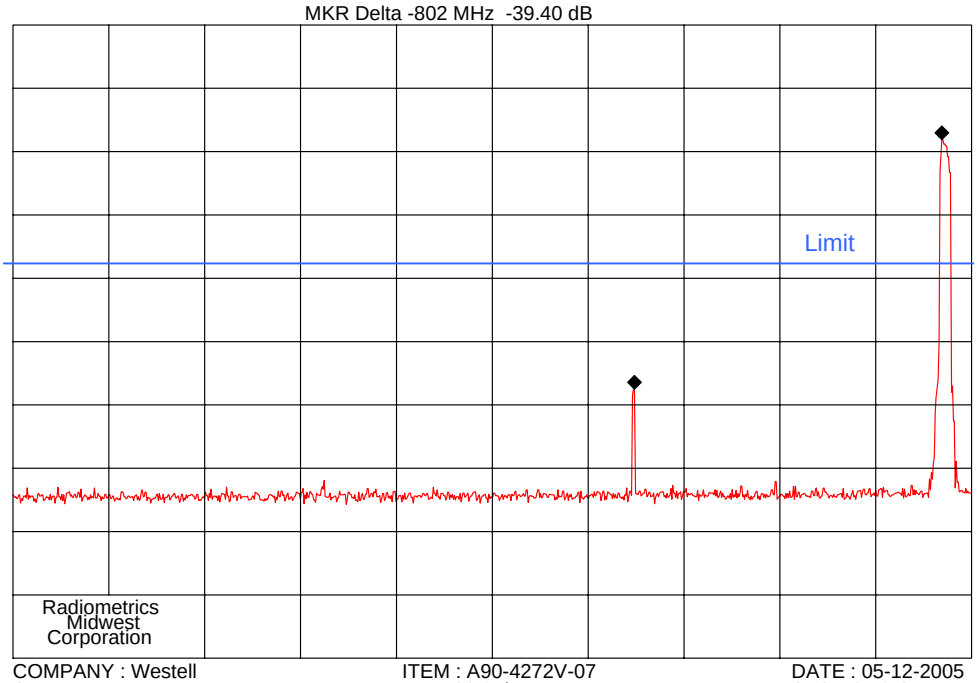
DATE : 05-12-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:15

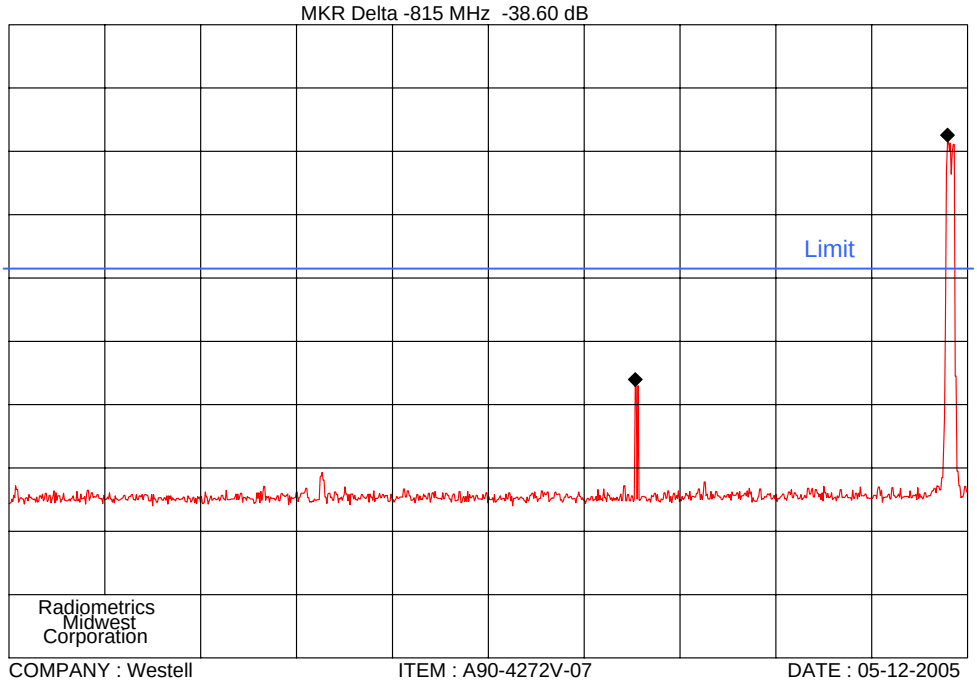
DATE : 05-12-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:22

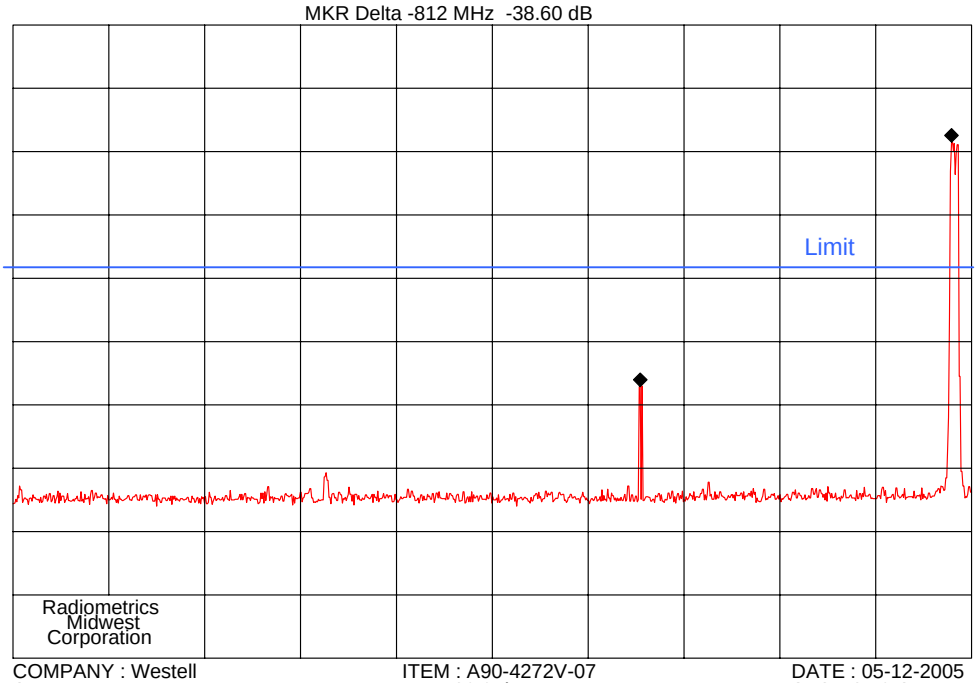
DATE : 05-12-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:16

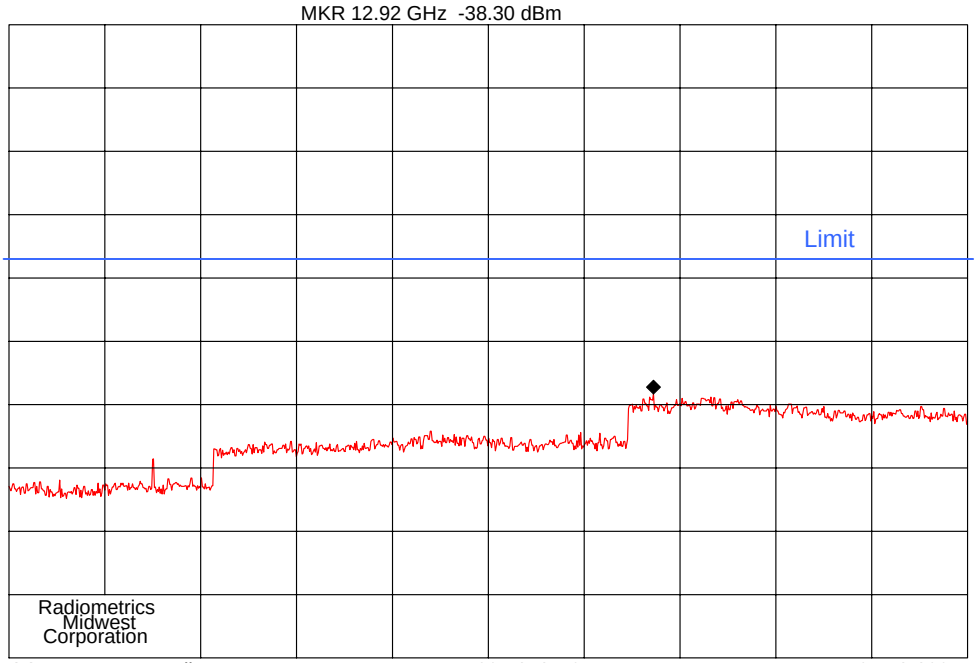
DATE : 05-12-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



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

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 300 kHz
TIME : 13:19

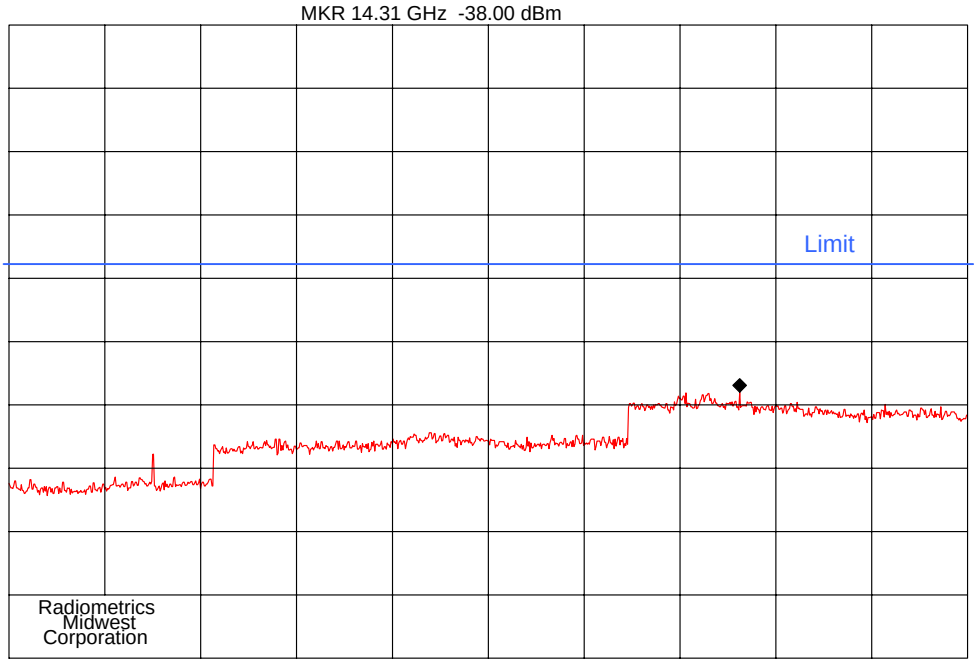
DATE : 05-12-2005
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Ant cond Em, 802.11b Ch 1

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 1 MHz
TIME : 13:30

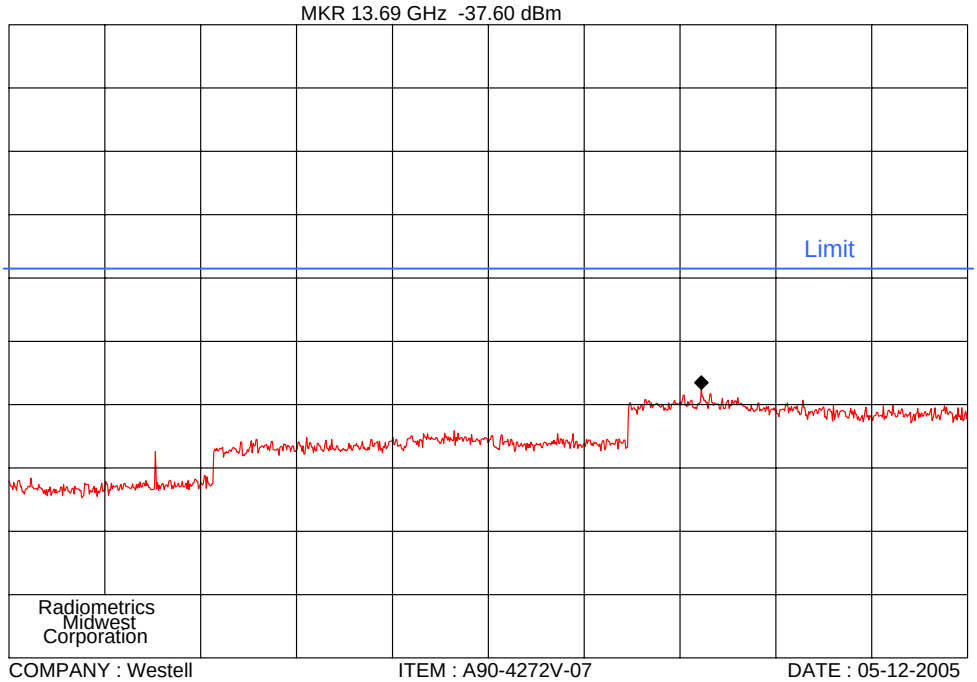
DATE : 05-12-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec



COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Ant cond Em, 802.11g Ch 1

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 1 MHz
TIME : 13:24

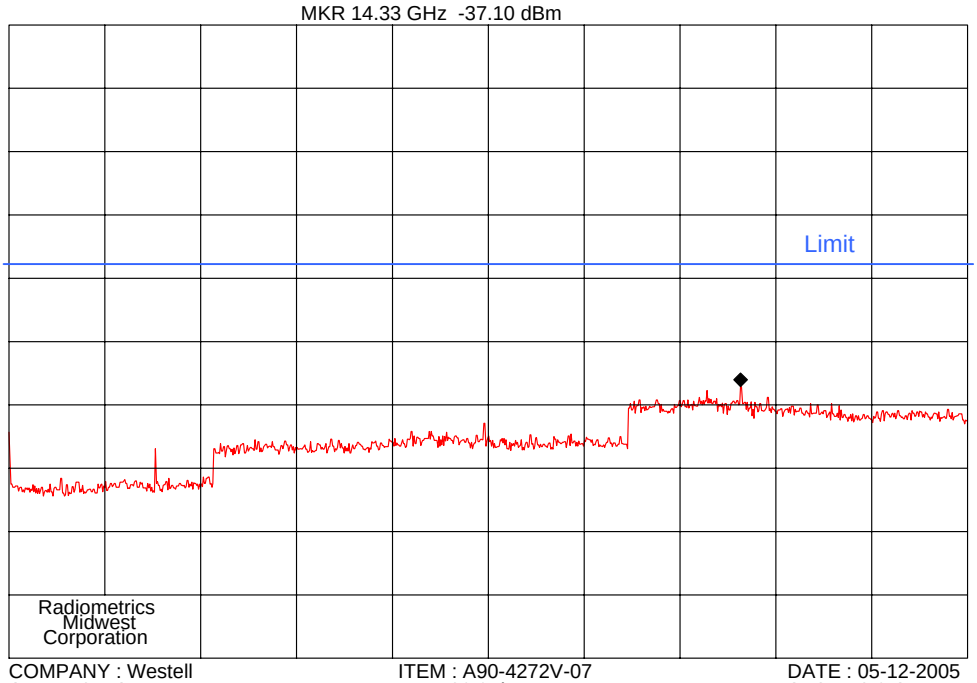
DATE : 05-12-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec



COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Ant cond Em, 802.11b Ch 6

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 1 MHz
TIME : 13:29

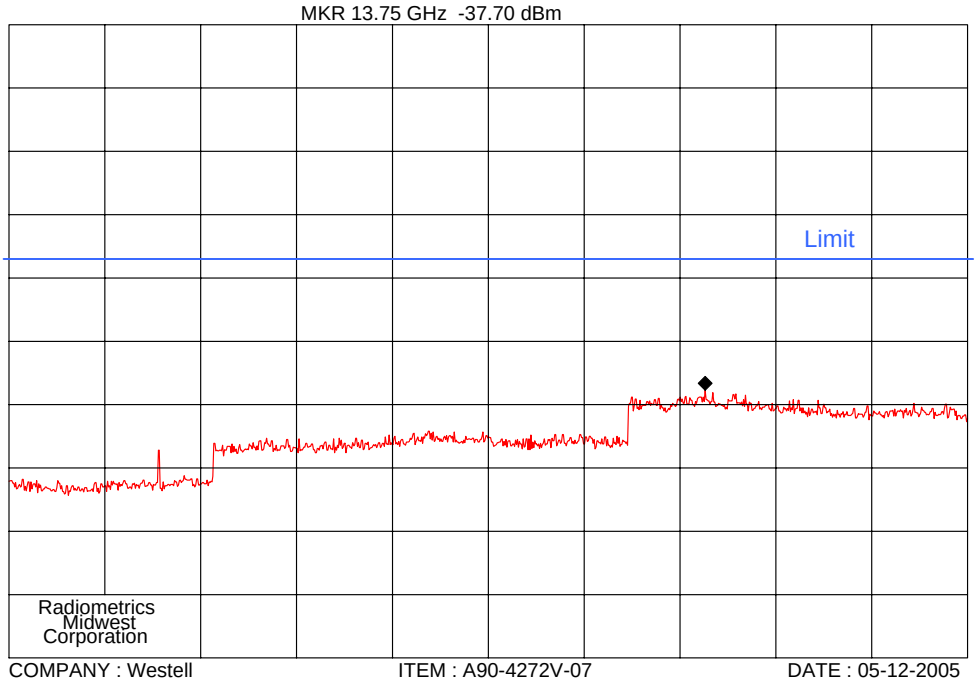
DATE : 05-12-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec



COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Ant cond Em, 802.11g Ch 6

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 1 MHz
TIME : 13:26

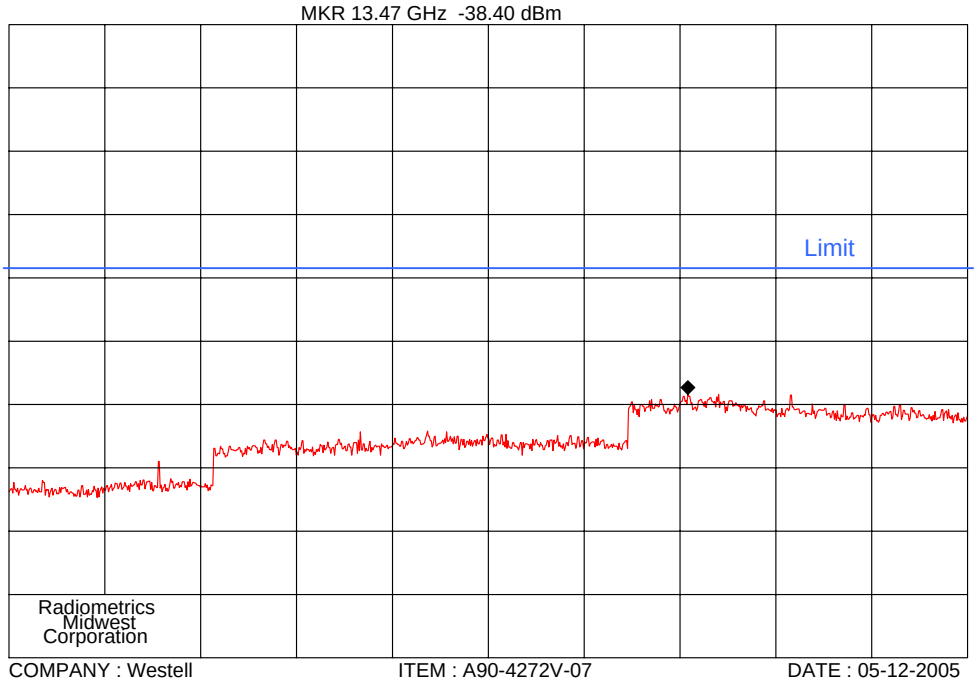
DATE : 05-12-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec



COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Ant cond Em, 802.11b Ch 11

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 1 MHz
TIME : 13:28

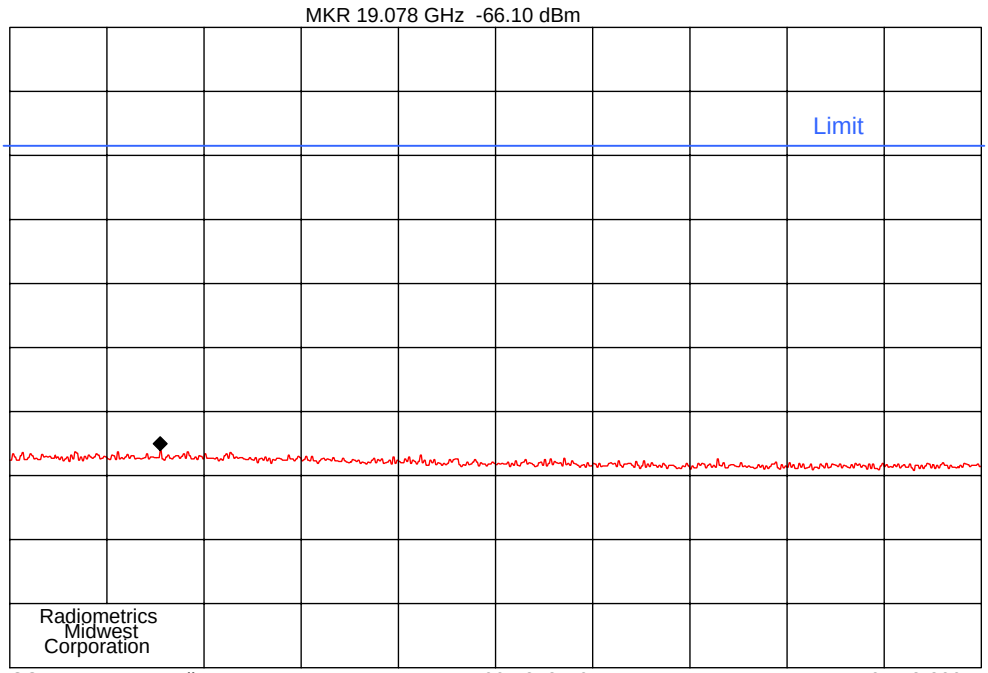
DATE : 05-12-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec



COMPANY : Westell
START 2.5 GHz
RES BW 300 kHz
10 dB/
NOTES : Ant cond Em, 802.11g Ch 11

ITEM : A90-4272V-07
REF 20.0 dBm
VBW 1 MHz
TIME : 13:27

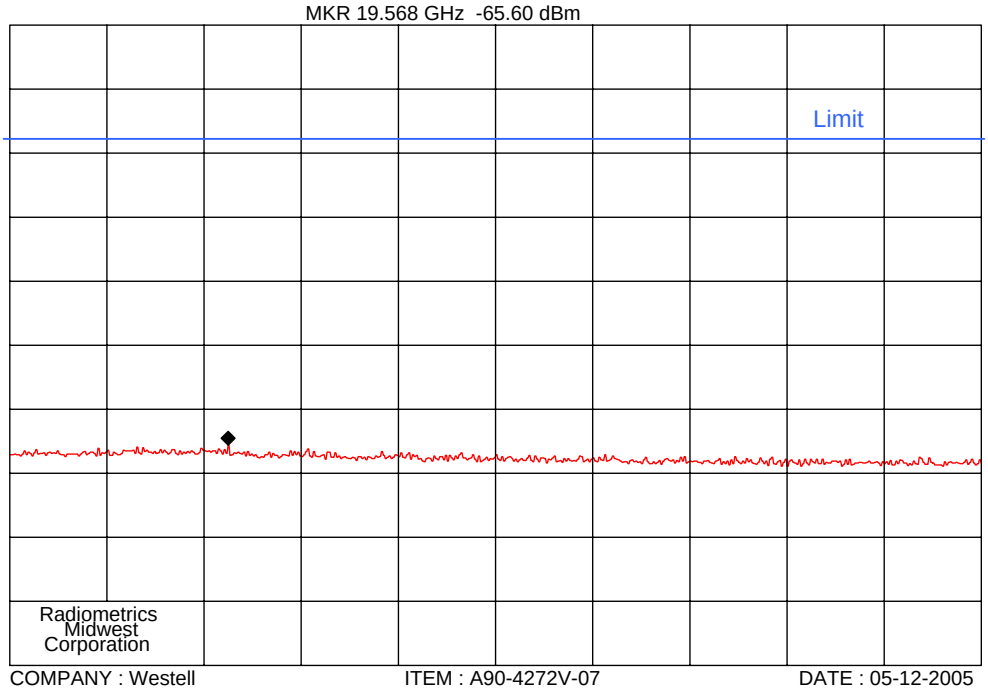
DATE : 05-12-2005
STOP 18.0 GHz
ATTEN 30 dB
SWP 465 msec



COMPANY : Westell
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Ant cond Em, 802.11b Ch 1

ITEM : A90-4272V-07
REF 0.0 dBm
VBW 3 MHz
TIME : 13:55

DATE : 05-12-2005
STOP 25.00 GHz
HARMONIC 6
SWP 23.3 msec

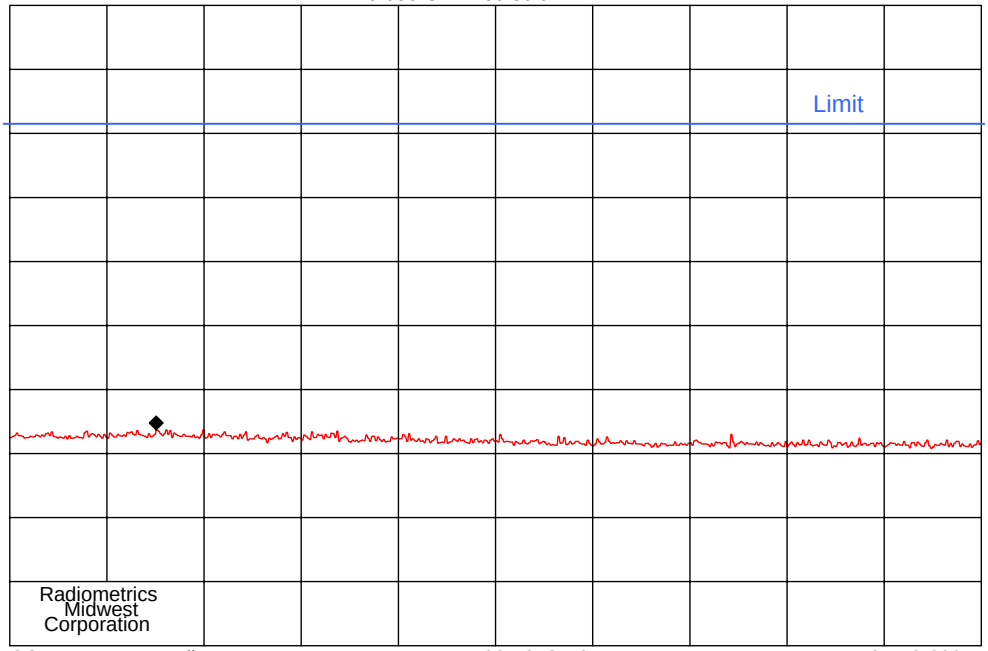


COMPANY : Westell
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Ant cond Em, 802.11g Ch 1

ITEM : A90-4272V-07
REF 0.0 dBm
VBW 3 MHz
TIME : 13:59

DATE : 05-12-2005
STOP 25.00 GHz
HARMONIC 6
SWP 23.3 msec

MKR 19.050 GHz -66.30 dBm

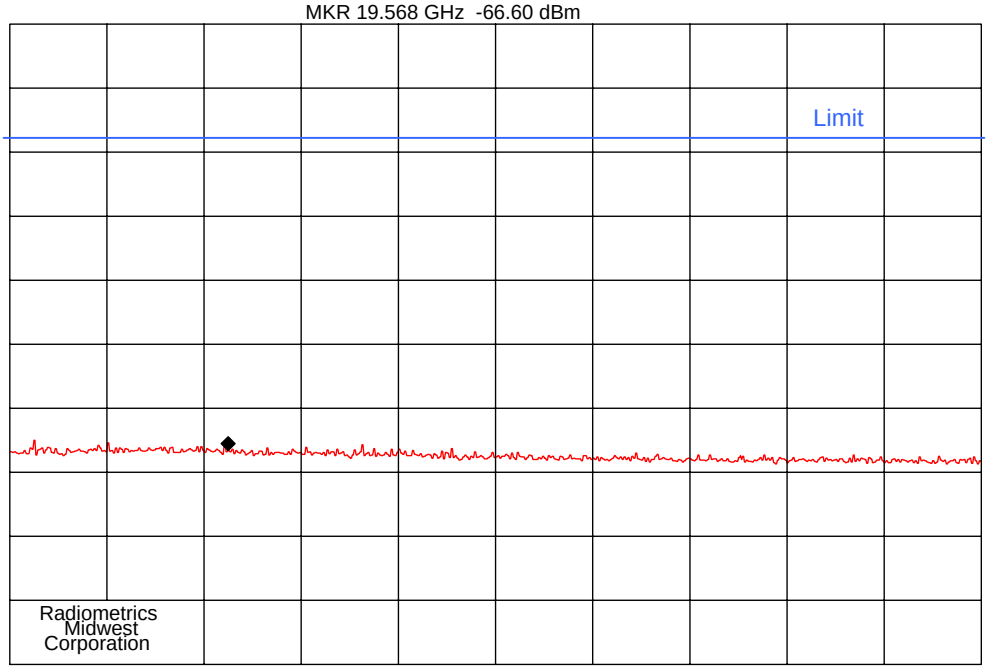


COMPANY : Westell
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Ant cond Em, 802.11b Ch 6

ITEM : A90-4272V-07
REF 0.0 dBm
VBW 3 MHz
TIME : 13:56

DATE : 05-12-2005
STOP 25.00 GHz
HARMONIC 6
SWP 23.3 msec

MKR 19.568 GHz -66.60 dBm

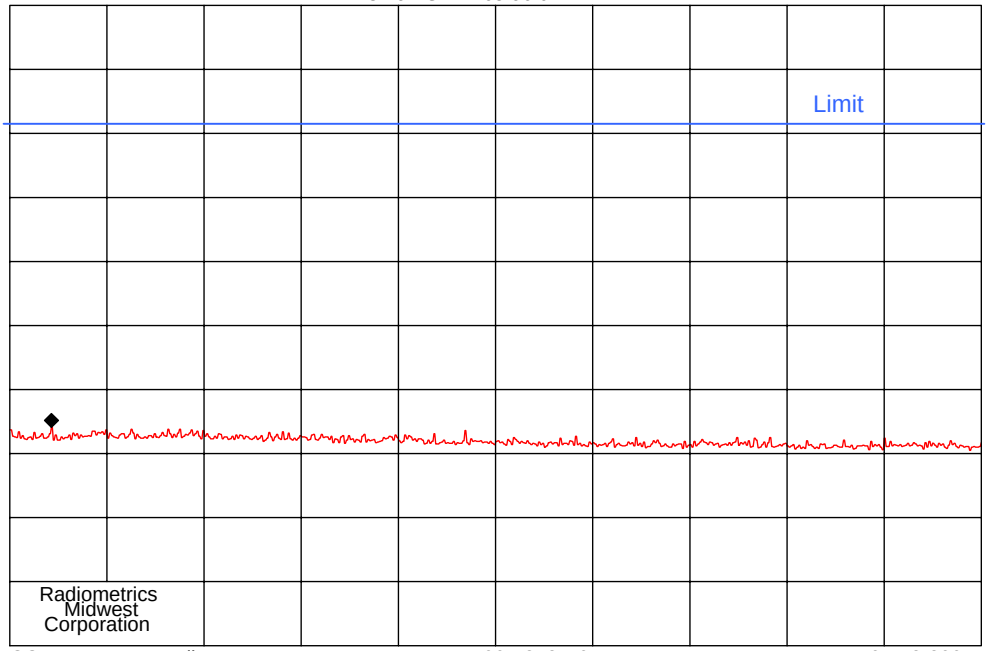


COMPANY : Westell
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Ant cond Em, 802.11g Ch 6

ITEM : A90-4272V-07
REF 0.0 dBm
VBW 3 MHz
TIME : 14:00

DATE : 05-12-2005
STOP 25.00 GHz
HARMONIC 6
SWP 23.3 msec

MKR 18.294 GHz -65.90 dBm

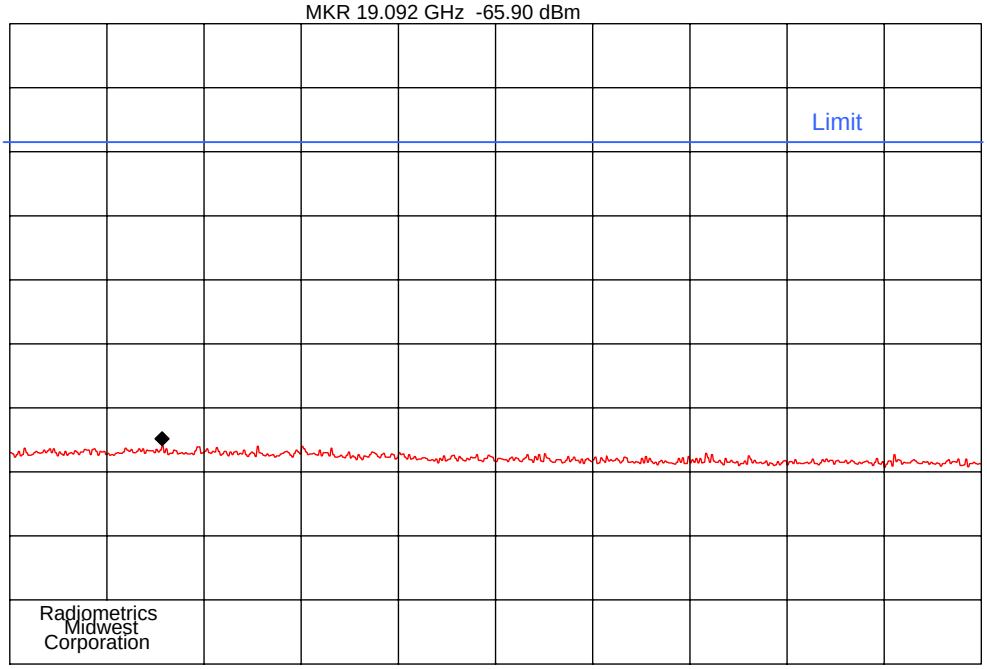


COMPANY : Westell
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Ant cond Em, 802.11b Ch 11

ITEM : A90-4272V-07
REF 0.0 dBm
VBW 3 MHz
TIME : 13:58

DATE : 05-12-2005
STOP 25.00 GHz
HARMONIC 6
SWP 23.3 msec

MKR 19.092 GHz -65.90 dBm



COMPANY : Westell
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Ant cond Em, 802.11g Ch 11

ITEM : A90-4272V-07
REF 0.0 dBm
VBW 3 MHz
TIME : 14:01

DATE : 05-12-2005
STOP 25.00 GHz
HARMONIC 6
SWP 23.3 msec

10.7 Spurious Radiated Emissions (Restricted Band)

Radiated emission measurements in the restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz, an Anritsu spectrum analyzer and a preamplifier were used. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 25 GHz, an HP8566A spectrum analyzer was used with a preamplifier. A harmonic mixer was used from 20 to 25 GHz. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

Radiated emission measurements are performed with linearly polarized broadband antennas. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

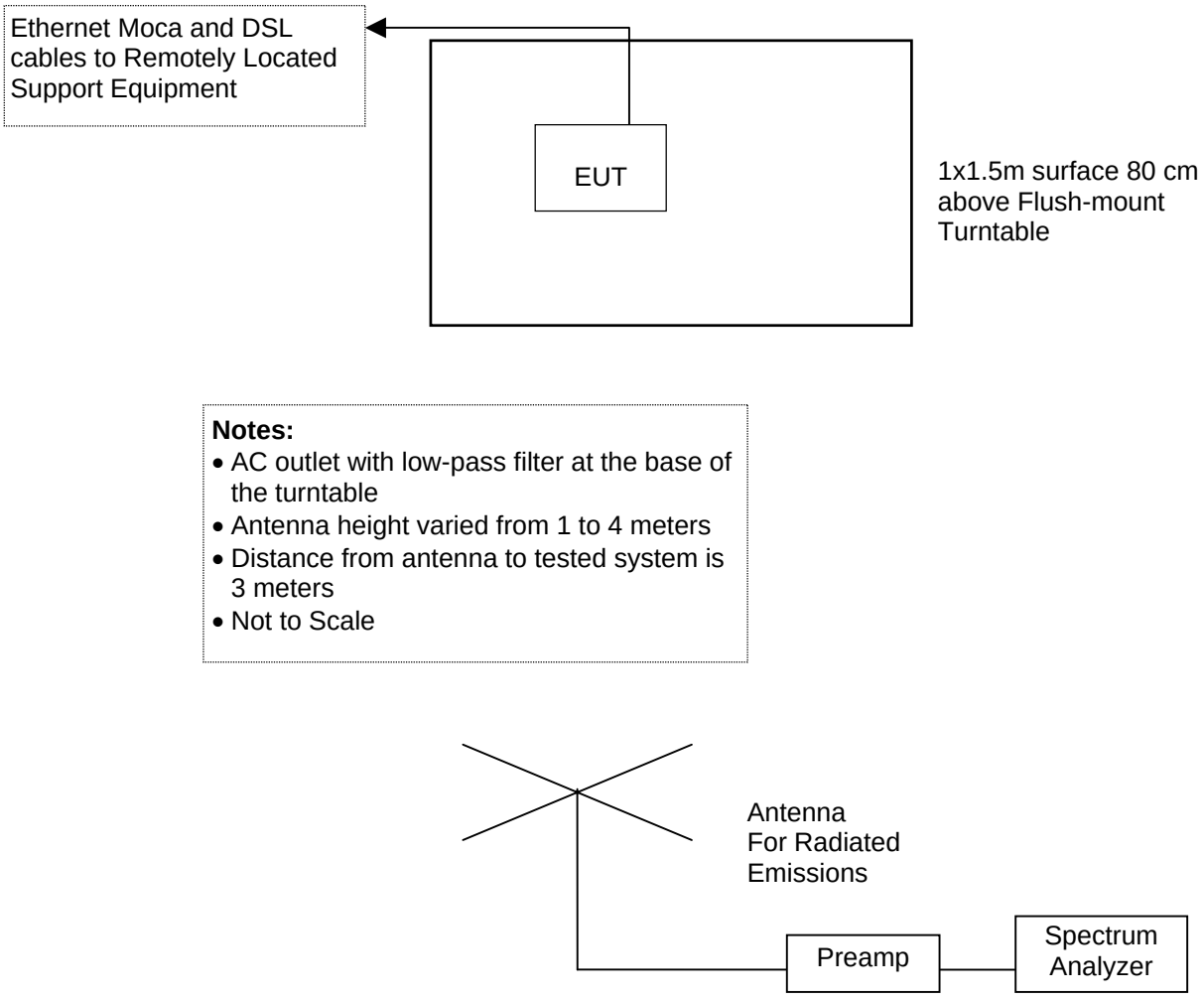
Final radiated emissions measurements were performed in Chamber E at a test distance of 3 meters. The entire frequency range from 30 MHz to 25 GHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The anechoic test chamber has a metal ground screen.

10.7.1 Radiated Emissions Field Strength Sample Calculation

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

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

Figure 3. 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.

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	A90-816030-07	Test Date	9-9-2005
Serial Number	05BS09231879	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

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	EUT FS dBuV/m	Limit dBuV/m	Margin under limit
802.11b	2412	V	Peak	1200	54.1	74	19.9
802.11b	2412	H	Peak	1200	45.3	74	28.7
802.11b	2412	V	Peak	1420	54.3	74	19.7
802.11b	2412	H	Peak	1420	53.9	74	20.1
802.11b	2412	V	Peak	2390	70.0	74	4.0
802.11b	2412	H	Peak	2390	49.6	74	24.4
802.11b	2412	H	Peak	2615	41.9	74	32.1
802.11b	2412	V	Peak	4824	54.7	74	19.3
802.11b	2412	H	Peak	4824	49.6	74	24.4
802.11b	2412	V	Peak	7236	56.7	74	17.3
802.11b	2412	H	Peak	7236	55.2	74	18.8
802.11b	2412	V	Peak	9648	62.6	74	11.4
802.11b	2412	H	Peak	9648	52.9	74	21.1
802.11b	2437	V	Peak	4874	55.3	74	18.7
802.11b	2437	H	Peak	4874	50.3	74	23.7
802.11b	2437	V	Peak	7311	52.3	74	21.7
802.11b	2437	H	Peak	7311	52.3	74	21.7
802.11b	2437	V	Peak	9748	62.2	74	11.8
802.11b	2437	H	Peak	9748	53.9	74	20.1
802.11b	2462	V	Peak	2484	60.5	74	13.5
802.11b	2462	H	Peak	2484	58.6	74	15.4
802.11b	2462	V	Peak	4924	56.5	74	17.5
802.11b	2462	H	Peak	4924	53.8	74	20.2
802.11b	2462	V	Peak	7386	55.5	74	18.5
802.11b	2462	H	Peak	7386	55.5	74	18.5
802.11b	2462	V	Peak	9848	62.1	74	11.9

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	EUT FS dBuV/m	Limit dBuV/m	Margin under limit
802.11b	2462	H	Peak	9848	53.2	74	20.8
802.11b	2412	V	Ave	1200	43.2	54	10.8
802.11b	2412	H	Ave	1200	42.0	54	12.0
802.11b	2412	V	Ave	1420	43.9	54	10.1
802.11b	2412	H	Ave	1420	47.4	54	6.6
802.11b	2412	V	Ave	2390	49.1	54	4.9
802.11b	2412	H	Ave	2390	38.6	54	15.4
802.11b	2412	V	Ave	4824	46.3	54	7.7
802.11b	2412	H	Ave	4824	38.1	54	15.9
802.11b	2412	V	Ave	7236	44.9	54	9.1
802.11b	2412	H	Ave	7236	45.0	54	9.0
802.11b	2437	V	Ave	4874	38.2	54	15.8
802.11b	2437	H	Ave	4874	38.2	54	15.8
802.11b	2437	V	Ave	7311	42.3	54	11.7
802.11b	2437	H	Ave	7311	42.3	54	11.7
802.11b	2462	V	Ave	2484	39.0	54	15.0
802.11b	2462	H	Ave	2484	39.0	54	15.0
802.11b	2462	V	Ave	4924	38.3	54	15.7
802.11b	2462	H	Ave	4924	38.3	54	15.7
802.11b	2462	V	Ave	7386	45.5	54	8.5
802.11b	2462	H	Ave	7386	45.5	54	8.5
802.11g	2412	V	Peak	2390	72.1	74	1.9
802.11g	2412	H	Peak	2390	62.0	74	12.0
802.11g	2412	V	Peak	2615	44.5	74	29.5
802.11g	2412	H	Peak	2615	42.9	74	31.1
802.11g	2412	V	Peak	4824	55.3	74	18.7
802.11g	2412	H	Peak	4824	50.6	74	23.4
802.11g	2412	V	Peak	7236	56.9	74	17.1
802.11g	2412	H	Peak	7236	57.3	74	16.7
802.11g	2412	V	Peak	9648	65.1	74	8.9
802.11g	2412	H	Peak	9648	53.6	74	20.4
802.11g	2437	V	Peak	4874	54.2	74	19.8
802.11g	2437	H	Peak	4874	48.0	74	26.0
802.11g	2437	V	Peak	7311	52.3	74	21.7
802.11g	2437	H	Peak	7311	53.6	74	20.4
802.11g	2462	V	Peak	2485	69.1	74	4.9
802.11g	2462	H	Peak	2485	64.3	74	9.7
802.11g	2462	V	Peak	4924	57.1	74	16.9
802.11g	2462	H	Peak	4924	56.3	74	17.7
802.11g	2462	V	Peak	7386	57.1	74	16.9
802.11g	2462	H	Peak	7386	56.4	74	17.6
802.11g	2462	V	Peak	7386	59.1	74	14.9
802.11g	2412	H	Ave	1200	43.6	54	10.4
802.11g	2412	V	Ave	1420	45.1	54	8.9
802.11g	2412	H	Ave	1420	49.2	54	4.8
802.11g	2412	V	Ave	2390	48.2	54	5.8
802.11g	2412	H	Ave	2390	38.6	54	15.4

Mode	Tx Freq	Ant Pol.	Detector Function	Emission Freq. MHz	EUT FS dBuV/m	Limit dBuV/m	Margin under limit
802.11g	2412	V	Ave	4824	40.1	54	13.9
802.11g	2412	H	Ave	4824	38.1	54	15.9
802.11g	2412	V	Ave	7236	45.2	54	8.8
802.11g	2412	H	Ave	7236	45.3	54	8.7
802.11g	2412	H	Ave	9648	42.9	54	11.1
802.11g	2412	V	Ave	9648	50.8	54	3.2
802.11g	2437	V	Ave	4874	40.2	54	13.8
802.11g	2437	H	Ave	4874	38.2	54	15.8
802.11g	2437	V	Ave	7311	42.3	54	11.7
802.11g	2437	H	Ave	7311	42.3	54	11.7
802.11g	2462	V	Ave	2484	49.1	54	4.9
802.11g	2462	H	Ave	2484	37.5	54	16.5
802.11g	2462	V	Ave	4924	38.3	54	15.7
802.11g	2462	H	Ave	4924	38.3	54	15.7
802.11g	2462	V	Ave	7386	43.2	54	10.8
802.11g	2462	H	Ave	7386	43.2	54	10.8

Judgment: Passed by 1.9 dB
No other emissions were detected in the restricted bands.

Emissions Below 1 GHz

Test Date	08-23-2005	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		
Notes	FCC Part 15.209 limits Correction factors = Cable Loss – Preamp gain P = Peak; Q = QP Detector function		

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
175.3	42.9 P	9.0	H/44	-25.9	26.0	43.5	17.5
199.9	44.4 P	10.7	H/44	-25.7	29.4	43.5	14.1
211.8	49.6 P	10.9	H/44	-25.6	34.9	43.5	8.6
224.8	45.4 P	11.8	H/44	-25.5	31.7	46.0	14.3
237.3	42.1 P	12.4	H/44	-25.4	29.1	46.0	16.9
250.3	42.8 P	12.9	H/44	-25.3	30.4	46.0	15.6
256.3	43.2 P	12.5	H/44	-25.2	30.5	46.0	15.5
275.2	43.0 P	13.7	H/44	-25.2	31.5	46.0	14.5
275.4	43.3 P	13.7	H/44	-25.2	31.8	46.0	14.2
300.3	43.0 P	14.3	H/44	-25.0	32.3	46.0	13.7
384.2	48.8 P	16.2	H/44	-24.5	40.5	46.0	5.5
396.0	54.1 Q	16.0	H/44	-24.5	45.6	46.0	0.4
396.0	52.3 P	16.0	H/44	-24.5	43.8	46.0	2.2
449.7	39.1 P	17.1	H/44	-23.9	32.3	46.0	13.7

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
449.7	39.3 P	17.1	H/44	-23.9	32.5	46.0	13.5
450.4	39.2 P	17.2	H/44	-23.9	32.5	46.0	13.5
475.6	39.7 P	17.2	H/44	-23.7	33.2	46.0	12.8
500.8	41.2 P	18.1	H/44	-23.6	35.7	46.0	10.3
512.3	40.4 P	17.9	H/44	-23.4	34.9	46.0	11.1
512.8	43.6 P	17.9	H/44	-23.4	38.1	46.0	7.9
659.2	36.3 P	19.9	H/44	-22.7	33.5	46.0	12.5
923.2	30.6 P	22.9	H/44	-20.3	33.2	46.0	12.8
1024.3	33.4 P	24.0	H/44	-19.1	38.3	54.0	15.7
1029.3	31.7 P	24.0	H/44	-19.0	36.7	54.0	17.3
41.9	42.4 P	16.2	V/44	-27.5	31.1	40.0	8.9
50.2	38.6 P	12.4	V/44	-27.4	23.6	40.0	16.4
64.3	44.3 P	10.1	V/44	-27.1	27.3	40.0	12.7
75.1	48.4 P	7.2	V/44	-27.0	28.6	40.0	11.4
75.3	49.7 P	7.2	V/44	-27.0	29.9	40.0	10.1
82.4	42.7 P	6.9	V/44	-26.9	22.7	40.0	17.3
106.8	42.3 P	12.1	V/44	-26.6	27.8	43.5	15.7
119.8	45.6 P	10.8	V/44	-26.4	30.0	43.5	13.5
131.9	40.5 P	10.1	V/44	-26.3	24.3	43.5	19.2
160.3	45.0 P	12.9	V/44	-26.1	31.8	43.5	11.7
165.4	48.5 P	12.3	V/44	-26.0	34.8	43.5	8.7
175.0	51.9 P	10.5	V/44	-25.9	36.5	43.5	7.0
199.9	44.5 P	10.5	V/44	-25.7	29.3	43.5	14.2
211.8	50.5 P	11.1	V/44	-25.6	36.0	43.5	7.5
224.8	48.3 P	11.7	V/44	-25.5	34.5	46.0	11.5
237.3	42.0 P	12.7	V/44	-25.4	29.3	46.0	16.7
250.3	44.5 P	12.8	V/44	-25.3	32.0	46.0	14.0
256.3	40.5 P	12.8	V/44	-25.2	28.1	46.0	17.9
384.2	44.3 P	15.9	V/44	-24.5	35.7	46.0	10.3
396.0	51.1 Q	15.8	V/44	-24.5	42.4	46.0	3.6
455.3	40.8 P	16.8	V/44	-23.9	33.7	46.0	12.3
512.3	37.7 P	17.8	V/44	-23.4	32.1	46.0	13.9
528.3	38.5 P	18.3	V/44	-23.2	33.6	46.0	12.4
659.9	40.1 P	19.5	V/44	-22.7	36.9	46.0	9.1
660.2	37.3 P	19.5	V/44	-22.7	34.1	46.0	11.9
924.3	36.8 P	22.8	V/44	-20.3	39.3	46.0	6.7

Judgment: Passed by 0.4 dB
All detected frequencies below 1 GHz were listed herein, not just the restricted bands.