Electromagnetic Compatibility Test Report

Tests Performed on a Westell, Inc.

Gateway with WIFI, Model A90-9100VM10-20

Radiometrics Document RP-6493

ACCREDITED
Certification # 1495.01

Product Detail: FCC ID: CH89100VMXX-10 Equipment type: Digital Transmission System
Test Standards: US CFR Title 47, Chapter I, FCC Part 15 Subpart C FCC Part 15 CFR Title 47: 2006 Industry Canada RSS-210, Issue 6 as required for Category I Equipment This report concerns: Class II Permissive Change FCC Part 15.247

Tests Performed For:	*Test Facility:*
Westell, Inc. 750 West Commons Dr. Aurora, IL 60504	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446

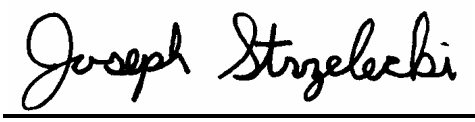
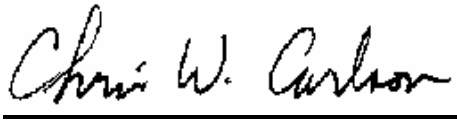
Test Date(s): (Month-Day-Year)
June 8 and 9, 2009

Document RP-6493 Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	September 8, 2009		

Table of Contents

1 ADMINISTRATIVE DATA

Equipment Under Test: A Westell, Inc., xDSL Gateway Model: A90-9100VM10-20 Serial Number: 08B403196860 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) June 8, 2009	*Test Date(s): (Month-Day-Year)* June 8 and 9, 2009
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 an xDSL Gateway, Model A90-9100VM10-20 with H/W Rev. C, manufactured by Westell, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

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

Spread Spectrum Transmitter Requirements

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

2.1 RF Exposure Compliance Requirements

Since the peak power output is 290 mW, The EUT meets the FCC requirement for RF exposure. The detailed calculations for RF Exposure are presented in a separate document.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Gateway, Model A90-9100VM10-20, manufactured by Westell, Inc. The EUT operates in the 2412 to 2462 MHz range. The EUT was in good working condition during the tests, with no known defects.

The A90-9000X series router has the same function as the previous model A90-9100VM15-10 approved under grant CH89100VMXX-10, except the Ikanos VDSL transceiver has been replaced by an Infineon VINAX DSL transceiver chipset. The new model is built with the same 802.11G radio transceiver as the existing models covered under grant CH89100VMXX-10.

3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna is permanently attached to the PCB internal to the EUT. The connector is not readily available to public. Therefore, it meets the 15.203 Requirement.

3.2 Related Submittals

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

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

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

The EUT was tested as a remotely located device. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply. The identifications for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	xDSL Gateway	E	Westell, Inc.	A90-9100VM10-20C	08B403196860
2	Power Supply	E	Westell Mitra	585-200085 MPBS-12020000	None
3	Power Supply	E	Westell TESEC	585-200085 TS-0206B	None
4	Central Office (CO) simulator single port	S	Infineon	Easy 8300	None
5	Notebook PC	S	MPC	T2200	Not Available
6	Ikanos ULS3 Gateway (MoCA LAN)	S	Westell, Inc	A90-9100VM15-10	4027

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

List of System Cables

QTY	Length (m)	Cable Description	Connected to	Shielded?
1	1.8	Low Voltage Power Cord	Power to EUT	No
4	10	Ethernet Cable	EUT and Laptop PC	No
1	10	Coax Cable	EUT and Moca LAN	Yes
1	10	Phone Cable	EUT and CO simulator	No

The coax and Ethernet cables were routed outside the test enclosure to the support equipment.

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 during the tests in order to achieve compliance.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2008	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2003	2003	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 7	2007	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 2	2007	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)
FCC 558074	2005	Measurement of Digital Transmission Systems Operating under Section 15.247

The test procedures used are in accordance with the FCC 558074, Industry Canada RSS-212 and ANSI document C63.4-2003, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

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

The following is a list of sites located in Romeoville, Illinois used for testing:

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

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

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

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

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

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

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

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	02/01/09
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	02/01/09
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	02/03/09
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/22/08
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/26/07
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	10/04/07
HPF-03	Mini-Circuits	High Pass Filter	VHP-39	HPF-03	3-10 GHz	12 Mo.	01/30/09
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	06/01/09
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	03/09/09
REC-01	HP / Agilent	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	10/23/08
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	12 Mo.	02/23/09

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

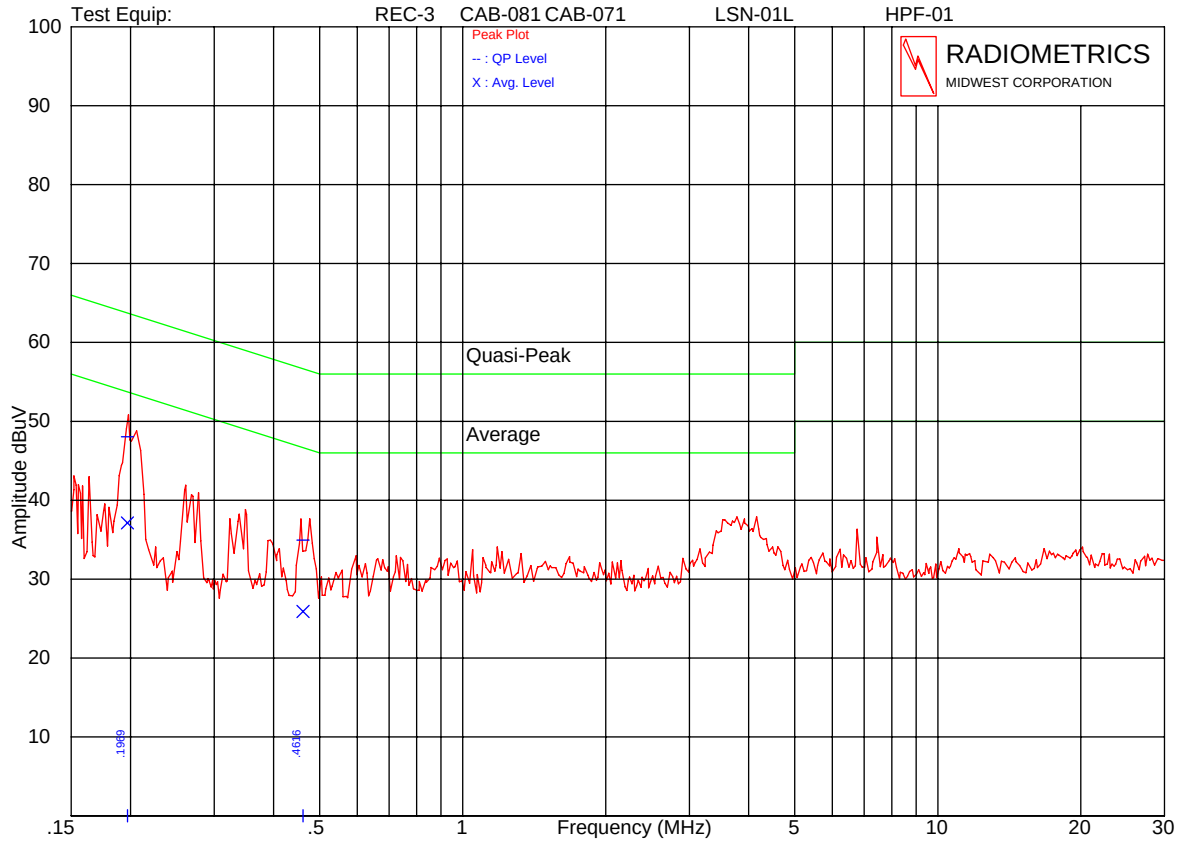
Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

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 and the three tested channels.

Test Date : June 8, 2009
The Amplitude is the final corrected value with cable and LISN Loss.

EUT Mode	Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
TSEC PS	AC Neutral	0.208	51.9 Q	63.3	36.6	53.3
TSEC PS	AC Neutral	0.264	39.5 Q	61.3	29.4	51.3
TSEC PS	AC Neutral	3.373	39.3 Q	56.0	33.1	46.0
TSEC PS	AC Hot	0.197	47.3 Q	63.7	34.5	53.7
TSEC PS	AC Hot	0.263	39.5 Q	61.3	28.6	51.3
TSEC PS	AC Hot	3.375	36.0 Q	56.0	28.9	46.0
Mitra PS	AC Neutral	0.197	49.8 Q	63.7	38.7	53.7
Mitra PS	AC Neutral	0.263	39.9 Q	61.3	27.9	51.3
Mitra PS	AC Neutral	0.451	38.4 Q	56.9	26.0	46.9
Mitra PS	AC Neutral	7.891	34.0 Q	60.0	23.6	50.0
Mitra PS	AC Hot	0.197	48.0 Q	63.7	37.1	53.7
Mitra PS	AC Hot	0.462	35.0 Q	56.7	25.9	46.7

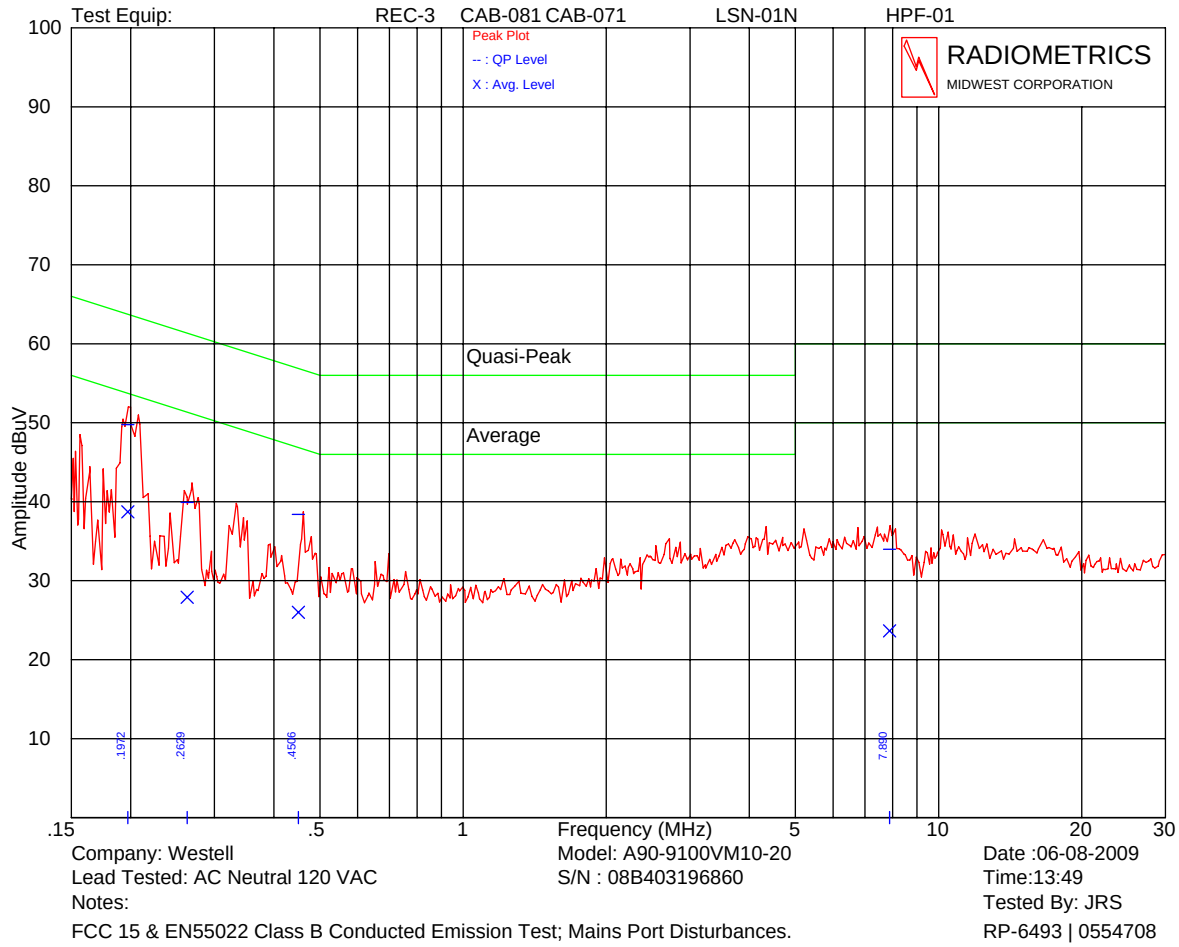
The above are the worst case results with three frequencies test for each EUT
* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.
Judgment: Passed by 11.4 dB



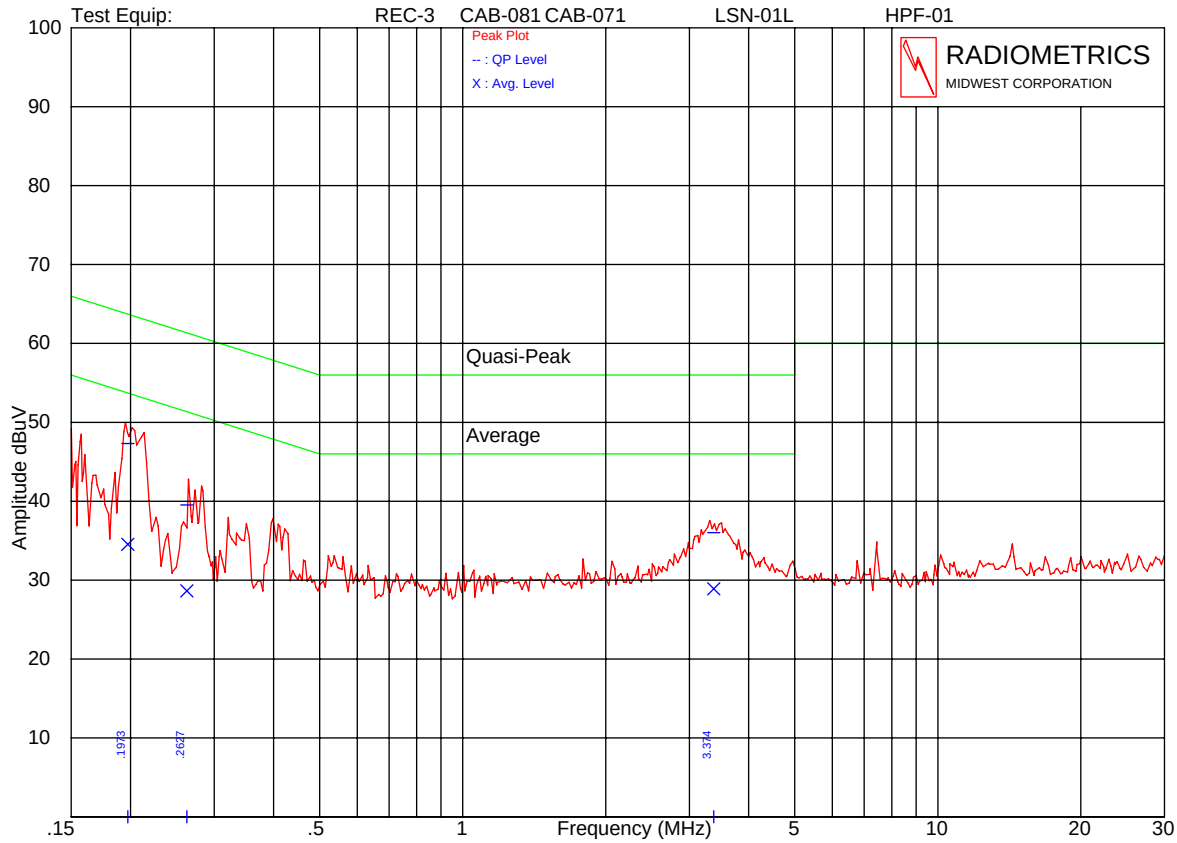
Company: Westell
Lead Tested: AC Hot 120 VAC
Notes:
FCC 15 & EN55022 Class B Conducted Emission Test; Mains Port Disturbances.

Model: A90-9100VM10-20
S/N : 08B403196860

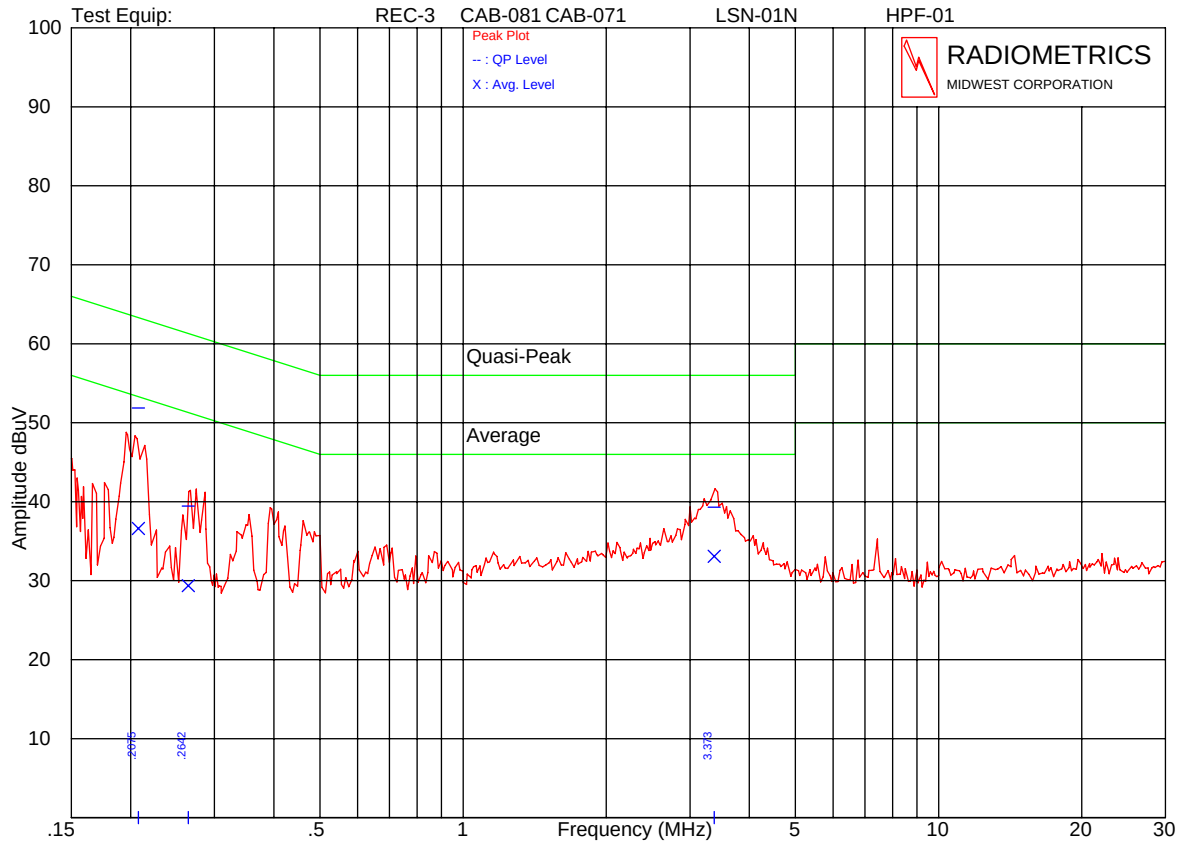
Date :06-08-2009
Time:13:54
Tested By: JRS
RP-6493 | 3342450



Company: Westell
Model: A90-9100VM10-20
Date :06-08-2009
Lead Tested: AC Neutral 120 VAC
S/N : 08B403196860
Time:13:49
Notes:
Tested By: JRS
FCC 15 & EN55022 Class B Conducted Emission Test; Mains Port Disturbances.
RP-6493 | 0554708

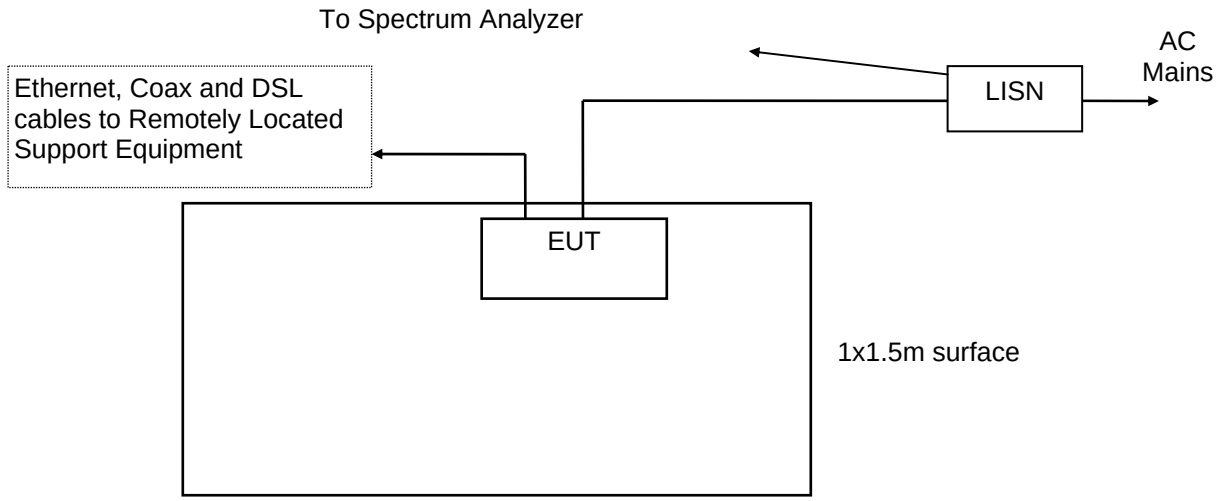


Company: Westell
Model: A90-9100VM10-20
Date :06-09-2009
Lead Tested: AC Hot 120 VAC
S/N : 08B403196860
Time:08:15
Notes: Tsec Power Supply
Tested By: JRS
FCC 15 & EN55022 Class B Conducted Emission Test; Mains Port Disturbances.
RP-6493 | 7951813



Company: Westell
Model: A90-9100VM10-20
Date :06-09-2009
Lead Tested: AC Neutral 120 VAC
S/N : 08B403196860
Time:08:18
Notes: Tsec Power Supply
Tested By: JRS
FCC 15 & EN55022 Class B Conducted Emission Test; Mains Port Disturbances.
RP-6493 | cel2

Figure 1. Conducted Emissions Test Setup



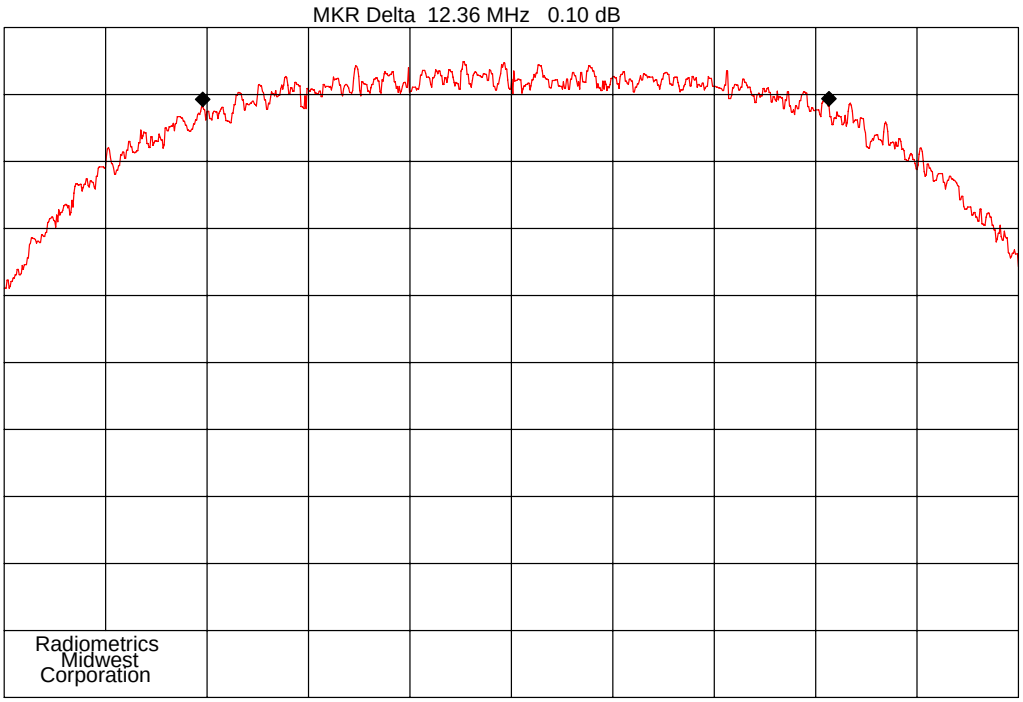
Notes:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled

10.2 Occupied Bandwidth (6 dB)

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

The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 6 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission. The minimum occupied is required to be 0.5 MHz.

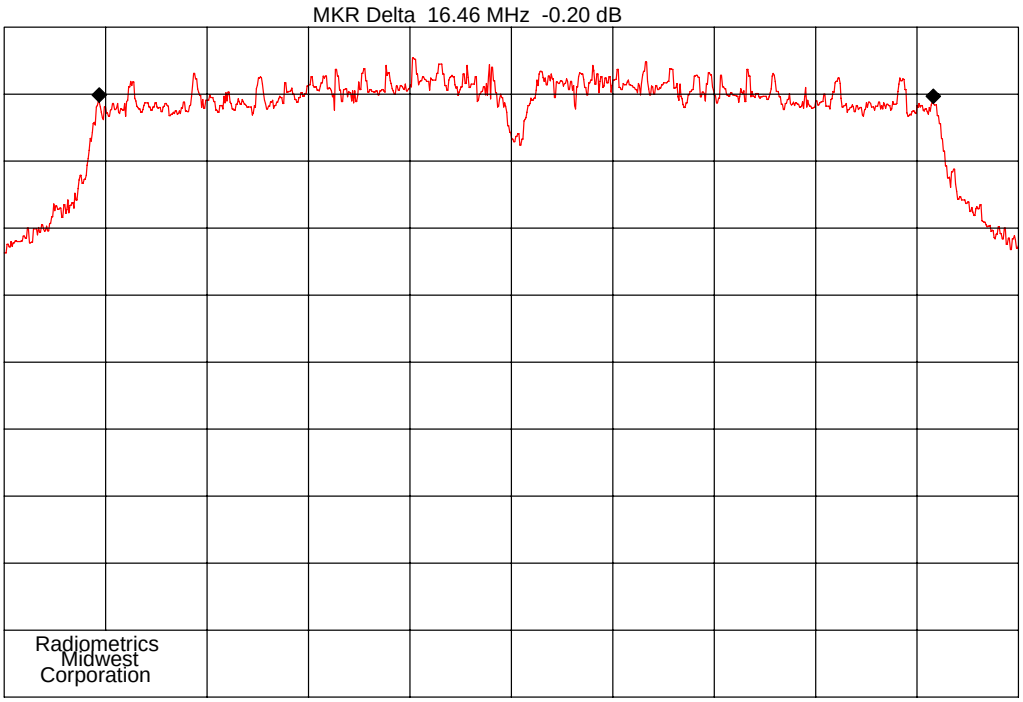
	802.11b	802.11g
Channel	6 dB EBW MHz	6 dB EBW MHz
1	12.36	16.46
6	12.34	16.50
11	12.02	16.10



Company: Westell
CENTER 2.412 0 GHz
RES BW 100 kHz
10 dB/
Notes: 6 dB Occupied Bandwidth, Ch 1; 802.11b

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 08:37

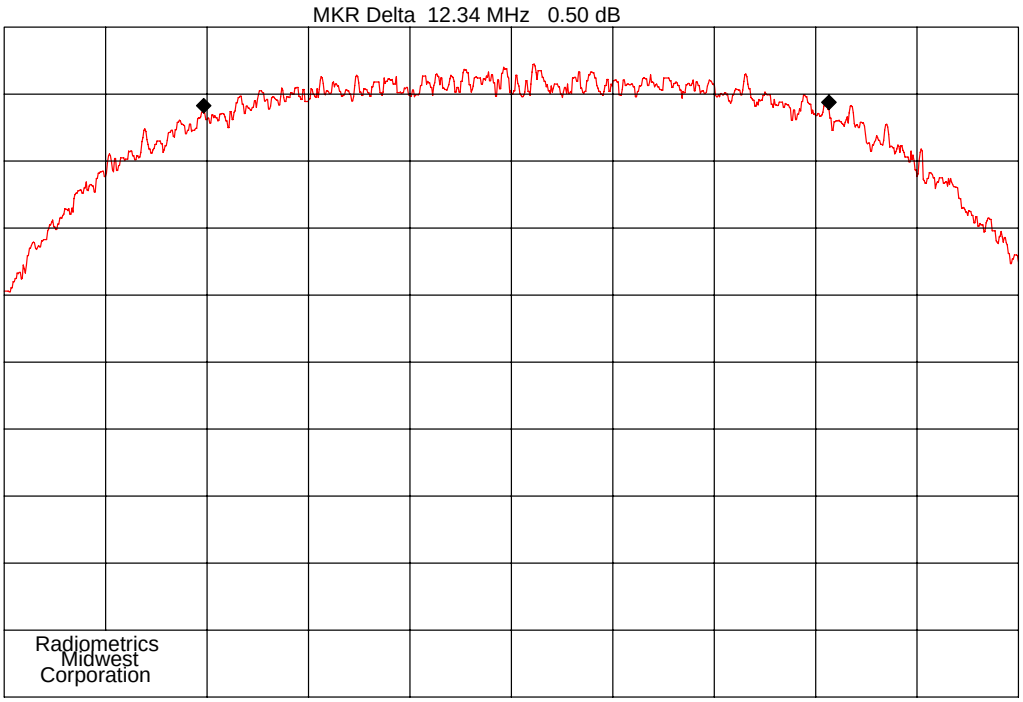
Date : 07-14-2009
SPAN 20.0 MHz
ATTEN 20 dB
SWP 20.0 msec



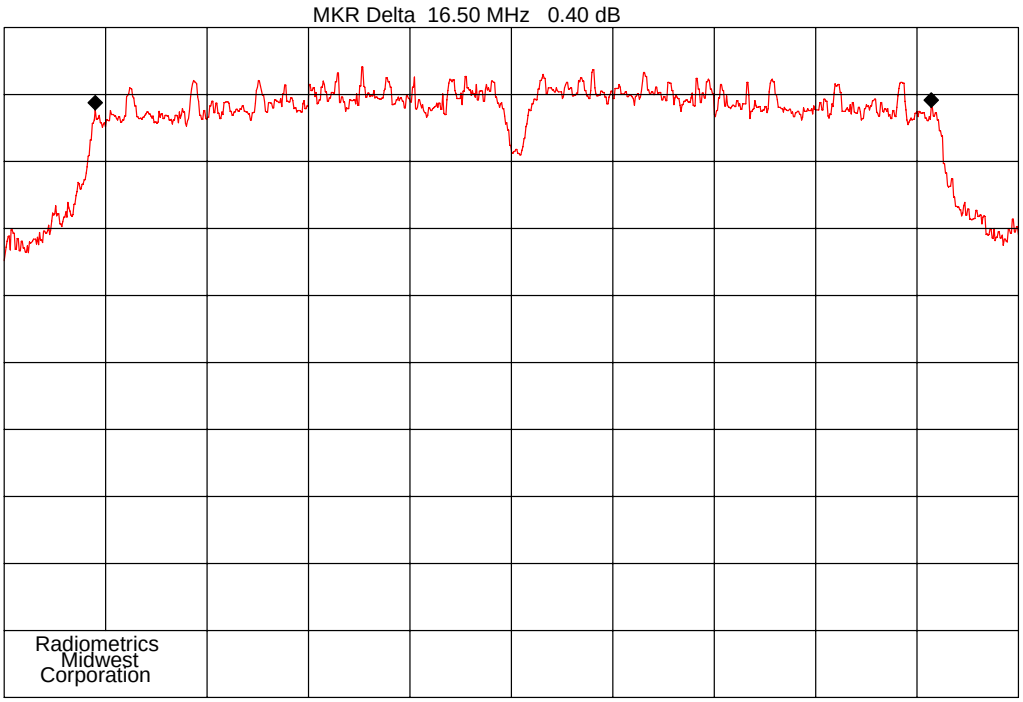
Company: Westell
CENTER 2.412 0 GHz
RES BW 100 kHz
10 dB/
Notes: 6 dB Bandwidth Test, Ch 1; 802.11g

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:56

Date : 07-14-2009
SPAN 20.0 MHz
ATTEN 20 dB
SWP 20.0 msec



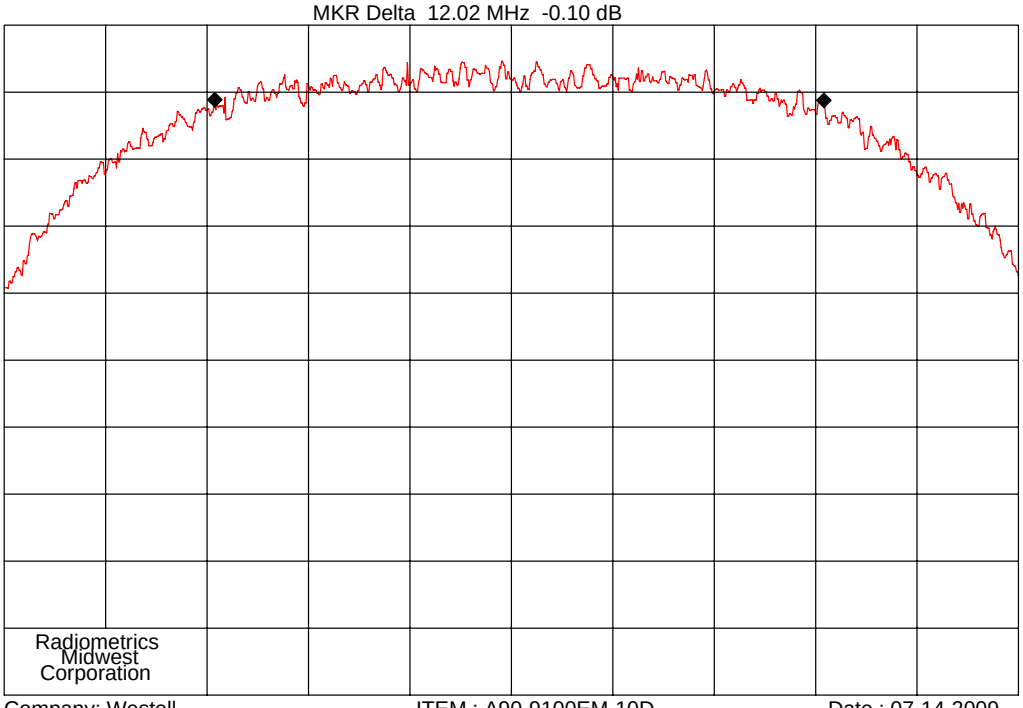
Company: Westell
CENTER 2.437 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 08:33
Date : 07-14-2009
SPAN 20.0 MHz
ATTEN 20 dB
SWP 20.0 msec
Notes: 6 dB Occupied Bandwidth, Ch 6; 802.11b



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

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:48

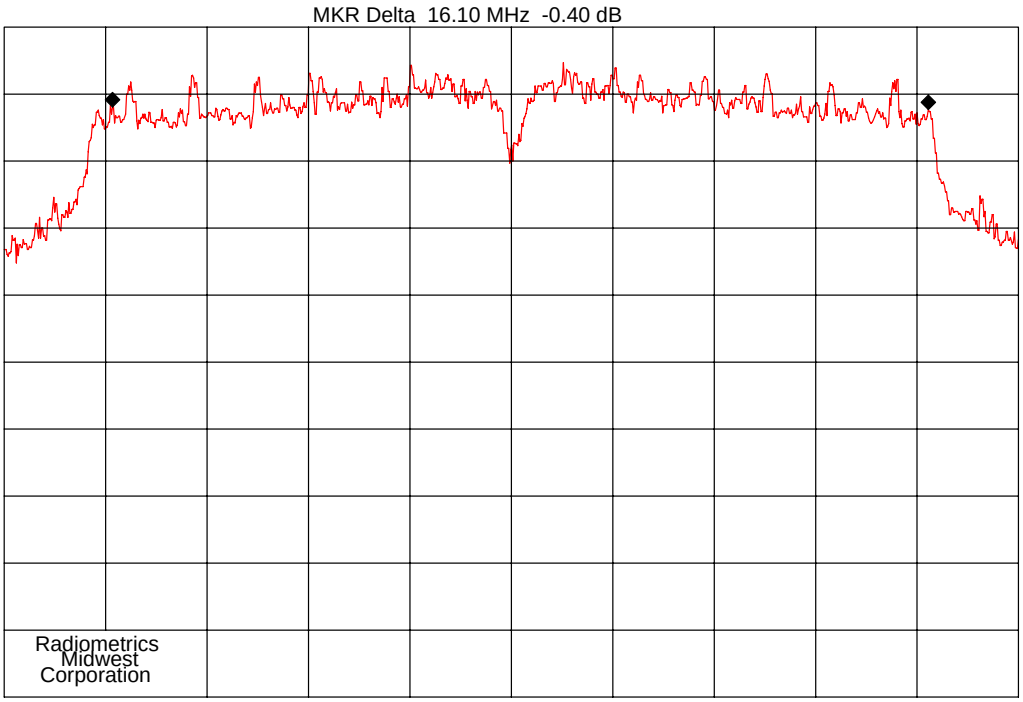
Date : 07-14-2009
SPAN 20.0 MHz
ATTEN 20 dB
SWP 20.0 msec



Company: Westell
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
Notes: 6 dB Occupied Bandwidth, Channel 11

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 08:16

Date : 07-14-2009
SPAN 20.0 MHz
ATTEN 20 dB
SWP 20.0 msec



10.3 Peak Output Power

The EUT antenna port was connected to the spectrum analyzer via a low loss coaxial cable. The power output option 2; Method #3 from FCC rules 558074 was used for this test. The spectrum analyzer was set to the following settings:

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

The trace was allowed to stabilize. The marker-to-peak function was used to measure the peak of the emission. The indicated level is the peak output power. The BW correction factor is 10*Log(BW). Note 30 dBm = 1 watt. Since the gain of the antenna is always less than 6 dB, the limit is not reduced.

Mode	Freq. (MHz)	Reading (dBm)	BW Corr Factor (dB)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
					dBm	Watts	
802.11b	2412	10.6	10.8	0.3	21.7	0.148	30
802.11b	2437	11.5	10.9	0.3	22.7	0.185	30
802.11b	2462	11.2	11.1	0.3	22.6	0.180	30
802.11g	2412	11.7	11.9	0.3	23.9	0.246	30
802.11g	2437	12.3	12.0	0.3	24.6	0.290	30
802.11g	2462	11.8	12.0	0.3	24.1	0.257	30

Judgement pass by 4.6 dB

10.4 Power Spectral Density

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

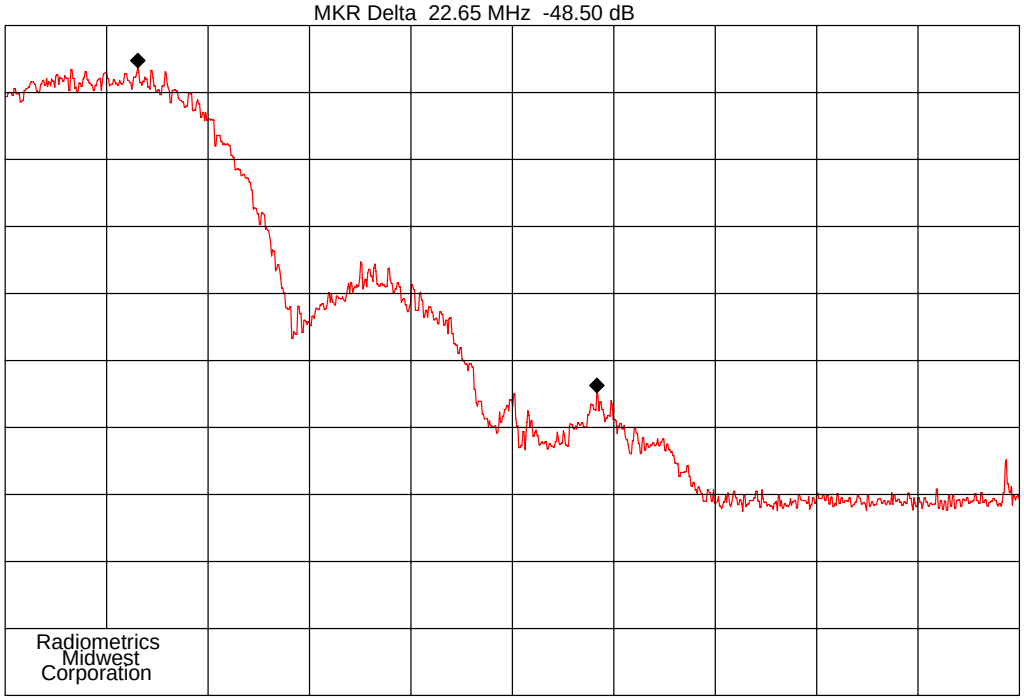
Span = 500 kHz RBW = 3 kHz; VBW = 10 kHz; Sweep = 167 seconds
Detector function = Peak

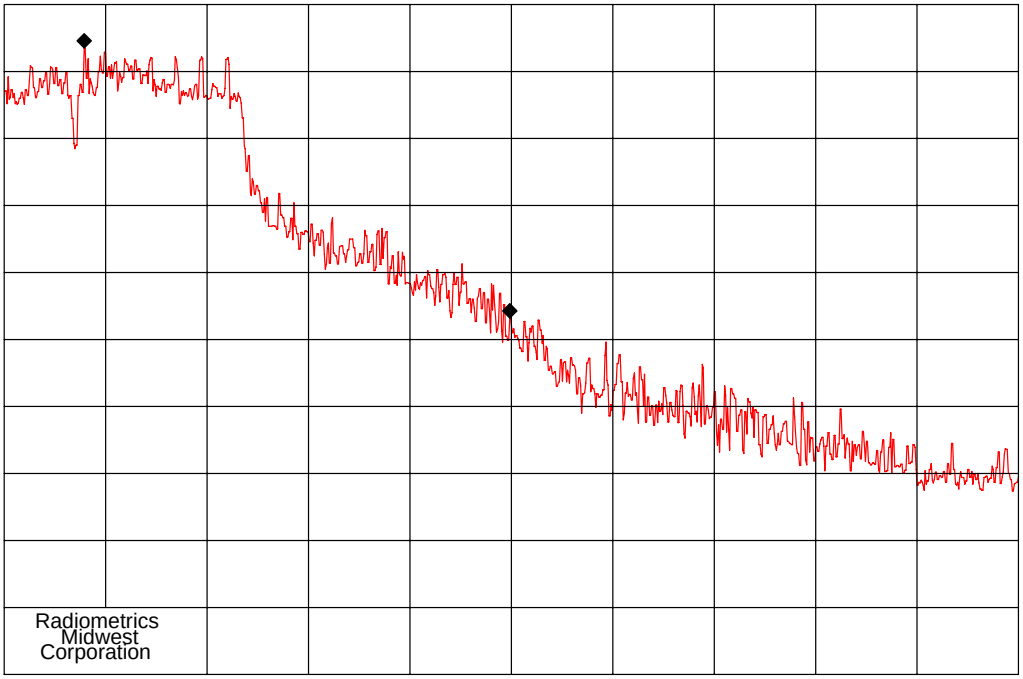
Mode	Frequency (MHz)	Reading dBm	Cable Loss (dB)	3 kHz Spectral Density (dBm)	Limit (dBm)
802.11b	2412	-7.1	0.3	-6.8	8.0
802.11b	2437	-8.2	0.3	-7.9	8.0
802.11b	2462	-6.9	0.3	-6.6	8.0
802.11g	2412	-8.2	0.3	-7.9	8.0
802.11g	2437	-7.4	0.3	-7.1	8.0
802.11g	2462	-7.8	0.3	-7.5	8.0

Judgement pass by dB

10.5 Band-edge Compliance of RF Conducted Emissions

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

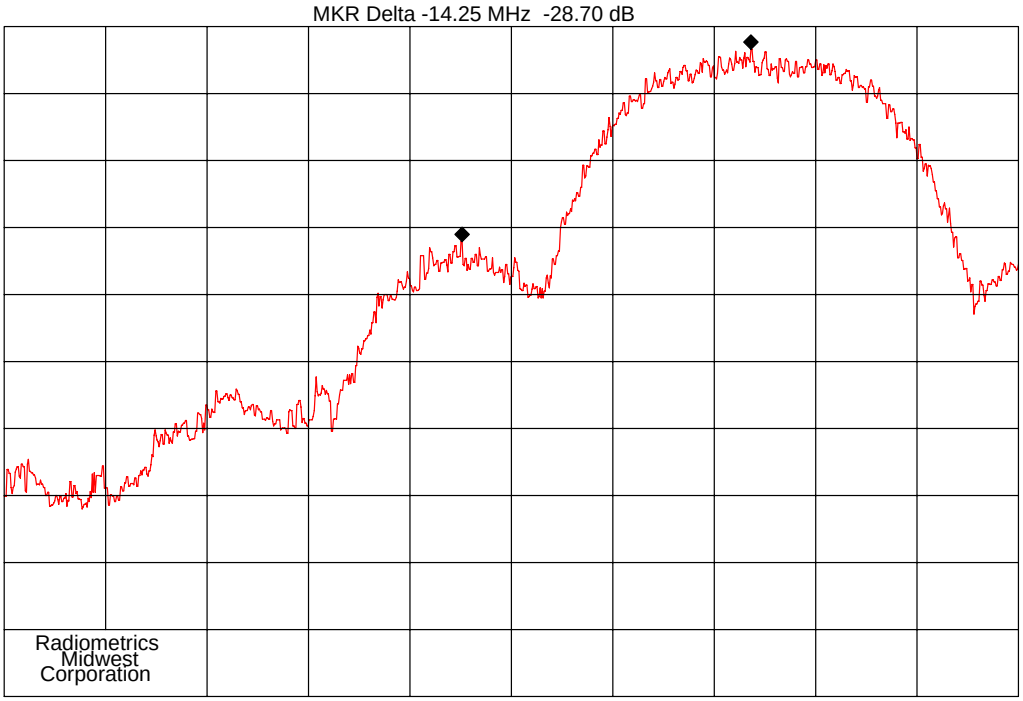




Company: Westell
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
Notes: Band Edge Test, Ch 11; 802.11g

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:22

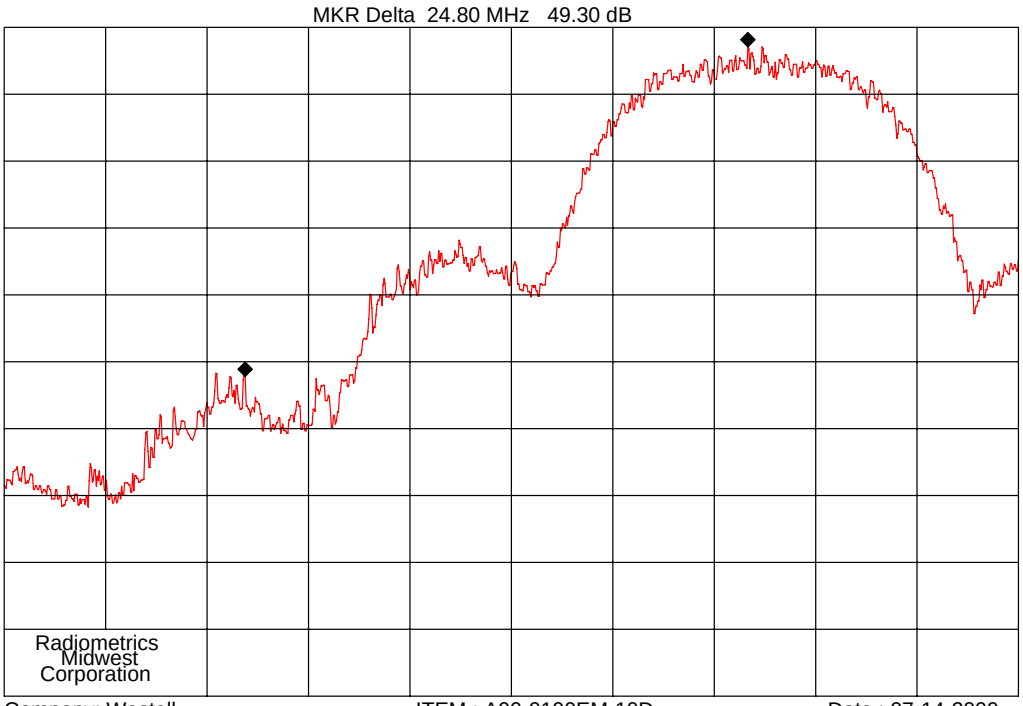
Date : 07-14-2009
SPAN 50.0 MHz
ATTEN 20 dB
SWP 20.0 msec



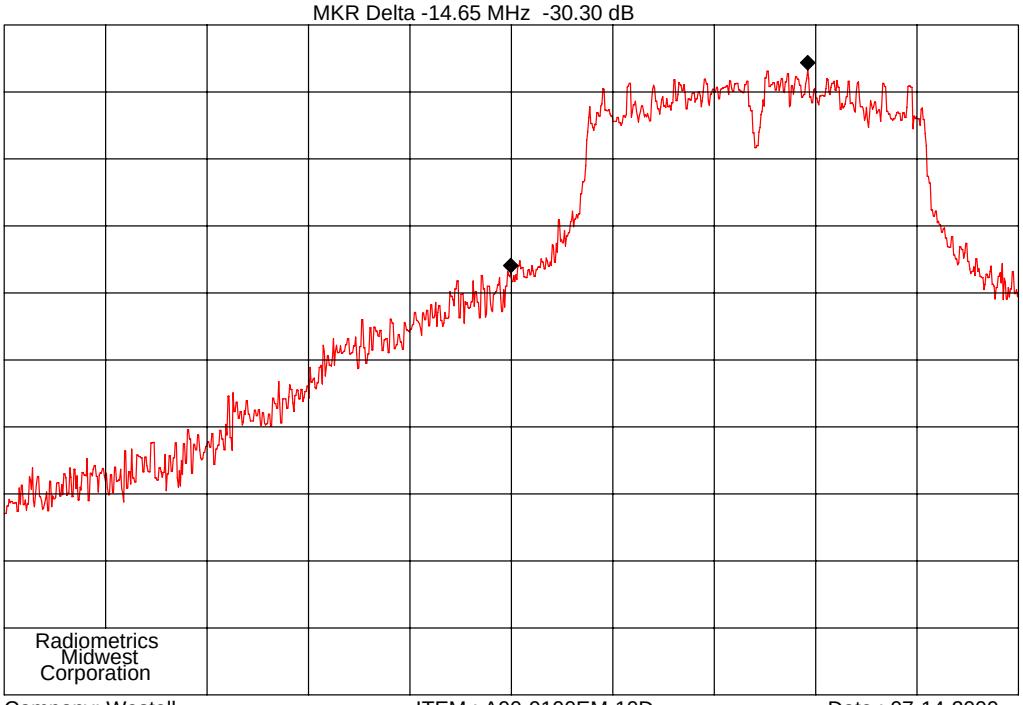
Company: Westell
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
Notes: Band Edge Test 2.4 GHz, Ch 1; 802.11b

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 08:47

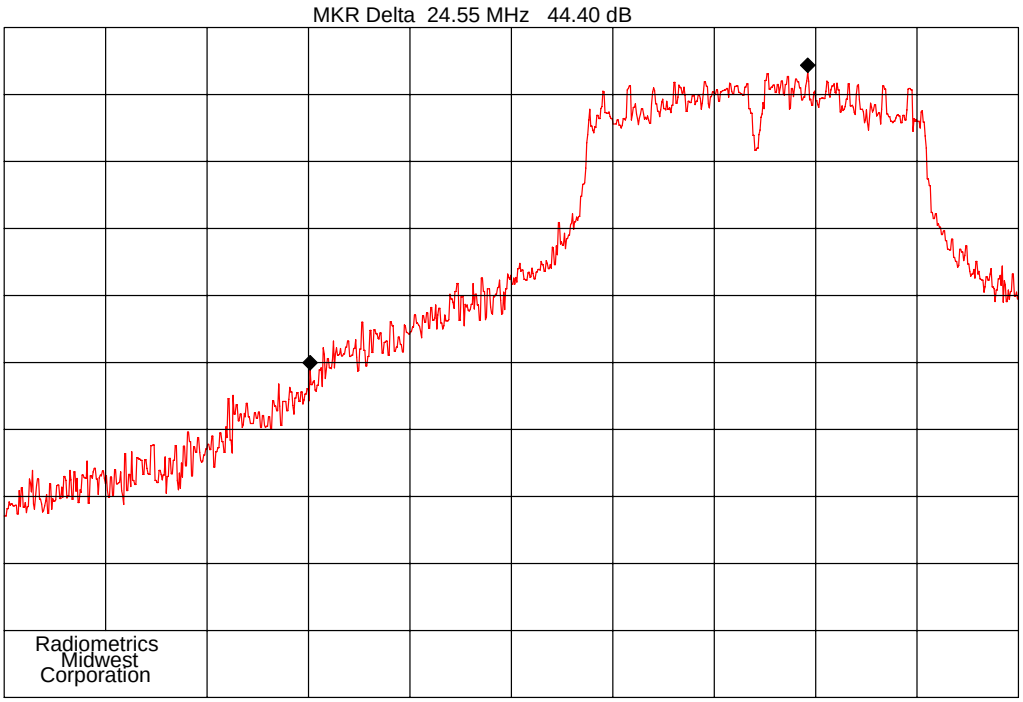
Date : 07-14-2009
SPAN 50.0 MHz
ATTEN 20 dB
SWP 20.0 msec



Company: Westell
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 08:49
Date : 07-14-2009
SPAN 50.0 MHz
ATTEN 20 dB
SWP 20.0 msec
Notes: Band Edge Test 2.39 GHz, Ch 1; 802.11b



Company: Westell
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 10:05
Date : 07-14-2009
SPAN 50.0 MHz
ATTEN 20 dB
SWP 20.0 msec
Notes: Band Edge Emissions, Ch 1; 802.11g



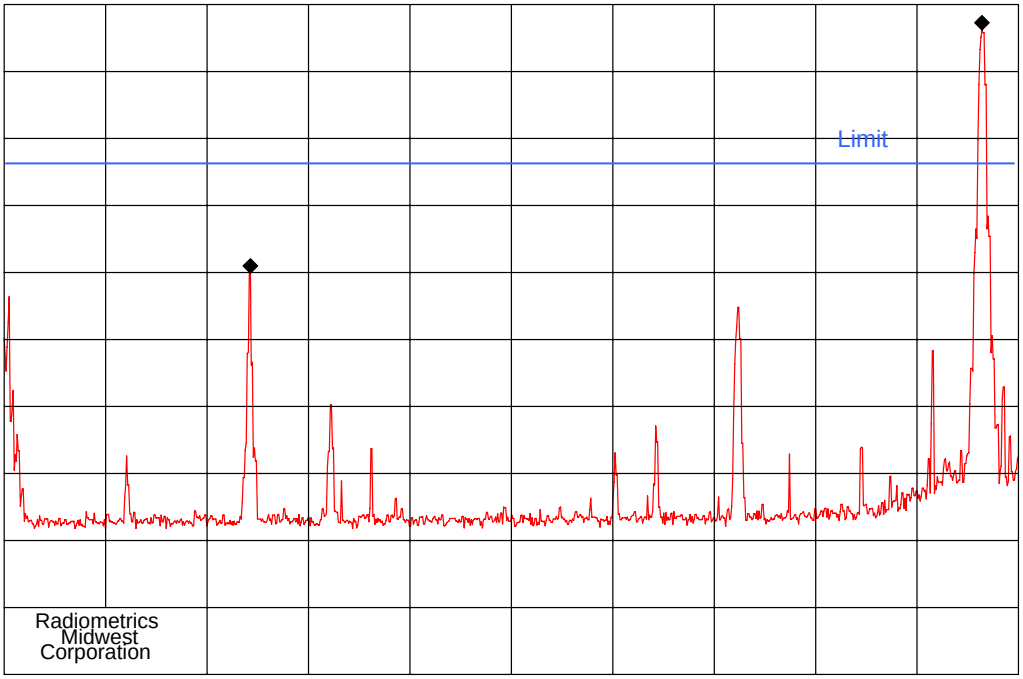
Judgement: pass by 8.7 dB

10.6 Spurious RF Conducted Emissions

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

The limits are closer to the top of the scale for the 18-25 GHz plots because the reference level is lower for these plots.

MKR Delta -1.804 GHz -36.30 dB

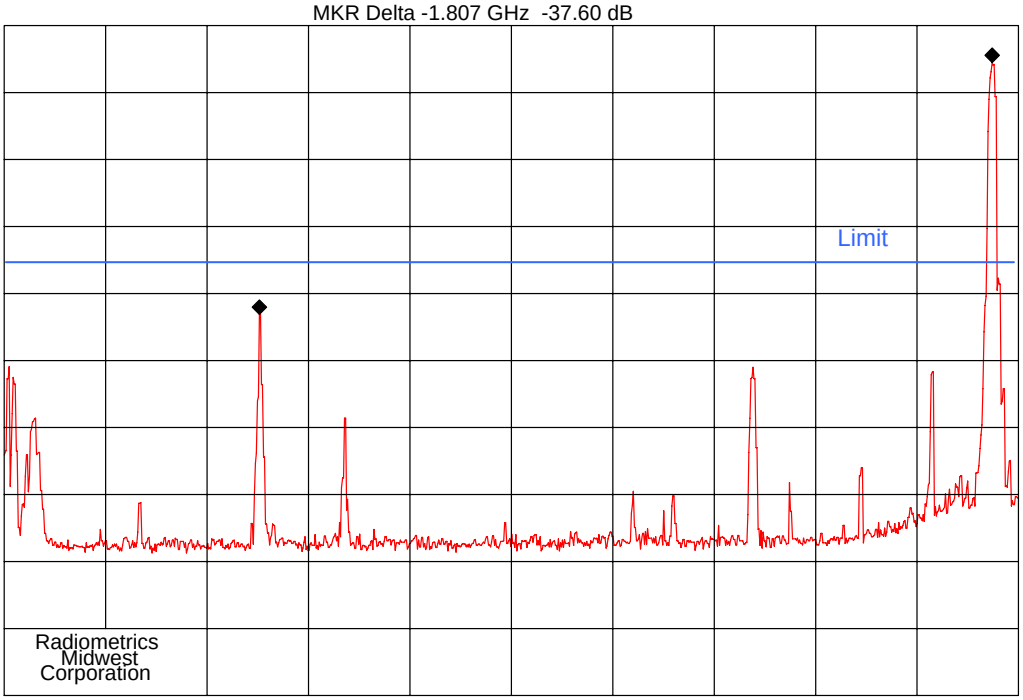


Company: Westell
START 1 MHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 1; 802.11b

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 08:53

Date : 07-14-2009
STOP 2.50 GHz
ATTEN 20 dB
SWP 750 msec

MKR Delta -1.807 GHz -37.60 dB

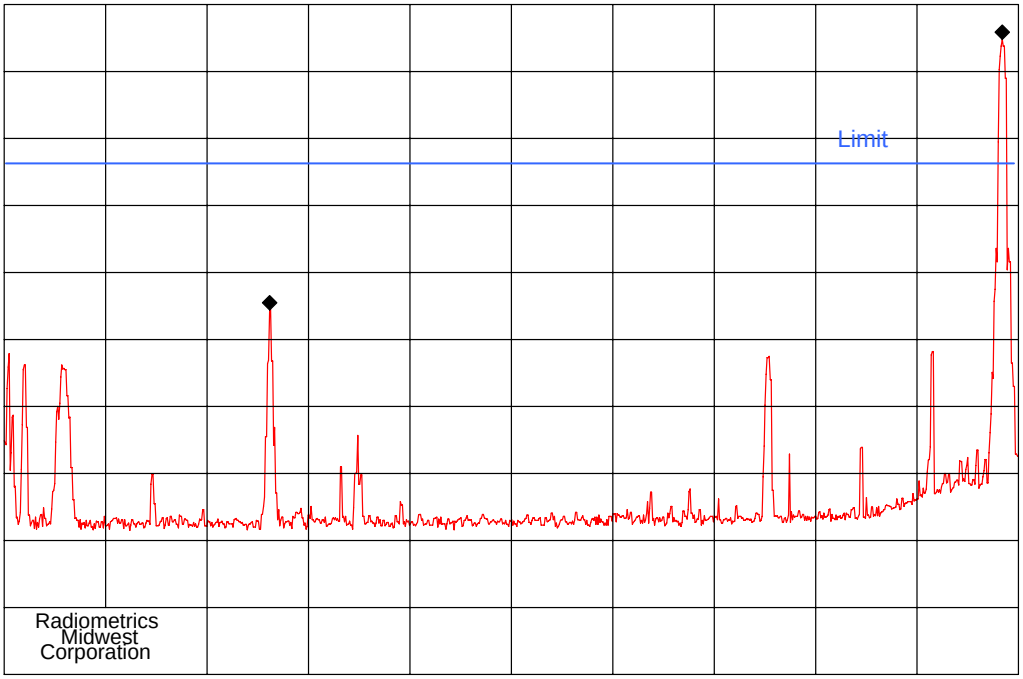


Company: Westell
START 1 MHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 6; 802.11b

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:02

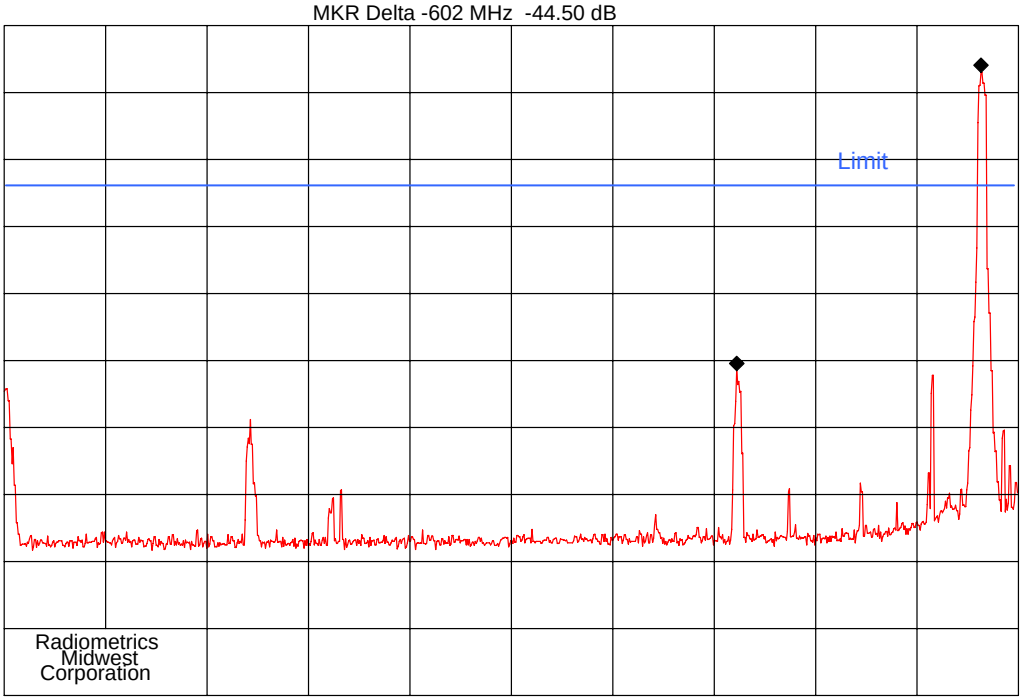
Date : 07-14-2009
STOP 2.50 GHz
ATTEN 20 dB
SWP 750 msec

MKR Delta -1.807 GHz -40.40 dB



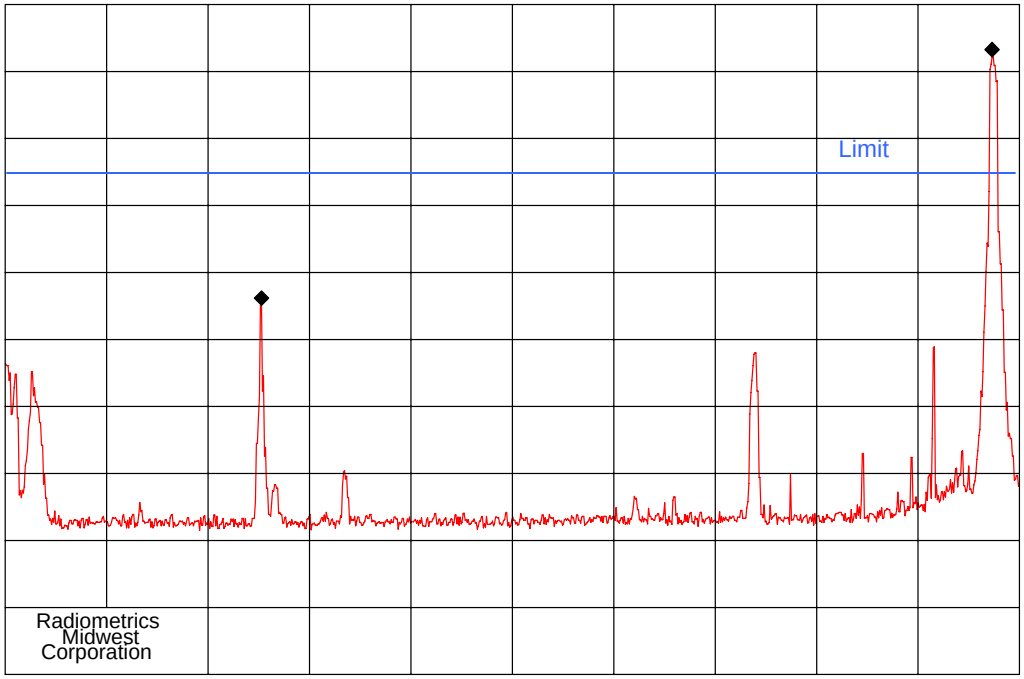
Company: Westell
START 1 MHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:09
Date : 07-14-2009
STOP 2.50 GHz
ATTEN 20 dB
SWP 750 msec
Notes: Antenna Conducted Emissions, Ch 11; 802.11b

MKR Delta -602 MHz -44.50 dB



Company: Westell
START 1 MHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 10:01
Date : 07-14-2009
STOP 2.50 GHz
ATTEN 20 dB
SWP 750 msec
Notes: Antenna Conducted Emissions, Ch 1; 802.11g

MKR Delta -1.802 GHz -37.10 dB

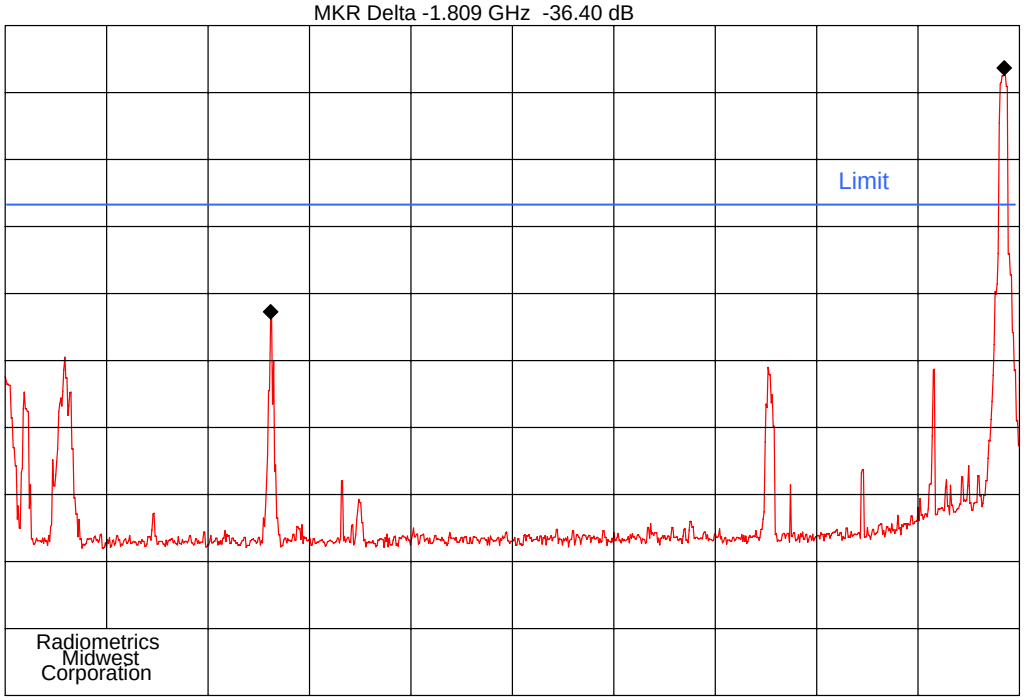


Company: Westell
START 1 MHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 6; 802.11g

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:41

Date : 07-14-2009
STOP 2.50 GHz
ATTEN 20 dB
SWP 750 msec

MKR Delta -1.809 GHz -36.40 dB

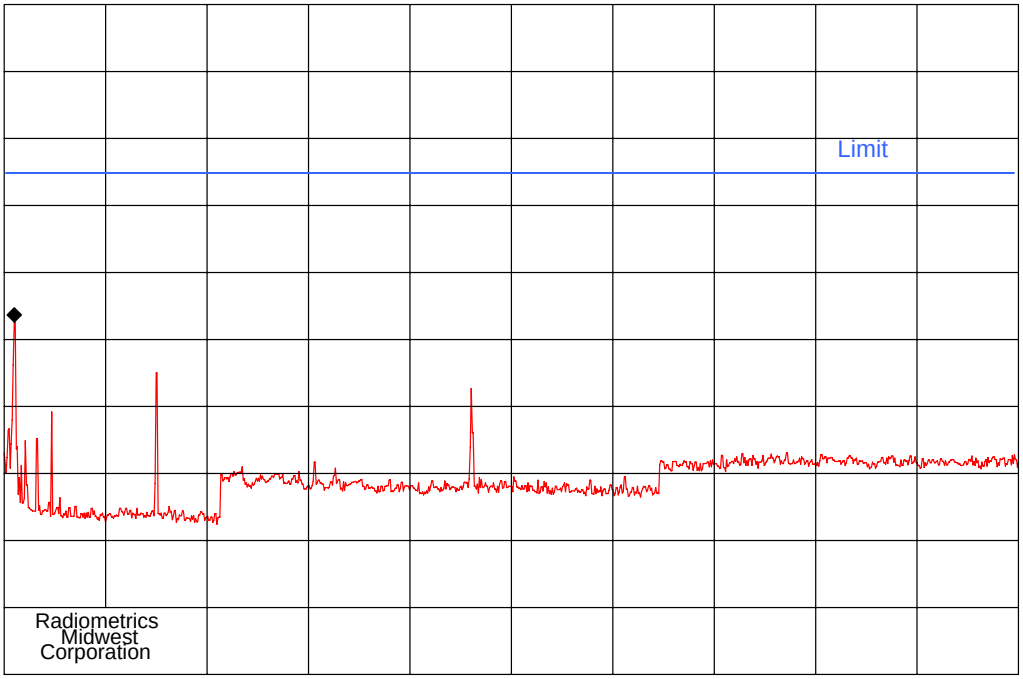


Company: Westell
START 1 MHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 11; 802.11g

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:36

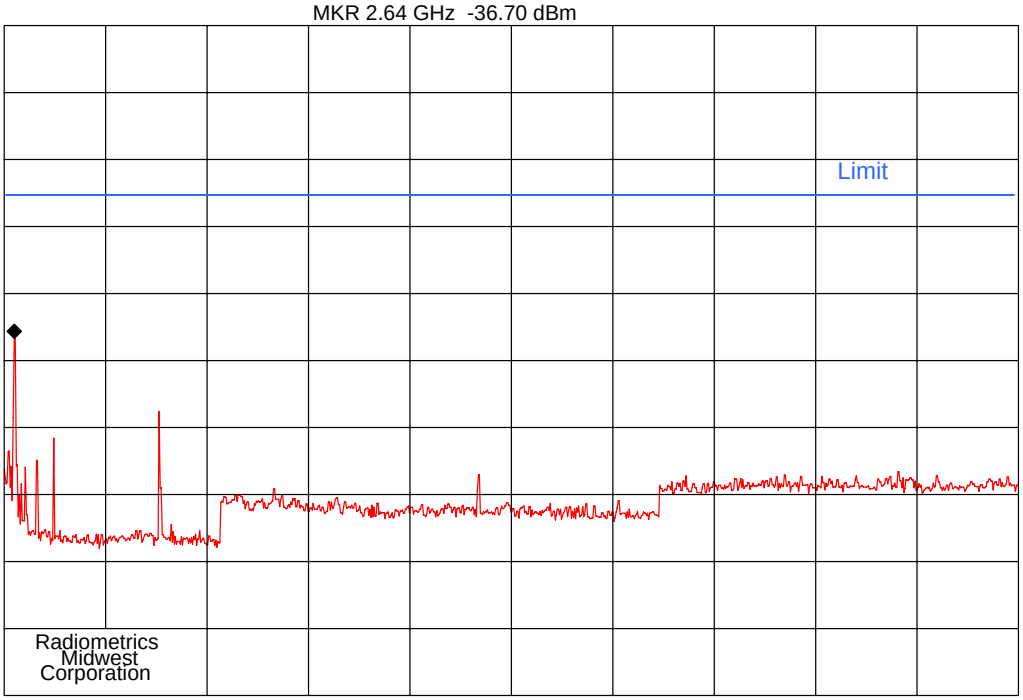
Date : 07-14-2009
STOP 2.50 GHz
ATTEN 20 dB
SWP 750 msec

MKR 2.64 GHz -37.40 dBm



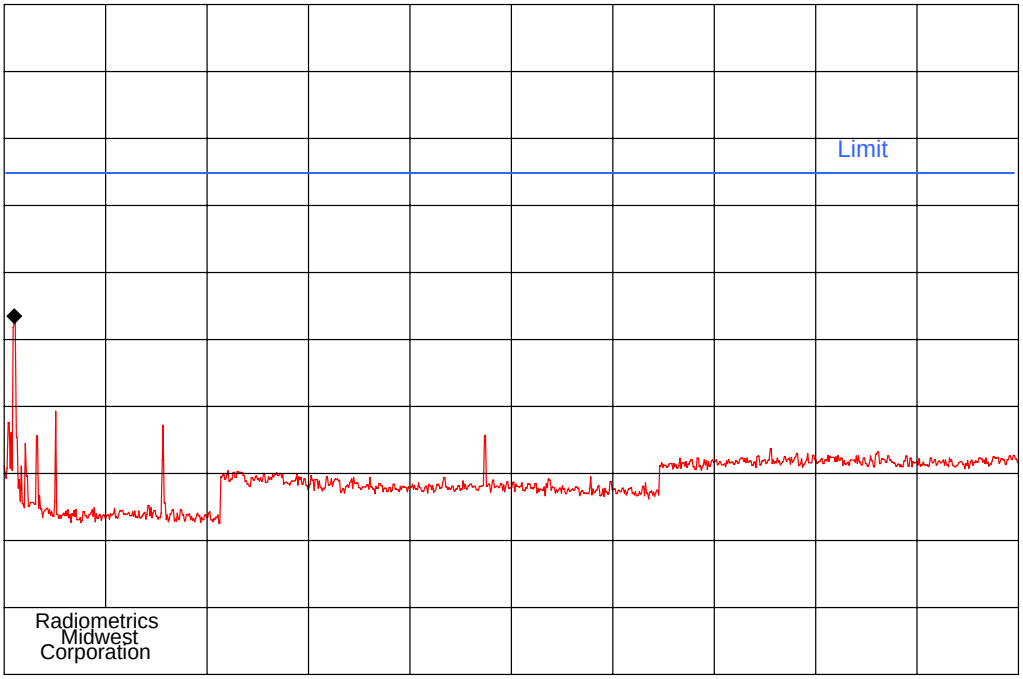
Company: Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 08:58
Date : 07-14-2009
STOP 18.0 GHz
ATTEN 20 dB
SWP 4.65 sec
Notes: Antenna Conducted Emissions, Ch 1; 802.11b

MKR 2.64 GHz -36.70 dBm



Company: Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:01
Date : 07-14-2009
STOP 18.0 GHz
ATTEN 20 dB
SWP 4.65 sec
Notes: Antenna Conducted Emissions, Ch 6; 802.11b

MKR 2.64 GHz -37.60 dBm

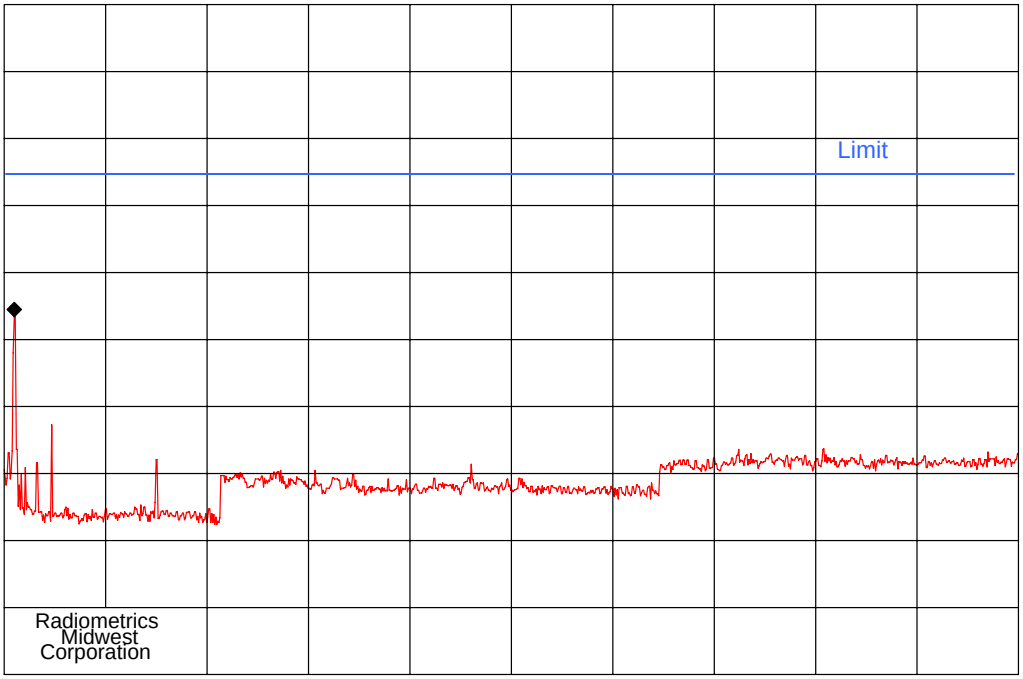


Company: Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 11; 802.11b

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:11

Date : 07-14-2009
STOP 18.0 GHz
ATTEN 20 dB
SWP 4.65 sec

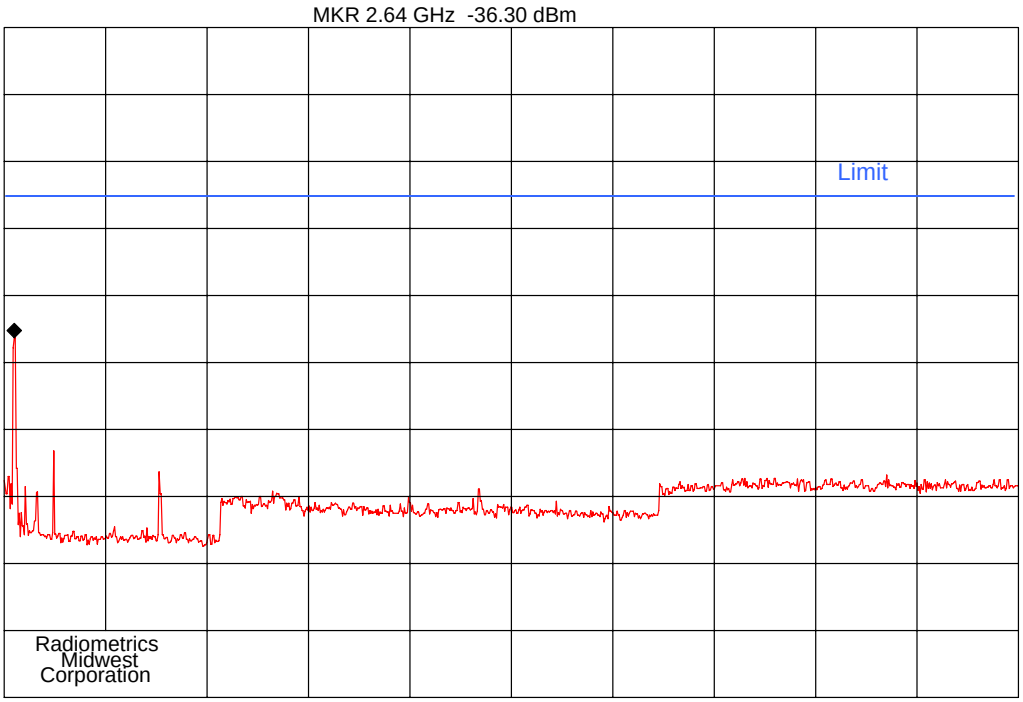
MKR 2.64 GHz -36.60 dBm



Company: Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 1; 802.11g

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 10:03

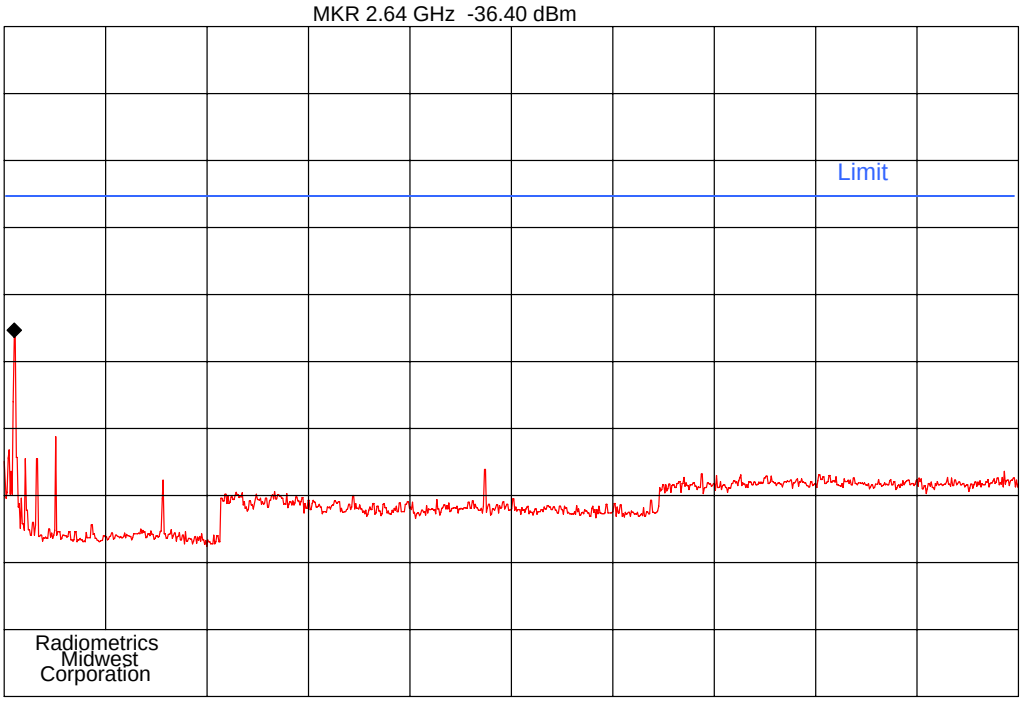
Date : 07-14-2009
STOP 18.0 GHz
ATTEN 20 dB
SWP 4.65 sec



Company: Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 6; 802.11g

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:44

Date : 07-14-2009
STOP 18.0 GHz
ATTEN 20 dB
SWP 4.65 sec

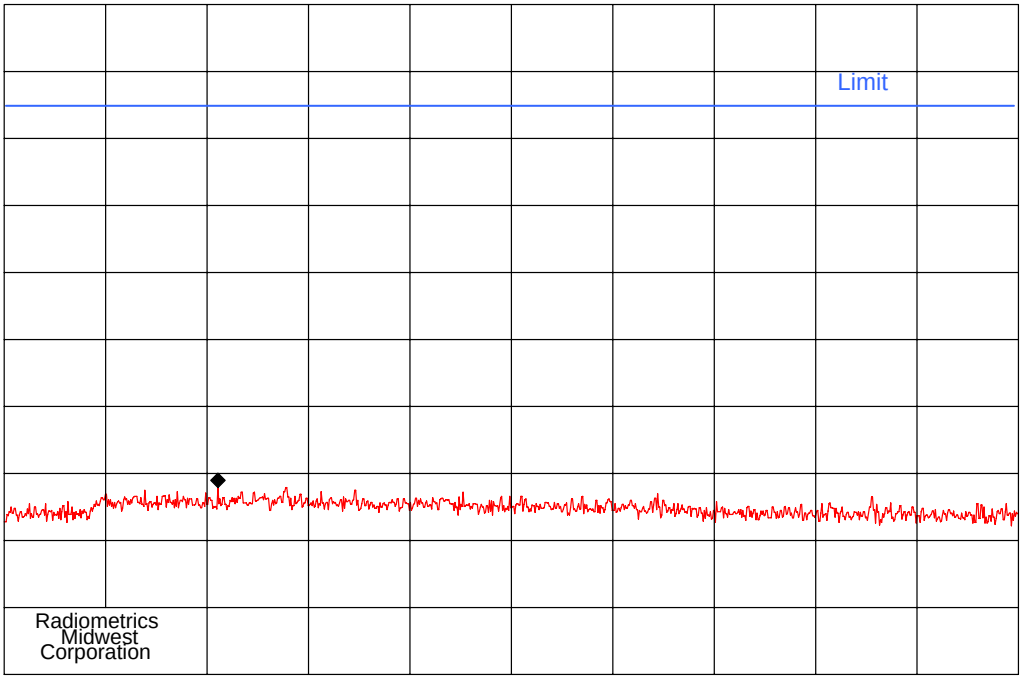


Company: Westell
START 2.5 GHz
RES BW 100 kHz
10 dB/
Notes: Antenna Conducted Emissions, Ch 11; 802.11g

ITEM : A90-9100EM-10D
REF 10.0 dBm
VBW 300 kHz
Time: 09:38

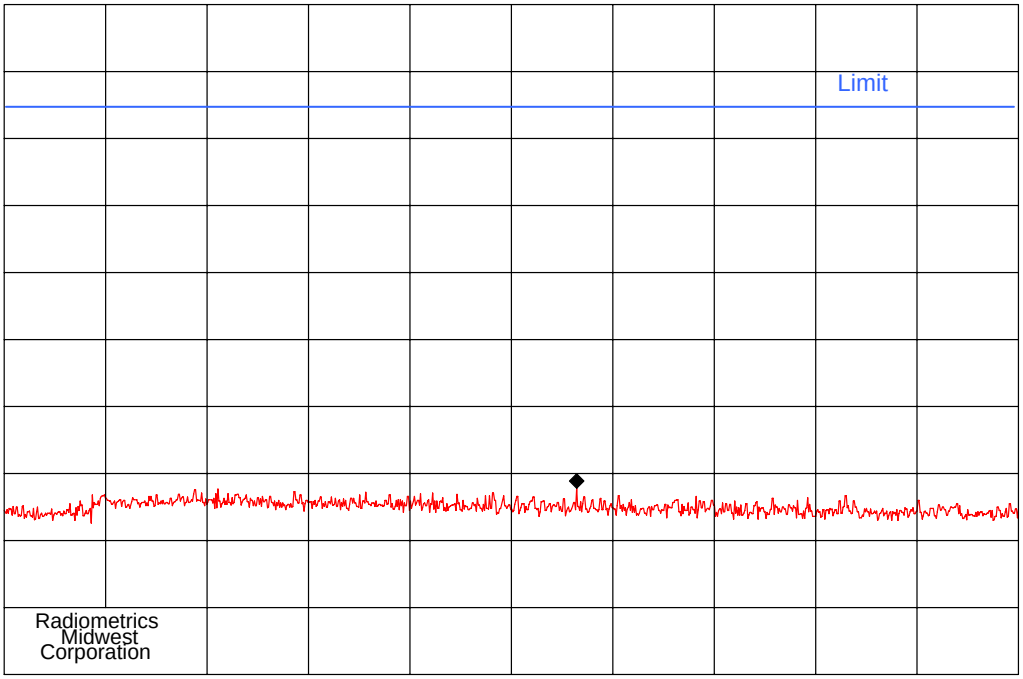
Date : 07-14-2009
STOP 18.0 GHz
ATTEN 20 dB
SWP 4.65 sec

MKR 19.470 GHz -72.10 dBm



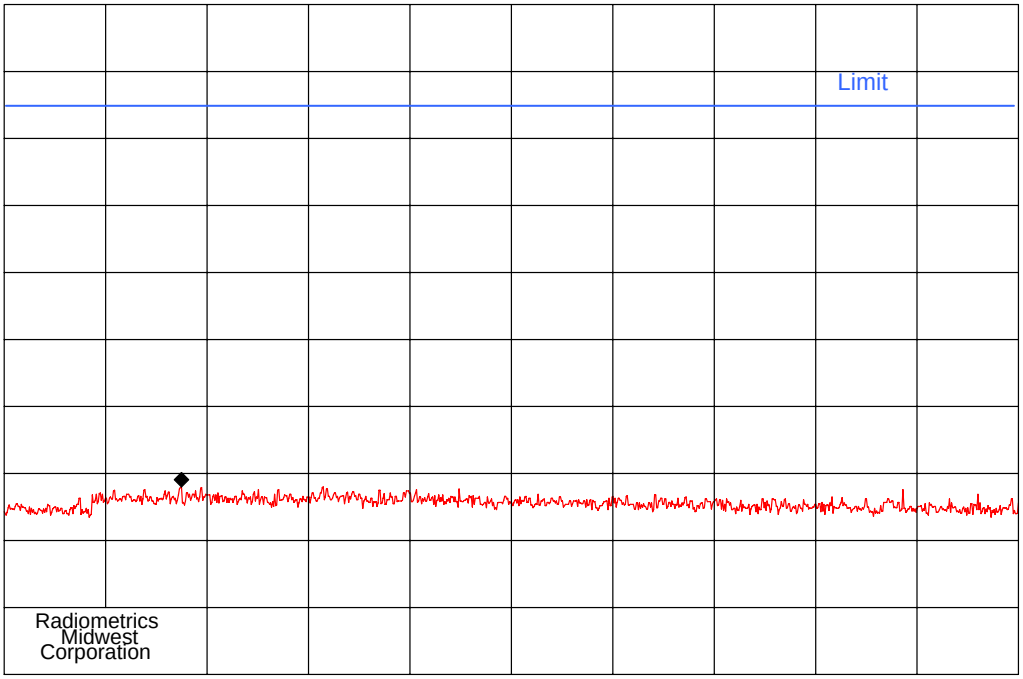
Company: Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 0.0 dBm
VBW 300 kHz
Time: 10:35
Date : 07-14-2009
STOP 25.00 GHz
ATTEN 10 dB
SWP 2.10 sec
Notes: Antenna Conducted Emissions, Ch 1; 802.11b

MKR 21.948 GHz -72.20 dBm



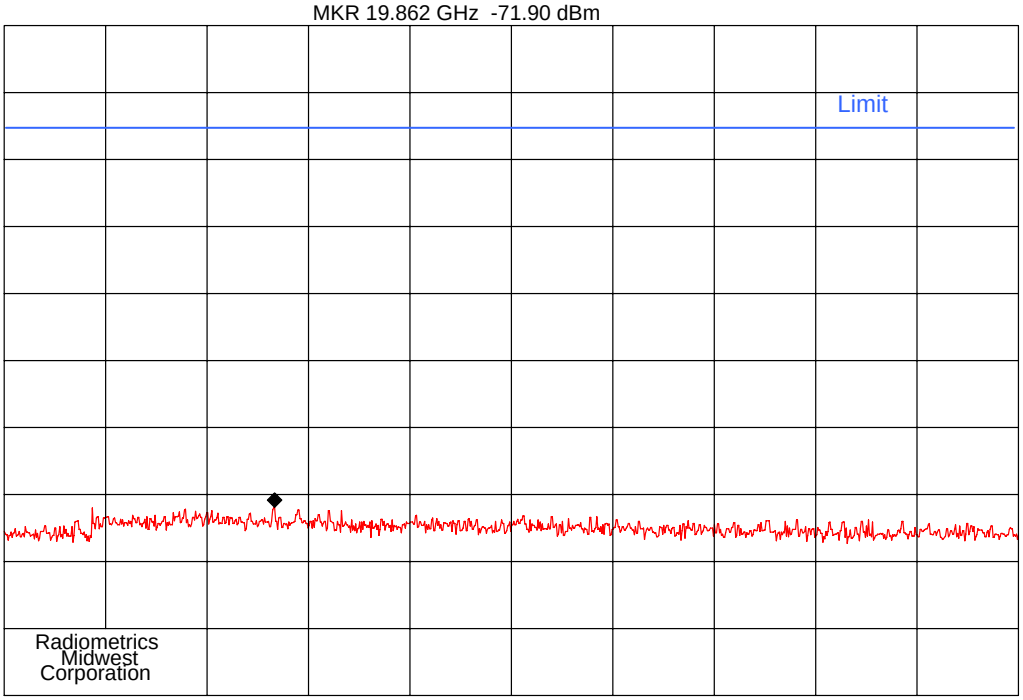
Company: Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 0.0 dBm
VBW 300 kHz
Time: 10:37
Date : 07-14-2009
STOP 25.00 GHz
ATTEN 10 dB
SWP 2.10 sec
Notes: Antenna Conducted Emissions, Ch 6; 802.11b

MKR 19.218 GHz -72.00 dBm



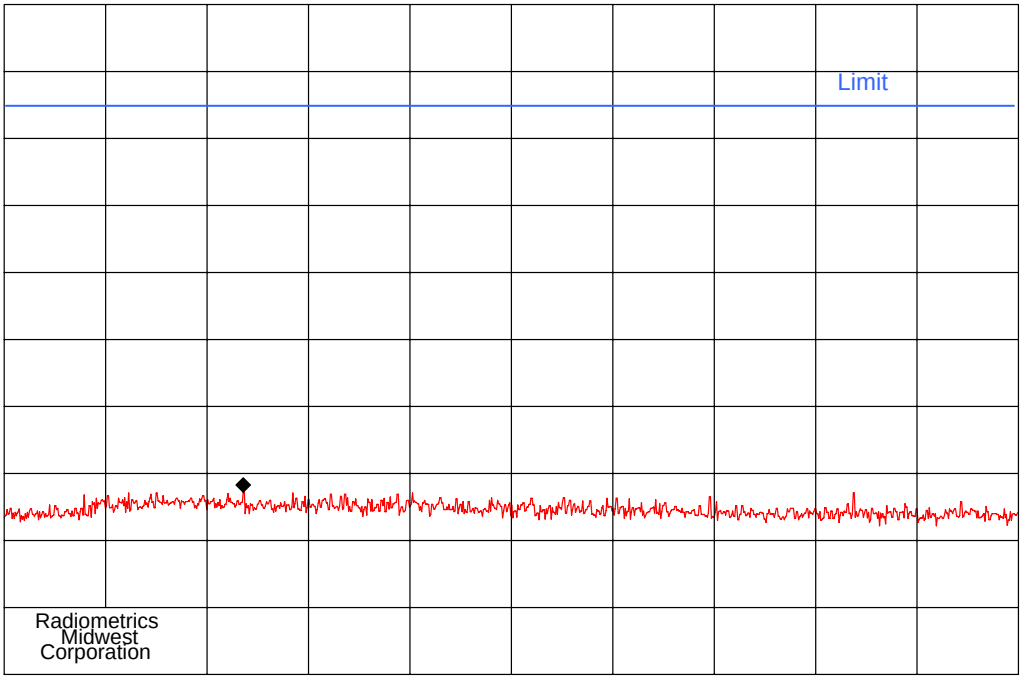
Company: Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 0.0 dBm
VBW 300 kHz
Time: 10:38
Date : 07-14-2009
STOP 25.00 GHz
ATTEN 10 dB
SWP 2.10 sec
Notes: Antenna Conducted Emissions, Ch 11; 802.11b

MKR 19.862 GHz -71.90 dBm



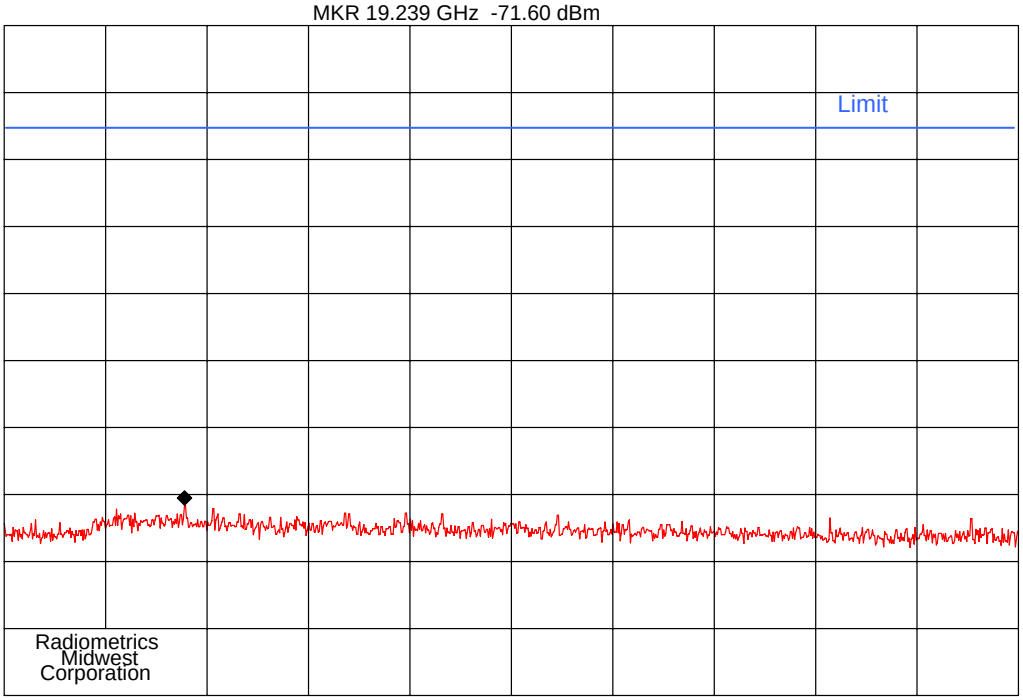
Company: Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 0.0 dBm
VBW 300 kHz
Time: 10:28
Date : 07-14-2009
STOP 25.00 GHz
ATTEN 10 dB
SWP 2.10 sec
Notes: Antenna Conducted Emissions, Ch 1; 802.11g

MKR 19.645 GHz -72.80 dBm



Company: Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 0.0 dBm
VBW 300 kHz
Time: 10:30
Date : 07-14-2009
STOP 25.00 GHz
ATTEN 10 dB
SWP 2.10 sec
Notes: Antenna Conducted Emissions, Ch 6; 802.11g

MKR 19.239 GHz -71.60 dBm



Company: Westell
START 18.00 GHz
RES BW 100 kHz
10 dB/
ITEM : A90-9100EM-10D
REF 0.0 dBm
VBW 300 kHz
Time: 10:32
Date : 07-14-2009
STOP 25.00 GHz
ATTEN 10 dB
SWP 2.10 sec
Notes: Antenna Conducted Emissions, Ch 11; 802.11g

10.7 Spurious Radiated Emissions (Restricted Band)

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

From 30 to 1000 MHz, an Anritsu spectrum analyzer and a preamplifier with a 10 dB attenuator connected to the input were used. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 25 GHz, an HP8566 spectrum analyzer was used with a preamplifier. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

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

Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

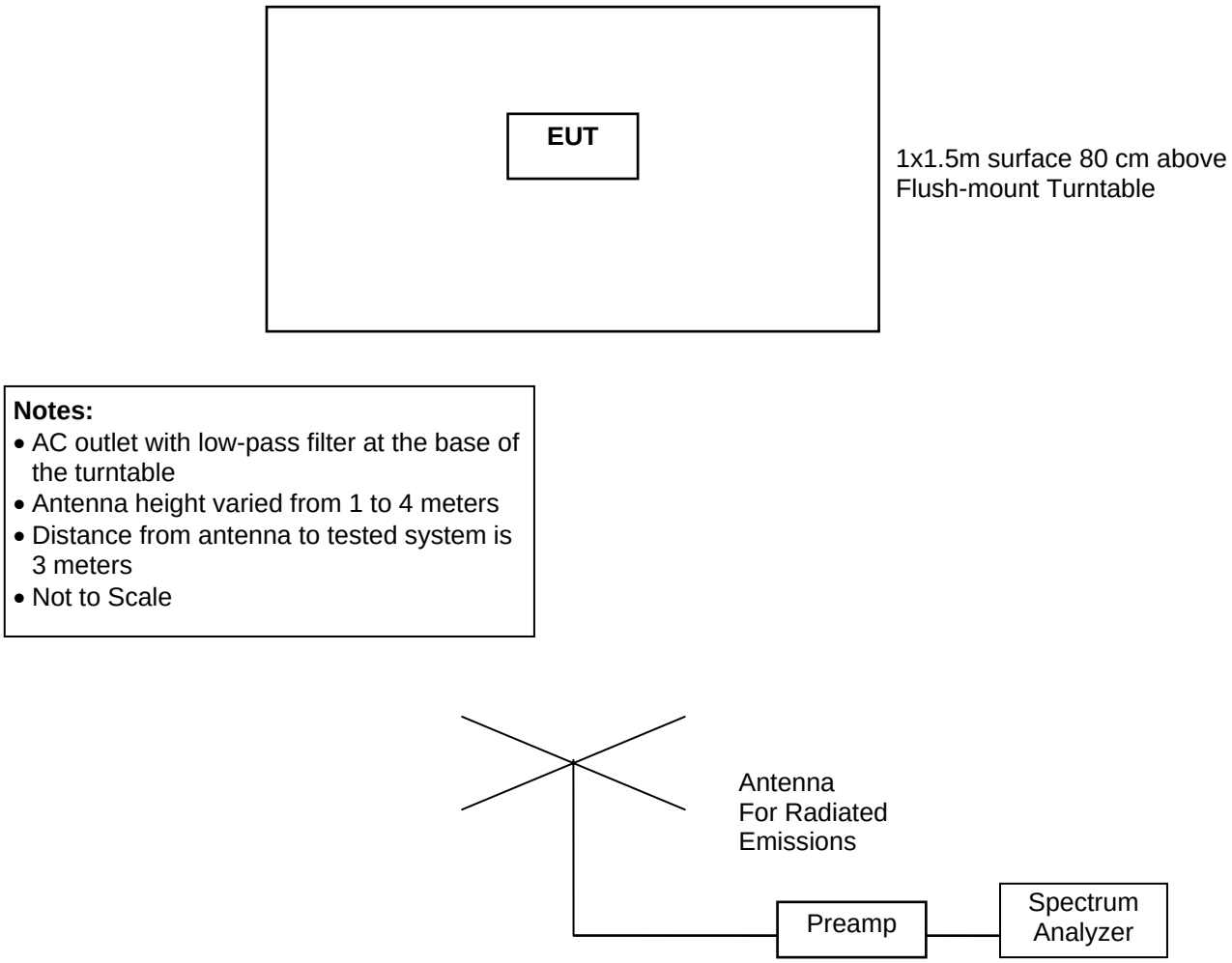
10.7.1 Radiated Emissions Field Strength Sample Calculation

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

FS = RA + AF + CF - AG

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

Figure 2. Drawing of Radiated Emissions Setup



10.7.2 Spurious Radiated Emissions Test Results (2 to 25 GHz)

The following spectrum analyzer settings were used.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW = 1 MHz for peak and 100 Hz for Average
Sweep = auto; Detector function = peak; Trace = max hold

Manufacturer	Westell, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	A90-9100VM10-20	Test Date	June 8, 2009
Serial Number	08B403196860	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain – Duty Cycle Factor + HP Filter Loss		

Emissions above 1 GHz

		802.11b		802.11g		802.11b		802.11g			EUT	Peak	Ave	Peak	Ave	Margin
hrm	Tx	Peak	Ave	Peak	Ave	Peak	Ave	Peak	Ave	Corr.	Emission	Tot. FS		Limit		Under
#	Freq	Vertical Polarization				Horizontal Polarization				Fact.	Freq MHz	dBuV/m		dBuV/m		Limit
1	2412	104.9	81.7	105.6	93.5	100.1	77.3	98.3	88.1	9.3	2412	114.9	102.8	125	125	10.1
be	2412	47.0	34.6	48.1	40.7	43.9	32.1	44.3	35.1	9.3	2390	57.4	50.0	74	54	4.0
2	2412	44.1	34.2	41.3	33.2	35.2	34.6	35.9	32.0	11.8	4824	55.9	46.4	74	54	7.6
3	2412	37.4	27.0	36.8	27.0	36.0	27.0	36.0	27.0	19.2	7236	56.6	46.2	94	74	27.8
1	2437	105.3	87.8	106.1	94.0	102.1	86.5	99.6	89.3	9.5	2437	115.6	103.5	125	125	9.4
2	2437	43.2	35.9	39.6	34.9	38.8	31.4	39.7	33.6	11.8	4874	55.0	47.7	74	54	6.3
3	2437	36.8	27.0	36.2	27.0	36.5	27.0	36.0	27.0	19.3	7311	56.1	46.3	74	54	7.7
1	2462	106.2	84.1	106.5	95.6	99.2	83.1	101.2	93.1	9.8	2462	116.3	105.4	125	125	8.7
be	2462	54.4	39.4	54.1	42.6	52.3	37.6	52.2	40.3	9.9	2484	58.3	46.5	74	54	7.5
2	2462	45.3	36.5	43.6	34.6	40.6	32.7	38.9	30.2	11.8	4924	57.1	48.3	74	54	5.7
3	2462	37.5	27.0	36.9	27.0	36.0	27.0	36.0	27.0	19.5	7386	57.0	46.5	74	54	7.5
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Notes on Columns:

Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Columns 3 to 10 are the uncorrected readings from the spectrum analyzer
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor + High pass filter (for harmonics only)
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit. Non restricted bands limits set to 94 dBuV/m. The fundamental was tested with a direct connect so there is no radiated emissions limit.
Column #16. Average Limit. Non restricted bands limits set to 74 dBuV/m. There is no fundamental average limit.
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

No other emissions were detected above 2 GHz.

Judgment: Passed by 4.0 dB

10.7.3 Radiated Emissions Below 2 GHz

Company	Westell, Inc.	Specification	FCC Part 15.247
Model	A90-9100VM10-20	Test Date	06/08/2009
Serial Number	08B403196860	Test Distance	3 Meters
Test Personnel	Joseph Strzelecki	Test Location	Chamber E
Notes	Corr. Factors = cable loss - preamp gain - distance factor.		
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal		
Notes	This is the worst case emissions from the different transmit frequencies		

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
30.0	33.7 P	17.8	H/44	-20.3	31.1	40.0	8.9
43.2	36.6 P	16.2	H/44	-20.0	32.8	40.0	7.2
62.4	37.3 P	10.2	H/44	-19.7	27.8	40.0	12.2
68.4	40.2 P	7.8	H/44	-19.6	28.4	40.0	11.6
92.4	30.5 P	8.3	H/44	-19.3	19.5	43.5	24.0
103.6	30.8 P	10.7	H/44	-19.2	22.3	43.5	21.2
132.4	36.3 P	13.9	H/44	-18.8	31.3	43.5	12.2
171.6	43.4 P	9.4	H/44	-18.6	34.1	43.5	9.4
178.4	42.7 P	9.3	H/44	-18.6	33.4	43.5	10.1
208.4	40.9 P	10.9	H/44	-18.3	33.5	43.5	10.0
228.8	33.7 P	11.7	H/44	-18.2	27.3	46.0	18.7
252.7	41.1 P	12.7	H/44	-17.9	35.9	46.0	10.1
268.4	45.2 P	13.4	H/44	-17.8	40.8	46.0	5.2
283.0	40.1 P	13.1	H/44	-17.7	35.5	46.0	10.5
400.0	35.0 P	15.8	H/44	-16.9	33.9	46.0	12.1
500.0	41.0 P	17.3	H/44	-16.2	42.1	46.0	3.9
550.0	31.4 P	18.4	H/44	-16.1	33.7	46.0	12.3
650.0	32.5 P	19.8	H/44	-15.4	36.9	46.0	9.1
800.0	33.2 P	21.7	H/44	-14.5	40.4	46.0	5.6
850.0	35.7 Q	21.8	H/44	-14.4	43.2	46.0	2.8
899.0	31.5 P	22.6	H/44	-14.1	40.0	46.0	6.0
1050.0	28.1 P	23.3	H/44	-13.4	38.1	54.0	15.9
1150.0	35.0 P	24.1	H/44	-13.1	46.0	54.0	8.0
1249.0	37.7 P	24.5	H/44	-12.7	49.5	54.0	4.5
1299.0	31.7 P	24.8	H/44	-12.5	44.0	54.0	10.0
1348.0	30.9 P	25.3	H/44	-12.3	43.9	54.0	10.1
1398.0	30.8 P	25.3	H/44	-12.2	43.9	54.0	10.1
1739.0	26.0 P	27.5	H/44	-10.0	43.5	54.0	10.5
42.0	37.9 P	14.4	V/44	-20.1	32.2	40.0	7.8
50.0	38.6 P	13.4	V/44	-19.9	32.1	40.0	7.9
62.4	46.5 P	9.2	V/44	-19.7	36.0	40.0	4.0
71.6	44.4 P	6.5	V/44	-19.6	31.3	40.0	8.7
94.4	43.6 P	9.9	V/44	-19.3	34.2	43.5	9.3
102.0	42.7 P	10.8	V/44	-19.2	34.2	43.5	9.3

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
142.4	32.9 P	11.2	V/44	-18.9	25.1	43.5	18.4
179.2	43.4 P	9.4	V/44	-18.6	34.2	43.5	9.3
199.2	36.7 P	10.1	V/44	-18.5	28.4	43.5	15.1
219.2	29.2 P	11.6	V/44	-18.2	22.6	46.0	23.4
250.4	37.6 P	12.5	V/44	-17.9	32.2	46.0	13.8
260.2	39.2 P	12.8	V/44	-17.8	34.2	46.0	11.8
262.0	37.7 P	13.0	V/44	-17.8	32.9	46.0	13.1
282.9	39.1 P	12.7	V/44	-17.7	34.1	46.0	11.9
288.7	36.2 P	12.8	V/44	-17.6	31.3	46.0	14.7
350.1	40.4 P	14.8	V/44	-17.3	38.0	46.0	8.0
375.1	37.8 P	15.7	V/44	-17.0	36.5	46.0	9.5
400.0	39.5 P	15.5	V/44	-16.9	38.1	46.0	7.9
449.9	37.0 P	16.4	V/44	-16.6	36.8	46.0	9.2
500.0	39.3 P	16.8	V/44	-16.2	39.9	46.0	6.1
550.0	33.3 P	17.6	V/44	-16.1	34.8	46.0	11.2
600.0	29.3 P	18.3	V/44	-15.8	31.8	46.0	14.2
701.0	29.3 P	19.6	V/44	-15.3	33.7	46.0	12.3
800.0	31.5 P	20.7	V/44	-14.5	37.7	46.0	8.3
849.0	29.6 P	20.9	V/44	-14.4	36.1	46.0	9.9
937.0	28.3 P	21.8	V/44	-13.9	36.2	46.0	9.8
1050.0	27.8 P	22.5	V/44	-13.4	37.0	54.0	17.0
1249.0	33.1 P	23.9	V/44	-12.7	44.3	54.0	9.7
1299.0	29.3 P	24.0	V/44	-12.5	40.8	54.0	13.2
1348.0	28.7 P	24.5	V/44	-12.3	40.9	54.0	13.1
1635.0	25.9 P	26.3	V/44	-10.8	41.4	54.0	12.6

Judgment: Passed by 2.8 dB