MEASUREMENT/TECHNICAL REPORT

WESTELL, INC.

Model A90-36R210

FCC ID: CH8AR210

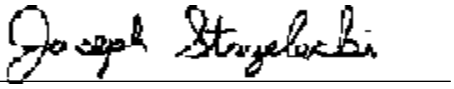
APPLICATION FOR CERTIFICATION

RF Emission Measurements Performed For Determination of Compliance with the US Code of Federal Regulations Title 47, Chapter I, FCC Part 15 Subpart B As Required for Certification for Unintentional Radiators

Issue Date: July 2, 1998

This report concerns: Original grant

Equipment type: Rate Adaptive, ADSL Modem
Transition Rules per 15.37 are not requested.

Report Prepared by: 

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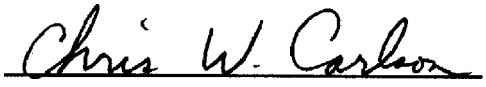
Application Approved by: 

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Table of Contents

1.0 General Information

1.1 Product Description

The Model A90-36R210 (referred to as the EUT in this report) is a Rate Adaptive, ADSL modem. The EUT has an external transformer power supply manufactured by Electro-Mech Co. for Westell as a Westell number 6024-08.

The EUT is a high speed digital modem. It connects to the Pubic Switched Telephone Network (PSTN), using Carrierless Amplitude and Phase modulation (CAP), and provides a 10BASE-T (ETHERNET) interface to a users personal computer.

1.2 Related Submittals

Westell is not submitting any other submittals related to the EUT.

1.4 Tested System Details

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system which have grants, are:

Model & Serial Number	FCC ID	Manufacturer & Description	Cable Descriptions
A90-36R210 (EUT) S/N: N/A	CH8AR210	Westell ADSL Modem	Unshielded DSL Cbl, 10 m Unshielded 10BT Cbl, 4 m Pwr Supply cord 2m from X-former to EUT
N10-EPXISA2W S/N: N/A	EJMN10-EPXISA2W	Intel Network Interface Card	Unshielded 10BT Cbl, 4 m
1782 S/N: 5334514144	GSS933001	Viewsonic Monitor	Shielded data cbl, 1.8 m 1.9 m Unshd PWR Cbl
P100PCI S/N 372698-002	KPV-M54TR1-MT	Micron Computer	Unshielded, 2 m Power Cord
RT101+ S/N 52652191	AQ6-MTN4XZ15	Micron Keyboard	2 m, Integral Data Cbl
NX-1001 S/N: 510010542390	B6DZ150L	Star Printer	Shielded data cable 1.8 m; w/ metal shells 1.9 m Unshd PWR Cbl
P/N: 92841 S/N: 00750774	C3KKMP1	Microsoft Mouse	2 m, Integral Data Cbl

1.5 Test Methodology

The test procedures used are in accordance with the ANSI document C63.4-1992, (July 17, 1992) "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.

1.6 Test Facility

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. Details of the site characteristics are on file with the FCC. Conducted emission measurements and preliminary radiated emission scans were performed in shielded enclosure “B” at Radiometrics' Romeoville, Illinois EMI test lab. These sites have been fully described in a report and accepted by the FCC in a letter dated October 1, 1996 (31040/SIT 1300F2).

Conducted emission measurements were performed using an Electrometrics Model FCC/VDE 50/2 Line Impedance Stabilization Network (LISN) as the pick-up device. This device is constructed in accordance with the circuit diagram provided in Figure 3 of ANSI document C63.4-1992.

1.7 Test Equipment

Radiated emission measurements 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.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidths of the spectrum analyzers are adjusted to the correct bandwidths as specified by the FCC Rules. The bandwidth used from 450 kHz to 30 MHz is 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. From 1 to 2 GHz a 1 MHz bandwidth is used. In order to increase the sensitivity of the spectrum analyzer, a preamplifier was used. The preamplifiers used had sufficient dynamic range that ensured that an overload condition was not present during the tests.

2.0 System Test Configuration

2.1 Test System and Justification

Wiring was consistent with manufacturer's recommendations. The EUT was connected to the Network interface card which was installed inside the host computer. The EUT was also connected to the support equipment (remotely located). The support equipment was located 13 m from the antenna for radiated emissions tests. It was located outside the shielded enclosure for the conducted emissions tests.

The host computer system had a VGA monitor with its integral data cable. A printer was connected to the parallel port. A mouse was connected to the serial port (COM1). A keyboard was attached to the system keyboard connector. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply.

2.1.1 Support Equipment

The support equipment simulated the central office equipment. The central office equipment is located at the phone company offices. The support equipment consisted of Dual Central office line card (ATU-C), Shelf and Multiplexor (NAIM).

2.2 EUT Exercise Software

The EUT was tested in normal communication during the tests. The EUT was continuously communicating with both the computer and the support equipment during the tests. The EUT was communicating to the Network interface card at the maximum rate.

The EUT exercise program used during radiated and conducted testing was contained on the hard drive of the host computer and the support equipment. The program sequentially exercises each system component in turn. The software continuously fills the screens with capitol H's. No data was sent to the keyboard and mouse during the tests. This program ran until it was manually stopped at the end of each test.

2.3 Special Accessories

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

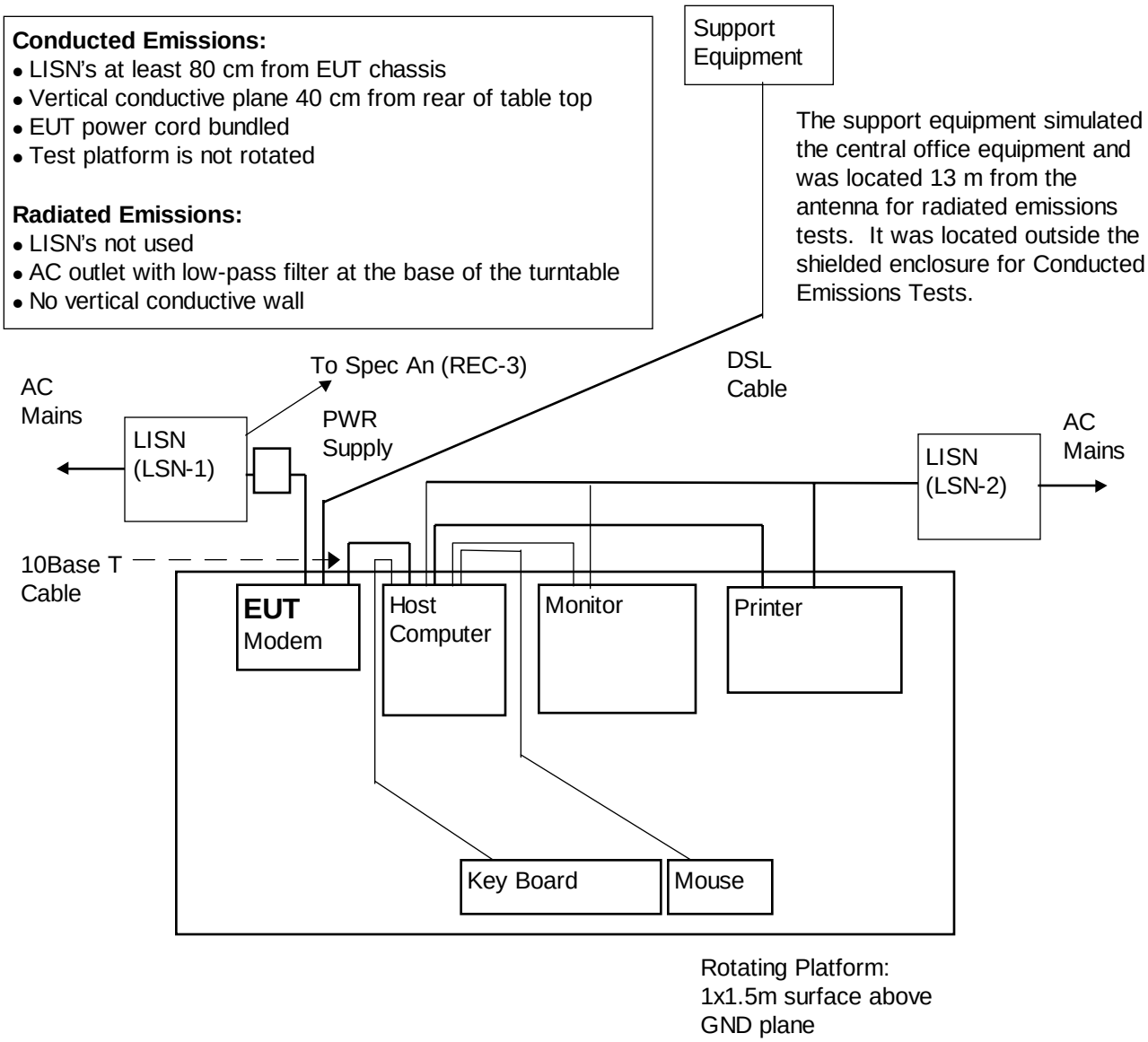
2.4 Equipment Modifications

No modifications to the EUT were made by Radiometrics Midwest Corp. prior to or during the testing in order to achieve compliance with Class B limits.

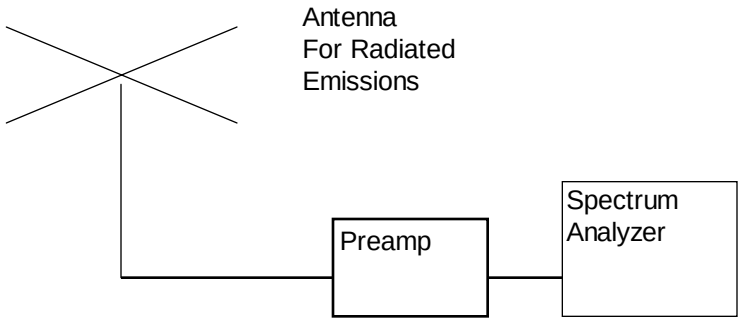
Figure 2.1 Configuration of Tested System

Conducted Emissions:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled
- Test platform is not rotated

Radiated Emissions:
- LISN's not used
- AC outlet with low-pass filter at the base of the turntable
- No vertical conductive wall



Notes:
- Not to Scale
- Antenna height varied 1-4 mtrs
- Distance from antenna to tested system is 3 meters
- LISN=Line Impedance Stabilization Network



3.0 Conducted Emission Data

The initial step in collecting conducted data is a spectrum analyzer peak 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 the host computer (with the EUT connected) power cord, after testing all modes of operation.

Model : A90-36R210
Test Date : 5/28/98

Line Tested	Freq. MHz	Meter* Reading dBuV	Cable Loss dB	Strength of Signal dBuV	Limit dBuV	Margin Under Limit dB
Neutral	0.47	32.3	0.1	32.4	48.0	15.6
Neutral	0.74	27.8	0.1	27.9	48.0	20.1
Neutral	8.25	27.6	0.2	27.8	48.0	20.2
AC Hot	0.49	30.3	0.1	30.4	48.0	17.6
AC Hot	2.20	28.3	0.1	28.4	48.0	19.6
AC Hot	11.77	28.0	0.2	28.2	48.0	19.8

* All reading are quasi-peak with a 9 kHz bandwidth and no video filter.

Changing the frequency of the transmitter did not affect the emissions listed above.
Judgment: Passed by 15.6 dB

Test Personnel: Chuck Grimes
EMC Engineer

4.0 Radiated Emissions Data

The following table lists the highest measured emission frequencies, and measured levels and the Class B limit. A sample calculation is given in paragraph 7.1. . The analyzer readings are quasi-peak with a 120 kHz bandwidth and no video filter.

Model : A90-36R210
Test Date : March 27, 1998
Test Distance : 3 Meters
Notes: Pol = Antenna Polarization; V = Vertical; H = Horizontal
BC = Biconical; LP = Log Periodic; DP = Dipole; P = Peak; Q = QP
Corr. Factors = cable loss - preamp gain

Freq. MHz	Analyzer Reading dBuV	Antenna Factor dB	Antenna Polarity/ Type	Correction Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
48.6	36.6 Q	12.8	V/BC	-17.3	32.1	40.0	7.9
82.7	30.6 P	8.8	V/BC	-16.1	23.2	40.0	16.8
68.1	36.4 Q	7.3	V/BC	-14.4	29.3	40.0	10.7
116.7	32.7 P	13.7	V/BC	-16.5	29.9	43.5	13.6
130.6	41.4 Q	10.9	V/DP	-16.4	35.9	43.5	7.6
140.0	31.7 P	13.2	V/BC	-16.3	28.5	43.5	15.0
150.0	31.0 P	14.3	V/BC	-16.3	29.0	43.5	14.5
165.8	29.5 P	16.2	V/BC	-16.1	29.5	43.5	14.0
233.4	34.0 P	11.3	V/LP	-15.7	29.7	46.0	16.3
280.0	30.4 P	14.6	V/LP	-15.7	29.3	46.0	16.7
291.7	31.1 P	14.4	V/LP	-15.6	29.9	46.0	16.1
320.0	33.1 P	14.3	V/LP	-15.5	31.9	46.0	14.1
391.6	30.4 P	15.3	V/LP	-15.3	30.4	46.0	15.6
481.4	31.6 P	17.4	V/LP	-15.0	34.0	46.0	12.0
64.7	30.2 P	8.7	H/BC	-14.4	24.5	40.0	15.5
68.0	32.4 P	7.3	H/BC	-14.4	25.3	40.0	14.7
80.9	33.8 P	8.3	H/BC	-16.0	26.2	40.0	13.8
83.3	36.9 P	9.0	H/BC	-16.2	29.7	40.0	10.3
120.0	30.7 P	13.6	H/BC	-16.5	27.8	43.5	15.7
130.6	38.6 Q	13.2	H/BC	-16.4	35.4	43.5	8.1
132.7	33.4 P	13.2	H/BC	-16.4	30.2	43.5	13.3
137.1	31.3 P	13.2	H/BC	-16.4	28.1	43.5	15.4
140.0	33.5 P	13.2	H/BC	-16.3	30.4	43.5	13.1
160.0	34.8 Q	15.6	H/BC	-16.2	34.2	43.5	9.3
165.8	29.1 P	16.2	H/BC	-16.1	29.2	43.5	14.3
170.0	27.6 P	16.6	H/BC	-16.0	28.2	43.5	15.3
300.0	37.8 Q	14.3	H/LP	-15.5	36.6	46.0	9.4
360.0	29.2 P	15.9	H/LP	-15.4	29.7	46.0	16.3
408.3	31.2 P	16.0	H/LP	-15.2	32.0	46.0	14.0
482.1	28.0 P	17.5	H/LP	-15.0	30.5	46.0	15.5

Judgment: Passed by 7.6 dB
No Emissions were detected from 490 to 2000 MHz within 15 dB of the limits.

Test Personnel: Chuck Grimes
EMC Engineer

4.1 Field Strength 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 with a sample calculation 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

Assume a receiver reading of 49.5 dBuV is obtained. The Antenna Factor of 8.1 and a Cable Factor of 1.7 is added. The Amplifier Gain of 23.3 dB is subtracted, giving a field strength of 36 dBuV/m. The 36 dBuV/m can be mathematically converted to its corresponding level in uV/m.

FS = 49.5 + 8.1 + 1.7 - 23.3 = 36.0 dBuV/m

Level in uV/m = Common Antilogarithm [(36 dBuV/m)/20] = 63.1 uV/m