

RADIO DISTURBANCE TEST REPORT

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SENSAR, INC.
NS-1USB NETWORK SECURITY CAMERA

USA CFR 47 PART 15 REQUIREMENTS

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PREFACE

This report documents product testing conducted to verify compliance of the specified test sample with applicable standards and requirements as identified herein. Test sample, test instrument configurations, test procedures and recorded data are generally described or attached in the appendices of this report. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

SUMMARY

The Sensar, Inc., NS-1USB Network Security Camera, as described in Section 2.1, was tested to the standards listed below, and found to have the following characteristics:

TEST	STANDARD	REQUIREMENT	RESULT
Radiated Emissions	FCC Class B	General Requirements 30 MHz - 1 GHz	Below Limit
Conducted Emissions	FCC Class B	General Requirements 450 kHz to 30 MHz	Below Limit

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1.0 Client Information

Client Name: Sensar, Inc.
121 Whittendale Drive
Moorestown, NJ 08057

Coordinator(s): Scott Demarest
Stu Levy
Jonathan Wells

1.1 Requested Service

- Measurement of radio disturbance characteristics of sample product to FCC Part 15, Class B.

1.2 Purpose of Test(s)

The purpose of testing was to verify compliance of the sample test item to regulatory and/or qualification requirements adhered to by the client for product sale, distribution and use.

2.0 Test Item**2.1 Test Sample Identification**

Reproduction Unit

Model No./Name: NS-1USB Network Security Camera
Serial Number 04
Manufacturer: Sensar, Inc.
Received by PCTC: 4/20/99

2.2 Description of the Test Item

2.2.1 General

The Model NS-1USB Network Security Camera is a security device that is used to verify the identity of individuals. The basis for this security device is the uniqueness of the iris. The NS-1USB Network Security Camera captures an image of the subject's eye and transmits this image over the Internet, via the host computer, where it will then be coded and verified with an image code from a previously stored and controlled enrolled image. The NS-1USB Network Security Camera interfaces with the host computer via USB (Universal Serial Bus) interface.

The NS-1USB Network Security Camera operates on DC power at 5 VDC which it receives from the host computer.

2.3 Test Item Classification

The test item has been defined as a Class B, Information Technology Equipment (ITE) because it has a "primary function of entry, storage, display, retrieval, transmission, processing, switching, or control of data," and has a rated supply voltage not more than 600 Volts. It is expected to be used or operated in a residential environment.

2.4 Test Sample Modifications

The following modifications were made in order to bring the test subject NS-1USB Network Security Camera into radiated emissions compliance.

1. An EMI (metal) shield was installed around the 2 boards (Camera Interface Board and ViCam Camera Board) located at the bottom of the test subject. Grounded the EMI shield to the metal shell of the USB connector on the Camera Interface Board.
2. Replaced the existing plastic housing (body) with a plastic housing having entire inner surface coated with copper based conductive paint (Acheson Colloids Part Number: SP-010). Grounded the conductive surface of the body (right side) to the EMI shield at the bottom of the test subject.
3. Shielded the illuminator cable (101314ASM-1) and grounded the shield at the EMI shield.
4. Replaced the metal screw in the bottom of the camera with a nylon screw.

2.5 Support Equipment

The following devices were installed in the test field to support the operation of the NS-1USB Network Security Camera, during testing.

Item	Manufacturer	Model Number	S/N
Computer	Dell Computer Co.	MM8	FXOH2
Keyboard	Micro Innovations	KB-9001RE	None
Mouse	IBM	M-S34	23-003197
Monitor	Hewlett Packard	D2840A	FI80677961
Printer	Hewlett Packard	722C	ES858142C8
AC Adapter	Hewlett Packard	C4557-60004	None
Serial Mouse	Logitech	M-CU15-9F	LTC61000426

The following devices were installed below the ground plane to support the operation of the test subject during the testing.

Item	Manufacturer	Model Number	S/N
Laptop PC	AMS Tech	TravelPro 2000	A6620240530
AC Adapter	Delta Electronics	ADP-38AB	B2646026871

Photos of the test item can be found in Appendix 3.

3.0 Applicable Requirements, Methods And Procedures

3.1 Applicable Requirements

The results of the measurement of the radio disturbance characteristics of the test sample described herein may be applied, and where appropriate provide a presumption of compliance to one or more of the following regulatory requirements or to other requirement at the discretion of the client, regulatory agencies, or other entities.

3.1.1 USA

- a) 47 CFR, part 15, Subpart B, "Unintentional Radiators, General Rules and Regulations."
- b) 47 CFR, part 15, Subpart C, "Intentional Radiators."

3.2 Basic Test Methods and Procedures

The applicable regulatory product family or generic standards require that radio disturbance/interference tests be performed in accordance with the following:

- C63.4, 1992 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in The Range of 9 kHz to 40 GHz."

A listing of test equipment used during this testing is provided in Appendix 1.

Detailed descriptions of the test procedures are provided in Appendix 2 of this report.

4.0 Deviations or Exclusions from The Requirements and Standards

None.

5.0 Operation of The Test Sample During Testing**5.1 Test Environment****5.1.1 Climatic Environment**

The following were the ambient conditions in the laboratory during testing:

Temperature: 22° C \pm 1° C
Relative Humidity 50% RH

5.1.2 Electrical Power

During the testing, the NS-1USB Network Security Camera received DC power at 5 VDC from the Dell model MM8 Computer. During the radiated disturbance testing, the MM8 computer was supplied input AC power at 230 VAC/50 Hz, single phase. Conducted disturbances were measured with supplying input AC power at 120 VAC/60 Hz.

5.2 Grounding

The test sample was not provided any earth ground connection.

5.3 Operating Mode

To facilitate EMI testing and to simulate normal operation, the NS-1USB Network Security Camera was operated continuously for image capturing mode using Sensar 'Testbed.Exe' software program. During this mode of operation, the NS-1USB captures the image of a known object which is then digitized and transmitted to the host computer. The host computer was operated remotely by a laptop PC via an Ethernet cable. The captured images were then displayed at the monitors of both the host computer as well the laptop PC.

5.4 Test Configurations

Refer to Appendix 3 for the photos of the test setup and drawings of EMI test configuration. The drawing shows the physical hardware layout used for the EMI tests along with I/O cables connection and AC power distribution. A description of any external interface cable present during the test is attached to this drawing for reference.

6.0 Summary of Test Results

6.1 Emission Tests

6.1.1 Radiated Emission Test (4/20/99)

30 to 1000 MHz

The table below shows the detected field strengths as measured from the test sample(s) over the frequency range from 30 MHz to 1000 MHz, at a distance of 3 meters compared to the maximum permissible FCC Class B limit at 3 meters. A detailed description of the procedures used in the performance of this test is provided in Appendix 2.

Freq [MHz]	Height (cm) Pol(H/V)	Angle (Deg)	Q-Peak Voltage [dBuV]	Corr' Factor	Field Strength [dBuV/m]	FCC Class B Limit @ 3m [dBuV/m]	Delta Limit [dB]	Result
70.001	100V	76	25.6	12.2	37.8	40	-2.2	Below limit
79.243	100V	70	27.7	11.5	39.2	40	-0.8	Below limit
100.005	100V	78	22.1	12.9	35	43.5	-8.5	Below limit
140.026	100V	275	24.5	13.1	37.6	43.5	-5.9	Below limit
159.983	100V	1	27	12.4	39.4	43.5	-4.1	Below limit
180.012	100V	344	17.8	13	30.8	43.5	-12.7	Below limit
210.002	100V	21	15.7	14.4	30.1	43.5	-13.4	Below limit
230.027	100V	181	18.4	15.4	33.8	46	-12.2	Below limit
300.017	100H	252	20.2	17.3	37.5	46	-8.5	Below limit

- Overall Result: All measured radiated emissions from the NS-1USB Network Security Camera are below the FCC Class B limits by a margin of 0.8 dB.

6.1.2 Conducted Emission Test (4/21/99)

The following tables show the conducted emissions measured on the AC power lines of the NS-1USB Network Security Camera compared to FCC Class B limits. Compliance testing to these limits was performed on the test sample. A detailed description of the procedures used in the performance of this test is provided in Appendix 2.

Frequency Range (MHz)	Limit (dBuV)	Comments	Results
0.45 - 30	48	None	Below limit

- MM8 Computer - Phase Line.

Peak found above 37 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
0.5259	37.7	Below limit
0.6962	38.1	Below limit
11.33	38.6	Below limit
11.76	40.6	Below limit
12.20	40.8	Below limit
23.77	38.2	Below limit

- MM8 Computer - Neutral Line.

Peak found above 37 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
0.5231	37.3	Below limit
0.6962	38.3	Below limit
0.7822	37.2	Below limit
1.658	38.0	Below limit
11.21	38.3	Below limit
11.82	41.2	Below limit
23.77	39.9	Below limit

- Overall Results: The MM8 Computer complied with the requirements of FCC Class B.

- D2840A Monitor– Phase Line.

Peak found above 37 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
0.9168	37.2	Below limit
1.019	37.3	Below limit
1.286	37.2	Below limit
1.342	38.1	Below limit
19.23	37.7	Below limit
19.96	37.7	Below limit
23.77	37.8	Below limit

- D2840A Monitor– Neutral Line.

Peak found above 37 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
0.9666	39.2	Below limit
1.025	39.1	Below limit
1.127	36.9	Below limit
1.240	37.0	Below limit
1.453	36.9	Below limit
19.23	37.4	Below limit
20.17	37.4	Below limit

- Overall Results: The D2840A Monitor complied with the requirements of FCC Class B.

- 722C Printer – Phase Line.

Peak found above 33 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
6.196	33.4	Below limit
10.86	36.0	Below limit
11.33	36.9	Below limit
15.24	40.0	Below limit
23.77	39.2	Below limit
27.13	38.2	Below limit

- 722C Printer – Neutral Line.

Peak found above 35 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
10.35	35.1	Below limit
11.15	36.3	Below limit
11.75	36.4	Below limit
20.71	39.0	Below limit
23.77	37.5	Below limit
27.56	37.2	Below limit

- Overall Results: The 722C Printer complied with the requirements of FCC Class B.

Appendix 1 - Test Equipment Listing

Radio Disturbance Test Equipment

<u>Equipment</u>	<u>Model</u>	<u>Manufacturer</u>	<u>ID No.</u>	<u>Last Cal Date</u>
QuasiPeak Adapter	85650A	Hewlett Packard	X717	2/9/99
QuasiPeak Adapter	85650A	Hewlett Packard	U182	3/12/99
Spectrum Analyzer Display	85662A	Hewlett Packard	X719	3/12/99
Spectrum Analyzer Display	85662A	Hewlett Packard	U181	2/9/99
Spectrum Analyzer	8568B	Hewlett Packard	X718	2/9/99
Spectrum Analyzer	8568B	Hewlett Packard	U180	3/12/99
RF Preselector	85685A	Hewlett Packard	W927	2/9/99
Manual Receiver 9 kHz-30 MHz	ESH2	Polarad	U964	12/28/98
Manual Receiver 20 - 1000 MHz	ESV	Polarad	U965	6/8/98
Antenna 30 - 1500 MHz	LPB2520A	ARA	B926	4/30/98
LISN	MN2053	Chase	U775	8/18/98
LISN	MN2053	Chase	U775	8/18/98

Appendix 2 - Description Of Test Facility and Procedures

A.2.0 Description of Test Methods**A.2.1 Emissions Testing****A.2.1.1 Radiated Emissions Test****30MHz to 1GHz**

The test site is an all weather, open field measurement facility defined by an elliptical area of 3258 square meters, which is free of reflective metallic objects and extraneous electromagnetic signals. A non-metallic A-Frame enclosure covers 172 square meters of the ellipse. This enclosure contains a ground level 5 meter diameter turntable, capable of rotating equipment through a complete 360 degrees, and a 3 meter and 10 meter test range with remotely controlled antennae masts. The floor of the A-Frame and surface of the turntable are covered with a flat metal continuous ground plane. The ground plane extends outside the A-Frame to a distance of 35.6 meters from the center of the turntable. The width of the extension is 2.4 meters.

The ground plane is partially covered with protective insulating material. A cellar located beneath the ground level of the A-Frame structure houses personnel and instrumentation for remote control of the antennae, the turntable, and other equipment above ground level. Reference the attached drawing for a view of the test facility. The test site complies with the Attenuation Measurements specified in ANSI C63.4 - 1992, and is registered with FCC, VCCI, NEMKO and EZU.

For electric field radiated emissions, the test sample and support peripherals or devices required to facilitate test sample operation were positioned either directly on the turntable surface or on a wooden table 80 cm. in height, depending on the size of the sample. Hardware not needed in the test field such as remote terminals or non standard exercisers, were placed in the basement below the turntable.

Initial measurements, for the purpose of identifying suspect emissions from the equipment under test, were performed by dividing the test frequency range into the following twenty bands:

1)	30 - 40 MHz	8)	108 - 148 MHz	15)	570 - 670 MHz
2)	40 - 50 MHz	9)	148 - 165 MHz	16)	670 - 770 MHz
3)	50 - 88 MHz	10)	165 - 200 MHz	17)	770 - 855 MHz
4)	88 - 93 MHz	11)	200 - 300 MHz	18)	855 - 875 MHz
5)	93 - 98 MHz	12)	300 - 450 MHz	19)	875 - 892 MHz
6)	98 - 103 MHz	13)	450 - 470 MHz	20)	892 - 1000 MHz
7)	103 - 108 MHz	14)	470 - 570 MHz		

Each of these bands was monitored on a spectrum analyzer display while the turntable was initially positioned at the reference 0 degree point. A mast mounted broadband antenna was located at a distance of 10 meters from the periphery of the test sample(s). The antenna was set to 1 meter height, for the vertical polarity and 2.5 meters height, for horizontal polarity for these suspect emission scans. All emissions with amplitudes 8 dB or less below the appropriate regulatory limit were identified and saved for later source identification and investigation. This initial suspect identification procedure was repeated for turntable positions of 90, 180 and 270 degrees.

The source of questionable emissions was verified by powering off the test sample(s). Those emissions remaining were removed from the suspect list. Valid suspect emissions were then maximized through cable manipulation. The highest six signals or all within 4 dB of the limit, identified during this initial investigation, were then maximized by rotating the turntable through a complete 360 degrees of azimuth and raising the antenna from 1 to 4 meters of elevation. When the test sample(s) azimuth, antenna height and polarization that produced the maximum indication were found, the emission amplitude and frequency were remeasured to obtain maximum peak and quasi-peak field strength. The frequencies and amplitudes of RFI emissions are recorded in this report in units derived as follows:

$$\begin{aligned} \text{Field Strength (dBuV/m)} = & \text{ meter reading (dBuV)} \\ & + \text{antenna factor (dB/m)} \\ & + \text{Cable Loss (dB)} \end{aligned}$$

A.2.1.2 Conducted Emissions Test, 450 kHz To 30 MHz

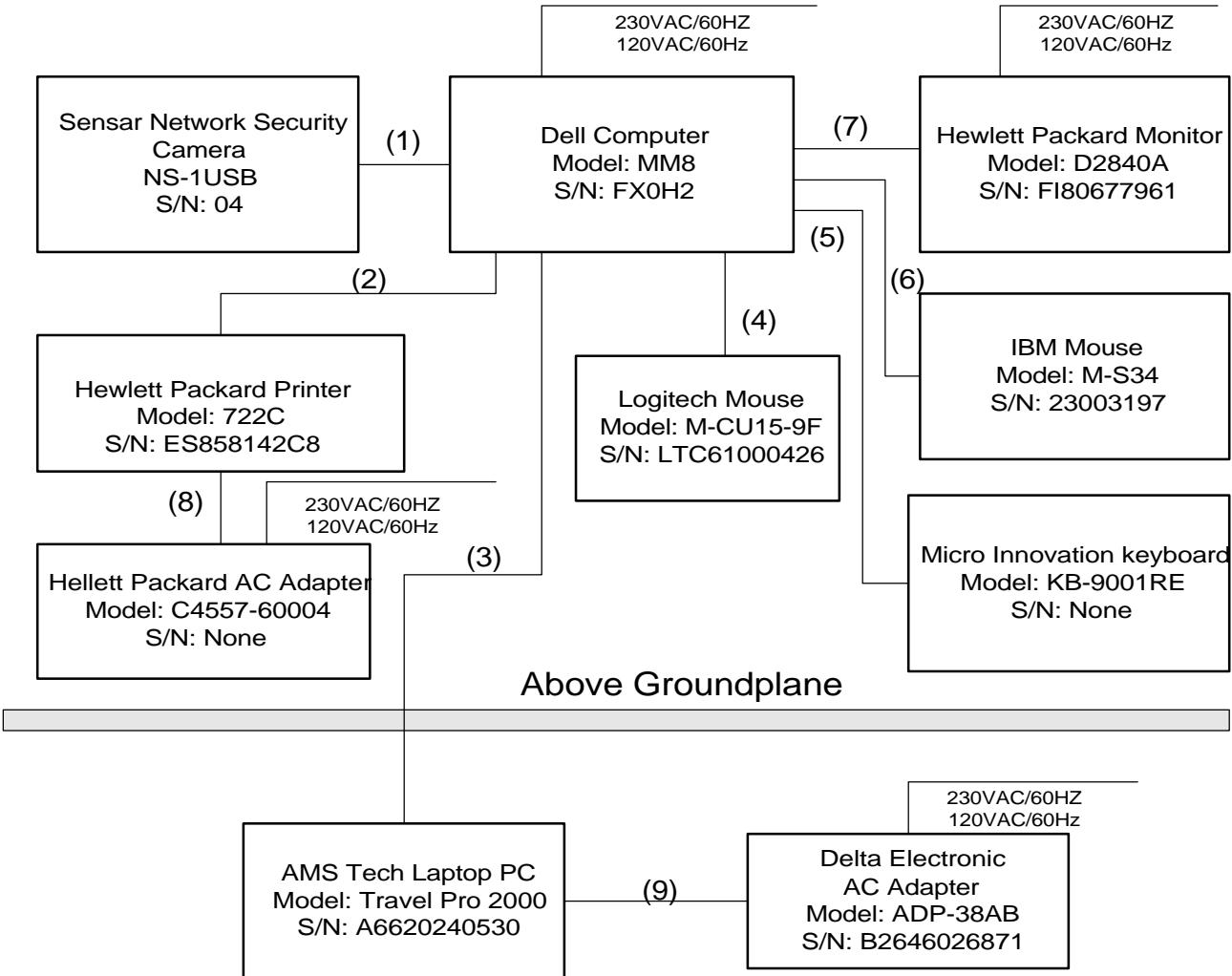
Peak amplitude terminal voltage emissions at the power line input to the test sample(s) were measured with a spectrum analyzer, using a peak detector and the appropriate CISPR bandwidth, connected to the RF output of a 50 Ohm, 50 microhenry Line Impedance Stabilization Network (LISN) installed in each power line. Measurements were made over the frequency range from 450 kHz to 30 MHz while the test sample(s) was operating as described in paragraph 5.3.

The significant amplitudes of emissions measured on the AC power lines of the test sample(s) are recorded in this report in units derived as follows:

$$\text{Peak Emission (dBuV)} = \text{meter reading (dBuV)} + \text{LISN factor (dB)}$$

Note: For speed and convenience, a spectrum analyzer employing a peak detector was used as the measuring receiver to sweep through and record the spectrum. As a tool to judge compliance of the emissions, the peak detector sweep is displayed and graphed against the appropriate average limit. This type of measurement is valid given that the peak reading will always be greater than or equal to the average or quasi-peak reading. Peak emissions recorded with the spectrum analyzer that exceed the average limit, or are found to be within 2 dB of the average limit are re-measured using a manually tuned receiver with the detector function first set to quasi-peak and then to average.

Appendix 3 - Test Sample Configuration Drawings/Photographs



Cable:

1. USB Interface cable, 10', shielded
2. Parallel printer cable, 6', shielded
3. 10 BaseT Ethernet cable, 50', unshielded
4. Serial mouse cable, 6', shielded
5. Keyboard cable, 5.5', shielded
6. P/S2 mouse cable, 6', shielded
7. Monitor video cable, 6', shielded
8. DC cable to printer, 6.5', unshielded
9. DC cable to laptop PC, 6', unshielded

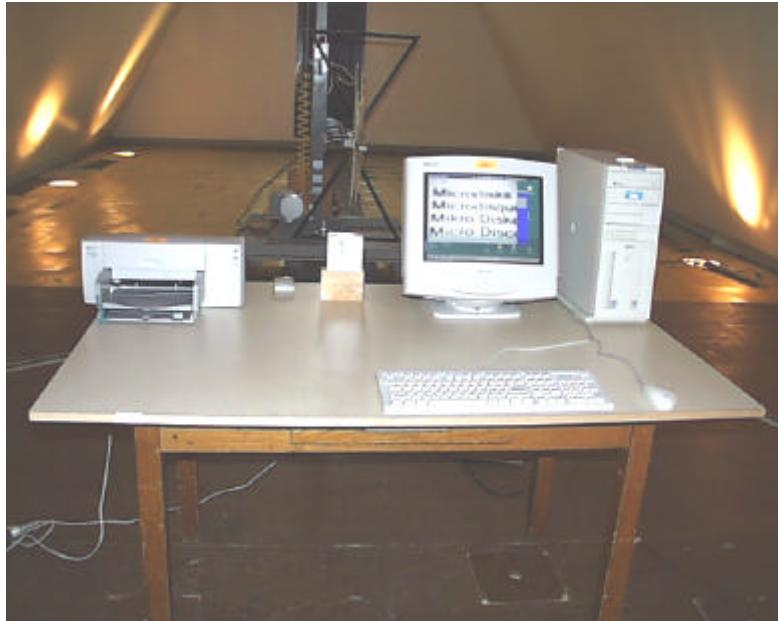
Block Diagram For NS-1USB Network Security Camera - EMI Testing



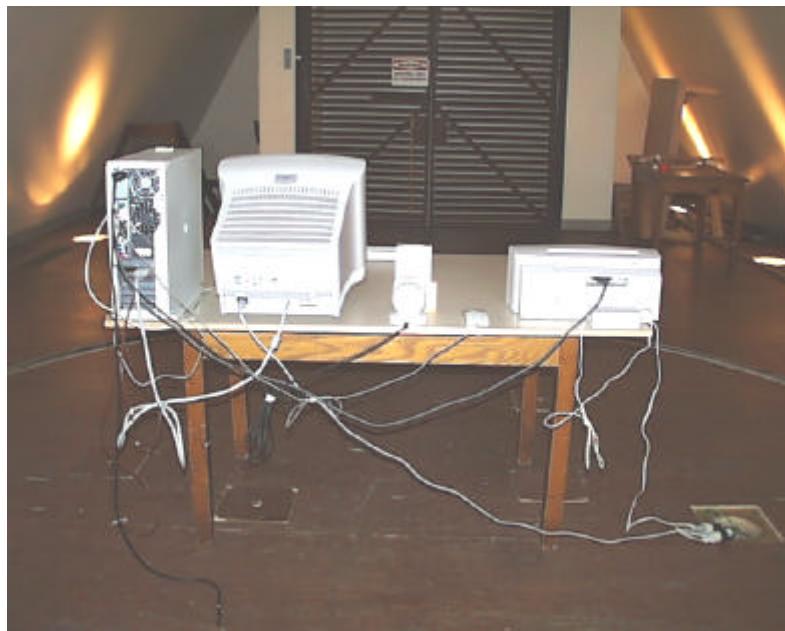
NS-1USB Front View



NS-1USB Rear View



Front View

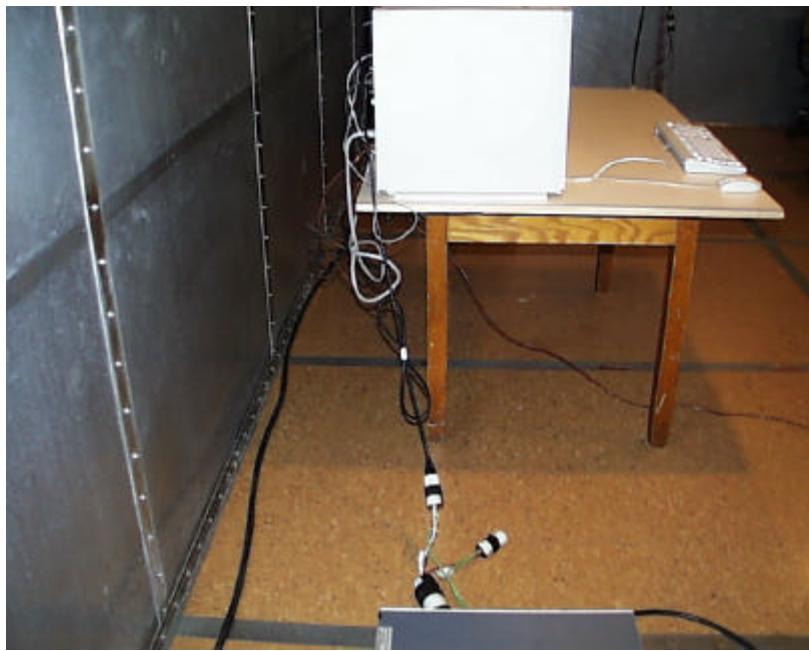


Rear View

NS-1USB Network Security Camera - Radiated EMI Test Setup



Front View



Side View

NS-1USB Network Security Camera - Conducted EMI Test Setup