

PCTC

Product Compliance Test Center

2476 Swedesford Road, Malvern, PA 19355

RADIO DISTURBANCE TEST REPORT

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Project No. 449

FCC ID: OKSNS2PAR

SENSAR, INC.

NS-2PAR NETWORK SECURITY CAMERA

USA CFR 47 PART 15 REQUIREMENTS

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Sponsor: Sensar, Inc.
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The results described in this report relate only to the item(s) tested.
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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 Sensor, Inc., NS-2PAR 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 Administrative Information

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

Coordinator(s): Scott Demarest
 Stu Levy
 Jonathan Wells

PCTC Test Personnel: Dipak Patel
 Joseph Wagner

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**

The test sample is a preproduction unit.

Model No./Name: NS-2PAR Network Security Camera

Serial Number: 02

Manufacturer: Sensor, Inc.

Received by PCTC: 6/8/99

2.2 Condition of the Test Sample

The visual examination of the Sensor NS-2PAR Network Security Camera was carried out for test subject identity and condition. No evidence of physical damages was noticed. The test item condition was acceptable for the performance of the requested test services. One of the coordinators from Sensor was present during the entire test duration for monitoring the test item operation.

2.3 Description of the Test Subject

The Model NS-2PAR 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 System captures an image of the subject's eye and transmits this image over the Internet where it will then be coded and verified with an image code from a previously stored and controlled enrolled image. The NS-2PAR Network Security Camera interfaces with the host computer via parallel interface.

The NS-2PAR Network Security Camera operates on DC power at voltage 5 VDC which it receives from the host computer. The ViCam camera board has a 20Mhz oscillator on it. This is used to drive the processor and generate the vertical and horizontal sync clock pulses for the CCD (Charged Coupled Device) sensor. The path for the sync signals to CCD is from the camera board through the interface board to the sensor board. Data from the sensor board returns to the camera board via the same path.

2.4 Network Security Camera Versions

Sensar manufactures two versions of the Network Security Camera: (1) USB Version (Sensor model NS-1USB), and (2) Parallel Port Version (Sensor model NS-2PAR). Both models have the same housing. The NS-1USB interfaces with the host computer via Universal Serial Bus (USB) while the NS-2PAR interfaces with the host computer via parallel interface. Thus the operating difference between these two models is the format of the data sent from the camera to the host computer. The NS-1USB uses a two wire serial communication format. All commands and data between the NS-1USB camera and the computer is in the form of a serial bit stream. The NS-2PAR uses an 8-bit wide communication format. All commands and data between the camera and computer is in the form of an 8-bit wide word with clock and load.

The following table identifies their major hardware differences:

<u>Part Description</u>	<u>NS-1USB</u>	<u>NS-2PAR</u>
Camera Interface PWB	101174ASM-1	101338ASM-1
ViCam Camera PWB	101204VEN	101321ALT-1
Camera Interface Cable Assembly	101257VEN	101485ASM-1

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

There were no deviations or exclusions of the requirements.

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-2PAR 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-2PAR Network Security Camera was operated continuously for image capturing mode using Sensor 'Testbed.Exe' software program. During this mode of operation, the NS-2PAR 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.

5.4.1 Test Subject Details

The major hardware of the test item is identified below.

Part Description	Sensar Part Number
Body, Left Hand	101205DET-1
Body, Right Hand	101186DET-1
Window	101177DET-1
NS NSOP Assembly*	101187ASM-1
Camera Interface PWB	101338ASM-1
ViCam Camera PWB	101321ALT-1
Camera Interface Cable Assembly**	101485ASM-1

*: Includes Illuminator Pulse Board

** : Includes a ferrite block (Steward P/N: 28A2025-000) with two wraps of interface cable through it

5.4.2 Support Equipment

The following devices were installed adjacent to the test subject to support the operation of the test subject during the testing.

Item	Manufacturer	Model Number	S/N
Computer	Dell Computer Co.	MM8	FXOH2
Keyboard	Micro Innovations	KB-9001RE	198100262360
Mouse	IBM	M-S34	23-003197
Monitor	Hewlett Packard	D2840A	FI80677961
Printer	Hewlett Packard	CS871A	ES858142C8
AC Adapter	Hewlett Packard	C4557-60004	None
Serial Mouse	Logitech	MCU15-9F	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
Computer	Dell Computer Co.	MM8	FXOH2
AC Adapter	Delta Electronics	ADP-38AB	B2646026871

5.4.3 Rationale for The Chosen Test Configuration

The hardware configurations of the test item for the testing as assembled represents the deliverable item.

5.5 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.

5.6 Test Sample Modifications

There were no modifications made during EMI testing.

6.0 Summary of Test Results

6.1 Emission Tests

6.1.1 Radiated Emission Test (6/8/99)

30 to 1000 MHz

The table below shows eight 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 [dB/m]	Field Strength [dBuV/m]	FCC Class B Limit @ 3m [dBuV/m]	Delta Limit [dB]	Result
78.765	212H	296	28.7	7.9	36.6	40.00	-3.4	Below limit
159.961	117V	146	17.3	17.3	34.6	43.50	-8.9	Below limit
179.99	105V	208	13.9	17	30.9	43.50	-12.6	Below limit
190.011	101V	53	14.6	18	32.6	43.50	-10.9	Below limit
200.038	103V	112	14.5	18.9	33.4	43.50	-10.1	Below limit
229.993	116V	341	8.4	19.5	27.9	46.00	-18.1	Below limit
400.016	112V	21	16.8	21.1	37.9	46.00	-8.1	Below limit
600.019	127V	136	15.3	24.8	40.1	46.00	-5.9	Below limit

- Overall Result: All measured radiated emissions from the NS-2PAR Network Security Camera are below the FCC Class B limits by a margin of 3.4 dB.

6.1.2 Conducted Emission Test (6/9/99)

The following tables show the conducted emissions measured on the AC power lines 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 41 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
4.100	41.0	Below limit
4.166	41.2	Below limit
10.41	44.7	Below limit
10.80	45.4	Below limit
10.92	45.1	Below limit
11.39	43.3	Below limit

- MM8 Computer - Neutral Line.

Peak found above 39 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
9.313	39.0	Below limit
9.924	40.0	Below limit
10.19	43.2	Below limit
10.80	46.0	Below limit
13.78	39.1	Below limit
23.77	40.3	Below limit

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

- D2840A Monitor– Phase Line.

Peak found above 38 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
0.540	38.7	Below limit
0.590	39.3	Below limit
0.966	41.5	Below limit
1.025	43.1	Below limit
1.127	38.8	Below limit
1.342	38.6	Below limit

- D2840A Monitor– Neutral Line.

Peak found above 38 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
0.483	38.6	Below limit
0.590	38.7	Below limit
0.966	39.5	Below limit
1.025	41.4	Below limit
1.233	38.8	Below limit
1.393	39.4	Below limit
1.556	38.7	Below limit

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

- 722C Printer – Phase Line.

Peak found above 36 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
9.022	37.1	Below limit
9.167	36.6	Below limit
9.412	37.0	Below limit
9.614	36.6	Below limit
10.35	37.8	Below limit
15.16	37.9	Below limit
23.52	44.5	Below limit

- 722C Printer – Neutral Line.

Peak found above 35 dBuV

Freq. (MHz)	Peak Amplitude (dBuV)	Result
9.215	36.4	Below limit
9.665	35.9	Below limit
10.41	37.5	Below limit
14.60	40.0	Below limit
23.64	41.7	Below limit
27.13	39.9	Below limit
28.60	35.6	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
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	Y0312	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	VHA9103	Schwarzbeck	U752	3/12/99
Antenna	LP9107	Schwarzbeck	U751	3/12/99
LISN	8121	Schwarzbeck	Y0691	2/6/99
LISN	8121	Schwarzbeck	U774	1/12/99

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 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 3 or 10 meters (as appropriate) 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:

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

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

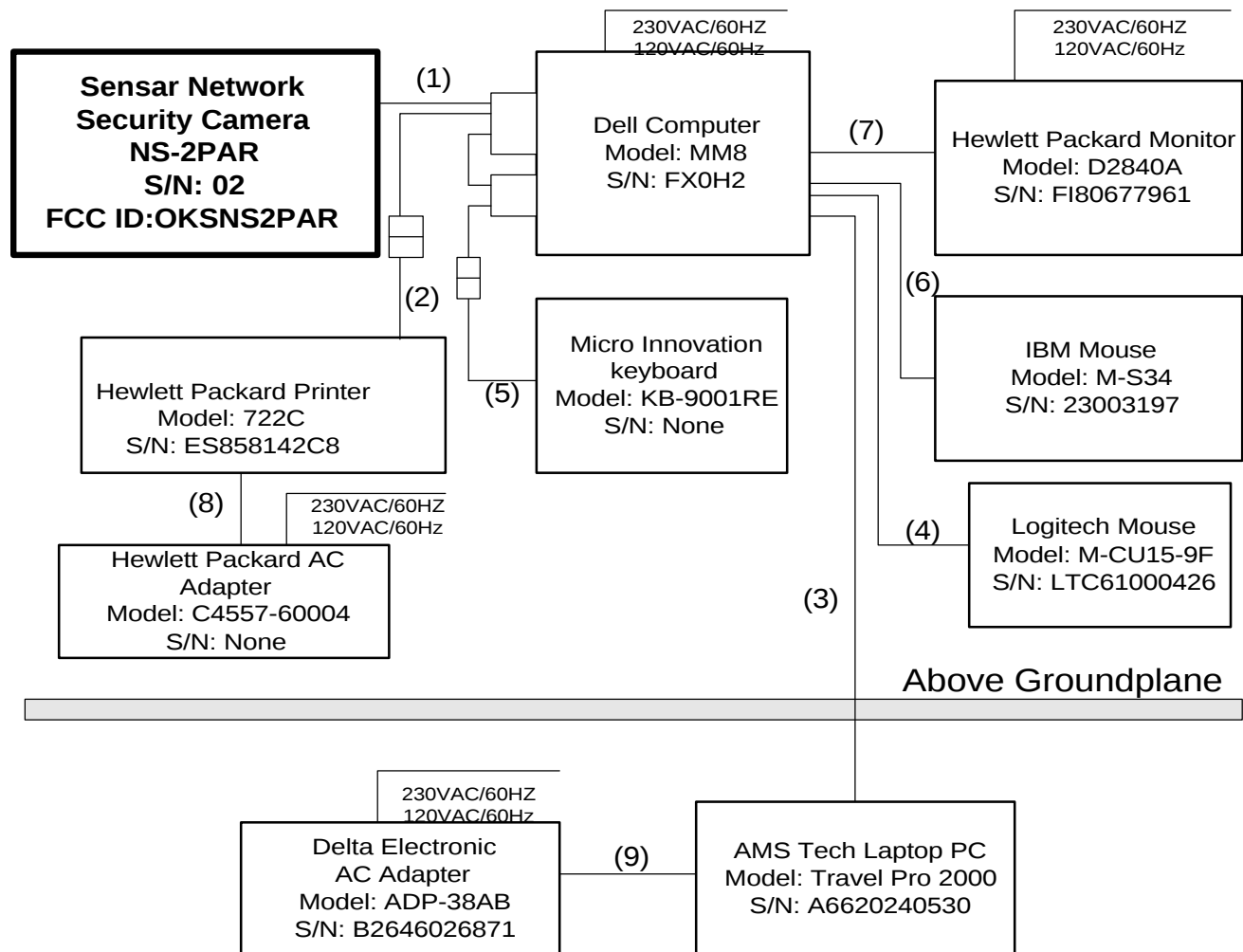
Peak amplitude terminal voltage emissions at the power line input to the test sample(s) were measured with a spectrum analyzer, using a peak detector and the appropriate CISPR bandwidth, connected to the RF output of a 50 Ohm, 50 microhenry Line Impedance Stabilization Network (LISN) installed in each 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.

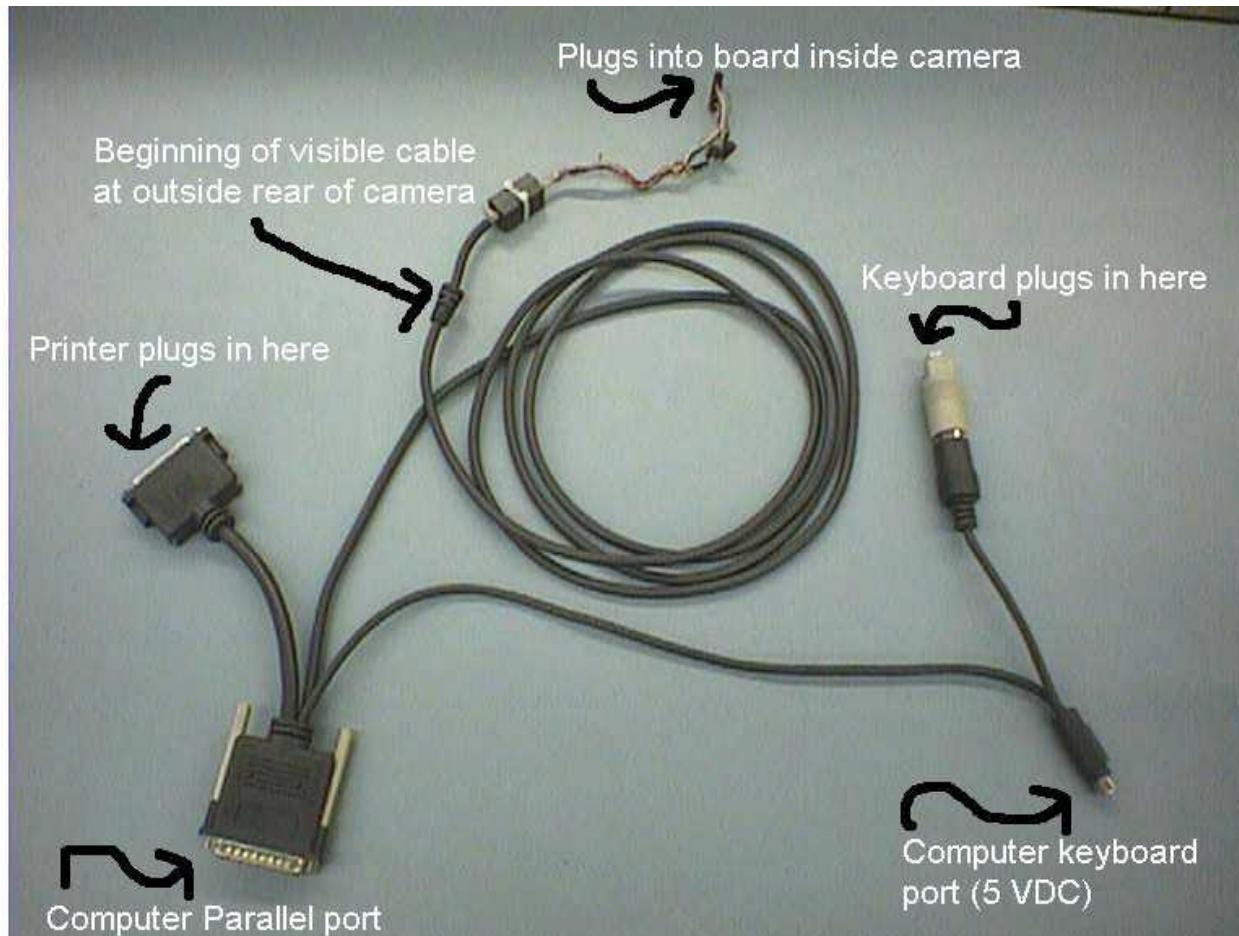
Appendix 3 - Test Sample Configuration Drawings/Photographs



Cable:

1. Sensar P/N: 101485ASM-1, Parallel interface cable, 99", shielded (see attached photo)
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-2PAR Network Security Camera - EMI Testing



Parallel Interface Cable
(Sensar P/N: 101485ASM-1)



NS-2PAR Front View



NS-2PAR Rear View



Front View



Rear View

NS-2PAR Network Security Camera - Radiated EMI Test Setup



Front View



Side View