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**PCTC**
**Product Compliance Test Center**
**2476 Swedesford Road, Malvern, PA 19355**

# ELECTROMAGNETIC INTERFERENCE TEST REPORT

**Doc. 20021009R/Project No. 804**

**TEST STANDARD - USA CFR 47 PART 15**

**STRATA PX W/TR4024/22 CONTROL BOARD**
**ELECTRONIC ARTICLE SURVEILANCE**
**DETECTION SYSTEM**
**FCC ID: DO4STRATAPX24-22**

**CHECKPOINT SYSTEMS, INC.**
**THOROFARE, NJ**

**Test Dates: 14 August to 18 September 2002**
**Issue: October 15, 2002**

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ACCREDITED
Cert. No.: 1028.01

AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

## PREFACE

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. EUT, 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 Checkpoint Systems, Inc., Strata PX w/TR4024/22 Control Board as described in Section 2.1, was tested to the standards listed below, and found to have the following characteristics:

| TEST | STANDARD | Frequency Range | RESULT |
|---|---|---|---|
| Radiated Emissions Intentional Radiator, Fundamental | FCC Part 15.223 | 1.705 to 10 MHz | Below Max. Permissible Limit |
| Radiated Emissions Intentional Radiator, Harmonics | FCC Part 15.209 | 10 MHz to 1 GHz | Below Max. Permissible Limit |
| Radiated Emissions Unintentional Radiator (Related to Digital Circuitry) | FCC Part 15.109 | 30 MHz to 1 GHz | Below Max. Permissible Limit |
| Conducted Emissions Unintentional & Intentional Radiators | FCC Part 15.207 | 450 kHz to 30 MHz | Below Max. Permissible Limit |

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## 1.0 Client Information

| | |
|---|---|
| Client Name: | Checkpoint Systems, Inc.<br>101 Wolf Drive<br>Thorofare, NJ 08086 |
| Coordinators: | Gregory Sleet, Nimesh Shah |
| PCTC Test Personnel: | Daniel J. Mis, Itamar Gonan |

### 1.1 Requested Service

- Measurement of radio disturbance characteristics of sample product to FCC Part 15 requirements for an intentional radiator with fundamental operating in the frequency band of 1.704 MHz to 10 MHz.

### 1.2 Purpose of Test(s)

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

## 2.0 Description of the Equipment Under Test (EUT)

### 2.1 Equipment Family Description

#### 2.1.1 General

The Checkpoint Systems, Inc., Strata PX, with TR4024/22 control electronics, is a pulse-listen EAS system, which consists of three main components, the antenna, electronics, and the power supply.

The Strata system is a transceiver design using both a 3-loop, 2-loop, and a 1-loop antenna design. The Strata alternates between using the 2-loop antenna and the 3-loop antenna. The 1-loop antenna is used as a shield that is tied to ground. This technique provides the system with different views of the detection field allowing the system to improve detection by minimizing the holes typically found at the crossbars of typical swept antennas.

The TR4024/22 is the electronics PCB component of a pulse-listen Electronic Article Surveillance (EAS) detection system, which utilizes targets that are applied to merchandise. These targets resonate in the region of 8.2MHz. When an article of merchandise is purchased, the target is deactivated which causes it to no longer resonate. The pulse-listen EAS system typically monitors an area 3 feet on either side of the antenna in the 7.6MHz to 8.7MHz band, and triggers an alarm when a non-deactivated target is detected. The TR4024/22 electronics PCB consists of two class D HF transmitters, a synchronous I and Q receiver, an RF selector switch, a DDS, and a DSP-based computer used to detect the presence of the target. All control signals, interface signals and off-board communications are generated and controlled by a digital logic subsystem consisting of a dedicated communications microprocessor and a FPGA.

The external power supply is a linear type 24VDC 4.0 Amp design.

### 2.1.2 Detailed Description

#### 2.1.2.1 Direct Digital Synthesizer (DDS) Operation

The Direct Digital Synthesizer (DDS) generates a sequence of 16 discrete frequencies from 8.6MHz to 7.6MHz (digital sweep). The DSP loads the DDS with the desired frequency for transmission. The DSP on power-up is initialized with the frequencies for transmission by the communications controller.

#### 2.1.2.2 Transmitter Operation

The two transmitters are functionally identical: TX1 is used to drive the canceling 2-Loop antenna and TX2 drives the canceling 3-Loop antenna. Each TX is functioning in a push pull, class D mode of operation. The control signals are timed for 64 six-microsecond bursts at approximately a 100 hertz rate. The signals are grouped into 16 pairs of frequencies. The frequencies used are dictated by the digital sweep, which are controlled by the DSP. Each bin is transmitted two times for 6 us each. The pattern of 16 bins is used once for the 2 Loop and then repeated for the 3 Loop, this pattern constitutes the "frame" rate of the Strata System.

The overall duty cycle for transmitter operation is **3.84 percent**. This rate is derived by taking the amount of time that the transmitter is operational (2 antenna * 16 bins * 2 blasts per bin * 6 microseconds per blast = 384 microseconds) and dividing it by the frame rate of 100Hz (10 milliseconds) .

## 2.2 Equipment Sample

### 2.2.1 Identification

A pre-production model of the Strata PX w/TR4024/22 Control Board was tested:

| | |
|---|---|
| Description: | Electronic Article Surveillance System<br>(Anti-Pilferage Device) |
| Model: | Strata PX with TR4024/22 Controller and Worldwide 425 Module |
| Serial Number | Strata PX: 121-28218-A<br>TR4024/22 Controller: 747240C0P0090402018<br>425 Power Supply: 128194 |
| Manufacturer: | Checkpoint SystemsCheckpoint Systems, Inc, Inc. |
| Received by PCTC: | 14 August 2002 |
| Sample type | Production Level Version |

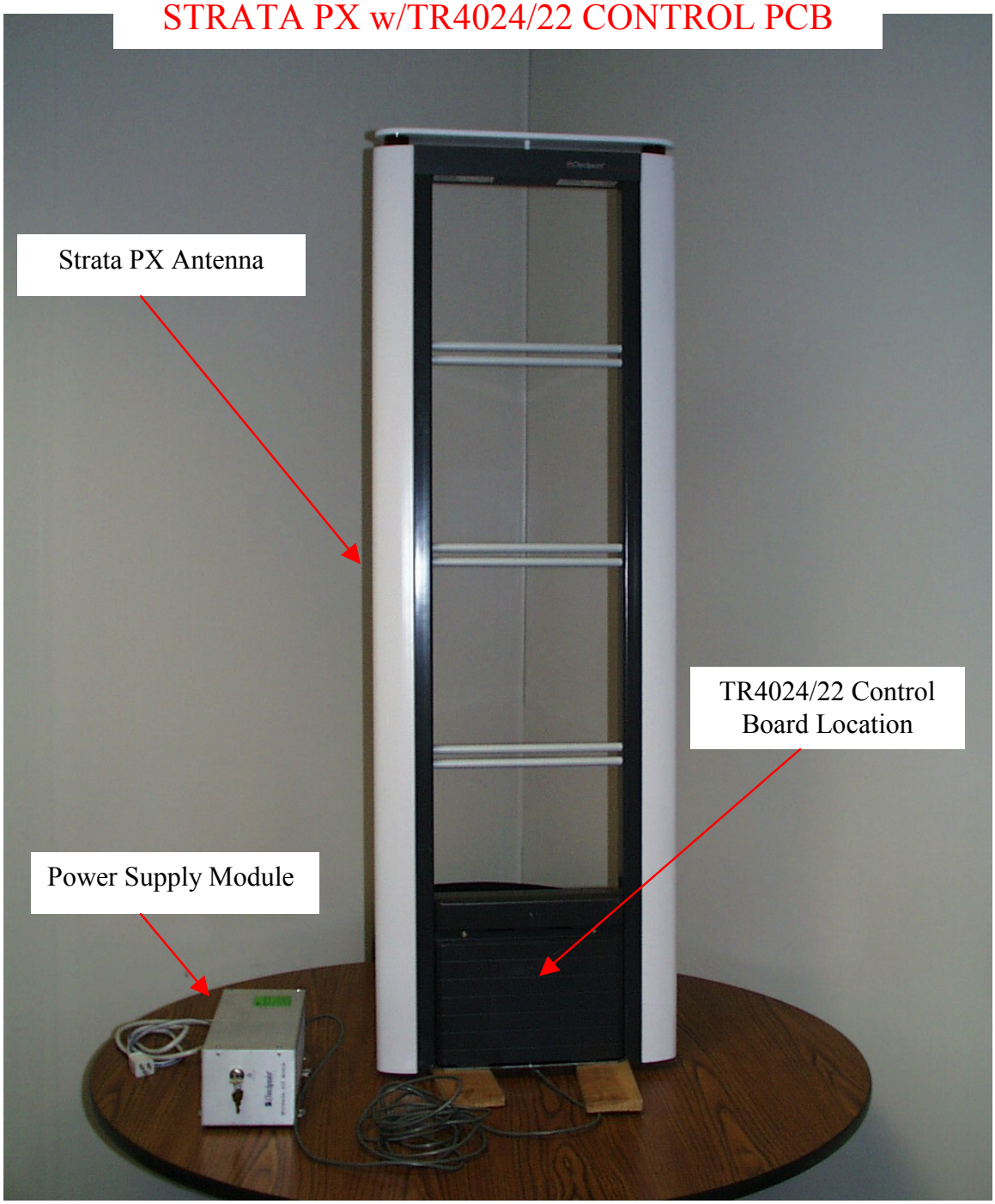


**Photo 1 – Strata PX w/TR4024/22 Control Board**

### 2.2.2 Condition of Received Sample

An evaluation of the Checkpoint, Strata PX w/TR4024/22 Control Board was conducted to verify test subject identity and condition and to ensure suitability for testing. No evidence of physical damages was noticed. The test item condition was deemed acceptable for the performance of the requested test services.

## 3.0 Applicable Requirements, Methods and Procedures

### 3.1 Applicable Requirements

The results of the measurement of the radio disturbance, fundamental and bandwidth, characteristics of the EUT 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

47 CFR, Part 15

Subpart B, Unintentional Radiators

Subpart C, Intentional Radiators
(Including Clause 15.223: Operation in the band 1.705MHz to 10 MHz.)

### 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:

- ANSI 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".

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

## 4.0 Deviations or Exclusions from the Requirements and Standards

Per customer instructions and agreement with FCC, for measurement of the fundamental and harmonic emissions in the band 1.705 MHz to 10 MHz, a 20 dB reduction from the true peak is to be compared to the limits of 100 µV/meter (40 dBµV/meter) at 30 meters. The EUT is to be modulated as normally installed. True peak is the point at which the analyzer bandwidth is adjusted for minimum pulse desensitization. (A copy of the correspondence between Checkpoint and FCC is attached in Appendix 4 for reference).

Measurement of the fundamental -- 7.6 to 8.7 MHz -- was performed by setting a spectrum analyzer to "max-hold", peak detector, a 300 kHz bandwidth, and a span from 7.2 to 9.2 MHz. A resolution bandwidth of 300 kHz was used because increasing the bandwidth above 300 kHz did not increase the detected peak of the fundamental.

## 5.0 Operation of the EUT During Testing

### 5.1 Test Environment

#### 5.1.1 Climatic Environment

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

| | |
|---|---|
| Temperature: | $22^{o}$ C $\pm$ $1^{o}$ C |
| Relative Humidity | 50% RH $\pm$ 10% |

### 5.1.2 Electrical Power

The EUT was operated at electrical power voltages sufficient to ensure that the measured results were representative of operation of the EUT in the power environments in which it would be installed, as specified by the client. Specifically, the EUT was supplied AC power at 120 Vac/60 Hz for all testing described in this report.

## 5.2 Grounding

AC ground was provided to the power supply through the AC power cord.

## 5.3 Operating Mode

During testing, the EUT was continuously transmitting and monitoring for the presence of a security tag. By design, the EUT is not capable of "standby mode". A security tag was swept through the field of the EUT antenna every 5 seconds to initiate a verification cycle. During this cycle, the EUT would indicate the presence of an article tag with an audible alarm and flashing red lamps on the upper corners of the antenna.

The TR4024/22 is a digital swept frequency-hopping transmitter. The TR4025 hops on discrete frequencies. The frequencies that can be transmitted by the TR4025 are as follows:

| | | | |
|---|---|---|---|
| 7.600708 MHz | 7.673950 MHz | 7.747192 MHz | 7.820435 MHz |
| 7.893677 MHz | 7.966919 MHz | 8.040161 MHz | 8.113403 MHz |
| 8.186646 MHz | 8.259888 MHz | 8.333130 MHz | 8.406372 MHz |
| 8.479614 MHz | 8.552856 MHz | 8.626099 MHz | 8.699341 MHz |

The restricted frequency bands (per FCC Part 15 Clause 15.205) in the operating frequency band of the EUT are as follows:

| | | | | |
|---|---|---|---|---|
| Frequency (MHz) | 8.291 - 8.294 | 8.362 - 8.366 | 8.37625 - 8.38675 | 8.41425 - 8.41475 |

The transmitter is not capable of hopping into or operating within the restricted frequency bands.

During an antenna's cycle, the system performs two "blasts" which are called a "bin". There are sixteen bins per frame. A bin consists of two "noise" cycles and two blast cycles, a blast is a transmit cycle and then a receive cycle. During the noise cycle, the system is not transmitting, only receiving ambient noise. This allows the system to establish the baseline noise level of the environment for later comparison. The system then transmits or "pulses" the field and then receives or "listens" for an echo of a tag signal. This frame is repeated on the other antenna.

A tag response need only be present on one of the antennas to cause an alarm. In effect, the system provides the best of both worlds, a 2-loop and 3-loop design. The switching between antenna loops minimizes the size of detection holes at the null points of the RF field.

The Strata system is a transceiver design using both a 3-loop, 2-loop, and a 1-loop antenna design. The Strata alternates between using the 2-loop antenna and the 3-loop antenna. The 1-loop antenna is used as a shield that is tied to ground. This technique provides the system with different views of the detection field allowing the system to improve detection by minimizing the holes typically found at the crossbars of typical swept antennas.

The two transmitters are functionally identical: TX1 is used to drive the canceling 2-Loop antenna and TX2 drives the canceling 3-Loop antenna. Each TX is functioning in a push pull, class D mode of operation. The control signals are timed for 64 six-microsecond bursts at approximately a 100 hertz rate. The signals are grouped into 16 pairs of frequencies. The frequencies used are dictated by the digital sweep, which are controlled by the DSP. Each bin is transmitted two times for 6 us each. The pattern of 16 bins is used once for the 2 Loop and then repeated for the 3 Loop, this pattern constitutes the "frame" rate of the Strata System.

The overall duty cycle for transmitter operation is **3.84 percent**. This rate is derived by taking the amount of time that the transmitter is operational (2 antenna * 16 bins * 2 blasts per bin * 6 microseconds per blast = 384 microseconds) and dividing it by the frame rate of 100Hz (10 milliseconds) .

## 5.4 Test Configurations

All testing described in this report was performed with the EUT in the equipment configuration shown below. The drawing shows the block diagram of the tested configuration used for the EMI and immunity tests along with AC power distribution. There were no other external interfaces or support equipment attached to the Strata PX w/TR4024/22 Control Board.

Ferrite suppression devices are installed at the following locations on the TR4025 Controller (Note: These were installed as part of the overall design of the EUT and not as a direct result of the testing performed or to correct on-site failures):

1. Fair Rite P/N 2865000202 – 2 multi-aperture cores each on the TX1, TX2 antenna wires
2. Fair Rite P/N 2861006802 – 1 multi-aperture core to the speaker wires, (four turns through each side)
3. Fair Rite P/N 2643801502 – Add 1 shield bead to the antenna ground loop (four turns).
4. Fair Rite P/N 0443806406 – 1 suppression core (with three turns) on the DC cable

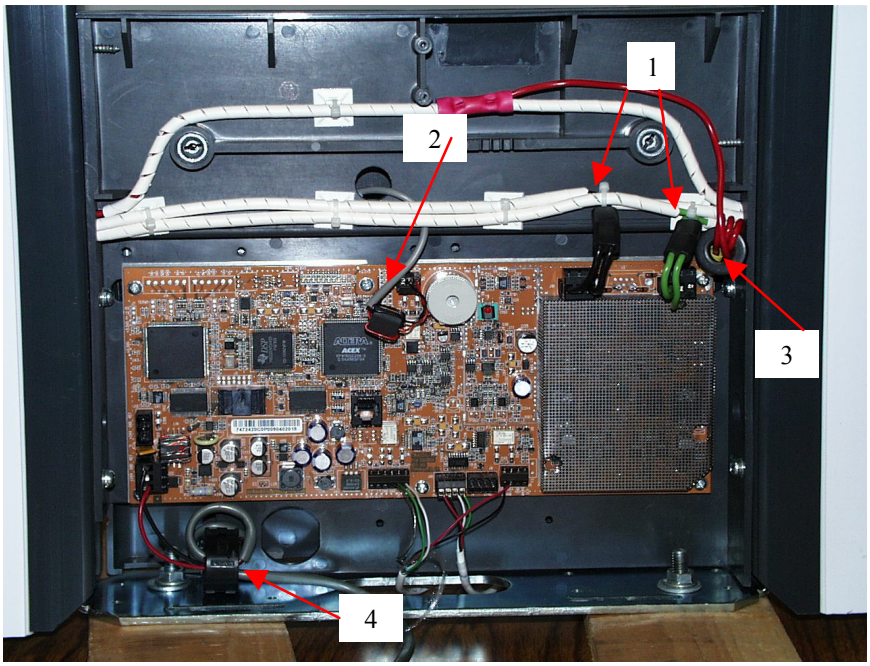


**Photo 2 – Ferrite Locations**

The TR4024/22 is different from previous pulse-listen transceivers because it does not use jumpers, DIP switches or potentiometers to modify its configuration. All operating parameters are now controlled by a software application running on a Palm Pilot connected to J1 on the TR4024/22 PCB. The application is known as the PDA-Assisted Service System (PASS).

The output power of the Strata PX w/TR4024/22 Control Board is factory set by two digital potentiometers accessed through the PASS software application. located on the TR4025. TX1 PWR controls current to the "Loop 1" and TX2 PWR controls current to the "Loop 2." These settings can be adjusted through a range of values between 0 and 31. Below are the settings used for this test.

| **EUT** | | **Loop 1 (TX1)** | | **Loop 2 (TX2)** | |
|---|---|---|---|---|---|
| **Model:** Strata PX w/TR4024/22Controller | | **POT POSITION** | **CURRENT LEVEL** | **POT POSITION** | **CURRENT LEVEL** |
| **Serial:** none | Forward current | 24 | 430 mA | 24 | 748 mA |
| | Reverse current | " | 764 mA | " | 384 mA |
| **Date:** 7/30/2001 | | | | | |
| **Notes:** Settings for measurement of fundamental at 30 Meters (FCC) | | | | | |

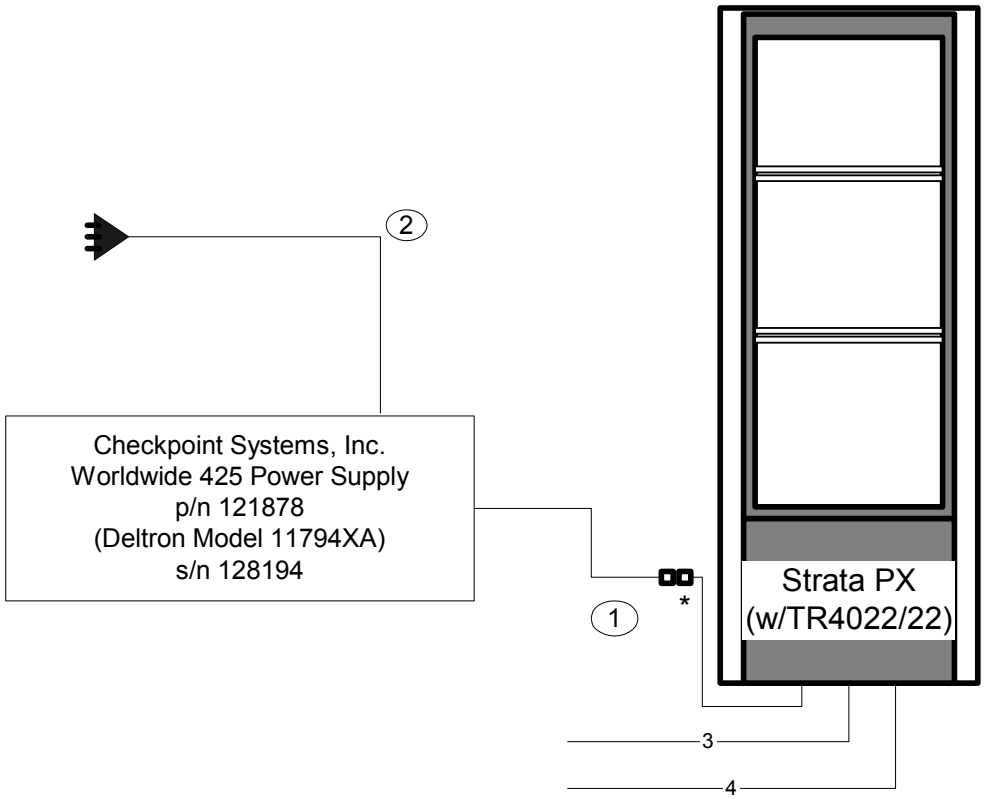


**Figure 1 – Block Diagram, EMI Testing of Strata PX w/TR4024/22 Control Board**

**Table 1 – Cable List of EUT configuration**

| # | Cable Description | Part Number | Manufacturer | Length |
|---|---|---|---|---|
| 1 | DC Power cable | - | Checkpoint Systems, Inc | 20’ |
| 2 | AC Line Cord, shielded | IMX 04 | Eupen | 2 Meters |
| 3 | Slave Cable, 4-conductor, shielded | - | Generic | 10’ |
| 4 | Sync Cable, 20’, 4 conductor | - | Generic | 20’ |

### 5.4.1 EUT Details

The following devices were installed in the test field during testing:

| Description | Model # | Part # | Manufacturer | Serial # |
|---|---|---|---|---|
| Antenna | Strata PX | 7778800 | Checkpoint Systems, Inc. | 121-29218-A |
| Control module | TR4024/22 | 7353656 Rev *60 | Checkpoint Systems, Inc. | 7472420C0P00 90402018 |
| Power Supply | Worldwide 425 Module | 11794XA | Deltron | 128194 |

### 5.4.2 Support Equipment

No other equipment was used to support the operation of the Strata PX w/TR4024/22 Control Board during testing.

## 5.5 EUT Modifications

There were no modifications added during testing.

## 6.0 Summary of Test Results

### 6.1 Emission Tests

#### 6.1.1 Radiated Emission Test (18 September 2002)

Tables 2, 3 and 4 below show the detected field strengths as measured from the EUT(s) over the frequency range from 7.6 MHz to 30 MHz, at a distance of 30 meters compared to the maximum permissible FCC limit at 30 meters. All measurements were made using a magnetic field loop antenna, placed 1-meter above the ground plane. A description of the procedures used in the performance of this test is provided in Appendix 2.

- **MEASUREMENT OF THE FUNDAMENTAL (Per Section 15.223):**

Table 2 shows the true peak measurement of the fundamental and the comparison of the adjusted true peak to the average limit.

**Table 2 – Fundamental E-Field Measurement – True Peak**

| Freq [MHz] | Height, Pol (1) [cm 1/2/3] | Angle [Deg] | Peak Detector Voltage [dBuV] | Corr' Factor [dB/m] (2) | Field Strength [dBuV/m] | FCC Average Limit @ 30m [dBuV/m] | Delta Limit [dB] |
|---|---|---|---|---|---|---|---|
| 8.200 Fund* | 100,1 | 002 | 59.0 Peak | -21.4 | 37.6 | 40 | -2.4 |

* The true peak signal level of the fundamental was measured using a peak detector as described in section 4.0. True Peak was determined by increasing the receiver bandwidth until a point where the peak excursion stopped increasing.

1) Polarity of the measuring antenna is 1 - along measuring axis, 2 - along vertical axis, 3 horizontal axis. The reported signal is the highest of the signals measured along each of the axes.
2) The correction factor shown represents an antenna factor of –1.4 dB/m and the 20-dB reduction as specified in the measurement procedure.

- **MEASUREMENT RESULT -- AVERAGE**

As indicated earlier, the transmitter operates with a duty cycle of 3.84%. This would result in the following calculations for conversion from peak to average and a subsequent comparison of the fundamental with the average limit.

**Table 3 – Calculated Average vs. Average Limit**

| | |
|---|---|
| Indicated Peak Detector Voltage (1): | 59.0 dBµV |
| Antenna Correction Factor (2): | -1.4 dB/m |
| Corrected True Peak: | 57.6 dBµV/m |
| Pulse CW Duty Cycle: | 3.84% |
| Correction to Average:<br>20 * $Log_{10}$ (Duty Cycle) | -28.3 dB |
| Average Level:<br>(Indicated True Peak + Avg Correction) | 30.7 dBµV |
| Antenna Correction Factor: | -1.4 dB/m |
| Corrected Average Field Strength:<br>(Avg Value + C.F) | 29.3 dBµV/m |
| Limit: | 40 dBµV/m |
| Margin with Limit: | -10.7 dB |
| Peak Margin with Average Limit<br>[Clause 15.35(b)] | 17.6 dB |

NOTES: (1) Peak meter reading taken from the receiver.

(2) The antenna correction factor is calibrated to yield a magnetic field. To this factor the plane wave E-Field correction (51.54 dB) is added to convert the measurement to an electric field strength value, or as follows for a measurement recorded at 8.2 MHz:

Antenna Factor + E-Field Correction = Antenna Correction Factor
(-53.4 dB) + (51.54 dB) = (-1.4 dB)

- **EMISSIONS OUTSIDE THE BAND 1.705 MHz to 10 MHz (Per Section 15.223):**

Table 4 shows the recorded levels of emissions of the harmonics found below 30 MHz specifically, signals outside the frequency range of 1.705 MHz to 10 MHz. These emissions were recorded using a quasi-peak detector as indicated in both the standard and the opinion letter on measurement requirements.

**Table 4 – E-Field Emissions (< 1.705 MHz and > 10 MHz)**

| Freq [MHz] | Height, Pol[1] [cm 1/2/3] | Angle [Deg] | Quasi-Peak Voltage [dBuV] | Corr' Factor [dB/m] | Field Strength [dBuV/m] | FCC QP Limit @ 30m [dBuV/m] | Delta Limit [dB] |
|---|---|---|---|---|---|---|---|
| 16.40 | 100,1 | 270 | 18.6 | -0.6 | 18.0 | 40 | -22.0 |
| 24.60 | 100,1 | 270 | 19.4 | 1.1 | 20.5 | 40 | -19.5 |

1) Polarity of the measuring antenna is 1 - along measuring axis, 2 - along vertical axis, 3 horizontal axis.

- **E-FIELD EMISSIONS 30 MHz to 1000 MHz (Per Section 15.209)**

Table 5 below shows the detected field strengths as measured from the EUT(s) over the frequency range from 30 MHz to 1000 MHz, at a distance of 3 meters compared to the maximum permissible FCC limit at 3 meters. A description of the procedures used in the performance of this test is provided in Appendix 2.

**Table 5 – E-Field Emissions (30 MHz to 1000 MHz)**

| Freq [MHz] | Height, Pol [cm H/V] | Angle [Deg] | Quasi-Peak Voltage [dBuV] | Corr' Factor [dB/m] | Field Strength [dBuV/m] | FCC QP Class B Limit @ 3m [dBuV/m] | Delta Limit [dB] | Result |
|---|---|---|---|---|---|---|---|---|
| 41.644 | 100,V | 91 | 18.0 | 16.6 | 34.6 | 46 | -11.4 | Below limit |
| 42.008 | 100,V | 90 | 18.7 | 16.5 | 35.2 | 46 | -10.8 | Below limit |
| 42.382 | 100,V | 90 | 19.0 | 16.5 | 35.5 | 46 | -10.5 | Below limit |
| 42.746 | 100,V | 94 | 19.2 | 16.3 | 35.5 | 46 | -10.5 | Below limit |
| 43.120 | 100,V | 269 | 20.6 | 16.3 | 36.9 | 46 | -9.1 | Below limit |
| 43.485 | 100,V | 265 | 21.2 | 16.2 | 37.4 | 46 | -8.6 | Below limit |
| 86.994 | 100,V | 48 | 25.1 | 9.9 | 35.0 | 46 | -11.0 | Below limit |
| 362.495 | 100,V | 340 | 21.7 | 18.0 | 39.7 | 46 | -6.3 | Below limit |
| 700.001 | 115,H | 223 | 17.8 | 24.6 | 42.4 | 46 | -3.6 | Below limit |
| 899.999 | 100,V | 187 | 5.8 | 27.5 | 33.3 | 46 | -12.7 | Below limit |
| 900.000 | 120,H | 146 | 16.0 | 27.5 | 43.5 | 46 | -2.5 | Below limit |

- Overall Result: All measured radiated emissions from the Strata PX w/TR4024/22 Control Board are below the FCC 15.223 and 15.209 limits by a margin of at least 2.5 dB. Also, Peak emission levels do not exceed the 20 dB margin with the Average limit per 15.35(b).


**Photo 3 -- Strata PX w/TR4024/22 Control Board Radiated Emissions Test Setup – Front View**

**Photo 4 -- Strata PX w/TR4024/22 Control Board  Radiated Emissions Test Setup – Rear View**

**Photo 5 - Strata PX w/TR4024/22 Control Board Radiated Emissions Test Setup – Side View**

### 6.1.2 Bandwidth Measurement (19 September 2002)

A plot of the operating bandwidth was recorded on the operating Strata PX w/TR4024/22 Control Board after the measurement of the fundamental true peak emission level was completed. The conditions under which the plot was recorded are as follows:

- Antenna Separation: 30 Meters
- Antenna Type: Magnetic Field Loop Antenna
- Resolution Bandwidth: 300 kHz
- Video Bandwidth: 300 kHz
- Center Frequency: 8.2 MHz
- Frequency Span: 2 MHz
- Detector: Peak
- Sweep: Max Hold
- Vertical Scale: 10 dB/division
- Reference Level: 85 dBµV

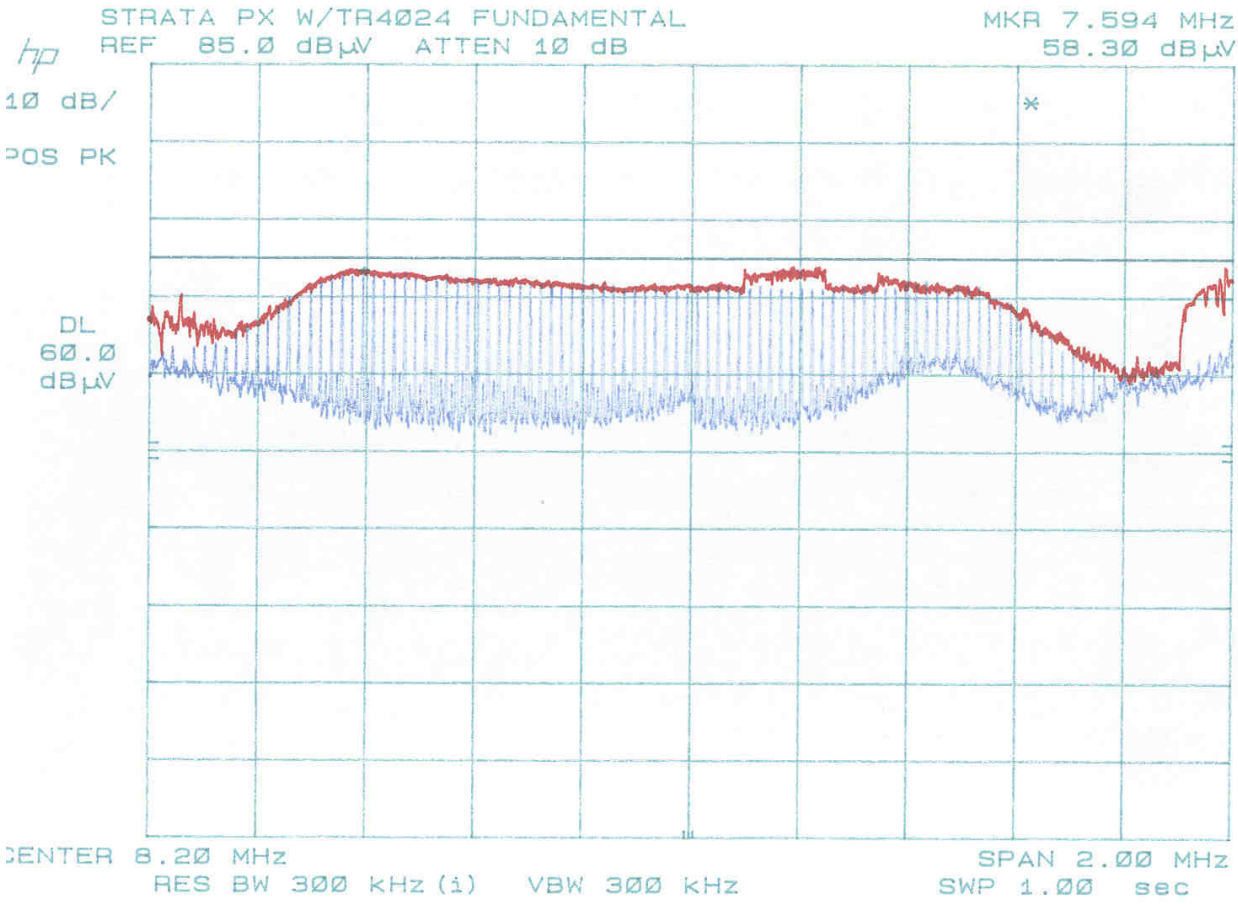


**Photo 6 – Bandwidth Plot**

The plot above confirms the transmitter bandwidth is 1.1 MHz as stated by the manufacturer. The bandwidth is 13.4% of the fundamental (1.1 MHz / 8.2 MHz) or not less than than 10% of the fundamental, and therefore, per FCC Section 15.223, the limit of 100 µV/m (40 dBµV/m) applies for emissions between 1.705 MHz and 10 MHz.

### 6.1.3 Conducted Emission Test (2 October 2002)

The following tables show the conducted emissions measurement results over the frequency range 450kHz to 30MHz for the EUT for devices operating under 47 CFR part 15C, where the limit of FCC 15.207 applies. A description of the procedures used in the performance of this test is provided in Appendix 2. The measurement of conducted emissions was performed with the Worldwide 425 power supply positioned on an 80-cm high table and the Strata PX antenna with integral TR4024/22 Control Board standing on the floor. This position created higher conducted emissions than positioning the power supply on the ground plane.

**- Worldwide 425 Power Supply Module, Neutral Line 120VAC/60Hz**

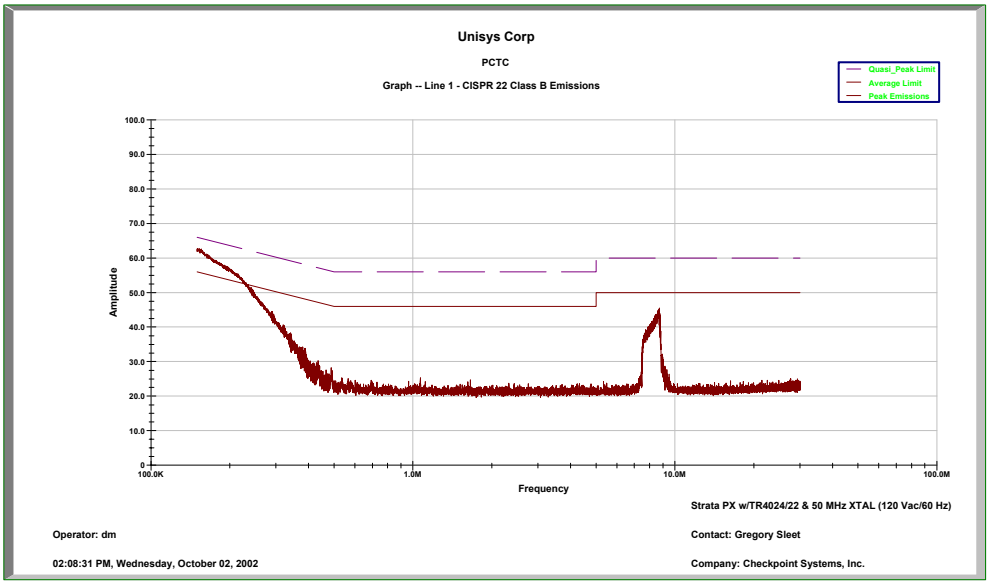


**Figure 2 – Graph of AC Wireline Conducted Emissions - Neutral**

## Table 6 – Conducted Emissions, Neutral Line

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Table 1 – Line 1 Conducted Data

Operator: dm
Item Under Test: Strata PX w/TR4024/22 & 50 MHz XTAL (120 Vac/60 Hz)
Contact: Gregory Sleet
02:08:30 PM, Wednesday, October 02, 2002
Company: Checkpoint Systems, Inc.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Frequency | Top 10 | Peaks | Avg. | Margin with | Corr. | |
| MHz | Peaks | Within 1 | Limit | Avg. Limit | Factor | |
| 155.720 KHz | 62.512 | 62.512 | 55.689 | 6.823 | 14.512 | |
| 164.009 KHz | 61.109 | 61.109 | 55.258 | 5.851 | 14.109 | |
| 195.296 KHz | 57.489 | 57.489 | 53.808 | 3.680 | 12.589 | |
| 238.957 KHz | 51.503 | 51.503 | 52.132 | -0.629 | 11.503 | |
| 241.993 KHz | 51.336 | 51.336 | 52.028 | -0.691 | 11.436 | |
| 242.576 KHz | 50.923 | | 52.008 | -1.084 | 11.423 | |
| 245.728 KHz | 50.654 | | 51.900 | -1.246 | 11.354 | |
| 247.596 KHz | 50.013 | | 51.837 | -1.825 | 11.313 | |
| 267.365 KHz | 46.770 | | 51.199 | -4.430 | 11.170 | |
| 8.717 MHz | 45.486 | | 50.000 | -4.514 | 10.286 | |

The table above lists 5 frequencies where the peak detector level of the emission exceeded the average limit or was within 1 dB below the average limit. These 5 signals were re-measured using both a quasi-peak and average detector to verify their compliance with the Quasi-Peak and Average requirements of the standard. These further measurements are shown below in Table 7.

## Table 7 – Quasi-Peak and Average Detector Measurements, Neutral Line

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Table 2 - Line 1 - CISPR 22 Class B Emissions

Operator: dm
Item Under Test: Strata PX w/TR4024/22 & 50 MHz XTAL (120 Vac/60 Hz)
Contact: Gregory Sleet
02:29:50 PM, Wednesday, October 02, 2002
Company: Checkpoint Systems, Inc.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Q-P | Avg | Q-P | Avg | Q-P | Avg | Corr. | |
| MHz | Meas't | Meas't | Limit | Limit | Margin | Margin | Factor | |
| 151.022 KHz | 59.040 | 36.000 | 65.944 | 55.944 | -6.903 | -19.943 | 14.740 | |
| 155.490 KHz | 58.493 | 34.853 | 65.701 | 55.701 | -7.208 | -20.848 | 14.523 | |
| 186.760 KHz | 54.553 | 29.383 | 64.179 | 54.179 | -9.626 | -24.796 | 13.003 | |
| 229.220 KHz | 49.357 | 22.977 | 62.478 | 52.478 | -13.121 | -29.501 | 11.717 | |
| 232.610 KHz | 48.763 | 22.723 | 62.356 | 52.356 | -13.593 | -29.633 | 11.643 | |

**- Worldwide 425 Power Supply Module, Phase Line 120VAC/60Hz**

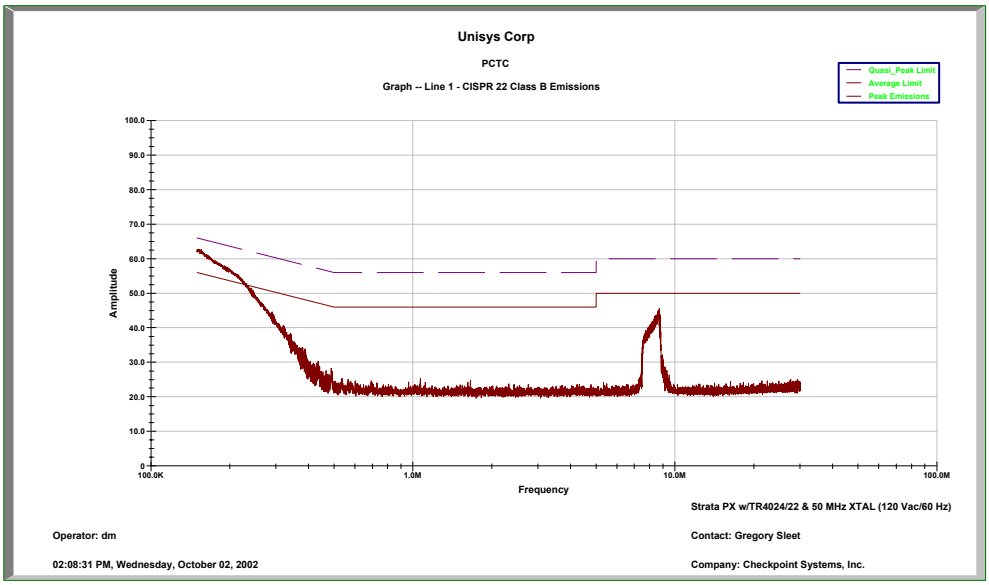


**Figure 3 – Graph of AC Wireline Conducted Emissions - Phase**

**Table 8 – Conducted Emissions, Phase Line**

Unisys Corp
PCTC
Table 1 - Line 2 – CISPR 22 Class B Emissions
Operator: dm
Item Under Test: Strata PX w/TR4024/22 & 50 MHz XTAL (120 Vac/60 Hz)
Contact: Gregory Sleet
02:14:02 PM, Wednesday, October 02, 2002
Company: Checkpoint Systems, Inc.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Frequency MHz | Top 10 Peaks | Peaks Within 1 | Avg. Limit | Margin with Avg. Limit | Corr. Factor | |
| 157.005 KHz | 65.260 | 65.260 | 55.621 | 9.639 | 14.460 | |
| 217.827 KHz | 57.774 | 57.774 | 52.901 | 4.873 | 11.974 | |
| 229.268 KHz | 55.420 | 55.420 | 52.476 | 2.944 | 11.720 | |
| 231.603 KHz | 55.068 | 55.068 | 52.392 | 2.676 | 11.668 | |
| 239.891 KHz | 53.184 | 53.184 | 52.100 | 1.084 | 11.484 | |
| 241.876 KHz | 52.840 | 52.840 | 52.032 | 0.809 | 11.440 | |
| 242.576 KHz | 52.625 | 52.625 | 52.008 | 0.617 | 11.425 | |
| 243.394 KHz | 52.407 | 52.407 | 51.980 | 0.427 | 11.407 | |
| 244.911 KHz | 52.173 | 52.173 | 51.928 | 0.245 | 11.373 | |
| 246.079 KHz | 52.047 | 52.047 | 51.888 | 0.159 | 11.347 | |
| 247.013 KHz | | 51.826 | 51.857 | -0.031 | 11.326 | |
| 248.413 KHz | | 51.795 | 51.810 | -0.015 | 11.295 | |
| 249.581 KHz | | 51.069 | 51.771 | -0.702 | 11.269 | |

The table above lists 10 frequencies where the peak detector level of the emission exceeded the average limit or was within 1 dB below the average limit. These signals were re-measured using both a quasi-peak and average detector to verify their compliance with the Quasi-Peak and Average requirements of the standard. These further measurements are shown below in Table 9.

**Table 9 – Quasi-Peak and Average Detector Measurements, Phase Line**

UNISYS
PCTC
Table 2 - Line 2 - CISPR 22 Class B Emissions

Operator: dm
Item Under Test: Strata PX w/TR4024/22 & 50 MHz XTAL (120 Vac/60 Hz)
Contact: Gregory Sleet
02:23:54 PM, Wednesday, October 02, 2002
Company: Checkpoint Systems, Inc.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Frequency | Q-P | Avg | Q-P | Avg | Q-P | Avg | Corr. |
| MHz | Meas't | Meas't | Limit | Limit | Margin | Margin | Factor |
| 153.690 KHz | 61.771 | 35.731 | 65.798 | 55.798 | -4.027 | -20.067 | 14.621 |
| 207.890 KHz | 55.235 | 26.025 | 63.289 | 53.289 | -8.054 | -27.264 | 12.195 |
| 220.250 KHz | 53.250 | 24.350 | 62.809 | 52.809 | -9.559 | -28.459 | 11.920 |
| 222.580 KHz | 52.599 | 23.886 | 62.722 | 52.722 | -10.123 | -28.836 | 11.869 |
| 231.010 KHz | 51.052 | 22.962 | 62.413 | 52.413 | -11.362 | -29.452 | 11.682 |
| 232.600 KHz | 50.796 | 22.364 | 62.356 | 52.356 | -11.560 | -29.993 | 11.646 |
| 233.500 KHz | 50.556 | 22.606 | 62.324 | 52.324 | -11.768 | -29.718 | 11.626 |
| 234.810 KHz | 50.237 | 22.577 | 62.278 | 52.278 | -12.041 | -29.701 | 11.597 |
| 235.130 KHz | 50.320 | 22.270 | 62.266 | 52.266 | -11.946 | -29.996 | 11.590 |
| 236.780 KHz | 49.793 | 22.833 | 62.208 | 52.208 | -12.415 | -29.375 | 11.553 |
| 237.870 KHz | 49.489 | 23.749 | 62.170 | 52.170 | -12.681 | -28.421 | 11.529 |
| 240.080 KHz | 49.120 | 28.665 | 62.093 | 52.093 | -12.973 | -23.428 | 11.480 |
| 240.890 KHz | 49.042 | 29.562 | 62.065 | 52.065 | -13.023 | -22.503 | 11.462 |

- Overall Results:

  - The Strata PX w/TR4024/22 Control Board powered by the Worldwide 425 Module complied with the requirements of FCC 15.207 by a margin of at least 4 dB (Quasi-Peak Margin at 153 kHz, Phase line).

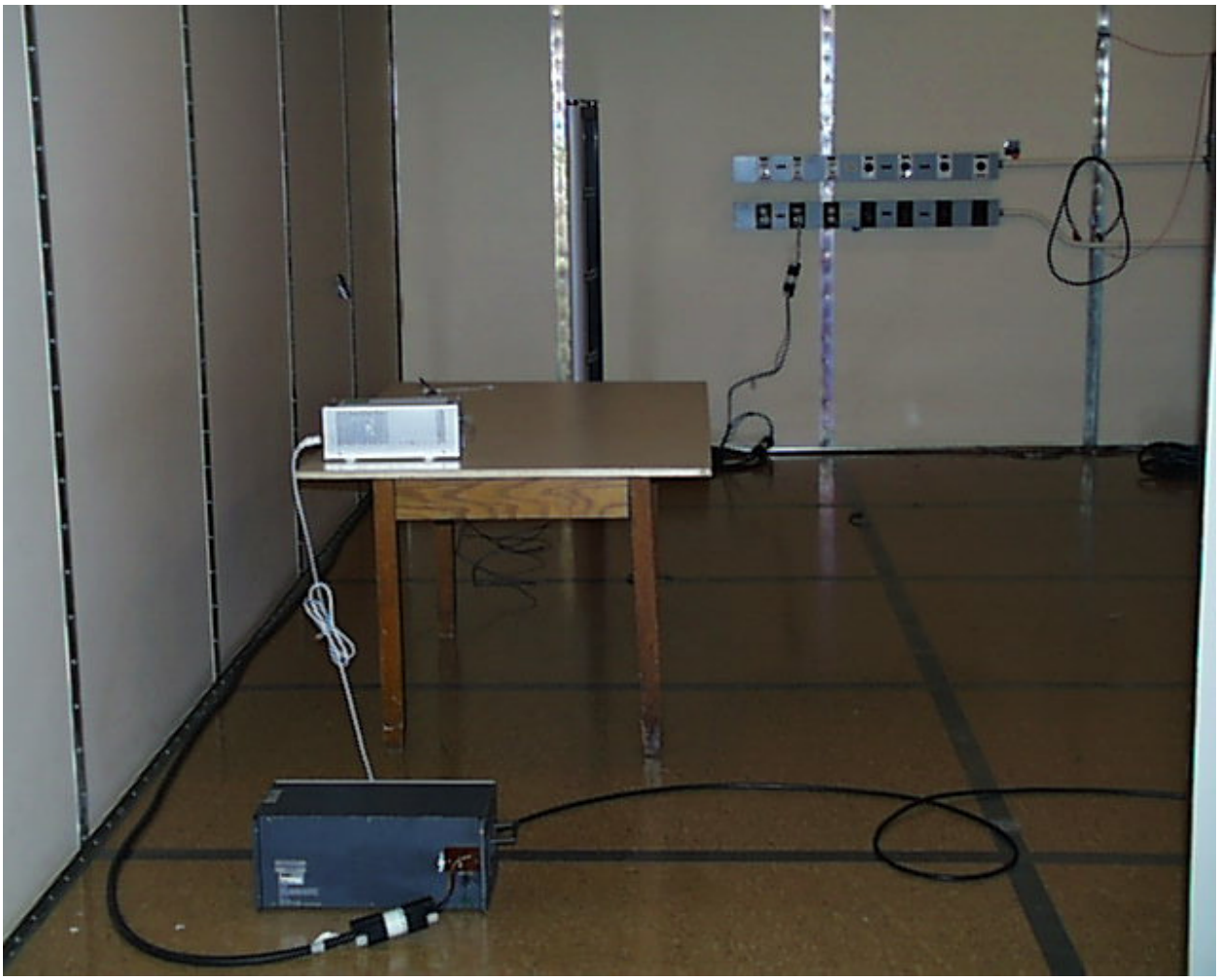

**Photo 7 – Strata PX w/TR4024/22 Control Board Conducted Emissions Test Setup**

**Photo 8 – Strata PX w/TR4024/22 Control Board Conducted Emissions Test Setup**

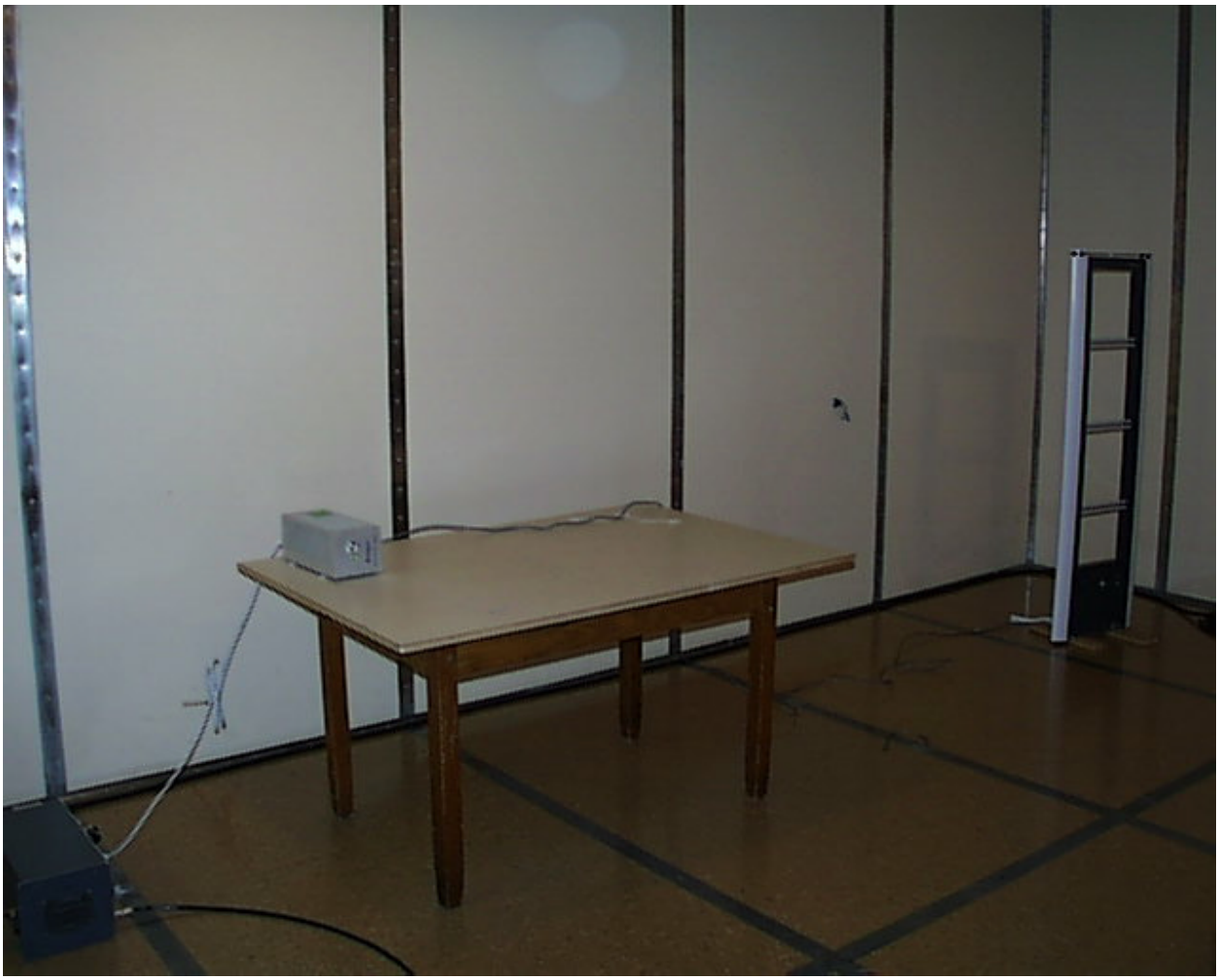

**Photo 9 – Strata PX w/TR4024/22 Control Board Conducted Emissions Test Setup**

# Appendix 1 – Test Equipment Listing

## Radio Disturbance Test Equipment

| Equipment | Model | Manufacturer | ID No. | Last Cal Date |
|---|---|---|---|---|
| QuasiPeak Adapter (10KHz - 1GHz) | 85650A | Hewlett Packard | X717 | 4/26/02 |
| QuasiPeak Adapter (10KHz - 1GHz) | 85650A | Hewlett Packard | U182 | 8/8/02 |
| | | | | |
| Spectrum Analyzer Display | 85662A | Hewlett Packard | U181 | 6/18/02 |
| Spectrum Analyzer Display | 85662A | Hewlett Packard | U180 | 8/7/02 |
| | | | | |
| Spectrum Analyzer (10KHz – 1.5GHz) | 8566B | Hewlett Packard | X718 | 6/18/02 |
| Spectrum Analyzer (10KHz – 1.5GHz) | 8566B | Hewlett Packard | X719 | 8/7/02 |
| | | | | |
| RF Preselector (20 Hz to 2GHz) | 85685A | Hewlett Packard | Y0312 | 6/18/02 |
| RF Preselector (20 Hz to 2GHz) | 85685A | Hewlett Packard | W927 | 8/7/02 |
| | | | | |
| Manual Receiver (9 kHz-1 GHz) | EMC-30 Mk IV | Electro Metrics | Y0331 | 3/1/02 |
| | | | | |
| LISN | MN2053 | Chase Electric Limited | U776 | 8/8/02 |
| | | | | |
| Loop Antenna (300 Hz – 100 MHz) | BBH-500/B | ARA | V640 | 7/3/02 |
| | | | | |
| Antenna (25MHz to 2GHz) | LFB-2025 | ARA | B-962 | 2/26/02 |

# 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

**Test Facilities**

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. The test site complies with the Attenuation Measurements specified in ANSI C63.4 - 1992, and is registered with FCC, and is accredited by AALA, VCCI, and NEMKO.

For electric field radiated emissions, the EUT and support peripherals or devices required to facilitate EUT 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.

**Procedures 9kHz to 30 MHz**

Testing below 30 MHz was performed with the EUT configured on the test site as above. A loop antenna was placed at a distance of 30 meters from the EUT, one meter above the ground plane. The EUT was rotated 360° in order to obtain a maximum indication on the measuring receiver. This was repeated for each of the three polarizations of the antenna. The position of the antenna relative to the ground plane was noted in the reported data.

**Procedures 1.704 MHz to 10 MHz**

Testing below 30 MHz was performed with the EUT configured on the test site as above. A magnetic field loop antenna was placed at a distance of 30 meters from the EUT, one meter above the ground plane. The EUT was rotated 360° in order to obtain a maximum indication on the measuring receiver. This was repeated for each of the three polarization of the antenna.

Per the agreement between Checkpoint and FCC, testing in this frequency range for fundamental emissions, a 20 dB reduction from the true peak was compared with the average limit of 100 µV/meter (40 dBµV/meter) at a measurement distance of 30 meters. The unit under test shall be modulated as normally installed.

True peak was determined by setting the spectrum analyzer with peak detector, to "max-hold" and a frequency span from 7.2 to 9.2 MHz. The resolution bandwidth was increased until no further change was noted in the peak level of the emission. Because of the duty cycle and repetition rate of the pulsed signals, a bandwidth of 300 kHz was found to be sufficient to display the true peak level of the fundamental. This insured that pulse desensitization has been minimized. The peak level was then recorded.

**Procedures 30 MHz to 1000 MHz**

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 EUT(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 EUT(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 EUT(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:

Field Strength (dBuV/m) = meter reading (dBuV)
+ antenna factor (dB/m)
+ Cable Loss (dB)

### A.2.1.2 Conducted Emissions Test

**Procedure 150 kHz To 30 MHz**

Peak amplitude terminal voltage emissions at the power line input to the EUT(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 150 kHz to 30 MHz while the EUT(s) was operating as described in paragraph 5.3.

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

Peak Emission (dBuV) = meter reading (dBuV)
+ 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 the spectrum analyzer detector function first set to quasi-peak and then to average. These measurements, if necessary, are recorded and printed below each graph.

**Appendix 3 – Correspondence Letter**

MAR 13 '97 10:59 TO-9121052?3396 FROM-CHECKPOINT SYSTEMS INC T-085 P.02/02 F-071
JUL 2? '?? 15:19 TO-918013443060 FROM-CHECKPOINT SYSTEMS INC T-031 P.01/02 F-074

# CHECKPOINT SYSTEMS, INC.

## FACSIMILE TRANSMISSION COVER

To: F.C.C. Lab

Date: 7/26/96

Attention: Mr. Ed Gibbons

Fax No: (301) 344-2050

No. of Pages: 2
(Incl. Cover)

From: Mr. Gregory E. Sleet
CHECKPOINT SYSTEMS, INC.
101 WOLF DRIVE, P.O. BOX 188
THOROFARE, N.J. 08086

Telephone: (609) 384-2339 Direct
Toll Free: (800) 257-8540 Ext. 2339
Fax. No.: (609) 384-2366

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Dear Mr. Gibbons:

Following up on our recent phone conversations, please confirm and if necessary correct our understanding of the points discussed below. Based on the details of our fax dated 7/3/96:

✓ • Our pulsed emissions will be treated as frequency hoping, where the bandwidth will be considered the spectrum contained between the lowest and highest carrier frequency we pulse.

✓ • A simple ratio of the maximum single restricted band infringed upon divided by the bandwidth of our fundamental emission must be less the 1% to satisfy section 15.205 of the rules.

→ • For fundamental and harmonic emissions [illegible] a 20 dB reduction from the true peak is to be compared to the limits of 100uV/meter [illegible] at 30 meters. The unit is modulated as normally installed. True peak refers to the point at which the analyzer bandwidth is adjusted for minimum pulse desensitization.

→ • For [illegible] CISPR quasi-peak measurements will be made with the unit modulating as normally installed. Based on the bandwidth plot, care must be given to measure multiples of the worst case emission points. Limits are as specified in section 15.209.

✓ • Conducted emissions remain as specified in part 15 of the rules.

Ed Gibbons
8/2/96