

ELECTROMAGNETIC INTERFERENCE TEST REPORT

Doc.20010817R/Project No. 621

TEST STANDARD - USA CFR 47 PART 15

**STRATA EX ELECTRONIC ARTICLE SURVEILLANCE
DETECTION SYSTEM
FCC ID: DO4STRATAEX**

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

Test Date: 10/11/2000 – 10/26/2000

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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 EX 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 15.209 | 450 kHz to 30 MHz | Below Max. Permissible Limit |

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1.0 Client Information

Client Name: Checkpoint Systems, Inc.
101 Wolf Drive
Thorofare, NJ 08086

Coordinator(s): Eric Eckstein
Nimesh Shah

PCTC Test Personnel: Paul Banker
Ray Rashid

1.1 Requested Service

- Measurement of radio disturbance characteristic of sample product to FCC Part 15.223 (Intentional Radiators) and FCC parts 15.207 and 15.209 (Unintentional Radiators).

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 Strata EX is an Electronic Article Surveillance System (EAS). The system detects target tags attached to merchandise. The targets resonate in the region of 8.2 MHz. When an article of merchandise is purchased, the target is deactivated which causes it to no longer resonate. The Strata EX system monitors an area 3-feet on either side of the antenna in the 7.6 to 8.7 MHz range, and triggers an alarm when a non-deactivated target is detected.

The Strata EX utilizes the Model 4022 *61 Printed Circuit Board (PCB). Checkpoint Systems, Inc. manufactures several different types of antennae that are used with the 4022 PCB. The Strata EX antenna is a wooden structure surrounding the loop antenna and control PCB. The Strata system is a transceiver with a 3-loop, 2-loop and 1-loop antenna design. The 1-loop is used as a shield and is tied to ground. This antenna design provides the system with different views of the detection field. It also eliminates “holes” typically found at the crossbars of typical swept antennae.

Two identical transmitters, each operating in a push-pull class D mode of operation, are used to drive the 2-loop and 3-loop antennae separately. The control signals are timed for 64 six-microsecond bursts at a 100 Hz rate. During an antenna’s cycle, the system performs two “blasts” which are called a “bin.” A bin consists of two “noise” cycles and two blast cycles. A blast is a transmit cycle followed by a receive cycle. During the noise cycle, the system does not transmit but only receives 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 target signal.

The overall duty cycle for transmitter operation is 3.84 %.

$(2 \text{ antennae} * 16 \text{ bins} * 2 \text{ blasts per bin} * 6 \mu\text{sec/blast}) = 384 \mu\text{sec}$

$384/\text{frame rate } 100 \text{ Hz (10 milliseconds)} = .0384$

2.2 Equipment Sample

2.2.1 Identification

A pre-production model of the Strata EX was tested:

| | |
|-------------------|--|
| Description: | Electronic Article Surveillance System |
| Model: | Strata EX |
| Serial Number | None |
| Manufacturer: | Checkpoint Systems, Inc. |
| Received by PCTC: | 9 October 2000 |
| Sample type | Pre-production |

Photos of the Strata EX can be found below.



Photo 1 – Strata EX

2.2.2 Condition of Received Sample

An evaluation of the Checkpoint, Strata EX 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

FCC 47 CFR, part 15, Subpart C, "Intentional Radiators ", Clause 15.223, Radiators operating in the range 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 $\mu\text{V}/\text{meter}$ (40 $\text{dB}\mu\text{V}/\text{meter}$) 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 8.8 MHz -- was performed by setting a spectrum analyzer to “max-hold”, peak detector, a 300 kHz bandwidth, and a span from 6.5 to 10.5 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: | $22^{\circ}\text{C} \pm 1^{\circ}\text{C}$ |
| Relative Humidity | $50\% \text{ RH} \pm 10\%$ |

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 via the AC power cord.

5.3 Operating Mode

During testing, the Strata EX 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 Strata EX antenna every 5 seconds to initiate a verification cycle. During this cycle, the Strata EX would indicate the presence of an article tag with an audible alarm. A green LED on the logic module of the unit would light if the tag was detected and red or yellow LED would light if an error occurred.

The TR4022 electronics PCB consist of two class D HF transmitters, synchronous I and Q receiver, RF selector switch, DDS and PLL, and a DSP based computer used to detect the presence of the target. All control and subsystem interface signals are generated and controlled by an FPGA.

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

The two transmitters are functionally identical; one is used to drive the canceling 2 Loop and the other to drive the canceling 3 Loop. 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 FPGA. 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)

The TR4022 is a digital swept frequency hopping transmitter. The TR4022 hops on discrete frequencies. The frequencies that can be transmitted by the TR4022 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 |

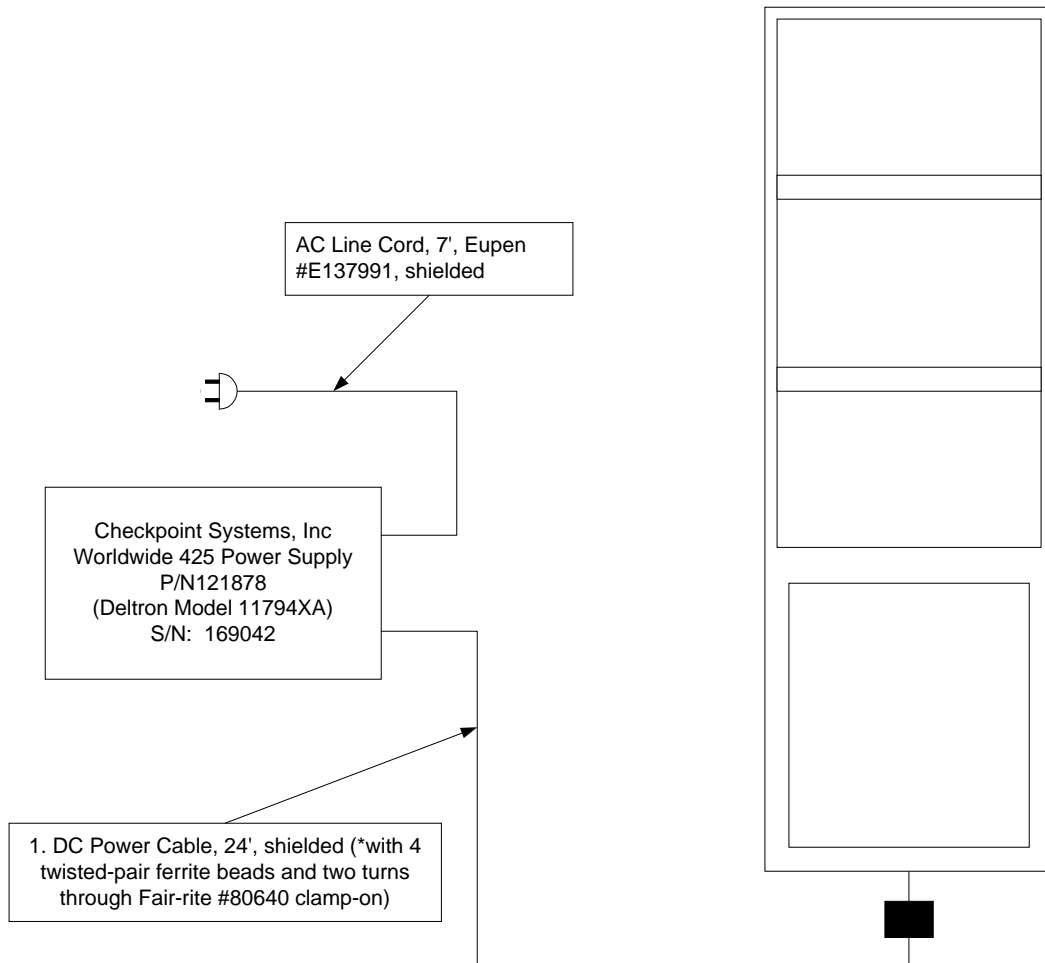
The restricted frequency bands (per FCC Part 15 Clause 15.205) in the operating frequency band of the EUT are as follows:

8.291 - 8.294MHz
8.362 – 8.366 MHz
8.37625 – 8.38675 MHz
8.41425 – 8.41475 MHz

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

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 external interfaces or support equipment attached to the Strata EX.



CABLE LIST

1. DC Power Cable, 24', shielded (*with 4 twisted-pair ferrite beads and two turns through Fair-rite #80640 clamp-on)
2. AC Line Cord, 7', Eupen #E137991, shielded

Figure 1 – Block Diagram, EMI Testing of Strata EX

5.4.1 EUT Details

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

| Description | Model # | Part # | Manufacturer | Serial # |
|------------------------|---------------|--------|--------------------------|----------|
| Antenna/Control Module | Strata EX | N/A | Checkpoint Systems, Inc. | N/A |
| Power Supply | Worldwide 425 | 121878 | Checkpoint Systems, Inc. | 169042 |

5.4.1 Support Equipment

No equipment was used to support the operation of the Strata EX during testing.

5.5 EUT Modifications

No equipment was used to support the operation of the Strata EX during testing.

6.0 Summary Of Test Results**6.1 Emission Tests****6.1.1 Radiated Emission Test (11 Oct 2000)**

Tables 1, 2 and 3 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 with the magnetic field measuring antenna 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

Table 1 shows the true peak measurement of the fundamental and the comparison of the adjusted true peak to the average limit.

Table 1 – Fundamental Measurement – True Peak (11 Oct, 2000)

| 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] |
|------------|---------------------------------------|-------------|------------------------------|-------------------------|-------------------------|----------------------------------|------------------|
| 8.2 Fund* | 100, 3 | 0 | 57.3 Peak | -21.8 | 35.5 | 40 | -4.5 |

*The true peak signal level of the fundamental was measured using a peak detector as described in section 4.0.

- 1) Polarity of the measuring antenna is 1 - along measuring axis, 2 - along vertical axis, 3 horizontal axis.
- 2) The correction factor shown represents an antenna factor of -1.8 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 2 – Calculated Average vs. Average Limit

| | |
|---|-------------|
| True Peak: | 57.3 dBμV |
| Pulse Duty Cycle: | 3.84% |
| Correction to Average: 20 * Log ₁₀ (Duty Cycle) | -28.3 dB |
| Average Level: (True Peak + Correction) | 29.0 dBμV |
| Antenna Correction: | -1.2 dB/m |
| Corrected Average Field Strength: (Avg Value + C.F) | 27.8 dBμV/m |
| Limit: | 40 dBμV/m |
| Margin with Limit: | -12.2 dB |

- MEASUREMENT OF HARMONICS BELOW 30 MHz

Table 3 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.

Table 3 – H-Field Emissions (< 1.705 MHz and > 10 MHz) (11 Oct, 2000)

| 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] |
|------------|-------------------------------------|-------------|---------------------------|---------------------|-------------------------|-----------------------------|------------------|
| 16.4 | 100,3 | 0 | 21.6 | -1.1 | 20.5 | 30 | -9.5 |
| 24.8 | 100,3 | 0 | 15.7 | 1.4 | 17.1 | 30 | -12.9 |

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

- MEASUREMENT OF INTENTIONAL RADIATOR EMISSIONS – 30 MHz TO 1 GHz

There were no signals recorded in the frequency range of 30 MHz to 1000 MHz, which were harmonics of the fundamental carrier frequency.

- Overall Result: All measured radiated emissions from the Strata EX are below the FCC 15.223 and 15.209 limits by a margin of at least 3.0 dB.

- **DIGITAL CIRCUITRY RELATED SIGNALS – 30 TO 1000 MHz – FCC 15.209**

Table 5 below shows the detected field strengths as measured from the EUT over the frequency range from 30 MHz to 1000 MHz, using an E-field antenna at a distance of 10 meters compared to the maximum permissible FCC Class A limit. A description of the procedures used in the performance of this test is provided in Appendix 2.

Table 4 – E-Field Emissions Related to Digital Circuitry (11 Oct, 2000)

| 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 |
|------------|----------------------|-------------|---------------------------|---------------------|-------------------------|------------------------------------|------------------|-------------|
| 539.996 | 338, H | 149 | 15.1 | 21.4 | 31.7 | 49.5 | -17.8 | Below limit |
| 599.988 | 103, V | 252 | 20 | 22.3 | 36.1 | 49.5 | -13.4 | Below limit |
| 600.011 | 342, H | 29 | 15.1 | 22.3 | 37.4 | 49.5 | -12.1 | Below limit |
| 680.006 | 102, V | 92 | 20 | 23.6 | 43.6 | 49.5 | -5.9 | Below limit |
| 680.022 | 187, H | 160 | 21.4 | 23.6 | 45.0 | 49.5 | -4.5 | Below limit |
| 839.808 | 255, V | 17 | 9.3 | 25.9 | 35.2 | 49.5 | -14.3 | Below limit |
| 840.204 | 398, H | 357 | 9.3 | 25.9 | 35.2 | 49.5 | -14.3 | Below limit |
| 920.366 | 101, V | 2 | 9.6 | 27.3 | 36.9 | 49.5 | -12.6 | Below limit |
| 979.764 | 398, H | 4 | 11.4 | 27.5 | 38.9 | 49.5 | -10.6 | Below limit |

- Overall Result: All measured radiated emissions from the Strata EX are below the FCC Class A limits by a margin of at least 4.5 dB.



Photo 2 – Photo of EMI Test Setup (Rear View)



Photo 3 – Photo of EMI Test Setup (Front View)

6.1.2 Bandwidth Measurement (13 Oct 2000)

A plot of the operating bandwidth was taken on the operating Strata EX by placing the measuring antenna close to the EUT, setting a spectrum analyzer to 10 dB/div, RBW=VBW=300 kHz, span = 7.2 to 9.2 MHz, Peak detection, max hold. This plot is shown below.



Photo 4 – Bandwidth Plot

The plot above confirms the transmitter bandwidth is 1.2 MHz as stated by the manufacturer. The bandwidth is 14.6% of the fundamental ($8.2 \text{ MHz} / 1.2 \text{ MHz}$) and therefore per FCC Section 15.223, the limit of $100 \mu\text{V/m}$ applies for emissions between 1.705 MHz and 10 MHz.

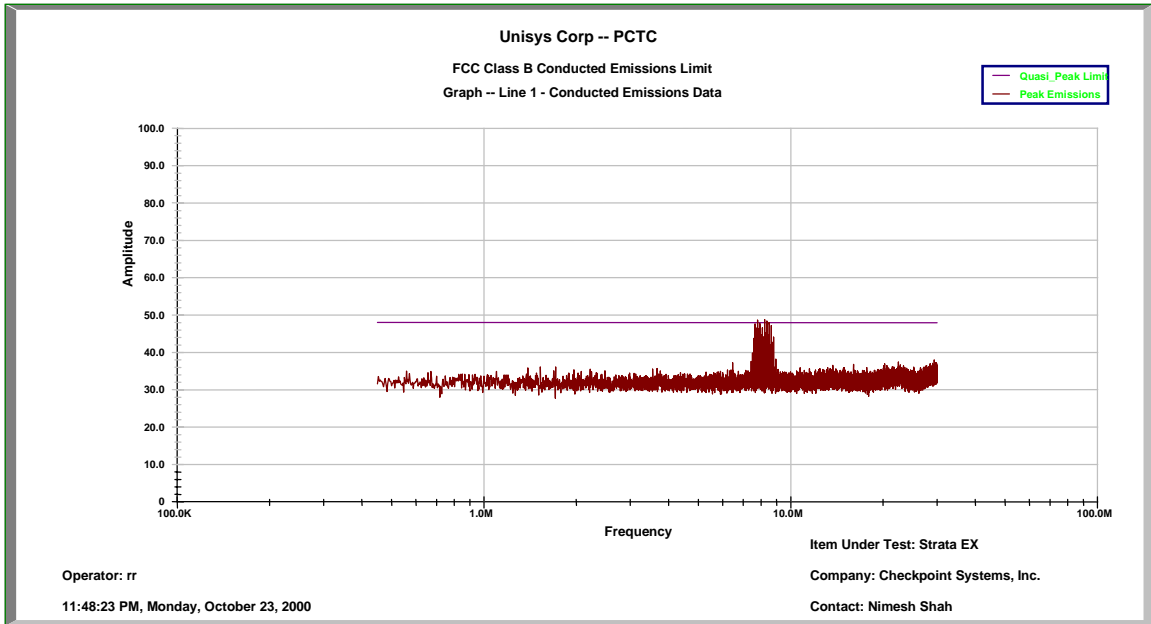
6.1.3 Conducted Emission Test (23 Oct 2000)

The following tables show the conducted emissions measurement results over the frequency range 450kHz to 30MHz for the EUT for devices operating under FCC 15.223, where the limit of FCC 15.209 applies. A description of the procedures used in the performance of this test is provided in Appendix 2.

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

Table 5 – Conducted Emissions, Neutral Line (23 Oct 2000)

| Frequency (MHz) | Quasi-Peak Detector Emission Corrected Amplitude (dBuV) | FCC Class B Limit (dB) | Quasi-Peak Margin with FCC Class B Limit (dB) | Correction Factor (dB) | Result |
|--------------------|--|------------------------------|--|------------------------------|-------------|
| 7.6439 | 44.3 | 48.0 | -3.6 | 10.3 | Below Limit |
| 7.7176 | 44.6 | 48.0 | -3.4 | 10.3 | Below Limit |
| 7.7911 | 44.8 | 48.0 | -3.2 | 10.4 | Below Limit |
| 7.8653 | 44.5 | 48.0 | -3.4 | 10.3 | Below Limit |
| 7.9369 | 44.7 | 48.0 | -3.2 | 10.3 | Below Limit |
| 8.0835 | 44.8 | 48.0 | -3.2 | 10.3 | Below Limit |
| 8.2203 | 44.5 | 48.0 | -3.5 | 10.3 | Below Limit |
| 8.3510 | 44.7 | 48.0 | -3.3 | 10.3 | Below Limit |
| 8.4978 | 44.4 | 48.0 | -3.6 | 10.3 | Below Limit |
| 8.6442 | 44.4 | 48.0 | -3.5 | 10.3 | Below Limit |

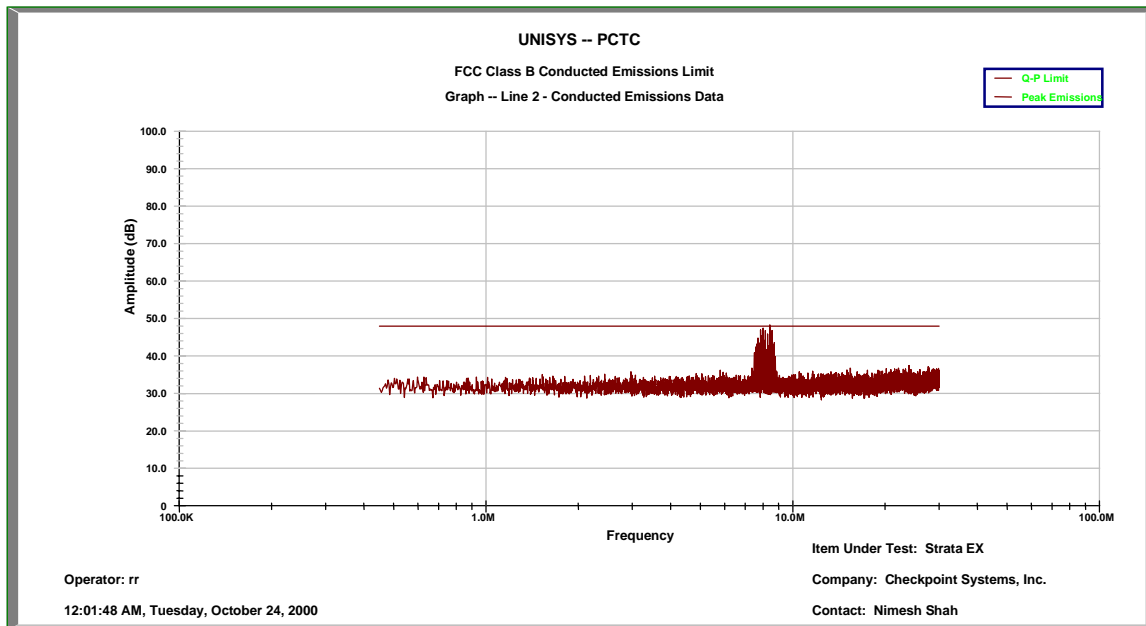


Graph 1 – Peak Detector Emissions - Neutral

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

Table 6 – Conducted Emissions, Phase Line (23 Oct 2000)

| Frequency (MHz) | Quasi-Peak Detector Emission Corrected Amplitude (dBuV) | FCC Class B Limit (dB) | Quasi-Peak Margin with FCC Class B Limit (dB) | Correction (dB) | Result |
|-----------------|---|------------------------|---|-----------------|-------------|
| 7.8483 | 43.1 | 48.0 | -4.9 | 10.4 | Below Limit |
| 7.9850 | 43.5 | 48.0 | -4.5 | 10.3 | Below Limit |
| 8.1306 | 43.7 | 48.0 | -4.2 | 10.3 | Below Limit |
| 8.4241 | 43.7 | 48.0 | -4.3 | 10.3 | Below Limit |
| 8.5708 | 43.7 | 48.0 | -4.3 | 10.3 | Below Limit |



Graph 2 – Peak Detector Emissions - Phase

- Overall Results:
 - The Strata EX complied with the requirements of FCC 15.207 by a margin of at least 3.2 dB.



Photo 5 – Conducted Test Setup

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 (10KHz - 1GHz) | 85650A | Hewlett Packard | X717 | 3/2/00 |
| Spectrum Analyzer Display | 85662A | Hewlett Packard | U181 | 3/2/00 |
| Spectrum Analyzer (10KHz – 1.5GHz) | 8566B | Hewlett Packard | X718 | 3/2/00 |
| RF Preselector (20 Hz to 2GHz) | 85685A | Hewlett Packard | Y0312 | 3/2/00 |
| Manual Receiver (9 kHz-30 MHz) | ESH2 | Polarad | U964 | 12/2/99 |
| Manual Receiver (20 MHz -1GHz) | ESV | Polarad | U965 | 7/15/99 |
| LISN | MN2053 | Chase Electric Limited | U776 | 6/12/99 |
| Antenna (25MHz to 2GHz) | LFB-2025 | ARA | B-962 | 6/23/99 |

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****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. An H-field measuring antenna was placed at a distance of 30 meters from the EUT at a height of 1 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. In some cases the measuring antenna was taken off the ground plane and placed in the adjacent grass area. 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. An H-field measuring antenna was placed at a distance of 30 meters from the EUT at a height of 1 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.

Per the agreement between Checkpoint and FCC, testing in this frequency range for fundamental and harmonic 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 6.5 to 10.5 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:

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

A.2.1.2 Conducted Emissions Test

Procedure 450 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 450 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:

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

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 an manually tuned receiver with the detector function first set to quasi-peak and then to average. These manual measurements are recorded and printed below each graph, which is attached in Appendix 4 of this report.

Appendix 3 – EUT Drawings

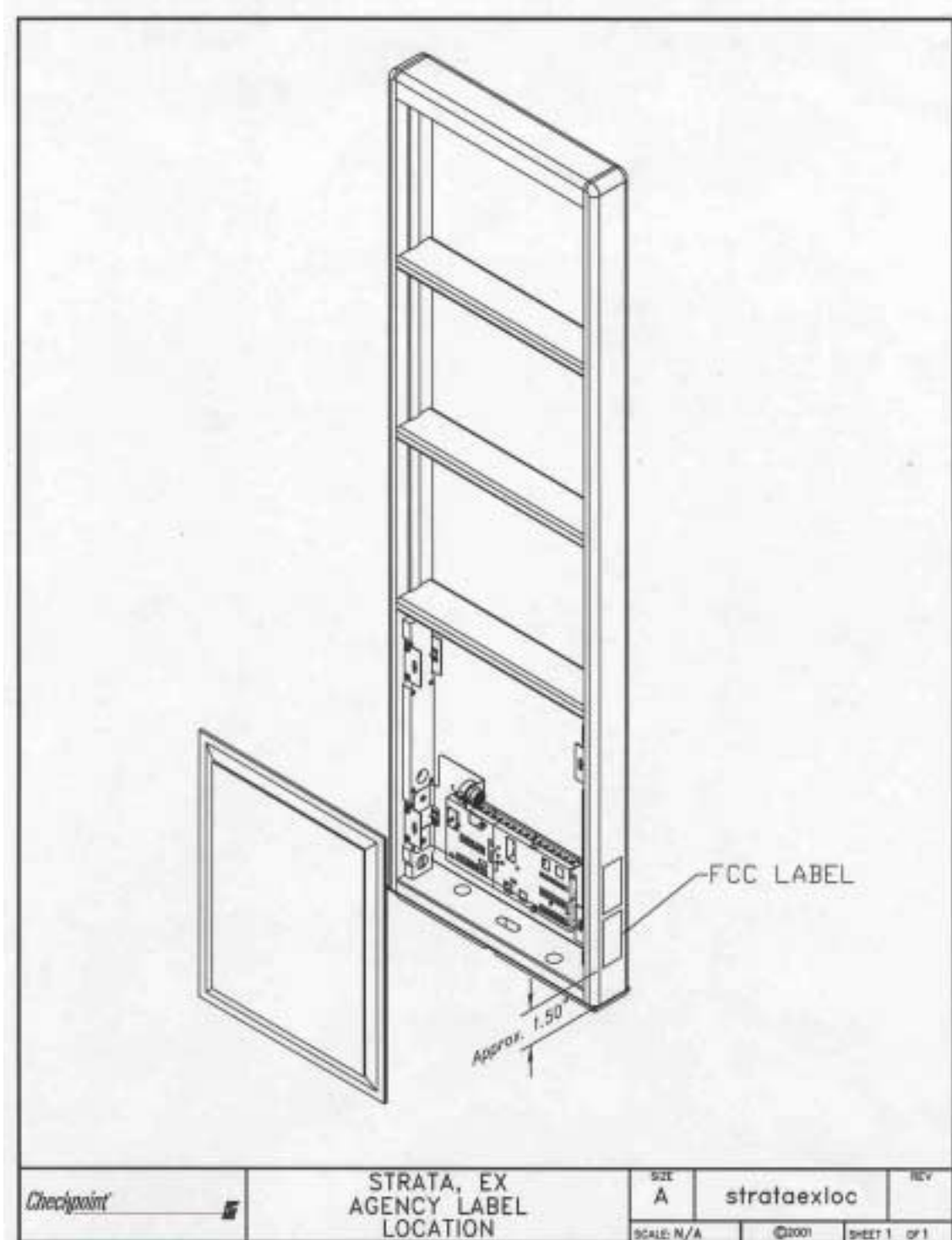


Figure 2 – Location of Agency Labels on Strata EX

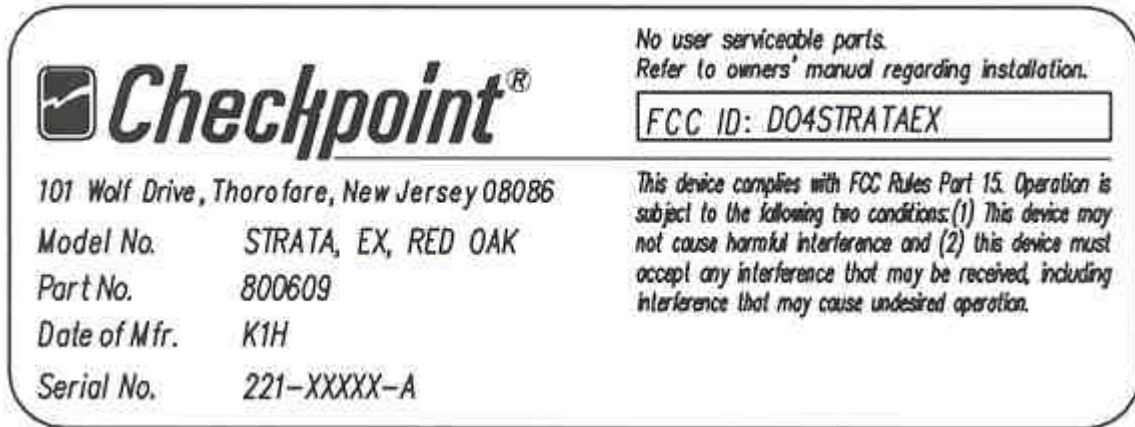


Figure 3 – Sample of Strata EX Label

Appendix 4 – Correspondence Letter

MAR 13 '97 10:59 TO-912105223396
JUL 27 '98 15:19 TO-918013440680

FROM-CHECKPOINT SYSTEMS INC
FROM-CHECKPOINT SYSTEMS INC

T-085 P.02/02 F-071
T-081 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: (609) 344-2080

No. of Pages: 2
(Incl. Cover)

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

Telephone: (609) 344-2339 Direct
Toll Free: (800) 287-8840 Ext. 2339
Fax No.: (609) 344-2366

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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 hopping, 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 than 1% to satisfy section 15.205 of the rules.
in the band 1.705 - 10 MHz
- • For fundamental and harmonic emissions ~~between 20-30 MHz~~, a 20 dB reduction from the true peak is to be compared to the limits of 100uV/meter ~~and 30uV/meter respectively~~ 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 deconvolution.
- • For ~~emissions above 30-300 MHz~~ *emissions outside the 1.705 - 10 MHz band*, 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*