

RADIO DISTURBANCE TEST REPORT

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Project No. 295

FCC ID DO4STRATAPXW

CHECKPOINT SYSTEMS STRATA PX

USA CFR 47 PART 15 REQUIREMENTS

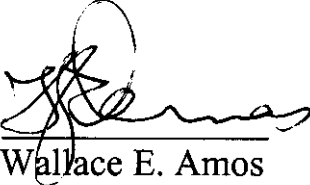
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Test Dates: 10/8/98

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Sponsor: Checkpoint Systems, Inc.

101 Wolf Drive

Thorofare, NJ 08086

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 Checkpoint Systems, Strata PX 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 - Intentional Radiator	FCC	15.223 - 1.705 to 10 MHz	Below Limit
Radiated Emissions	FCC	General Requirements 15.209 10 MHz - 1 GHz	Below Limit
Conducted Emissions	FCC	General Requirements 15.207 450 kHz to 30 MHz	Below Limit

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1.0 Client Information

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

Coordinator(s): Eric Eckstein

1.1 Requested Service

- Measurement of radio disturbance characteristic of sample product to FCC Part 15.223 for intentional radiators.

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**

A production model sample of the test item was tested as follows:

Model No./Name: Strata PX
Serial Number 100-00198-A (antenna), 122819 (power supply)
Manufacturer: Checkpoint Systems, Inc.
Received by PCTC: 11/8/98

2.2 Description of The Test Item

2.2.1 General

The Strata PX is an Electronic Article Surveillance(EAS) detection system which uses targets that are applied to merchandise. These targets resonate in the frequency range of 8.2, 9.0 or 9.5 MHz. When an article of merchandise is purchased, the target is de-activated which causes in to no longer resonate. The Strata PX monitors an area 3 feet on either side of the antenna in the 7.6 MHz to 8.7 MHz, 7.8 MHz to 9.42 MHz, or 9.0 MHz to 9.8 MHz band and triggers an alarm when an active target is detected.

2.3 Test Item Classification

The test item has been defined an intentional radiator operating in the band 1.705 MHz to 10 MHz. For this reason the emissions testing was carried out in accordance with the requirements of FCC 15.223.

2.4 Test Sample Modifications

In order to meet the radiated emission limits in the 30 to 50 MHz range, the common mode chokes in the "2 loop" and "3 loop" antennas were changed from three turns to two turns each.

2.5 Support Equipment

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

Photos of the test sample can be found in Appendix 5.

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

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

Per customer instructions, measurement of the fundamental, 7.6 to 9.8 MHz, was performed by setting a spectrum analyzer to "max-hold", peak detector, 300 kHz bandwidth, and a span from 6.5 to 10.5 MHz. This peak detected signal was then compared to the average limit of 15.223 plus 20 dB. This was done due to the pulsed and swept nature of the transmission and in accordance with previous agreement with the FCC and Checkpoint Systems, Inc.

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: $22^{\circ} \text{C} \pm 1^{\circ} \text{C}$
Relative Humidity: 50% RH

5.1.2 Electrical Power

The test sample was operated at electrical power voltages sufficient to ensure that the measured results were representative of operation of the test sample in the power environments in which it would be installed , as specified by the client.

5.2 Grounding

The test item was not provided any direct connection to the test site ground plane.

5.3 Operating Mode

During testing, the Strata PX was operating in a standalone mode - the antenna was placed vertically, centered on the turntable and connected to a separate power supply. The Strata PX was sweeping/transmitting continuously during testing.

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.

Only one test configuration, normal standalone operation, was tested. This configuration consisted of the Strata PX antenna system, P/N 500898 Rev 02 serial number 100-00198-A, and a power supply, P/N 11794XA serial number 122819.

6.0 Summary Of Test Results

6.1 Emission Tests

6.1.1 Radiated Emission Test (10/8/98)

The table below shows the detected field strengths as measured from the test sample(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 measuring antenna on the ground plane. A detailed description of the procedures used in the performance of this test is provided in Appendix 2.

Freq [MHz]	Height, Pol ¹ [cm 1/2/3]	Angle [Deg]	Quasi-Peak Voltage [dBuV] Detector	Corr' Factor [dB/m]	Field Strength [dBuV/m]	FCC Limit @ 30m [dBuV/m]	Delta Limit [dB]	Result
8.26 Fund	100,3	-	60.4 Peak	-1.17	59.33	60	-0.67	Below limit
16.55	100,3	-	26.0	-0.57	25.43	30	-4.57	Below limit
25.50	100,3	-	14.0	0.5	14.5	30	-15.5	Below limit

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

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

The table below shows the detected field strengths as measured from the test sample(s) over the frequency range from 30 MHz to 1000 MHz, at a distance of 3 meters compared to the maximum permissible FCC 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, Pol [cm H/V]	Angle [Deg]	Quasi-Peak Voltage [dBuV] Detector	Corr' Factor [dB/m]	Field Strength [dBuV/m]	FCC Limit @ 3m [dBuV/m]	Delta Limit [dB]	Result
39.223	101V	17	18.5	18.4	36.9	40	-3.1	Below limit
39.751	100V	39	13.5	18.4	31.9	40	-8.2	Below limit
42.862	100V	351	22.3	17.6	39.9	40	-0.1	Below limit
43.685	101V	9	22.4	17.4	39.8	40	-0.2	Below limit
46.425	100V	359	21.7	16.7	38.4	40	-1.6	Below limit
65.046	102V	126	24.6	12.9	37.5	40	-2.5	Below limit
66.313	100V	111	25.7	12.7	38.4	40	-1.6	Below limit
400.671	101V	84	20.4	20.3	40.7	46	-5.3	Below limit
566.480	100V	295	19.3	23	42.3	46	-3.7	Below limit
568.071	100V	247	19.2	23	42.2	46	-3.8	Below limit
608.664	100V	260	18.9	23.7	42.6	46	-3.4	Below limit

- Overall Result: All measured radiated emissions from the Strata PX are below the FCC 15.223 and 15.209 limits by a margin of 0.1 dB.

6.1.2 Bandwidth Test (11/8/98)

A plot of the operating bandwidth was taken on the operating Strata PX by placing the measuring antenna close to the test item, setting a spectrum analyzer to 2dB/div, RBW=VBW=300 kHz, span = 6.5 to 10.5 MHz, Peak detection, max hold. This plot is attached to this report in Appendix 4.

6.1.3 Conducted Emission Test (11/8/98)

The following table shows the Conducted Emissions Limits for devices operating under FCC 15.223. 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)	FCC Limits (dBuV)		Comments	Results
	NB	WB		
0.45 - 30	48	61	None	Below limit

- Graphs of the recorded emissions detected on the power lines of the test sample were captured during normal operation of the sample. This data was recorded using a spectrum analyzer with a peak detector. The graphs are attached to this report in Appendix 4.

Overall Results: - The Strata PX complied with the requirements of FCC 15.207 by a margin of 8.4 dB.

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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>
Spectrum Analyzer QuasiPeak Adapter	85650A	Hewlett Packard	U182	3/16/98
Spectrum Analyzer Display	85662A	Hewlett Packard	X719	3/16/98
Spectrum Analyzer	8568B	Hewlett Packard	U180	3/16/98
RF Preselector	85685A	Hewlett Packard	W927	3/16/98
Manual Receiver 9 kHz-30 MHz	ESH2	Polarad	U964	12/30/97
Manual Receiver 20 - 1000 MHz	ESV	Polarad	U965	12/30/97
Antenna	LPB2520	ARA	B962	4/30/98
Antenna	BBH-500/B	ARA	U640	6/5/98
LISN	MN2053	Chase	U776	8/18/98
Open Area Test Site (OATS) (see appendix A.2.1.1)	N/A	Unisys Corp.	N/A	4/10/97

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****30 MHz to 1000 MHz**

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

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

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

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

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

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

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

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

9kHz to 30 MHz

Testing below 30 MHz was performed with the test item configured on the test site as above. An H-field measuring antenna was placed at a distance of 30 meters from the test item at a height of 1 meter above the ground plane. The test item 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.

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

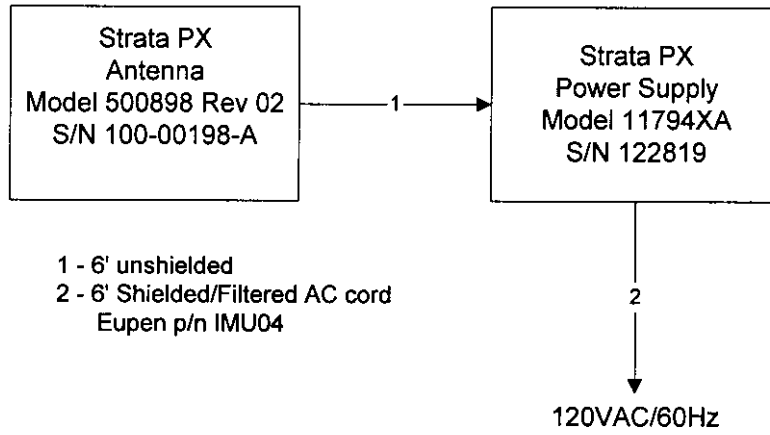
Peak amplitude terminal voltage emissions at the power line input to the test sample(s) were measured with a spectrum analyzer, using a peak detector and the appropriate CISPR bandwidth, connected to the RF output of a 50 Ohm, 50 microhenry Line Impedance Stabilization Network (LISN) installed in each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

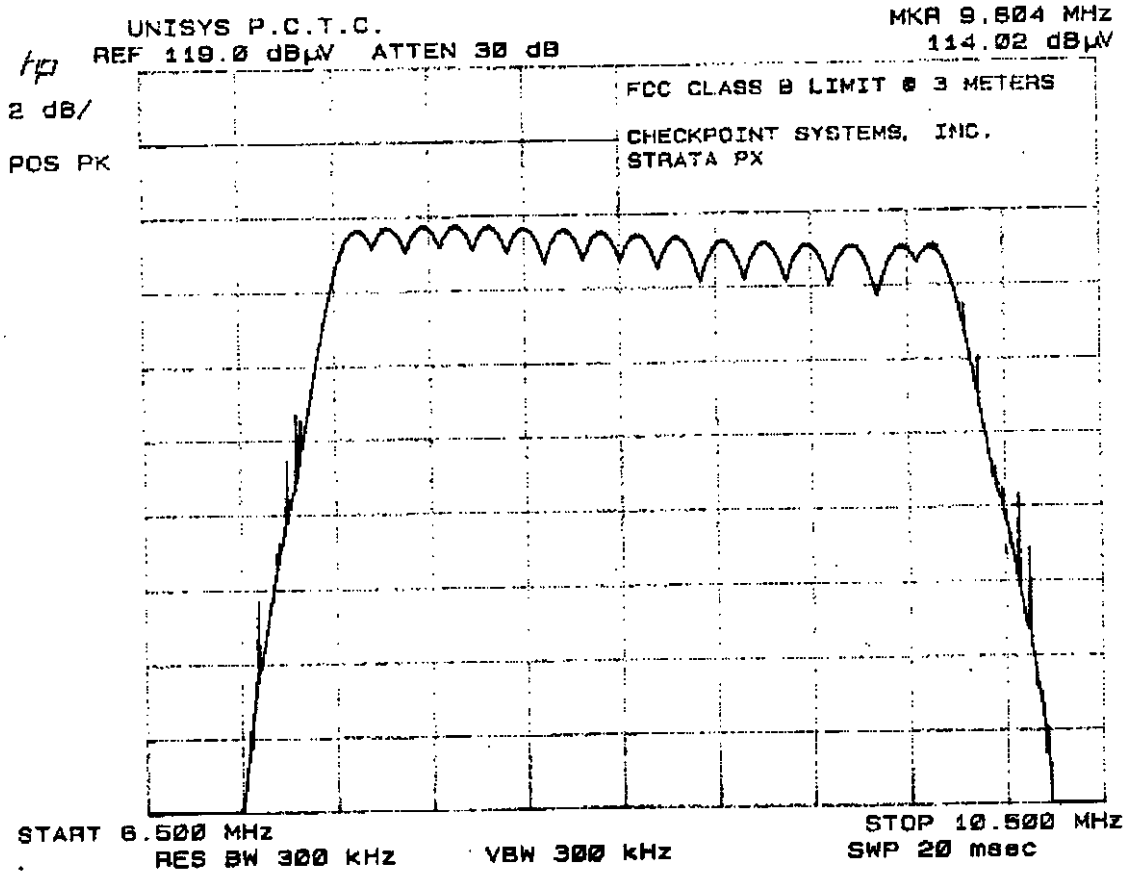
Appendix 3 - Test Sample Configuration Drawings/Photographs



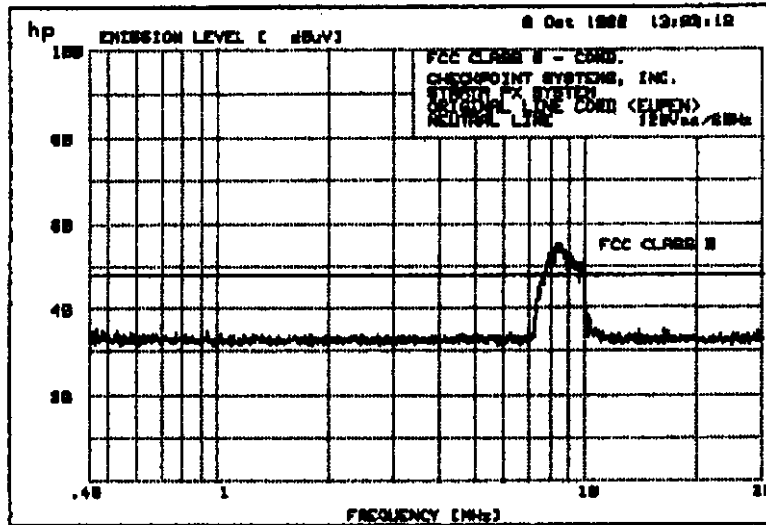
Block Diagram For Strata PX - EMI Testing

Appendix 4 - Supplementary Results

Strata PX Bandwidth Plot - 10/8/98



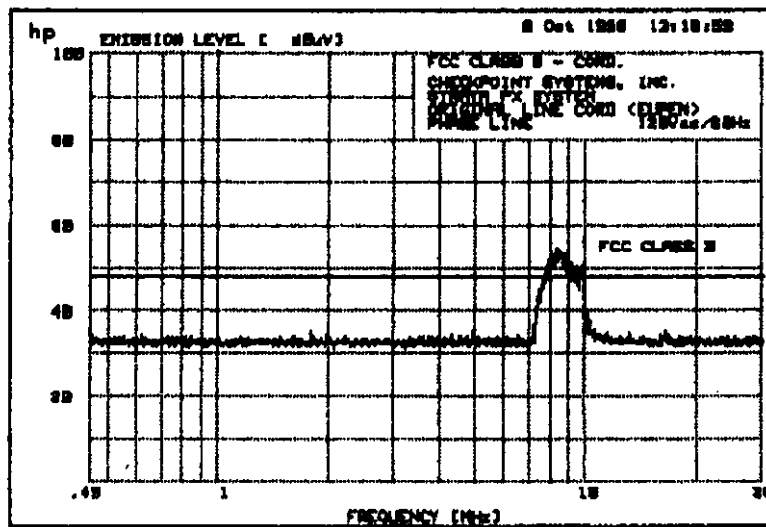
Conducted Emissions Test Result - 10/8/98
Strata PX



MEASUREMENT NOTES:

Frequency (MHz)	Quasi-peak (dBuV)	Average (dBuV)
8.440	52.6	31.8
9.917	43.4	25.1

Handwritten: JCS
10/12/98



MEASUREMENT NOTES:

Frequency (MHz)	Quasi-peak (dBuV)	Average (dBuV)
8.440	51.6	32.8
9.917	42.6	24.6