

ELECTROMAGNETIC INTERFERENCE TEST REPORT

Doc. 20050805R01/Project No. 1212

TEST STANDARDS: 47 CFR PART 15,

CP9- 2

FCC ID: D04CP9-2

CHECKPOINT SYSTEMS, INC.
THOROFARE, NJ 08086

TEST DATES: July 20th & 21st, 2005

ISSUE: August 16th, 2005

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Certificate No: 1028.01

ERRATA SHEET

This document is revision 1 to document 20050805R and is marked as “PCTC Doc. No. 20050805R01”, dated 16 August 2005. This revision is issued to make the following corrections and clarifications:

Page	Change
8	Added duty cycle calculation
9	Corrected typographical error in paragraph 6 from “50 kHz” to “300 kHz.”
10	Added Peak detector RBW and “Measurement Result – Average” table to show compliance to 15.223 average limit.

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 in 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 CP9- 2 was tested to the standards listed below, and found to have the following characteristics:

Emission Tests

	FCC	Frequency Range	RESULT
Radiated Emissions Intentional Radiator, Fundamental	Part 15.223	1.705 to 10 MHz	Below Max. Permissible Limit
Radiated Emissions Intentional Radiator, Harmonics	Part 15.209	10 MHz to 1 GHz	Below Max. Permissible Limit
Conducted Emissions Intentional Radiators	Part 15.209	450 kHz to 30 MHz	Below Max. Permissible Limit

EUT Modifications:

Fair Rite p/n 0444164281 was added to the controller end of the antenna cable to suppress a radiated emission signal at 160.021 MHz.

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1.0 Description of the Equipment Under Test (EUT)

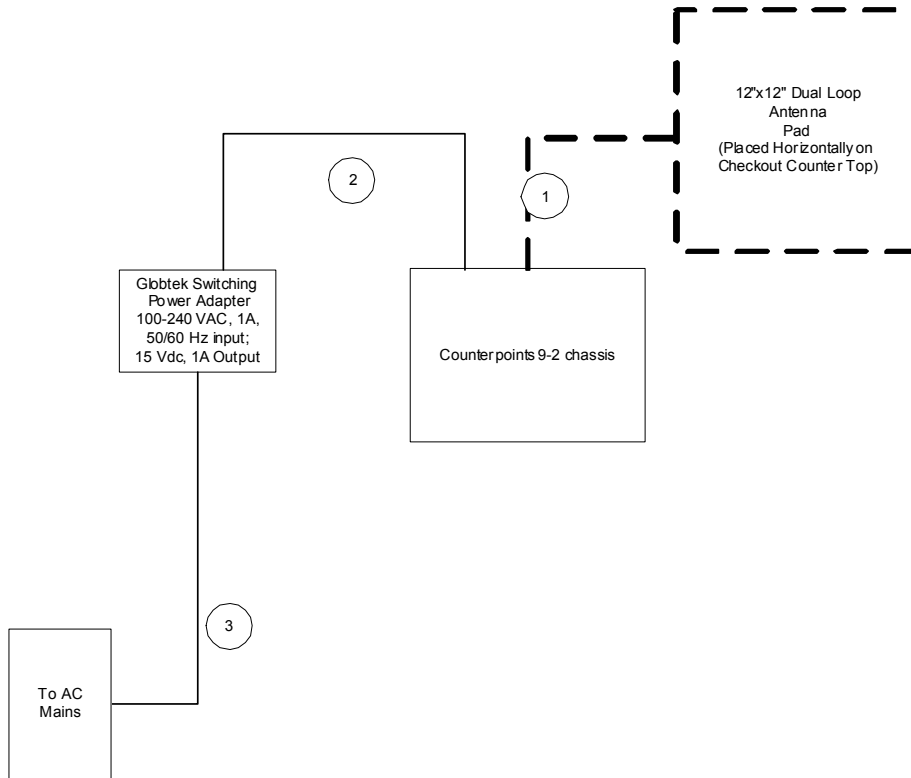
Equipment Identification	CP9-2
Serial Number	None
Manufacturer	Checkpoint Systems, Inc.
Technical Contact	Greg Sleet, Bayode Olabisi
Condition Received	Acceptable for Test
Date Received	7/20/05
Sample Type	Prototype
Equipment Classification	Non-residential, Information Technology Equipment (ITE)
Unisys Test Personnel	Paul Banker, Itamar Gonen

1.1 General Description

The CP9-2 is one of Checkpoint's retail loss prevention products that utilize low power, narrow pulsing electromagnetic field to detect 2.0 MHz +/- 5% hard tags attached to merchandise in a Point of Sale environment. 2.0 MHz Hard tags that are within up to 15" of the antenna pad are detected, and tag detection results in an alarm event. The Globtek GT-21089 worldwide switching power supply provides 15 Vdc to power the CP9-2 chassis.

1.2 Test Configurations

The CP9-2 is to be tested as follows: the CP9-2 chassis, 12"x12" antenna pad, and Globtek power supply are mounted horizontally on a wooden test table/countertop. The VPA setting, which can increase/decrease the radiated and conducted field strength measurements, is fixed at 15 Vdc, and cannot be adjusted.



Cable List

1. 8', 3-conductor #16 Antenna Pad Cable (black, white, drain), shielded
2. 6' 2-conductor Low Voltage DC Cable, unshielded
3. 6', IEC 320 Cordset, unshielded

EMI Test Setup Block Diagram of CP9- 2

EUT Hardware:

Description	Manufacturer	Model#	Serial#
Counterpoint 9-2:	Checkpoint	CP 9-2	Pre-production
Power Supply	Globtek	GT-21089-1515-T3	N/A
12"x 12" Antenna Pad	Checkpoint	CP9-2 Antenna Pad	N/A

1.3 Rationale for the Chosen Configuration

The EUT configuration represent condition that will emit the maximum levels of RF energy – fixed VPA setting, typical installed I/O options, and power supply in its typical end installation.

1.4 EUT Modifications

Fair Rite p/n 0444164281 was added to the controller end of the antenna cable to suppress a radiated emission signal at 160.021 MHz.



2.0 Operation of the EUT During Testing

2.1 General

Climatic Environment

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

Temperature: $22^{\circ}\text{C} \pm 5^{\circ}\text{C}$ Relative Humidity $50\% \pm 10\% \text{RH}$

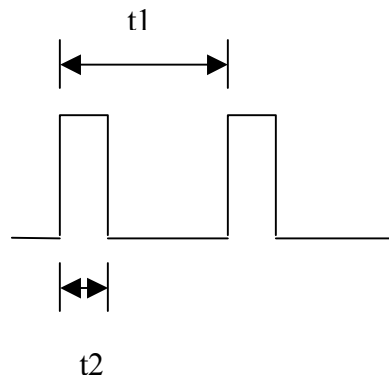
Selection of AC Power Voltage/Frequencies

The radiated and conducted emissions tests were performed with the EUT operating at 120 Vac / 60Hz.

2.2 Operating Mode

The CP9-2 was tested with the 12"x12" antenna pad horizontally positioned on the test table. The Green power LED on the rear of the chassis stays ON at all times, and red LED comes on upon a tag detection/alarm event. A 2.0 MHz hard tag placed within a height of up to 15" of the antenna pad triggers an alarm event. A test tag is placed in the field of the antenna pad to observe any changes in the measured field strength.

Since the natural resonant frequency varies slightly from label to label, the RF transmission pattern must be a form of frequency hopping. The CP9-2 electronics will transmit (and receive) a slightly different frequency for each RF "blast". The array, on the following page, contains the discrete frequencies, in Hertz, generated by the CP9-2.



164 Hz Mode of Operation (Average Frequency)

Frequencies within the 2MHz Band have the following timing characteristics:

- t1 transmission period: 6.09 msec
- t2 transmission On Time: 50µsec
- One frame constitutes 64 transmission bursts.
- Frames are repeated continuously.

Duty Cycle = 50 usec/6.09msec = .00821 or .821%

Frequency Table (1.9 – 2.1 MHz)							
2099609	2093506	2086792	2080078	2073975	2067261	2061157	2054443
2048340	2041626	2034912	2028809	2022095	2015991	2009277	2003174
1996460	1989746	1983643	1976929	1970825	1964111	1958008	1951294
1944580	1938477	1931763	1925659	1918945	1912842	1906128	1899414
1903076	1909180	1915283	1921387	1928101	1934204	1940308	1946411
1953125	1959229	1965332	1971436	1977539	1984253	1990356	1996460
2002563	2009277	2015381	2021484	2027588	2034302	2040405	2046509
2052612	2058716	2065430	2071533	2077637	2083740	2090454	2096558

2.3 Rationale for the Chosen Mode of Operation

The chosen operating mode fully exercises and duplicates all normal activity that may be expected in the unit's end installation.

3.0 Applicable Requirements, Methods and Procedures

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

47 CFR, Part 15, Subpart B, "Unintentional Radiators, General Rules and Regulations"

Basic Test Methods and Procedures

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

ANSI C63.4, 2003 “American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”.

CISPR 22: 1993, A1/1995,A2/1996 “Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment.”

Deviations or Exclusions from the Requirements and Standards

In 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 B for reference.

Measurement of the fundamental, 1.9 to 2.1 MHz, was performed by setting a spectrum analyzer to “max-hold”, peak detector, a 300 kHz bandwidth, and a span from 1.75 to 2.25 MHz. Increasing the resolution bandwidth above 300 kHz did not increase fundamental signal level.

4.0 Test Results

4.1 Radiated Emissions

Test Standard:	USA: 47 CFR Parts 15 B
Frequency Range:	9 kHz to 1000 MHz
Test Distances:	3 and 30 Meters
Antenna Polarity and Height:	1.705 MHz – 30 MHz: Three orthogonal axes @ 1 meter 30MHz-1 GHz: Vertical and Horizontal @ 1 to 4 Meters
AC Power:	120 Vac, 60 Hz
EUT Type:	Table Top
Highest Oscillator Frequency:	40 MHz
Measurement Uncertainty:	5.0 dB (CISPR 16-4: 2002)
Field Strength Calculations:	Field Strength (dBµV/m) = meter reading (dBµV) + antenna factor (dB/m)+ Cable Loss (dB)

4.1.1 Radiated Emissions Test Results (7/20/05)

Radiated Emissions 9 kHz – 30 MHz (FCC 15.209, 15.223)

Measurement Distance is 30 meters. Vert | is antenna perpendicular, Vert = is antenna parallel

Freq. (MHz)	Description	Polarity	Azimuth	Corrected Peak Level	Cable Loss (dB)	Corrected Level (dBμV/m)	Limit (30 meters)	Δ
1.9	Fundamental	Vert	360	52.31	0.50	52.81	60.00	-7.19
1.9	Fundamental	Vert =	360	53.11	0.50	53.61	60.00	-6.39
1.9	Fundamental	Horiz	360	51.32	0.50	51.82	60.00	-8.18
2	Fundamental	Vert	360	55.55	0.50	56.05	60.00	-3.95
2	Fundamental	Vert =	360	55.92	0.50	56.42	60.00	-3.58
2	Fundamental	Horiz	360	53.92	0.50	54.42	60.00	-5.58
2.1	Fundamental	Vert	360	51.31	0.50	51.81	60.00	-8.19
2.1	Fundamental	Vert =	360	51.59	0.50	52.09	60.00	-7.91
2.1	Fundamental	Horiz	360	48.25	0.50	48.75	60.00	-11.25

The true peak signal level of the fundamental was measured using a peak detector. True Peak was determined by increasing the receiver bandwidth until a point where the peak excursion stopped increasing. (300 kHz RBW)

The levels of the 2nd through 4th harmonics of the fundamental were not detected at 30 meters. No other signals associated with the EUT were detected between 9 kHz and 30 MHz.

- **MEASUREMENT RESULT - AVERAGE**

As indicated in section 2.2, the CP9-2 transmitter operates with a duty cycle of 0.821%. This would result in the following calculations for conversion from peak to average and a subsequent comparison of the fundamental with the average limit. (Guidance for this calculation was taken from HP Application Note 150-2 Spectrum Analysis – Pulsed RF).

Table 1 – Calculated Average vs. Average Limit

	2 MHz Fundamental
Corrected Maximum True Peak:	56.42 dBμV/m
Pulse Duty Cycle:	.0821%
Correction to Average: 20 * Log ₁₀ (Duty Cycle)	-41.7dB
Average Level: (True Peak + Average Correction)	14.7 dBμV/m
Limit:	40 dBμV/m
Margin with Limit:	-25.3 dB

Spurious Emissions: 30 MHz - 1000 MHz (FCC 15.209)

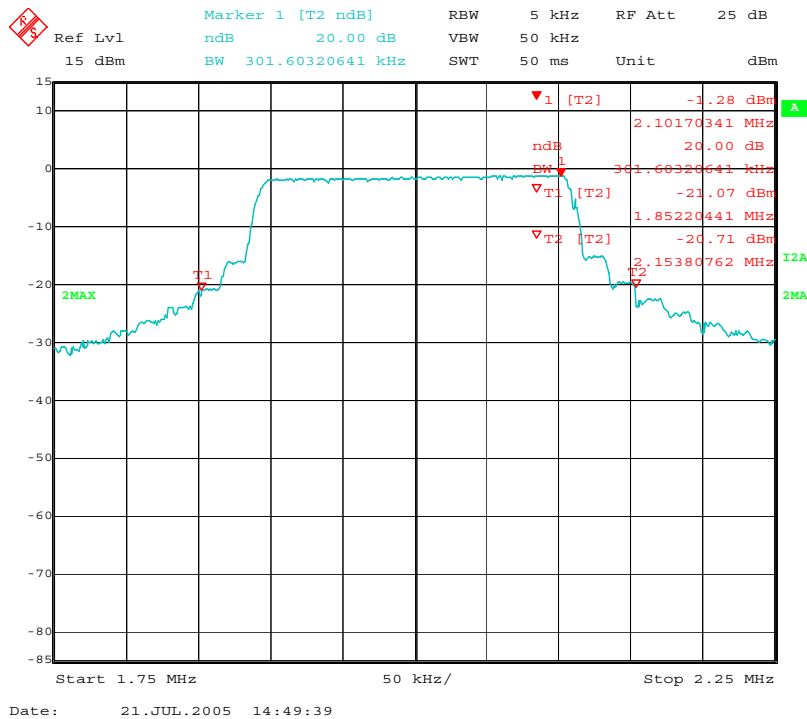
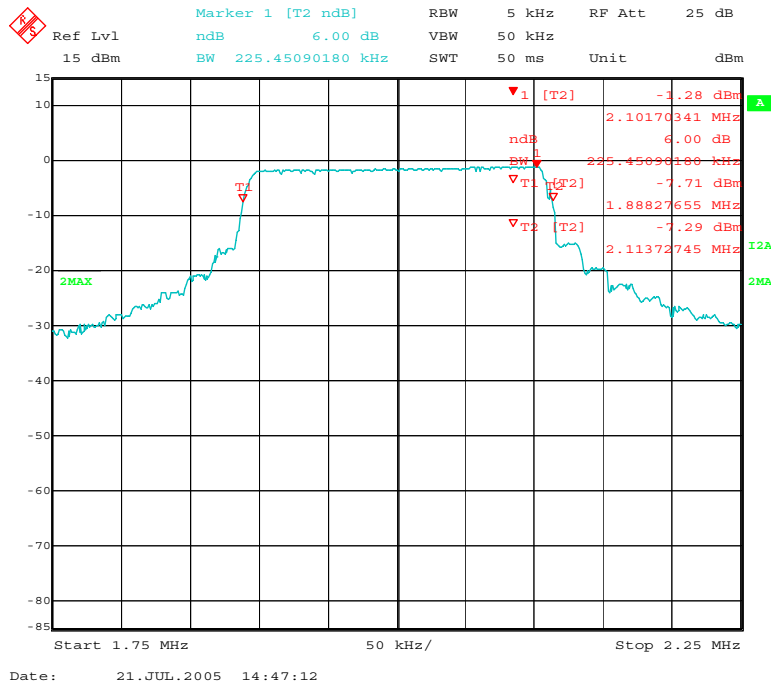
The tables below show the highest amplitude quasi-peak detected field strengths of spurious emissions measured from the EUT over the frequency range from 30 MHz to 1000 MHz, at a distance of 3 meters compared to the maximum permissible 47 CFR Part 15C limit at 3 meters.

Freq [MHz]	Pk [dBmV/m]	Q-Pk [dBmV/m]	Pol	Angle [deg]	Ht [cm]	CF [dB]	Limit [dBmV/m]	Delta [dB]
160.021	57.11	41.4	V	275	100	11.9	43.5	-2.1
160.021	41.05	38.26	H	292	111	11.9	43.5	-5.24
180.038	31.63	21.52	V	206	100	11.45	43.5	-21.98
180.038	29.43	20.75	H	83	141	11.45	43.5	-22.75
260.047	33.67	30.92	V	112	119	15.09	46	-15.08
320.068	36.1	34.38	V	288	153	16.65	46	-11.62
340.074	36.23	34.69	V	83	100	17.17	46	-11.31
380.081	34.07	31.84	V	319	123	18.34	46	-14.16
380.081	37.52	35.52	H	125	100	18.34	46	-10.48
460.09	40.45	39.3	V	241	100	19.93	46	-6.7
460.09	40.08	38.71	H	199	158	19.93	46	-7.29
500.099	42.39	40.6	V	269	100	20.61	46	-5.4
500.099	42.01	37.81	H	217	177	20.61	46	-8.19
540.103	42.31	40.11	V	146	100	21.58	46	-5.89
540.103	45.56	41.65	H	289	136	21.58	46	-4.35

Overall Results: All radiated emissions are recorded at a various distances from the CP9- 2 are below the specified limits. There were no other emissions detected from the EUT.

4.1.2 Occupied Bandwidth (7/20/05)

The 6-dB and 20-dB bandwidth plots are shown below is for the CP9-2.



Test Setup Photos



Radiated Emissions Test Setup – Rear View



Radiated Emissions Test Setup – Front View

4.2 Conducted Emissions

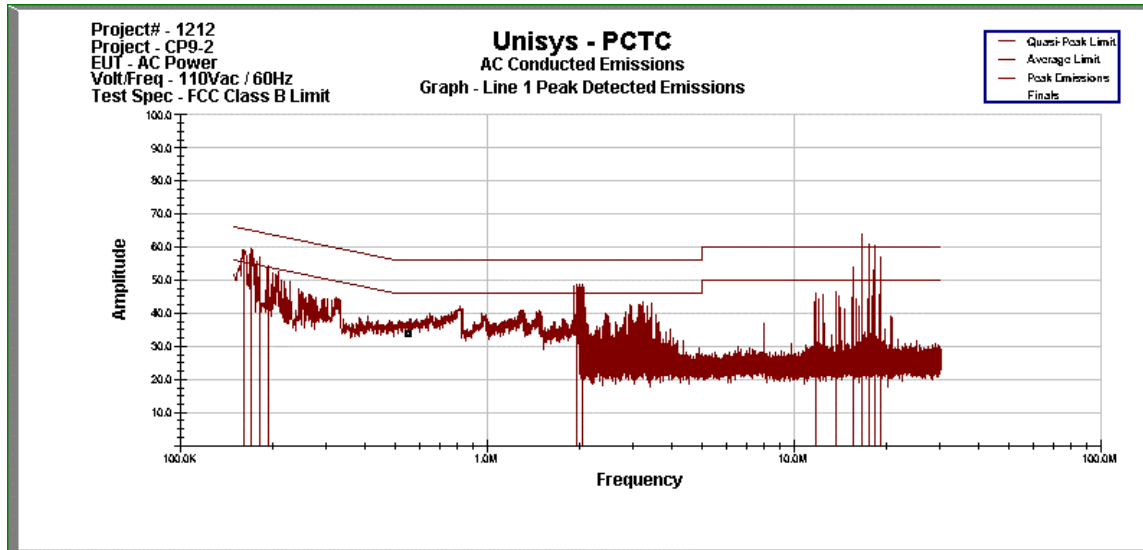
Test Standard:	USA: CISPR 22 Class B
Frequency Range:	150kHz to 30 MHz
AC Power:	120 Vac, 60 Hz
EUT Type:	Table Top
Highest Oscillator Frequency:	40 MHz
Measurement Uncertainty:	5.0 dB (CISPR 16-4: 2002)
Conducted Emission Calculation:	Peak Emission (dBuV Peak) = Meter reading (dBuV) + cable loss (dB) + Limiter loss (dB)

4.2.1 Conducted Emission Test Results (7/21/05)

The conducted emissions recorded on the EUT AC power cord (s), displayed against the limits for CISPR 22, Class A devices are presented on the following pages. Conducted emission amplitudes (dBuV PK) measured with a peak detector are compared with CISPR 22, Class A average limit and displayed on the graph. Where the measured peak detector emission exceeded the average limit, or found to be within 1 dB of average limit, re-measurement using quasi-peak and average detector functions was made. The re-measured emissions are presented in a table below the appropriate table of peak detector emissions, which displays quasi-peak measurements vs. the quasi-peak limit and the average measurements vs. the average limit.

Conducted Emission Test Results (FCC 15.207)

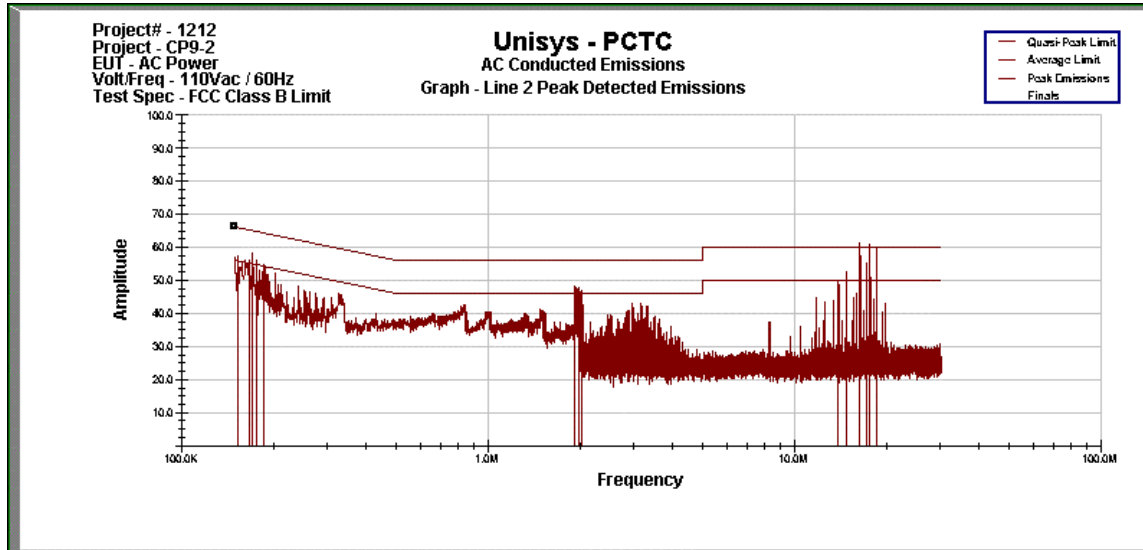
CP9-2, with Globtek GT-21089-1515-T3 power supply, 120Vac/60 Hz, Neutral Line



Unisys - PCTC
Line 1 Conducted Emissions
12:56:20 PM, Thursday, July 21, 2005

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
161.000 KHz	36.73	55.69	-18.96	49.62	65.69	-16.06	13.105
170.000 KHz	40.26	55.43	-15.16	51.14	65.43	-14.29	12.758
181.000 KHz	30.07	55.11	-25.04	44.08	65.11	-21.04	12.333
193.000 KHz	25.66	54.77	-29.11	39.88	64.77	-24.89	11.870
1.958 MHz	17.52	46.00	-28.48	33.03	56.00	-22.97	10.113
2.048 MHz	19.21	46.00	-26.79	34.72	56.00	-21.28	10.110
11.724 MHz	17.23	50.00	-32.77	25.61	60.00	-34.39	10.294
13.740 MHz	17.18	50.00	-32.82	24.60	60.00	-35.40	10.335
15.511 MHz	17.05	50.00	-32.95	33.51	60.00	-26.49	10.380
16.691 MHz	18.09	50.00	-31.91	36.94	60.00	-23.06	10.428
17.523 MHz	18.89	50.00	-31.11	35.32	60.00	-24.68	10.461
18.370 MHz	18.98	50.00	-31.02	35.91	60.00	-24.09	10.495
19.154 MHz	17.91	50.00	-32.09	29.61	60.00	-30.39	10.526
Project# - 1212							
Project - CP9-2							
EUT - AC Power							
Volt/Freq - 110Vac / 60Hz							
Test Spec - FCC Class B Limit							

CP9-2, with Globtek GT-21089-1515-T3 power supply, 120Vac/60 Hz, Phase Line



Unisys - PCTC
Line 2 Conducted Emissions
12:51:19 PM, Thursday, July 21, 2005

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Corr
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
152.000 KHz	28.842	55.943	-27.101	45.915	65.943	-20.027	13.453
166.000 KHz	38.981	55.543	-16.562	51.292	65.543	-14.251	12.912
171.000 KHz	36.486	55.400	-18.914	49.108	65.400	-16.292	12.719
176.000 KHz	30.165	55.257	-25.092	47.091	65.257	-18.166	12.526
185.000 KHz	26.905	55.000	-28.095	41.120	65.000	-23.880	12.179
1.910 MHz	16.677	46.000	-29.323	32.933	56.000	-23.067	10.117
1.974 MHz	21.698	46.000	-24.302	36.554	56.000	-19.446	10.112
2.028 MHz	20.442	46.000	-25.558	35.293	56.000	-20.707	10.110
13.800 MHz	16.903	50.000	-33.097	26.812	60.000	-33.188	10.336
14.699 MHz	17.009	50.000	-32.991	27.458	60.000	-32.542	10.354
16.218 MHz	17.339	50.000	-32.661	34.489	60.000	-25.511	10.409
17.143 MHz	18.504	50.000	-31.496	33.366	60.000	-26.634	10.446
17.621 MHz	19.687	50.000	-30.313	34.545	60.000	-25.455	10.465
18.548 MHz	19.108	50.000	-30.892	33.213	60.000	-26.787	10.502
Project# - 1212							
Project - CP9-2							
EUT - AC Power							
Volt/Freq - 110Vac / 60Hz							
Test Spec - FCC Class B Limit							

Overall Results: The conducted emissions recorded from the CP9- 2 are below the specified limits.



Conducted Emission Test Setup

Appendix A – Test Equipment List**Emission Test Equipment**

Description	Freq Range (Hz)	Model Number	Manufacturer	ID / SN	Last Cal Date
EMI Test Receiver	20 – 40 G	ESIB40	Rohde & Schwarz	C-062	12/7/04
Antenna	25 M – 2 G	LPB-2520/A	ARA	B965	9/27/04
Antenna, Active Loop	1 k – 30 M	6507	EMCO	D-244	4/20/05
Controller, Tower and Turntable	NA	2090	EMCO	B812	NA
EMI Test Receiver	20 – 26.5 G	ESIB26	Rohde & Schwarz	C-232	3/18/05
Filter, Bandpass	0.15 M – 30 M	NA	Unisys	NA	NA
Limiter, Pulse	DC – 30 M	ESH3-Z2	Polarad	NA	NA
LISN	9 k – 30 M	8012-50-R-24-BNC	Chase	U775	9/21/04

Appendix B – FCC Correspondence

MAR 13 '97 10:59 TO-012105223396
 JUL 29 '98 15:19 TO-018013443085

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) 384-2366

No. of Pages: 3
 (Incl. Cover)

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

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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 the 1% to satisfy section 15.205 of the rules.
- • For fundamental and harmonic emissions ~~below 28.2 MHz~~, a 20 dB reduction from the true peak is to be compared to the limits of 100uV/meter and 300uV/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 desensitization.
- • For ~~emissions outside the 1.785-10 MHz band~~ ~~emissions above 28.2 MHz~~ 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