UNISYS

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

ELECTROMAGNETIC INTERFERENCE TEST REPORT

Doc.20030618R / Project No. 953

TEST STANDARD - USA CFR 47 PART 15

LIBERTY DX ELECTRONIC ARTICLE SURVEILANCE DETECTION SYSTEM
FCC ID: DO4LIB82

CHECKPOINT SYSTEMS, INC.
THOROFARE, NJ

Test Date: 27 May to 12 June 2003
Issue: 25 June 2003

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ACCREDITED
AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION
Cert. No.: 1028-01

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., Liberty DX 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

TABLE OF CONTENTS

INDEX OF PHOTOGRAPHS

INDEX OF FIGURES

INDEX OF TABLES

1.0 Client Information

Client Name:	Checkpoint Systems, Inc. 101 Wolf Drive Thorofare, NJ 08086
Coordinator(s):	Gregory Sleet Nimesh Shah Ed Hopton
PCTC Test Personnel:	Paul Banker Daniel Mis

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 Liberty DX with a TR4022(2/8) PCB is an Electronic Article Surveillance (EAS) detection system, which utilizes targets that are applied to merchandise. These targets resonate in the region of 8.2 MHz and 2 MHz. When an article of merchandise is purchased, the target is deactivated which causes it to no longer resonate. The EAS System monitors an area 3 feet on either side of the antenna in the 7.6 MHz to 8.7 MHz band for 8.2MHz targets, and in the 1.9 MHz to 2.05 MHz band for 2.0 MHz targets, and triggers an alarm when a non-deactivated target is detected.

The Liberty DX utilizes the Model TR4022(2/8) Printed Circuit Board (PCB). Checkpoint Systems, Inc. manufactures several different types of antennae that are used with the TR4022(2/8) PCB. The Liberty DX antenna is a plastic 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.

The two transmitters are functionally identical, one is used to drive the canceling 2 Loop (8MHz) and the other to drive the canceling 3 Loop (2MHz). Each TX is functioning in a push pull, class D mode of operation. TX1 transmits 16 frequencies on the 2-loop antenna; TX2 transmits 8 frequencies on the 3-loop. 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 the 8 bins are transmitted for the 3 Loop. This pattern constitutes the "frame" of the TR4022(2/8) PCB. The frame repeats at a rate of approximately 100Hz.

The overall duty cycle for 2.0 MHz transmitter operation is 2.88 %.

- (3 antennae * 8 bins * 2 blasts per bin * 6 µsec/blast) = 288 µsec
- 288/frame rate 100 Hz (10 milliseconds) = .0288

The overall duty cycle for 8.2 MHz transmitter operation is 3.84 %.

- (2 antennae * 16 bins * 2 blasts per bin * 6 µsec/blast) = 384 µsec
- 384/frame rate 100 Hz (10 milliseconds) = .0384

2.2 Equipment Sample

2.2.1 Identification

A pre-production model of the Liberty DX was tested:

Description:	Electronic Article Surveillance System
Model:	Liberty DX
Serial Number	None
Manufacturer:	Checkpoint Systems, Inc.
Received by PCTC:	27 May 2003
Sample type	Pre-production

Photos of the Liberty DX can be found below.

Photo 1 – Liberty DX

Physical Specifications for the Liberty DX

- **Antenna Dimensions:**
  - **Height:** 68" (1727 mm)
  - **Width:** 19.75" (502 mm)
  - **Depth:** 1.5" (38 mm)
- **Antenna Base Dimensions:**
  - **Height:** 12" (305 mm)
  - **Width:** 19.75" (502 mm)
  - **Depth:** 4.25" (108 mm)
- **Antenna Construction:**
  - **Frame:** Textured, molded-through color, impact-resistant SMC plastic
  - **Base:** Textured, molded-through color, impact-resistant, injection-molded plastic
- **Weight:** 25 lbs. (11.4 kg)

2.2.2 Condition of Received Sample

An evaluation of the Checkpoint, Liberty DX 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 1.705 MHz 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 2.0 MHz fundamental, at 30 Meters, as per the requirements, could not be performed due to the presence of ambient emissions. Measurement was however, performed with the loop antenna repositioned at a 10 meter distance from the EUT. The recorded level was extrapolated using the square of the inverse linear distance extrapolation factor (40 dB/decade) for comparison with the limit. A further discussion is contained in Section 6.1.1 of this report.

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 in performing the "true peak" measurements, 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 via the AC power cord.

5.3 Operating Mode

During testing, the Liberty DX 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 Liberty DX antenna every 5 seconds to initiate a verification cycle. During this cycle, the Liberty DX 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(2/8) electronics PCB consists of two class D HF transmitters, synchronous I and Q receiver, RF selector switch, DDS, 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 DDS also generates a sequence of 8 discrete frequencies from 1.9MHz to 2.05MHz. 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.

5.3.1 Operation in Restricted Bands

The TR4022(2/8) is a digital swept frequency hopping transmitter. The TR4022(2/8) hops on discrete frequencies. In the 2.0 MHz Band, the system ‘sweeps’ one of 4 predefined sets of frequencies which is dependent on the switch selection on the controller PCB as shown below.

SW 7-1	SW 7-2	TX 1 (Transmitter 1)
Off	Off	Sweep 1.9-2.05 MHz 1.90, 1.92, 1.94, 1.96, 1.98, 2.00, 2.02, 2.04
On	Off	Sweep 1.91-2.06 MHz 1.91, 1.93, 1.95, 1.97, 1.99, 2.01, 2.03, 2.05
Off	On	Sweep 1.92-2.07 MHz 1.92, 1.94, 1.96, 1.98, 2.00, 2.02, 2.04, 2.06
On	On	Sweep 1.93-2.08 MHz 1.93, 1.95, 1.97, 1.99, 2.01, 2.03, 2.05, 2.07

These operating frequencies do not fall within the nearest restricted band (per FCC Part 15 Clause 15.205) of 2.1735-2.1905 MHz and complies with the restriction.

The discrete frequencies that can be transmitted by the TR4022(2/8) in the 8.2 MHz operational band 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

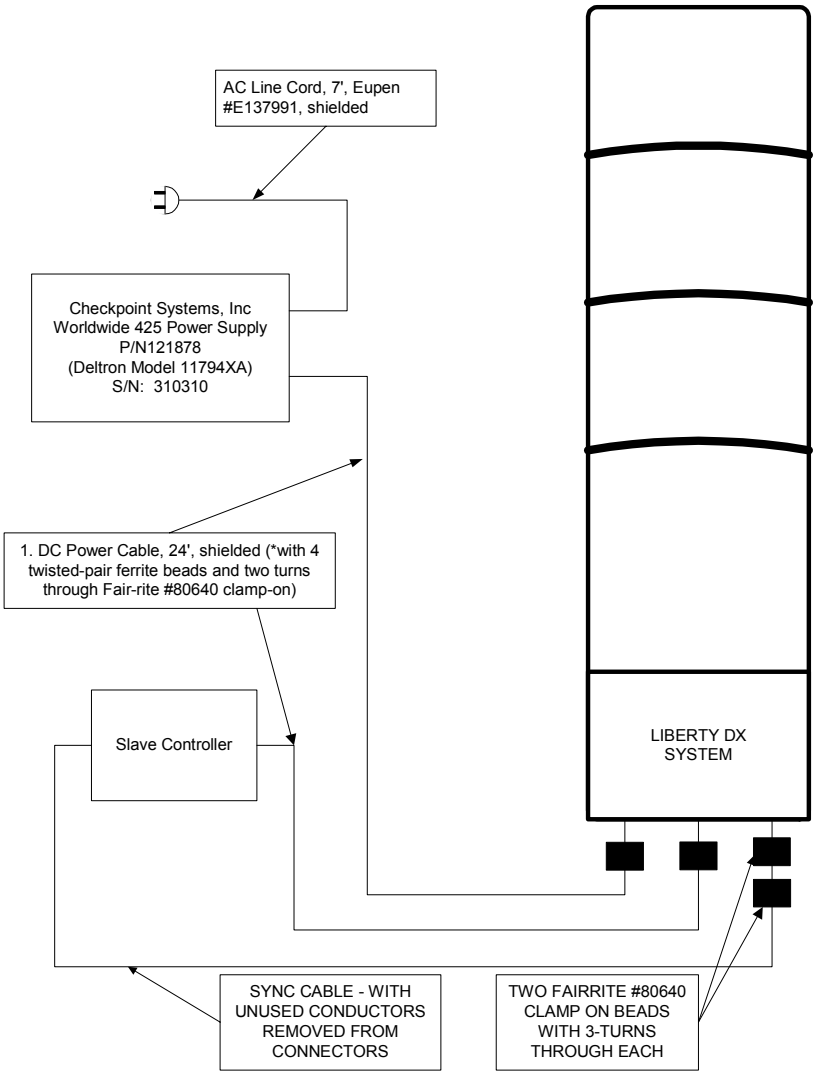
The restricted frequency bands (per FCC Part 15 Clause 15.205) in the operating frequency band of the EUT are as follows:

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 and therefore, complies with the restriction.

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 Liberty DX.



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
3. SYNC Cable, 10', shielded (*with unused conductors cut back and not installed in connectors – SYNC+, SYNC-, & SHIELD only to be connected. Also has 2-#80640 Ferrite beads on both ends of cable with three turns of cable in each

Figure 1 – Block Diagram, EMI Testing of Liberty DX

5.4.1 EUT Details

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

Description	Model #	Part #	Manufacturer	Serial #
Antenna/Control Module	Liberty DX	N/A	Checkpoint Systems, Inc.	N/A
Power Supply	Worldwide 425	121878	Checkpoint Systems, Inc.	310310

5.4.1 Support Equipment

No equipment was used to support the operation of the Liberty DX during testing.

5.5 EUT Modifications

No equipment was used to support the operation of the Liberty DX during testing.

6.0 Summary Of Test Results

6.1 Emission Tests

6.1.1 Radiated Emission Test (11 Oct 2000)

Tables 1, through 5 below show the detected field strengths as measured from the EUT(s) over the frequency range from 1.9 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 loop measuring antenna supported 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 – 2.0 MHz Fundamental Measurement – True Peak (27 May, 2003)

Freq [MHz]	Height, Pol (1) [cm 1/2/3]	Angle [Deg]	Peak Field Strength [dBuV/m] (2)	Corr' Factor [dB/m] (3)	Field Strength [dBuV/m]	FCC Average Limit @ 30m [dBuV/m]	Delta Limit [dB]
2.0 Fund*	100, 3	0	70.0 Peak	-39.1	30.9	40	-9.1

NOTE: As described in Section 4.0 – Deviations of this report, it was not possible to properly measure the true peak level of the 2.0 MHz fundamental with the antenna positioned at a distance of 30 meters from the EUT due to the presence of strong ambient interference. The antenna was moved in to a separation distance of 10 meters. At this distance, a measurement was possible. As an approximation, an adjustment was added to the the correction factor to adjusted the data per FCC 15.31 (f) (2) using the square of an inverse linear distance extrapolation factor (40 dB/decade), for comparison with the limit.

*The true peak signal level of the fundamental was measured using a peak detector as described in section 4.0. Measurement of the fundamental was performed using a broadband magnetic field loop antenna.

1) Polarity of the measuring loop antenna is 1 - along measuring axis, 2 - along vertical axis, 3 horizontal axis.
2) Peak Detector Voltage shown includes an E-Field antenna correction factor of 17.3 dB/m.
3) The correction factor shown represents the 20 dB reduction as specified in the measurement procedure and a 19.1 dB extrapolation as indicated above for the adjusted measurement distance of 10 meters.

Table 2 – 8.2 MHz Fundamental Measurement – True Peak (27 May, 2003)

Freq [MHz]	Height, Pol (1) [cm 1/2/3]	Angle [Deg]	Peak Field Strength [dBuV/m] (2)	Corr' Factor [dB/m] (3)	Field Strength [dBuV/m]	FCC Average Limit @ 30m [dBuV/m]	Delta Limit [dB]
8.2 Fund*	100, 3	180	59.0 Peak	-20.0	39.0	40	-1.0

*The true peak signal level of the fundamental was measured using a peak detector as described in section 4.0. Measurement of the fundamental was performed using a broadband magnetic field loop antenna. The loop antenna was located on the ground plane.

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

2) Peak Detector Voltage shown includes an E-Field antenna correction factor of 16.6 dB/m.

3) The correction factor shown represents the 20 dB reduction as specified in the measurement procedure.

MEASUREMENT RESULT -- AVERAGE

As indicated earlier, the 2.0 MHz transmitter operates with a duty cycle of 2.88%, while the 8.2 MHz 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

	2 MHz Fundamental	8.2 MHz Fundamental
Corrected True Peak:	50.9 dBµV/m (1)	59.0 dBµV/m
Pulse Duty Cycle:	2.88%	3.84%
Correction to Average: 20 * Log_{10} (Duty Cycle)	-28.3 dB	-28.3 dB
Average Level: (True Peak + Average Correction)	21.6 dBµV/m	30.7 dBµV/m
Limit:	40 dBµV/m	40 dBµV/m
Margin with Limit:	-18.4 dB	-9.3 dB

1. The Corrected True Peak voltage shown in the table for the 2.0 MHz fundamental was derived from the actual corrected value recorded at 10 meters, extrapolated for the distance correction of 19.1 dB.

   SAMPLE CALCULATION:
   Value recorded at 10 meters corrected for antenna loss: 70 dBuV/m
   Extrapolation for distance adjustment: $E_{30} = E_{10} + 20\ Log_{10}\ [(10/30)^2]$
   $= 70$ dBuV/m + (-19.1 dB)
   $= 50.9$ dBuV/m

- **MEASUREMENT OF HARMONICS BELOW 30 MHz**

Tables 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. During testing, no harmonics of the 2.0 MHz fundamental could be found at either 30 meters or 10 meters antenna separation distance. Table 4 presents harmonics that were found and recorded for the 8.2 MHz fundamental.

Table 4 – H-Field Emissions (< 1.705 MHz and > 10 MHz) (27 May 2003)

Freq [MHz]	Height, Pol[1] [cm 1/2/3]	Angle [Deg]	Quasi-Peak Detector Voltage [dBuV]	E-Field Corr' Factor [dB/m]	Field Strength [dBuV/m]	FCC QP Limit @ 30m [dBuV/m]	Delta Limit [dB]
16.4	100,1	0	6.9	16.1	23.0	30	-7.0

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

NOTE: No emission could be detected at the third harmonic of 24.6 MHz.

- **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 determined to be harmonics of the fundamental carrier frequency.

- Overall Result: All measured radiated emissions from the Liberty DX 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 of signals determined to be related to the operation of the digital circuitry of the controller, 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 5 – E-Field Emissions Related to Digital Circuitry (12 June 2003)

Freq [MHz]	Pk [dBuV/m]	Q-Pk [dBuV/m]	Avg [dBuV/m]	Pol	Angle [deg]	Ht [cm]	CF [dB]	Limit [dBuV/m]	Delta [dB]
240.005	25.93	21.57	0	H	316	243	14.41	46.4	-24.83
240.005	31.93	29.17	0	V	73	399	14.41	46.4	-17.23
320	28.27	23.87	0	V	112	102	16.64	46.4	-22.53
399.996	34.16	31.52	0	V	303	100	18.6	46.4	-14.88
399.998	33.72	29.9	0	H	195	325	18.6	46.4	-16.5
480	35.18	29.8	0	V	240	100	20.12	46.4	-16.6
560	41.66	38.43	0	V	166	100	21.38	46.4	-7.97
560	42.22	38.53	0	H	311	395	21.38	46.4	-7.87
600	41.88	28.71	0	H	233	116	22.1	46.4	-17.69
605.721	35.03	30.3	0	V	156	236	22.14	46.4	-16.1
640	42.73	42.5	0	V	-1	101	22.86	46.4	-3.9
640	40.92	40.54	0	H	310	359	22.86	46.4	-5.86
660	38.98	32.54	0	V	267	100	23.32	46.4	-13.86
680	43.49	39.21	0	H	319	244	23.44	46.4	-7.19
680	44.82	41.08	0	V	265	100	23.44	46.4	-5.32
720	45.3	39.99	0	H	349	326	23.92	46.4	-6.41
760	43.93	38.01	0	V	192	242	24.2	46.4	-8.39
760	44.07	39.18	0	H	227	400	24.2	46.4	-7.22
800	34.19	29.62	0	V	146	341	25	46.4	-16.78
840	34.87	28.68	0	V	263	164	25.7	46.4	-17.72
840	36.66	32.64	0	H	316	370	25.7	46.4	-13.76
920	37.44	32.67	0	V	121	100	27.02	46.4	-13.73
920	46.65	38.28	0	H	319	384	27.02	46.4	-8.12
960	38.4	34.26	0	V	67	314	27.34	46.4	-12.14
960	41.72	38.87	0	H	35	367	27.34	46.4	-7.53

- Overall Result: All measured radiated emissions from the Liberty DX are below the FCC Class A limits by a margin of at least 3.9 dB.

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

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

6.1.2 Bandwidth Measurement (16 June 2003)

Bandwidth plots of both the two fundamental operating frequencies – 2.0 MHz and 8.2 MHz – were recorded on the operating Liberty DX by placing the measuring antenna close to the EUT, setting a spectrum analyzer to 10 dB/div, RBW=300 kHz, VBW=3 MHz, span = 1.5 MHz (for 2 MHz fundamental) 2.0 MHz (for 8.2 MHz fundamental), Peak detection, max hold. These plots are shown below. In accordance with Clause 15.223, each plot shown the bandwidth defined by the points 6 dB down from the peak.

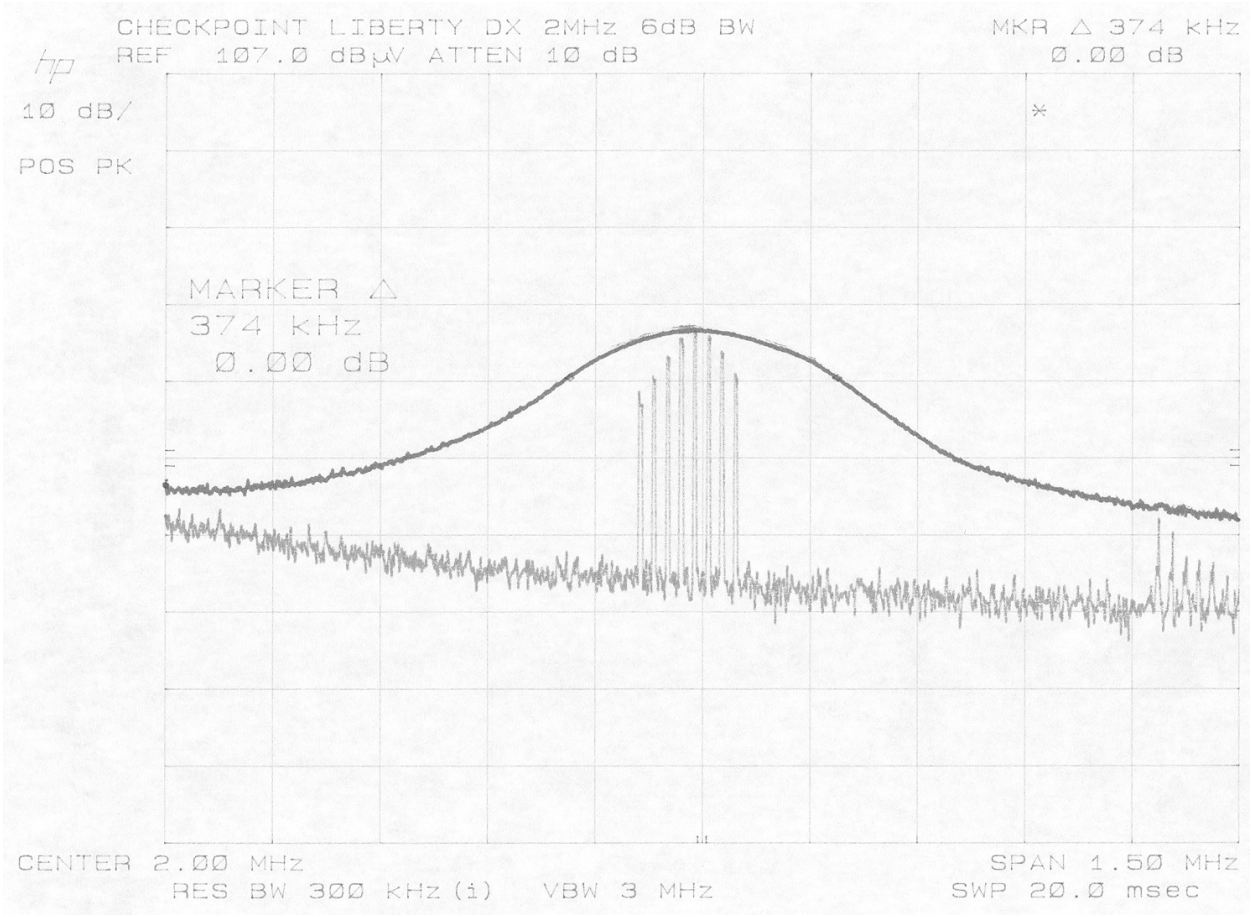


Figure 2 – 2.0 MHz Fundamental 6-dB Bandwidth Plot

The plot above of the 2.0 MHz fundamental, indicates the transmitter 6 dB bandwidth is 374 kHz. This bandwidth is 18.7% of the fundamental (374 kHz / 2.0 MHz) and therefore, per FCC Section 15.223, the limit of 100 μV/m applies for the 2.0 MHz fundamental.

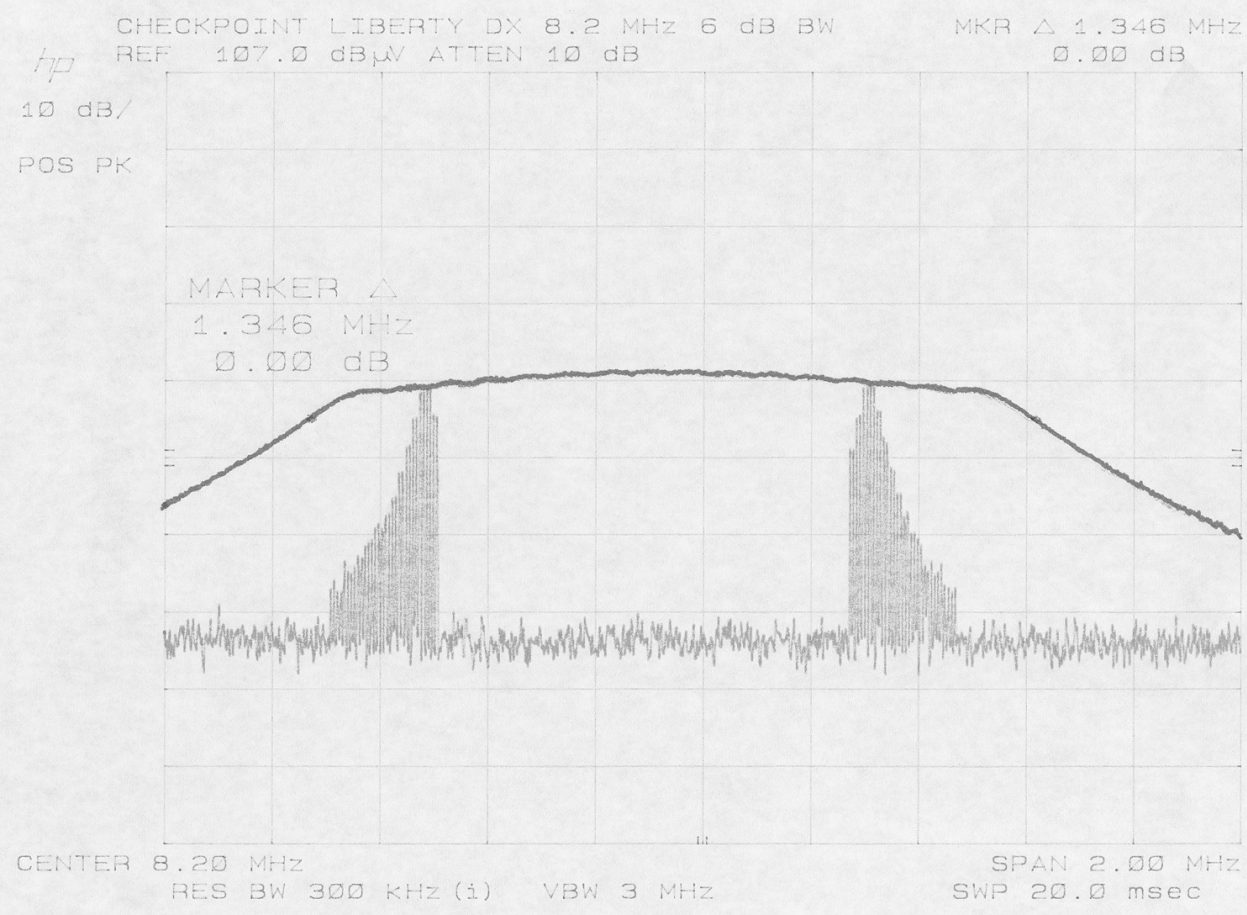


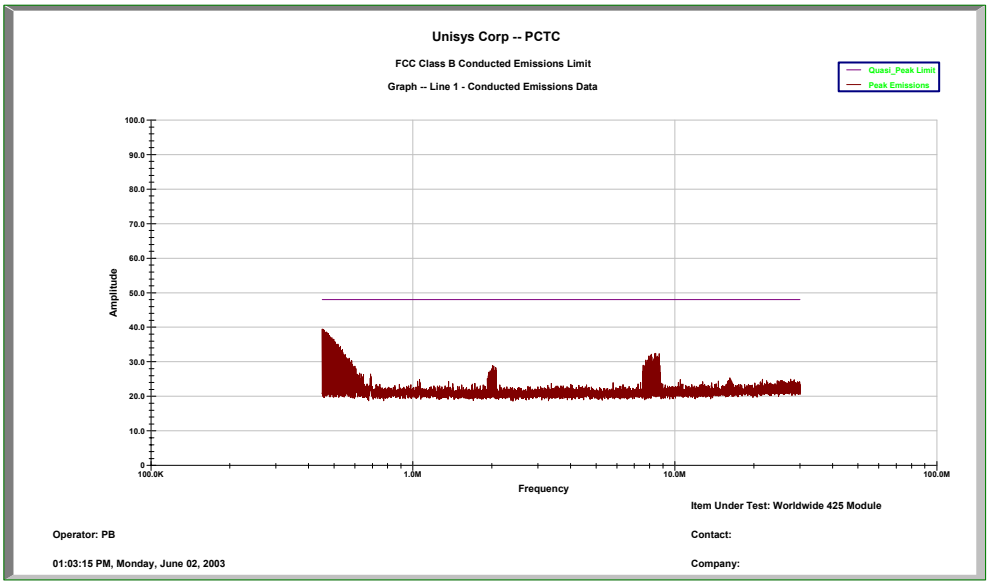
Figure 3 – 8.2 MHz Fundamental 6-dB Bandwidth Plot

The plot above of the 8.2 MHz fundamental, indicates the transmitter 6 dB bandwidth is 1.346 MHz. This bandwidth is 16.4% of the fundamental (1.346 MHz / 8.2 MHz) and therefore, per FCC Section 15.223, the limit of 100 μV/m applies for the 8.2 MHz fundamental.

6.1.3 Conducted Emission Test (2 June 2003)

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.

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



Graph 1 – Peak Detector Emissions - Neutral

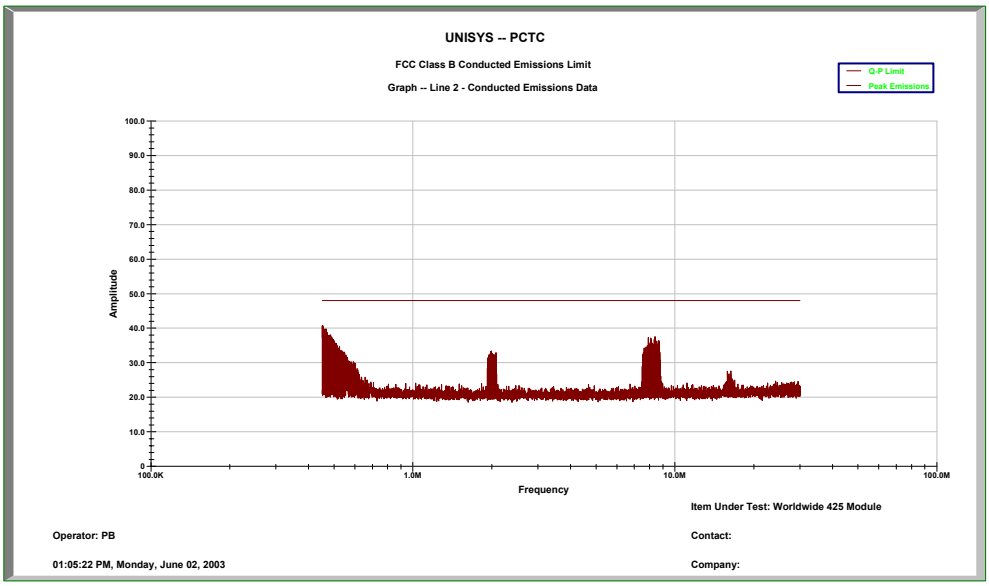
Table 6 – Conducted Emissions, Neutral Line (2 June 2003)

Unisys Corp – PCTC
FCC Class B Conducted Emissions Limit
Table 1 – Line 1– Conducted Emissions Data, Peak Detector

Operator: PB
Item Under Test: Worldwide 425 Module
Contact:
01:03:14 PM, Monday, June 02, 2003
Company:

	1	2	3	4	5	
Frequency	Top 10	Peaks	Avg.	Margin with	Corr.	
MHz	Peaks	Within 3	Limit	Avg. Limit	Factor	
451.051 KHz	39.499		47.960	-8.461	10.599	
452.452 KHz	39.398		47.960	-8.562	10.598	
453.852 KHz	38.896		47.960	-9.064	10.596	
455.253 KHz	39.395		47.960	-8.565	10.595	
457.004 KHz	38.993		47.960	-8.967	10.593	
458.405 KHz	39.092		47.960	-8.868	10.592	
459.806 KHz	38.690		47.960	-9.270	10.590	
462.958 KHz	38.587		47.960	-9.373	10.587	
465.760 KHz	38.584		47.960	-9.376	10.584	
468.912 KHz	38.581		47.960	-9.379	10.581	

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



Graph 2 – Peak Detector Emissions - Phase

Table 7 – Conducted Emissions, Phase Line (2 June 2003)

Unisys Corp – PCTC
FCC Class B Conducted Emissions
Table 1 - Line 2 – Conducted Emissions Data, Peak Detector

Operator: PB
Item Under Test: Worldwide 425 Module
Contact:
01:05:21 PM, Monday, June 02, 2003
Company:

	1	2	3	4	5	
Frequency	Top 10	Peaks	Quasi-Peak	Margin with	Corr.	
MHz	Peaks	Within 2	Limit	Q-P Limit	Factor	
450.350 KHz	40.660		47.960	-7.300	10.660	
451.751 KHz	40.158		47.960	-7.802	10.658	
453.152 KHz	40.657		47.960	-7.303	10.657	
454.553 KHz	39.955		47.960	-8.005	10.655	
456.304 KHz	40.254		47.960	-7.706	10.654	
457.705 KHz	39.552		47.960	-8.408	10.652	
459.106 KHz	39.651		47.960	-8.309	10.651	
460.507 KHz	39.449		47.960	-8.511	10.649	
462.258 KHz	39.748		47.960	-8.212	10.648	
467.862 KHz	39.742		47.960	-8.218	10.642	

- Overall Results:

  - The Liberty DX complied with the requirements of FCC 15.207 by a margin of at least 10.6 dB.

Photo 4 – Conducted Test Setup

Appendix 1 – Test Equipment Listing

Radio Disturbance Test Equipment

Description	Freq. Range (Hz)	Model Number	Manufacturer	ID / SN	Last Cal Date
Adapter, Quasi Peak	10k - 1G	85650A	Hewlett Packard	U182	8/8/02
Analyzer, Spectrum	100Hz - 1.5G	8568B	Hewlett Packard	U180	8/7/02
Antenna	25M - 2G	LFB-2520	ARA	B962	1/28/03
Computer	NA	9836	Hewlett Packard	V831	NA
Controller, Tower	NA	1050	EMCO	W926	NA
Controller, Turntable	NA	1060	EMCO	W580	NA
Display, Analyzer	NA	85662A	Hewlett Packard	X719	8/7/02
Drive, Floppy (external)	NA	9122	Hewlett Packard	X711	NA
Drive, Hard (external)	NA	7957B	Hewlett Packard	Y0763	NA
Receiver	20 Hz – 26.5 GHz	ESIB 26	Rohde & Schwarz	C232	1/10/03
LISN	9k - 30M	8012-50-R-24-BNC	Chase	U776	2/5/03
Loop Antenna, Active	1 kHz-30 MHz	6507	EMCO	D244	11/26/02

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. 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 of a minimum of 1.5 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:

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

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:

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 a manually tuned receiver with the detector function first set to quasi-peak and then to average.

Appendix 3 – EUT Drawings

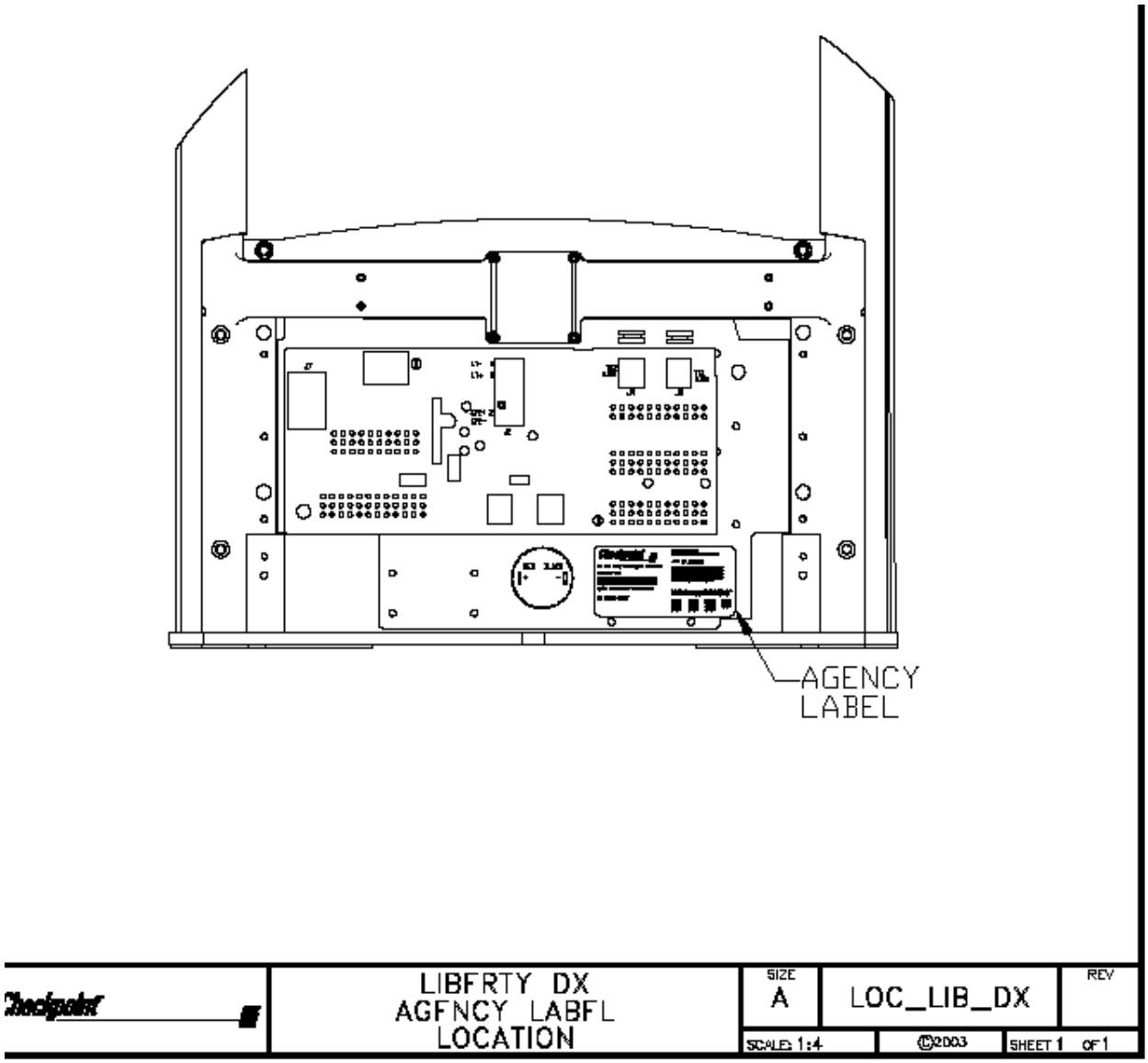


Figure 4 – Location of Agency Labels on the Liberty DX

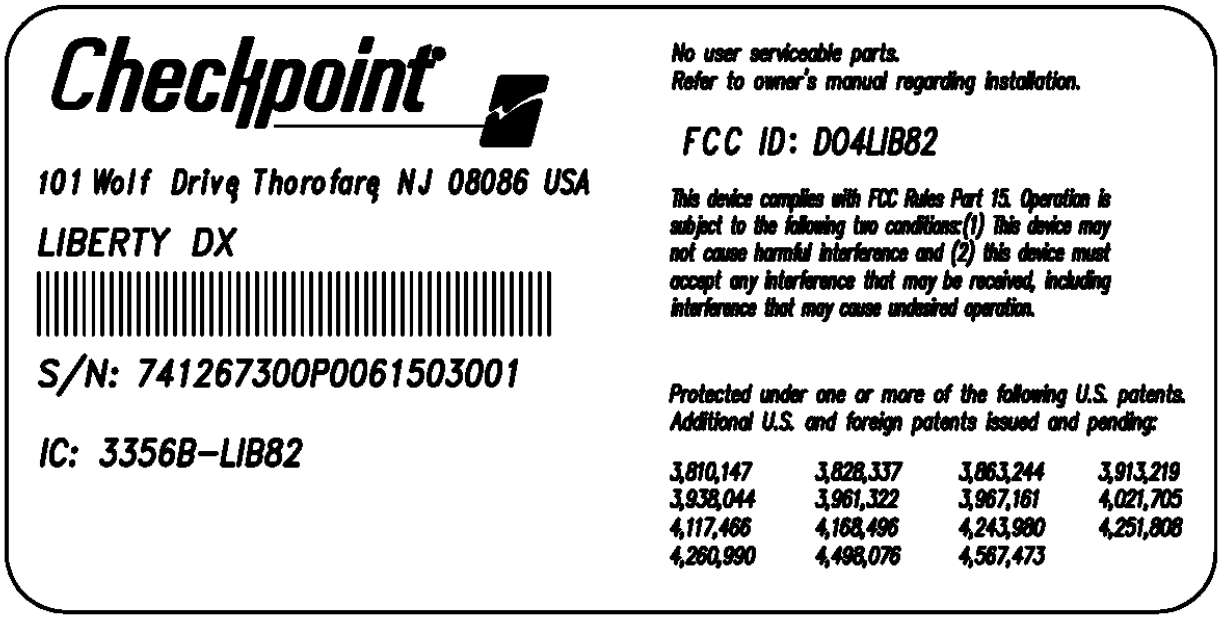


Figure 5 – Sample of Liberty DX Agency Label

Appendix 4 – Correspondence Letter

MAR 13 '97 10:59 TO-912105223396 FROM-CHECKPOINT SYSTEMS INC T-085 P.02/02 F-071
JUL 29 '96 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 ~~below 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 desensitization.

→ • For ~~harmonics above 30 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