UNISYS

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

ELECTROMAGNETIC COMPATIBILITY TEST REPORT

Doc. 20010808R1/Project 598
FCC ID: D04PV20009-5

TEST STANDARD - USA CFR 47 PART 15

PORTABLE VERIFIER MODEL PV2000

CHECKPOINT SYSTEMS, INC.
THOROFARE, NJ

Test Date: 2/14/01
Issue: October 12, 2001

Prepared by: Daniel J. Mis

Daniel J. Mis
Technical Staff Engineer

Approved by: Wallace E. Amos

Wallace E. Amos
Group Manager, PCTC/ICC

A2LA ACCREDITED
AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION
Cert. No.: 1028-01

ERRATA

This document is revision 1 to document 20010808R and is marked as "PCTC Doc. No. 20010808R1", dated 10/12/01. This revision is issued to make the following corrections and clarifications:

- Photos 2 – Detail of Interior Construction - Photo 3 – Top View of PCB - Photo 4 – Bottom View of PCB	Removed Photos from the Report.
- Figures 1 & 2 – PCB Fabrication - Figures 3, 4 & 5 – Schematics - Figure 6 – Housing Specification	Removed Photos from the Report.
- Section 6.2	Added Section covering Bandwidth Measurement
- All Pages	Reformatted and renumbered all pages

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, Portable Verifier Model PV2000, were tested to the standards listed below, and found to have the following characteristics:

TEST	STANDARD	FREQUENCY	RESULT
Radiated Emissions - Intentional Radiator	FCC, Class B Part 15.223	1.705 to 10 MHz	Below Limit Max. Permissible
Radiated Emissions - Unintentional Radiator	FCC, Class B Part 15.209	30 MHz – 1.0 GHz	Below Limit Max. Permissible
Conducted Emissions – Unintentional Radiator	FCC, Class B Part 15.207	450 kHz - 30 MHz	Below Limit Max. Permissible

TABLE OF CONTENTS

INDEX OF PHOTOGRAPHS

INDEX OF TABLES

INDEX OF FIGURES

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

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 adhered to by the client for product sale, distribution and use.

2.0 Description of The Equipment Under Test (EUT)

2.1 General Description

The Portable Verifier (PV2000) is a battery operated, hand held, portable, Electronic Article Surveillance (EAS) Tag detector that operates from a standard 9 Vdc alkaline battery. This particular version of the PV2000 detects EAS tags using an analog fundamental frequency swept from 9.0 MHz to 10.0 MHz, centered on 9.5 MHz and is meant for intermittent use. The unit is normally in a nonpowered condition. The unit operates, when a side mounted momentary switch is depressed, by radiating an FM RF signal whose center frequency is the resonant frequency of the Tag. An AM Receiver detects the disturbance of the RF field caused by the presence of a Tag, which is then indicated by an audible alarm and the illumination of a red LED

Photo 1 – PV2000

The EUT uses an internal, integral, dedicated antenna. The antenna is simply three turns of copper etched into the circuit board, and is co-located; that is, the transmitter and receiver use the same physical antenna.

2.2 Equipment Family Description

The PV2000 is an intentional radiator emitting a frequency modulated (17 Hz modulating frequency) sinusoidal radio-frequency signal. The device must be compliant to Section 15.223 of 47 CFR Code of Federal Regulations.

2.3 Equipment Sample

2.3.1 Identification

A preproduction sample of the EUT were tested as follows:

Model No./Name:	PV2000 (9.5 MHz Version)
Serial Number	Preproduction
Manufacturer:	Checkpoint Systems, Inc.
Received by PCTC:	2/1/00
Sample type	preproduction

2.3.2 Condition of Received Sample

An evaluation of the Checkpoint Systems, Inc. Model PV2000 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

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 requirements or to other requirement at the discretion of the client, regulatory agencies, or other entities.

3.1 USA

47 CFR, part 15, Subpart C, "Intentional Radiators, General Rules and Regulations".

3.2 Basic Test Methods and Procedures

The applicable 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”.

4.0 Deviations or Exclusions from the Requirements and Standards

There were no deviations or exclusions from the requirements.

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 ± 5^{o} C
Relative Humidity	32%RH

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, during all testing described in this report the EUT was supplied power from an internal 9 Vdc alkaline battery. There are no auxiliary chargers or AC adapters available for use with this device.

5.2 Grounding

By design, this is a hand help portable device, consequently, there is no facility available to provide an earth ground connection to this device.

5.3 Operating Mode

During testing, the EUT was continuously transmitting and monitoring for the presence of a security tag. By design, the EUT is not capable of "standby mode". A security tag was placed in the detection area of the unit. The activation button was held in the ON position. As the unit detected the presence of a tag, an alarm was sounded and a red LED blinked.

5.4 Test Configurations

The PV2000 was tested in a single configuration. This product is a stand alone device. It does not have I/O ports to allow for cabling to other products.

5.4.1 Support Equipment

The PV2000 is a standalone device. Support equipment are not required for the EUT to function.

5.5 EUT Modifications

There were no modifications needed or added to the EUT during testing.

6.0 Summary Of Test Results

6.1 Radiated Emission Test

6.1.1 Radiated Emission Test (2/14/2001)

Tables 1 and 2 below show the detected field strengths as measured from the EUT(s) over the frequency range from 9.0 MHz to 30 MHz, at a distance of 30 meters compared to the maximum permissible FCC limit at 30 meters. All measurements were made using a magnetic field loop antenna positioned 1 meter above the ground plane. A description of the procedures used in the performance of this test is provided in Appendix 2.

- MEASUREMENT OF THE FUNDAMENTAL (Per Section 15.223):

Table 1 shows the peak measurement of the fundamental as compared to the FCC limit.

Table 1 – Fundamental Measurement –Peak (14 Jan 2001)

Freq [MHz]	Height, Pol[1] [cm 1/2/3]	Angle [Deg]	Peak Detector Voltage [dBuV]	Corr' Factor [dB/m]	Field Strength [dBuV/m]	FCC Average Limit @ 30m [dBuV/m]	Delta Limit [dB]
9.5 Fund*	100,3	0	13.8 Peak	-1.8	12.0	40	-28.0

NOTE: The recorded emission level above represents the noise floor of the measurement system (spectrum analyzer and magnetic field antenna). No EUT related emissions could be detected at the fundamental frequency of 9.5 MHz with the unit positioned vertically as shown in the attached photos or in a horizontal orientation, at a measurement distance of 30 meters as specified in the standard or at an alternative measurement distance of 10 meters.

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

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

Table 2 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 2 – H-Field Emissions (< 1.705 MHz and > 10 MHz) (14 Jan 2001)

Freq [MHz]	Height(cm), Polarity (1/2/3)*	Angle (Deg)	Q-Peak Voltage [dBuV]	Corr' Factor [dB/m]	Field Strength [dBuV/m]	FCC B Limit @ 30m [dBuV/m]	Delta Limit [dB]	Result
19.000	100, 3	0	19	-1.5	17.5	29.5	-12.0	Below limit
28.500	100, 3	0	13	0.0	13	29.5	-16.5	Below limit

NOTE: The recorded emission level above represents the noise floor of the measurement system (spectrum analyzer and magnetic field antenna). No EUT related emissions could be detected at the above harmonic frequencies of 9.5 MHz with the unit positioned vertically as shown in the attached photos or in a horizontal orientation (flat on the table), or at a measurement distance of 30 meters as specified in the standard or at an alternative measurement distance of 10 meters.

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

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

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

Table 3 – E-Field Emissions (30 MHz to 1000 MHz) (14 Jan 2001)

Freq [MHz]	Height, Pol [cm H/V]	Angle [Deg]	Quasi-Peak Voltage [dBuV]	Corr' Factor [dB/m]	Field Strength [dBuV/m]	FCC QP Class B Limit @ 3m [dBuV/m]	Delta Limit [dB]	Result
41.24	117, V	354	13.6	16.6	30.2	40.0	-9.8	Below limit
121.257	394, V	356	9.1	11.9	21.0	43.5	-22.5	Below limit
160.273	143, V	215	15	10.7	25.7	43.5	-17.8	Below limit
183.369	328, V	217	7.7	11.8	19.5	43.5	-24	Below limit
251.408	369, V	4	10.3	15.6	25.9	46.0	-20.1	Below limit
458.078	103, V	1	9.2	19.8	29.0	46.0	-17	Below limit

- Overall Result: All measured radiated emissions from the Portable Verifier Model PV2000 (are below the FCC 15.223 and 15.209 limits by a margin of at least 9.8 dB.

Photo 2 – Portable Verifier Model PV2000 Radiated Emissions Test Setup – Front View

Photo 3 – Portable Verifier Model PV2000 Radiated Emissions Test Setup – Rear View

6.1.2 Conducted Emissions Test

Conducted Emissions measurements were not applicable to this EUT as it has no exposure to the mains. The unit is powered through an internal 9 Vdc alkaline battery.

6.2 Bandwidth Measurement

The operating bandwidth of the PV2000 (9.5 MHz Version) was recorded using an HP 8566B spectrum analyzer and a small magnetic field probe placed in near proximity to the unit under test. A plot of the bandwidth is attached below.

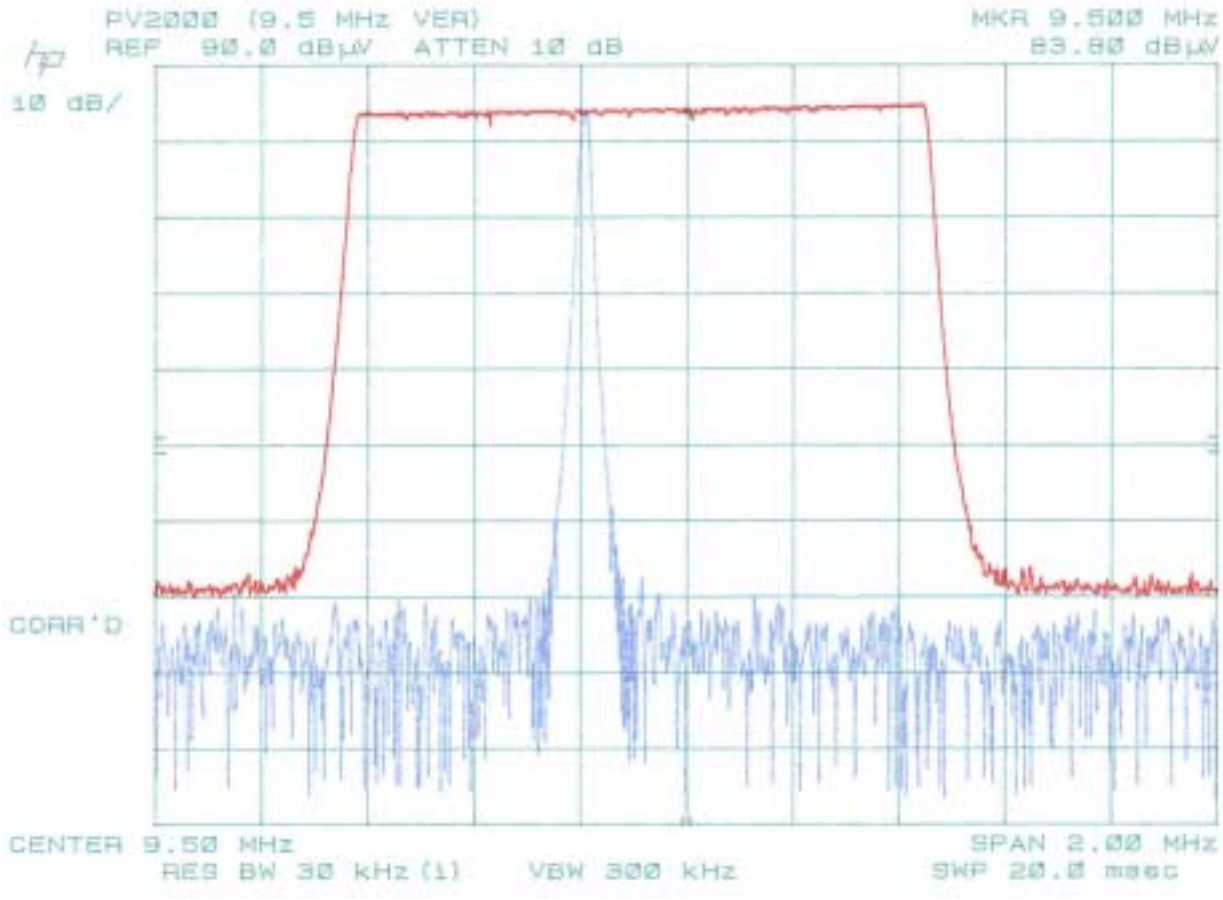

Figure 1 – Bandwidth Plot

The RED trace is a max hold sweep of the output fundamental. The blue trace is a live sweep of the fundamental.

Appendix 1 - Test Equipment Listings

Equipment	Model	Manufacturer	ID No.	Last Cal Date
Quasi-Peak Adapter (10KHz - 1GHz)	85650A	Hewlett Packard	U182	3/3/00
Spectrum Analyzer Display	85662A	Hewlett Packard	X719	3/3/00
Spectrum Analyzer (10KHz - 1.5GHz)	8568B	Hewlett Packard	X718	3/3/00
RF Preselector	85685A	Hewlett Packard	W927	3/3/00
Spectrum Analyzer (100Hz - 22GHz)	8566B	Hewlett Packard	Y0313	3/29/01
Spectrum Analyzer Display	85662A	Hewlett Packard	Y0314	3/29/01
Manual Receiver (9 kHz-30 MHz)	ESH2	Polarad	U964	12/2/00
Manual Receiver (20 MHz -1GHz)	ESV	Polarad	U965	8/3/00
Antenna (300 Hz – 100 MHz), Magnetic Field Loop	BBH-500/B	ARA	V640	12/29/00
Antenna (25MHz – 2 GHz), E-Field	LPB-2520	ARA	B-962	6/21/00

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 1GHz

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 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.

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. The position of the antenna relative to the ground plane was noted in the reported data. 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)

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 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 re-measured 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)

Appendix 3 – EUT Drawings

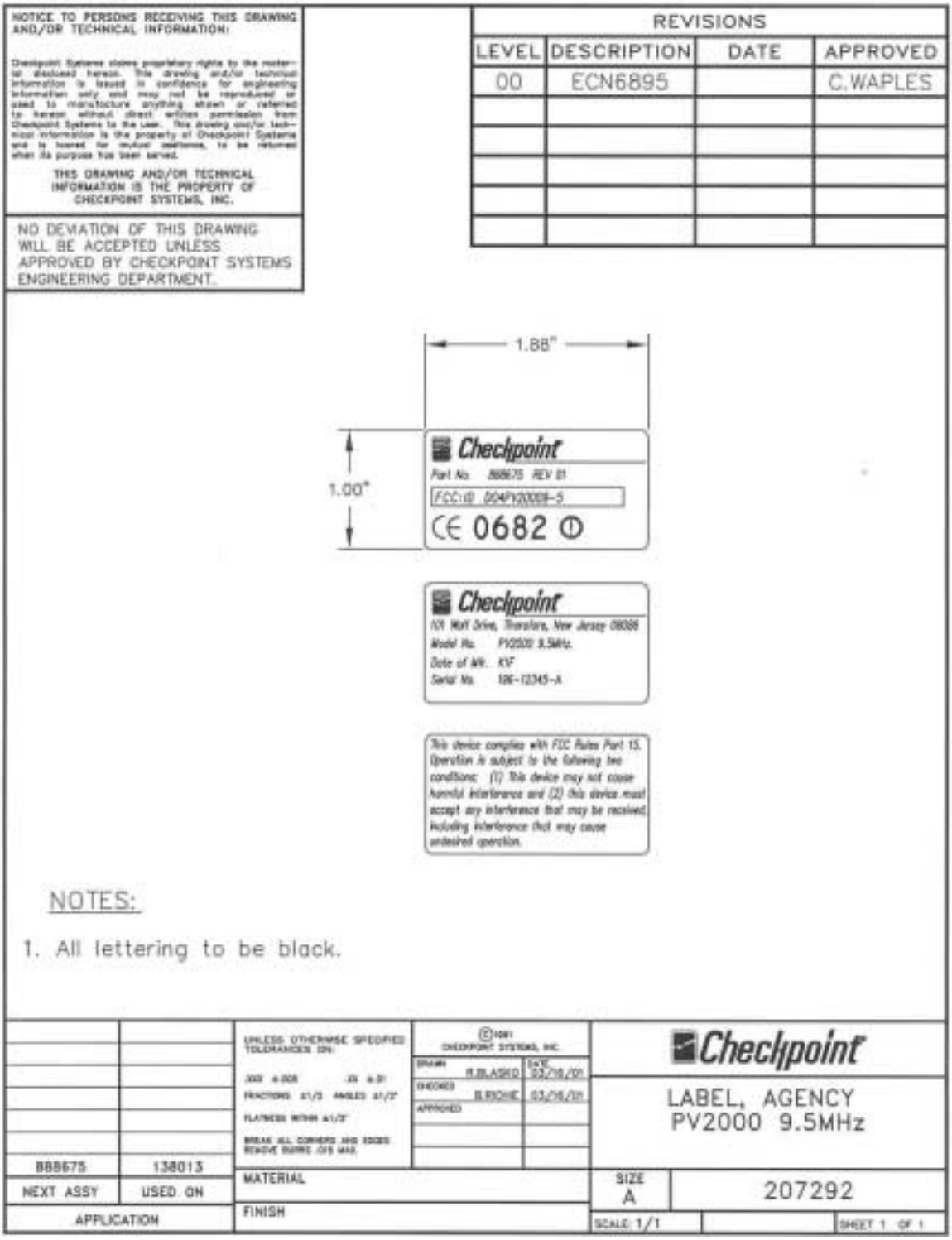

Figure 2 – PV2000 (9.5 MHz Ver) Labels

Figure 3 – Detail of Labeling

Figure 4 – Detail of Labeling

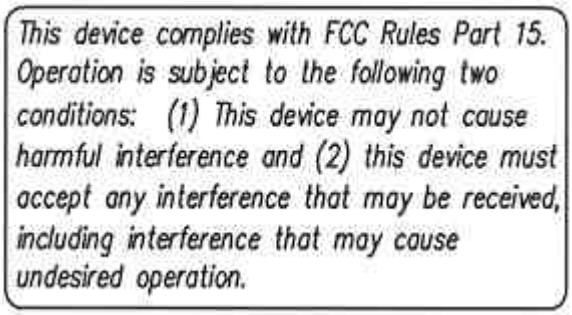

Figure 5 – Detail of Labeling

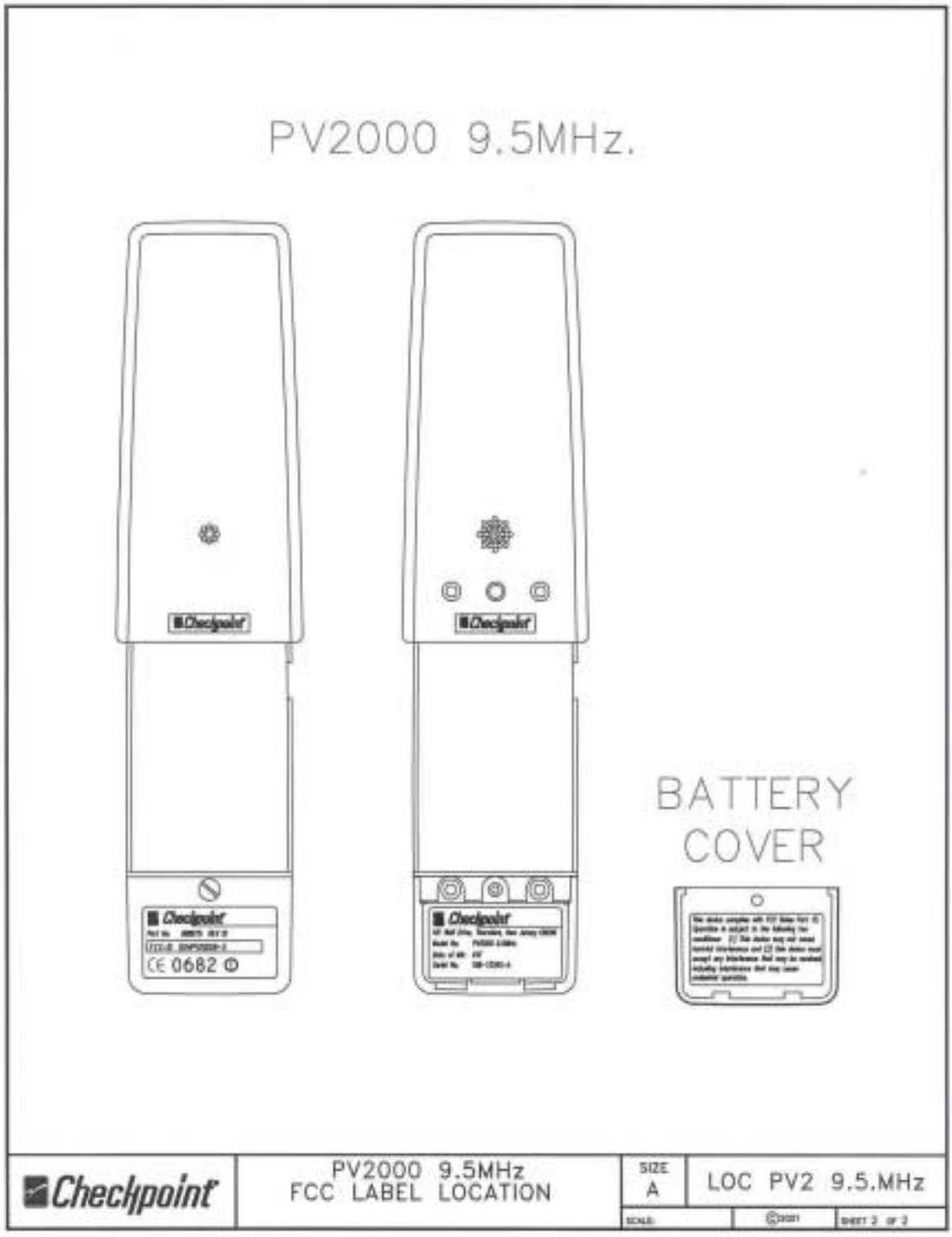

Figure 6 – PV2000 (9.5 MHz Ver) Location of Labels