

FCC ID: PP9P2000MOBITEX

Exhibit 2b

Engineering Report on

Radiated Spurious Emissions (2.1053)



Assessment of Compliance

for

Measurement of Field Strength of Spurious
Radiation in accordance with the FCC Rules &
Regulations Part 2.1053 and 90

Point of Sale Terminal

P2000 with a Research In Motion

R902-M-2-0 radio transmitter

Descartes Corp.



July 2001

DESB-P2000 w. 902M mobitex-3681

51 Spectrum Way Nepean ON K2R 1E6
Tel: (613) 820-2730 Fax: (613) 820-4161
email: info@aprel.com

Engineering Report

Subject: Measurement of Field Strength of Spurious Radiation in accordance with the FCC Rules & Regulations Part 2.1053 and 90

FCC ID: PP9P2000MOBITEX

Equipment: Point of Sale Terminal


Model: P2000

Client: Descartes Corp.
Colonial Lake Drive
Lawrenceville, NJ 08648
USA

Project #: DESB-P2000 w. 902M Mobitex -3681

Prepared by: APREL Laboratories,
Regulatory Compliance Division

Approved by:


Jay Sarkar
Technical Director, Standards & Certification

Date:

July 31, 2001

Submitted by:


Jay Sarkar
Technical Director, Standards & Certification

Date:

July 31, 2001

Released by:


Dr. Jack J. Wojcik, P.Eng.

Date:

July 31/01.

THE LABORATORY FOR WIRELESS

FCC ID: PP9P2000MOBITEX
Applicant: Descartes Corp.
Equipment: Point of Sale Terminal
Model: P2000
Standard: FCC Rules and Regulations Part 2.1053 and 90

ENGINEERING SUMMARY

This report contains the results of Field Strength of Spurious Radiation measurement performed on a Descartes Corp. Point of Sale Terminal operating with a built-in Research in Motion MOBITEX radio transmitter. The measurements were carried out in accordance with the FCC Rules and Regulations Part 2.1053 and 90. The product was evaluated for spurious when it was set at the maximum power level.

The evaluation was performed using 1) Direct Method and 2) Substitution Method, both as radiated.

The results for Direct Method are given in Tables 1 to 6, and for Substitution Method in Tables 1A to 6A.

The sample of the P2000 covered by this report complies with the applicable requirements of the FCC Rules and regulations Part 2.1053 and 90.210 Mask J.

(The results presented in this report relate only to the sample tested.)

INTRODUCTION

General

This report describes the results of the Field Strength of Spurious Radiation measurement conducted on a Descartes Corp. Point of Sale Terminal model P2000 operating with a built-in Research in Motion MOBITEK radio transmitter.

Test Facility

The tests were performed for Descartes by APREL Laboratories at APREL's EMI facility located in Nepean, Ontario, Canada. The laboratory operates an (3m and 10m) Open Area Test Site (OATS). The measurement facility is calibrated in accordance with ANSI C63.4-1992.

A description of the measurement facility in accordance with the radiated and AC line conducted test site criteria per ANSI C63.4-1992 is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations.

APREL's registration number is 90416

APREL is accredited by Standard Council of Canada. APREL is also accredited by Industry Canada and recognised by the Federal Communications Commissions (FCC).

Standard

The evaluation and analysis were conducted in accordance with FCC Rules and Regulations Parts 2.1053 and the appropriate limits.

Test Equipment

The test equipment used during the evaluation is listed in Appendix A with calibration due dates.

Environmental Conditions

Measurements were conducted in open area test site.

- Temperature: 24 °C ± 2
- Relative Humidity: 30 - 50 %
- Air Pressure: 101 kPa ± 3

FCC SUBMISSION INFORMATION

FCC ID: **PP9P2000MOBITEX**

Equipment: Point of Sale Terminal

Model: P2000

For: Certification

Applicant: **Descartes Corp.**
Colonial Lake Drive
Lawrenceville, NJ 08648
U.S.A.

Manufacturer: **Descartes Corp..**
Colonial Lake Drive
Lawrenceville, NJ 08648
U.S.A.

Evaluated by: **APREL Laboratories**
51 Spectrum Way
Nepean, Ontario
Canada K2R 1E6

Test: Field Strength of Spurious Radiation

Ref: FCC Parts 2.1046 and 90.210

Criteria: Emission **Mask J:**

The permitted maximum level of spurious emission is $50 + 10 \log (P)$ dB below the unmodulated carrier power of the transmitter (P).

Set-up: See Figure 1.a

Conditions: Voltage Supply: 7.4/8.4 DC Battery

Equipment: See Appendix A.

Procedure: *A. Direct Method as Radiated (See Section B for Substitution Method)*

The final measurements were taken at APREL Laboratory's open area test site (OATS) measurement facility. This open area test site is calibrated to ANSI C63.4 document and a description of the measurement facility is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations. (FCC Registration No.:90416).

The Point of Sale Terminal was configured to operate at maximum power with appropriate modulation. Special software was employed in order that the transmitter was processing data in a normal manner.

Prior to final measurement in the OATS, preliminary radiated spurious emissions were scanned in a shielded enclosure at a distance of 1 m using biconical, log-periodic and horn antennas in order to determine the characteristic frequencies of the field strength of spurious emissions. Based on this information, measurements were performed in the OATS at these characteristic frequencies using calibrated antennas.

All field strength measurements were made with a spectrum analyser and the appropriate calibrated antenna for the frequency range from 9 kHz up to 10^{th} harmonics of the transmit frequency (see equipment list for the calibrated antenna used).

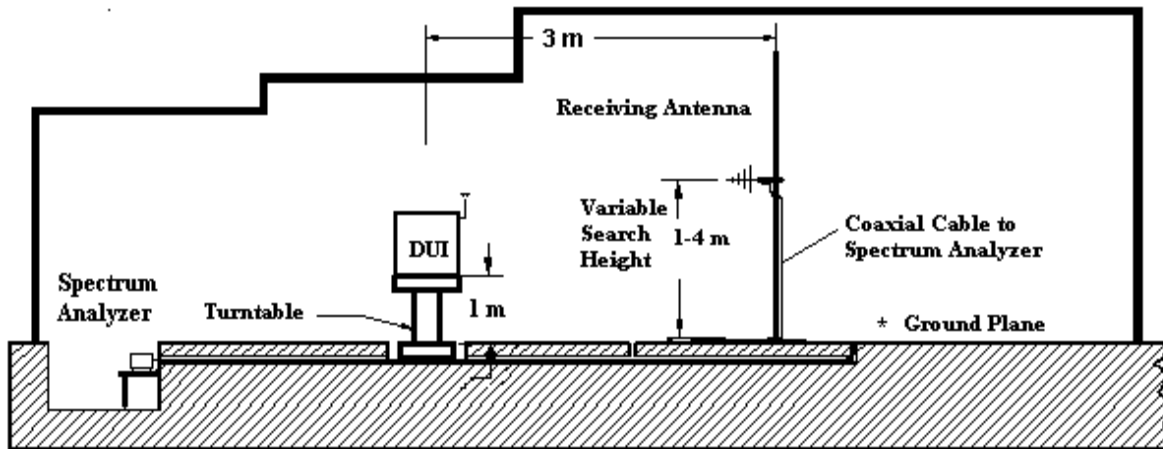


Figure 1.a Test set up for the Field Strength of Spurious Radiation Measurement in OATS
(Not to scale)



Fig. 1.b APREL's OATS (Open Area Test Site)

The equipment under test was placed on a turntable positioned 3 meters away from the calibrated receiving antenna, which in turn was connected to the spectrum analyzer. For each identified frequency, the received signal was maximized by the positioning of the turntable and the height of the antenna. The process was repeated for both horizontal and vertical polarisation.

Information submitted includes the relative radiated power of each spurious emissions with reference to the appropriate limits as described in Mask J, Part 90.210 assuming all emissions are radiated from half-wave dipole antenna.

Measurements given in the spurious emissions test result tables contain: analyzer reading, correction factor, and final reading. The final field strength level are derived from the analyzer measurement and the correction factor (antenna factor and cable loss) as shown in the following example:

Sample Calculation for direct method

A. Spectrum analyzer reading

At 1792.00 MHz (2nd harmonic, see Table 1), a spurious level of 24.10 dBμV @ 3 meters is measured.

B. Correction factor (antenna factor and cable loss)

Cable loss: 0.4 dB

Antenna Factor: 29.66 dB

Total Correction Factor: $0.4 + 29.66 = 30.06$ dB/m

C. Final reading (Field Strength of spurious emission):

$$C = A + B$$

$$C = 24.10 \text{ dB}\mu\text{V} + 30.06 \text{ dB}$$

$$C = 54.16 \text{ dB}\mu\text{V/m @ 3 meters}$$

D. The criteria level (Direct Method Radiated).

The field intensity, which would be produced by the transmitter carrier operating into a half-wave dipole antenna (gain of 1.64), at a distance of 3 m, was calculated using the following formula:

$$\text{Field Strength of unmodulated carrier (dB}\mu\text{V/m)} = 10 \log_{10} (\text{PtG}/4\pi r^2) + 146 \text{ dB}$$

r is distance, 3 meters

E = 24.30 dB μ V/m

Test Data using Direct Method

Table 1

Field Strength of Spurious Radiation,

Frequency: 896.00 MHz

Channel: 480-low ch.

Antenna Polarization: Vertical

Resolution Bandwidth:

10 kHz (below 1 GHz)/

100 kHz (above 1 GHz)

Direct Method

Frequency (MHz)	Measured Level (dB μ V)	Correction Factor (dB/m)	Field Strength (dB μ V/m)	Criteria Level (dB μ V/m)	Margin (dB)
	"A"	"B"	"C"	"D"	"E"
896.00 Carrier	96.75	26.58	123.33	-	-
1792.00 2 nd harmonic	24.10	30.06	54.16	78.50	24.34
2688.00 3 rd harmonic	22.70	32.95	55.65	78.50	22.85
3584.00 4 th harmonic	27.96	36.80	64.76	78.50	13.74
4480.00 5 th harmonic	24.91	37.82	62.73	78.50	15.77
5376.00 6 th harmonic	18.00 noise floor	41.00	59.00	78.50	19.50
6272.00 7 th harmonic	22.40	44.70	67.10	78.50	11.40
7168.00 8 th harmonic	17.20 noise floor	42.48	59.68	78.50	18.82
8064.00 9 th harmonic	18.00 noise floor	43.70	61.70	78.50	16.80

Test performed by: K. C. B. P. P. P.

Date: July, 2001

Table 2
 Field Strength of Spurious Radiation
 Frequency: 896.00 MHz
 Channel: 480-low ch.
 Antenna Polarization: Horizontal
Resolution Bandwidth:
 10 kHz (below 1 GHz)
 100 kHz (above 1 GHz)
 Direct Method

Frequency (MHz)	Measured Level (dB μ V)	Correction Factor (dB/m)	Field Strength (dB μ V/m)	Criteria Level (dB μ V/m)	Margin (dB)
	"A"	"B"	"C"	"D"	"E"
896.00 Carrier	94.50	26.58	121.08	-	-
1792.00 2 nd harmonic	25.89	30.06	55.95	78.50	22.55
2688.00 3 rd harmonic	26.54	32.95	59.49	78.50	19.01
3584.00 4 th harmonic	25.46	36.80	62.26	78.50	16.24
4480.00 5 th harmonic	25.98	37.82	63.80	78.50	14.70
5376.00 6 th harmonic	17.50 noise floor	41.00	58.50	78.50	20.00
6272.00 7 th harmonic	21.60	44.70	66.30	78.50	12.20
7168.00 8 th harmonic	18.50 noise floor	42.48	60.98	78.50	17.52

Test performed by:

Kir Celas Roman

Date:

July, 2001

Table 3
 Field Strength of Spurious Radiation
 Frequency: 899.00 MHz
 Channel: 720-medium ch.
 Antenna Polarization: Vertical
Resolution Bandwidth:
 10 kHz (below 1 GHz)
 100 kHz (above 1 GHz)
 Direct Method

Frequency (MHz)	Measured Level (dB μ V)	Correction Factor (dB/m)	Field Strength (dB μ V/m)	Criteria Level (dB μ V/m)	Margin (dB)
	"A"	"B"	"C"	"D"	"E"
899.00 Carrier	97.50	26.58	124.08		
1798.00 2 nd harmonic	24.00	30.11	54.11	78.50	24.39
2697.00 3 rd harmonic	23.40	32.96	56.36	78.50	22.14
3596.00 4 th harmonic	29.33	36.84	66.17	78.50	12.33
4495.00 5 th harmonic	23.17	37.81	60.98	78.50	17.52
5394.00 6 th harmonic	17.70 noise floor	40.99	58.69	78.50	19.81
6293.00 7 th harmonic	19.20	44.52	63.72	78.50	14.78
7192.00 8 th harmonic	18.90 noise floor	42.51	61.41	78.50	17.09
8091.00 9 th harmonic	18.10 noise floor	43.67	61.77	78.50	16.73

Test performed by: Ken C. Roman Date: July, 2001

Table 4
 Field Strength of Spurious Radiation
 Frequency: 899.00 MHz
 Channel: 720-medium ch.
 Antenna Polarization: Horizontal
Resolution Bandwidth:
 10 kHz (below 1 GHz)
 100 kHz (above 1 GHz)
 Direct Method

Frequency (MHz)	Measured Level (dB μ V)	Correction Factor (dB/m)	Field Strength (dB μ V/m)	Criteria Level (dB μ V/m)	Margin (dB)
	"A"	"B"	"C"	"D"	"E"
899.00 Carrier	94.64	26.58	121.22	-	-
1798.00 2 nd harmonic	22.31	30.11	52.42	78.50	26.08
2697.00 3 rd harmonic	26.00	32.96	58.96	78.50	19.54
3596.00 4 th harmonic	29.53	36.84	66.37	78.50	12.13
4495.00 5 th harmonic	25.43	37.81	63.24	78.50	15.26
5394.00 6 th harmonic	18.20 noise floor	40.99	59.19	78.50	19.31
6293.00 7 th harmonic	18.00 noise floor	44.52	62.52	78.50	15.98
7192.00 8 th harmonic	19.38	42.51	61.89	78.50	16.61
8091.00 9 th harmonic	19.30 noise floor	43.67	62.97	78.50	15.53

Test performed by:

Ku Cha Roman

Date:

July, 2001

Table 5
 Field Strength of Spurious Radiation
 Frequency: 901.00 MHz
 Channel: 880-high ch.
 Antenna Polarization: Vertical
Resolution Bandwidth:
 10 kHz (below 1 GHz)
 100 kHz (above 1 GHz)
 Direct Method

Frequency (MHz)	Measured Level (dB μ V)	Correction Factor (dB/m)	Field Strength (dB μ V/m)	Criteria Level (dB μ V/m)	Margin (dB)
	"A"	"B"	"C"	"D"	"E"
901.00 Carrier	96.95	26.59	123.54	-	-
1802.00 2 nd harmonic	24.85	30.13	54.98	78.50	23.52
2703.00 3 rd harmonic	20.51	32.97	53.48	78.50	25.02
3604.00 4 th harmonic	29.90	36.87	66.77	78.50	11.73
4505.00 5 th harmonic	25.01	37.84	62.85	78.50	15.65
5406.00 6 th harmonic	18.50 noise floor	40.98	59.48	78.50	19.02
6307.00 7 th harmonic	19.92	44.41	64.33	78.50	14.17
7208.00 8 th harmonic	18.02 noise floor	42.53	60.55	78.50	17.95
8109.00 9 th harmonic	25.50 noise floor	43.65	69.15	78.50	9.35

Test performed by: Kir Celia Roman Date: July, 2001

Table 6
Field Strength of Spurious Radiation
 Frequency: 901.00 MHz
 Channel: 880-high ch.
 Antenna Polarization: Horizontal
Resolution Bandwidth:
 10 kHz (below 1 GHz)
 100 kHz (above 1 GHz)
 Direct Method

Frequency (MHz)	Measured Level (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Criteria Level (dBμV/m)	Margin (dB)
	"A"	"B"	"C"	"D"	"E"
901.00 Carrier	94.46	26.59	121.05	-	-
1802.00 2 nd harmonic	20.07	30.13	50.20	78.50	28.30
2703.00 3 rd harmonic	19.70	32.97	52.67	78.50	25.83
3604.00 4 th harmonic	32.15	36.87	69.02	78.50	9.48
4505.00 5 th harmonic	27.55	37.84	65.39	78.50	13.11
5406.00 6 th harmonic	17.80 noise floor	40.98	58.78	78.50	19.72
6307.00 7 th harmonic	21.15 noise floor	44.41	65.56	78.50	12.94
7208.00 8 th harmonic	18.00	42.53	60.53	78.50	17.97
8109.00 9 th harmonic	25.50 noise floor	43.65	69.15	78.50	9.35

Test performed by:

K. C. R. R. R. R. R.

Date:

July, 2001

Section B: Substitution Method

The P2000 was also tested for spurious RE measurement using the substitution method using a procedure similar to that used in the ERP measurement and described in the ERP measurement portion of the Test Report.

A set of three reference dipoles, a horn antenna and a signal generator to duplicate the signal were used. Signals radiated from the POS P2000 on the fundamental frequency as well as second and third harmonic were evaluated by comparing to the signals transmitted from the reference dipoles. As reference antenna for the first three harmonics a set of three dipoles was used: $l = 149.0$ mm (first harmonic/fundamental), $l = 72.0$ mm (second harmonic), and $l = 47.0$ mm (third harmonic). For testing the higher frequencies, fourth to tenth harmonic, a calibrated horn antenna (with known gain) was used as replacement source of radiation thus substituting the POS P2000. The duplicated reading was then referenced to the dipole. Finally, the duplicated readings were converted to dB μ V/m.

Criteria: The Criteria level using substitution method was calculated to be

This level was obtained by using the following expression:

$$\begin{aligned}\text{Limit} &= \text{ERP carrier} - 50 + 10 \log P(\text{ERP W}) \\ &= 24.78 \text{ dBm} - 50 + 10 \log(0.363) \\ &= -20 \text{ dBm}\end{aligned}$$

Test Data using Substitution Method

Table 1A

Field Strength of Spurious Radiation,
Frequency: 896.00 MHz/Channel: 480-low ch.

Resolution Bandwidth:

10 kHz (below 1 GHz)/100 kHz (above 1 GHz)

Substitution Method

Antenna Polarization: Vertical

f	ERP _V	E _V @3m	Limit	Margin
MHz	dBm	dBμV/m	dBm	dB
896.00	24.78	122.17	-	-
1792.00	-44.67	52.72	-20.00	24.67
2688.00	-43.59	53.80	-20.00	23.59
3584.00	-34.91	62.48	-20.00	14.91
4480.00	-37.30	60.09	-20.00	17.30
5376.00	-41.44	55.95	-20.00	21.44
6272.00	-33.73	63.66	-20.00	13.73
7168.00	-41.61	55.78	-20.00	21.61
8064.00	-39.96	57.43	-20.00	19.96

Table 2A

Antenna Polarization Horizontal

f	ERP _V	E _V @3m	Limit	Margin
MHz	dBm	dBμV/m	dBm	dB
896.00	22.56	119.95	-	-
1792.00	-42.68	54.71	-20.00	22.68
2688.00	-38.91	58.48	-20.00	18.91
3584.00	-36.13	61.26	-20.00	16.13
4480.00	-34.80	62.59	-20.00	14.80
5376.00	-40.07	57.32	-20.00	20.07
6272.00	-32.23	65.16	-20.00	12.23
7168.00	-37.60	59.79	-20.00	17.60
8064.00	-33.94	63.45	-20.00	13.94

Test performed by: Ku Celine Poulos

Date: July, 2001

Table 3A

Field Strength of Spurious Radiation
Frequency: 899.00 MHz/Channel: 720-medium ch.

Resolution Bandwidth:

10 kHz (below 1 GHz)/100 kHz (above 1 GHz)

Substitution Method

Antenna Polarization: Vertical

f	ERP _V	E _V @3m	Limit	Margin
MHz	dBm	dB μ V/m	dBm	dB
899.00	25.68	123.07	-	-
1798.00	-44.67	52.72	-20.00	24.67
2697.00	-43.04	54.35	-20.00	23.04
3596.00	-33.45	63.94	-20.00	13.45
4495.00	-38.99	58.40	-20.00	18.99
5394.00	-41.65	55.74	-20.00	21.65
6293.00	-37.03	60.36	-20.00	17.03
7192.00	-39.80	57.59	-20.00	19.80
8091.00	-39.69	57.70	-20.00	19.69

Table 4A

Antenna Polarization Horizontal

f	ERP _V	E _V @3m	Limit	Margin
MHz	dBm	dB μ V/m	dBm	dB
899.00	22.70	120.09	-	-
1798.00	-45.02	52.37	-20.00	25.02
2697.00	-39.44	57.95	-20.00	19.44
3596.00	-32.16	65.23	-20.00	12.16
4495.00	-35.24	62.15	-20.00	15.24
5394.00	-39.25	58.14	-20.00	19.25
6293.00	-35.90	61.49	-20.00	15.90
7192.00	-36.60	60.79	-20.00	16.60
8091.00	-35.63	61.76	-20.00	15.63

Test performed by: Julio Roman Date: July, 2001

Table 5A

Field Strength of Spurious Radiation,
Frequency: 901.00 MHz/ Channel: 880-high ch.

Resolution Bandwidth:

10 kHz (below 1 GHz)/100 kHz (above 1 GHz)

Substitution Method

Antenna Polarization: Vertical

f	ERP _V	E _V @3m	Limit	Margin
MHz	dBm	dBμV/m	dBm	dB
901.00	25.87	123.26	-	-
1802.00	-43.83	53.56	-20.00	23.83
2703.00	-45.73	51.66	-20.00	25.73
3604.00	-32.78	64.61	-20.00	12.78
4505.00	-37.18	60.21	-20.00	17.18
5406.00	-40.86	56.53	-20.00	20.86
6307.00	-36.35	61.04	-20.00	16.35
7208.00	-40.63	56.76	-20.00	20.63
8109.00	-32.31	65.08	-20.00	12.31

Table 6A

Antenna Polarization Horizontal

f	ERP _V	E _V @3m	Limit	Margin
MHz	dBm	dBμV/m	dBm	dB
901.00	22.48	119.87	-	-
1802.00	-48.30	49.09	-20.00	28.30
2703.00	-45.73	51.66	-20.00	25.73
3604.00	-29.39	68.00	-20.00	9.39
4505.00	-33.20	64.19	-20.00	13.20
5406.00	-39.62	57.77	-20.00	19.62
6307.00	-32.98	64.41	-20.00	12.98
7208.00	-37.99	59.40	-20.00	17.99
8109.00	-29.44	67.95	-20.00	9.44

Test performed by: Ku Che Roman Date: July, 2001

APPENDIX A

List of Test Equipment

List of Equipment

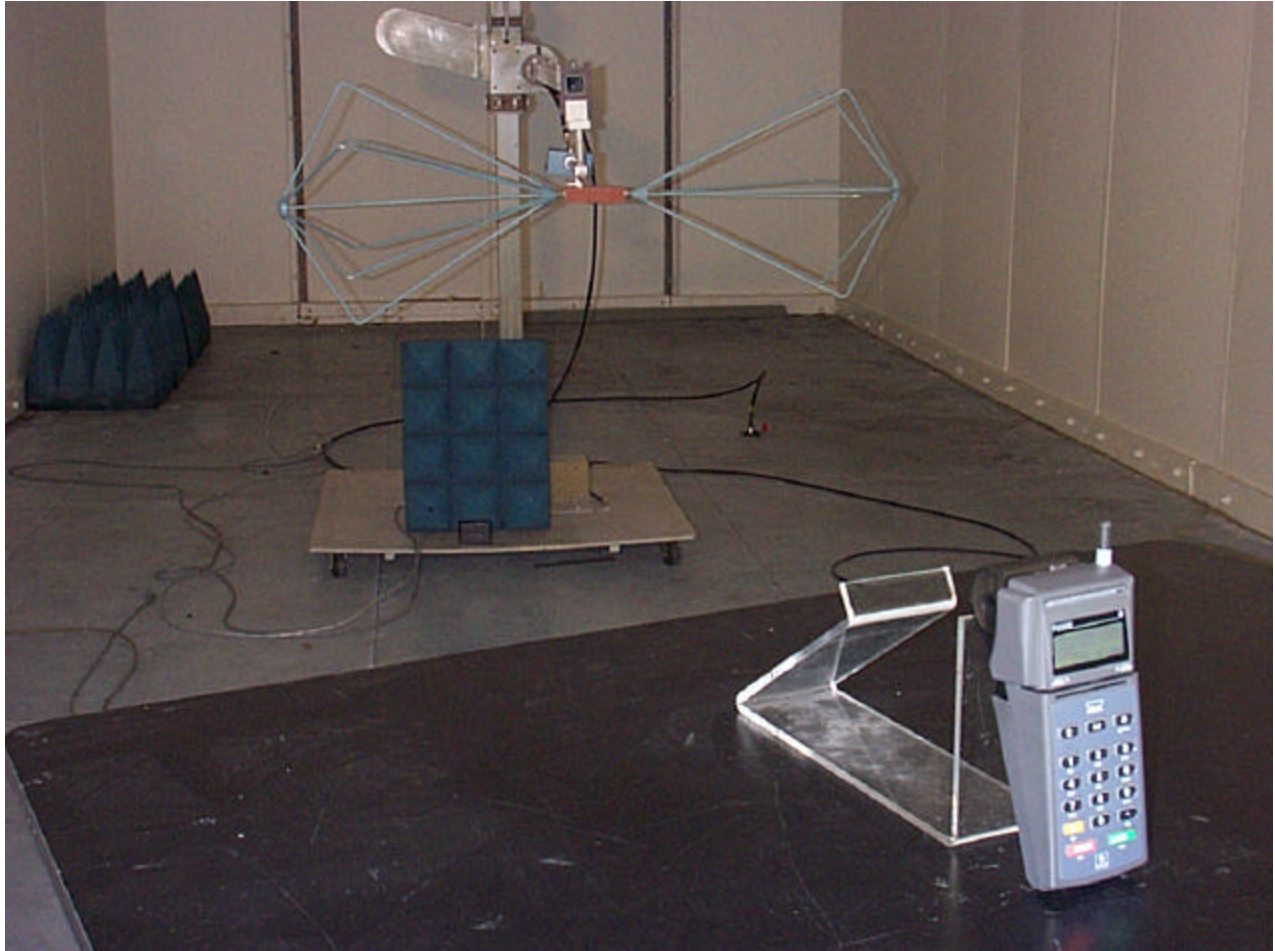
Description	Range	Manufacturer	Model #	APREL Asset #	Cal. Due Date
Spectrum Analyzer	9 kHz - 3 GHz	Anritsu	MS2661C	301330	Dec 10, 2001
Spectrum Analyzer	9 kHz - 30 GHz	Anritsu	MS2667C	301436	Nov 3, 2001
Biconical Antenna	20 MHz - 200 MHz	Eaton	94455-1	100890	July 21, 2002
Log - Periodic Antenna	200 MHz -1.0 GHz	Eaton	ALP-1	100761	July 21, 2002
Horn Antenna	1 – 18 GHz	APREL Inc.	AA – 118	100553	March 12, 2002
Anechoic Shielded Room	10 kHz - 10 GHz	APREL Inc.	—	301329	N/A
OATS	30 MHz – 1 GHz	APREL Inc.	3 m & 10 m	N/A	N/A
Mast with the Controller	1 m – 4 m	EMCO	1051 – 12	100507	N/A
Turntable with the Controller	0° - 360°	EMCO	1060 – 1.241	100506	N/A
Notch Filter	DC - 6 GHz	APREL Inc.	NFLT-835	301470	CBT
Attenuator	20 dB	Pasternack	PE 7002-20	301370	May 18, 2002
Amplifier (LNA)	30-1000 MHz	APREL Inc.	APRLNA-001	301415	June 20, 2002

APPENDIX B

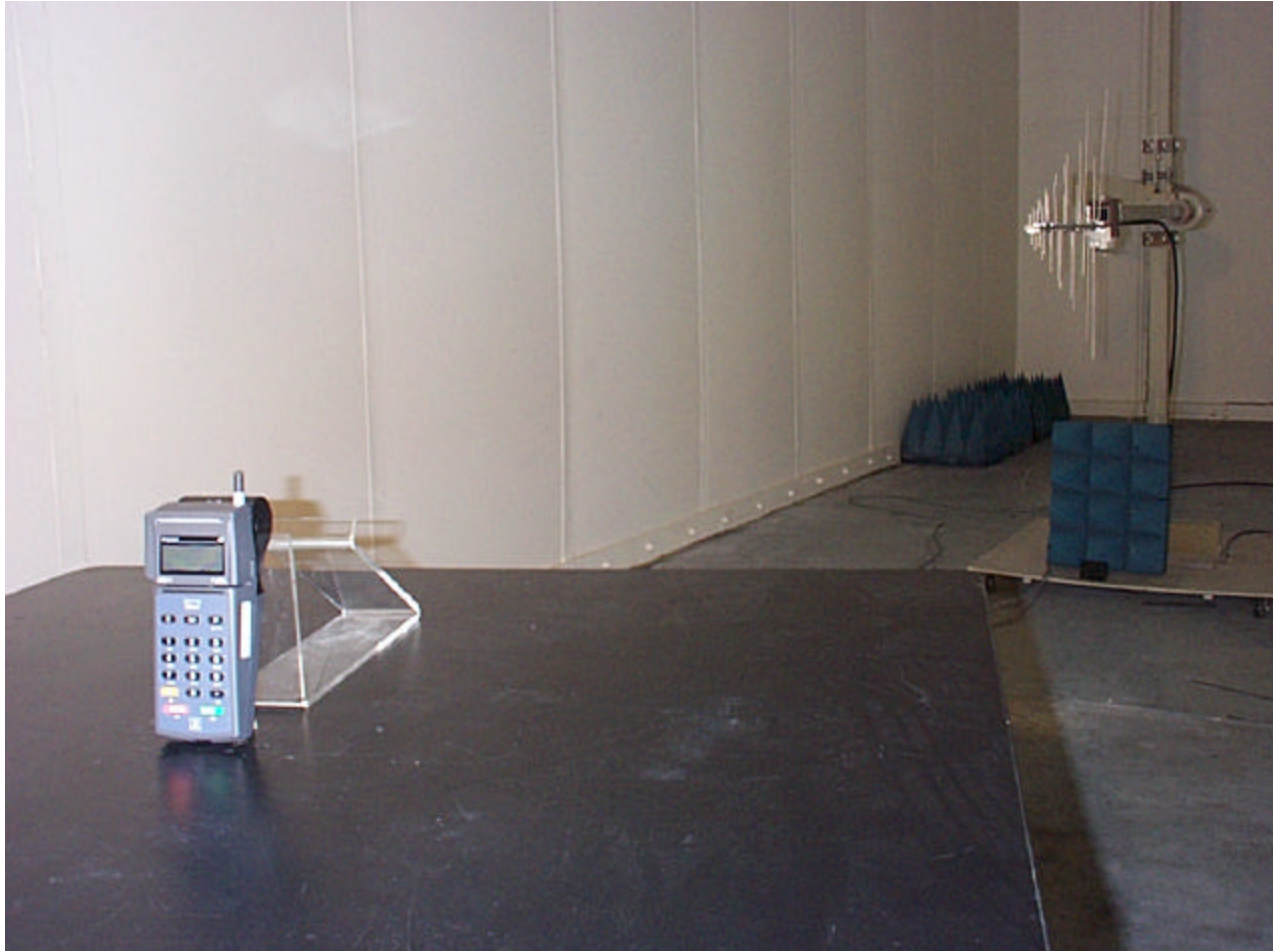
PHOTOGRAPHS



**Descartes Point of Sale Device P2000
With Mobitex R902 Modem**



**Descartes Point of Sale Device P2000 Tested for Spurious Emissions at the OATS
Frequency range: 30 MHz – 200 MHz**



Descartes Point of Sale Device P2000 Tested for Spurious Emissions at the OATS
Frequency range: 200 MHz – 1.0 GHz



**Descartes Point of Sale Device P2000 Tested for Spurious Emissions at the OATS
Frequency range: 1.0 GHz – 10.0 GHz**