

FCC ID: PQ9MCW4

Exhibit 2f

Engineering Report on

MPE (47 CFR §2.1091)



Assessment of Compliance

for

Maximum Permissible Exposure Evaluation with Respect to
FCC Rule Part 47 CFR §2.1091

Wireless Data Relay
MCW4 with a Research In Motion
R802-M-2-0 radio transmitter
Remtrol, Inc.



July 2001

REMB-MCW4 w. RIM 802D-3734

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Engineering Report

Subject: Maximum Permissible Exposure Evaluation with Respect to
FCC Rule Part 47CFR §2.1091 and the standards
ANSI/IEEE C95.1-1992 and C95.3-1992

FCC ID: PQ9MCW4

Equipment: Wireless Data Relay

Model: MCW4

Client: Remtrol Inc.
141 Suburban Road, Suite A2
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U.S.A.

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Project # REMB-MCW4 w. RIM 802D-3734

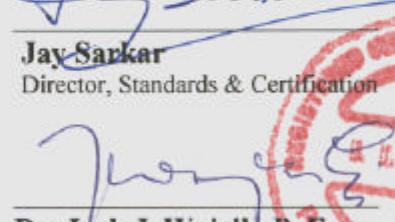
Approved by:

 Date: July 27, 2001
Jay Sarkar
Director, Standards & Certification

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 Date: July 27, 2001
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Released by:

 Date: July 27/01
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FCC ID: **PQ9MCW4**
Client : Remtrol Inc.
Equipment : Wireless Data Relay
Model: MCW4
Standard: FCC Rule Part 47 CFR §2.1091

ENGINEERING SUMMARY

This report contains the results of the maximum permissible exposure (MPE) evaluation performed on the device under investigation (DUI) which was comprised of a Remtrol MCW4 Wireless Data Relay containing a built in RIM R802D radio-modem. The tests were carried out in accordance with the applicable requirements of FCC rules found in 47CFR §2.1091 and the standards ANSI/IEEE C95.1-1992 and C95.3-1992.

The methodology and results for the test are described in the appropriate section of this report.

The DUI was tested on frequency 815.00 MHz. The maximum power exposure level measured at 20.0 cm and 25.0 cm was 0.32 mW/cm² and 0.21 mW/cm² respectively. Users and installers should be provided with the appropriate operating instructions regarding safe distances and mounting configurations, for satisfying RF exposure compliance.

FCC SUBMISSION INFORMATION

FCC ID: **PQ9MCW4**

Equipment: Wireless Data Relay

Model: MCW4 with a RIM 802D Wireless Modem

For: Certification

Applicant: **Remtrol Inc.**
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Manufacturer: **Remtrol Inc.**
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ACRONYMS

| | |
|------|-----------------------------------|
| DUI | Device Under Investigation |
| ERP | Effective Radiated Power |
| FCC | Federal Communications Commission |
| MPE | Maximum Permissible Exposure |
| N/A | Not Applicable |
| NTS | Not To Scale |
| OATS | Open Area Test Site |
| OEM | Original Equipment Manufacturer |
| QA | Quality Assurance |
| RIM | Research in Motion |

1.0 INTRODUCTION

1.1 General

This report describes the Maximum Permissible Exposure (MPE) tests on a Remtrol MCW4 Wireless Data Relay containing a built in RIM R802D radio-modem, the device hereinafter called the DUI (Device Under Investigation).

1.2 Scope

MPE evaluation was performed on the DUI in accordance with the requirements of the FCC rules for RF compliance found in 47CFR §2.1091 and the standard ANSI/IEEE C95.3-1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave. This Engineering Report contains the following:

- Methodology as to how the tests were performed.
- Test results and analysis.
- Identification of the test equipment used for the testing.
- Test set-up diagram.

1.3 Schedule

The MPE tests were completed on July 10, 2001.

2.0 APPLICABLE DOCUMENTS

FCC Rule Part 47CFR §2.1091

ANSI/IEEE C95.1-1992, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz.

ANSI/IEEE C95.3-1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

OET Bulletin 65 (Edition 97-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.

3.0 TEST SAMPLE

The MPE test described in this procedure was performed on:

- Remtrol MCW4 Wireless Data Relay with a built in RIM R802D radio-modem.

4.0 GENERAL REQUIREMENTS

4.1 Location of Test Facilities

The tests were performed by APREL Laboratories at APREL's test facility located in Nepean, Ontario, Canada. The laboratory operates a 3 and 10 meter Open Area Test Site (OATS) measurement facility. The test site is calibrated to ANSI C63.4-1992.

A description of the measurement facility in accordance with the radiated and AC line conducted test site criteria in 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 31070/SIT(1300F2).

APREL is accredited by Standard Council of Canada, under the PALCAN program (ISO Guide 25). All equipment used is calibrated or verified in accordance with the intent of AQAP-6/MIL-STD-45662. APREL is also accredited by Industry Canada (formerly DOC) and recognized by the Federal Communications Commission (FCC).

4.2 Personnel

EMC/EMI testing staff member, Yingzhi Chen, carried out all MPE tests.

4.3 Failure Criteria

The device under investigation was considered to have failed if any of the following occurred:

When the MPE limits exceeded those permitted by appropriate limits defined by the FCC.

4.4 Tolerance

The following tolerances on test conditions, exclusive of equipment accuracy, were maintained:

Voltage: $\pm 10\%$.

5.0 TEST INSTRUMENTATION & CALIBRATION

5.1 General

APREL Laboratories, located in Nepean, Ontario is equipped with the necessary instrumentation to ensure accurate measurement of all data recorded during the tests outlined in this document. To ensure continued accuracy, each instrument is re-calibrated at intervals established by APREL and based on standards traceable to the National and International Standards. Accuracy surveillance is a function of APREL Quality Assurance.

5.2 MPE Test Equipment Required

The test equipment required to perform the MPE testing was selected from the equipment available at APREL as listed in APPENDIX C.

5.3 Calibration Requirements

All test equipment instrumentation required for MPE qualification testing was calibrated and controlled.

6.0 ELECTRICAL/MECHANICAL DESCRIPTION

The MPE Test Program was performed on a Remtrol MCW4 Wireless Data Relay with a built in RIM R802D radio-modem, the combination hereinafter called the DUI. The test sample consisted of the components supplied by the customer and described below.

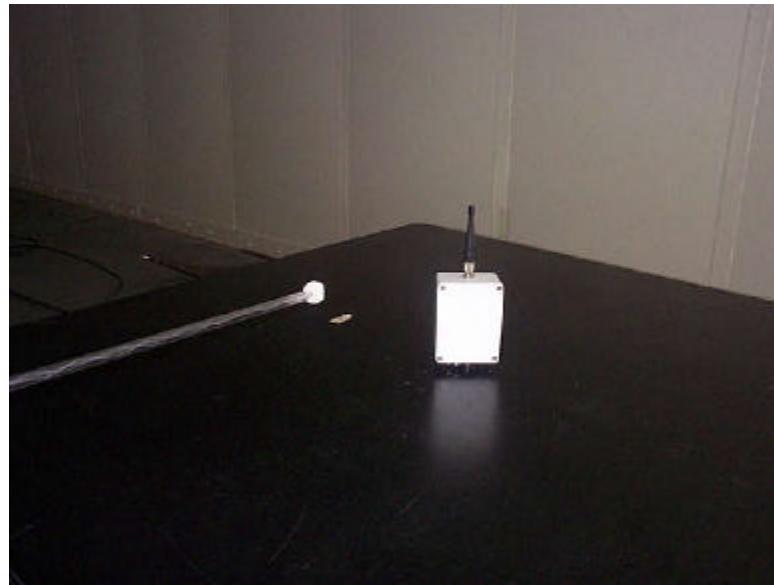
6.1 Test Unit Description

The a Remtrol MCW4 Wireless Data Relay with a built in RIM R802D radio-modem, consisted of the following components:

| <u>Part Number</u> | <u>Description</u> |
|---------------------------|---|
| - | Remtrol MCW4 Wireless Data Relay |
| FCCTEST815 | RIM Radio Type Tester 5.0 software |
| ID# 193 | RIM execution lock device for radio tools |

6.2 MPE Test Setup

- a) The DUI antenna shall be installed on the “top” side of the unit (see Figures 6.2.1).
- b) The DUI shall be positioned on the turntable in the OATS in such a way that the antenna will be located in the centre of rotation.
- c) For the selection and placement of the measuring probe, the requirements of ANSI/IEEE C95.3-1992 shall be met.



**Figure 6.2.1. Photographs of the Setup
MPE Testing @ the OATS**

7.0 MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

7.1 Purpose

This test method is used to verify that the DUI meets the MPE requirements as defined in the criteria for general population/uncontrolled exposure when operating at maximum ERP and in all operating modes.

7.2 Test Equipment

See APPENDIX

7.3 Criteria

Power Density Limits – The DUI shall not generate a power density beyond the limits in the frequency band listed in the left hand column of Table 7.3.1, and the power density given in the right hand column. The power density shall be measured for distances 20 cm and more from the radiating antenna axis (see Figure 7.3.1). The measured values shall be recorded.

Table 7.3.1

Power Density Limits
for General Population/Uncontrolled Exposure

| Frequency Range | Power Density (mW/cm ²) |
|-----------------|-------------------------------------|
| 300 - 1500 MHz | f/1500 |
| 815.00 MHz | 0.54 |

Note: f = frequency in MHz

The measurements shall be performed at one transmitting frequency, the highest ERP of the high, middle or low channels.

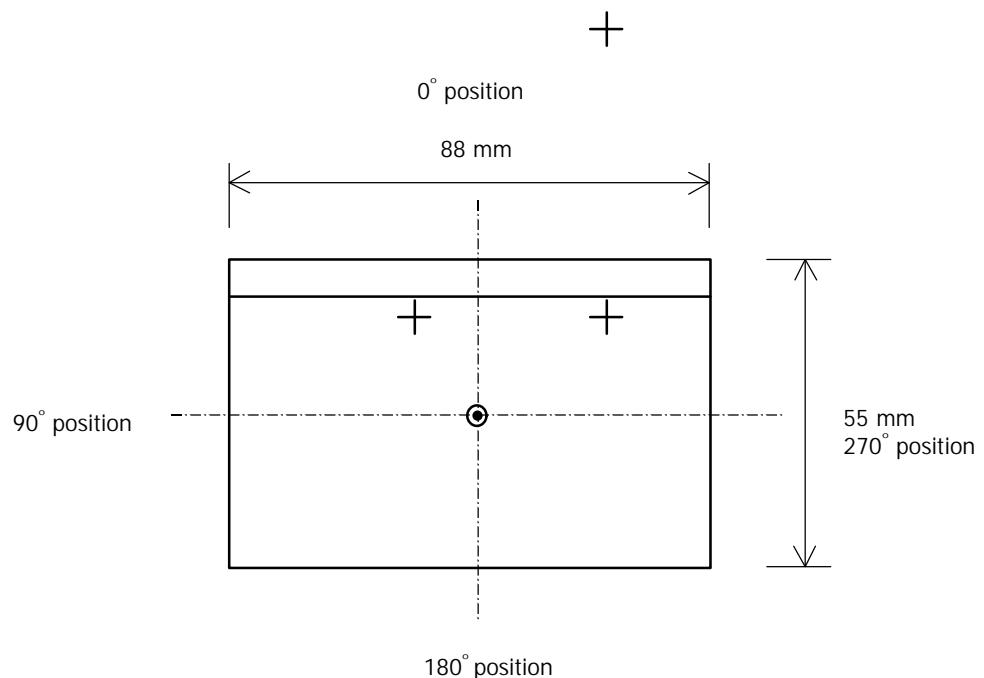


Figure 7.3.1. Plan View of Setup.

7.4 Test Procedure

- a) The probe shall be positioned horizontally with its tip 25 cm from the radiating antenna, and its axis normal to the antenna.
- b) Rotate the turntable so that the probe is at the 0° position (see Figure 7.3.1).
- c) Turn on the DUI and allow a sufficient time for stabilization. Turn on the transmitter and simulate normal operation condition. Operate the transmitter at full rated output power. The test frequency is 815 MHz.
- d) Determine the location of the maximum power density: locate the maximum emissions by scanning vertically along the DUI's antenna. Take and record measurements of the power density at a number of points along the length of the antenna as well as just past its tip.
- e) At every 45° of rotation take and record a measurement of the power density at the maximum power density height as for at least the following locations:
 - half the maximum power density height
 - just above the tip of the antenna
- f) Turn off the DUI.

7.5 Results

Table 7.5.1 presents the results of the measurements made vertically along the DUI in order to find the location of the maximum power density (the DUI has a height of 21 cm). Column 1 shows the height at which the measurements were taken and column 2 shows the results (Power density). Column 3 indicates the limit for the MPE test. Margin to the limit is given in column 4.

Table 7.5.1
Power Density Measured at 0° as a Function of Height
Frequency: 815.00 MHz; Channel: 22D0 (medium)

| Height [cm] | Measured Power Density @ 0.20 m | | Limit [mW/cm ²] | Margin [mW/cm ²] |
|----------------|------------------------------------|-----------------------|--------------------------------|---------------------------------|
| | [mW/cm ²] | [mW/cm ²] | | |
| 2 | 0.282 | 0.181 | 0.541 | 0.360 |
| 4 | 0.306 | 0.199 | 0.541 | 0.342 |
| 6 | 0.316 | 0.201 | 0.541 | 0.340 |
| 8 | 0.324 | 0.207 | 0.541 | 0.334 |
| 10 | 0.312 | 0.193 | 0.541 | 0.348 |
| 12 | 0.296 | 0.182 | 0.541 | 0.359 |
| 14 | 0.248 | 0.155 | 0.541 | 0.386 |
| 16 | 0.206 | 0.135 | 0.541 | 0.406 |
| 18 | 0.180 | 0.114 | 0.541 | 0.427 |
| 20 | 0.140 | 0.087 | 0.541 | 0.454 |
| 22 | 0.091 | 0.060 | 0.541 | 0.481 |
| 24 | 0.067 | 0.043 | 0.541 | 0.498 |
| 26 | 0.052 | 0.033 | 0.541 | 0.508 |

The data in Table 7.5.1 is presented in Figure 7.5.1.

Test performed by: Kathleen Powers Date: July, 2001

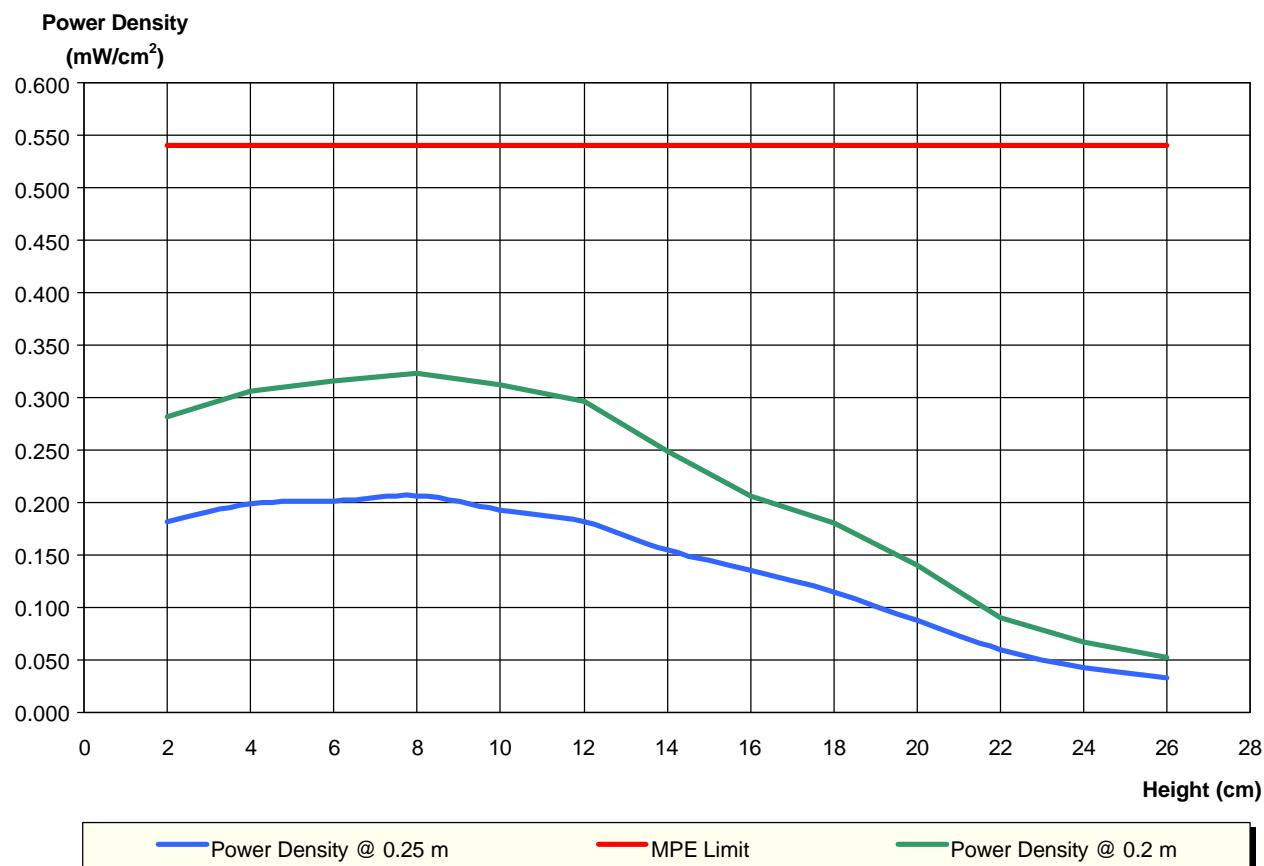
**Figure 7.5.1**

Table 7.5.2 presents the results of the measurements made around the DUI at every 45° of rotation. Column 1 shows the angle at which the measurements were taken and columns 2 through 4 show the measured power density at the different measurement heights. Column 5 shows the limit of MPE test. The measured power density at any angular position and any heights should be with the limit.

Table 7.5.2

Power Density Measured
at every 45° as a Function of Height

| Angular Position [°] | Measured Power Density for Different Heights [mW/cm ²] | | | MPE Limit [mW/cm ²] |
|-------------------------|---|----------|-----------|------------------------------------|
| | H = 4 cm | H = 8 cm | H = 22 cm | |
| 0 | 0.140 | 0.205 | 0.067 | 0.541 |
| 45 | 0.125 | 0.164 | 0.068 | 0.541 |
| 90 | 0.136 | 0.158 | 0.080 | 0.541 |
| 135 | 0.133 | 0.173 | 0.089 | 0.541 |
| 180 | 0.175 | 0.170 | 0.103 | 0.541 |
| 225 | 0.159 | 0.186 | 0.130 | 0.541 |
| 270 | 0.194 | 0.201 | 0.123 | 0.541 |
| 315 | 0.155 | 0.191 | 0.102 | 0.541 |
| 360 | 0.139 | 0.207 | 0.078 | 0.541 |

The data in Table 7.5.2 is presented in Figure 7.5.2.

Test performed by: Kin-Elo Polson Date: July, 2001

Power Density Test Data Plot

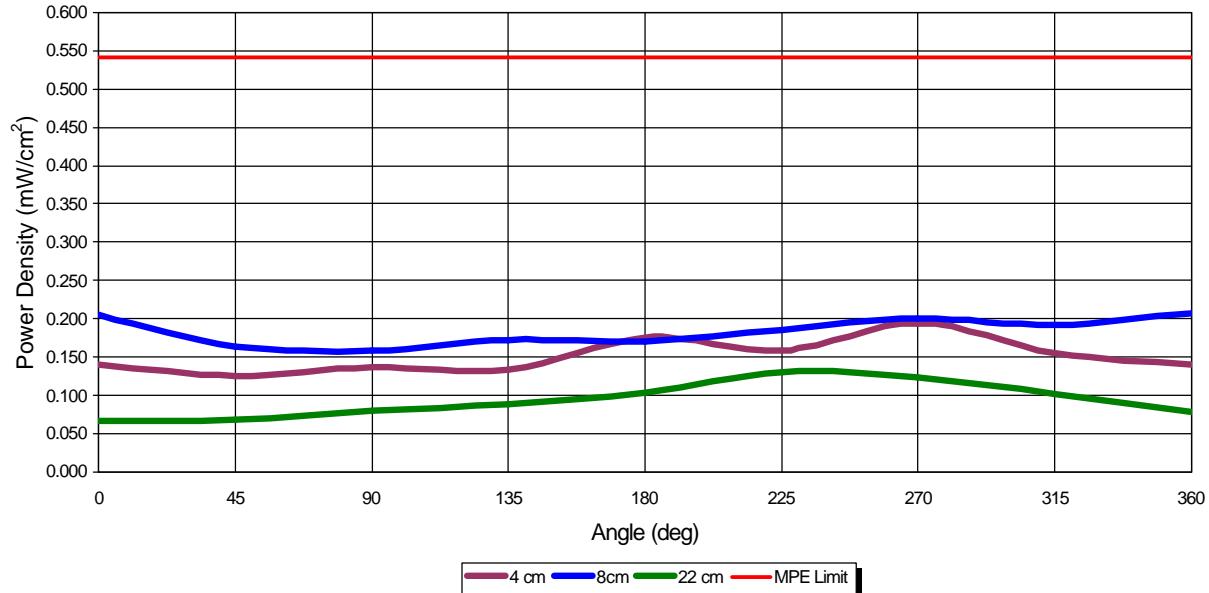


Figure 7.5.2.a

Power Density Levels in Polar Plot

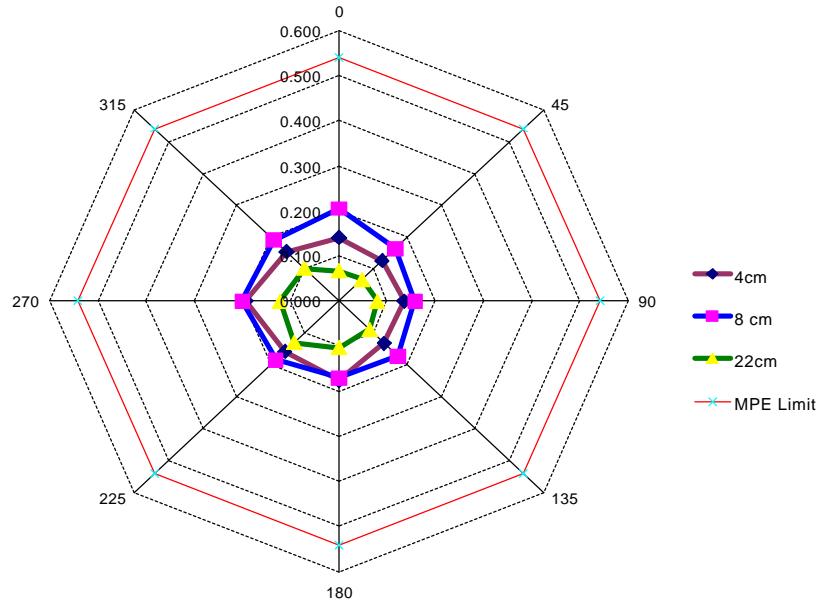


Figure 7.5.2.b

8.0 CONCLUSION

The DUI consisting of a Remtrol MCW4 Wireless Data Relay containing a built in RIM R802D radio-modem will not exceed the MPE requirements for the 806-821 MHz band. The maximum power exposure level measured at 20.0 cm and 25.0 cm was 0.32 mW/cm² and 0.21 mW/cm² respectively.

APPENDIX

List of Test Equipment

| Description | Range | Manufacturer | Model # | APREL Asset # | Cal. Due Date |
|------------------------------|-------------------|---------------------------|--------------|---------------|---------------|
| Field Sensor Probe | 20 MHz – 3 GHz | APREL Inc | APR Sensor | 301433 | CBT |
| Digital Multimeter | – | Fluke | 8505A | 100665 | July 17, 2001 |
| RF-Signal Generator | 10 kHz – 1.28 GHz | HP | 8662A | 100456 | Nov 1, 2000 |
| RF-Signal Generator | 10 MHz – 26.5 GHz | HP | 8340B | 100955 | Nov 1, 2000 |
| RF Power Meter | – | Rhode & Schwarz | NRVS | 100851 | July 21, 2001 |
| TEM Cell | – | Fisher Custom Comm., Inc. | FCC-TEM-JM1 | 301438 | N/A |
| 20 dB Attenuator | DC – 18 GHz | Narda | 4779-20 | 301370 | CBT |
| RF Amplifier | 500 MHz – 1 GHz | – | – | 100995 | CBT |
| 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 |
| Turtable with the Controller | 0° – 360° | EMCO | 1060 – 1.241 | 100506 | N/A |