

**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  
San Luis Obispo, CA 93401  
U.S.A.

**Prepared by:** APREL Laboratories,  
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51 Spectrum Way  
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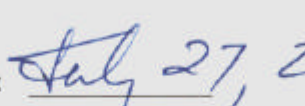
**Project #** REMB-MCW4 w. RIM 802D-3734

**Approved by:**

  
**Jay Sarkar**

Director, Standards & Certification

**Date:**

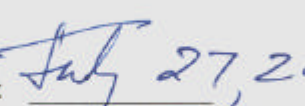
  
July 27, 2001

**Submitted by:**

  
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Director, Standards & Certification

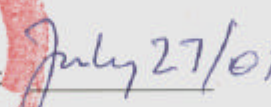
**Date:**

  
July 27, 2001

**Released by:**

  
**Dr. Jack J. Wojcik, P. Eng.**

**Date:**

  
July 27/01

**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  $0.32 \text{ mW/cm}^2$  and  $0.21 \text{ mW/cm}^2$  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.**  
141 Suburban Road, Suite A2  
San Luis Obispo, CA 93401  
U.S.A.

**Manufacturer:** **Remtrol Inc.**  
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**Evaluated by:** **APREL Inc.**  
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## TABLE OF CONTENTS

SECTION	TITLE	PAGE
	ACRONYMS.....	5
1.0	INTRODUCTION .....	6
1.1	General.....	6
1.2	Scope .....	6
1.3	Schedule.....	6
2.0	APPLICABLE DOCUMENTS .....	6
3.0	TEST SAMPLE .....	7
4.0	GENERAL REQUIREMENTS .....	7
4.1	Location of Test Facilities.....	7
4.2	Personnel .....	7
4.3	Failure Criteria.....	7
4.4	Tolerances .....	8
5.0	TEST INSTRUMENTATION .....	8
5.1	General.....	8
5.2	MPE Test Equipment Required .....	8
5.3	Calibration Requirements .....	8
6.0	ELECTRICAL/MECHANICAL DESCRIPTION .....	9
6.1	Test Unit Description.....	9
6.2	MPE Test Setup .....	9
7.0	MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST PLAN.....	11
7.1	Purpose .....	11
7.2	Test Equipment .....	11
7.3	Criteria .....	11
7.4	Test Procedure .....	13
7.5	Results .....	14
8.0	CONCLUSION .....	18
APPENDIX	Equipment List.....	19

## **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.

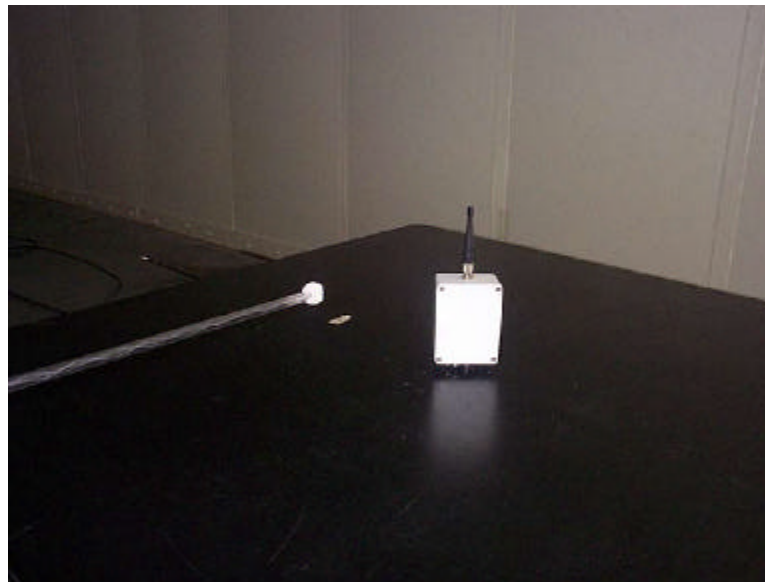
### 6.1 Test Unit Description

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.

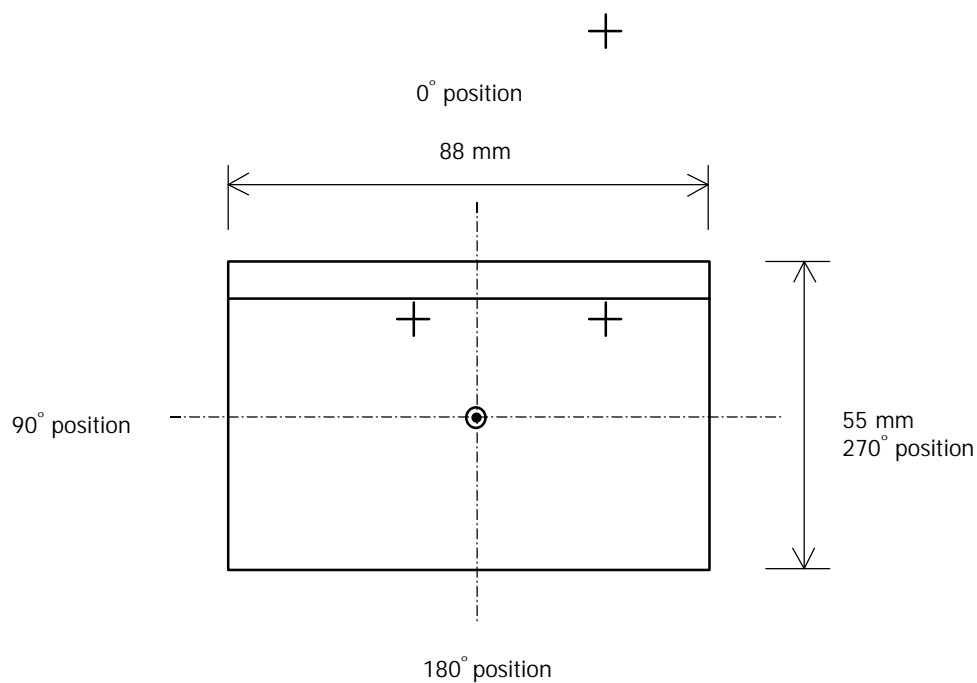
**Table 7.3.1**

Power Density Limits  
for General Population/Uncontrolled Exposure

Frequency Range	Power Density (mW/cm <sup>2</sup> )
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**

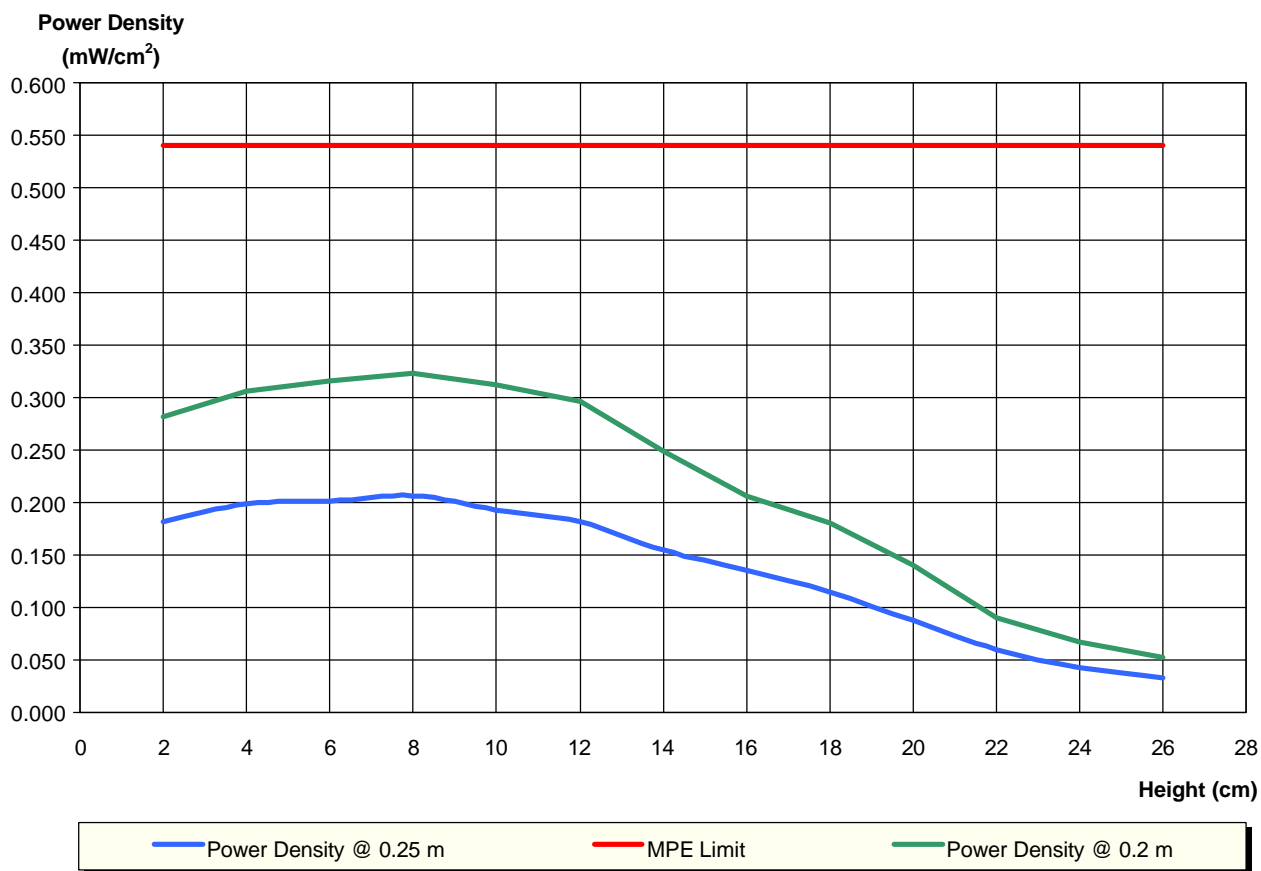
Power Density Measured at 0° as a Function of Height  
Frequency: 815.00 MHz; Channel: 22D0 (medium)

Height	Measured Power Density @ 0.20 m	Measured Power Density @ 0.25 m	Limit	Margin
[cm]	[mW/cm <sup>2</sup> ]	[mW/cm <sup>2</sup> ]	[mW/cm <sup>2</sup> ]	[mW/cm <sup>2</sup> ]
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: Kulabe Pourn 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 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 <sup>2</sup> ]			MPE Limit [mW/cm <sup>2</sup> ]
	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

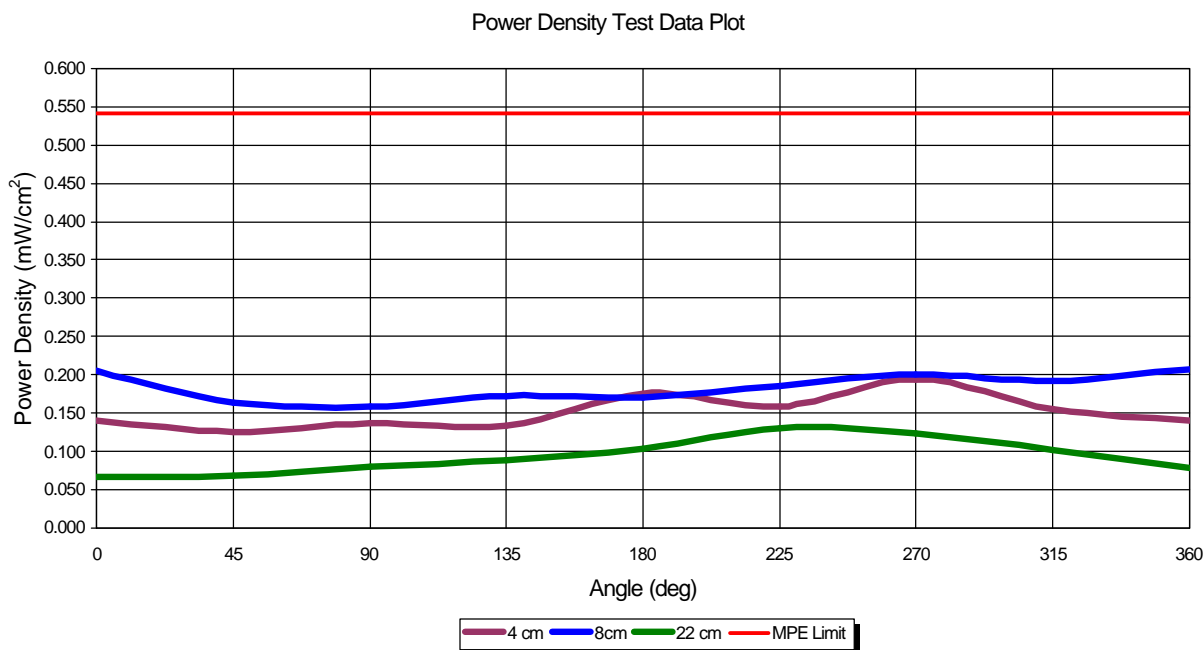
The data in Table 7.5.2 is presented in Figure 7.5.2.

Test performed by:

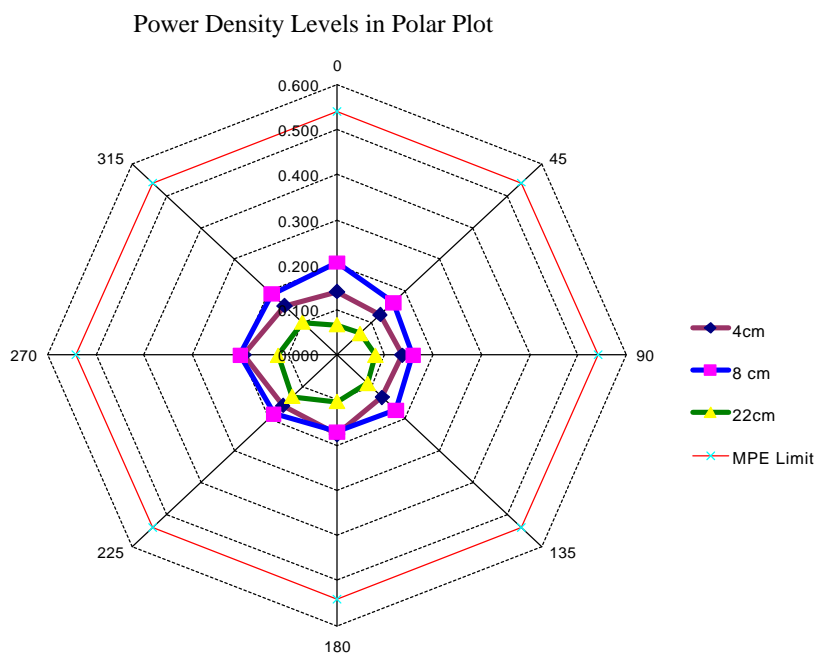
*Ku Chia Polun*

Date:

*July, 2001*



**Figure 7.5.2.a**



**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  $0.32 \text{ mW/cm}^2$  and  $0.21 \text{ mW/cm}^2$  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
Turntable with the Controller	0° – 360°	EMCO	1060 – 1.241	100506	N/A