

**FCC ID: PQ9MCW4**

## 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 2.1046  
and 90

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

FCC ID: PQ9MCW4

**Equipment: Wireless Data Relay**

Model: MCW4

**Client:** **Remtrol, Inc.**  
141 Suburban Rd. A2  
San Luis Obispo, CA 93401  
USA

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

Prepared by: **APREL Laboratories,**  
Regulatory Compliance Division

Approved by:  Date: 

~~Jay Sarkar~~  
Technical Director, Standards & Certification

Submitted by:

Jay Sarkar  
Technical Director Standards & Certification

Released by:

Dr. Jack J. Wojcik, P.Eng.



## THE LABORATORY FOR WIRELESS

**FCC ID:** **PQ9MCW4**  
**Applicant:** Remtrol, Inc.  
**Equipment:** Wireless Data Relay  
**Model:** MCW4 with a Research in Motion R802D-2-O transceiver  
**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 Remtrol, Remote Monitoring and Control Solutions. Wireless Data Relay operating with a built-in Research in Motion ARDIS 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 emissions when it was set at the maximum power level.

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

## Summary of the Results

Test Description	Page No.	Test Set-up Figure No.	Results Summary
Field Strength of Spurious Radiation Ref. Paragraph 2.1053 and 90	8	1	<b>Passed</b>

## INTRODUCTION

## General

This report describes the results of the Field Strength of Spurious Radiation measurement conducted on a Remtrol, Inc. Wireless Data Relay model MCW4 operating with a built-in Research in Motion ARDIS radio transmitter.

## Test Facility

The tests were performed for Remtrol, Inc. 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:** **PQ9MCW4**

Equipment: Wireless Data Relay

Model: MCW4 with a Research in Motion R802D-2-O transceiver

For: Certification

Applicant:  
**Remtrol, Inc.**  
141 Suburban Rd. A2  
San Luis Obispo, CA 93401  
U.S.A.

Manufacturer:  
**Remtrol, Inc..**  
141 Suburban Rd. A2  
San Luis Obispo, CA 93401  
U.S.A.

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

## MANUFACTURER'S DATA

**FCC ID No:** PQ9MCW4

**Equipment Type:** Wireless Data Relay

**Model:** MCW4

**Reference:** FCC Rules and Regulations Parts 2 and Part 90

**Manufacturer:** Remtrol, Inc.

**Power Source:** 6 V Rechargeable Battery

**Development Stage of Unit:** Production

## GENERAL SPECIFICATIONS

1. Frequency Range: 806.00 to 821.00 MHz (Transmitter)
2. Measured ERP 1..349 W
3. Emission Designators (See 47 CFR § 2.201 and §2.202): 20K0F1D
4. Antenna Impedance: 50 Ohms

**Test:** **Field Strength of Spurious Radiation**

**Ref:** FCC Parts 2.1046 and 90.210

**Criteria:** **Emission Mask G:**

The permitted maximum level of spurious emission is  $43 + 10 \log (P)$  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 Wireless Data Relay 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<sup>th</sup> harmonics of the transmit frequency (see equipment list for the calibrated antenna used).

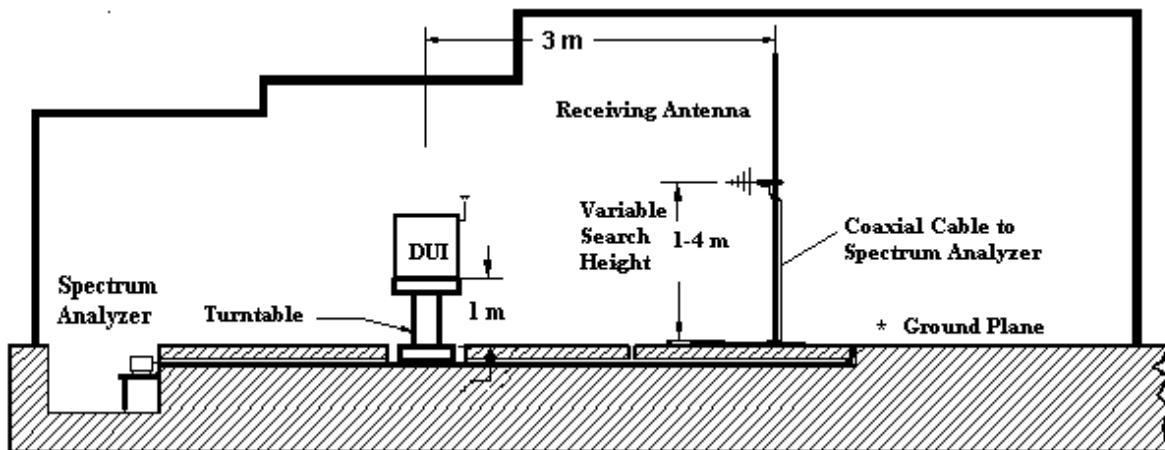


Figure 1.a Test set up for the Field Strength of Spurious Radiation Measurement in OATS  
(Not to scale)



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 calculated 84.6 dB $\mu$ V/m limit per 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 1630.00 MHz (2<sup>nd</sup> harmonic, see Table 1), a spurious level of 35.0 dB $\mu$ V @ 3 meters is measured.

##### B. Correction factor (antenna factor and cable loss)

Cable loss: 0.4 dB

Antenna Factor: 26.0 dB

Total Correction Factor:  $0.4 + 26.0 = 26.4$  dB/m

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

$$C = A + B$$

$$C = 35.0 \text{ dB}\mu\text{V} + 26.4 \text{ dB}$$

$$C = 63.90 \text{ dB}\mu\text{V/m} @ 3 \text{ meters}$$

##### 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:

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

Pt is transmitter carrier power, unmodulated (ERP)

G is gain, 1.64

r is distance, 3 meters

Criteria (reference) level at 3 meters from 1.349 Watt (ERP) into half-wave dipole antenna is 84.6 dB $\mu$ V/m (Direct Method Radiated).

E = Margin (spurious emission below the reference level)

$$E = D - C$$

$$E = 84.6 \text{ dB}\mu\text{V/m} - 63.9 \text{ dB}\mu\text{V/m}$$

$$E = 20.7 \text{ dB}\mu\text{V/m}$$

**Results:**      **Passed**      .      **See Tables 1 and 2**

**Table 1**

Field Strength of Spurious Radiation

Fundamental Transmitting Frequency: 815.00 MHz

Antenna Polarization: Vertical

**Resolution Bandwidth:**

10 kHz (below 1 GHz)

100 kHz (above 1 GHz)

Direct Method Radiated

Frequency (MHz)	Measured Level (dB $\mu$ V) "A"	Correction Factor (dB/m) "B"	Field Strength (dB $\mu$ V/m) "C"	Criteria Level (dB $\mu$ V/m) "D"	Margin (dB) "E"
1630.00 2 <sup>nd</sup> harmonic	35.00	28.90	63.90	84.6	20.7
2445.00 3 <sup>rd</sup> harmonic	24.00	32.70	56.70	84.6	27.9
3260.00 4 <sup>th</sup> harmonic	11.10 noise level	35.00	46.10	84.6	38.5
4075.00 5 <sup>th</sup> harmonic	11.10 noise level	38.20	49.30	84.6	35.3

**Table 2**

Field Strength of Spurious Radiation

Fundamental Transmitting Frequency: 815.00 MHz

Antenna Polarization: Horizontal

**Resolution Bandwidth:**

10 kHz (below 1 GHz)

100 kHz (above 1 GHz)

Direct Method Radiated

Frequency (MHz)	Measured Level (dB $\mu$ V) "A"	Correction Factor (dB/m) "B"	Field Strength (dB $\mu$ V/m) "C"	Criteria Level (dB $\mu$ V/m) "D"	Margin (dB) "E"
1630.00 2 <sup>nd</sup> harmonic	11.20	28.90	40.10	84.6	44.5
2445.00 3 <sup>rd</sup> harmonic	7.60 noise level	32.70	40.30	84.6	44.3
3260.00 4 <sup>th</sup> harmonic	9.50 noise level	35.00	44.50	84.6	40.1
4075.00 5 <sup>th</sup> harmonic	9.00 noise level	38.20	47.20	84.6	37.4

Test performed by:

*Karen Roman*

Date:

*July, 2001*

## B: Substitution Method

The MCW4 was also tested for spurious RE measurement using the substitution method with a procedure similar to the one 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 MCW4 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 MCW4. The duplicated reading was then referenced to the dipole.

Criteria: The Criteria level using substitution method was calculated to be  $-13$  dBm.

This level was obtained by using the following expression:

$$\begin{aligned}\text{Limit} &= \text{ERP carrier} - 43 + 10 \log P \text{ (ERP W)} \\ &= 30.2 \text{ dBm} - 43 + 10 \log (1.047) \\ &= -13 \text{ dBm}\end{aligned}$$

**Table 3**  
 Field Strength of Spurious Radiation  
 Fundamental Transmitting Frequency: 815.00 MHz  
 Antenna Polarization: Vertical  
**Resolution Bandwidth:**  
 10 kHz (below 1 GHz)/100 kHz (above 1 GHz)  
 Substitution Method

f MHz	ERP <sub>V</sub> dBm	Limit dBm	Margin dB
815.00	30.20	-	-
1630.00	-34.37	-13.0	21.37
2445.00	-41.44	-13.0	28.44
3260.00	-52.44	-13.0	39.44
4075.00	-50.72	-13.0	37.72

**Table 4**  
 Field Strength of Spurious Radiation  
 Fundamental Transmitting Frequency: 815.00 MHz  
 Antenna Polarization: Horizontal  
**Resolution Bandwidth:**  
 10 kHz (below 1 GHz)/100 kHz (above 1 GHz)  
 Substitution Method

f MHz	ERP <sub>V</sub> dBm	Limit dB $\mu$ V/m	Margin dB
1630.00	-58.14	-13.0	45.14
2445.00	-58.58	-13.0	45.58
3260.00	-54.64	-13.0	41.64
4075.00	-52.26	-13.0	39.26

Test performed by: Karen Celen Ronan 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	CBT
Amplifier (LNA)	30-1000 MHz	APREL Inc.	APRLNA-001	301415	N/A

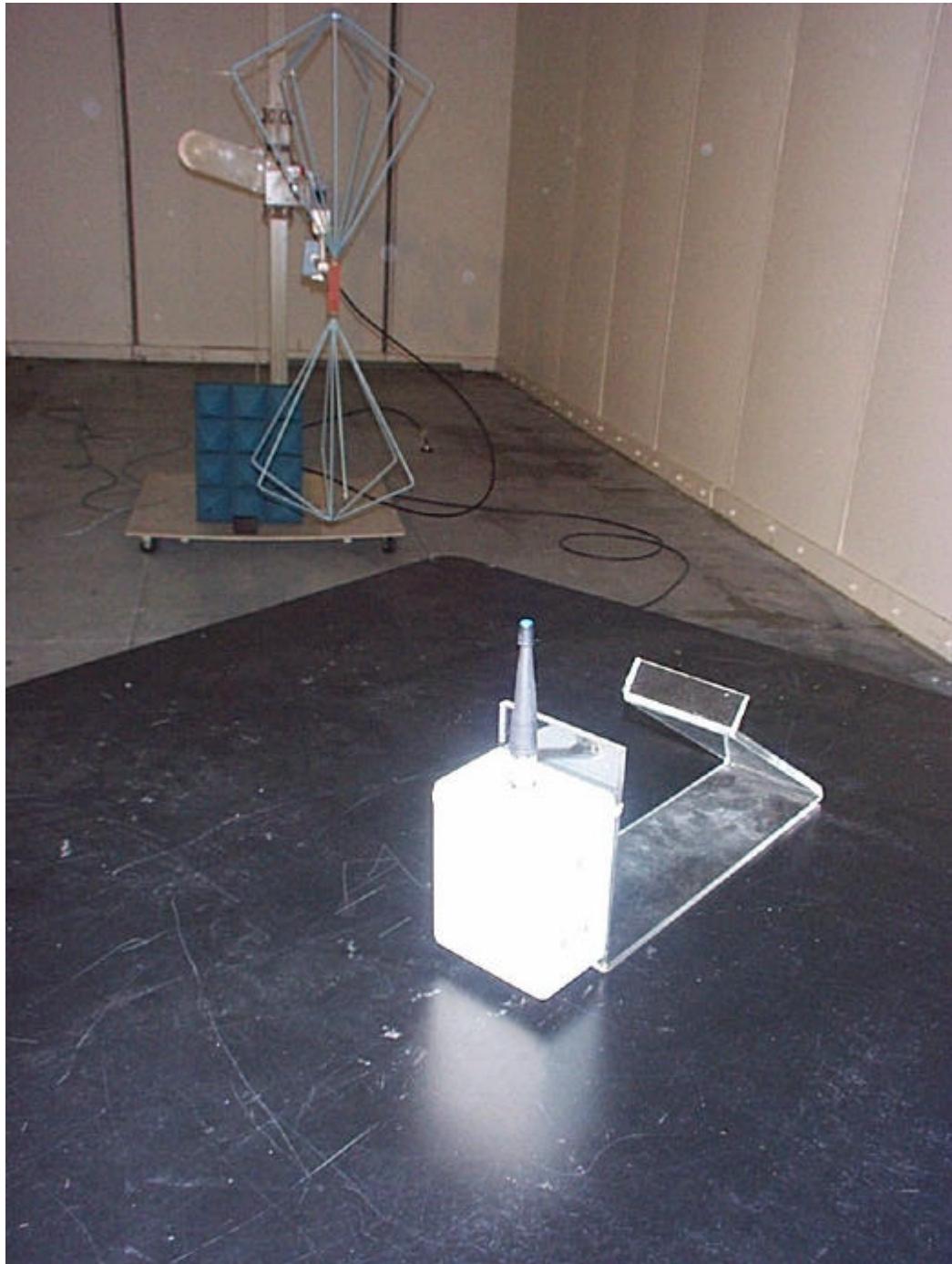
# **APPENDIX B**

## **PHOTOGRAPHS**



**Remtrol, Inc. Wireless Data Relay MCW4  
With RIM ARDIS R802 Modem**

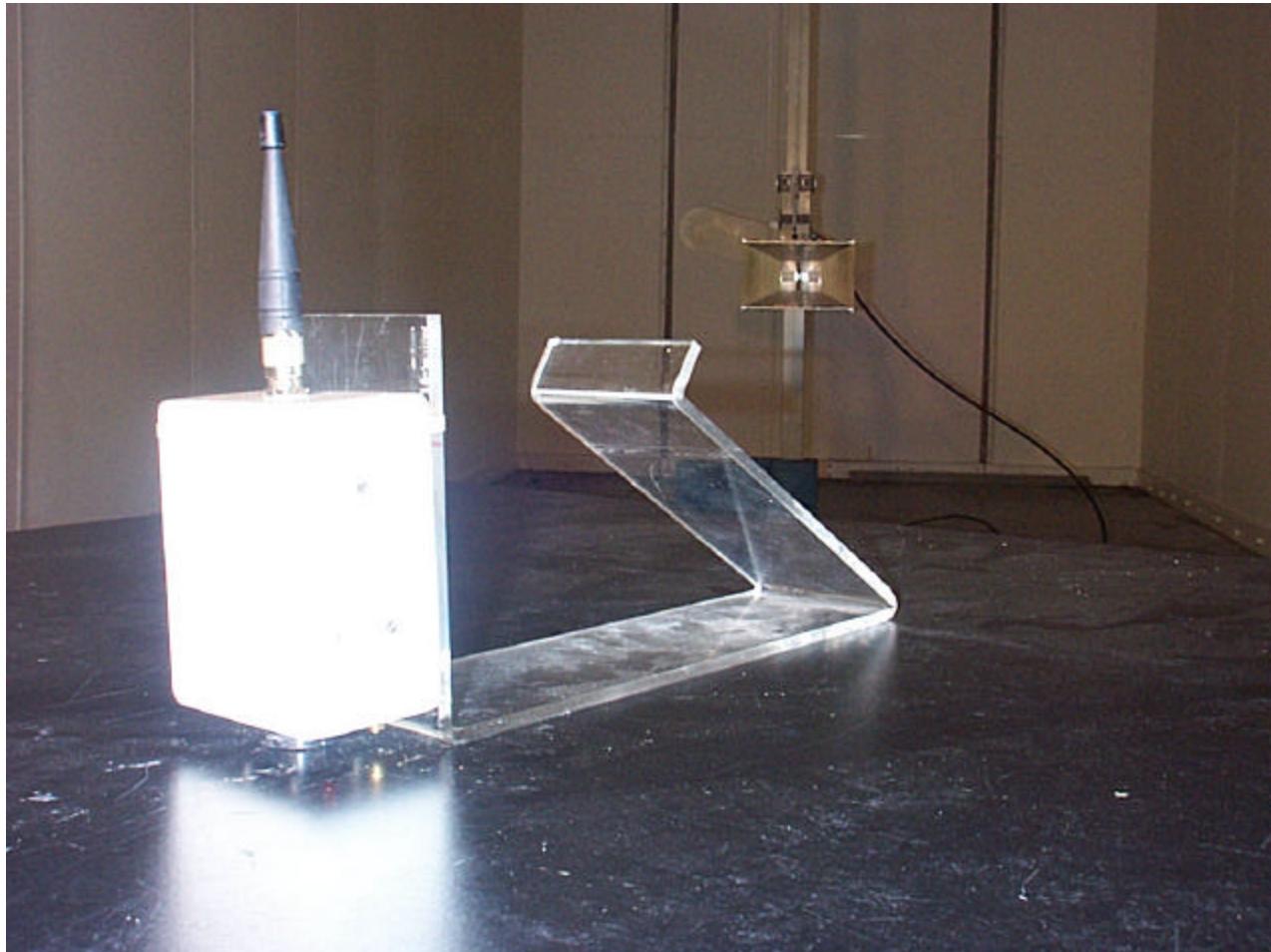
Typical Installation



**Remtrol, Inc. Wireless Data Relay MCW4 Tested for Spurious Emissions at the OATS**  
**Frequency range: 30 MHz – 200 MHz**



**Remtrol, Inc. Wireless Data Relay MCW4 Tested for Spurious Emissions at the OATS**  
**Frequency range: 200 MHz – 1.0 GHz**



**Remtrol, Inc. Wireless Data Relay MCW4 Tested for Spurious Emissions at the OATS**  
**Frequency range: 1.0 GHz – 10.0 GHz**