# TEST REPORT

**Report Number: 3119977MIN-001**
**Project Number: 3119977**
**April 13, 2007**

**Evaluation of the M2 Remote Control**
**FCC ID: MMURTI0700**
**Canada ID: 3166-RTI0700**

**For**
**Remote Technologies**

| Test Performed by: | Test Authorized by: |
|---|---|
| Intertek | Remote Technologies |
| 7250 Hudson Blvd. Suite 100 | 7651 Anagram Drive |
| Oakdale, MN 55128 | Eden Prairie, MN 55344 |

Prepared by: _____ Date: April 13, 2007
Uri Spector

Approved by: _____ Date: April 13, 2007
Norman Shpilsher

**Intertek ETL SEMKO**
7250 Hudson Boulevard, Suite 100, Oakdale, MN 51228
Telephone 651-730-1188, Fax 651-730-1282 Home Page www.intertek.com

# CONTENTS

# 1.0 GENERAL DESCRIPTION

## 1.1 Related Submittals Grants

This is single application of the *Remote Technologies M2 Remote Control* for Certification under FCC Part 15, Subpart C.
There are no other simultaneous applications.
The Receiver portion will be verified under Declaration of Conformity.

## 1.2 Product Description

*M2 Remote Control* is a RF remote control operating in 433.91MHz. The intended use of the *M2Remote Control* is to generate and transmit a RF signal to control audio/video systems. The *M2 Remote Control is* powered at 6VDC from four AAA batteries.

Antenna Description:

Integrated antenna

Sample Submitted: April 10, 2007
Test Work Started: April 10, 2007
Test Work Completed: April 13, 2007

## 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2003. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

## 1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on December 2005 submitted to FCC. Please reference the site registration number: 90706, dated December 6, 2005.

## 2.0 SYSTEM TEST CONFIGURATION

### 2.1 Justification

N/A

### 2.2 EUT Setup

For simplicity of testing, the transmitter was wired to transmit continuously

### 2.3 EUT Exercising Software

N/A

### 2.4 Special Accessories

Internal USB port. The USB port is only used to download software (by an RTI dealer). Therefore, USB cable was not connected to the M2 remote control during testing.

### 2.5 Equipment Modification

No modifications were installed during the testing.

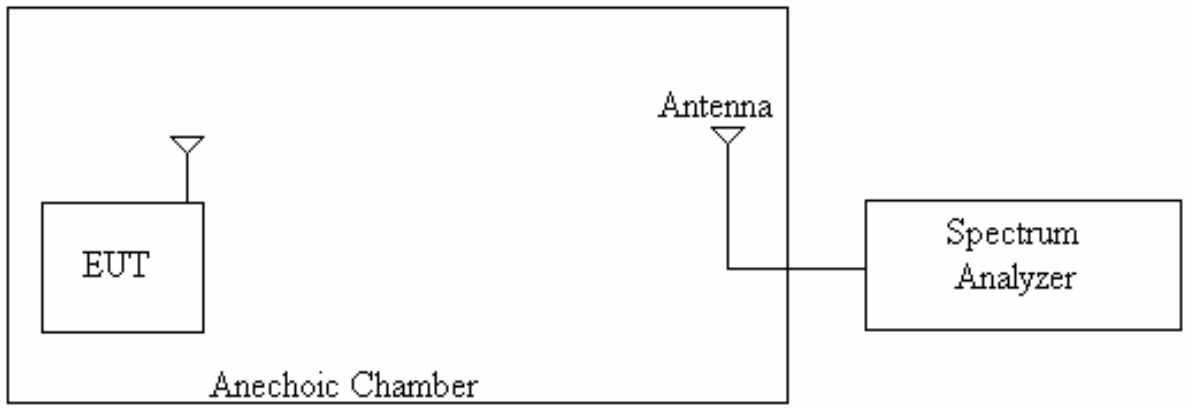
### 2.6 Support Equipment List and Description

N/A

## 2.7 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.
The EUT was powered at 6VDC from four AAA new batteries. New batteries were placed prior to testing.

Field Strength Measurements



## 3.0 TEST RESULTS

Data is included for the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

47 CFR 15.231(a)(1), RSS-Gen Issue 1/RSS-210 Issue 6, A1.1.1- Transmitting Time

47 CFR 15.231(b), RSS-Gen Issue 1/RSS-210 Issue 6, A1.1.2- Field Strength of Fundamental and Spurious Emissions

47 CFR 15.231(c), RSS-Gen Issue 1/RSS-210 Issue 6, A1.1.3- Bandwidth of Emissions

The EUT should comply with requirements of Part 15 Subpart B:

47 CFR 15.109, Class B, ICES003 Radiated Emissions

**Note:** The M2 Remote Control Transmitter is battery operated device, therefore Line Conducted Emissions testing is inappropriate and therefore unnecessary.

## 3.1 Transmitting Time, FCC 15.231(a)(1)

The transmitter transmitted continuously while the activation button was pressed. According to FCC Part 15.231(a)(1) a manually operated transmitter should stop transmitting within 5 sec after release the activation button. The transmitter was deactivates automatically less then 1 sec after releasing the activation button.

## 3.2 Field Strength of Fundamental and Spurious Emissions, FCC 15.231(b)

Field Strength of Fundamental and Spurious Emissions measurements were made at Fundamental frequency of 433.91MHz; Spurious Emissions were tested up to 4.5GHz (10th harmonic).

The Table 3-2-1 shows the Field Strength of Fundamental Radiation. Graphs 3-2-1, 3-2-2, & 3-2-3 show calculation of the Average Value Factor. The Table 3-2-2 shows Field Strength of Spurious Emissions for M2 Remote Control.

| | | | |
|---|---|---|---|
| **Company:** | Remote Technologies | **Date:** | 4/10/2007 |
| **Model:** | M2 Remote Control | | |
| **Test Engineer:** | Uri Spector | | |
| **Standard:** | FCC Part 15.231(b) | | |
| **Test Site:** | 3m Anechoic Chamber, 3m measurement distance | | |
| **Note:** | The table shows the worst case radiated emissions | | |
| | Readings below 1GHz were taken with RBW 100kHz | | |
| | All measurements were taken using a peak detector | | |
| | Measurement of Fundamental frequency using procedure for Average Value | | |

**Table # 3-2-1**

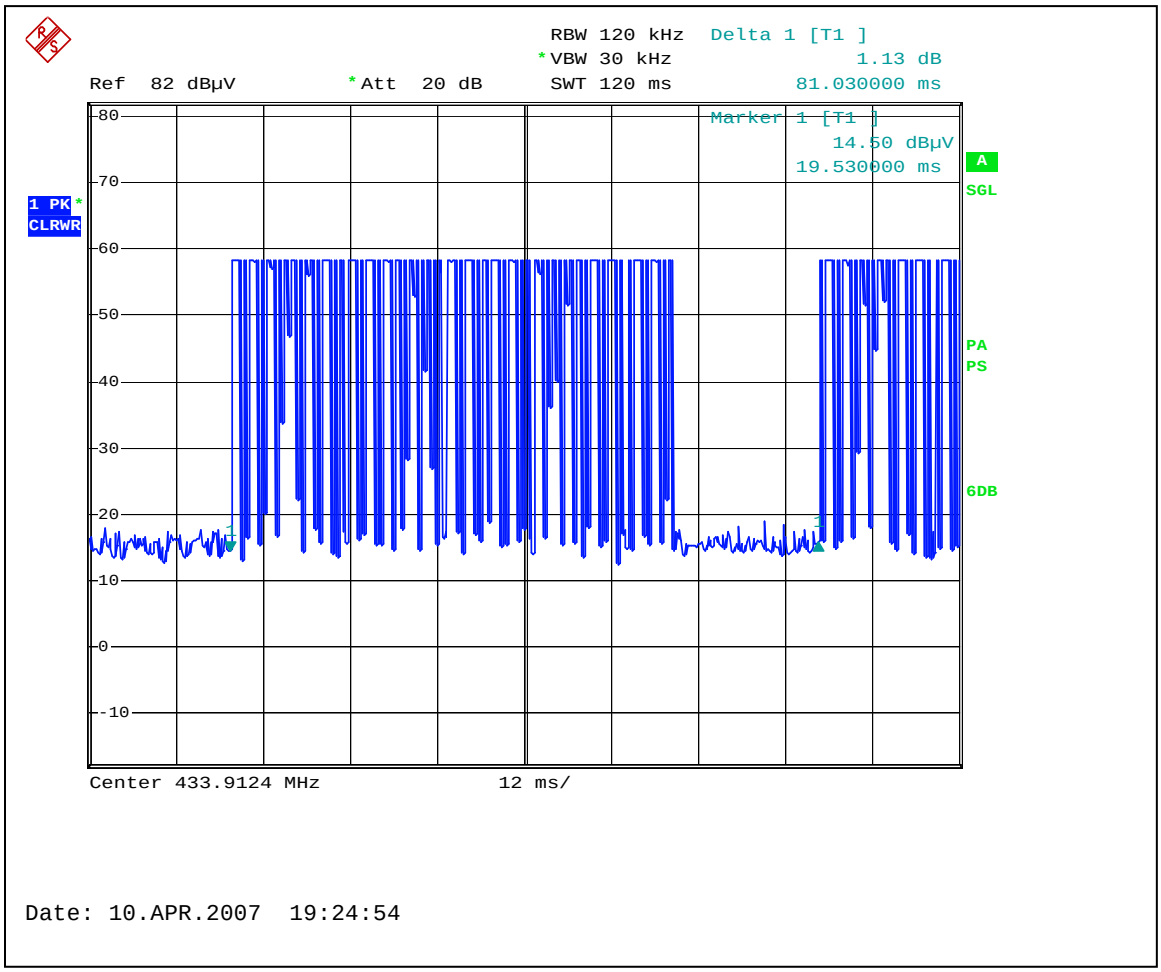
| Frequency | Antenna | | Ant. CF | Cable loss | Pre-amp | Reading | Avg Value | Total @ 3m | Limit | Margin | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | dB1/m | dB | Gain (dB) | dBµV | dB | dBµV/m | dBµV/m | dB | |
| 433.91 | V | 114 | 17.0 | 2.4 | 0.0 | 70.2 | 9.35 | 80.3 | 80.8 | -0.5 | |
| 433.91 | H | 168 | 17.0 | 2.4 | 0.0 | 61.1 | 9.35 | 71.2 | 80.8 | -9.6 | |

**Calculation of the Average Value Factor:**

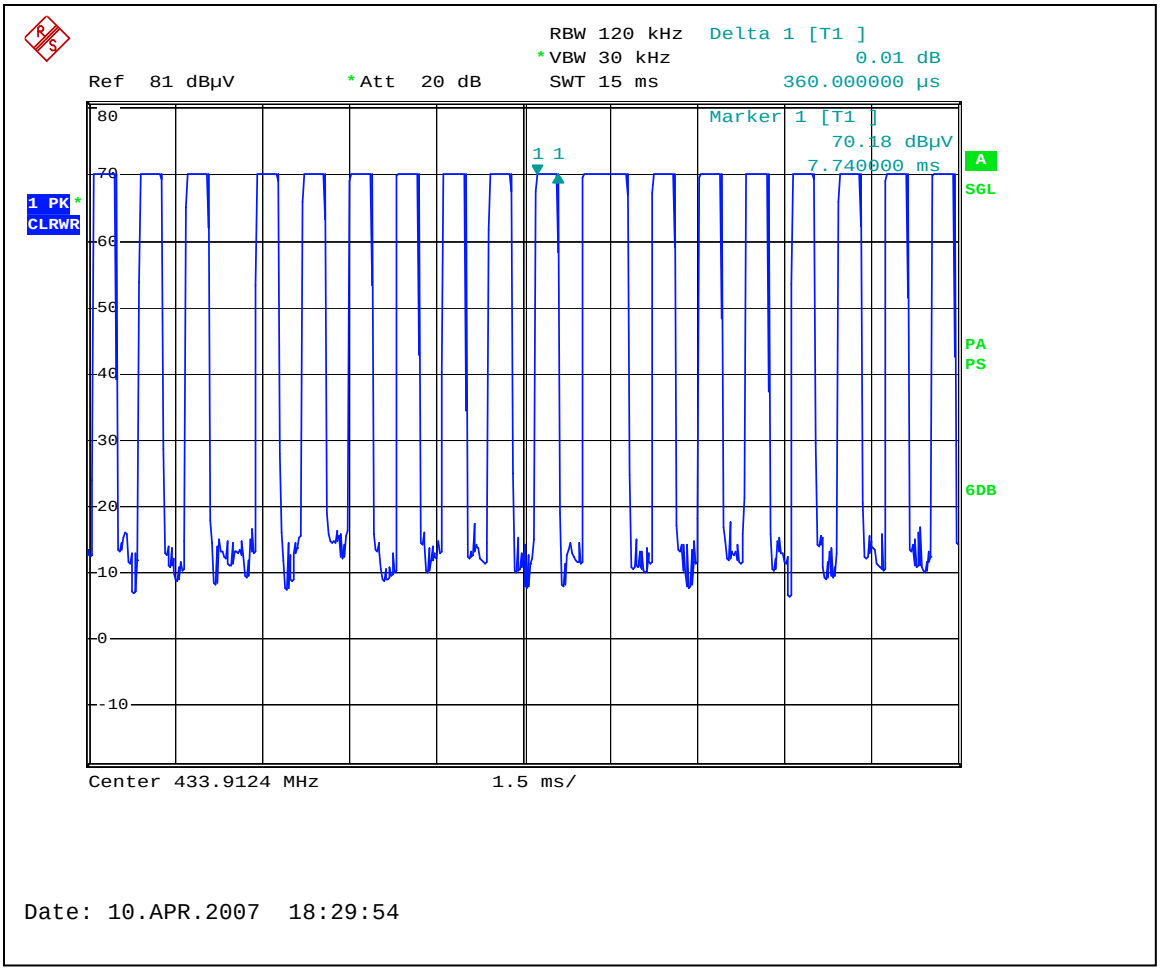
Average Factor= 20Log(On air/Pulse Train)=20Log(4*0.780)+(68*0.360)/81.03=20Log0.3519= -9.35dB

Pulse train=81.03msec (see Graph 3-2-1)
"Wide pulses": 4 each of 0.780msec (see Graphs ##3-2-2 & 3-2-3)
"Regular pulses": 68 each of 0.360msec (see Graphs ##3-2-2 & 3-2-3)

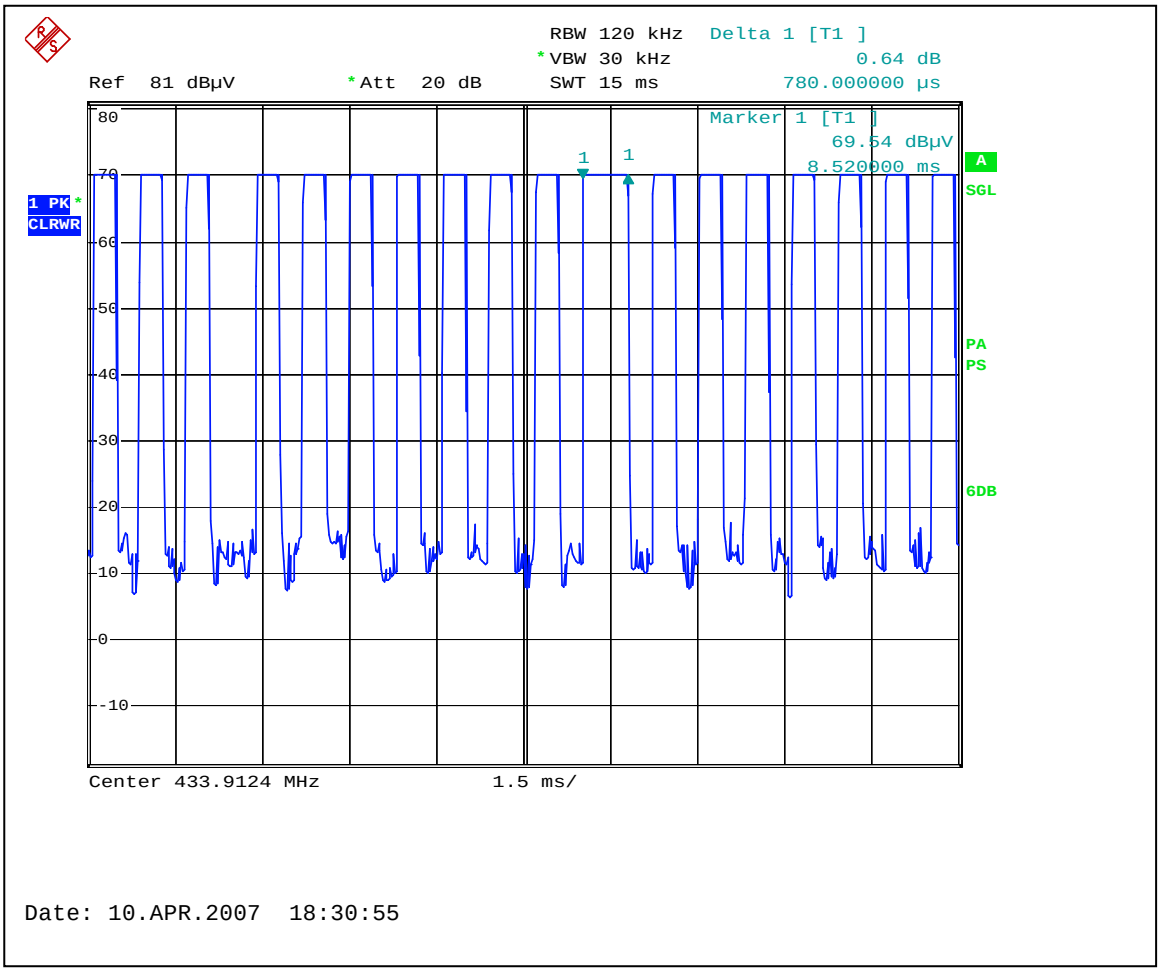
## Graph 3-2-1


RBW 120 kHz
Delta 1 [T1 ]
*VBW 30 kHz
1.13 dB
Ref 82 dBµV
*Att 20 dB
SWT 120 ms
81.030000 ms
Marker 1 [T1 ]
14.50 dBµV
19.530000 ms
1 PK
CLRWR
A
SGL
PA
PS
6DB
80
70
60
50
40
30
20
10
0
-10
Center 433.9124 MHz
12 ms/
Date: 10.APR.2007 19:24:54

## Graph 3-2-2


RBW 120 kHz
*VBW 30 kHz
SWT 15 ms
Delta 1 [T1 ]
0.01 dB
360.000000 µs
Ref 81 dBµV
*Att 20 dB
Marker 1 [T1 ]
70.18 dBµV
7.740000 ms
1 1
1 PK*
CLRWR
A
SGL
PA
PS
6DB
80
70
60
50
40
30
20
10
0
-10
Center 433.9124 MHz
1.5 ms/
Date: 10.APR.2007 18:29:54

## Graph 3-2-3


RBW 120 kHz
*VBW 30 kHz
Ref 81 dBµV
*Att 20 dB
SWT 15 ms
Delta 1 [T1 ]
0.64 dB
780.000000 µs
Marker 1 [T1 ]
69.54 dBµV
8.520000 ms
1 PK*
CLRWR
A
SGL
PA
PS
6DB
80
70
60
50
40
30
20
10
0
-10
Center 433.9124 MHz
1.5 ms/
Date: 10.APR.2007 18:30:55

**Radiated Spurious Emissions** **Date:** 4-10-2007

**Company:** Remote Technologies
**Model:** M2 Remote Control
**Test Engineer:** Uri Spector
**Standard:** FCC Part 15.231(b)
**Test Site:** 3m Anechoic Chamber, 3m measurement distance
**Note:** The table shows the worst case radiated emissions
All measurements were taken using a peak detector
Readings below 1GHz were taken with RBW 100kHz and above 1GHz with RBW 1MHz

**Table # 3-2-2**

| Frequency | Antenna | | Ant. CF | Cable loss | Pre-amp | Reading | Total @ 3m | Limit | Margin | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | dB1/m | dB | Gain (dB) | dBµV | dBµV/m | dBµV/m | dB | |
| 867.82 | V | 109 | 21.4 | 3.6 | 0.0 | 27.5 | 52.5 | N/A | N/A | 1 |
| 867.82 | H | 146 | 21.4 | 3.6 | 0.0 | 25.0 | 50.0 | N/A | N/A | 1 |
| 1301.73 | V | 153 | 24.3 | 4.7 | 39.6 | 62.1 | 51.5 | 60.8 | -9.3 | |
| 1301.73 | H | 208 | 24.3 | 4.7 | 39.6 | 57.5 | 46.9 | 60.8 | -13.9 | |
| 1735.64 | V | 104 | 26.7 | 5.6 | 39.0 | 59.5 | 52.7 | N/A | N/A | 1 |
| 1735.64 | H | 170 | 26.7 | 5.6 | 39.0 | 56.2 | 49.4 | N/A | N/A | 1 |
| 2169.55 | V | 120 | 27.9 | 3.0 | 38.3 | 61.7 | 54.2 | N/A | N/A | 1 |
| 2169.55 | H | 168 | 27.9 | 3.0 | 38.3 | 70.1 | 62.6 | N/A | N/A | 1 |
| 2603.46 | V | 130 | 28.8 | 3.0 | 37.8 | 44.8 | 38.7 | N/A | N/A | 1 |
| 2603.46 | H | 177 | 28.8 | 3.0 | 37.8 | 48.4 | 42.3 | N/A | N/A | 1 |
| 3471.28 | V | 116 | 31.0 | 3.4 | 37.6 | 53.7 | 50.5 | N/A | N/A | 1 |
| 3471.28 | H | 167 | 31.0 | 3.4 | 37.6 | 55.7 | 52.5 | N/A | N/A | 1 |
| 3905.19 | V | 163 | 32.1 | 3.7 | 37.7 | 61.2 | 59.4 | 60.8 | -1.4 | |
| 3905.19 | H | 160 | 32.1 | 3.7 | 37.7 | 60.6 | 58.8 | 60.8 | -2.0 | |
| 4339.10 | V | 130 | 32.5 | 4.0 | 37.6 | 49.6 | 48.5 | 60.8 | -12.3 | |
| 4339.10 | H | 180 | 32.5 | 4.0 | 37.6 | 53.6 | 52.5 | 60.8 | -8.3 | |
| 4773.01 | V | 115 | 33.0 | 4.2 | 37.6 | 40.8 | 40.4 | 60.8 | -20.4 | |
| 4773.01 | H | 210 | 33.0 | 4.2 | 37.6 | 43.9 | 43.5 | 60.8 | -17.3 | |

**Comments:** Frequency outside restricted bands of operation per 15.205

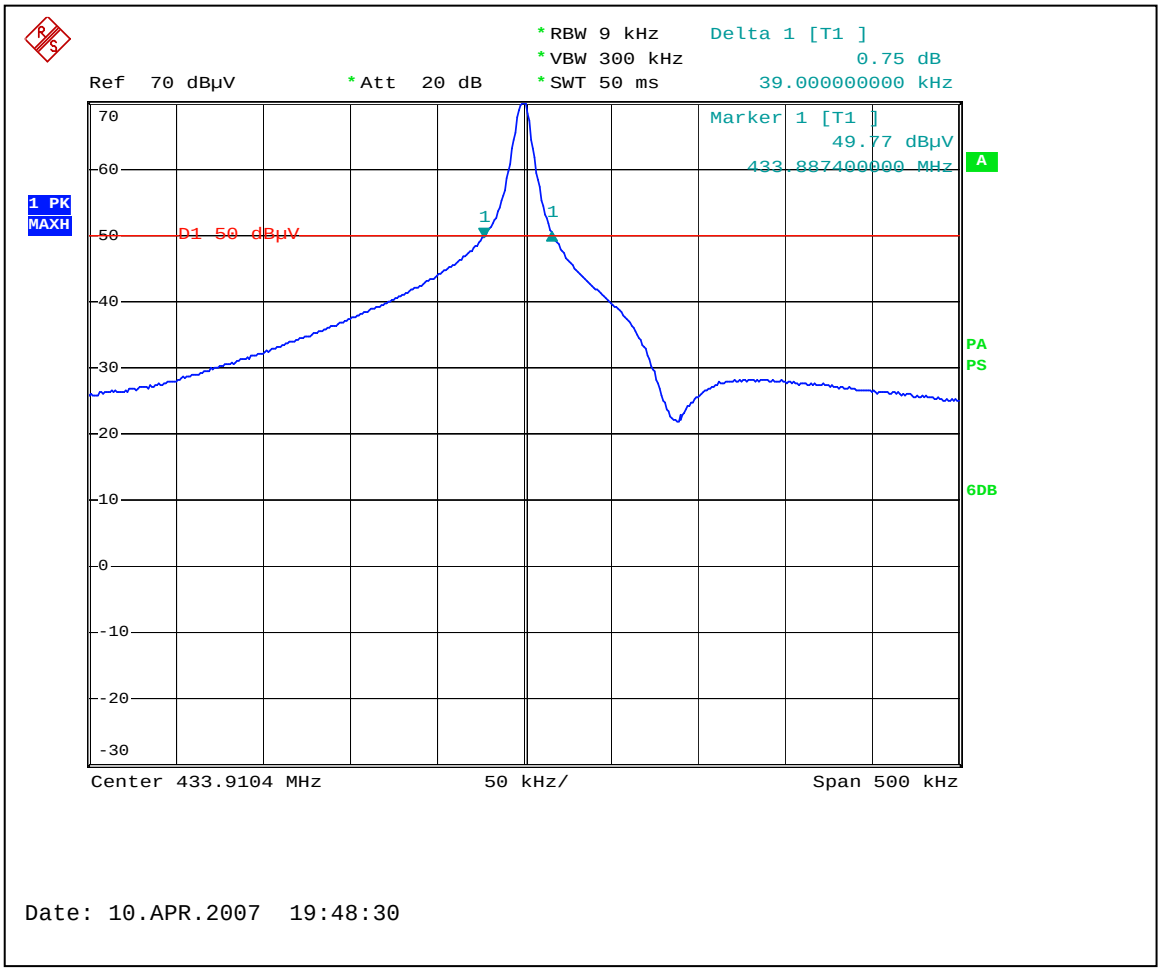
### 3.3 Bandwidth of Emissions, FCC 15.231(c)

Bandwidth of Emissions measurements was made for frequency of 433.91MHz.

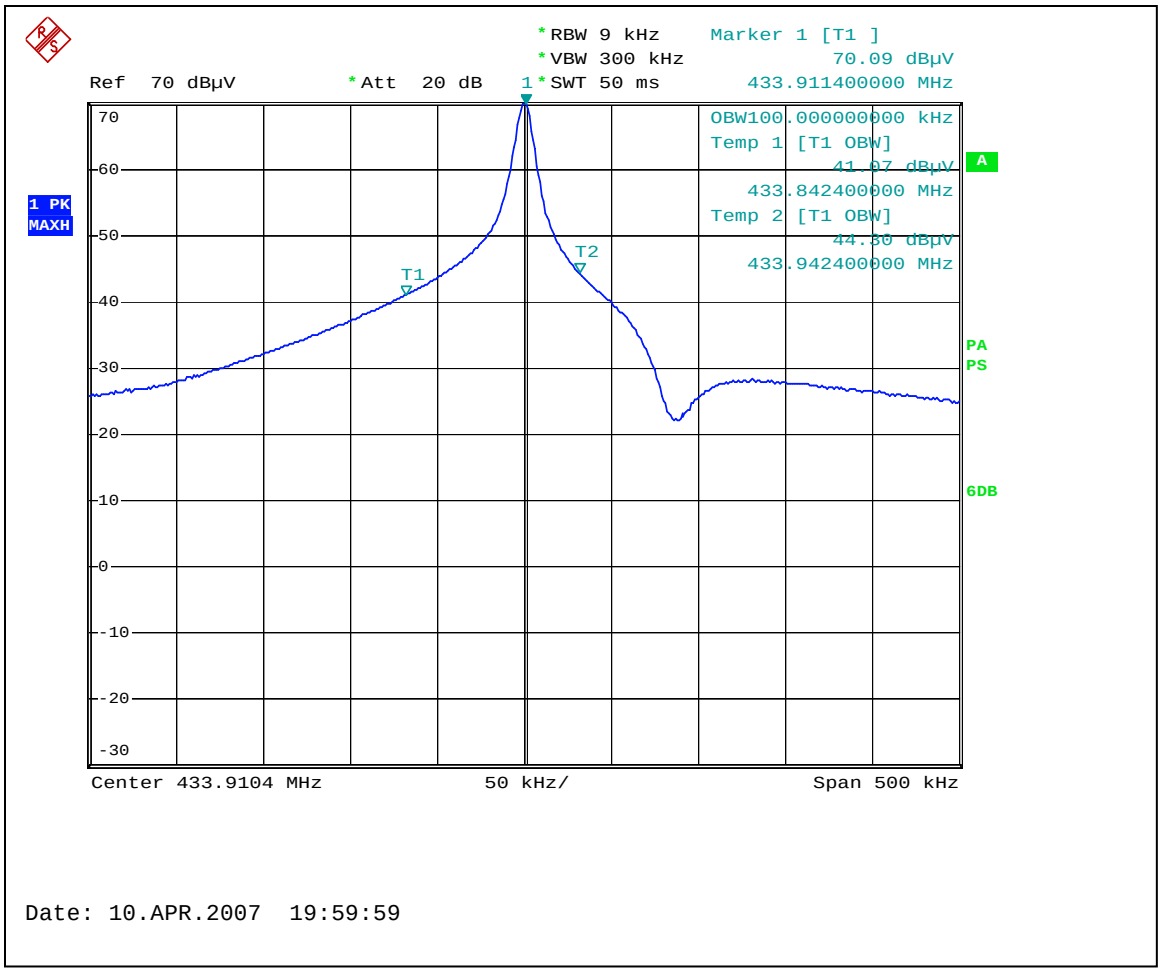
Bandwidth of Emissions at –20dB level was measured at 39kHz.
The maximum allowed level is 433.91MHz x 0.25% = 1084.77kHz
Bandwidth of Emissions for the EUT at 99% power was measured at 100kHz.

The Graph# 3-3-1 shows the Bandwidth of Emissions at –20dB level.
The Graph# 3-3-2 shows the Bandwidth of Emissions at 99% power.

**Graph 3-3-1**



## Graph 3-3-2


*RBW 9 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 20 dB
1*SWT 50 ms
Marker 1 [T1 ]
70.09 dBµV
433.911400000 MHz
OBW100.000000000 kHz
Temp 1 [T1 OBW]
41.07 dBµV
433.842400000 MHz
Temp 2 [T1 OBW]
44.80 dBµV
433.942400000 MHz
1 PK
MAXH
A
PA
PS
6DB
T1
T2
70
60
50
40
30
20
10
0
-10
-20
-30
Center 433.9104 MHz
50 kHz/
Span 500 kHz
Date: 10.APR.2007 19:59:59

## 3.4 Radiated Emissions, FCC 15.109, Class B (M2 Remote Control)

The EUT (M2 Remote Control) as a digital device was tested according to FCC Part 15.109, Class B in frequency range from 30MHz to 2GHz; emissions at transmitter fundamental frequency and 2nd harmonic were excluded from the Table.

The M2 Remote Control is battery operated device, therefore Line Conducted Emissions testing is inappropriate and therefore unnecessary.

Table 3-4-1 shows the Field Strength of Radiated Emissions from 30MHz to 2GHz.

**Radiated Emissions from 30MHz to 2GHz** **Date:** 4/10/2007

**Company:** Remote Technologies
**Model:** M2 Remote Control
**Test Engineer:** Uri Spector
**Standard:** FCC Part 15.109, Class B
**Test Site:** 3m Anechoic Chamber, 3m measurement distance
**Note:** The table shows the worst case radiated emissions
All measurements were taken using a peak detector

**Table # 3-4-1**

| Frequency | Antenna | | Ant. CF | Cable loss | Pre-amp | Reading | Total @ 3m | Limit | Margin | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | dB1/m | dB | Gain (dB) | dBµV | dBµV/m | dBµV/m | dB | |
| 47.13 | V | 100 | 9.0 | 0.8 | 0.0 | 12.5 | 22.3 | 40.0 | -17.7 | |
| 68.50 | V | 100 | 6.2 | 0.9 | 0.0 | 12.9 | 20.0 | 40.0 | -20.0 | |
| 136.65 | V | 100 | 11.8 | 1.2 | 0.0 | 12.1 | 25.2 | 43.5 | -18.4 | |
| 274.26 | V | 100 | 13.6 | 1.9 | 0.0 | 17.2 | 32.7 | 46.0 | -13.3 | |
| 41.44 | H | 100 | 11.8 | 0.7 | 0.0 | 11.8 | 24.3 | 40.0 | -15.7 | |
| 85.32 | H | 100 | 8.3 | 0.9 | 0.0 | 12.1 | 21.3 | 40.0 | -18.7 | |
| 148.47 | H | 100 | 11.1 | 1.3 | 0.0 | 12.6 | 25.0 | 43.5 | -18.5 | |
| 274.26 | H | 100 | 13.6 | 1.9 | 0.0 | 14.4 | 29.9 | 46.0 | -16.1 | |
| 1165.30 | V | 100 | 23.4 | 4.3 | 39.8 | 34.2 | 22.1 | 54.0 | -31.9 | |
| 1234.66 | V | 100 | 23.8 | 4.5 | 39.6 | 37.5 | 26.3 | 54.0 | -27.7 | |
| 1302.36 | V | 109 | 24.3 | 4.7 | 39.6 | 48.0 | 37.4 | 54.0 | -16.6 | |
| 1165.30 | H | 100 | 23.4 | 4.3 | 39.8 | 33.6 | 21.5 | 54.0 | -32.5 | |
| 1234.66 | H | 100 | 23.8 | 4.5 | 39.6 | 33.7 | 22.5 | 54.0 | -31.5 | |
| 1302.36 | H | 204 | 24.3 | 4.7 | 39.6 | 45.7 | 35.1 | 54.0 | -18.9 | |

## 3.5 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz, and the Horn antenna was used in frequency range above 1GHz. The radiated emissions were maximized by configuring the EUT through its placement in three orthogonal axes, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the direct Field Strength Calculation is shown in Section 3.6.

### 3.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB($m^{-1}$)
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB($m^{-1}$) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB($m^{-1}$)
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Uri Spector
Sr. Project Engineer
Intertek ETL SEMKO

Signature

Date: April 13, 2007

## 4.0 TEST EQUIPMENT

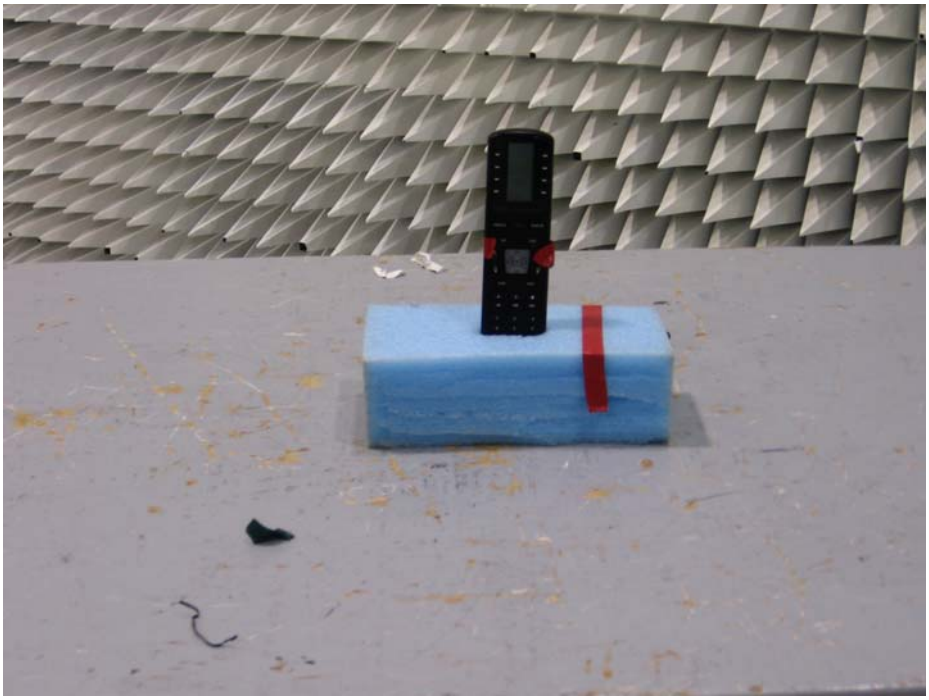
**Receivers/Spectrum Analyzers and Test Software**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| Rohde & Schwarz FSP 40 Spectrum Analyzer | 100024 | 07/06 | 07/07 | X |
| Rohde & Schwarz ESCI Spectrum Analyzer | 100358 | 04/18/06 | 04/18/07 | X |
| TILE! Instrument Control System | ver. 3.4.k.20 | N/A | N/A | X |

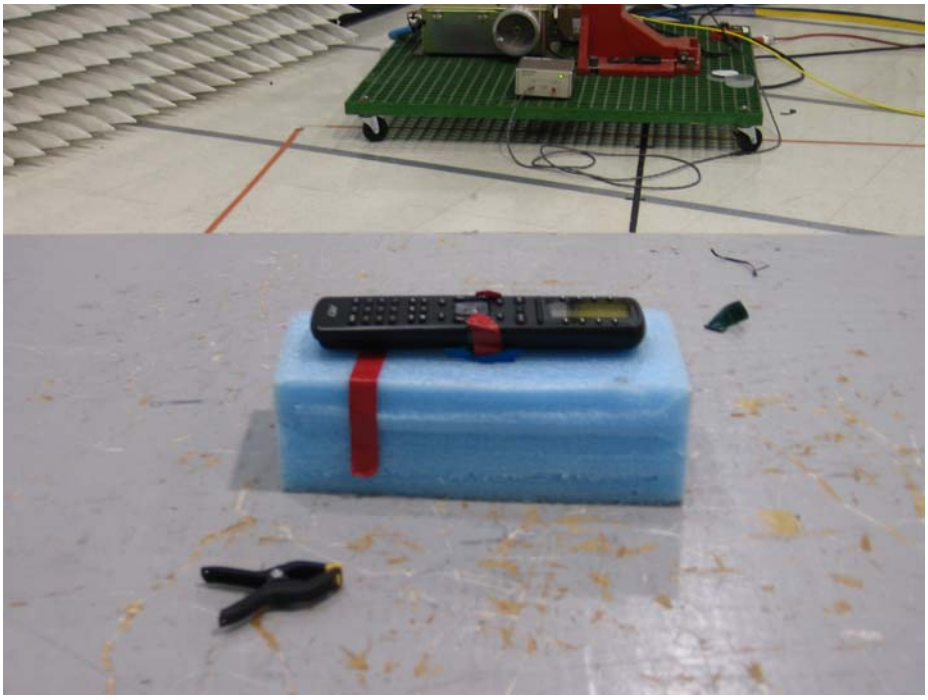
**Antennas/Pre-Amplifiers**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| Schaffner-Chase Bicono-Log Antenna | 2630 | 08/06 | 08/07 | X |
| EMCO Horn Antenna 3115 | 6579 | 03/07 | 03/08 | X |
| MITEQ Pre-Amplifier AMF-5D-00501800-28-13P | 1122951 | 02/07 | 02/08 | X |

# EXHIBIT 1
# CONFIGURATION PHOTOS



**Radiated Emissions Test Configuration**



**Radiated Emissions Test Configuration**