| | |
|---|---|
| **Nemko Test Report:** | 4L0148RUS1 |
| **Applicant:** | Micro Systems Inc.<br>35 Hill Avenue<br>Fort Walton Beach, FL 32548<br>USA |
| **Equipment Under Test:**<br>**(E.U.T.)** | Rapid Scoring System |
| **In Accordance With:** | **FCC** Part 15, Subpart C, 15.249<br>For 2.4 GHz Transmitters |
| **Tested By:** | Nemko Dallas Inc.<br>802 N. Kealy<br>Dallas, Texas 75057 |
| **Authorized By:** |  <br>David Light, Lab Production Manager |
| **Date:** | 7/13/04 |

## Table of Contents

## Section 1. Summary Of Test Results

Manufacturer: Micro Systems Inc.

Model No.: Rapid Scoring System

Serial No.: SN001

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15.249. All tests were conducted using measurement procedure ANSI C63.4-2001. Radiated Emissions were made on an open area test site.

☒ New Submission ☐ Production Unit

☐ Class II Permissive Change ☒ Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE
See " Summary of Test Data".

NVLAP
LAB CODE: # 100426-0

## Summary Of Test Data

| NAME OF TEST | PARA. NO. | RESULT |
|---|---|---|
| Conducted Emissions | 15.207 | Complies |
| Radiated Emissions | 15.249 | Complies |

## Section 2. General Equipment Specification

### Base:

| | |
|---|---|
| **Frequency Range:** | 2405 - 2480 MHz |
| **Operating Frequency(ies) of Sample:** | 2405 - 2480 MHz |
| **Tunable Bands:** | N/A |
| **Number of Channels:** | Sixteen |
| **Channel Spacing:** | 5 MHz |
| **Crystal Frequencies:** | 500 kHz, 4.00 MHz, 12.00 MHz, 14.7456 MHz, 16.00 MHz, 19.2 kB/sec, 250 kB/sec, 2.405 - 2.480 GHz |
| **User Frequency Adjustment:** | Manual adjustment in 5 MHz increments |
| **Antenna** | The remote unit has integral antenna Base unit has duck antenna with reverse SMA connector |

## Description of EUT

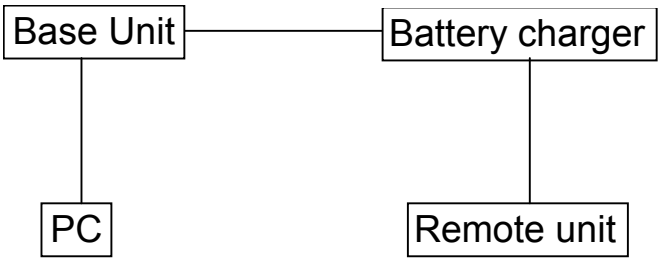
A wireless testing and assessment tool for use in classrooms which displays questions and records answers. Comprised of the following three devices:

NiMH Battery Charger, designed to simultaneously charge 8 battery packs within a 3 hour period.

Base Unit, transmits tests to Remote Units and collects test data, communicates data to PC.

Remote Unit, displays questions, records answers, relays data to base unit.

## System Diagram



## Section 3. Powerline Conducted Emissions

| | |
|---|---|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207 |
| TESTED BY: Dana Tassler | DATE: 7/2/04 |

**Minimum Standard:**

| **Frequency range** MHz | **Limits dB (μV)** | |
|---|---|---|
| | **Quasi-peak** | **Average** |
| 0.15 to 0.50 | 66<br>Decreasing linearly with logarithm of frequency to<br>56 | 56<br>Decreasing linearly with logarithm of frequency to<br>46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| NOTE – Care should be taken to comply with leakage current requirements. | | |

**Test Results:** Complies. See attached graph(s).

**Measurement Data:** See attached data.

**Method of Measurement: (Procedure ANSI C63.4-2001)**

Measurements were made using a spectrum analyzer with 10 kHz RBW, Peak Detector. Any emissions that are close to the limit are measured using a test receiver with 10 kHz bandwidth, CISPR Quasi-Peak Detector.

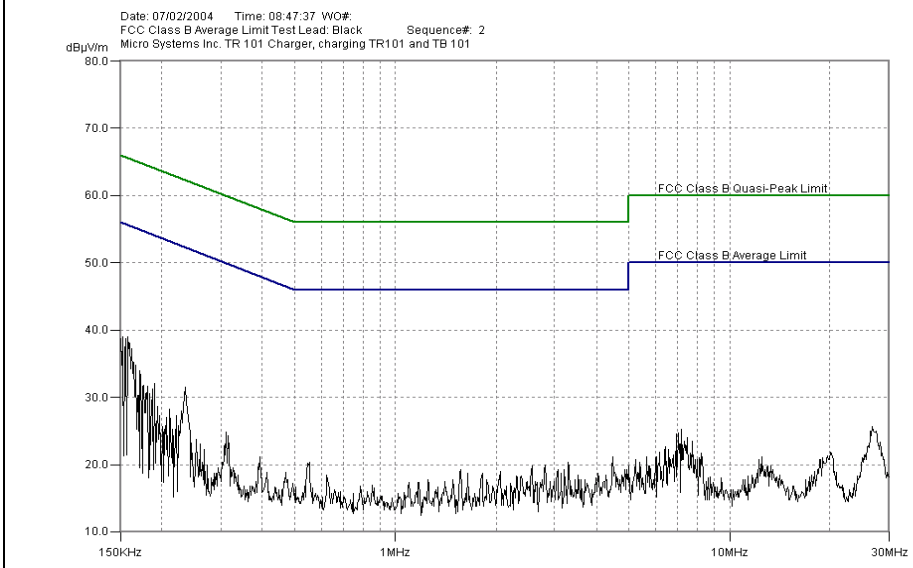
## Test Data – Powerline Conducted Emissions

**Conducted Emissions**
**Powerline Voltage Measurement**

| | | | | | |
|---|---|---|---|---|---|
| Complete | X | | Job # : 4L0148E | Test # : | CEPV-01 |
| Preliminary | | | Page 1 | of | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Client Name : | Micro Systems Inc | | | | |
| EUT Name : | IRespond Battery Charger | | | | |
| EUT Model # : | None | | | | |
| EUT Part # : | AY03150 | | | | |
| EUT Serial # : | None | | | | |
| EUT Config. : | Charging | | | | |
| Specification : | CFR 47, Part 15, Subpart B, Class B | | | Reference : | |
| Transducer # : | 1258 | Temp. (deg. C) : | 21 | Date : | 07/02/04 |
| HP Filter # : | 968 | Humidity (%) : | 37 | Time : | 8:30 |
| Cable 1 # : | 1551 | EUT Voltage : | 120 VAC | Staff : | Dana Tassler |
| Cable 2 # : | 970 | EUT Frequency : | 60 Hz | Location : | Shielded Enclosure |
| Detector 1 # : | 1464 | Peak Bandwidth: | 10kHz | Photo ID: | 0148CEPV01F1SR |
| Detector 2 # : | NA | QP Bandwidth | 10kHz | | |
| Limiter # : | NA | Avg. Bandwidth | 10kHz | | |

| Meas. Freq. (MHz) | EUT Test Point | Detector Type (P,QP, A) | Limit Type (QP, A) | Meter Reading (dBuV) | Path Loss (dB) | Transducer Factor (dB) | Corrected Reading (dBuV) | Spec.limit (dBuV) Q.P. | Spec.limit (dBuV) Avg. | CR/SL Diff. (dB) | Pass Fail Unc. | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.1582 | Line | P | A | 39.0 | 0 | 0 | 39.0 | 65.6 | 55.6 | -16.6 | Pass | |




..\EMCShare\AUTOMATE\DATASHTS\CEP_Voltage Rev C.xl: Document Control #EMC DS EM COND VOLT

## Test Data – Powerline Conducted Emissions

**Conducted Emissions**
**Powerline Voltage Measurement**

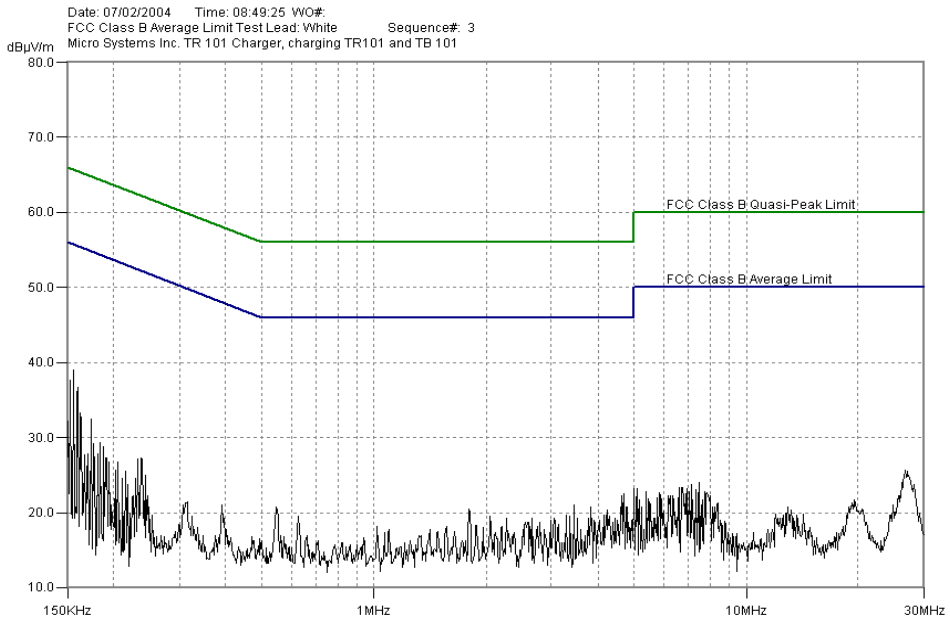
Complete X
Preliminary

Job # : 4L0148E Test # : CEPV-01
Page 2 of 2

Client Name : Micro Systems Inc
EUT Name : IRespond Battery Charger
EUT Model # : None
EUT Part # : AY03150
EUT Serial # : None
EUT Config. : Charging

Specification : CFR 47, Part 15, Subpart B, Class B Reference :

| Meas. Freq. (MHz) | EUT Test Point | Detector Type (P,QP, A) | Limit Type (QP, A) | Meter Reading (dBuV) | Path Loss (dB) | Transducer Factor (dB) | Corrected Reading (dBuV) | Spec.limit (dBuV) Q.P. | Spec.limit (dBuV) Avg. | CR/SL Diff. (dB) | Pass Fail Unc. | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.1562 | Neutral | P | A | 39.0 | 0.0 | 0.0 | 39.0 | 65.6 | 56.6 | -17.6 | Pass | |




..\EMCShare\AUTOMATE\DATASHTS\CEP_Voltage Rev C.xls Document Control #EMC DS EM COND VOLT

## Conducted Photographs (Worst Case Configuration)

## Section 4. Radiated Emissions

| | |
|---|---|
| NAME OF TEST: Radiated Emissions | PARA. NO.: 15.249 |
| TESTED BY: Dana Tassler | DATE: 7/2/04 |

**Minimum Standard:** Para no. 15.249

(a) The field strengths shall not exceed the following:

| Fundamental (MHz) | Field Strength (mV/m) | Field Strength (dBµV) | Harmonic (mV/m) | Harmonic (dBµV) |
|---|---|---|---|---|
| 2400 - 2483.5 | 50 | 94 | 0.5 | 54 |

(b) Field strength limits are specified at a distance of 3 meters.

(c) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limits of 15.209 whichever is the less attenuation.

(d) The emission limits shown above are based on measurement instrumentation employing a CISPR quasi-peak detector below 1000 MHz and an averaging detector above 1000 MHz. However, the peak field strength of any emission shall not exceed the average limit by more than 20 dB.

**Test Results:** Complies. The worst-case emission level is 90.0 dBµV/m @ 3m at 2429.5 MHz. This is 4.0 dB below the specification limit.

Note – The supply voltage was varied from 2.55 to 3.45 Vdc with no effect on output power of the carrier.

**Measurement Data:** See data below.

**Maximizing Emission Levels:**

The EUT was tested on three channels. During operation, the transmitting frequency and its harmonics were recorded after finding the maximum amplitude using vertical and horizontal antenna polarities and 360˚ table rotation.

## Test Data - Radiated Emissions

**NEMKO Dallas, Inc.**

**Dallas Headquarters:**
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

### Radiated Emissions Data

| | | | | | |
|---|---|---|---|---|---|
| Complete | X | | | Job # : | 4L0148E |
| Preliminary | | | | Page | 1 |
| Test # : | REHE-01 | | | of | 1 |

| | |
|---|---|
| Client Name : | Micro Systems Inc |
| EUT Name : | IRapid Scoring System |
| EUT Model # : | TR101, TB101 |
| EUT Part # : | AY03150, AY04745, AY04735 |
| EUT Serial # : | SN001 |
| EUT Config. : | Charging |

| | | | | | |
|---|---|---|---|---|---|
| Specification : | CFR47 Part 15.209 | | | Reference : | |
| Rod. Ant. #: | NA | Temp. (deg. C) : | 23 | Date : | 07/02/04 |
| Bicon Ant.#: | 1479 | Humidity (%) : | 39 | Time : | 14:00 |
| Log Ant.#: | NA | EUT Voltage : | 3 VDC | Staff : | Dana Tassler |
| Bilog Ant.#: | NA | EUT Frequency : | NA | Photo ID: | 0148REHE01F1SR |
| Dipole Ant.#: | NA | Phase: | NA | Peak Bandwidth: | 100 kHz |
| Cable#: | 1983 | Location: | A OATS | Video Bandwidth | 100kHz |
| Preamp#: | 1025 | Distance: | 3m | | |
| Limiter#: | NA | | | | |
| Atten #: | NA | | | | |
| Detector#: | 765 | | | | |

| Meas. Freq. (MHz) | Ant. Pol. (H/V) | Atten. (dB) | Meter Reading (dBuV) | Antenna Factor (dB) | Path Loss (dB) | RF Gain (dB) | Corrected Reading (dBuV/m) | Spec. limit (dBuV/m) | CR/SL Diff. (dB) | Pass Fail Unc. | peak readings Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 53.541 | V | 0 | 50 | 9.8 | 1.6 | 28.1 | 33.3 | 40.0 | -6.7 | Pass | |
| 49.889 | V | 0 | 47 | 10.3 | 1.3 | 28.2 | 30.4 | 40.0 | -9.6 | Pass | |
| 48.658 | V | 0 | 45 | 10.3 | 1.3 | 28.2 | 28.4 | 40.0 | -11.6 | Pass | |
| 48.023 | V | 0 | 45.2 | 10.3 | 1.3 | 28.2 | 28.6 | 40.0 | -11.4 | Pass | |
| 49.214 | V | 0 | 41 | 10.3 | 1.3 | 28.2 | 24.4 | 40.0 | -15.6 | Pass | |
| 57.38 | V | 0 | 48.4 | 9.9 | 1.6 | 28.1 | 31.8 | 40.0 | -8.2 | Pass | |
| 47.348 | V | 0 | 38 | 10.3 | 1.3 | 28.2 | 21.4 | 40.0 | -18.6 | Pass | |
| | | | | | | | | | | | |
| 53.541 | H | 0 | 30.5 | 9.8 | 1.6 | 28.1 | 13.8 | 40.0 | -26.2 | Pass | |
| 49.889 | H | 0 | 27 | 10.3 | 1.3 | 28.2 | 10.4 | 40.0 | -29.6 | Pass | |
| 48.658 | H | 0 | 27.5 | 10.3 | 1.3 | 28.2 | 10.9 | 40.0 | -29.1 | Pass | |
| 48.023 | H | 0 | 31.4 | 10.3 | 1.3 | 28.2 | 14.8 | 40.0 | -25.2 | Pass | |
| 49.214 | H | 0 | 28.8 | 10.3 | 1.3 | 28.2 | 12.2 | 40.0 | -27.8 | Pass | |
| 57.38 | H | 0 | 35 | 9.9 | 1.6 | 28.1 | 18.4 | 40.0 | -21.6 | Pass | |
| 47.348 | H | 0 | 28 | 10.3 | 1.3 | 28.2 | 11.4 | 40.0 | -28.6 | Pass | |
| | | | | | | | | | | | |

..\EMCShare\AUTOMATE\DATASHTS\RADEMEV Rev C.xls Document Control #EMC DS EM RAD HFE

## Test Data - Radiated Emissions

**NEMKO Dallas, Inc.**

**Dallas Headquarters:**
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

### Microwave Radiated Emissions Data

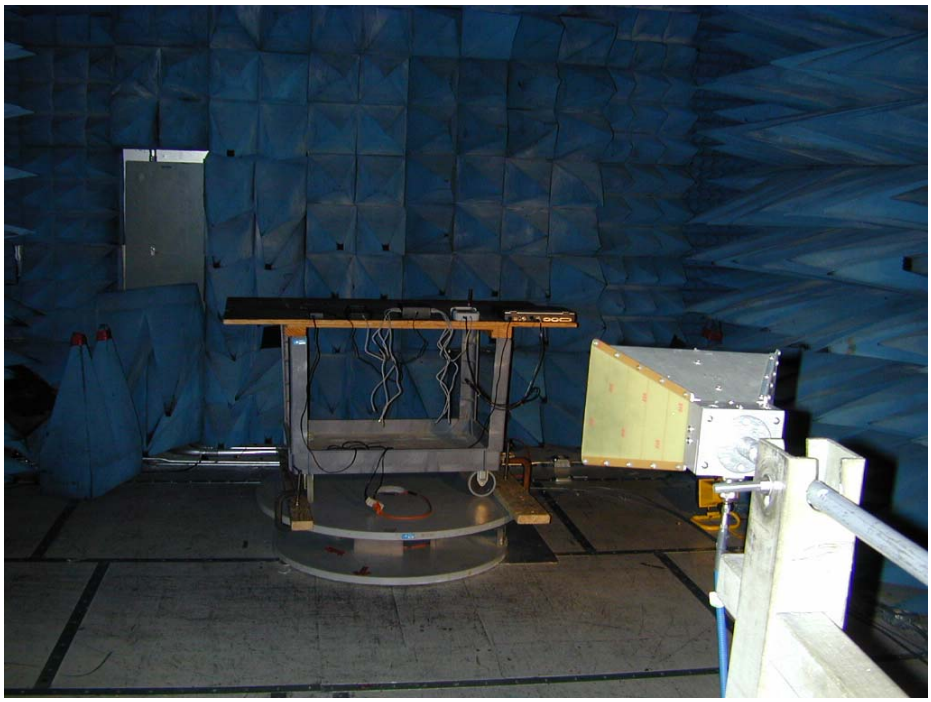
| | | | | | |
|---|---|---|---|---|---|
| Complete | X | | | Job # : 4L0148E | Test # : REWE-01 |
| Preliminary | | | | Page 1 | of 1 |
| Client Name : | Micro Systems Inc | | | | |
| EUT Name : | Rapid Scoring System | | | | |
| EUT Model # : | TR101, TB101 | | | | |
| EUT Part # : | AY03150, AY04745, AY04735 | | | | |
| EUT Serial # : | SN001 | | | | |
| EUT Config. : | Charging batteries, remote and base units communicating. | | | | |
| Specification : | CFR47 Part 15.249 | | | Reference : | |
| Antenna #: | 1033 | Temp. (deg. C) : | 21 | Date : | 07/07/04 |
| Detector #: | 1464 | Humidity (%) : | 38 | Time : | 10:30 |
| Cable 1 # : | 1041 | EUT Voltage : | 3 VDC | Staff : | Dana Tassler |
| Cable 2 # : | 1972 | EUT Frequency : | NA | Photo ID: | |
| Cable 3 # : | 1067 | Phase: | NA | Peak Bandwidth: | 1 MHz |
| Preamp 1 #: | 1016 | Location: | AC 2 | Avg. Bandwidth: | 10 Hz |
| Preamp 2 #: | NA | Distance: | 3m | Video Bandwidth | 1 MHz |
| Preamp 3 # : | NA | | | | |

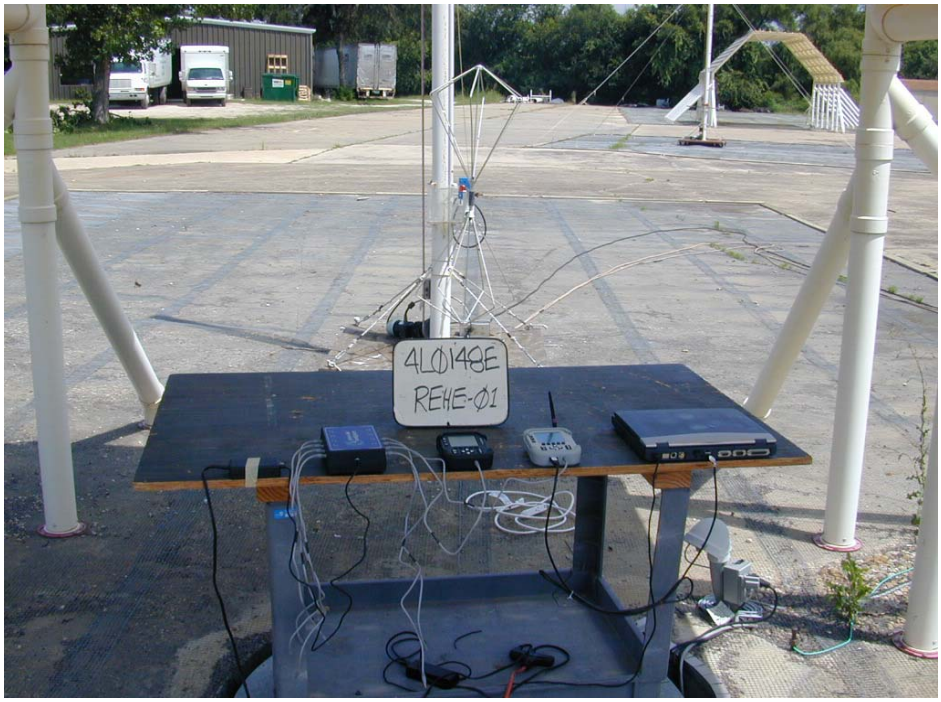
| Meas. Freq. (GHz) | Meter Reading (dBm) | Antenna Factor (dB) | Path Loss (dB) | RF Gain (dB) | Conversion Factor (dB) | Corrected Reading (dBuV/m) | Spec. limit (dBuV/m) | CR/SL Diff. (dB) | Pass Fail Unc. | Pol. | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.4295 | -17 | 28.3 | 4.7 | 32.98 | 107.0 | 90.0 | 94.0 | -4.0 | Pass | V | Carrier (channel 5) |
| 2.4295 | -26.33 | 28.3 | 4.7 | 32.98 | 107.0 | 80.7 | 94.0 | -13.3 | Pass | H | Carrier (channel 5) |
| | | | | | | | | | | | |
| 2.4550 | -17 | 28.3 | 4.7 | 32.98 | 107.0 | 90.0 | 94.0 | -4.0 | Pass | V | Carrier (channel 10) |
| 2.4550 | -25.67 | 28.3 | 4.7 | 32.98 | 107.0 | 81.4 | 94.0 | -12.7 | Pass | H | Carrier (channel 10) |
| | | | | | | | | | | | |
| 2.4801 | -17.3 | 28.3 | 4.7 | 32.98 | 107.0 | 89.7 | 94.0 | -4.3 | Pass | V | Carrier (channel 15) |
| 2.4801 | -26.33 | 28.3 | 4.7 | 32.98 | 107.0 | 80.7 | 94.0 | -13.3 | Pass | H | Carrier (channel 15) |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

..\EMCShare\AUTOMATE\DATASHTS\FCCmwradem Rev C.xls Document Control #EMC DS EM RAD MW FCC

Note: The spectrum was searched to the 10th harmonic of the carrier. No harmonic emissions were detected above the noise floor.

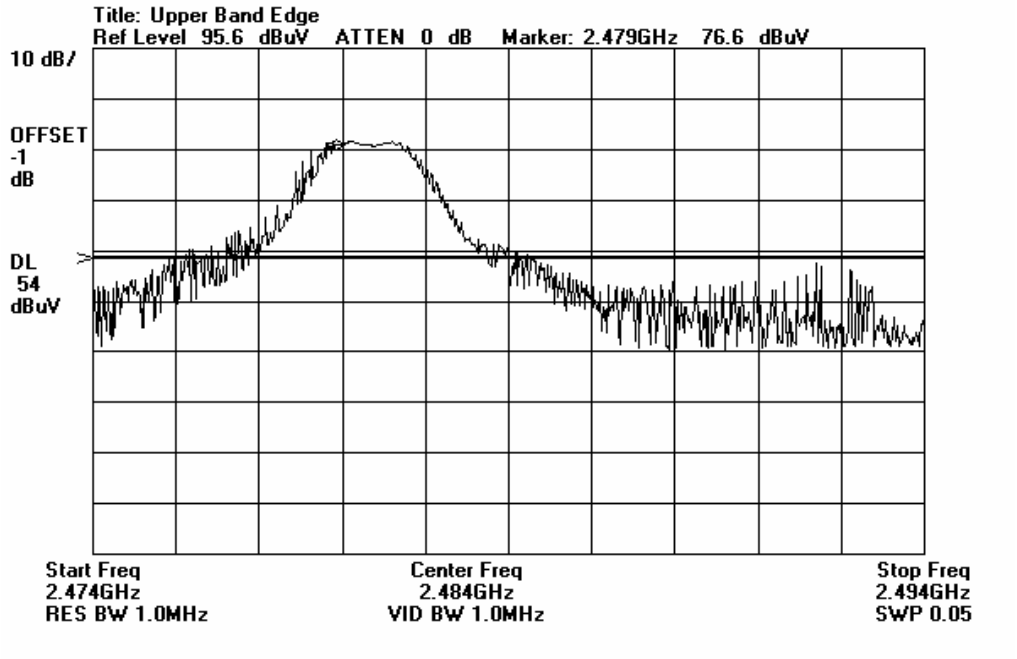
## Radiated Photographs



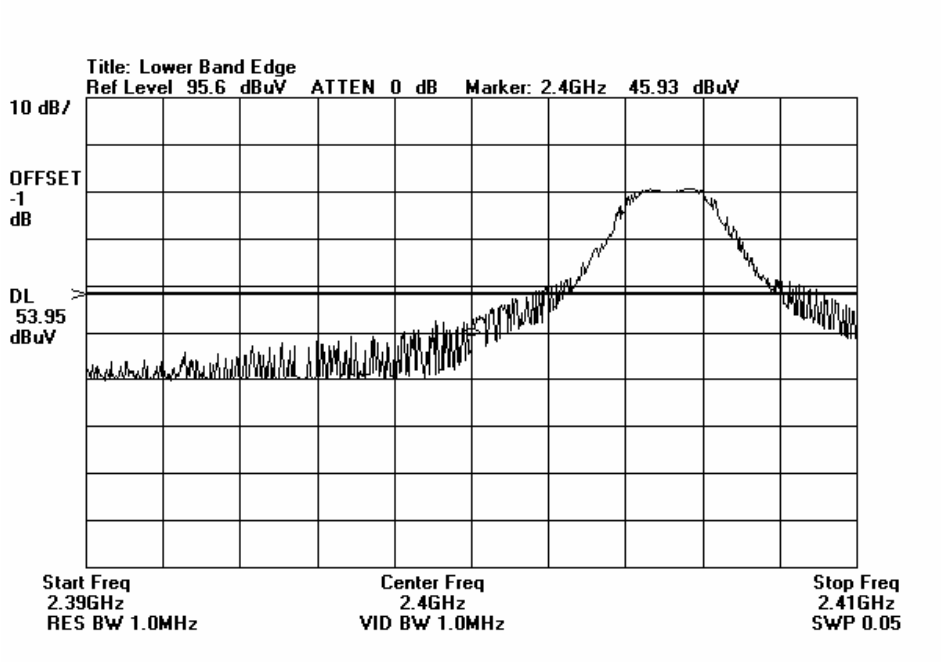


## Test Data - Radiated Emissions

Upper Band Edge (Plot is PEAK measurement)




Lower Band Edge (Plot is PEAK measurement)




**Marker Delta method used to show compliance at Band Edge.**

**Marker Delta Method:**
Step 1: (1MHz RBW=VBW) Fundamental
PK: 87.27dBuV
AV: 70.8dBuV

Step 2: (100kHz = RBW=VBW; Span = 10MHz)
Delta from Fund to bandedge= 37.0dB @ 2479.5MHz

Step 3: Band edge reading
**Band Edge measurement = 70.8 – 37.0 = 33.8dBuV @ 3 meters**

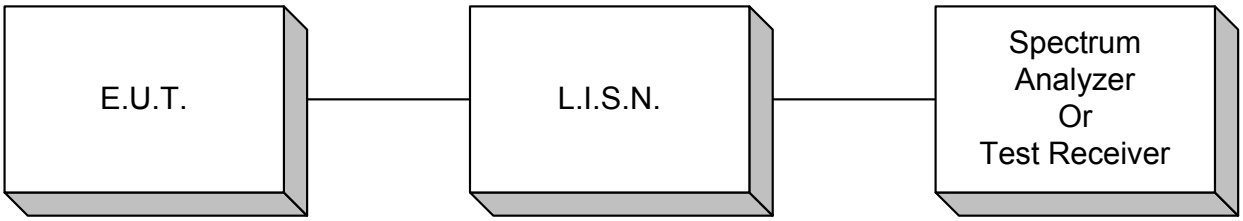
## Section 5. Test Equipment List

| Nemko ID | Description | Manufacturer Model Number | Serial Number | Calibration Date | Calibration Due |
|---|---|---|---|---|---|
| 1464 | Spectrum analyzer | Hewlett Packard 8563E | 3551A04428 | 02/11/03 | 02/11/05 |
| 1041 | CABLE, 3m | KTL Semi-Flex | N/A | 07/29/03 | 07/28/04 |
| 1016 | Pre-Amp | HEWLETT PACKARD 8449A | 2749A00159 | 10/27/03 | 10/26/04 |
| 1083 | Cable 2m | Astrolab 32027-2-29094-72TC | N/A | 09/02/03 | 09/01/04 |
| 1033 | Horn antenna | EMCO 3115 | 8812-3035 | 09/22/03 | 09/22/05 |
| 1067 | Blue cable 4m | Storm PR90-010-144 | 0 | 07/29/03 | 07/28/04 |
| 1479 | Bi Conical Antenna 20-330 Mhz | A. H. Systems SAS-200/540 | 496 | 07/02/03 | 07/01/04 |
| 1983 | CABLE | KTL Site A OATS | N/A | 03/11/04 | 03/11/05 |
| 1025 | PREAMP, 25dB | ICC LNA25 | 399 | 06/09/04 | 06/09/05 |
| 765 | RECEIVER (20-1000 MHz) | ROHDE & SCHWARZ ESVS 30 | 843710/0001 | 09/12/03 | 09/11/04 |
| A OATS | Open Area Test Site | KTL None | A | 03/11/04 | 03/11/05 |

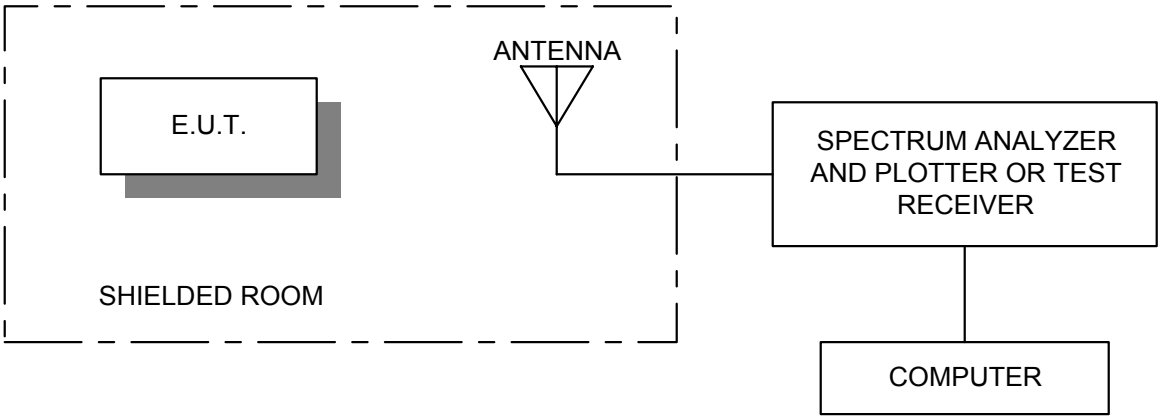
# ANNEX A

# TEST DIAGRAMS

## Conducted Emissions




## Radiated Prescan



## Test Site For Radiated Emissions