

**IAL****INTERNATIONAL APPROVALS  
LABORATORIES**

## EMC EMISSIONS - TEST REPORT (Full)

|                            |   |             |                        |
|----------------------------|---|-------------|------------------------|
| Test Report No.            | <b>BC500354-1</b>   | Issue Date: | <b>Tue 01/Nov/2005</b> |
| Model / Serial No.         | <b>GP-RWT / SN: 0001</b>  |             |                        |
| Product Type               | <b>Active RFID Tag &amp; Infrared Handheld Trigger</b>  |             |                        |
| Client                     | <b>Active RFID Systems, Inc.</b>  |             |                        |
| Manufacturer               | <b>Active RFID Systems, Inc.</b>  |             |                        |
| License holder             | <b>Active RFID Systems, Inc.</b>  |             |                        |
| Address                    | <b>477 CR 65<br/>Evergreen, CO 80437</b>  |             |                        |
| Test Criteria Applied      | <div><b>CISPR 22: 2003 Class B</b><br/><b>PASS</b><br/><b>BC500354-1</b><br/>29</div> <div>INFORMATION TECHNOLOGY<br/>EQUIPMENT - RADIO DISTURBANCE<br/>CHARACTERISTICS - LIMITS AND<br/>METHODS AND MEASUREMENTS<br/>Report Includes: IEC/EN 61000-3-2 and<br/>IEC/EN 61000-3-3 Where applicable</div> |             |                        |
| Test Result                |   |             |                        |
| Test Project Number        |   |             |                        |
| References                 |   |             |                        |
| Total Pages                |   |             |                        |
| Including                  |   |             |                        |
| Appendices:                |   |             |                        |
| <i>Michael Spataro</i>     | <i>Robert Cresswell</i>   |             |                        |
| Reviewed By : Mike Spataro | Approved By : Robert Cresswell  |             |                        |

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Lab Code:200264-0

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### STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty for Conducted Emissions in the frequency range of 150kHz – 30MHz is calculated to be  $\pm 2.30\text{dB}$  and for Radiated Emissions is calculated to be  $\pm 3.60\text{dB}$  in the frequency range of 30MHz – 200MHz and  $\pm 3.38\text{dB}$  in the frequency range of 200MHz – 1000MHz.

EUT Received Date: 9-Sep-2005

Testing Start Date: 9-Sep-2005

Testing End Date: 13-Sep-2005

**The tests were performed according to following regulations:**

1. EMC Directive 89/336/EEC
2. IEC/CISPR 22: 1997, +A1: 2000, +A2: 2002
3. EN 55022: 1998, +A1: 2000, +A2: 2003
4. FCC CFR47 Part 15
5. AS/NZS CISPR22: 2002
6. CNS13438 ICES-003, Issue-4
7. VCCI-03: 2004

**Emission Test Results:****Conducted Emissions, Powerline - N/A****Test Result**Minimum limit margin 00.00 dB at 000.00 MHzMaximum limit exceeding        dB at        MHz

Remarks: \_\_\_\_\_

**Conducted Emissions, Data I/O (Ethernet, RJ11, etc.) - N/A****Test Result**Minimum limit margin 00.00 dB at 000.00 MHzMaximum limit exceeding        dB at        MHz

Remarks: \_\_\_\_\_

**Radiated Emissions (Electric Field) - PASS****Test Result**Minimum limit margin -5.7 dB at 224.83 MHzMaximum limit exceeding        dB at        MHz

Remarks: \_\_\_\_\_

**Harmonics and Flicker (Conducted) - N/A****Test Result**

Remarks: \_\_\_\_\_

**GENERAL REMARKS: TESTING WAS COMPLETED IN ACCORDANCE TO CISPR 22: 30-1000MHz**Modifications required to pass: None**Test Specification Deviations: None**

Test-setup photo(s):  
Radiated Emissions



Test-setup photo(s):  
Radiated Emissions





## Appendix A

### Test Data Sheets and Test Equipment Used

## **Radiated Emissions Data**

**Where Applicable the Data Flows as Follows:**

**30-1000 MHz at 100VAC/50Hz, 110VAC/60Hz, 220VAC/60Hz, 230VAC/50Hz  
>1000 MHz at 110VAC/60Hz**

# Radiated Electromagnetic Emissions



|                  |  |            |                       |                    |           |
|------------------|--|------------|-----------------------|--------------------|-----------|
| Test Report #:   | <b>BC500354 Run 04</b>   | Test Area: | Pinewood Site 1 (10m) | Temperature:       | _____ °C  |
| Test Method:     | EN55022  | Test Date: | 13-Sep-2005           | Relative Humidity: | _____ %   |
| EUT Model #:     | GP-RWT/  | EUT Power: | 3.5 VDC/3.0VDC        | Air Pressure:      | _____ kPa |
| EUT Serial #:    | 0001   |            |                       | Page:              | 1 of 4    |
| Manufacturer:    | Active RFID Systems, Inc.  |            |                       |                    |           |
| EUT Description: | Active RFID Tag & Infrared Handheld Trigger  |            |                       |                    |           |
| Notes:           | <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">Level Key</p> <p>Pk – Peak                      Nb – Narrow Band</p> <p>Qp – QuasiPeak              Bb – Broad Band</p> <p>Av - Average</p> </div> |            |                       |                    |           |

| FREQ   | LEVEL   | CABLE / ANT / PREAMP | FINAL    | POL / HGT / AZ  | DELTA1 (dB) | DELTA2 (dB) |
|--|---------|----------------------|----------|-----------------|-------------|-------------|
| (MHz)  | (dBuV)  | (dB) (dB/m) (dB)     | (dBuV/m) | (m) (DEG)       | EN55022 B   | N/A         |
| 72.01  | 35.7 Qp | 2.3 / 8.0 / 28.1     | 17.9     | V / 1.0 / 0.0   | -12.1       | N/A         |
| 156.12   | 28.9 Qp | 3.2 / 12.0 / 27.7    | 16.5     | V / 1.0 / 0.0   | -13.5       | N/A         |
| 184.87   | 32.1 Qp | 3.7 / 12.5 / 27.5    | 20.7     | V / 1.0 / 0.0   | -9.3        | N/A         |
|  |         |                      |          |                 |             |             |
| No higher emissions found 90Deg, Vertical.           |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| No higher emissions found 180Deg, Vertical.          |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| No higher emissions found 270Deg, Vertical.          |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| The following were maximized between 30 and 200 MHz. |         |                      |          |                 |             |             |
| 72.01MHz did not maximize any higher.                |         |                      |          |                 |             |             |
| 156.34   | 29.1 Qp | 3.2 / 12.0 / 27.7    | 16.6     | V / 1.0 / 12.0  | -13.4       | N/A         |
| 184.87MHz did not maximize any higher.               |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| No higher emissions found 0Deg, Horizontal.          |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| No higher emissions found 90Deg, Horizontal.         |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| No higher emissions found 180Deg, Horizontal.        |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| No higher emissions found 270Deg, Horizontal.        |         |                      |          |                 |             |             |
| Noise floor.   |         |                      |          |                 |             |             |
| 30.00  | 23.0 Qp | 1.5 / 12.9 / 28.2    | 9.2      | H / 2.5 / 270.0 | -20.8       | N/A         |
| 80.00  | 30.9 Qp | 2.4 / 6.9 / 28.1     | 12.2     | H / 2.5 / 270.0 | -17.8       | N/A         |
| 190.00   | 26.9 Qp | 3.7 / 12.8 / 27.5    | 15.9     | H / 2.5 / 270.0 | -14.1       | N/A         |
|  |         |                      |          |                 |             |             |
| 221.16   | 33.6 Qp | 4.0 / 10.4 / 27.3    | 20.7     | V / 1.0 / 0.0   | -9.3        | N/A         |
| 224.83   | 35.0 Qp | 4.0 / 10.2 / 27.2    | 21.9     | V / 1.0 / 0.0   | -8.1        | N/A         |
| 239.82   | 31.1 Qp | 4.1 / 10.6 / 27.1    | 18.8     | V / 1.0 / 0.0   | -18.2       | N/A         |



# Radiated Electromagnetic Emissions



Test Report #: **BC500354 Run 04** Test Area: Pinewood Site 1 (10m)

Test Method: EN55022 Test Date: 13-Sep-2005

EUT Model #: GP-RWT/ EUT Power: 3.5 VDC/3.0VDC

EUT Serial #: 0001

Manufacturer: Active RFID Systems, Inc.

EUT Description: Active RFID Tag & Infrared Handheld Trigger

Notes:

Temperature: °C

Relative Humidity: %

Air Pressure: kPa

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| Level Key      |                  |
|----------------|------------------|
| PK – Peak      | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band  |
| Av - Average   |                  |

| FREQ   | LEVEL   | CABLE / ANT / PREAMP | FINAL    | POL / HGT / AZ  | DELTA1 (dB) | DELTA2 (dB) |
|--|---------|----------------------|----------|-----------------|-------------|-------------|
| (MHz)  | (dBuV)  | (dB) (dB/m) (dB)     | (dBuV/m) | (m) (DEG)       | EN55022 B   | N/A         |
| 245.75   | 29.4 Qp | 4.2 / 11.0 / 27.1    | 17.5     | V / 1.0 / 0.0   | -19.5       | N/A         |
| 250.56   | 34.2 Qp | 4.2 / 11.3 / 27.1    | 22.5     | V / 1.0 / 0.0   | -14.5       | N/A         |
| 334.08   | 35.0 Qp | 4.9 / 13.8 / 27.2    | 26.5     | V / 1.0 / 0.0   | -10.5       | N/A         |
|  |         |                      |          |                 |             |             |
| 221.16   | 34.3 Qp | 4.0 / 10.4 / 27.3    | 21.4     | V / 1.0 / 90.0  | -8.6        | N/A         |
| 214.84   | 36.2 Qp | 4.0 / 10.3 / 27.3    | 23.2     | V / 1.0 / 90.0  | -6.8        | N/A         |
|  |         |                      |          |                 |             |             |
| No higher emissions found 180Deg, Horizontal.          |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| 207.98   | 28.7 Qp | 3.9 / 10.4 / 27.4    | 15.7     | V / 1.0 / 270.0 | -14.3       | N/A         |
| 215.98   | 27.7 Qp | 4.0 / 10.3 / 27.3    | 14.7     | V / 1.0 / 270.0 | -15.3       | N/A         |
| 240.03   | 28.3 Qp | 4.1 / 10.7 / 27.1    | 15.9     | V / 1.0 / 270.0 | -21.1       | N/A         |
| 288.01   | 23.9 Qp | 4.5 / 12.8 / 27.0    | 14.2     | V / 1.0 / 270.0 | -22.8       | N/A         |
|  |         |                      |          |                 |             |             |
| The following were maximized between 200 and 1000 MHz. |         |                      |          |                 |             |             |
| 214.84   | 36.5 Qp | 4.0 / 10.3 / 27.3    | 23.4     | V / 1.0 / 72.0  | -6.6        | N/A         |
| 221.17   | 35.4 Qp | 4.0 / 10.4 / 27.3    | 22.5     | V / 1.0 / 55.0  | -7.5        | N/A         |
| 224.83   | 37.3 Qp | 4.0 / 10.2 / 27.2    | 24.3     | V / 1.0 / 31.0  | -5.7        | N/A         |
|  |         |                      |          |                 |             |             |
| No higher emissions found 0Deg, Horizontal.            |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| 250.56   | 33.3 Qp | 4.2 / 11.3 / 27.1    | 21.7     | H / 2.5 / 90.0  | -15.3       | N/A         |
| 334.08   | 34.2 Qp | 4.9 / 13.8 / 27.2    | 25.7     | H / 2.5 / 90.0  | -11.3       | N/A         |
|  |         |                      |          |                 |             |             |
| No higher emissions found 180Deg, Horizontal.          |         |                      |          |                 |             |             |
|  |         |                      |          |                 |             |             |
| 214.84   | 31.8 Qp | 4.0 / 10.3 / 27.3    | 18.7     | H / 2.5 / 270.0 | -11.3       | N/A         |
| 221.17   | 35.1 Qp | 4.0 / 10.4 / 27.3    | 22.3     | H / 2.5 / 270.0 | -7.7        | N/A         |
| 224.83   | 32.9 Qp | 4.0 / 10.2 / 27.2    | 19.9     | H / 2.5 / 270.0 | -10.1       | N/A         |
| 240.03   | 28.8 Qp | 4.1 / 10.7 / 27.1    | 16.5     | H / 2.5 / 270.0 | -20.5       | N/A         |
| 250.56   | 33.2 Qp | 4.2 / 11.3 / 27.1    | 21.6     | H / 2.5 / 270.0 | -15.4       | N/A         |

# Radiated Electromagnetic Emissions



|                  |   |            |                       |                    |           |
|------------------|---|------------|-----------------------|--------------------|-----------|
| Test Report #:   | <b>BC500354 Run 04</b>  | Test Area: | Pinewood Site 1 (10m) | Temperature:       | _____ °C  |
| Test Method:     | EN55022   | Test Date: | 13-Sep-2005           | Relative Humidity: | _____ %   |
| EUT Model #:     | GP-RWT/   | EUT Power: | 3.5 VDC/3.0VDC        | Air Pressure:      | _____ kPa |
| EUT Serial #:    | 0001  |            |                       | Page:              | 3 of 4    |
| Manufacturer:    | Active RFID Systems, Inc.   |            |                       |                    |           |
| EUT Description: | Active RFID Tag & Infrared Handheld Trigger   |            |                       |                    |           |
| Notes:           | <div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div> |            |                       |                    |           |

| Level Key      |                  |
|----------------|------------------|
| Pk – Peak      | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band  |
| Av - Average   |                  |

| FREQ   | LEVEL   | CABLE / ANT / PREAMP | FINAL    | POL / HGT / AZ  | DELTA1 (dB) | DELTA2 (dB) |
|--|---------|----------------------|----------|-----------------|-------------|-------------|
| (MHz)  | (dBuV)  | (dB) (dB/m) (dB)     | (dBuV/m) | (m) (DEG)       | EN55022 B   | N/A         |
| 288.01   | 24.2 Qp | 4.5 / 12.8 / 27.0    | 14.5     | H / 2.5 / 270.0 | -22.5       | N/A         |
| 334.08   | 34.6 Qp | 4.9 / 13.8 / 27.2    | 26.1     | H / 2.5 / 270.0 | -10.9       | N/A         |
| The following were maximized between 200 and 1000 MHz. |         |                      |          |                 |             |             |
| 334.08   | 35.1 Qp | 4.9 / 13.8 / 27.2    | 26.6     | H / 2.4 / 270.0 | -10.4       | N/A         |
| 224.83   | 33.8 Qp | 4.0 / 10.2 / 27.2    | 20.7     | H / 3.0 / 268.0 | -9.3        | N/A         |
| 221.17   | 36.3 Qp | 4.0 / 10.4 / 27.3    | 23.4     | H / 2.9 / 268.0 | -6.6        | N/A         |
| The following are noise floor points.                  |         |                      |          |                 |             |             |
| 500.00   | 23.7 Qp | 6.1 / 17.0 / 28.4    | 18.5     | H / 2.5 / 270.0 | -18.5       | N/A         |
| 995.00   | 20.0 Qp | 9.3 / 23.2 / 27.3    | 25.2     | H / 2.5 / 270.0 | -11.8       | N/A         |
|  |         |                      |          |                 |             |             |

# Radiated Electromagnetic Emissions



|  |                                  |                            |
|--|----------------------------------|----------------------------|
| Test Report #: <b>BC500354 Run 04</b>                        | Test Area: Pinewood Site 1 (10m) | Temperature: _____ °C      |
| Test Method: EN55022   | Test Date: 13-Sep-2005           | Relative Humidity: _____ % |
| EUT Model #: GP-RWT/   | EUT Power: 3.5 VDC/3.0VDC        | Air Pressure: _____ kPa    |
| EUT Serial #: 0001   |                                  | Page: 4 of 4               |
| Manufacturer: Active RFID Systems, Inc.                      |                                  |                            |
| EUT Description: Active RFID Tag & Infrared Handheld Trigger |                                  |                            |
| Notes:   |                                  |                            |

| Level Key      |                  |
|----------------|------------------|
| Pk – Peak      | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band  |
| Av - Average   |                  |

| FREQ                                   | LEVEL   | CABLE / ANT / PREAMP | FINAL    | POL / HGT / AZ  | DELTA1 (dB) | DELTA2 (dB) |
|--|---------|----------------------|----------|-----------------|-------------|-------------|
| (MHz)                                  | (dBuV)  | (dB) (dBm) (dB)      | (dBuV/m) | (m) (DEG)       | EN55022 B   | N/A         |
| <b>***** Measurement Summary *****</b> |         |                      |          |                 |             |             |
| 224.83                                 | 37.3 Qp | 4.0 / 10.2 / 27.2    | 24.3     | V / 1.0 / 31.0  | -5.7        | N/A         |
| 214.84                                 | 36.5 Qp | 4.0 / 10.3 / 27.3    | 23.4     | V / 1.0 / 72.0  | -6.6        | N/A         |
| 221.17                                 | 36.3 Qp | 4.0 / 10.4 / 27.3    | 23.4     | H / 2.9 / 268.0 | -6.6        | N/A         |
| 184.87                                 | 32.1 Qp | 3.7 / 12.5 / 27.5    | 20.7     | V / 1.0 / 0.0   | -9.3        | N/A         |
| 30.00                                  | 33.6 Qp | 1.5 / 12.9 / 28.2    | 19.8     | H / 2.5 / 270.0 | -10.2       | N/A         |
| 334.08                                 | 35.1 Qp | 4.9 / 13.8 / 27.2    | 26.6     | H / 2.4 / 270.0 | -10.4       | N/A         |
| 995.00                                 | 20.0 Qp | 9.3 / 23.2 / 27.3    | 25.2     | H / 2.5 / 270.0 | -11.8       | N/A         |
| 72.01                                  | 35.7 Qp | 2.3 / 8.0 / 28.1     | 17.9     | V / 1.0 / 0.0   | -12.1       | N/A         |
| 156.34                                 | 29.1 Qp | 3.2 / 12.0 / 27.7    | 16.6     | V / 1.0 / 12.0  | -13.4       | N/A         |
| 156.12                                 | 28.9 Qp | 3.2 / 12.0 / 27.7    | 16.5     | V / 1.0 / 0.0   | -13.5       | N/A         |
| 190.00                                 | 26.9 Qp | 3.7 / 12.8 / 27.5    | 15.9     | H / 2.5 / 270.0 | -14.1       | N/A         |
| 207.98                                 | 28.7 Qp | 3.9 / 10.4 / 27.4    | 15.7     | V / 1.0 / 270.0 | -14.3       | N/A         |
| 250.56                                 | 34.2 Qp | 4.2 / 11.3 / 27.1    | 22.5     | V / 1.0 / 0.0   | -14.5       | N/A         |
| 215.98                                 | 27.7 Qp | 4.0 / 10.3 / 27.3    | 14.7     | V / 1.0 / 270.0 | -15.3       | N/A         |
| 80.00                                  | 30.9 Qp | 2.4 / 6.9 / 28.1     | 12.2     | H / 2.5 / 270.0 | -17.8       | N/A         |
| 239.82                                 | 31.1 Qp | 4.1 / 10.6 / 27.1    | 18.8     | V / 1.0 / 0.0   | -18.2       | N/A         |
| 500.00                                 | 23.7 Qp | 6.1 / 17.0 / 28.4    | 18.5     | H / 2.5 / 270.0 | -18.5       | N/A         |
| 245.75                                 | 29.4 Qp | 4.2 / 11.0 / 27.1    | 17.5     | V / 1.0 / 0.0   | -19.5       | N/A         |
| 240.03                                 | 28.8 Qp | 4.1 / 10.7 / 27.1    | 16.5     | H / 2.5 / 270.0 | -20.5       | N/A         |
| 288.01                                 | 24.2 Qp | 4.5 / 12.8 / 27.0    | 14.5     | H / 2.5 / 270.0 | -22.5       | N/A         |
|  |         |                      |          |                 |             |             |

# Radiated Electromagnetic Emissions



Test Report #: **BC500354 Run 05** Test Area: Pinewood Site 1 (3m)

Test Method: FCC Part 15.209 Test Date: 13-Sep-2005

EUT Model #: GP-RWT/ EUT Power: 3.5 VDC/3.0VDC

EUT Serial #: 0001

Manufacturer: Active RFID Systems, Inc.

EUT Description: Active RFID Tag & Infrared Handheld Trigger

Notes:

Temperature: °C

Relative Humidity: %

Air Pressure: kPa

Page: 1 of 3

| Level Key      |                  |
|----------------|------------------|
| PK – Peak      | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band  |
| Av - Average   |                  |

| FREQ   | LEVEL   | CABLE / ANT / PREAMP | FINAL  | POL / HGT / AZ | DELTA1 (dB)  | DELTA2 (dB)  |
|--|---------|----------------------|--------|----------------|--------------|--------------|
| (MHz)  | (dBuV)  | (dB) (dB/m) (dB)     | (dBuV) | (m) (DEG)      | 15.209 <1GHz | 15.209 >1GHz |
| The loop antenna is perpendicular.                   |         |                      |        |                |              |              |
| No emissions were found from .038 to 30 MHz.         |         |                      |        |                |              |              |
| The following are noise floor points.                |         |                      |        |                |              |              |
| 0.0380   | 34.9 Qp | 0.0 / 12.1 / 0.0     | 47.1   | V / 1.0 / 0.0  | -68.9        | N/A          |
| 10.00  | 17.6 Qp | 0.2 / 10.5 / 0.0     | 28.3   | V / 1.0 / 0.0  | -41.2        | N/A          |
| 20.00  | 8.3 Qp  | 0.4 / 10.3 / 0.0     | 19.0   | V / 1.0 / 0.0  | -50.5        | N/A          |
| The loop antenna is parallel                         |         |                      |        |                |              |              |
| No emissions were found from .038 to 30 MHz.         |         |                      |        |                |              |              |
| The following are noise floor points.                |         |                      |        |                |              |              |
| 0.100  | 30.1 Qp | 0.1 / 11.0 / 0.0     | 41.2   | H / 1.0 / 0.0  | -66.4        | N/A          |
| 15.00  | 9.2 Qp  | 0.3 / 10.7 / 0.0     | 20.2   | H / 1.0 / 0.0  | -49.3        | N/A          |
| 29.00  | 6.9 Qp  | 0.5 / 8.7 / 0.0      | 16.1   | H / 1.0 / 0.0  | -53.4        | N/A          |
| No emissions found between 1 and 4 GHz Vertical.     |         |                      |        |                |              |              |
| 1000.00  | 32.0 Av | 3.7 / 22.0 / 37.6    | 20.1   | V / 1.0 / 0.0  | N/A          | -33.9        |
| 3000.00  | 34.3 Av | 4.6 / 27.7 / 38.1    | 28.5   | V / 1.0 / 0.0  | N/A          | -25.5        |
| 4000.00  | 33.2 Av | 5.7 / 29.7 / 37.7    | 31.0   | V / 1.0 / 0.0  | N/A          | -23.0        |
| No emissions found between 1 and 4 GHz Horizontal.   |         |                      |        |                |              |              |
| 1500.00  | 33.9 Av | 2.9 / 23.7 / 37.3    | 23.1   | V / 1.0 / 0.0  | N/A          | -30.9        |
| 3500.00  | 34.5 Av | 4.8 / 28.6 / 37.7    | 30.2   | V / 1.0 / 0.0  | N/A          | -23.8        |
| No emissions found between 4 and 4.5 GHz Horizontal. |         |                      |        |                |              |              |
| Noise floor.   |         |                      |        |                |              |              |
| 4500.00  | 32.6 Av | 6.6 / 30.1 / 40.5    | 28.8   | V / 1.0 / 0.0  | N/A          | -25.2        |
| No emissions found between 4 and 4.5 GHz Vertical.   |         |                      |        |                |              |              |
| Noise floor.   |         |                      |        |                |              |              |
| 4400.00  | 32.9 Av | 6.4 / 30.0 / 40.3    | 29.1   | V / 1.0 / 0.0  | N/A          | -24.9        |

# Radiated Electromagnetic Emissions



Test Report #: **BC500354 Run 05** Test Area: Pinewood Site 1 (3m)

Test Method: FCC Part 15.209 Test Date: 13-Sep-2005

EUT Model #: GP-RWT/ EUT Power: 3.5 VDC/3.0VDC

EUT Serial #: 0001

Manufacturer: Active RFID Systems, Inc.

EUT Description: Active RFID Tag & Infrared Handheld Trigger

Notes:

Temperature: \_\_\_\_\_ °C

Relative Humidity: \_\_\_\_\_ %

Air Pressure: \_\_\_\_\_ kPa

Page: 3 of 3

| Level Key      |                  |
|----------------|------------------|
| PK – Peak      | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band  |
| Av - Average   |                  |

| FREQ                                   | LEVEL   | CABLE / ANT / PREAMP | FINAL  | POL / HGT / AZ | DELTA1 (dB)  | DELTA2 (dB)  |
|--|---------|----------------------|--------|----------------|--------------|--------------|
| (MHz)                                  | (dBuV)  | (dB) (dBm) (dB)      | (dBuV) | (m) (DEG)      | 15.209 <1GHz | 15.209 >1GHz |
| <b>***** Measurement Summary *****</b> |         |                      |        |                |              |              |
| 4000.00                                | 33.2 Av | 5.7 / 29.7 / 37.7    | 31.0   | V / 1.0 / 0.0  | N/A          | -23.0        |
| 3500.00                                | 34.5 Av | 4.8 / 28.6 / 37.7    | 30.2   | V / 1.0 / 0.0  | N/A          | -23.8        |
| 4400.00                                | 32.9 Av | 6.4 / 30.0 / 40.3    | 29.1   | V / 1.0 / 0.0  | N/A          | -24.9        |
| 4500.00                                | 32.6 Av | 6.6 / 30.1 / 40.5    | 28.8   | V / 1.0 / 0.0  | N/A          | -25.2        |
| 3000.00                                | 34.3 Av | 4.6 / 27.7 / 38.1    | 28.5   | V / 1.0 / 0.0  | N/A          | -25.5        |
| 1500.00                                | 33.9 Av | 2.9 / 23.7 / 37.3    | 23.1   | V / 1.0 / 0.0  | N/A          | -30.9        |
| 1000.00                                | 32.0 Av | 3.7 / 22.0 / 37.6    | 20.1   | V / 1.0 / 0.0  | N/A          | -33.9        |
| 10.00                                  | 17.6 Qp | 0.2 / 10.5 / 0.0     | 28.3   | V / 1.0 / 0.0  | -41.2        | N/A          |
| 15.00                                  | 9.2 Qp  | 0.3 / 10.7 / 0.0     | 20.2   | H / 1.0 / 0.0  | -49.3        | N/A          |
| 20.00                                  | 8.3 Qp  | 0.4 / 10.3 / 0.0     | 19.0   | V / 1.0 / 0.0  | -50.5        | N/A          |
| 29.00                                  | 6.9 Qp  | 0.5 / 8.7 / 0.0      | 16.1   | H / 1.0 / 0.0  | -53.4        | N/A          |
| 0.100                                  | 30.1 Qp | 0.1 / 11.0 / 0.0     | 41.2   | H / 1.0 / 0.0  | -66.4        | N/A          |
| 0.0380                                 | 34.9 Qp | 0.0 / 12.1 / 0.0     | 47.1   | V / 1.0 / 0.0  | -68.9        | N/A          |
|  |         |                      |        |                |              |              |



## List of Equipment Utilized for Final Test

# Project Report

**Begin Date:** 9/9/2005    **End Date:** 9/13/2005

**Technician**    Mike Spataro

**Project:** BC500354

| Capital Asset ID | Manufacturer      | Model #        | Serial #   | Description                        | Test Performed       | Service Type | Service Date | Service Due |
|------------------|-------------------|----------------|------------|------------------------------------|----------------------|--------------|--------------|-------------|
| 135              | EMCO              | 3146           | 9402-3775  | Log Periodic Antenna (200-1000MHz) | R Radiated Emissions | For Cal      | 9/18/2004    | 9/18/2005   |
| 138              | EMC TEST SYSTEMS  | 3109           | 3142       | Biconical Antenna 30-300MHz        | R Radiated Emissions | For Cal      | 9/30/2004    | 9/30/2005   |
| 187              | EMCO              | 3115           | 9205-3886  | Horn Antenna 1-18GHz               | R Radiated Emissions | For Cal      | 1/18/2005    | 1/18/2006   |
| 195              | EMCO              | 6502           | 9205-2738  | Magnetic loop                      | R Radiated Emissions | For Cal      | 7/13/2005    | 7/13/2006   |
| 203              | Avantek           | AFT97-8434-10F | 1007       | RF Pre-Amplifier (4-8 GHz)         | R Radiated Emissions | For Ver      | 4/4/2005     | 4/4/2006    |
| 213              | Mini-Circuits Lab | ZHL-42         | N052792-2  | Amplifier                          | R Radiated Emissions | For Ver      | 5/6/2005     | 5/6/2006    |
| 248              | Hewlett-Packard   | 8447F          | 3113A05545 | 9 kHz- 1.3GHz Pre Amp              | R Radiated Emissions | For Ver      | 5/6/2005     | 5/6/2006    |
| 259              | Hewlett-Packard   | E7405A         | My44211889 | Spectrum Analyzer                  | R Radiated Emissions | For Cal      | 10/11/2004   | 10/11/2005  |



## Appendix B

### Test Plan and Constructional Data Form

## Request for Estimate & Test Plan

### Laboratory/Agent Information:

|                 |   |
|-----------------|---|
| Agent/Test Lab: | International Approvals Laboratories, LLC       |
| Contact:        | Todd Seeley                                     |
| Title:          | Principal Engineer (Services Development Focus) |
| Phone Number:   | (303) 402-5272                                  |
| Cell Number:    | (303) 503-2491                                  |
| Fax Number:     | (303) 449-6160                                  |
| Email Address:  | todd@ialabs.com                                 |

### Client Information:

|                 |                                       |
|-----------------|---------------------------------------|
| License Holder: | Active RFID Systems Inc. (ARS Inc.)   |
| Address:        | 477 Cr 65, Evergreen, Colorado. 80437 |
| Contact:        | Joe Desimone                          |
| Title:          | CTO, Chief Hardware Design Engineer   |
| Phone Number:   | (303) 459-0859                        |
| Fax Number:     |                                       |
| Email Address:  | jdesimone.ars-inc@direcway.com        |

Please provide all pertinent information below and email this Form to Todd and Amy at [todd@ialabs.com](mailto:todd@ialabs.com) and [Amy@ialabs.com](mailto:Amy@ialabs.com) for a quotation:

### Estimates Requested:

#### EMC Testing

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Requesting Estimate | <input type="checkbox"/> No Estimate Required |
| <input type="checkbox"/> Pre-Compliance Scans           | <input type="checkbox"/> Engineering Test     |

#### Radio Device Testing and Certification

- |   |  |
|---|--|
| <input type="checkbox"/> Requesting Estimate                              | <input type="checkbox"/> No Estimate Required  |
| <input checked="" type="checkbox"/> FCC Certification                     | <input checked="" type="checkbox"/> Industry Canada Certification (Receivers required) |
| <input checked="" type="checkbox"/> Class 2 Notification Under the R&TTED |  |

#### Safety Testing and Certification

- |   |  |
|---|--|
| <input type="checkbox"/> Requesting Estimate        | <input checked="" type="checkbox"/> No Estimate Required                   |
| <input type="checkbox"/> NRTL Listing               | <input type="checkbox"/> 1 Day Pre-Assessment (conducted at your facility) |
| <input type="checkbox"/> Letter of Findings         | <input type="checkbox"/> CB Report Covering all country Deviations         |
| <input type="checkbox"/> CE Report to Cover the LVD | <input type="checkbox"/> CB Report Covering - Specify Countries:           |

Please list all applicable standards that you would like your device certified under:

## General Product Information:

|   |   |        |         |         |
|---|---|--------|---------|---------|
| Product/Model Number(s):                                    | GP-RWT  |        |         |         |
| Description of product(s):                                  | Infared -RF ID Tag  |        |         |         |
| Intended Use:   | <input type="checkbox"/> Household <input checked="" type="checkbox"/> Commercial <input checked="" type="checkbox"/> Industrial <input type="checkbox"/> Hospital <input type="checkbox"/> Life Supporting |        |         |         |
| Intended Location:  | <input checked="" type="checkbox"/> Dry <input checked="" type="checkbox"/> Damp <input checked="" type="checkbox"/> Wet <input type="checkbox"/> Hazardous Location  |        |         |         |
| Product Type:   | <input type="checkbox"/> Prototype <input checked="" type="checkbox"/> Production Sample<br><input type="checkbox"/> Manufacturing Design Change: Please Describe   |        |         |         |
| If there is more than one product what are the differences? |   |        |         |         |
| Is the Product Enclosure:                                   | <input type="checkbox"/> Metal <input checked="" type="checkbox"/> Plastic <input type="checkbox"/> Both  |        |         |         |
| Size:   | Length:   | Width: | Height: | Weight: |
| What Voltages/Current does the EUT run at?                  | Rated Voltage:3.5<br>Rated Current:6 mA<br># of Phases/Conductors:n/a/<br># of Power Cords:n/a  |        |         |         |
| Are their multiple suppliers of power supplies?             | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes Please Describe:  |        |         |         |
| Are there Multiple Modes of Operation?                      | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes Please Describe:  |        |         |         |
| Can all modes of operation be operated simultaneously?      | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No          Explain:   |        |         |         |
| In which countries will you be selling the product?         | USA, Europe   |        |         |         |

## EMC Information:

|   |   |
|---|---|
| What EMC certifications are desired?  | <input checked="" type="checkbox"/> FCC/ICES (US & Canada)<br><input checked="" type="checkbox"/> CE / EMC / MMD<br><input type="checkbox"/> BSMI (Taiwan)<br><input type="checkbox"/> VCCI (Japan)<br><input type="checkbox"/> SII (Israel)<br><input type="checkbox"/> AS/NZS (Australia/New Zealand)<br><input type="checkbox"/> Other: Please Specify |
| Highest frequency utilized for device operation:  | 433.92 MHz +/- 200 KHz  |
| List of Clock Frequencies:  | 4 MHz (internal microprocessor clock, no external crystal)  |
| What is the time that it takes for the device to complete a full cycle of operation? (time required to identify any degradation in performance)                       | 1 Second beacon mode for testing.   |
| Total Number of I/O Cables:<br># Greater than 3m (9.75 feet) in Length<br># Greater than 30m (97.5 feet) in Length<br># of cables at a longer length (specify)        | n/a   |
| Number of Dedicated Earth Equalization Ports  | n/a   |
| Number of Ethernet and/or Telecommunications Ports  | n/a   |
| When the device is a compilation of subsystems (in separate chassis) how many interconnecting I/O's are greater than 1 meter in length between the Subsystem chassis? | n/a   |
| For medical devices:<br>Are there any coupled or direct patient contact points on the device?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Describe:   |

## Radio Information:

|   |  |
|---|--|
| What Radio certifications are desired?                                      | <input checked="" type="checkbox"/> FCC (USA)<br><input checked="" type="checkbox"/> Industry Canada<br><input checked="" type="checkbox"/> ETSI (R&TTE)<br><input type="checkbox"/> Other: Please Specify |
| Operating Frequency:  | 433.92 MHz +/- 200 kHz   |
| RF Output Power:  | Part 231 Section A&E   |
| Is there an RF Conducted Port?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No      Description:  |
| Number of Antennas & Description:<br>(Internal, External, Known Gain, etc.) | 1 Internal PCB, not user accessible  |
| Modulation Technique:   | ASK, <10 kbps  |
| Number of Channels/Number of Discrete frequencies per Channel:              | 1/   |
| Can the device be operated in CW Mode?                                      | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| What is the lowest utilized frequency within the device?                    | 38 kHz   |

**Notes: Please ensure to bring a notch filter covering your fundamental operating frequency.**

### Safety Information:

|   |   |               |                        |                        |             |  |
|---|---|---------------|------------------------|------------------------|-------------|--|
| Has the device been tested and certified for product safety before?<br><br>A. If it has been previously tested, to which standard and by which organization?<br><br>B. Can you provide the test report?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br><br>Standard tested to:<br><br>Organization tested by:<br><br><input type="checkbox"/> Yes <input type="checkbox"/> No |               |                        |                        |             |  |
| Is the power supply   | <input type="checkbox"/> An approved off the shelf power supply<br><br>OR<br><br><input type="checkbox"/> A Custom Model that will need evaluation/ certification                             |               |                        |                        |             |  |
| Does the device contain batteries?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br><br>What Type? Lithium<br><br>How Many? 1  |               |                        |                        |             |  |
| What technology is used? (i.e., lasers, X Ray, etc.)  |   |               |                        |                        |             |  |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">If Laser:</td> <td style="width: 20%;">Class:</td> <td style="width: 20%;">Output Power:</td> <td style="width: 25%;">Beam Divergence Angle:</td> <td style="width: 20%;">Wavelength:</td> </tr> </table> | If Laser:   | Class:        | Output Power:          | Beam Divergence Angle: | Wavelength: |  |
| If Laser:   | Class:  | Output Power: | Beam Divergence Angle: | Wavelength:            |             |  |
| Is the product a Medical Device?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |               |                        |                        |             |  |
| Is it an In Vitro Diagnostic Device?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |               |                        |                        |             |  |
| Testing location: (to be filled in by IALabs)   |   |               |                        |                        |             |  |

## Additional Information:

This information is required to be filled in to act as a test plan and constructional data form required to be supplied as part of the test report in accordance to the required standards. This information is not required to obtain a quote.

### Support Equipment:

IALabs requires our customers provide all support equipment necessary to fully operate the EUT. This includes any filters required for testing radio devices.

| Item | Description    | Manufacturer | Model No.        |
|------|----------------|--------------|------------------|
| 1    | <b>Reader</b>  | <b>AWS</b>   | <b>EZR-43RO</b>  |
| 2    | <b>Trigger</b> | <b>AWS</b>   | <b>EZCC-7500</b> |
| 3    |                |              |                  |
| 4    |                |              |                  |

### Cabling Information:

| Cable | Function* | Type of Shield | Length | Connectors | Connection** |
|-------|-----------|----------------|--------|------------|--------------|
| 1     |           |                |        |            |              |
| 2     |           |                |        |            |              |
| 3     |           |                |        |            |              |
| 4     |           |                |        |            |              |
| 5     |           |                |        |            |              |
| 6     |           |                |        |            |              |

\* Function examples (Ethernet, RS232, USB, Analog, physiological parameter, etc.)

\*\* Connection examples (Outside Plant, Patient Coupled, Ring Voltage, etc.)

### Monitoring the EUT:

Please provide instructions below on how to observe the EUT to verify proper operation in all modes. (including software revision)

### Any other information required: (Notes, Photos, Block Diagrams, Drawings, etc.)

A minimum of a block diagram showing the equipment under test and its support equipment.

#### Notes:

1. In some versions of Word when unlocking and rellocking the form some data may be lost. Please ensure that you save the Form before rellocking it.
2. To insert files and photos and drawings within this document please fill in the information above and then unlock the FORM by:
  - a. Right click on the tool bar above and select "Form"
  - b. Select the Lock Button within the "form" toolbar



For International Approvals Laboratories, Use Only.  
Please do not fill in the following Information.

|  |  |  |   |
|--|--|--|---|
| <b>Quoting Engineer: Todd</b>  |  |  |   |
| <b>Emissions Testing Required</b>  |  |  |   |
| <input type="checkbox"/> Class A <input type="checkbox"/> Class B <input checked="" type="checkbox"/> Radio Device <input type="checkbox"/> Group 1 <input type="checkbox"/> Group 2   |  |  |   |
| <input checked="" type="checkbox"/> FCC Part 15  | <input type="checkbox"/> ICES-003  | <input type="checkbox"/> VCCI  |   |
| <input type="checkbox"/> FCC Part 18   | <input type="checkbox"/> BSMI  | <input type="checkbox"/> CISPR 22/EN 55022   |   |
| <input type="checkbox"/> CISPR 11/EN 55011   | <input type="checkbox"/> IEC/EN 61326  | <input type="checkbox"/> IEC/EN61000-6-3   |   |
| <input type="checkbox"/> IEC/EN61000-6-4   | <input type="checkbox"/> CNS13438  | <input type="checkbox"/> AS/NZS 3548   |   |
| <input type="checkbox"/> IEC/EN61000-3-2   | <input type="checkbox"/> IEC/EN61000-3-3   | <input checked="" type="checkbox"/> ETSI/EN 301 489  |   |
| <input checked="" type="checkbox"/> Other: ETSI 300 220 and FCC Part 15.231 Sections A & E Unintentional and intentional to 4.5GHz starting at 38kHz   |  |  |   |
| <b>OATS Testing Voltages</b>   |  |  |   |
| <input type="checkbox"/> 100VAC/50 Hz  | <input type="checkbox"/> 120VAC/60Hz   | <input type="checkbox"/> 230VAC/50Hz   |   |
| <input type="checkbox"/> 110VAC/60Hz   | <input type="checkbox"/> 220VAC/60Hz   | <input type="checkbox"/> 240VAC/50Hz   |   |
| <input checked="" type="checkbox"/> Other: Battery Operated... make sure there are fresh batteries   |  |  |   |
| <b>Immunity Product Family Standard</b>  |  |  |   |
| <input type="checkbox"/> CISPR24/EN 55024  | <input type="checkbox"/> IEC/EN 61000-6-1  | <input type="checkbox"/> IEC/EN 61000-6-2  |   |
| <input type="checkbox"/> IEC/EN 60601-1-2 <input type="checkbox"/> Art. Hand.  | <input type="checkbox"/> IEC/EN 61326  | <input type="checkbox"/> CISPR14/ EN 55014-2   |   |
| <input checked="" type="checkbox"/> ETSI/EN 301 489  | <input type="checkbox"/> Add Israel Frequencies  |  |   |
| <input type="checkbox"/> Other:  |  |  |   |
| <b>Immunity Methods</b>  |  |  |   |
| <input checked="" type="checkbox"/> EN61000-4-2  | <input checked="" type="checkbox"/> 4kV/8kV<br><input type="checkbox"/> 6kV/8kV  | <input type="checkbox"/> 8kV<br><input type="checkbox"/> 12kV<br><input type="checkbox"/> 15kV   | <input type="checkbox"/> Other: Normal testing (3)  |
| <input checked="" type="checkbox"/> EN61000-4-3  | <input checked="" type="checkbox"/> 3V/m<br><input type="checkbox"/> 10V/m   | <input checked="" type="checkbox"/> 1 kHz Modulation<br><input type="checkbox"/> 400 Hz Modulation<br><input type="checkbox"/> 2 Hz Modulation | <input type="checkbox"/> Other: 80MHz - 2.5 GHz standard currently stops at 2GHz but 2.5 will be in standard soon (6) |
| <input checked="" type="checkbox"/> EN61000-4-4  | <input type="checkbox"/> 0.5 kV<br><input type="checkbox"/> 1.0 kV   | <input type="checkbox"/> 2.0 kV  | <input type="checkbox"/> Other:   |
| <input type="checkbox"/> EN61000-4-5   | <input type="checkbox"/> 0.5 kV<br><input type="checkbox"/> 1.0 kV   | <input type="checkbox"/> 2.0 kV<br><input type="checkbox"/> 4.0 kV   | <input type="checkbox"/> Other:   |
| <input type="checkbox"/> EN61000-4-6   | <input type="checkbox"/> 3Vrms<br><input type="checkbox"/> 10Vrms  | <input type="checkbox"/> 1 kHz Modulation<br><input type="checkbox"/> 400 Hz Modulation<br><input type="checkbox"/> 2 Hz Modulation            | <input type="checkbox"/> Other:   |
| <input checked="" type="checkbox"/> EN61000-4-8  | <input checked="" type="checkbox"/> 1A/m<br><input type="checkbox"/> 30A/m   | <input type="checkbox"/> 400A/m  | <input checked="" type="checkbox"/> Other: Not in standard but still test it will be in standard soon (1)             |
| <input type="checkbox"/> EN61000-4-11  | <input type="checkbox"/> >95% 0.5 Cycles<br><input type="checkbox"/> 30% 0.5 Cycles<br><input type="checkbox"/> 60% 5 Cycles<br><input type="checkbox"/> 60% 50 Cycles | <input type="checkbox"/> 30% 25 Cycles<br><input type="checkbox"/> >95% 250 Cycles<br><input type="checkbox"/> >95% 1 Cycle                    | <input checked="" type="checkbox"/> Other: Termal testing and voltage stability testing - (6)                         |
| <b>Test Reports Requested</b>  |  |  |   |
| <input type="checkbox"/> Emissions   | <input type="checkbox"/> Engineering Data Only   | <input checked="" type="checkbox"/> ETSI "Radio"   |   |
| <input type="checkbox"/> Immunity  | <input checked="" type="checkbox"/> FCC/Industry Canada "Radio"  | <input type="checkbox"/> Other:  |   |
| <input checked="" type="checkbox"/> Other/special notes: There is a total of 2 tags and therefore 2 separate sets of reports need compiled. Please use - 1a and -1b report numbering to segregate the reports  |  |  |   |
| Test procedure:<br>Complete unintentional emissions (Trigger and both tags on table - trigger activated and button pressed) The reader can go on the floor because it is support equipment and the supporting computer can go benienth the ground reference plane because it is support equipment as well -- make sure that the ethernet cable is ferrited under the table coming up to the reader device) testing at 10m for unintentional up to 1GHz and 3m above 1GHz. A NOTE MUST E INSERTED IN THE REPORT STATING THAT THE TESTING WAS COMPLETED IN ACCORDANCE TO CISPR 30-1000MHZ --- BELOW 30MHz USE THE STATED IN THE REPORT |  |  |   |

Test both tags for intentional emissions measuring the emissions in both Peak and QP for sections A and E of FCC Part 15.231 on worst case axis (record all testing for worst case axis --- must retest Axis at each power level of the tag "A & E")

Test and record the transmit time of each tag while operating under Part A power

Test the bandwidth requirements under subpart C for all modes of operation

There are 2 tags that operate under sections A and E of FCC CFR47 Part 15.231 - Therefore, there will be a total of 4 separate tests for intentional radiation for this test

After all FCC Testing is completed in every mode of operation, we will set up for signal substitution measurements for ETSI where all signal substitution measurements will be taken. Mike must be available for this testing to help out and the portable tripod must be available for this testing along with 1 extra antenna. Each of the emissions must be remaximized at 10m distance for each of the tags operating modes (yes --- complete the intentional testing again at 10m) then substitute the products with a transmit antenna and maximize the signal in height. This process is completely explained in section 8.3 of Also check spurious emissions with QP detector to cover section 8.7 (should have been completed in FCC testing --- read section 8.7 (must complete in active and standby modes of operation and recorded)

Section 8.1 & 8.8 will be tested in boulder with the thermal chamber

Total time in Pinewood - about 3 to 3.5 days in pinewood

Total Time in Boulder - 2 days (16)

## Appendix C

Measurement Protocol

And

Test Procedures

## MEASUREMENT PROTOCOL

### GENERAL INFORMATION

#### Test Methodology

Conducted and radiated emission testing is performed according to the procedures in ANSI C63.4 & CNS13438.

#### Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

### CONDUCTED EMISSIONS

The final level, expressed in dB $\mu$ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the applicable limit.

To convert between dB $\mu$ V and  $\mu$ V, the following conversions apply:

- $\text{dB}\mu\text{V} = 20(\log \mu\text{V})$
- $\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$

### RADIATED EMISSIONS

The final level, expressed in dB $\mu$ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB $\mu$ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the applicable limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

*Example: At a Test Frequency of 30 MHz, with a peak reading on the spectrum analyzer or measuring receiver of 14 dB $\mu$ V:*

| Measured Level | + | Transducer & Cable Loss factor | = | Corrected Reading | Specification Limit | - | Corrected Reading | = | Delta Specification |
|----------------|---|--------------------------------|---|-------------------|---------------------|---|-------------------|---|---------------------|
| (dB $\mu$ V)   |   | (dB)                           |   | (dB $\mu$ V/m)    | (dB $\mu$ V/m)      |   | (dB $\mu$ V/m)    |   |                     |
| <b>14.0</b>    |   | <b>14.9</b>                    |   | <b>28.9</b>       | <b>40.0</b>         |   | <b>28.9</b>       |   | <b>-11.1</b>        |

## DETAILS OF TEST PROCEDURES

### *General Standard Information*

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

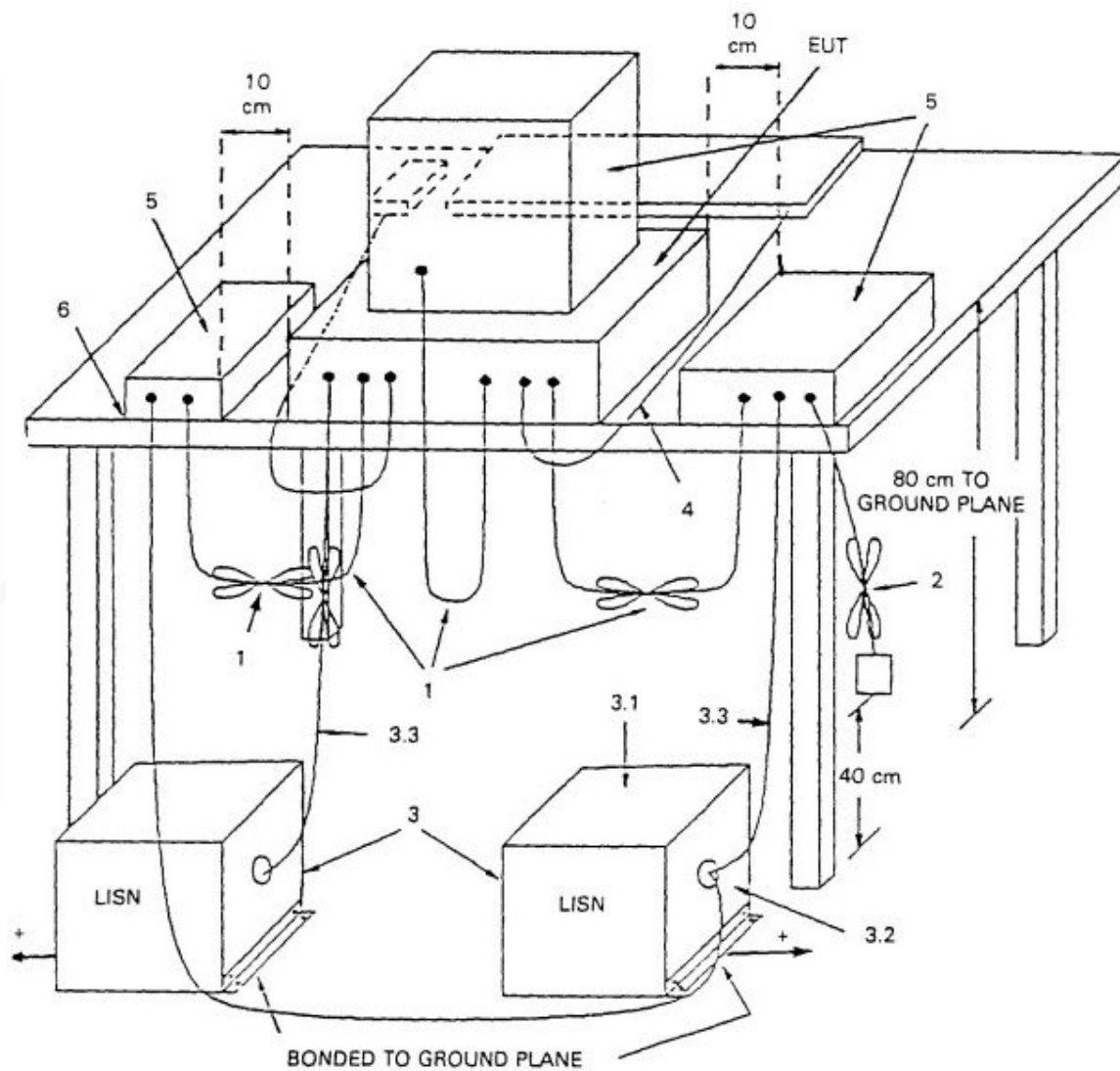
### **Conducted Emissions**

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50  $\Omega$ /50  $\mu$ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

### **Radiated Emissions**

Radiated emissions from the EUT are measured in the frequency range of 30 to 22GHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees.

## Conducted Emissions Diagram:



## Radiated Emissions Diagram:

