# FCC Test Report for
# 47CFR15, Subpart B for Unintentional Radiators, per Section 101
# Equipment authorization of unintentional radiators,
# and
# 47CFR15, Subpart C per Section 209
# General Limits for Operation of Intentional Radiators

on

# Jaguar X-150 5.8 GHz Microwave Sensor

**[FCC ID: LQN2915]**
**[FCC ID: LQN2916]**

Model and Part Number:

# 902915(Jaguar's Part No: GW83-19G535-AA)
# 902916(Jaguar's Part N0: GW83-19G535-BA)

Report No.

# 20050616-01-Fc15

Judgement

# Complies as Tested

Provided for evaluation by

## Connaught Electronics, LTD

**IDA Industrial Estate**
**Dunmore Road, Tuam**
**Co. Galway, Ireland**

Tests and Report by

## ITC Engineering Services, Inc.

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**Lab Code: 200172-0**

**EN45001 Accredited Compliance Laboratory (RES-GmbH)**
**Registration number: TTI-P-G 159/98-00 (RES-GmbH)**

## Table of Contents

## List of Tables

# List of Figures

# PART 1 General

## Test Information

| | | |
|---|---|---|
| **Product:**<br>**Model Number:**<br>**Model Number:** | Jaguar X-150, 5.8 GHz Microwave Sensor<br>902915<br>902916 | |
| **Manufacturer's Name**<br>**Manufacturer's Address**<br><br><br>**Contact** | Connaught Electronics, LTD<br>IDA Industrial Estate<br>Dunmore Road, Tuam<br>Co. Galway, Ireland<br>Tel: + 011 353 (93) 25128<br>Mr. Patrick Denny | <br><br><br><br>Fax : +011 353 (93) 25133<br>Email dennypatrick@cei.ie |
| **Test Laboratory** | ITC Engineering Services, Inc.<br>9959 Calaveras Road,<br>PO Box 543<br>Sunol, CA 94586-0543<br>Email: itcemc@itcemc.com<br>Web Site: http://www.itcemc.com | <br><br><br><br>Tel: +1(925) 862-2944<br>Fax: +1(925) 862-9013 |
| **Test Number**<br>**Report Number** | 20050616-01<br>20050616-01-Fc15 | |
| **Test Date(s) & Issue Date** | July 07 – July 08, 2005 | July 13,2005 |
| **Test Engineer(s)** | Lan Vu, Bob Kershaw, Femi Ojo | |
| **Documentation** | George W Brown II | |
| **Test Results** | ☑ Complies as Tested | ❑ Fail |
| **Total Number of Pages** | 32 | |

The electromagnetic interference and RF tests, which this report describes, were performed by an independent engineering consultancy firm, ITC Engineering Services, Inc. (ITC), in accordance with the requirements specified in the FCC rules, 47CFR Part 15, Subparts B and C. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications specified in this report for compliance must be implemented in all production units for compliance to be maintained.

## Tests Performed:

**Emissions Requirements:**

- OPEN FIELD RADIATED EMISSIONS in accordance with the FCC PART 15 Sub-Part B.

**RF Requirements:**

- FIELD STRENGTH OF FUNDAMENTAL in accordance with the FCC 47 CFR 15.209.
- HARMONIC EMISSIONS in accordance with the FCC 47 CFR 15.209.
- SPURIOUS EMISSIONS in accordance with the FCC 47 CFR 15.209.

**Report generated by**

**Femi Ojo,**

**Compliance Engineer**

**Report reviewed by**

**Michael Gbadebo, P.E, Chief Engineer.**
**(California License # 11303)**

## Declaration/Disclaimer

ITC Engineering Services, Inc. (ITC) reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. ITC Engineering Services, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from ITC Engineering Services, Inc. issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full with our written approval. The applicant/manufacturer shall not use this report to claim product endorsement by NIST, NVLAP or any US Government agency.

**ITC Engineering Services, Inc. (ITC) is:**
Accepted by the Federal Communications Commission (FCC) for FCC Methods, CISPR Methods and AUSTEL Technical Standards (Ref: NVLAP Lab Code 200172-0)

Approved by the Industry Canada for Telecom Testing

Certified by Rockford Engineering Services GmbH for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001

Certified by Reg. TP for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001 for RES GmbH (DAR-Registration number: TTI-P-G 159/98-00)

Certified by the Voluntary Control Council for Interference by Information Technology Equipment (VCCI) for EMC testing, in accordance with the Regulations for Voluntary Control Measures, Article 8, Registration Numbers - Site 1: C-1582 and R-1497.

# PART 1 General (Cont)

## Test Methodology

The electromagnetic interference and RF tests, which this report describes, were performed by an independent engineering consultancy firm, ITC Engineering Services, Inc. (ITC), in accordance with the FCC test procedure ANSI C63.4-2003

## Test Facility

The open area test site, the conducted measurement facility, the semi anechoic chamber and the test equipment used to collect the emissions and RF data is located in Sunol, California, and is fully described in site attenuation report. The approved site attenuation description is on file at the Federal Communications Commission.

**Table 1 Radio Device Measurement Information**

| | | |
|---|---|---|
| **Product Type**<br>**Model** | Jaguar X-150, 5.8 GHz Microwave Sensor<br>902915 and 902916 | |
| **Applicant / Manufacturer Address** | Connaught Electronics, Ltd.<br>IDA Industrial Estate,<br>Dunmore Road, Tuam,<br>Co. Galway, Ireland | |
| **Contact** | Mr. Patrick Denny<br>Tel: +011 353 93 25128 | dennypatrick@cel.ie<br>Fax: +011 353 93 25133 |
| **Total Number of Pages including Appendices** | 32 Pages | |
| **Test Report File No.** | 20050616-01-Fc15 | |

**Table 2 Measurement Uncertainty**

| | | |
|---|---|---|
| 150kHz to 30MHz: | | |
| Combined standard uncertainty uc(y) | ± 1.68 dB | Normal |
| Expanded uncertainty U | ± 3.36 dB | Normal (k = 2) |
| 30MHz to 1GHz: | | |
| Combined standard uncertainty uc(y) | ± 3.24 dB | Normal |
| Expanded uncertainty U | ± 6.48 dB | Normal (k = 2) |
| 1GHz to 18GHz: | | |
| Combined standard uncertainty uc(y) | ± 2.48 dB | Normal |
| Expanded uncertainty U | ± 4.96 dB | Normal (k = 2) |
| Above 18GHz: | | |
| Radiated emission up to 26 GHz | ± 3 dB | |
| Radiated emission up to 40 GHz | ± 3 dB | |
| Radiated emission up to 75 GHz | ± 3 dB | |

# PART 2 RECEIVER MEASUREMENTS

## OPEN FIELD RADIATED EMISSIONS

**Test Specification: 47 CFR PART 15, Sub-Part B**

Connaught's product 5.8GHz microwave sensor, models; 902915 and 902916(or the EUTs) as referred to in this report are intentional radiators. The units are similar both in design and functionality. One of the EUT (model 902916) was tested and based on engineering judgment, the results hold for both models. The EUT was set up at 1, 3 or 10 meters in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-2003. The measurement instrumentation used was a receiver with bandwidth parameters as stipulated in ANSI C63.4-2003. The 5.8GHz Microwave Sensor was set up on a wooden non-conductive tabletop, 80 cm above the ground reference plane, in an open field. The transmit function was not activated for the tests.

**Table 3 Test Equipment – Radiated Emissions Tests**

| Equipment Description | Manufacturer | Model Name | Serial Number | Calibration Due |
|---|---|---|---|---|
| Preamplifier | Hewlett-Packard | 8449B | 3008A00101 | N/A |
| Preselector | Hewlett-Packard | 85685A | 2620A00265 | 12-11-2005 |
| Biconical Antenna | EMCO | 3104 | 9111-4463 | 01-16-2006 |
| l.p. Ant (200 -1000MHz) | EMCO | 3146 | 2261 | 01-22-2006 |
| Quasi Peak Adapter | Hewlett-Packard | 85650A | 2521A00737 | 12-11-2005 |
| Spectrum Analyzer | Hewlett-Packard | 8568B | 2841A04315 | 12-11-2005 |
| Spectrum Analyzer Display | Hewlett-Packard | | | 12-11-2005 |
| Horn. Ant (Below 18GHz) | EMCO | 3115 | 8812-3050 | 01-19-2006 |
| Horn. Ant (Below 40GHz) | HP | 3116 | 4663 | 02-18-2006 |
| Spectrum Analyzer | Hewlett-Packard | 8569A | 2128A00270 | 04-23-2006 |

**Table 4 Support Equipment – Radiated Emissions Tests**

| Description | Manufacturer | Model No. | Serial No. | Calibration Due |
|---|---|---|---|---|
| DC Power Supply | BK Precision | 1688 | | n/a |
| Digital Multimeter | Fluke | 16 | 79510141 | December 14, 2005 |

**Test Procedure – Radiated Emissions Tests**

The measurement range investigated was from 30 MHz to 18 GHz due to lack of emissions activity above 5.8GHz. For measurements below 1GHz, the 5.8 GHz Microwave Sensor (the EUT) was set up at 10 meters from the receiving antenna, on an Open Area Test Site (OATS) with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. For measurements above 1GHz, the EUT was set up at 3 meters from the antenna, on the OATS, with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. For measurements above 18GHz, the EUT was set up at a 1 meter from the receiving in a semi-anechoic chamber with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits.

# OPEN FIELD RADIATED EMISSIONS (cont)

**Spectrum Analyzer Configuration (during swept frequency scans) – Radiated Emissions**

IF Bandwidth.....120 kHz
Measurements below 1000 MHz (unless stated otherwise)
- Analyzer Mode (for Peak Measurements) ..... Peak/Log
  - Resolution Bandwidth..... 100 kHz
  - Video Bandwidth..... 100 kHz
- Analyzer Mode (for Quasi-Peak Measurements)
  - Ouasi-Peak/Linear Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 1000 kHz

Measurements above 1000 MHz (unless stated otherwise)
- Quasi-Peak Adapter Mode ..... Disabled
- Analyzer Mode (for Peak Measurements) ..... Peak
  - Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 1000 kHz
- Analyzer Mode (for Average Measurements) ..... Video Filter
  - Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 10 Hz

**Table 5 Data Table Legend and Field Strength Calculation – Radiated Emissions Tests**

Detector mode: Peak (P) or Quasi-Peak (QP) or Average (A)

| | Polarization | Antenna | Freq Range (MHz) |
|---|---|---|---|
| VB | Vertical | EMCO 3104/sn 4463 Biconical | 30 – 200 |
| HB | Horizontal | EMCO 3104/sn 4463 Biconical | 30 – 200 |
| VL | Vertical | EMCO 3146/sn. 2261 Log Periodic | 200 – 1000 |
| HL | Horizontal | EMCO 3146/sn. 2261 Log Periodic | 200 – 1000 |
| VH1 | Vertical | EMCO 3115/sn. 8812-3050 Horn | Below 18000 |
| HH1 | Horizontal | EMCO 3115/sn. 8812-3050 Horn | Below 18000 |
| VH2 | Vertical | HP 3116/sn. 4663 Horn | Below 26500 |
| HH2 | Horizontal | HP 3116/sn. 4663 Horn | Below 26500 |
| VH4 | Vertical | S&D DBD-520 Horn | Below 75000 |
| HH4 | Horizontal | S&D DBD-520 Horn | Below 75000 |

**The margin in the Table 6 is calculated as follows:**
Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyzer Amplitude + Cable Loss + Antenna Factor – Pre-Amp Gain.

# OPEN FIELD RADIATED EMISSIONS Results

**Site Used – Radiated Emissions Measurement**

☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
☒ Test Site 1 - 3m Open Field Radiated Site
☒ Test Site 1 - 10m Open Field Radiated Site
☐ Test Site 2 - Environmental Lab
☐ EMC Lab 1 - Test Laboratory
☒ Semi-Anechoic Absorber Lined Shielded Room
☐ Other: _____

**Administrative Details & Environmental Conditions – Radiated Emissions Measurement**

| | |
|---|---|
| **Test Date:** | July 08, 2005 |
| **Test Engineer:** | Bob Kershaw & Femi Ojo |
| **Temperature** | 75.4°F |
| **Humidity** | 37% |

**Table 6 Test Data for Radiated Emissions Measurement up to 1 GHz @ 10 meters**

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations.

| INDICATED | | CORRECTION | | CORR | TURNTABLE | ANT | | CLASS A | | CLASS B | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQ | AMPL | ANT | CAB | AMPL | ANG | HT | POL | AMPL | MARG | AMPL | MARG | FILTER | |
| MHz | dBuV/m | dB | dB | dBuV/m | DEG | m | - | dBuV/m | dB | dBuV/m | db | MODE | NOTES |
| 32.94 | 5.9 | 11.1 | 1.9 | 18.9 | 90 | 2.5 | HB | - | - | 30.0 | -11.1 | P | |
| 40.04 | 6.1 | 11.3 | 2.2 | 19.6 | 0 | 1.0 | VB | - | - | 30.0 | -10.4 | P | |
| 50.13 | 8.8 | 11.7 | 2.2 | 22.7 | 180 | 2.0 | HB | - | - | 30.0 | -7.3 | P | |
| 65.84 | 5.8 | 7.9 | 2.6 | 16.3 | 90 | 1.0 | VB | - | - | 30.0 | -13.7 | P | |
| 110.57 | 5.6 | 12.0 | 3.2 | 20.9 | 90 | 1.0 | VB | - | - | 33.0 | -12.1 | P | |
| 117.49 | 5.2 | 12.9 | 3.2 | 21.4 | 120 | 1.0 | VB | - | - | 33.0 | -11.6 | P | |
| 132.77 | 5.6 | 12.5 | 3.4 | 21.5 | 90 | 1.0 | VB | - | - | 33.0 | -11.5 | P | |
| 149.38 | 5.8 | 12.2 | 3.8 | 21.8 | 0 | 2.0 | HB | - | - | 33.0 | -11.2 | P | |
| 203.86 | 8.9 | 11.8 | 3.9 | 24.5 | 90 | 1.0 | VL | - | - | 33.0 | -8.5 | P | |
| 204.68 | 2.5 | 11.4 | 3.9 | 17.8 | 0 | 2.0 | HL | - | - | 33.0 | -15.2 | P | |
| 220.57 | 7.9 | 11.1 | 3.8 | 22.8 | 0 | 1.0 | VL | - | - | 36.0 | -13.2 | P | |
| 408.60 | 4.0 | 15.7 | 6.2 | 25.9 | 90 | 1.0 | VL | - | - | 36.0 | -10.1 | P | |
| 440.81 | 3.6 | 15.9 | 6.6 | 26.1 | 90 | 2.0 | HL | - | - | 36.0 | -9.9 | P | |
| 444.86 | 4.3 | 16.2 | 6.8 | 27.3 | 90 | 1.0 | VL | - | - | 36.0 | -8.7 | P | |
| 558.44 | 1.5 | 18.0 | 8.1 | 27.6 | 90 | 1.0 | VL | - | - | 36.0 | -8.4 | P | |
| 573.30 | 3.1 | 17.5 | 8.5 | 29.1 | 0 | 1.0 | VL | - | - | 36.0 | -6.9 | P | |

No emission of significant level was observed between 573.30MHz and 1GHz.

## Test Data Legend

P = Peak
QP = Quasi Peak

The margin is calculated as follows:
Margin = Corrected Amplitude - Limit; where Corrected Amplitude = Amplitude + Cable Loss + Antenna Factor.

## Conclusion

The Jaguar's X-150, 5.8 GHz Microwave Sensor meets the requirements of FCC Part 15, Class B for radiated emissions.

# OPEN FIELD RADIATED EMISSIONS Results (cont.)

**Open Field Radiated Emissions Test Setup Photographs**

**Figure 1: Open Field Radiated Emissions below 1 GHz (front view)**

**Figure 2: Open Field Radiated Emissions below 1 GHz (rear view)**

# OPEN FIELD RADIATED EMISSIONS Results (cont.)

**Administrative Details and Environmental Conditions– Radiated Emissions Measurement**

| | |
|---|---|
| **Test Date:** | July 08, 2005 |
| **Test Engineer:** | Bob Kershaw & Femi Ojo |
| **Temperature** | 75.4°F |
| **Humidity** | 37% |

**Table 7 Test Data for Radiated Emissions Measurement above 1 GHz @ 3 meters**

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations.

| INDICATED | | CORRECTION | | CORR | TURNTABLE | ANT | | CLASS A | | CLASS B | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQ | AMPL | ANT | CAB | AMPL | ANG | HT | POL | AMPL | MARG | AMPL | MARG | FILTER | |
| MHz | dBuV/m | dB | dB | dBuV/m | DEG | m | - | dBuV/m | dB | dBuV/m | db | MODE | NOTES |
| 1038.0 | 46.8 | 24.3 | -34.6 | 36.5 | 0 | 1.0 | VH | - | - | 54.0 | -17.5 | P | |
| 1040.0 | 45.6 | 24.3 | -34.6 | 35.3 | 90 | 1.2 | HH | - | - | 54.0 | -18.7 | P | |
| 1138.0 | 49.2 | 24.4 | -34.5 | 39.1 | 0 | 1.0 | VH | - | - | 54.0 | -14.9 | P | |
| 1173.0 | 49.7 | 24.5 | -34.4 | 39.7 | 0 | 1.0 | VH | - | - | 54.0 | -14.3 | P | |
| 1184.0 | 48.7 | 24.5 | -34.4 | 38.8 | 90 | 1.2 | HH | - | - | 54.0 | -15.2 | P | |
| 1215.0 | 46.2 | 24.6 | -34.4 | 36.4 | 0 | 1.0 | HH | - | - | 54.0 | -17.6 | P | |
| 1243.0 | 51.5 | 24.6 | -34.3 | 41.8 | 0 | 1.0 | VH | - | - | 54.0 | -12.2 | P | |
| 1244.0 | 45.5 | 24.6 | -34.3 | 35.8 | 90 | 1.2 | HH | - | - | 54.0 | -18.2 | P | |
| 2181.0 | 44.7 | 28.0 | -32.8 | 39.9 | 0 | 1.0 | VH | - | - | 54.0 | -14.1 | P | |
| 2215.0 | 43.3 | 28.2 | -32.7 | 38.7 | 90 | 1.2 | HH | - | - | 54.0 | -15.3 | P | |
| 3642.0 | 44.2 | 31.6 | -31.2 | 44.6 | 0 | 1.0 | VH | - | - | 54.0 | -9.4 | P | |
| 4750.0 | 45.3 | 32.8 | -29.8 | 48.3 | 0 | 1.0 | VH | - | - | 54.0 | -5.7 | P | |
| 5371.0 | 45.8 | 34.0 | -29.5 | 50.3 | 0 | 1.0 | VH | - | - | 54.0 | -3.7 | P | |
| 5765.0 | 36.3 | 34.4 | -29.2 | 41.4 | 0 | 1.0 | VH | - | - | 54.0 | -12.6 | P | |
| 5799.0 | 56.2 | 34.4 | -29.2 | 61.4 | 90 | 1.2 | HH | - | - | 141.0 | -79.6 | P | Fund. |
| 6857.0 | 44.0 | 35.0 | -29.1 | 50.0 | 90 | 1.2 | HH | - | - | 54.0 | -4.0 | P | |
| 11531. | 37.7 | 39.1 | -27.4 | 49.4 | 0 | 1.0 | VH | - | - | 54.0 | -4.6 | P | |
| 11531. | 36.0 | 39.2 | -27.4 | 47.8 | 90 | 1.2 | HH | - | - | 54.0 | -6.2 | P | |
| 17296. | 30.5 | 42.9 | -23.9 | 49.6 | 0 | 1.0 | VH | - | - | 54.0 | -4.4 | P | |

No emission of significant level was observed between 17.3GHz and 10GHz

## Test Data Legend

P = Peak
QP = Quasi Peak

The margin is calculated as follows:
Margin = Corrected Amplitude - Limit; where Corrected Amplitude = Amplitude + Cable Loss + Antenna Factor.

## Conclusion

The Jaguar's X-150, 5.8 GHz Microwave Sensor meets the requirements of FCC Part 15, Class B for radiated emissions.

# OPEN FIELD RADIATED EMISSIONS Results (cont.)

### Radiated Emissions Test Setup Photographs

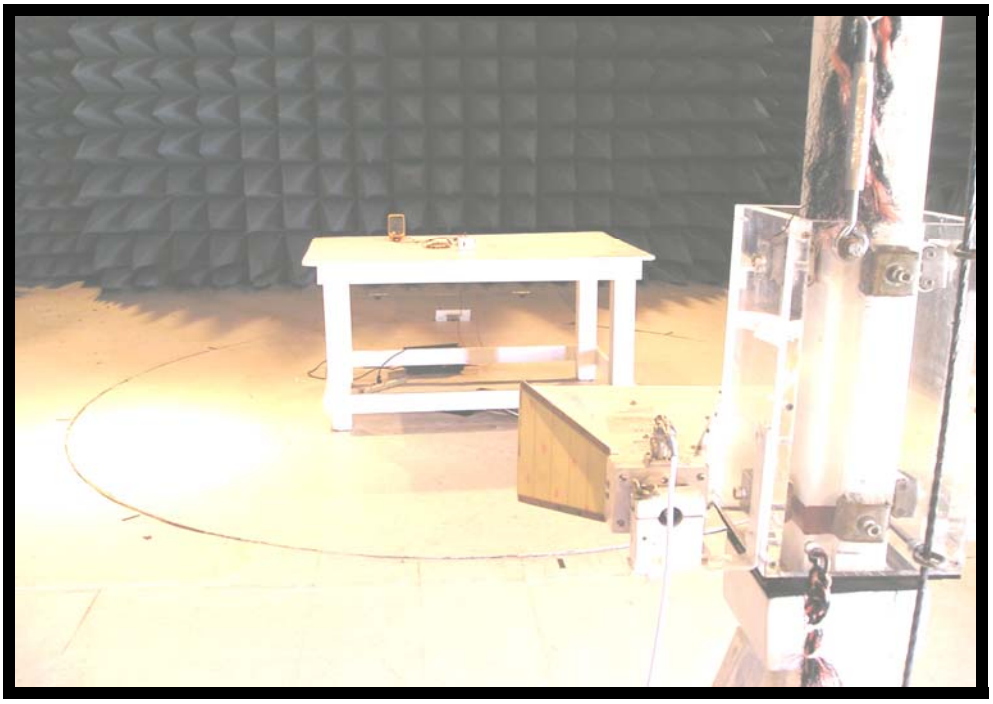

**Figure 3: Radiated Emissions above 1 GHz (front view)**

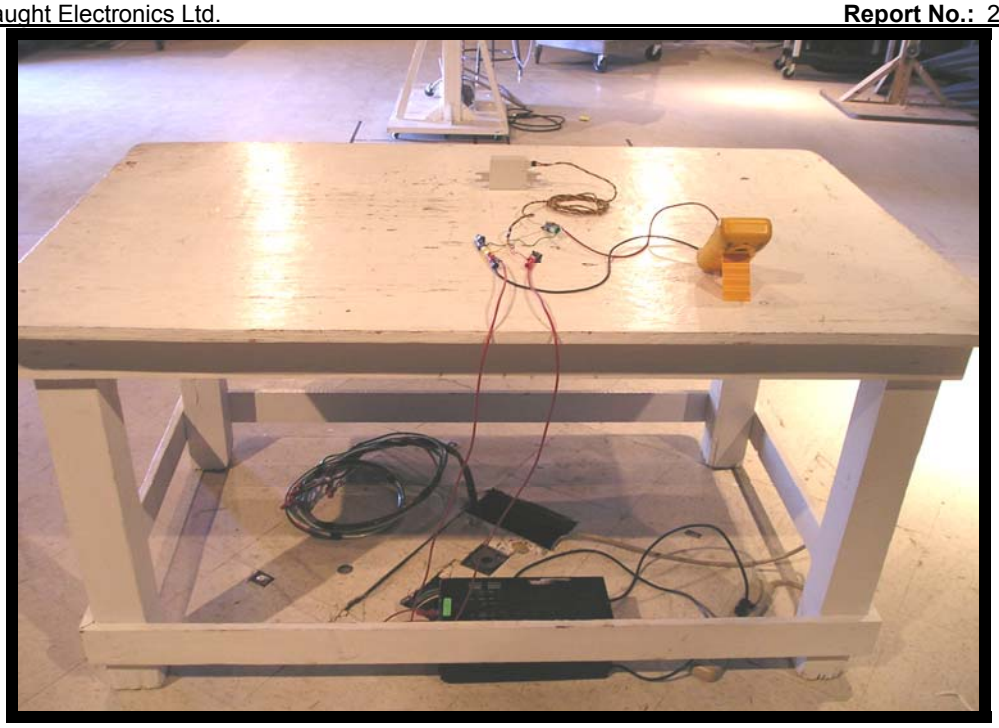

**Figure 4: Radiated Emissions above 1 GHz (rear view)**

# PART 3 RF MEASUREMENTS

**Test Specification: 47 CFR PART 15, Sub-Part C**

**EUT Description:**
Connaught's product 5.8GHz microwave sensor, models; 902915 and 902916(or the EUTs) as referred to in this report are intentional radiators. The units are similar both in design and functionality. One of the EUTs (model 902916) was tested and based on engineering judgment, the results hold for both models. The EUT comes with an antenna permanently attached. The EUT, was set up on a wooden table, 80cm above the ground reference plane in an anechoic chamber and or on an open field. It was powered and tested in normal continuous mode.

**Supply Voltage Tested: 13.5VDC**

**Table 8: Support Equipment – RF Measurements**

| Description | Manufacturer | Model No. | Serial No. | Calibration Due |
|---|---|---|---|---|
| DC Power Supply | BK Precision | 1688 | | n/a |
| Digital Multimeter | Fluke | 16 | 79510141 | December 14, 2005 |

**Table 9: Test Equipment – RF Measurements**

| Equipment Description | Manufacturer | Model Name | Serial Number | Calibration Due |
|---|---|---|---|---|
| Preamplifier | Hewlett-Packard | 8449B | 3008A00101 | N/A |
| Preselector | Hewlett-Packard | 85685A | 2620A00265 | 12-11-2005 |
| Biconical Antenna | EMCO | 3104 | 9111-4463 | 01-16-2006 |
| l.p. Ant (200 -1000MHz) | EMCO | 3146 | 2261 | 01-22-2006 |
| Quasi Peak Adapter | Hewlett-Packard | 85650A | 2521A00737 | 12-11-2005 |
| Spectrum Analyzer | Hewlett-Packard | 8568B | 2841A04315 | 12-11-2005 |
| Spectrum Analyzer Display | Hewlett-Packard | - | - | 12-11-2005 |
| Horn. Ant (Below 18GHz) | EMCO | 3115 | 8812-3050 | 01-19-2006 |
| Horn. Ant (Below 40GHz) | HP | 3116 | 4663 | 02-18-2006 |
| Spectrum Analyzer | Hewlett-Packard | 8569A | 2128A00270 | 04-23-2006 |

**Table 10 Support Equipment – Radiated Emissions Tests**

| Description | Manufacturer | Model No. | Serial No. | Calibration Due |
|---|---|---|---|---|
| DC Power Supply | BK Precision | 1688 | | n/a |
| Digital Multimeter | Fluke | 16 | 79510141 | December 14, 2005 |

**General Test Procedure – RF Tests**

For the spurious and harmonics measurements, below 18GHz, the 5.8 GHz Microwave Sensor (the EUT) was set up at a 3 meter distance from the receiving antenna, on an Open Area Test Site (OATS), with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. For measurements above 18GHz, the EUT was set up at a 1 meter distance from the antenna, in a semi-anechoic chamber, with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits.

For the field strength measurements of the fundamental frequency, the EUT was setup in an anechoic chamber at a 3 meter distance from the receiving antenna. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the field strength emission of the fundamental. The maximum level of the fundamental emission from the EUT was measured and recorded at optimum antenna and table orientation to determine margin to the limits.

# PART 3 RF MEASUREMENTS (cont.)

**Spectrum Analyzer Configuration (during swept frequency scans) – Radiated Emissions**

IF Bandwidth.....120 kHz
Measurements below 1000 MHz (unless stated otherwise)
- Analyzer Mode (for Peak Measurements) ..... Peak/Log
  - Resolution Bandwidth..... 100 kHz
  - Video Bandwidth..... 100 kHz
- Analyzer Mode (for Quasi-Peak Measurements)
  - Ouasi-Peak/Linear Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 1000 kHz

Measurements above 1000 MHz (unless stated otherwise)
- Quasi-Peak Adapter Mode ..... Disabled
- Analyzer Mode (for Peak Measurements) ..... Peak
  - Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 1000 kHz
- Analyzer Mode (for Average Measurements) ..... Video Filter
  - Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 10 Hz

**Table 11 Data Table Legend and Field Strength Calculation – Radiated Emissions Tests**

Detector mode: Peak (P) or Quasi-Peak (QP) or Average (A)

| | Polarization | Antenna | Freq Range (MHz) |
|---|---|---|---|
| VB | Vertical | EMCO 3104/sn 4463 Biconical | 30 – 200 |
| HB | Horizontal | EMCO 3104/sn 4463 Biconical | 30 – 200 |
| VL | Vertical | EMCO 3146/sn. 2261 Log Periodic | 200 – 1000 |
| HL | Horizontal | EMCO 3146/sn. 2261 Log Periodic | 200 – 1000 |
| VH1 | Vertical | EMCO 3115/sn. 8812-3050 Horn | Below 18000 |
| HH1 | Horizontal | EMCO 3115/sn. 8812-3050 Horn | Below 18000 |
| VH2 | Vertical | HP 3116/sn. 4663 Horn | Below 26500 |
| HH2 | Horizontal | HP 3116/sn. 4663 Horn | Below 26500 |
| VH4 | Vertical | S&D DBD-520 Horn | Below 75000 |
| HH4 | Horizontal | S&D DBD-520 Horn | Below 75000 |

# FIELD STRENGTH OF FUNDAMENTAL

### FIELD STRENGTH Measurement

The EUT was set up as described above. The measurement instrumentation used was an Analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003.

**Site Used – Field Strength of Fundamental Measurements**

☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
☐ Test Site 1 - 3m Open Field Radiated Site
☐ Test Site 1 - 10m Open Field Radiated Site
☐ Test Site 2 - Environmental Lab
☐ EMC Lab 1 - Test Laboratory
☒ Semi-Anechoic Absorber Lined Shielded Room
☐ Other: _____

**Administrative Details and Environmental Conditions – Field Strength of Fundamental Measurements**

| | |
|---|---|
| **Test Date(s):** | July 07 , 2005 |
| **Test Engineer(s):** | Bob Kershaw & Femi Ojo |
| **Temperature** | 71°F |
| **Humidity** | 42% |

### Test Data – Field Strength of Fundamental

The measurement plot below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### Field Strength of Fundamental Plot.

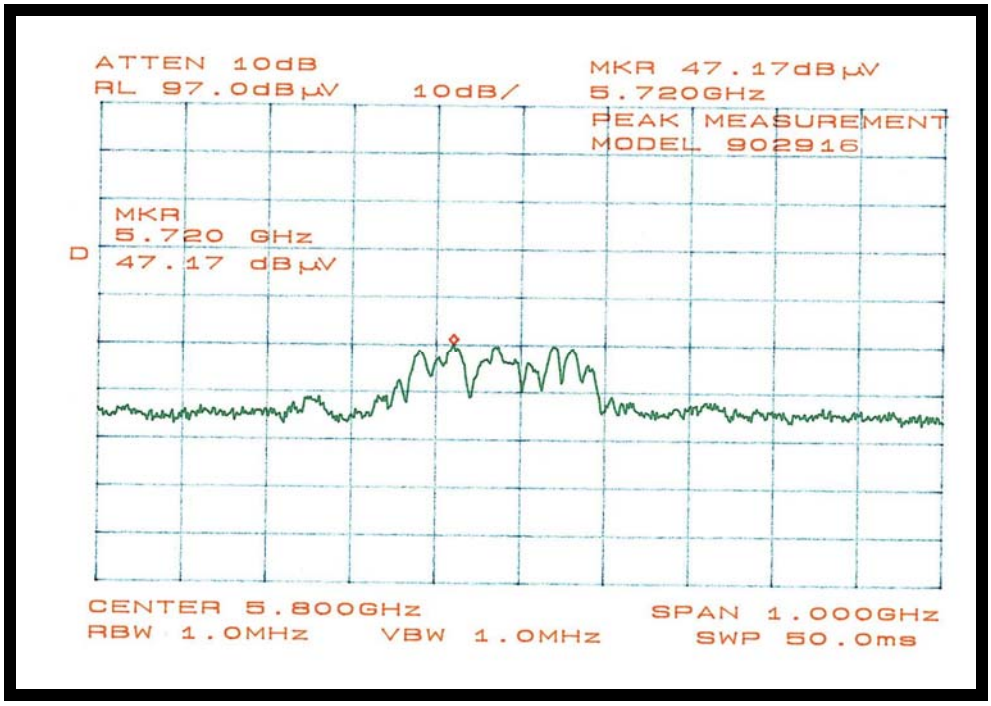


**Figure 5: Plot of Field Strength of Fundamental Peak Measurement.**

# FIELD STRENGTH OF FUNDAMENTAL (cont.)

| INDICATED | | CORRECTION | | CORR | TURNTABLE ANT | | | CLASS A | | CLASS B | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQ | AMPL | ANT | CAB / AMP | AMPL | ANG | HT | POL | AMPL | MARG | AMPL | MARG | DET |
| GHz | dBuV/m | dB | dB | dBuV/m | DEG | m | - | dBuV/m | dB | dBuV/m | dB | MODE |
| 5.720 | 47.2 | 34.3 | -29.3 | 52.2 | 90 | 1.0 | VH | - | - | 74 | -21.8 | p |
| 5.723 | 45.7 | 34.3 | -29.3 | 50.7 | 0 | 1.0 | HH | - | - | 74 | -23.3 | p |

**Table 12: Field Strength of Fundamental Test Data – Peak Measurement**

**The margin in Table 12 is calculated as follows:**
Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyzer Amplitude + Cable Loss + Antenna Factor – Pre-Amp Gain.

**Test-Data Summary – Peak Measurement:**

**Center Frequency** = 5800 MHz
**Peak Level:** = 52.2dBµV/m
**Peak Limit (15.209)** = 74.00dBµV/m (54dBµV/m + 20dB)

**Average Level Calculation of Field Strength of Fundamental with Duty Cycle correction.**
The duty cycle rating as provided by the manufacturer is 0.83% (or 0.0083) over a 100mSec interval = 0.0083 seconds.

| | | |
|---|---|---|
| **dB (in µV) Duty Cycle Correction** | =0.0083 secs =20log(0.0083) | = -41. 62dBµV |
| **Pulse Desensitization Factor (PDF)** | = -40dB | |
| **Peak Level with PDF** | = 52.2 dBµV/m + 40dB | = 92.2dBµV/m |
| **Peak Level with Duty Cycle Correction** | =92.2dBµV/m – 41.62dB | = 50.58dBµV/m |

**Test-Data Summary – Average Measurement:**

**Center Frequency** = 5800 MHz
**Average Level:** = 50.58dBµV/m (Calculated).
**Average Limit (15.209)** = 54.00dBµV/m

## Conclusion

The 5.8 GHz Microwave Sensor meets the requirements of the test reference for Fundamental Frequency Field Strength.

# FIELD STRENGTH OF FUNDAMENTAL (cont.)

**OCCUPIED BANDWIDTH measurement**

For the measurements, a spectrum analyzer was used. The EUT was measured according to the method specified in ANSI C63.4-2003.

**Site Used – Occupied Bandwidth Measurements**

☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
☒ Test Site 1 - 3m Open Field Radiated Site
☐ Test Site 1 - 10m Open Field Radiated Site
☐ Test Site 2 - Environmental Lab
☐ EMC Lab 1 - Test Laboratory
☒ Semi-Anechoic Absorber Lined Shielded Room
☐ Other: _____

**Administrative Details – Occupied Bandwidth Measurements**

| | |
|---|---|
| **Test Date(s):** | July 07 , 2005 |
| **Test Engineer(s):** | Bob Kershaw & Femi Ojo |
| **Temperature** | 71°F |
| **Humidity** | 42% |

**Test Measurement: Occupied Bandwidth Measurements (Performed in Anechoic Chamber)**

The EUT was set up on a wooden non-conductive tabletop, 80 cm above the ground plane of the test location. Pre-scan measurements were first performed with a spectrum analyzer at 3 meter from a receiving antenna, in a Semi-Anechoic Chamber at the pre-determined worst-case height at 1 meter and in vertical polarity. The EUT running in continuous mode and was rotated 360 degrees azimuth in its x-y-z axis positions. It was also measured in the horizontal polarity. The analyzer was then placed in 'max-hold' mode to record signal level.

**Spectrum Analyzer Configuration (during swept frequency scans) – Occupied Bandwidth**

Start Frequency ..... 5.300 GHz
Stop Frequency ..... 6.300 GHz
Sweep Speed ..... 100 mSecs
RES Bandwidth..... 1000 kHz
Video Bandwidth..... 1000 kHz
Quasi Peak Adapter Mode ..... Bypass
Quasi peak Adapter Bandwidth ..... Disabled

# FIELD STRENGTH OF FUNDAMENTAL (cont.)

**Occupied Bandwidth Measurement Plot**

The plot and test data below represents the maximum worst-case results from the measurements performed in accordance to the requirements of the standard and extreme test conditions specified at the beginning of this Part.

**Spectrum Mask Measurement**

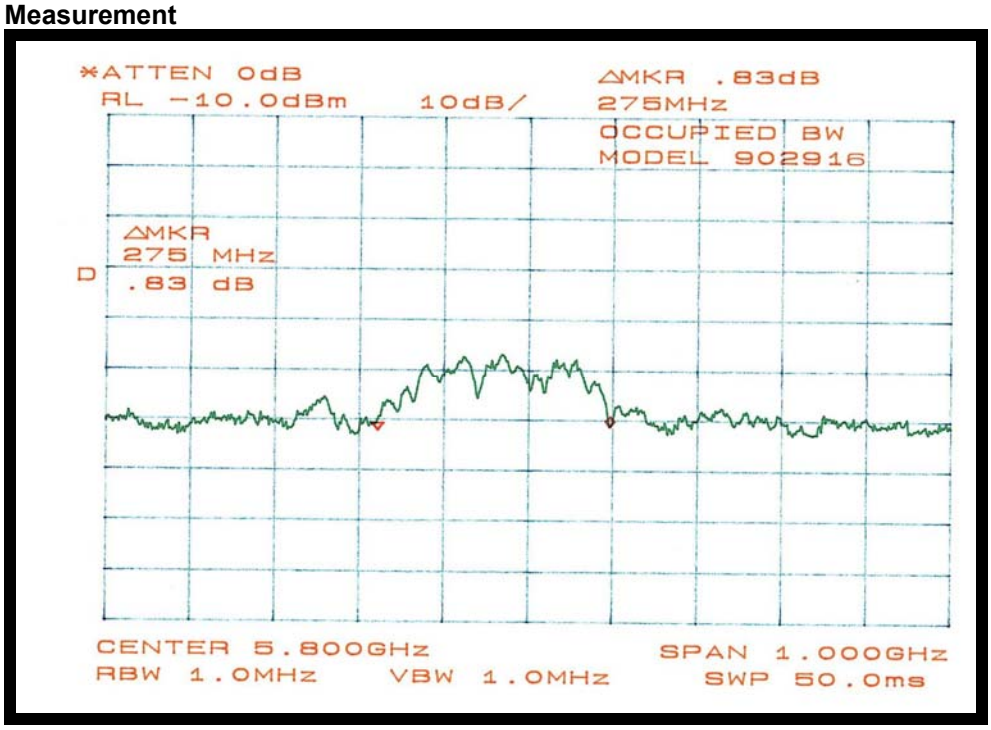


**Figure 6: Occupied Bandwidth Plot**

**Test-Data Summary – Occupied Bandwidth:**

| | | | |
|---|---|---|---|
| **Center frequency:** | 5800 MHz | | |
| **Mask Bandwidth:** | 275 MHz | | |
| **Occupied Bandwidth Data:** | | | |
| **Upper Frequency ($F_u$)** | $=f_0 + 275/2$ | =5800 MHz + 137.5 | =5937.5 MHz |
| **Lower Frequency ($f_L$)** | $=f_0 - 275/2$ | =5800 MHz – 137.5 | =5662.5 MHz |

## FIELD STRENGTH OF FUNDAMENTAL (cont.)

**Measurement Photographs for Field Strength of Fundamental and Occupied Bandwidth**

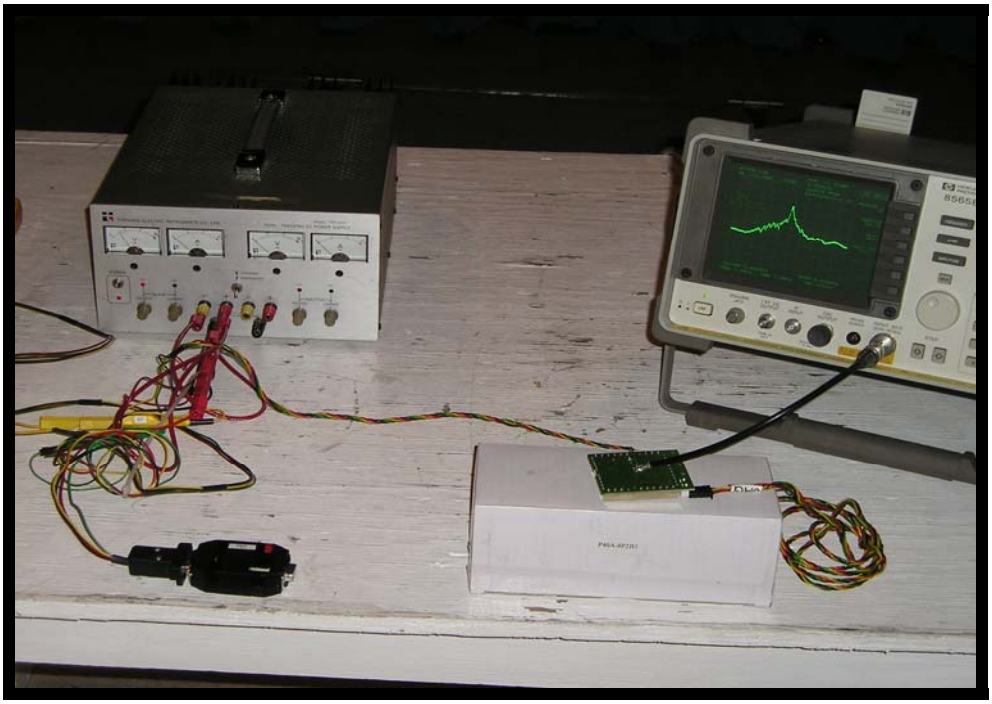

**Figure 7 Test Set Up Photos – Field Strength of Fundamental Measurement (Front)**

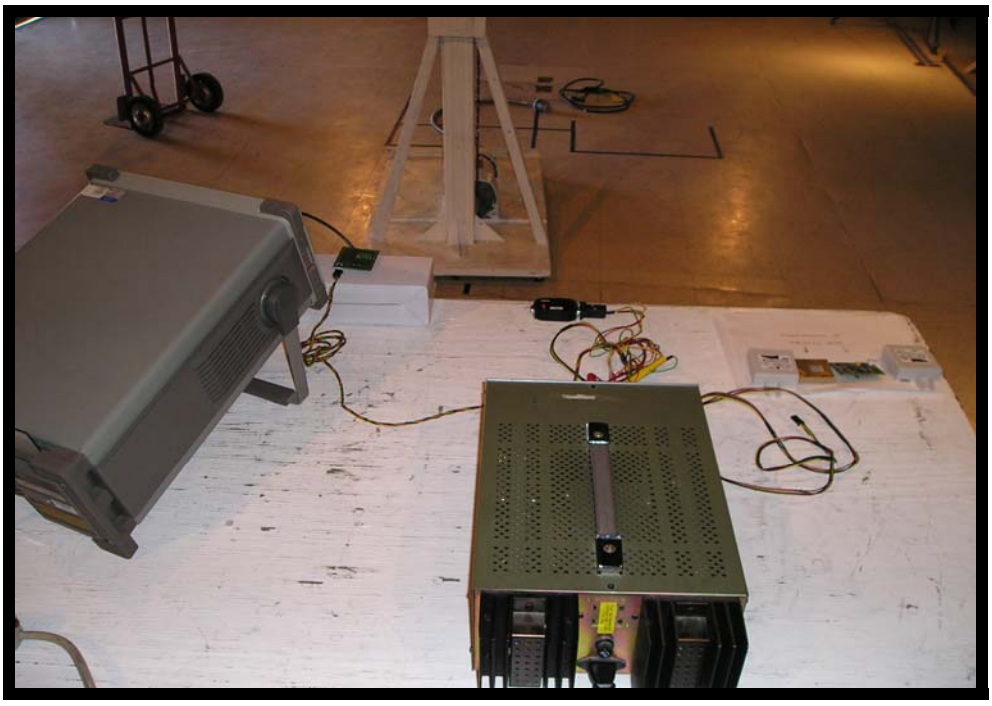

**Figure 8 Test Set Up Photos – Field Strength of Fundamental Measurement (Rear)**

# SPURIOUS EMISSIONS, HARMONICS, and Emissions in the RESTRICTED BANDS

**Test Specification:** FCC PART 15, SECTION 47 CFR 15.205
FCC PART 15, SECTION 47 CFR 15.209

**Test Procedure – Spurious Emissions:**
The measurement range investigated was from 30 MHz to 18 GHz due to lack of emissions activity above 5.8GHz. The measurement instrumentation used was an Analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003

**Site Used – Harmonics Emissions Measurements**

☐ Test Site 1 - Shielded Room: 16' x 12' x 9'
☒ Test Site 1 - 3m Open Field Radiated Site
☐ Test Site 1 - 10m Open Field Radiated Site
☐ Test Site 2 - Environmental Lab
☐ EMC Lab 1 - Test Laboratory
☒ Semi-Anechoic Absorber Lined Shielded Room
☐ Other: _____

**Administrative Details and Environmental Conditions– Spurious and Restricted Bands Emissions**

| | |
|---|---|
| **Test Date:** | July 08, 2005 |
| **Test Engineer:** | Bob Kershaw & Femi Ojo |
| **Temperature** | 75.4°F |
| **Humidity** | 37% |

**Spectrum Analyzer Configuration (during swept frequency scans) – Spurious and Restricted Emissions**

IF Bandwidth.....120 kHz
Measurements below 1000 MHz (unless stated otherwise)
- Analyzer Mode (for Peak Measurements) ..... Peak/Log
  - Resolution Bandwidth..... 100 kHz
  - Video Bandwidth..... 100 kHz
- Analyzer Mode (for Quasi-Peak Measurements)
  - Ouasi-Peak/Linear Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 1000 kHz

Measurements above 1000 MHz (unless stated otherwise)
- Quasi-Peak Adapter Mode ..... Disabled (if available)
- Analyzer Mode (for Peak Measurements) ..... Peak
  - Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 1000 kHz
- Analyzer Mode (for Average Measurements) ..... Video Filter
  - Resolution Bandwidth..... 1000 kHz
  - Video Bandwidth..... 10 Hz

## SPURIOUS, HARMONICS, and RESTRICTED BANDS Emissions (cont.)

### Test Details – Spurious and Restricted Bands Emissions

| | |
|---|---|
| **Transmitter** | Operating Mode |
| **Limit** | 47CFR 15.209 (a) |

The tables below shows the summary of the highest amplitudes of the spurious RF radiated emissions from the equipment under test.

### Table 13 Test Data – Spurious and Restricted Bands Emissions below 1GHz

| INDICATED | | CORRECTION | | CORR | TURNTABLE | ANT | | CLASS A | | CLASS B | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQ | AMPL | ANT | CAB | AMPL | ANG | HT | POL | AMPL | MARG | AMPL | MARG | FILTER | |
| MHz | dBuV/m | dB | dB | dBuV/m | DEG | m | - | dBuV/m | dB | dBuV/m | db | MODE | NOTES |
| 32.94 | 5.9 | 11.1 | 1.9 | 18.9 | 90 | 2.5 | HB | - | - | 30.0 | -11.1 | P | |
| 40.04 | 6.1 | 11.3 | 2.2 | 19.6 | 0 | 1.0 | VB | - | - | 30.0 | -10.4 | P | |
| 50.13 | 8.8 | 11.7 | 2.2 | 22.7 | 180 | 2.0 | HB | - | - | 30.0 | -7.3 | P | |
| 65.84 | 5.8 | 7.9 | 2.6 | 16.3 | 90 | 1.0 | VB | - | - | 30.0 | -13.7 | P | |
| 110.57 | 5.6 | 12.0 | 3.2 | 20.9 | 90 | 1.0 | VB | - | - | 33.0 | -12.1 | P | |
| 117.49 | 5.2 | 12.9 | 3.2 | 21.4 | 120 | 1.0 | VB | - | - | 33.0 | -11.6 | P | |
| 132.77 | 5.6 | 12.5 | 3.4 | 21.5 | 90 | 1.0 | VB | - | - | 33.0 | -11.5 | P | |
| 149.38 | 5.8 | 12.2 | 3.8 | 21.8 | 0 | 2.0 | HB | - | - | 33.0 | -11.2 | P | |
| 203.86 | 8.9 | 11.8 | 3.9 | 24.5 | 90 | 1.0 | VL | - | - | 33.0 | -8.5 | P | |
| 204.68 | 2.5 | 11.4 | 3.9 | 17.8 | 0 | 2.0 | HL | - | - | 33.0 | -15.2 | P | |
| 220.57 | 7.9 | 11.1 | 3.8 | 22.8 | 0 | 1.0 | VL | - | - | 36.0 | -13.2 | P | |
| 408.60 | 4.0 | 15.7 | 6.2 | 25.9 | 90 | 1.0 | VL | - | - | 36.0 | -10.1 | P | |
| 440.81 | 3.6 | 15.9 | 6.6 | 26.1 | 90 | 2.0 | HL | - | - | 36.0 | -9.9 | P | |
| 444.86 | 4.3 | 16.2 | 6.8 | 27.3 | 90 | 1.0 | VL | - | - | 36.0 | -8.7 | P | |
| 558.44 | 1.5 | 18.0 | 8.1 | 27.6 | 90 | 1.0 | VL | - | - | 36.0 | -8.4 | P | |
| 573.30 | 3.1 | 17.5 | 8.5 | 29.1 | 0 | 1.0 | VL | - | - | 36.0 | -6.9 | P | |

No emission of significant level was observed between 17.3GHz and 10GHz

### Table 14 Test Data for Radiated Emissions Measurement above 1 GHz @ 3 meters

| INDICATED | | CORRECTION | | CORR | TURNTABLE | ANT | | CLASS A | | CLASS B | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FREQ | AMPL | ANT | CAB | AMPL | ANG | HT | POL | AMPL | MARG | AMPL | MARG | FILTER | |
| MHz | dBuV/m | dB | dB | dBuV/m | DEG | m | - | dBuV/m | dB | dBuV/m | db | MODE | NOTES |
| 1038.0 | 46.8 | 24.3 | -34.6 | 36.5 | 0 | 1.0 | VH | - | - | 54.0 | -17.5 | P | |
| 1040.0 | 45.6 | 24.3 | -34.6 | 35.3 | 90 | 1.2 | HH | - | - | 54.0 | -18.7 | P | |
| 1138.0 | 49.2 | 24.4 | -34.5 | 39.1 | 0 | 1.0 | VH | - | - | 54.0 | -14.9 | P | |
| 1173.0 | 49.7 | 24.5 | -34.4 | 39.7 | 0 | 1.0 | VH | - | - | 54.0 | -14.3 | P | |
| 1184.0 | 48.7 | 24.5 | -34.4 | 38.8 | 90 | 1.2 | HH | - | - | 54.0 | -15.2 | P | |
| 1215.0 | 46.2 | 24.6 | -34.4 | 36.4 | 0 | 1.0 | HH | - | - | 54.0 | -17.6 | P | |
| 1243.0 | 51.5 | 24.6 | -34.3 | 41.8 | 0 | 1.0 | VH | - | - | 54.0 | -12.2 | P | |
| 1244.0 | 45.5 | 24.6 | -34.3 | 35.8 | 90 | 1.2 | HH | - | - | 54.0 | -18.2 | P | |
| 2181.0 | 44.7 | 28.0 | -32.8 | 39.9 | 0 | 1.0 | VH | - | - | 54.0 | -14.1 | P | |
| 2215.0 | 43.3 | 28.2 | -32.7 | 38.7 | 90 | 1.2 | HH | - | - | 54.0 | -15.3 | P | |
| 3642.0 | 44.2 | 31.6 | -31.2 | 44.6 | 0 | 1.0 | VH | - | - | 54.0 | -9.4 | P | |
| 4750.0 | 45.3 | 32.8 | -29.8 | 48.3 | 0 | 1.0 | VH | - | - | 54.0 | -5.7 | P | |
| 5371.0 | 45.8 | 34.0 | -29.5 | 50.3 | 0 | 1.0 | VH | - | - | 54.0 | -3.7 | P | |
| 5765.0 | 36.3 | 34.4 | -29.2 | 41.4 | 0 | 1.0 | VH | - | - | 54.0 | -12.6 | P | |
| 5799.0 | 56.2 | 34.4 | -29.2 | 61.4 | 90 | 1.2 | HH | - | - | 141.0 | -79.6 | P | Fund. |
| 6857.0 | 44.0 | 35.0 | -29.1 | 50.0 | 90 | 1.2 | HH | - | - | 54.0 | -4.0 | P | |
| 11531. | 37.7 | 39.1 | -27.4 | 49.4 | 0 | 1.0 | VH | - | - | 54.0 | -4.6 | P | |
| 11531. | 36.0 | 39.2 | -27.4 | 47.8 | 90 | 1.2 | HH | - | - | 54.0 | -6.2 | P | |
| 17296. | 30.5 | 42.9 | -23.9 | 49.6 | 0 | 1.0 | VH | - | - | 54.0 | -4.4 | P | |

No emission of significant level was observed between 17.3GHz and 10GHz

# SPURIOUS, HARMONICS, and RESTRICTED BANDS Emissions (cont.)

**Test-Data Summary – Spurious, Harmonics, and Restricted Bands Measurements**

**The margin in Table 14 is calculated as follows:**
Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyzer Amplitude + Cable Loss + Antenna Factor – Pre-Amp Gain.

**Conclusion**
The 5.8 GHz Microwave Sensor meets the requirements of the test reference for Spurious and Restricted Bands emissions levels specified in the 47CFR15.209

# SPURIOUS and RESTRICTED BANDS Emissions (cont)

**Test Photographs**

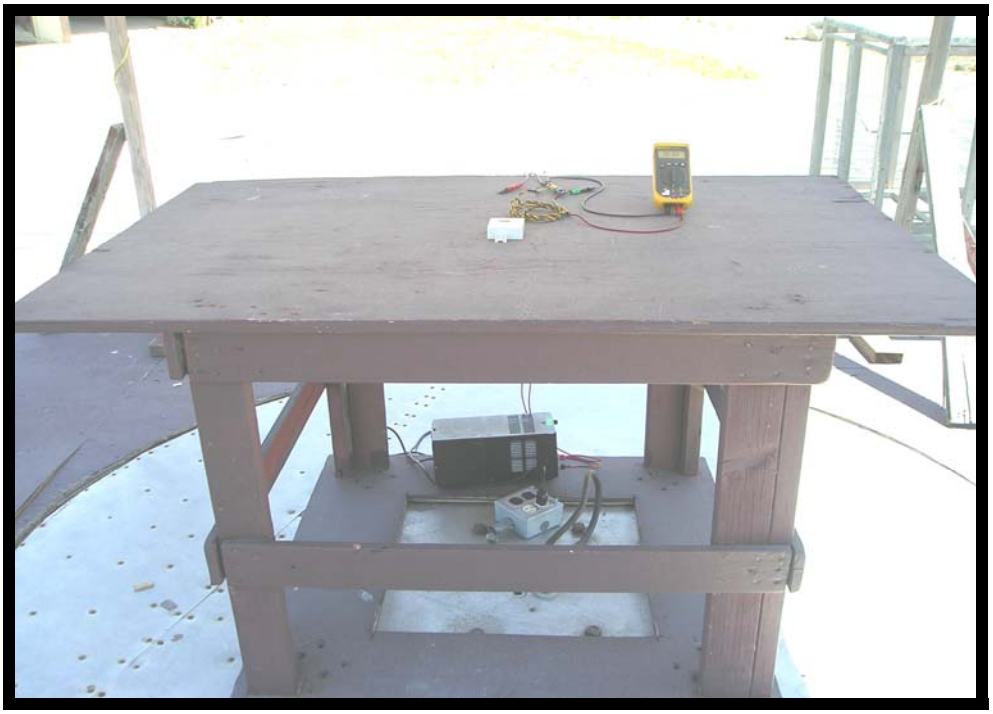

**Figure 9: Spurious emissions below 1 GHz (front view)**

**Figure 10: Spurious emissions below 1GHz (rear view)**

**Spurious emissions (cont.)**

**Test Photographs (cont.)**

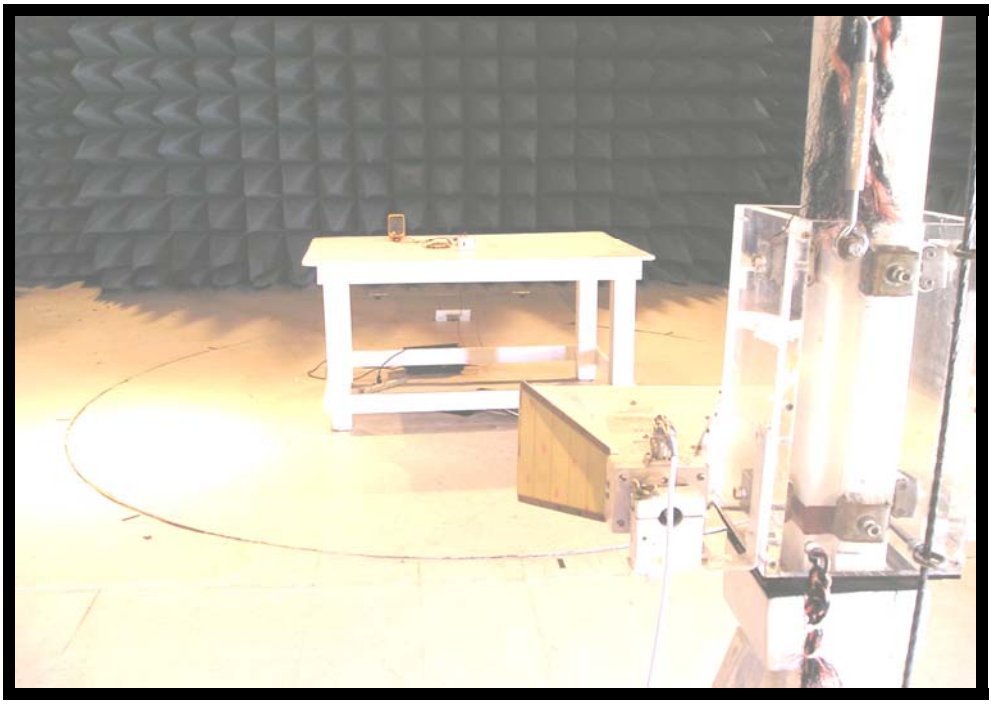

**Figure 11: Spurious emission above 1 GHz (front view)**

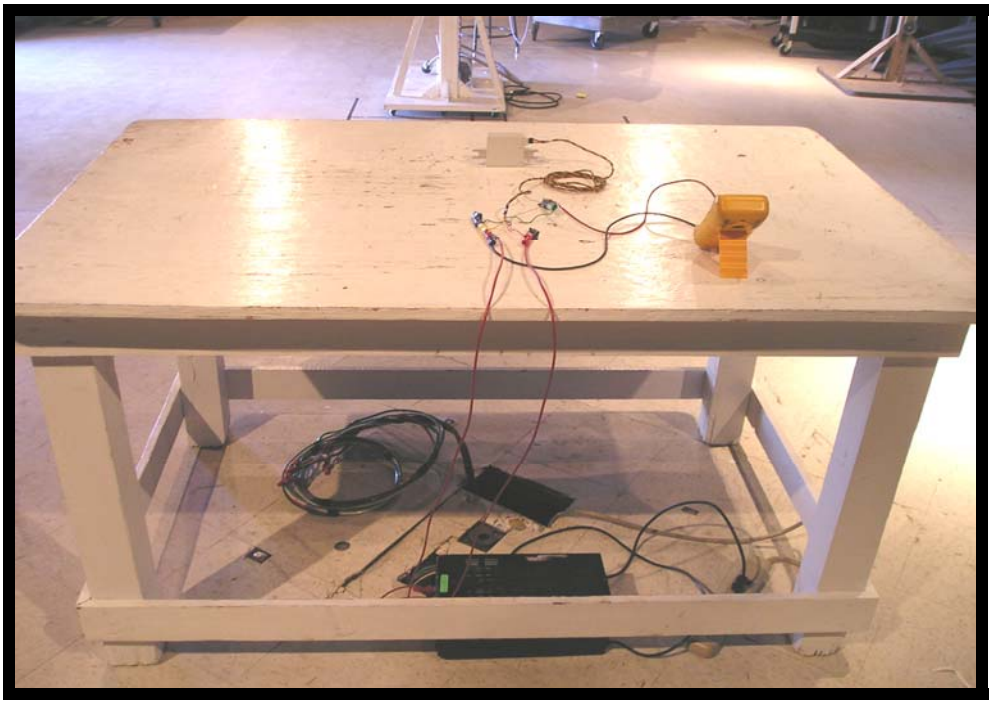

**Figure 12: Spurious emission above 1 GHz (rear view)**

# PART 4 APPENDICES

## A. EUT Technical Specification

| | | | |
|---|---|---|---|
| Applicant | Connaught Electronics, Ltd. | | |
| Product Specifications | | | |
| Description | 5.8GHz Microwave Sensor | | |
| | Frequency Range | 5616.0 MHz to 5984.0 MHz | |
| | Part Number(s) | CEL | 902915<br>902916 |
| | Serial Number(s) | 101000000000000<br>3dof0000000000ee | |
| | Central Processor | 16LF876A – 1/SO | |
| | Cable(s) | n/a | |
| | Peak Output Power | -37.33dBm | |
| | Mainboard | Manufacturer | CEL |
| | | Model | CTX 0507<br>CTX 0502 |
| | | Part Number | 152887 Rev 004 |
| | | Dimension | Approx. 65mm x 59mm |
| | | Connector(s) | One (1) 4-pin, p/n. 4-1393472-9 |
| | Antenna Board | Manufacturer | CEL |
| | | Model | CTX/A 0509 |
| | | Part Number | 516299 |
| | | Dimension | Approx. 23mm x 10mm |
| | | Layers | 2-sided |
| | | Antenna | Two (2) 10mm Dual loop, 1mm traces |
| | Ports | One (1) 4-pin | |
| | Power Supply(s) | DC Cell | |
| | | Input | 13.5Vdc/50mA |
| | | Output | n/a |

## B. EUT Photographs


**Figure 13: EUT Top View [Front (902915) sensor and Rear (902916) sensor]**

**Figure 14: EUT Front View [Front (902915) sensor and Rear (902916) sensor]**

**Figure 15: EUT Rear View [Front (902915) sensor and Rear (902916) sensor]**

**Figure 16: EUT Board Mount View**

**EUT Photographs (cont.)**

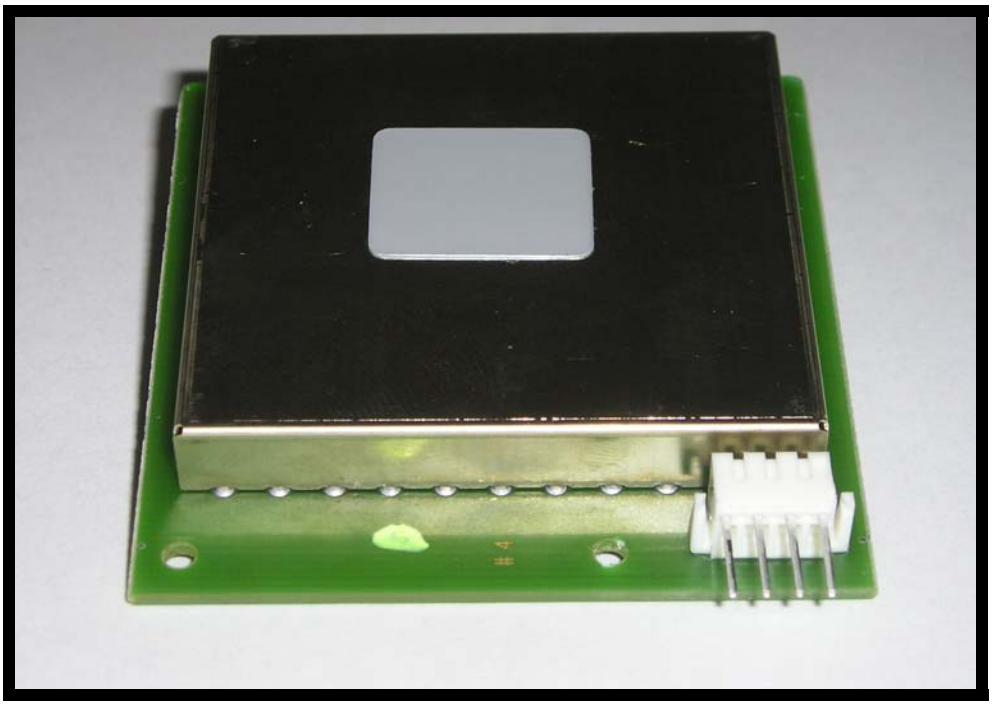

**Figure 17: EUT Internal View 1**

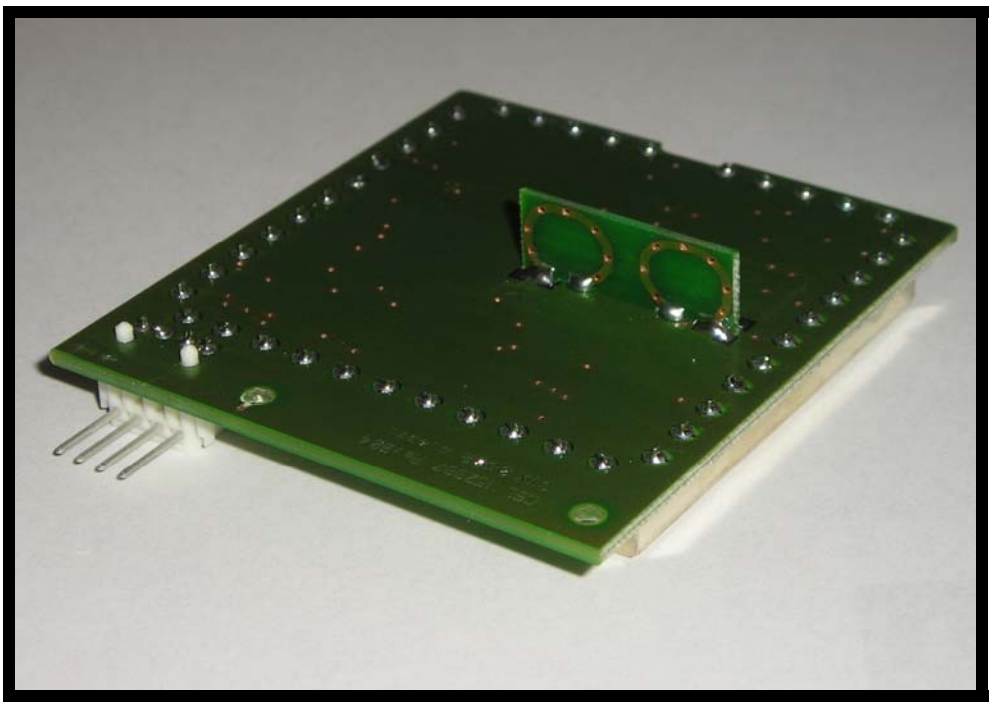

**Figure 18: EUT Internal View 2**

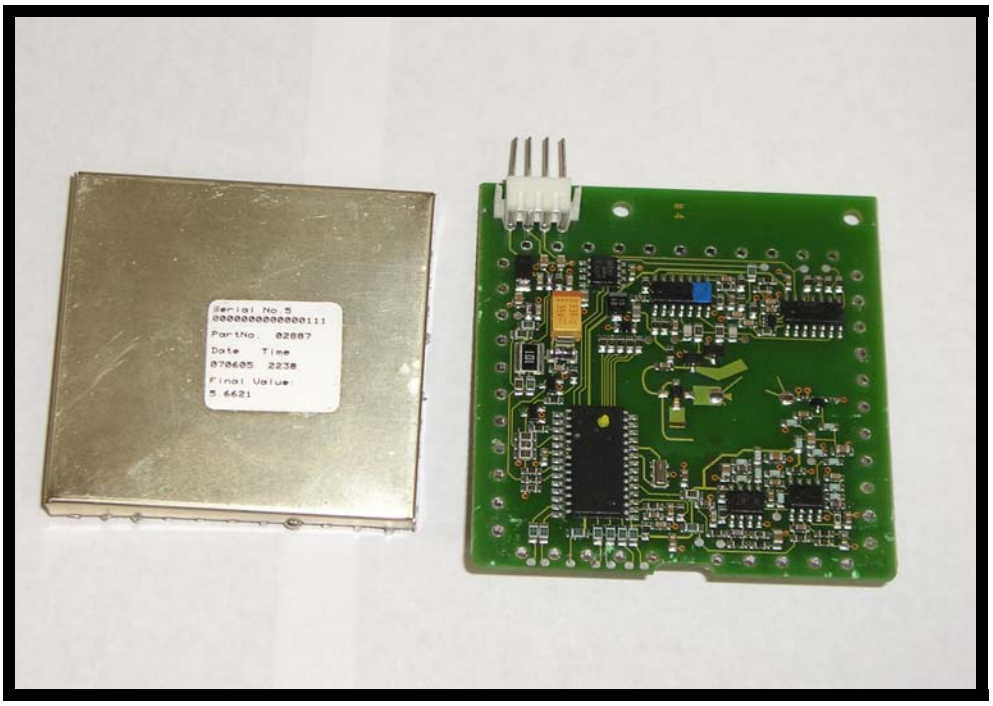

**Figure 19: EUT Component View with shield off**

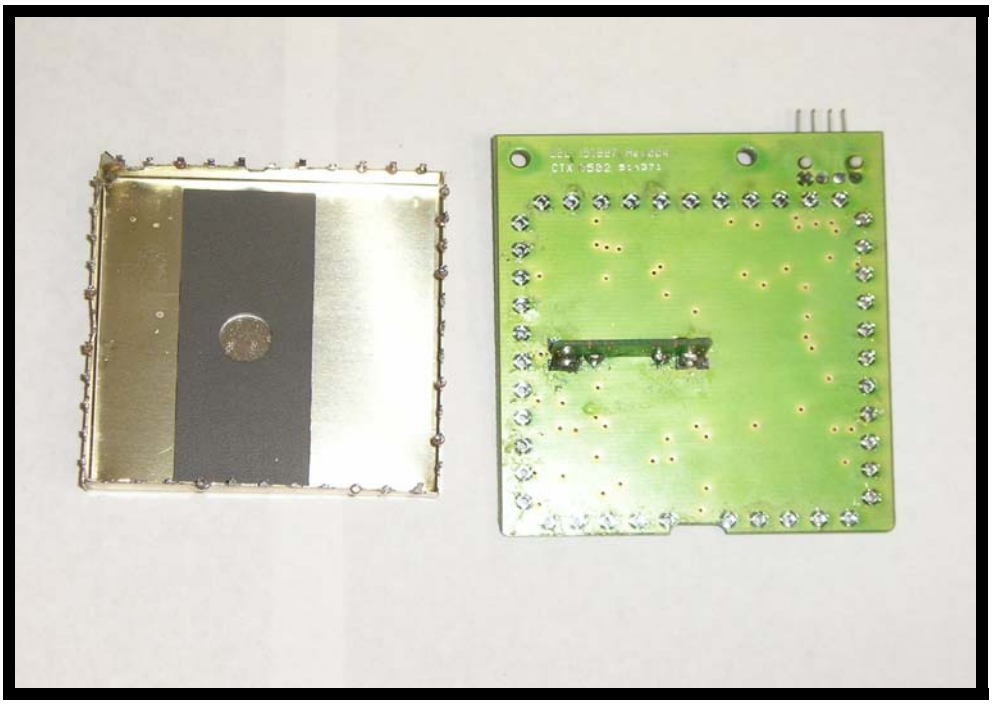

**Figure 20: EUT Solder View.**

# C. Modification Letter

To Whom It May Concern:

This is to certify that no modifications were necessary for 5.8GHz Microwave Sensor, models 902915 and 902916 to comply with the required Requirements of:

FCC Rules and Regulations per 47 CFR 15.209

It is the manufacturer's responsibility to ensure that additional production units of the 5.8GHz Microwave Sensor, models 902915 and 902916 are manufactured with identical electrical and mechanical characteristics. For further information, please contact the manufacturer at:

Connaught Electronics, Ltd.
IDA Industrial Estate, Dunmore Road,
Tuam,Co. Galway, Ireland

Tel: +353 932-5128
Attention: Mr. Joe Danaher