# COMPLIANCE TESTING REPORT

## FOR

# FCC TITLE 47 PART 15, SUBPARTS A & C

| | |
|---|---|
| CLIENT: | SILICON CONTROLS |
| ADDRESS: | UNIT 14A / 2 EDEN PARK DRIVE<br>MACQUARIE PARK NSW 2113, AUSTRALIA |
| REPORT NUMBER: | 1126SILSC441C721_FCC15 |
| DATE OF TESTING: | 22ND SEPTEMBER TO 23RD OCTOBER 2009 |
| FILE NUMBER: | SILICON090901 |
| EQUIPMENT NAME: | GASLOG TRANSCEIVER |
| EQUIPMENT MODEL NUMBER: | SC441C721 |
| EQUIPMENT SERIAL NUMBER: | NOT SUPPLIED |
| EQUIPMENT FCC ID: | XV2SC441001 |
| EQUIPMENT DESCRIPTION: | GAS TANK TELEMETRY DEVICE |
| RESULT: | **COMPLIES** |
| TESTED AND COMPILED BY: | **RICHARD TURNER** |
| APPROVED BY: | **COLIN GAN** |
| DATE OF ISSUE: | 26 NOV 2009 |

**FCC REGISTRATION NUMBER 90455**

CONTENTS:

# 1. TEST SUMMARY

Austest makes no claim regarding the consistency of production versions of the EUT.

The results in this report apply only to the tested EUT, described in Section 3 of this report.

| Section | Test(s) | Result | Notes |
|---|---|---|---|
| FCC Part 15, Subpart C | | | |
| 15.205 | Restricted Bands of Operation | Complies | (ii) |
| 15.207 | Conducted Limits | Not Applicable | (iv) |
| 15.209 | Radiated Emission Limits | Complies | (ii) |
| 15.215 | Additional Provisions to the General Radiated Emission Limitations | Complies | (ii) |
| 15.249 | Operation within Bands 902-928MHz, 2400-2483.5MHz, 5725-5850MHz, 24.0-24.25GHz | Complies | (ii) |

**Notes** (only applicable if referenced in "Notes" column in summary table above):
(i) EUT complies (the measurement results were below the applicable limits), but some emissions were within the range of measurement uncertainty of the limits.
(ii) EUT complies (when modified as described in Section 2 of this report)
(iii) There were deviations from the applied standard as described in Section 5.2 of this report.
(iv) Not applicable because the EUT can only be powered from internal batteries.

# 2. MODIFICATION(S)

The EUT achieved compliance to FCC Part 15, Subpart C when the output power setting was set to -4dBm (controlled by firmware).

# 3. EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The EUT was a telemetry device used for monitoring gas tanks. The EUT utilised a Chipcon CC100 transceiver, operating at 916MHz, and a PCB track antenna.

The EUT was housed in a plastic case and could only be powered from an internal, non-rechargeable 3.6V Lithium battery.

Main PBA #101559 rev 1 with 3.686MHz and 26MHz crystals.
Antenna PBA #101559 Rev G.

# 4. EUT TEST SETUP AND CONFIGURATION

The following cables and supporting equipment was used:

The EUT was tested with its two sensor ports connected by supplied 1m long unshielded cables (p/n 621351-10), each terminated with a magnetic sensor.

The EUT was tested within its allowable temperature and humidity range.

The test sample was powered by its internal 3.6V Lithium battery.

# 5. TEST SPECIFICATIONS

## 5.1 ACCREDITATIONS AND LISTINGS

Austest Laboratories' Yarramalong test facilities are listed with the FCC under Registration Number 90455.

## 5.2 DEVIATIONS FROM STANDARD AND/OR ACCREDITATIONS

None.

## 5.3 TEST FACILITY

The test facilities are located at 46 Glenola Farm Lane in Yarramalong Valley, New South Wales, Australia.

Radiated disturbance testing is performed on a 3m Open Area Test Site (OATS), where some ambients may exceed the continuous disturbance limit. The possibility of missing a disturbance during testing is removed by use of a pre-scan, which is performed in a shielded enclosure.

Austest Laboratories has been found to be in compliance with the requirements of Section 2-948 of the FCC Rules and Test Site Criteria (ANSI C63.4-2003) by the FCC Customer Services Branch and is listed in the Commission's List of Facilities. This list is available from the FCC Customer Services Branch, 7435 Oakland Mills Road, Columbia, Maryland 21046.

## 5.4 TEST EQUIPMENT

| Type | Model | Cal. Due |
|---|---|---|
| EMI Receiver | HP 8574B | 23 Feb 2010 |
| Spectrum Analyser | HP 8593E | 09 Oct 2010 |
| Biconical Array Antenna | Compower AB100 | 28 Aug 2010 |
| Log-Periodic Array Antenna | Compower AL100 | 28 Aug 2010 |
| DRG Horn Antenna | AH Systems SAS-571 | 29 Dec 2011 |
| Loop Antenna | EM-6876 | 09 Sep 2010 |
| Preamp (25MHz – 1GHz) | HP 8447E | 24 Feb 2010 |
| Preamp (1GHz – 25GHz) | RE 218A | 12 Oct 2010 |

## 5.5 MEASUREMENT UNCERTAINTY

Radiated Disturbances: ±4.7dB with a level of confidence of approximately 95% (k=2).

# 6. FCC PART 15, SUBPART C - INTENTIONAL RADIATORS

## 6.1 RESTRICTED BANDS OF OPERATION (SECTION 15.205)

The EUT is designed to operate at 916MHz only, which is not within the listed restricted bands of operation, and therefore complies with this requirement.

## 6.2 RADIATED EMISSION LIMITS (SECTION 15.209)

### 6.2.1 EUT OPERATING MODE

a. The EUT was continuously transmitting with modulation during testing.
b. The battery voltage at 3.6V was monitored throughout.

### 6.2.2 TEST METHOD

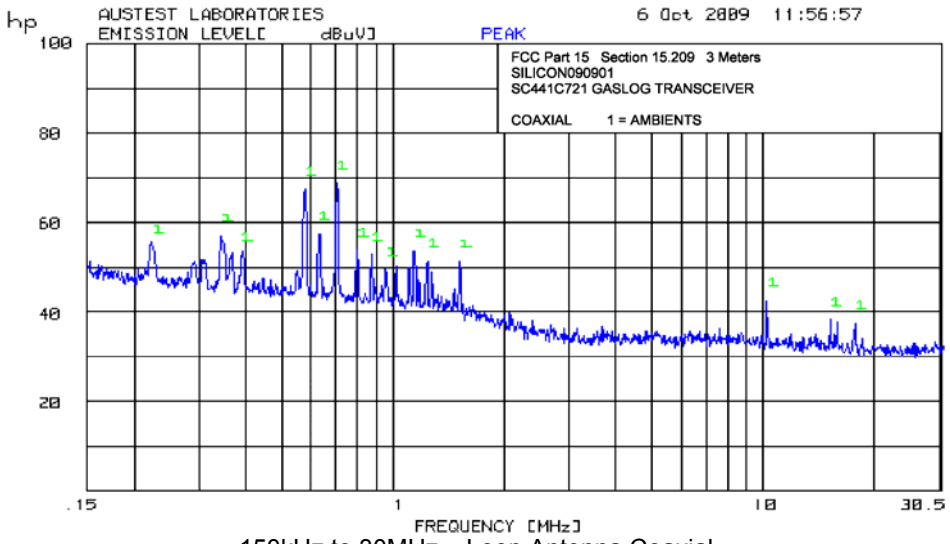
a. Measurements were performed in accordance with ANSI C63.4-2003.
b. The measuring receiver RBW was set to:
   - 9kHz (150kHz to 30MHz).
   - 120kHz (30MHz to 1GHz).
   - 1MHz (1GHz to 9.2GHz).
c. The EUT was setup on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at either 1m or 3m test distance away from the measuring antenna.
d. To maximise emissions, the EUT was rotated through 360$^{o}$ and the measuring antenna height adjusted between 1m to 4m.
e. Measurements were made with the measuring antenna in the following orientations:
   - Loop antenna (150kHz to 30MHz) – Coaxial and coplanar orientations.
   - Biconical and Log-Periodic antennas (30MHz to 1GHz) - Both vertical and horizontal polarizations.
   - Horn antenna (1GHz to 9.2GHz) - Both vertical and horizontal polarizations.
f. The intentional transmission signal at 916MHz was ignored for this measurement.

### 6.2.3 TEST RESULTS

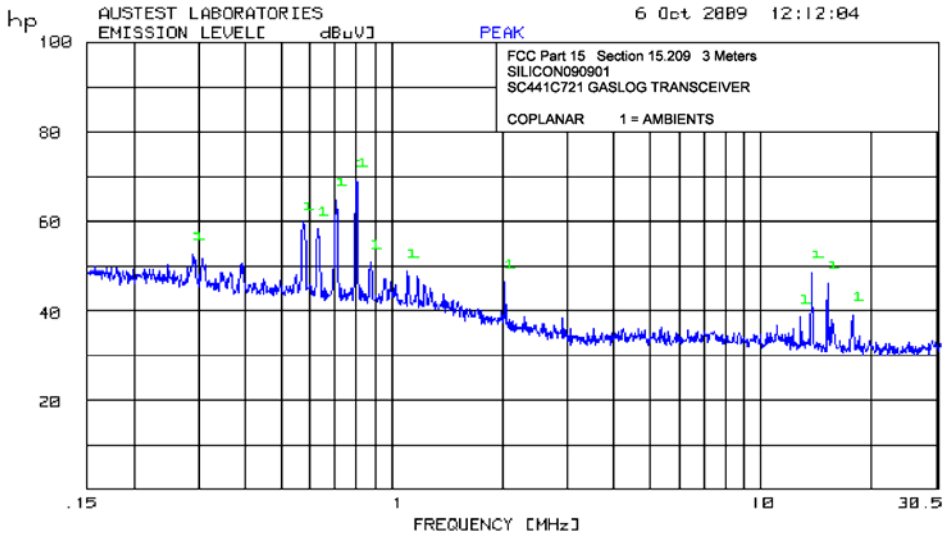
a. All measured disturbances between 150kHz to 30MHz were greater than 10dB below the limits.
b. All measured disturbances between 30MHz to 1GHz were greater than 10dB below the limits.
c. Band edge measurements at 902MHz and 928MHz were also greater than 10dB below the limits.
d. The highest measured peak level between 1GHz to 9.2GHz was 380µV/m at 1.832GHz. Average measurements were unnecessary as all peak levels were below the 500µV/m Average limit, as tabulated below.

| Frequency GHz | Polarisation | Measured Peak | | Peak Limit | | Margin dB | Average Limit µV/m |
|---|---|---|---|---|---|---|---|
| | | dBµV/m | µV/m | dBµV/m | µV/m | | |
| 1.832 | Vertical | 51.6 | 380 | 74.0 | 5000 | -22.4 | 500 |
| 5.496* | Horizontal | 51.0 | 355 | 74.0 | 5000 | -23.0 | 500 |
| 7.328* | Vertical | 50.7 | 343 | 74.0 | 5000 | -23.3 | 500 |
| 5.496* | Vertical | 50.6 | 339 | 74.0 | 5000 | -23.4 | 500 |
| 1.832 | Horizontal | 50.5 | 335 | 74.0 | 5000 | -23.5 | 500 |
| 7,328* | Horizontal | 48.0 | 251 | 74.0 | 5000 | -26.0 | 500 |

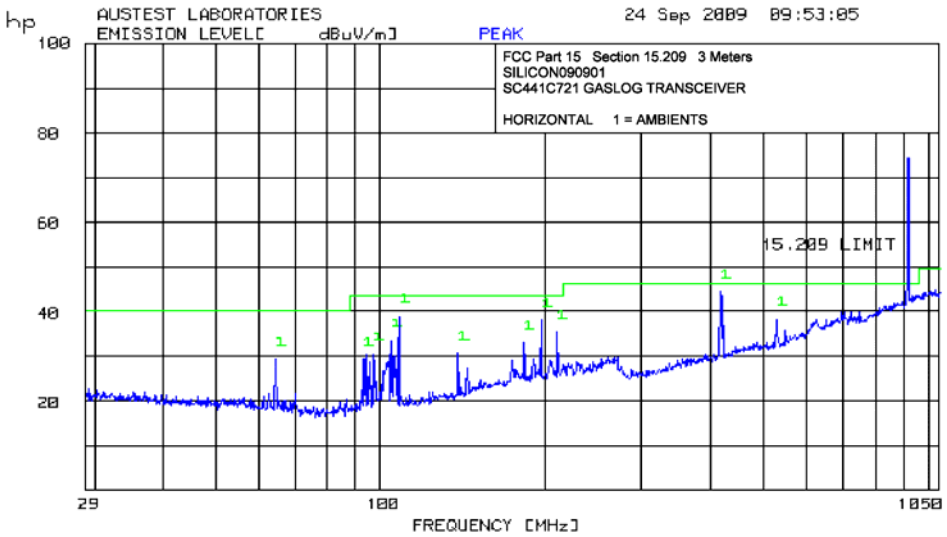
*Measured at 1m test distance. Results were then extrapolated to 3m distance using an extrapolation factor of 20dB/decade in accordance with section 15.31 (f) (1). The emission at 5.496GHz was present when the EUT was placed into receive mode (i.e. no transmission).



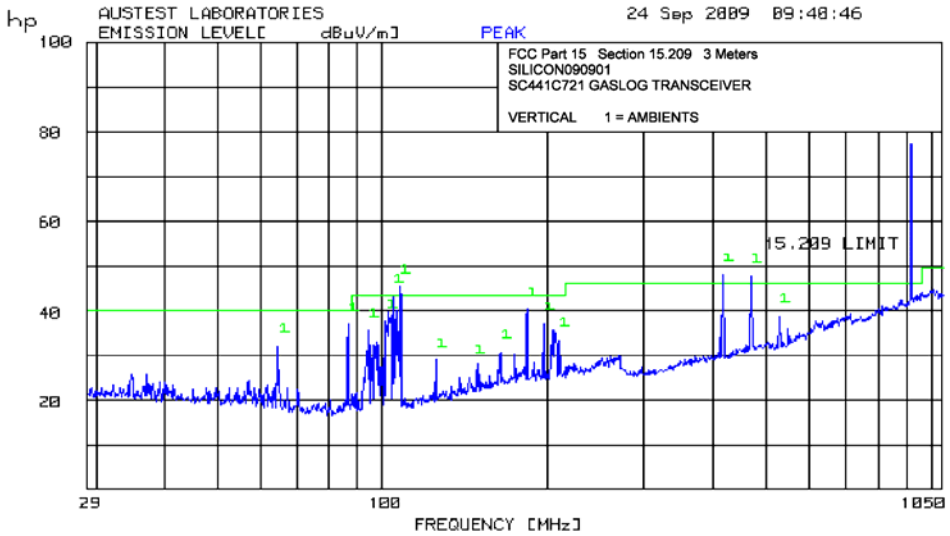

150kHz to 30MHz – Loop Antenna Coaxial



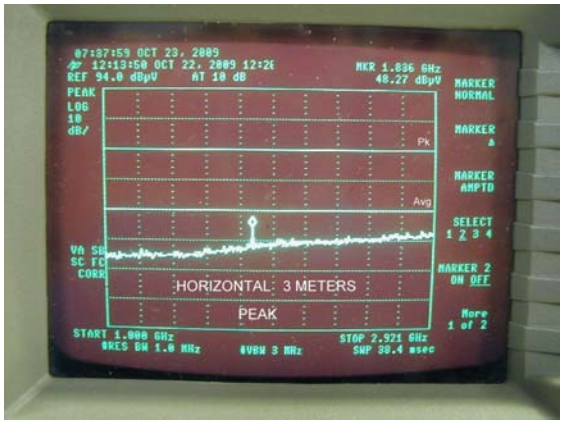

150kHz to 30MHz – Loop Antenna Coplanar



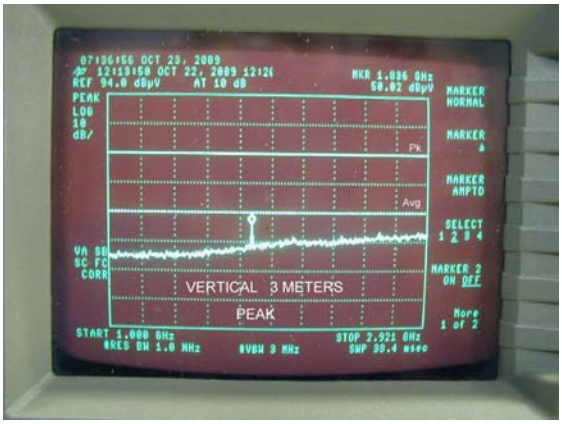

30MHz to 1GHz – Horizontal Polarization



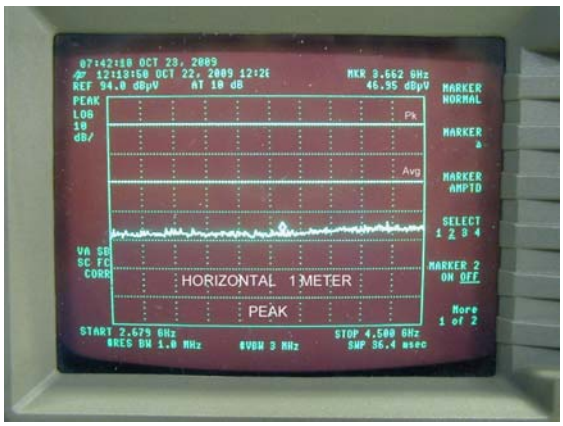

30MHz to 1GHz – Vertical Polarization



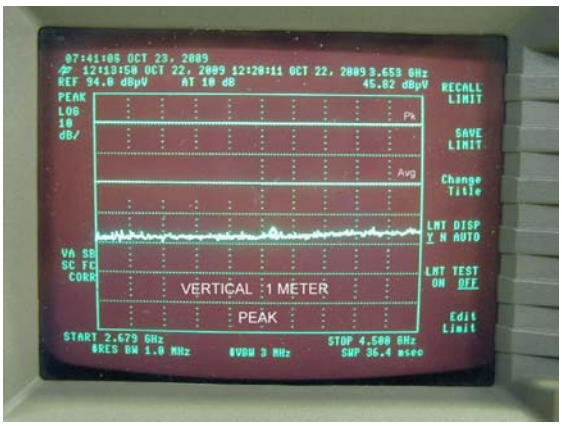

1GHz to 2.9GHz – Peak H Pol




1GHz to 2.9GHz – Peak V Pol

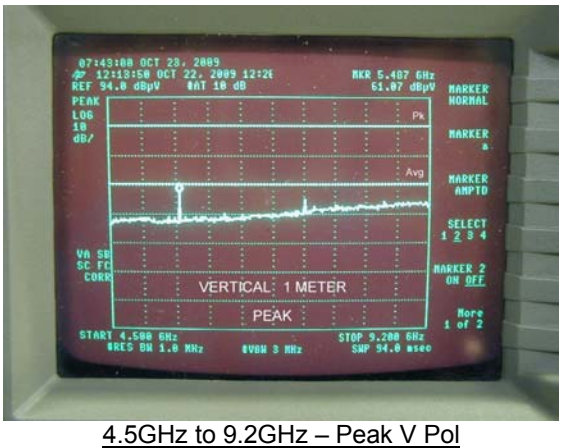



2.7GHz to 4.5GHz – Peak H Pol

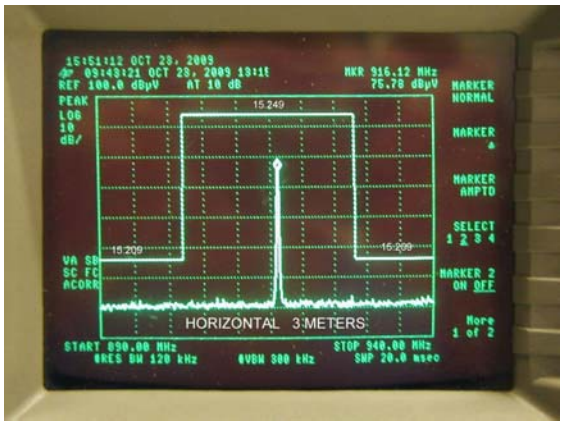



2.7GHz to 4.5GHz – Peak V Pol

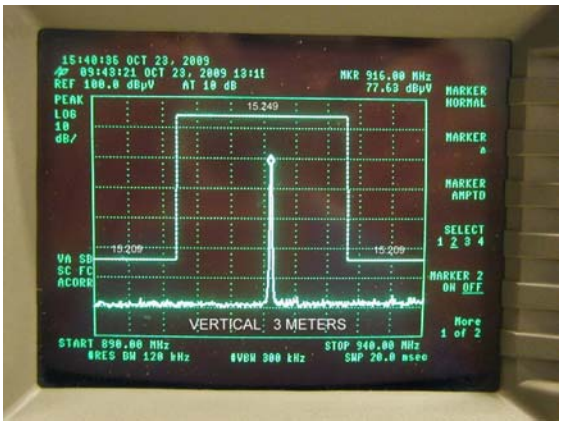

4.5GHz to 9.2GHz – Peak H Pol




4.5GHz to 9.2GHz – Peak V Pol




Band Edge Measurements – H Pol




Band Edge Measurements – V Pol

## 6.3 Additional Provisions to the General Radiated Emission Limitations (Section 15.215)

### 6.3.1 EUT Operating Mode

a. The EUT was continuously transmitting with modulation during testing.
b. The battery voltage at 3.6V was monitored throughout.

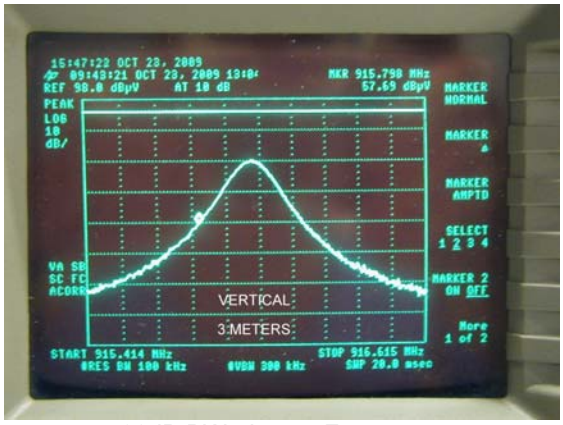
### 6.3.2 Test Method

a. Since the EUT has an integral antenna, this measurement was done at the OATS during the field strength measurements in Clause 7.4.1 of this report, with the EUT orientation maximised.

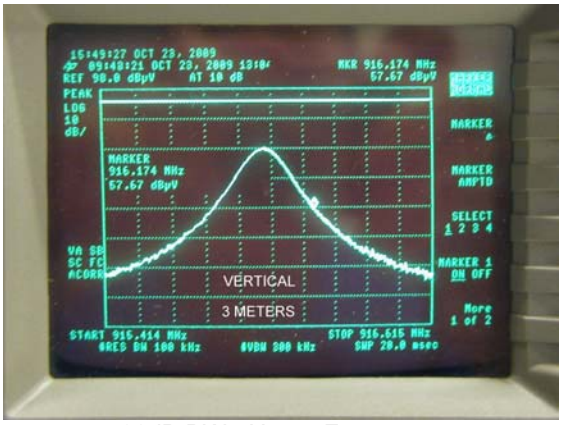
b. For this measurement, the RBW was set to 100kHz.

### 6.3.3 Test Results

a. The 20dB bandwidth of the emission was measured as 370kHz.
b. The lower frequency marker was at 915.80MHz and the upper frequency marker was at 916.17MHz.
c. The 20dB bandwidth was within the operating frequencies specified in FCC Part 15, Section 15.249.




20dB BW - Lower Frequency




20dB BW - Upper Frequency

## 6.4 Operation within the Bands 902-928MHz, 2400-2483.5MHz, 5725-5850MHz and 24.0-24.25GHz (Section 15.249)

### 6.4.1 Field Strength at 3 Metres (Section 15.249, Paragraphs (a), (c) & (e))

#### 6.4.1.1 EUT Operating Mode

a. The EUT was continuously transmitting with modulation during testing.
b. The battery voltage at 3.6V was monitored throughout.

#### 6.4.1.2 Test Method

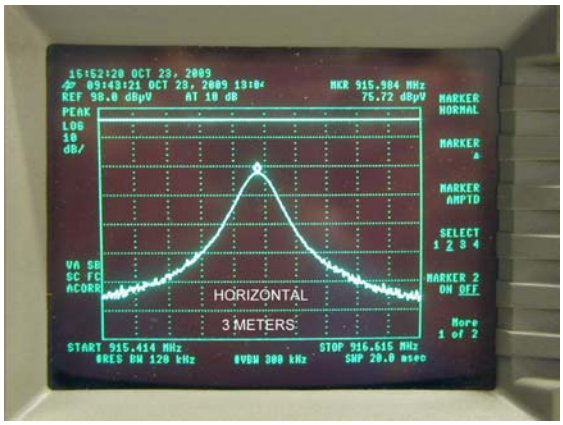
a. Measurements were performed in accordance with ANSI C63.4-2003.
b. The measuring receiver was set for Peak detection with RBW set to 120kHz.

c. The EUT was setup on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at either 1m or 3m test distance away from the measuring antenna.
d. To maximise emissions, the EUT was rotated through 360$^{o}$ and the measuring antenna height adjusted between 1m to 4m.
e. Measurements were made with the measuring antennas in both vertical and horizontal polarizations.

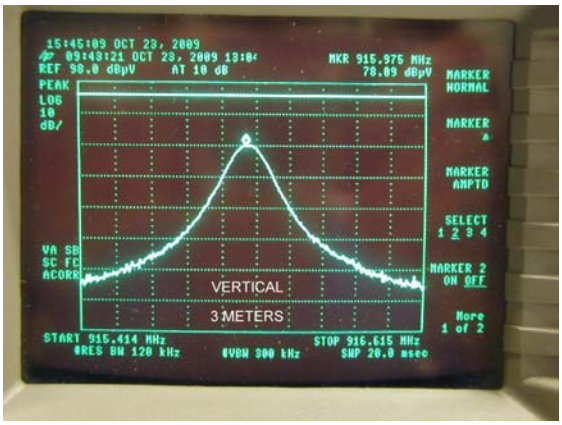
### 6.4.1.3 TEST RESULTS

a. The maximum field strength at 916MHz was measured at 8.0mV/m, or 15.9dB below the specified limit.

| Frequency MHz | Polarization | Measured Peak | | Limit | | Margin |
|---|---|---|---|---|---|---|
| | | dBµV/m | mV/m | dBµV/m | mV/m | dB |
| 916.0 | Horizontal | 75.7 | 6.1 | 94.0 | 50.0 | -18.3 |
| 916.0 | Vertical | 78.1 | 8.0 | 94.0 | 50.0 | -15.9 |



Field Strength – H Pol



Field Strength – V Pol

b. All measured harmonic levels, for harmonics up to 9.2GHz, were below the limits specified in FCC Part 15, Sections 15.209 and 15.249. For further details, please refer to Clause 7.2.3 of this report.

### 6.4.2 EMISSIONS RADIATED OUTSIDE OF THE SPECIFIED FREQUENCY BANDS (SECTION 15.249, PARAGRAPH (D))

All emissions outside the specified frequency bands were below the radiated emission limits specified in FCC Part 15, Section 15.209.