



COMPLIANCE TESTING REPORT	
FOR	
FCC TITLE 47 PART 15, SUBPARTS A, B (CLASS B) & C	
CLIENT:	SILICON CONTROLS
ADDRESS:	UNIT 14A / 2 EDEN PARK DRIVE MACQUARIE PARK NSW 2113, AUSTRALIA
REPORT NUMBER:	1203SILSC414C7411_FCC15A
DATE OF TESTING:	22 ND SEPTEMBER TO 27 TH OCTOBER 2009
FILE NUMBER:	SILICON090901
EQUIPMENT NAME:	GASLOG TRANSCEIVER
EQUIPMENT MODEL NUMBER:	SC414C7411
EQUIPMENT SERIAL NUMBER:	NOT SUPPLIED
EQUIPMENT FCC ID:	XV2SC414001
EQUIPMENT DESCRIPTION:	GAS TANK TELEMETRY DEVICE
RESULT:	COMPLIES
TESTED AND COMPILED BY:	RICHARD TURNER 
APPROVED BY:	COLIN GAN 
DATE OF ISSUE:	03 DEC 2009
FCC REGISTRATION NUMBER 90455	
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Report Revision History:

Date	Report Number	Changes
24 Nov 2009	1124SILSC414C7411_FCC15	Original Report.
03 Dec 2009	1203SILSC414C7411_FCC15a	Minor error amendments in original report.

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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 B			
15.107	Conducted Limits	Not Applicable	(iv)
15.109	Radiated Emission Limits	Complies	
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	(i), (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 +2dBm (controlled by firmware).

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3. EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The EUT was a telemetry device used for monitoring gas tanks. The EUT utilised a Chipcon CC1101 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 3.9V Lithium HLC-1550 capacitor, charged from an internal 3.9V Lithium battery.

The EUT also contained a Q24 Plus GSM module with PCB track antenna.

Main PBA #101557 rev 2 with 3.686MHz and 26MHz crystals.

4. EUT TEST SETUP AND CONFIGURATION

The following cables and auxiliary equipment were used:

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

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

The test sample was powered by an internal 3.9V lithium HLC capacitor. With a fully charged HLC, the supply voltage measured at the battery terminals was 3.6V.

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.

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

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6. FCC PART 15, SUBPART B - UNINTENTIONAL RADIATORS

6.1 RADIATED EMISSION LIMITS (SECTION 15.109)

6.1.1 EUT OPERATING MODE

- a. Prior to measurement, the EUT was setup to continually transmit and receive data packets from the supplied supporting equipment SC441 transmitter unit.
- b. During measurement, the supporting transmitter unit was switched off and removed from the test area.

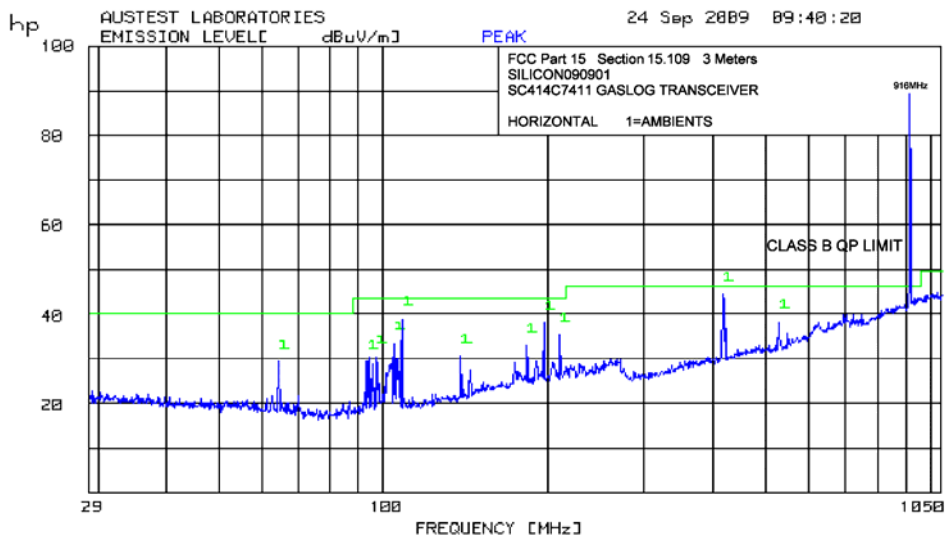
6.1.2 TEST METHOD

- a. Measurements were performed in accordance with ANSI C63.4-2003.
- b. EMI measuring receiver RBW was set to 120kHz (30MHz to 1GHz).
- c. The EUT was setup on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and 3m test distance away from the measuring antenna.
- d. To maximise emissions, the EUT was rotated through 360° and the measuring antenna height adjusted between 1m to 4m.
- e. Measurements were made with the measuring Biconical and Log-Periodic antennas in both vertical and horizontal polarizations.
- f. The intentional transmission signal at 916MHz was ignored for this measurement.

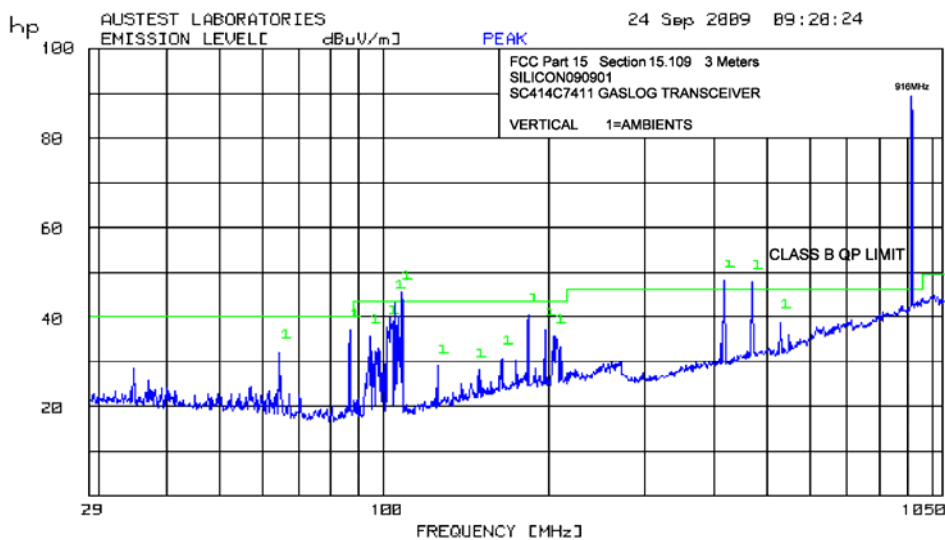
6.1.3 TEST RESULTS

- a. Measurement range was restricted between 30MHz to 1GHz in accordance with FCC Part 15, Section 15.33, since the EUT's highest operating frequency was 26MHz.
- b. All measured disturbances were greater than 10dB below the Class B Quasi-Peak limit.

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Radiated Emission – Horizontal Polarization



Radiated Emission – Vertical Polarization

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7. FCC PART 15, SUBPART C - INTENTIONAL RADIATORS

7.1 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.

7.2 RADIATED EMISSION LIMITS (SECTION 15.209)

7.2.1 EUT OPERATING MODE

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

7.2.2 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° 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.

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7.2.3 TEST RESULTS

- All measured disturbances between 150kHz to 30MHz were greater than 10dB below the limits.
- All measured disturbances between 30MHz to 1GHz were greater than 10dB below the limits.
- Band edge measurements at 902MHz and 928MHz were also greater than 10dB below the limits.
- The highest measured peak level between 1GHz to 9.2GHz was 692 μ V/m at 1.832GHz. Peak level results are as tabulated below.

Frequency GHz	Polarisation	Measured Peak		Peak Limit		Margin dB	Average Limit μ V/m
		dB μ V/m	μ V/m	dB μ V/m	μ V/m		
1.832	Horizontal	56.8	692	74.0	5000	-17.2	500
5.496*	Vertical	55.2	575	74.0	5000	-18.8	500
1.832	Vertical	51.5	376	74.0	5000	-22.5	500
5.496*	Horizontal	50.5	335	74.0	5000	-23.5	500
7.328*	Vertical	47.5	237	74.0	5000	-26.5	500
7.328*	Horizontal	47.3	232	74.0	5000	-26.7	500

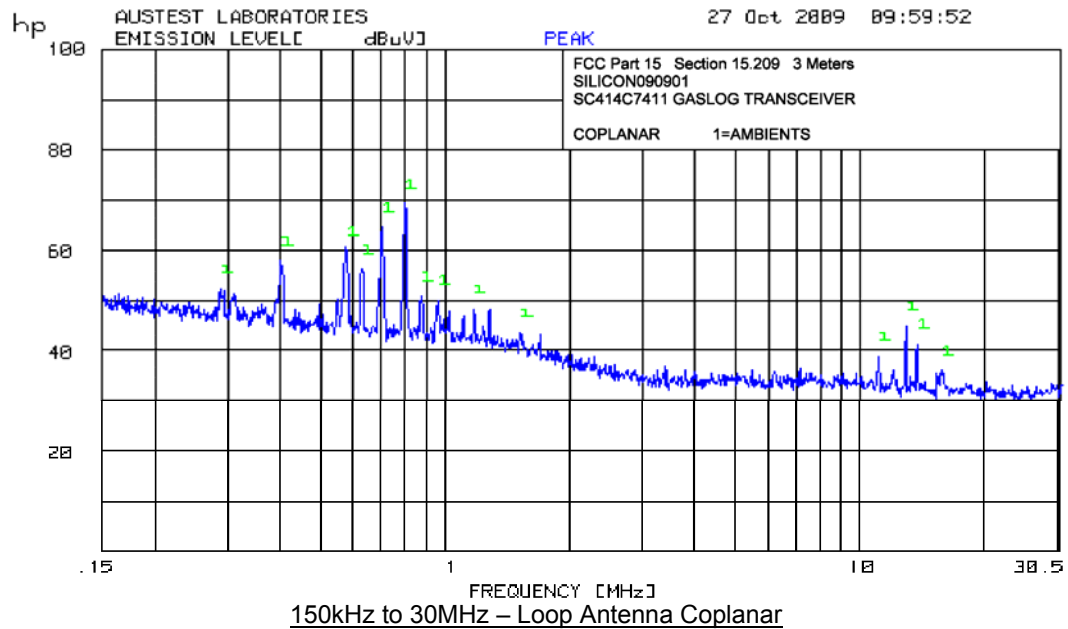
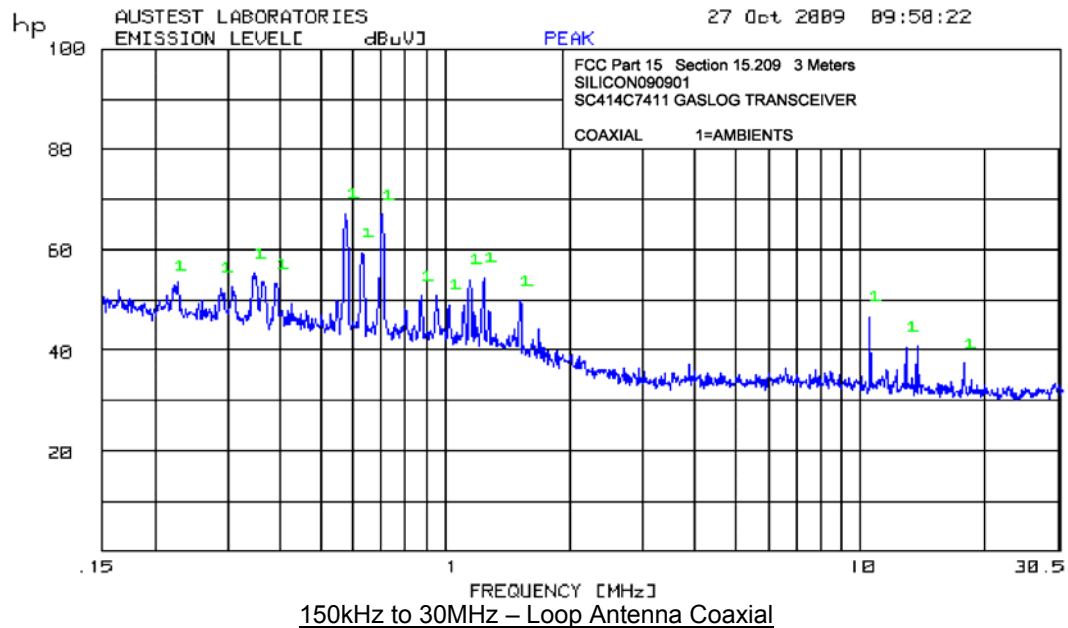
Average levels were measured when peak levels exceeded the 500 μ V/m average limit. The highest average level measured was 473 μ V/m at 5.496GHz. Average level results are as tabulated below.

Frequency GHz	Polarisation	Measured Average		Average Limit		Margin dB
		dB μ V/m	μ V/m	dB μ V/m	μ V/m	
5.496	Vertical	53.5	473	54.0	500	-0.5**
1.832	Horizontal	51.6	380	54.0	500	-2.4**

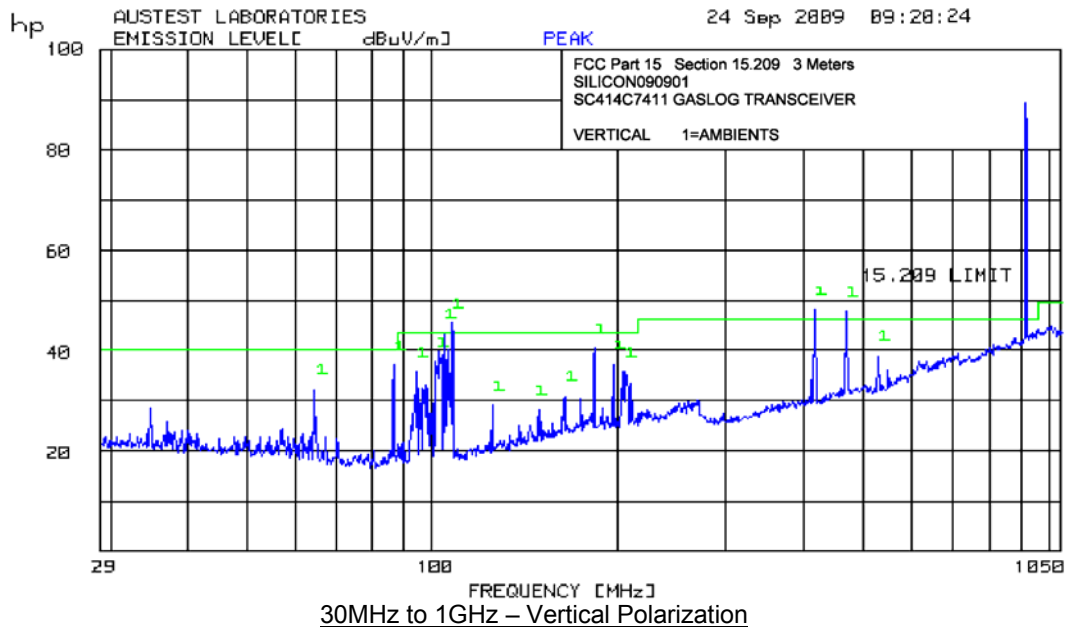
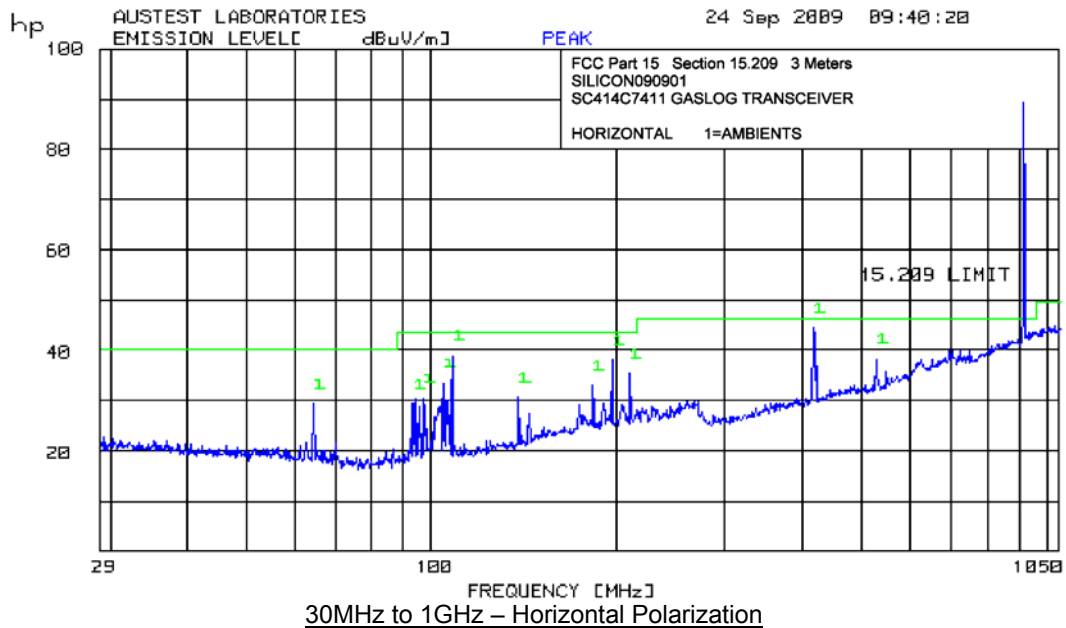
*Measured at 1m test distance. Results were then extrapolated to 3m distance using an extrapolation factor of 20dB/decade in accordance with section 15.31 (f) (1). The emission at 5.496GHz was present when the EUT was placed into receive mode (i.e. no transmission).

**Results were within the laboratory's measurement uncertainty.

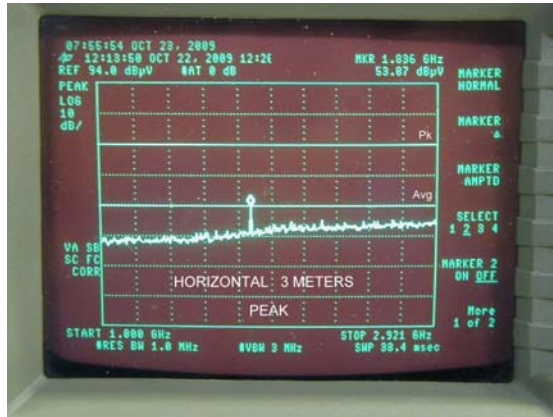
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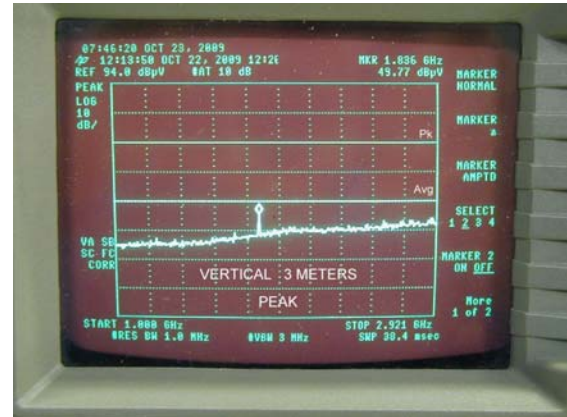
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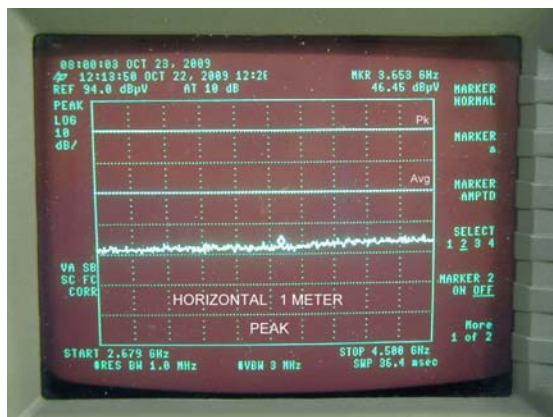
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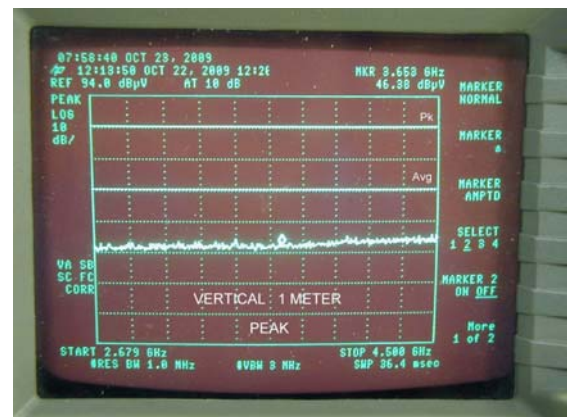
1GHz to 2.9GHz – Peak H Pol



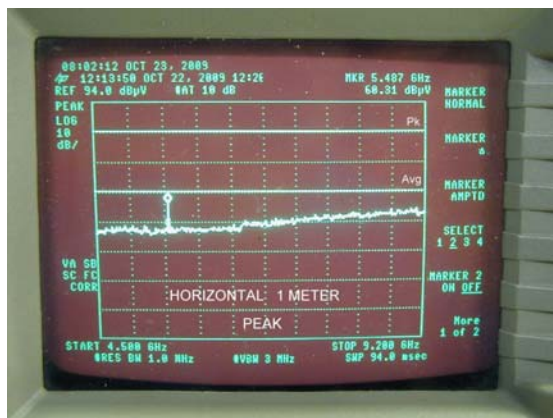
1GHz to 2.9GHz – Peak V Pol



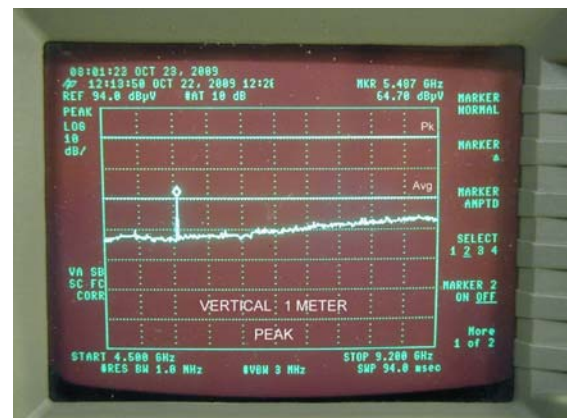
2.7GHz to 4.5GHz – Peak H Pol



2.7GHz to 4.5GHz – Peak V Pol

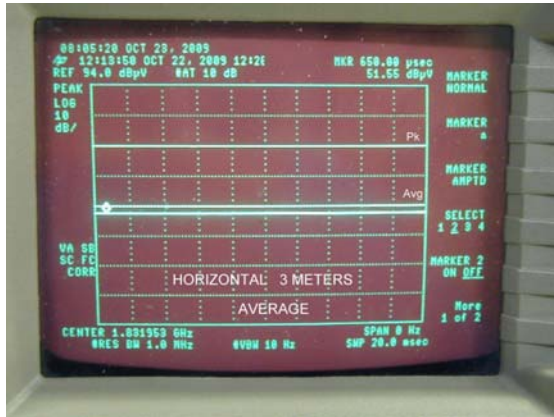


4.5GHz to 9.2GHz – Peak H Pol

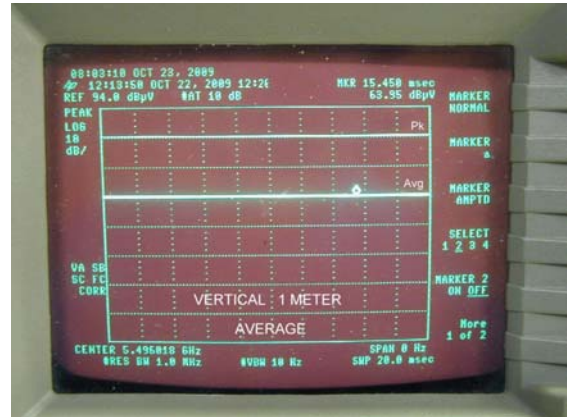


4.5GHz to 9.2GHz – Peak V Pol

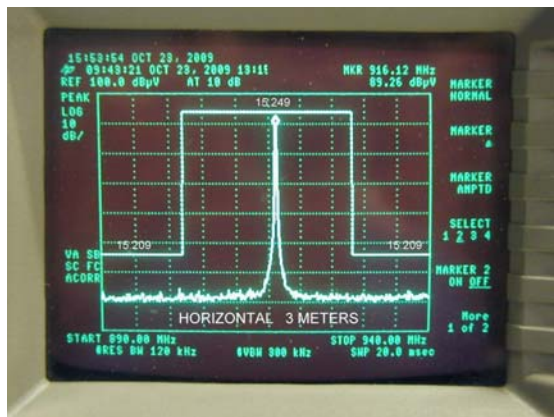
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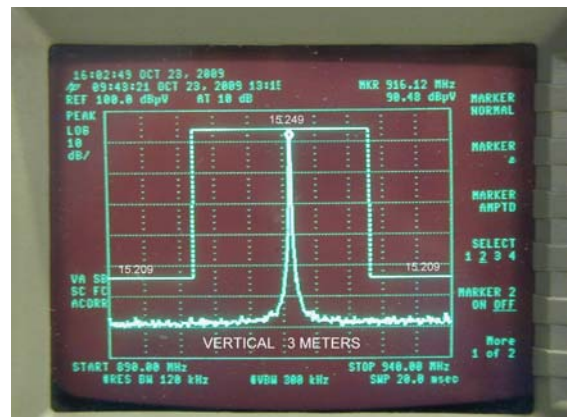
1.832GHz – Average H Pol



5.496GHz – Average V Pol



Band Edge Measurements – H Pol



Band Edge Measurements – V Pol

7.3 ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS (SECTION 15.215)

7.3.1 EUT OPERATING MODE

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

7.3.2 TEST METHOD

- Since the EUT has an integral antenna, this measurement was done at the OATS during the field strength measurements in Clause 6.4.1 of this report, with the EUT orientation maximised.

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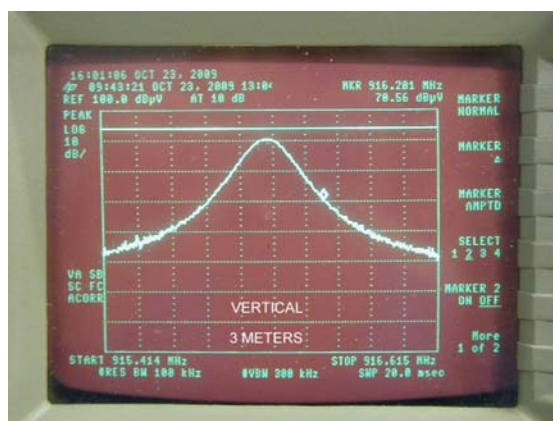
- b. For this measurement, the RBW was set to 100kHz.

7.3.3 TEST RESULTS

- a. The 20dB bandwidth of the emission was measured as 420kHz.
- b. The lower frequency marker was at 915.78MHz and the upper frequency marker was at 916.20MHz.
- 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

7.4 OPERATION WITHIN THE BANDS 902-928MHz, 2400-2483.5MHz, 5725-5850MHz AND 24.0-24.25GHz (SECTION 15.249)

7.4.1 FIELD STRENGTH AT 3 METRES (SECTION 15.249, PARAGRAPHS (A), (C) & (E))

7.4.1.1 EUT OPERATING MODE

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

7.4.1.2 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.

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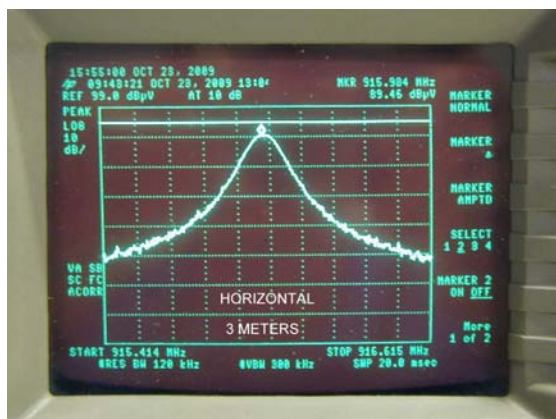
- c. The EUT was setup on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at either 1m or 3m test distance away from the measuring antenna.
- d. To maximise emissions, the EUT was rotated through 360° and the measuring antenna height adjusted between 1m to 4m.
- e. Measurements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

7.4.1.3 TEST RESULTS

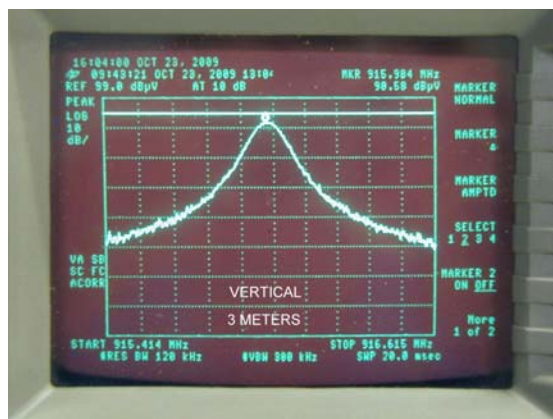
- a. The maximum field strength at 916MHz was measured at 33.9mV/m, or 3.4dB below the specified limit.

Frequency MHz	Polarization	Measured Peak		Limit		Margin dB
		dBμV/m	mV/m	dBμV/m	mV/m	
916.0	Vertical	90.6	33.9	94.0	50.0	-3.4*
916.0	Horizontal	89.5	29.9	94.0	50.0	-4.5*

*Results were within the laboratory's measurement uncertainty.



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 6.2.3 of this report.

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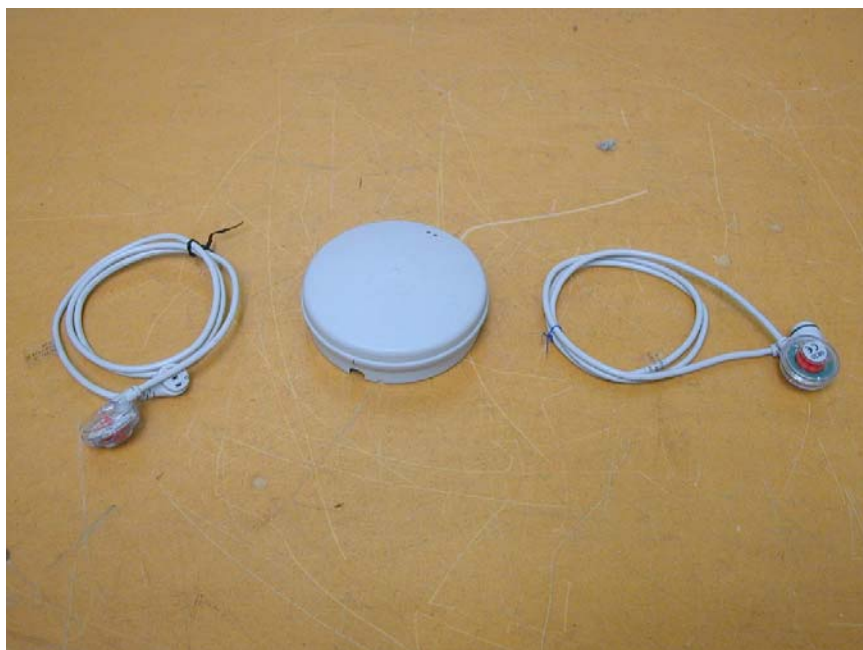
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FCC ID: XV2SC414001

7.4.2 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.

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8. APPENDIX A – PHOTOGRAPHIC RECORD OF EUT



EUT with Sensors



EUT Top View

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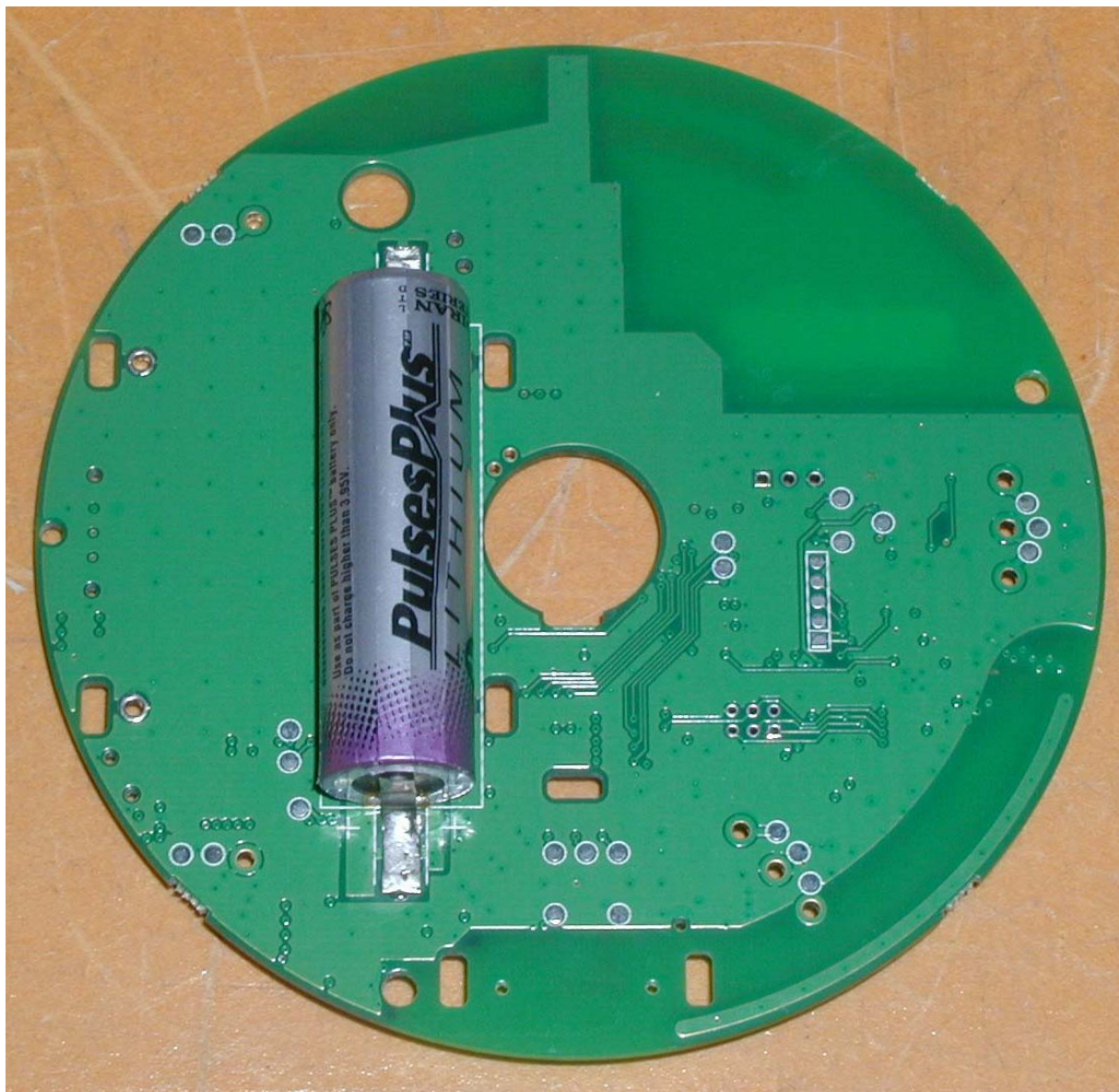
EUT Bottom View

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EUT Uncovered

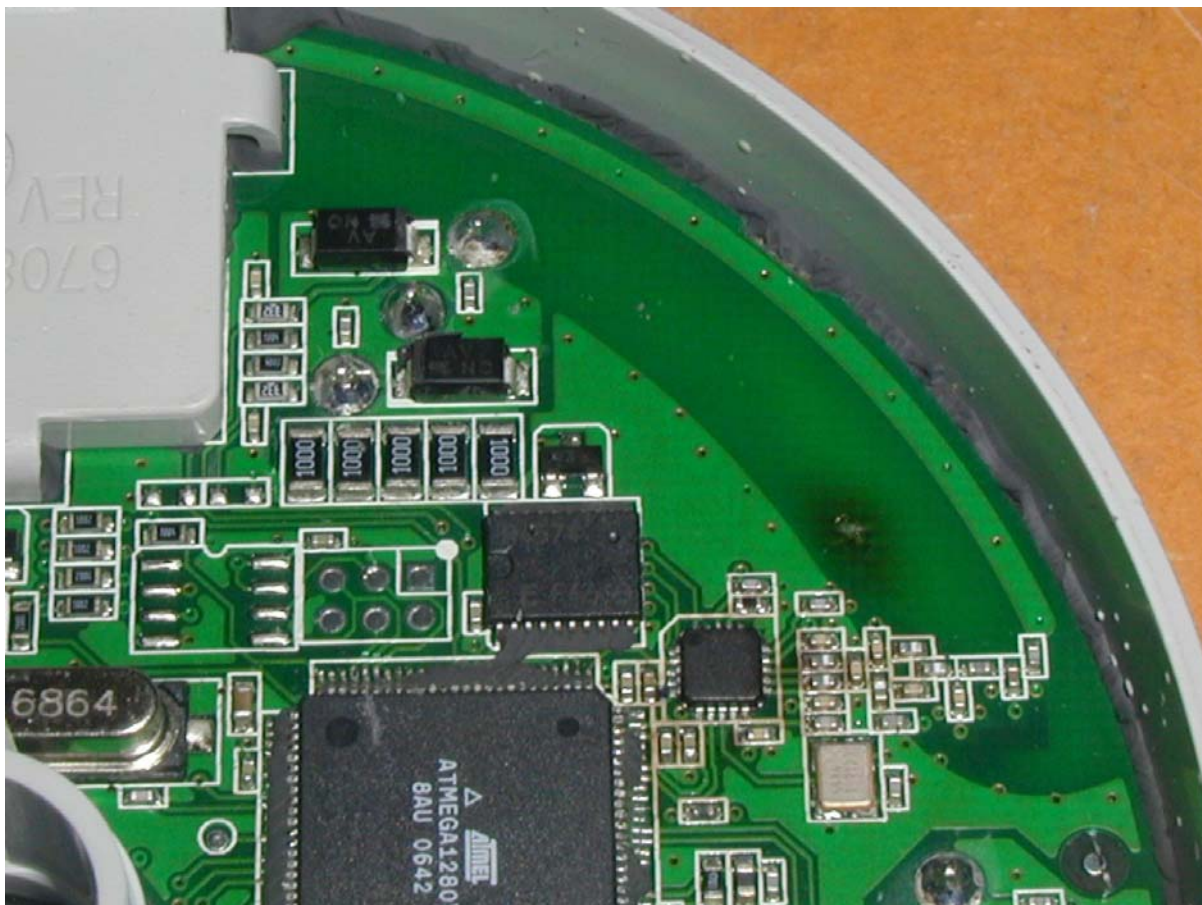
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EUT Main PBA

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Approval Specialists Pty Ltd (ACN: 094 656 354) Trading as Austest Laboratories
35 Alleyne St, Chatswood NSW 2067 Australia. Ph: +612 9882 6500



EUT Transceiver Circuit

Please refer to client for FCC Label design and location.

FCC Label Location

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9. APPENDIX B – TEST SETUP PHOTOGRAPHS



Radiated Emissions Test Setup (EUT Rear View)



Radiated Emissions Test Setup (EUT Front View)

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