

Compliance Testing Report

FCC Title 47 Part 15



Subparts A & B (Class B) & C

Client: Protrac ID Pty Ltd
Address: Unit 4, Hyperdome Technology Park, 2 – 12 Knobel Court,
Shailer Park 4128 QLD
Report Number: 1011COMP4T8000_fcc15ab&c
Date of Testing: 8th October 2009 to 27th August 2010
File Number: COMP090917

Equipment Name: Tag, 916MHz
Equipment Model Number: 4T8000 Asset Tag
Equipment Serial Number: Not Supplied
Equipment FCC ID: X6X4T8000
Equipment Description: RFID Tracking System Tag

Result: Complies
Tested by: Richard Turner

Approved by: Colin Gan

Date of Issue: 11 October 2010

AUSTEST (NSW) FCC REGISTRATION NUMBER 90455

Results appearing herein relate only to the sample(s) tested.

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Report Revision History:

Date	Report Number	Changes
15 th Dec 2009	1215COMPTAG fcc15ab&c	Original Report.
3 rd Jun 2010	0603COMP4T8000_fcc15ab&c	Edited report for RFID Tag Transmitter only per TCB instructions.
29 th Sep 2010	0929COMP4T8000_fcc15ab&c	Retest report to FCC15.249.
11 th Oct 2010	1011COMP4T8000_fcc15ab&c	Clarified worst-case emissions axis position – reference Clauses 11.2(d) & 13.1.2(d) of this 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.

FCC Section	Test	Result	Notes
FCC Part 15, Subpart B – Unintentional Radiators			
15.107	Conducted Limits	N.A.	(iv)
15.109	Radiated Emission Limits	N.A.	(v)
FCC Part 15, Subpart C – Intentional Radiators			
15.203	Antenna Requirement	Complies	
15.205	Restricted Bands of Operation	Complies	
15.207	Conducted Limits	N.A.	(iv)
15.209	Radiated Emission Limits, General Requirements	Complies	
15.215	Additional Provisions to the General Radiated Limitations	Complies	
15.249	Operation within the Bands 902-928MHz, 2400-2483.5MHz, 5725-5875MHz, and 24.0-24.25GHz	Complies	

Notes (applicable only if referenced in “Notes” column of above summary table):

- (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) The EUT is battery powered.
- (v) The EUT is a transmitter and unwanted emissions requirements are covered within 15.209 and 15.249.

2 MODIFICATIONS

None.

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3 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

EUT Name:	RFID Tag
EUT Description:	916MHz RFID Tag Transmitter
EUT Model:	4T8000 Asset Tag
EUT Serial Number:	Not Supplied
EUT FCC ID:	X6X4T8000
Manufacturer:	Protac ID Pty Ltd
Power Supply & Rating:	Internal 3V battery
Highest Clock/Operating Frequency:	4MHz unintentional digital, 916.5MHz intentional RF fundamental
Transmit Frequency Range:	916.5MHz
Transmit Power:	55µW EIRP
Modulation Technique:	ASK
Number of Channels:	1
Antenna Specifications:	Integral Antenna

EUT Operating Modes

Normal operating mode with modulation. The EUT would transmit a "heartbeat" message (<10ms duration) occurring approximately every 20 secs.

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4 EUT TEST SETUP & CONFIGURATION

Refer to the photographs in Appendix B for the EUT test setup and physical configuration.

Details of supporting equipment and cables used are listed as follows:

4.1 Supporting Equipment

No supporting equipment was required.

4.2 Cables

The EUT has no external ports for cable connection.

4.3 Transmitter Test Channels

The EUT can only operate on one frequency (i.e. 916.5MHz).

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5 TEST SPECIFICATIONS

5.1 Accreditations & Listings

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 Laboratory Division for Certification testing under Parts 15 or 18 of the FCC Rules.

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

5.2 Deviations from Standards and/or Accreditations

None.

5.3 Test Facility

Testing was performed in New South Wales at Austest Laboratories (NSW)'s Yarramalong test facilities located at 46 Glenola Farm Lane in Yarramalong Valley, New South Wales, Australia.

Radiated emission testing is performed at an Open Area Test Site (OATS), where some ambient signals may exceed the continuous disturbance limit. The possibility of missing an emission during testing is removed by use of pre-scans, performed in a shielded enclosure, prior to the final OATS measurements.

5.4 Test Equipment

Test Equipment	Brand & Model	Cal. Due Date
EMI Receiver	HP 8574B	12 Mar 2011
Spectrum Analyser	HP 8593E	09 Oct 2010
Biconical Array Antenna	EMCO 93110B	08 Sep 2010
Log-Periodic Array Antenna	EMCO 93146	09 Sep 2010
DRG Horn Antenna	AH Systems SAS-571	29 Dec 2011
Loop Antenna	EM-6876	09 Sep 2010
Pre-Amplifier (25MHz-1GHz)	HP 8447E	03 Mar 2011
Pre-Amplifier (1GHz-4.5GHz)	RE 218A	12 Oct 2010
Pre-Amplifier (4.5GHz-9.2GHz)	RE 518A	12 Oct 2010

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5.5 Measurement Uncertainties

The following uncertainties are for a 95% level of confidence, based on a coverage factor, $k=2$.

Test	Measurement Uncertainty
Conducted Emissions (Austest NSW)	$\pm 2.6\text{dB}$
Radiated Emissions (Austest NSW)	$\pm 4.7\text{dB}$

6 FCC Part 15B, Section 15.107 - CONDUCTED LIMITS

Not applicable to the EUT as the EUT is only powered by an internal 3V battery.

7 FCC Part 15B, Section 15.109 - RADIATED EMISSION LIMITS

Not applicable as the EUT is a transmitter and unwanted emissions requirements are covered within 15.209 and 15.249.

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8 FCC Part 15C, Section 15.203 – ANTENNA REQUIREMENT

The EUT has an integral PCB track antenna.

The EUT complies with the requirement of this Section since it is “designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device”.

9 FCC Part 15C, Section 15.205 – RESTRICTED BANDS OF OPERATION

The EUT complies with the requirements of this Section since it does not operate within the listed Restricted Bands of Operation. The EUT operates at 916.5MHz.

10 FCC Part 15C, Section 15.207 - CONDUCTED LIMITS

Not applicable to the EUT as the EUT is only powered by an internal 3V battery.

11 FCC Part 15C, Section 15.209 - RADIATED EMISSION LIMITS, GENERAL REQUIREMENTS

Test Date:	26 th – 27 th August 2010	Temperature:	18°C
Test Officer:	Richard Turner	Humidity:	48 to 63%
Test Location:	Austest Laboratories (NSW)		

11.1 EUT Operating Mode

- a. EUT power supply voltage – nominal 3.0VDC using a new battery.
- b. Normal operating mode with modulation.

11.2 Test Method

- a. Measurements are performed in accordance with ANSI C63.4-2003.
- b. Set the measuring receiver BW settings to:
 - i. 9kHz (150kHz to 30MHz) EMI Receiver BW.
 - ii. 120kHz (30MHz to 1GHz) EMI Receiver BW.
 - iii. 1MHz (above 1GHz) RBW, 1MHz or more VBW, using a Spectrum Analyser for Peak measurements.
 - iv. 1MHz (above 1GHz) RBW, 10Hz VBW, using a Spectrum Analyser for Average measurements.
- c. The EUT was placed on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at the indicated test distance away from the measuring antenna.
- d. From preliminary EUT investigations of 3 orthogonal axes, it was determined that the worst-case EUT axes was in the horizontal position as shown in APPENDIX C – EUT TEST SETUP PHOTOGRAPHS.
- e. To maximise emissions, the EUT was rotated through 360° and the measuring antenna height adjusted between 1m to 4m in the following antenna orientations:
 - i. Loop antenna (150kHz to 30MHz) – Coaxial and coplanar orientations.
 - ii. Biconical and Log-Periodic antennas (30MHz to 1GHz) - Both vertical and horizontal polarizations.
 - iii. Horn antenna (above 1GHz) - Both vertical and horizontal polarizations.
- f. The maximised emission levels were recorded and the above was repeated for all measurement frequencies.
- g. Transmission at the fundamental frequency (916.5MHz) was not measured.

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11.3 Test Results

150kHz to 30MHz, measured at 3 meters

All measured emissions for both coaxial and coplanar orientations were greater than 20dB below limits.

30MHz to 1000MHz, measured at 3 meters

All measured emissions for both vertical and horizontal polarisations were greater than 20dB below limits.

1GHz to 9.2GHz, measured at 3 meters and 1 meter

The highest measured peak level was 1.97mV/m at 2.749GHz (3rd harmonic), 8.1dB below the peak limit.

The highest measured average level was 132µV/m at 2.749GHz (3rd harmonic), 11.6dB below the average limit.

The highest measured peak values are as follows:

Frequency (GHz)	Polarisation	Peak Level @ 3m (dBµV/m)	Peak Limit @ 3m (dBµV/m)	Pass Margin (dB)
1.833	Vertical	57.6	74.0	-16.4
1.833	Horizontal	61.1	74.0	-12.9
2.749	Vertical	58.5	74.0	-15.5
2.749	Horizontal	65.9	74.0	-8.1
3.666	Vertical	50.4	74.0	-23.6
3.666	Horizontal	51.0	74.0	-23.0
4.582	Vertical	46.8*	74.0	-27.2
4.582	Horizontal	50.8*	74.0	-23.2
5.499	Vertical	48.8*	74.0	-25.2
5.499	Horizontal	50.3*	74.0	-23.7
6.419	Horizontal	47.8*	74.0	-26.2

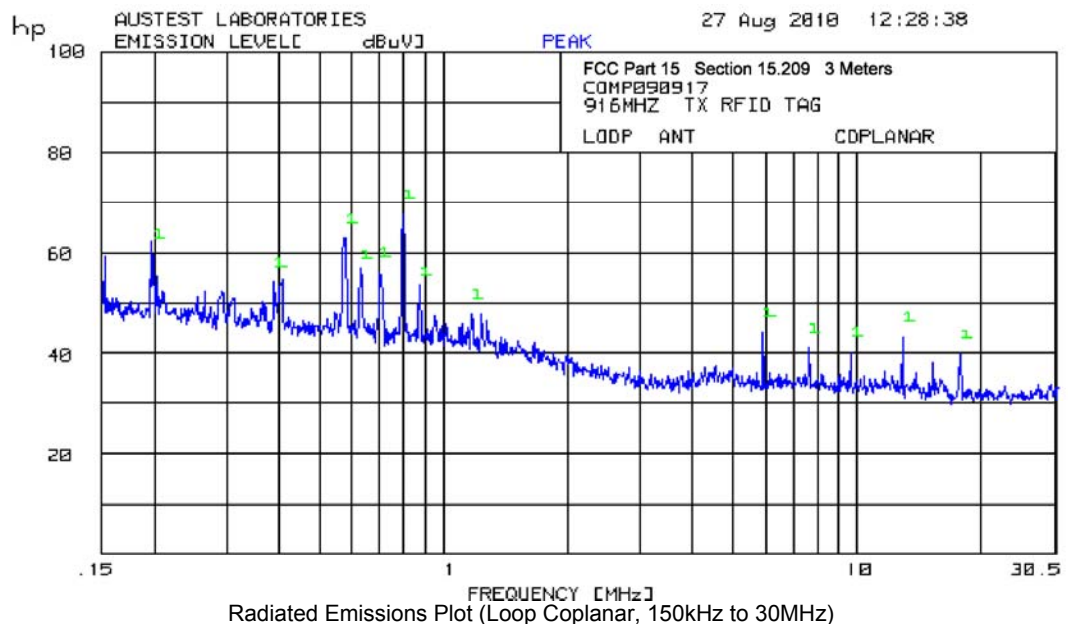
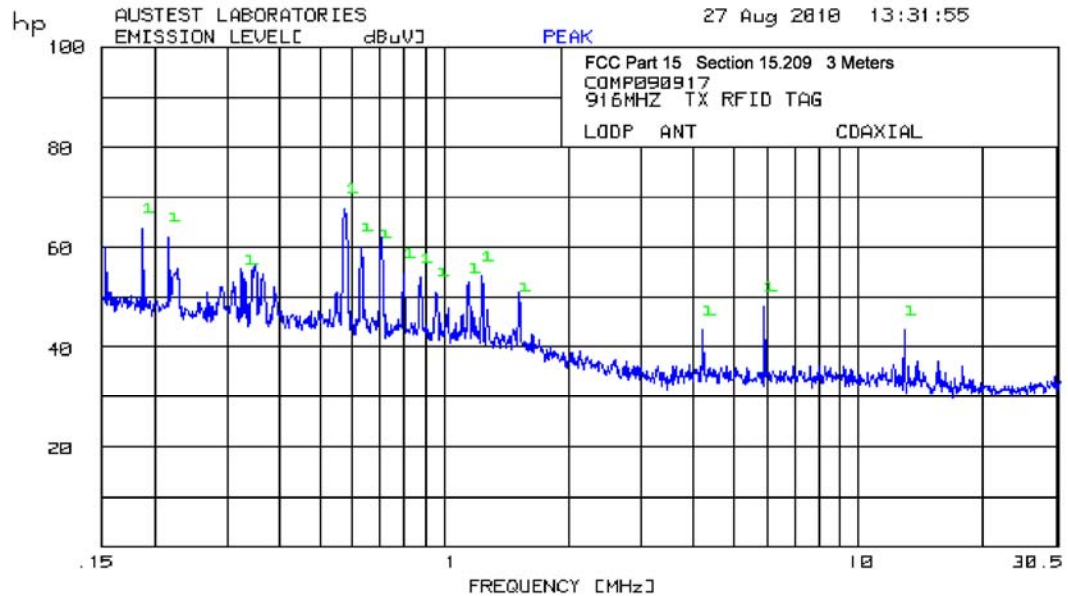
*Measured at 1m test distance. Results were then extrapolated to 3m distance using an extrapolation factor of 20dB/decade in accordance with Section 15.31(f)(1).

The highest measured average values are as follows:

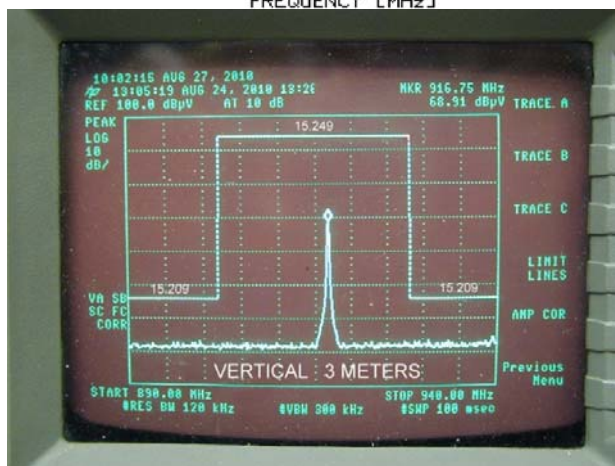
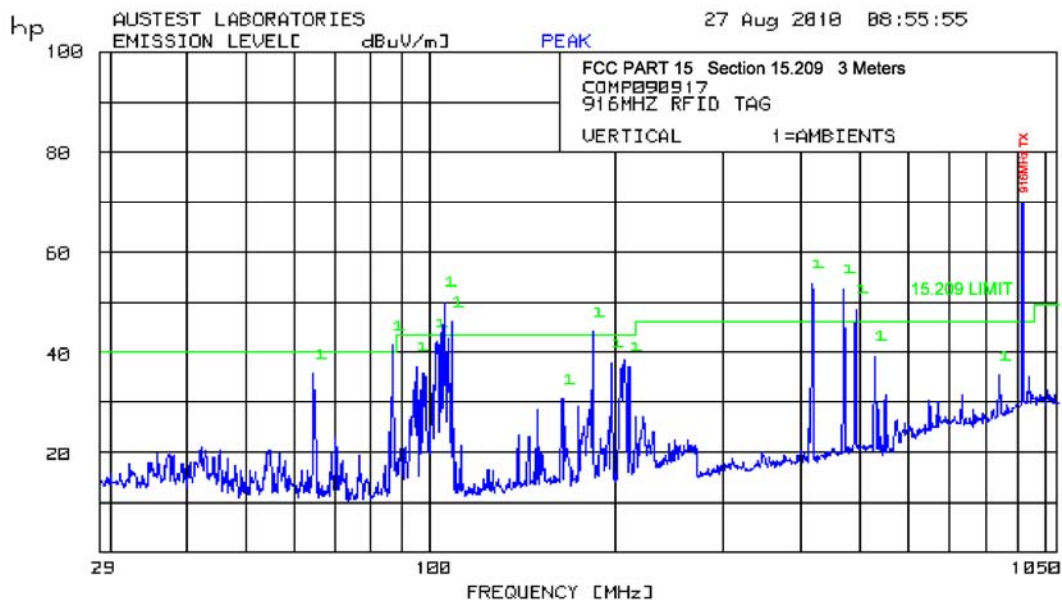
Frequency (GHz)	Polarisation	AV Level @ 3m (dBµV/m)	AV Limit @ 3m (dBµV/m)	AV Pass Margin (dB)
1.833	Vertical	37.7	54.0	-16.3
1.833	Horizontal	38.7	54.0	-15.3
2.749	Vertical	39.6	54.0	-14.4
2.749	Horizontal	42.4	54.0	-11.6

Average values were only measured when peak values exceeded the average limit.

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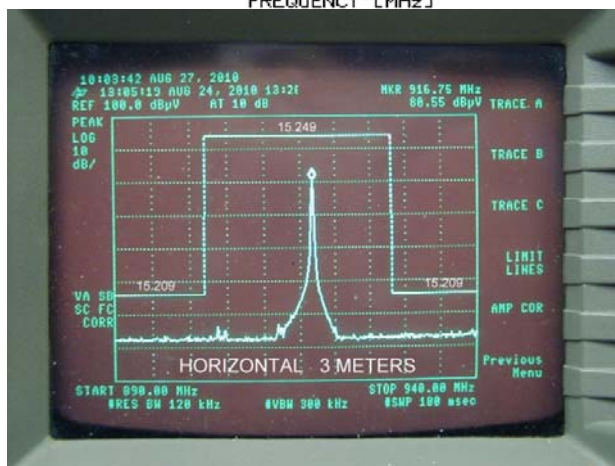
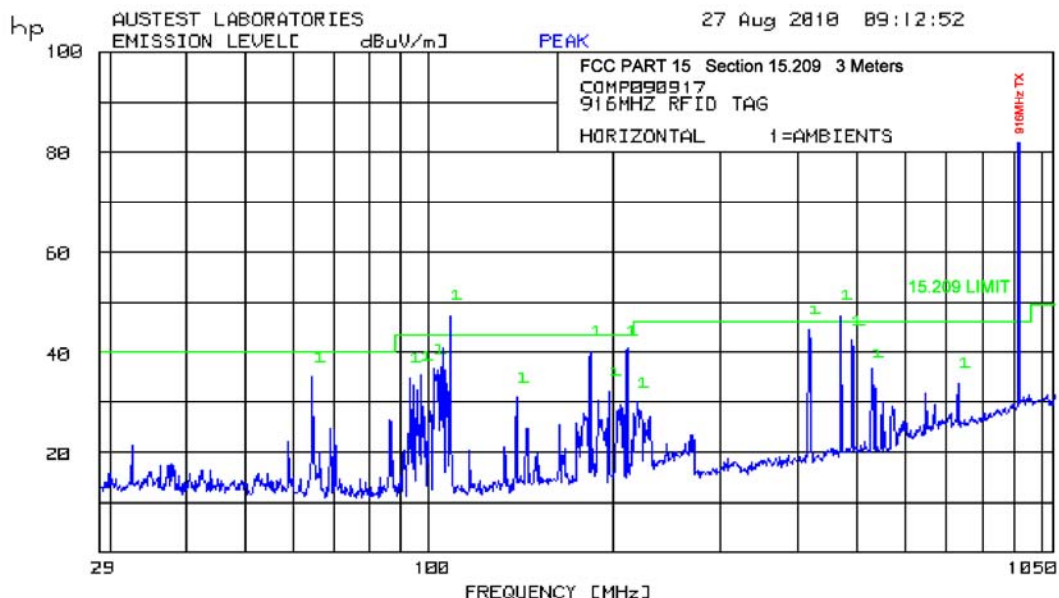


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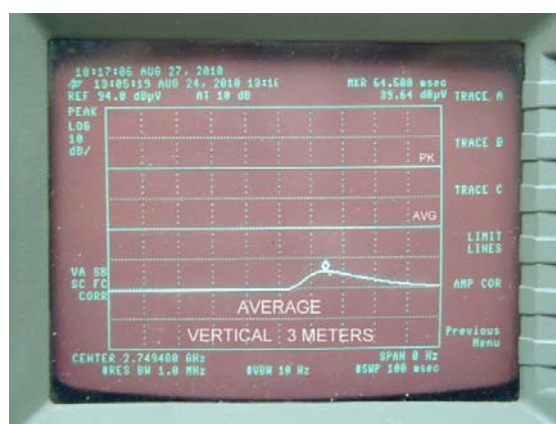
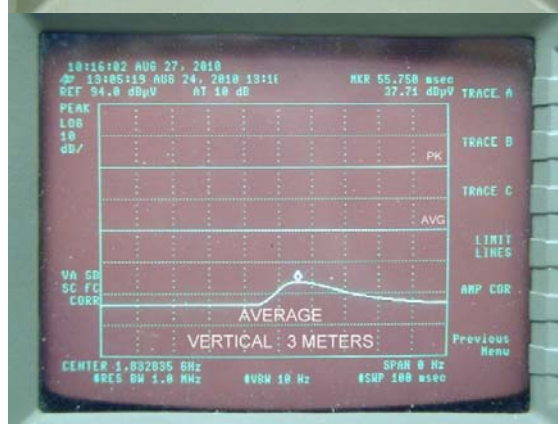
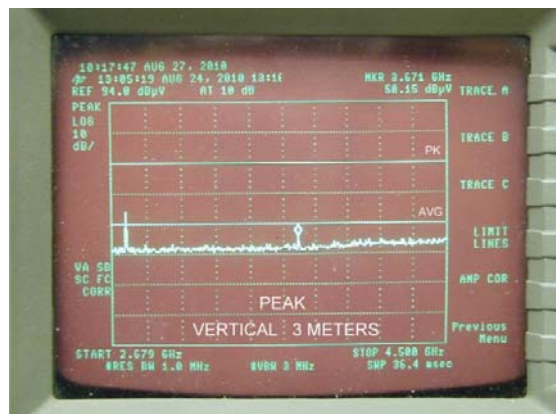
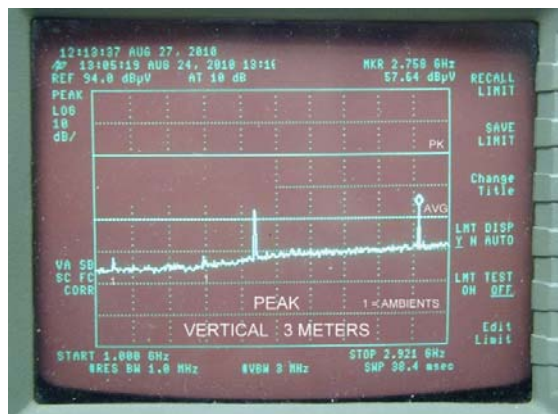
Radiated Emissions Plot (Vertical Polarisation, 30MHz to 1GHz)

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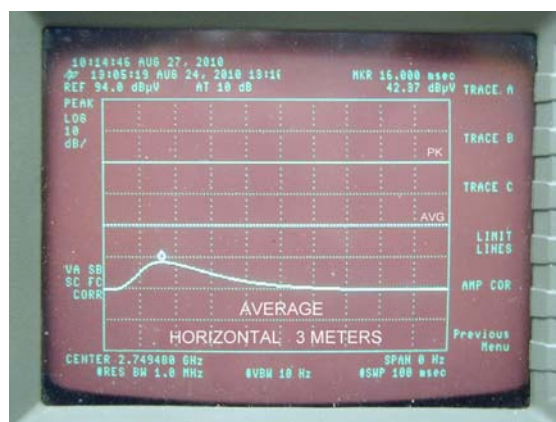
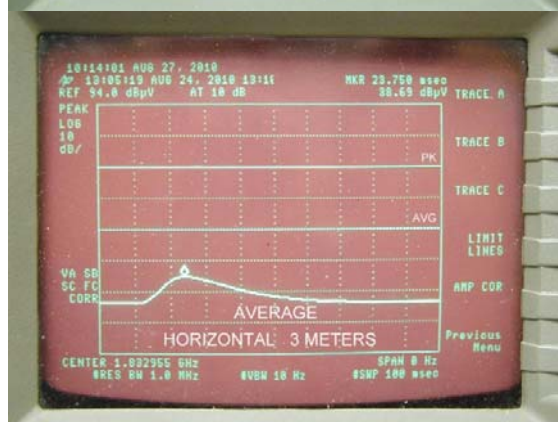
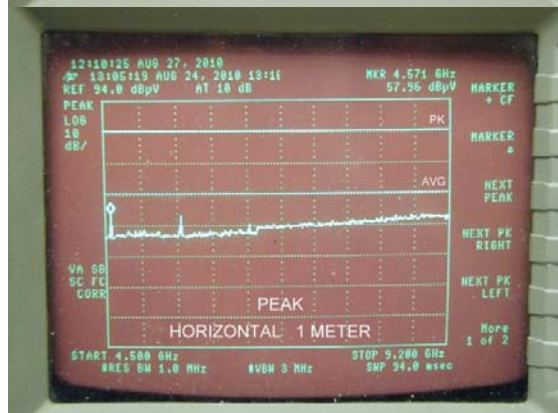
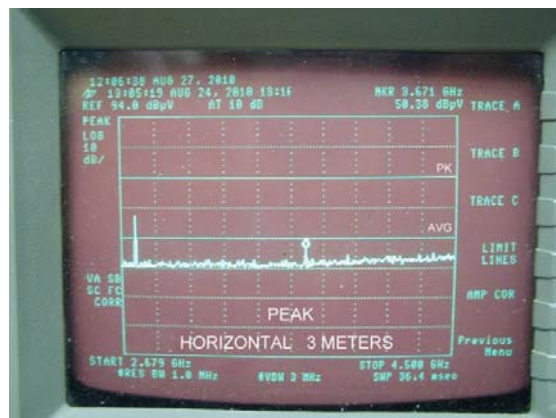
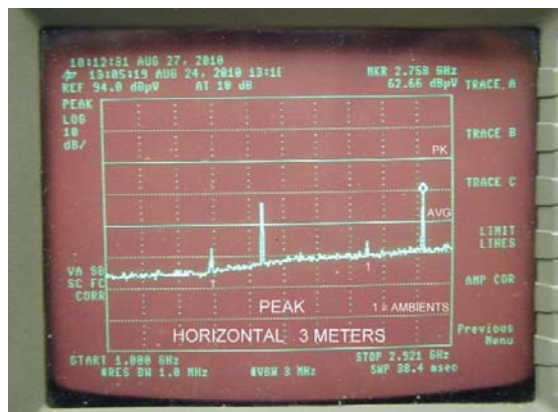
Radiated Emissions Plot (Horizontal Polarisation, 30MHz to 1GHz)

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Radiated Emissions Plot (Vertical Polarisation, Above 1GHz)

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Radiated Emissions Plot (Horizontal Polarisation, Above 1GHz)

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12 FCC Part 15C, Section 15.215 – ADDITIONAL PROVISIONS TO THE GENERAL RADIATED LIMITATIONS

The EUT complies with the requirements of this Section as shown by the test results of this report.

Test Date:	26 th August 2010	Temperature:	18°C
Test Officer:	Richard Turner	Humidity:	48%
Test Location:	Austest Laboratories (NSW)(SA)		

12.1 EUT Operating Mode

- EUT power supply voltage – nominal 3VDC using a new battery.
- Normal operating mode with modulation.

12.2 Test Method

20dB bandwidth measurement

- Set the spectrum analyser RBW to 100kHz RBW, and the VBW to 100kHz or more.
- Mark the peak frequency level and note the -20dB lower frequency of the Low Channel and the upper frequency of the High Channel to ensure that they are within the permitted operating frequency band.

12.3 Test Results

15.215 (b)

All unwanted emissions outside the allowed band of operation were below the limits specified in section 15.209 and below the intentional emission level at the fundamental frequency (916.5MHz).

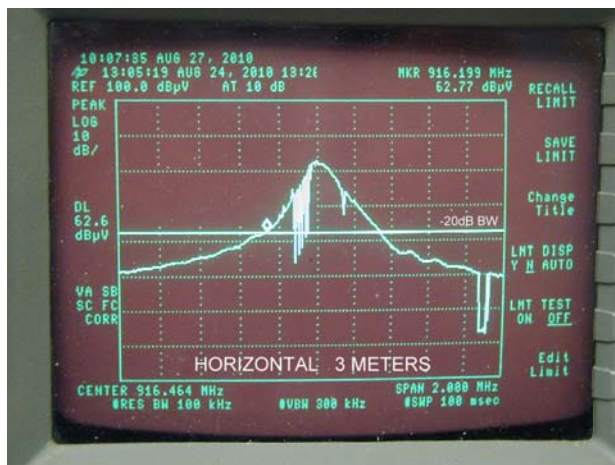
15.215 9 (c)

The 20dB bandwidth was measured as 600kHz.

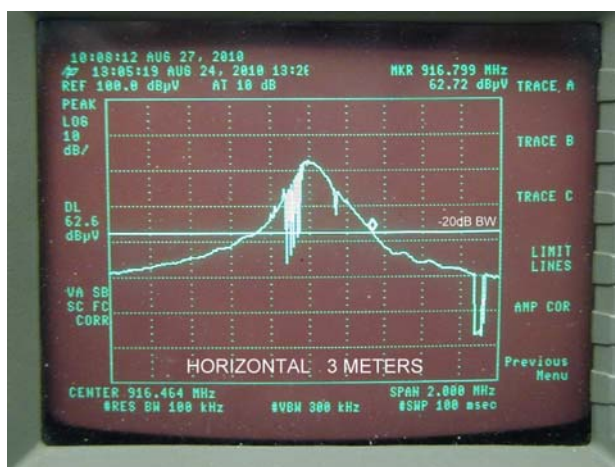
Low Channel Lower Frequency (MHz)	High Channel Upper Frequency (MHz)	Permitted Frequency Range (MHz)	Result
916.20	916.80	902.00 to 928.00	Complies

The above is within at least the central 80% of the permitted band, which is required in order to minimize the possibility of out-of-band operation.

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20dB Bandwidth Low Channel Plot (Lower Frequency)



20dB Bandwidth High Channel Plot (Upper Frequency)

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13 FCC Part 15C, Section 15.249 – OPERATION WITHIN THE BANDS 902-928MHz, 2400-2483.5MHz, 5725-5850MHz, AND 24.0-24.25GHz

13.1 Field Strength at 3m (Fundamental & Harmonics) – Section 15.249(a), (c) & (e)

Test Date:	26 th and 27 th August 2010	Temperature:	18°C
Test Officer:	Richard Turner	Humidity:	48 to 63%
Test Location:	Austest Laboratories (NSW)(SA)		

13.1.1 EUT Operating Mode

- a. EUT power supply voltage – nominal 3VDC using a new battery.
- b. Normal operating mode with modulation.

13.1.2 Test Method

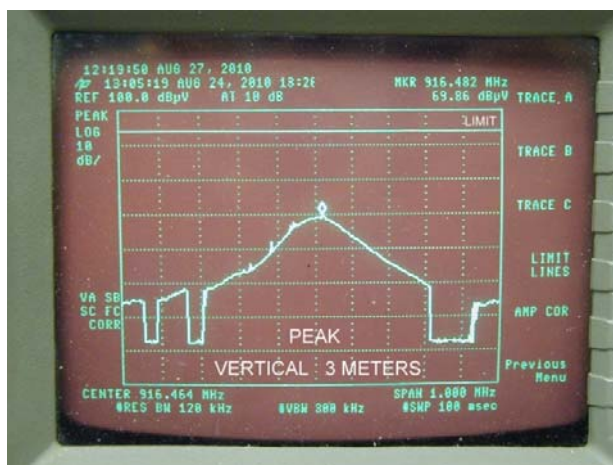
- a. Measurements are performed in accordance with ANSI C63.4-2003.
- b. Set the measuring receiver BW settings to:
 - i. 9kHz (150kHz to 30MHz) EMI Receiver BW.
 - ii. 120kHz (30MHz to 1GHz) EMI Receiver BW.
 - iii. 1MHz (above 1GHz) RBW, 1MHz or more VBW, using a Spectrum Analyser for Peak measurements.
 - iv. 1MHz (above 1GHz) RBW, 10Hz VBW, using a Spectrum Analyser for Average measurements.
- c. The EUT was placed on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at the indicated test distance away from the measuring antenna.
- d. From preliminary EUT investigations of 3 orthogonal axes, it was determined that the worst-case EUT axes was in the horizontal position as shown in APPENDIX C – EUT TEST SETUP PHOTOGRAPHS.
- e. To maximise emissions, the EUT was rotated through 360° and the measuring antenna height adjusted between 1m to 4m in the following antenna orientations:
 - i. Loop antenna (150kHz to 30MHz) – Coaxial and coplanar orientations.
 - ii. Biconical and Log-Periodic antennas (30MHz to 1GHz) - Both vertical and horizontal polarizations.
 - iii. Horn antenna (above 1GHz) - Both vertical and horizontal polarizations.
- f. The maximised emission levels were recorded and the above was repeated for all measurement frequencies (fundamental and harmonics).

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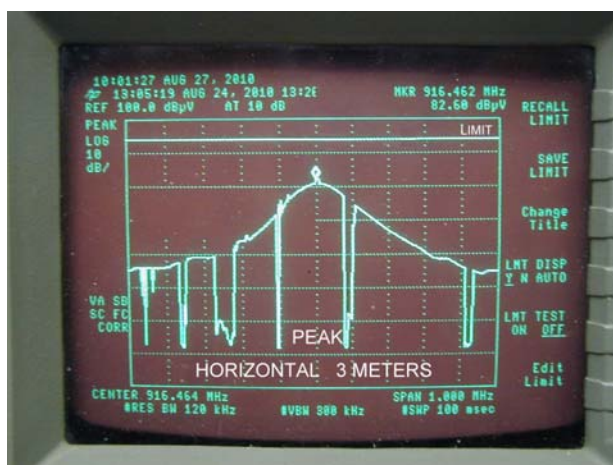
13.1.3 Test Results

Using peak detection, the measured field strength of the fundamental frequency is shown below.

Frequency (MHz)	Ant. Pol.	Measured Field Strength (Peak)		Field Strength Limit		Pass Margin (dB)
		(dB μ V/m)	(mV/m)	(dB μ V/m)	(mV/m)	
916.48	Vertical	69.9	3.1	94.0	50.0	-24.1
916.46	Horizontal	82.6	13.5	94.0	50.0	-11.4



Field Strength Plot (Vertical Polarization)



Field Strength Plot (Horizontal Polarization)

All measured harmonic levels were below the limits specified in FCC Part 15, Sections 15.209 and 15.249. For details, refer to Clause 11 of this report.

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13.2 Emissions Radiated Outside the Specified Frequency Bands – Section 15.249(d)

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

13.3 Intentional Radiators operating in the band 902-905MHz – Section 15.249(f)

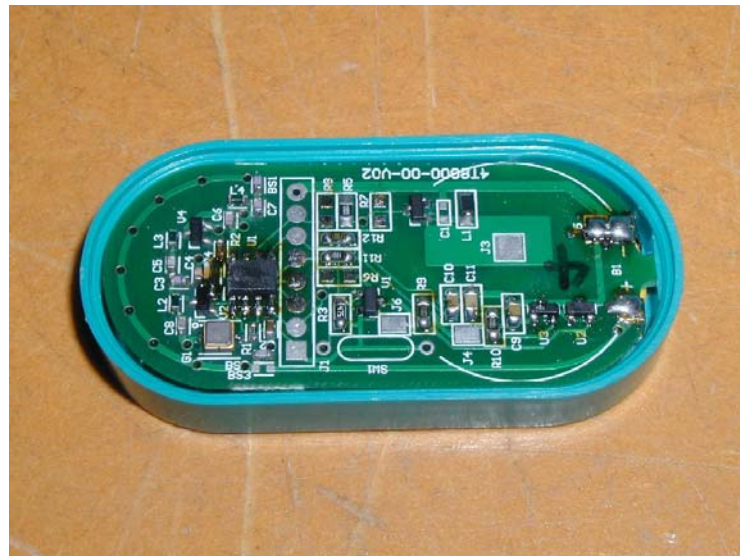
Not applicable.

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APPENDIX A – PHOTOGRAPHIC RECORD OF EUT



916.5MHz RFID Tag



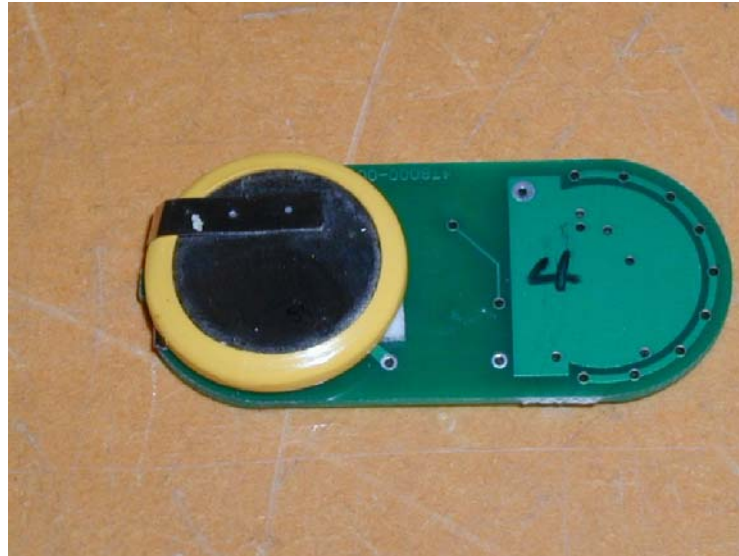
916.5MHz Tag PCB Top

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FCC ID: X6X4T8000



916.5MHz Tag PCB Bottom

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35 Alleyne St, Chatswood NSW 2067 Australia. Ph: +612 9882 6500

APPENDIX B – FCC LABEL & LOCATION



FCC Label



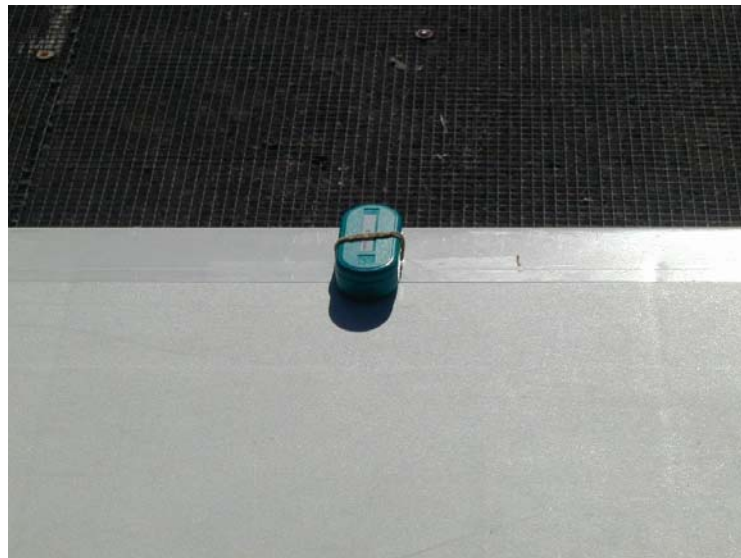
FCC Label Location on EUT

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APPENDIX C – EUT TEST SETUP PHOTOGRAPHS



Conducted Disturbance Test Setup



Radiated Disturbance Test Setup

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