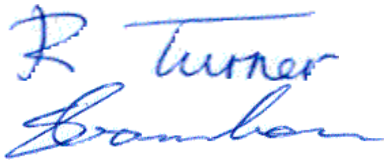
Compliance Testing Report

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:	1115COMP2T8000US_fcc15ab&c
Date of Testing:	8th October 2009 to 22nd January 2010
File Number:	COMP090917
Equipment Name:	433MHz RFID Tag
Equipment Model Number:	2T8000US
Equipment Serial Number:	Not Supplied
Equipment FCC ID:	X6X2T8000US
Equipment Description:	RFID Tracking System Tag
Result:	COMPLIES
Tested by:	Richard Turner
Approved by:	Steve Garnham
Date of Issue:	15th November 2010



AUSTEST (NSW) FCC REGISTRATION NUMBER 90455

Table of Contents:

Report Revision History:

Date	Report Number	Changes
15th Nov.2010	1115COMP2T8000US_fcc15ab&c	Original Report.

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	
15.231	Periodic operation in the band 40.66-40.70MHz and above 70MHz	Complies	(i)

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 can only be powered by internal battery
(v) The EUT is a transmitter and unwanted emissions requirements are covered within 15.209 and 15.231.

2 MODIFICATIONS

None.

3 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

EUT Name:	433MHz RFID Tag
EUT Description:	RFID Tracking System Tag
EUT Model:	2T8000US
EUT Serial Number:	Not Supplied
EUT FCC ID:	X6X2T8000US
Manufacturer:	Protrac ID PTY Ltd
Power Supply & Rating:	Internal 3V Lithium battery
Highest Clock Frequency:	433.92MHz
Transmit Frequency Range:	433.8MHz (single frequency)
Modulation Technique:	ASK
Antenna Specifications:	Integral PCB Track antenna

RFID Tag Operating Modes

Tag No.	Operation Description
5	When activated, continuous transmission
6	Repeated short duration transmissions (normal operation)

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 RFID tag has no external ports for cable connections.

4.3 Transmitter Test Channels

The RFID Tag transmits on one single frequency – 433.8MHz.

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	23 February, 2010
Spectrum Analyser	HP 8593E	09 October, 2010
Biconical Array Antenna	Compower AB100	28 August, 2010
Log-Periodic Array Antenna	Compower AL100	28 August, 2010
DRG Horn Antenna	AH Systems SAS-571	29 December, 2011
Loop Antenna	EM-6876	09 September, 2010
Pre-Amplifier (25MHz-1GHz)	HP 8447E	24 February, 2010
Pre-Amplifier (1GHz-25GHz)	RE 218A	12 October, 2010

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)	±2.6dB
Radiated Emissions (Austest NSW)	±4.7dB

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 15.231.

8 FCC Part 15C, Section 15.203 – ANTENNA REQUIREMENT

The RFID Tag 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”, as the antenna is an integral PCB track antenna.

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 433.8MHz.

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:	22nd January 2010	Temperature:	28°C
Test Officer:	RT	Humidity:	48%
Test Location:	Austest Laboratories (NSW)		

11.1 EUT Operating Mode

a. EUT power supply voltage – internal 3V battery.
b. RFID Tag 5 – continuous transmission.

11.2 Test Method

a. Measurements are performed in accordance with ANSI C63.4-2003.
b. The client advised that the lowest frequency utilised by the intentional radiator was 1MHz. Measurement was made from 150kHz to 4500MHz (10th harmonic of highest frequency).
c. 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.
d. The RFID Tag 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.
e. 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.

f. 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.
g. Only those disturbances that fall within the restricted bands specified in section 15.205 were recorded. Otherwise the limits specified in section 15.231(e) apply.

11.3 Test Results

11.3.1 150kHz to 30MHz

All measured disturbances in the restricted bands were greater than 10dB below the limits.

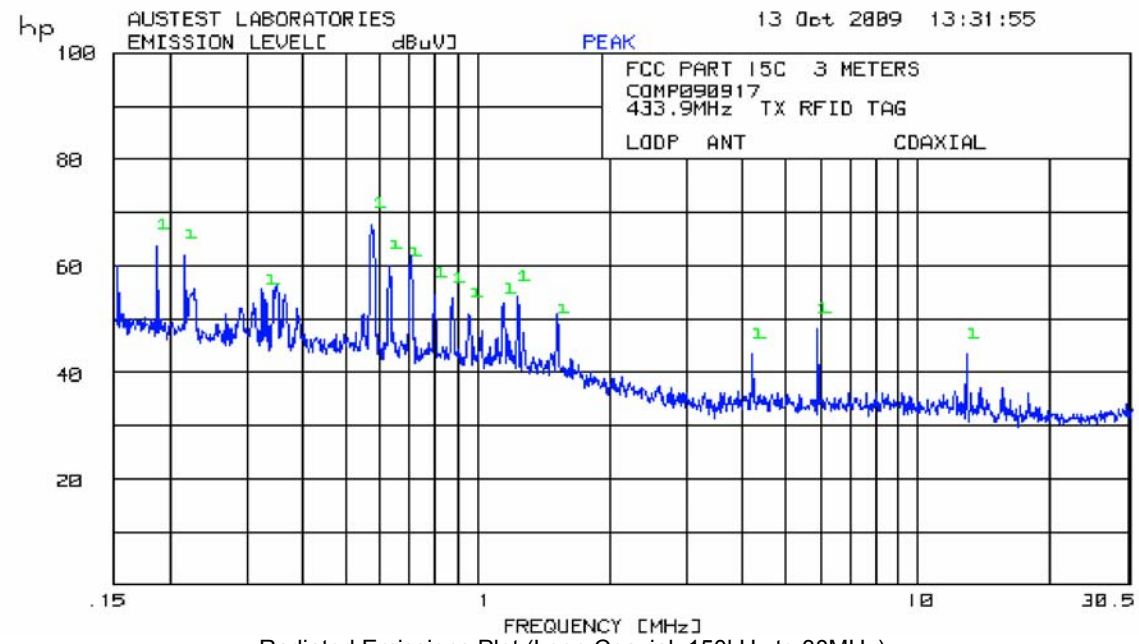
11.3.2 30MHz to 1000MHz

All measured disturbances in the restricted bands were greater than 10dB below the limits.

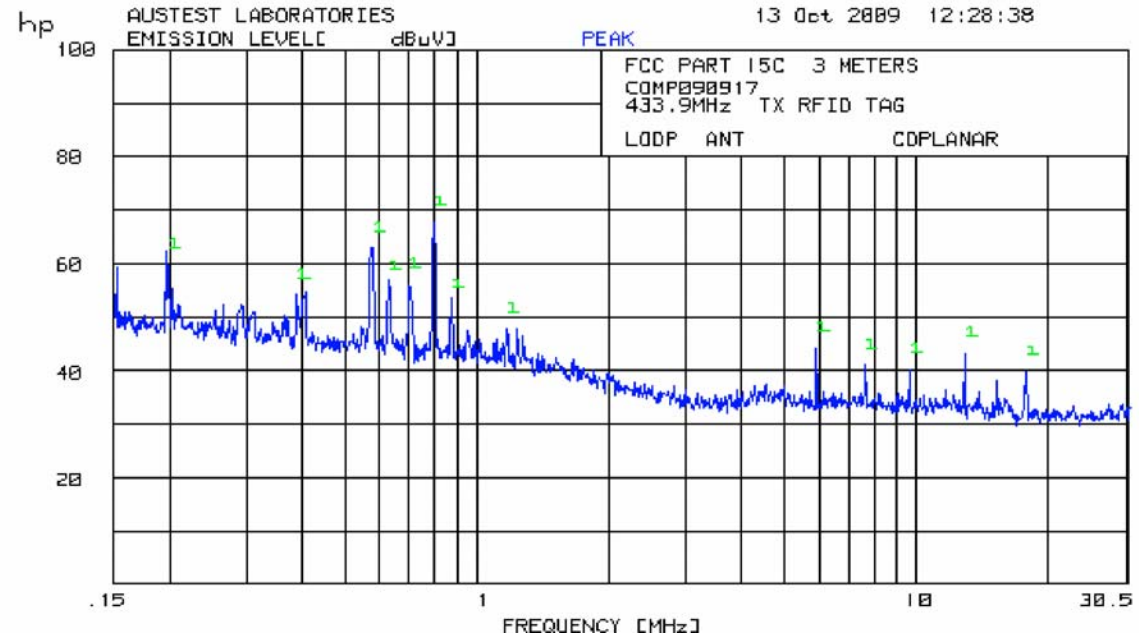
11.3.3 1000MHz to 4500MHz

a. The highest measured peak disturbance level within a restricted band was 288µV/m (49.2dBµV/m) at 3471.0MHz.
b. Average measurements were only made when peak levels exceeded the average limit of 500µV/m.
c. Field strength measurements were made at a 3 meter distance.
d. The highest measured emission levels within the restricted bands are shown below:

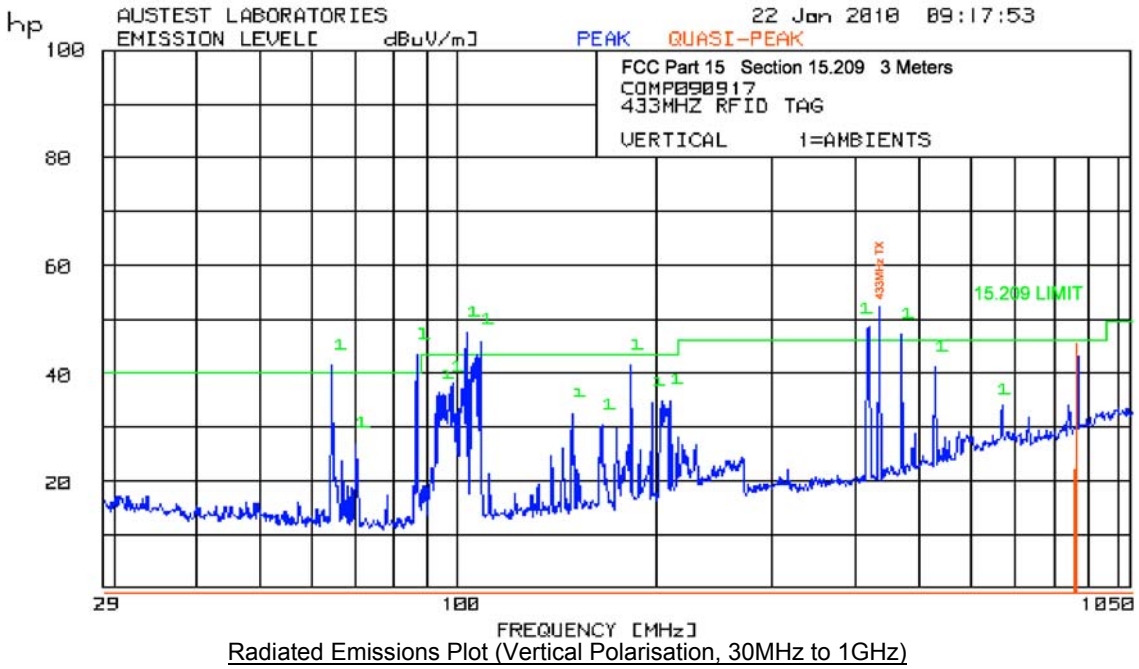
Frequency (MHz)	Ant. Pol.	Measured Peak Level		Field Strength Limit		Pass Margin (dB)
		(dBµV/m)	(µV/m)	(dBµV/m)	(µV/m)	
1301	Horizontal	48.1	254	74.0	5000	-25.9
1301	Vertical	45.7	193	74.0	5000	-28.3
3471	Horizontal	49.2	288	74.0	5000	-24.8



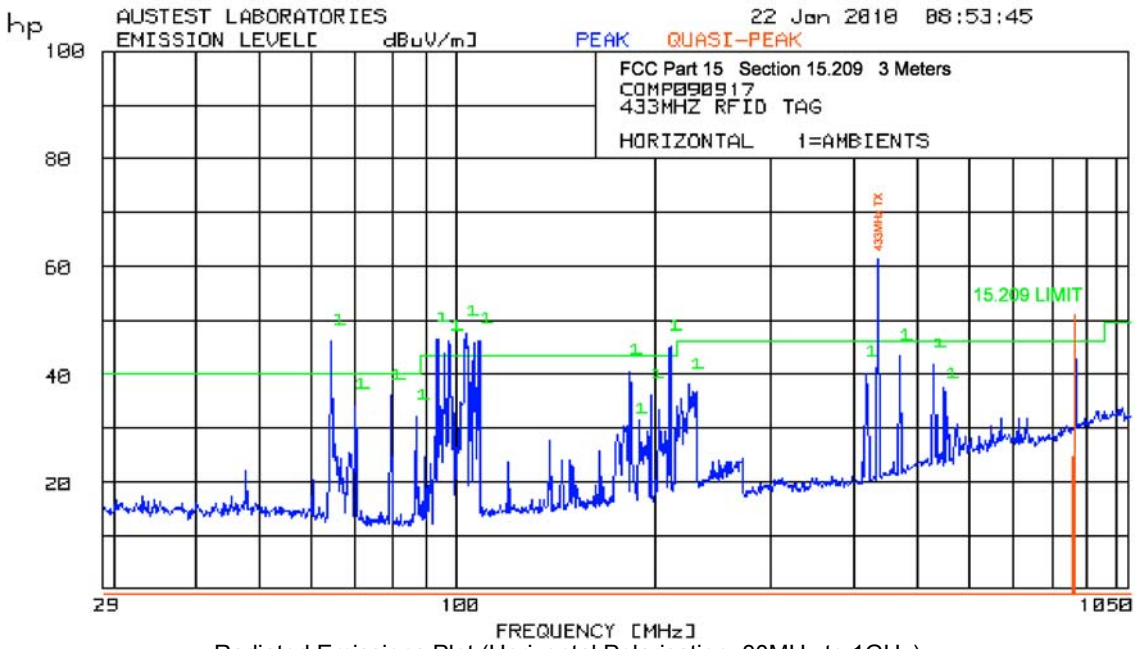
Radiated Emissions Plot (Loop Coaxial, 150kHz to 30MHz)



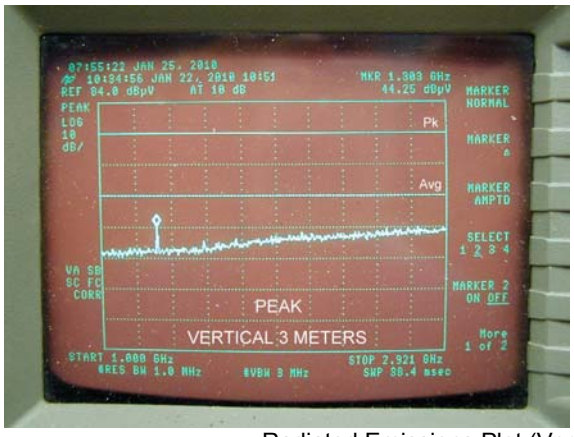
Radiated Emissions Plot (Loop Coplanar, 150kHz to 30MHz)

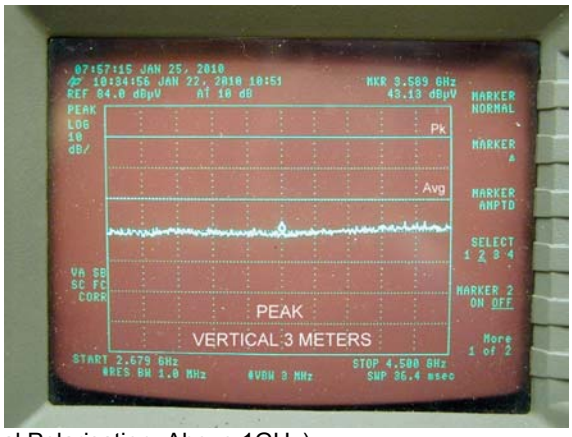


Radiated Emissions Plot (Vertical Polarisation, 30MHz to 1GHz)

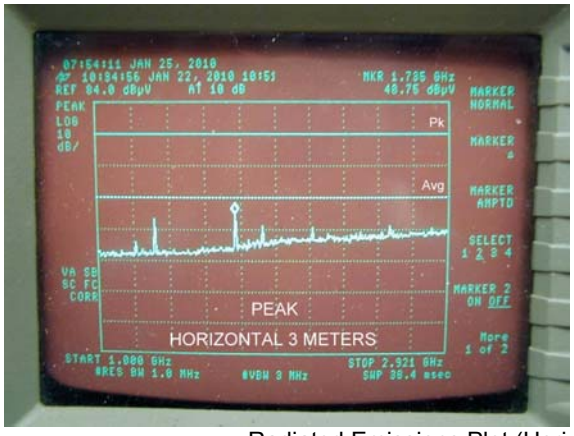


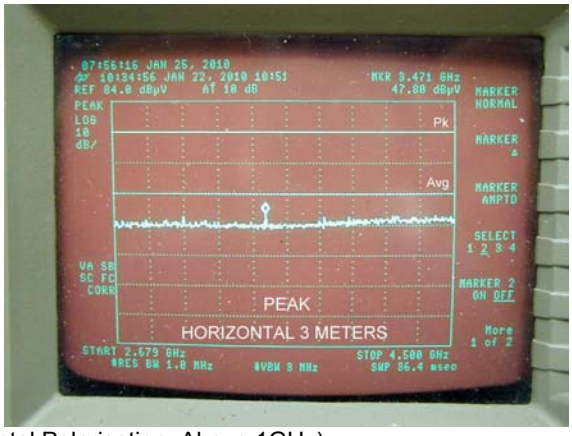
Radiated Emissions Plot (Horizontal Polarisation, 30MHz to 1GHz)





Radiated Emissions Plot (Vertical Polarisation, Above 1GHz)





Radiated Emissions Plot (Horizontal Polarisation, Above 1GHz)

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

The EUT complies with the requirements of this Section. Refer to Section 13 of this report for test results.

13 FCC Part 15C, Section 15.231 – PERIODIC OPERATION IN THE BAND 40.66-40.40MHz AND ABOVE 70MHz

13.1 Periodic Operation – Section 15.231 (a)

NOT APPLICABLE – Section 15.231(e) refers.

13.2 Field Strength of Emissions – Section 15.231 (b)

NOT APPLICABLE – Section 15.231(e) refers.

13.3 Emission Bandwidth for Devices Operating Above 70MHz – Section 15.231(c)

Test Date:	22nd January 2010	Temperature:	28°C
Test Officer:	Richard Turner	Humidity:	48%
Test Location:	Austest Laboratories (NSW)		

13.3.1 EUT Operating Mode

a. EUT power supply voltage – internal 3V battery.
b. RFID Tag 5 – continuous transmission.

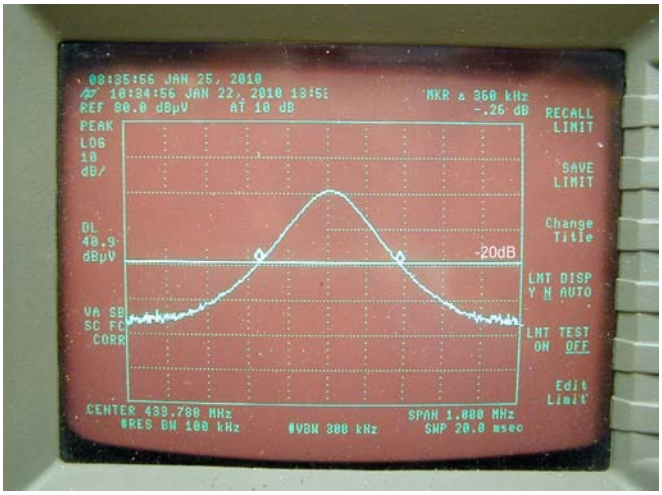
13.3.2 Test Method

a. Measurements are performed in accordance with ANSI C63.4-2003.
b. A RF field probe was placed close to the RFID tag and connected to the spectrum analyser 50Ω input.
c. The spectrum analyser bandwidth RBW was adjusted to 100kHz. VBW to 300kHz.
d. Mark the peak frequency level and note the -20dB lower frequency points. Record the -20dB bandwidth and ensure the upper and lower frequency points remain within the band.

13.3.3 Test Results

Measured 20dB bandwidth – 360kHz

Limit:
0.25% of the centre frequency (433.8MHz) = 1.08MHz



20dB Bandwidth Plot

13.4 Emission Bandwidth for Devices Operating Within the Frequency Band 40.66-40.70MHz – Section 15.231(d)

NOT APPLICABLE

13.5 Field Strength of Emissions at 3m (Fundamental & Harmonics) – Section 15.231(e)

Test Date:	22nd January 2010	Temperature:	28°C
Test Officer:	RT	Humidity:	48%
Test Location:	Austest Laboratories (NSW)(SA)		

13.5.1 EUT Operating Mode

a. EUT power supply voltage – internal 3V battery.
b. RFID Tag 5 – continuous transmission.
c. RFID Tag 6 – normal operation.

13.5.2 Test Method

a. Using RF Tag 6, measure the transmit duration and silent period for compliance with this section. Spectrum analyser span set to zero, sweep time adjusted accordingly.
b. Using RF Tag 5, field strength measurements were performed in accordance with ANSI C63.4-2003.
c. The client advised that the lowest frequency utilised by the intentional radiator was 1MHz. Measurement was made from 150kHz to 4500MHz (10^{th} harmonic).
d. Set the measuring receiver to Peak detection and the 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.
e. The RFID Tag was placed horizontally on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at the indicated test distance away from the measuring antenna.
f. To maximise emissions, the EUT was rotated through 360^{o} 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.
g. Measure the maximised emission and repeat the above for all measurement frequencies (i.e. fundamental and harmonics).

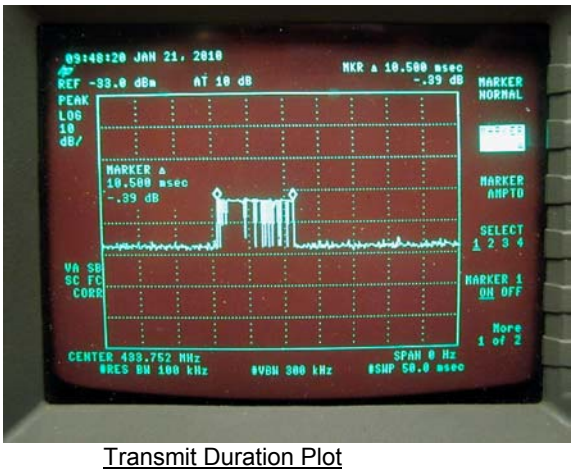
13.5.3 Test Results

13.5.3.1 Transmission duration and operation

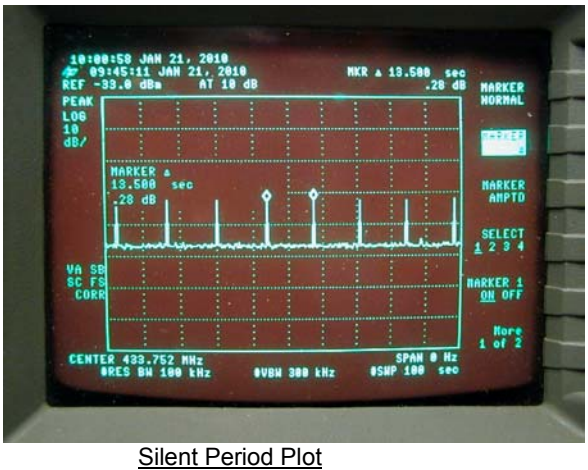
In normal use the RFID tag automatically initiates transmission at regular predetermined intervals.

The duration of the transmission was measured as 10.5ms. Limit is no greater than 1s.
The silent period between transmissions was measured as 13.5s. Limit is no less than 10s or at least 30 times the duration of the transmission (315ms)

The RFID tag satisfies the conditions for measurement to the fundamental and spurious limits specified in section 15.231(e)



Transmit Duration Plot

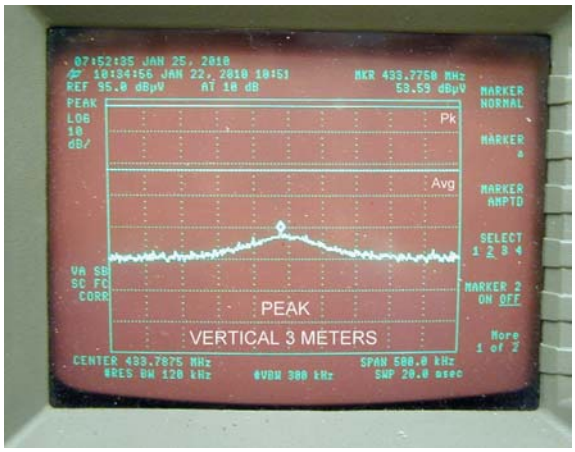


Silent Period Plot

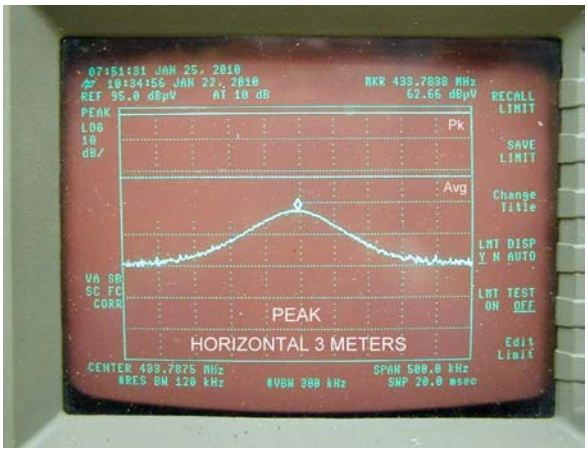
13.5.3.2 Fundamental Frequencies

a. The highest measured peak level was 1.4mV/m (62.7dBµV/m) at 433.8MHz.
b. Average measurements were only made when peak levels exceeded the average limit of 5mV/m.
c. The measured field strength of the fundamental frequencies at a 3 meter distance is shown below.

Frequency (MHz)	Ant. Pol.	Measured Peak Level		Limit		Pass Margin (dB)
		(dBµV/m)	(mV/m)	(dBµV/m)	(mV/m)	
433.8	Horizontal	62.7	1.4	92.9	44.2	-30.2
433.8	Vertical	53.6	0.5	92.9	44.2	-39.3



Field Strength Plot (Vertical Polarization)



Field Strength Plot (Horizontal Polarization)

13.5.3.3 Spurious emissions

Refer to Section 11 of this report for measurement plots of spurious emissions.

13.5.3.4 150kHz to 30MHz

All measured emissions were greater than 10dB below the spurious emission limits.

13.5.3.4.1 30MHz to 1000MHz

a. The highest measured quasi-peak level was 351µV/m (50.9dBµV/m) at 867.6MHz.
b. The measured field strength of the spurious emissions at a 3 meter distance is shown below.

Frequency (MHz)	Ant. Pol.	Measured Quasi-Peak Level		Limit		Pass Margin (dB)
		(dBµV/m)	(µV/m)	(dBµV/m)	(µV/m)	
867.6	Horizontal	50.9	351	52.9	442	-2.0*
867.6	Vertical	45.5	188	52.9	442	-7.4

*Result was within the laboratory's measurement uncertainty.

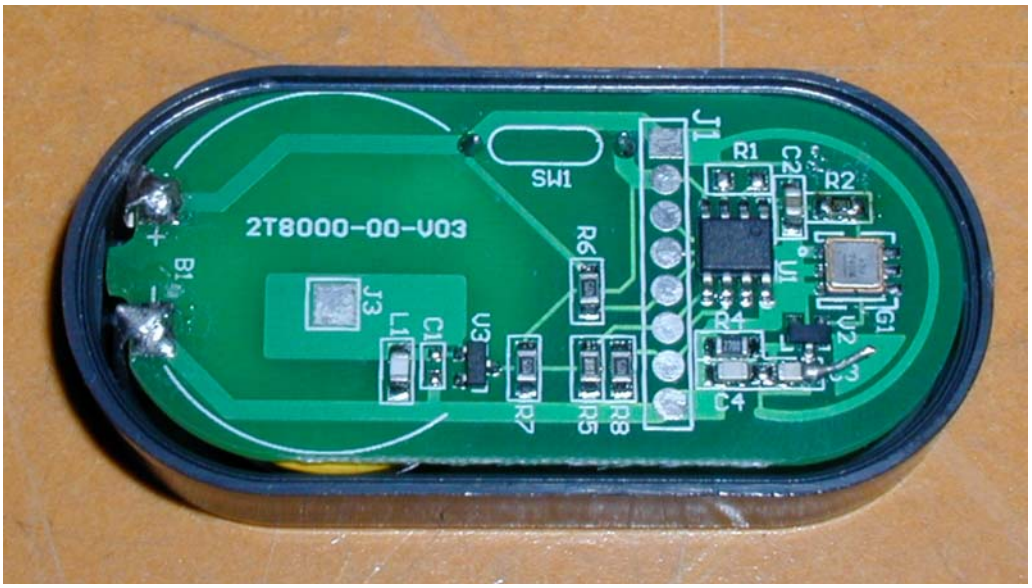
13.5.3.4.2 1000MHz to 4500MHz

a. The highest measured peak level was 316µV/m (50.0dBµV/m) at 1735MHz.
b. Average measurements were only made when peak levels exceeded the average limit of 442µV/m.
c. The six highest measured spurious emission levels at a 3 meter distance are shown below.

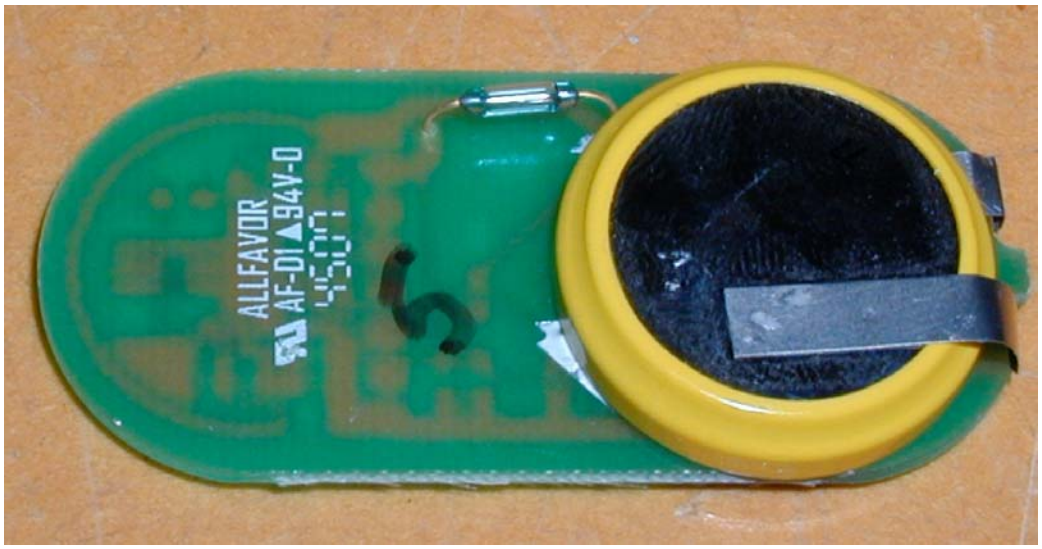
Frequency (MHz)	Ant. Pol.	Measured Peak Level		Field Strength Limit		Pass Margin (dB)
		(dBµV/m)	(µV/m)	(dBµV/m)	(µV/m)	
1735	Horizontal	50.0	316	72.9	4420	-22.9
3471	Horizontal	49.2	288	72.9	4420	-23.7
1301	Horizontal	48.1	254	72.9	4420	-24.8
3037	Horizontal	47.8	245	72.9	4420	-25.1
2169	Horizontal	46.9	221	72.9	4420	-26.0
2603	Horizontal	46.4	209	72.9	4420	-26.5

APPENDIX A – PHOTOGRAPHIC RECORD OF EUT

433.8MHz RFID Tag



433.8MHz Tag PCB Top



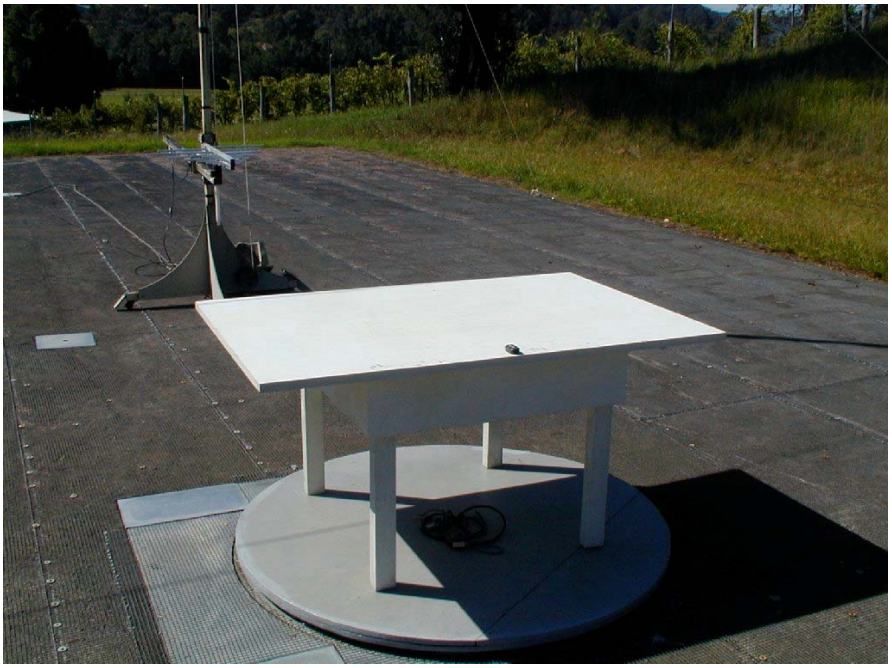
433.8MHz Tag PCB Bottom

APPENDIX B – FCC LABEL & LOCATION

FCC Label

FCC Label Location on EUT

APPENDIX C – EUT TEST SETUP PHOTOGRAPHS



Radiated Disturbance Test Setup

Radiated Disturbance Test Setup