

COMPLIANCE TESTING REPORT
FCC TITLE 47 PART 15
SUBPART C

Client:	Silicon Controls Pty Ltd
Address:	Unit 14A / 2 Eden Park Drive Macquarie Park NSW 2113, Australia
Report Number:	0913SILICON_SC414C7714_fcc c_r1
Date of Testing:	10 th July to 5 th August 2013
File Number:	SILICON130206
Equipment Name:	GASLOG SC414 mk2 Cellular Dialler
Equipment Model Number:	SC414C7714
Equipment Serial Number:	0025-17636
Equipment FCC ID:	XV2SC414002
Equipment Description:	916MHz Remote Telemetry Device
Result:	Complies
Tested by:	Richard Turner
Approved by:	Colin Gan Assessment Engineer
Date of Issue:	13 th September 2013
AUSTEST (NSW) FCC REGISTRATION NUMBER 90455	
DESIGN NUMBER AU0003 REGISTRATION NUMBER 520620	
Results appearing herein relate only to the sample(s) tested. This report may not be reproduced in any form unless done so in full.	

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Report Revision History:

Date	Report Number	Changes
20/08/2013	0820SILICON_SC414C7714_fcc ab&c	Original Report.
13/09/2013	0913SILICON_SC414C7714_fcc c	Report amended to cover requirements for subpart C only and other changes as advised by TCB.
13/09/2013	0913SILICON_SC414C7714_fcc c_r1	Report amended as per additional changes as advised by TCB

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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 C – Intentional Radiators			
15.203	Antenna Requirement	COMPLIES	
15.205	Restricted Bands of Operation	COMPLIES	
15.207	Conducted Limits	N/A	
15.209	Radiated Emission Limits, General Requirements	COMPLIES	(i)
15.215	Additional Provisions to the General Radiated Limitations	COMPLIES	
15.249	Operation within the Bands 902-928MHz, 2400-2483.5MHz, 5725-5850MHz and 24.0-24.25GHz	COMPLIES	(i)(ii)

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 6.2 of this report.

2 MODIFICATIONS

To ensure the field strength level at the fundamental frequency (916MHz) remained below limits specified in section 15.249 the transmit power was set to -4dBm using the client's software.

3 REFERENCES

FCC Title 47 Part 15 issued 1 st October 2012
ANSI C63.10: 2009

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4 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

EUT Name:	GASLOG SC414 mk2 Cellular Dialer
EUT Description:	916MHz remote telemetry device
EUT Model:	SC414C7714
EUT Serial Number:	0025-17636
EUT FCC ID:	XV2SC414002
Manufacturer:	Silicon Controls Pty Ltd
Power Supply & Rating:	3.9V High Energy Lithium Battery
Highest Clock/Operating Frequency:	26MHz
Lowest Internal Frequency source	32kHz RTC
Transmit Frequency Range:	916MHz only
Transmit Power:	-4dBm, as set by the client's software
Modulation Technique:	GFSK
Number of Channels:	One
Antenna Specifications:	Integral PCB track antenna

Derived Model(s) (included in this Report):	N/A
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The equipment under test (EUT) was a remote telemetry device incorporating a 916MHz radio transceiver (Chipcon CC1100) and CDMA module (Telit CE910-DUAL). Both radio circuits use integral PCB track antennas.

The EUT is housed in a circular plastic case which is normally potted inside. In the base of the unit access is provided to two sensor ports and a 3.9V Tadiran high energy lithium battery. The battery charges an internal capacitor.

Two small LEDs, located in the EUT case, were configured by the client to provide indication of the operating mode of 916MHz RF transceiver. Operating mode was controlled by placing a magnet near the LEDs, which operated an internal switch.

The EUT was labelled SC414C7714 Cellular Dialer with bar code 0025-17636

The EUT is powered by an internal capacitor, which is charged from the fitted 3.9V high energy lithium battery. There is no connection to a mains AC power supply.

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5 EUT TEST SETUP & CONFIGURATION

Refer to the photographs in APPENDIX C – EUT TEST SETUP PHOTOGRAPHS for the EUT test setup and physical configuration.

In the test setup, shown in Appendix C, the following cables and auxiliary equipment were used.

EUT Port	Connecting Cable	Source / Load
Sensor Ports (x2)	Supplied unshielded 1m cables	Attached transducers

For measurement of radiated emissions the EUT was placed horizontally on the test table.

Battery voltage was checked throughout testing, to ensure no significant drop in supply voltage occurred.

5.1 Transmitter Test Channels

The EUT can only transmit on one frequency, 916MHz.

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6 TEST SPECIFICATIONS

6.1 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 C63.4-2009) 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. Refer to Appendix D.

Austest Laboratories (NSW)'s Yarramalong test facilities are accredited by A2LA. The tests reported herein have been performed in accordance with its terms of accreditation.

6.2 Deviations from Standards and/or Accreditations

None.

6.3 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.

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6.4 Test Equipment

Test Equipment	Brand & Model	Serial No./ID	Cal. Date	Cal. Period	Cal. Due
EMI Receiver	HP 8574B	MEQ72	23/01/13	1 Year	22/01/14
Test Software	HP85969PC	-	-	-	Verified
Spectrum Analyser	HP 8593E	MEQ738	05/06/13	1 Year	04/06/14
Biconical Array Antenna	Emco 93110B	MEQ337	12/01/13	1 Year	11/01/14
Log-Periodic Array Antenna	Emco 93146	MEQ336	12/01/13	1 Year	11/01/14
DRG Horn Antenna	AH Systems SAS-571	MEQ530	14/01/11	3 Years	13/01/14
Loop Antenna	EM-6876	MEQ225	22/01/13	1 Year	21/01/14
Pre-Amplifier (30MHz-1GHz)	HP 8447E	MEQ74	17/01/13	1 Year	16/01/14
Pre-Amplifier (1GHz-25GHz)	RE 218A	MEQ651	15/01/13	1 Year	14/01/14
Pre-Amplifier (4.5GHz-25GHz)	RE 518A	MEQ650	15/01/13	1 Year	14/01/14
Attenuator	Omni Spectra 10dB	1022627	27/08/12	1 Year	26/08/13
Coaxial Cable (<1GHz)	Suhner	MEQ143	16/08/12	1 Year	15/08/13
Coaxial Cable (<1GHz)	Suhner	MEQ144	15/08/12	1 Year	14/08/13
Coaxial Cable (<1Ghz)	Suhner	MEQ145	15/08/12	1 Year	14/08/13
Coaxial Cable (<1GHz)	Suhner	MEQ146	16/08/12	1 Year	15/08/13
Coaxial Cable (>1GHz)	Suhner	MEQ680	17/01/13	1 Year	16/01/14
Coaxial Cable (>1GHz)	Suhner	MEQ681	17/01/13	1 Year	16/01/14
Multimeter	8060T	MEQ164	14/08/12	1 Year	13/08/13
Variable DC Power Supply	Austest	-	-	-	Verified

All test equipment was checked and performance verified prior to testing.

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6.5 Measurement Uncertainties

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

Test	Measurement Uncertainty
Radiated Emissions	$\pm 4.7\text{dB}$
Frequency	$\pm 5 \text{ part in } 10^{10}$

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7 FCC Part 15C, Section 15.203 – ANTENNA REQUIREMENT

The EUT uses an integral PCB track antenna with the 916MHz RF transceiver.

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”.

8 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 916MHz.

9 FCC Part 15C, Section 15.207 - CONDUCTED LIMITS

NOT APPLICABLE

The EUT does not connect to the AC mains supply either directly or indirectly.

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

Test Date:	11 th , 19 th & 22 nd July 2013 5 th August 2013	Temperature:	18-25°C
Test Officer:	Richard Turner	Humidity:	54-68%
Test Location:	Austest Laboratories (NSW)		

10.1 EUT Operating Mode

The EUT was put into “Transmit Modulate” mode, transmission with GFSK modulation. Transmit power was set to -4dBm, using the client’s software. Battery voltage – 3.9VDC.

10.2 Test Method

- a. Measurements are performed in accordance with ANSI C63.10-2009.
- b. In accordance with section 15.33 (a) (1), measurement was made from 9kHz to 9.16GHz (10th harmonic).
- c. Set the measuring receiver BW settings to:
 - i. 200Hz (9kHz to 150kHz) EMI Receiver BW
 - ii. 9kHz (150kHz to 30MHz) EMI Receiver BW.
 - iii. 120kHz (30MHz to 1GHz) EMI Receiver BW.
 - iv. 1MHz (above 1GHz) RBW, 1MHz or more VBW, using a Spectrum Analyser for Peak measurements.
 - v. 1MHz (above 1GHz) RBW, 10Hz VBW, using a Spectrum Analyser for Average measurements.
- d. Set up the EUT 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. For measurements below 150kHz, measurement was made at a 10m distance
- f. For measurements below 4.5GHz, measurement was made at a 3m distance.
- g. For measurement above 4.5GHz, measurement was made at a 1m distance.
- h. For measurement at a 1m distance, the specified limit at a 3m distance was extrapolated to a 1m distance using an extrapolation factor of 20dB/decade (inverse linear-distance). Section 15.31 (f) (1) refers.

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- i. For measurements below 30MHz, the specified limit at a 30m or 300m distance was extrapolated to a 3m or 10m distance using the square on inverse linear distance extrapolation factor (40dB/decade). Section 15.31 (f) (2) refers.
- j. To maximise emissions, rotate the EUT through 360° and adjust the measuring antenna height between 1m to 4m in the following antenna orientations:
 - i. Loop antenna (9kHz 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.
- k. Measure the maximised emission and repeat the above for all measurement frequencies.
- l. Where average limits are specified, average level measurements were not made where the peak level did not exceed the average limit.
- m. Check linearity of the measuring system, reducing gain when required.
- n. Supplied plots provide an indication of measured levels. Maximisation and measurement of levels was made with the EMI receiver or spectrum analyser span reduced, focused on the each individual emission.

10.3 Sample Calculation Example

The final radiated emission levels were obtained from the measurement equipment software which automatically applied all the stored calibration factors. The calibration / correction factors were applied as follows:

$$E = V + AF + L_{cbl} - G_{pre}$$

Where:

- E = Radiated Electric Field Strength in dB μ V/m at the specified distance.
- V = EMI Receiver measured signal input voltage in dB μ V.
- AF = Antenna Factor of the measuring antenna in dB/m.
- L_{cbl} = Total cable insertion loss in dB.
- G_{pre} = Preamplifier gain in dB.

Frequency (MHz)	Receiver Level, V (dB μ V)	AF (dB/m)	L _{cbl} (dB)	G _{pre} (dB)	Corrected Level, E (dB μ V/m)
100.0	40.0	12.0	2.9	22.5	32.4

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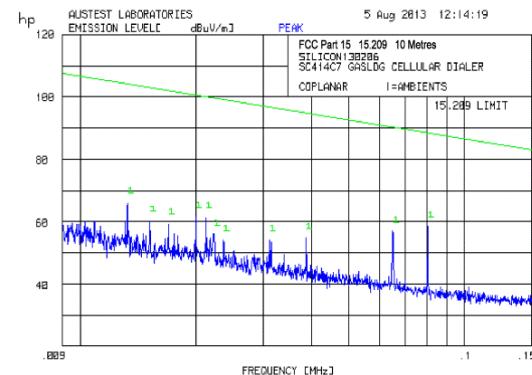
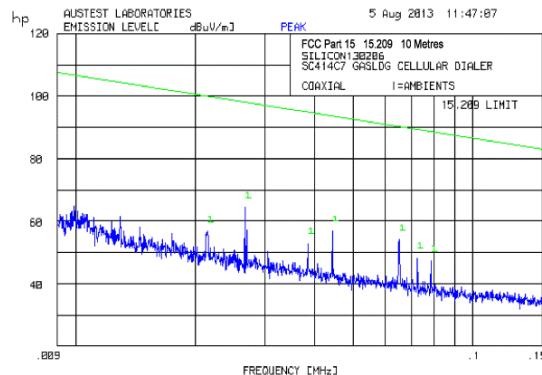
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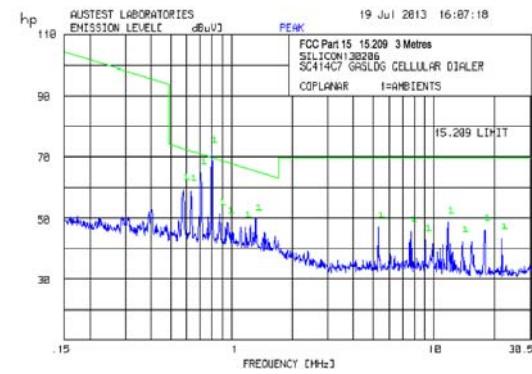
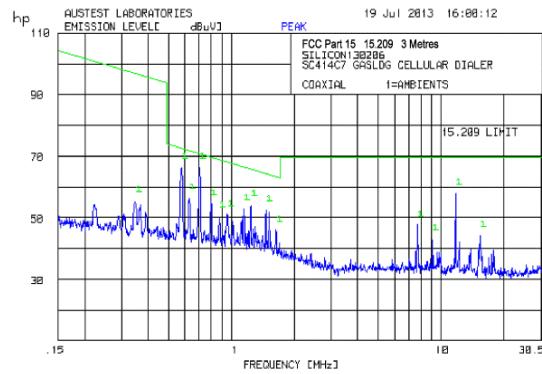
10.4 Test Results

10.4.1 Radiated Disturbances: 9kHz to 30MHz at 3m/10m distance

All measured intentional radiation was greater than 10dB below the limits specified in section 15.209



9kHz to 150kHz



150kHz to 30MHz

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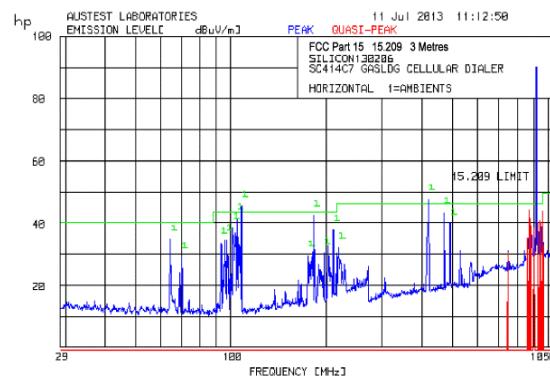
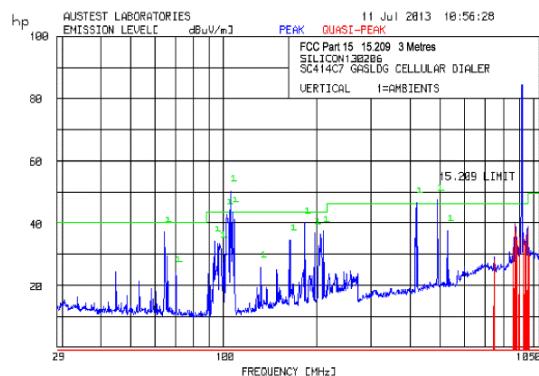


10.4.2 Radiated Disturbances: 30MHz to 1000MHz at 3m distance

The highest measured intentional radiated level was 2.0dB below the 15.209 quasi-peak limit at 871.8MHz.

Frequency MHz	Polarisation	Quasi-Peak μV/m	Quasi-Peak dB<μV/m	Limit μV/m	Limit dB<μV/m	Below Limit dB
871.8	Horizontal	158	44.0	200	46.0	2.0*
960.0	Horizontal	157	43.9	200	46.0	2.1*
879.2	Horizontal	119	41.5	200	46.0	4.5*
945.4	Horizontal	111	40.9	200	46.0	5.1
930.7	Horizontal	100	40.0	200	46.0	6.0
952.8	Horizontal	100	40.0	200	46.0	6.0
871.8	Vertical	91	39.2	200	46.0	6.8
886.5	Horizontal	90	39.1	200	46.0	6.9
901.2	Horizontal	83	38.4	200	46.0	7.6
960.0	Vertical	79	37.9	200	46.0	8.1
879.2	Vertical	69	36.8	200	46.0	9.2
952.8	Vertical	64	36.1	200	46.0	9.9

*Results were within the laboratory's measurement uncertainty.



30MHz to 1000MHz

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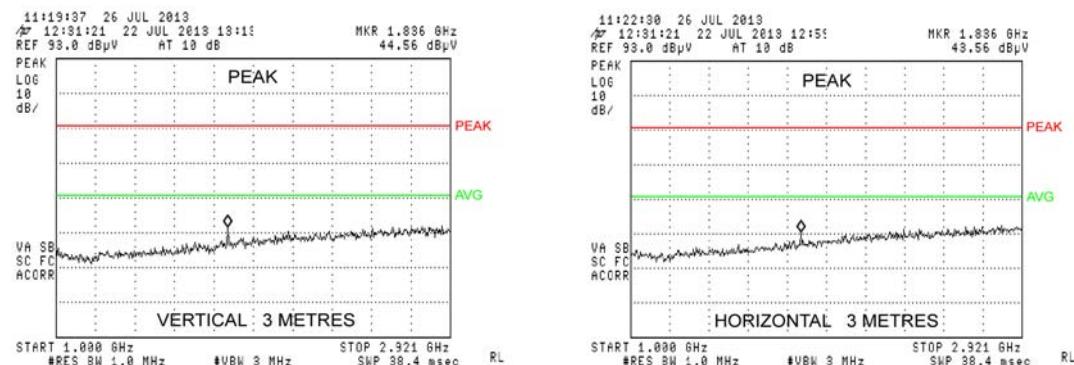


10.4.3 Radiated Disturbances: 1000MHz to 4500MHz at 3m distance

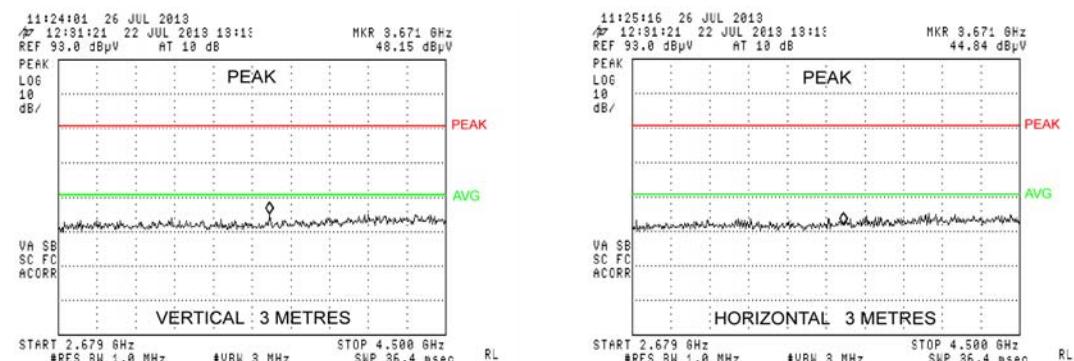
The highest measured peak level was 49.7dB_µV/m at 3664.0MHz, 24.3dB under the 15.209 peak limit.

15.209 limit: 500 μ V/m using average detection. Peak limit set to 20dB above the average limit.

Frequency MHz	Polarisation	Level dB _µ V/m		Limit dB _µ V/m		Δ Pk Limit dB	Δ Avg Limit dB
		Peak	Average	Peak	Average		
3664.0	Vertical	49.7	-	74.0	54.0	24.3	-
1831.9	Horizontal	46.4	-	74.0	54.0	27.6	-
1832.0	Vertical	45.3	-	74.0	54.0	28.7	-



1000MHz to 2900MHz



2600MHz to 4500MHz

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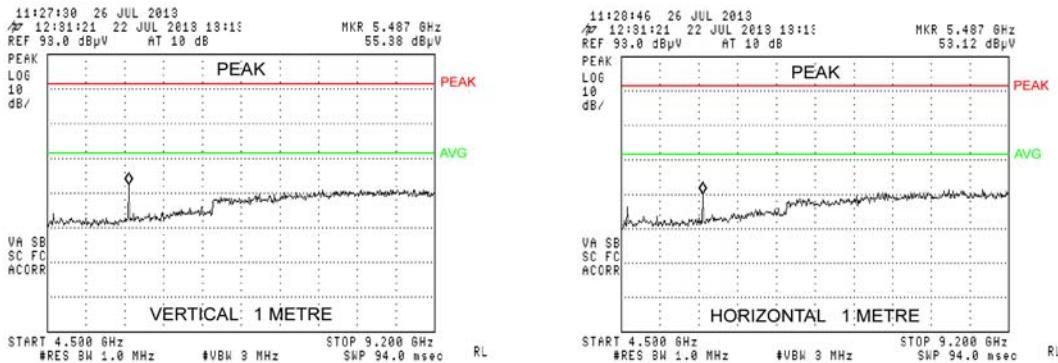
10.4.1 Radiated Disturbances: 4500MHz to 9200MHz at 1m distance

The highest measured peak level was 55.4dB_{UV}/m at 5496.0MHz, 29.1dB under the 15.209 peak limit.

15.209 limit: 500 μ V/m using average detection specified at a 3m distance. For measurement at a 1m distance reference was made to section 15.31 (f) (1), and the limit adjusted to take in account the extrapolation factor of 20dB/decade (inverse linear-distance). At a 1m distance the limit is adjusted by +9.5dB. Peak limit set to 20dB above the average limit.

Frequency	Pol	1m Level		3m Level		3m Limit		Δ Pk Limit	Δ Avg Limit
		Pk	Avg	Pk	Avg	Pk	Avg		
MHz		dB _{UV} /m		dB _{UV} /m		dB _{UV} /m		dB	dB
5496.0*	Vertical	55.4	-	45.9	-	74.0	54.0	28.1	-
7328.2*	Vertical	53.6	-	44.1	-	74.0	54.0	29.9	-
5496.2*	Horizontal	53.3	-	43.8	-	74.0	54.0	30.2	-
4580.0*	Horizontal	50.0	-	40.5	-	74.0	54.0	33.5	-
4579.9*	Vertical	48.9	-	39.4	-	74.0	54.0	34.6	-

*Measured at a 1m distance.



4500MHz to 9200MHz

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

11.1 Section 15.215 (b) – Unwanted Emissions

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 (916.0MHz).

11.2 Section 15.215 (c) - 20dB bandwidth

Test Date:	19 th July 2013	Temperature:	18°C
Test Officer:	Richard Turner	Humidity:	54%
Test Location:	Austest Laboratories (NSW)		

11.2.1 EUT Operating Mode

The EUT was put into “Transmit Modulate” mode, transmission with GFSK modulation. Transmit power was set to -4dBm, using the client’s software.
Battery voltage – 3.9VDC.

11.2.2 Test Method

- Measurement was made on the OATS with the measuring antenna at a 3m distance.
- Set the spectrum analyser RBW to 100kHz RBW, and the VBW to 300kHz.
- Mark the peak frequency level and note the -20dB low and high frequency points to ensure that they are within the permitted operating frequency band.

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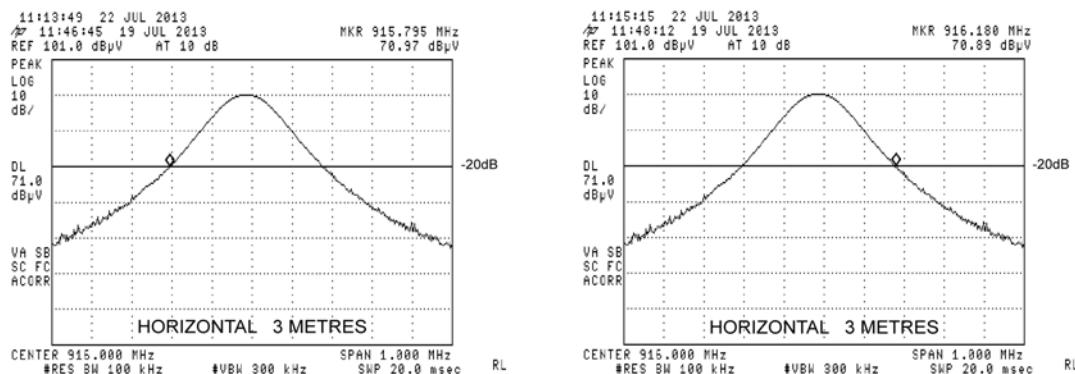


11.2.3 Test Results

The 20dB bandwidth was measured as 385kHz.

Lower Frequency Point (MHz)	Higher Frequency Point (MHz)	Permitted Frequency Range (MHz)	Result
915.795	916.180	902.00 to 928.00	COMPLIES

The above is within the central 80% of the permitted band.



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

12.1 Section 15.249 (a) - Field Strength at 3m (Fundamental & Harmonics)

Test Date:	19 th and 22 nd July 2013	Temperature:	18 - 23°C
Test Officer:	Richard Turner	Humidity:	48 to 63%
Test Location:	Austest Laboratories (NSW)		

12.1.1 EUT Operating Mode

The EUT was put into “Transmit Modulate” mode, transmission with GFSK modulation. Transmit power was set to -4dBm, using the client’s software.
Battery voltage – 3.9VDC.

12.1.2 Test Method

- a. Measurements are performed in accordance with ANSI C63.10-2009.
- b. Set the measuring receiver BW settings to:
 - i. 200Hz (9kHz to 150kHz) EMI Receiver BW
 - ii. 9kHz (150kHz to 30MHz) EMI Receiver BW.
 - iii. 120kHz (30MHz to 1GHz) EMI Receiver BW.
 - iv. 1MHz (above 1GHz) RBW, 1MHz or more VBW, using a Spectrum Analyser for Peak measurements.
 - v. 1MHz (above 1GHz) RBW, 10Hz VBW, using a Spectrum Analyser for Average measurements.
- c. Set up the EUT 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. To maximise emissions, rotate the EUT through 360° and adjust the measuring antenna height between 1m to 4m in the following antenna orientations:
 - i. Loop antenna (9kHz 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.
- e. Measure the maximised emission and repeat the above for all measurement frequencies.
- f. Where average limits are specified, average level measurements were not made where the peak level did not exceed the average limit.
- g. Check linearity of the measuring system, reducing gain when required.

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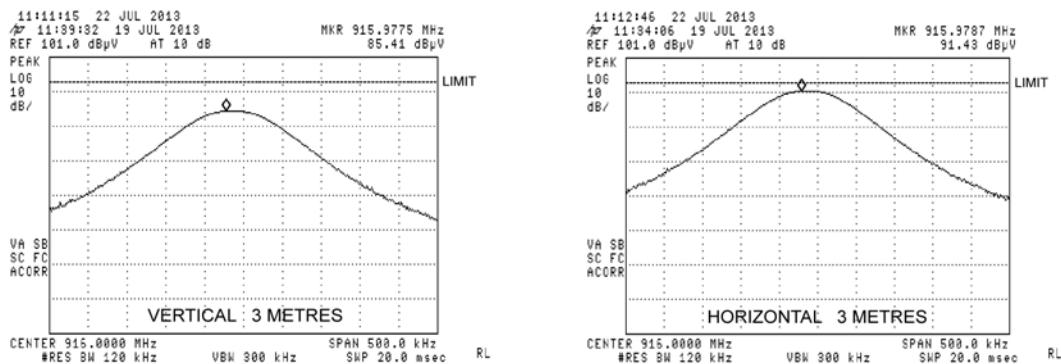


12.1.3 Test Results

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)	
915.98	Horizontal	91.4	37	94.0	50	2.6*
915.98	Vertical	85.4	17	94.0	50.0	8.6

*Result was within the laboratory's measurement uncertainty.



916MHz

Section 15.31 (e) requires transmitted power at the fundamental to be measured with the supply voltage varied between 85% and 115% of the nominal voltage range.

No change in transmit power at the fundamental was observed with when the DC supply voltage was varied.

All measured harmonic levels were below the limits specified in FCC Part 15, Sections 15.209 and 15.249. For details, refer to Clause 10 of this report.

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12.2 Section 15.249 (b) – Fixed, point to point operation

NOT APPLICABLE

The EUT is not intended to be used for fixed, point to point installations

12.3 Section 15.249 (c) – Measurement Distance

NOTED

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

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

12.5 Section 15.249 (e) – Field Strength Limits

NOTED

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APPENDIX D – FCC LETTER OF RENEWAL OF REGISTRATION

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

October 27, 2011

Registration Number: 90455

Austest Laboratories
35 Alleyne Street,
Chatswood NSW 2067
Australia

Attention: Steven Garnham,

Re: Measurement facility located at Yarramalong
10 meter site
Date of Renewal: October 27, 2011

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

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