



HURSLEY
EMC
SERVICES

EMC TEST REPORT

No. 14R307a FR

Issue#1: 7th August 2014

UKAS Accredited
EU Notified Body
FCC & VCCI Registered
BSMI Lab ID: SL2-IN-E-3008
KC Lab ID: EU0184

FCC Part 15C Certification Report

for the

Avonwood Developments Ltd

Compact Zone Safe Control Unit and Antenna

Project Engineer: R. P. St John James

Approval Signatory

Approved signatories: S. M. Connolly J. A. Jones

The above named are authorised Hursley EMC Services engineers.

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1.0 DECLARATION

1.1 FCC Part 15C Statement and Industry Canada (IC) Statement

The Equipment Under Test (EUT), as described and reported within this document, complies with parts 15.109 and 15.209 of the CFR 47:2013 FCC rules in accordance with ANSI C63.4:2003. The EUT operates at frequencies of 902.4 MHz and complies with part 15C emission requirements.

1.2 Related Submittal(s) Grants

This is an application for certification of an Avonwood Compact Zone Safe Control Unit and Antenna (transmitting at 125 kHz and receiving at 902.4 MHz), described in this report.

The sections of FCC Part 15 that apply to the EUT are:

15.209 General requirements

15.109 applied to the EUT in receive mode.

Note: The EUT in receiver mode complies with part 15B of the FCC rules for unintentional radiators.

1.3 EUT Manufacturer

Trade name:	Avonwood Developments Ltd
Company name:	Avonwood Developments Ltd
Company address:	Knoll Technology Centre Stapehill Road Hampreston Wimborne Dorset BH21 7ND United Kingdom
Manufacturing address:	As above.
Company representative:	Mr Martin Hoyle Tel: +44 (0) 1202 868000

2.0 EUT DESCRIPTION

2.1 Identity

EUT:	Compact Zone Safe Control Unit and Antenna		
Model:	Kit:	EURIDK6082	
	containing:		
	Control unit:	EURIDI6147	
	Antenna:	EURIDA5669	
Serial numbers:	Control unit:	22403	
	Wakeup Antenna:	23185	
Sample build:	Production		

2.2 Product Operation

The EUT is part of a safety system for use in vehicular environments such as warehouses and depots. Typically the EUT could be installed on a forklift truck. The EUT emits a low power 125 kHz modulated signal over a short range (approximately 9m). Tags are worn by staff which sense this emitted signal and when within the designated range respond transmitting on 902.4 MHz indicating to the EUT that personnel are within the safety circumference this creates an alarm to alert the driver.

2.3 Support Equipment

SUPPORTING EQUIPMENT	PART/MODEL NUMBER	SERIAL NUMBER
Farnell Power Supply	LT 30/2	009310

2.4 Exerciser Program

Not applicable.

3.0 MEASUREMENT PROCEDURE AND INSTRUMENTATION

3.1 EMI Site Address & Test Date

EMI Company Office	Hursley EMC Services Ltd Trafalgar House, Trafalgar Close, Chandlers Ford, Hampshire
EMI Measurement Site	Hursley EMC Services Ltd Hursley Park, Winchester; FCC Registered UK Designation number: UK0006 Industry Canada Registration number: 7104A
Test Dates	21 st to 25 th July 2014
HEMCS References:	14R307 and 14R281

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.4:2003. Final radiated testing was performed at a EUT to antenna distance of three metres.

Instrumentation, including receiver and spectrum analyser bandwidth, comply with the requirements of ANSI C63.2:1996.

3.3 Environmental Ambient

Test Type	Temperature	Humidity	Atmospheric Pressure
Radiated & Conducted	21 - 28 degrees Celsius	42 - 47% relative	997 - 1008 millibars

3.4 Radiated Emissions

Initial Scan

A radiated profile scan was taken at a three metre distance on eight azimuths of the system under test in both vertical and horizontal polarities of the antenna in a semi-anechoic chamber. Instrumentation used in the chamber as below:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
008	1	HP	8568B	2517A01791	Spectrum analyser	Internal
132	1	HP	8447D	2944A07094	Pre-amplifier (30-1000MHz)	Internal
053	1	HP	8449B	3008A01394	Pre-amplifier (1.0-26.5GHz)	04/07/2015
026	1	Chase	CBL6140	1036	Antenna X-wing (chamber)	Internal
073	3	Schwarzbeck	BBHA9120B	237	Horn antenna (1-10GHz)	03/07/2016

The data obtained from the profile scan was used as a guide for the final measurements.

Final Measurements

The system under test was then measured at three metres in the Open Area Test site (OATS) using a receiver. The data obtained from the chamber profile-scan was used to guide the test engineer. Above 30 MHz, each emission from the transmitter was maximised by revolving the system on the turntable and moving the antennae in height and azimuth. Below 30 MHz the loop antenna was set at a height of 1m, the EUT was measured with the antenna in the vertical and horizontal polarity and each emission was maximised by revolving the system on the turntable. The worst-case data is presented in this report. Test instrumentation used was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
109	3	Schwarzbeck	VULB 9163	9163-321	Trilog antenna (OATS)	19/10/2015
053	1	HP	8449B	3008A01394	Pre-amplifier (1.0-26.5GHz)	04/07/2015
538	1	HP	8593EM	3710A00204	Analyser	03/10/2014
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	06/06/2015
242	3	Rohde & Schwarz	HFH2-Z2	881056/4	Loop antenna (9kHz-30MHz)	31/05/2015
073	3	Schwarzbeck	BBHA9120B	237	Horn antenna (1-10GHz)	03/07/2016
215	1	Sucoflex	106		Cable SMA (18GHz)	30/09/2014

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate.
'Internal' means internally calibrated using HEMCS procedures

4.0 TEST DATA

4.1 FCC – Radiated Emissions (Transmitting 125 kHz Receiving 902.4 MHz)

A search was made of the frequency spectrum from 9 kHz to 10 GHz and the measurements reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 Limits & RSS Gen Section 7.2.5 Limits' at a measuring distance of three metres. Below 30 MHz the results have been extrapolated from measurements made at a distance of three and ten metres to the limit distance set at 300m or 30m.

To calculate the extrapolation factor (see FCC Part 15.31 or RSS Gen 4.11) measurements were made at three metres and ten metres from the EUT. The extrapolation factor (x) was then calculated as follows:

$$x = \frac{E_1 - E_2}{20 \text{Log} (d_2 / d_1)}$$

Where (E) is the receiver reading at the distance (d) from the EUT. The extrapolation factor (x) is then used to calculate the extrapolated result at the limit distance.

Between 110 and 490 kHz measurements were made using an average detector with a 200 Hz bandwidth.

RESULTS - 9 kHz to 490 kHz

kHz	Measured amplitude (E ₁)	Measured amplitude (E ₂)	Extrapolation Factor (x)	Calculated amplitude @ 300m		Specified limit @ 300m	
	dBµV/m @ 3m (d ₁)	dBµV/m @ 10m (d ₂)		dBµV/m	µV/m	dBµV/m	µV/m
125	91.4	66.0	2.429	-5.8	0.51555	25.66	19.2
250	67.4	38.7	2.744	-42.4	0.00761	19.65	9.6

For example:

The limit at 125 kHz is calculated from FCC 15.209 RSS Gen Table 6 as $\frac{2400}{125} = 19.2 \mu\text{V/m}$.

The extrapolation factor is calculated as $\frac{91.4 - 66.0}{20 \text{Log} (10/3)} = 2.429$

The calculated amplitude is $91.4 - (20 \times 2.429 \times \text{Log} (300 / 3)) = -5.8 \text{ dB}\mu\text{V/m}$

30 MHz to 10 GHz

A search was made of the frequency spectrum from 30 MHz to 10 GHz and the measurements reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 Limits' at a measuring distance of three metres.

Testing was performed with the EUT powered on transmitting at 125kHz. Below 1 GHz a quasi-peak detector was used (bandwidth 120 kHz), above 1 GHz a peak and average detector was used (bandwidth 1 MHz). The worst-case results from all tests are presented here.

RESULTS - 30 MHz to 1000 MHz

Note: A Steward Ferrite, type 28B2025-0A0, was fitted to the power cable to sufficiently reduce the emission at 160.3 MHz.

Frequency MHz	Receiver amplitude dB μ V	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m dB μ V/m	Specified limit @ 3m dB μ V/m
32.98	22.5	11.2	0.7	34.4	40.0
35.55	19.1	11.7	0.7	31.5	40.0
70.48	21.5	8.2	1.0	30.7	40.0
160.30	27.2	9.5	1.7	38.4	43.5
182.05	18.6	10.8	1.8	31.2	43.5
224.72	23.2	10.9	2.0	36.1	46.0
246.73	19.5	11.7	2.2	33.4	46.0
291.47	15.6	12.9	2.4	30.9	46.0

*Transmitter frequency

Uncertainty of measurements: ± 4.2 dB μ V for a 95% confidence level.

Radiated emissions (continued)
RESULTS - 1.0 GHz to 10.0 GHz

Frequency GHz	Receiver amplitude dB μ V	Antenna factor dB	Cable loss dB	Pre-amp gain dB	Actual average value @ 3m dB μ V/m	Specified average limit @ 3m dB μ V/m
2.410	34.1	26.0	2.8	38.6	24.3	54.0
5.413	54.2	29.5	4.8	37.9	50.6	54.0

Frequency GHz	Receiver amplitude dB μ V	Antenna factor dB	Cable loss dB	Pre-amp gain dB	Actual peak value @ 3m dB μ V/m	Specified limit @ 3m dB μ V/m
2.410	58.0	26.0	2.8	38.6	48.2	74.0
5.413	57.1	29.5	4.8	37.9	53.5	74.0

Procedure: In accordance with ANSI C63.4:2003

Measurements below 1.0 GHz performed with a quasi-peak detector. Measurements above 1.0 GHz performed with an average and peak detector.

TEST ENGINEER: Richard Pennell

4.2 FCC – Radiated Emissions (Receive Mode)

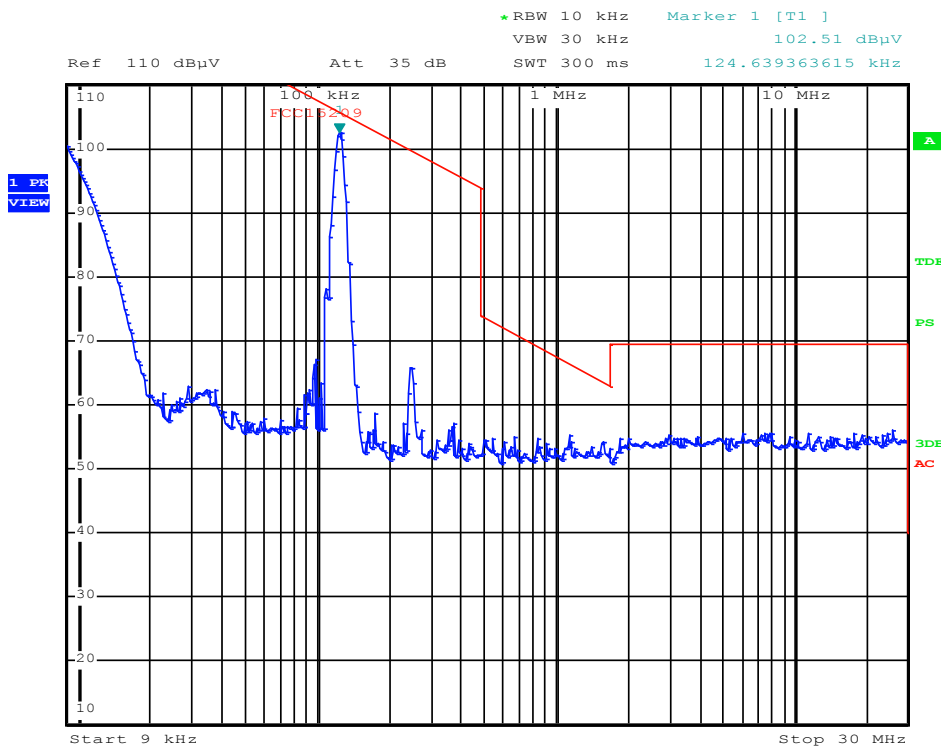
Not applicable, as unit is always transmitting at 125 kHz and receiving at 902.4 MHz.

Procedure: In accordance with ANSI C63.4:2003

Measurements below 1000 MHz performed with a quasi-peak detector. Measurements above 1000 MHz performed with an average and peak detector.

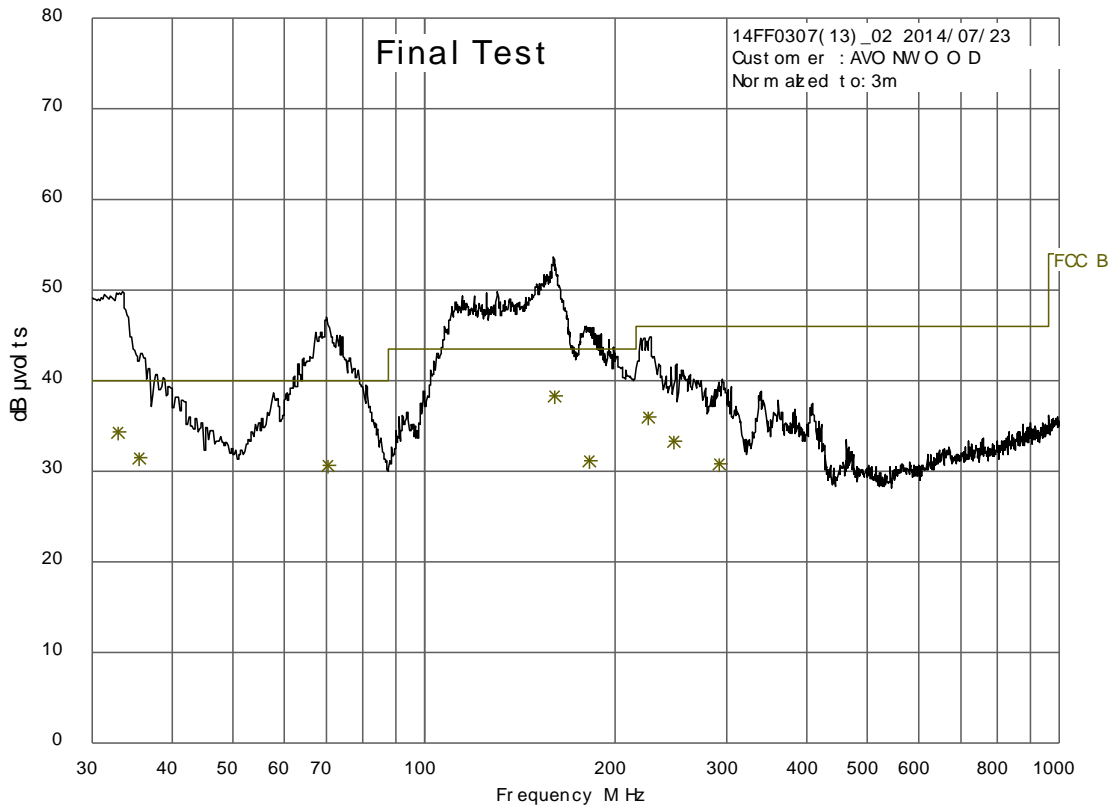
5.0 TEST PLOTS

5.1 Radiated Emission Plot, 9 kHz to 30 MHz



Date: 23.JUL.2014 11:02:52

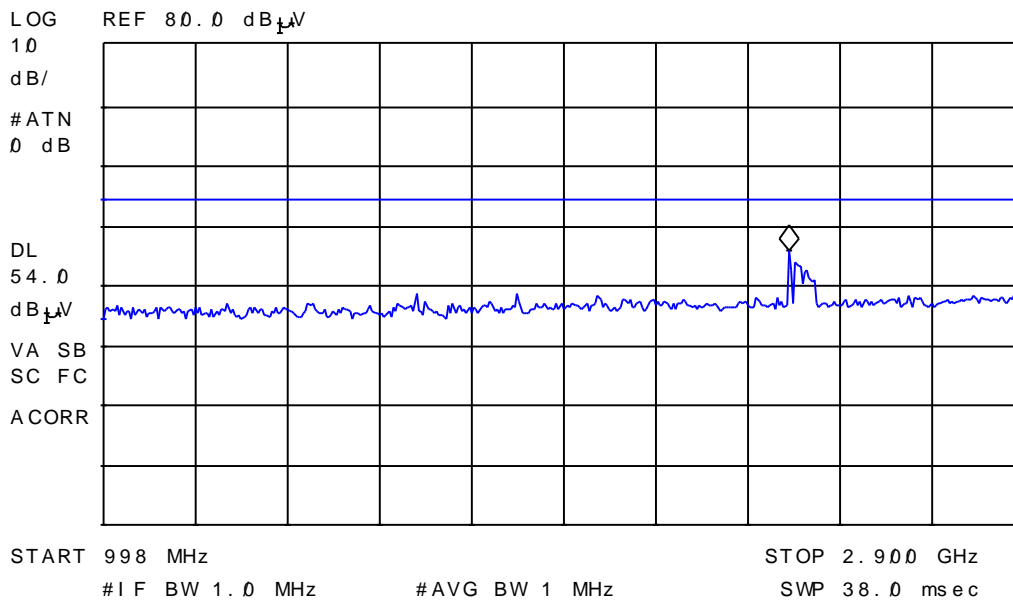
5.2 Radiated Emission Plot, 30 to 1000 MHz



5.3 Radiated Emissions Plot, 0.998 to 2.9 GHz

12:25:47 JUL 22, 2014

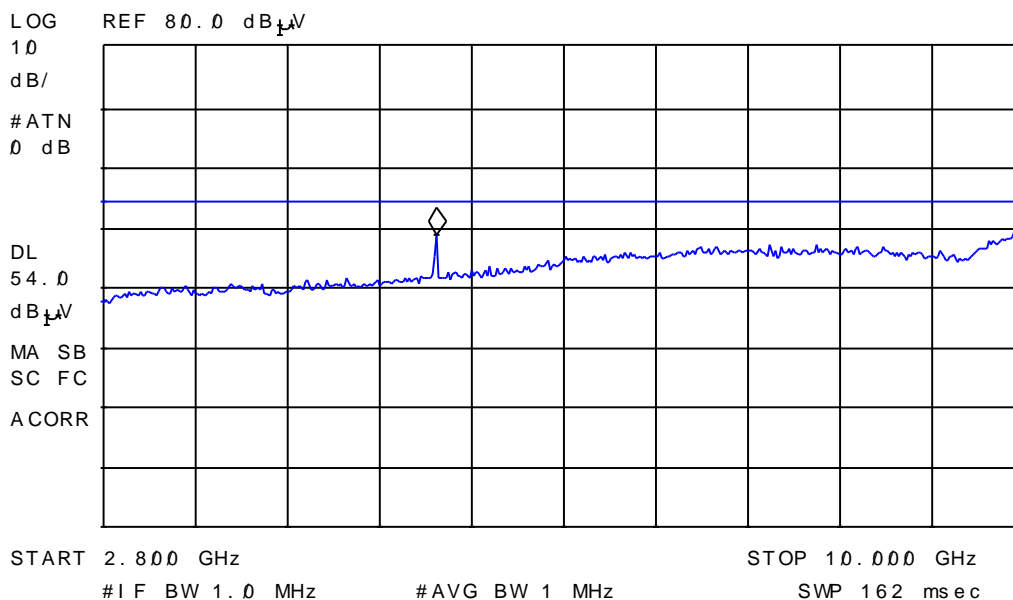
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.415 GHz
45.46 dB μ V



5.4 Radiated Emissions Plot, 2.8 to 10.0 GHz

12:31:26 JUL 22, 2014
HP

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 5.410 GHz
48.59 dB μ V



6.0 RADIATED EMISSIONS PLOTS – RECEIVE MODE

Not applicable, as unit is always transmitting at 125 kHz and receiving at 902.4 MHz.

7.0 FCC DETAILS

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

February 13, 2006

Hursley EMC Services Ltd.
Unit 16
Brickfield Lane
Chandlers Ford - Hampshire, SO53 4DB
United Kingdom
Attention: R P St John James

Re: Accreditation of Hursley EMC Services Ltd.
Designation Number: UK0006

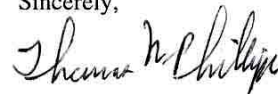
Dear Sir or Madam:

We have been notified by Department of Trade and Industry (DTI) that Hursley EMC Services Ltd. has been accredited as a Conformity Assessment Body (CAB).

At this time your organization is hereby designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Parts 15 and 18 of the Commission's Rules.

This designation will expire upon expiration of the accreditation or notification of withdrawal of designation.

Sincerely,



Thomas Phillips
Electronics Engineer