# FCC Part 15C Certification Report

**for the**

## Avonwood Developments Ltd

# Standard 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

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 Standard Zone Safe Control Unit and Antenna (transmitting at 125kHz 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<br>Stapehill Road<br>Hampreston<br>Wimborne<br>Dorset<br>BH21 7ND<br>United Kingdom |
| Manufacturing address: | As above. |
| Company representative: | Mr Martin Hoyle<br>Tel: +44 (0) 1202 868000 |

# 2.0 EUT DESCRIPTION

## 2.1 Identity

| | | |
|---|---|---|
| EUT: | Standard Zone Safe Control Unit and Antenna | |
| Model: | K = kit EURIDK6083 control and 1 antenna<br>K = kit EURIDK6059 control and 2 antenna<br>K = kit EURIDK6085 control and 3 antenna<br>K = kit EURIDK6025 control and 4 antenna<br>Containing:<br>Control unit: EURIDI6089<br>Large Wakeup unit: EURIDW6068 | |
| Serial numbers: | Control unit: | 22969 |
| | Large Wakeup unit: | 23508 |
| 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 Offices | Hursley EMC Services Ltd<br>Trafalgar House, Trafalgar Close, Chandlers Ford, Hampshire |
| EMI Measurement Site | Hursley EMC Services Ltd<br>Hursley Park, Winchester; FCC Registered<br>UK Designation number: UK0006<br>Industry Canada Registration number: 7104A |
| Test Dates | 21st to 25th 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 |
| 026 | 1 | Chase | CBL6140 | 1036 | Antenna X-wing (chamber) | Internal |
| 053 | 1 | HP | 8449B | 3008A01394 | Pre-amplifier (1.0-26.5GHz) | 04/07/2015 |
| 073 | 3 | Schwarzbeck | BBHA9120B | 237 | Horn antenna (1-10GHz) | 03/07/2016 |
| 132 | 1 | HP | 8447D | 2944A07094 | Pre-amplifier (30-1000MHz) | Internal |

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 |
|---|---|---|---|---|---|---|
| 053 | 1 | HP | 8449B | 3008A01394 | Pre-amplifier (1.0-26.5GHz) | 04/07/2015 |
| 073 | 3 | Schwarzbeck | BBHA9120B | 237 | Horn antenna (1-10GHz) | 03/07/2016 |
| 109 | 3 | Schwarzbeck | VULB 9163 | 9163-321 | Trilog antenna (OATS) | 19/10/2015 |
| 215 | 1 | Sucoflex | 106 | | Cable SMA (18GHz) | 30/09/2014 |
| 242 | 3 | Rohde & Schwarz | HFH2-Z2 | 881056/4 | Loop antenna (9kHz-30MHz) | 31/05/2015 |
| 289 | 1 | Rohde & Schwarz | ESCI 7 | 100765 | CISPR 7GHz Receiver | 06/06/2015 |
| 538 | 1 | HP | 8593EM | 3710A00204 | Analyser | 03/10/2014 |

**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

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**

| | **Measured amplitude ($E_1$)** | **Measured amplitude ($E_2$)** | **Extrapolation** | **Calculated amplitude @ 300m** | | **Specified limit @ 300m** | |
|---|---|---|---|---|---|---|---|
| **kHz** | **dBµV/m @ 3m ($d_1$)** | **dBµV/m @ 10m ($d_2$)** | **Factor (x)** | **dBµV/m** | **µV/m** | **dBµV/m** | **µV/m** |
| 125 | 96.7 | 71.0 | 2.458 | -1.6 | 0.83156 | 25.66 | 19.2 |
| 250 | 72.0 | 41.0 | 2.964 | -46.6 | 0.00469 | 19.65 | 9.6 |

For example:

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

The extrapolation factor is calculated as $\frac{96.7 - 71.0}{20 \text{ Log } (10/3)}$ = 2.458

The calculated amplitude is 96.7 – (20 x 2.458 x Log (300 / 3)) = -1.6 dBµV/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 125 kHz. 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**

| Frequency MHz | Receiver amplitude dBµV | Antenna factor dB | Cable loss dB | Actual quasi-peak value @ 3m dBµV/m | Specified limit @ 3m dBµV/m |
|---|---|---|---|---|---|
| 30.68 | 13.1 | 10.8 | 0.7 | 24.6 | 40.0 |
| 80.01 | 17.5 | 7.0 | 1.1 | 25.6 | 40.0 |
| 90.35 | 12.7 | 10.0 | 1.2 | 23.9 | 43.5 |
| 108.05 | 11.7 | 11.1 | 1.3 | 24.1 | 43.5 |
| 144.00 | 16.3 | 8.2 | 1.5 | 26.0 | 43.5 |
| 187.58 | 7.7 | 11.3 | 1.8 | 20.8 | 43.5 |
| 255.98 | 13.2 | 11.9 | 2.2 | 27.3 | 46.0 |

*Transmitter frequency

Uncertainty of measurements: ± 4.2 dBµV for a 95% confidence level.

## Radiated emissions (continued)

**RESULTS - 1.0 GHz to 10.0 GHz**

| Frequency GHz | Receiver amplitude dBµV | Antenna factor dB | Cable loss dB | Pre-amp gain dB | Actual average value @ 3m dBµV/m | Specified average limit @ 3m dBµV/m |
|---|---|---|---|---|---|---|
| 2.429 | 34.0 | 26.0 | 2.8 | 38.6 | 24.2 | 54.0 |
| 2.444 | 33.6 | 26.0 | 2.8 | 38.6 | 23.8 | 54.0 |
| 5.413 | 50.7 | 29.5 | 4.8 | 37.9 | 47.1 | 54.0 |

| Frequency GHz | Receiver amplitude dBµV | Antenna factor dB | Cable loss dB | Pre-amp gain dB | Actual peak value @ 3m dBµV/m | Specified limit @ 3m dBµV/m |
|---|---|---|---|---|---|---|
| 2.429 | 50.1 | 26.0 | 2.8 | 38.6 | 40.3 | 74.0 |
| 2.444 | 46.4 | 26.0 | 2.8 | 38.6 | 36.6 | 74.0 |
| 5.413 | 55.8 | 29.5 | 4.8 | 37.9 | 52.2 | 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

## 4.1 FCC – Radiated Emissions (Receive Mode)

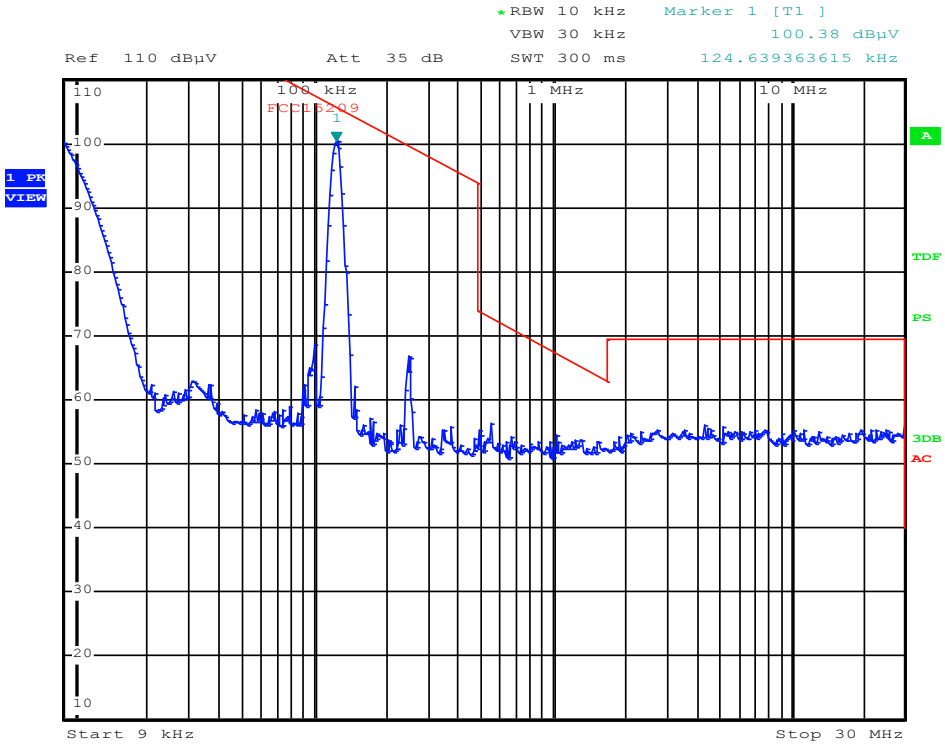
N/A as unit is always transmitting at 125 kHz and receiving at 902.4MHz

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.

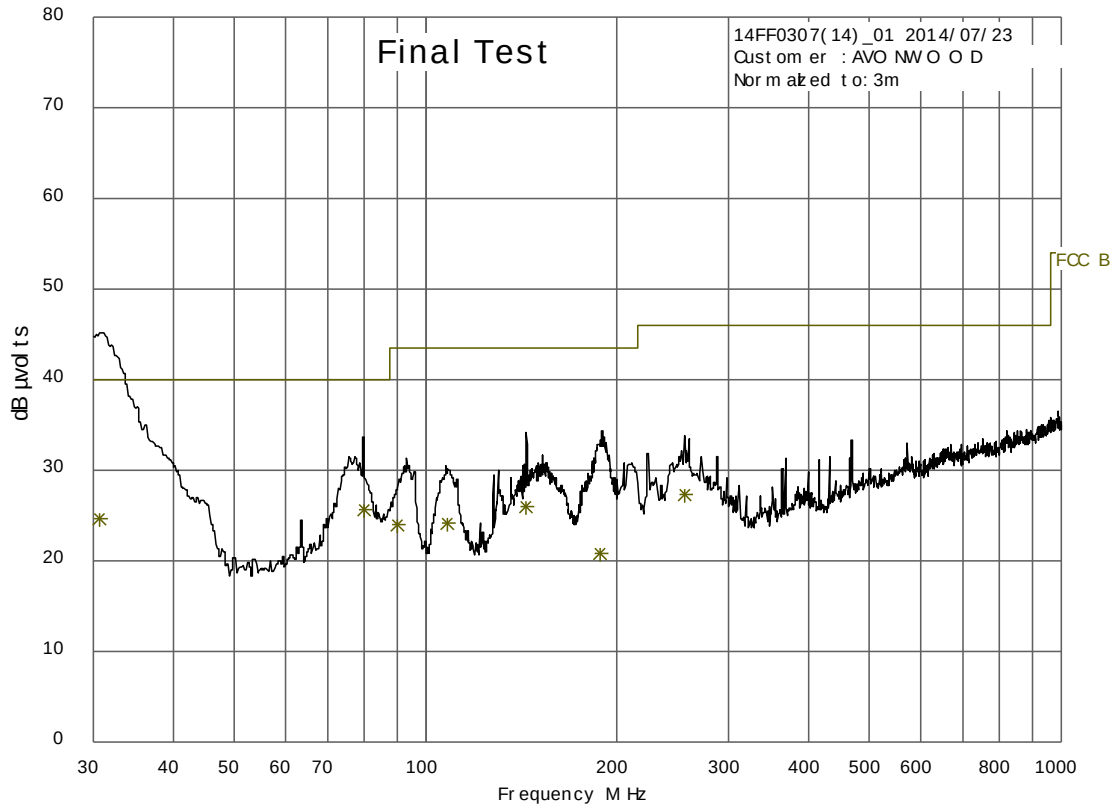
# 5.0 TEST PLOTS

## 5.1 Radiated Emission Plot, 9 kHz to 30 MHz

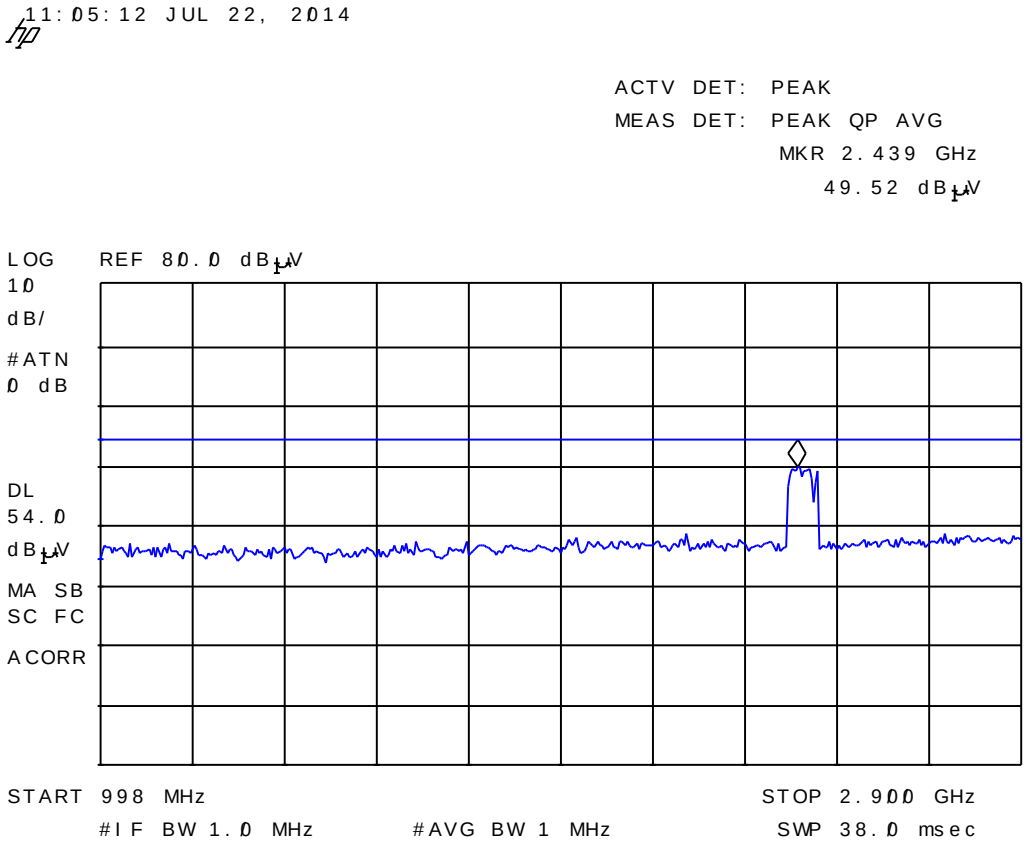



Date: 23.JUL.2014 10:41:55

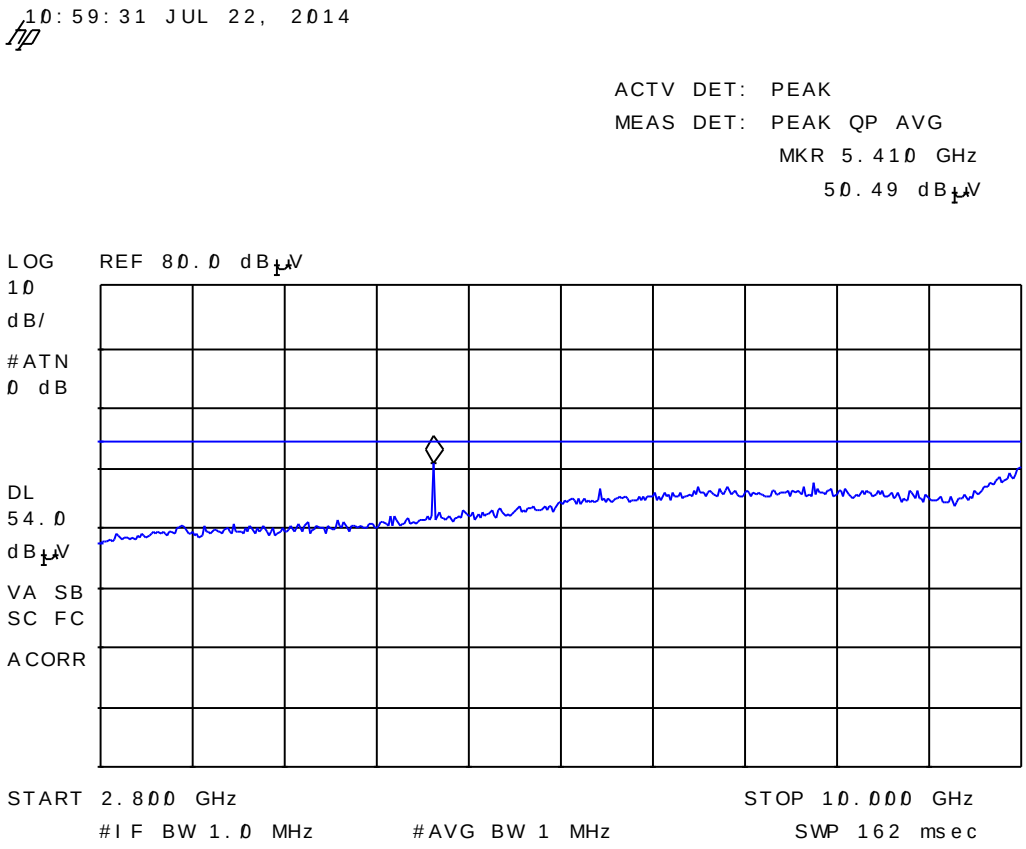
## 5.2 Radiated Emission Plot, 30 to 1000 MHz



# 5.3 Radiated Emissions Plot, 0.998 to 2.9 GHz



# 5.4 Radiated Emissions Plot, 2.8 to 10.0 GHz



# 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