



HURSLEY  
**EMC**  
SERVICES

## EMC TEST REPORT

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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**

**Pedestrian Transponder (Tag)**

Project Engineer: R. P. St John James

Approval Signatory

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

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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, 15.209 and 15.249 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 Pedestrian Transponder (transmitting at 902.4 MHz and receiving at 125 kHz), described in this report.

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

- 15.209 General requirements
- 15.249 Operation within the band 902 to 928 MHz
- 15.109 applied to the EUT in receive mode.

Note: The EUT in receive 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:            | Pedestrian Transponder |
| Model:          | EURIDT6026             |
| Serial numbers: | 10084                  |
| 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 system could be installed on a forklift truck. The system emits a low power 125 kHz modulated signal over approximately 9m. Transponders are worn by staff which sense the 125 kHz signal and respond transmitting on 902.4 MHz indicating to the system that personnel are within the circumference, thus creating an alarm to alert the driver. The transponder is a battery powered device.

### 2.3 Support Equipment

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

### 2.4 Exerciser Program

For the purposes of measurement the Transponder tag was placed in a mode of continuously transmit. In normal operation it would only transmit for a few seconds in any day. The EUT was fitted with a new battery at the start of testing. The EUT was tested standalone in both transmit and standby mode.

### 3.0 MEASUREMENT PROCEDURE AND INSTRUMENTATION

#### 3.1 EMI Site Address & Test Date

|                      |   |
|----------------------|---|
| EMI Company Office   | 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           | 21 <sup>st</sup> to 25 <sup>th</sup> 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             |
| 242 | 3  | Rohde & Schwarz | HFH2-Z2   | 881056/4   | Loop antenna (9kHz-30MHz)   | 31/05/2015           |

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           |
| 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

### 3.5 Occupied Bandwidth

| #ID | CP | Manufacturer    | Type  | Serial No  | Description       | Calibration due date |
|-----|----|-----------------|-------|------------|-------------------|----------------------|
| 456 | 1  | Rohde & Schwarz | ESCI7 | 1144573407 | EMI Test Receiver | 13/11/2014           |
| 502 | 1  | 0               | Cable | 0          | BNC Cable         | Internal             |

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 902.4 MHz, Receiving 125 kHz)

#### 9kHz to 30MHz

A search was made of the frequency spectrum from 9 kHz to 30MHz and the measurements reported are the highest emissions relative to the 'FCC 15.209 and 15.249 Limits' at a measuring distance of three metres.

Below 30 MHz the results measured at 3m have been compared to the limits extrapolated from 30m or 300m, the limits were extrapolated using 40 dB per decade.

#### **RESULTS - 9 kHz to 30 MHz**

| Frequency   | Receiver amplitude | Antenna factor | Measured amplitude @ 10m | Specified limit @ 30m |           |
|---|--------------------|----------------|--------------------------|-----------------------|-----------|
| MHz   | dB $\mu$ V         | dB             | dB $\mu$ V/m             | dB $\mu$ V/m          | $\mu$ V/m |
| All emissions were below the noise floor of the measuring system. |                    |                |                          |                       |           |

The attached plot shows the transmitter emission relative to the FCC part 15.209 limit envelope/mask.

### 30MHz to 10GHz

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 and 15.249 Limits' at a measuring distance of three metres.

Testing was performed with the EUT powered on transmitting at 902.4 MHz stimulated by a 125 kHz Signal from the control system. 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<br>MHz | Receiver<br>amplitude<br>dB $\mu$ V | Antenna<br>factor<br>dB | Cable<br>loss<br>dB | Actual<br>quasi-peak value<br>@ 3m<br>dB $\mu$ V/m | Specified limit<br>@ 3m<br>dB $\mu$ V/m |
|------------------|-------------------------------------|-------------------------|---------------------|--|---|
| 30.58            | 12.6                                | 10.8                    | 0.7                 | 24.1   | 40.0                                    |
| 54.46            | 8.2                                 | 13.1                    | 0.9                 | 22.2   | 40.0                                    |
| 75.18            | 8.7                                 | 7.6                     | 1.1                 | 17.4   | 46.0                                    |
| 160.00           | 23.1                                | 9.3                     | 1.6                 | 34.0   | 43.5                                    |
| 694.35           | 8.5                                 | 19.5                    | 4.2                 | 32.2   | 46.0                                    |
| 901.95           | 14.5                                | 21.9                    | 5.0                 | 41.4   | 46.0                                    |
| 902.00           | 16.9                                | 21.9                    | 5.0                 | 43.8   | 94.0                                    |
| 902.40           | 59.5                                | 21.9                    | 5.0                 | 86.4   | 94.0                                    |
| 928.00           | 8.2                                 | 22.0                    | 5.1                 | 35.3   | 94.0                                    |
| 928.05           | 8.4                                 | 22.0                    | 5.1                 | 35.5   | 46.0                                    |

\*Transmitter frequency

Uncertainty of measurements:  $\pm 4.2$  dB $\mu$ V for a 95% confidence level.



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

| Frequency<br>GHz | Receiver<br>amplitude<br>dB $\mu$ V | Antenna<br>factor<br>dB | Cable<br>loss<br>dB | Pre-amp<br>gain<br>dB | Actual<br>average value<br>@ 3m<br>dB $\mu$ V/m | Specified average<br>limit<br>@ 3m<br>dB $\mu$ V/m |
|------------------|-------------------------------------|-------------------------|---------------------|-----------------------|---|--|
| 1.805            | 30.3                                | 26.7                    | 2.4                 | 39.0                  | 20.4  | 54.0   |
| 4.512            | 33.0                                | 29.1                    | 4.2                 | 37.7                  | 28.6  | 54.0   |
| 5.414            | 48.1                                | 29.5                    | 4.8                 | 37.9                  | 44.5  | 54.0   |
| 5.415            | 33.6                                | 29.5                    | 4.8                 | 37.9                  | 30.0  | 54.0   |
| 6.317            | 33.9                                | 30.7                    | 5.6                 | 37.9                  | 32.3  | 54.0   |
| 7.219            | 34.7                                | 31.5                    | 5.9                 | 38.0                  | 34.1  | 54.0   |
| 8.122            | 34.9                                | 32.3                    | 5.9                 | 38.5                  | 34.6  | 54.0   |

| Frequency<br>GHz | Receiver<br>amplitude<br>dB $\mu$ V | Antenna<br>factor<br>dB | Cable<br>loss<br>dB | Pre-amp<br>gain<br>dB | Actual peak value<br>@ 3m<br>dB $\mu$ V/m | Specified limit<br>@ 3m<br>dB $\mu$ V/m |
|------------------|-------------------------------------|-------------------------|---------------------|-----------------------|---|---|
| 1.805            | 62.4                                | 26.7                    | 2.4                 | 39.0                  | 52.5                                      | 74.0                                    |
| 4.512            | 52.8                                | 29.1                    | 4.2                 | 37.7                  | 48.4                                      | 74.0                                    |
| 5.414            | 59.0                                | 29.5                    | 4.8                 | 37.9                  | 55.4                                      | 74.0                                    |
| 5.415            | 58.4                                | 29.5                    | 4.8                 | 37.9                  | 54.8                                      | 74.0                                    |
| 6.317            | 53.0                                | 30.7                    | 5.6                 | 37.9                  | 51.4                                      | 74.0                                    |
| 7.219            | 56.4                                | 31.5                    | 5.9                 | 38.0                  | 55.8                                      | 74.0                                    |
| 8.122            | 56.5                                | 32.3                    | 5.9                 | 38.5                  | 56.2                                      | 74.0                                    |

Procedure: In accordance with ANSI C63.4:2003

Measurements below 1.0 GHz performed with a quasi-peak detector (120kHz Bandwidth). Measurements above 1.0 GHz performed with an average and peak detector (1MHz Bandwidth).

Note: To confirm the average results the ESCI 7 spectrum analyzer was set to zero span and the duty cycle was measured according to the method described by ANSI C63.4 H.4.J. The duty cycle was measured as  $(3.36\text{ms} \times 2) / 100\text{ms} = 0.0672$  which equates to -23.45dB.

The average results given above are measured. The average results can also be derived from the peak value by deducting the duty cycle factor (calculated as 23.45dB) from the peak results.

TEST ENGINEER: Rob St John James

## 4.2 FCC – Radiated Emissions (Receive Mode)

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.

### RESULTS - 9 kHz to 30 MHz

| Frequency<br>MHz  | Receiver<br>amplitude<br>dB $\mu$ V | Antenna<br>factor<br>dB | Cable<br>loss<br>dB | Actual<br>quasi-peak value<br>@ 3m<br>dB $\mu$ V/m | Specified limit<br>@ 3m<br>dB $\mu$ V/m |
|---|-------------------------------------|-------------------------|---------------------|--|---|
| All emissions were below the noise floor of the measuring system. |                                     |                         |                     |  |   |

### RESULTS - 30 MHz to 1000 MHz

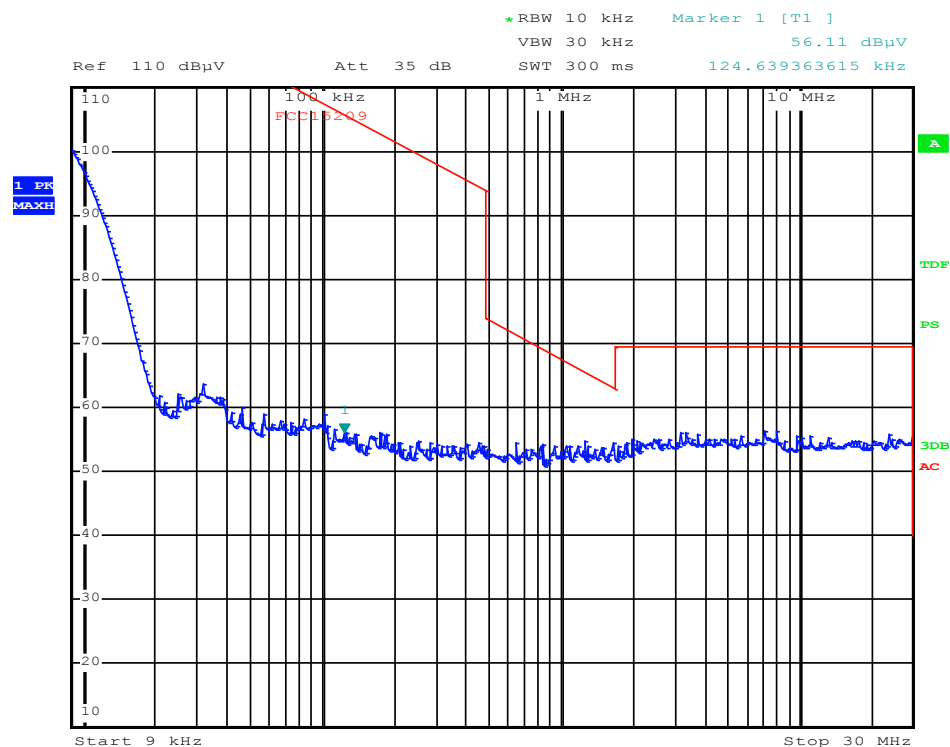
| Frequency<br>MHz  | Receiver<br>amplitude<br>dB $\mu$ V | Antenna<br>factor<br>dB | Cable<br>loss<br>dB | Actual<br>quasi-peak value<br>@ 3m<br>dB $\mu$ V/m | Specified limit<br>@ 3m<br>dB $\mu$ V/m |
|---|-------------------------------------|-------------------------|---------------------|--|---|
| All emissions were below the noise floor of the measuring system. |                                     |                         |                     |  |   |

### RESULTS - 1.0 GHz to 10.0 GHz

| Frequency<br>MHz  | Receiver<br>amplitude<br>dB $\mu$ V | Antenna<br>factor<br>dB | Cable<br>loss<br>dB | Actual<br>quasi-peak value<br>@ 3m<br>dB $\mu$ V/m | Specified limit<br>@ 3m<br>dB $\mu$ V/m |
|---|-------------------------------------|-------------------------|---------------------|--|---|
| All emissions were below the noise floor of the measuring system. |                                     |                         |                     |  |   |

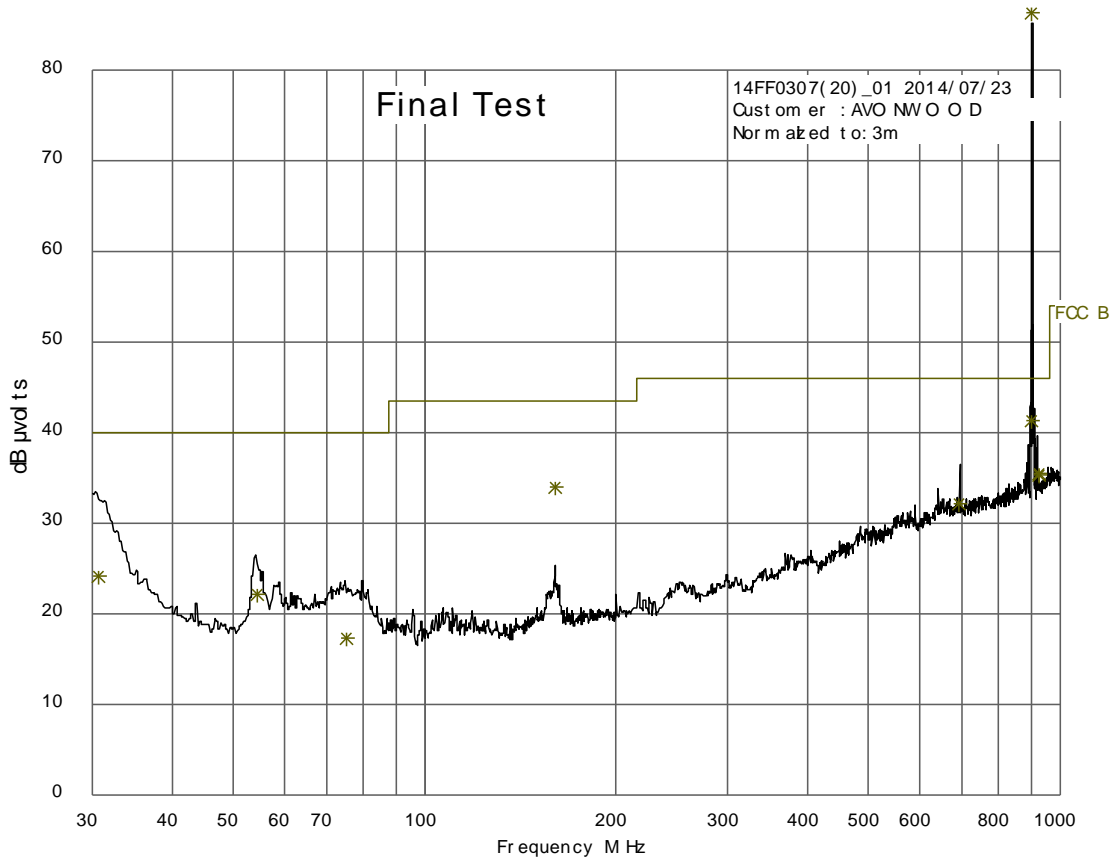
## 5.0 TEST PLOTS

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



Date: 23.JUL.2014 11:10:20

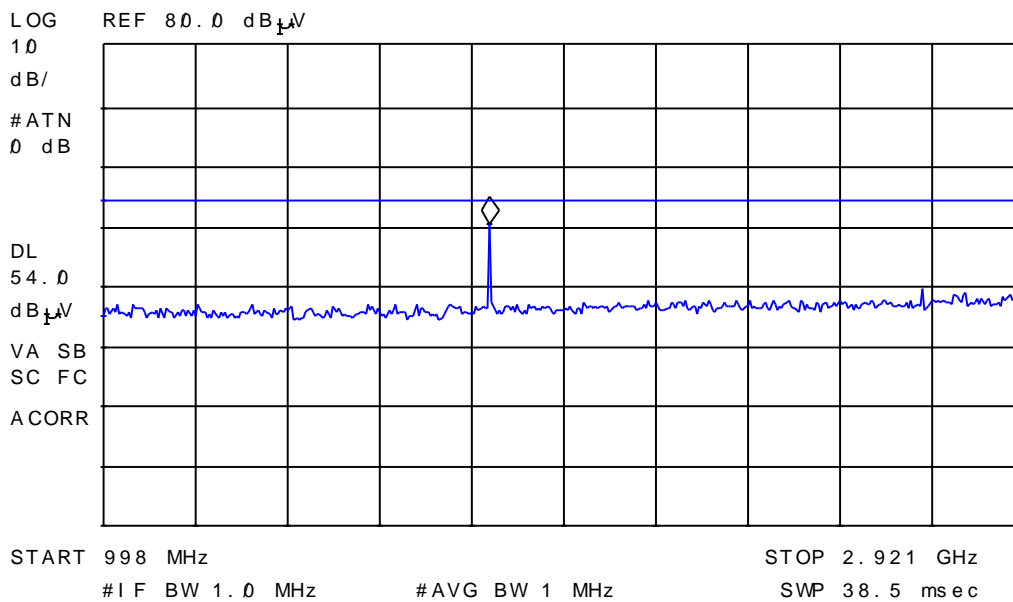
## 5.2 Radiated Emission Plot, 30 to 1000 MHz



### 5.3 Radiated Emissions Plot, 0.998 to 2.9 GHz

14:24:28 JUL 21, 2014  
*hp*

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 1.806 GHz  
50.23 dB $\mu$ V



### 5.4 Radiated Emissions Plot, 2.8 to 10.0 GHz

15:05:31 JUL 21, 2014

STOP  
10.000 GHz

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 5.410 GHz  
60.63 dB $\mu$ V

MARKER  
→ HIGH

MARKER  
→ CF

LOG REF 80.0 dB $\mu$ V

10

dB/

#ATN

0 dB

DL

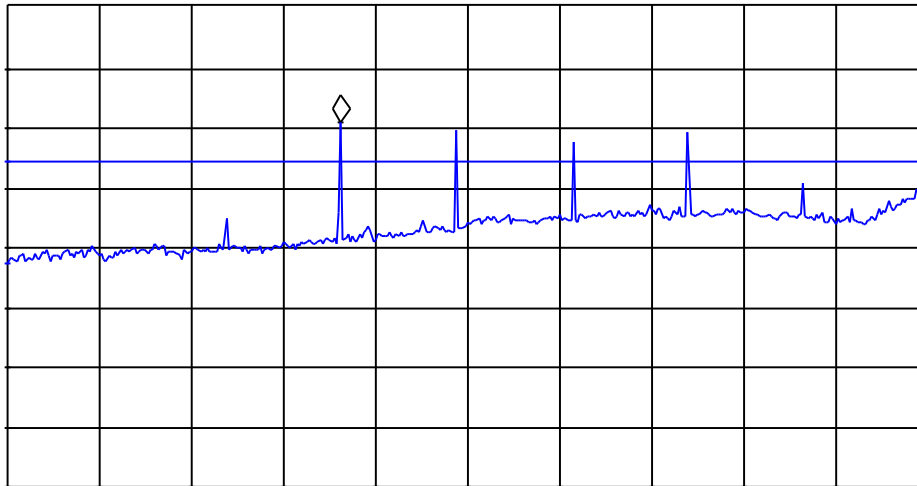
54.0

dB $\mu$ V

MA SB

SC FC

ACORR



NEXT  
PEAK

NEXT PK  
RI GHT

NEXT PK  
LEFT

More  
1 of 3

START 2.800 GHz

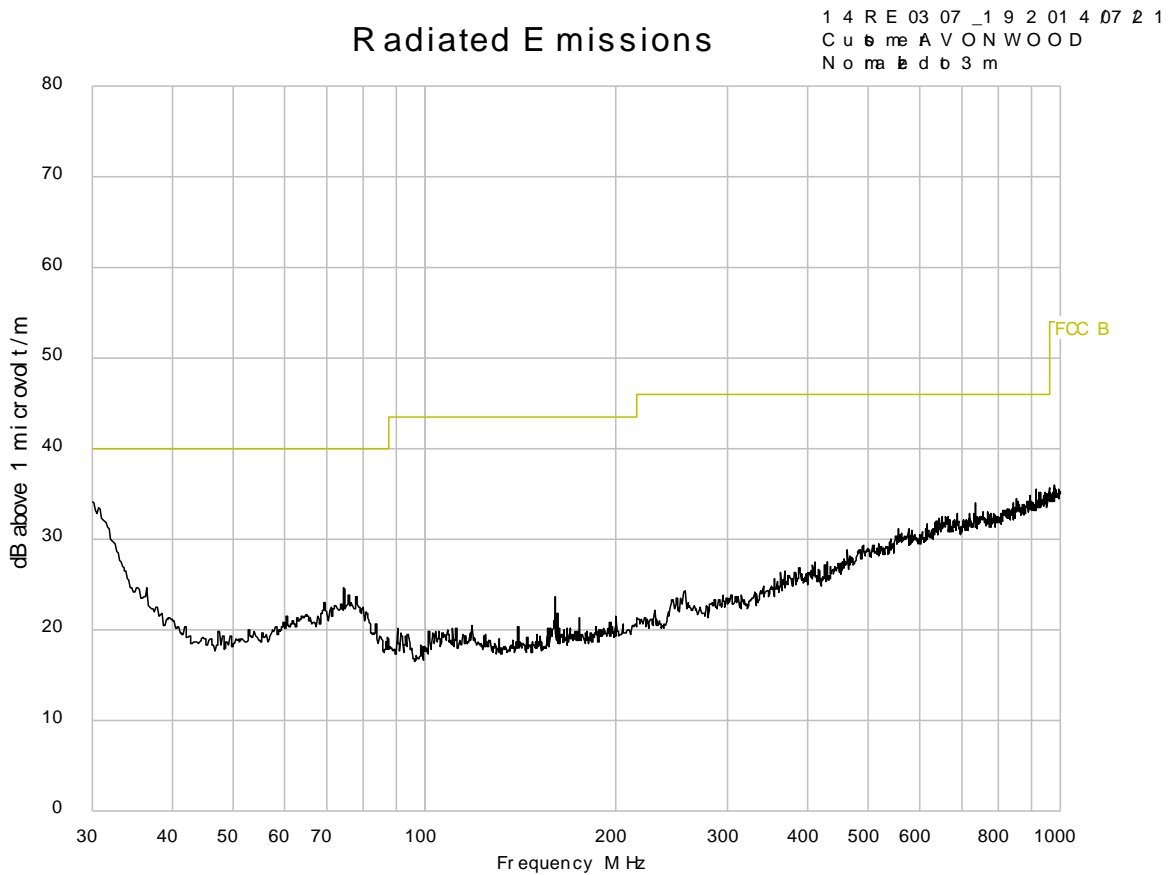
#1 F BW 1.0 MHz

#AVG BW 1 MHz

STOP 10.000 GHz

SWP 162 msec

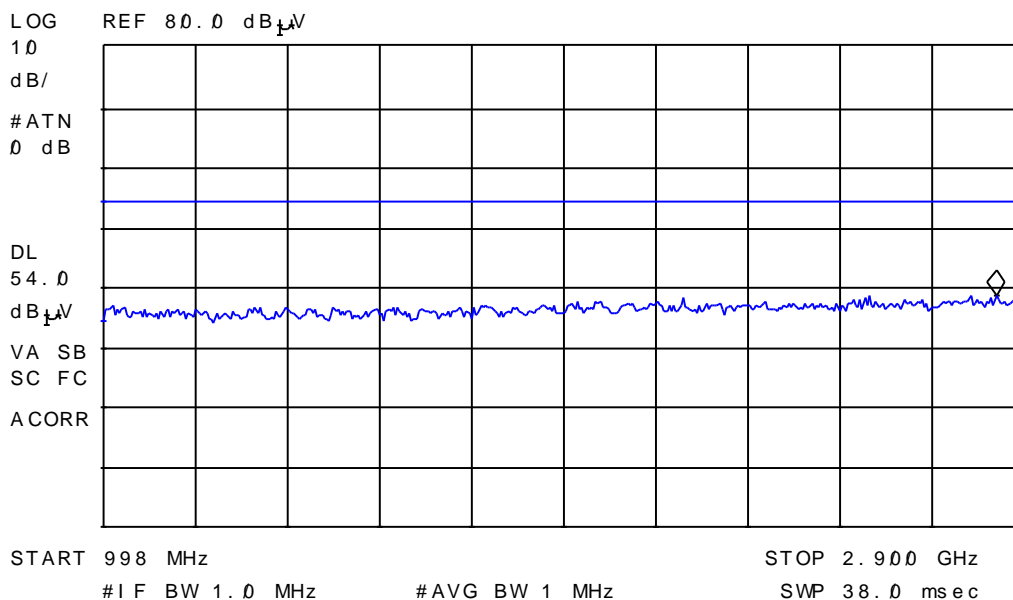
### 5.5 FCC – Radiated Emissions (Receive Mode) 30 to 1000 MHz



### 5.6 FCC – Radiated Emissions (Receive Mode) 0.998 to 2.9 GHz

15:43:28 JUL 21, 2014  
*HP*

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.843 GHz  
38.40 dB $\mu$ V

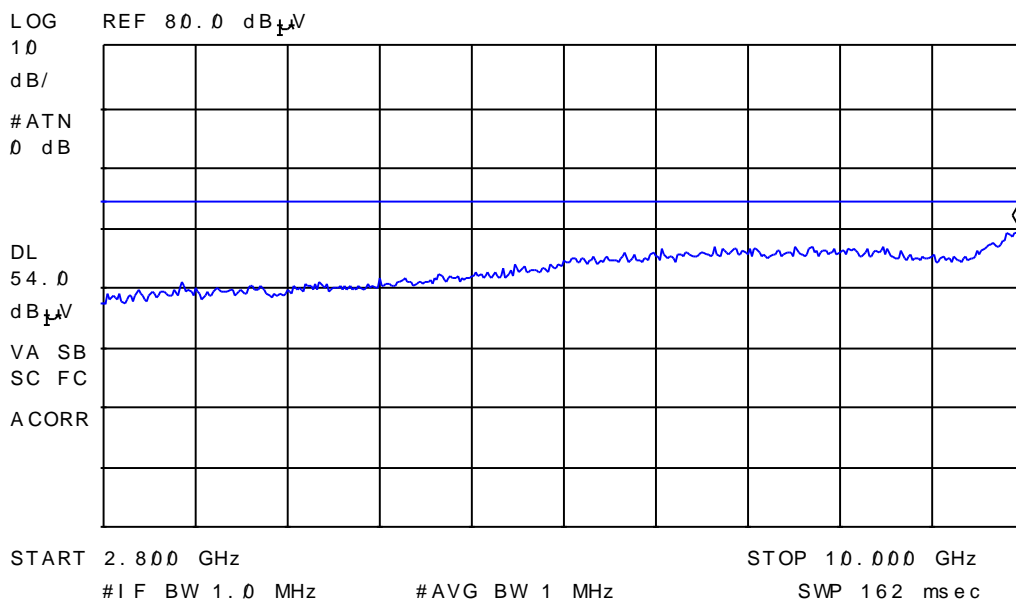




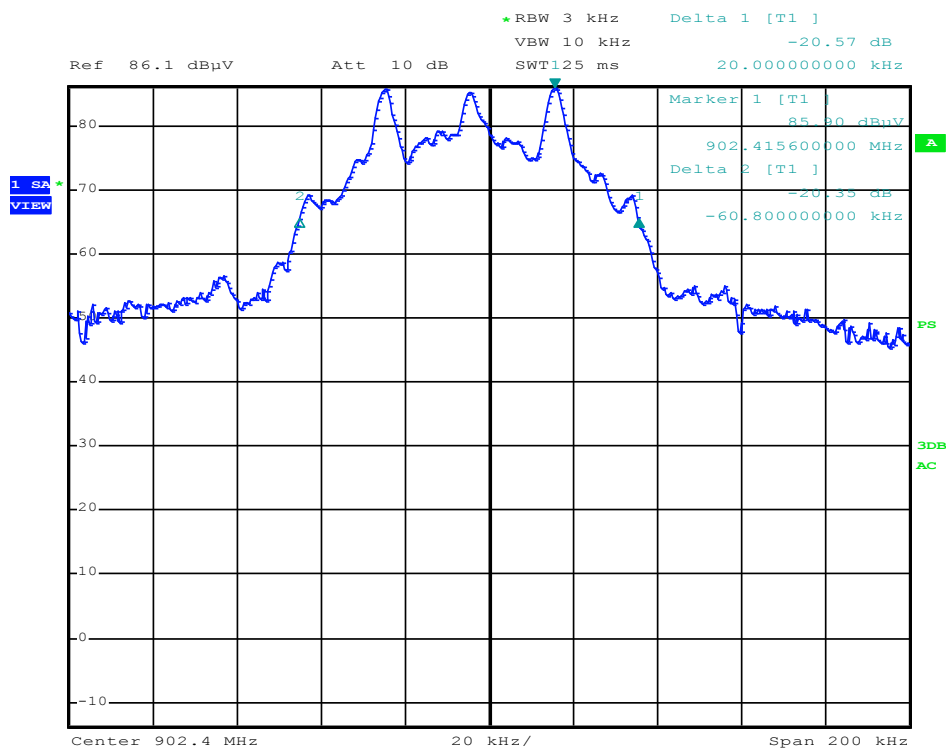
### 5.7 FCC – Radiated Emissions (Receive Mode) 2.8 to 10 GHz

15:45:11 JUL 21, 2014  
*HP*

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 9.982 GHz  
49.62 dB $\mu$ V

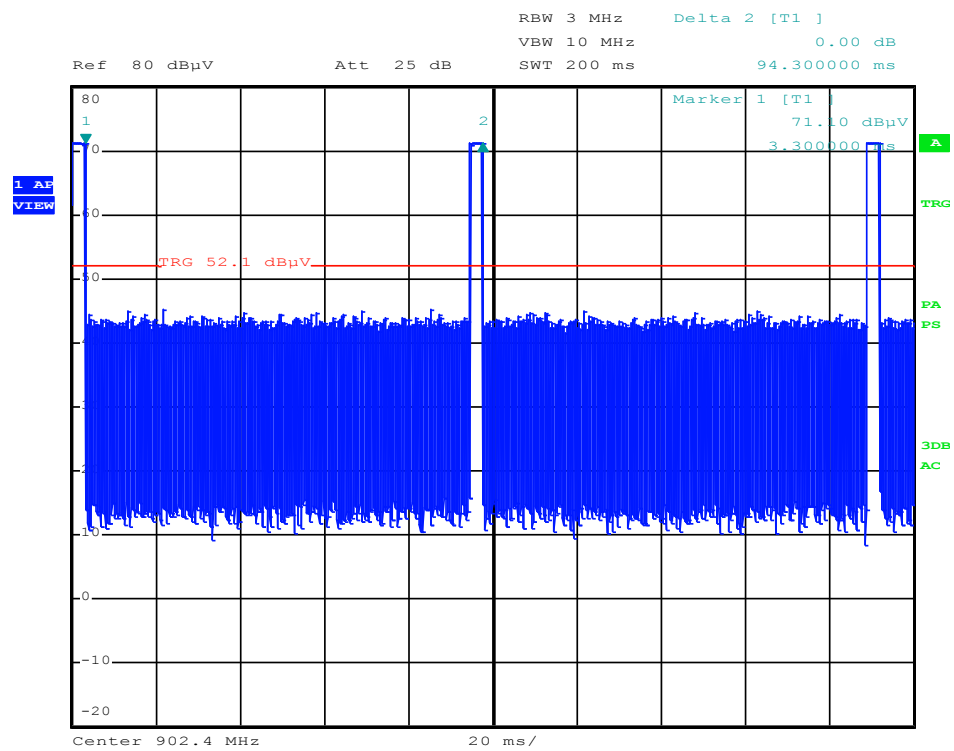


### 5.8 FCC – Transmitter Emissions Plot (20dB Bandwidth)



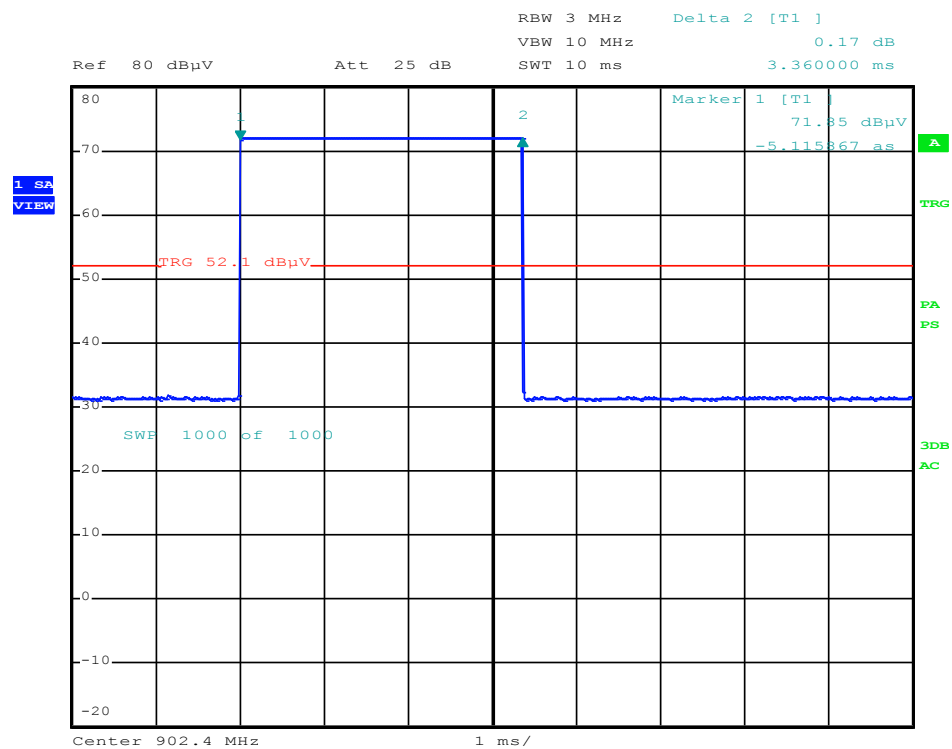
Date: 6.AUG.2014 11:28:34

### 5.9 Duty Cycle Plots (Pulse Train) 902.4 MHz



Date: 25.JUL.2014 10:59:49

### 5.10 Duty Cycle Plots (On Time) 902.4 MHz



Date: 25.JUL.2014 11:07:22

## 6.0 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

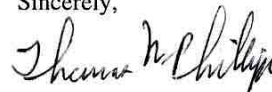
Dear Sir or Madam:

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