FCC Part 15C Certification Report

for the

Avonwood Developments Ltd

Operator Transponder (Tag)

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, 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 Operator 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 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:	Operator Transponder
Model:	EURIDT6027
Serial numbers:	10085
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 Operator. 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 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	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
242	3	Rohde & Schwarz	HFH2-Z2	881056/4	Loop antenna (9kHz-30MHz)	31/05/2015

The EUT was measured in three orthogonal axes to determine which produced the highest emissions. 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	dBµV	dB	dBµV/m	dBµV/m	µV/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 MHz	Receiver amplitude dBµV	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m dBµV/m	Specified limit @ 3m dBµV/m
34.56	18.8	11.5	0.7	31.0	40.0
57.78	11.9	12.9	0.9	25.7	40.0
160.01	30.1	9.5	1.7	41.3	43.5
402.17	7.2	15.9	2.9	26.0	46.0
694.41	8.5	19.5	4.2	32.2	46.0
901.95	13.1	21.9	5.0	40.0	46.0
902.00	15.5	21.9	5.0	42.4	94.0
902.40	57.6	21.9	5.0	84.5	94.0
928.00	8.5	22.0	5.1	35.6	94.0
928.05	8.5	22.0	5.1	35.6	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
1.805	34.6	26.7	2.4	39.0	24.7	54.0
6.317	35.6	30.7	5.6	37.9	34.0	54.0
4.512	28.9	29.1	4.2	37.7	24.5	54.0
5.179	32.7	29.1	4.7	37.8	28.7	54.0
5.414	34.6	29.5	4.8	37.9	31.0	54.0
7.219	30.0	31.5	5.9	38.0	29.4	54.0
8.122	33.9	32.3	5.9	38.5	33.6	54.0
9.024	33.8	31.4	6.0	38.2	33.0	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
1.805	58.1	26.7	2.4	39.0	48.2	74.0
6.317	59.7	30.7	5.6	37.9	58.1	74.0
4.512	49.6	29.1	4.2	37.7	45.2	74.0
5.179	50.0	29.1	4.7	37.8	46.0	74.0
5.414	58.2	29.5	4.8	37.9	54.6	74.0
7.219	52.7	31.5	5.9	38.0	52.1	74.0
8.122	53.9	32.3	5.9	38.5	53.6	74.0
9.024	50.2	31.4	6.0	38.2	49.4	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 (3.36ms x 2) / 100ms = 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 MHz	Receiver amplitude dBµV	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m dBµV/m	Specified limit @ 3m dBµV/m
All emissions were below the noise floor of the measuring system.					

RESULTS - 30 MHz to 1000 MHz

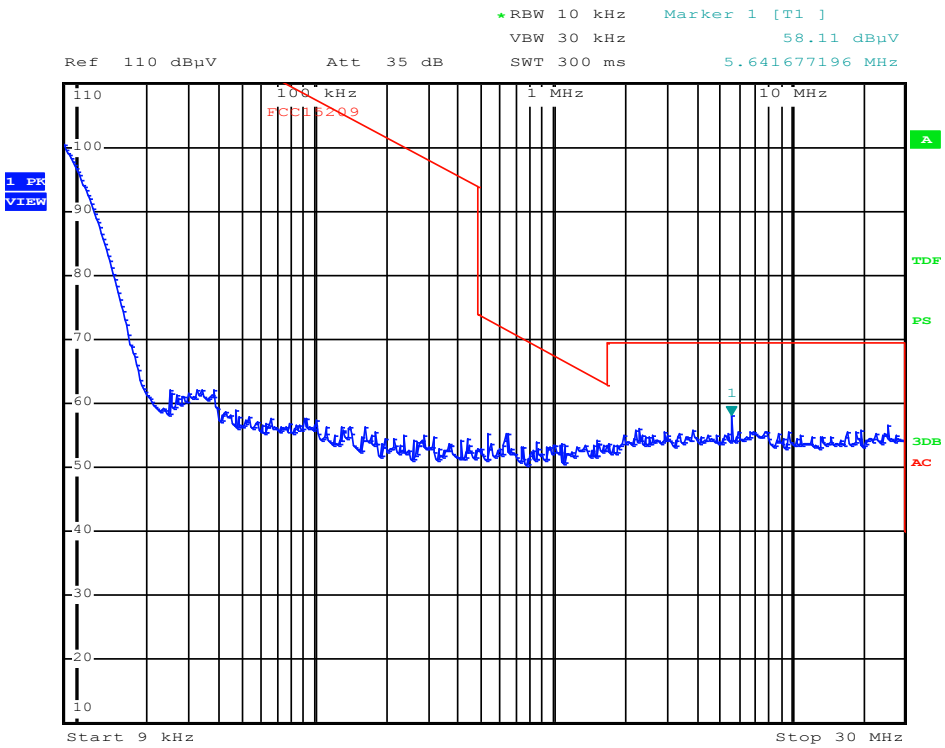
Frequency MHz	Receiver amplitude dBµV	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m dBµV/m	Specified limit @ 3m dBµV/m
All emissions were below the noise floor of the measuring system.					

RESULTS - 1.0 GHz to 10.0 GHz

Frequency MHz	Receiver amplitude dBµV	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m dBµV/m	Specified limit @ 3m dBµV/m
All emissions were below the noise floor of the measuring system.					

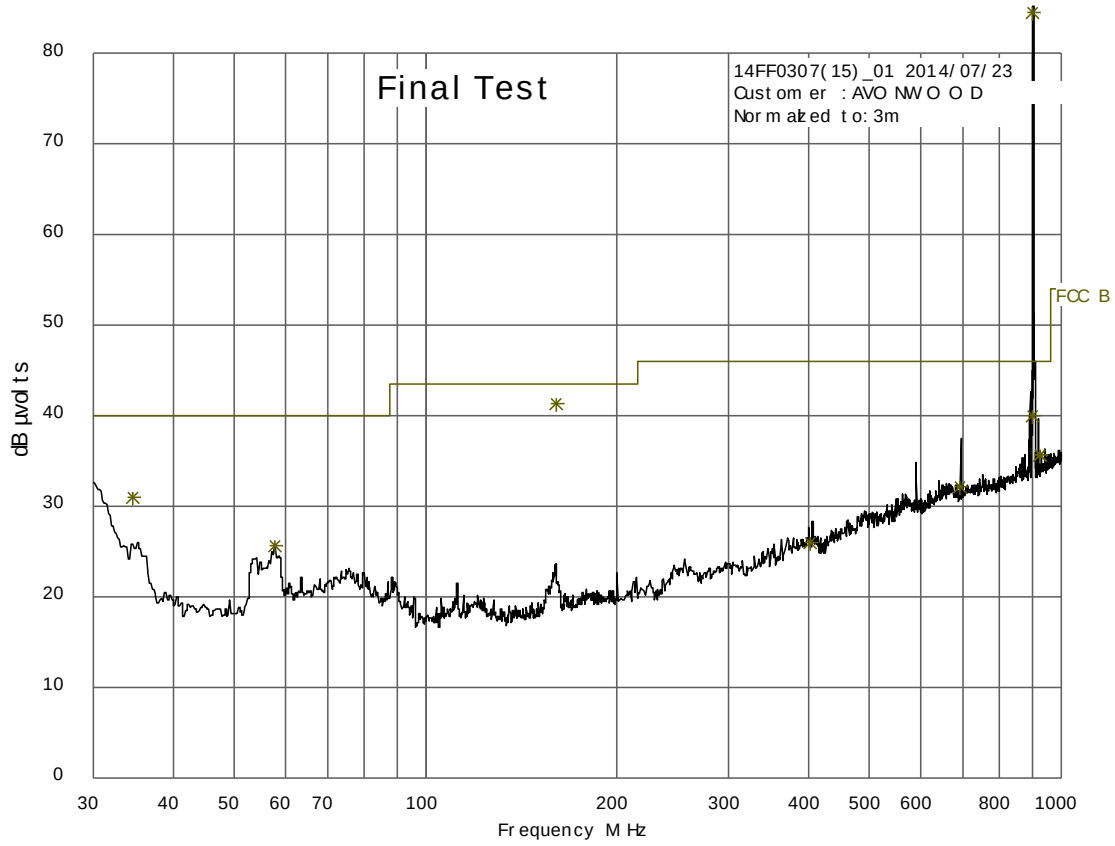
5.0 TEST PLOTS

5.1 Radiated Emission Plot, 9 kHz to 30 MHz



Date: 23.JUL.2014 10:51:15

5.2 Radiated Emission Plot, 30 to 1000 MHz



5.3 Radiated Emissions Plot, 0.998 to 2.9 GHz

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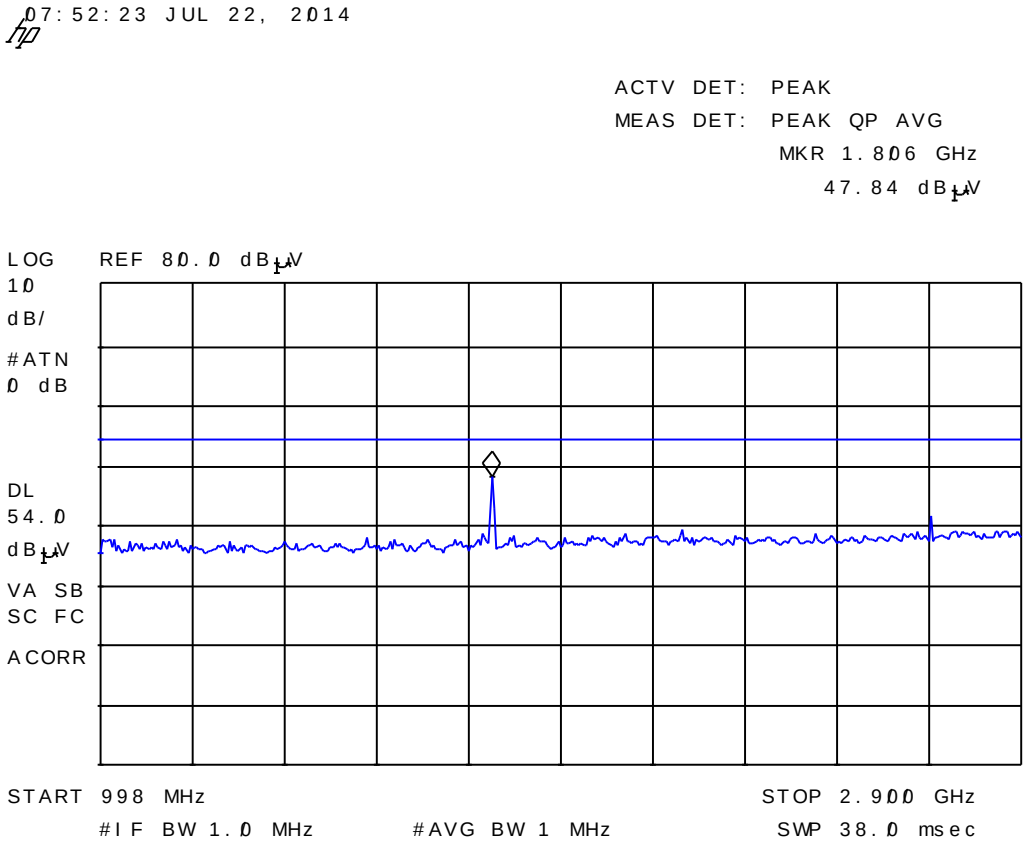
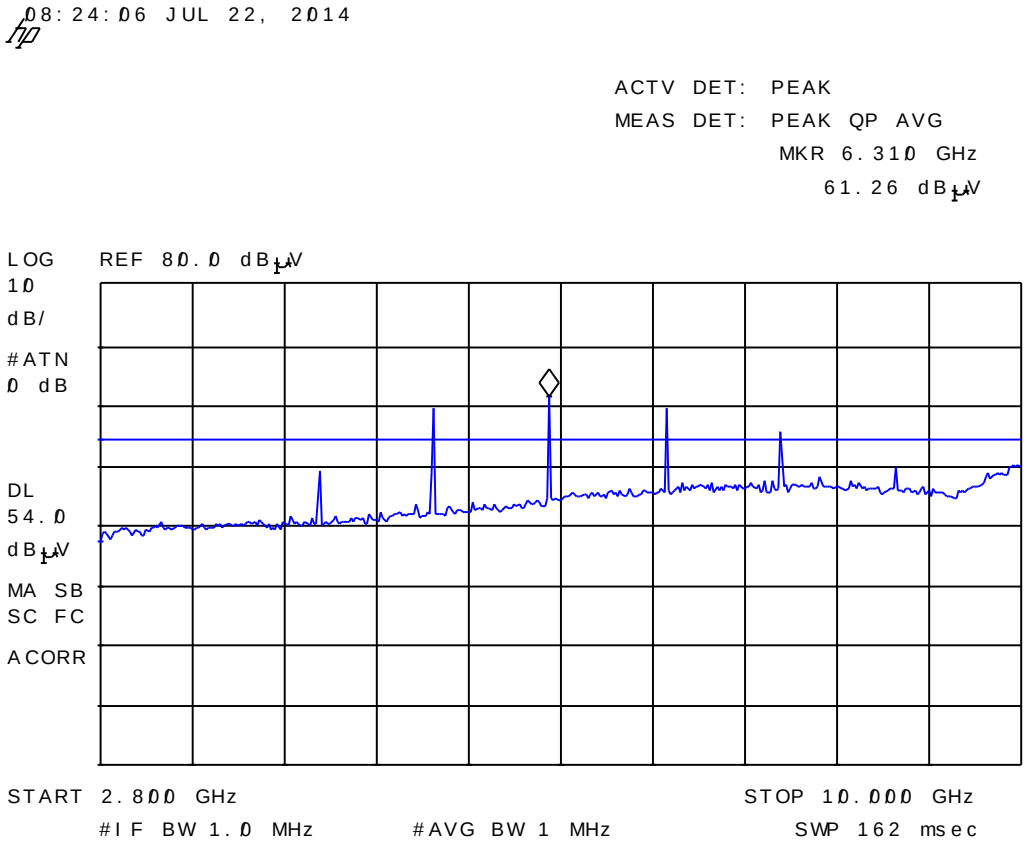
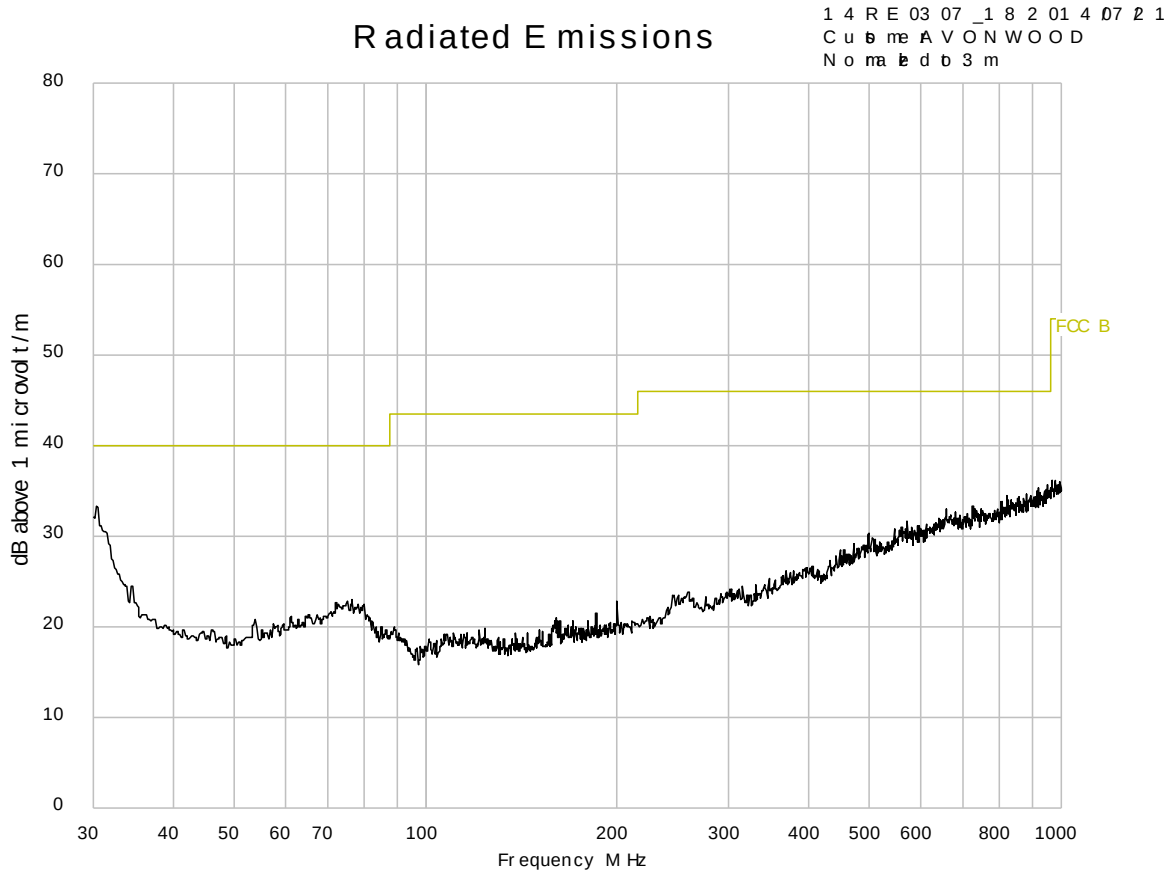


5.4 Radiated Emissions Plot, 2.8 to 10.0 GHz

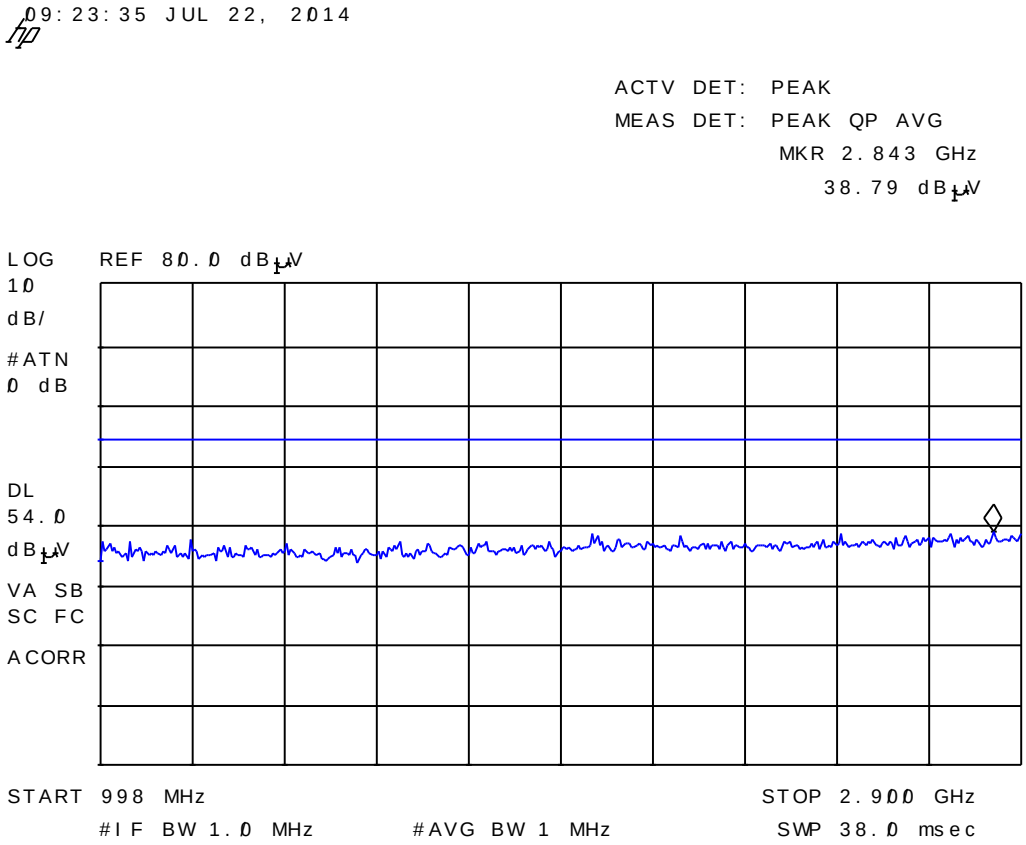


5.5 FCC – Radiated Emissions (Receive Mode) 30 to 1000 MHz

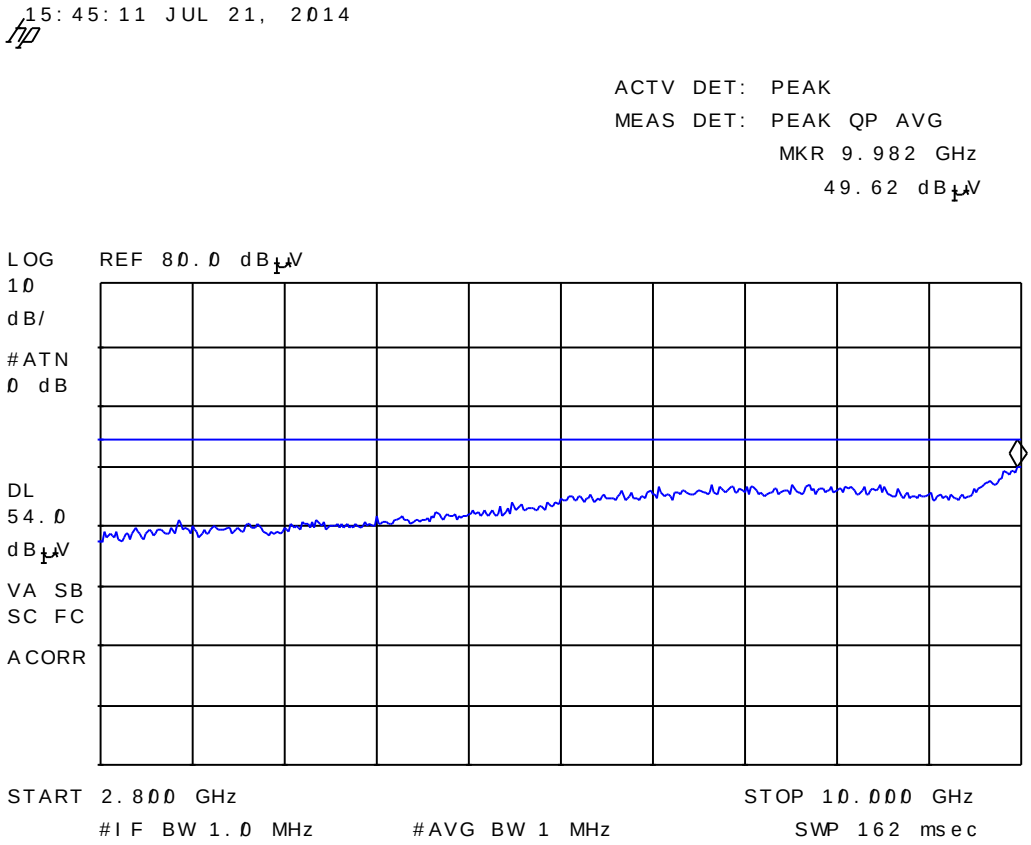


No Emissions were observed above 1GHz

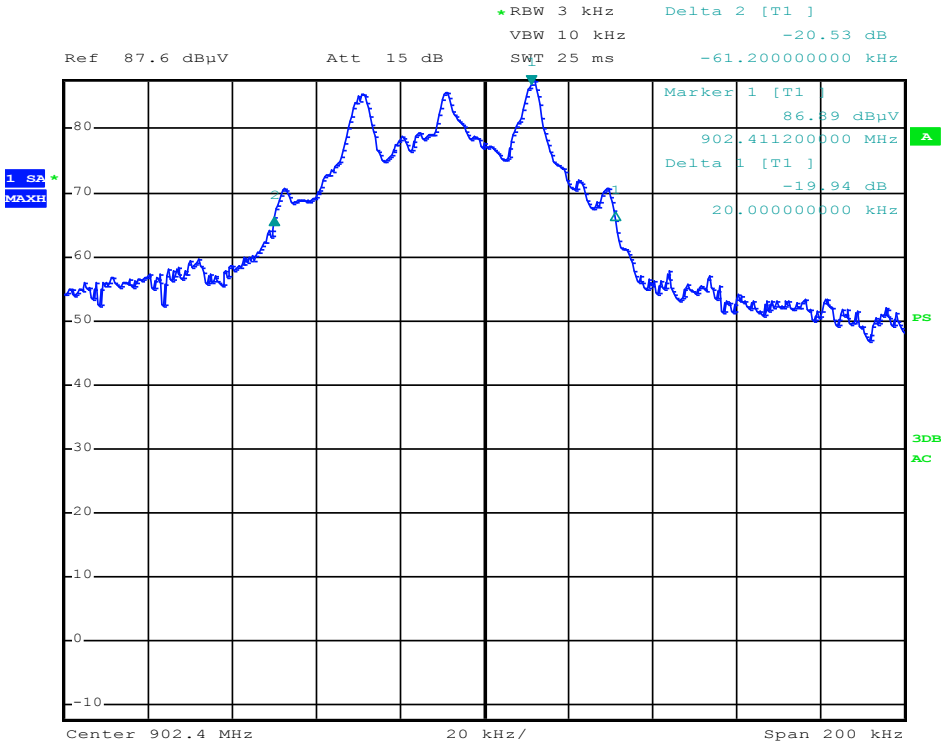
5.6 FCC – Radiated Emissions (Receive Mode) 0.998 to 2.9 GHz



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

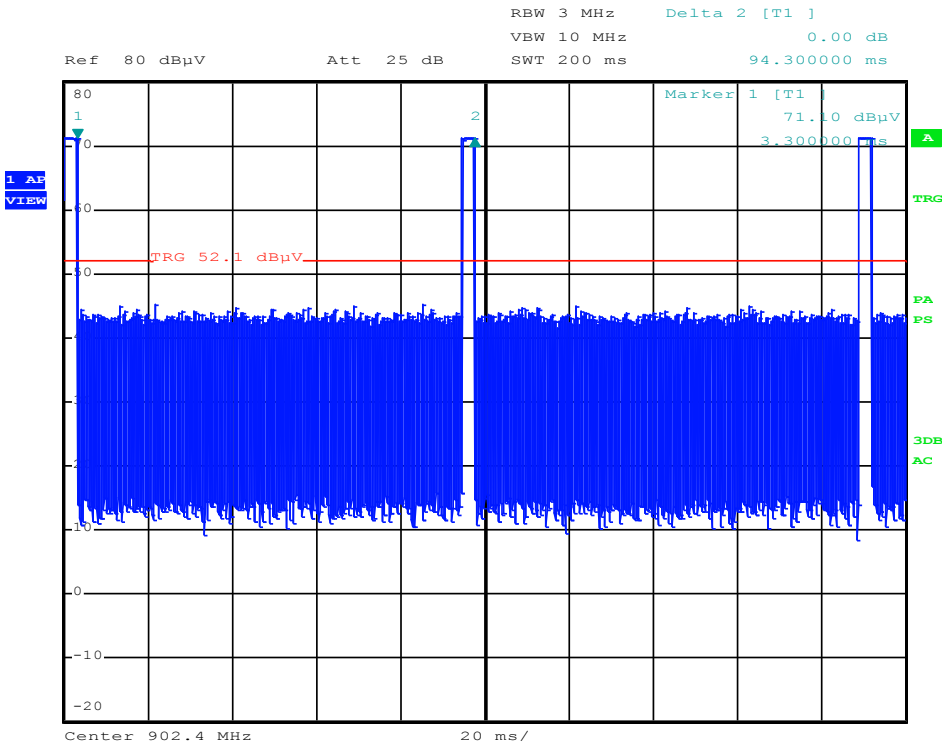


5.8 FCC – Transmitter Emissions Plot (20dB Bandwidth)



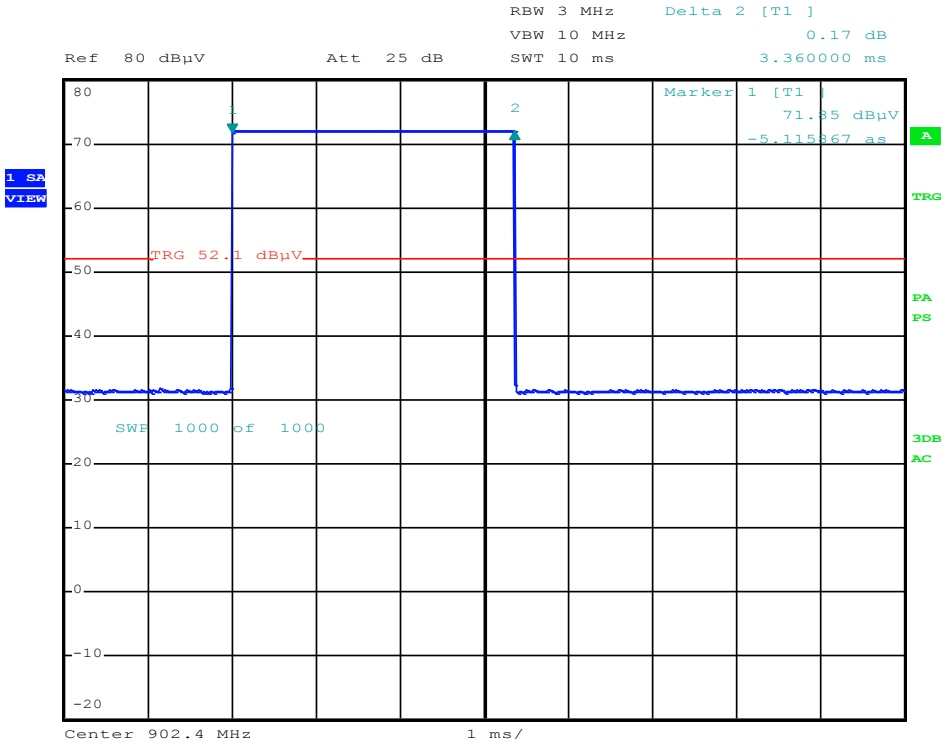
Date: 6.AUG.2014 11:32:05

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