

FCC Part 15C & Industry Canada Verification Report

for the

**Shearwell Data Ltd
Data Tag Reader
SDL 150S-001**



Project Engineer: R. Pennell



Approval Signatory

Approved signatories: J. A. Jones R. P. St John James A. V. Jones

The above named are authorised Hursley EMC Services signatories.

Contents

1.0	DECLARATION	3
1.1	FCC PART 15C AND INDUSTRY CANADA STATEMENT	3
1.2	RELATED SUBMITTAL(S) GRANTS	3
1.3	EUT MANUFACTURER	3
2.0	EUT DESCRIPTION	4
2.1	IDENTITY	4
2.2	PRODUCT OPERATION	4
2.3	SUPPORT EQUIPMENT	4
2.4	EXERCISER PROGRAM	4
3.0	MEASUREMENT PROCEDURE AND INSTRUMENTATION	5
3.1	EMI SITE ADDRESS & TEST DATE	5
3.2	GENERAL OPERATING CONDITIONS	5
3.3	ENVIRONMENTAL AMBIENT	5
3.4	RADIATED EMISSIONS	6
3.5	CONDUCTED EMISSIONS	7
4.0	TEST DATA	8
4.1	FCC – CONDUCTED EMISSIONS (TRANSMITTING)	8
4.1.1	<i>Profiles</i>	10
4.2	FCC – RADIATED EMISSIONS (TRANSMITTING)	11
4.1	99% OCCUPIED BANDWIDTH (IC)	12
4.2	20dB OCCUPIED BANDWIDTH (FCC)	13
4.3	EMISSIONS PLOTS (CARRIED OUT AT 3M WITH THE LIMITS EXTRAPOLATED)	14
4.3.1	<i>9kHz to 150kHz (carried out at 3m with the limits extrapolated at 40dB / Decade)</i>	14
4.3.2	<i>150k to 30MHz Limit line above corrected using extrapolated value X= -54.8884</i>	14
4.4	99% BANDWIDTH PLOT (IC)	16
4.5	20dB BANDWIDTH PLOT (FCC)	17
5.0	FCC DETAILS	18
6.0	INDUSTRY CANADA LETTER	19

Document History: Issue 1 7th February 2018 replaced with issue 2 , correction to Bluetooth module FCCID, uncertainty values added and correction of RSS issue 8 to issue 9.

1.0 DECLARATION

1.1 FCC Part 15C and Industry Canada Statement

The Equipment Under Test (EUT), as described and reported within this document, complies with the parts 15.207 and 15.209 of the CFR 47:2015 FCC rules in accordance with ANSI C63.4. The EUT operates at a transmit frequency of 134.2 kHz and complies with part 15C emission requirements. The EUT also complies with Industry Canada RSS-210 Issue 9.

Note: The EUT also contains a blue tooth module that was inactive during the test. The module is an FCC certified module and is not included within the scope of this report.

1.2 Related Submittal(s) Grants

The Blue tooth module carries the FCC ID: PVH0946

1.3 EUT Manufacturer

Trade name:	Shearwell
Company name:	Shearwell Data Ltd
Company address:	Putham Farm Wheddon Cross Minehead Somerset TA24 7AS United Kingdom
Manufacturing address:	As above.
Company representative:	Mr David Brown Tel: +44 (0) 1643 841611

2.0 EUT DESCRIPTION

2.1 Identity

EUT: SDL 150L-002 Data Tag Reader
Model: SDL 150L-002440-S 424
Serial numbers: 170517001
Sample build: Production

2.2 Product Operation

The SDL150L-002 Reader has been designed for reading microchips that are housed in ear tags of livestock. To operate, the SDL150L-002 is activated when a tag passes near to the antenna.

2.3 Support Equipment

None.

2.4 Exerciser Program

The EUT was placed in a mode where once powered on it continually transmitted.

3.0 MEASUREMENT PROCEDURE AND INSTRUMENTATION

3.1 EMI Site Address & Test Date

EMI Company Offices	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
Test Date	19 th September 2017 to 17 th January 2018
HEMCS References:	17R503

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.4:2003 and ANSI C63.4 2013. Final radiated testing was performed at a EUT to antenna distance of three metres (above 30 MHz).

Below 30 MHz the EUT was measured at an antenna distance of three and ten metres and the extrapolation factor calculated.

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	20.1 - 22 degrees Celsius	33 - 59% relative	1012 – 1023.5 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
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	29/11/2018
047	3	Rohde & Schwarz	HFH2-Z2	879021/22	Loop antenna (9kHz-30MHz)	01/06/2019
071a	3	Q-par Angus	WBH218HN	5367	Horn antenna (2-18GHz)	22/06/2019
250	1	HP	8449B	3008A01077	Pre-amplifier (1.0-26.5GHz)	31/08/2018
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	24/08/2018
456	1	Rohde & Schwarz	ESCI7	1.145E+09	EMI Test Receiver	30/05/2018
456	1	Rohde & Schwarz	ESCI7	1.145E+09	EMI Test Receiver	30/05/2018
466	3	Schwarzbeck	BBHA 9120 571	571	1-10GHz Horn	24/02/2019
600	1	HP	8447D	2944A07419	Amplifier	24/07/2018
762	3	Schwarzbeck	VULB9162	129	30-7000MHz	07/04/2019
762a	3	Schwarzbeck	DGA 9552N	0	6dB attenuator for #762	07/04/2019

The data obtained from the profile scan was used as a guide for the final Open Area Test Site (OATS) measurements.

Final Measurements

The system under test was transferred to the OATS from the semi-anechoic chamber. 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 in the OAT's measurements was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
047	3	Rohde & Schwarz	HFH2-Z2	879021/22	Loop antenna (9kHz-30MHz)	01/06/2019
071a	3	Q-par Angus	WBH218HN	5367	Horn antenna (2-18GHz)	22/06/2019
250	1	HP	8449B	3008A01077	Pre-amplifier (1.0-26.5GHz)	31/08/2018
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	24/08/2018
456	1	Rohde & Schwarz	ESCI7	1.145E+09	EMI Test Receiver	30/05/2018
466	3	Schwarzbeck	BBHA 9120 571	571	1-10GHz Horn	24/02/2019
600	1	HP	8447D	2944A07419	Amplifier	24/07/2018
762	3	Schwarzbeck	VULB9162	129	30-7000MHz	07/04/2019
762a	3	Schwarzbeck	DGA 9552N	0	6dB attenuator for #762	07/04/2019

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.

'*' denotes that the calibration, as defined by Hursley EMC Services quality system, remains valid whilst within four calendar months of the due date.

3.5 Conducted Emissions

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
189	1	Rohde & Schwarz	ESH3-Z2	-	Pulse limiter N type	11/11/2018
674	1	Rohde & Schwarz	ESH3-Z5	838576-018	1 phase LISN	26/05/2018
698	1	Gauss	TDEMI30M	1510002	Time Domain Conducted Receiver	24/01/2019

4.0 TEST DATA

4.1 FCC – Conducted Emissions (Transmitting)

MAINS - NEUTRAL

Frequency	Quasi-peak value (dB μ V)			Average value (dB μ V)			Status
	Measured	Class A Limit	Pass Margin	Measured	Class A Limit	Pass Margin	
150.000 kHz	43.13	66.00	22.87	34.05	54.54	20.49	Pass
207.424 kHz	43.07	63.31	20.24	43.39	54.32	10.93	Pass
240.803 kHz	35.04	62.07	27.03	32.94	52.07	19.13	Pass
278.950 kHz	32.09	60.85	28.76	27.43	50.85	23.42	Pass
312.328 kHz	29.55	59.91	30.36	26.31	49.91	23.60	Pass
345.707 kHz	27.77	59.06	31.30	24.42	49.06	24.64	Pass
379.086 kHz	25.30	58.30	33.00	20.78	48.30	27.52	Pass
417.233 kHz	24.80	57.50	32.70	19.98	47.50	27.52	Pass
450.611 kHz	24.51	56.86	32.36	20.40	46.86	26.46	Pass
483.990 kHz	23.65	56.27	32.62	18.95	46.27	27.32	Pass
555.515 kHz	22.36	56.00	33.64	17.96	46.00	28.04	Pass
1.061 MHz	26.41	56.00	29.59	22.69	46.00	23.31	Pass
1.609 MHz	25.08	56.00	30.92	23.10	46.00	22.90	Pass
2.148 MHz	33.30	56.00	22.70	33.06	46.00	12.94	Pass
2.682 MHz	33.15	56.00	22.85	33.06	46.00	12.94	Pass
2.954 MHz	30.94	56.00	25.06	30.61	46.00	15.39	Pass
3.221 MHz	28.85	56.00	27.15	28.15	46.00	17.85	Pass
3.760 MHz	22.54	56.00	33.46	18.35	46.00	27.65	Pass
4.294 MHz	20.57	56.00	35.43	16.53	46.00	29.47	Pass
4.833 MHz	19.96	56.00	36.04	15.29	46.00	30.71	Pass
6.711 MHz	20.71	60.00	39.29	16.28	50.00	33.72	Pass
9.663 MHz	22.60	60.00	37.40	18.77	50.00	31.23	Pass
10.202 MHz	20.76	60.00	39.24	15.86	50.00	34.14	Pass
14.746 MHz	22.06	60.00	37.94	18.04	50.00	31.96	Pass
17.178 MHz	22.14	60.00	37.86	17.89	50.00	32.11	Pass
18.117 MHz	20.35	60.00	39.65	15.13	50.00	34.87	Pass
21.474 MHz	22.44	60.00	37.56	17.82	50.00	32.18	Pass
22.547 MHz	21.54	60.00	38.46	16.58	50.00	33.42	Pass
25.771 MHz	21.00	60.00	39.00	15.47	50.00	34.53	Pass
27.916 MHz	21.17	60.00	38.83	15.75	50.00	34.25	Pass

MAINS - LINE

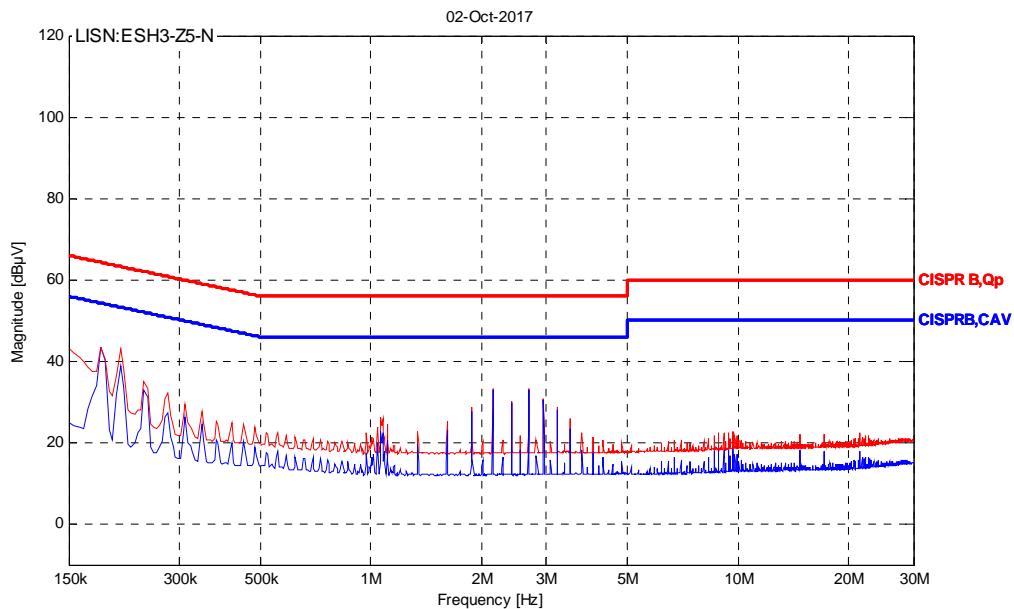
Frequency	Quasi-peak value (dB μ V)			Average value (dB μ V)			Status
	Measured	Class A Limit	Pass Margin	Measured	Class A Limit	Pass Margin	
150.000 kHz	42.64	66.00	23.36	27.51	54.77	27.25	Pass
183.582 kHz	35.31	64.32	29.02	30.96	54.32	23.36	Pass
216.961 kHz	27.19	62.93	35.75	20.38	52.07	31.68	Pass
283.718 kHz	25.25	60.71	35.46	20.19	50.71	30.52	Pass
312.328 kHz	24.26	59.91	35.65	19.45	49.91	30.46	Pass
345.707 kHz	22.61	59.06	36.46	17.31	49.06	31.76	Pass
379.086 kHz	20.86	58.30	37.44	15.43	48.30	32.87	Pass
417.233 kHz	20.43	57.50	37.07	14.96	47.50	32.54	Pass
450.611 kHz	20.35	56.86	36.51	14.89	46.86	31.97	Pass
483.990 kHz	20.38	56.27	35.89	14.89	46.27	31.38	Pass
517.368 kHz	19.83	56.00	36.17	14.55	46.00	31.45	Pass
1.061 MHz	23.02	56.00	32.98	18.97	46.00	27.03	Pass
1.609 MHz	23.61	56.00	32.39	21.14	46.00	24.86	Pass
2.148 MHz	31.52	56.00	24.48	31.13	46.00	14.87	Pass
2.682 MHz	31.52	56.00	24.48	31.27	46.00	14.73	Pass
2.954 MHz	29.46	56.00	26.54	28.79	46.00	17.21	Pass
3.221 MHz	27.58	56.00	28.42	26.52	46.00	19.48	Pass
3.760 MHz	21.63	56.00	34.37	17.35	46.00	28.65	Pass
4.294 MHz	19.90	56.00	36.10	15.39	46.00	30.61	Pass
4.833 MHz	19.35	56.00	36.65	14.57	46.00	31.43	Pass
6.711 MHz	20.19	60.00	39.81	15.18	50.00	34.82	Pass
9.663 MHz	22.11	60.00	37.89	18.04	50.00	31.96	Pass
10.202 MHz	20.34	60.00	39.66	15.36	50.00	34.64	Pass
14.746 MHz	21.32	60.00	38.68	16.81	50.00	33.19	Pass
17.178 MHz	22.17	60.00	37.83	17.79	50.00	32.21	Pass
19.863 MHz	20.85	60.00	39.15	15.69	50.00	34.31	Pass
21.474 MHz	23.31	60.00	36.69	18.94	50.00	31.06	Pass
22.547 MHz	22.34	60.00	37.66	17.28	50.00	32.72	Pass
25.771 MHz	21.36	60.00	38.64	16.10	50.00	33.90	Pass
28.856 MHz	21.82	60.00	38.18	16.46	50.00	33.54	Pass

Uncertainty of measurement: $\pm 3.22\text{dB}\mu\text{V}$ for a 95% confidence level.

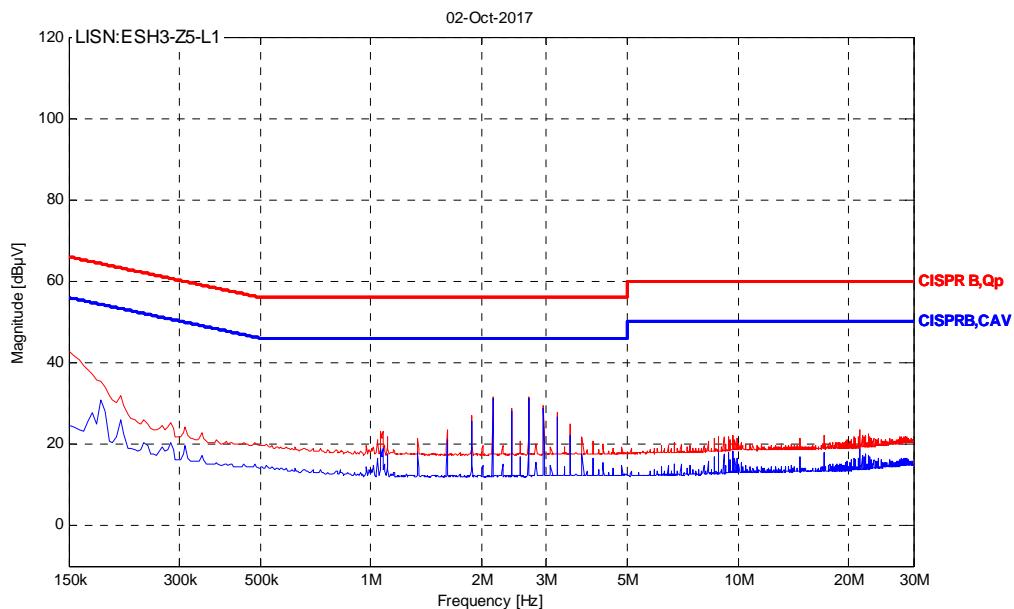
TEST ENGINEER: Richard Pennell

4.1.1 Profiles

Shown here is the mains-neutral plot



Shown here is the mains-line plot



4.2 FCC – Radiated Emissions (Transmitting)

A search was made of the frequency spectrum from 9 kHz to 18 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. 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.

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

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

RESULTS - 9 kHz to 30 MHz

MHz	Measured amplitude (E ₁)	Extrapolation Factor (x)	Calculated amplitude @ 300m		Specified limit @ 300m	
	dB μ V/m @ 10m		dB μ V/m	μ V/m	dB μ V/m	μ V/m
0.1342	97.7	-54.8884	16.62	6.78	25.05	17.88

Uncertainty of measurement: ± 3.2 dB μ V/m for a 95% confidence level.

Extrapolation

To calculate the extrapolation factor (see FCC Part 15.31 (2)) measurements were made at three metres and ten metres from the EUT. The extrapolation factor (x) was then calculated as follows:

The figures below were measured using pk detector

Limit at 134.22kHz is calculated from FCC 15.209 as $\frac{2400}{134.22} = 17.88\mu\text{V/m} \Rightarrow 25.05\text{dBuV/m}$

$$\text{Extrapolation factor } X = E_1 - E_2 \quad x = 20 \frac{\log(\frac{E_1}{E_2})}{\log(\frac{D_1}{D_2})}$$

Where: E1 field strength uV/m at D1 (closest distance)

E1 field strength uV/m at D2 (farthest distance)

$$E_1 = 138.07 \text{ dBuV/m} @ 3\text{m} \Rightarrow 8007556\mu\text{V/m}$$

$$E_2 = 109.37 \text{ dBuV/m} @ 10\text{m} \Rightarrow 294103.4\mu\text{V/m}$$

$$\Rightarrow X = 20 \frac{\log(\frac{8007556}{294103.4})}{\log(\frac{3}{10})}$$

$$\Rightarrow X = -54.8884$$

EUT measured Average Value at 200Hz measurement bandwidth $134.22\text{kHz} = 97.7\text{dBuV/m}$ at 10m

Using Extrapolation factor $X = -54.8884$

For $E1 = 97.7$, $D1 = 10$, $E2 = ?$, $D2 = 300$

$\Rightarrow E2 = 16.62\text{dBuV/m} @ 300\text{m}$, Limit = 25.05dBuV/m

$\Rightarrow E2 = 6.78\mu\text{V/m} @ 300\text{m}$, Limit = $17.88\mu\text{V/m}$

Radiated emissions (continued)

RESULTS - 30 MHz to 1000 MHz

Frequency MHz	Receiver amplitude dB μ V	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m	FCC B Specified limit @ 3m	
					dB μ V/m	dB μ V/m
34.34	24.5	11.5	0.7	36.69	40	100
49.00	14.3	13.3	0.9	28.48	40	100
58.88	12.6	12.8	0.9	26.25	40	100
73.74	19.8	7.8	1.1	28.66	40	100
144	18.7	8.2	1.6	28.46	43.5	150
208	13.7	10.4	1.9	25.97	43.5	150

Uncertainty of measurement: $\pm 4.2 \text{ dB}\mu\text{V/m}$ for a 95% confidence level.

Note: Above 1.0 GHz no significant emissions were detected.

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.

4.1 99% Occupied Bandwidth (IC)

Section 4.6 of RSS-GEN

The output from the measuring antenna was fed into the input of the ESCI spectrum analyser/receiver. The bandwidth of the transmitter was measured with an ESIB receiver set to 99% Occupied Bandwidth with a sampling detector on max hold. The resolution bandwidth, span and video bandwidth are indicated on the occupied bandwidth plot (modulated) included with this report.

The bandwidth of the Transmitter was measured as 1.58 kHz.

Uncertainty of measurement: 4.6% for a 95% confidence level.

TEST ENGINEERS: Richard Pennell

4.2 20dB Occupied Bandwidth (FCC)

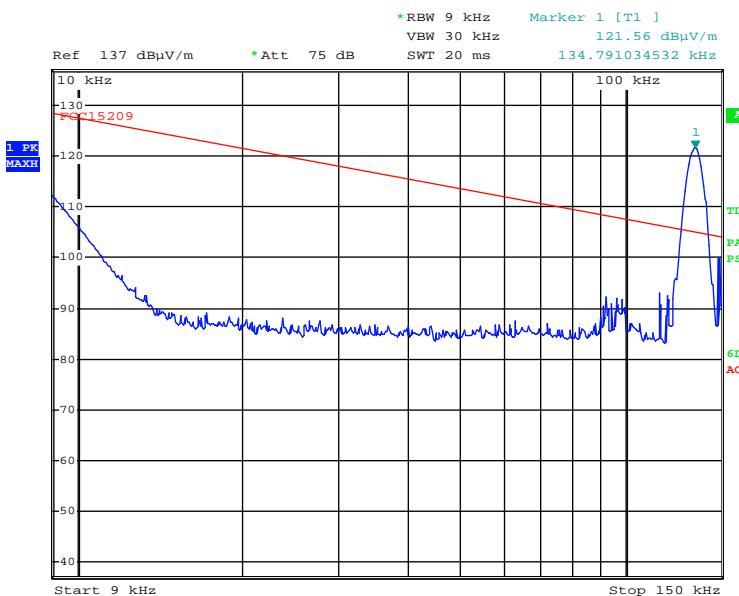
ANSI 63.10 6.9.3

The output from the measuring antenna was fed into the input of the ESCI spectrum analyser/receiver. The bandwidth of the transmitter was measured 20dB down either side of the peak. The ESCI7 analyser was set to sampling detector on max hold. The resolution bandwidth, span and video bandwidth are indicated on the occupied bandwidth plot (modulated) included with this report.

The bandwidth of the Transmitter signal was measured as 610 Hz.

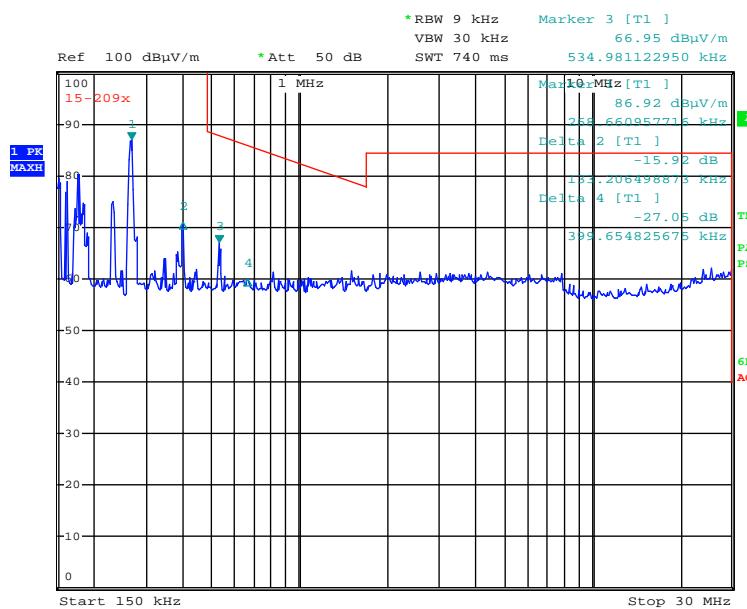
4.3 Emissions plots (carried out at 3m with the limits extrapolated)

4.3.1 9kHz to 150kHz (carried out at 3m with the limits extrapolated at 40dB / Decade)

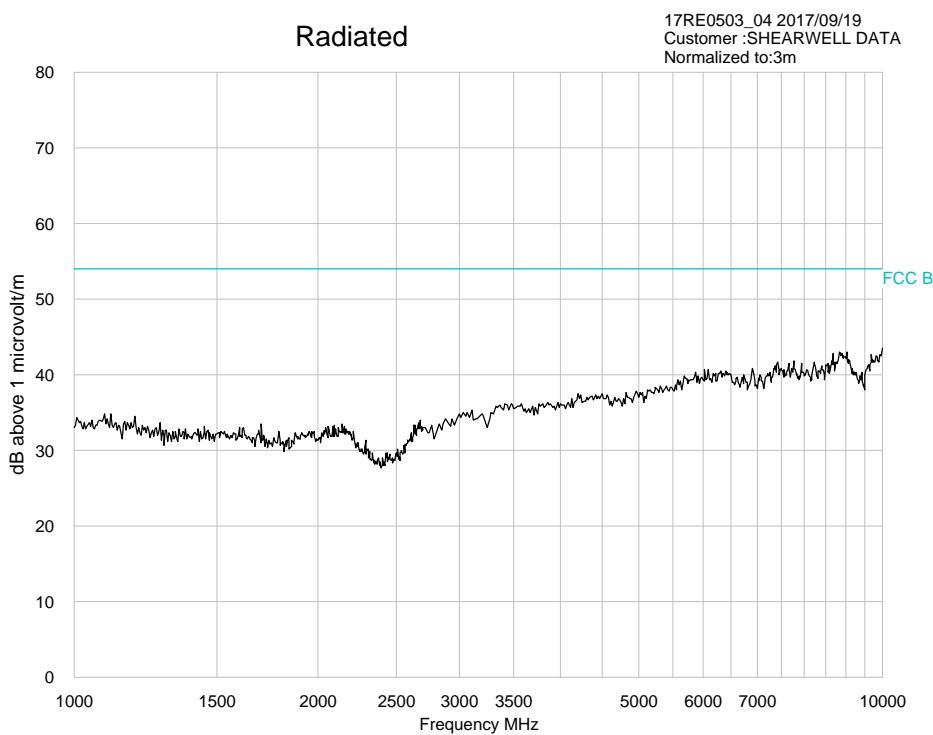
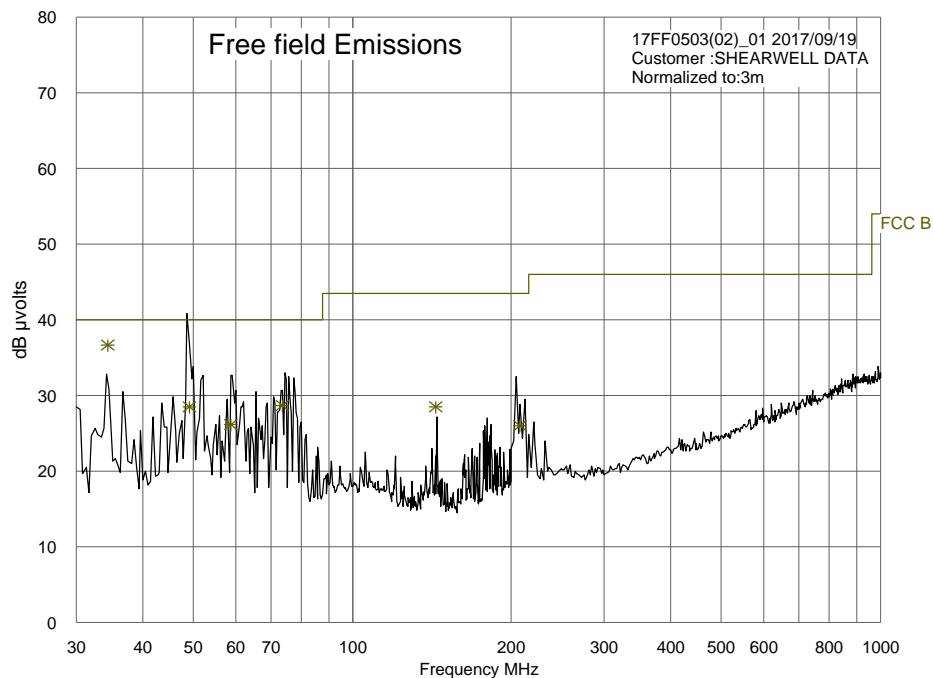


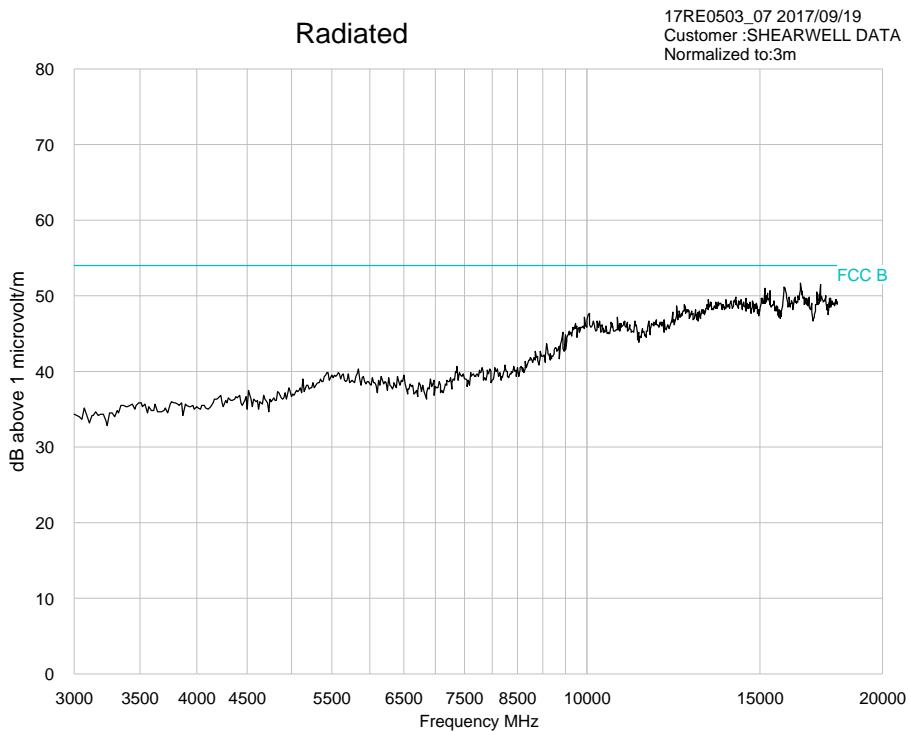
Date: 19.SEP.2017 17:06:23

4.3.2 150k to 30MHz Limit line above corrected using extrapolated value X= -54.8884

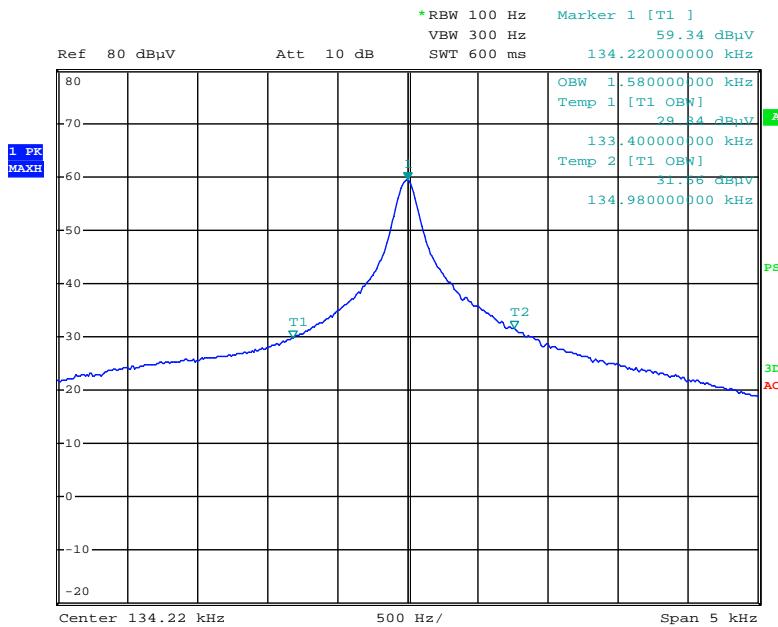


Date: 17.JAN.2018 13:27:16



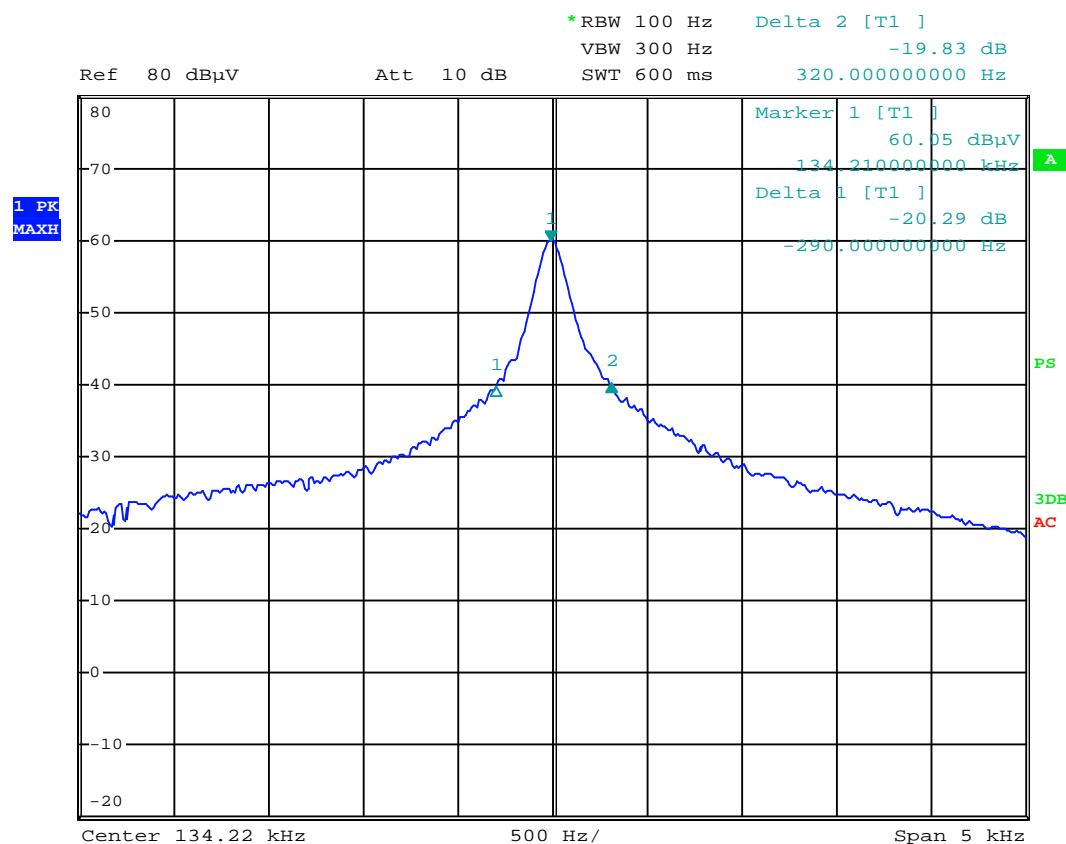


4.4 99% Bandwidth Plot (IC)



Date: 2.OCT.2017 12:33:35

4.5 20dB Bandwidth Plot (FCC)



Date: 2.OCT.2017 12:36:25

5.0 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

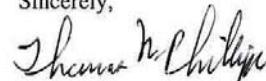
Dear Sir or Madam:

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

6.0 INDUSTRY CANADA LETTER



September 24, 2010

OUR FILE: 46405-7104

Submission No: 142641

Hursley EMC Services Ltd.
Unit 16, Brickfield Lane, Eastleigh
Hampshire, SO53 4DP
Great Britain

Attention: Rob St. John James

Dear Sir/Madame:

The Bureau has received your application for the renewal of a 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought (7104A-1). Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- The company address code associated to the site(s) located at the above address is: 7104A

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to exceed two years. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca Please reference our file and submission number above for all correspondence.

Yours sincerely,



Dalwinder Gill
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: dalwinder.gill@ic.gc.ca
Tel. No. (613) 998-8363
Fax. No. (613) 990-4752