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

FCC Part 15C & Industry Canada Certification Report

for the

Research Instruments Ltd

Embryology Heated Plate, USB and Powered via AC/DC Adapter
IC ID: 12146A-670807
FCC ID: 2ACOO-670807

Project Engineer: R. Pennell

Approval Signatory

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

The above named are authorised Hursley EMC Services signatories.

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1871

Contents

Document History:

Issue#1: 4th October 2017 was withdrawn and replaced by Issue#2: updated with editorial correction.

1.0 DECLARATION

1.1 FCC Part 15C and Industry Canada Statement

The Equipment Under Test (EUT) operates at a transmit frequency of 13.56 MHz and complies with CFR 47 part 15.225 emission requirements. The EUT also complies with Industry Canada RSS-210 Issue 9 and RSS-Gen Issue 4 requirements.

For emissions outside the 13.110-13.410 MHz band the EUT, as described and reported within this document, complies with the parts 15.207 and 15.209 of the CFR 47 FCC rules in accordance with ANSI C63.10:2013 and ANSI C63.4:2014.

The EUT uses passive tags without their own power source and will only work when collocated with the EUT.

1.2 Related Submittal(s) Grants

None

1.3 EUT Manufacturer

Trade name:	Research Instruments Ltd
Company name:	Research Instruments Ltd
Company address:	Brickland Industrial Park Falmouth Cornwall TR11 4TA United Kingdom
Manufacturing address:	As above.
Company representative:	Mr Will Thalliens Tel: +44 (0) 1326 372753

2.0 EUT DESCRIPTION

2.1 Identity

EUT:	Embryology Heated Plate
Serial numbers:	00319
Sample build:	Production
Powered by a Mains AC to DC Power supply:	ICCNEXERGY MWA220048A serial number 0001551

2.2 Product Operation

The Embryology Heated Plate (EUT) is used in fertility laboratories to track containers using RFID technology. All containers have an RFID tag attached so when they are placed in the reader tray, the reader RFID is used to digitally recognize the container identity therefore reducing human errors. The device operates at the frequency of 13.56MHz. The reader is heated to 37°C to maintain the integrity of the samples.

2.3 Support Equipment

Windows 8 surface Tablet 037682231553 (Research Instruments ID 000300)

Windows 8 surface PSU

2.4 Exerciser Program

For the purpose of testing the following program was used to monitor the device under test.

Software: "EmbryologyReaderTestTool.exe"

The software was running on the MS Tablet under Windows 8. With the software active the EUT continually transmitted, with the software application closed the transmitter turns off. The EUT was tested with 5 tags placed on EUT at the same time, 2 tags were attached to two test tubes placed in the vertical axis 3rd, 4th and 5th tags were attached to a Petri dishes in the horizontal axis.

The software is constantly sending an Inventory command which requests the ID of the tags in the work area. As the tags are passive the RF transmitter is always on, so when the tags are inside the reading area they power up and send their ID to the reader. This process is done continuously for the rear, sides and bottom antenna, one at a time. When samples are detected inside the reading area the containers are shown on the operators' display, ready to be worked on and will disappear once they are removed.

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, Eastleigh Hampshire, SO53 4BW , UK
EMI Measurement Site	Hursley EMC Services Ltd Hursley Park, Winchester, SO21 2JK, UK; FCC Registered UK Designation number: UK0006 Canada Registration Number: 7104A
Test Dates	12th September 2017 to the 21st September 2017
HEMCS References:	17R490

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.10:2013, RSS-210 Issue 9, RSS Gen Issue 4 using a test site that is compliant to ANSI C63.4 2014. 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 compared to the limits.

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	20.6 to 23.4 degrees Celsius	46 to 53 % relative	1003.8 to 1023 millibars

3.4 Radiated Emissions

Initial Scan

Above 30 MHz 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. 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 for each polarity a radiated emission profile obtained by revolving the system on the turntable. Instrumentation used in the chamber as below:

3.5 Test Equipment

#ID	CP	Manufacturer	Type	Serial No	Description	Ext Calibration
762	3	Schwarzbeck	VULB9162	129	30-7000MHz	07/04/2019
762a	3	Schwarzbeck	DGA 9552N	0	6dB attenuator for #762	07/04/2019
050	1	HP	8447D	1937A02341	Pre-amplifier (30-1000MHz)	14/09/2017
456	1	Rohde & Schwarz	ESCI7	1.145E+09	EMI Test Receiver	30/05/2018
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	11/10/2017
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	24/08/2018
047	3	Rohde & Schwarz	HFH2-Z2	879021/22	Loop antenna (9kHz-30MHz)	01/06/2019

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.
'Internal' means internally calibrated using HEMCS procedures

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:

3.6 Conducted Emissions

Test Configuration

A filtered 115V/60Hz supply was fed to the system under test, via a 50Ω/50µH Line Impedance Stabilisation Network (LISN). The LISN was directly bonded to a conductive ground plane.

Test Measurement

The worst-case emissions were identified on both the neutral and phase(s) with a spectrum analyser set to scan from 0.15 MHz to 30 MHz.

The worst-case peaks were then identified and measured using an RF receiver using a quasi-peak detector and compared to the frequency range and limits of CISPR 22 as specified by ANSI C63.4-2014. Quasi-peak values that exceeded the average limit were then re-measured using the average signal detector.

The worst-case results are presented in this report.

Test instrumentation used in the conducted test was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
189	1	Rohde & Schwarz	ESH3-Z2	-	Pulse limiter N type	19/10/2017
674	1	Rohde & Schwarz	ESH3-Z5	838576-018	1 phase LISN	26/05/2018
698	1	Gauss	TDEMI30M	1510002	Time Domain Conducted Receiver	09/01/2018

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.

4.0 TEST DATA

4.1 Power Line Conducted Emissions

4.1.1 Data

A search was made of the frequency spectrum between 0.15 MHz to 30 MHz and the measurements reported here are the highest emissions relative to the CISPR 22 Class B limits. Emissions that meet the average limit on a quasi-peak measurement are deemed to meet both the average and quasi-peak specification.

The uncertainty of measurement for each test has been included to support a level of confidence of approximately 95%.

MAINS - NEUTRAL

	Quasi-peak value (dBµV)		Average value (dBµV)		
Frequency	Measured	Class B Limit	Measured	Class B Limit	**Status**
150.000 kHz	49.53	66.00	38.50	54.32	Pass
4.113 MHz	23.35	56.00	14.90	46.00	Pass
6.926 MHz	21.46	60.00	14.40	50.00	Pass
9.849 MHz	20.48	60.00	14.40	50.00	Pass
13.635 MHz	20.14	60.00	14.92	50.00	Pass
15.419 MHz	19.35	60.00	13.94	50.00	Pass
18.752 MHz	20.09	60.00	15.04	50.00	Pass
23.634 MHz	20.13	60.00	14.86	50.00	Pass
26.896 MHz	21.83	60.00	16.90	50.00	Pass
29.743 MHz	24.85	60.00	21.31	50.00	Pass

MAINS – LINE

	Quasi-peak value (dBµV)		Average value (dBµV)		
Frequency	Measured	Class B Limit	Measured	Class B Limit	**Status**
150.000 kHz	49.44	66.00	38.31	54.32	Pass
4.113 MHz	23.08	56.00	14.73	46.00	Pass
7.145 MHz	20.75	60.00	14.12	50.00	Pass
9.849 MHz	20.05	60.00	14.16	50.00	Pass
13.635 MHz	20.07	60.00	14.95	50.00	Pass
17.788 MHz	19.29	60.00	13.94	50.00	Pass
18.752 MHz	20.16	60.00	14.93	50.00	Pass
23.634 MHz	19.97	60.00	14.75	50.00	Pass
26.896 MHz	21.81	60.00	16.70	50.00	Pass
29.747 MHz	25.04	60.00	21.43	50.00	Pass

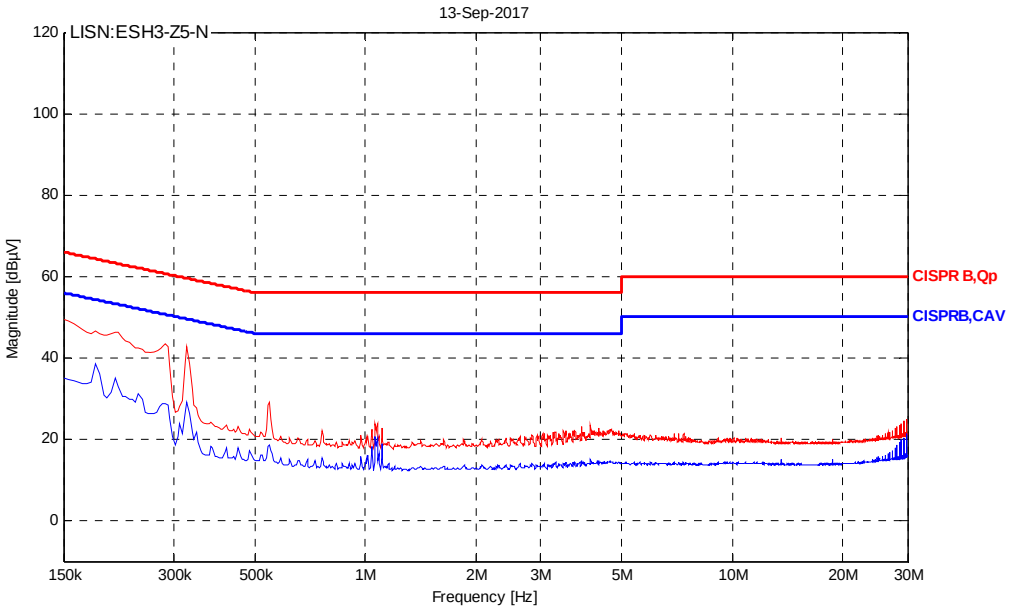
Uncertainty of measurement: ± 3.22dBµV for a 95% confidence level.

Measurements made according to the FCC rules and Hursley EMC Services test procedure CON-02.

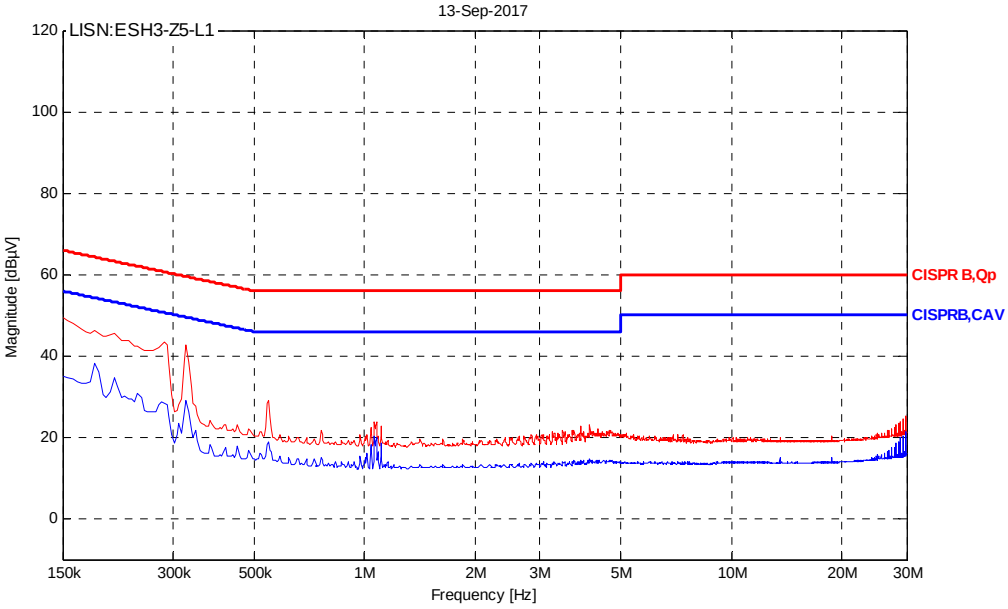
TEST ENGINEER: Richard Pennell

4.1.2 Profiles

Shown here is the natural plot



Shown here is the line plot



4.2 FCC – Radiated Emissions (Transmitting)

A search was made of the frequency spectrum from 9 kHz to 1 GHz and the measurements reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 and 15.225 Limits' and RSS-210 A2.6 Issue 9, RSS Gen 8.9 Issue 4 limits at a measuring distance of three metres above 30MHz. Below 30 MHz the results at 3m have been compared to the limits extrapolated from 30m or 300m, the limits were extrapolated using 40 dB per decade.

Limit at 13.56MHz is calculated from FCC 15.225 as 15848uV/m at 30m => 84dBuV/m at 30m

The transmitter emission at 13.56MHz was measured at 3m and re-measured at 10m.

The extrapolation factor is calculated as follows.

E1 = 40.85 , E2 = 21.05 , D1 = 3 , D2 = 10

Extraoplotion factor $x = 20\frac{\log\left(\frac{E_1}{E_2}\right)}{\log\left(\frac{D_1}{D_2}\right)}$

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

E2 field strength **uV/m** at D2 (farthest distance **m**)

⇨ E1 = 40.85 dBuv/m @ 3m => 110.2808uV/m
⇨ E2 = 21.05 dBuv/m @ 10m => 11.2850uV/m

$$\Rightarrow X = 20\frac{\log\left(\frac{110.2808}{11.2850}\right)}{\log\left(\frac{3}{10}\right)}$$

$$\Rightarrow X = -37.8673$$

D1 = 3 , D2 = 30 , E1 = 110.2808uV/m , E2 = ? uV/m

$$x = 20\frac{\log\left(\frac{E1}{E2}\right)}{\log\left(\frac{D1}{D2}\right)}$$

$$\rightarrow E2 = \frac{110.2808}{10\text{^}\left(\left(\frac{-37.8673}{20}\right).\log\left(\frac{3}{30}\right)\right)}$$

$\Rightarrow E2 = 1.40973\,uV/m$ @ 30m $\Rightarrow E2 = 2.96271\,dBuV/m$ *at 30m*

Measurements were made using a quasi-peak detector with a 9kHz bandwidth below 30MHz and a 120kHz bandwidth above 30MHz. Below 30MHz the only significant emission was from the transmitter at 13.56MHz.

Below 30MHz no significant emissions were detected with the transmitter off (idle state).

RESULTS - 9 kHz to 30 MHz

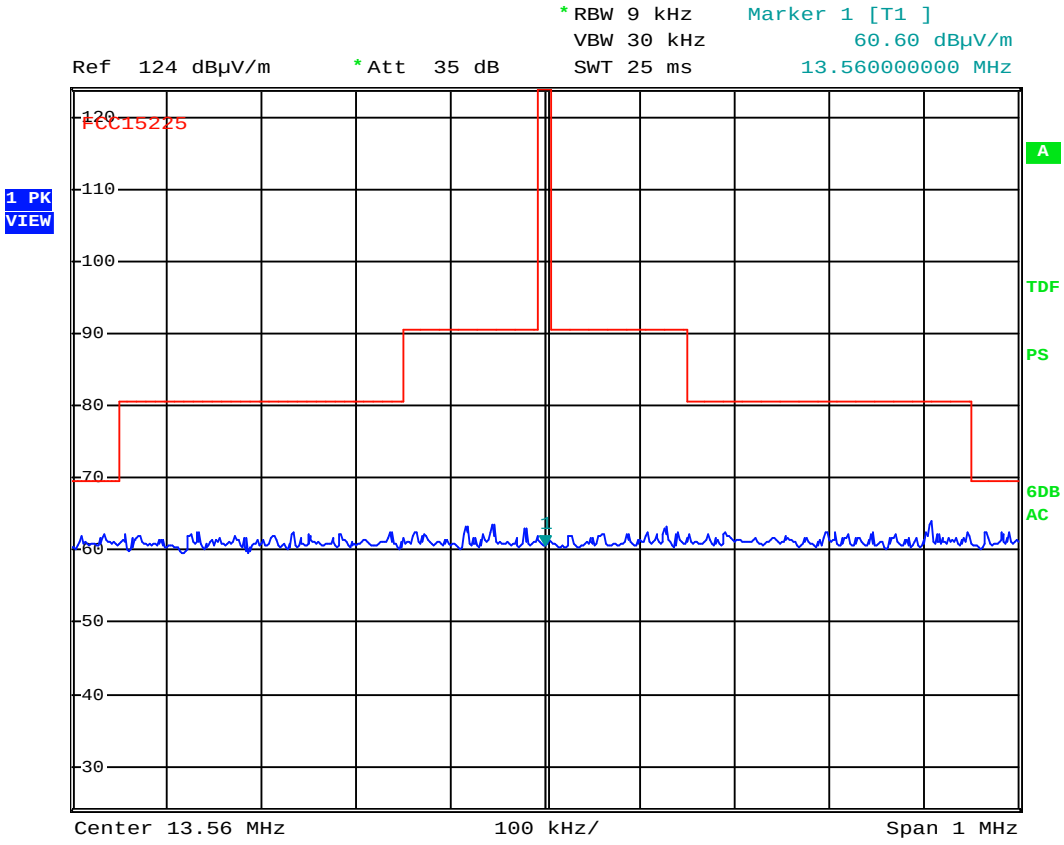
	Measured amplitude (E_1)	Extrapolation	Calculated amplitude @ 30m		Specified limit @ 30m	
MHz	**dBµV/m @10m**	**Factor (x)**	**dBµV/m**	**µV/m**	**dBµV/m**	**µV/m**
13.56	40.85	-37.8673	2.98271	1.40973	84.00	15848

Uncertainty of measurement: ± 3.2 dBµV/m for a 95% confidence level.

4.3 Transmitter Mask

The plot below was measured at 3m with limit line corrected 40dB/decade correction in accordance with FCC 15.31(2) & RSS-210 A2.6 Issue 9 to reflect the limit given at 30m.

The plot shows the band edge is compliant, please note the emissions are below the noise floor.



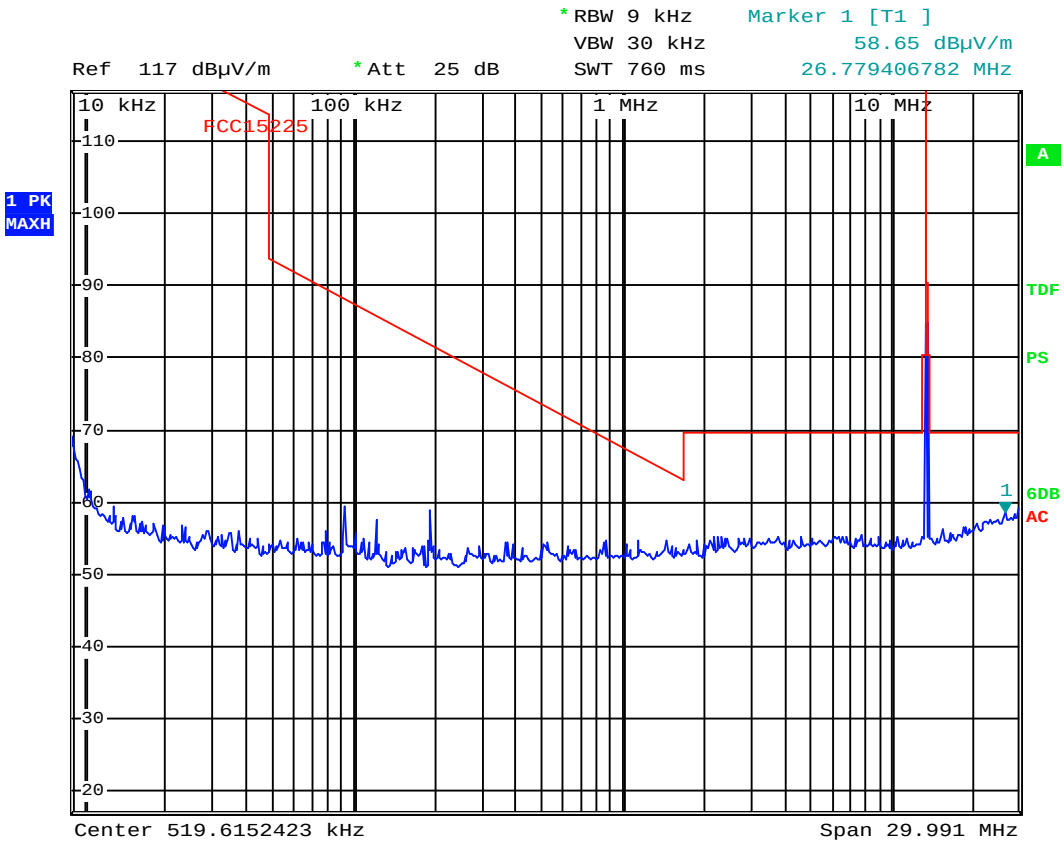
Date: 20.SEP.2017 16:43:47

4.4 Emissions Plots

A search was made of the frequency spectrum from 9 kHz to 1 GHz and the measurements reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 /15.255 and RSS-210 A2.6 Issue 9, RSS Gen 8.9 Issue 4 Limits' at a measuring distance of three metres above 30MHz. Below 30 MHz the results measured at 3m with a corrected limit line extrapolated from 30m or 300m, the limits were extrapolated using 40dB per decade.

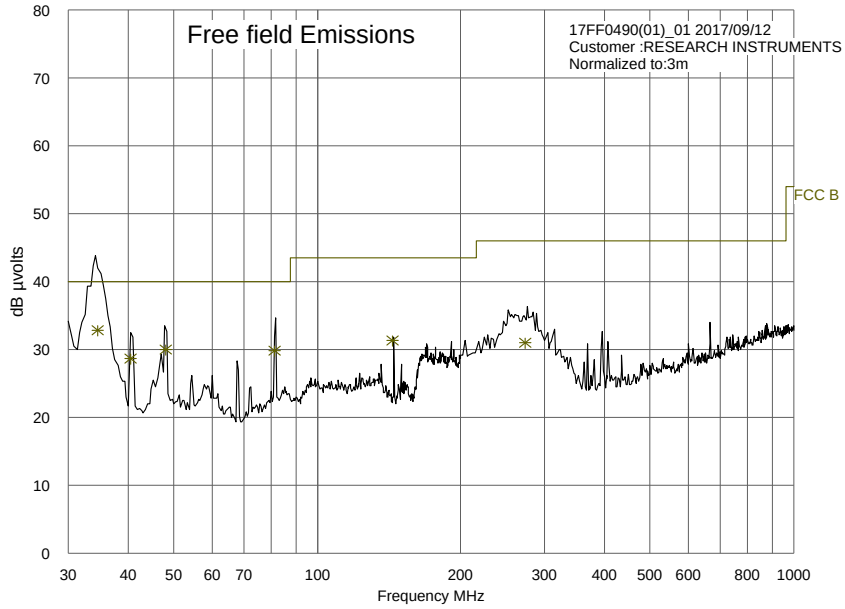
Measurements were made using a quasi-peak detector with a 9kHz bandwidth below 30MHz and a 120kHz bandwidth above 30MHz. Below 30MHz the only significant emission was from the transmitter at 13.56MHz. Below 30MHz no significant emissions were detected with the transmitter off (idle state).

Tx

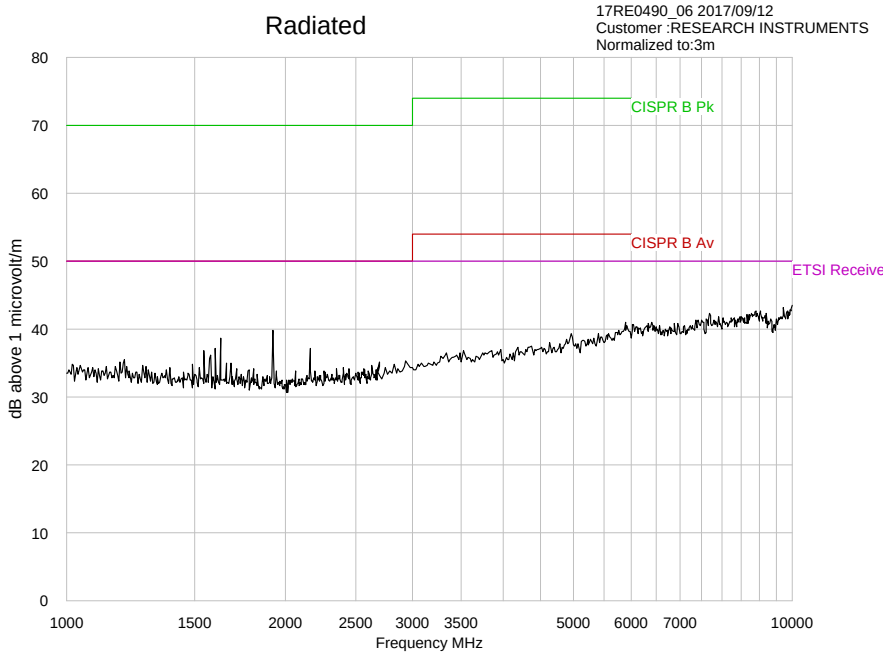


Date: 12.SEP.2017 15:42:52

TX


Free field Emissions
17FF0490(01)_01 2017/09/12
Customer :RESEARCH INSTRUMENTS
Normalized to:3m
FCC B
dB µvolts
Frequency MHz
80
70
60
50
40
30
20
10
0
30
40
50
60
70
100
200
300
400
500
600
800
1000

TX


Radiated
17RE0490_06 2017/09/12
Customer :RESEARCH INSTRUMENTS
Normalized to:3m
CISPR B Pk
CISPR B Av
ETSI Receive
dB above 1 microvolt/m
Frequency MHz
80
70
60
50
40
30
20
10
0
1000
1500
2000
2500
3000
3500
5000
6000
7000
10000

Radiated emissions (continued)

RESULTS (Transmitting) - 30 MHz to 1000 MHz

Frequency	Receiver amplitude	Antenna factor	Cable loss	Actual quasi-peak value @ 3m	Specified limit @ 3m	
MHz	dBµV	dB	dB	dBµV/m	dBµV/m	µV/m
34.68	20.6	11.5	0.7	32.8	40.0	100
40.66	15.0	12.8	0.8	28.6	40.0	100
48	15.8	13.4	0.9	30.1	43.5	150
81.34	21.4	7.3	1.1	29.8	46.0	200
144	21.6	8.2	1.6	31.4	46.0	200
273	16.6	12.2	2.3	31.1	46.0	200

Uncertainty of measurement: ± 4.2 dBµV/m for a 95% confidence level.

Procedure: In accordance with ANSI C63.4:2014

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

TEST ENGINEER: Richard Pennell

4.5 Frequency Error

FCC 15.225 (e) & RSS-210 A2.6 Issue 9

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +55 degrees C, and for a variation in the primary supply voltage from 85% to 115% (85V to 276V) of the rated supply voltage (100-240V) at a temperature of 20 degrees C.

The EUT was placed in a climatic chamber. A small loop antenna was placed in a jig under the Transmitter; the output from the loop antenna was fed via a 10 dB attenuator into the input of the ESCI 7 spectrum analyser/receiver. The frequency of the transmitter was measured with an ESCI 7 receiver.

Limit = +/-100 ppm (+/-0.01%)

Voltage	Deg C	f (MHz)	Error (Hz)	Limit (Hz)	Pass / Fail
100	Ambient	13.559913		-	-
85	Ambient	13.559918	5	+/-1356	Pass
276	Ambient	13.559918	5	+/-1356	Pass
85	-20	13.559989	76	+/-1356	Pass
276	-20	13.559988	75	+/-1356	Pass
85	-10	13.559996	83	+/-1356	Pass
276	-10	13.560000	87	+/-1356	Pass
85	0	13.560000	87	+/-1356	Pass
276	0	13.559992	79	+/-1356	Pass
85	10	13.559980	67	+/-1356	Pass
276	10	13.559992	79	+/-1356	Pass
85	20	13.559932	19	+/-1356	Pass
276	20	13.559936	23	+/-1356	Pass
85	30	13.559864	-49	+/-1356	Pass
276	30	13.559868	-45	+/-1356	Pass
85	40	13.559892	-21	+/-1356	Pass
276	40	13.559888	-25	+/-1356	Pass
85	50	13.559900	-13	+/-1356	Pass
276	50	13.559684	-229	+/-1356	Pass
85	55	13.559856	-57	+/-1356	Pass
276	55	13.559900	-13	+/-1356	Pass

TEST ENGINEER: Richard Pennell

4.6 Occupied Bandwidth

Section 6.6 of RSS-GEN and ANSI 63.10 6.9.3

A small loop antenna was placed in a jig under the Transmitter; the output from the loop antenna was fed via a 10 dB attenuator into the input of the spectrum analyzer. The bandwidth of the transmitter was measured with an ESCI 7 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 99% bandwidth of the Transmitter was measured as 227Hz (modulated).

The 20dB bandwidth of the Transmitter was measured as 129Hz (modulated).

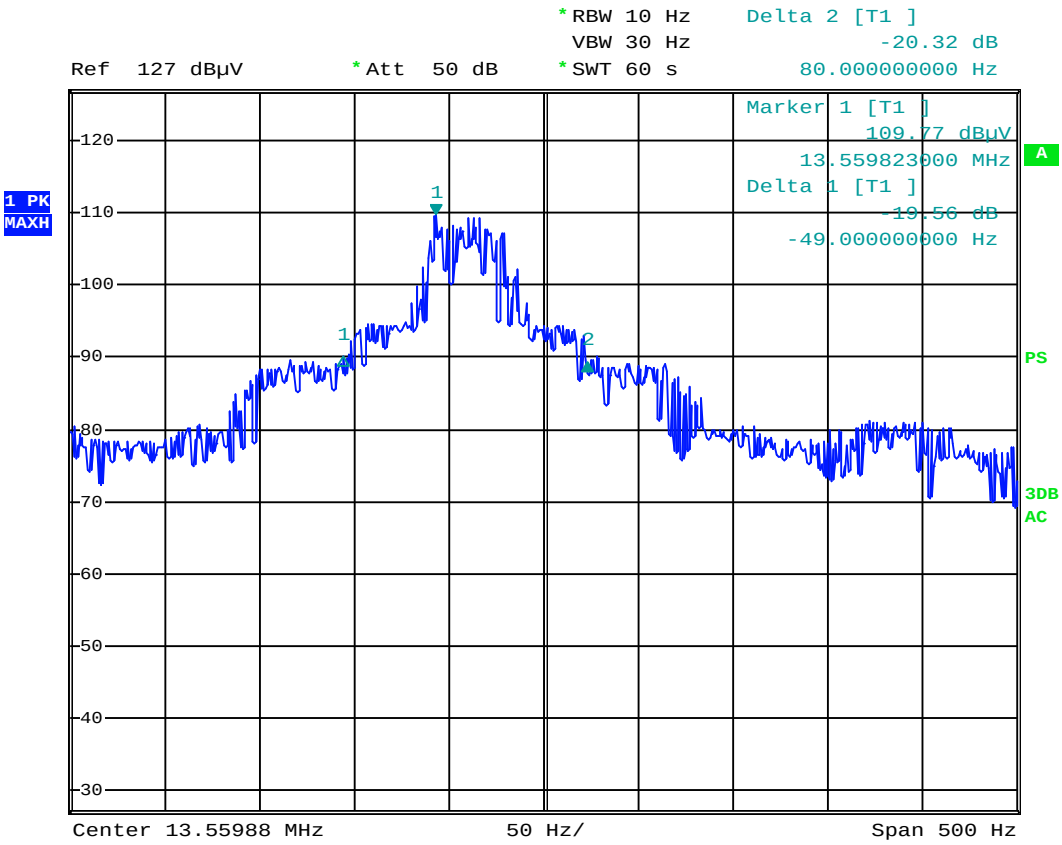
Uncertainty of measurement: 4.6% for a 95% confidence level.

4.7 Bandwidth Plot

99% Plot

Date: 13.SEP.2017 12:39:02

-20dB Plot



Date: 4.OCT.2017 17:04:01

TEST ENGINEER: Richard Pennell

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

Industry Canada Industrie Canada

May 22, 2013

OUR FILE: 46405-7104
Submission No: 167120

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

Attention: Rob St. John James

Dear Sir:

The Bureau has received your application for the renewal of 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 **(Site# 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 three 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,

Bill Payn
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: Bill.Payn@ic.gc.ca
Tel. No. (613) 990-3639
Fax. No. (613) 990-4752

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