EMC TEST REPORT

No. 18R219 FR

Issue#2: 5th July 2018

FCC Part 15C & Industry Canada Certification Report

for the

Access-IS Ltd
CPM module

IC ID: 9653A-CPM01
FCC ID: ZERCPM01

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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Document History:

Issue#1: 9th May 2018 was withdrawn and replaced by Issue#2: updated with editorial correction.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 5 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 (conducted Limits), 15.209 (Radiated emissions) and 15.212 (Modular transmitters) of the CFR 47 FCC rules in accordance with ANSI C63.10:2013 and ANSI C63.4:2014.

The EUT is a Near Field Communication module for used for contactless payment cards.

1.2 Related Submittal(s) Grants

None

1.3 EUT Manufacturer

Trade name:	Access-IS Ltd
Company name:	Access-IS Ltd
Company address:	18 Suttons Business Park Reading Berkshire RG6 1AZ United Kingdom
Manufacturing address:	As above.
Company representative:	Mr Mohamed Ismail Bari Tel: +44 (0) 118 966 3333

2.0 EUT DESCRIPTION

2.1 Identity

EUT:	13.56MHz NFC contactless payment module
Serial numbers:	EMC#2
Sample build:	Production
Powered via:	USB (from Laptop)

2.2 Product Operation

The NFC module is intended for use within other products. When cards are placed near the module, it digitally recognizes the card identity. The device operates at the frequency of 13.56MHz. There is no idle state the EUT constantly transmits at 13.56MHz.

2.3 Support Equipment

Dell precision M90 laptop Service tag No. 46-082-339-83 with PA-13 family psu model number PA113102D2.

2.4 Exerciser Program

For the purpose of testing the EUT was exercised by polling for ISO14443 A/B media which with the close proximity of a card can be used to monitor the EUT during immunity testing.

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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	30th April 2018 to the 09th May 2018
HEMCS References:	18R219

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.10:2013, RSS-210 Issue 9, RSS Gen Issue 5 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). Extrapolation measurements and calculations are provided.

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	21.2 to 27.1 degrees Celsius	31 to 49% relative	1004.4 to 1021.3 millibars

3.4 Power Line Conducted Emissions

Test Configuration

A filtered 5V DC supply USB supply was fed from a Dell laptop 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 Line(s) with an FFT Receiver set to scan from 0.15 MHz to 30 MHz.

The worst-case peaks are identified and measured with the FFT 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
158	1	Rohde & Schwarz	ESH3-Z2	357881052	Pulse limiter N type	07/10/2018
147	1	Rohde & Schwarz	ESH3-Z5	846695/011	1 phase LISN	05/07/2018
698	1	Gauss	TDEMI30M	1510002	Time Domain Conducted Receiver	24/01/2019

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.

3.4.1 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 FCC CFR 47 Section 15.212 requirements and 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%.

3.4.2 Antenna fitted

Neutral

	Quasi-peak value (dBµV)		Average value (dBµV)		
Frequency	Measured	Class B Limit	Measured	Class B Limit	**Status**
574.589 kHz	49.11	66.00	35.73	46.00	Pass
5.958 MHz	32.36	60.00	26.94	50.00	Pass
13.559 MHz	51.45	60.00	51.76	50.00	Carrier
15.237 MHz	36.45	60.00	31.10	50.00	Pass
24.002 MHz	35.06	60.00	29.70	50.00	Pass
27.120 MHz	35.86	60.00	31.06	50.00	Pass

Line

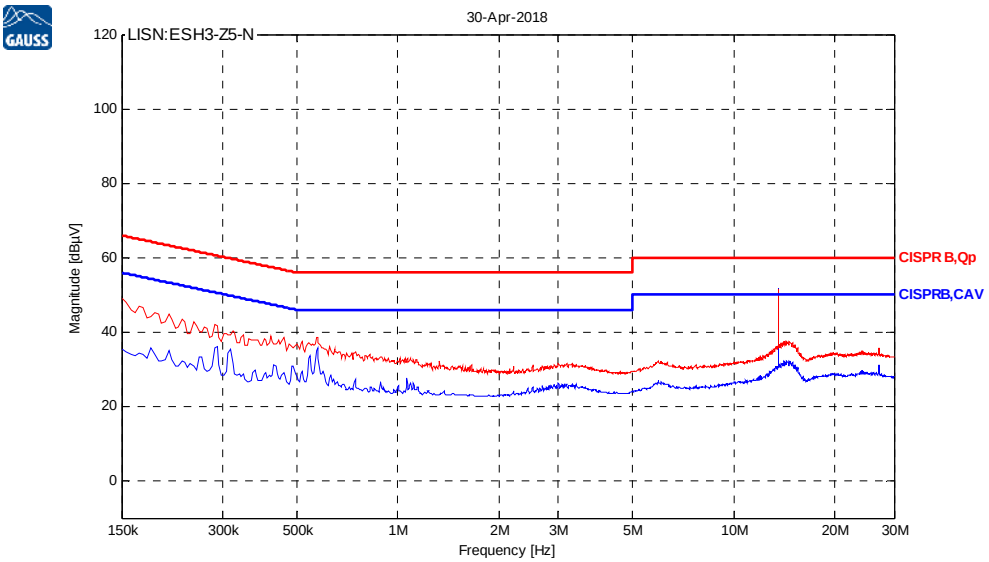
	Quasi-peak value (dBµV)		Average value (dBµV)		
Frequency	Measured	Class B Limit	Measured	Class B Limit	**Status**
574.589 kHz	38.59	56.00	35.57	46.00	Pass
5.958 MHz	32.48	60.00	27.05	50.00	Pass
13.559 MHz	57.50	60.00	57.82	50.00	Carrier
13.564 MHz	37.66	60.00	54.87	50.00	Carrier
15.099 MHz	35.46	60.00	32.23	50.00	Pass
23.997 MHz	36.59	60.00	30.29	50.00	Pass

Uncertainty of measurement: ± 3.28dBµV for a 95% confidence level.

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

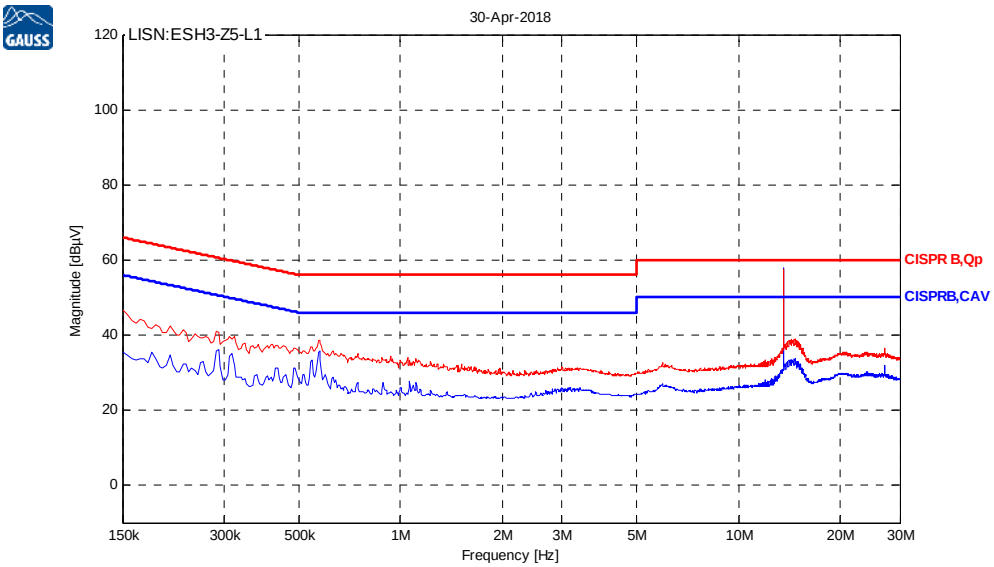
3.4.2.1 Profiles

Shown here is the natural plot (Antenna fitted)



Receiver Model: TDEMI_v5.00_1510002
Protocol Number: 18J219_02_Antenna
Serial Number: EMC#2
Operation State: Active with antenna
Notes: Tested via Dell PC on 110v 60Hz

Shown here is the line plot (Antenna fitted)



Receiver Model: TDEMI_v5.00_1510002
Protocol Number: 18J219_02_Antenna
Serial Number: EMC#2
Operation State: Active with antenna
Notes: Tested via Dell PC on 110v 60Hz

TEST ENGINEER: Richard Pennell

3.4.3 Antenna load fitted

Neutral

	Quasi-peak value (dBµV)		Average value (dBµV)		
Frequency	Measured	Class B Limit	Measured	Class B Limit	**Status**
560.284 kHz	38.78	56.00	34.95	46.00	Pass
10.083 MHz	33.51	60.00	27.70	50.00	Pass
13.559 MHz	41.09	60.00	36.09	50.00	Pass
19.910 MHz	40.18	60.00	34.73	50.00	Pass
24.006 MHz	41.30	60.00	35.85	50.00	Pass
25.032 MHz	40.56	60.00	35.14	50.00	Pass

Line

	Quasi-peak value (dBµV)		Average value (dBµV)		
Frequency	Measured	Class B Limit	Measured	Class B Limit	**Status**
560.284 kHz	38.49	56.00	34.67	46.00	Pass
6.096 MHz	33.26	60.00	27.47	50.00	Pass
13.559 MHz	40.68	60.00	35.70	50.00	Pass
20.025 MHz	40.29	60.00	34.89	50.00	Pass
24.292 MHz	41.57	60.00	35.97	50.00	Pass
25.265 MHz	40.75	60.00	35.45	50.00	Pass

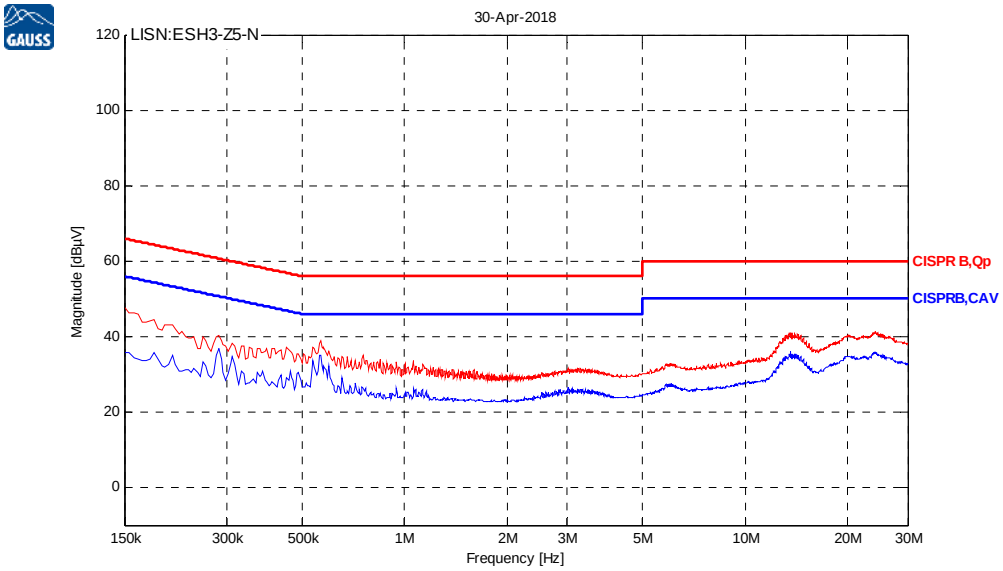
Uncertainty of measurement: ± 3.28dBµV for a 95% confidence level.

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

TEST ENGINEER: Richard Pennell

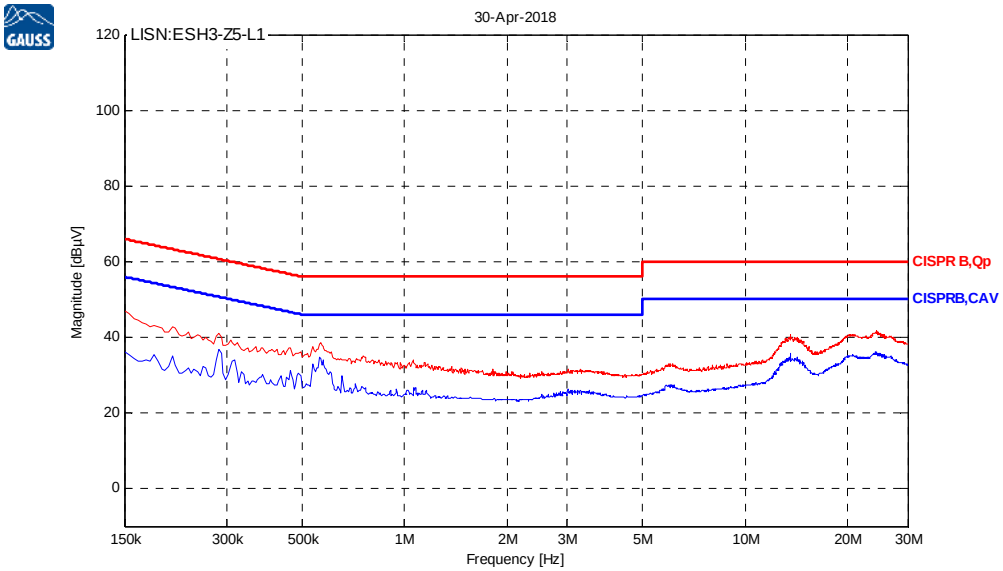
3.4.3.1 Profiles

Shown here is the natural plot (Antenna load fitted)



Receiver Model: TDEMI_v5.00_1510002
Protocol Number: 18J219_01_Load
Serial Number: EMC#2
Operation State: Active with dummy antenna load (50ohm)
Notes: Tested via Dell PC on 110v 60Hz

Shown here is the line plot (Antenna load fitted)



Receiver Model: TDEMI_v5.00_1510002
Protocol Number: 18J219_01_Load
Serial Number: EMC#2
Operation State: Active with dummy antenna load (50ohm)
Notes: Tested via Dell PC on 110v 60Hz

3.5 Radiated Emissions

Initial Scan

Radiated profile scans were taken at a three metre distance on eight azimuths in both the vertical and horizontal polarities of the antennae in a semi-anechoic chamber. The resulting data obtained from these scans was used to determine subsequent measurement for final measurement evaluation.

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	2	HP	8447D	1937A02341	Pre-amplifier (30-1000MHz)	06/10/2019
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	29/11/2018
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	24/08/2018
466	3	Schwarzbeck	BBHA 9120 571	571	1-10GHz Horn	24/02/2019
250	1	HP	8449B	3008A01077	Pre-amplifier (1.0-26.5GHz)	31/08/2018
047	3	Rohde & Schwarz	HFH2-Z2	879021/22	Loop antenna (9kHz-30MHz)	01/06/2019
456	1	Rohde & Schwarz	ESCI7	1.145E+09	EMI Test Receiver	30/05/2018

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.
'Internal' means internally calibrated using HEMCS procedures

Final Measurements

The EUT was then measured at a distance of three metres in the chamber using the pre-scan results as a guide. Emissions from the EUT were 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. Cable and system component positions had been investigated for maximum emissions, and the system under test represented the worst-case configuration. The values reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 and 15.225 Limits' and RSS-210 Issue 9, RSS Gen 8.9 Issue 5 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 as per FCC 15.31.

Additionally extrapolation measurements have been made (in accordance with ANSI 63.10 section 6.4.4.4) using an open area test site (OATS) to assess the carrier power relative to the limit at 300m.

Test instrumentation used in the OAT's measurements was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Ext Calibration
047	3	Rohde & Schwarz	HFH2-Z2	879021/22	Loop antenna (9kHz-30MHz)	01/06/2019
456	1	Rohde & Schwarz	ESCI7	1.145E+09	EMI Test Receiver	30/05/2018

3.5.1 Carrier Power Extrapolation Measurements:

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

The extrapolation factor is calculated as follows.

Extraoplotion factor X = E1-E2 $x = 20\frac{\log\left(\frac{E_1}{E_2}\right)}{\log\left(\frac{D_1}{D_2}\right)}$

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

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

⇨ E1 = 79.05 dBuv/m @ 3m => 8963.96uV/m
⇨ E2 = 54.25 dBuv/m @ 10m => 515.82uV/m

$$\Rightarrow X = 20\frac{\log\left(\frac{8963.96}{515.82}\right)}{\log\left(\frac{3}{10}\right)}$$

$$\Rightarrow X = -47.4297$$

D1 = 3 , D2 = 30 , E1 = 515.82uV/m , E2 = ? uV/m

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

$$\Rightarrow E2 = \frac{8963.96}{10\text{^}\left(\left(\frac{-47.4297}{20}\right).\log\left(\frac{3}{30}\right)\right)}$$

$$\Rightarrow E2 = 17.88\,uV/m$$

$$\Rightarrow E2 = 25.04788\,dBuV/m \text{ at } 30m$$

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

Uncertainty of measurement: ± 2.9 dBµV/m for a 95% confidence level.

3.5.2 Radiated Emissions 9kHz to 30MHz (H-Field)

Measurements were made using a quasi-peak detector with a 9kHz bandwidth below 30MHz

RESULTS - 9 kHz to 30 MHz

Frequency	Receiver amplitude	Antenna factor	Measured amplitude @ 3m	Specified limit @ 3m adjusted at 40dB / decade
MHz			dBµV/m	dBµV/m
0.009	45.93	24.9	70.83	128.52
0.065137	46.31	19.4	65.71	111.33
0.859212	35.11	19.2	54.31	68.92
23.9045	34.28	21.9	56.18	69.54

Uncertainty of measurement: ± 2.9 dBµV/m for a 95% confidence level.

3.5.3 RESULTS - 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
53.26	11.0	13.1	0.9	24.99	40.0	100
97.96	10.5	11.1	1.3	22.92	40.0	100
148.72	14.4	7.9	1.6	23.9	40.0	100
191.92	13.9	11.5	1.8	27.18	43.5	150
335.92	6.8	13.9	2.6	23.29	46.0	200
724.02	3.7	20.3	4.3	28.28	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

3.5.4 RESULTS - >1000 MHz

	AVERAGE @ 3m			PEAK @ 3m						
Frequency	Measured	Specified CLASS B Limit	Pass Margin	Measured	Specified CLASS B Limit	Pass Margin	Antenna polarity	Antenna height	Turntable azimuth	
GHz	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	H/V	m	deg	STATUS
No significant emissions were observed										

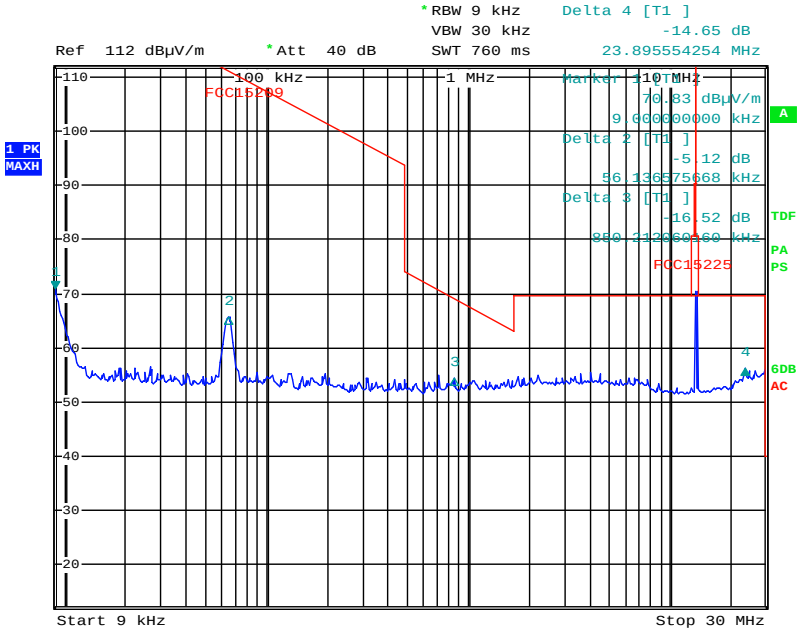
Uncertainty of measurement: ± 4.5dBµV/m for a 95% confidence level.

3.6 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 /15.225 and RSS-210 A2.6 Issue 9, RSS Gen 8.9 Issue 5 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.

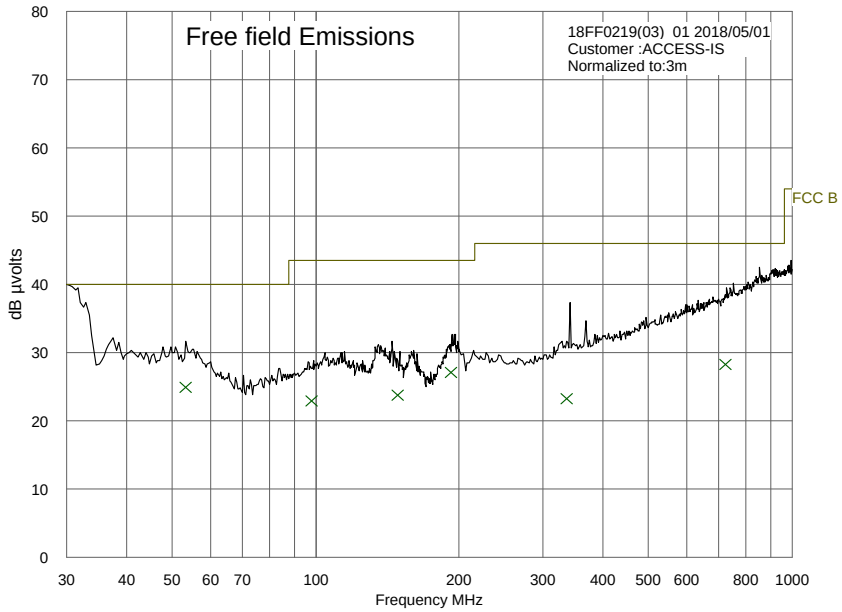
Measurements were made using a quasi-peak detector with a 9kHz bandwidth below 30MHz and a 120kHz bandwidth above 30MHz. Above 1GHz peak and Average detectors are used with a 1MHz measurement bandwidth.

3.6.1 9kHz to 30MHz

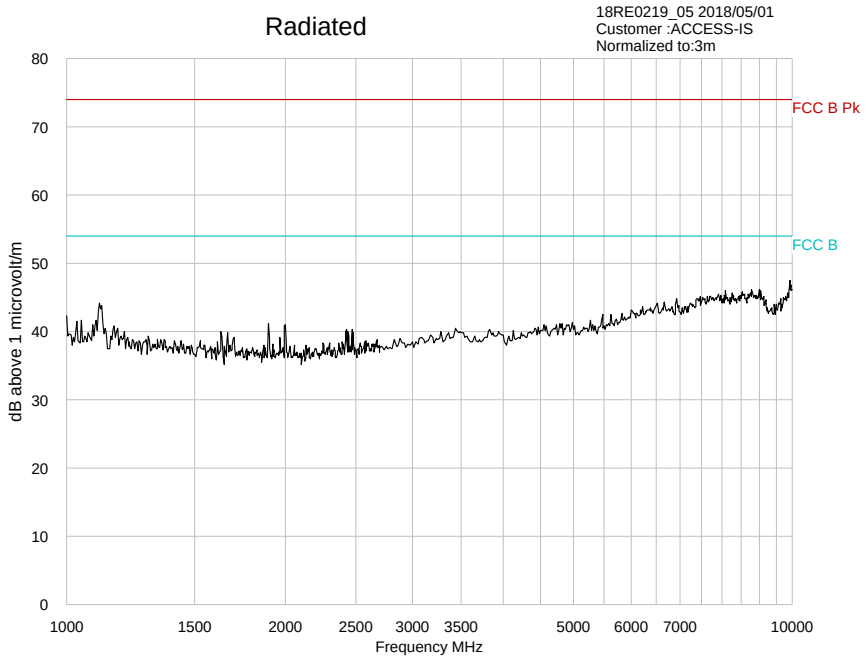


Date: 2.MAY.2018 09:56:19

3.6.2 30MHz to 1GHz



3.6.3 1GHz to 10GHz



3.7 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 Issue 9 to reflect the limit given at 30m.

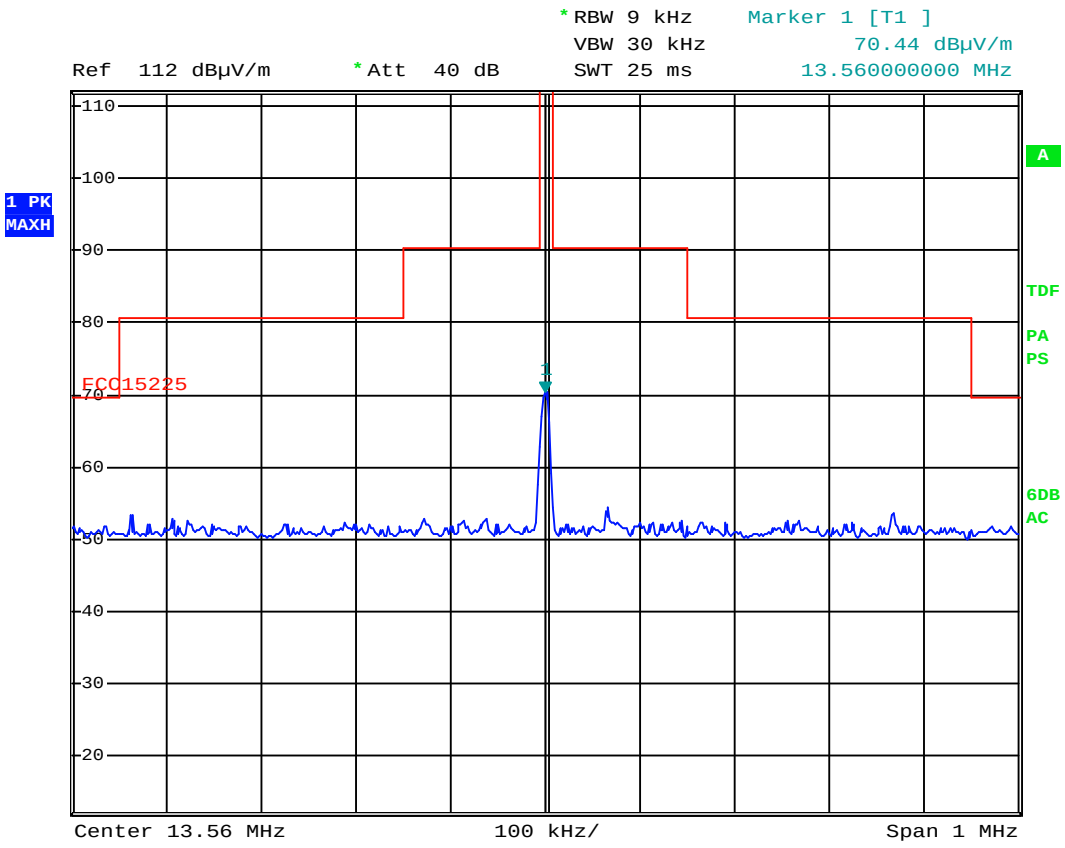
Test instrumentation used in the conducted test was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
456	1	Rohde & Schwarz	ESCI7	1.145E+09	EMI Test Receiver	30/05/2018
264	0	Climatic systems Ltd	0	0	Climate Chamber	Internal
175	1	ETI	uTherma2K	D01101007	Thermometer and probes	21/02/2020
-	0	EMCO	7405-901	1048	Near field loop antenna	N/A

The plot shows the band edge is compliant.

Uncertainty = 0.3dB with 95% confidence

3.7.1 Transmitter Mask Plot



Date: 2.MAY.2018 10:04:45

3.8 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 –30 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
5	Ambient	13.56009		-	-
4.25	Ambient	13.56009	3	+/-1356	Pass
5.75	Ambient	13.56008	-7	+/-1356	Pass
4.25	-30	13.56005	-34	+/-1356	Pass
5.75	-30	13.56007	-14	+/-1356	Pass
4.25	-20	13.56009	2	+/-1356	Pass
5.75	-20	13.56012	28	+/-1356	Pass
4.25	-10	13.56013	41	+/-1356	Pass
5.75	-10	13.56013	46	+/-1356	Pass
4.25	0	13.56013	43	+/-1356	Pass
5.75	0	13.56013	40	+/-1356	Pass
4.25	10	13.56013	38	+/-1356	Pass
5.75	10	13.56012	32	+/-1356	Pass
4.25	20	13.5601	7	+/-1356	Pass
5.75	20	13.56009	4	+/-1356	Pass
4.25	30	13.56008	-13	+/-1356	Pass
5.75	30	13.56007	-16	+/-1356	Pass
4.25	40	13.56006	-31	+/-1356	Pass
5.75	40	13.56006	-32	+/-1356	Pass
4.25	50	13.56006	-31	+/-1356	Pass
5.75	50	13.56006	-27	+/-1356	Pass
4.25	55	13.56008	-12	+/-1356	Pass
5.75	55	13.56008	-9	+/-1356	Pass

Uncertainty of measurement: ± 0.62% for a 95% confidence level.

TEST ENGINEER: Richard Pennell

3.9 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 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 Peak detector on max hold. The resolution bandwidth, span and video bandwidth are indicated on the occupied bandwidth plot (modulated) included with this report.

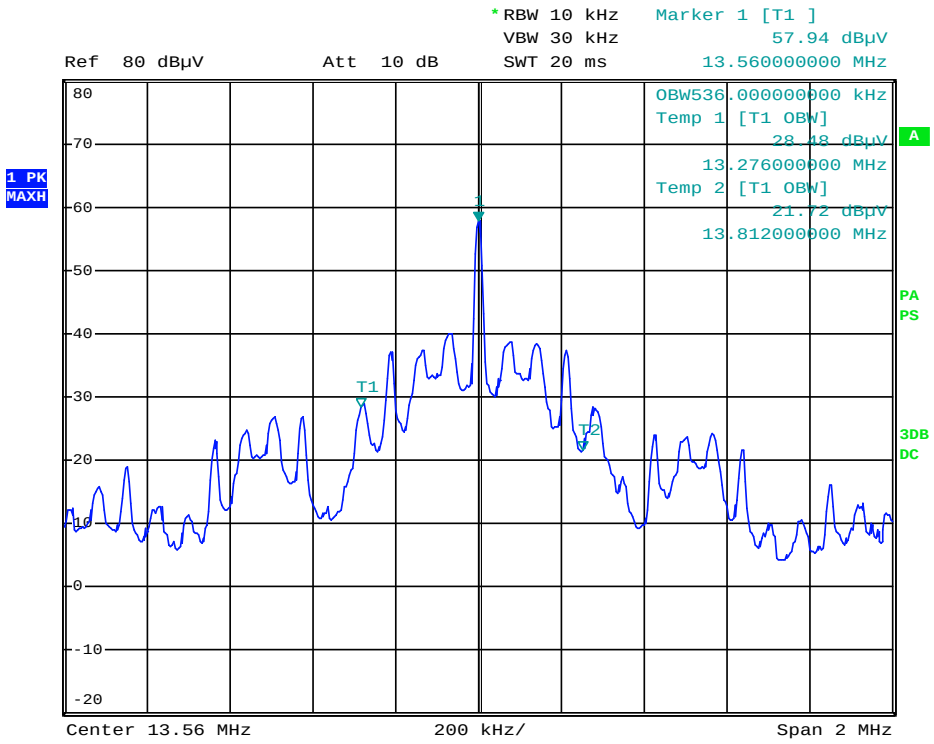
Span 2 to 5 times obw
Rbw 1 to 5% obw
Ref level 20dB above pk
Trace = pk detector / maxhold

The 99% bandwidth of the Transmitter was measured as 536kHz (modulated).

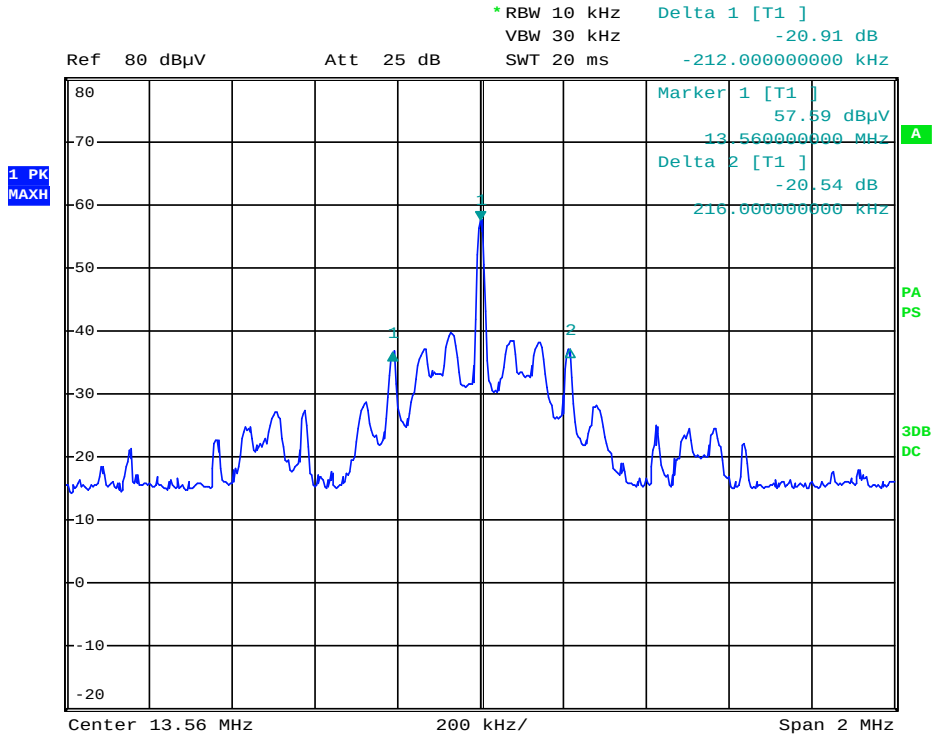
The 20dB bandwidth of the Transmitter was measured as 428kHz (modulated).

Uncertainty of measurement: ± 1.24% for a 95% confidence level.

3.9.1 99% Occupied Bandwidth Plot



3.9.2 -20dB Bandwidth Plot



Date: 30.APR.2018 11:20:11

TEST ENGINEER: Richard Pennell

4.0 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

5.0 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
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