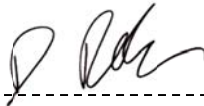

FCC Part 15C Test Report

for

Senceive Limited

FM3 Gateway

FCC ID: 2AMFBFM3G



Project Engineer: D. Tiroke



Approval Signatory

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

The above named are authorised Hursley EMC Services signatories.

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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 the selected sections of part 15C of the CFR 47:2017 FCC rules.

- CONDUCTED EMISSIONS - Power Line, from 0.15 MHz to 30.0 MHz
- RADIATED EMISSIONS - Airborne, from 30.0 MHz to 26.5 GHz

Note: The highest associated operating frequency on the system, as declared by the manufacturer, was 2475 MHz.

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

For emissions outside the 2400 – 2483.5 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

This report relates to the sample tested and may not represent the entire population. It is valid only for the product identified, either in part or in full, to the relevant electromagnetic requirements necessary for compliance.

Hursley EMC Services Limited is recognised by the Federal Communications Commissions (FCC) as an EMI laboratory, outside of the USA, for the measurement of conducted emissions and radiated emissions at three and ten metres.

1.2 Product Modifications

None to sample submitted.

1.3 EMC Test Lab Reference

Hursley EMC Services file: 17R321.

1.4 EUT Manufacturer

Trade name: Senceive Ltd
Company name: Senceive Ltd
Company address: Hurlingham Studios
Ranelagh Gardens
London
SW6 3PA
Manufacturing address: As above.
Company representative: Mr Charlie Blackham, Sulis Consultants Limited

2.0 EUT DESCRIPTION

2.1 Identity

Product (EUT):	Model: FM3 Gateway Serial number: 164880004
Product build level:	Production sample

2.2 EUT Description and exerciser program

The device operates inside the 2400 – 2483.5 MHz band with a single bandwidth and single modulation.

For the purposes of testing, the EUT was configured with test firmware that transmitted continuously with a 100% duty cycle.

The following test frequencies were used to cover the full band of operation of the device:

Test Channel	Centre Frequency (MHz)
Bottom, channel 11	2405.0
Middle, channel 18	2440.0
Top, channel 25	2475.0

The EUT was connected to an external mains-dc power supply, and to a laptop via USB cable.

2.3 EUT Support Equipment

Description	Manufacturer	Model Number	Serial number
DC power supply	XP power	AEL20US24C2	09511165 1448
Laptop	Dell	XPS 15 9550	5PMYRF2

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 Trafalgar House, Trafalgar Close, Chandlers Ford, Hampshire
Test Dates	18 th August to 6 th September 2017

3.2 General Operating Conditions

Testing was performed according to the procedures in accordance with ANSI C63.10 2013. 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

Temperature	20 to 26° Celsius
Relative Humidity	34 to 40%
Atmospheric Pressure	1007 to 1032 millibars

3.4 Conducted Emissions

Test Configuration

A filtered 115V/60Hz supply was fed to the EUT 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 30.0 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 C63.10-2013.

The worst-case results are presented in this report.

Test instrumentation used in the conducted test was as follows:

#ID	CP	Manufacturer	Type	Serial Nø	Description	Calibration due date
416	1	Rohde & Schwarz	ESH3Z2	1537	Pulse Limiter	23/05/2018
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.

3.5 Radiated Emissions

Method

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.

The data obtained from the profile scan was used as a guide for the final measurements

Final measurements

The EUT was then re-measured from 30MHz to 26.5 GHz using a receiver at three metres using the pre-scan results as a guide. 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. The worst-case data is presented in this report.

The instrumentation used in the CISPR 16-1-4 compliant semi-anechoic chamber was as below:

#ID	CP	Manufacturer	Type	Serial Nø	Description	Calibration due date
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	11/10/2017
050	1	HP	8447D	1937A02341	Pre-amplifier (30-1000MHz)	14/09/2017
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
256	0	HEMCS	PA XVIII	001	Pre-amp, 1-18GHz 55dB	Internal
357	1	Microtronics	BRM50702-01	25	Notch Filter	Internal
399	3	Q-par Angus	WBH18-40k	10300	18 to 40GHz Horn	23/01/2019
456	1	Rohde & Schwarz	ESCI7	1144573407	EMI Test Receiver	30/05/2018
466	3	Schwarzbeck	BBHA 9120 571	571	1-10GHz Horn	24/02/2019
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.
'Internal' means internally calibrated using HEMCS procedures

4.0 TEST DATA

The EUT was tested for radiated and conducted disturbance measurements. The worst-case results are reported within this document.

4.1 Power Line Conducted Emissions; 0.15 to 30.0 MHz

A search was made of the frequency spectrum between 0.15 MHz to 30.0 MHz and the measurements reported here are the highest emissions relative to the CISPR 22 Class B limits. Measurements were made using both Quasi peak and average detectors.

4.1.1 Data

MAINS – NEUTRAL

Frequency	Quasi-peak value (dB μ V)		Frequency	Average value (dB μ V)		Status
	Measured	Limit		Measured	Limit	
181.198 kHz	46.19	64.43	183.582 kHz	36.99	54.32	Pass
15.070 MHz	39.46	60.00	15.051 MHz	25.25	50.00	Pass
15.080 MHz	39.57	60.00	15.080 MHz	25.27	50.00	Pass
20.401 MHz	28.37	60.00	20.397 MHz	17.61	50.00	Pass
21.460 MHz	26.42	60.00	27.001 MHz	17.25	50.00	Pass
29.981 MHz	27.56	60.00	27.964 MHz	17.92	50.00	Pass

MAINS – LIVE

Frequency	Quasi-peak value (dB μ V)		Frequency	Average value (dB μ V)		Status
	Measured	Limit		Measured	Limit	
207.424 kHz	36.45	63.31	183.582 kHz	35.40	54.32	Pass
15.061 MHz	39.72	60.00	15.051 MHz	25.39	50.00	Pass
15.080 MHz	39.79	60.00	15.080 MHz	25.50	50.00	Pass
20.378 MHz	28.28	60.00	20.406 MHz	17.53	50.00	Pass
21.465 MHz	26.31	60.00	21.465 MHz	16.73	50.00	Pass
29.991 MHz	27.55	60.00	27.955 MHz	17.87	50.00	Pass

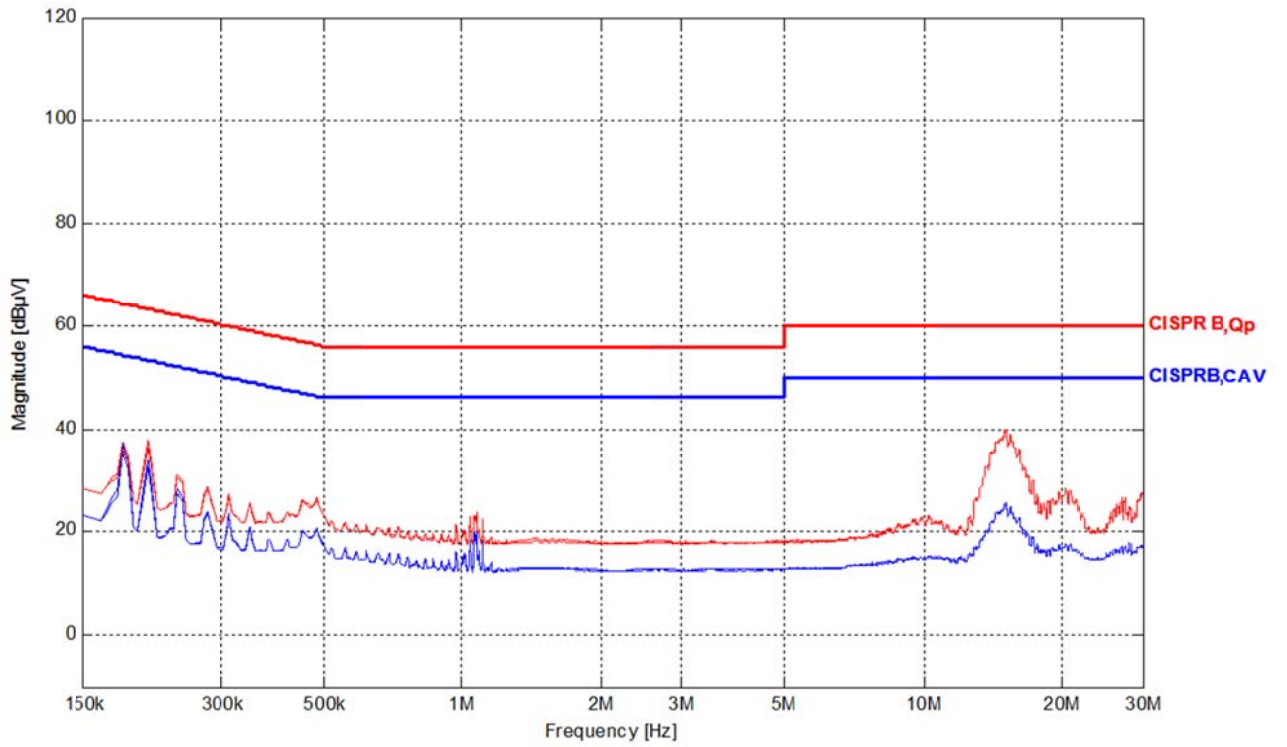
Uncertainty of measurement: ± 3.22 dB μ V for a 95% confidence level.

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

TEST ENGINEER: Andy Jones

4.1.2 Profile; Power Line Conducted Emissions; 0.15 to 30.0 MHz

0.15 MHz to 30.0 MHz, line and Neutral



4.2 Radiated Emissions

The EUT was connected to an external mains-dc power supply and to a laptop via USB cable.

A peak detector max-hold search was made of the frequency spectrum from 30 MHz to 26.5 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 at the top, bottom and middle transmitter operating frequencies.

Final measurements were taken for emissions in restricted bands. 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.

The measurements were made according to ANSI C63-10 test standard and Hursley EMC Services test procedure RAD-01.

4.2.1 Results 30 MHz to 1000 MHz

The measurements were taken at a distance of three metres and normalised to ten metres.

Emission frequency (MHz)	Antenna polarity	Measured quasi-peak value (dB μ V/m)	Specified quasi-peak limit (dB μ V/m)	Status
30.189	Vertical	15.04	29.54	Pass
68.600	Vertical	13.06	29.54	Pass
85.800	Vertical	12.26	29.54	Pass
140.400	Horizontal	14.42	33.04	Pass
216.000	Horizontal	20.12	35.54	Pass
456.060	Vertical	21.05	35.54	Pass

TEST ENGINEER: Daniel Tiroke

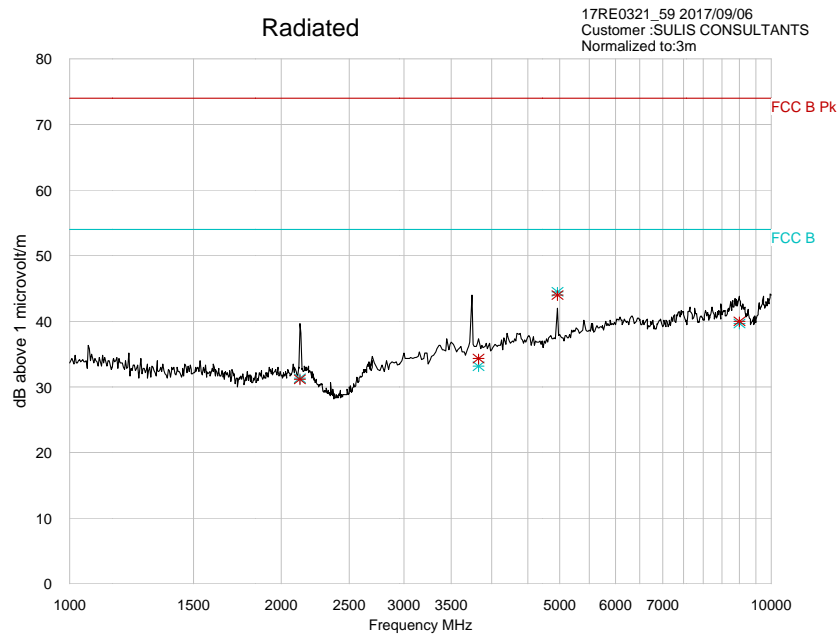
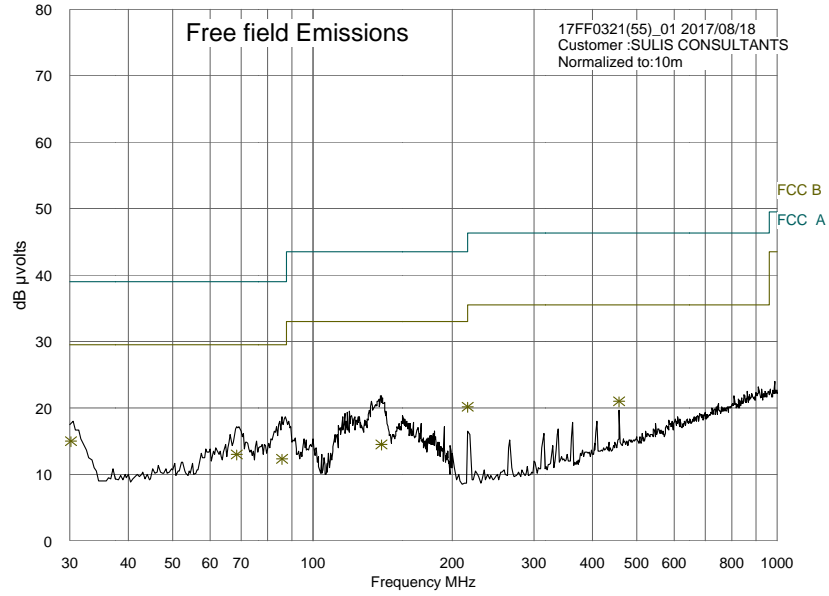
4.2.3 Results; 1.0 to 26.5 GHz

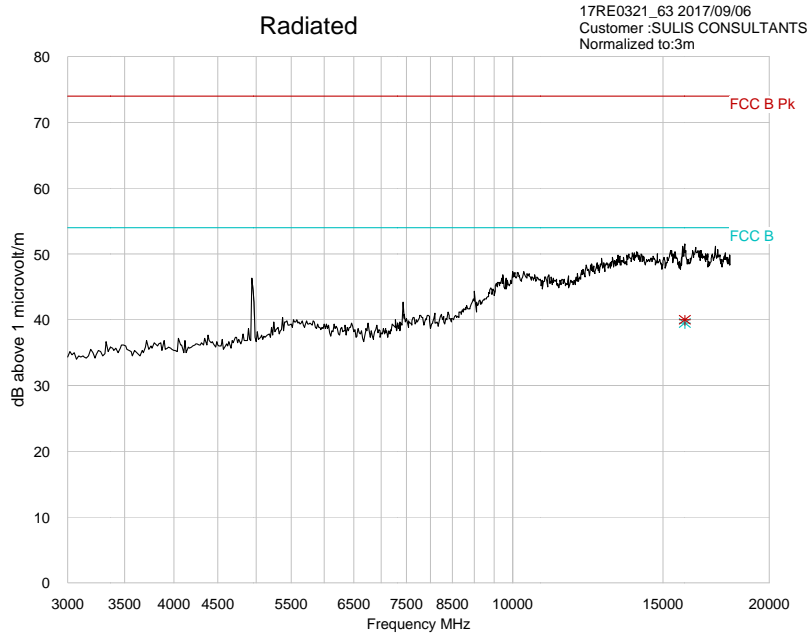
The measurements were taken at a distance of three metres.

Channel	Frequency (MHz)	Detector	Level (dBm)	Maximum emission relative to peak limit (dB)	Maximum emission relative to average limit (dB)	Result
11	1063.75	Peak	35.58	.38.42	-18.42	Pass
25	2483.5	Average	47.95	N/A	-6.05	Pass
25	4951.3	Peak	44.23	-29.77	N/A	Pass
		Average	43.95	N/A	-10.05	Pass
25	9000.9	Peak	40.04	-33.96	N/A	Pass
		Average	39.67	N/A	-14.33	Pass
25	15897.2	Peak	40.00	-34.00	N/A	Pass
		Average	39.54	N/A	-14.46	Pass

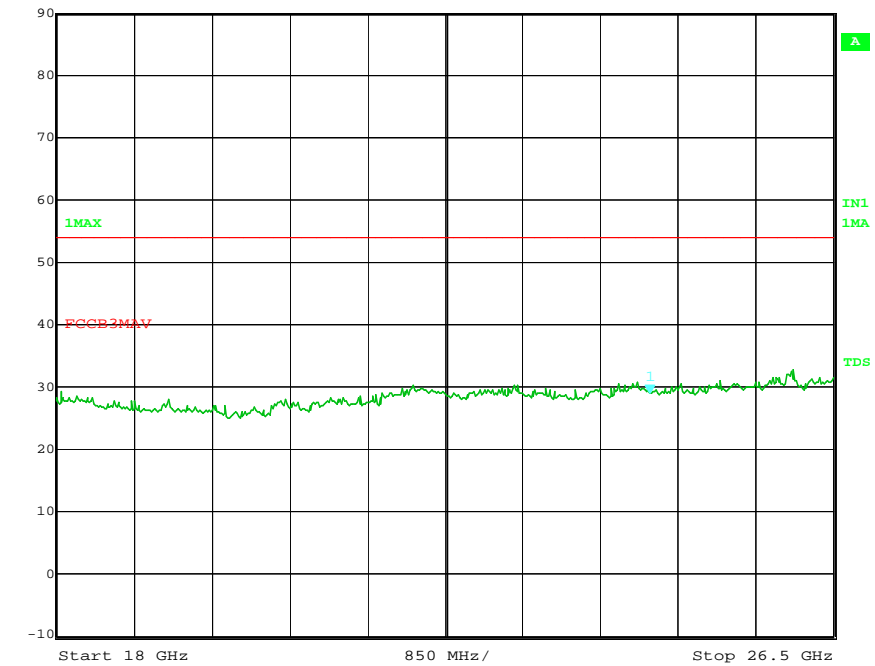
Worst case emissions in restricted bands

4.2.4 Profiles





	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
Ref Lvl	29.00 dBµV/m	VBW	10 MHz		
90 dB*	24.49763262 GHz	SWT	205 ms	Unit	dBµV/m



Date: 6.SEP.2017 22:06:21

5.0 FCC SITE COMPLIANCE STATEMENT

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

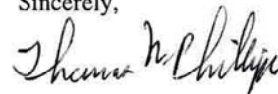
Dear Sir or Madam:

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

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