



Global Product Certification
EMC-EMF Safety Approvals

Melbourne
176 Harrick Road
Keilor Park, Vic 3042
Tel: +61 3 9365 1000

Sydney
Unit 3/87 Station Road
Seven Hills, NSW 2147
Tel: +61 2 9624 2777

Email: emc-general@emctech.com.au
Web: www.emctech.com.au

47 CFR PART 2.1091

RADIOFREQUENCY RADIATION EXPOSURE EVALUATION: MOBILE DEVICES

REPORT NUMBER: M2105018-5

STANDARD: 47 CFR § 2.1091

**CLIENT: FLEET SPACE
TECHNOLOGIES**

DEVICE: FLEET PORTAL

**MODEL: FSPOR0201-2 &
FSPOR0201-3**

DATE OF ISSUE: 27 JULY 2021

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REVISION TABLE

Version	Sec/Para Changed	Change Made	Date
1		Initial issue of document	27/07/2021



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RADIOFREQUENCY RADIATION EXPOSURE EVALUATION REPORT - MPE

Device: Fleet Portal

Model Number: FSPOR0201-2 & FSPOR0201-3

FCC ID: 2AZ55-FSPOR0201

Manufacturer: Fleet Space Technologies



Inspected for: Fleet Space Technologies
Address: 8A, Myer Court, Beverly, SA, 5009
Phone Number: +61 418823218
Contact: Flavia Tata Nardini
Email: flavia@fleetspace.com


Standards: **447498 D01 General RF Exposure Guidance v06**
RF exposure procedures and equipment authorization policies for mobile and portable devices.
47 CFR § 2.1091
Radiofrequency radiation exposure evaluation: mobile devices (Transmitter is more than 20 cm from human body).

Result: Based on an assessment of the documentation provided the Fleet Portal, models FSPOR0201-2 & FSPOR0201-3 comply with the RF exposure requirements of 47 CFR Part 2.1091, however an exclusion zone of 20 cm in front of the radiating elements applies, elsewhere the exposure level was below the applicable limits.. Refer to Report M2105018-5 for full details

Assessment Date: 1 July 2021

Issue Date: 27 July 2021

Assessment Engineer:  Deborah Olaley Graduate/Trainee Test Engineer – EMR  Shaun Reid Trainee Test Engineer - EMR

Authorised Signatory:  Emad Mansour
EMR and Sites Manager
EMC Technologies Pty Ltd

Issued by: EMC Technologies Pty. Ltd.,
176 Harrick Road, Keilor Park, VIC, 3042, Australia.

Phone: +61 3 9365 1000

E-mail: emc-general@emctech.com.au

Web: www.emctech.com.au



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1 INTRODUCTION

This report is intended to demonstrate compliance of the Fleet Portal models FSPOR0201-2 & FSPOR0201-3 with the RF exposure requirements of 47 CFR Part 2.1091. Evaluation was performed in accordance with FCC KDB 447498 D01.

The test sample was provided by the Client. The conclusion herein is based on the information provided by the client.

1.1 Laboratory Overview

EMC Technologies Pty. Ltd. is an independently owned Australian company that is NATA accredited to ISO 17025 for both testing and calibration and ISO 17020 for Inspection. – **Accreditation Number 5292.**

1.2 Test Laboratory/Accreditations

Inspection was performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia.

Table 1-1: *Accreditations for Conformity Assessment*

Country/Region	Body	
Australia/New Zealand	NATA	Accreditation Number: 5292
Europe	European Union	Notified Body Number: 0819
USA	FCC	Designation Number: AU0001 (Melb) Designation Number: AU0002 (Syd)
Canada	ISED Canada	Company Number: 3569B(Melb) Company Number: 4207A (Syd)
Japan	VCCI	Company Number: 785
Taiwan	BSMI	Lab Code SL2-IN-E-5001R

2 DEVICE DETAILS

(Information supplied by the Client)

Network system that performs the collection and storage of data from the LoRa IoT deployment, as well as forwarding of this data to the satellite constellation.

The FSPOR0201-2 uses the Quectel EC21-AUX 3G and 4G cellular modem and the FSPOR0201-3 uses the Quectel BG96 Cat M1/NB-IoT cellular modem.

Manufacturer: Fleet Space Technologies
Inspected Sample: Fleet Portal
Model Number: FSPOR0201-2 & FSPOR0201-3

Transmit parameters were provided by the customer and are shown below:

Table 2-1: Transmitter 1 Parameters

Transmitter #1	
Wireless Interface:	Ublox LILY-W1
Operating Frequency:	2.4GHz
EIRP:	19 dBm
Antenna Type:	Multi Band Antenna

Table 2-2: Transmitter 2 Parameters

Transmitter #2	
Wireless Interface:	SemTech SX1250
Operating Frequency:	902MHz to 928MHz
Max. RF Output Power Level:	22 dBm
Antenna Type:	Omnidirectional Antenna
Max Antenna gain:	6 dBi

Table 2-3: Transmitter 3 Parameters

Transmitter #3	
Wireless Interface:	Quectel EC21-AUX
Operating Frequency:	LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B28; LTE-TDD: B40 WCDMA: B1/B2/B4/B5/B8 GSM: B2/B3/B5/B8
RF Output Power level:	4G: +23 dBm ±2 3G: +24 dBm +1/-3
Antenna Type:	Blackhawk BH-MM-101
Max Antenna gain:	2 dBi

Table 2-4: Transmitter 4 Parameters

Transmitter #4	
Wireless Interface:	Quectel BG96
Operating Frequency:	Cat M1/Cat NB1 LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B28; LTE-TDD: B39 EGPRS: 850/900/1800/1900 MHz
RF Output Power level:	4G: +23 dBm ±2 GSM850/EGSM900: 33 dBm ±2 DCS1800/PCS1900: 30 dBm ±2
Antenna Type:	Blackhawk BH-MM-101
Max Antenna gain:	2 dBi

3 LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE), §1.1310

Table 6: Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	* 100	6
3.0-30	1842/f	4.89/f	* 900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* 100	30
1.34-30	824/f	2.19/f	* 180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

4 UNCERTAINTY

EMC Technologies has evaluated the tools and methods used to perform Radiated Electromagnetic Field predictions.

The estimated inspection uncertainties for the test shown within this report are as follows:

Electromagnetic Modelling

30 MHz to 100GHz ±2.8 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

5 ASSUMPTIONS IN THIS ASSESSMENT

This assessment does not include accumulated RF fields from nearby sites/antennas or possible radio signal reflections or attenuation due to buildings or the general environment.

Antenna Parameters and power settings were supplied by the customer.

A 100% duty cycle is assumed.

The aperture of the radiating element assumed to be a point source in free space and far field conditions.

6 RF EXPOSURE CALCULATIONS

The reference level was evaluated at 20 cm to show compliance with the power density listed in Table 4 (Section3)

The following formula was used to calculate the power density at 20 cm:

$$S = \frac{P * G}{4\pi R^2}$$

$$S = \frac{EIRP}{4\pi R^2}$$

Where:

- (S): Power density (mW/cm^2)
- (P): Output power at antenna terminal (mW)
- (G): Gain (ratio)
- (R): Minimum test separation distance (20 cm)

Table 6-1: Calculations

Technology	Frequency Band (MHz)	Power	Gain	Duty Cycle	EIRP	EIRP	Flux Density at 20 cm	Flux Density limit	Percentage of the limit
		<i>dBm</i>	<i>dBi</i>	%	<i>dBm</i>	<i>mW</i>	<i>mW/cm²</i>	<i>mW/cm²</i>	%
Proprietary	902	22	6	100%	28.0	631.0	0.1	0.6	20.9%
WLAN	2412	16	3	100%	19.0	79.4	0.0	1	1.6%
4G	700	25	2	100%	27.0	501.2	0.1	0.5	21.4%
	850	25	2	100%	27.0	501.2	0.1	0.6	17.7%
	1700	25	2	100%	27.0	501.2	0.1	1	10.0%
	1900	25	2	100%	27.0	501.2	0.1	1	10.0%
3G	850	25	2	100%	27.0	501.2	0.1	0.6	17.7%
	1700	25	2	100%	27.0	501.2	0.1	1	10.0%
	1900	25	2	100%	27.0	501.2	0.1	1	10.0%
GSM	850	35	2	25%	37.0	1253.0	0.2	0.6	44.1%
	1900	32	2	25%	34.0	628.0	0.1	1	12.5%
Total percentage of the limit at 20 cm for simultaneous transmission (Worst-case)									66.6%

7 CO-LOCATION CONSIDERATION:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0 .

$$\sum_1^N \frac{S_{eqN}}{S_{limN}} = \frac{S_{eq1}}{S_{lim1}} + \frac{S_{eq2}}{S_{lim2}} + \dots + \frac{S_{eqN}}{S_{limN}} \leq 1$$

Where: S_{eq} = Power Spectral density (mw/cm^2) of a specific transmitter
 S_{lim} = MPE limit (mw/cm^2)

The following simultaneous transmissions are possible:

Transmitter 1	Transmitter 2	Transmitter 3	MPE Ratio Sum	Result
Proprietary	WLAN	Cellular	0.67	Pass

8 CONCLUSION

Based on an assessment of the documentation provided the Fleet Portal, models FSPOR0201-2 & FSPOR0201-3 comply with the 47 CFR Part 2.1091. An exclusion zone of 20 cm in front of the radiating elements applies, elsewhere the exposure level was below the applicable limits.

APPENDIX A

Referenced Documents

Document	Comments
Form 005 Customer and EUT Information2	Product and transmitter information
Blackhawk-M2M-Antennas	Antenna details
Quectel_EC21_LTE_Specification_V1.8	EC21 transmit power information
Quectel_BG96_LPWA_Specification_V1.8	BG96 transmit power information
BG96 Hardware Design	BG96 transmit power information



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