RE051-20-104233-7-A Ed. 0

MPE test report

According to the standard:

CFR 47 FCC PART 15

Equipment under test:

S-lynks gateway

FCC ID: KQ9-0A01A

Company:

SERCEL Inc

Distribution: Mr TIJOU **(Company:** SERCEL NANTES**)**

Number of pages: 11

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	16-Jan-24	Creation	S. LOUIS, Radio Technician	

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DESIGNATION OF PRODUCT:	**S-lynks gateway**
Serial number (S/N):	EDE565C20271E0004 EDE565C20271E0007
Reference / model (P/N):	S-lynks gateway
Software version:	SLBB_F V4 S38/20
MANUFACTURER:	SERCEL Inc

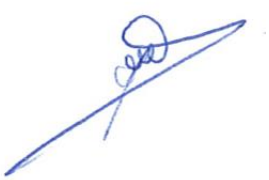
COMPANY CERTIFYING THE PRODUCT:

Company:	SERCEL Inc
Address:	17200 Park Row TEXAS 77084 UNITED STATES
Responsible:	Mr WENTZLER

COMPANY SUBMITTING THE PRODUCT:

Company:	SERCEL NANTES
Address:	16 RUE DU BEL AIR BP 30439 44470 CARQUEFOU - FRANCE
Responsible:	Mr TIJOU
***Person(s) present during the tests*:**	Mr DESSARCE, the first two days (company: SERCEL) Mr PORCHEL, the first day (company: MODULIC)
DATES OF TEST:	From 30-Nov-20 to 7-Dec-20
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677
TESTED BY:	M. DUMESNIL
WRITTEN BY:	M. DUMESNIL

VISA:



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1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **S-lynks gateway**, in accordance with normative reference.

The product integrates the followings radio functions:

- GNSS receiver
- LoRa transceiver
- Wi-Fi 2.4GHz transceiver
- 2G and LTE-M module already certified (FCC ID : N7NWP77B)

Wi-Fi and 2G/LTE or Wi-Fi and LoRa radio can emit in the same time.

The host device of certified module(s) shall be properly labeled to identify the module(s) within.

2. PRODUCT DESCRIPTION

Class:	A
Utilization:	Industrial
Power source:	Internal battery 7.2Vdc or 12Vdc external power source.

GNSS receiver part:

Antenna type and gain:	Internal PCB antenna : Unknow gain External antenna (TW3322) : Gain => +26dB typ
Operating frequency range:	From 1559 MHz to 1610 MHz
Modulation:	GPS and GLONASS

LoRa radio part:

Antenna type and gain:	Internal PCB antenna : Gain at 903MHz => -1.32dBi Gain at 915MHz => -2.02dBi Gain at 927MHz => -0.42dBi External dipole antenna (ANT-8WHIP3H-SMA) : Gain => +3dBi
Operating frequency range:	From 902 MHz to 928 MHz
Frequencies tested:	903MHz, 915MHz, 927MHz
Number of channels:	41
Channel spacing:	600 kHz
Modulation:	LoRa 500kHz / SF12
Power level adjusted to	+18 dBm by software

WiFi radio part:

Antenna type and gain: The product possesses one external antenna (BKR2400) and two internal antennas.
The product can emit on the external antenna (SISO) or on the internal antennas as follow:

- For mode b and g the product emit on chains one (SISO), however the mode n the product can emit on the chain one (SISO) or chain one and two (MIMO).

Internal PCB antennas : Antenna 1 Gain at 2412MHz => +4.70dBi
Antenna 1 Gain at 2437MHz => +3.75dBi
Antenna 1 Gain at 2462MHz => +3.48dBi
Antenna 2 Gain at 2412MHz => +3.18dBi
Antenna 2 Gain at 2437MHz => +3.17dBi
Antenna 2 Gain at 2462MHz => +2.05dBi
External dipole antenna (BKR2400) with SMA connector: Gain => +2dBi

Operating frequency range:	From 2400 MHz to 2483.5 MHz
Number of channels:	11
Channel spacing:	5MHz
Channel bandwidth:	20 MHz
Modulation:	DBPSK OFDM: BPSK OFDM: 64-QAM
Channel tested:	Channel 1: 2412 MHz Channel 6: 2437 MHz Channel 11: 2462 MHz

Mode tested:	802.11 b SISO 802.11 g SISO 802.11 n SISO and MIMO (MIMO with internals antennas only)
Data rate:	For 802.11b: 1Mbit/s For 802.11g: 6Mbit/s For 802.11n: MCS0
Correlated signal:	For mode n the signals are considered as correlated, the mode cyclic delay diversity (CDD) is used. (IEEE 802.11) The product is not using spatial multiplexing or intentional beamforming.
Power level adjusted to	+16 dBm by software

2G radio part

The equipment possesses two different antennas:

- Internal antenna: Band 2 (PCS1900): +2.32 dBi (declared)
  Band 5 (GSM850): -0.13 dBi (declared)

- External antenna (ANT-MOD6-N): gain +4.5dBi in band 680-960MHz and +6dBi in band 1710-2700MHz deported with antenna cable of several meters.

Radio technology: GPRS

Frequency band used: 850, 1900

LTE-M radio part

The equipment possesses two different antennas:

- Internal antenna: Band 2: +2.32 dBi (declared)
  Band 4: +0.22 dBi (declared)
  Band 5: -0.13 dBi (declared)
  Band 12: +0.48 dBi (declared)
  Band 13: -0.07 dBi (declared)
  Band 26: +1.04 dBi (declared)

- External antenna (ANT-MOD6-N): gain +4.5dBi in band 680-960MHz and +6dBi in band 1710-2700MHz deported with antenna cable of several meters.

Radio technology: LTE

Frequency band used: B2, B4, B5, B12, B13, B26

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 (2020)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for ComplianceTesting of Unlicensed Wireless Devices.
447498 D01 General RF Exposure Guidance v06	RF Exposure procedures and equipment authorization policies for mobile and portable equipment
OET BULLETIN 65	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

4. RF EXPOSURE

LoRa radio part in standalone:

MPE
According Emitech test report n° RR051-20-104233-14-A Ed. 0:

Maximum measured power = 19.82 dBm e.i.r.p. = 0.09594 W at 915 MHz
With declared maximum antenna gain: 3 dBi

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

PSD= $EIRP/(4*\pi*R^{2})$

⇨ $95.94/(4*\pi*(20\ cm)^{2})=$ ***19.09 x 10^{-3} mW/cm² (limit = 0.61 mW/cm²) (for f / 1500 MHz)***

MPE RATIO = 0.031

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

WiFi radio part in standalone:

MPE
According Emitech test report n° RR051-20-104233-15-A Ed. 0:

Maximum measured power = 26.29 dBm e.i.r.p. = 0.42531 W at 2412 MHz (802.11.n – MIMO)
Declared maximum antenna gain: Transmit chain 1 at 2412MHz => +4.70dBi
Transmit chain 2 at 2412MHz => +3.18dBi

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

PSD= $EIRP/(4*\pi*R^{2})$

$425.31/(4*\pi*(20\ cm)^{2})=$ ***84.61 x 10^{-3} mW/cm² (limit = 1 mW/cm²) (for f > 1500 MHz)***

MPE RATIO = 0.085

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

2G radio part in standalone:

MPE

The results are extracted from WP7702-Module-FCC-MPE-Evaluation and calculated with the internal antenna used (most critical configuration).
The exemption limits for routine RF exposure evaluation are calculated using the lowest frequency of the operating band presenting the most stringent limits.

Operating Mode	TX Freq Range (MHz)		Max Time Avg Cond Power (dBm)	Max Time Avg Cond Power (W)	Max Ant Gain (dBi)	Duty Cycle	Source Based Time Averaged Max EIRP (dBm)	ERP / EIRP Limits	Power density at 20cm (mW/cm²)	Limit (mW/cm²)	MPE Ratio
G850-GMSK (2TS)	824	849	33	2.00	-0.13	25%	26.87	7W ERP	0.097	0.549	**0.176**
G850-GMSK (3TS)	824	849	30	1.00	-0.13	38%	25.67	7W ERP	0.073	0.549	0.134
G850-GMSK (4TS)	824	849	28	0.63	-0.13	50%	24.87	7W ERP	0.061	0.549	0.111
G850-8PSK (4TS)	824	849	27.5	0.56	-0.13	50%	24.37	7W ERP	0.054	0.549	0.099
G1900-GMSK (2TS)	1850	1910	30	1.00	2.32	25%	26.32	2W EIRP	0.085	1.000	0.085
G1900-GMSK (3TS)	1850	1910	28	0.63	2.32	38%	26.12	2W EIRP	0.081	1.000	0.081
G1900-GMSK (4TS)	1850	1910	27	0.50	2.32	50%	26.32	2W EIRP	0.085	1.000	0.085
G1900-8PSK (4TS)	1850	1910	26.5	0.50	2.32	50%	25.82	2W EIRP	0.076	1.000	0.076

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

LTE-M radio part in standalone:

MPE

The results are extracted from WP7702-Module-FCC-MPE-Evaluation and calculated with the internal antenna used (most critical configuration).

The exemption limits for routine RF exposure evaluation are calculated using the lowest frequency of the operating band presenting the most stringent limits.

Operating Mode	TX Freq Range (MHz)		Max Time Avg Cond Power (dBm)	Max Time Avg Cond Power (W)	Max Ant Gain (dBi)	Duty Cycle	Source Based Time Averaged Max EIRP (dBm)	ERP / EIRP Limits	Power density at 20cm (mW/cm^2)	Limit (mW/cm^2)	MPE Ratio
LTE Band 2	1850	1910	24	0.25	2.32	100%	26.32	2W EIRP	0.085	1.000	0.085
LTE Band 4	1710	1755	24	0.25	0.22	100%	24.22	1W EIRP	0.053	1.000	0.053
LTE Band 5	824	849	24	0.25	-0.13	100%	23.87	7W ERP	0.049	0.549	0.088
LTE Band 12	699	716	24	0.25	0.48	100%	24.48	3W ERP	0.056	0.466	**0.120**
LTE Band 13	777	787	24	0.25	-0.07	100%	23.93	3W ERP	0.049	0.518	0.095
LTE Band 26	814	849	24	0.25	1.04	100%	25.04	7W ERP	0.064	0.543	0.117

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

Calculus for simultaneous transmission WiFi + 2G:

Only the worst critical case for the WiFi function is taken into account for this analysis
Only the worst critical case for the 2G module is taken into account for this analysis

$\sum$ of MPE ratio = MPE ratio(WiFi) + MPE ratio(2G) = 0.085 + 0.176 = **0.261 ≤ 1.0**

The product met the requirement for Simultaneous transmission MPE test exclusion from §7.2 of KDB 447498

Calculus for simultaneous transmission WiFi + LTE-M:

Only the worst critical case for the WiFi function is taken into account for this analysis
Only the worst critical case for the LTE-M module is taken into account for this analysis

$\sum$ of MPE ratio = MPE ratio(WiFi) + MPE ratio(LTE-M) = 0.085 + 0.120 = **0.205 ≤ 1.0**

The product met the requirement for Simultaneous transmission MPE test exclusion from §7.2 of KDB 447498

Calculus for simultaneous transmission WiFi + LoRa

Only the worst critical case for the WiFi function is taken into account for this analysis
Only the worst critical case for the LoRa function is taken into account for this analysis

$\sum$ of MPE ratio = MPE ratio(WiFi) + MPE ratio(LoRa) = 0.085 + 0.031 = **0.116 ≤ 1.0**

The product meets the requirement for Simultaneous transmission MPE test exclusion from §7.2 of KDB 447498