



# EMC TEST REPORT

**Applicant** Spireon Inc  
**FCC ID** O9YFLF3M  
**Product** GPS tracker  
**Model** Flex2-M  
**Report No.** R2109A0847-E1  
**Issue Date** October 19, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC Code CFR47 Part15B (2020)/ ANSI C63.4 (2014)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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### Summary of measurement results

| Number  | Test Case          | Clause in FCC Rules             | Conclusion |
|---|--------------------|---------------------------------|------------|
| 1   | Radiated Emission  | FCC Part15.109, ANSI C63.4-2014 | PASS       |
| 2   | Conducted Emission | FCC Part15.107, ANSI C63.4-2014 | NA         |
| Date of Testing: October 3, 2021  |                    |                                 |            |
| Date of Sample Received: September 23, 2021   |                    |                                 |            |
| Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. |                    |                                 |            |

# 1 Test Laboratory

## 1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

## 1.2 Test facility

### **FCC (Designation number: CN1179, Test Firm Registration Number: 446626)**

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

### **A2LA (Certificate Number: 3857.01)**

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

## 1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.  
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City: Shanghai  
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## 2 General Description of Equipment under Test

### 2.1 Applicant and Manufacturer Information

|                             |  |
|-----------------------------|--|
| <b>Applicant</b>            | Spireon Inc  |
| <b>Applicant address</b>    | 9724 Kingston Pike, Suite 800 Knoxville  |
| <b>Manufacturer</b>         | Asiatelco Technologies Co  |
| <b>Manufacturer address</b> | #289 Bisheng Road, Building-8, 3F, Zhangjiang Hi-Tech Park, Pudong, Shanghai 201204, China |

### 2.2 General information

| EUT Description   |  |             |             |
|---|--|-------------|-------------|
| Device Type   | Fixed Device   |             |             |
| Model   | Flex2-M  |             |             |
| SN  | 864919057421931  |             |             |
| HW Version  | P3.0.0   |             |             |
| SW Version  | B1   |             |             |
| Power Rating  | DC 12V from battery  |             |             |
| Connecting I/O Port(s)  | Please refer to the User's Manual.                                   |             |             |
| Antenna Type  | Internal Antenna   |             |             |
| Frequency   | Band   | Tx (MHz)    | Rx (MHz)    |
|   | LTE Band 2   | 1850 ~ 1910 | 1930 ~ 1990 |
|   | LTE Band 4   | 1710 ~ 1755 | 2110 ~ 2155 |
|   | LTE Band 12  | 699 ~ 716   | 729 ~ 746   |
|   | LTE Band 13  | 777 ~ 787   | 746 ~ 756   |
|   | LTE Band 25  | 1850 ~ 1915 | 1930 ~ 1995 |
| EUT Accessory   |  |             |             |
| Battery   | Manufacturer: Expecell Group, Inc.<br>Model: LIP-2S2PLx18650LT-PTC25 |             |             |
| Note: The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant. |  |             |             |



## 2.3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

### Test standards

**FCC Code CFR47 Part15B (2020)**

**ANSI C63.4 (2014)**



## 2.4 Test Mode

| Test Mode |                          |
|-----------|--------------------------|
| Mode 1    | Battery + EUT + Receiver |

### 3 Test Case Results

#### 3.1 Radiated Emission

##### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 15°C~35°C   | 30%~60%           | 101.5kPa |

##### Methods of Measurement

The EUT is placed on a non-metallic table 0.8m above the horizontal metal reference ground plane. The distance between EUT and receive antenna should be 3 meters. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier. During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum of radiated signal level.

The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. During the test, the EUT is worked at maximum output power.

Set the spectrum analyzer in the following:

Below 1GHz:

RBW=100 kHz / VBW=300 kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK Detector: RBW=1MHz / VBW=3MHz / Sweep=AUTO

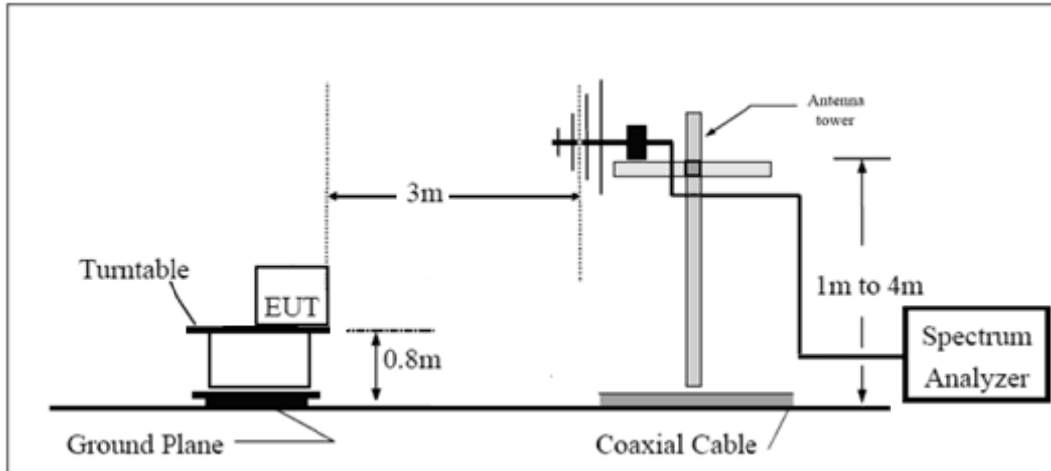
(b) AVERAGE Detector: RBW=1MHz / VBW=3MHz / Sweep=AUTO

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

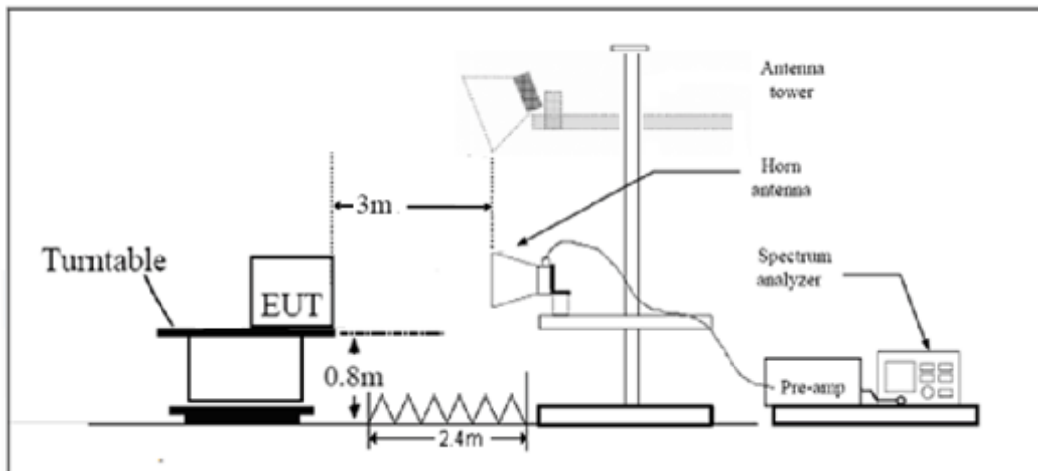


**Test Setup**

**Below 1GHz**



**Above 1GHz**



Note: Area side: 2.4mX3.6m

Antenna Tower meets ANSI C63.4 requirements for measurements above 1 GHz by keeping the antenna aimed at the EUT during the antenna's ascent/ descent along the antenna mast.

**Limits**

**Class B**

| Frequency (MHz)   | Field Strength (dB $\mu$ V/m) | Detector        |
|---|-------------------------------|-----------------|
| 30 -88  | 40.0                          | Quasi-peak      |
| 88-216  | 43.5                          | Quasi-peak      |
| 216 – 960   | 46.0                          | Quasi-peak      |
| 960-1000  | 54.0                          | Quasi-peak      |
| 1000-5 <sup>th</sup> harmonic of the highest frequency or 40GHz, which is lower | 54<br>74                      | Average<br>Peak |

**Measurement Uncertainty**

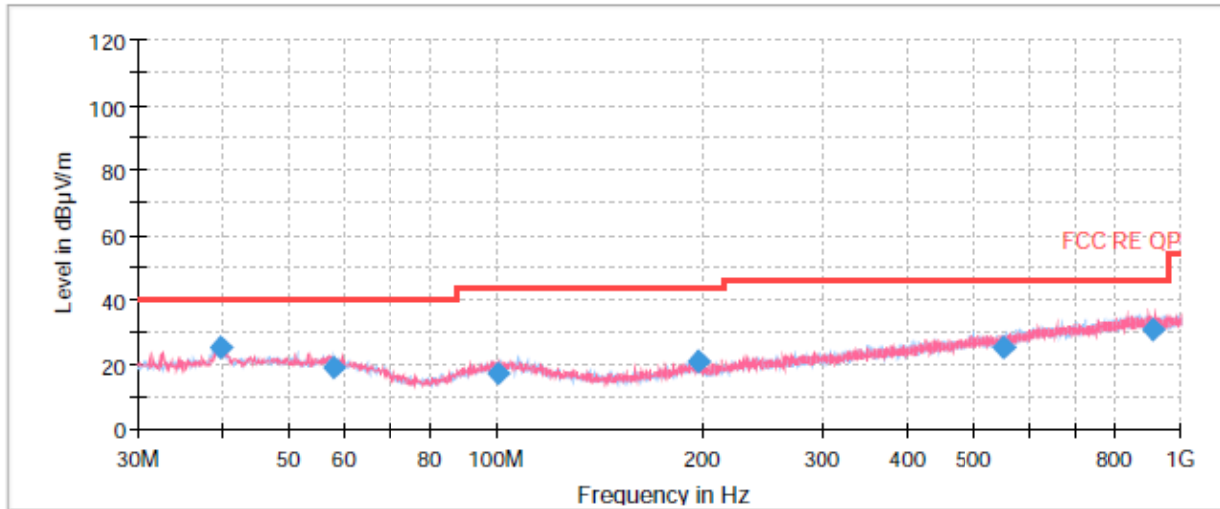
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .

| Frequency      | Uncertainty |
|----------------|-------------|
| 30MHz~200MHz   | 4.17 dB     |
| 200MHz~1000MHz | 4.84 dB     |
| 1GHz~18GHz     | 4.35 dB     |
| 18GHz~26.5GHz  | 5.90 dB     |
| 26.5GHz~40GHz  | 5.92 dB     |

**Test Results**

Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier, the Emissions in the frequency band 18GHz –40GHz is more than 20dB below the limit are not reported.

The following graphs display the maximum values of horizontal and vertical by software. For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

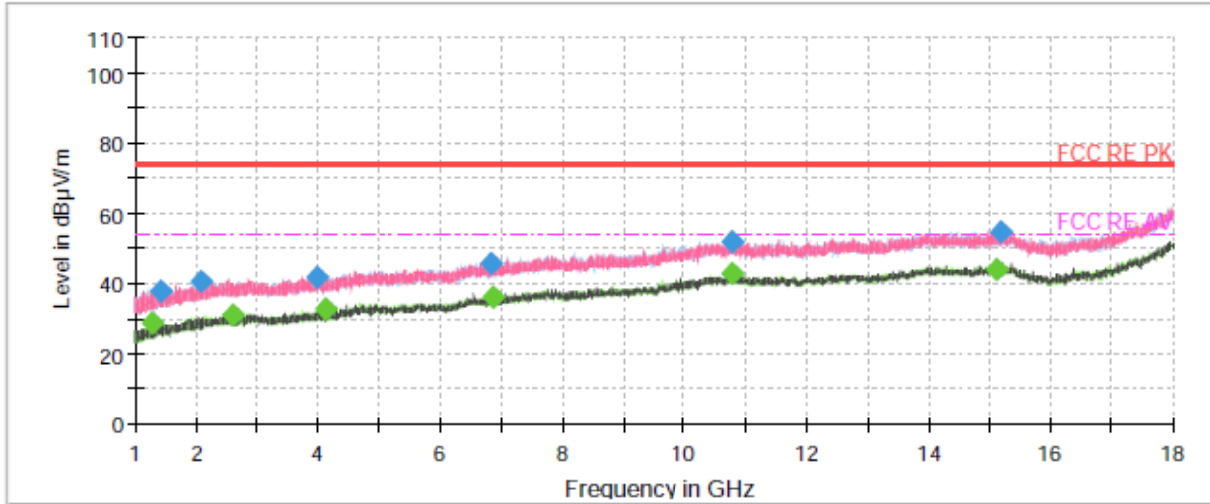


Radiated Emission from 30MHz to 1GHz

| Frequency (MHz) | Quasi-Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------------|-------------|--------------|---------------|---------------------|-------------|----------------|
| 39.661250       | 25.39               | 100.0       | H            | 290.0         | 14                  | 14.61       | 40.00          |
| 57.925000       | 19.07               | 117.0       | V            | 302.0         | 14                  | 20.93       | 40.00          |
| 101.138750      | 17.28               | 125.0       | H            | 216.0         | 13                  | 26.22       | 43.50          |
| 198.012500      | 21.02               | 100.0       | V            | 70.0          | 12                  | 22.48       | 43.50          |
| 553.317500      | 25.01               | 125.0       | H            | 13.0          | 20                  | 20.99       | 46.00          |
| 907.805000      | 30.88               | 105.0       | V            | 22.0          | 25                  | 15.12       | 46.00          |

Remark: 1. Correction Factor = Antenna factor + Insertion loss(cable loss+amplifier gain)

2. Margin = Limit – Quasi-Peak



Radiated Emission from 1GHz to 18GHz

| Frequency (MHz) | MaxPeak (dB µ V/m) | Average (dB µ V/m) | Limit (dB µ V/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|--------------------|--------------------|------------------|-------------|-------------|-----|---------------|--------------|
| 1273.133333     | ---                | 28.66              | 54.00            | 25.34       | 100.0       | H   | 25.0          | -18          |
| 1433.500000     | 37.77              | ---                | 74.00            | 36.23       | 200.0       | H   | 232.0         | -17          |
| 2088.566667     | 40.75              | ---                | 74.00            | 33.25       | 100.0       | V   | 205.0         | -15          |
| 2607.066667     | ---                | 31.05              | 54.00            | 22.95       | 100.0       | V   | 150.0         | -14          |
| 3986.900000     | 41.96              | ---                | 74.00            | 32.04       | 200.0       | H   | 218.0         | -11          |
| 4128.566667     | ---                | 32.45              | 54.00            | 21.55       | 200.0       | H   | 188.0         | -11          |
| 6841.200000     | 45.77              | ---                | 74.00            | 28.23       | 100.0       | V   | 7.0           | -4           |
| 6863.866667     | ---                | 36.08              | 54.00            | 17.92       | 100.0       | H   | 280.0         | -3           |
| 10785.200000    | 52.17              | ---                | 74.00            | 21.83       | 100.0       | V   | 290.0         | 0            |
| 10797.666667    | ---                | 42.71              | 54.00            | 11.29       | 100.0       | V   | 0.0           | 0            |
| 15116.800000    | ---                | 44.12              | 54.00            | 9.88        | 100.0       | H   | 0.0           | 5            |
| 15201.800000    | 54.61              | ---                | 74.00            | 19.39       | 200.0       | H   | 0.0           | 4            |

## 3.2 Conducted Emission

### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 15°C~35°C   | 30%~60%           | 101.5kPa |

### Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .  $U = 2.57$  dB.



## Test Results

The equipment doesn't connected to public network, therefore this requirement do not apply.

## 4 Main Test Instruments

| Name                    | Manufacturer | Type      | Serial Number | Calibration Date | Expiration Time |
|-------------------------|--------------|-----------|---------------|------------------|-----------------|
| Spectrum Analyzer       | R&S          | FSV40     | 15195-01-00   | 2021-05-15       | 2022-05-14      |
| EMI Test Receiver       | R&S          | ESC17     | 100936        | 2020-12-13       | 2021-12-13      |
| Trilog Antenna          | SCHWARZBECK  | VULB 9163 | 391           | 2019-12-16       | 2022-12-15      |
| Horn Antenna            | R&S          | HF907     | 102723        | 2020-08-11       | 2023-08-10      |
| Horn Antenna            | ETS-Lindgren | 3160-09   | 00102643      | 2018-06-20       | 2023-06-19      |
| Bore Sight Antenna mast | ETS          | 2171B     | 00058752      | /                | /               |
| Test software           | EMC32        | R&S       | 9.26.0        | /                | /               |

\*\*\*\*\*END OF REPORT \*\*\*\*\*



## ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.





## **ANNEX B: Test Setup Photos**

The Test Setup Photos are submitted separately.