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# Assessment Report

REP010975-4ARFWL

Type of assessment:

**MPE Calculation report**

Manufacturer:

**Space Exploration Technologies Corporation**

Model:

**UTW-231**

Product Marketing Name (PMN):

**Wireless Module**

HVIN/Model variant(s):

**N/A**

FCC ID:

**2AWHPW231**

IC certification number:

**26207-UTW231**

Specification:

- ◆ FCC 47 CFR Part 1 Subpart I, §§1.1307, 1.1310
- ◆ FCC 47 CFR Part 2 Subpart J, §2.1091
- ◆ FCC KDB 447498 D01 General RF Exposure Guidance v06
- ◆ ISED Canada RSS-102 Issue 5 Amendment 1, (February 2021)

## **RSS-102 Annex B - Declaration of RF Exposure Compliance**

ATTESTATION: I attest that the information provided in Annex A is correct; that the Technical Brief was prepared and the information contained therein is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed; and that the device meets the SAR and/or RF field strength limits of RSS-102.

Date of issue: June 7, 2024

James Cunningham, EMC/WL Manager

Prepared by

Signature



#### Lab locations=

|                 |                                                                  |
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| FCC Site Number | Test Firm Registration Number: 392943 Designation Number: US5058 |
| ISED Test Site  | 2040B-3                                                          |

|             |                                                                                   |
|-------------|-----------------------------------------------------------------------------------|
| Prepared by | James Cunningham, EMC/WL Manager                                                  |
| Date        | June 7, 2024                                                                      |
| Signature   |  |

#### Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

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## Section 1 Evaluation summary

### 1.1 MPE calculation for simultaneous transmission

#### 1.1.1 References, definitions and limits

##### FCC §2.1091(d)

- (2) For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part, except for portable devices as defined in §2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in §2.1093.

**Table 1.1-1:** Table 1 to §1.1310(e)(1)—Limits for Maximum Permissible Exposure (MPE)

| Frequency range<br>(MHz)                                        | Electric field strength<br>(V/m) | Magnetic field strength<br>(A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|-----------------------------------------------------------------|----------------------------------|----------------------------------|----------------------------------------|-----------------------------|
| <b>(i) Limits for Occupational/Controlled Exposure</b>          |                                  |                                  |                                        |                             |
| 0.3–3.0                                                         | 614                              | 1.63                             | *(100)                                 | ≤6                          |
| 3.0–30                                                          | 1842 / f                         | 4.89 / f                         | *(900 / f <sup>2</sup> )               | <6                          |
| 30–300                                                          | 61.4                             | 0.163                            | 1.0                                    | <6                          |
| 300–1500                                                        |                                  |                                  | f / 300                                | <6                          |
| 1500–100000                                                     |                                  |                                  | 5                                      | <6                          |
| <b>(ii) Limits for General Population/Uncontrolled Exposure</b> |                                  |                                  |                                        |                             |
| 0.3–1.34                                                        | 614                              | 1.63                             | *(100)                                 | <30                         |
| 1.34–30                                                         | 824 / f                          | 2.19 / f                         | *(180 / f <sup>2</sup> )               | <30                         |
| 30–300                                                          | 27.5                             | 0.073                            | 0.2                                    | <30                         |
| 300–1500                                                        |                                  |                                  | f / 1500                               | <30                         |
| 1500–100000                                                     |                                  |                                  | 1.0                                    | <30                         |

Notes: f = frequency in MHz. \* = Plane-wave equivalent power density.

##### RSS-102, Section 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $0.0131 f^{0.6834}$  W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.



Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density (mW/cm<sup>2</sup> or W/m<sup>2</sup>)  
P = power input to the antenna (mW or W)  
G = power gain of the antenna in the direction of interest relative to an isotropic radiator  
R = distance to the center of radiation of the antenna (cm or m)

### 1.1.2 EUT technical information

As a worst-case, the EUT was evaluated for simultaneous operation of both 2.4 GHz and 5 GHz Wi-Fi. Conducted powers and antenna gains below are also worst-case based on measured values.

|                                     | Transmitter 1 (2.4 GHz Wi-Fi) | Transmitter 2 (5 GHz Wi-Fi) |
|-------------------------------------|-------------------------------|-----------------------------|
| Prediction frequency                | 2480 MHz                      | 5785 MHz                    |
| Antenna type                        | Integrated (x3)               | Integrated (x3)             |
| Antenna gain                        | 5.11 dBi (highest gain)       | 6.37 dBi (highest gain)     |
| Maximum transmitter conducted power | 25.83 dBm (383 mW)            | 25.56 dBm (360 mW)          |
| Prediction distance                 | 80 cm                         | 80 cm                       |

Antenna gain and conducted power for 2.4 GHz operation taken from the worst-case (highest) measured data in Nemko test report REP010975-1TRFWL.

Antenna gain and conducted power for 5 GHz operation taken from the worst-case (highest) measured data in Nemko test report REP010975-2TRFWL

### 1.1.3 MPE calculation

|                                                              | Transmitter 1                                                    |                                                                  | Transmitter 2                                                    |                                                                  |
|--------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|
| Fundamental transmit (prediction) frequency:                 | 2480 MHz                                                         |                                                                  | 5785 MHz                                                         |                                                                  |
| Maximum measured conducted peak output power:                | 25.83 dBm                                                        |                                                                  | 25.56 dBm                                                        |                                                                  |
| Cable and/or jumper loss:                                    | 0 dB                                                             |                                                                  | 0 dB                                                             |                                                                  |
| Maximum peak power at antenna input terminal:                | 25.83 dBm                                                        |                                                                  | 25.56 dBm                                                        |                                                                  |
| Tx On time:                                                  | 1.000 ms                                                         |                                                                  | 1.000 ms                                                         |                                                                  |
| Tx period time:                                              | 1.000 ms                                                         |                                                                  | 1.000 ms                                                         |                                                                  |
| Average factor:                                              | 100 %                                                            |                                                                  | 100 %                                                            |                                                                  |
| Maximum calculated average power at antenna input terminal:  | 382.825 mW                                                       |                                                                  | 359.749 mW                                                       |                                                                  |
| Single Antenna gain (typical):                               | 5.11 dBi                                                         |                                                                  | 6.37 dBi                                                         |                                                                  |
| Number of antennae:                                          | 3                                                                |                                                                  | 3                                                                |                                                                  |
| Total system gain:                                           | 9.88 dBi                                                         |                                                                  | 11.14 dBi                                                        |                                                                  |
| MPE limit for uncontrolled exposure at prediction frequency: | ISED limit<br>0.547 mW/cm <sup>2</sup><br>5.469 W/m <sup>2</sup> | FCC limit<br>1.000 mW/cm <sup>2</sup><br>10.000 W/m <sup>2</sup> | ISED limit<br>0.976 mW/cm <sup>2</sup><br>9.756 W/m <sup>2</sup> | FCC limit<br>1.000 mW/cm <sup>2</sup><br>10.000 W/m <sup>2</sup> |
| Minimum calculated prediction distance for compliance:       | 23 cm                                                            | 20 cm                                                            | 20 cm                                                            | 20 cm                                                            |
| Typical (declared) distance:                                 | 80 cm                                                            | 80 cm                                                            | 80 cm                                                            | 80 cm                                                            |
| Average power density at prediction frequency:               | 0.046 mW/cm <sup>2</sup><br>0.463 W/m <sup>2</sup>               | 0.046 mW/cm <sup>2</sup><br>0.463 W/m <sup>2</sup>               | 0.058 mW/cm <sup>2</sup><br>0.582 W/m <sup>2</sup>               | 0.058 mW/cm <sup>2</sup><br>0.582 W/m <sup>2</sup>               |
| Combined MPE compliance:                                     | 10.72 dB                                                         | 13.34 dB                                                         | 12.25 dB                                                         | 12.35 dB                                                         |
| Margin of Compliance:                                        | 20.60 dBi                                                        | 13.34 dBi                                                        | 23.39 dBi                                                        | 12.35 dBi                                                        |
| Maximum allowable antenna gain:                              | 0.085                                                            | 0.046                                                            | 0.060                                                            | 0.058                                                            |
| Average power density to MPE limit ratio:                    | 0.104                                                            |                                                                  |                                                                  |                                                                  |
| Total sum of ratios for FCC:                                 | 0.144                                                            |                                                                  |                                                                  |                                                                  |
| Total sum of ratios for ISED:                                | 1                                                                |                                                                  |                                                                  |                                                                  |
| Maximum allowed sum of ratios:                               |                                                                  |                                                                  |                                                                  |                                                                  |

### 1.1.4 Verdict

The calculation is below the limit; therefore, the product is passing the RF Exposure requirements for the declared distance.

End of the test report