

# RF EXPOSURE REPORT

## CERTIFICATE OF CONFORMITY

**FCC Rule Part:** FCC Part 2 (Section 2.1091)

**Report No.:** MFBCKS-WTW-P23090477A

**FCC ID:** 2AWHPR232

**Product:** Starlink Router

**Brand:** SPACEX



**Model No.:** UTR-232

**Received Date:** 2023/9/21

**Test Date:** 2023/10/27

**Issued Date:** 2023/11/20

**Applicant:** Space Exploration Technologies Corp. (SPACEX)

**Address:** 1 Rocket Rd., Hawthorne, CA 90250 USA


**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Hsin Chu Laboratory

**Lab Address:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

**FCC Registration /** 723255 / TW2022

**Designation Number:**

**Approved by:**  , **Date:** 2023/11/20  
Wen Yu / Assistant Manager

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Prepared by : Vito Lung / Specialist



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## Release Control Record

Issue No.	Description	Date Issued
MFBCKS-WTW-P23090477A	Original release.	2023/11/20

## 1 Certificate

**Product:** Starlink Router

**Brand:** SPACEX



**Test Model:** UTR-232

**Sample Status:** Engineering sample

**Applicant:** Space Exploration Technologies Corp. (SPACEX)

**Test Date:** 2023/10/27

**FCC Rule Part:** FCC Part 2 (Section 2.1091)

**Standard:** KDB 447498 D04 Interim General RF Exposure Guidance v01

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

## 2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT.

Parameter	Specification	Uncertainty (±)
RF Exposure	1 GHz ~ 2.5 GHz	1.2 dB
	2.5 GHz ~ 8 GHz	1.3 dB

## 3 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### Routine Evaluation

#### Routine Evaluation Procedure - Single and/or Multiple RF Sources

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
EM Field Meter Wavecontrol	SMP2 Dual	22SN1914	2023/5/15	2024/5/14
Probe Wavecontrol	WPF60	22SN1914	2023/5/15	2024/5/14

#### Notes:

1. The test was performed in 966 Chamber No. 4.
2. Tested Date: 2023/10/27

## 4 Applicable RF Exposure Limit

§ 1.1310 Radiofrequency radiation exposure limits.

(a) Specific absorption rate (SAR) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b) of this part within the frequency range of 100 kHz to 6 GHz (inclusive).

(b) The SAR limits for occupational/controlled exposure are 0.4 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 8 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit for occupational/controlled exposure is 20 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 6 minutes to determine compliance with occupational/controlled SAR limits.

(c) The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

(e) Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields

➤ Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
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 <sup>2</sup> )*	30
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30

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

➤ Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
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
300-1,500			f/300	<6
1,500-100,000			5	<6

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

## **Routine Evaluation**

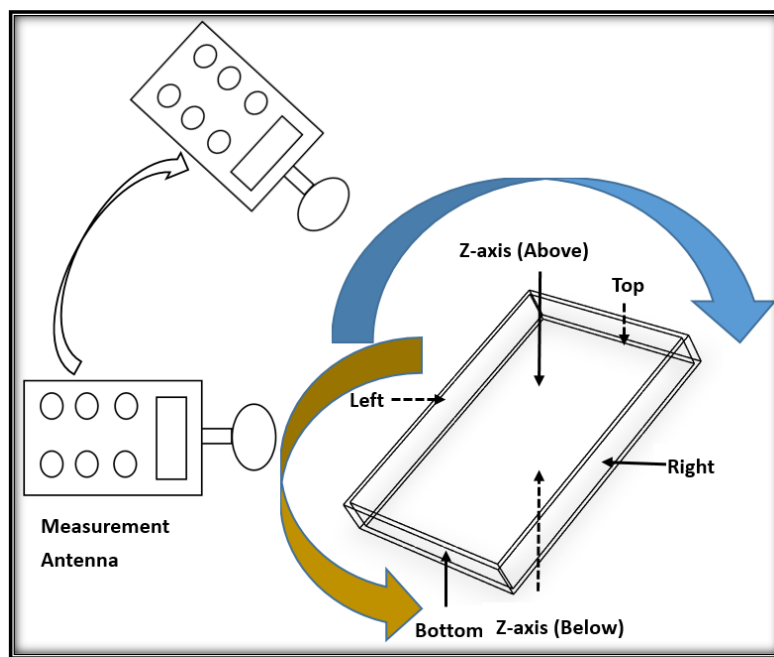
### **Routine Evaluation Procedure - Single and/or Multiple RF Sources**

- MPE compliance are measurement in all directions surrounding the antenna and radiating structures of the device.

For non-directional antennas, MPE evaluation points shall be along radials extending from the antenna (axis) that are no more than 30° apart. The direction of maximum exposure shall be aligned with one of the radials.

For each specific exposure condition, the evaluation points along the longest dimension (e.g., vertical) shall use a spatial resolution of 10 cm or less, and shall extend at least 10 cm beyond the exposed portions of a person's body or until the evaluated results are less than 10% of the MPE limit. For exposures occurring next to the ground or next to a ground plane, the evaluation points shall be no closer than 10 cm from the ground.

### **Test Setup**



#### **Note:**

1. The measurement antenna are moving and surrounding the EUT when performed the test, the test results recorded the highest values for each sides of the EUT (left/right/top/bottom/z-axis)
2. The Worst Condition: z-axis (Above).

### Fixed RF sources operating in the same time-averaging period – §1.1307(b)(3)(ii)(B)

- Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated<sub>k</sub> term) should be used to determine exemption for simultaneous transmission according to Formula below,

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

The sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE should be less than 1, to determine simultaneous transmission exposure compliance.

Where:

$a$  = number of fixed, mobile, or portable RF sources claiming exemption using [paragraph \(b\)\(3\)\(i\)\(B\)](#) of this section for  $P_{th}$ , including existing exempt transmitters and those being added.

$c$  = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

$P_{th,i}$  = the exemption threshold power ( $P_{th}$ ) according to [paragraph \(b\)\(3\)\(i\)\(B\)](#) of this section for fixed, mobile, or portable RF source  $i$ .

$ERP_{th,j}$  = exemption threshold ERP for fixed, mobile, or portable RF source  $j$ , at a distance of at least  $\lambda/2\pi$  according to the applicable formula of [paragraph \(b\)\(3\)\(i\)\(C\)](#) of this section.

$Exposure Limit_k$  = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source  $k$ , as applicable from [§ 1.1310 of this chapter](#).

$b$  = number of fixed, mobile, or portable RF sources claiming exemption using [paragraph \(b\)\(3\)\(i\)\(C\)](#) of this section for Threshold ERP, including existing exempt transmitters and those being added.

$P_i$  = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source  $i$  at a distance between 0.5 cm and 40 cm (inclusive).

$ERP_j$  = the ERP of fixed, mobile, or portable RF source  $j$ .

$Evaluated_k$  = the maximum reported SAR or MPE of fixed, mobile, or portable RF source  $k$  either in the device or at the transmitter site from an existing evaluation at the location of exposure.



## 5 Test Results

Environmental Conditions:	25°C, 60% RH	Tested By:	Sampson Chen
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### CDD

#### For Single RF Source

Routine Evaluation (General Population)					
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm <sup>2</sup> )	Test Distance (cm)	Limit (mW/cm <sup>2</sup> )	Test Result
WLAN 2.4GHz	2412-2462	0.18	20	1	Pass
WLAN 5 GHz(UNII-1)	5180-5240	0.16	20	1	Pass
WLAN 5 GHz(UNII-2A)	5250-5320	0.09	20	1	Pass
WLAN 5 GHz(UNII2C)	5500-5720	0.148	20	1	Pass
WLAN 5 GHz(UNII-3)	5745-5825	0.2	20	1	Pass

#### For Multiple RF Sources (Simultaneous Operations)

Multiple RF Sources (Simultaneous Operations)							
Routine Evaluation (General Population)					Sum of Ratios	Limit of Ratios	Test Result
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Ratio			
WLAN 2.4GHz	2412-2462	0.18	1	0.18	0.418	1	Pass
WLAN 5 GHz(UNII-2A)	5250-5320	0.09	1	0.09			
WLAN 5 GHz(UNII2C)	5500-5720	0.148	1	0.148			



Environmental Conditions:	25°C, 60% RH	Tested By:	Sampson Chen
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**Beamforming**

**For Single RF Source**

Routine Evaluation (General Population)					
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm <sup>2</sup> )	Test Distance (cm)	Limit (mW/cm <sup>2</sup> )	Test Result
WLAN 2.4 GHz	2412-2462	0.23	20	1	Pass
WLAN 5 GHz(UNII-1)	5180-5240	0.25	20	1	Pass
WLAN 5 GHz(UNII-2A)	5250-5320	0.12	20	1	Pass
WLAN 5 GHz(UNII2C)	5500-5720	0.163	20	1	Pass
WLAN 5 GHz(UNII-3)	5745-5825	0.22	20	1	Pass

**For Multiple RF Sources (Simultaneous Operations)**

Multiple RF Sources (Simultaneous Operations)							
Routine Evaluation (General Population)					Sum of Ratios	Limit of Ratios	Test Result
Operation Mode	Frequency Band (MHz)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Ratio			
WLAN 2.4 GHz	2412-2462	0.23	1	0.23	0.513	1	Pass
WLAN 5 GHz(UNII-2A)	5250-5320	0.12	1	0.12			
WLAN 5 GHz(UNII2C)	5500-5720	0.163	1	0.163			

## 6 Conclusion

Source-base time average power is below Exemption Criteria and/or Routine Evaluation MPE thresholds, therefore the device is compliant FCC RF exposure requirement.

## 7 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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