

RF Exposure Report

Report No.: MFBCKS-WTW-P23040515

FCC ID: 2AWHPR231

Test Model: UTR-231

Received Date: 2023/4/25

Test Date: 2023/6/20

Issued Date: 2023/7/4

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 /
Designation Number:** 723255 / TW2022



This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

Table of Contents

Release Control Record	3
1 Certificate of Conformity.....	4
2 RF Exposure.....	5
2.1 Limits for Maximum Permissible Exposure (MPE)	5
2.2 MPE Calculation Formula	5
2.3 Classification	5
2.4 Antenna Gain	6
2.5 Calculation Result of Maximum Conducted Power	7

Release Control Record

Issue No.	Description	Date Issued
MFCKS-WTW-P23040515	Original release.	2023/7/4

1 Certificate of Conformity

Product: Starlink Router

Brand: SPACEX



Test Model: UTR-231

Sample Status: Engineering sample

Applicant: Space Exploration Technologies Corp. (SPACEX)

Test Date: 2023/6/20

FCC Rule Part: FCC Part 2 (Section 2.1091)

Standard: KDB 447498 D01 General RF Exposure Guidance v06

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 EMC characteristics under the conditions specified in this report.

Prepared by : Vito Lung , **Date:** 2023/7/4
Vito Lung / Specialist

Approved by : May Chen , **Date:** 2023/7/4
May Chen / Manager

2 RF Exposure

2.1 Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	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 ²)*	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

2.2 MPE Calculation Formula

$$P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$$

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

2.3 Classification

The antenna of this product, under normal use condition, is at least 20 cm away from the body of the user.
So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

Antenna NO.	RF Chain NO.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type
2G1	Ant1	SPACEX	UTR-231	4.26	2.4~2.4835GHz	PIFA	ipex(MHF)
2G2	Ant2			4.13	2.4~2.4835GHz	PIFA	ipex(MHF)
2G3	Ant3			3.14	2.4~2.4835GHz	PIFA	ipex(MHF)
2G4	Ant4			3.92	2.4~2.4835GHz	PIFA	ipex(MHF)
5L1	Ant1	SPACEX	UTR-231	2.86	5.15~5.25GHz	PIFA	ipex(MHF)
				4.20	5.25~5.35GHz		
5L2	Ant2			2.28	5.15~5.25GHz	PIFA	ipex(MHF)
				1.04	5.25~5.35GHz		
5L3	Ant3			1.29	5.15~5.25GHz	PIFA	ipex(MHF)
				1.68	5.25~5.35GHz		
5L4	Ant4			1.53	5.15~5.25GHz	PIFA	ipex(MHF)
				1.51	5.25~5.35GHz		
5H1	Ant1	SPACEX	UTR-231	4.02	5.47~5.725GHz	PIFA	ipex(MHF)
				4.23	5.725~5.85GHz		
5H2	Ant2			4.02	5.47~5.725GHz	PIFA	ipex(MHF)
				3.72	5.725~5.85GHz		
5H3	Ant3			3.04	5.47~5.725GHz	PIFA	ipex(MHF)
				3.93	5.725~5.85GHz		
5H4	Ant4			4.90	5.47~5.725GHz	PIFA	ipex(MHF)
				3.27	5.725~5.85GHz		

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

2.5 Calculation Result of Maximum Conducted Power

For WLAN - CDD Mode

Operation Mode	Evaluation Frequency (MHz)	Max Avg. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
WLAN 2.4 GHz	2412-2462	859.765	4.26	20	0.12636	1	Pass
WLAN 5 GHz(L)	5180-5240	969.319	2.86	20	0.10320	1	Pass
WLAN 5 GHz(H)	5745-5825	961.078	4.23	20	0.14028	0.442	Pass

For WLAN - Beamforming Mode

Operation Mode	Evaluation Frequency (MHz)	Max Avg. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
WLAN 2.4 GHz	2412-2462	891.671	5.81	20	0.18725	1	Pass
WLAN 5 GHz(L)	5180-5240	947.638	6.21	20	0.21821	1	Pass
WLAN 5 GHz(H)	5745-5825	961.078	6.14	20	0.21776	0.442	Pass

NOTE:

1. For MPE calculation is based on the PSD Effective Legacy Gain.
2. Pls, take care MPE distance on warning statement, because distance to Human body is over 20cm
3. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Conclusion:

The formula of calculated the MPE is:

$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

WLAN - CDD Mode

$WLAN\ 2.4\ GHz + WLAN\ 5\ GHz(L) + WLAN\ 5\ GHz(H) = 0.12636 / 1 + 0.10320 / 1 + 0.14028 / 0.442 = 0.54694$

WLAN - Beamforming Mode

$WLAN\ 2.4\ GHz + WLAN\ 5\ GHz(L) + WLAN\ 5\ GHz(H) = 0.18725 / 1 + 0.21821 / 1 + 0.21776 / 0.442 = 0.89813$

Therefore the maximum calculations of above situations are less than the “1” limit.

--- END ---