

# RF Exposure Exemption Report

Iridium Satellite LLC  
Iridium Transceiver  
Model:9704

In accordance with FCC CFR 47 Pt 1.1307



Prepared for: Iridium Satellite LLC  
1750 Tysons Boulevard  
Suite 1400  
McLean  
VA 22102  
U.S.A

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### SIGNATURE

A handwritten signature in blue ink that reads "Matthew Russell".

| NAME            | JOB TITLE      | RESPONSIBLE FOR      | ISSUE DATE       |
|-----------------|----------------|----------------------|------------------|
| Matthew Russell | Chief Engineer | Authorised Signatory | 13 November 2024 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

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### EXECUTIVE SUMMARY

The wireless devices described within this report are compliant with the exemption criteria related to human exposure to electromagnetic fields laid out in FCC CFR 47 Part 1.1307 at a distance of 55 mm



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TÜV SÜD Group Company

Phone: +44 (0) 1489 558100  
Fax: +44 (0) 1489 558101  
[www.tuvsud.com/en](http://www.tuvsud.com/en)

TÜV SÜD  
Octagon House  
Concorde Way  
Fareham  
Hampshire PO15 5RL  
United Kingdom



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## 1 Report Summary

### 1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue |
|-------|-----------------------|---------------|
| 1     | First Issue           | 13-Nov-2024   |

**Table 1**

### 1.2 Introduction

|                          |  |
|--------------------------|--|
| Applicant                | Iridium Satellite LLC  |
| Manufacturer             | Iridium Satellite LLC  |
| Model Number(s)          | Iridium 9704 Transceiver   |
| Hardware Version(s)      | S5L5-V5  |
| Software Version(s)      | SX-1.4.9   |
| Specification/Issue/Date | FCC 47 CFR Part 1.1307: 2022   |
| Order Number             | 91944  |
| Date                     | <ul style="list-style-type: none"><li>• 10-June-2024</li></ul>       |
| Related Document(s)      | <ul style="list-style-type: none"><li>• KDB 447498 D04 v01</li></ul> |



### 1.3 Brief Summary of Results

The wireless device described within this report was compliant with the restrictions related to human exposure to electromagnetic fields for both general public and worker/occupational exposures for a separation distance of 5.5 cm.

The calculations shown in this report were made in accordance with the procedures specified in the applied test specification(s).



## 1.4 Product Information

### 1.4.1 Technical Description

The equipment under test (EUT) is a data terminal for communication with the Iridium satellite network.

### 1.4.2 Transmitter Description

The following radio access technologies and frequency bands are supported by the equipment under test.

| Radio Access Technology | Frequency Band (MHz) | Minimum Frequency (MHz) | Output Power (dBm) | Duty Cycle (%) |
|-------------------------|----------------------|-------------------------|--------------------|----------------|
| Iridium                 | 1616 - 1626.5        | 1616                    | 32.00              | 9.2            |

**Table 2 – Transmitter Description - FCC**

Note: Transmitter power includes upper bounds of uncertainty therefore maximum values are used.

### 1.4.3 Antenna Description

The following antennas are supported by the equipment under test.

| Radio Access Technology | Antenna Model | Frequency Band (MHz) | Gain (dBi) | Antenna length (cm) | Minimum Separation Distance (cm) |
|-------------------------|---------------|----------------------|------------|---------------------|----------------------------------|
| Iridium                 | Not Specified | 1616 - 1626.5        | 5.0        | 17                  | 5.5                              |

**Table 3 – Antenna Description**

In the case of more than one type of antenna being supported by the equipment, the calculation is based on the maximum of the antenna gains. If other antennas can be used that have greater gains, the minimum separation distances will need to be recalculated.

Note: Antenna gain includes upper bounds of uncertainty therefore maximum values are used.

### 1.4.4 Equipment Configuration

The device supports the following modes:-

- Single Iridium Transceiver operating in the 1616 MHz to 1626.5 MHz band



## 2 Assessment Details

### 2.1 Single RF Source options for determination of exemption.

| Option                     | Reference                 | RF Exposure Test Exemptions for Single Source  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
|----------------------------|---------------------------|--|---------------------------|-----------------------|----------------|---------------|---------------|-------------------|--------------|--------------|-----------------|------------------|---------------------|--------------|
| A<br>(1-mW Test Exemption) | FCC<br>1.1307(b)(3)(i)(A) | The available maximum time averaged power is no more than 1 mW, regardless of separation distance.   |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
| B<br>(SAR-Based Exemption) | FCC<br>1.1307(b)(3)(i)(B) | <p>The available maximum timeaveraged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold <math>P_{th}</math> (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). <math>P_{th}</math> is given by:</p> $P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$ <p>Where</p> $x = -\log_{10} \left( \frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$ <p>and</p> $ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$ <p><math>d</math> = the separation distance (cm);</p>  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
| C<br>(MPE-Based Exemption) | FCC<br>1.1307(b)(3)(i)(C) | <p>Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least <math>\lambda/2\pi</math>, where <math>\lambda</math> is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of <math>\lambda/4</math> or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).</p> <p><b>TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION</b></p> <table border="1"> <thead> <tr> <th>RF Source frequency (MHz)</th> <th>Threshold ERP (watts)</th> </tr> </thead> <tbody> <tr> <td>0.3–1.34 .....</td> <td><math>1,920 R^2</math>.</td> </tr> <tr> <td>1.34–30 .....</td> <td><math>3,450 R^2/f^2</math>.</td> </tr> <tr> <td>30–300 .....</td> <td><math>3.83 R^2</math>.</td> </tr> <tr> <td>300–1,500 .....</td> <td><math>0.0128 R^2 f</math>.</td> </tr> <tr> <td>1,500–100,000 .....</td> <td><math>19.2 R^2</math>.</td> </tr> </tbody> </table> | RF Source frequency (MHz) | Threshold ERP (watts) | 0.3–1.34 ..... | $1,920 R^2$ . | 1.34–30 ..... | $3,450 R^2/f^2$ . | 30–300 ..... | $3.83 R^2$ . | 300–1,500 ..... | $0.0128 R^2 f$ . | 1,500–100,000 ..... | $19.2 R^2$ . |
| RF Source frequency (MHz)  | Threshold ERP (watts)     |  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
| 0.3–1.34 .....             | $1,920 R^2$ .             |  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
| 1.34–30 .....              | $3,450 R^2/f^2$ .         |  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
| 30–300 .....               | $3.83 R^2$ .              |  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
| 300–1,500 .....            | $0.0128 R^2 f$ .          |  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |
| 1,500–100,000 .....        | $19.2 R^2$ .              |  |                           |                       |                |               |               |                   |              |              |                 |                  |                     |              |



## 2.2 Multiple RF Sources options for determination of exemption.

| Option   | Reference                  |  |
|--|----------------------------|--|
| A<br>1-mW Test<br>Exemption for<br>Multiple<br>Sources   | FCC<br>1.1307(b)(3)(ii)(A) | The available maximum time averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A). |
| B<br>Simultaneous<br>Transmission with both<br>SAR-based<br>and MPE-<br>Based Test<br>Exemptions | FCC<br>1.1307(b)(3)(ii)(B) | in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.<br>$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$   |



## 2.3 Individual Antenna Port Exposure Results

### 2.3.1 Calculation of Exposure at Specified Separation Distance

The frequencies shown in the tables below have been chosen based on the lowest possible frequency that the EUT can transmit.

| RAT     | Frequency (MHz) | Conducted Power Output mW | Duty Cycle % | Time Average Conducted Power Output mW | Antenna Gain Ratio | Maximum Power (EIRP) mW | Maximum Power (ERP) mW | Minimum Antenna to User Separation Distance (mm) | Pth (mW) 1.1307 (b)(3)(i)(B) | Greater of Max time averaged conducted power or ERP? mW | 1.1307(b)(3)(i)(B) Exemption (Yes/No) (300 MHz to 6 GHz, 0.5 cm to 40 cm) |
|---------|-----------------|---------------------------|--------------|--|--------------------|-------------------------|------------------------|--|------------------------------|---|---|
| Iridium | 1616            | 1584.893                  | 9.2          | 145.810                                | 3.162              | 461.092                 | 281.155                | 55   | 3060                         | 295.059   | Yes   |

**Table 4 –Transmitter Result**

The calculations show that the individual transmitters comply with FCC 1.1307(b)(3)(i)(B) SAR-based exemption at a minimum distance of 55mm.