

RF Exposure Exemption Report

LARS THRANE A/S

LT-4200 Satellite Communications System

In accordance with FCC CFR 47 Pt 1.1307

Prepared for: LARS THRANE A/S
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FCC ID: 2A9Z4-GC542298

Document 75956617-11 Issue: 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Matthew Russell	Chief Engineer (RF)	Authorised Signatory	17 April 2023

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

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

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 Title 47 Part 1.1307.



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Contents

1 Report Summary 2

1.1 Report Modification Record.....2

1.2 Introduction.....2

1.3 Brief Summary of Results 3

1.4 Application Form 4

1.5 Product Information 6

2 Assessment Details 7

2.1 Single RF Source options for determination of exemption.....7

2.2 Multiple RF Sources options for determination of exemption. 8

2.3 Individual Antenna Port Exposure Results.....9



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	17-April-2023

Table 1

1.2 Introduction

Applicant	Lars Thrane A/S
Manufacturer	Lars Thrane A/S
Model Number(s)	LT-4200 Satellite Communications System comprising: Control Unit: LT-4210 Antenna Unit: LT-4230 Handset: LT-3120
Applicant	Lars Thrane A/S
Specification/Issue/Date	FCC 47 CFR Part 1.1307: 2021
Order Number	• 188988 Rev:0
Date	• 16-September-2022
Related Document(s)	• KDB 447498 D04 v01



1.3 Brief Summary of Results

The non co-located transmitters described within this report were compliant with the exemption criteria related to human exposure to electromagnetic fields laid out in FCC CFR Title 47 Part 1.1307 at the following separation distances:-

- o 55cm - Antenna Unit: LT-4230
- o 20cm - Control Unit: LT-4210

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



1.4 Application Form

Equipment Description

Technical Description: <i>(Please provide a brief description of the intended use of the equipment)</i>	The user may perform voice call and data transfer sessions from the Control Unit, via the Iridium satellite network.
Manufacturer:	Lars Thrane Communication Systems
Model:	LT-4200, consisting of LT-4210 Control Unit and LT-4230 Antenna Unit
Part Number:	LT-4210 Control Unit: 51-102640 LT-4230 Antenna Unit: 51-102640

If more than one frequency band is supported, please confirm which combinations of bands are capable of Simultaneous Transmit.	The Iridium transceiver in the LT-4230 Antenna Unit, and the Bluetooth module in the LT-4210 Control Unit may transmit simultaneously.
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Frequency Band 1: Iridium

Antenna Model:	LT-4230	
Antenna length:	20	cm
Bottom frequency:	1616	MHz
Middle frequency:	1621	MHz
Top frequency:	1626	MHz

Maximum power (input to the antenna including a tolerance):	41.7	dBm
Antenna gain (or maximum gain allowed):	2.3	dBi

Or

Field Strength Measurement:		dBμA/M
Measurement Distance:		cm

Separation distance from antenna to the user/bystander	>55	cm
Transmitter Duty Cycle:	36.4	%



Frequency Band 2: Bluetooth

Antenna Model:	BT111 (in LT-4210 Control Unit)	
Antenna length:	<1	cm
Bottom frequency:	2402	MHz
Middle frequency:	2439	MHz
Top frequency:	2480	MHz

Maximum power (input to the antenna including a tolerance):	8.3	dBm
Antenna gain (or maximum gain allowed):	0.5	dBi

Or

Field Strength Measurement:		dB μ A/M
Measurement Distance:		cm

Separation distance from antenna to the user/bystander	>20	cm
Transmitter Duty Cycle:	100	%

I hereby declare that the information supplied is correct and complete.

Name: Carsten Thomsen

Position held: CTO

Date: 25-November-2022



1.5 Product Information

1.5.1 Technical Description

The LT-4200 consists of an LT-4210 Control Unit and an LT-4230 Antenna Unit which are not co located. The user may perform voice call and data transfer sessions from the Control Unit, via the Iridium satellite network.

1.5.2 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	41.7	36.4
Bluetooth	2400 - 2483.5	2402	8.3	100

Table 2 – Transmitter Description- FCC

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

1.5.3 Antenna Description

The following antennas are supported by the equipment under test.

Radio Access Technology	Antenna Model	Gain (dBi)	Antenna length (cm)	Minimum Separation Distance (cm)
Iridium	LT-4230	2.3	20	>55
Bluetooth	BT111	0.5	<1	>20

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.

1.5.4 Equipment Configuration

Single transmitter – Iridium
Single transmitter – Bluetooth



2 Assessment Details

2.1 Single RF Source options for determination of exemption.

Option	Reference	RF Exposure Test Exemptions for Single Source												
A (1-mW Test Exemption)	FCC 1.1307(b)(3)(i)(A)	The available maximum time averaged power is no more than 1 mW, regardless of separation distance.												
B (SAR-Based Exemption)	FCC 1.1307(b)(3)(i)(B)	The available maximum timeaveraged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (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). P_{th} is given by: $P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$ Where $x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$ and $ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$ <i>d</i> = the separation distance (cm);												
C (MPE-Based Exemption)	FCC 1.1307(b)(3)(i)(C)	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 λ/2π, where λ 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 λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value). TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION <table><tr><th>RF Source frequency (MHz)</th><th>Threshold ERP (watts)</th></tr><tr><td>0.3–1.34</td><td>1,920 R².</td></tr><tr><td>1.34–30</td><td>3,450 R²/f².</td></tr><tr><td>30–300</td><td>3.83 R².</td></tr><tr><td>300–1,500</td><td>0.0128 R²f.</td></tr><tr><td>1,500–100,000</td><td>19.2R².</td></tr></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	19.2R 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	19.2R ² .													



2.2 Multiple RF Sources options for determination of exemption.

Option	Reference	
A 1-mW Test Exemption for Multiple Sources	FCC 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 Simultaneous Transmission with both SAR-based and MPE- Based Test Exemptions	FCC 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. $\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$



2.3 Individual Antenna Port Exposure Results

2.3.1 Single Source Calculation of Exposure at Specified Separation Distance FCC 1.1307(b)(3)(i)(C) 'Option C' (MPE Based Exemption)

2.3.1.1 Antenna Unit: LT-4230

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 separation distance for MPE evaluation $\lambda/2$ π mm	Actual Distance (mm)	Threshold ERP (mW)	1.1307(b)(3)(i)(C) Exemption (Yes/No) (300 kHz to 100 GHz)
Iridium	1616	14791.08	36.4	5383.95	1.698	9143.26	5575.16	29.5	550	5808	Yes

Table 4 –Transmitter Result - Antenna Unit: LT-4230

The calculations show that the Antenna Unit: LT-4230 transmitter complies with FCC 1.1307(b)(3)(i)(C) MPE-based exception at a minimum distance of 55 cm.

2.3.1.2 Control Unit: LT-4210

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 separation distance for MPE evaluation $\lambda/2$ π mm	Actual Distance (mm)	Threshold ERP (mW)	1.1307(b)(3)(i)(C) Exemption (Yes/No) (300 kHz to 100 GHz)
Bluetooth	2402	6.76	100	6.76	1.122	7.58	4.63	19.9	200	768	Yes

Table 5 –Transmitter Result - Control Unit: LT-4210

The calculations show that the Antenna Unit: LT-4230 transmitter complies with FCC 1.1307(b)(3)(i)(C) MPE-based exception at a minimum distance of 20 cm.