Radio Frequency Exposure Evaluation Report

FOR:
Geoforce Inc.

Model Name:
Geoforce GT2

Product Description:
GNSS enabled logistics modem

FCC ID: OWA00GT2X
IC ID: 10540A-00GT2X

Per:

CFR Part Part1 (1.1307 &1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06
ISEDC RSS-102 Issue 5

Report number: EMC_GEOFO-023-21001_FCC_ISED_MPE_R1

DATE: 2021-10-07

CETECOM **Inc.**
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1 Assessment

This RF Exposure evaluation report provides evidence for compliance of the below identified device with the RF Exposure limits for mobile devices as defined in FCC CFR Part 1 (1.1307 &1.1310), Part 2 (2.1091) and IC standard RSS-102 issue 5 under worst case conditions (measured or rated RF output power, antenna gain, distance towards human body, multiple transmitter information as presented by the applicant).
In addition, maximum antenna gain or minimum distance towards the human body is calculated respectively, where relevant.

The device meets the limits as stipulated by the above given FCC and IC rule parts based on available specifications for worst case conditions at 20cm distance to the body.

Company	Description	Model #
Geoforce Inc.	GNSS enabled logistics modem	GT2h (OWAH86), GT2s (OWAS86), GT2c (OWAC00)

Report reviewed by: TCB Evaluator

Date	Section	Name	Signature
2021-10-07	Compliance	Kevin Wang (Lab Manager)	kevin.wang@cetecom.com Digitally signed by: kevin.wang@cetecom.com DN: CN = kevin.wang@cetecom.com Date: 2021.10.07 12:50:15 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2021-10-07	Compliance	Yuchan Lu (Test Engineer)	Yuchan Lu Digitally signed by: Yuchan Lu DN: CN = Yuchan Lu email = Yuchan.Lu@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2021.10.07 11:03:01 -07'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
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Lab Manager:	Kevin Wang
Responsible Project Leader:	Sangeetha Sivaraman

2.2 Identification of the Client / Manufacturer

Client's Name:	Geoforce Inc.
Street Address:	5830 Granite Parkway, Suite 1200
City/Zip Code	Plano, TX 75024
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Assessment

Marketing name:	Geoforce GT2
HW Version :	R2
SW Version :	0.4.T (Test supporting software version)
Hardware Version Identification Number (HVIN):	GT2h (OWAH86), GT2s (OWAS86), GT2c (OWAC00)
Product Marketing Name (PMN):	Geoforce GT2
Regulatory Band:	❖ **WLAN :** ▪ Nominal band: 2400 MHz – 2483.5 MHz; ▪ Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels ❖ **Bluetooth LE:** ▪ Nominal band: 2400 MHz – 2483.5 MHz; ▪ Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels ❖ **Iridium:** ▪ Nominal band: 1616 MHz – 1626.5 MHz; ❖ **Cellular** ▪ LTE Band 2: 1850 MHz – 1915 MHz; ▪ LTE Band 4: 1710 MHz – 1780 MHz; ▪ LTE Band 5: 824 MHz – 849 MHz; ▪ LTE Band 12: 699 MHz – 716 MHz; ▪ LTE Band 13: 777 MHz – 787 MHz; ▪ LTE Band 14: 788 MHz – 798 MHz; ▪ LTE Band 17: 704 MHz – 716 MHz; ▪ LTE Band 25: 1850 MHz – 1915 MHz; ▪ LTE Band 26: 814 MHz – 849 MHz; ▪ LTE Band 66: 1710 MHz – 1780 MHz;
Integrated Module Info:	❖ **WLAN** ▪ Module name: u-blox NINA-W151 ▪ Manufacture: UBlox ▪ FCC ID: XPYNINAW15 ▪ IC ID: 8595A-NINAW15 ❖ **Bluetooth LE:** ▪ Module name: Nordic, nRF52840

	▪ FCC ID: OWA00GT2X ❖ **Iridium:** ▪ Module name: Iridium 9603N ▪ FCC ID: OWA00GT2X ❖ **Cellular** ▪ Module name: Nordic nRF9160 ▪ Manufacture: Nordic ▪ FCC ID: 2ANPO00NRF9160 ▪ IC ID: 24529-NRF9160
Antenna Type:	❖ **WLAN:** ▪ Model Name : Molex 479480001 ▪ Antenna Gain: 3 dBi ❖ **Bluetooth LE:** ▪ Model No.: Molex 479480001 ▪ Antenna gain: 3 dBi ❖ **Iridium:** ▪ Model No.: TW11-0060-X ▪ Antenna gain: 5 dBi ❖ **Cellular:** ▪ Model Name : ethertronics P822601 ▪ Antenna Gain: ▪ 698 – 960MHz : 2.6 dBi ▪ 1710 – 2200 MHz : 4.4 dBi
Maximum Conducted Output Power:	❖ **WLAN:** From modular grant [Watts]: 0.0363 ❖ **Bluetooth LE:** 0.00038 [Watts] ❖ **Iridium:** 2.34963 [Watts] ❖ **Cellular:** ▪ LTE Band 2: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 4: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 5: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 12: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 13: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 14: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 17: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 15: 23dBm, tune-up: +1/-3 dB; ▪ LTE Band 26: 23dBm, tune-up: +1/-3 dB;

	▪ LTE Band 66: 23dBm, tune-up: +1/-3 dB;
Power Supply/ Rated Operating Voltage Range:	Dedicated Battery Pack Vmin: 1.8 VDC/ Vnom: 3.6 VDC / Vmax: 3.7 VDC
Operating Temperature Range:	-40 ºC to 85 ºC
Sample Revision:	☐Prototype Unit; ■Production Unit; ☐Pre-Production

4 RF Exposure Limits and FCC and IC Basic Rules

For the specific described radio apparatus the following basic limits and rules apply for both, FCC and IC where not indicated differently.

4.1 Power Density Limits acc. to FCC 1.1310(e) / RSS-102 i5, cl. 4:

FCC

Frequency Range (MHz)	Power density (mW/cm²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100000	1.0	30

IC

300 – 6000	0.02619 x f (MHz) $^{0.6834}$	6

4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c) / RSS-102, cl. 2.5 (rounded to 1 decimal point):

FCC
operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8dBm (EIRP: 33.9 dBm);
operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm (EIRP: 36.9 dBm);

IC
300MHz < = operating frequency < 6 GHz: excluded if EIRP < 0.0131 x f (MHz) $^{0.6834}$ W

4.3 RF Exposure Estimation (MPE Estimation)

Having available the source based average output power and peak antenna gain or the ERP/EIRP of the specified device and for a known minimum distance of its radiating structures from the body of persons according to its use cases (at least 20cm) the power density at that distance can be estimated by the following formula for plane-wave equivalent conditions (far-field conditions), when ground reflection is neglected.

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

where: S = power density (mW/cm² or W/m²)
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)

5 Evaluations

5.1 Analysis of RF Exposure for simultaneous transmission

- Evaluations are based on worst case power density limits for Canada.
- Calculations are made for 20cm.
- Evaluations are based on ERP/EIRP measured or calculated from known gain and conducted output power.
- All radios transmit independently.

Radio	freq [MHz]	Max Conducted power + Tune up [W]	Gain [dBi]	Gain [lin]	EIRP [W]	EIRP With DC [W]	IC Limit [W/m2]	FCC LImit [W/m2]	Actual $[W/m2]^2$	How much of limit is used up
WLAN	2400	0.0363	3	2.00	0.072	0.072	5.348	10.000	0.144	2.69%
BT-LE	2402	0.00038	3	2.00	0.001	0.001	5.351	10.000	0.002	0.02%
Iridium	1616	2.34963	5	3.16	7.430	0.684	4.081	10.000	1.360	33.30%
LTE 2	1850	0.251	4.4	2.75	0.691	0.691	4.476	10.000	1.375	30.72%
LTE 4	1710	0.251	4.4	2.75	0.691	0.691	4.242	10.000	1.375	32.42%
LTE 5	824	0.251	2.6	1.82	0.457	0.457	2.576	5.493	0.909	35.26%
LTE 12	699	0.251	2.6	1.82	0.457	0.457	2.302	4.660	0.909	39.46%
LTE 13	777	0.251	2.6	1.82	0.457	0.457	2.474	5.180	0.909	36.70%
LTE 14	788	0.251	2.6	1.82	0.457	0.457	2.498	5.253	0.909	36.35%
LTE 17	704	0.251	2.6	1.82	0.457	0.457	2.313	4.693	0.909	39.27%
LTE 25	1850	0.251	4.4	2.75	0.691	0.691	4.476	10.000	1.375	30.72%
LTE 26	814	0.251	2.6	1.82	0.457	0.457	2.554	5.427	0.909	35.55%
LTE 66	1710	0.251	4.4	2.75	0.691	0.691	4.242	10.000	1.375	32.42%

Note1：The calculation is based on the distance of 20cm

Note2：EIRP of Iridium is corrected with DC 9.2%

5.2 Conclusion:

The transmission of LTE band 12 is the worst case, using 39.46 of a limit of 100%. The equipment is passing RF exposure requirements for 20cm distance.

6 Revision History

Date	Report Name	Changes to report	Prepared by
2021-08-18	EMC_GEOFO-023-21001_FCC_ISED_MPE	Initial Release	Yuchan Lu
2021-10-07	EMC_GEOFO-023-21001_FCC_ISED_MPE_R1	Corrected model Typo	Yuchan Lu

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