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RF Exposure Compliance – MPE Calculation Report

Applicant information: **Geotab Inc.**

Product information:

<i>Model number (HVIN):</i>	GATAA1
<i>Model name (PMN):</i>	GATAA1
<i>Product description:</i>	Asset tracker
<i>Product type:</i>	Mobile Device
<i>Device category</i>	Consumer Device for General Population/Uncontrolled Exposure
<i>FCC Identification:</i>	FCC ID:2AV57GATAA1
<i>ISED certification number:</i>	IC:11140A-GATAA1

Date of issue: **July 28, 2025**

Compliance **FCC 47 CFR Part 1 Subpart I, §§1.1307, 1.1310**

Specifications: **FCC 47 CFR Part 2 Subpart J, §§2.1091, 2.1093**

FCC KDB 447498 D01 General RF Exposure Guidance v06

FCC KDB 865664 D01 RF Exposure Procedures and Equipment Authorization Policies

ISED Canada RSS-102 Issue 6 December 15, 2023

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The test results included in this report are within the scope of this accreditation.
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Test locations of Nemko Canada Inc.

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Test site identifier - FCC	CA2040	CA2041	CA0101
Test site identifier – ISED Canada	2040A-4	2040G-5	24676
ANAB File Number	AT-3195	AT-3193	AT-3194

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Signature

Limits of responsibility

The results presented in this report apply solely to the specific device model tested and are valid only for the operating conditions and installation requirements specified herein. Testing was conducted in accordance with ISO/IEC 17025:2017 requirements, and all results fall within the scope of Nemko Canada's accreditation.

This MPE evaluation is based on the maximum power levels and operating conditions specified. Any modifications to the device hardware, software, or installation that could affect RF output power or antenna characteristics may invalidate this compliance demonstration.

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1. Executive Summary

This report presents the Maximum Permissible Exposure (MPE) analysis for [Product Name] to demonstrate compliance with FCC and ISED RF exposure requirements. The evaluation considers both single transmitter operation and simultaneous multi-transmitter scenarios where applicable.

2. Key Findings

Compliance status	Complies
Critical separation distances	20 cm
Special conditions or limitations	N/A

MPE calculations for stand-alone and simultaneous transmission

Device Classification Requirements

Portable Device Definition (§2.1093)	Devices designed for use by a person where the radiating structure is within 20 cm of the user's body require SAR evaluation rather than MPE calculation.
Mobile Device Definition	Devices installed in vehicles or with permanently installed antennas may use MPE calculations if minimum separation distances can be established.
Fixed/Base Station Definition	Stationary transmitters with controlled access to antenna locations may use MPE calculations for both occupational and general population exposure scenarios.

3. References, definitions and limits for FCC

FCC §2.1091(d)

- (2) For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part, except for portable devices as defined in §2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in §2.1093.

Table 1: §1.1310(e)(1)—Power Density Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure		
0.3–3.0	*(100)	≤6
3.0–30	*(900 / f ²)	<6
30–300	1.0	<6
300–1500	f / 300	<6
1500–100000	5	<6
(ii) Limits for General Population/Uncontrolled Exposure		
0.3–1.34	*(100)	<30
1.34–30	*(180 / f ²)	<30
30–300	0.2	<30
300–1500	f / 1500	<30
1500–100000	1.0	<30

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

4. References, definitions and limits for ISED

RSS-102

Section 5.3.2 The power density reference levels, and associated reference period for devices employed by the general public (uncontrolled environment) and controlled-use devices (controlled environment) are specified in table below. Note that the power density limits specified in this table apply to whole body exposure conditions.

Table 2: RSS-102— Power density limits

Frequency range (MHz)	Power density (W/m ²)	Power density (mW/cm ²)	Reference Period (minutes)
Limits for controlled-use devices (controlled environment)			
10–20	10	1	6
20–48	$44.72 / f^{0.5}$	$4.472 / f^{0.5}$	6
48–100	6.455	0.6455	6
100–6000	$0.6455 f^{0.5}$	$0.06455 f^{0.5}$	6
6000–15000	50	5	$616000 / f^{1.2}$
15000–30000	$3.33 \times 10^{-4} f$	$0.333 \times 10^{-4} f$	$616000 / f^{1.2}$
Limits for devices used by the general public (uncontrolled environment)			
10–20	2	0.2	6
20–48	$8.944 / f^{0.5}$	$0.8944 / f^{0.5}$	6
48–300	1.291	0.1291	6
300–6000	$0.02619 f^{0.6834}$	$0.002619 f^{0.6834}$	6
6000–15000	10	1	$616000 / f^{1.2}$
15000–30000	$6.67 \times 10^{-5} / f$	$0.667 \times 10^{-5} / f$	$616000 / f^{1.2}$

Notes: f = frequency in MHz.

The above table refers to Health Canada's Safety Code 6 for relevant notes and additional information.

Additional ISED Considerations

Routine Evaluation Thresholds	ISED requires routine evaluation when predicted or measured field strength exceeds certain thresholds, even for equipment that would otherwise be categorically excluded.
Environmental Classification	Clear distinction must be made between controlled and uncontrolled environments based on RF awareness and access control measures.

5. Power density calculation formula

The fundamental equation (from page 18 of OET Bulletin 65, Edition 97-01) for calculating power density at a specified distance from an RF source is derived from the far-field assumption:

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

where:

- S = Power density (mW/cm² or W/m²)
- P = Power input to antenna (mW or W)
- G = Antenna gain (linear ratio, not dB)
- R = Distance from radiation center (cm or m)

This equation assumes:

- Far-field conditions ($R > 2D^2/\lambda$, where D is largest antenna dimension) are assumed at the evaluation distance of 20 cm
- Isotropic power distribution (conservative approach)
- Free-space propagation conditions
- Worst-case antenna orientation

Multiple Transmitter Analysis (if applicable)

Total Exposure Ratio (TER) Calculation: $TER = \sum(S_i/L_i) \leq 1.0$

Where:

- S_i = Power density from transmitter i
- L_i = Applicable limit for transmitter i

6. EUT technical information for a single transmitter operation

Transmitter (BLE – main radio)	
Prediction frequency	2402
Antenna gain	2.7
Number of antennas	1
Maximum transmitter power	9.41 dBm
Declared separation distance	20 cm
Duty cycle	100%

7. Test report references

Transmitter maximum output power measurement result was taken from the following RF test reports:

	Report 1	Reports (Cellular module)	Report – SCS under FCC Part 25
Report ID	REP101860	75461RRF.003, 75461RRF.004, 75461RRF.001, 75461RRF.002	SCS Compliance Report Geotab GATAA1-v3
Issue date	July 15, 2025	Various: 2023	August 7, 2025
Test standard	FCC Part 15 Subpart C and RSS-247, Issue 3	FCC Parts 27, 90R, 22H, 24E, RSS-132, RSS-133, RSS-139, RSS-140	FC Part 25

8. Verdict

The calculated power density at the declared separation distance is below the applicable regulatory limits. Therefore, the product **COMPLIES** with FCC and ISED RF exposure requirements for single transmitter operation.

Product info: FCC ID: 2AV57GATAA1
IC: 11140A-GATAA1
Model (HVIN): GATAA1

9. MPE calculation for stand-alone (single) transmitter (conducted method)

Fundamental transmit (prediction) frequency: 2402 MHz
 Maximum measured conducted peak output power: 9.41 dBm
 Cable and/or jumper loss: 0 dB
 Maximum peak power at antenna input terminal: 9.41 dBm
 Duty cycle: 100 %
 Maximum calculated average power at antenna input terminal: 8.73 mW
 Single Antenna gain (typical): 2.7 dBi
 Number of antennae: 1
 Total system gain: 2.70 dBi

FCC calculations

ISED calculations

Uncontrolled environment

Declared distance:	20 cm	20 cm
Average power density at declared distance:	0.003234 mW/cm ² 0.032339 W/m ²	0.003234 mW/cm ² 0.032339 W/m ²
MPE limit at prediction frequency:	1.000000 mW/cm ² 10.000000 W/m ²	0.535080 mW/cm ² 5.350805 W/m ²
Minimum calculated prediction distance for compliance:	20 cm	20 cm
Margin of Compliance:	24.90 dB	22.19 dB
with Maximum permitted antenna gain:	27.60 dBi	24.89 dBi

Controlled environment

Declared distance:	20 cm	20 cm
Average power density at declared distance:	0.003234 mW/cm ² 0.032339 W/m ²	0.003234 mW/cm ² 0.032339 W/m ²
MPE limit at prediction frequency:	5.000000 mW/cm ² 50.000000 W/m ²	3.163609 mW/cm ² 31.636086 W/m ²
Minimum calculated prediction distance for compliance:	20 cm	20 cm
Margin of Compliance:	31.89 dB	29.90 dB
with Maximum permitted antenna gain:	34.59 dBi	32.60 dBi

10. EUT technical information for multiple transmitter simultaneous operation

	Transmitter (BLE): 2400–2483.5 MHz	Transmitter 2 (Cellular lower): 698–900 MHz	Transmitter 2(Cellular upper): 1710–2200 MHz
Prediction frequency	2402 MHz	787 MHz	1780 MHz
Antenna gain	2.7 dBi	1.9 dBi	4.0 dBi
Number of antennas	1	1	1
Maximum transmitter power	9.41 dBm	23.23 dBm	22.94 dBm
Declared separation distance	20 cm	20 cm	20 cm
Duty cycle	100%	100%	100%

11. Verdict

The calculated Total Exposure Ratio (TER) is less than 1.0, indicating that the combined RF exposure from simultaneous transmission does not exceed regulatory limits. Therefore, the product **COMPLIES** with FCC and ISED RF exposure requirements for simultaneous multi-transmitter operation.

12. MPE calculation for simultaneous operation

	BLE Transmitter	Cell (low) Transmitter	Cell (high) Transmitter
Fundamental transmit (prediction) frequency:	2402 MHz	787 MHz	1780 MHz
Maximum measured conducted peak output power:	9.41 dBm	23.23 dBm	22.94 dBm
Cable and/or jumper loss:	0 dB	0 dB	0 dB
Maximum peak power at antenna input terminal:	9.41 dBm	23.23 dBm	22.94 dBm
Duty cycle:	100 %	100 %	100 %
Maximum calculated average power at antenna input terminal:	8.73 mW	210.38 mW	196.79 mW
Single Antenna gain (typical):	2.7 dBi	1.9 dBi	4 dBi
Number of antennae:	1	1	1
Total system gain:	2.70 dBi	1.90 dBi	4.00 dBi

	FCC calculations	ISED calculations	FCC calculations	ISED calculations	FCC calculations	ISED calculations
Uncontrolled environment						
Declared distance:	20 cm	20 cm	20 cm	20 cm	20 cm	20 cm
Average power density at declared distance:	0.003234 mW/cm ² 0.032339 W/m ²	0.003234 mW/cm ² 0.032339 W/m ²	0.064823 mW/cm ² 0.648232 W/m ²	0.064823 mW/cm ² 0.648232 W/m ²	0.098340 mW/cm ² 0.983400 W/m ²	0.098340 mW/cm ² 0.983400 W/m ²
MPE limit at prediction frequency:	1.000000 mW/cm ² 10.000000 W/m ²	0.535080 mW/cm ² 5.350805 W/m ²	0.524667 mW/cm ² 5.246667 W/m ²	0.249600 mW/cm ² 2.496000 W/m ²	1.000000 mW/cm ² 10.000000 W/m ²	0.435986 mW/cm ² 4.359860 W/m ²
Minimum calculated prediction distance for compliance:	20 cm	20 cm	20 cm	20 cm	20 cm	20 cm
Margin of Compliance:	24.90 dB	22.19 dB	9.08 dB	5.86 dB	10.07 dB	6.47 dB
with Maximum permitted antenna gain:	27.60 dBi	24.89 dBi	10.98 dBi	7.76 dBi	14.07 dBi	10.47 dBi
Individual transmitter exposure ratio (average density to MPE limit):	0.003234	0.006044	0.123551	0.259708	0.098340	0.225558
Total exposure ratio for FCC:	0.225125 <1					
Total exposure ratio for ISED:	0.491310 <1					
Total RF value for ISED listing:	1.663971 W/m ²					
Controlled environment						
Declared distance:	20 cm	20 cm	20 cm	20 cm	20 cm	20 cm
Average power density at declared distance:	0.003234 mW/cm ² 0.032339 W/m ²	0.003234 mW/cm ² 0.032339 W/m ²	0.064823 mW/cm ² 0.648232 W/m ²	0.064823 mW/cm ² 0.648232 W/m ²	0.098340 mW/cm ² 0.983400 W/m ²	0.098340 mW/cm ² 0.983400 W/m ²
MPE limit at prediction frequency:	5.000000 mW/cm ² 50.000000 W/m ²	3.163609 mW/cm ² 31.636086 W/m ²	2.623333 mW/cm ² 26.233333 W/m ²	1.810855 mW/cm ² 18.108547 W/m ²	5.000000 mW/cm ² 50.000000 W/m ²	2.723367 mW/cm ² 27.233675 W/m ²
Minimum calculated prediction distance for compliance:	20 cm	20 cm	20 cm	20 cm	20 cm	20 cm
Margin of Compliance:	31.89 dB	29.90 dB	16.07 dB	14.46 dB	17.06 dB	14.42 dB
with Maximum permitted antenna gain:	34.59 dBi	32.60 dBi	17.97 dBi	16.36 dBi	21.06 dBi	18.42 dBi
Individual transmitter exposure ratio (average density to MPE limit):	0.000647	0.001022	0.024710	0.035797	0.019668	0.036110
Total exposure ratio for FCC:	0.045025 <1					
Total exposure ratio for ISED:	0.072929 <1					
Total RF value for ISED listing:	1.663971 W/m ²					

End of the test report