



Choose Scandinavian trust

RADIO TEST REPORT – APFWL

Report ID:

REP032377

Project ID:

PRJ0053969

Type of assessment:

MPE Calculation report

Manufacturer:

ORBCOMM LICENCE Corp. (ORBCOMM Inc.)

Hardware Version Identification Number (HVIN):

CT3600

Product Marketing Name (PMN):

CT 3600

FCC identifier:

FCC ID: XGS-CT3600

ISED certification number:

IC: 11881A-CT3600

Contains FCC identifier:

FCC ID: XMR202212EG21GL

Contains ISED certification number:

IC: 10224A-2022EG21GL

Specification:

- ◆ FCC 47 CFR Part 1 Subpart I, §§1.1307, 1.1310
- ◆ FCC 47 CFR Part 2 Subpart J, §2.1091
- ◆ FCC KDB 447498 D01 General RF Exposure Guidance v06
- ◆ ISED Canada RSS-102 Issue 5 Amendment 1, (February 2021)

RSS-102 Annex B - Declaration of RF Exposure Compliance

ATTESTATION: I attest that the information provided in Annex A is correct; that the Technical Brief was prepared and the information contained therein is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed; and that the device meets the SAR and/or RF field strength limits of RSS-102.

Date of issue: **March 22, 2024**

Kevin Rose, EMC/RF Specialist

Prepared by

Signature

Nemko Canada Inc., a testing laboratory, is accredited by ANSI National Accreditation Board (ANAB).
The tests included in this report are within the scope of this accreditation.
The ANAB symbol is an official symbol of the ANSI National Accreditation Board, used under licence.

ANAB File Number: AT-3195 (Ottawa); AT-3193 (Pointe-Claire); AT-3194 (Cambridge)



Lab locations

| | | | | |
|----------------------|--|---------------|---|---|
| Company name | Nemko Canada Inc. | | | |
| Facilities | <i>Ottawa site:</i> | | <i>Montréal site:</i> | <i>Cambridge site:</i> |
| | 303 River Road Ottawa, Ontario Canada K1V 1H2 Tel: +1 613 737 9680 Fax: +1 613 737 9691 | | 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8 Tel: +1 514 694 2684 Fax: +1 514 694 3528 | 1-130 Saltsman Drive Cambridge, Ontario Canada N3E 0B2 Tel: +1 519 650 4811 |
| Test site identifier | Organization | Ottawa | Montreal | Cambridge |
| | FCC: | CA2040 | CA2041 | CA0101 |
| | ISED: | 2040A-4 | 2040G-5 | 24676 |
| Website | www.nemko.com | | | |

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
 This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1 Evaluation summary

1.1 MPE calculation for standalone transmission

References, definitions and limits

FCC §2.1091(d)

- (2) (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 1.1-1: Table 1 to §1.1310(e)(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) | Averaging time (minutes) |
|---|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (i) Limits for Occupational/Controlled Exposure | | | | |
| 0.3–3.0 | 614 | 1.63 | *(100) | ≤6 |
| 3.0–30 | 1842 / f | 4.89 / f | *(900 / f ²) | <6 |
| 30–300 | 61.4 | 0.163 | 1.0 | <6 |
| 300–1500 | | | f / 300 | <6 |
| 1500–100000 | | | 5 | <6 |
| (ii) 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 |
| 1500–100000 | | | 1.0 | <30 |

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

RSS-102, Section 4

For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada’s RF exposure guideline, Safety Code 6:

Table 1.1-2: Table 4 to RSS-102— RF Field Strength Limits

| Frequency range (MHz) | Electric field strength (V/m rms) | Magnetic field strength (A/m rms) | Power density (W/m ²) | Reference Period (minutes) |
|--|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------|
| Limits for Controlled Environment | | | | |
| 10–20 | 61.4 | 0.163 | 10 | 6 |
| 20–48 | 129.8 / f ^{0.25} | 0.3444 / f ^{0.25} | 44.72 / f ^{0.5} | 6 |
| 48–100 | 49.33 | 0.1309 | 6.455 | 6 |
| 100–6000 | 15.60 f ^{0.25} | 0.04138 f ^{0.25} | 0.6455 f ^{0.5} | 6 |
| 6000–15000 | 137 | 0.364 | 50 | 6 |
| Limits for Uncontrolled Environment | | | | |
| 10–20 | 27.46 | 0.0728 | 2 | 6 |
| 20–48 | 58.07 / f ^{0.25} | 0.1540 / f ^{0.25} | 8.944 / f ^{0.5} | 6 |
| 48–300 | 22.06 | 0.05852 | 1.291 | 6 |
| 300–6000 | 3.142 f ^{0.3417} | 0.008335 f ^{0.3417} | 0.02619 f ^{0.6834} | 6 |
| 6000–15000 | 61.4 | 0.163 | 10 | 6 |

Notes: f = frequency in MHz.

References, definitions and limits, continued

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

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)

EUT technical information

| | |
|--------------------------------|----------------------|
| Prediction frequency | 2402 MHz |
| Antenna type | Integrated antenna |
| Antenna gain | 3.7 dBi |
| Number of antennas | 1 |
| Maximum transmitter power | 6.25 dBm (conducted) |
| Prediction distance (declared) | 20 cm |

MPE calculation

| | | |
|--|--|--|
| Fundamental transmit (prediction) frequency: | 2402 MHz | |
| Maximum measured conducted peak output power: | 6.25 dBm | |
| Cable and/or jumper loss: | 0 dB | |
| Maximum peak power at antenna input terminal: | 6.25 dBm | |
| Duty cycle: | 100 % | |
| Maximum calculated average power at antenna input terminal: | 4.216965034 mW | |
| Single Antenna gain (typical): | 3.7 dBi | |
| Number of antennae: | 1 | |
| Total system gain: | 3.70 dBi | |
| MPE limit for <u>uncontrolled</u> exposure at prediction frequency: | FCC limit: 1.000000 mW/cm ² 10.000000 W/m ² | ISED limit: 0.535080 mW/cm ² 5.350805 W/m ² |
| MPE limit for <u>controlled</u> exposure 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 |
| Typical (declared) distance: | 20 cm | 20 cm |
| Average power density at prediction frequency: | 0.001967 mW/cm ² 0.019667 W/m ² | 0.001967 mW/cm ² 0.019667 W/m ² |
| Margin of Compliance for <u>uncontrolled</u> environment: | 27.06 dB | 24.35 dB |
| with Maximum permitted antenna gain: | 30.76 dBi | 28.05 dBi |
| Margin of Compliance for <u>controlled</u> environment: | 34.05 dB | 32.06 dB |
| with Maximum permitted antenna gain: | 44.00 dBi | 42.01 dBi |

1.2 MPE calculation for simultaneous transmission

References, definitions and limits

FCC §2.1091(d)

- (2) (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 1.1-3: Table 1 to §1.1310(e)(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) | Averaging time (minutes) |
|---|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (i) Limits for Occupational/Controlled Exposure | | | | |
| 0.3–3.0 | 614 | 1.63 | *(100) | ≤6 |
| 3.0–30 | 1842 / f | 4.89 / f | *(900 / f ²) | <6 |
| 30–300 | 61.4 | 0.163 | 1.0 | <6 |
| 300–1500 | | | f / 300 | <6 |
| 1500–100000 | | | 5 | <6 |
| (ii) 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 |
| 1500–100000 | | | 1.0 | <30 |

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

RSS-102, Section 4

For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada’s RF exposure guideline, Safety Code 6:

Table 1.1-4: Table 4 to RSS-102— RF Field Strength Limits

| Frequency range (MHz) | Electric field strength (V/m rms) | Magnetic field strength (A/m rms) | Power density (W/m ²) | Reference Period (minutes) |
|--|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------|
| Limits for Controlled Environment | | | | |
| 10–20 | 61.4 | 0.163 | 10 | 6 |
| 20–48 | 129.8 / f ^{0.25} | 0.3444 / f ^{0.25} | 44.72 / f ^{0.5} | 6 |
| 48–100 | 49.33 | 0.1309 | 6.455 | 6 |
| 100–6000 | 15.60 f ^{0.25} | 0.04138 f ^{0.25} | 0.6455 f ^{0.5} | 6 |
| 6000–15000 | 137 | 0.364 | 50 | 6 |
| Limits for Uncontrolled Environment | | | | |
| 10–20 | 27.46 | 0.0728 | 2 | 6 |
| 20–48 | 58.07 / f ^{0.25} | 0.1540 / f ^{0.25} | 8.944 / f ^{0.5} | 6 |
| 48–300 | 22.06 | 0.05852 | 1.291 | 6 |
| 300–6000 | 3.142 f ^{0.3417} | 0.008335 f ^{0.3417} | 0.02619 f ^{0.6834} | 6 |
| 6000–15000 | 61.4 | 0.163 | 10 | 6 |

Notes: f = frequency in MHz.

References, definitions and limits, continued

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

- 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)

EUT technical information

| | Transmitter 1 (BLE) | Transmitter 2 (Cellular) |
|-------------------------------------|---------------------|--------------------------|
| Prediction frequency | 2402 MHz | 777 MHz |
| Antenna gain | 3.7 dBi | 3.98 dBi |
| Maximum transmitter conducted power | 6.25 dBm | 25 dBm |
| Prediction distance (declared) | 20 cm | 20 cm |

MPE calculation

| | Transmitter 1 | | Transmitter 2 | |
|---|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Fundamental transmit (prediction) frequency: | 2402 MHz | | 777 MHz | |
| Maximum measured conducted peak output power: | 6.25 dBm | | 25 dBm | |
| Cable and/or jumper loss: | 0 dB | | 0 dB | |
| Maximum peak power at antenna input terminal: | 6.25 dBm | | 25 dBm | |
| Duty cycle: | 100 % | | 100 % | |
| Maximum calculated average power at antenna input terminal: | 4.216965 mW | | 316.22777 mW | |
| Single Antenna gain (typical): | 3.7 dBi | | 3.98 dBi | |
| Number of antennae: | 1 | | 1 | |
| Total system gain: | 3.70 dBi | | 3.98 dBi | |
| MPE limit for <u>uncontrolled</u> exposure at prediction frequency: | 0.53508 mW/cm ² | 1.00000 mW/cm ² | 0.24743 mW/cm ² | 0.51800 mW/cm ² |
| | 5.350805 W/m ² | 10.00000 W/m ² | 2.474282 W/m ² | 5.18000 W/m ² |
| MPE limit for <u>controlled</u> exposure at prediction frequency: | 3.16361 mW/cm ² | 5.00000 mW/cm ² | 1.79931 mW/cm ² | 2.59000 mW/cm ² |
| | 31.63609 W/m ² | 50.00000 W/m ² | 17.99313 W/m ² | 25.90000 W/m ² |
| Minimum calculated prediction distance for compliance: | 20 cm | 20 cm | 20 cm | 20 cm |
| Typical (declared) distance: | 20 cm | 20 cm | 20 cm | 20 cm |
| Average power density at prediction frequency: | 0.001967 mW/cm ² | 0.001967 mW/cm ² | 0.157301 mW/cm ² | 0.157301 mW/cm ² |
| | 0.019667 W/m ² | 0.019667 W/m ² | 1.573005 W/m ² | 1.573005 W/m ² |
| MPE compliance for simultaneous operation: | | | | |
| Margin of Compliance for <u>controlled</u> environment: | 32.06 dB | 34.05 dB | 10.58 dB | 12.17 dB |
| with Maximum permitted antenna gain: | 35.76 dBi | 37.75 dBi | 14.56 dBi | 16.15 dBi |
| Margin of Compliance for <u>uncontrolled</u> environment: | 24.35 dB | 27.06 dB | 1.97 dB | 5.18 dB |
| with Maximum permitted antenna gain: | 28.05 dBi | 27.06 dBi | 5.95 dBi | 5.18 dBi |
| Average power density to MPE limit ratio (<u>uncontrolled</u>): | 0.004 | 0.002 | 0.636 | 0.304 |
| Average power density to MPE limit ratio (<u>controlled</u>): | 0.001 | 0.000 | 0.087 | 0.061 |
| Total sum of ratios for FCC (uncontrolled): | 0.306 <1 | | 0.061 <1 | |
| Total sum of ratios for FCC (controlled): | 0.639 <1 | | 0.088 <1 | |
| Maximum allowed sum of ratios: | 1 | | | |
| Total RF value for ISED: | | | | 1.5927 W/m ² |

Verdict

The calculation is below the limit; therefore, the product is passing the RF Exposure requirements for the declared distance.

RSS-102, Annex A - RF technical brief cover sheet

| | |
|---|--|
| ISED certification number | IC: 11881A-CT3600 |
| Product marketing name (PMN) | CT 3600 |
| Hardware version identification number (HVIN) | CT3600 |
| Firmware version identification number (FVIN) | N/A |
| Host marketing name (HMN) | N/A |
| Applicant name | ORBCOMM LICENCE Corp. (ORBCOMM Inc.) |
| SAR/RF exposure test laboratory | 2040A-4 (3 m semi anechoic chamber - Ottawa) |
| Type of evaluation | <input type="checkbox"/> SAR Evaluation: Device Used in the Vicinity of the Human Head <input type="checkbox"/> SAR Evaluation: Body-Worn Device and Body-Supported Device <input type="checkbox"/> SAR Evaluation: Limb-Worn Device <input checked="" type="checkbox"/> RF Exposure Evaluation <input type="checkbox"/> Nerve Stimulation Exposure Evaluation (SPR-002) |
| SAR evaluation | Multiple transmitters: <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | Evaluated against exposure limits: <input type="checkbox"/> General Public Use <input type="checkbox"/> Controlled Use |
| | Duty cycle used in evaluation: N/A % |
| | Separation distance: N/A mm |
| | Standard used for evaluation: N/A |
| | SAR value: N/A W/kg <input type="checkbox"/> Measured <input type="checkbox"/> Computed <input type="checkbox"/> Calculated |
| Nerve Stimulation Evaluation (SPR-002) | Evaluated against exposure limits: <input type="checkbox"/> General Public Use <input type="checkbox"/> Controlled Use |
| | Measurement distance: N/A m |
| | Field Strength: N/A <input type="checkbox"/> V/m (electric) <input type="checkbox"/> A/m (magnetic) <input type="checkbox"/> Measured <input type="checkbox"/> Computed <input type="checkbox"/> Calculated |
| | Exposure condition: <input type="checkbox"/> Whole body/Torso/Head <input type="checkbox"/> Leg <input type="checkbox"/> Arm <input type="checkbox"/> Hand/Foot |
| RF exposure evaluation | Evaluated against exposure limits: <input checked="" type="checkbox"/> General Public Use <input checked="" type="checkbox"/> Controlled Use |
| | Duty cycle used in evaluation: 100 % |
| | Operational frequency: 2402 and 777 MHz |
| | Standard used for evaluation: Safety Code 6 |
| | Measurement distance: 0.20 m |
| | RF value: 1.5927 <input checked="" type="checkbox"/> W/m ² <input type="checkbox"/> V/m <input type="checkbox"/> A/m <input type="checkbox"/> Measured <input type="checkbox"/> Computed <input checked="" type="checkbox"/> Calculated |

End of the test report