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# Report On

RF Exposure Assessment of the
Quake Global Inc
1158-500X QLOCATE SBD-Iridium Satellite Modem

FCC ID: PB5QLoc
IC ID: 4650A-1158

**Document 75921853 Report 01 Issue 1** **October 2014**

Product Service

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**SECTION 1**

**REPORT SUMMARY**

RF Exposure Assessment of the
Quake Global Inc
1158-500X QLOCATE SBD-Iridium Satellite Modem

## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the Quake Global Inc 1158-500X QLOCATE SBD-Iridium Satellite Modem to the requirements of the applied test specifications.

| | |
|---|---|
| Objective | To perform RF Exposure Assessment to determine the Equipment Under Test's (EUT's) compliance of the applied rules. |
| Applicant | Quake Global Inc |
| Manufacturer | Quake Global Inc |
| Manufacturing Description | SBD-Iridium Satellite Modem |
| Model Number(s) | 1158-500X QLOCATE |
| Test Specification/Issue/Date | EN 62311:2008<br>FCC KDB 447498D01<br>RSS-102 Issue 4 March 2010<br>Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard: 2003 |
| Related Document(s) | Council Recommendation 1999/519/EC:1999<br>FCC CFR 47 Part 1: 2013<br>FCC CFR 47 Part 2: 2013<br>Health Canada's Safety Code 6<br>ARPANSA<br>ICNIRP 1998<br>National Council on Radiation Protection and Measurements (NRPC) - Report No. 86(1986)<br>50383:2010<br>IEEE Std C95.1-2005<br>Australian Standard 2772.2 – 1988 |

## 1.2 BRIEF SUMMARY OF RESULTS

### 1.2.1 General Public Exposure Levels

| Antenna Gain (Numeric) | Peak Output Power (mW) | Field | Calculated RF Exposure at 0.2 m (20cm) | General Public Exposure Limit | Application |
|---|---|---|---|---|---|
| 1.995 | 1600 | S | 6.35 W/m$^2$ | 8.080 W/m$^2$ | ICNIRP |
| | | S | 0.635 mW/cm$^2$ | 1 mW/cm$^2$ | FCC 47 CFR § 1.1310 |
| | | S | 6.35 W/m$^2$ | 10 W/m$^2$ | Canada's RF Safety Code 6 |
| | | S | 6.35 W/m$^2$ | 8.080 W/m$^2$ | ARPANSA |
| | | E | 48.93 V/m | 55.274 V/m | ICNIRP |
| | | E | 48.93 V/m | N/A V/m | FCC 47 CFR § 1.1310 |
| | | E | 48.93 V/m | 61.4 V/m | Canada's RF Safety Code 6 |
| | | E | 48.93 V/m | 55.073 V/m | ARPANSA |
| | | H | 0.13 A/m | 0.149 A/m | ICNIRP |
| | | H | 0.13 A/m | N/A A/m | FCC 47 CFR § 1.1310 |
| | | H | 0.13 A/m | 0.163 A/m | Canada's RF Safety Code 6 |
| | | H | 0.13 A/m | 0.146 A/m | ARPANSA |

The calculations have shown that they **meet** the General Public Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines, Health Canada's RF exposure guideline Safety Code 6 and the Australian ARPANSA limits at **20**cm, the point of investigation.

### 1.2.2 Occupational Exposure Levels

| Antenna Gain (Numeric) | Peak Output Power (mW) | Field | Calculated RF Exposure at 0.2 m (20cm) | Occupational Exposure Limit | Application |
|---|---|---|---|---|---|
| 1.995 | 1600 | S | 6.35 W/m$^2$ | 40.400 W/m$^2$ | ICNIRP |
| | | S | 0.635 mW/cm$^2$ | 5 mW/cm$^2$ | FCC 47 CFR § 1.1310 |
| | | S | 6.35 W/m$^2$ | 50 W/m$^2$ | Canada's RF Safety Code 6 |
| | | S | 6.35 W/m$^2$ | 40.400 W/m$^2$ | ARPANSA |
| | | E | 48.93 V/m | 120.599 V/m | ICNIRP |
| | | E | 48.93 V/m | N/A V/m | FCC 47 CFR § 1.1310 |
| | | E | 48.93 V/m | 137 V/m | Canada's RF Safety Code 6 |
| | | E | 48.93 V/m | 123.412 V/m | ARPANSA |
| | | H | 0.13 A/m | 0.322 A/m | ICNIRP |
| | | H | 0.13 A/m | N/A A/m | FCC 47 CFR § 1.1310 |
| | | H | 0.13 A/m | 0.364 A/m | Canada's RF Safety Code 6 |
| | | H | 0.13 A/m | 0.327 A/m | ARPANSA |

The calculations have shown that they **meet** the Occupational Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines, Health Canada's RF exposure guideline Safety Code 6 and the Australian ARPANSA limits at **20 cm,** the point of investigation.

## 1.3 PRODUCT INFORMATION

### 1.3.1 Attestation

The wireless device described within this report has been shown to be capable of compliance with the basic restrictions related to human exposure to electromagnetic fields for both General public and Occupational. The calculations shown in this report were made in accordance the procedures specified in the applied test specification(s).

### 1.3.2 Technical Description

The Equipment under test was a Quake Global Inc 1158-500X QLOCATE SBD-Iridium Satellite Modem. A full technical description can be found in the manufacturer's documentation.

All reported calculations were carried out on the relevant information supplied for the 1158-500X QLOCATE SBD-Iridium Satellite Modem to demonstrate compliance with the applied test specification(s) the sample assessed was found to comply with the requirements of the applied rules.

## 1.4 SUMMARY

The RF exposure assessment is based upon the following criteria:

The 1158-500X QLOCATE SBD-Iridium Satellite Modem operates in the frequency range of 1616 – 1626.5 MHz.

| | |
|---|---|
| Gain | 3 dBi |
| Power | 1.6 W |
| Distance | 0.2 m (20 cm) |
| Duty Cycle | 100% |

## SECTION 2

## TEST DETAILS

## 2.1 RATIONALE FOR ASSESSMENT OF THE RF EXPOSURE

The aim of the assessment report is to evaluate the compliance boundary for a set of given input power(s) according to the basic restrictions (directly or indirectly via compliance with reference levels) related to human exposure to radio frequency electromagnetic fields.
The chosen assessment method to establish the compliance boundary in the far-field region is the reference method as defined in EN50383:2010 Clause 5.2; E-field or H-field calculation. The method of calculation used is defined in EN50383:2010; Clause 8.2.2, 8.2.3 and 8.2.4.
The calculated values have been compared with limits provided in the ICNIRP guidelines.
Calculations can be made in three separate regions, based on distance from the antenna. These are called:

- far-field region,
- radiating near-field region,
- reactive near-field region.

The theory that defines these regions is given in EN50383:2010 Annex A.

**Far-field region**

As shown in EN50383 Annex A, the far-field calculations are accurate when the distance, r, from an antenna of length D to a point of investigation is greater than

$$r = \frac{2D^2}{\lambda}$$

Where, r is the distance from the antenna to the point of investigation.

**Radiating near-field region**

The radiating near-field region of an antenna of length D as shown in EN50383 Annex A, this region is defined by

$$\frac{\lambda}{4} < r > \frac{2D^2}{\lambda}$$

**Reactive near-field region**

The reactive near-field region of an antenna as shown in EN50383 Annex A, this region is defined by

$$r \leq \frac{\lambda}{4}$$

Where, r is the distance from the antenna to the point of investigation.
Recommend λ/4 as the boundary between the radiated near-field and reactive near-field for RF exposure compliance assessment.

## 2.2 DEFINED LIMITS

Normative Reference: ICNIRP Advice on Limiting Exposure to Electromagnetic Fields (0-300GHz). Table A4, Reference Levels for General Public Exposure to Time Varying Electric & Magnetic Fields. Vol 15 No.2. 2004. The defined limits are in accordance with 47 CFR § 1.1310 Radiofrequency radiation exposure limits.

Reference levels for general public exposure to time-varying electric and magnetic fields (unperturbed rms values)

At 1616 MHz

| | | |
|---|---|---|
| Power density ($W/m^2$) | = 8.080 | ICNIRP |
| Power density ($mW/cm^2$) | = 1 | FCC 47 CFR § 1.1310 |
| Power density ($W/m^2$) | = 10 | Canada's RF Safety Code 6 |
| Power density ($W/m^2$) | = 8.080 | Australian Radiation Protection Series Publication No. 3 |
| E-Field (Vm-1) | = 55.274 | ICNIRP |
| E-Field (Vm-1) | = N/A | FCC 47 CFR § 1.1310 |
| E-Field (Vm-1) | = 61.4 | Canada's RF Safety Code 6 |
| E-Field (Vm-1) | = 55.073 | Australian Radiation Protection Series Publication No. 3 |
| H-Field (Am-1) | = 0.149 | ICNIRP |
| H-Field (Am-1) | = N/A | FCC 47 CFR § 1.1310 |
| H-Field (Am-1) | = 0.163 | Canada's RF Safety Code 6 |
| H-Field (Am-1) | = 0.146 | Australian Radiation Protection Series Publication No. 3 |

Reference levels for occupational exposure to time-varying electric and magnetic fields (unperturbed rms values)

At 1616 MHz

| | | |
|---|---|---|
| Power density ($W/m^2$) | = 40.400 | ICNIRP |
| Power density ($mW/cm^2$) | = 5 | FCC 47 CFR § 1.1310 |
| Power density ($W/m^2$) | = 50 | Canada's RF Safety Code 6 |
| Power density ($W/m^2$) | = 40.400 | Australian Radiation Protection Series Publication No. 3 |
| E-Field (Vm-1) | = 120.599 | ICNIRP |
| E-Field (Vm-1) | = N/A | FCC 47 CFR § 1.1310 |
| E-Field (Vm-1) | = 137 | Canada's RF Safety Code 6 |
| E-Field (Vm-1) | = 123.412 | Australian Radiation Protection Series Publication No. 3 |
| H-Field (Am-1) | = 0.322 | ICNIRP |
| H-Field (Am-1) | = N/A | FCC 47 CFR § 1.1310 |
| H-Field (Am-1) | = 0.364 | Canada's RF Safety Code 6 |
| H-Field (Am-1) | = 0.327 | Australian Radiation Protection Series Publication No. 3 |

## 2.3 ESTABLISHING WAVELENGTH AND 1/4 WAVELENGTH

| Frequency (MHz) | $\lambda = \frac{3x10^8}{f}$ | | $\frac{\lambda}{4}$ | |
|---|---|---|---|---|
| | m | cm | m | cm |
| 1616 | 0.185643564356436 | 18.5643564356436 | 0.0464108910891089 | 4.64108910891089 |
| 1621 | 0.185070943861814 | 18.5070943861814 | 0.0462677359654534 | 4.62677359654534 |
| 1626.5 | 0.184445127574547 | 18.4445127574547 | 0.0461112818936366 | 4.61112818936366 |

## 2.4 FAR FIELD CALCULATIONS

The following calculations are based on: 3 dBi gain antenna

P = 1.6 Watts or 1600 milliwatts
G = 1.995 Numeric Gain
r = 20 centimetres or 0.2metres

The power flux:

$$S = \frac{PG_{(\theta,\phi)}}{4\pi r^2}$$

S = 6.35 W/m$^2$

S= 0.635 mW/cm$^2$

The electric field strength:

$$E = \frac{\sqrt{30PG}_{(\theta,\phi)}}{r}$$

E = 48.93 V/m

The magnetic field strength:

$$H = \frac{E}{\eta_o}$$

H = 0.13 A/m

The calculations meet the General Public Exposure Levels described in the ICNIRP Guidelines.
The calculations meet the General Public Exposure Levels described in the FCC 47CFR§1.1310.
The calculations meet the General Public Exposure Levels described in the Canada's RF Safety Code 6.
The calculations meet the General Public Exposure Levels described in the Australian Radiation Protection Series Publication No. 3

The calculations meet the Occupational Exposure Levels described in the ICNIRP Guidelines.
The calculations meet the Occupational Exposure Levels described in the FCC 47CFR§1.1310
The calculations meet the Occupational Exposure Levels described in the Canada's RF Safety Code 6
The calculations meet the Occupational Exposure Levels described in the Australian Radiation Protection Series Publication No. 3

## SECTION 3

## DISCLAIMERS AND COPYRIGHT

## 3.1 DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.