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# Report On

RF Exposure Assessment of the
SRT Marine Technology
em-trak B100 with Cobalt II Class B AIS Transponder (SOTDMA and CSTDMA)

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**SECTION 1**

**REPORT SUMMARY**

RF Exposure Assessment of the
SRT Marine Technology
em-trak B100 with Cobalt II Class B AIS Transponder (SOTDMA and CSTDMA)

## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the SRT Marine Technology em-trak B100 with Cobalt II Class B AIS Transponder (SOTDMA and CSTDMA) 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 | SRT Marine Technology |
| Manufacturer | SRT Marine Technology |
| Manufacturing Description | Class B AIS Transponder (SOTDMA and CSTDMA) |
| Model Number(s) | em-trak B100 with Cobalt II |
| Test Specification/Issue/Date | EN 62311:2008<br>CFR 47 Pt1.1310 (2016)<br>Health Canada Safety Code 6<br>ARPANSA Radiation Protection Series No.3 |

## 1.2 REGIONAL REQUIREMENTS

The table below shows the regional requirements that are referenced in this test report. A full list of the requirements is shown in Annex A.

| Report Reference | Regional Requirement |
|---|---|
| EU | EN 62311:2008 |
| FCC | CFR 47 Pt1.1310 (2016) |
| IC | Health Canada Safety Code 6 |
| AUS | ARPANSA Radiation Protection Series No.3 |

## 1.3 PRODUCT INFORMATION

### 1.3.1 Technical Description

The Equipment under test was a SRT Marine Technology em-trak B100 with Cobalt II Class B AIS Transponder (SOTDMA and CSTDMA). 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 em-trak B100 with Cobalt II Class B AIS Transponder (SOTDMA and CSTDMA) to demonstrate compliance with the applied test specification(s). The sample assessed was found to comply with the requirements of the applied rules.

### 1.3.2 Supported Features

The following radio access technologies and frequency bands are supported by the equipment under test.

| | |
|---|---|
| Radio Access Technology | AIS (SOTDMA) |
| | AIS (CSTDMA) |

| | |
|---|---|
| Frequency Band | 156.025 - 162.025 |

### 1.3.3 Antennas

The following antennas are supported by the equipment under test.

| No. | Model | Gain(dB) |
|---|---|---|
| 1 | AIS | 3 |

### 1.3.4 EUT Configurations

The EUT is a SRT Marine Technology em-trak B100 with Cobalt II Class B AIS transponder (SOTDMA / CSTDMA): when active the AIS transmission occur on 156.025 – 162.025 MHz as per the Manufacturers transmission schedule.

## 1.4 BRIEF SUMMARY OF RESULTS

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 with the procedures specified in the applied test specification(s).

| Configuration | Required Compliance Boundary (m) | |
|---|---|---|
| | Occupational | General Population |
| SOTDMA | 0.2 | 0.2 |
| CSTDMA | 0.2 | 0.2 |

**Table 1 – Compliance Boundary Results**

### 1.4.1 Configuration 1 - SOTDMA

| Regional Requirement | Calculated RF exposure level at compliance boundary of 0.2 m | | | | | |
|---|---|---|---|---|---|---|
| | S Field ($W/m^2$) | | E Field (V/m) | | H Field (A/m) | |
| | Result | Limit | Result | Limit | Result | Limit |
| EU | 0.1985 | 10.0000 | 8.6503 | 61.0000 | 0.0229 | 0.1620 |
| FCC* | 0.0198 | 1.0000 | 8.6503 | 61.4000 | 0.0229 | 0.1630 |
| IC | 0.1985 | 8.0629 | 8.6503 | 55.1345 | 0.0229 | 0.1462 |
| AUS | 0.1985 | 10.0000 | 8.6503 | 61.4000 | 0.0229 | 0.1630 |

* Requirement and Result in $mW/cm^2$

**Table 2 – Occupational Results**

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310 (2016), Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.2 m.

| Regional Requirement | Calculated RF exposure level at compliance boundary of 0.2 m | | | | | |
|---|---|---|---|---|---|---|
| | S Field ($W/m^2$) | | E Field (V/m) | | H Field (A/m) | |
| | Result | Limit | Result | Limit | Result | Limit |
| EU | 0.1985 | 2.0000 | 8.6503 | 28.0000 | 0.0229 | 0.0730 |
| FCC* | 0.0198 | 0.2000 | 8.6503 | 27.5000 | 0.0229 | 0.0730 |
| IC | 0.1985 | 1.2910 | 8.6503 | 22.0600 | 0.0229 | 0.0585 |
| AUS | 0.1985 | 2.0000 | 8.6503 | 27.4000 | 0.0229 | 0.0729 |

* Requirement and Result in $mW/cm^2$

**Table 3 – General Population Results**

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310 (2016), Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.2 m.

### 1.4.2 Configuration 2 - CSTDMA

| Regional Requirement | Calculated RF exposure level at compliance boundary of 0.2 m | | | | | |
|---|---|---|---|---|---|---|
| | S Field ($W/m^2$) | | E Field (V/m) | | H Field (A/m) | |
| | Result | Limit | Result | Limit | Result | Limit |
| EU | 0.0794 | 10.0000 | 5.4705 | 61.0000 | 0.0145 | 0.1620 |
| FCC* | 0.0079 | 1.0000 | 5.4705 | 61.4000 | 0.0145 | 0.1630 |
| IC | 0.0794 | 8.0629 | 5.4705 | 55.1345 | 0.0145 | 0.1462 |
| AUS | 0.0794 | 10.0000 | 5.4705 | 61.4000 | 0.0145 | 0.1630 |

* Requirement and Result in $mW/cm^2$

**Table 4 – Occupational Results**

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310 (2016), Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.2 m.

| Regional Requirement | Calculated RF exposure level at compliance boundary of 0.2 m | | | | | |
|---|---|---|---|---|---|---|
| | S Field ($W/m^2$) | | E Field (V/m) | | H Field (A/m) | |
| | Result | Limit | Result | Limit | Result | Limit |
| EU | 0.0794 | 2.0000 | 5.4705 | 28.0000 | 0.0145 | 0.0730 |
| FCC* | 0.0079 | 0.2000 | 5.4705 | 27.5000 | 0.0145 | 0.0730 |
| IC | 0.0794 | 1.2910 | 5.4705 | 22.0600 | 0.0145 | 0.0585 |
| AUS | 0.0794 | 2.0000 | 5.4705 | 27.4000 | 0.0145 | 0.0729 |

* Requirement and Result in $mW/cm^2$

**Table 5 – General Population Results**

The calculations show that the EUT complies with the occupational exposure levels described in the EN 62311:2008, CFR 47 Pt1.1310 (2016), Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.2 m.

## 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 the relevant specifications.

The RF exposure assessment is based upon the following criteria:

The em-trak B100 with Cobalt II Class B AIS trasnponder operates with the following transmitters active on the antenna ports shown in Section 1.3.3. For each transmitter, the Radio Access Technology (RAT), EIRP inclusive of antenna gain and duty cycle, gain of the antenna and lowest frequency of operation are shown as they contribute to the calculation of S Field, E field and H field values according to the following formulas.

The power flux (S Field):

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

The electric field strength (E Field):

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

The magnetic field strength (H Field):

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

Where:

P = Average Power (W)
G = Antenna Gain (dBi)
r = Distance (cm) or (m)
$\eta_o$ = 377

## 2.2 TEST RESULT DETAILS

The frequencies shown in the tables below have been chosen based on the lowest possible frequency that the EUT can transmit.

### 2.2.1 Configuration 1 - SOTDMA

| Antenna Port | Tx No. | Ant No. | RAT | EIRP (W) | Duty Cycle (%) | Gain (dBi) | Frequency (MHz) | RF Exposure Level at compliance boundary of 0.2 m | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | S Field ($W/m^2$) | E Field (V/m) | H Field (A/m) |
| 1 | 1 | 1 | AIS (SOTDMA) | 0.100 | 1 | 3 | 156.025 | 0.1985 | 8.6503 | 0.0229 |

**Table 6 – Occupational Transmitter Summary**

| Antenna Port | Tx No. | Ant No. | RAT | EIRP (W) | Duty Cycle (%) | Gain (dBi) | Frequency (MHz) | RF Exposure Level at compliance boundary of 0.2 m | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | S Field ($W/m^2$) | E Field (V/m) | H Field (A/m) |
| 1 | 1 | 1 | AIS (SOTDMA) | 0.100 | 1 | 3 | 156.025 | 0.1985 | 8.6503 | 0.0229 |

**Table 7 – General Population Transmitter Summary**

### 2.2.2 Configuration 2 - CSTDMA

| Antenna Port | Tx No. | Ant No. | RAT | EIRP (W) | Duty Cycle (%) | Gain (dBi) | Frequency (MHz) | RF Exposure Level at compliance boundary of 0.2 m | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | S Field ($W/m^2$) | E Field (V/m) | H Field (A/m) |
| 1 | 1 | 1 | AIS (CSTDMA) | 0.040 | 1 | 3 | 156.025 | 0.0794 | 5.4705 | 0.0145 |

**Table 8 – Occupational Transmitter Summary**

| Antenna Port | Tx No. | Ant No. | RAT | EIRP (W) | Duty Cycle (%) | Gain (dBi) | Frequency (MHz) | RF Exposure Level at compliance boundary of 0.2 m | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | S Field ($W/m^2$) | E Field (V/m) | H Field (A/m) |
| 1 | 1 | 1 | AIS (CSTDMA) | 0.040 | 1 | 3 | 156.025 | 0.0794 | 5.4705 | 0.0145 |

**Table 9 – General Population Transmitter Summary**

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## SECTION 3

## DISCLAIMERS AND COPYRIGHT

## 3.1 DISCLAIMERS AND COPYRIGHT

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# ANNEX A

# REGIONAL REQUIREMENTS

| Frequency Range (MHz) | Power Density ($W/m^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 0.065 - 1 | - | 610 | 1.6/f |
| 1 - 10 | - | 610/f | 1.6/f |
| 10 - 400 | 10 | 61 | 0.162 |
| 400 - 2000 | f/40 | 3*f^0.5 | 0.008*f^0.5 |
| 2000 - 300000 | 50 | 137 | 0.36 |

**Table A.1 – EN 62311:2008 Occupational Limits**

| Frequency Range (MHz) | Power Density ($W/m^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 0.003 - 0.15 | - | 87 | 5 |
| 0.15 - 1 | - | 87 | 0.73/f |
| 1 - 10 | - | 87/f^0.5 | 0.73/f |
| 10 - 400 | 2 | 28 | 0.073 |
| 400 - 2000 | f/200 | 1.375*f^0.5 | 0.0037*f^0.5 |
| 2000 - 300000 | 10 | 61 | 0.16 |

**Table A.2 – EN 62311:2008 General Population Limits**

| Frequency Range (MHz) | Power Density ($mW/cm^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 0 - 0.3 | - | - | - |
| 0.3 - 3 | 100 | 614 | 1.63 |
| 3 - 30 | 900/f^2 | 1842/f | 4.89/f |
| 30 - 300 | 1 | 61.4 | 0.163 |
| 300 - 1500 | f/300 | - | - |
| 1500 - 100000 | 5 | - | - |

**Table A.3 – CFR 47 Pt1.1310 (2016) Occupational Limits**

| Frequency Range (MHz) | Power Density ($mW/cm^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 0 - 0.3 | - | - | - |
| 0.3 - 3 | 100 | 614 | 1.63 |
| 3 - 30 | 180/f^2 | 824/f | 2.19/f |
| 30 - 300 | 0.2 | 27.5 | 0.073 |
| 300 - 1500 | f/1500 | - | - |
| 1500 - 100000 | 1 | - | - |

**Table A.4 – CFR 47 Pt1.1310 (2016) General Population Limits**

| Frequency Range (MHz) | Power Density (W/m$^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 10 - 20 | 10 | 61.4 | 0.163 |
| 20 - 48 | 44.72/f^0.5 | 129.8/f^0.25 | 0.3444/f^0.25 |
| 48 - 100 | 6.455 | 49.33 | 0.1309 |
| 100 - 6000 | 0.6455*f^0.5 | 15.60*f^0.25 | 0.04138*f^0.25 |
| 6000 - 150000 | 50 | 137 | 0.364 |

**Table A.5 – Health Canada Safety Code 6 Occupational Limits**

| Frequency Range (MHz) | Power Density (W/m$^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 10 - 20 | 2 | 27.46 | 0.0728 |
| 20 - 48 | 8.944/f^0.5 | 58.07/f^0.25 | 0.1540/f^0.25 |
| 48 - 300 | 1.291 | 22.06 | 0.05852 |
| 300 - 6000 | 0.02619*f^0.6834 | 3.142*f^0.3417 | 0.008335*f^0.3417 |
| 6000 - 15000 | 10 | 61.4 | 0.163 |

**Table A.6 – Health Canada Safety Code 6 General Population Limits**

| Frequency Range (MHz) | Power Density (W/m$^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 0.1 - 1 | - | 614 | 1.63/f |
| 1 - 10 | 1000/f^2 | 614 | 1.63/f |
| 10 - 400 | 10 | 61.4 | 0.163 |
| 400 - 2000 | f/40 | 3.07*f^0.5 | 0.00814*f^0.5 |
| 2000 - 300000 | 50 | 137 | 0.364 |

**Table A.7 – ARPANSA Radiation Protection Series No.3 Occupational Limits**

| Frequency Range (MHz) | Power Density (W/m$^2$) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|---|---|---|---|
| 0.1 - 0.15 | - | 86.8 | 4.86 |
| 0.15 - 1 | - | 86.8 | 0.729/f |
| 1 - 10 | - | 86.8/f^0.5 | 0.729/f |
| 10 - 400 | 2 | 27.4 | 0.0729 |
| 400 - 2000 | f/200 | 1.37*f^0.5 | 0.00364*f^0.5 |
| 2000 - 300000 | 10 | 61.4 | 0.163 |

**Table A.8 – ARPANSA Radiation Protection Series No.3 General Population Limits**