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# Report On

RF Exposure Assessment of the SRT Marine Technology Ltd CS100 AIS Coast station

FCC ID: UYW-4230002 IC: 7075A-4230002

Document 75928171 Report 08 Issue 1

November 2014



**Product Service** 

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**REPORT ON** 

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# **SECTION 1**

# **REPORT SUMMARY**

RF Exposure Assessment of the SRT Marine Technology Ltd CS100 AIS Coast station



# 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the SRT Marine Technology Ltd CS100 AIS Coast station 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 Ltd  |
| Manufacturer                  | SRT Marine Technology Ltd  |
| Manufacturing Description     | AIS Coast station  |
| Model Number(s)               | CS100  |
| Test Specification/Issue/Date | Council Recommendation 1999/519/EC<br>CFR 47 Pt1.1310<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               | Council Recommendation 1999/519/EC       |
| FCC              | CFR 47 Pt1.1310                          |
| 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 Ltd CS100 AIS Coast station. A full technical description can be found in the manufacturer's documentation.

The CS100 AIS Coast station uses the following Wi-Fi module.

FCC:Identifier- XR2WIZ630WI Part number: WizFi630 Manufacturer: WIZNET.Co, Ltd

All reported calculations were carried out on the relevant information supplied for the CS100 AIS Coast station 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               |
|-------------------------|-------------------|
|                         | WLAN              |
| Frequency Band          | 156.025 - 162.025 |
|                         | 2412.0 - 2472.0   |

#### 1.3.3 Antennas

The following antennas are supported by the equipment under test.

| No. | Model | Gain (dBi) |
|-----|-------|------------|
| 1   | W1030 | 2.0        |



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

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

Table 1 – Compliance Boundary Results



The tables below show the summed fractional results from the antenna port summary in section 2.2. Where the result is less than one, the EUT is deemded compliant.

| Regional    | Calculated RF expo | Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit |         |  |  |  |  |  |
|-------------|--------------------|---|---------|--|--|--|--|--|
| Requirement | S Field            | E Field   | H Field |  |  |  |  |  |
| EU          | 0.0255             | 0.1835  | 0.1834  |  |  |  |  |  |
| FCC         | 0.0255             | 0.1577  | 0.1576  |  |  |  |  |  |
| IC          | 0.0255             | 0.1862  | 0.1823  |  |  |  |  |  |
| AUS         | 0.0255             | 0.1825  | 0.1823  |  |  |  |  |  |

#### Table 2 – Occupational Results

The calculations show that the EUT complies with the occupational exposure levels described in the Council Recommendation 1999/519/EC, CFR 47 Pt1.1310, Health Canada Safety Code 6 and ARPANSA Radiation Protection Series No.3 at the point of investigation, 0.2 m.

| Regional    | Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit |         |         |  |  |  |  |
|-------------|---|---------|---------|--|--|--|--|
| Requirement | S Field   | E Field | H Field |  |  |  |  |
| EU          | 0.1274  | 0.4143  | 0.4174  |  |  |  |  |
| FCC         | 0.1274  | 0.3521  | 0.3519  |  |  |  |  |
| IC          | 0.1274  | 0.4012  | 0.4071  |  |  |  |  |
| AUS         | 0.1274  | 0.4087  | 0.4076  |  |  |  |  |

#### Table 3 – General Population Results

The calculations show that the EUT complies with the general population exposure levels described in the Council Recommendation 1999/519/EC, CFR 47 Pt1.1310, 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 CS100 AIS Coast station operates with the following transmitters active on the antenna ports shown in table 1. 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):

$$H=\frac{E}{\eta_{\circ}}$$

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.

| Antenna<br>Port | Tx<br>No. | Ant<br>No. | RAT  | EIRP<br>(W) | Duty Cycle<br>(%) | Gain<br>(dBi) | Frequency<br>(MHz) | RF Exposure Level at compliance boundary of 0.2 m |         |         |
|-----------------|-----------|------------|------|-------------|-------------------|---------------|--------------------|---|---------|---------|
|                 |           |            |      |             |                   |               |                    | S Field   | E Field | H Field |
| 1               | 1         | -          | AIS  | 0.125       | 1                 | -             | 156.025            | 0.2487  | 9.6835  | 0.0257  |
| 2               | 1         | 1          | WLAN | 0.015       | 100               | 2.0           | 2412               | 0.0306  | 3.3965  | 0.0090  |

#### Table 4 – Occupational Transmitter Summary

| Antenna<br>Port | Tx<br>No. | Ant<br>No. | RAT  | EIRP<br>(W) | Duty Cycle<br>(%) | Gain<br>(dBi) | Frequency<br>(MHz) | RF Exposure<br>boundary of | RF Exposure Level at compliance boundary of 0.2 m |         |
|-----------------|-----------|------------|------|-------------|-------------------|---------------|--------------------|----------------------------|---|---------|
|                 |           |            |      |             |                   |               |                    | S Field                    | E Field   | H Field |
| 1               | 1         | -          | AIS  | 0.125       | 1                 | -             | 156.025            | 0.2487                     | 9.6835  | 0.0257  |
| 2               | 1         | 1          | WLAN | 0.015       | 100               | 2.0           | 2412               | 0.0306                     | 3.3965  | 0.0090  |

#### Table 5 – General Population Transmitter Summary

The following tables show the regional requirements for the frequencies used in the RF exposure calculation. A full list of the requirements is shown in Annex A.

| Frequency (MHz) | Occupational Limit          |               |               | General Population Limit    |               |               |
|-----------------|-----------------------------|---------------|---------------|-----------------------------|---------------|---------------|
|                 | S Field (W/m <sup>2</sup> ) | E Field (V/m) | H Field (A/m) | S Field (W/m <sup>2</sup> ) | E Field (V/m) | H Field (A/m) |
| 156.025         | 10.0000                     | 61.0000       | 0.1620        | 2.0000                      | 27.0000       | 0.0710        |
| 2412            | 50.0000                     | 137.0000      | 0.3630        | 10.0000                     | 61.0000       | 0.1620        |

#### Table 6 – Council Recommendation 1999/519/EC Limits

| Frequency (MHz) | Occupational Limit            |               |               | General Population Limit      |               |               |
|-----------------|-------------------------------|---------------|---------------|-------------------------------|---------------|---------------|
|                 | S Field (mW/cm <sup>2</sup> ) | E Field (V/m) | H Field (A/m) | S Field (mW/cm <sup>2</sup> ) | E Field (V/m) | H Field (A/m) |
| 156.025         | 1.0000                        | 61.4000       | 0.1630        | 0.2000                        | 27.5000       | 0.0730        |
| 2412            | 5.0000                        | -             | -             | 1.0000                        | -             | -             |

## Table 7 – CFR 47 Pt1.1310 Limits

| Frequency (MHz) | Occupational Limit          |               |               | General Population Limit    |               |               |
|-----------------|-----------------------------|---------------|---------------|-----------------------------|---------------|---------------|
|                 | S Field (W/m <sup>2</sup> ) | E Field (V/m) | H Field (A/m) | S Field (W/m <sup>2</sup> ) | E Field (V/m) | H Field (A/m) |
| 156.025         | 10.0000                     | 60.0000       | 0.1630        | 2.0000                      | 28.0000       | 0.0730        |
| 2412            | 50.0000                     | 137.0000      | 0.3640        | 10.0000                     | 61.4000       | 0.1630        |

## Table 8 – Health Canada Safety Code 6 Limits

| Frequency (MHz) | Occupational Limit          |               |               | General Population Limit    |               |               |
|-----------------|-----------------------------|---------------|---------------|-----------------------------|---------------|---------------|
|                 | S Field (W/m <sup>2</sup> ) | E Field (V/m) | H Field (A/m) | S Field (W/m <sup>2</sup> ) | E Field (V/m) | H Field (A/m) |
| 156.025         | 10.0000                     | 61.4000       | 0.1630        | 2.0000                      | 27.4000       | 0.0729        |
| 2412            | 50.0000                     | 137.0000      | 0.3640        | 10.0000                     | 61.4000       | 0.1630        |

## Table 9 – ARPANSA Radiation Protection Series No.3 Limits



As the frequency of operation for each transmitter is not the same, in order to evaluate compliance with the limit which is dependent on frequency, the calculated RF exposure fields are divided by the limit to get a fractional exposure value. Any values less than one are compliant with the limit. Table 2 shows a summary of each antenna port and the summation of the fractional RF exposure results of each transmitter.

| Antenna<br>Port | EIRP<br>(W) | Regional<br>Requirement | Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit |         |         |
|-----------------|-------------|-------------------------|---|---------|---------|
|                 |             |                         | S Field   | E Field | H Field |
| 1               | 0.125       | EU                      | 0.0249  | 0.1587  | 0.1586  |
|                 |             | FCC                     | 0.0249  | 0.1577  | 0.1576  |
|                 |             | IC                      | 0.0249  | 0.1614  | 0.1576  |
|                 |             | AUS                     | 0.0249  | 0.1577  | 0.1576  |
| 2               | 0.015       | EU                      | 0.0006  | 0.0248  | 0.0248  |
|                 |             | FCC                     | 0.0006  | N/A     | N/A     |
|                 |             | IC                      | 0.0006  | 0.0248  | 0.0248  |
|                 |             | AUS                     | 0.0006  | 0.0248  | 0.0248  |

#### Table 10 – Occupational Antenna Port Summary

| Antenna<br>Port | EIRP<br>(W) | Regional<br>Requirement | Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit |         |         |
|-----------------|-------------|-------------------------|---|---------|---------|
|                 |             |                         | S Field   | E Field | H Field |
| 1               | 0.125       | EU                      | 0.1244  | 0.3586  | 0.3618  |
|                 |             | FCC                     | 0.1244  | 0.3521  | 0.3519  |
|                 |             | IC                      | 0.1244  | 0.3458  | 0.3519  |
|                 |             | AUS                     | 0.1244  | 0.3534  | 0.3523  |
| 2               | 0.015       | EU                      | 0.0031  | 0.0557  | 0.0556  |
|                 |             | FCC                     | 0.0031  | N/A     | N/A     |
|                 |             | IC                      | 0.0031  | 0.0553  | 0.0553  |
|                 |             | AUS                     | 0.0031  | 0.0553  | 0.0553  |

Table 11 – General Population Antenna Port Summary



# **SECTION 3**

# DISCLAIMERS AND COPYRIGHT



# 3.1 DISCLAIMERS AND COPYRIGHT

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

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# ANNEX A

# **REGIONAL REQUIREMENTS**



| Frequency Range (MHz) | Power Density (W/m <sup>2</sup> ) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|-----------------------|-----------------------------------|-------------------------------|-------------------------------|
| 10 - 400              | 10                                | 61                            | 0.162                         |
| 40 - 2000             | f/40                              | 3*f^0.5                       | 0.00796*f^0.5                 |
| 2000 - 300000         | 50                                | 137                           | 0.363                         |

#### Table A.1 – Council Recommendation 1999/519/EC Occupational Limits

| Frequency Range (MHz) | Power Density (W/m <sup>2</sup> ) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|-----------------------|-----------------------------------|-------------------------------|-------------------------------|
| 10 - 400              | 2                                 | 27                            | 0.071                         |
| 40 - 2000             | f/200                             | 1.375*f^0.5                   | 0.00364*f^0.5                 |
| 2000 - 300000         | 10                                | 61                            | 0.162                         |

#### Table A.2 – Council Recommendation 1999/519/EC General Population Limits

| Frequency Range (MHz) | S Field (mW/cm <sup>2</sup> ) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------|
| 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 Occupational Limits

| Frequency Range (MHz) | S Field (mW/cm <sup>2</sup> ) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------|
| 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 General Population Limits

| Frequency Range (MHz) | Power Density (W/m <sup>2</sup> ) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|-----------------------|-----------------------------------|-------------------------------|-------------------------------|
| 30 - 300              | 10                                | 60                            | 0.163                         |
| 300 - 1500            | f/30                              | 3.54*f^0.5                    | 0.0094*f^0.5                  |
| 1500 - 150000         | 50                                | 137                           | 0.364                         |

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

| Frequency Range (MHz) | Power Density (W/m <sup>2</sup> ) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) |
|-----------------------|-----------------------------------|-------------------------------|-------------------------------|
| 30 - 300              | 2                                 | 28                            | 0.073                         |
| 300 - 1500            | f/150                             | 1.585*f^0.5                   | 0.0042*f^0.5                  |
| 1500 - 150000         | 10                                | 61.4                          | 0.163                         |

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

| Frequency Range (MHz) | Power Density (W/m <sup>2</sup> ) | 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 <sup>2</sup> ) | 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