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Report On

RF Exposure Assessment of the
SRT Marine Technology Ltd
Apollo AIS Class A Transceiver

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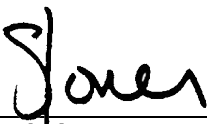
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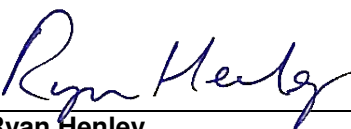
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SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
SRT Marine Technology Ltd
Apollo AIS Class A Transceiver



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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 Apollo AIS Class A Transceiver 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 Class A Transceiver
Model Number(s)	Apollo
Test Specification/Issue/Date	Council Recommendation 1999/519/EC CFR 47 Pt1.1310 Health Canada Safety Code 6 ARPANSA Radiation Protection Series No.3



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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



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1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment under test was a SRT Marine Technology Ltd Apollo AIS Class A Transeiver. 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 Apollo AIS Class A Transeiver 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	EXT	3
2	WLAN antenna	0.5



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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



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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 deemed compliant.

Regional Requirement	Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.0522	0.2750	0.2748
FCC	0.0522	0.2228	0.2226
IC	0.0522	0.2788	0.2733
AUS	0.0522	0.2736	0.2733

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 Requirement	Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit		
	S Field	E Field	H Field
EU	0.2610	0.6207	0.6250
FCC	0.2610	0.4974	0.4970
IC	0.2610	0.6018	0.6103
AUS	0.2610	0.6125	0.6109

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.



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SECTION 2

TEST DETAILS



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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 Apollo AIS Class A Transceiver 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):

$$H = \frac{E}{\eta_0}$$

Where:

P = Average Power (W)

G = Antenna Gain (dBi)

r = Distance (cm) or (m)

$\eta_0 = 377$



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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 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	E Field	H Field
1	1	1	AIS	0.249	1	3	156.025	0.4963	13.6783	0.0363
2	1	2	WLAN	0.065	100	0.5	2412	0.1284	6.9587	0.0185

Table 4 – 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	E Field	H Field
1	1	1	AIS	0.249	1	3	156.025	0.4963	13.6783	0.0363
2	1	2	WLAN	0.065	100	0.5	2412	0.1284	6.9587	0.0185

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 ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	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 ²)	E Field (V/m)	H Field (A/m)	S Field (mW/cm ²)	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 ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	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 ²)	E Field (V/m)	H Field (A/m)	S Field (W/m ²)	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



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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 Port	EIRP (W)	Regional 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	0.249	EU	0.0496	0.2242	0.2240
		FCC	0.0496	0.2228	0.2226
		IC	0.0496	0.2280	0.2226
		AUS	0.0496	0.2228	0.2226
2	0.065	EU	0.0026	0.0508	0.0508
		FCC	0.0026	N/A	N/A
		IC	0.0026	0.0508	0.0507
		AUS	0.0026	0.0508	0.0507

Table 10 – Occupational Antenna Port Summary

Antenna Port	EIRP (W)	Regional 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	0.249	EU	0.2481	0.5066	0.5110
		FCC	0.2481	0.4974	0.4970
		IC	0.2481	0.4885	0.4970
		AUS	0.2481	0.4992	0.4977
2	0.065	EU	0.0128	0.1141	0.1139
		FCC	0.0128	N/A	N/A
		IC	0.0128	0.1133	0.1132
		AUS	0.0128	0.1133	0.1132

Table 11 – General Population Antenna Port Summary



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SECTION 3

DISCLAIMERS AND COPYRIGHT



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3.1 DISCLAIMERS AND COPYRIGHT

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ANNEX A

REGIONAL REQUIREMENTS



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Frequency Range (MHz)	Power Density (W/m ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.065 - 1	-	610/f	1.6/f
1 - 10	-	610/f	1.6/f
10 - 400	10	61	0.162
400 - 2000	f/40	3*f ^{0.5}	0.00796*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 ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.003 - 0.15	-	87	5
0.15 - 1	-	87/f	0.73/f
1 - 10	-	87/f ^{0.5}	0.73/f
10 - 400	2	27	0.071
400 - 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 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 Occupational Limits

Frequency Range (MHz)	S Field (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 General Population Limits

Frequency Range (MHz)	Power Density (W/m ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.003 - 1	-	600	4.9
1 - 10	-	600/f	4.9/f
10 - 30	-	60	4.9/f
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 ²)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)
0.003 - 1	-	280	2.19
1 - 10	-	280/f	2.19/f
10 - 30	-	28	2.19/f
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



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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