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Report On

RF Exposure Assessment of the
Orolia Limited
Z701 EPIRB

FCC ID: Not Applicable
IC: Not Applicable

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October 2017



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SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
Orolia Limited
Z701 EPIRB



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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 Orolia Z701 EPIRB 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	Orolia Limited
Manufacturer	Orolia Limited
Manufacturing Description	EPIRB
Model Number(s)	Z701
Test Specification/Issue/Date	EN 62311:2008 CFR 47 Pt1.1310 (2016) 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	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 Orolia Limited Z701 EPIRB. 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 Z701 EPIRB 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	406
	AIS
	121 MHz Homing
Frequency Band	121.5 MHz
	161.025-161.975 MHz
	406.040 MHz

1.3.3 Antennas

The following antennas are supported by the equipment under test.

No.	Model	Gain(dB)
1	406 antenna	3.5
2	AIS antenna	-2.5
3	121.5 homer antenna	-1.5

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).

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	0.0219	0.2355	0.2348
FCC	0.0190	0.1251	0.1250
IC	0.0217	0.2328	0.2328
AUS	0.0219	0.2322	0.2321

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.

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	0.1096	0.5134	0.5148
FCC	0.0952	0.2794	0.2792
IC	0.1542	0.6190	0.6189
AUS	0.1096	0.5203	0.5191

Table 3 – General Population Results

The calculations show that the EUT complies with the general population 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.



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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 Z701 EPIRB 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):

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

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 (W/m ²)	E Field (V/m)	H Field (A/m)
1	1	3	406	0.185	1.04	-1.5	406.040	0.1163	6.6229	0.0176
	2	3	AIS	0.003	0.35	-1.5	161.025	0.0070	1.6202	0.0043
	3	3	121 homing transmitter	0.049	55	-1.5	161.025	0.0975	6.0633	0.0161

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 (W/m ²)	E Field (V/m)	H Field (A/m)
1	1	3	406	0.185	1.04	-1.5	406.040	0.1163	6.6229	0.0176
	2	3	AIS	0.003	0.35	-1.5	161.025	0.0070	1.6202	0.0043
	3	3	121 homing transmitter	0.049	55	-1.5	161.025	0.0975	6.0633	0.0161

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)
406.040	10.1510	60.4513	0.1612	2.0302	27.7068	0.0746
161.025	10.0000	61.0000	0.1620	2.0000	28.0000	0.0730
121.5	10.0000	61.0000	0.1620	2.0000	28.0000	0.0730

Table 6 – EN 62311:2008 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)
406.040	1.3535	-	-	0.2707	-	-
161.025	1.0000	61.4000	0.1630	0.2000	27.5000	0.0730
121.5	1.0000	61.4000	0.1630	0.2000	27.5000	0.0730

Table 7 – CFR 47 Pt1.1310 (2016) Limits



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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)
406.040	13.0071	70.0272	0.1858	1.5879	24.4655	0.0649
161.025	8.1911	55.5710	0.1474	1.2910	22.0600	0.0585
121.5	8.1911	55.5710	0.1474	1.2910	22.0600	0.0585

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)
406.040	10.1510	61.8618	0.1640	2.0302	27.6061	0.0733
161.025	10.0000	61.4000	0.1630	2.0000	27.4000	0.0729
121.5	10.0000	61.4000	0.1630	2.0000	27.4000	0.0729

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)	Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit			
			S Field	E Field	H Field
1	0.111	EU	0.0219	0.2355	0.2348
		FCC	0.0190	0.1251	0.1250
		IC	0.0217	0.2328	0.2328
		AUS	0.0219	0.2322	0.2321

Table 10 – Occupational Antenna Port Summary

Antenna Port	EIRP (W)	Calculated RF exposure level at compliance boundary of 0.2 m as a Fraction of the Limit			
			S Field	E Field	H Field
1	0.111	EU	0.1096	0.5134	0.5148
		FCC	0.0952	0.2794	0.2792
		IC	0.1542	0.6190	0.6189
		AUS	0.1096	0.5203	0.5191

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

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

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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	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



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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