Safety Test Report

for human exposure

(IEC 60945 and EN/IEC 62311)

For

Trade name: Furuno
Model: Radar Sensor
Type: DRS4DL

Report No.: FLI 12-14-093

Date of Issue: 22 January 2015

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Report Summary

FLI project number:	FLI 04-14-0549		
Test report number of initial issue:	FLI 12-13-154	Date of initial issue	22 January 2015
Test report number of revised/replaced issue:	---	Date of revised/replaced issue	---
Test report revision/ replacement history:	---		
Test standard(s)/ Test specifications:	EN 62311: 2008, and IEC 62311: 2007 ICNIRP Guideline Gen.Pub.1998 IEC 62233: 2005 IEC 60945, 12.2 RF radiation.		
Customer:	Furuno Electric Co., Ltd. 9-52 Ashihara-Cho, Nishinomiya-City, 662-8580 Japan		
Manufacturer:	Furuno Electric Co., Ltd. 9-52 Ashihara-Cho, Nishinomiya-City, 662-8580 Japan		
Trade name:	FURUNO		
Model:	Radar Sensor		
Type:	DRS4DL		
Product function and intended use:	For Marine Safety Navigation		
Number of samples tested:	One each		
Serial number:	1000-3200-0010 (for IEC 60945, RF radiation test) 1000-3200-0011 (for EN/IEC 62311 and IEC 62233, human exposure test)		
Power rating:	12 - 24 VDC, 2.1 - 1.0 A		
Product status:	Pre-production model		
Modifications made to samples during testing:	None.		
Date of receipt of samples:	4 November 2014		
Test period:	4 November 2014 and 17 November 2014		
Place of test:	Furuno Labotech International Co., Ltd. - LABOTECH EMC Center 1-16, Fukazu-cho, Nishinomiya-shi, Hyogo, 663-8203 Japan		
Test results/ Compliance:	Passed. The test results of this report relate only to the samples tested.		
Tested by:	Tadayuki Ekawa, Osamu Araki and Yasuharu Nakamura		
Written by:	Akiko Inoue		
Verified by:	Yoshihiro Ishii		
Approved by:	Date: 22 January 2015 Name: Yoshihiro Ishii Title: Senior Manager, Technical Department, Furuno Labotech International Co., Ltd. Signature: 		

Testing Laboratory Status

Furuno Labotech International Co., Ltd. (hereafter called “FLI”) has been holding the following status after having been assessed according to the provisions of ISO/IEC 17025 and/or the relevant rules:

(1) JAB Accredited Testing Laboratory:
- accredited by Japan Accreditation Board (JAB),
- Laboratory accreditation number: RTL03220
- Date of initial accreditation: 14 January 2011
- Scope of accreditation: Electrical testing - EMC testing (*)

(2) Telefication Listed Testing Laboratory:
- listed by Telefication B. V., (The Netherlands)
- Laboratory assignment number: L116
- Date of initial listing: 26 July 1999 (*)
- for testing the following product categories/ test standards: EN 60945, IEC 61162-1/-2, IEC/EN 61162-450 and IEC 62288

(3) BSH Recognized Testing Laboratory:
- recognized by Bundesamt für Seeschifffahrt und Hydrographie (BSH), (Germany)
- Recognition certificate number: BSH/4613/06202/1864/11
- Date of initial recognition: 4 April 2003 (*)
- for testing the following product categories/ test standards:
- IEC/EN 60945, IEC 62388, IEC 61162-1/-2, and IEC 62288

(4) TÜV Appointed EMC Test Laboratory:
- appointed by TÜV Rheinland Japan Ltd.,
- Laboratory assignment number: UA 50046428
- Date of initial appointment: 21 December 1998 (*)
- for carrying out the tests of: EN 55011, CISPR 11, EN 55022, CISPR 22, EN 55024, CISPR 24, EN 55025, CISPR 25, EN/IEC 61000-3-2/-3, EN/IEC 61000-4-2/-3/-4/-5/-6/-8/-11, EN/IEC 61000-6-1/-2/-3/-4, EN/IEC 60945, EN/IEC 61326-1, EN/IEC 61326-2-6, EN/IEC 60601-1-2, JIS T 0601-1-2, JIS C 1806-1, and ISO 11452-1/-2/-4.

(5) RMRS Recognized Testing Laboratory:
- recognized by Russian Maritime Register of Shipping (RMRS), (Russia)
- Laboratory recognition number: 11.02594.011
- Date of initial recognition: 27 January 2009 (*)
- for carrying out testing in the field of:
  Elecrtrical measurements and tests, EMC tests, Mechanical measurements and tests, Equipment protection degree tests, and Climatic tests for Ship’s radio and navigational equipment and IEC 60945: 2002

(6) RRR Recognized Test Laboratory:
- recognized by Russian River Register (RRR), (Russia)
- Recognition certificate number: 154262
- Date of initial recognition: 31 May 2013
- for carrying out of tests of ships radio and navigation equipment

(7) DNV Recognized Environmental Test Laboratory:
- recognized by Det Norske Veritas AS (DNV), (Norway)
- Recogntion certificate number: 262.1-015854-J-12
- Date of initial recognition: 12 July 2013
- Scope of recognition: Testing according to the standards IEC 60945, IEC 61162-1/-2/-450, IEC 62288, IEC 62388 and IEC 62252 Annex E
- Application: Provisions of Environmental, interface and safety testing.

(8) CCS Recognized Test Agency :
- recognized by China Classification Society
- Recognition certificate number : DB13A00001
- Date of initial recognition : 29 January 2014
- Scope of recognition : Performance/Environmental/EMC/Special purpose/Safety precautions tests for Electrical & Electronic Product including Maritime Navigation and Radio-communication Equipment & Systems

Note: (*) – The current certificates may be found in the FLI web site (http://www.furuno-labotech.co.jp).

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1 Principal Information

1.1 Equipment under test (EUT)

Configurations of the EUT unit(s):

No. (*)	Name	Type	Serial number	Size (W/H/D) and mass	Note
1	Radar Sensor	DRS4DL	1000-3200-0011	ϕ 488 x 220, 5.7 kg	Scanner RSB-127 and Transceiver RTR-104. TX freq.: 9410 MHz, TX power: 4 kWpp.
6	Radar Sensor	DRS4DL	1000-3200-0010		

(*): Item number(s) is(are) corresponding to the unit(s) shown in Clause 5 “EUT Setup/Test Arrangement” of this report.

Configurations of the Associated unit(s) (AU) forming the system except EUT: None

Auxiliary Equipment (AE) used for exercising and/or monitoring the operation and/or the performance of the EUT during testing:

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
2	Display Unit	TZT9	4392-0010	Furuno	Used for EN/IEC 62311 test.
7	Display Unit	TZT14	4393-0010	Furuno	Used for IEC 60945 test.

(*): Item number(s) is(are) corresponding to the unit(s) shown in Clause 5 “EUT Setup/Test Arrangement” of this report.

Software(s) contained in the EUT, and AE

No.	Category	Item/Type	Program name	Program number	Rev. number
1,6	EUT	Radar Sensor	DRS4DL	0359338	T1.07
2	AE	Display Unit	TZT9	01950123-03.12	
7	AE	Display Unit	TZT14	01950123-03.12	

1.2 Observation and comments

(1) Test items to be performed were specified by the customer.

1.3 Test Conditions

For Radar TX mode (under IEC 60945): 24 VDC
For Radar Standby (under EN/IEC 62311): 12 VDC and 24 VDC

1.4 Test items

For Radar TX mode,

	Item (Method)
IEC 60945 12.2	RF Radiation

For Radar Standby mode,

EN/IEC 62311 Clause no.	Item (Method)
8	Sources with multiple frequencies
8.2	Frequency range from 1 Hz – 10 MHz (ICNIRP-based)
8.2.1	Frequency domain assessment
8.2.2	Time domain assessment
8.3	Frequency range from 100 kHz – 300 GHz (ICNIRP-based)

1.5 Measurement Uncertainty

±2.3 dB (IEC 60945)
30% (EN/IEC 62311: 2007, Clause 6)

2 Test Results

2.1 for Radar TX mode,
with Antenna stopped (based on IEC 60945),

Unit	Distance to 100 W/m^2 (m)	Distance to 50 W/m^2 (m)	Distance to 10 W/m^2 (m)
DRS4DL	Not detected.	Not detected.	1.1

Note: the Probe was located on the TX antenna main beam line, and Peak point was searched with the Probe varied horizontally and vertically.

2.2 for Radar Standby mode (based on IEC/EN 62311),

Unit	Operation mode	Results	Note
DRS4DL	Standby	Passed at 0 cm.	See Clause 6 of this report for details.

Note: Following test conditions/limits were applied for the tests:
(1) Distance: From 0 cm to 30 cm apart from EUT surface. (according to IEC 62233),
(The EUT passed the tests at 0 cm, so, tests at 10/30 cm were not performed.)
(2) Measuring equipment: Complied with "ICNIRP guideline Gen.Pub.1998",
(3) Test frequency range (including Upper test frequency):
For H-field, 1 Hz to 1 GHz.
For E-field, 100 kHz to 50 GHz (> EUT TX frequency 9.410 GHz × 5 = 47.050 GHz).
(4) Compliance to limits: Reference level (according to ICNIRP guideline Gen.Pub.1998).
(5) EUT directions observed: 0° through 360°.

3 Date of test and environmental conditions observed during testing

	Item	Date of test	Temperature, humidity (Before-test to After-test)	Power supply voltage (Before-test to After-test)
EN/IEC 62311	Human exposure (Radar Standby mode)	17 February 2014	See Clause 6 for details.	12.0 VDC to 12.0 VDC, 24.0 VDC to 24.0 VDC.
IEC 60945, 12.2	Electromagnetic radiofrequency radiation: (Radar TX mode)	4 November 2014	20°C to 20°C, 56% to 56%RH.	24.0 VDC to 24.0 VDC.

4 List of Measuring/Test Instruments

Measuring/Test instruments have been appropriately calibrated/maintained according to the FLI programs/ procedures. Measuring/Test instruments used for the tests are listed below.

4.1 for Radar Standby mode (under EN/IEC 62311),

(*)	C/N	Instrument	Type	S/N	Manufacturer
X	HT918	Exposure level tester (Magnetic field)	ELT-400	N-0191	Narda
X	HT918-1	100 cm^2 magnetic field probe	--	M-0634	Narda
X	HT919	Broadband field meter (Electric and Magnetic fields)	NBM-520	D-0684	Narda
X	HT919-1	field probe (100 kHz - 3 GHz)	EF0391	D-0628	Narda
X	HT919-2	field probe (300 kHz - 50 GHz)	ED5091	01061	Narda
X	HT919-3	Magnetic field probe (300 kHz - 30 MHz)	HF3061	D-0239	Narda
X	HT919-4	Magnetic field probe (27 MHz - 1 GHz)	HF0191	D-0175	Narda
--	HT590	RF Radiation meter	EMR-300/33C	AY-0029/F-0021	Narda
X	HT151	DC power supply	GP035-30	101439048	Takasago
X	HT368	Anechoic chamber	3mAC	D-001	Riken

Note (*): X – used for tests, -- – not used.

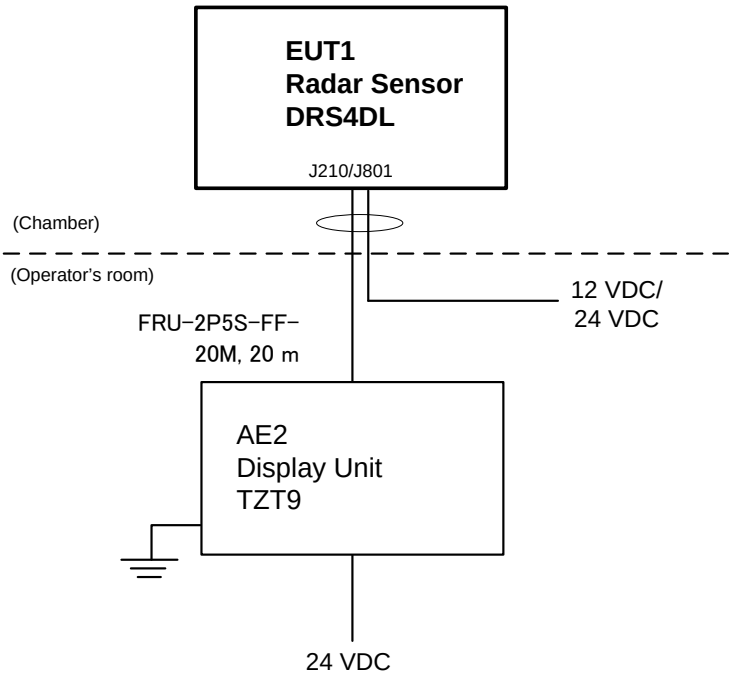
4.2 for Radar TX mode (under IEC 60945)

(*)	C/N	Instrument	Type	S/N	Manufacturer	Note
--	HT919	Broadband field meter	NBM-520	D-0684	Narda	Used for IEC/EN 62311 test.
--	HT919-2	Electric field probe(300 k - 50 GHz)	ED5091	01061	Narda	
X	HT590	RF Radiation meter	EMR-300/33C	AY-0029/F-0021	Narda	Used for IEC 60945 test.
X	HT779	Semi-Anechoic chamber	10mAC	90984	TOKIN	

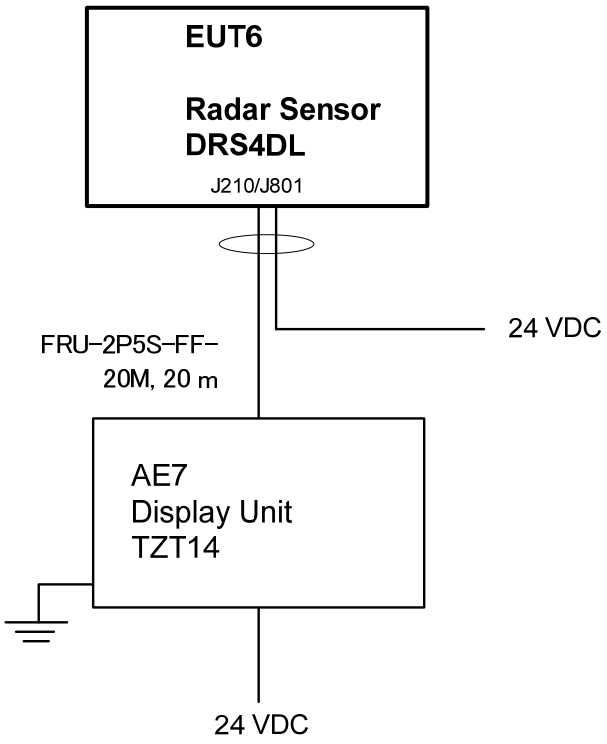
Note (*): X – used for tests, -- – not used.

5 EUT Setup/Test Arrangement

Test under IEC/EN 62311,



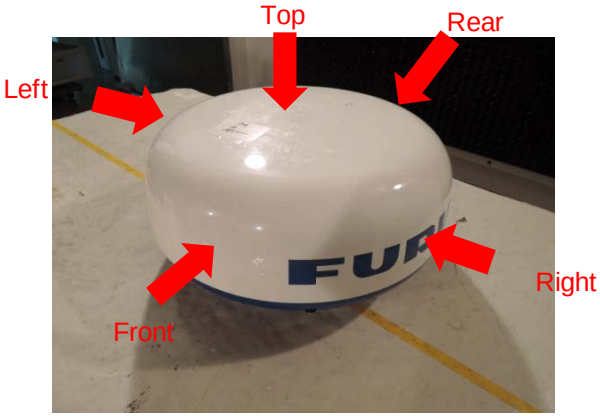
Test under IEC 60945,



Note: AE - Auxiliary Equipment.

6 EUT Test data obtained

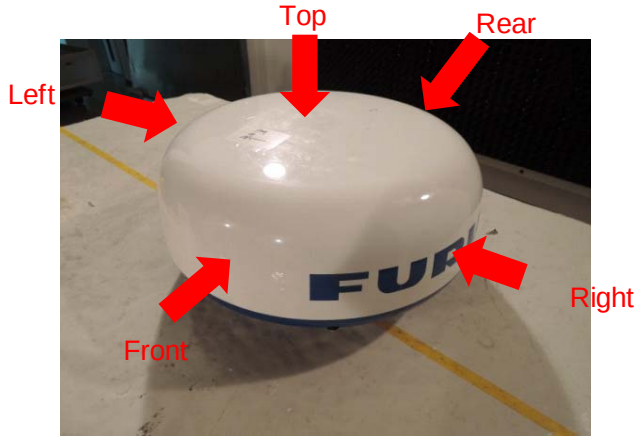
Date & Location:	2014/11/17, FLI EMC Center
Manufacture:	Furuno Electric Co., Ltd.
Product Category:	Pre-production model
Model Name (S/N)	DRS4DL (1000-3200-0011)
Standard:	ICNIRP Guideline Gen.Pub.*1998*
Power supply voltage:	12.0 VDC
Temperature, humidity:	21 °C, 57 %RH to 21 °C, 57 %RH
Operating Mode:	Standby
Operator:	O.Araki, T.Ekawa
Result:	Passed. (at 0 cm)
Measurement uncertainty value:	30%



The uncertainty values specified under each assessment method are the maximum allowed uncertainty.
If the uncertainty value is not specified, then a default value of 30 % shall be used. (Refer to EN 62311: 2008 and IEC 62311: 2007, Clause 6)

Field	frequency range	Measuring equipment used	Measurement mode applied	Limits (Reference level)	Distance	Measurement value		Max. point	Result
H-Field	1 Hz to 400 kHz	narda ELT-400	Std Mode	100%	Ambient	0.17	%	--	--
					0 cm	0.186		Front	Passed.
	300 kHz to 30 MHz	narda NBM-520 (HF3061)	MAX Hold (Peak)	0.073 A/m	Ambient	0.0089	A/m	--	--
					0 cm	0.0128		Front	Passed.
	27 MHz to 1 GHz	narda NBM-520 (HF0191)	MAX Hold (Peak)	0.073 A/m	Ambient	0.0106	A/m	--	--
					0 cm	0.0316		Front	Passed.
E-Field	100 kHz to 3 GHz	narda NBM-520 (EF0391)	MAX Hold (Peak)	27.5 V/m	Ambient	0.2	V/m	--	--
					0 cm	0.39		Front	Passed.
	3 GHz to 50 GHz	narda NBM-520 (ED5091)	MAX Hold (Peak)	20%	Ambient	0.4836	%	--	--
					0 cm	0.689		Front	Passed.

Date & Location:	2014/11/17, FLI EMC Center
Manufacture:	Furuno Electric Co., Ltd.
Product Category:	Pre-production model
Model Name (S/N)	DRS4DL (1000-3200-0011)
Standard:	ICNIRP Guideline Gen.Pub.*1998*
Power supply voltage:	24.0 VDC
Temperature, humidity:	21 °C, 57 %RH to 21 °C, 57 %RH
Operating Mode:	Standby
Operator:	T. Ekawa
Result:	Passed. (at 0 cm)
Measurement uncertainty value: 30%	



The uncertainty values specified under each assessment method are the maximum allowed uncertainty.
If the uncertainty value is not specified, then a default value of 30 % shall be used. (Refer to EN 62311: 2008 and IEC 62311: 2007, Clause 6)

Field	frequency range	Measuring equipment used	Measurement mode applied	Limits (Reference level)	Distance	Measurement value		Max. point	Result
H-Field	1 Hz to 400 kHz	narda ELT-400	Std Mode	100%	Ambient	0.17	%	--	--
					0 cm	0.172		Front	Passed.
	300 kHz to 30 MHz	narda NBM-520 (HF3061)	MAX Hold (Peak)	0.073 A/m	Ambient	0.0089	A/m	--	--
					0 cm	0.01		Front	Passed.
	27 MHz to 1 GHz	narda NBM-520 (HF0191)	MAX Hold (Peak)	0.073 A/m	Ambient	0.0106	A/m	--	--
					0 cm	0.0276		Front	Passed.
E-Field	100 kHz to 3 GHz	narda NBM-520 (EF0391)	MAX Hold (Peak)	27.5 V/m	Ambient	0.2	V/m	--	--
					0 cm	0.41		Front	Passed.
	3 GHz to 50 GHz	narda NBM-520 (ED5091)	MAX Hold (Peak)	20%	Ambient	0.4836	%	--	--
					0 cm	0.6668		Front	Passed.