Safety Test Report

for human exposure

(EN 60945 and EN/IEC 62311)

For

Trade name: Furuno
Model: Radar Sensor
Type: DRS25A X-Class

Report No.: LIC 12-16-093

Date of Issue: 31 August 2016

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Report Summary

LIC project number:	LIC 04-16-0335		
Test report number of initial issue:	LIC 12-16-093	Date of initial issue	31 August 2016
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 EN 62233: 2005 EN 60945: 2002, 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:	DRS25A X-class		
Product function and intended use:	MARINE RADAR		
Number of samples tested:	One		
Serial number:	1000-7000-0010		
Power rating:	24 VDC, 5.6 A		
Product status:	Pre-production model		
Modifications made to samples during testing:	None.		
Date of receipt of samples:	24 June 2016		
Test period:	10 July 2016		
Place of test:	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:	Yasuharu Nakamura		
Written by:	Akiko Inoue		
Verified by:	Yoshihiro Ishii		
Approved by:	Date: 31 August 2016 Name: Yoshihiro Ishii Title: Senior Manager, Technical Department, Labotech International Co., Ltd. Signature: 		

Testing Laboratory Status

Labotech International Co., Ltd. (hereafter called “LIC”) 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, Climatic, and Vibration tests

(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) 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, ISO 11452-1/-2/-4.

(4) 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:
  Electrical 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

(5) 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

(6) DNV Recognized Environmental Test Laboratory:
- recognized by Det Norske Veritas AS (DNV), (Norway)
- Recognition 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.

(7) 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 LIC web site (http://www.labotech-intl.co.jp/).

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1 Principal Information

1.1 Equipment under test (EUT)

Configurations of the EUT unit(s):

No. (*)	Item	Type	Unit serial number	Equipment category	Test setup	Note
2	Radar Sensor	DRS25A X-Class	1000-7000-0010	Exposed	Table-top	TX freq.: 9410 MHz, TX power: 25 kW Magnetron used: MG5436
	Transceiver	RTR-114				
	Scanner	RSB-134				
	Antenna Radiator	XN12A	50924588			One selectable.
		XN13A	50286160			

(*): 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:

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
4	Display unit	TZT9	4392-0692	Furuno	

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

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
8	Power Supply	PLA150F-24	--	COSEL	

(*): 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 AU

No.	Category	Item/Type	Program name	Program number	Rev. number
2	EUT	DRS25A X-Class	DRS25A_X-CLASS	01.01:01.01:T1.33:01.11	---
4	AU	TZT9	TZT9	04.03:23.01:01.02	---

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

TX mode,

Rain: 0
Sea: 0
Gain: 88
Range: 12 NM
IR: OFF

For Radar Standby modes (under IEC 62311): 24 VDC

1.4 Test items

For Radar TX mode,

IEC 60945 Clause no	Item (Method)
12.2	RF Radiation

For Radar Standby modes,

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% (IEC 62311: 2007, Clause 6)

2 Test Results

2.1 for Radar TX mode,
(1) 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)
DRS25A X-Class＋XN12A	0.8	1.7	7.7

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

Unit	Distance to 100 W/m^2 (m)	Distance to 50 W/m^2 (m)	Distance to 10 W/m^2 (m)
DRS25A X-Class＋XN13A	0.7	1.6	6.8

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 modes (based on IEC/EN 62311),

Unit	Operation mode	Results	Note
DRS25A X-Class＋XN12A	For Radar, 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, 10 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°.

Unit	Operation mode	Results	Note
DRS25A X-Class＋XN13A	For Radar, 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, 10 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)
IEC/EN 62311	Human exposure (Radar Standby)	10 July 2016	See Clause 6 for details.	24.0 VDC to 24.0 VDC.
EN 60945, 12.2	Electromagnetic radiofrequency radiation: (Radar TX mode)	10 July 2016	23°C to 23°C, 63%RH to 63%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 LIC programs/ procedures. Measuring/Test instruments used for the tests are listed below.

4.1 for Radar Standby modes (under IEC/EN 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
--	HT151	DC power supply	GP035-30	101439048	Takasago
X	HT779	Semi-Anechoic chamber	10mSAC	90984	TOKIN
X	HT780	Programmable AC/DC Power Supply	ES18000W	9128767-1 +9128767-2	NF

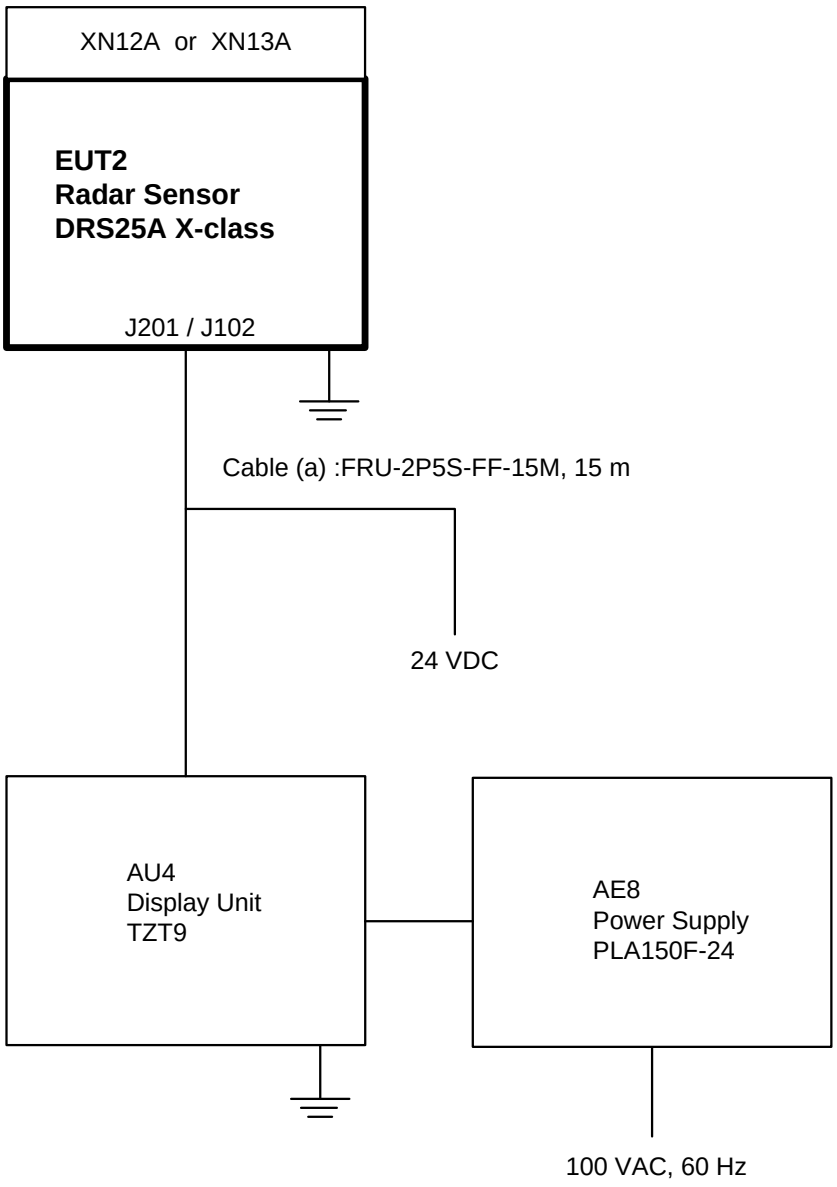
Note (*): X – used for tests, -- – not used.

4.2 for Radar TX mode (under EN 60945 and IEC/EN 62311)

(*)	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	10mSAC	90984	TOKIN	
X	HT780	Programmable AC/DC Power Supply	ES18000W	9128767-1 +9128767-2	NF	--

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

5 EUT Setup/Test Arrangement

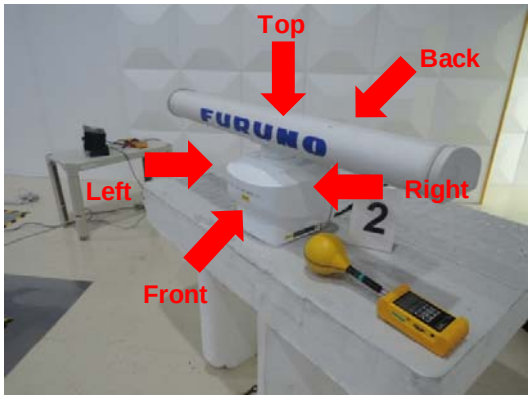


Note: AU - Associated Unit, AE - Auxiliary Equipment.

6 EUT Test data obtained

DRS25A X-Class+XN12A

Date & Location:	10 July 2016, LIC EMC Center
Manufacture:	Furuno Electric Co., Ltd.
Product Category:	Pre-production model
Model Name (S/N)	1000-7000-0010
Standard:	ICNIRP Guideline Gen.Pub.*1998*
Power supply voltage:	24 VDC
Temperature, humidity:	23°C, 63%RH to 23°C, 63%RH
Operating Mode:	Standby Mode
Operator:	Y.Nakamura
Result:	Passed. (at 0 cm)
Measurement uncertainty value: 30%	

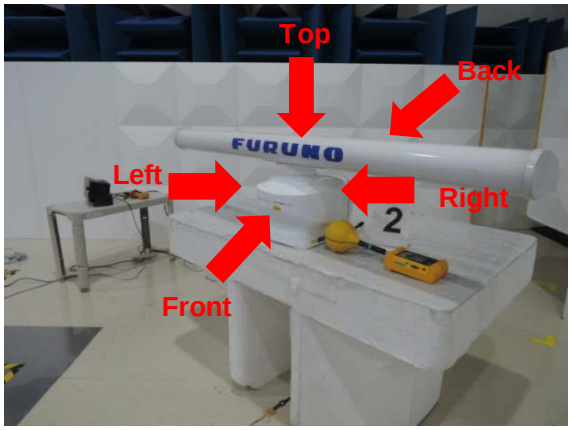


The uncertainty values specified under each assessment method are the maximum allowed uncertainty.
If the uncertainty value is not specified, then a default value of 30 % shall be used. (Refer to EN 62311: 2008/IEC 62311: 2007, Clause 6)

Field	frequency range	Measuring equipment used	Measurement mode applied	Limits (Reference level)	Distance	Measured value		Max. point	Result
H-Field	1 Hz to 400 kHz	narda ELT-400	Std Mode	100%	Ambient	0.190	%	--	--
					0 cm	0.698		Back	Passed.
	300 kHz to 30 MHz	narda NBM-520 (HF3061)	MAX Hold (Peak)	0.073 A/m	Ambient	0.009	A/m	--	--
					0 cm	0.019		Right	Passed.
	27 MHz to 1 GHz	narda NBM-520 (HF0191)	MAX Hold (Peak)	0.073 A/m	Ambient	0.010	A/m	--	--
					0 cm	0.017		Front	Passed.
E-Field	100 kHz to 3 GHz	narda NBM-520 (EF0391)	MAX Hold (Peak)	27.5 V/m	Ambient	0.10	V/m	--	--
					0 cm	0.62		Front	Passed.
	3 GHz to 50 GHz	narda NBM-520 (ED5091)	MAX Hold (Peak)	20%	Ambient	0.119	%	--	--
					0 cm	0.237		Front	Passed.

DRS25A X-Class+XN13A

Date & Location:	10 July 2016, LIC EMC Center
Manufacture:	Furuno Electric Co., Ltd.
Product Category:	Pre-production model
Model Name (S/N)	1000-7000-0010
Standard:	ICNIRP Guideline Gen.Pub.*1998*
Power supply voltage:	24 VDC
Temperature, humidity:	23°C, 63%RH to 23°C, 63%RH
Operating Mode:	Standby Mode
Operator:	Y.Nakamura
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/IEC 62311: 2007, Clause 6)

Field	frequency range	Measuring equipment used	Measurement mode applied	Limits (Reference level)	Distance	Measured value		Max. point	Result
H-Field	1 Hz to 400 kHz	narda ELT-400	Std Mode	100%	Ambient	0.190	%	--	--
					0 cm	0.848		Back	Passed.
	300 kHz to 30 MHz	narda NBM-520 (HF3061)	MAX Hold (Peak)	0.073 A/m	Ambient	0.009	A/m	--	--
					0 cm	0.012		Right	Passed.
	27 MHz to 1 GHz	narda NBM-520 (HF0191)	MAX Hold (Peak)	0.073 A/m	Ambient	0.010	A/m	--	--
					0 cm	0.019		Front	Passed.
E-Field	100 kHz to 3 GHz	narda NBM-520 (EF0391)	MAX Hold (Peak)	27.5 V/m	Ambient	0.10	V/m	--	--
					0 cm	0.62		Front	Passed.
	3 GHz to 50 GHz	narda NBM-520 (ED5091)	MAX Hold (Peak)	20%	Ambient	0.119	%	--	--
					0 cm	0.170		Front	Passed.