

Test Report

FCC Rules 47 CFR,
Part 90 (90.213)
Part 2 (2.1055)

for

Trade name: Furuno
Model: Transceiver
for MARINE RADAR
FAR-2228-NXT/2228-NXT-BB/2328-NXT
FAR-3220-NXT/3220-NXT-BB/3320-NXT
Type: RTR-123

Report no.: LIC 12-22-016

Date of issue: 28 February 2022


Labotech International Co., Ltd.

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Report Summary

LIC project number:	LIC 04-22-0068		
Test report number of initial issue:	LIC 12-22-016	Date of initial issue	28 February 2022
Test report number of revised/replaced issue:	--	Date of revised/replaced issue	--
Test report revision/replacement history:	--		
Test standard(s)/ Test specifications:	FCC Rules 47 CFR, Sections: 2.1055 - Frequency stability 90.213 - Frequency stability (the latest version on the first day of the testing period)		
Customer:	Furuno Electric Co., Ltd. 9-52, Ashihara-cho, Nishinomiya-city, Hyogo, 662-8580 Japan		
Manufacturer:	Furuno Electric Co., Ltd. 9-52, Ashihara-cho, Nishinomiya-city, Hyogo, 662-8580 Japan		
Trade name:	Furuno		
Model:	Transceiver for MARINE RADAR FAR-2228-NXT/2228-NXT-BB/2328-NXT/FAR-3220-NXT/3220-NXT-BB/3320-NXT		
Type:	RTR-123		
Product function and intended use:	Marine radar: CAT 1C, 2C / 1HC, 2HC		
Number of samples tested:	One		
Serial number:	See Clause 1.1 of this report.		
Power rating:	100–230 VAC, 50–60 Hz, 2.9–1.3 A (for RPU-025 (AU))		
Modifications made to samples during testing:	None		
Date of receipt of samples:	1 February 2022		
Test period:	2 February 2022 and 24 February 2022		
Place of test:	Labotech International Co., Ltd. - Nishinomiya Lab. FCC Test firm Designation Number: JP2010 FCC Test firm Registration #: 696248 9-52, Ashihara-cho, Nishinomiya-shi, Hyogo, 662-8580 Japan - Kishu Lab. FCC Test firm Designation Number: JP2009 FCC Test firm Registration #: 381950 579-1 Umehara, Wakayama-shi, Wakayama, 640-8452 Japan		
Test results/Compliance:	Passed. The test results of this report relate only to the samples tested.		
Tested by:	Yukihiro Hijiri		
Written by:	Arisa Ogino		
Verified by:	Tadayuki Ekawa		
Approved by:	Date: 28 February 2022 Name: Tadayuki Ekawa Title: Manager, EMC and Environmental Testing Section, Technical Department, Labotech International Co., Ltd. Signature: <div style="text-align: right; margin-top: 20px;">  </div>		

Disclaimer:

The test results of this report relate only to the samples tested.

LIC has no responsibility for the followings except for the requirements of test standards.

- The thing(s) in association with the test and information pertaining to it/them, which are provided by the customer; information described in Clause 1 and the information of the cable(s) used.
- The matter(s) specified by the customer; Test standard(s) applied, test item(s), test conditions, criteria, object(s) to be tested or excluded, operation mode(s) and connection/configuration.

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, Vibration and Radio 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, IEC 62288, ETSI EN 301 843-1 / -2, ETSI EN 301 489-1 / -3 / -17

(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 EMC emission and immunity

(4) RMRS Recognized Testing Laboratory:

- recognized by Russian Maritime Register of Shipping (Russia)
- Laboratory recognition number: 17.13259.170 (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 (Russia)
- Certificate number: 131927 (- Date of initial recognition: 31 May 2013 (*))
- for carrying out of tests of ships radio and navigation equipment

(6) DNV GL Recognized Environmental Test Laboratory:

- recognized by Det Norske Veritas AS, Germanischer Lloyd (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

(8) SABS EMC A-Lab program Laboratory:

- recognized by South African Bureau of Standards
- Assigned Lab number : SABS/A-LAB/0042/2018 (Date of initial recognition : 5 July 2018 (*))
- Approved List of EMC Standards : SANS 211 / 214-1 / 214-2 / 222 / 2332 / 2335, CISPR 11 / 14-1 / 14-2 / 22 / 32 / 35, SANS/IEC 60601-1-2, SANS/IEC 61326-1, IEC 61326-2-6, SANS/IEC 61000-3-2 / -3-3 / -4-2 / -4-3 / -4-4 / -4-5 / -4-6 / -4-8 / -4-11 / -6-1 / -6-2 / -6-3 / -6-4

(9) A2LA accredited Testing Laboratory:

- accredited by American Association of Laboratory (A2LA)
- Certificate number: 5241.01 (Date of initial accreditation: 17 Jul 2019 (*))
- Scope of accreditation: Electrical testing - Emissions - Radiated and Conducted, Radio - Maritime Radio Systems, Stations in the maritime services, Private land mobile radio service, Radio / Intentional radiators, RF Exposure and EMC - Automotive Electronic Devices (AED), Machine and Vehicle

(*) The latest certification status may be found on the LIC website (<https://www.labotech-intl.co.jp/>)

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1 Principal Information

1.1 Equipment under test (EUT)

1.1.1 General

- (a) Trade name: Furuno
- (b) Manufacturer: Furuno Electric Co., Ltd.
9-52, Ashihara-cho, Nishinomiya-city, Hyogo, 662-8580 Japan
- (c) Model:
Transceiver for MARINE RADAR FAR-2228-NXT/2228-NXT-BB/2328-NXT/
FAR-3220-NXT/3220-NXT-BB/3320-NXT

Name	Type	Serial number	Note
MARINE RADAR ANTENNA UNIT	RSB-128-123	R000-2510-0102	--
Transceiver	RTR-123	--	--
Scanner	RSB-128	--	Antenna rotation rate: 24/36/42 rpm
Performance monitor	PM-32B		--
ANTENNA RADIATOR	XN12CF	--	One (1) selectable as the specification. Not used for the test.
	XN20CF	--	
	XN24CF	--	

Associated units (AU)

Name	Type	Serial number	Note
MARINE RADAR PROCESSOR UNIT	RPU-025	1000-7910-0180	Used for the measurement reported in Clause 3.1.4 of this report.
CONTROL UNIT	RCU-014	201682	
MARINE RADAR PROCESSOR UNIT	RPU-025	1000-7910-1918	Used for the measurement reported in Clause 3.1.3 of this report.
CONTROL UNIT	RCU-014	201681	
MONITOR UNIT	MU-190	030764	--

No Auxiliary Equipment (AE) used.

- (d) FCC ID: ADB9ZWRTR123
- (e) Primary function: Ship radar station operating in the band 9300–9500 MHz
- (f) Frequency range: Fixed frequency, X-band (9380–9440 MHz)
- (g) Type of emission: P0N/Q0N
(Emission designator)

(h) Occupied bandwidth:

Pulse type			S1	S2	M1	M2	M3	L
Occupied bandwidth (MHz)	TT24NM	ch1 (P0N)	44.9	33.0	25.7	18.3	12.8	9.2
		ch2 (P0N)	46.8	36.7	26.6	19.3	12.8	9.2
		ch1 (Q0N)	9.2	9.2	9.2	7.3	7.3	6.4
		ch2 (Q0N)	10.1	9.2	9.2	7.3	6.4	6.4
	TT32NM	ch1 (P0N)	44.9	33.0	25.7	17.4	12.8	9.2
		ch2 (P0N)	45.8	35.8	26.6	18.3	12.8	9.2
		ch1 (Q0N)	10.1	9.2	9.2	7.3	7.3	6.4
		ch2 (Q0N)	10.1	9.2	9.2	6.4	6.4	6.4
	2nd trace	ch1 (P0N)	44.0	33.0	25.7	18.3	12.8	9.2
		ch2 (P0N)	44.9	36.7	27.5	18.3	12.8	9.2
		ch1 (Q0N)	9.2	9.2	9.2	6.4	6.4	6.4
		ch2 (Q0N)	10.1	9.2	9.2	8.3	6.4	6.4

(i) Size and mass: MARINE RADAR ANTENNA UNIT: ϕ 1300 mm \times 575 mm (H), 49 kg (*1)
 MARINE RADAR ANTENNA UNIT: ϕ 2100 mm \times 575 mm (H), 51 kg (*2)
 MARINE RADAR ANTENNA UNIT: ϕ 2600 mm \times 575 mm (H), 52 kg (*3)

(*1) with ANTENNA RADIATOR XN12CF installed.
 (*2) with ANTENNA RADIATOR XN20CF installed.
 (*3) with ANTENNA RADIATOR XN24CF installed.

(j) Power supply: 100-230 VAC, 50-60 Hz (*)
 (*) Powered from MARINE RADAR PROCESSOR UNIT, not directly from AC mains.

1.1.2 Transceiver module

Type: RTR-123 (Contained in MARINE RADAR ANTENNA UNIT)

1.1.2.1 Transmitter

- (a) Assignable frequency band: Between 9300 and 9500 MHz (CFR Title 47 Sections: 2.106)
- (b) Type of RF generator:
 - Type: Solid-state device (no magnetron)
 - Peak output power: 600 W nominal
- (c) Fundamental frequency:
 - ch1: P0N 9403.75 MHz/ Q0N 9423.75±5 MHz
 - ch2: P0N 9413.75 MHz/ Q0N 9433.75±5 MHz

- (d) Pulse characteristics:

Pulse type		S1	S2	M1	M2	M3	L
Pulse length (µs)	P0N	0.06	0.15	0.3	0.5	0.7	1.2
	Q0N	4.68	7.02	8.89	13.57	13.57	20.59
PRF(Hz)	TT24NM (Normal mode)	1500	1500	1200	1000	1000	600
	TT32NM	1200	1200	1200	1000	1000	600
	2nd trace	1000	1000	600	600	600	450

1.1.2.2 Receiver

- (a) Passband
 - RF Stage: 850 MHz
 - IF Stage: 40 MHz
- (b) Intermediate Frequency: P0N 83.75 MHz
Q0N 103.75 MHz
- (c) Gain (overall): Approximately 40 dB
- (d) Overall Noise Figure: 4 dB (typical)
- (e) Video Output Voltage: Not available
- (f) Features Provided: Anti-clutter Sea, Anti-clutter Rain
- (g) If receiver is tunable, describe method for adjusting frequency: Phase locked loop

1.1.3 Antenna and Scanner

(a) Antenna specifications

Antenna model	XN12CF	XN20CF	XN24CF
Length (mm)	1260	2110	2610
Rotation diameter (mm)	1400	2200	2700
Transmission frequency	X band: 9410±30 MHz		
Horizontal beam width (-3 dB)	1.9°	1.23°	0.95°
Vertical beam width (-3 dB)	20°		
Side lobe (max.)	Less than ±10°	-24 dB	-28 dB
	Outside ±10°	-30 dB	-32 dB
Gain	27.5 dBi	30.0 dBi	31.0 dBi
Radiator	Slot array		
Polarization	Horizontal		
Type of beam	Vertical fan		

(b) Antenna Rotation ON-OFF Switch: Provided

(c) Scanning (rotating or oscillating): Rotating over 360° continuously clockwise

(d) Antenna Rotation Rate: 24/36/42 rpm

(e) Sector Scan: Provided

(f) Rated Loss of Transmission Line per 100 Feet: Negligible

(Transmission path is only in ANTENNA RADIATOR.)

1.1.4 Operational Features

(a) Is positive means provided to indicate whether or not the overall operation of the equipment is such that it may be relied upon to provide effective operation in accordance with its primary function:

Yes (Hardware alarms)

(b) Is the equipment for continuous operation: Yes

(c) Is provision made for operation with shore based radar beacons (RACONS): Yes (RACONS)

1.1.5 Construction Features

(a) Does equipment embody replacement units with chassis type assembly: Yes

(b) Are fuse alarms provided: No

(c) State units that are weatherproof: Antenna Unit (IEC 60529 – IP56)

(d) If all units are not housed in a single container, indicate number and give description of individual units:
See Clause 1.1.1 (c) of this report.

(e) Approximate space required for installation excluding Antenna Unit: Not applicable

1.2 Observation and comments

As per the customer's instructions, the frequency stability was measured only at -30°C and +20°C.

2 Test Results Summary

Clause No. of this report	47 CFR Section	Item	Result	Test engineer
3.1	2.1055 (a)(1),(d)(1),(d)(3) 90.213	Frequency stability	Passed.	Y. Hijiri

3 Test Results

3.1 Frequency stability – temperature & voltage (FCC Rule 47 CFR, 2.1055(a)(1)/(d)(1)/(d)(3) and 90.213)

3.1.1 Test conditions:

- (1) Radar transmitter: All TX (S1/S2/M1/M2/M3/L) pulses
- (2) Ambient temperature: -30°C and +20°C
- (3) Power supply voltage: 85/100/115% of nominal voltage

MARINE RADAR PROCESSOR UNIT: 100 VAC – 230 VAC

V_L : 85 VAC / V_{nom} : 230 VAC / V_H : 264.5 VAC

3.1.2 Test setup:

See Clause 4.

3.1.3 Frequency tolerance limits (FCC Rule 47 CFR 2.1055 (a) (1), 90.213(a)):

TT24NM mode

ch1, P0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	31.2	10.7	5.2	3.0	2.2	1.3
Upper limit (MHz) (*2)	9468.8	9489.3	9494.8	9497.0	9497.8	9498.7
Lower limit (MHz) (*2)	9331.2	9310.7	9305.2	9303.0	9302.2	9301.3

ch1, Q0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	0.3	0.2	0.2	0.1	0.1	0.1
Upper limit (MHz) (*2)	9499.7	9499.8	9499.8	9499.9	9499.9	9499.9
Lower limit (MHz) (*2)	9300.3	9300.2	9300.2	9300.1	9300.1	9300.1

ch2, P0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	31.0	10.7	5.2	3.0	2.2	1.3
Upper limit (MHz) (*2)	9469.0	9489.3	9494.8	9497.0	9497.8	9498.7
Lower limit (MHz) (*2)	9331.0	9310.7	9305.2	9303.0	9302.2	9301.3

ch2, Q0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	0.3	0.2	0.2	0.1	0.1	0.1
Upper limit (MHz) (*2)	9499.7	9499.8	9499.8	9499.9	9499.9	9499.9
Lower limit (MHz) (*2)	9300.3	9300.2	9300.2	9300.1	9300.1	9300.1

(*1) Guard Band is specified to be equal to $1.5/T$ MHz, where "T" is the pulse length in microseconds.
(CFR Title 47 Sections: 80.209 (b))

(*2) Upper limit frequency, $f(U) = 9500 - 1.5/T$
Lower limit frequency, $f(L) = 9300 + 1.5/T$

TT32NM mode

ch1, P0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	31.2	10.7	5.2	3.0	2.2	1.3
Upper limit (MHz) (*2)	9468.8	9489.3	9494.8	9497.0	9497.8	9498.7
Lower limit (MHz) (*2)	9331.2	9310.7	9305.2	9303.0	9302.2	9301.3

ch1, Q0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	0.3	0.2	0.2	0.1	0.1	0.1
Upper limit (MHz) (*2)	9499.7	9499.8	9499.8	9499.9	9499.9	9499.9
Lower limit (MHz) (*2)	9300.3	9300.2	9300.2	9300.1	9300.1	9300.1

ch2, P0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	31.0	10.7	5.2	3.0	2.2	1.3
Upper limit (MHz) (*2)	9469.0	9489.3	9494.8	9497.0	9497.8	9498.7
Lower limit (MHz) (*2)	9331.0	9310.7	9305.2	9303.0	9302.2	9301.3

ch2, Q0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	0.3	0.2	0.2	0.1	0.1	0.1
Upper limit (MHz) (*2)	9499.7	9499.8	9499.8	9499.9	9499.9	9499.9
Lower limit (MHz) (*2)	9300.3	9300.2	9300.2	9300.1	9300.1	9300.1

(*1) Guard Band is specified to be equal to $1.5/T$ MHz, where "T" is the pulse length in microseconds.

(CFR Title 47 Sections: 80.209 (b))

(*2) Upper limit frequency, $f(U) = 9500 - 1.5/T$

Lower limit frequency, $f(L) = 9300 + 1.5/T$

2nd trace mode

ch1, P0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	30.9	10.7	5.2	3.1	2.2	1.3
Upper limit (MHz) (*2)	9469.1	9489.3	9494.8	9496.9	9497.8	9498.7
Lower limit (MHz) (*2)	9330.9	9310.7	9305.2	9303.1	9302.2	9301.3

ch1, Q0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	0.3	0.2	0.2	0.1	0.1	0.1
Upper limit (MHz) (*2)	9499.7	9499.8	9499.8	9499.9	9499.9	9499.9
Lower limit (MHz) (*2)	9300.3	9300.2	9300.2	9300.1	9300.1	9300.1

ch2, P0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	30.9	10.7	5.2	3.1	2.2	1.3
Upper limit (MHz) (*2)	9469.1	9489.3	9494.8	9496.9	9497.8	9498.7
Lower limit (MHz) (*2)	9330.9	9310.7	9305.2	9303.1	9302.2	9301.3

ch2, Q0N

Pulse type	S1	S2	M1	M2	M3	L
Guard Band $f(1.5/T)$ (MHz) (*1)	0.3	0.2	0.2	0.1	0.1	0.1
Upper limit (MHz) (*2)	9499.7	9499.8	9499.8	9499.9	9499.9	9499.9
Lower limit (MHz) (*2)	9300.3	9300.2	9300.2	9300.1	9300.1	9300.1

(*1) Guard Band is specified to be equal to $1.5/T$ MHz, where "T" is the pulse length in microseconds.

(CFR Title 47 Sections: 80.209 (b))

(*2) Upper limit frequency, $f(U) = 9500 - 1.5/T$

Lower limit frequency, $f(L) = 9300 + 1.5/T$

3.1.4 Test Results:

Complied.

(1) Temperature test at the rated supply voltage of 230 VAC, 50 Hz:

TT24NM mode

ch1, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9403.8	9403.7	9403.8	9403.8	9403.8	9403.8	Complied.
	+20°C	9404.2	9403.8	9403.7	9403.8	9403.8	9403.8	Complied.

ch1, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	+20°C	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.

ch2, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9413.8	9413.9	9413.8	9413.8	9413.8	9413.8	Complied.
	+20°C	9414.1	9413.7	9413.8	9413.8	9413.8	9413.8	Complied.

ch2, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	+20°C	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.

TT32NM mode

ch1, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9403.9	9403.8	9403.8	9403.8	9403.8	9403.8	Complied.
	+20°C	9404.1	9403.8	9403.8	9403.8	9403.8	9403.8	Complied.

ch1, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	+20°C	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.

ch2, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9413.8	9413.9	9413.8	9413.8	9413.8	9413.8	Complied.
	+20°C	9414.5	9414.0	9413.9	9413.8	9413.8	9413.8	Complied.

ch2, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	+20°C	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.

2nd trace mode

ch1, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9404.1	9403.9	9403.9	9403.8	9403.8	9403.8	Complied.
	+20°C	9404.2	9403.7	9403.8	9403.8	9403.8	9403.8	Complied.

ch1, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	+20°C	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.

ch2, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9413.7	9413.6	9413.7	9413.8	9413.8	9413.8	Complied.
	+20°C	9414.1	9413.7	9413.8	9413.8	9413.8	9413.8	Complied.

ch2, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	-30°C	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	+20°C	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.

(2) Voltage variation test at the temperature of +20°C:

TT24NM mode

ch1, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9403.8	9403.8	9403.9	9403.8	9403.8	9403.8	Complied.
	V _{nom}	9404.2	9403.8	9403.7	9403.8	9403.8	9403.8	Complied.
	V _H	9404.0	9403.7	9403.8	9403.8	9403.8	9403.8	Complied.

ch1, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	V _{nom}	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	V _H	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.

ch2, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9414.1	9413.7	9413.8	9413.8	9413.8	9413.8	Complied.
	V _{nom}	9414.1	9413.7	9413.8	9413.8	9413.8	9413.8	Complied.
	V _H	9414.2	9413.8	9413.8	9413.8	9413.8	9413.8	Complied.

ch2, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9433.8	9433.8	9433.8	9433.8	9433.7	9433.8	Complied.
	V _{nom}	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	V _H	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.

TT32NM mode

ch1, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9404.1	9403.8	9403.7	9403.8	9403.8	9403.8	Complied.
	V _{nom}	9404.1	9403.8	9403.8	9403.8	9403.8	9403.8	Complied.
	V _H	9404.3	9403.7	9403.8	9403.8	9403.8	9403.8	Complied.

ch1, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	V _{nom}	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	V _H	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.

ch2, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9414.0	9413.7	9413.8	9413.8	9413.8	9413.8	Complied.
	V _{nom}	9414.5	9414.0	9413.9	9413.8	9413.8	9413.8	Complied.
	V _H	9414.3	9414.0	9413.8	9413.8	9413.8	9413.8	Complied.

ch2, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	V _{nom}	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	V _H	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.

2nd trace mode

ch1, P0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9404.2	9403.8	9403.8	9403.7	9403.8	9403.8	Complied.
	V _{nom}	9404.2	9403.7	9403.8	9403.8	9403.8	9403.8	Complied.
	V _H	9404.1	9403.5	9403.8	9403.7	9403.7	9403.8	Complied.

ch1, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	V _{nom}	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.
	V _H	9423.8	9423.8	9423.8	9423.8	9423.8	9423.8	Complied.

ch2, P0N

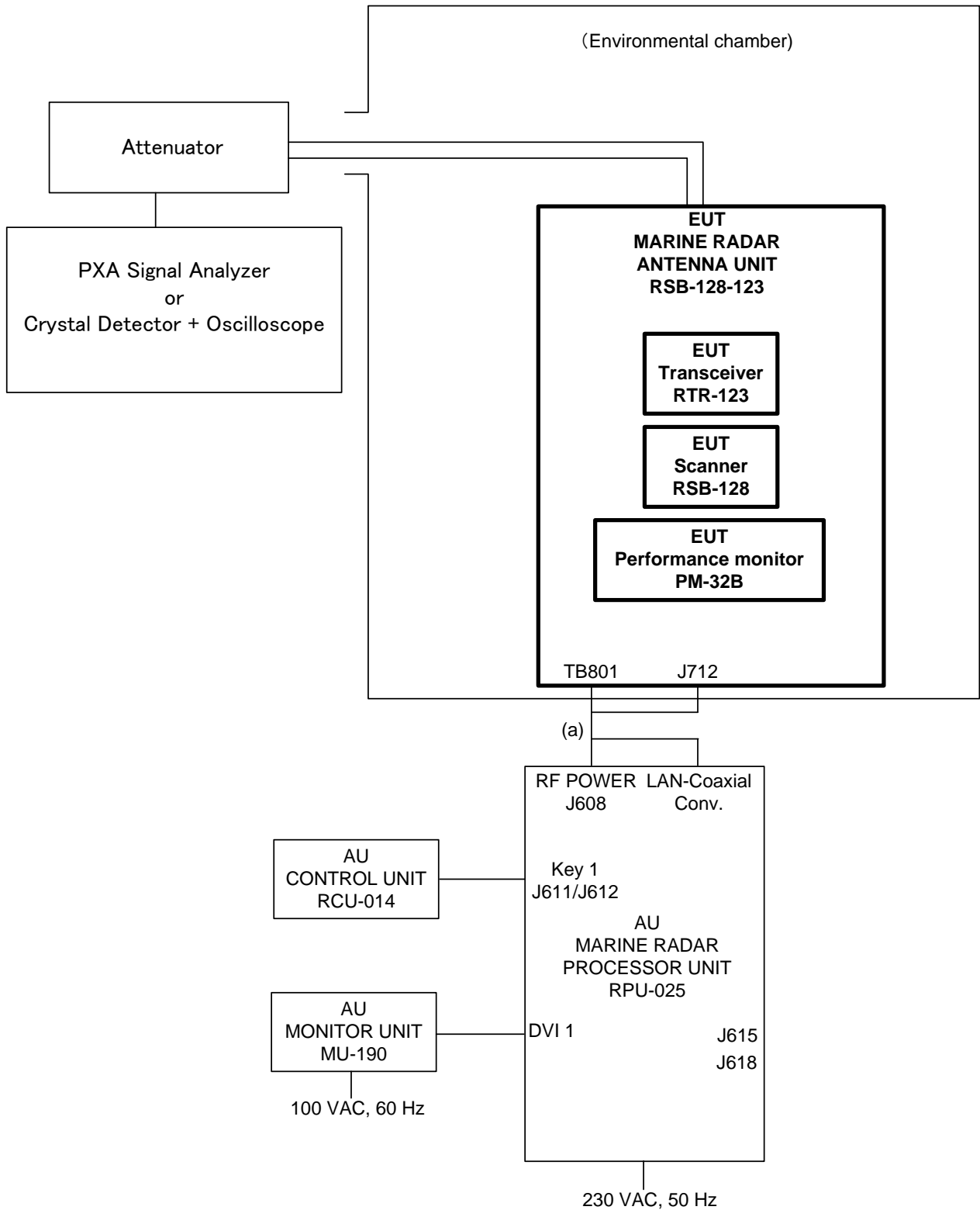
Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9414.0	9413.7	9413.8	9413.8	9413.8	9413.8	Complied.
	V _{nom}	9414.1	9413.7	9413.8	9413.8	9413.8	9413.8	Complied.
	V _H	9414.3	9413.7	9413.8	9413.7	9413.8	9413.8	Complied.

ch2, Q0N

Pulse type		S1	S2	M1	M2	M3	L	Result
Frequency at maximum emission (MHz)	V _L	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	V _{nom}	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.
	V _H	9433.8	9433.8	9433.8	9433.8	9433.8	9433.8	Complied.

Environmental conditions observed: On 2 February 2022, 22°C to 22°C, 45%RH to 45%RH
 On 24 February 2022, 18°C to 18°C, 31%RH to 31%RH

4 Test Setup for Measurements



Cable designations

No.	Category	Name	Type	Length (m)	Number of cables used	Cable shielded
a	Signal/control	Multicore cable	RW-9600	20	1	Yes

5 Measuring Equipment List

Measuring/Test instruments have been appropriately calibrated/maintained according to the LIC programs/procedures and ISO/IEC 17025. Measuring/Test instruments used for the tests are listed below.

C/N	Instrument	Type	S/N	Manufacturer	Date of last calibration	Calibration interval
HT370	Climatic chamber (Large)	TBE-3HW5GE2F	3013000995	Tabai Espec	17 July 2021	1 year
HT723	Paperless recorder/ Dual communication logger	FX106-4-1	S5JA01445	Yokogawa	Not applicable	--
HT1165	Climatic chamber (Extra-Large)	TBE-6E20W0P3T	3015006336	Espec	20 August 2021	1 year
RT213	Waveguide	WRJ-10	Not assigned	Furuno	13 July 2021	1 year
HT654	Attenuator	8494B	MY42148134	Agilent	5 February 2021	1 year (*)
HT1223	Attenuator	8495B	MY42148137	KEYSIGHT	3 March 2021	1 year
HT1317	PXA Signal Analyzer	N9030B	SG57142024	KEYSIGHT	5 March 2021	1 year
HT972	Oscilloscope	MSO4054B	C030483	TEKTRONIX	28 February 2021	1 year
HT1221	Crystal detector	423B	MY51342422	Agilent	24 February 2021	1 year
HT831	Digital multi-meter	115	15540244	Fluke	25 May 2021	1 year
HT167	Digital multi-meter	E2377A	3651J18668	Agilent	15 February 2022	1 year

(*) Due date: 28 February 2022

End of text