Test Report

(IEC 60945 and IEC 62388)

For

Trade name: Furuno
Model: MARINE RADAR
Type: FAR-3230S/-3330S
(with LAN Signal Converter)

Report No.: FLI 12-13-073

Date of Issue: 18 November 2013

Furuno Labotech International Co., Ltd.

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Report Summary

FLI project number:	FLI 04-13-0330		
Test report number of initial issue:	FLI 12-13-073	Date of initial issue	18 November 2013
Test report number of revised/replaced issue:	---	Date of revised/replaced issue	---
Test report revision/ replacement history:	---		
Test standard(s)/ Test specifications:	IEC 60945: 2002 (ed. 4), Clause 7.1, 7.2, 8.2, 8.3, 8.4, 8.7, 11, and 12, including IEC 60945 Corrigendum 1 (2008). IEC 62388: 2013 (ed.2.0), 17.3.2 Antenna shock test IEC 60068-2-1: 2007, IEC 60068-2-2: 2007, IEC 60068-2-6: 2007, IEC 60068-2-30: 2005.		
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:	MARINE RADAR		
Type:	FAR-3230S/-3330S (with LAN Signal Converter)		
Product function and intended use:	For marine safety navigation		
Number of test samples tested:	One.		
Serial number:	R00005-000003		
Power rating:	100-230 VAC, 50-60 Hz, 8 A		
Product status:	Pre-production model		
Modifications made to samples during testing:	None.		
Date of receipt of samples:	2 September 2013		
Test period:	From 3 September 2013 to 2 October 2013.		
Place of test:	Furuno Labotech International Co., Ltd. - LABOTECH EMC Center 1-16, Fukazu-cho, Nishinomiya-shi, Hyogo, 663-8203 Japan - Nishinomiya-Hama Lab. 2-20, Nishinomiya-Hama, Nishinomiya-shi, Hyogo, 662-0934 Japan - Nishinomiya Lab. 9-52 Ashihara-cho, Nishinomiya-shi, Hyogo, 662-8580 Japan		
Test results/ Compliance:	Passed. The test results of this report relate only to the samples tested.		
Tested by:	Tadayuki Ekawa, Yasuharu Nakamura, Osamu Araki, Fumiya Ueki, and Katsumi Imamura		
Written by:	Akiko Inoue		
Verified by:	Yoshihiro Ishii		
Approved by:	Date: 18 November 2013 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, 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, 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 Resister (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)
- Recogintion 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, interfave and safety testing.

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

TABLE OF CONTENTS

1 Principal Information

1.1 Equipment under test (EUT)

Configurations of the EUT units:

No. (*)	Item	Type	Unit serial number	Equipment category	Note
1	Antenna Unit			Exposed	
	Transceiver (with LAN Signal Converter)	RTR-107	---		TX: 30 kW_{pp}, TX/RX freq.: 3050 MHz Magnetron used: MG5223F
	Gear Box (with built-in deicer)	RSB-129	R00005-000003		
	Performance Monitor	PM-52A	---		
	Antenna Radiator (*1)	SN36CF	---		
2	Power Supply Unit (with LAN Signal Converter)	PSU-015	000006	Protected	

(*): Item number(s) is(are) corresponding to the unit(s) shown in Clause 5 “EUT Setup/Test Arrangement” and Clause 6 “Photographs of Test Setup/Arrangement” of this report.

Note (*1): Antenna Radiator was replaced with Auxiliary Equipment, “Antenna Dummy Load (S-band)” except for “Vibration”, “Antenna shock”, “Rain and Spray”, and “Electromagnetic radio frequency radiation” tests

Size and Mass of the EUT unit(s):

No.	Name	Type	Dimensions (W × H × D, or ϕ × H) (mm)	Mass (kg)	Note
1	Antenna Unit	---	3795 × 773 × 640	141	With Performance Monitor, Transceiver, and Gear Box (with built-in deicer), and SN36CF contained.
2	Power Supply Unit	PSU-015	392×147×405	10	

Configurations of the Associated unit(s) (AU) forming the system except EUT:

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
1	Processor Unit	EC-3000	4395-1205	Furuno	Used for the tests other than Vibration and Antenna Shock.
			4395-1207		Used for Vibration and Antenna Shock tests.
2	Monitor Unit	MU-190	001436	Furuno	Used for the tests other than Vibration and Antenna Shock.
			000457		Used for Vibration and Antenna Shock tests
3	Monitor Unit	MU-231	002719	Furuno	Used for the tests other than Vibration and Antenna Shock.
			000026		Used for Vibration and Antenna Shock tests
4	Control Unit	RCU-025	000169	Furuno	Used for the tests other than Vibration and Antenna Shock.
			000168		Used for Vibration and Antenna Shock tests.
5	Processor Unit	RPU-013	4366-4589	Furuno	Used for the tests other than Vibration and Antenna Shock.
			4317-2240		Used for Vibration and Antenna Shock tests.
6	Display Unit	U2412Mb	CN-007H8X-74 261-31F-4KYS	DELL	
7	Control Unit	RCU-014	2-0153	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
1	Antenna Dummy Load (S-band)	TF300-A	85D11	SANKEN	
2	PC	HP Compaq dx6100 ST	JPA5120546	HP	Used for the tests other than Vibration and Antenna Shock.

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
		E5520-2500HD(7P	29751700	DELL	Used for Vibration and Antenna Shock tests.
3	USB Serial Adapter (RS-422)	ESU2-400	03064100028	QUATECH	
4	Keyboard	TK-FCM007WH	28067474	ELECOM	

(*): 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, AU:

No.	Category	Item/Type	Program name	Program number	Rev. number	Note
1	EUT	Antenna Unit	App (SPU MAG)	0359281	01.04	
			App (MTR-DRV)	0359293	01.04	
			App(PM)	0359296	01.04	
2	EUT	Power Supply Unit PSU-015	App (PSU-Control)	0359299	01.04	
3	AU	Processor Unit EC-3000	App	0359266	02.04	
4	AU	Control Unit RCU-025	Key1	2450086	01.05	
5	AU	Monitor Unit (19.0-inch)	Monitor1	2651020	01.03	
6	AU	Monitor Unit (23.1-inch)	Monitor2	2651020	01.03	
7	AU	Processor Unit	RPU-013	0359204	03.51	
8	AU	Control Unit	RCU-014	0359203	01.04	
9	AE	PC	Winiec	Winexe=14 (Feb 27 2013) Winiec.mcr=02		

1.2 EUT Operation mode and Performance Check/Test

1.2.1 EUT Operation mode

Operation state: TX-on.

RANGE: 0.125 NM
TUNE: AUTO
GAIN: Manual, 100 (Max)
A/C SEA: Manual, 0 (Min)
A/C RAIN: Manual, 0 (Min)
Range rings: ON
VRM1,2: ON
EBL1,2: ON
Brilliance of all attributes: MAX.

1.2.2 Performance Test (PT)

(1) Radar display on MU-190 and MU-231 (AUs):
- Noise echo level/area should not change. Radar display should be updated (scanning).

(2) Antenna rotation:
- Antenna should be rotated in a clockwise direction through 360° continuously and automatically with the rotation rate of 40 rpm or more for HSC Radar.

(3) Tuning indicator:
- Indicator bar of RX tuning indicator should be 50% or more.

(4) Sub display:
- Radar display on Display Unit (AU6) should be displayed and updated (scanning).

(5) Own ship's information:
- Own ship's information should be displayed on MU-190 and MU-231 (AUs).

(6) Track ball control:
- Cursor should be moved as intended.

(7) TT-Test:
- Target should be tracked and Echo trail functions should be activated as intended.

(8) Startup:
- Startup time from Power-ON to the ST-BY state should be 4 min. or less.

(9) Magnetron:
- Magnetron current indicated in System monitor should be more than 0 A.

1.2.3 Performance Check (PC)

Same as those for PT.

1.3 Test Conditions

1.3.1 Normal power supply conditions:

100 VAC, 60 Hz (for “Vibration” and “Antenna shock” tests),
230 VAC, 50 Hz (for the tests other than the above)

1.3.2 Extreme power supply conditions:

Upper extreme conditions:

253 VAC, 52.5 Hz (230 VAC+10 %, 50 Hz+5 %).

Lower extreme conditions:

207 VAC, 47.5 Hz (230 VAC-10 %, 50 Hz-5 %). (*)

(*) specified by the customer.

1.4 Observation and comments

(1) Test items to be performed were specified by the customer.
Test items under IEC 60945 Clause 6, 9, 10, 13, 14, and 15 are separately reported.

(2) Unit combinations for Radar System of FAR-3230S/-3330S are as follows, and tests were performed with the MU-190 and MU-231 connected at the same time, and with PSU-015 (42 rpm) as the worst case.

Model	Band	Tx power	Scanner	Transceiver	Radiator	Display	Antenna rotation	Power Supply Unit	
								24 rpm	42 rpm
FAR-3230S	S band	30 kW	RSB-129	RTR-107	SN36CF (12 ft)	MU-190	24/42 rpm	PSU-014	PSU-015
FAR-3330S						MU-231			

Note: PSU-014 has been already tested with the Radar FAR-3210/-3310/-3220/-3320 systems.

(3) Corrosion (salt mist) test was not performed, because the evidence that the components, materials and finishes employed in the EUT satisfy the test was submitted by the manufacturer.
(See Furuno Electric Statement CW-038 dated 30 Septe4mebr 2013.)

(4) “Emission from visual display unit (VDU)” test was not applicable, because the EUT had no display devices.

(5) “X-radiation” test was not performed, because the evidence that the Magnetrons employed in the EUT satisfy the test was submitted by the manufacturer.

1.5 Measurement uncertainties

IEC 60945 Clause	Item	Measurement uncertainty (*)
7	Power supply	
7.1	Extreme power supply:	----
7.2	Excessive conditions:	----
8	Durability and resistance to environmental conditions	
8.2	Dry heat	----
8.2.1	- Storage test:	Temperature: ±1.5°C
8.2.2	- Functional test:	Temperature: ±1.5°C
8.3	Damp heat	
8.3.1	- Functional test:	Temperature: ±1.5°C, Humidity: ±4%
8.4	Low temperature	----
8.4.1	- Storage test:	----
8.4.2	- Functional tests:	Temperature: ±1.5°C
8.7	Vibration:	Acceleration: ±2.2 m/s^2
8.12	Corrosion:	----
11	Special purpose tests	
11.1	Acoustic noise and signals:	±2.4 dB
12	Safety precautions	
12.1	Protection against accidental access to dangerous voltages:	Not applicable.

(*): confidence level = 95%, coverage factor $k = 2$

IEC 62388	Item	Measurement uncertainty (*)
17.3.2	Antenna shock test	Acceleration: ±2.2 m/s^2

(*): confidence level = 95%, coverage factor $k = 2$

2 Test Results Summary

IEC 60945 Clause	Test Item	Result	Test Engineer
7	Power supply		
7.1	Extreme power supply:	Passed.	T. Ekawa
7.2	Excessive conditions:	Passed.	Y. Nakamura
8	Durability and resistance to environmental conditions		
8.2	Dry heat		
8.2.1	- Storage test:	Passed.	T. Ekawa.
8.2.2	- Functional test:	Passed.	T. Ekawa.
8.3.1	Damp heat - Functional test:	Passed.	T. Ekawa.
8.4	Low temperature		
8.4.1	- Storage test:	Not applicable.	---
8.4.2	- Functional tests:	Passed.	T. Ekawa.
8.7	Vibration:	Passed.	F. Ueki, K. Imamura
8.8	Rain and spray:	Not performed.	---
8.12	Corrosion:	Not performed.	---
11	Special purpose tests		
11.1	Acoustic noise and signals:	Passed.	Y. Nakamura
11.2	Compass safe distance (CSD):	Not performed.	---
12	Safety precautions		
12.1	Protection against accidental access to dangerous voltages:	Passed.	Y. Nakamura
12.2	Electromagnetic radiofrequency radiation:	Not performed.	---
12.3	Emission from visual display unit (VDU):	Not applicable.	---
12.4	X-radiation:	Not performed.	---

IEC 62388 Clause	Test Item	Result	Test Engineer
17.3.2	Antenna shock test	Passed.	F. Ueki, K. Imamura

3 Test Results

3.1 Power supply

3.1.1 Extreme power supply

Environment	Normal power supply		Extreme power supply	
Dry heat	Performance test (PT)	Passed	Performance check (PC)	Passed
Damp heat	Performance check (PC)	Passed	---	---
Low temperature	Performance test (PT)	Passed	Performance check (PC)	Passed
Normal temperature	Performance test (PT)	Passed	Performance test (PT)	Passed

3.1.2 Excessive conditions

	Item	Result	Description
1	Against Excessive current:	Passed.	7 A and 3 A fuses for both AC lines were activated, and the EUT was protected from damage.
2	Against Excessive voltage:	Passed.	Overvoltage protection circuits were provided in PSU-015. (activated at 290 VAC to 310 VAC)
3	When subjected to the input of 295 VAC (> 230 VAC + 10%) of: - improper phase sequence (for AC), for 5 min.	Passed.	No abnormality or damage occurred.

After the tests, PC was successfully performed without errors or abnormality.

3.2 Dry heat

3.2.1 Storage test

For Antenna unit and PSU-015 (*),
after the test, PT/PC were performed at the Normal temperature. See Clause 3.1 of this report.

(*): PSU-015 was additionally tested under the temperature of +70°C specified to “Exposed equipment” at the same time at the customer’s request.

3.2.2 Functional test

See Clause 3.1 of this report.

3.3 Damp heat - Functional test

See Clause 3.1 of this report.

3.4 Low temperature

3.4.1 Storage test

Not applicable to “Exposed”, “Protected” equipment.

3.4.2 Functional test

For Antenna Unit and PSU-015 (*),
see Clause 3.1 of this report.

(*): PSU-015 was additionally tested under the temperature of -25°C specified to “Exposed equipment” at the same time at the customer’s request.

3.5 Vibration

3.5.1 EUT attitude/mounting and Test fixture:

Unit	Attitude/mounting	Test fixture
PSU-015	Table-top	No. 54 (*1)
	Wall-mounting	No. 35 and No. 63 (*1)
Antenna Unit RSB-129 + RTR-107 + SN36CF	Table-top	No. 44 (*1)

(*): prepared by FLI.

3.5.2 Resonance search and Endurance tests

Position of Vibration Pick-up Sensors and Directions of Vibration: See Clause 6 of this report.

Unit	Vibration Direction	Resonance detected			Endurance test performed at freq. (Hz)	Results	Note
		Freq. (Hz)	Acceleration (m/s^2)	Magnitude ratio Q			
RSB-129 + RTR-107 + SN36CF, Table-top	X (left/right)	57.2	27.2	3.9	57.2	Passed.	
	Y (back/forth)	58.5	25.7	3.7	58.5	Passed.	
	Z (up/down)	(*)	(*)	(*)	30.0	Passed.	
PSU-015 Table-top	X (left/right)	(*)	(*)	(*)	30.0	Passed.	
	Y (back/forth)	76.0	14.2	2.0	76.0	Passed.	
	Z (up/down)	89.5	30.2	4.3	89.5	Passed.	
PSU-015 Wall-mounting	X (left/right)	(*)	(*)	(*)	30.0	Passed.	
	Y (back/forth)	76.0	28.1	4.0	76.0	Passed.	
	Z (up/down)	93.0	23.0	3.3	93.0	Passed.	

There was no damage, or degradation of performance during and after the tests.

3.6 Antenna Shock

3.6.1 EUT attitude/mounting and Test fixture:

Unit	Attitude/mounting	Test fixture
Antenna Unit RSB-129 + RTR-107 + SN36CF	Table-top	No. 44 (*1)

(*): prepared by FLI.

3.6.2 Result:

Unit	Test conditions	Results
Antenna Unit RSB-129 + RTR-107 + SN36CF	Acceleration: 100 m/s^2 Duration: 25 ms Number of shocks: Three Direction: Z -upward	Passed.

There was no damage, or degradation of performance during and after the tests.

3.7 Rain and spray (Not performed)

Not performed at the customer's request because it has been already tested and reported in the test report FLI 12-13-057.

3.8 Corrosion (salt mist) (Not performed)

Not performed. See Clause 1.4 of this report.

3.9 Special purpose tests

3.9.1 Acoustic noise and signals

Unit	Acoustic noise pressure (dB (A))			Limits	
	EUT powered off (Background noise)	EUT powered on	Alarm: on (*)	Acoustic noise power (pressure) dB(A)	Audible alarm power (pressure) dB(A)
PSU-015	30 or under.	50.9	Not applicable	≤ 60	75 to 85

Note: (*) The EUT had no audible alarm function or level control.

The tests to Antenna Unit were not applicable, because the unit was intended not to be installed in wheelhouses or bridge wings.

3.9.2 Compass safe distance (CSD) (Not performed)

Not performed at the customer's request because it has been already tested and reported in the test report FLI 12-13-057.

3.10 Safety precautions

3.10.1 Protection against accidental access to dangerous voltages

IEC 60945 Clause	Requirement	Result	Note
4.6.1/12.1	There shall be no openings of the enclosure of the EUT to allow access to hazardous parts with the access probe (test finger), or there shall be adequate clearance between the access probe and hazardous parts.	Passed.	Dangerous voltages were provided in the EUT, but there were no openings to allow with test finger.
	All parts and wiring in the EUT shall be isolated automatically from all sources of electrical energy when protective covers are removed. Alternatively any further access to the interior of the EUT shall be only possible by means of a spanner or screwdriver.	Passed.	Screw driver needed.
	Warning labels shall be prominently displayed both within the EUT and on protective covers.	Passed.	Warning label provided on the protective cover.
	Means shall be provided for earthing exposed metallic parts of the EUT, but this shall not cause any terminal of the source of electrical energy to be earthed.	Passed.	Earth terminal provided.

3.10.2 Electromagnetic radiofrequency radiation (Not performed)

Not performed at the customer's request because it has been already tested and reported in the test report FLI 12-13-057.

3.10.3 Emission from visual display unit (VDU)

Not applicable. The EUT had no display devices.

3.10.4 X-radiation (Not performed)

Not performed at the customer's request because it has been already tested and reported in the test report FLI 12-13-057.

3.11 Environmental conditions during Testing

IEC 60945 Clause	Item	Date of test	Temperature, humidity (Before-test to After-test)	Power supply voltage (Before-test to After-test)
7	Power supply			
7.1	Extreme Power supply:	3 September 2013	24°C to 25°C, 56% to 61%RH.	207.0 VAC, 50.0 Hz to 207.0 VAC, 50.0 Hz. 253.0 VAC, 50.0 Hz to 253.0 VAC, 50.0 Hz.
		4 September 2013	24°C to 24°C, 60% to 60%RH.	207.0 VAC, 50.0 Hz to 207.0 VAC, 50.0 Hz. 253.0 VAC, 50.0 Hz to 253.0 VAC, 50.0 Hz.
		6 September 2013	24°C to 24°C, 60% to 60%RH.	207.0 VAC, 50.0 Hz to 207.0 VAC, 50.0 Hz. 253.0 VAC, 50.0 Hz to 253.0 VAC, 50.0 Hz.
7.2	Excessive conditions tests	2 October 2013	26°C to 26°C, 62% to 62%RH.	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz.
8	Durability and resistance to environmental conditions			
8.2	Dry heat	----	----	----
8.2.1	- Storage test:	6 September 2013	24°C to 24°C, 60% to 60%RH.	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz.
8.2.2	- Functional test:	4 September 2013	24°C to 24°C, 60% to 60%RH.	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz.
8.3.1	Damp heat- Functional test:	5 September 2013	24°C to 25°C, 60% to 57%RH.	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz.
8.4	Low temperature			
8.4.1	- Storage test:	Not applicable.	----	----
8.4.2	- Functional tests:	3 September 2013	24°C to 25°C, 56% to 61%RH.	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz.
8.7	Vibration:	12 September 2013	25°C to 25°C, 54% to 54%RH	100.0 VAC, 60.0 Hz to 100.2 VAC, 60.0 Hz.
		13 September 2013	25°C to 25°C, 61% to 61%RH	101.0 VAC, 60.0 Hz to 101.2 VAC, 60.0 Hz.
		14 September 2013	27°C to 26°C, 70% to 62%RH	100.6 VAC, 60.0 Hz to 100.8 VAC, 60.0 Hz.
8.8	Rain and spray:	Not performed.	----	----
8.12	Corrosion:	Not performed.	----	----
11	Special purpose tests			
11.1	Acoustic noise and signals:	27 September 2013	26°C to 26°C, 62% to 62%RH.	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz.
11.2	Compass safe distance (CSD):	Not performed.	----	----
12	Safety precautions			
12.1	Protection against accidental access to dangerous voltages:	2 October 2013	26°C to 26°C, 62% to 62%RH.	No power supply.
12.2	Electromagnetic radiofrequency radiation:	Not performed.	----	----
12.3	Emission from visual display unit (VDU):	Not applicable.	----	----
12.4	X-radiation measurement:	Not performed	----	----

IEC 62388 Clause	Item	Date of test	Temperature, humidity (Before-test to After-test)	Power supply voltage (Before-test to After-test)
17.3.2	Antenna shock	14 September 2013	27°C to 26°C, 70% to 62%RH	100.6 VAC, 60.0 Hz to 100.8 VAC, 60.0 Hz.

4 List of Measuring/Test Instruments

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

4.1 Dry heat/Damp heat/Low temperature

(*)	C/N	Instrument	Type	S/N	Manufacturer
X	HT370	Climatic chamber (L)	TBE-3HW5GE2F	3013000995	Tabai Espec
X	HT723	Paperless recorder/Dual communication logger DAQSTATION FX100	FX106-4-1	S5JA01445	Yokogawa
--	HT415	Climatic chamber (S)	PL-4KP	14004204	Tabai Espec
--	HT724	Paperless recorder/Dual communication logger DAQSTATIOM FX100	FX106-4-1	S5JA01450	Yokogawa
--	HT510	Climatic chamber (Hama-L)	TBE-3HW4PE2F	3013002540	Tabai Espec
--	HT725	Paperless recorder/Dual communication logger DAQSTATION FX100	FX106-4-1	S5JA01447	Yokogawa
--	HT364	Climatic/Air pressure chamber (Hama-AL)	MZH-21HS	581989	Tabai Espec
--	HT161	Temperature recorder (Hama-AL)	µR180	4177WA303	Yokogawa
--	HT414	Climatic chamber (Hama-S)	PL-4KP	14004203	Tabai Espec
--	HT726	Paperless recorder/Dual communication logger DAQSTATION FX100	FX106-4-1	S5JA01448	Yokogawa
X	HT446	Programmable AC power supply	4420/4471	306043-4420024	NF
--	HT432	DC power supply	PAN55-20	AK003307	Kikusui
X	HT461	Digital Multimeter	111	78410077	Fluke

(*): X – indicates instruments used for the tests, -- – not used.

4.2 Vibration

(*)	C/N	Instrument	Type	S/N	Manufacturer	Note
X	HT562	Vibration test system (3.5-ton type)	G-0235LS	SG-4420	Shinken	
X	HT367	Vibration test system (2.0-ton type)	VS-2000-20	S-4798	IMV	
--	HT373	Vibration test system (0.6-ton type)	VS-600-140	212540	IMV	
--	HT439	Pickup sensor	VP-15	2325T	IMV	
X	HT577	Pickup sensor **(Reference)**	V11-101S	0522	Shinken	Used for PSU-015
--	HT578	Pickup sensor	V11-101S	0521	SHINKEN	
X	HT661	Pickup sensor **(Reference)**	V11-101S	1112	Shinken	Used for Antenna Unit
X	HT662	Pickup sensor **(Response)**	VP-15	0025U	IMV	
X	HT663	Pickup sensor **(Response)**	VP-15	0026U	IMV	Used for PSU-015
--	HT434	AC/DC Power Supply	PCR2000L	BB002789	Kikusui	Used for Antenna Unit
--	HT431	DC Power Supply	PAN55-20	AK003303	Kikusui	
X	HT462	Digital Multimeter	111	78120001	Fluke	
--	HT430	DC Power supply	PAD55-20L	10091786	Kikusui	

(*): X – indicates instruments used for the tests, -- – not used.

4.3 Antenna Shock

(*)	C/N	Instrument	Type	S/N	Manufacturer
X	HT562	Vibration test system (3.5-ton type)	G-0235LS	SG-4420	Shinken
--	HT367	Vibration test system (2.0-ton type)	VS-2000-20	S-4798	IMV
--	HT373	Vibration test system (0.6-ton type)	VS-600-140	212540	IMV
--	HT439	Pickup sensor	VP-15	2325T	IMV
--	HT577	Pickup sensor	V11-101S	0522	Shinken
--	HT578	Pickup sensor	V11-101S	0521	SHINKEN
X	HT661	Pickup sensor **(Reference)**	V11-101S	1112	Shinken
--	HT662	Pickup sensor	VP-15	0025U	IMV
--	HT663	Pickup sensor	VP-15	0026U	IMV
--	HT434	AC/DC Power Supply	PCR2000L	BB002789	Kikusui
--	HT431	DC Power Supply	PAN55-20	AK003303	Kikusui
X	HT462	Digital Multimeter	111	78120001	Fluke
--	HT430	DC Power supply	PAD55-20L	10091786	Kikusui

(*): X – indicates instruments used for the tests, -- – not used.

4.4 Special purpose tests

4.4.1 Acoustic noise and signals

(*)	C/N	Instrument	Type	S/N	Manufacturer
--	HT453	Sound level meter	VS-3701A	66645	Panasonic
X	HT702	Sound level meter	556A	935983	Testo
--	HT177	Screened room	USC-26	D-003	USC
--	HT164	Digital multimeter	E2378A	2943J06324	HP
--	HT173	DC power supply	GP035-30R	1014397082	Takasago
X	HT779	Semi-Anechoic chamber	10mAC	90984	TOKIN
X	HT780	Programmable AC/DC Power Supply	ES18000W	9128767-1+ 9128767-2	NF
X	HT687	Digital multimeter	115	10821183	FLUKE

(*): X – indicates instruments used for the tests, -- – not used.

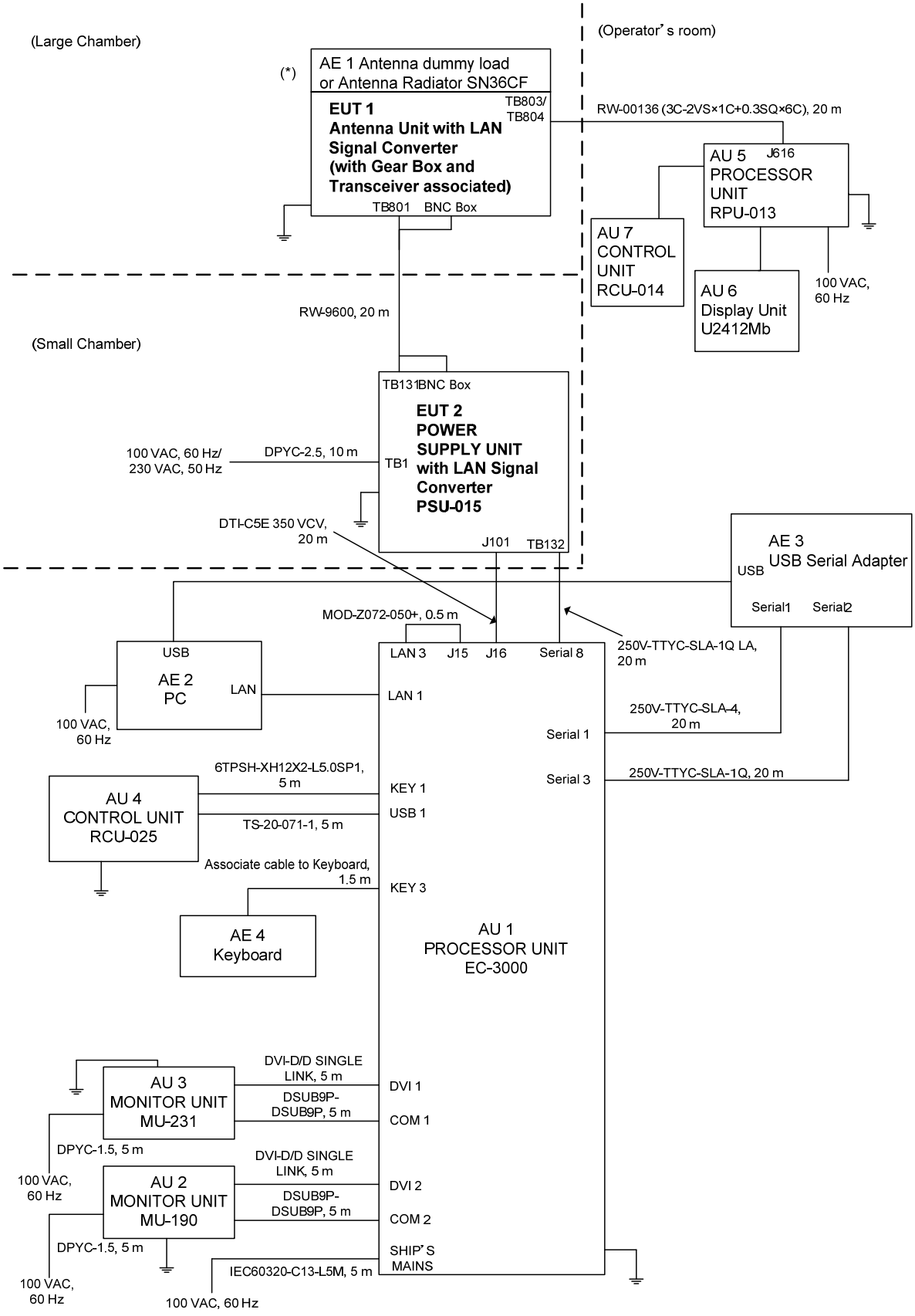
4.5 Safety precautions

4.5.1 Protection against accidental access to dangerous voltages

(*)	C/N	Instrument	Type	S/N	Manufacturer
X	HT435	Jointed test finger	P-10.09	D-008	EXCEL

(*): X – indicates instruments used for the tests, -- – not used.

5 EUT Setup/Test Arrangement



Note: AU - Auxiliary Unit, AE - Associated Equipment.
(*) - Antenna radiator was used for "Vibration" and "Antenna shock" tests.

6 Photographs of Test Setup/Arrangement

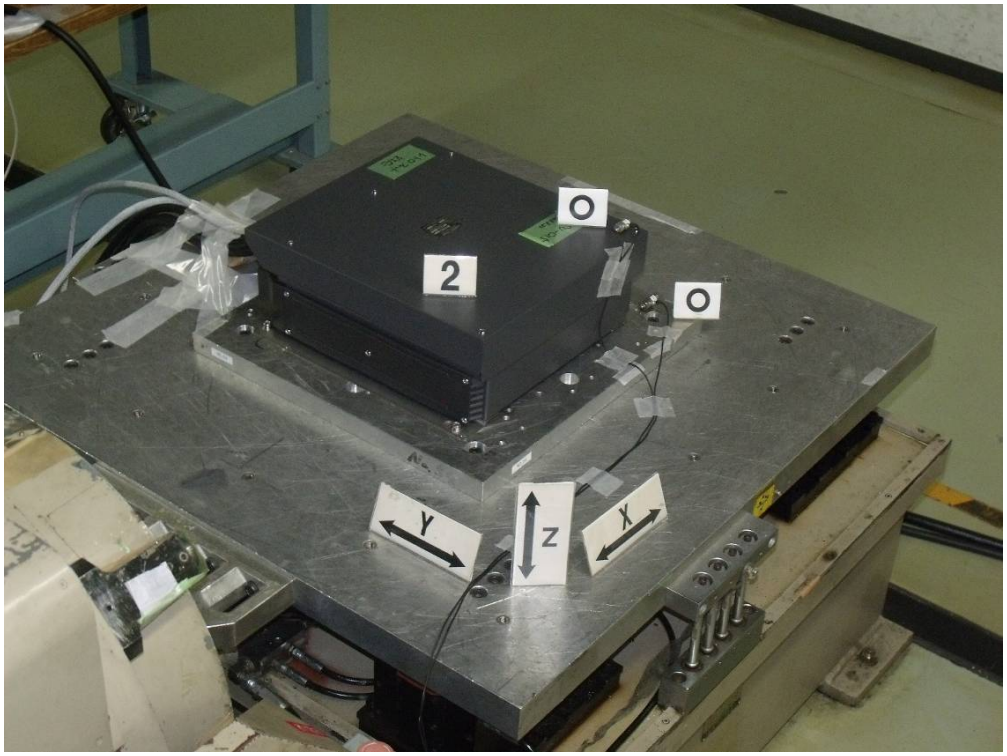
6.1 Dry heat/Damp heat/Low temperature

6.2 Vibration

Antenna Unit (RSB-129 + RTR-107 + SN36CF),

PSU-015,

(a) Table top



Note: ○ - Pick-up sensor, ↔ - Vibration direction

(b) Wall mounting

6.3 Antenna shock

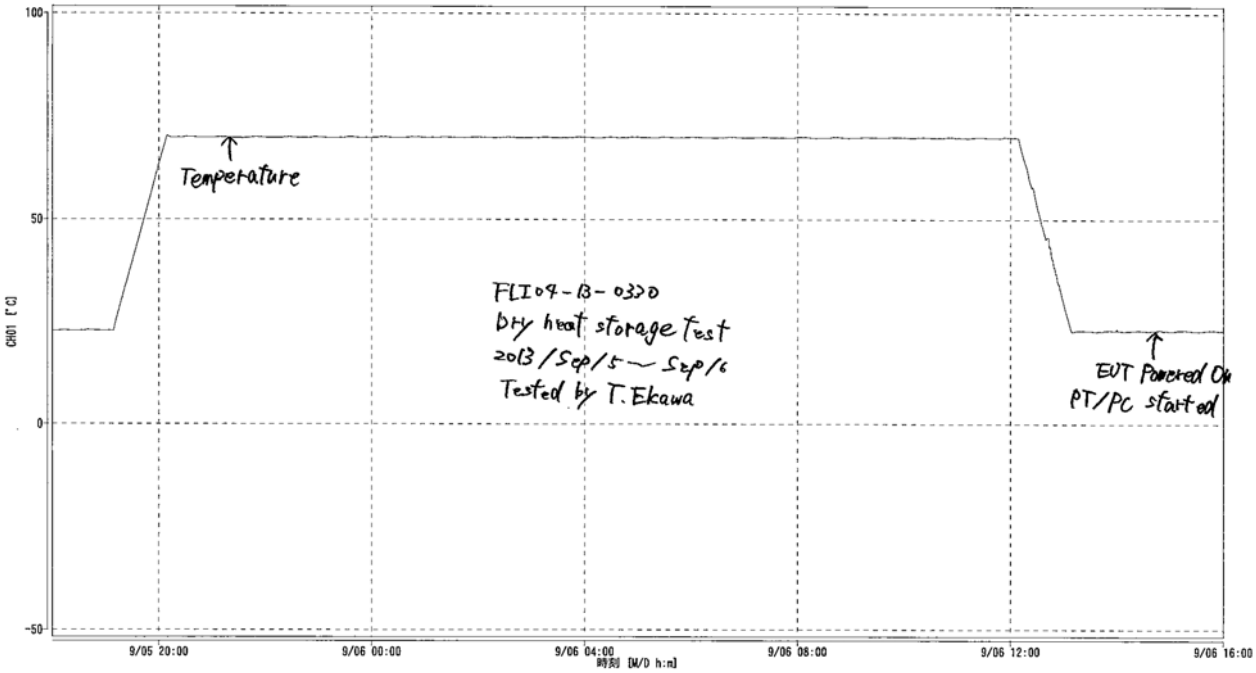
Antenna Unit (RSB-129 + RTR-107 + SN36CF),

Note: ○ - Pick-up sensor, ↔ - Vibration direction

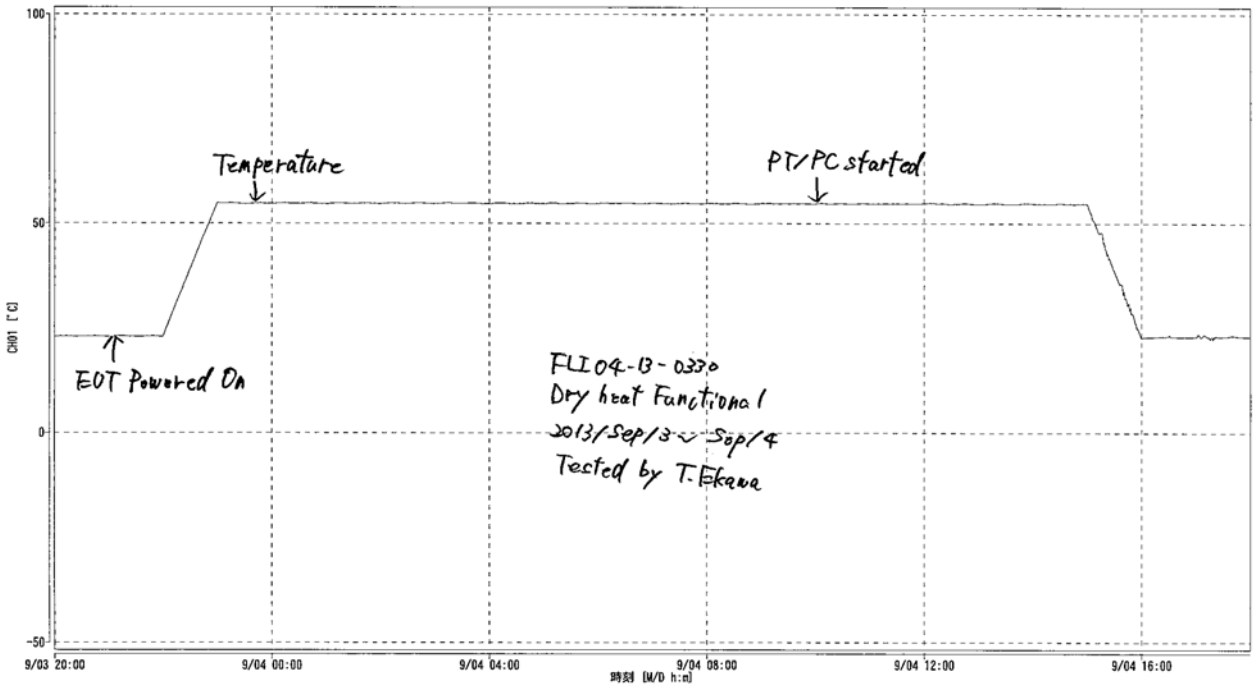
: Antenna shock test was performed to Z direction.

7 Temperature/humidity records taken during Dry heat/Damp heat/Low temperature tests

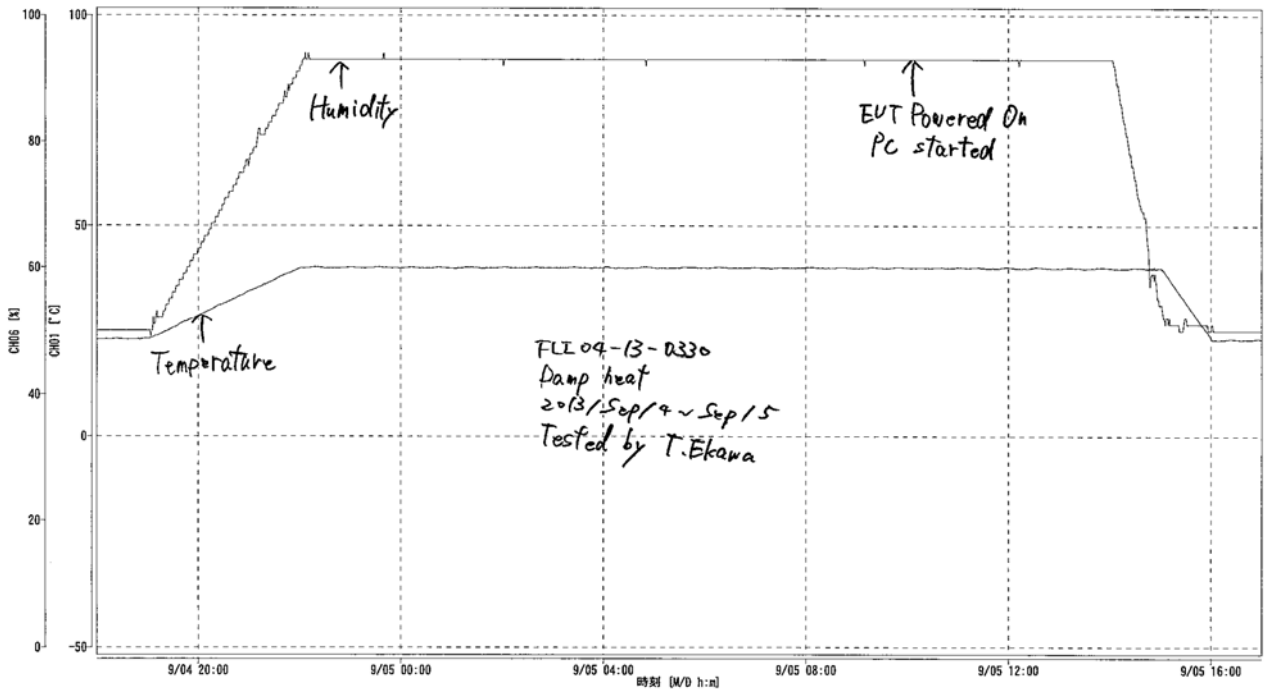
7.1 Dry heat - Storage,



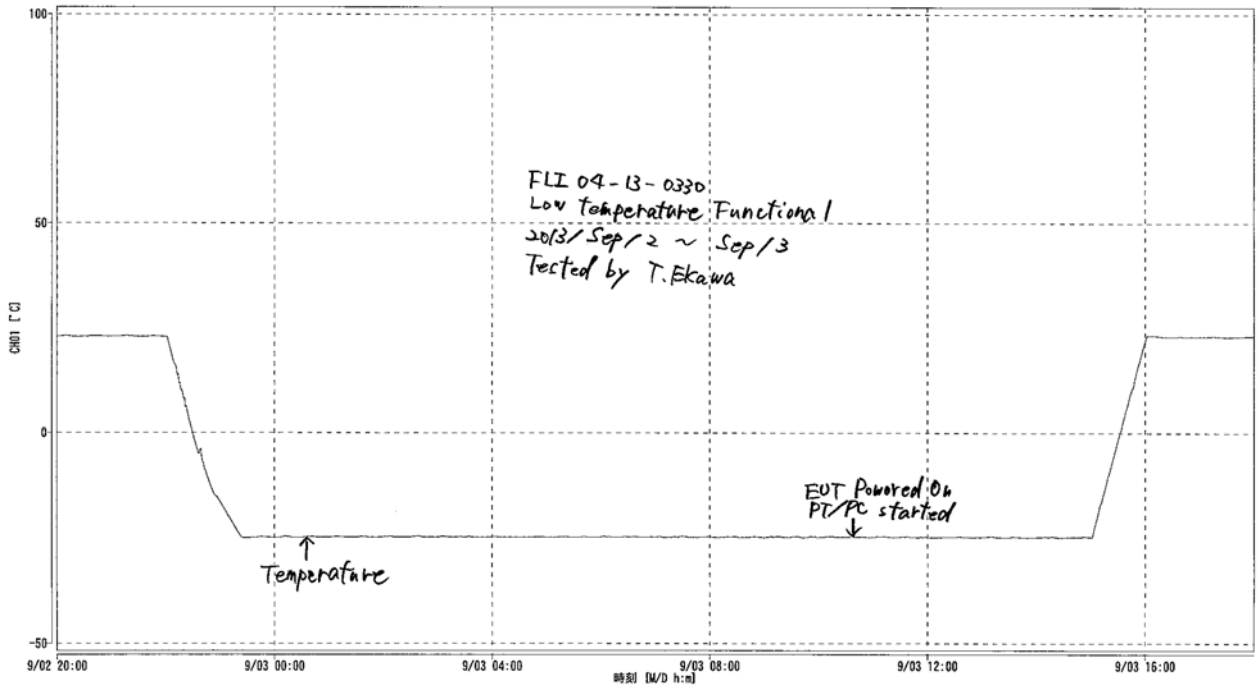
7.2 Dry heat - Functional,



7.3 Damp heat,



7.4 Low temperature - Functional,



8 Vibration response plots taken during tests

8.1 for Antenna Unit (RSB-129 + RTR-107 + SN36CF),

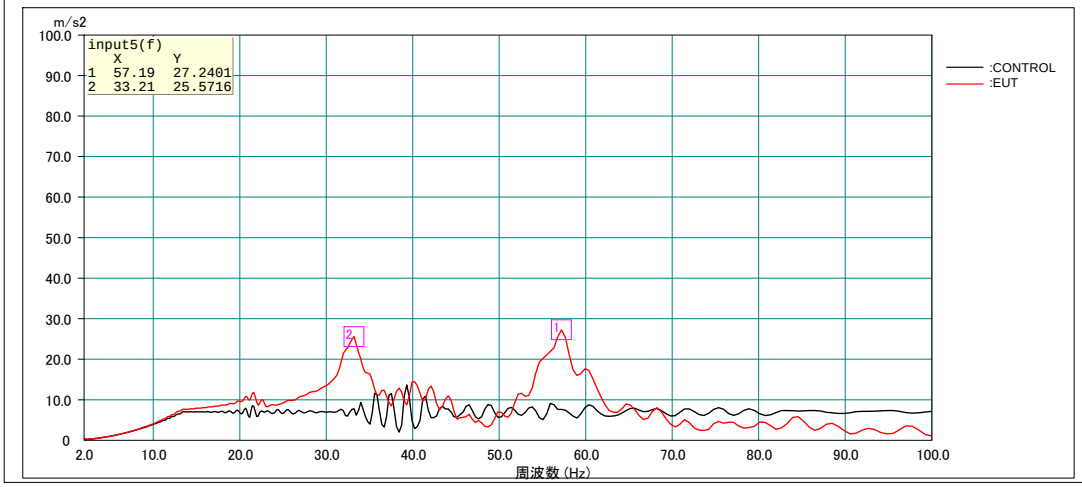
(1) for IEC 60945 Vibration test,

Ver.No.5.81

Resonance Search Test(■Before Endurance, □After Endurance)

Furuno Labotech International Co., Ltd.

Model Name	:	MARINE RADAR ANTENNA UNIT	Axis	:	X(L/R)	Date Tested	: 2013/09/13
Type Name	:	RSB-129	Sweep Freq.	:	2 Hz - 100 Hz	Test Time	: 12 min
Serial No.	:	R00005-000003	Sweep Rate	:	0.5 oct/min	Test Engineer	: K. Imamura
Memo	:	SN36CF, RTR-107, for Coaxial LAN conversion type					

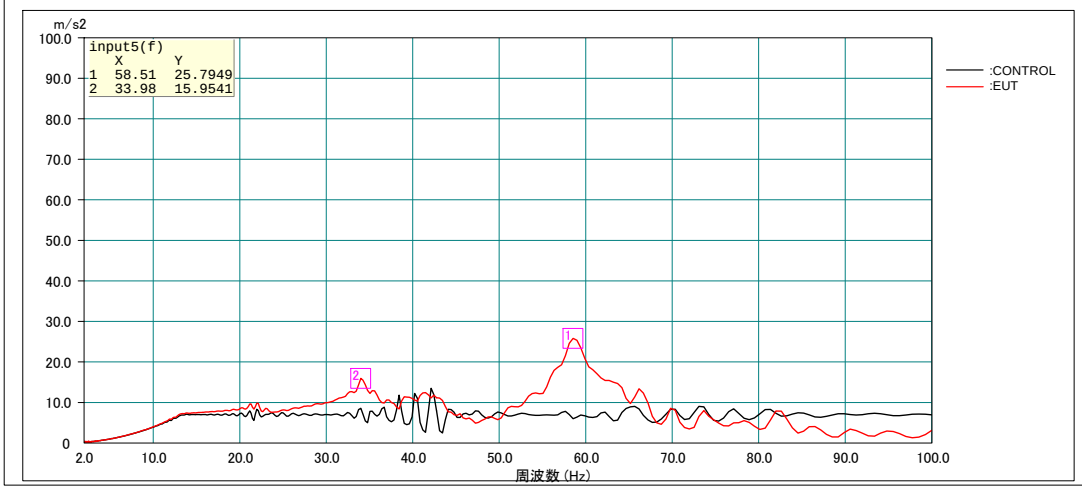


Ver.No.5.81

Resonance Search Test(■Before Endurance, □After Endurance)

Furuno Labotech International Co., Ltd.

Model Name	:	MARINE RADAR ANTENNA UNIT	Axis	:	Y(B/F)	Date Tested	: 2013/09/13
Type Name	:	RSB-129	Sweep Freq.	:	2 Hz - 100 Hz	Test Time	: 12 min
Serial No.	:	R00005-000003	Sweep Rate	:	0.5 oct/min	Test Engineer	: K. Imamura
Memo	:	SN36CF, RTR-107, for Coaxial LAN conversion type					

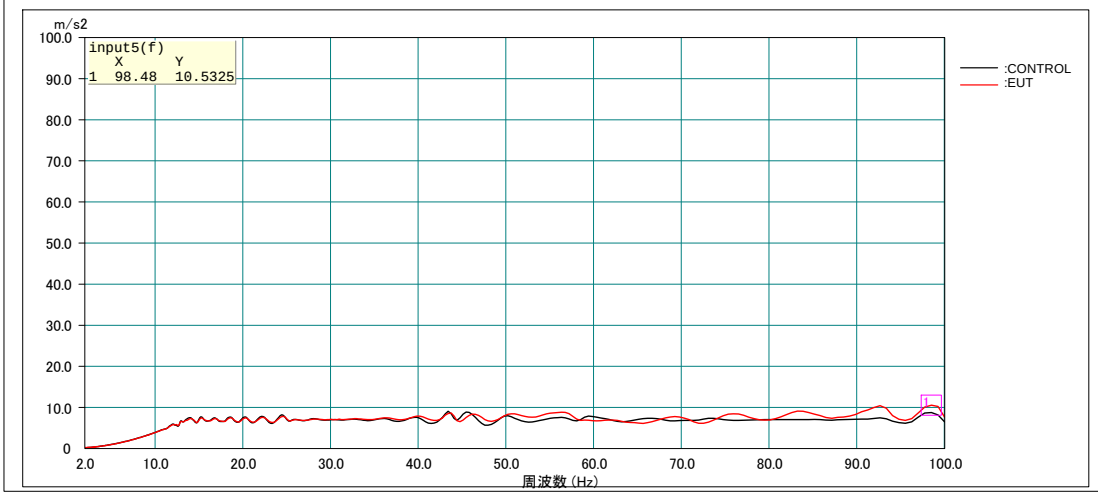


Ver.No.5.81

Resonance Search Test(■Before Endurance, □After Endurance)

Furuno Labotech International Co., Ltd.

Model Name	:	MARINE RADAR ANTENNA UNIT	Axis	:	Z(U/D)	Date Tested	: 2013/09/12
Type Name	:	RSB-129	Sweep Freq.	:	2 Hz - 100 Hz	Test Time	: 12 min
Serial No.	:	R00005-000003	Sweep Rate	:	0.5 oct/min	Test Engineer	: K. Imamura
Memo	:	SN36CF, RTR-107, for Coaxial LAN conversion type					



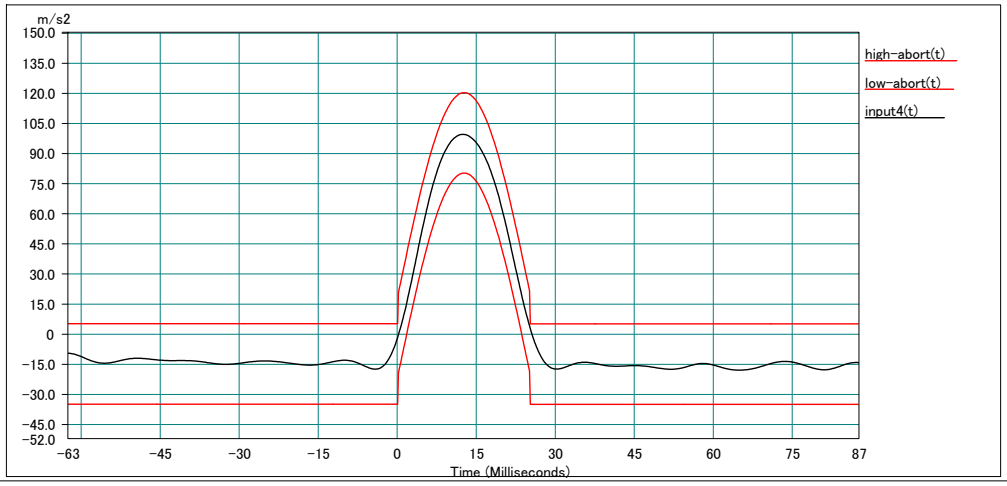
(2) for IEC 62388 Shock test

Shock/Bump Test

Ver. No: 5.81

Furuno Labotech International Co., Ltd

Model Name	:	MARINE RADAR ANTENNA UNIT	Axis	:	Z(U/D)	Wave Type	: Half sine At the end
Type Name	:	RSB-129	Acceleration	:	100 m/s^2		
Serial No.	:	R00005-000003	Bump Times	:	3 shock plotted.	Date Tested	: 2013/09/12
Memo	:	SN36CF, RTR-107 for Coaxial LAN conversion type	Interval	:	3 s		
			Duration	:	25 ms	Test Engineer	: K. Imamura



8.2 for PSU-015,
(1) Table-top mounting,

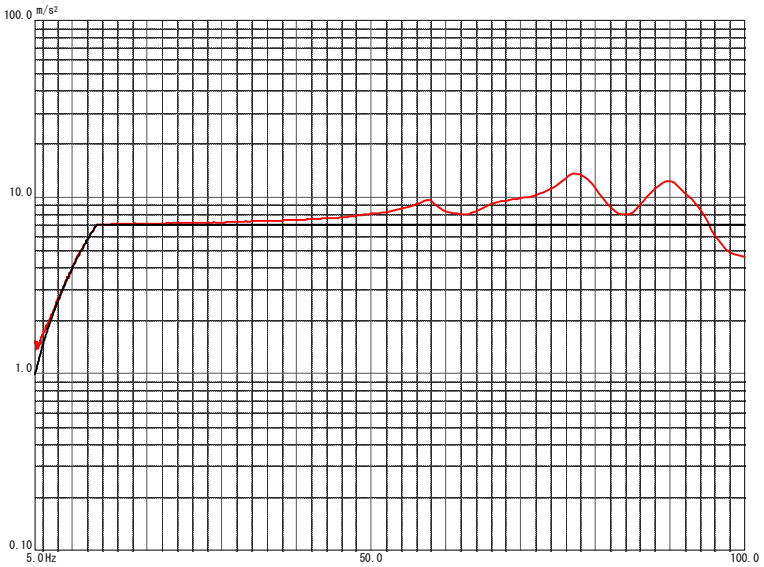
Resonance Search Test (■Before Endurance, ☐After Endurance)

Furuno Labotech International Co., Ltd
Date Tested: 2013/9/14
Operator:F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

AXIS:
■ X (LEFT/RIGHT)
☐ Y (BACK/FORTH)
☐ Z (UP/DOWN)

EUT: PSU-015
(Table top)
S/N: 000006

— EUT
— CONTROL



77.5Hz 13.6m/s²
90.0Hz 12.3m/s²

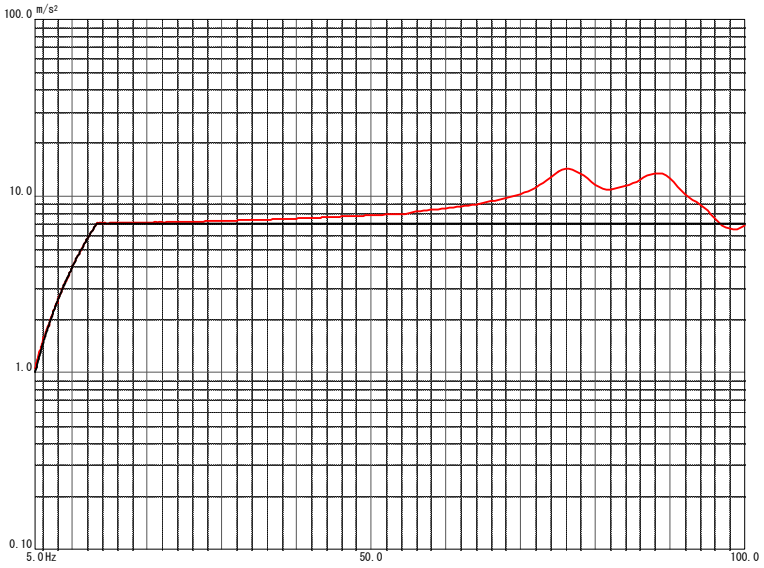
Resonance Search Test (■Before Endurance, ☐After Endurance)

Furuno Labotech International Co., Ltd
Date Tested: 2013/9/14
Operator:F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

AXIS:
☐ X (LEFT/RIGHT)
■ Y (BACK/FORTH)
☐ Z (UP/DOWN)

EUT: PSU-015
(Table top)
S/N: 000006

— EUT
— CONTROL



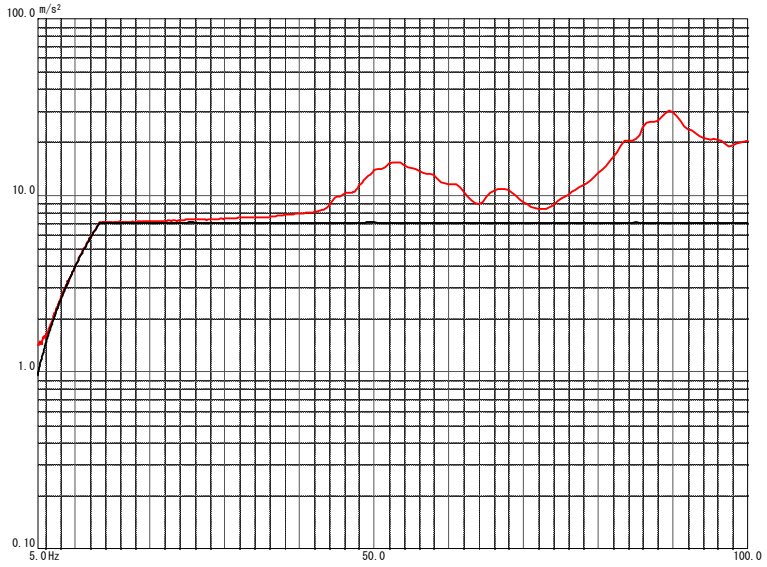
76.0Hz 14.2m/s²
88.5Hz 13.5m/s²

Resonance Search Test (■Before Endurance, ☐After Endurance)

Furuno Labotech International Co., Ltd

Date Tested: 2013/9/13

Operator:F.Ueki



Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

AXIS:
☐ X (LEFT/RIGHT)
☐ Y (BACK/FORTH)
■ Z (UP/DOWN)

EUT: PSU-015
(Table top)
S/N: 000006

— EUT
— CONTROL

89.5Hz	53.0Hz
30.2m/s²	15.4 m/s²

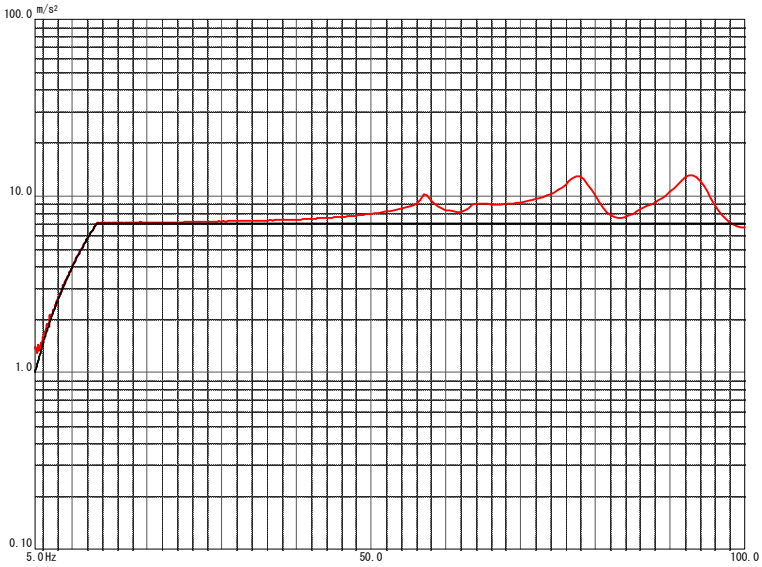
(2) Wall-mounting,

Resonance Search Test (■Before Endurance, ☐After Endurance)

Furuno Labotech International Co., Ltd

Date Tested: 2013/9/13

Operator:F.Ueki



Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

AXIS:
■ X (LEFT/RIGHT)
☐ Y (BACK/FORTH)
☐ Z (UP/DOWN)

EUT: PSU-015
(Wall-mounting)
S/N: 000006

— EUT
— CONTROL

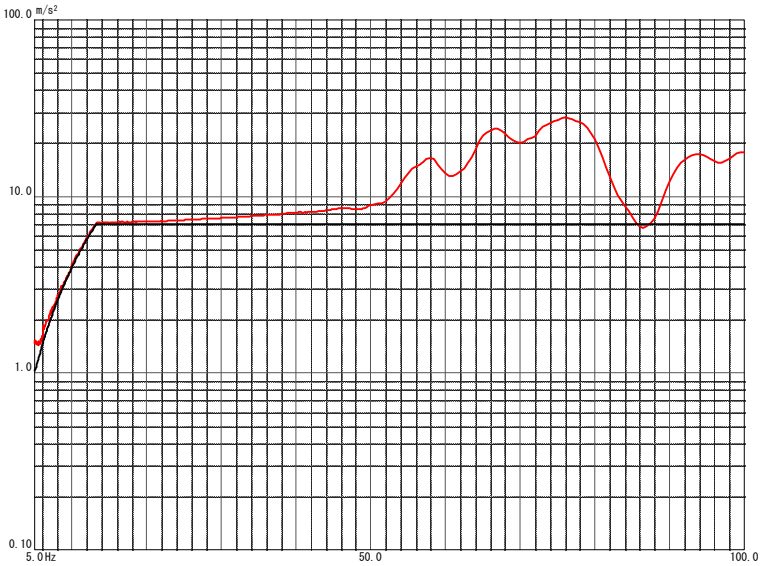
93.0Hz	77.5Hz
13.1m/s²	12.8m/s²

Resonance Search Test (■Before Endurance, ☐After Endurance)

Furuno Labotech International Co., Ltd

Date Tested: 2013/9/13

Operator:F.Ueki



Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

AXIS:
☐ X (LEFT/RIGHT)
■ Y (BACK/FORTH)
☐ Z (UP/DOWN)

EUT: PSU-015
(Wall-mounting)
S/N: 000006

— EUT
— CONTROL

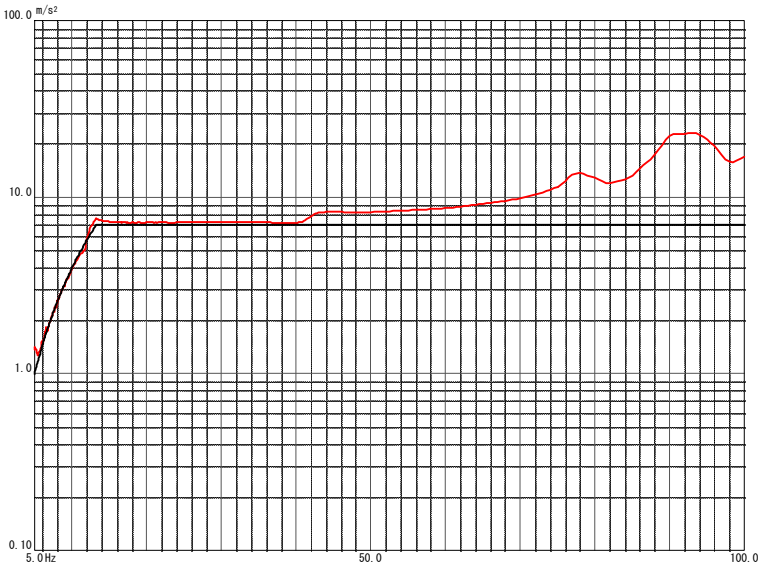
76.0Hz
28.1m/s²

Resonance Search Test (■Before Endurance, ☐After Endurance)

Furuno Labotech International Co., Ltd

Date Tested: 2013/9/13

Operator:F.Ueki



Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

AXIS:
☐ X (LEFT/RIGHT)
☐ Y (BACK/FORTH)
■ Z (UP/DOWN)

EUT: PSU-015
(Wall-mounting)
S/N: 000006

— EUT
— CONTROL

93.00Hz
23.0m/s²

9 Test results data of the EUT obtained during the climatic tests.

9.1 Dry heat - Storage test

Item no.	Results			Limit
	Power supply voltage and frequency			
	230 VAC / 50 Hz	207 VAC / 47.5 Hz	253 VAC / 52.5 Hz	
1	Passed.	Passed.	Passed.	---
2 (rpm)	41.9	41.8	41.8	≥ 40
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7	Passed.	Passed.	Passed.	---
8 (m:s)	3:33	3:33	3:33	≤ 4:00
9 (A)	8.62	8.59	8.62	---

Note: Item numbers are corresponding to those in Clause 1.2.2 Performance Test (PT).

9.2 Dry heat – Functional test

Item no.	Results			Limit
	Power supply voltage and frequency			
	230 VAC / 50 Hz	207 VAC / 47.5 Hz	253 VAC / 52.5 Hz	
1	Passed.	Passed.	Passed.	---
2 (rpm)	41.9	41.9	41.9	≥ 40
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7	Passed.	Passed.	Passed.	---
8 (m:s)	3:33	3:33	3:33	≤ 4:00
9 (A)	7.93	7.94	7.98	---

9.3 Damp heat – Functional test

Item no.	Results			Limit
	Power supply voltage and frequency			
	230 VAC / 50 Hz	207 VAC / 47.5 Hz	253 VAC / 52.5 Hz	
1	Passed.	NA	NA	---
2 (rpm)	41.9			≥ 40
3	Passed.			--
4	Passed.			---
5	Passed.			---
6	Passed.			---
7	Passed.			---
8 (m:s)	3:33			≤ 4:00
9 (A)	8.46			---

Note: NA - Not applicable.

9.4 Low temperature – Functional test

Item no.	Results			Limit
	Power supply voltage and frequency			
	230 VAC / 50 Hz	207 VAC / 47.5 Hz	253 VAC / 52.5 Hz	
1	Passed.	Passed.	Passed.	---
2 (rpm)	41.7	41.7	41.7	≥ 40
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7	Passed.	Passed.	Passed.	---
8 (m:s)	3:33	3:33	3:33	≤ 4:00
9 (A)	9.44	9.49	9.47	---