Test Report

(IEC 60945 and IEC 62388)

For

Trade name: Furuno
Model: MARINE RADAR
Type: FAR-3230S-SSD/-3330S-SSD

Report No.: FLI 12-13-059

Date of Issue: 28 October 2013

Furuno Labotech International Co., Ltd.

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Report Summary

FLI project number:	FLI 04-13-0308		
Test report number of initial issue:	FLI 12-13-059	Date of initial issue	28 October 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, 8.8,11, 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, IEC 60529: 2001, ISO 25862: 2009, IEC 61672-1: 2002.		
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-SSD/-3330S-SSD		
Product function and intended use:	For marine safety navigation		
Number of test samples tested:	One		
Serial number:	000002 (PSU-016), 000003 (PSU-018), R000006-000003(RSB-133) R000001-000001 (Rain)		
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:	1 August 2013		
Test period:	From 6 August 2013 to 26 August 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:	Yuya Katoh, Yasuharu Nakamura, Akira Inoue and Katsumi Imamura, Fumiya Ueki, and Tadayuki Ekawa.		
Written by:	Akiko Inoue		
Verified by:	Yoshihiro Ishii		
Approved by:	Date: 28 October 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).

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1 Principal Information

1.1 Equipment under test (EUT)

Configurations of the EUT units:

- for “Climatic” and “Rain and spray” tests:

No. (*)	Name	Type	Unit serial number	Equipment category	Note
4	Antenna Unit	---	---	Exposed	TX: 250 W, TX freq.: (1) - P0N:3043.75 MHz/ - Q0N:3063.75±5 MHz (2) - P0N:3053.75 MHz/ - Q0N:3073.75±5 MHz (Solid-State Device used for TX power output stage.)
	Transceiver	RTR-111	---		
	Gear Box	RSB-133	R00006-000002		
	Gear Box (with built-in deicer)	---	---		
	Performance Monitor	PM-52B	---		
	Antenna Radiator (*1)	SN36CF	---		
5	Power Supply Unit	PSU-016	000001	Protected	Used for Antenna rotation rate of 24 rpm.
6	Power Supply Unit	PSU-018	000002	Protected	Used for Antenna rotation rate of 42 rpm.

- for other than “Climatic” and “Rain and spray” tests,

No. (*)	Name	Type	Unit serial number	Equipment category	Note
1	Antenna Unit	---	---	Exposed	TX: 250 W, TX freq.: (1) - P0N:3043.75 MHz/ - Q0N:3063.75±5 MHz (2) - P0N:3053.75 MHz/ - Q0N:3073.75±5 MHz (Solid-State Device used for TX power output stage.)
	Transceiver	RTR-111	---		
	Gear Box	RSB-133	R00006-000003		
	Gear Box (with built-in deicer)	---	---		
	Performance Monitor	PM-52B	---		
	Antenna Radiator (*1)	SN36CF	---		
2	Power Supply Unit	PSU-016	000002	Protected	Used for Antenna rotation rate of 24 rpm.
3	Power Supply Unit	PSU-018	000003	Protected	Used for Antenna rotation rate of 42 rpm.

(*): 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 (X-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
1,4	Antenna Unit	---	3795 × 773 × 640	135	with Performance Monitor, Transceiver, and Gear Box (with built-in deicer), and SN36CF contained.
2,5	Power Supply Unit	PSU-016	392 × 147 × 400	8.5	
3,6	Power Supply Unit	PSU-018	392 × 147 × 400	10	

Configurations of the Associated unit(s) (AU) forming the system except EUT:
- for “Climatic” and “Rain and spray” tests,

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
8	Processor Unit	EC-3000	4395-1704	Furuno	
10	Monitor Unit	MU-190	000023	Furuno	
12	Monitor Unit	MU-231	000010	Furuno	
14	Control Unit	RCU-025	000235	Furuno	
16	Processor Unit	RPU-013	4317-5131	Furuno	

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
20	Display Unit	AL2017	ETL69090217050 22F03720	Acer	
24	CONTROL UNIT	RCU-014	1-8067	Furuno	

- for other than “Climatic” and “Rain and spray” tests,

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
7	Processor Unit	EC-3000	4395-1205	Furuno	
9	Monitor Unit	MU-190	001436	Furuno	
11	Monitor Unit	MU-231	002719	Furuno	
13	Control Unit	RCU-025	000169	Furuno	
15	Processor Unit	RPU-013	4366-4589	Furuno	
19	Display Unit	U2412Mb	CN-007H8X-726I-31F-4KYS	DELL	
23	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:

- for “Climatic” and “Rain and spray” tests,

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
18	PC	CF-B11 JWUYS	3AKSA15612	Panasonic	
22	Antenna Dummy Load (S-band)	3114NM	J01122B0010	INMET	
26	USB Serial Adapter (RS-422)	ESU2-40C (RS-422)	03064100027	QUATECH	

- for other than “Climatic” and “Rain and spray” tests,

No. (*)	Name	Type	Unit serial number	Manufacturer	Note
17	PC	LATITUDE E5520	WTV3T A01	DELL	
21	Antenna Dummy Load (S-band)	3114NM	---	INMET	
25	USB Serial Adapter (RS-422)	ESU2-40C (RS-422)	03064100028	QUATECH	

(*): 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 and AE:

No.	Category	Item/Type	Program name	Program number	Rev. number	Note
1	EUT	Antenna Unit	App (SPU)	0359286	01.03	
			App (MTR-DRV)	0359293	01.03	.
			App (PM)	0359296	01.03	
			App (RF-Converter)	0359302	01.03	
2	EUT	Power Supply Unit	App (PSU-Control)	0359299	01.03	
3	AU	Processor Unit EC-3000	App	0359266	02.03	
4	AU	Control Unit RCU-025	Key1	2450086	01.05	
5	AU	Monitor Unit (19.0”)	Monitor1	2651020	01.03	
6	AU	Monitor Unit (23.1”)	Monitor2	2651020	01.03	
7	AU	Processor Unit	RPU-013	0359204	02.51	Used for “Climatic” and “Rain and spray” tests.
					03.51	Used for other than the above tests.
8	AU	CONTROL UNIT	RCU-014	0359203	01.04	

No.	Category	Item/Type	Program name	Program number	Rev. number	Note
9	AE	PC	Winiec	Winexe=14(Feb 27 2013) Winiec.mcr= 02	---	

EUT documentation used for the tests:

No.	Item	Publication no.	Rev. number
1	Installation Manual	OME-36190	Z2

1.2 EUT Operation mode and Performance Check/Test

1.2.1 EUT Operation mode

Normal operation mode: TX-ON

RANGE: 6NM
TUNE: AUTO
GAIN: Manual, 97
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.
PULSE: LP

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 (sweeping).

(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 (with PSU-018), and 20 rpm or more for standard Radar (with PSU-016).

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

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

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

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

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

(8) HPA TX Current:
- TX 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”, “Antenna shock” and “Rain and Spray” tests),
100 VAC, 60 Hz and 230 VAC, 50 Hz (for CSD test),
230 VAC, 50 Hz (for the tests other than the above)

1.3.2 Extreme power supply conditions:
Upper extreme conditions:
255 VAC (230 VAC +10 %), 52.5 Hz (50 Hz +5 %)

Lower extreme conditions:
207 VAC (230 VAC -10 %), 47.5 Hz (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 Systems of FAR-3230S-SSD/-3330S-SSD are as follows, so the tests were performed with both types of display units connected to the system at the same time.

Model	Band	TX power	Gear Box	Transceiver	Radiator	Display	Power Supply Unit	
							24 rpm	42 rpm
FAR-3230S-SSD	S band	250 W	RSB-133	RTR-111	SN36CF	MU-190	PSU-016	PSU-018
FAR-3330S-SSD						MU-231		

(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 September 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 applicable, because The EUT had no devices that affect the test results.

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:	Temperature: ±1.5°C
8.4.2	- Functional tests:	Temperature: ±1.5°C
8.7	Vibration:	Acceleration: ±2.2 m/s^2
	Antenna shock:	Acceleration: ±2.2 m/s^2
8.8	Rain and spray:	Delivery rate: ±3.1 l/min for 100 l/min.
8.12	Corrosion:	----
11	Special purpose tests	
11.1	Acoustic noise and signals:	±2.4 dB
11.2	Compass safe distance (CSD):	±7.4%
12	Safety precautions	
12.1	Protection against accidental access to dangerous voltages:	Not applicable.
12.2	Electromagnetic radiofrequency radiation:	±2.3 dB
12.4	X-radiation:	----

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

IEC 62388 Clause	Item	Measurement uncertainty (*)
17.3.2	Antenna shock test	Acceleration: ±2.2 m/s2

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

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

3 Test Results

3.1 Power supply

3.1.1 Extreme power supply

PSU-016 + Antenna Unit:

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.

PSU-018 + Antenna Unit:

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.	For PSU-016, 5 A Fuse was activated, and the EUT was protected from damage. For PSU-018, 3 A and 7 A Fuses were activated, and the EUT was protected from damage.
2	Against Excessive voltage:	Passed.	For PSU-016, Overvoltage protection circuits were provided in the EUT, and activated at the voltages of 305.1 VAC (> 230 VAC+10%). For PSU-018, Overvoltage protection circuits were provided in the EUT, and activated at the voltages of 303.5 VAC (> 230 VAC+10%).
3	When subjected to the input of 300 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 PSU-016 and PSU-018
Not applicable to “Protected” equipment.

For Antenna Unit,
After the test, PT/PC were performed at the Normal temperature. See Clause 3.1 of this report.

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)

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

3.4.2 Functional test

See Clause 3.1 of this report.

3.5 Vibration

3.5.1 EUT attitude/mounting and Test fixture:

Unit	Attitude/mounting	Test fixture
Antenna Unit RSB-133 + RTR-111 + SN36CF	Table-top	No. 44 (*1)
Power Supply Unit PSU-016	Table-top	No. 54 (*1)
	Wall-mounting	No. 35 and No. 63 (*1)
Power Supply Unit PSU-018	Table-top	No. 54 (*1)
	Wall-mounting	No. 35 and No. 63 (*1)

(*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			
Antenna Unit RSB-133 + RTR-111 + SN36CF	X (left/right)	64.0	20.9	3.0	64.0	Passed.	
	Y (back/forth)	71.0	22.7	3.2	71.0	Passed.	
	Z (up/down)	(*)	(*)	(*)	30.0	Passed.	
PSU-016 Table-top	X (left/right)	79.8	11.4	1.6	79.8	Passed.	
	Y (back/forth)	80.0	13.1	1.9	80.0	Passed.	
	Z (up/down)	96.2	45.6	6.5	96.2	Passed.	
PSU-016 Wall-mounting	X (left/right)	81.0	15.2	2.2	81.0	Passed.	
	Y (back/forth)	84.5	34.5	4.9	84.5	Passed.	
	Z (up/down)	81.0	12.1	1.7	81.0	Passed.	
PSU-018 Table-top	X (left/right)	100	9.15	1.3	100	Passed.	
	Y (back/forth)	97.8	11.2	1.6	97.8	Passed.	
	Z (up/down)	75.0	19.8	2.8	75.0	Passed.	
PSU-018 Wall-mounting	X (left/right)	82.5	14.3	2.0	82.5	Passed.	
	Y (back/forth)	75.5	23.3	3.3	75.5	Passed.	
	Z (up/down)	96.0	19.8	2.8	96.0	Passed.	

Note: (*) - no resonance detected.

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-133 + RTR-111 + SN36CF	Table-top	No. 44 (*1)

(*1): prepared by FLI.

3.6.2 Result:

Unit	Test conditions	Results
Antenna Unit RSB-133 + RTR-111 + 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

Unit	Results
Antenna Unit RSB-133 + RTR-111 + SN36CF	Passed. (*)

(*): Ingress of water was found at a part of the bottom (around the drain hole) of the enclosure, but there was no damage or degradation of performance during and after the test. There were no water drops found on the rubber gaskets of the enclosure side covers.

3.8 Corrosion (salt mist) (Not peformed)

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-016	30 or under	50.3	Not applicable	≤ 60	75 to 85
PSU-015	30 or under	51.5			

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)

Test Conditions:

(1) with EUT powered-off in the received condition,
(2) with EUT powered-off after normalization,
(3) with EUT powered-on (100 VAC and 230 VAC).

Results:

Unit	CSD for Standard compass (m)	CSD for Steering compass (m)	CSD Marking	Test conditions that the worst measured results were obtained
Antenna Unit RSB-133 + RTR-111 + SN36CF	1.90	1.20	Described in the manual.	(3) 230 VAC
PSU-016	1.90	1.20	Described in the manual.	(3) 100 VAC
PSU-018	1.80	1.15	Described in the manual.	(1)

Normalization was done at about 23 m apart from the CSD test site.

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

Unit	Distance to 100 W/m^2 (m)	Distance to 50 W/m^2 (m)	Distance to 10 W/m^2 (m)
Antenna Unit RSB-133 + RTR-111 + SN36CF	Not detected.	Not detected.	1.0

Note: According to the results of the pre-tests performed with the radar pulse types of Short 1, Short 2, Middle 1, Middle 2, Middle 3, and Long, final tests were performed with Long pulse type with the highest TX power.

3.10.3 Emission from visual display unit (VDU) (Not applicable)

Not applicable. The EUT had no display devices.

3.10.4 X-radiation (Not applicable)

Not applicable. The EUT had no devices that affect the test results.

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: (PSU-016 used.)	7 August 2013	30°C to 30°C, 52% to 52%RH	255.0 VAC, 52.5 Hz to 255.0 VAC, 52.5 Hz 207.0 VAC, 47.5 Hz to 207.0 VAC, 47.5 Hz
		8 August 2013	26°C to 26°C, 62% to 62%RH	255.0 VAC, 52.5 Hz to 255.0 VAC, 52.5 Hz 207.0 VAC, 47.5 Hz to 207.0 VAC, 47.5 Hz
		9 August 2013	26°C to 26°C, 62% to 62%RH	255.0 VAC, 52.5 Hz to 255.0 VAC, 52.5 Hz 207.0 VAC, 47.5 Hz to 207.0 VAC, 47.5 Hz
	(PSU-018 used.)	11 August 2013	27°C to 27°C, 70% to 70%RH	255.0 VAC, 55.0 Hz to 255.0 VAC, 52.5 Hz 207.0 VAC, 45.0 Hz to 207.0 VAC, 47.5 Hz
		12 August 2013	30°C to 30°C, 65% to 65%RH	255.0 VAC, 55.0 Hz to 255.0 VAC, 52.5 Hz 207.0 VAC, 45.0 Hz to 207.0 VAC, 47.5 Hz
		13 August 2013	28°C to 28°C, 64% to 64%RH	255.0 VAC, 55.0 Hz to 255.0 VAC, 52.5 Hz 207.0 VAC, 45.0 Hz to 207.0 VAC, 47.5 Hz
7.2	Excessive conditions tests	21 August 2013	25°C to 25°C, 57% to 57%RH	230.0 VAC, 50.0 Hz to 230.2 VAC, 50.0 Hz
8	Durability and resistance to environmental conditions			
8.2	Dry heat	----	----	----
8.2.1	- Storage test:	9 August 2013 (PSU-016 used.)	26°C to 26°C, 62% to 62%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz
8.2.2	- Functional test:	7 August 2013 (PSU-016 used.)	30°C to 30°C, 52% to 52%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz
		12 August 2013 (PSU-018 used.)	30°C to 30°C, 65% to 65%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz.
8.3.1	Damp heat- Functional test:	10 August 2013 (PSU-016 used.)	28°C to 28°C, 70% to 70%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz
		13 August 2013 (PSU-018 used.)	28°C to 28°C, 64% to 64%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:	8 August 2013 (PSU-016 used.)	26°C to 26°C, 62% to 62%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz

IEC 60945 Clause	Item	Date of test	Temperature, humidity (Before-test to After-test)	Power supply voltage (Before-test to After-test)
		11 August 2013 (PSU-018 used.)	27°C to 27°C, 70% to 70%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz
8.7	Vibration:	10 August 2013	26°C to 26°C, 62% to 62%RH	100.0 VAC, 60.0 Hz to 100.2 VAC, 60.0 Hz
		11 August 2013	29°C to 28°C, 68% to 74%RH	101.0 VAC, 60.0 Hz to 101.2 VAC, 60.0 Hz
		12 August 2013	27°C to 26°C, 70% to 62%RH	100.6 VAC, 60.0 Hz to 100.8 VAC, 60.0 Hz
		13 August 2013	28°C to 28°C, 64% to 64%RH	100.5 VAC, 60.0 Hz to 101.2 VAC, 60.0 Hz
8.8	Rain and spray:	26 August 2013	33°C to 30°C, 62% to 57%RH Water temperature: 28°C to 28°C	101.0 VAC, 60.0 Hz to 100.2 VAC, 60.0 Hz
8.12	Corrosion:	Not applicable. Not performed.	----	----
11	Special purpose tests			
11.1	Acoustic noise and signals:	21 August 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):	4 August 20013	25°C to 25°C, 61% to 61%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz 100.0 VAC, 60.0 Hz to 100.0 VAC, 60.0 Hz
12	Safety precautions			
12.1	Protection against accidental access to dangerous voltages:	21 August 2013	25°C to 25°C, 57% to 57%RH	No power supply.
12.2	Electromagnetic radiofrequency radiation:	7 August 2013	23°C to 23°C, 67% to 67%RH	230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz
12.3	Emission from visual display unit (VDU):	Not applicable.	---	---
12.4	X-radiation measurement:	Not applicable.	----	----

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	12 August 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
--	HT370	Climatic chamber (L)	TBE-3HW5GE2F	3013000995	Tabai Espec
--	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
X	HT510	Climatic chamber (Hama-L)	TBE-3HW4PE2F	3013002540	Tabai Espec
X	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
X	HT414	Climatic chamber (Hama-S)	PL-4KP	14004203	Tabai Espec
X	HT726	Paperless recorder/Dual communication logger DAQSTATION FX100	FX106-4-1	S5JA01448	Yokogawa
--	HT446	Programmable AC power supply	4420/4471	306043-4420024	NF
--	HT432	DC power supply	PAN55-20	AK003307	Kikusui
X	HT462	Digital Multimeter	111	7812001	Fluke
X	HT434	AC power supply	PCR2000L	BB002789	Kikusui

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

4.2 Vibration

(*)	C/N	Instrument	Type	S/N	Manufacturer	Note
--	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	Used for Antenna Unit and PSU-016/-018 wall-mounting
X	HT373	Vibration test system (0.6-ton type)	VS-600-140	212540	IMV	Used for PSU-016/-018 Table-top mounting
X	HT439	Pickup sensor **(Response)**	VP-15	2325T	IMV	Used for PSU-016/-018.
X	HT577	Pickup sensor **(Reference)**	V11-101S	0522	Shinken	Used for Antenna Unit.
--	HT578	Pickup sensor	V11-101S	0521	SHINKEN	
X	HT661	Pickup sensor **(Reference)**	V11-101S	1112	Shinken	Used for PSU-016/-018.
X	HT662	Pickup sensor **(Response)**	VP-15	0025U	IMV	Used for Antenna Unit.
--	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.

4.3 Antenna Shock

(*)	C/N	Instrument	Type	S/N	Manufacturer
--	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 for EUT1)**	V11-101S	0522	Shinken
--	HT578	Pickup sensor	V11-101S	0521	SHINKEN
--	HT661	Pickup sensor	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 Rain and Spray

(*)	C/N	Instrument	Type	S/N	Manufacturer
X	HT587	Liquid flow meter (Area type)	SPG-1	050278	NFC
X	HT584	Rain test set for IPX6	IPX6	05-001	FLI
X	HT689	Digital Multimeter	115	10821185	Fluke

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

4.5 Special purpose tests

4.5.1 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.

4.5.2 Compass safe distance (CSD)

(*)	C/N	Instrument	Type	S/N	Manufacturer
X	HT433	3-axis Magnetic field meter	HM-310NR	003111	MTI
X	HT189	Helmholtz coil	2X2M-10T	0001	TSJ
--	HT157	Programmable AC power supply	8461	209648	NF
--	HT446	Programmable AC power supply	4420/4471	306043-4420024	NF
--	HT432	DC power supply	PAN55-20	AK003307	Kikusui
X	HT571	Programmable AC power supply	PCR6000W2	DH001240	Kikusui
X	HT430	DC power supply	PAD55-20L	10091786	Kikusui

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

4.6 Safety precautions

4.6.1 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

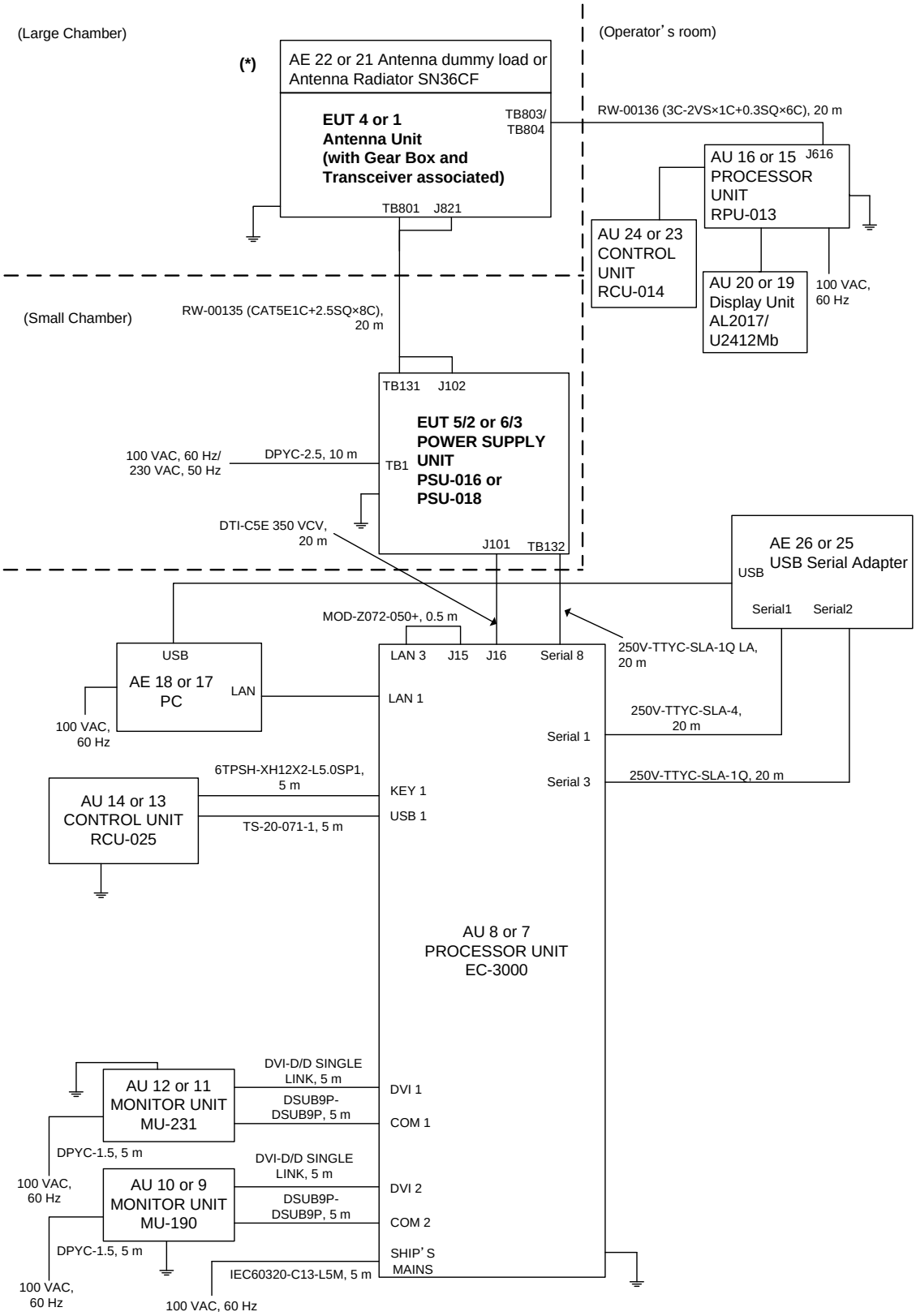
(*): X – indicates instruments used for the tests, -- – not used.

4.6.2 Electromagnetic radio frequency radiation

(*)	C/N	Instrument	Type	S/N	Manufacturer
X	HT590	RF Radiation meter	EMR-300/33C	AY-0029/F-0021	Narda

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

5 EUT Setup/Test Arrangement



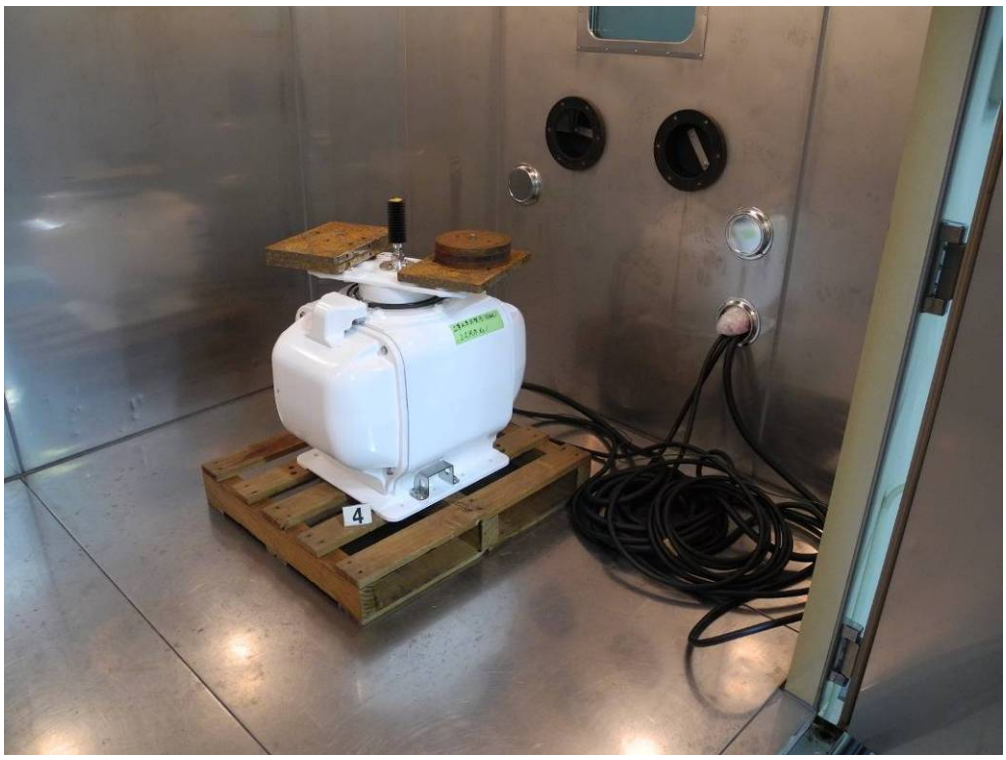
Note: AU - Auxiliary Unit, AE - Associated Equipment.

(*) - Antenna radiator was used only for Vibration, Antenna shock, Rain and spray, and Electromagnetic RF radiation tests.

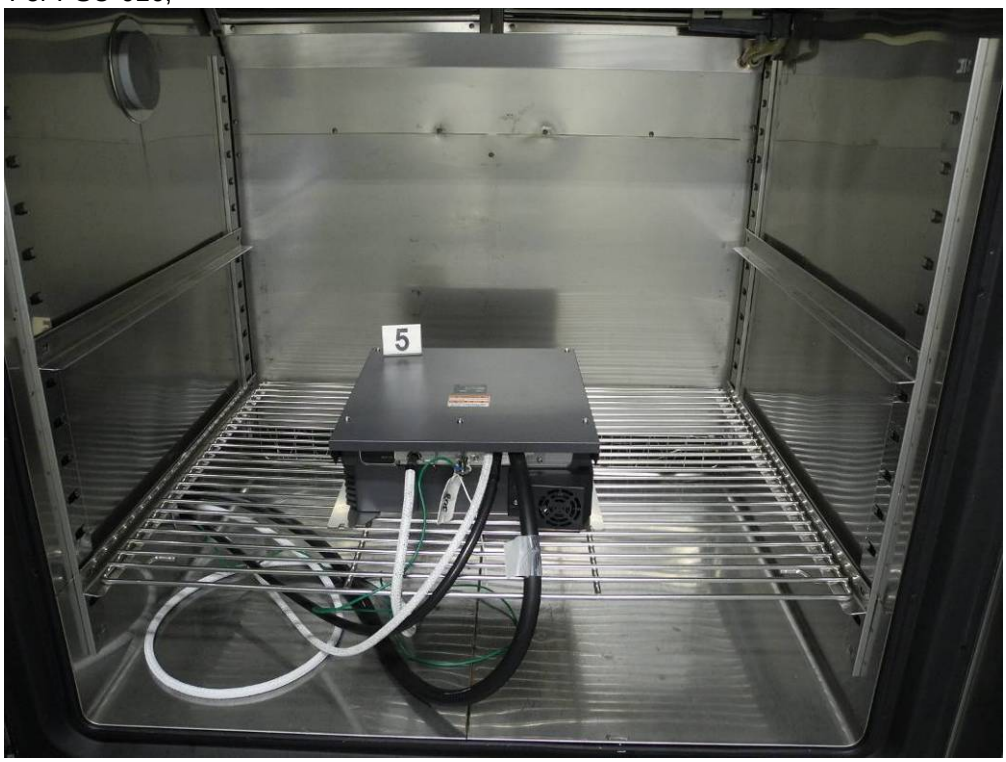
6 Photographs of Test Setup/Arrangement

6.1 Dry heat/Damp heat/Low temperature

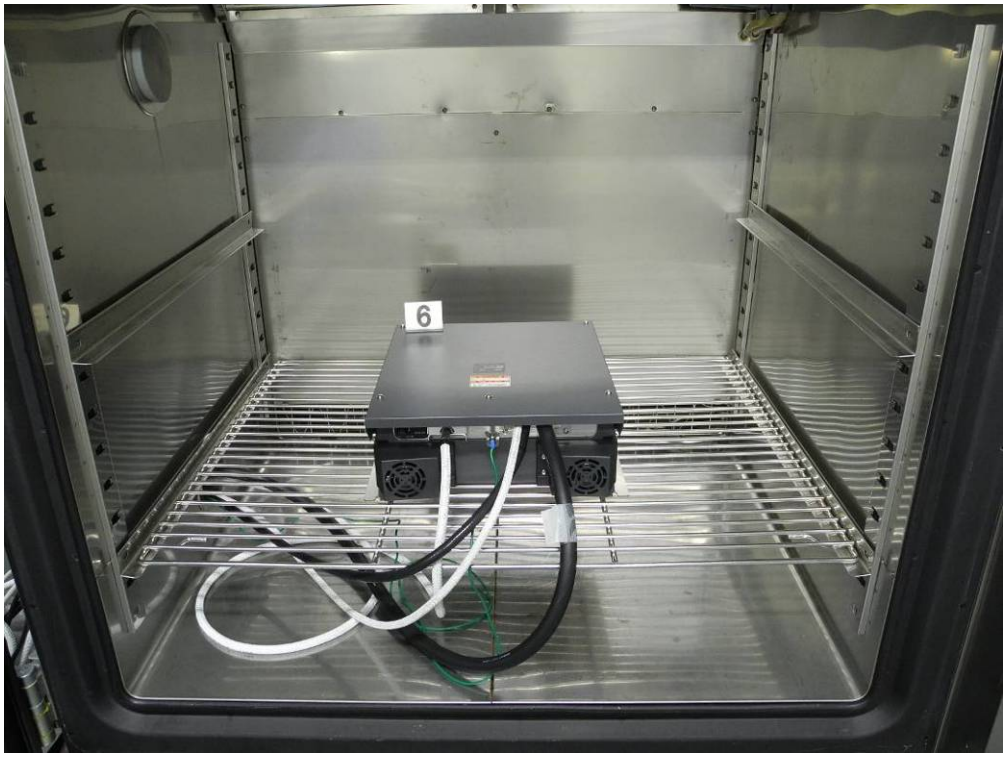
For Antenna Unit,



For PSU-016,



For PSU-018,

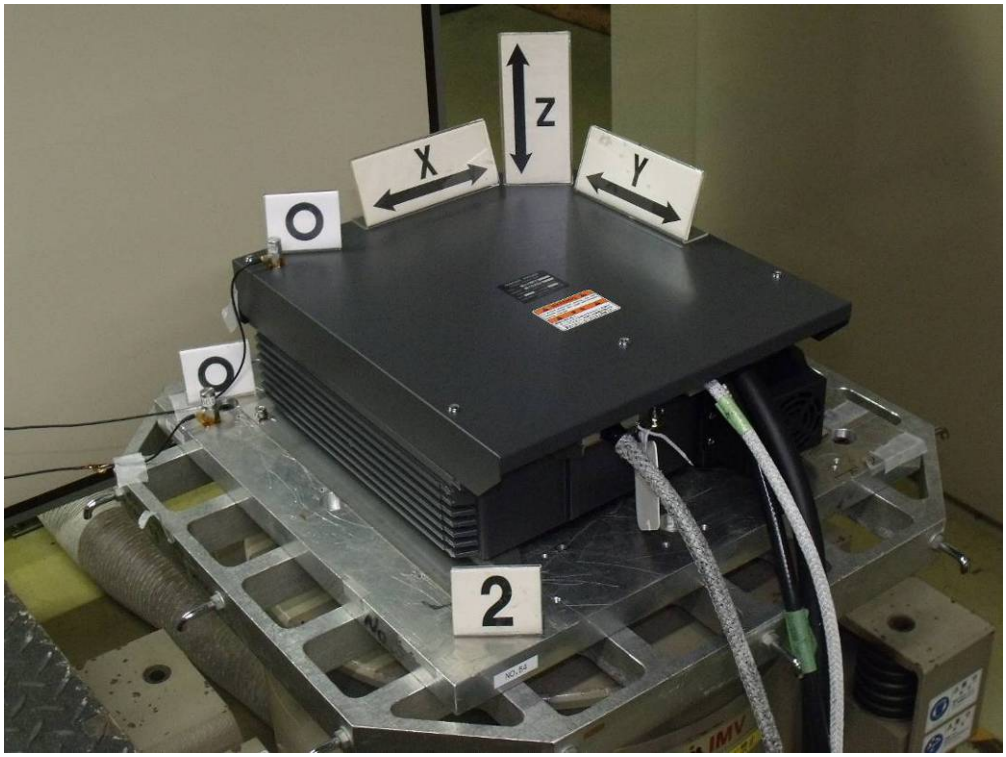


6.2 Vibration

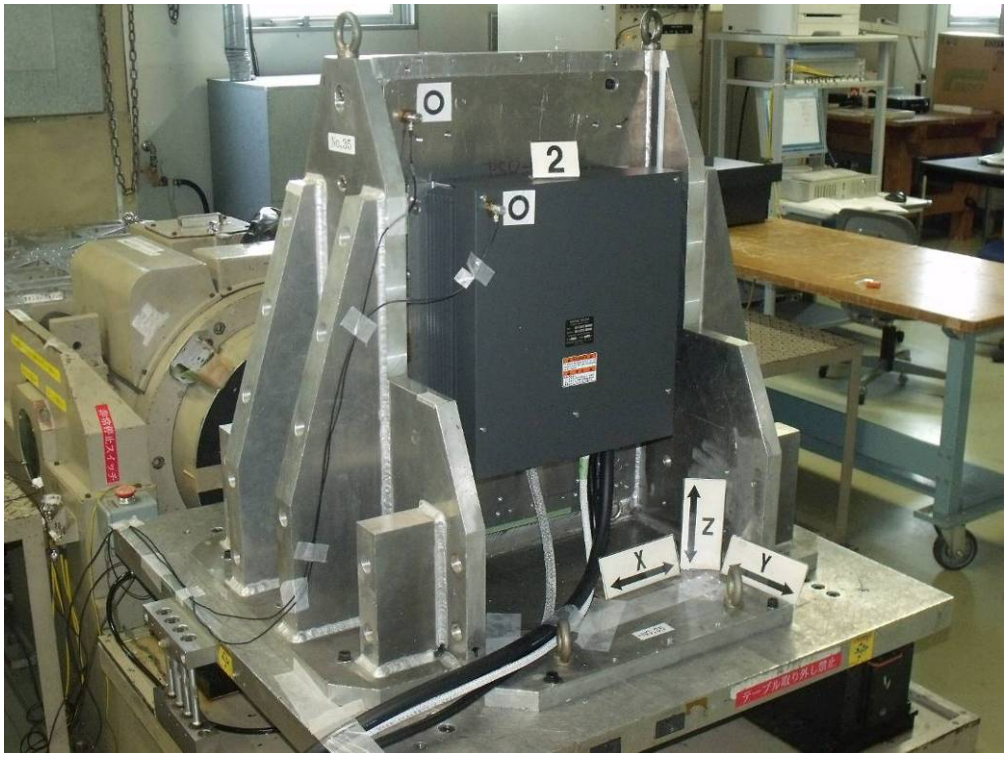
For Antenna Unit,,

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

For PSU-016 (Table-top mounting) ,

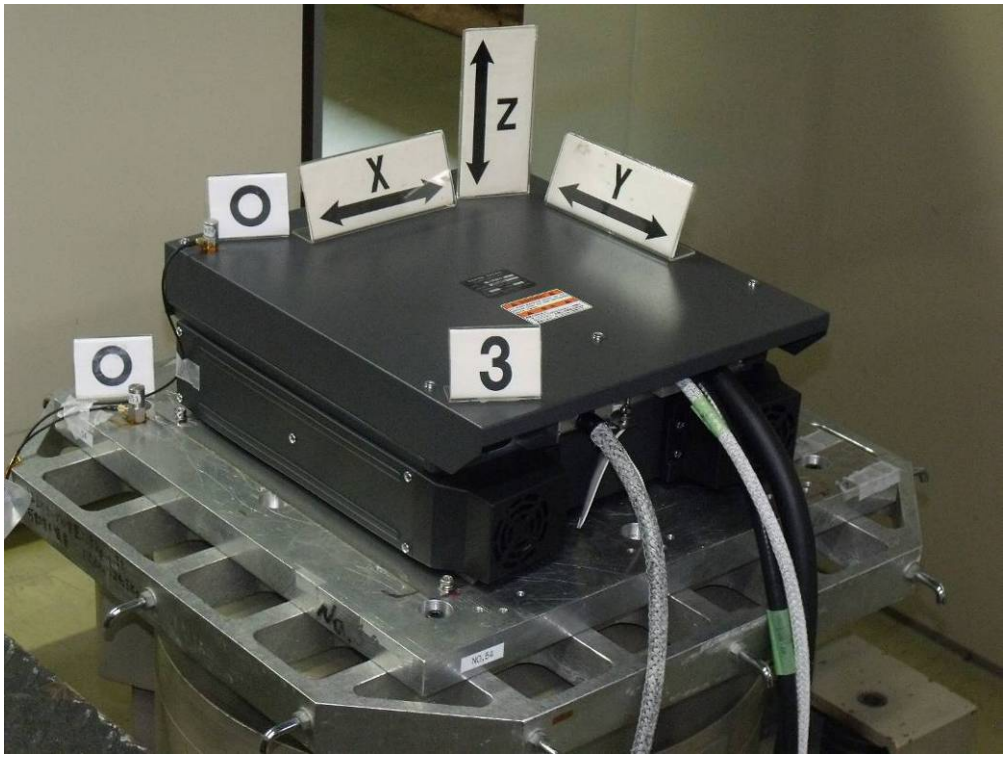


For PSU-016 (Wall mounting),

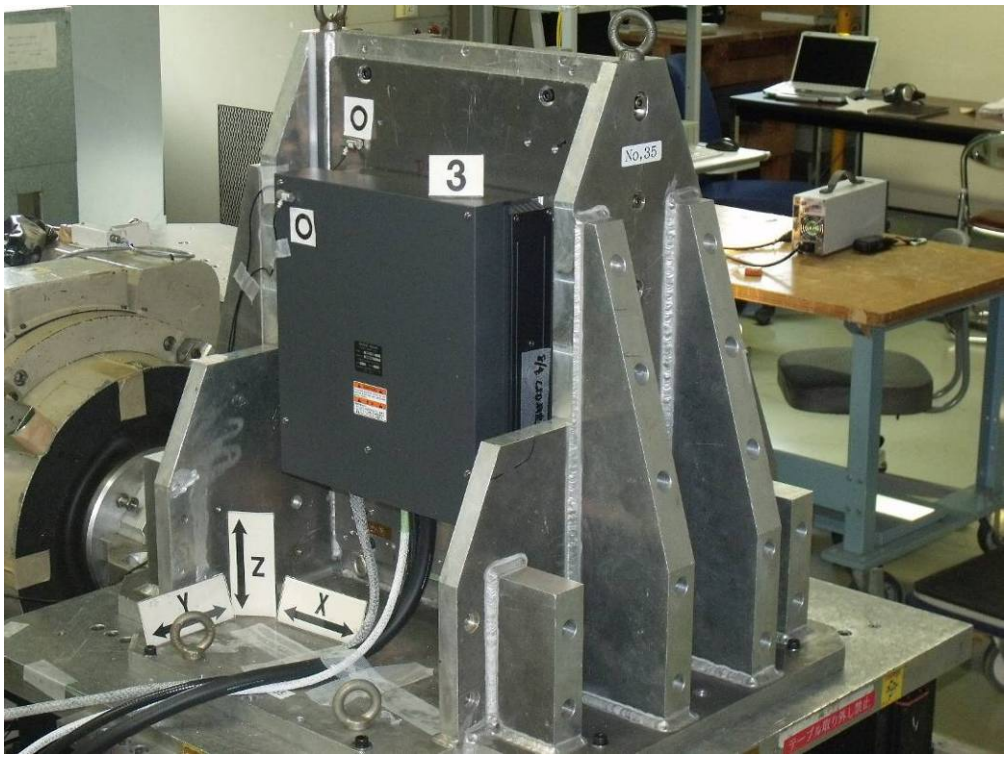


Note: ○ - Pick-up sensor, ↔ - Vibration direction

For PSU-018 (Table-top mounting),



For PSU-018 (Wall mounting),



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

6.3 Antenna Shock

For Antenna Unit,

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

6.4 Rain and spray

For Antenna Unit,

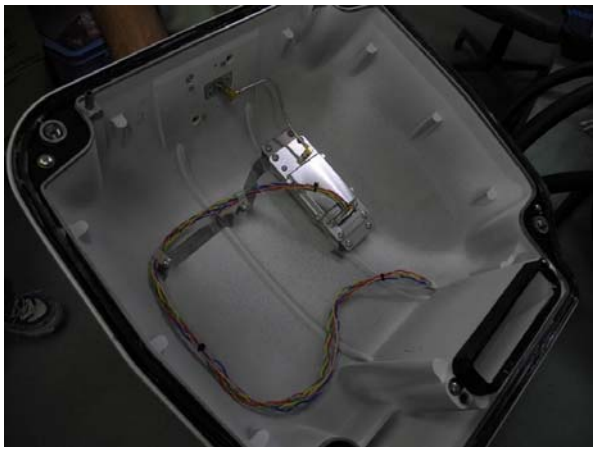
Test Setup

Spraying

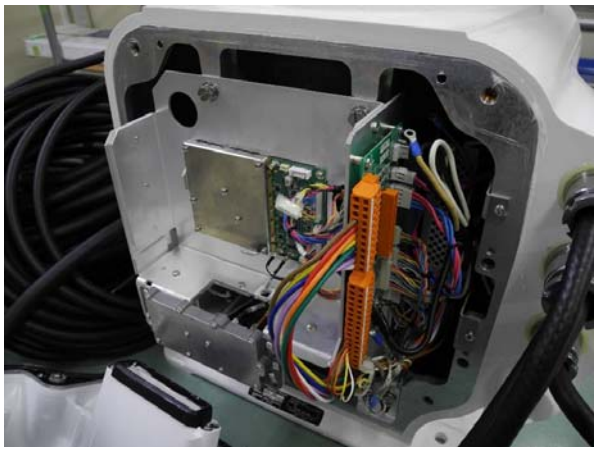
Photographs of the internal examinations done after the test

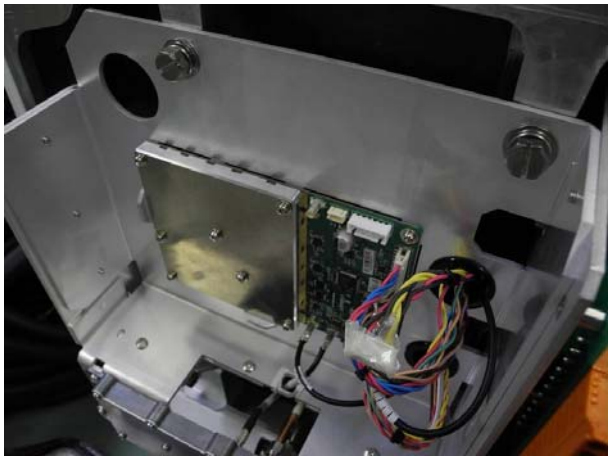
Antenna radiator removed:

with the side covers opened, (no ingress of water found on rubber gaskets)



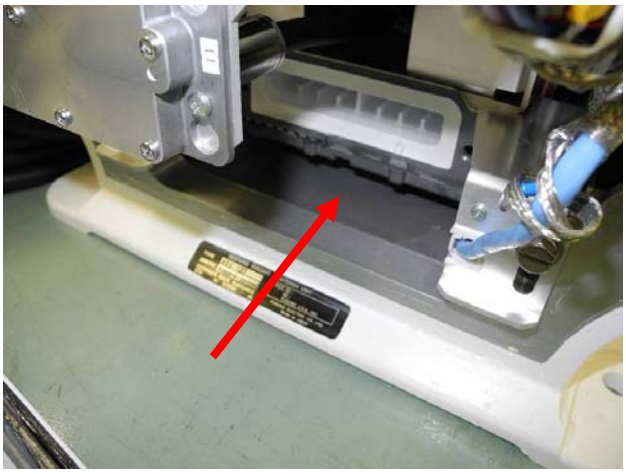
Transceiver module

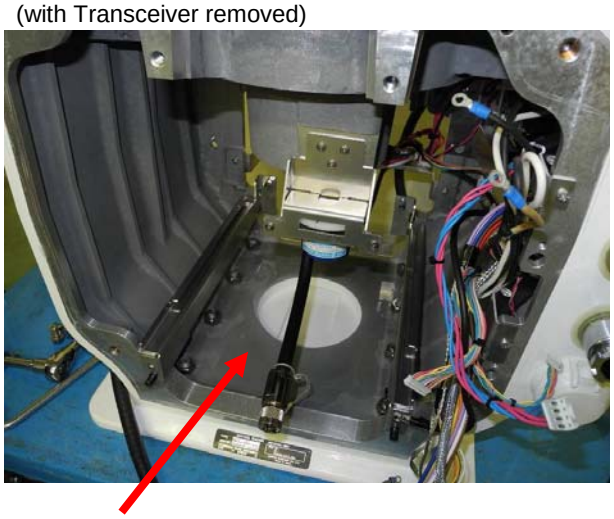




Scanner motor

Bottom of the enclosure (ingress of water found around the drain hole. Water drops are indicated by the red arrows.)
(with Transceiver removed)

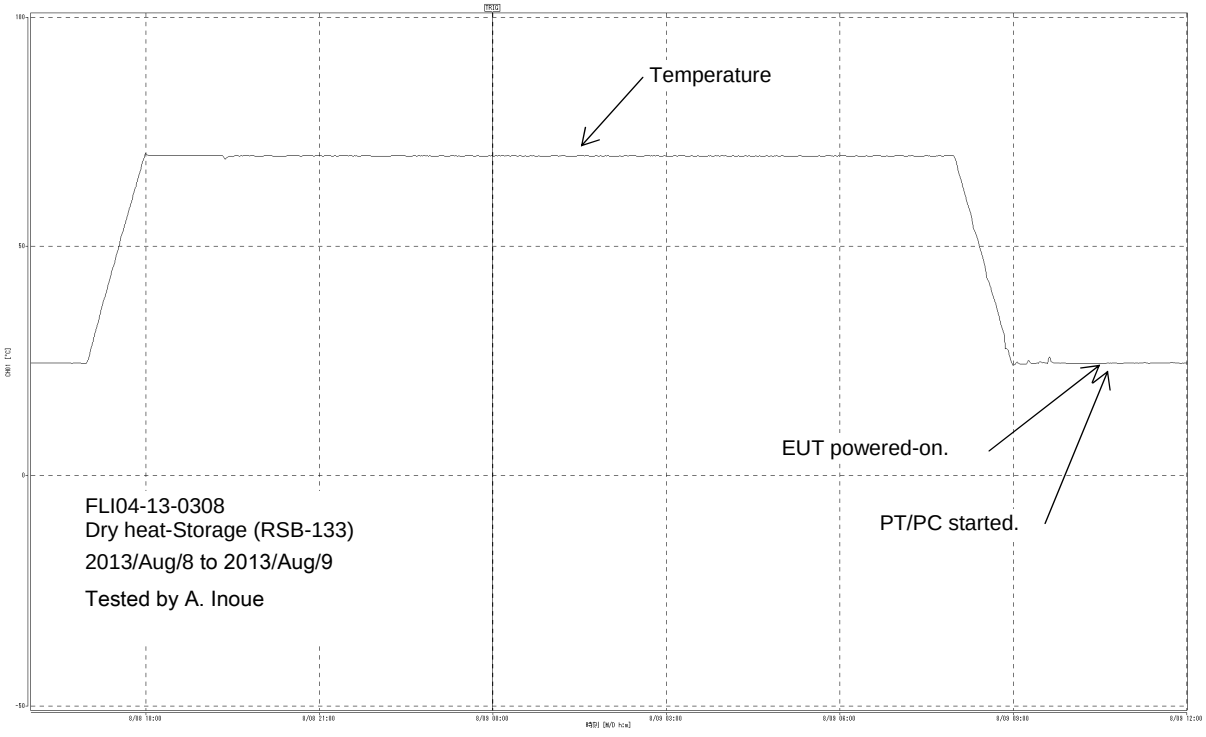




7 Temperature/humidity records taken during Dry heat/Damp heat/Low temperature tests

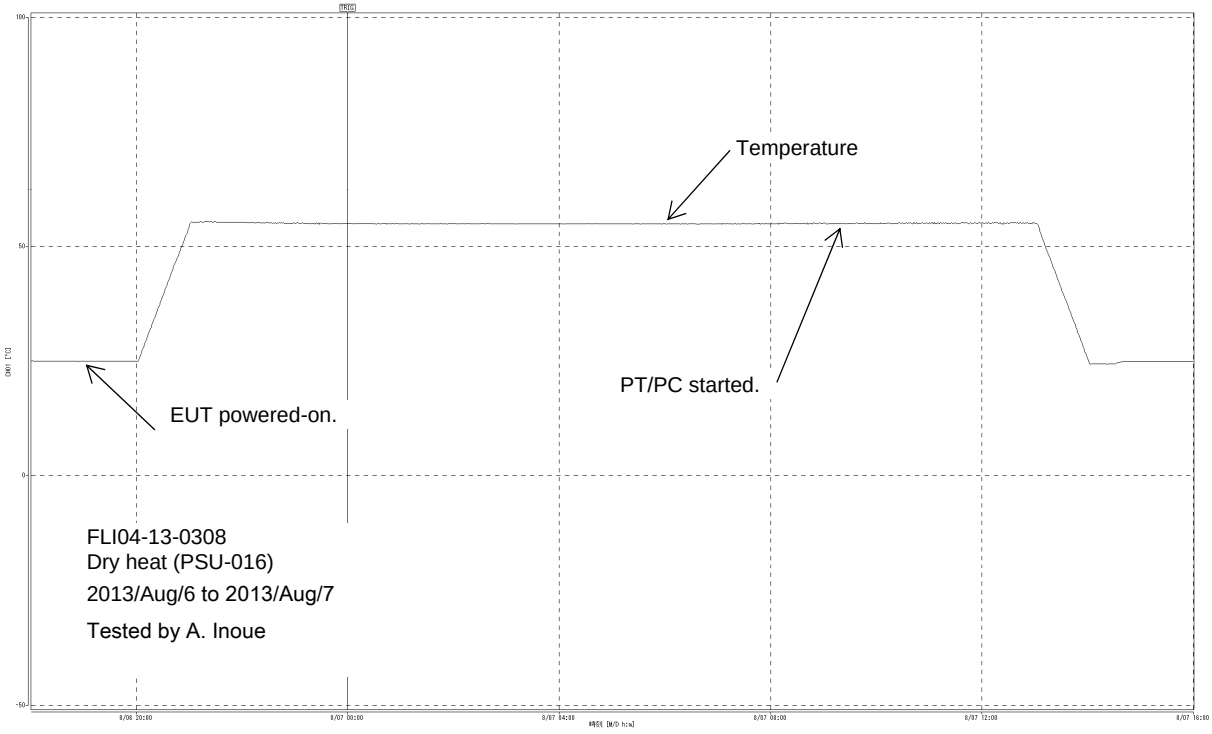
7.1 For the combination of Antenna Unit and PSU-016,
7.1.1 Dry heat - Storage,

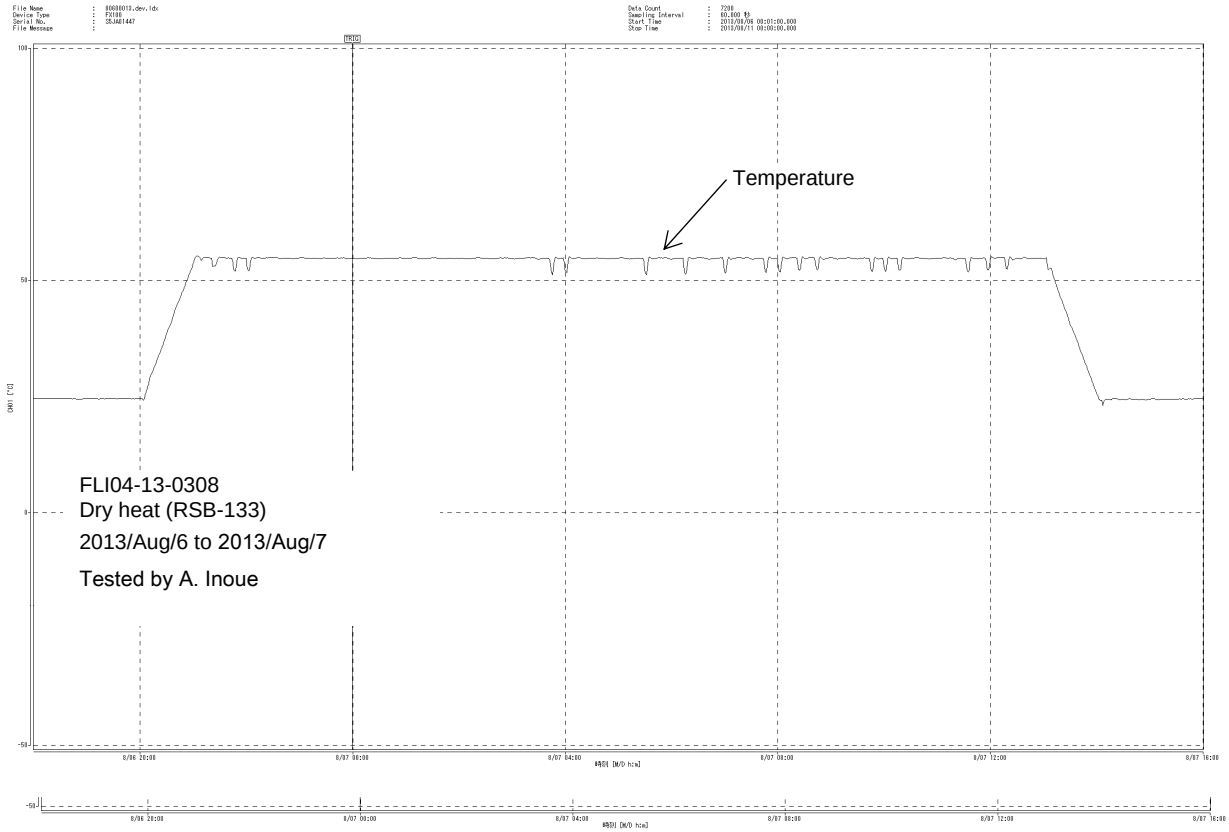
For Antenna Unit,



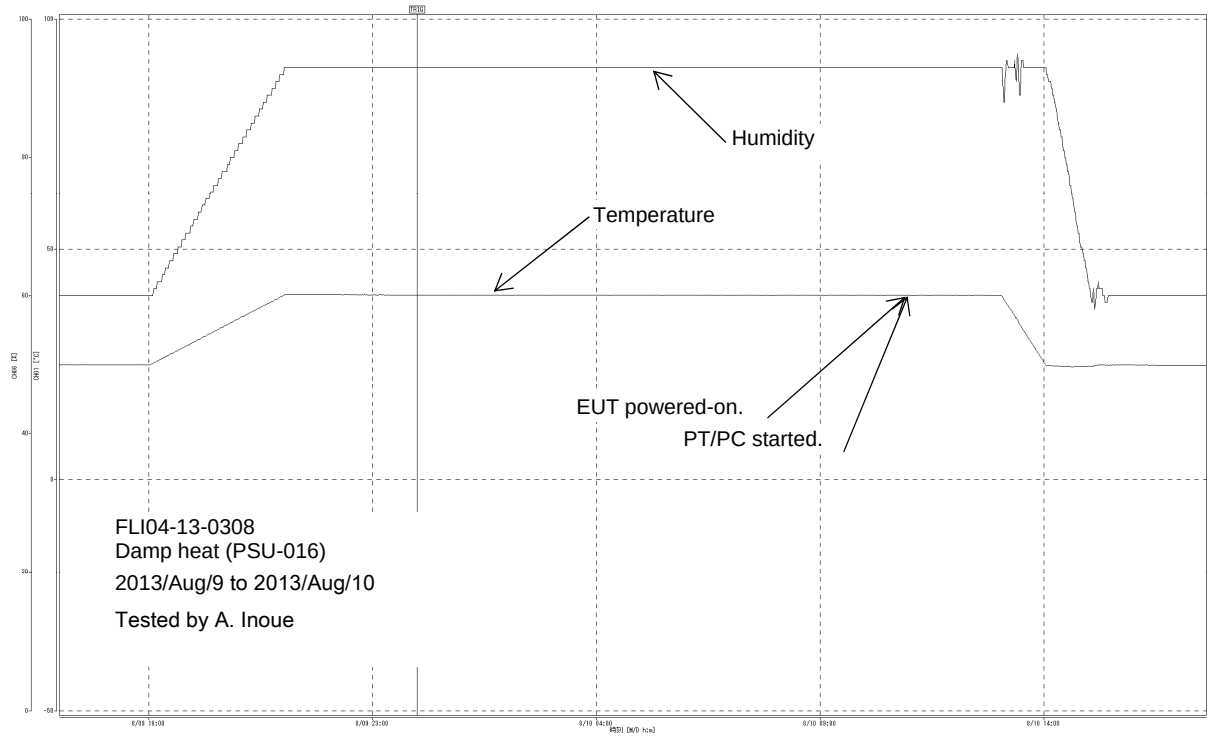
7.1.2 Dry heat - Functional,

For PSU-016,

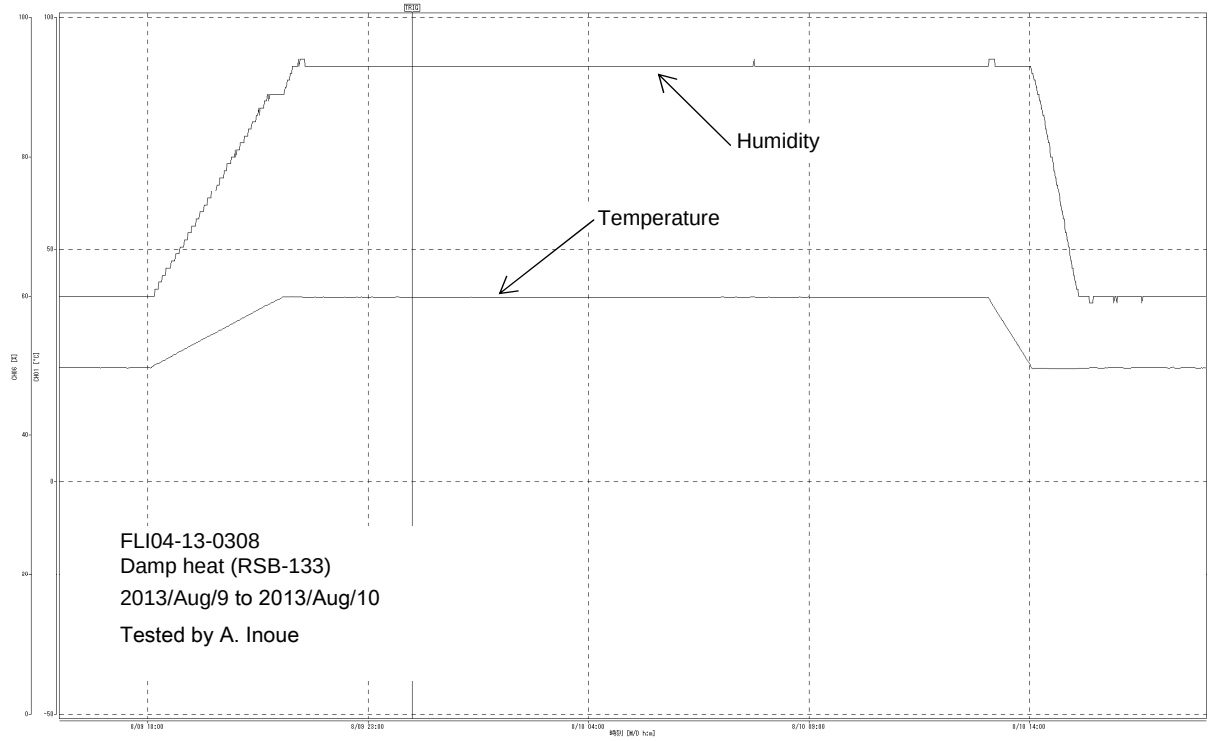




7.1.3 Damp heat,
For PSU-016,

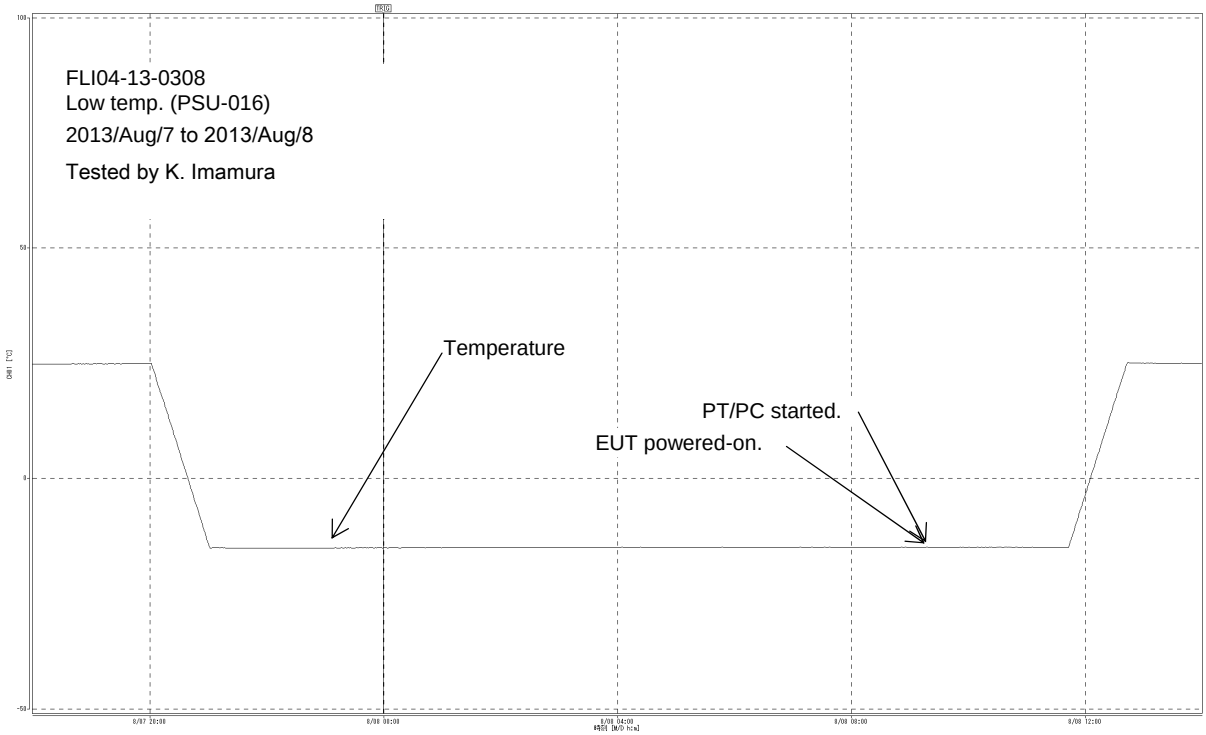


For Antenna Unit,

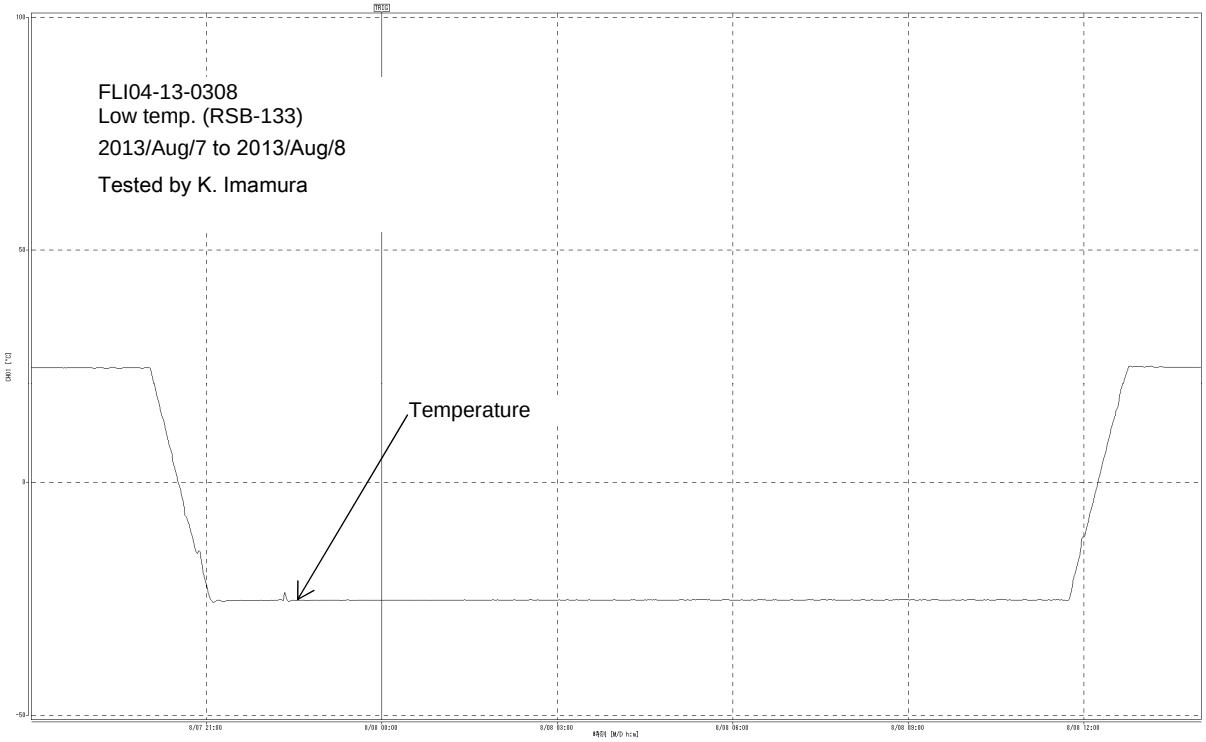


7.1.4 Low temperature - Functional,

For PSU-016,

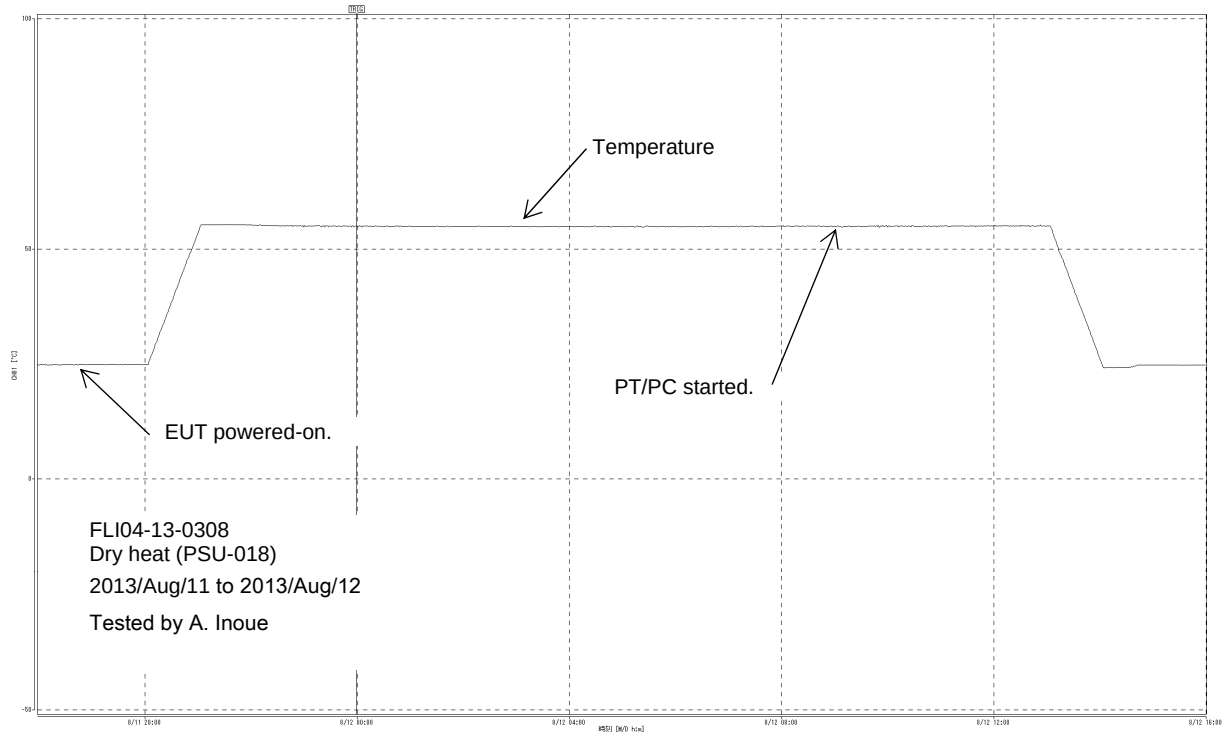


For Antenna Unit,

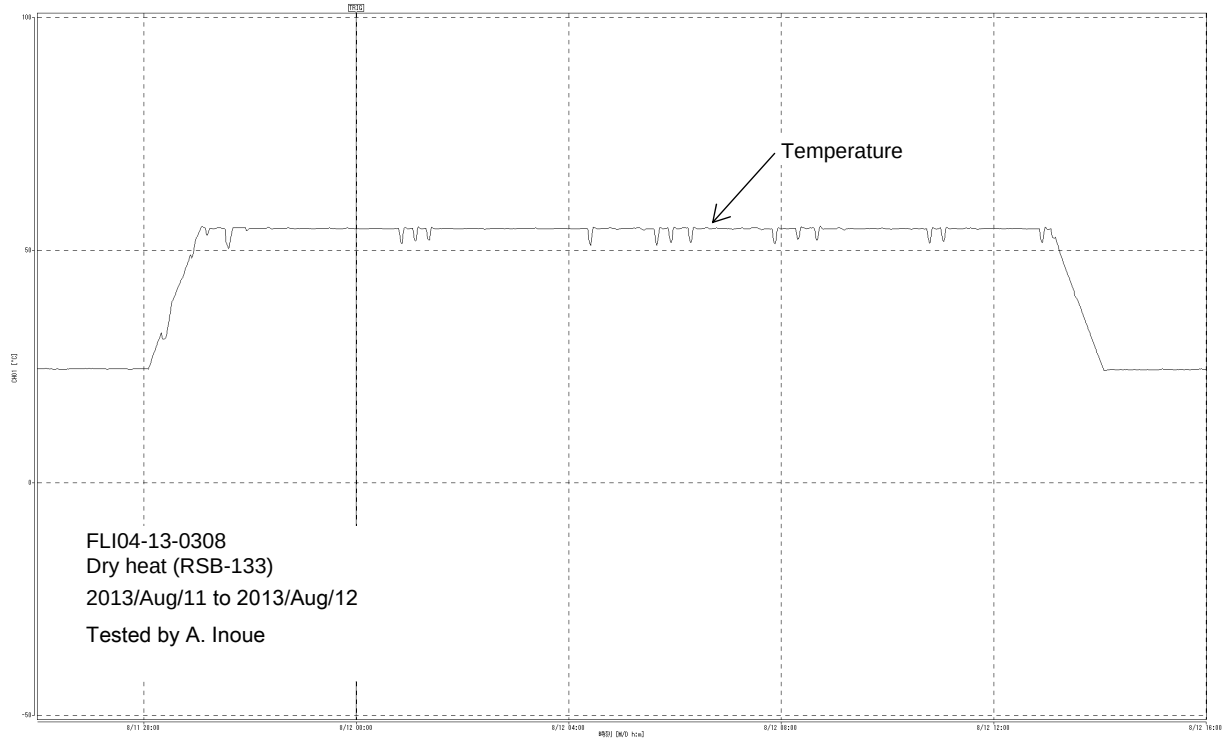


7.2 For the combination of Antenna Unit and PSU-018,
7.2.1 Dry heat - Functional,

For PSU-018,

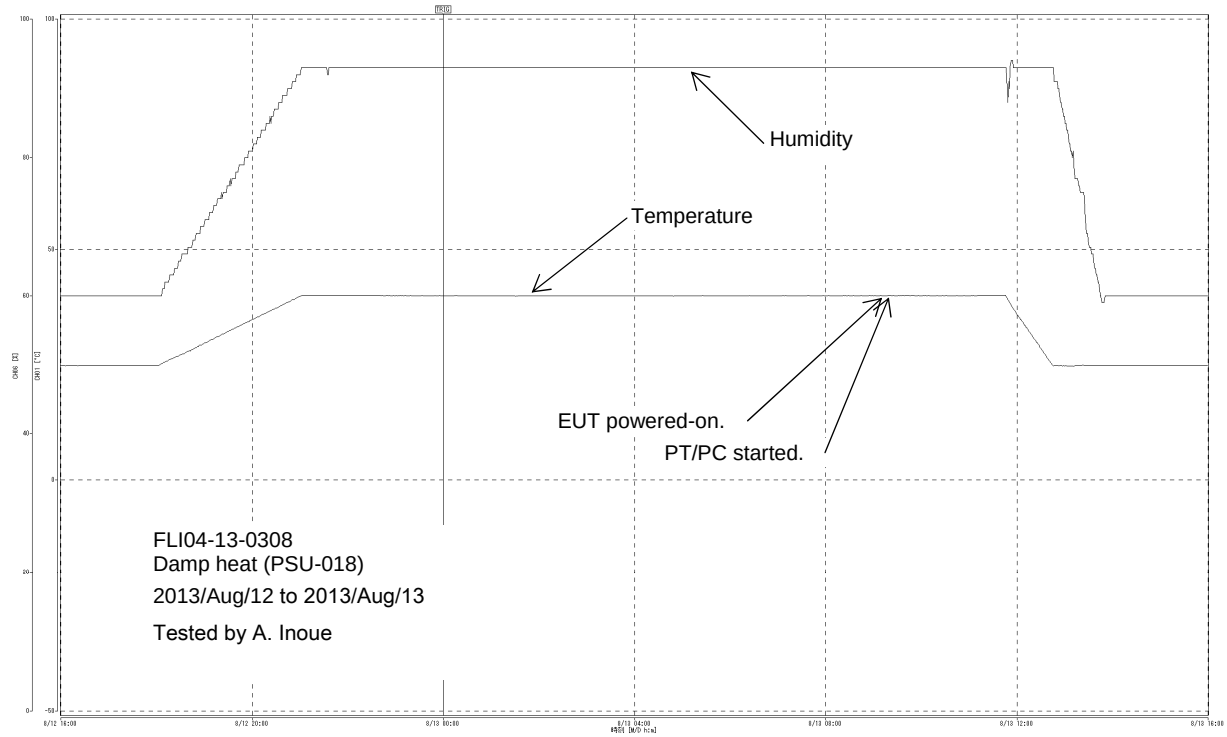


For Antenna Unit,

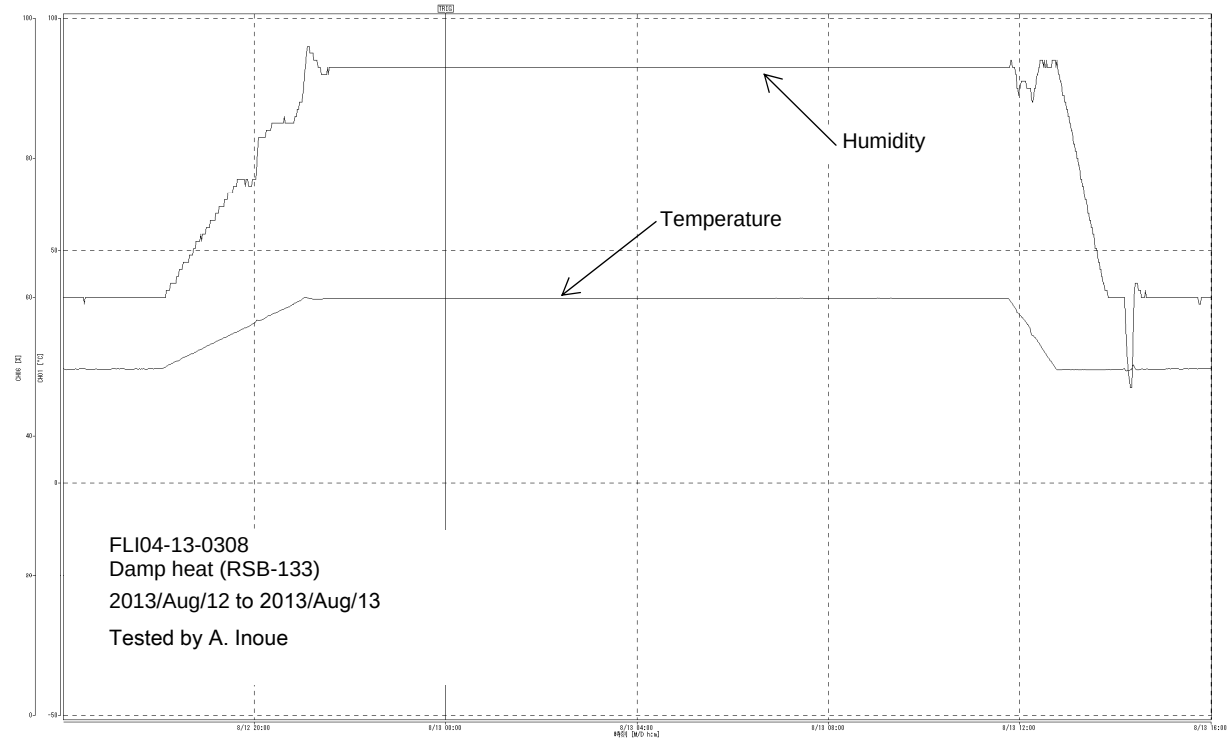


7.2.2 Damp heat,

For PSU-018,

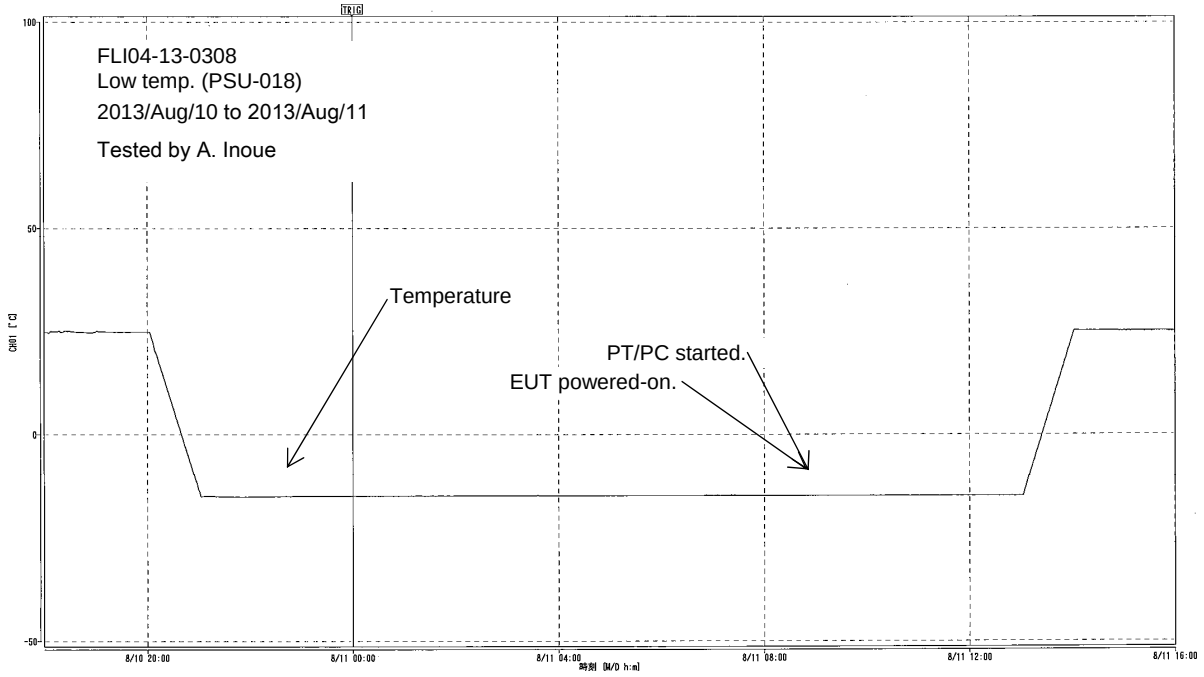


For Antenna Unit,

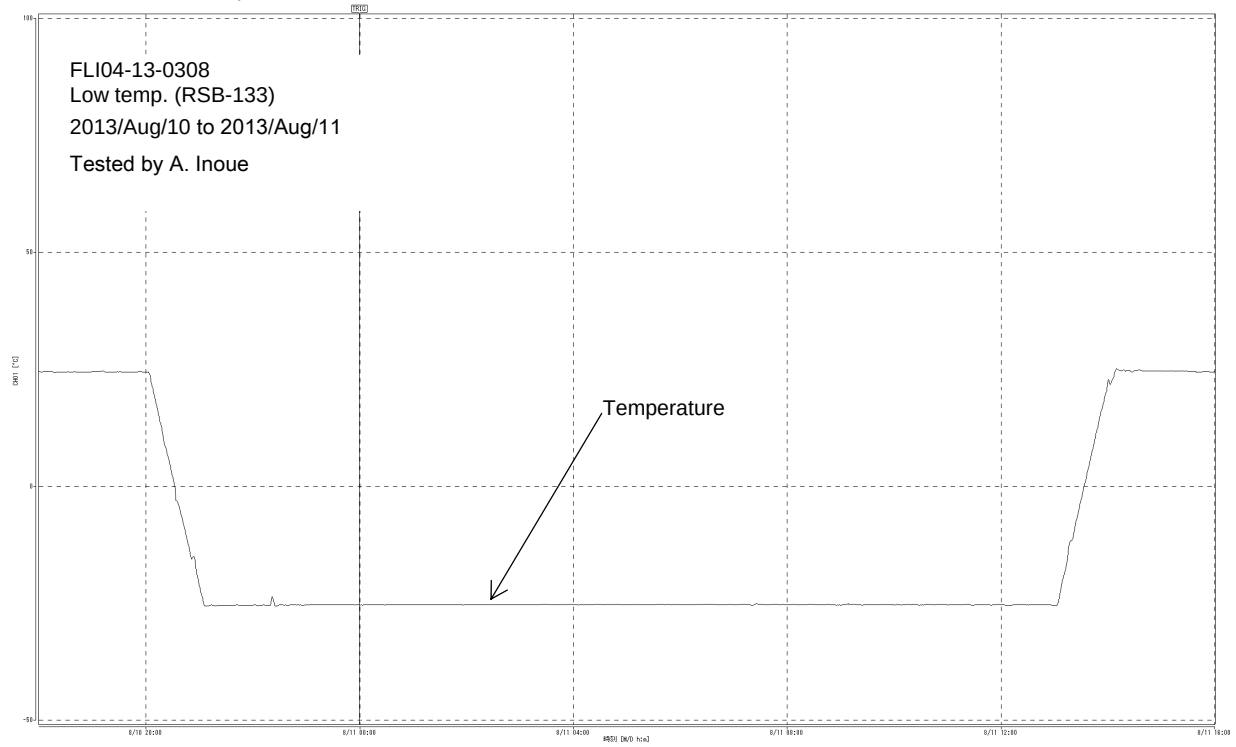


7.2.3 Low temperature - Functional,

For PSU-018,



For Antenna Unit,



8 Vibration response plots taken during tests

8.1 For Antenna Unit,

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

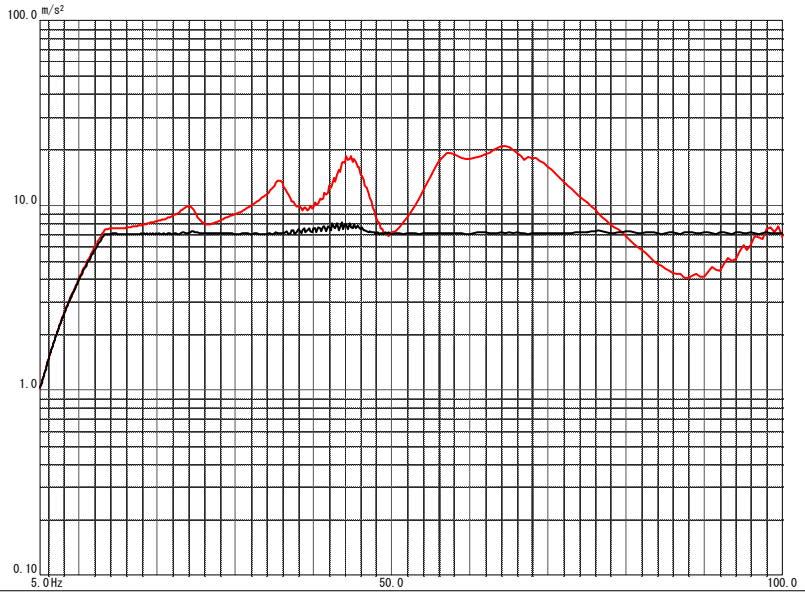
Furuno Labotech International Co., Ltd
Date Tested:2013/08/10
Operator:F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

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

EUT:RSB-133
SN36CF(12ft), RTR-111
S/N: R00006-000003

— EUT
— CONTROL

64.0Hz
20.9m/s^2



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

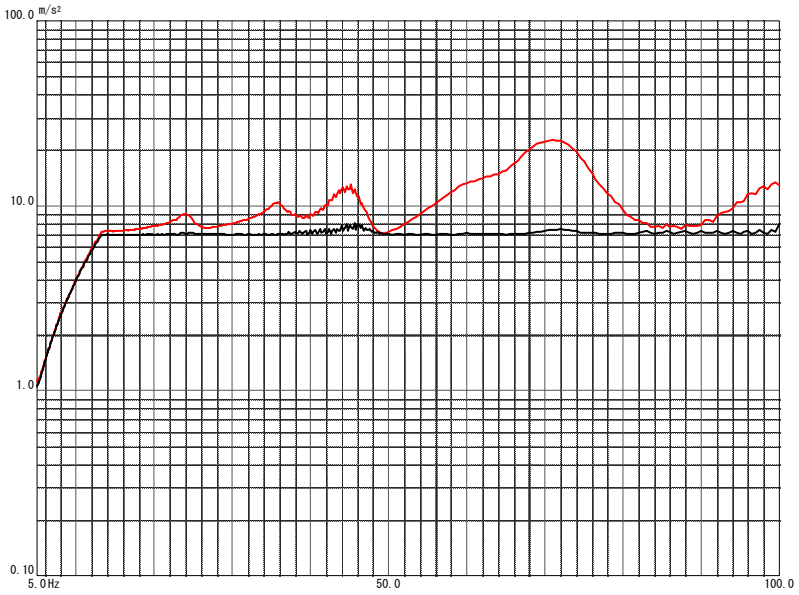
Furuno Labotech International Co., Ltd
Date Tested:2013/08/10
Operator:F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

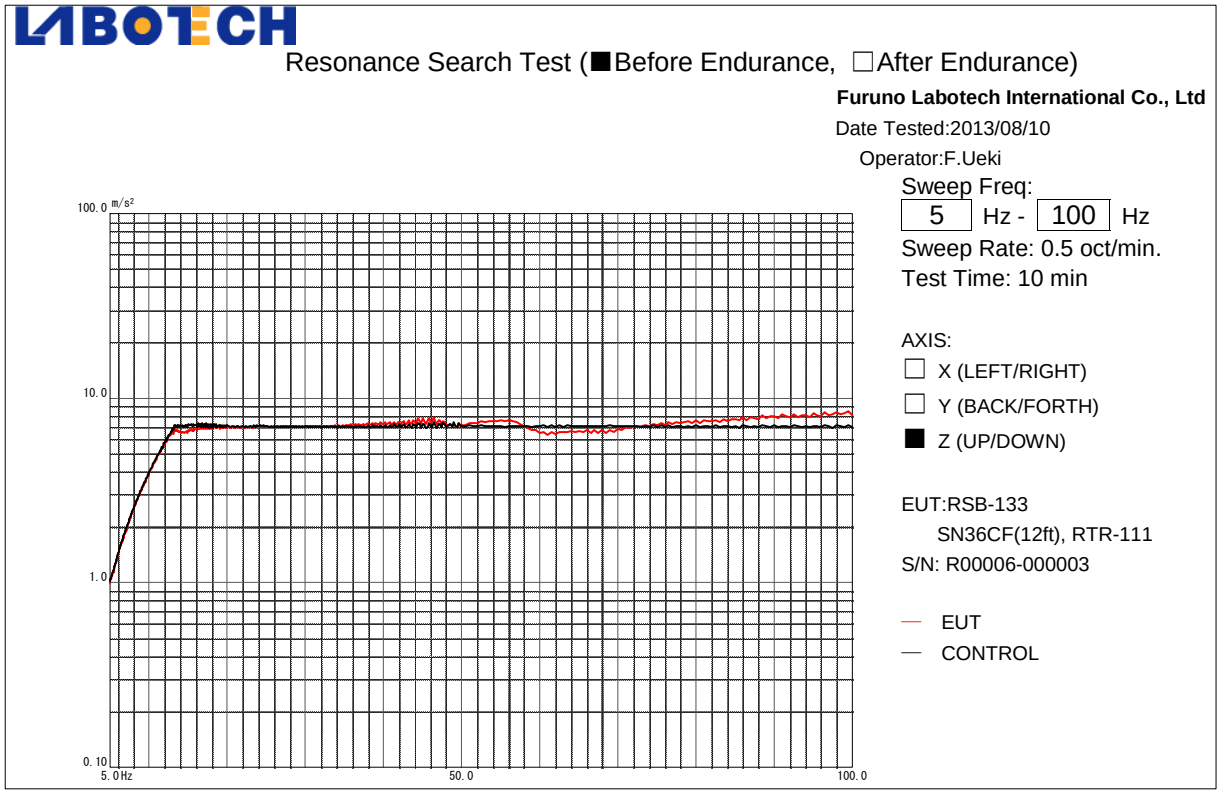
AXIS:
☐ X (LEFT/RIGHT)
■ Y (BACK/FORTH)
☐ Z (UP/DOWN)

EUT:RSB-133
SN36CF(12ft), RTR-111
S/N: R00006-000003

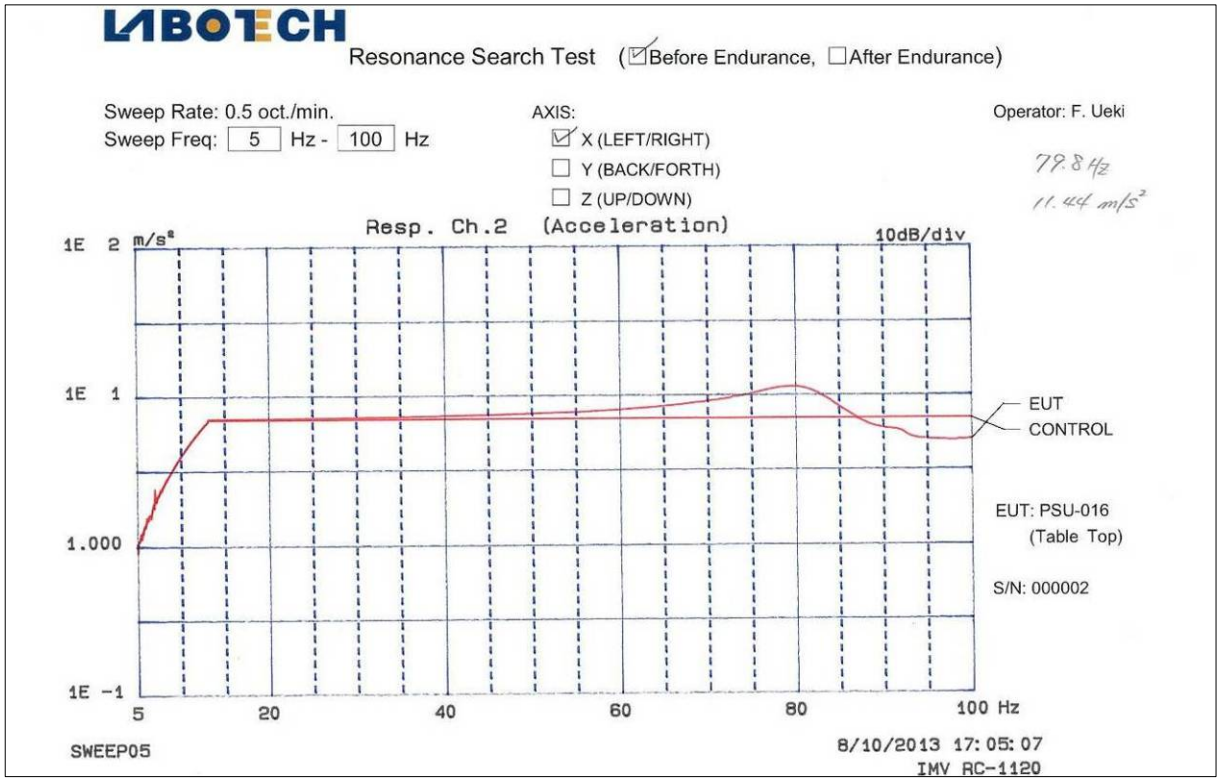
— EUT
— CONTROL

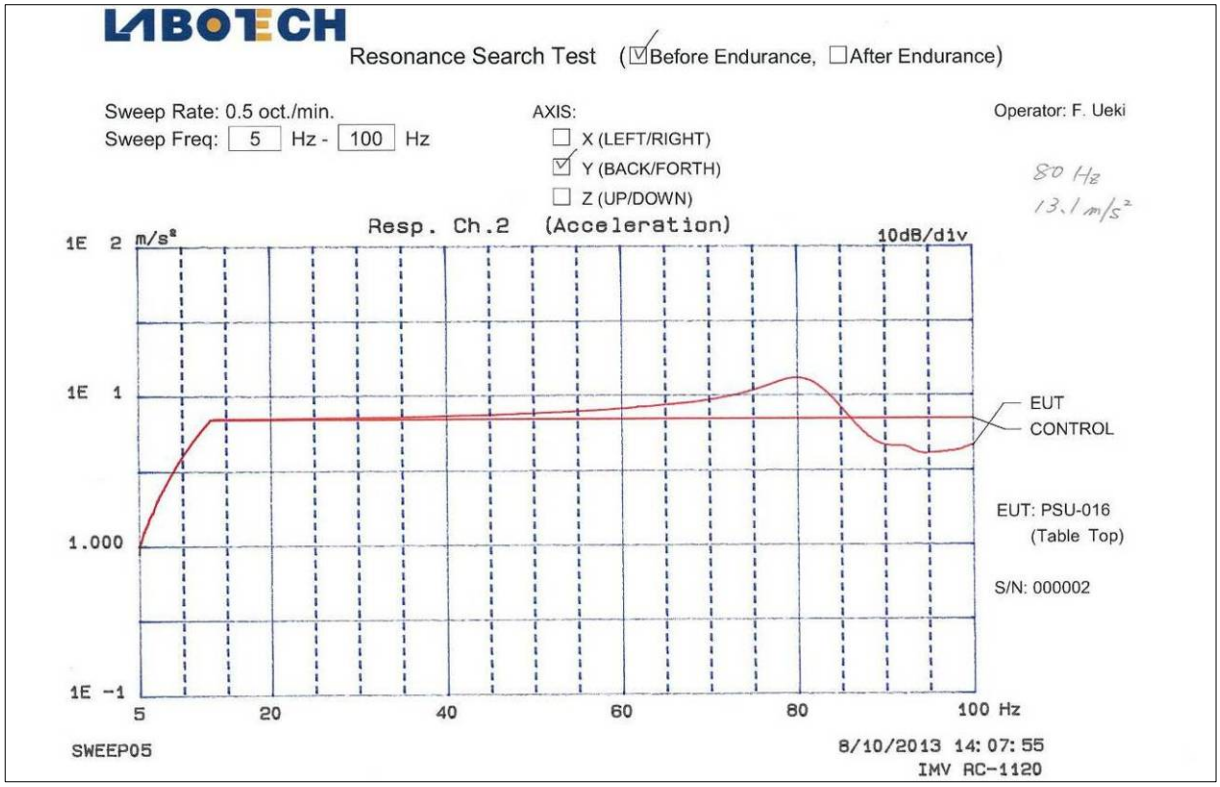
71.0Hz
22.7m/s^2

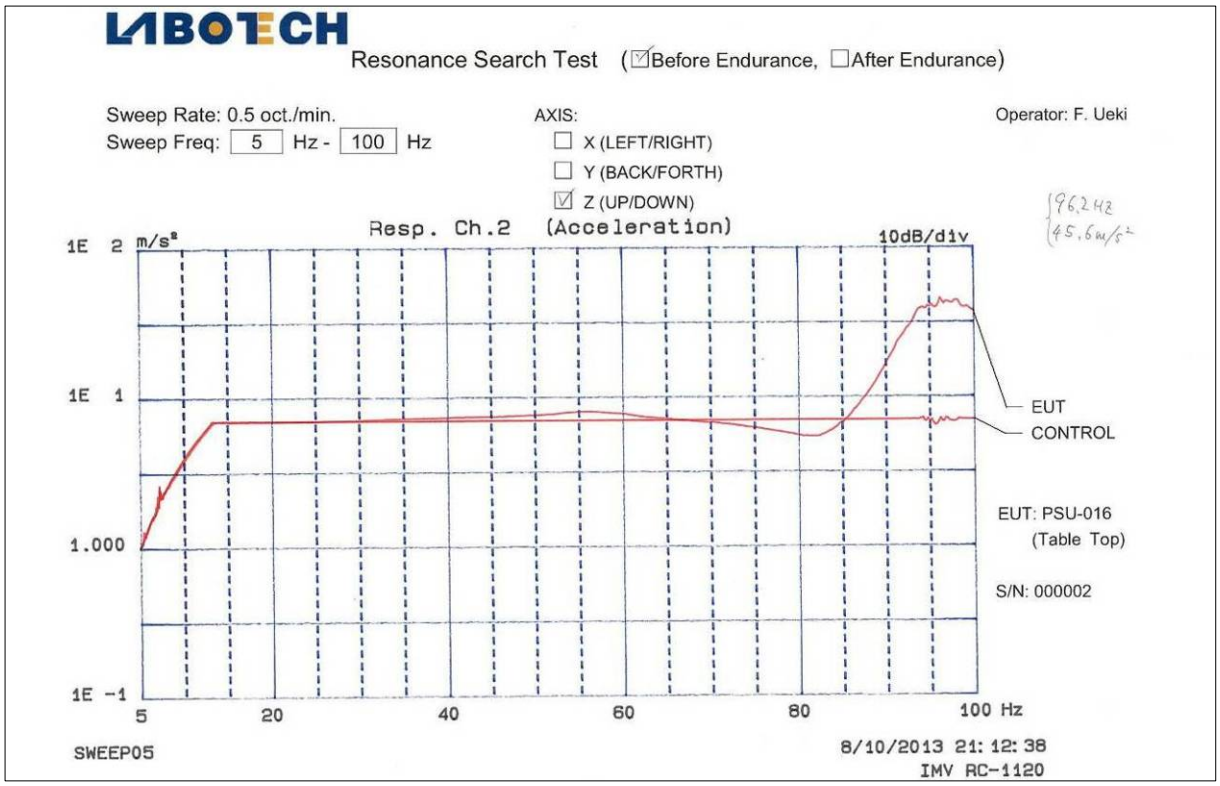




8.2 For PSU-016,
Table top,



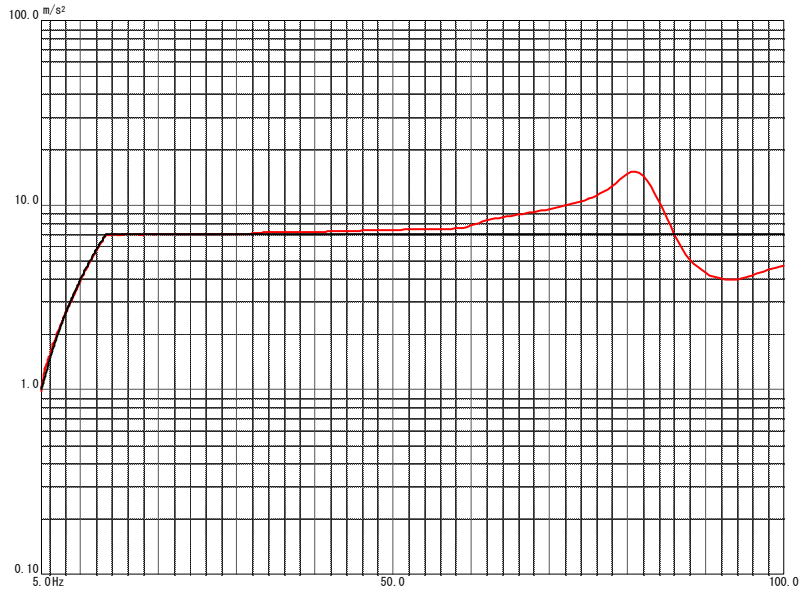

Resonance Search Test (☑Before Endurance, ☐After Endurance)
Sweep Rate: 0.5 oct./min.
Sweep Freq: 5 Hz - 100 Hz
AXIS:
☐ X (LEFT/RIGHT)
☑ Y (BACK/FORTH)
☐ Z (UP/DOWN)
Operator: F. Ueki
80 Hz
13.1 m/s²
Resp. Ch.2 (Acceleration)
10dB/div
1E 2 m/s²
1E 1
1.000
1E -1
5
20
40
60
80
100 Hz
EUT
CONTROL
EUT: PSU-016
(Table Top)
S/N: 000002
SWEEP05
8/10/2013 14: 07: 55
IMV RC-1120


Resonance Search Test (☑Before Endurance, ☐After Endurance)
Sweep Rate: 0.5 oct./min.
Sweep Freq: 5 Hz - 100 Hz
AXIS:
☐ X (LEFT/RIGHT)
☐ Y (BACK/FORTH)
☑ Z (UP/DOWN)
Operator: F. Ueki
96.2 Hz
45.6 m/s²
Resp. Ch.2 (Acceleration)
10dB/div
1E 2 m/s²
1E 1
1.000
1E -1
5
20
40
60
80
100 Hz
EUT
CONTROL
EUT: PSU-016
(Table Top)
S/N: 000002
SWEEP05
8/10/2013 21: 12: 38
IMV RC-1120

Wall-mounting,

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

Furuno Labotech International Co., Ltd
Date Tested:2013/08/12
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)

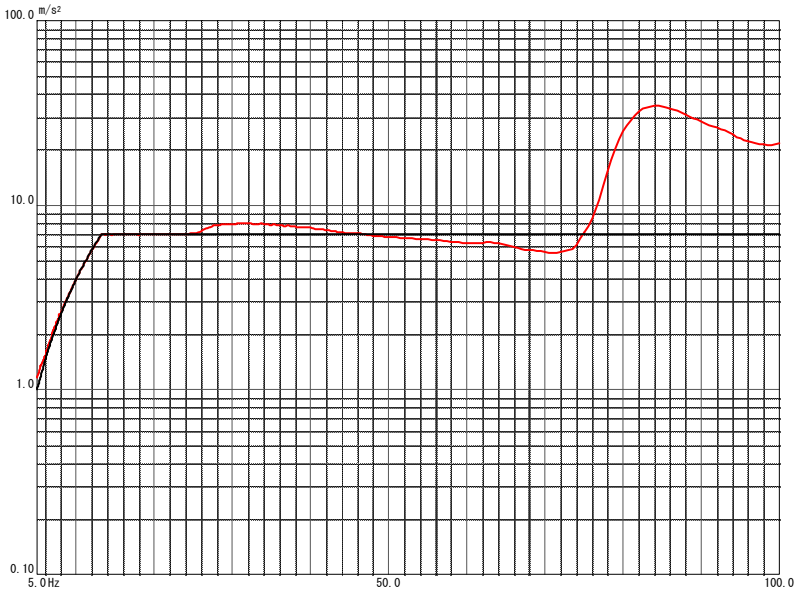
EUT:PSU-016
(Wall-mounting)
S/N: 000002

— EUT
— CONTROL

81.0Hz
15.2m/s^2

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

Furuno Labotech International Co., Ltd
Date Tested:2013/08/12
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-016
(Wall-mounting)
S/N: 000002

— EUT
— CONTROL

84.5Hz
34.5m/s^2

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

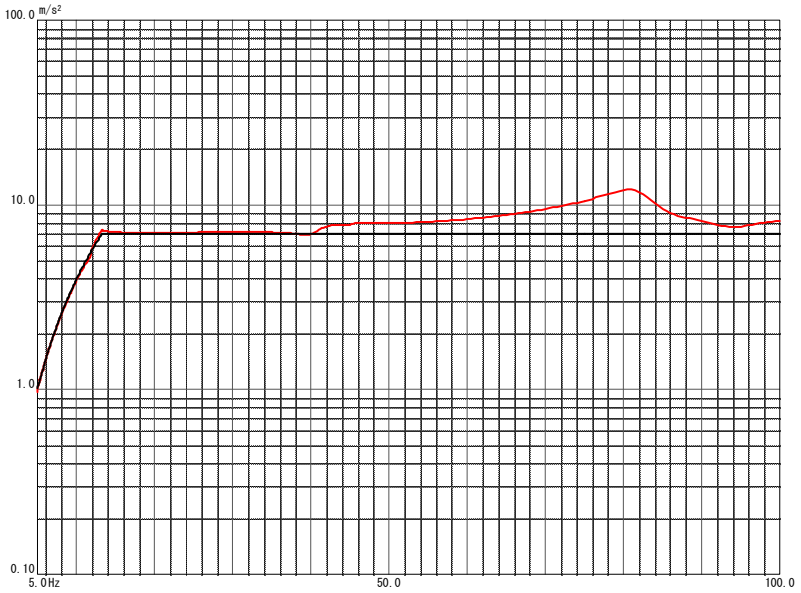
Furuno Labotech International Co., Ltd
Date Tested: 2013/08/13
Operator: F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

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

EUT:PSU-016
(Wall-mounting)
S/N: 000002

— EUT
— CONTROL

81.0 Hz
12.1 m/s²



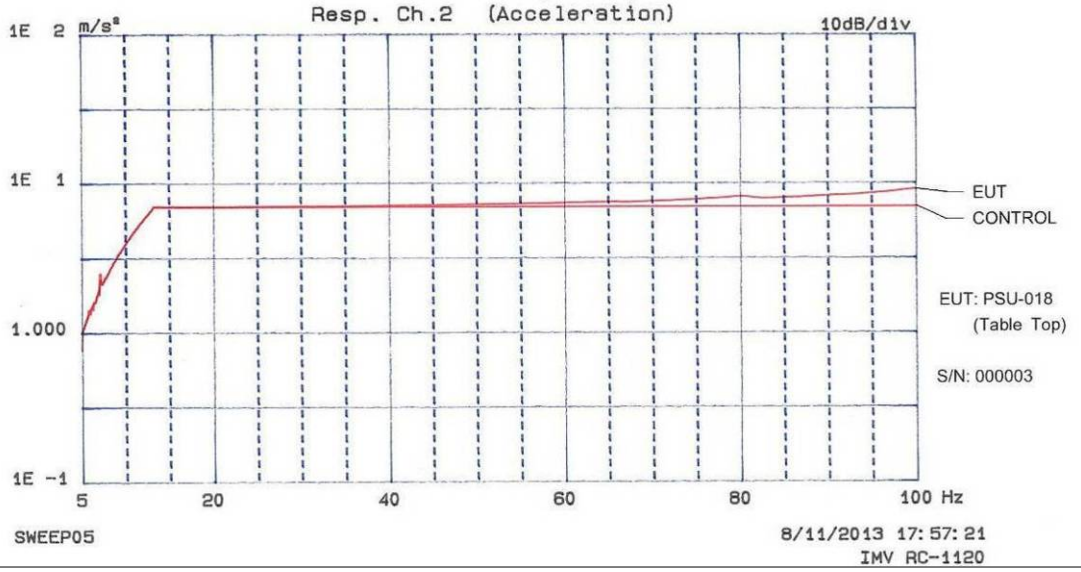
8.3 For PSU-018,
Table top

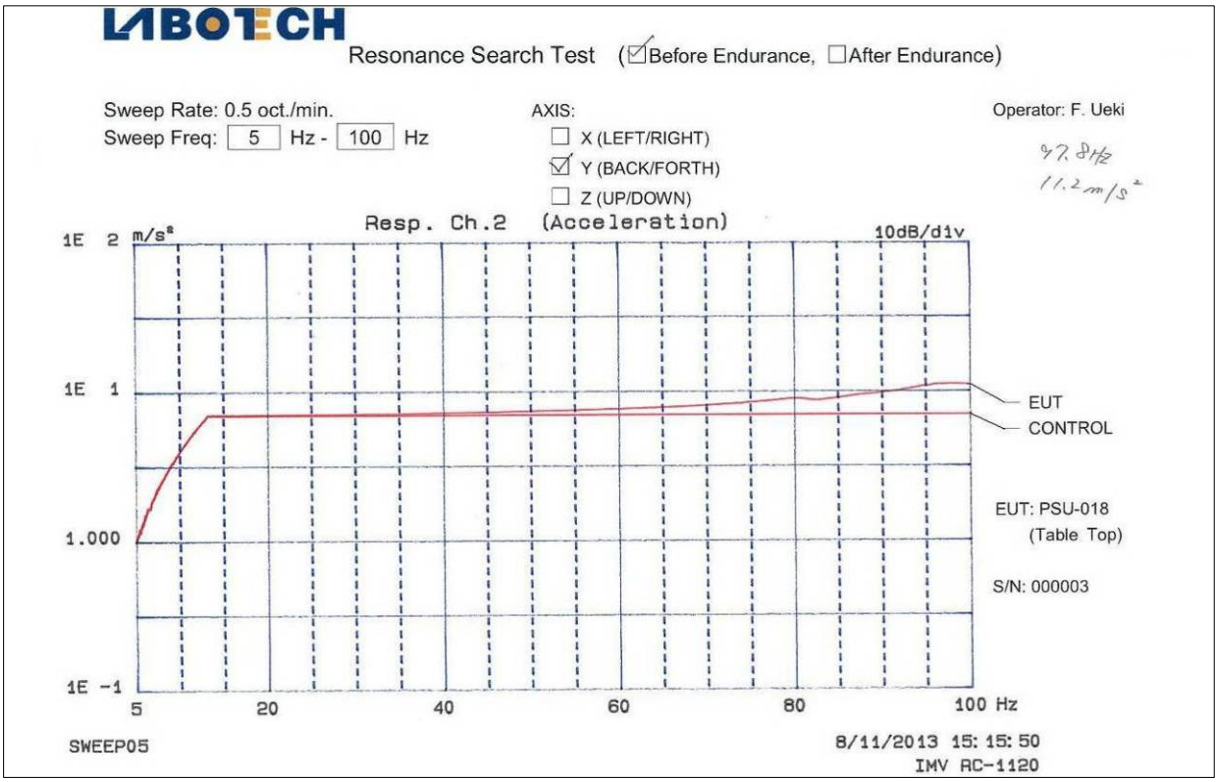
Resonance Search Test (☑Before Endurance, ☐After Endurance)

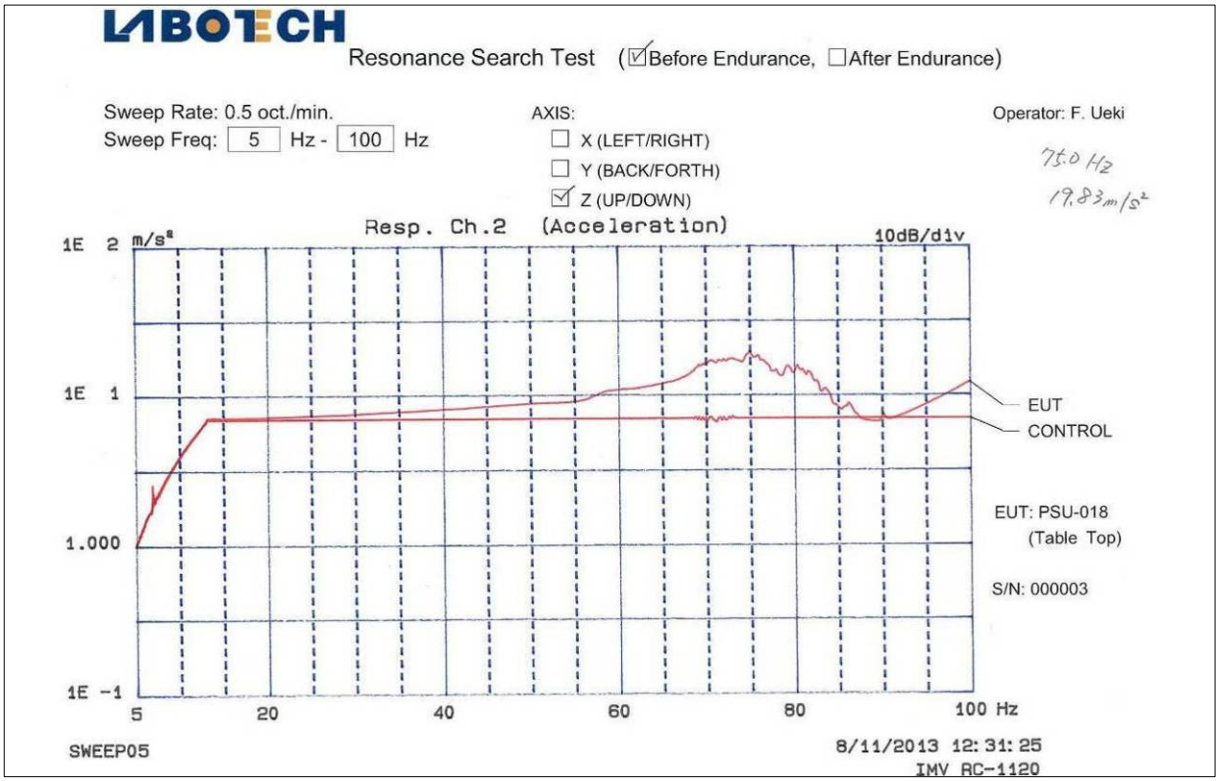
Sweep Rate: 0.5 oct./min.
Sweep Freq: 5 Hz - 100 Hz

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

Operator: F. Ueki
100 Hz
9.15 m/s²




Resonance Search Test (☑Before Endurance, ☐After Endurance)
Sweep Rate: 0.5 oct./min.
Sweep Freq: 5 Hz - 100 Hz
AXIS:
☐ X (LEFT/RIGHT)
☑ Y (BACK/FORTH)
☐ Z (UP/DOWN)
Operator: F. Ueki
47.8Hz
11.2m/s²
Resp. Ch.2 (Acceleration)
10dB/div
1E 2 m/s²
1E 1
1.000
1E -1
5
20
40
60
80
100 Hz
EUT
CONTROL
EUT: PSU-018
(Table Top)
S/N: 000003
SWEEP05
8/11/2013 15:15:50
IMV RC-1120


Resonance Search Test (☑Before Endurance, ☐After Endurance)
Sweep Rate: 0.5 oct./min.
Sweep Freq: 5 Hz - 100 Hz
AXIS:
☐ X (LEFT/RIGHT)
☐ Y (BACK/FORTH)
☑ Z (UP/DOWN)
Operator: F. Ueki
75.0 Hz
19.83m/s²
Resp. Ch.2 (Acceleration)
10dB/div
1E 2 m/s²
1E 1
1.000
1E -1
5
20
40
60
80
100 Hz
EUT
CONTROL
EUT: PSU-018
(Table Top)
S/N: 000003
SWEEP05
8/11/2013 12:31:25
IMV RC-1120

Wall-mounting,

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

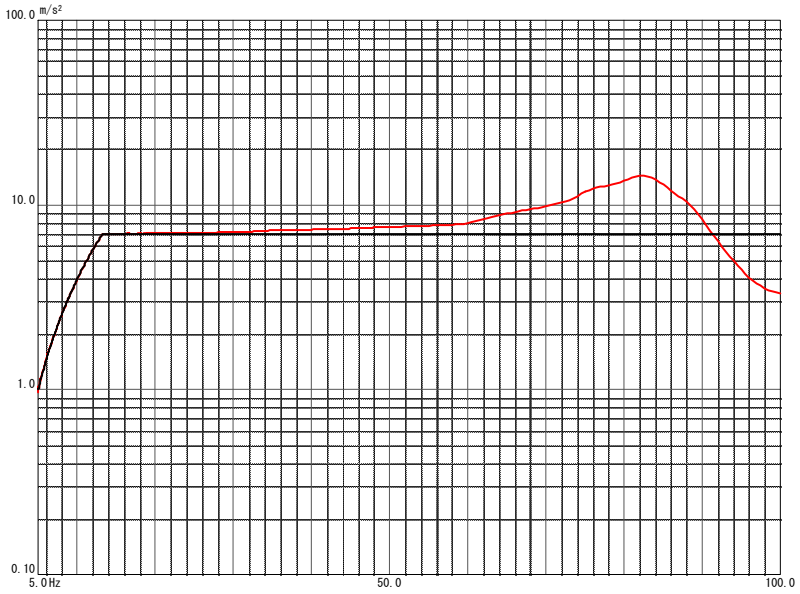
Furuno Labotech International Co., Ltd
Date Tested:2013/08/12
Operator:F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

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

EUT:PSU-018
(Wall-mounting)
S/N: 000003

— EUT
— CONTROL

82.5Hz
14.3m/s^2



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

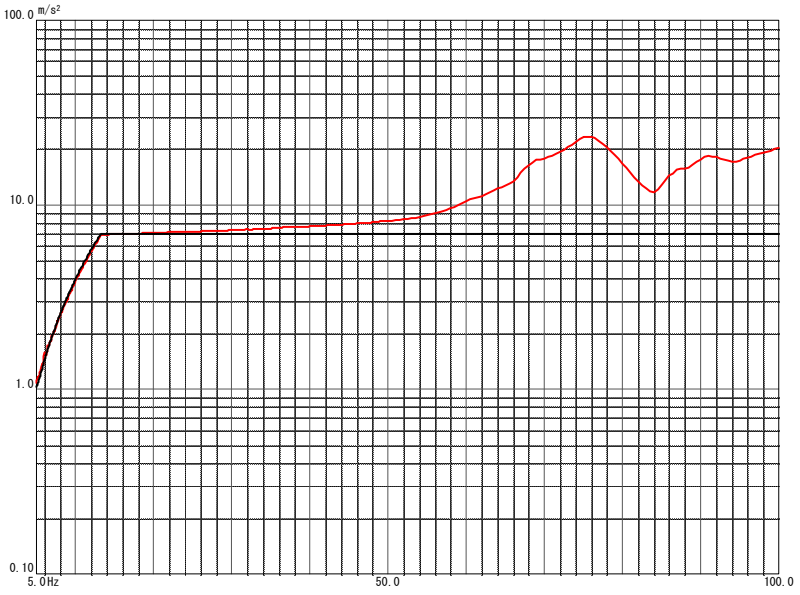
Furuno Labotech International Co., Ltd
Date Tested:2013/08/12
Operator:F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

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

EUT:PSU-018
(Wall-mounting)
S/N: 000003

— EUT
— CONTROL

75.5Hz
23.3m/s^2



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

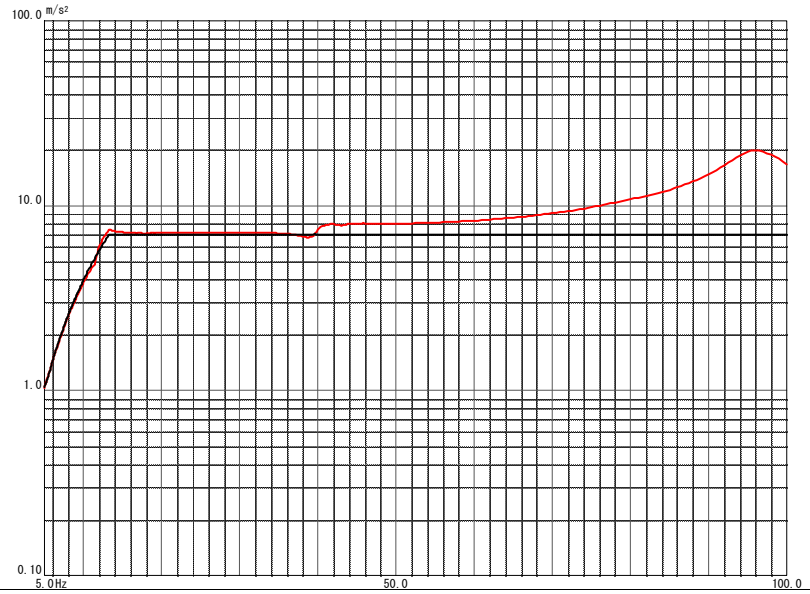
Furuno Labotech International Co., Ltd
Date Tested:2013/08/13
Operator:F.Ueki
Sweep Freq:
5 Hz - 100 Hz
Sweep Rate: 0.5 oct/min.
Test Time: 10 min

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

EUT:PSU-018
(Wall-mounting)
S/N: 000003

— EUT
— CONTROL

96.0 Hz
19.8 m/s²



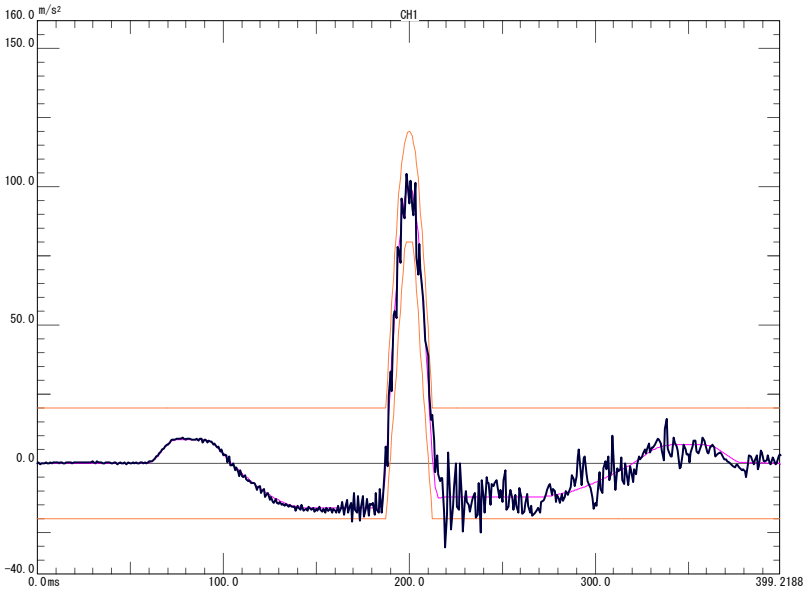
8.4 for IEC 62388 Antenna Shock test,

Shock/Bump Test

Furuno Labotech International Co., Ltd
Date Tested: 2013/08/12
Operator:F.Ueki
EUT:RSB-133
SN36CF(12ft), RTR-111
S/N: R00006-000003

AXIS:
☐ X (LEFT/RIGHT)
☐ Y (BACK/FORTH)
■ Z (UP/DOWN)
Acc. (m/s²):100
Wave Type:Half sine
Duration(ms):25
Interval(ms):1000
Bump Time:3

☐ At the Start
■ At the End



9 EUT Test Data taken during the tests

9.1 Antenna Unit and PSU-016

9.1.1 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)	23.8	23.8	23.8	≥ 20
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7 (m:s)	1:08	1:05	2.02	≤ 4:00
8 (A)	2.06	2.08	3.04	---

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

9.1.2 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)	23.9	24.0	23.9	≥ 20
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7 (m:s)	1:06	1:05	1:04	≤ 4:00
8 (A)	1.80	1.84	1.86	---

9.1.3 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)	23.8			≥ 20
3	Passed.			--
4	Passed.			---
5	Passed.			---
6	Passed.			---
7 (m:s)	1:06			≤ 4:00
8 (A)	2.20			---

Note: NA - Not applicable.

9.1.4 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)	23.8	23.8	23.8	≥ 20
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7 (m:s)	1:07	1:07	1:08	≤ 4:00
8 (A)	3.40	3.20	3.26	---

9.1.5 under normal temperature

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)	23.8	23.8	23.8	≥ 20
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7 (m:s)	1:06	1:04	1:04	≤ 4:00
8 (A)	2.18	2.22	2.24	---

9.2 Antenna Unit and PSU-018

9.2.1 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)	41.7	41.7	41.7	≥ 40
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7 (m:s)	1:05	1:05	1:04	≤ 4:00
8 (A)	1.88	1.88	1.88	---

9.2.2 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)	41.7			≥ 40
3	Passed.			--
4	Passed.			---
5	Passed.			---
6	Passed.			---
7 (m:s)	1:05			≤ 4:00
8 (A)	2.16			---

9.2.3 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)	41.6	41.6	41.6	≥ 40
3	Passed.	Passed.	Passed.	--
4	Passed.	Passed.	Passed.	---
5	Passed.	Passed.	Passed.	---
6	Passed.	Passed.	Passed.	---
7 (m:s)	1:05	1:04	1:04	≤ 4:00
8 (A)	3.34	3.26	3.30	---

9.2.4 under normal temperature

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 (m:s)	1:05	1:05	1:04	≤ 4:00
8 (A)	2.26	2.22	2.14	---