

Test Report

(IEC 60945 and IEC 62388)

For

**Trade name: Furuno
Model: MARINE RADAR
Type: FAR-3320W**

Report No.: FLI 12-13-079

Date of Issue: 28 November 2013


Furuno Labotech International Co., Ltd.

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Report Summary

| | | | |
|---|--|--------------------------------|------------------|
| FLI project number: | FLI 04-13-0178 | | |
| Test report number of initial issue: | FLI 12-13-079 | Date of initial issue | 28 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, 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 60068-2-30: 2005, IEC 60529: 2001, IEC 60068-2-6: 2007, 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-3320W | | |
| Product function and intended use: | For marine safety navigation | | |
| Number of test samples tested: | One | | |
| Serial number: | R00003-000002 (RSB-130) / R00004-000002 (RTR-108) | | |
| Power rating: | 100 - 230 VAC, 50-60 Hz, 8 A | | |
| Product status: | Pre-production model | | |
| Modifications made to samples during testing: | Modifications were made to the EUTs during the tests. See Clause 1.5 of this report. | | |
| Date of receipt of samples: | 23 August 2013 | | |
| Test period: | From 23 August 2013 to 8 November 2013 | | |
| Place of test: | Furuno Labotech International Co., Ltd. - LABOTECH EMC Center 1-16, Fukazu-cho, Nishinomiya-shi, Hyogo, 663-8203 Japan - Nishinomiya Lab. 9-52 Ashihara-cho, Nishinomiya-shi, Hyogo, 662-8580 Japan - Nishinomiya-Hama Lab. 2-20, Nishinomiya-Hama, Nishinomiya-shi, Hyogo, 662-0934 Japan | | |
| Test results/ Compliance: | Passed. The test results of this report relate only to the samples tested. | | |
| Tested by: | Akira Inoue, Fumiya Ueki, Osamu Araki, Yasuharu Nakamura, Sadatomo Kuwahara, Koji Kawai, Tadayuki Ekawa, and Katsumi Imamura. | | |
| Written by: | Akiko Inoue | | |
| Verified by: | Yoshihiro Ishii | | |
| Approved by: | Date: 28 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:
 - 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

(6) RRR Recognized Test Laboratory:

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

(7) DNV Recognized Environmental Test Laboratory:

- recognized by Det Norske Veritas AS (DNV), (Norway)
- 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, interlave 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:

| No. (*) | Item | Type | Unit serial number | Equipment category | Test setup | Note |
|---------|---------------------------------|---------|--------------------|--------------------|------------|---|
| 1 | Antenna Unit | | | Exposed | Table-top | |
| | Gear Box (with built-in deicer) | RSB-130 | R00003-000002 | | | |
| | Performance Monitor | PM-32A | | | | |
| | Antenna Radiator (*1) | XN12CF | --- | | | |
| | | XN24CF | --- | | | Contained in Gear Box. Used for Rain and spray test |
| 2 | Transceiver Unit | RTR-108 | R00004-000002 | Protected | | TX: 25 kW _{pp} , X-band, TX/RX freq.: 9410 MHz Magnetron used: MG5436 |

(*): 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 | Antenna Unit | --- | 2595 × 572 × 508 | 45 | |
| 2 | Transceiver unit | RTR-108 | 484 × 446 × 291 | 17 | |

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

| No. (*) | Name | Type | Unit serial number | Manufacturer | Note |
|---------|----------------------|---------|--------------------|--------------|--|
| 3 | Power Supply Unit | PSU-014 | 000008 | Furuno | |
| 4 | Processor Unit | EC-3000 | 4395-1207 | Furuno | Used for Climatic test. |
| | | | 4395-1205 | Furuno | Used for Vibration, Antenna shock, Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and “Protection against accidental access to dangerous voltages” and “Rain and spray” tests. |
| 5 | Monitor Unit (23.1”) | MU-231 | 002719 | Furuno | Used for Vibration, Antenna shock, Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and “Protection against accidental access to dangerous voltages” and “Rain and spray” tests. |
| | | | 000026 | Furuno | Used for Climatic test. |
| 6 | Control Unit | RCU-025 | 000169 | Furuno | Used for Vibration, Antenna shock, Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and “Protection against accidental access to dangerous voltages” and “Rain and spray” tests. |
| | | | 000168 | Furuno | Used for Climatic test. |
| 7 | Control Unit | RCU-014 | 2-0153 | Furuno | Used for Vibration, Antenna shock, Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and “Protection against accidental access to dangerous voltages” tests. |
| | | | 5453 | Furuno | Used for Climatic test. |
| 8 | Processor Unit | RPU-013 | 4366-4589 | Furuno | Used for Vibration, Antenna shock, Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and “Protection against accidental access to dangerous voltages” tests |
| | | | 4317-2240 | Furuno | Used for Climatic test. |

| No. (*) | Name | Type | Unit serial number | Manufacturer | Note |
|---------|----------------------|---------|---------------------------|--------------|--|
| 9 | Display Unit | U2412Mb | CN-007H8X-74261-31F-4 KYS | DELL | Used for Vibration, Antenna shock, Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" tests |
| | | U2412Mb | CN-007H8X-74261-31F-4 L4S | DELL | Used for Climatic test. |
| 10 | Monitor Unit (19.0") | MU-190 | 001436 | Furuno | Used for Vibration, and Antenna shock tests |

(*): 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 |
|---------|-----------------------------|---------------------|--------------------------|-----------------|---|
| 11 | Antenna Dummy Load (X-band) | 4D376 | 4535002 | SPC ELECTRONICS | |
| | | | R0627008 | SPC ELECTRONICS | Used for Climatic test. |
| 12 | USB Serial Adapter (RS-422) | COM-1PD(U SB)H | 8DRZD76002358 | CONTEC | Used for Climatic, Vibration, Antenna shock tests. |
| | | ESU2-400 (RS-422) | 03064100028 | QUATECH | Used for Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" tests. |
| 13 | PC | E5520-2500H D(7P | --- | DELL | Used for Climatic, Vibration, and Antenna shock tests. |
| | | HP Compaq dx6100 ST | JPA5120546 | HP | Used for Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" tests. |
| 14 | Display Unit | 1901FP | CN-02Y318-71618-473-AA9U | DELL | Used for Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" tests. |
| 15 | Keyboard | TK-FCM007 WH | 28067474 | ELECOM | Used for Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" tests. |
| | | KB-0316 | B77760AGA RD9MR | HP | Used for Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" tests. |
| 16 | Mouse | MO28KC | 23-024750 | IBM | Used for Electromagnetic radiofrequency radiation, Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" tests. |

(*): 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 | Transceiver Unit | App(SPU MAG) | 0359281 | 01.04 | |
| 2 | EUT | Antenna Unit | App(MTR-DRV) | 0359293 | 01.04 | |
| | | | App(PM) | 0359296 | 01.04 | |
| 3 | AU | Power Supply Unit | App(PSU-Control) | 0359299 | 01.04 | |
| 4 | AU | Processor Unit EC-3000 | App | 0359266 | 02.04 | |
| 5 | AU | Control Unit RCU-025 | Key1 | 2450086 | 01.05 | |
| 6 | AU | Monitor Unit (19.0-inch) | Monitor1 | 2651020 | 01.03 | |
| 7 | AU | Monitor Unit (23.1-inch) | Monitor2 | 2651020 | 01.03 | |
| 8 | AU | Processor Unit RPU-013 | --- | 0359204 | 02.51 | |
| 9 | AU | CONTROL UNIT RCU-014 | --- | 0359203 | 01.04 | |
| 10 | AE | PC | Winiec | Winexe=14 (Feb 27 2013) Winiec.mcr=02 | --- | |

EUT documentation used for the tests:

| No. | Item | Publication no. | Rev. number | Note |
|-----|---------------------|-----------------|-------------|------|
| 1 | Installation Manual | IME-36160 | Z2 | |

1.2 EUT Operation mode and Performance Check

1.2.1 EUT Operation mode

Operation state: TX-on

For Climatic, Vibration and Antenna shock tests,

RANGE: 6NM
TUNE: AUTO
GAIN: Manual, 96
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.

For Excessive conditions, Acoustic noise and signals, Compass safe distance (CSD), and "Protection against accidental access to dangerous voltages" and "Rain and spray" tests,

RANGE: 6NM
TUNE: AUTO
GAIN: Manual, 85
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: 97

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 (No. 9 AU) 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.
Items (3), (9) were not performed for Vibration test.

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 Climate test)
- 230 VAC, 50 Hz (for the tests other than the above)

1.3.2 Extreme power supply conditions:

Upper extreme conditions:
253 VAC, 63.0 Hz (230 VAC + 10 %, 60 Hz + 5 %).

Lower extreme conditions:
90 VAC, 47.5 Hz (100 VAC - 10 %, 50 Hz - 5 %).

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) 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-042 dated 11 November 2013.)
- (3) Unit combination for Radar System of FAR-3320W is as follows,

| Model | Band | Tx power | Scanner | Radiator | Transceiver | Display | Power Supply Unit |
|-----------|--------|----------|---------|----------------------------|-------------|---------|-------------------|
| FAR-3320W | X band | 25 kW | RSB-130 | XN12CF XN20CF XN24CF | RTR-108 | MU-231 | PSU-014 |

Note: Radiators XN12CF and XN24CF were used for the tests, representing all radiators.

- (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 Modification made to the EUT

| State | Description | Made by | Date |
|-------|---|---------|-----------------|
| 0 | As supplied by the customer. | --- | --- |
| 1 | For Antenna unit, Gap of cable clamp was filled with silicon. | Furuno | 31 October 2013 |
| 2 | For Antenna unit, (1) Packing was added to fill a gap between waterproof ribs on packing. (2) Rubber was winded to fill a gap around the waveguide. (3) Silicon was added on waterproof packing to fill the gap. | Furuno | 6 November 2013 |

1.6 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: $\pm 1.5^{\circ}\text{C}$ |
| 8.2.2 | - Functional test: | Temperature: $\pm 1.5^{\circ}\text{C}$ |
| 8.3 | Damp heat | |
| 8.3.1 | - Functional test: | Temperature: $\pm 1.5^{\circ}\text{C}$, Humidity: $\pm 4\%$ |
| 8.4 | Low temperature | ---- |
| 8.4.1 | - Storage test: | Temperature: $\pm 1.5^{\circ}\text{C}$ |
| 8.4.2 | - Functional tests: | Temperature: $\pm 1.5^{\circ}\text{C}$ |
| 8.7 | Vibration: | Acceleration: $\pm 2.2 \text{ m/s}^2$ |
| 8.8 | Rain and spray: | Delivery rate: $\pm 3.1 \text{ l/min}$ for 100 l/min. |
| 8.12 | Corrosion: | ---- |
| 11 | Special purpose tests | |
| 11.1 | Acoustic noise and signals: | $\pm 2.4 \text{ dB}$ |
| 11.2 | Compass safe distance (CSD): | $\pm 7.4\%$ |
| 12 | Safety precautions | |
| 12.1 | Protection against accidental access to dangerous voltages: | Not applicable. |
| 12.2 | Electromagnetic radiofrequency radiation: | $\pm 2.3 \text{ dB}$ |
| 12.4 | X-radiation: | ---- |

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

| IEC 62388 Clause | Item | Measurement uncertainty (*) |
|------------------|--------------------|---------------------------------------|
| 17.3.2 | Antenna shock test | Acceleration: $\pm 2.2 \text{ m/s}^2$ |

(*): 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. | F. Ueki |
| 7.2 | Excessive conditions: | Not performed. | ---- |
| 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. | F. Ueki |
| 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. | F. Ueki |
| 8.7 | Vibration: | Passed. | K. Imamura and F. Ueki |
| 8.8 | Rain and spray: | Passed. | Y. Nakamura, K. Kawai, 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. | Y. Nakamura, K. Kawai, T. Ekawa |
| 12 | Safety precautions | | |
| 12.1 | Protection against accidental access to dangerous voltages: | Passed. | Y. Nakamura |
| 12.2 | Electromagnetic radiofrequency radiation: | Passed. | Y. Nakamura, O. Araki, S. Kuwahara |
| 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 |

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 (Not performed)

Not performed at the customer's request because test to the EUTs has been already performed and the result have been reported in the test report FLI 12-13-057.

3.2 Dry heat

3.2.1 Storage test

For Antenna unit and PSU-014 (*), after the test, PT/PC were performed at the Normal temperature. See Clause 3.1.1 of this report.

(*): PSU-014 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 3.1.1 of this report.

3.3 Damp heat - Functional test

See Clause 3.1.1 of this report.

3.4 Low temperature

3.4.1 Storage test (Not applicable)

Not applicable to "Exposed" and "Protected" equipment.

3.4.2 Functional test

For Antenna Unit and PSU-014 (*), see Clause 3.1.1 of this report.

(*): PSU-014 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 |
|----------------|-------------------|-------------------|
| RSB-130+XN24CF | Table-top | No.44 (*) |
| RTR-108 | Wall-mounting | No. 80, No.83 (*) |

(*): 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-130+XN24CF Table-top | X (left/right) | 51.4 | 34.9 | 5.0 | 51.4 | Passed. | |
| | Y (back/forth) | 46.9 | 38.5 | 5.5 | 46.9 | Passed. | |
| | Z (up/down) | 81.3 | 14.3 | 2.0 | 81.3 | Passed. | |
| RTR-108 Wall-mounting | X (left/right) | 70.0 | 41.9 | 6.0 | 70.0 | Passed. | |
| | Y (back/forth) | 84.5 | 49.2 | 7.0 | 84.5 | Passed. | |
| | Z (up/down) | 88.0 | 37.0 | 5.3 | 88.0 | 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 |
|----------------|-------------------|--------------|
| RSB-130+XN24CF | Table-top | No. 44 (*1) |

(*1): prepared by FLI.

3.6.2 Results:

| Unit | Test conditions | Results |
|----------------|--|---------|
| RSB-130+XN24CF | 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-130+XN12CF | Passed. (*) |

(*) Ingress of water was found at a part of the bottom of the rear cover, but there was no damage or degradation of performance during and after the test. For water ingress areas/points, see Clause 6 for details.

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) |
| RTR-108 | Under 30 | 38.4 | Not applicable | ≤ 60 | 75 to 85 |

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

The test to RSB-130 was not applicable, because those units were 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 |
|---------|---------------------------------|---------------------------------|-------------------------|---|
| RSB-130 | 1.90 | 1.20 | Described in the manual | (1) |
| RTR-108 | 2.00 | 1.25 | 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) |
|----------------|--------------------------------------|-------------------------------------|-------------------------------------|
| RSB-130+XN12CF | 1.0 | 1.7 | 7.7 |
| RSB-130+XN20CF | 0.5 | 1.2 | 5.5 |
| RSB-130+XN24CF | 0.3 | 0.9 | 4.0 |

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 (longest distance).

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 performed)

The test was waived according to the evidence submitted by the manufacture.

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: | 28 Aug 2013 | 25°C to 25°C, 61% to 61%RH. | 90.0 VAC, 47.5 Hz to 90.0 VAC, 47.5 Hz. 253.0 VAC, 63.0 Hz to 253.0 VAC, 63.0 Hz. |
| | | 29 Aug 2013 | 26°C to 26°C, 62% to 62%RH. | 90.0 VAC, 47.5 Hz to 90.0 VAC, 47.5 Hz. 253.0 VAC, 63.0 Hz to 253.0 VAC, 63.0 Hz. |
| | | 31 Aug 2013 | 26°C to 26°C, 73% to 73%RH. | 90.0 VAC, 47.5 Hz to 90.0 VAC, 47.5 Hz. 253.0 VAC, 63.0 Hz to 253.0 VAC, 63.0 Hz. |
| 7.2 | Excessive conditions tests | Not performed. | ---- | ---- |
| 8 | Durability and resistance to environmental conditions | | | |
| 8.2 | Dry heat | ---- | ---- | ---- |
| 8.2.1 | - Storage test: | 31 Aug 2013 | 26°C to 26°C, 73% to 73%RH. | 100.0 VAC, 60.0 Hz to 100.0 VAC, 60.0 Hz 230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz. |
| 8.2.2 | - Functional test: | 29 Aug 2013 | 26°C to 26°C, 62% to 62%RH. | 100.0 VAC, 60.0 Hz to 100.0 VAC, 60.0 Hz 230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz. |
| 8.3.1 | Damp heat- Functional test: | 30 Aug 2013 | 26°C to 26°C, 65% to 65%RH. | 100.0 VAC, 60.0 Hz to 100.0 VAC, 60.0 Hz 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: | 28 Aug 2013 | 25°C to 25°C, 61% to 61%RH. | 100.0 VAC, 60.0 Hz to 100.0 VAC, 60.0 Hz 230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz. |
| 8.7 | Vibration: | 8 September 2013 | 26°C to 26°C, 62% to 69%RH | 100.0 VAC, 60.0 Hz to 100.2 VAC, 60.0 Hz. |
| | | 9 September 2013 | 26°C to 26°C, 62% to 62%RH | 100.5 VAC, 60.0 Hz to 100.8 VAC, 60.0 Hz. |
| 8.8 | Rain and spray: | 31 October 2013 | 17°C to 16°C, 51% to 50%RH. Water temperature: 12°C | 100.5 VAC, 60.0 Hz to 100.5 VAC, 60.0 Hz. |
| | | 1 November 2013 | 17°C to 17°C, 51% to 51%RH. Water temperature: 12°C | 100.2 VAC, 60.0 Hz to 100.3 VAC, 60.0 Hz. |
| | | 6 November 2013 | 16°C to 16°C, 45% to 45%RH. Water temperature: 13°C | 100.3 VAC, 60.0 Hz to 100.1 VAC, 60.0 Hz. |
| | | 8 November 2013 | 17°C to 17°C, 56% to 51%RH. Water temperature: 13°C | 100.5 VAC, 60.0 Hz to 100.2 VAC, 60.0 Hz. |
| 8.12 | Corrosion: | Not performed. | ---- | ---- |
| 11 | Special purpose tests | | | |
| 11.1 | Acoustic noise and signals: | 6 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): | 1 September 2013 | 26°C to 26°C, 69% to 69%RH. | 230.0 VAC, 50.0 Hz to 230.0 VAC, 50.0 Hz. |
| 12 | Safety precautions | | | |
| 12.1 | Protection against accidental access to dangerous voltages: | 23 August 2013 | 27°C to 27°C, 63% to 63%RH. | --- |
| 12.2 | Electromagnetic radiofrequency radiation: | 29 October 2013 | 23°C to 23°C, 55% to 55%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 performed. | ---- | ---- |

| IEC 62388 | Item | Date of test | Temperature, humidity (Before-test to After-test) | Power supply voltage (Before-test to After-test) |
|--------------|---------------|---------------------|--|---|
| 17.3.2 | Antenna shock | 8 September 2013 | 26°C to 26°C, 62% to 69%RH. | 100.0 VAC, 60.0 Hz to 100.2 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 DAQSTATION 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 |
| -- | HT414 | Climatic chamber (Hama-S) | PL-4KP | 14004203 | Tabai Espec |
| -- | 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 |
| -- | HT461 | Digital Multimeter | 111 | 78410077 | Fluke |
| X | HT462 | Digital Multimeter | 111 | 78120001 | Fluke |
| X | HT434 | AC/DC 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 |
|-----|-------|--------------------------------------|------------|----------|--------------|------------------|
| 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 | |
| X | HT439 | Pickup sensor (Response) | VP-15 | 2325T | IMV | Used for RSB-130 |
| X | HT577 | Pickup sensor (Reference) | V11-101S | 0522 | Shinken | Used for RTR-108 |
| X | HT578 | Pickup sensor (Reference) | V11-101S | 0521 | SHINKEN | |
| -- | HT661 | Pickup sensor | V11-101S | 1112 | Shinken | Used for RSB-130 |
| X | HT662 | Pickup sensor (Response) | VP-15 | 0025U | IMV | Used for RTR-108 |
| -- | 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 |
|-----|-------|--------------------------------------|------------|----------|--------------|
| 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 |
| X | HT439 | Pickup sensor (Response) | VP-15 | 2325T | IMV |
| -- | HT577 | Pickup sensor | V11-101S | 0522 | Shinken |
| X | HT578 | Pickup sensor (Reference) | 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 |
| -- | HT388 | Rain test chamber | QBY-1002 | D-006 | Furuno |

(*): 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 |

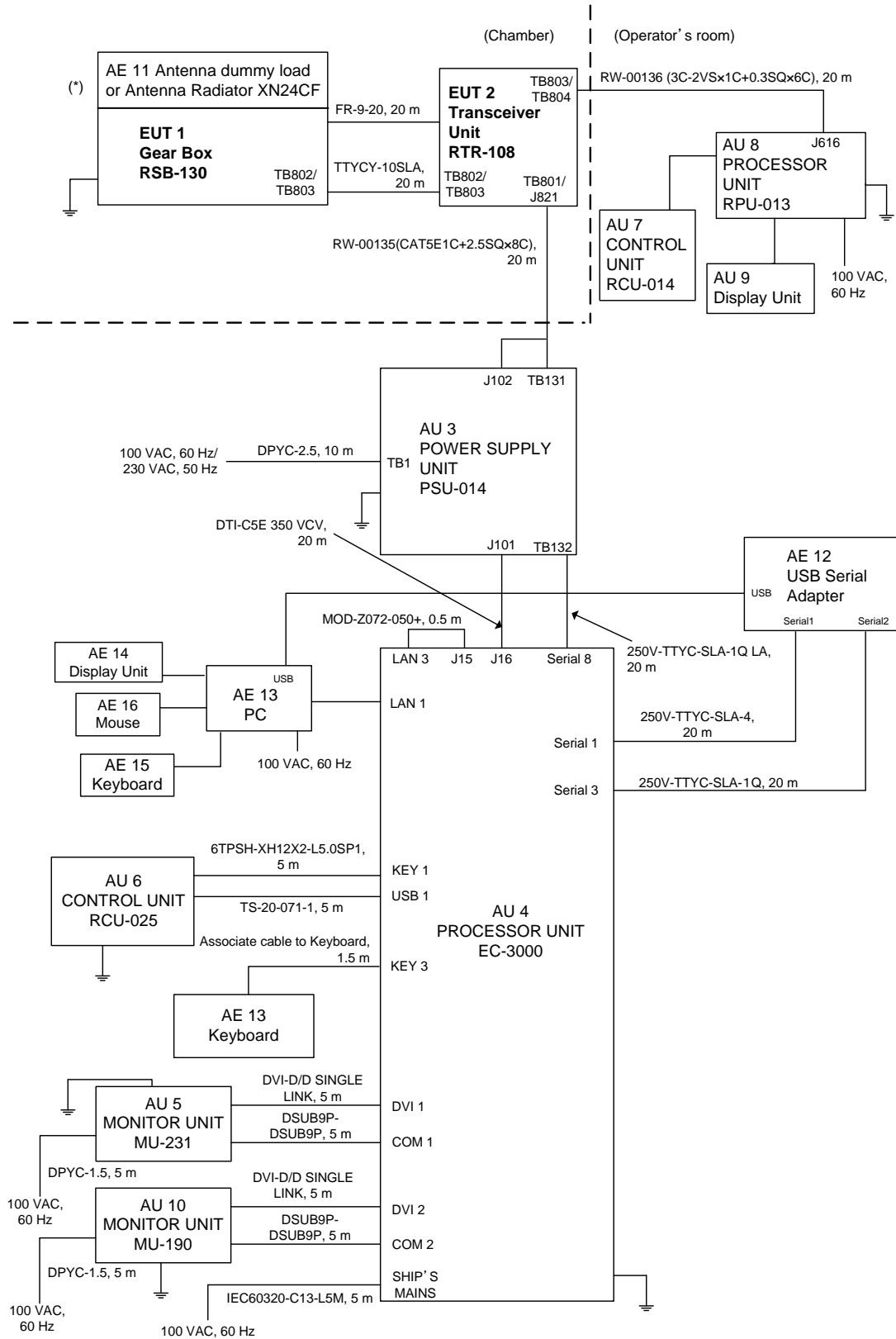
(*): X – indicates instruments used for the tests, -- – not used.

4.6.2 Electromagnetic radio frequency radiation

| (*) | C/N | Instrument | Type | S/N | Manufacturer |
|-----|-------|--------------------|-------------|--------|--------------|
| X | HT590 | RF Radiation meter | EMR-300/33C | 211171 | Narda |

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

5 EUT Setup/Test Arrangement

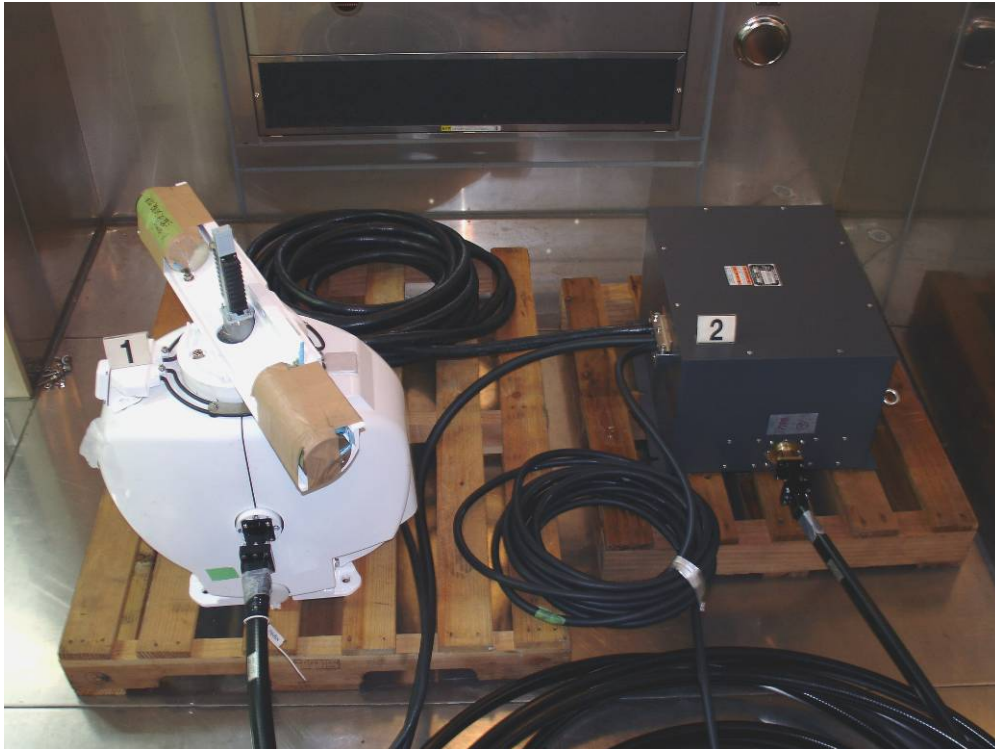


Note: AU - Auxiliary Unit, AE - Associated Equipment.

(*) - Antenna radiator was used 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

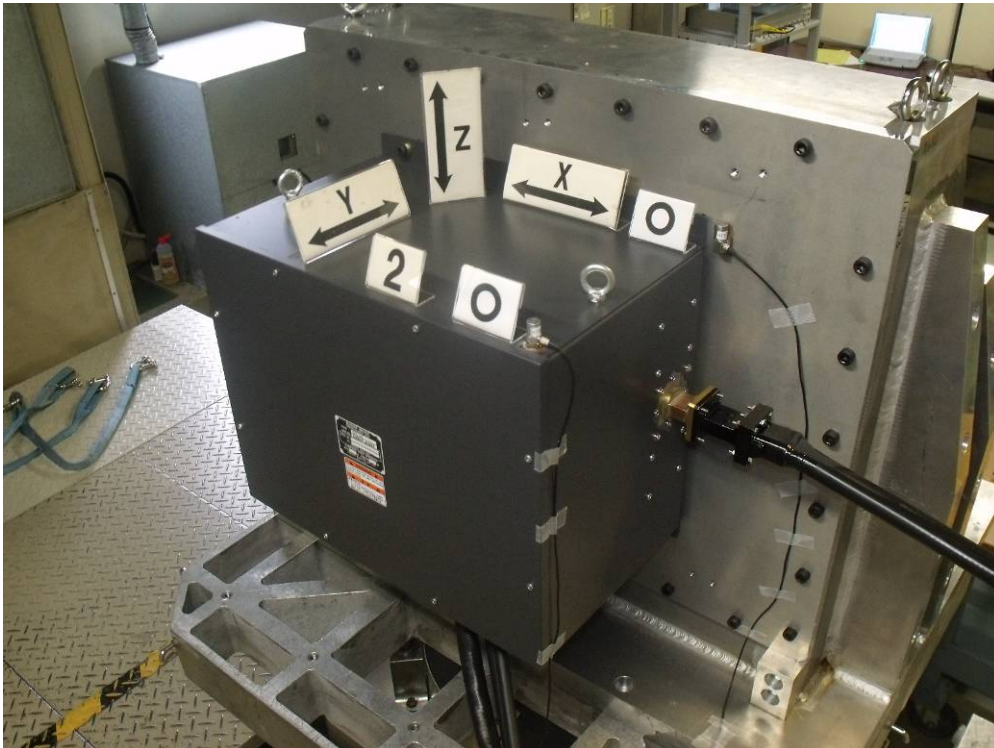


6.2 Vibration

RSB-130+XN24CF,



RTR-108,



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

6.3 Antenna shock

RSB-130+XN24CF,



6.4 Rain and spray

For Antenna Unit (RSB-130 + RTR-106 +XN12CF),
Test Setup,

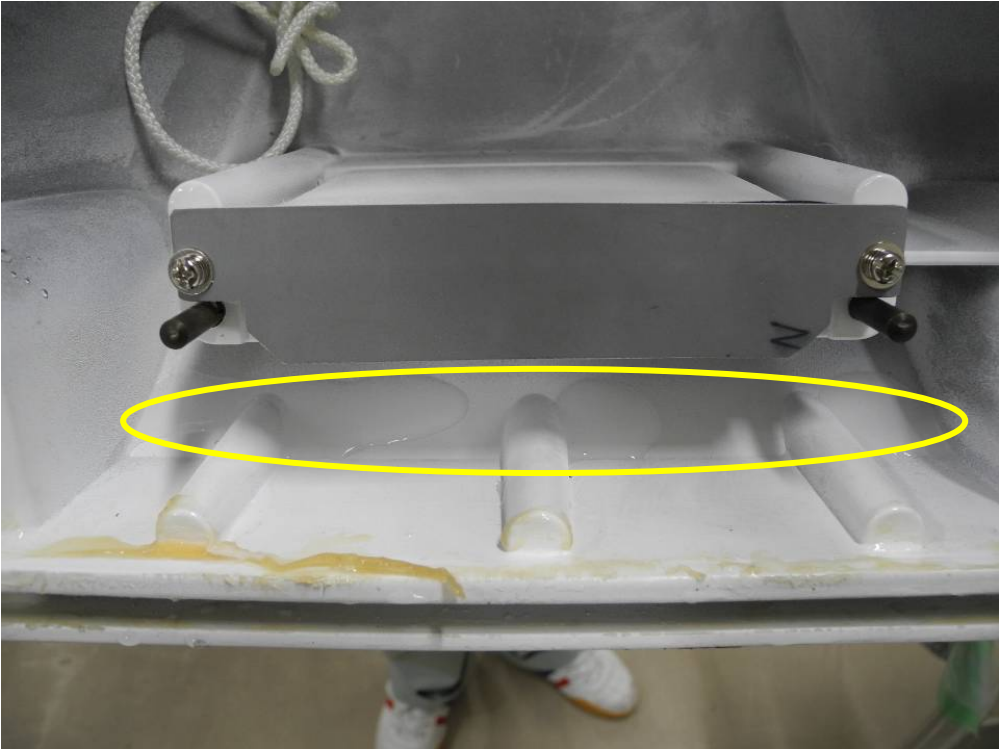


Spraying

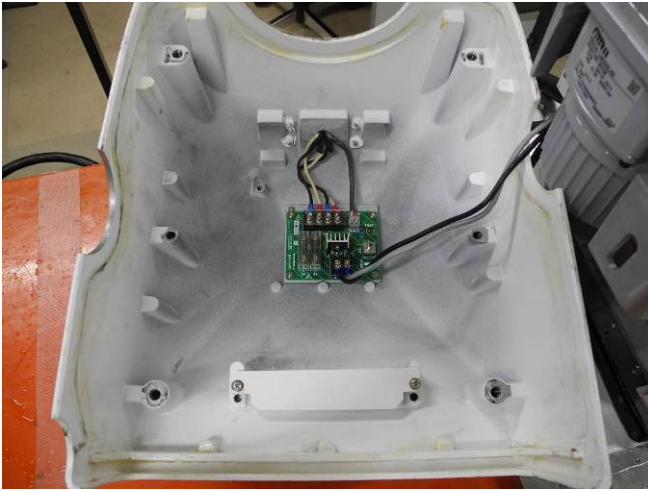


Photographs of the internal examinations done after the test,

With the rear cover opened, ingress of water found at a part of the bottom (indicated with yellow circle).



Front cover,



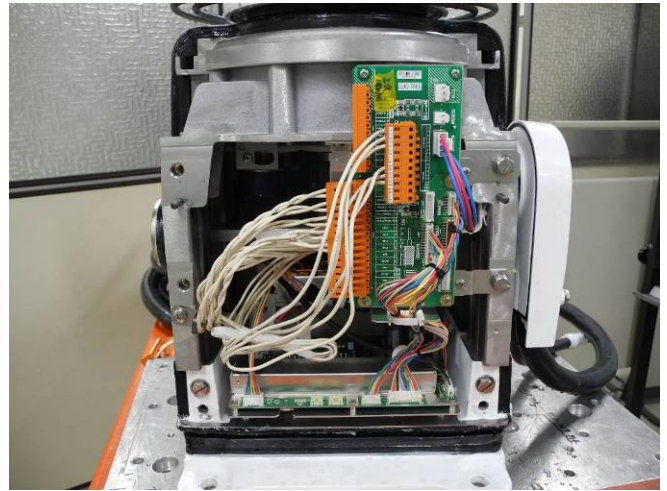
Upper side of Chassis (1),



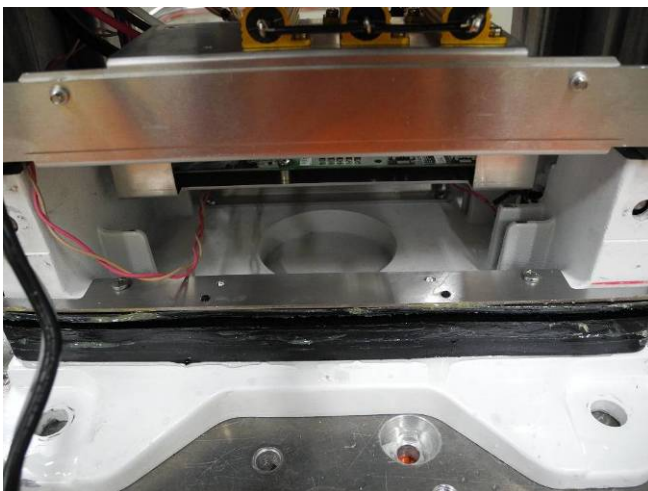
Upper side of Chassis (2),



Internal side of Chassis,



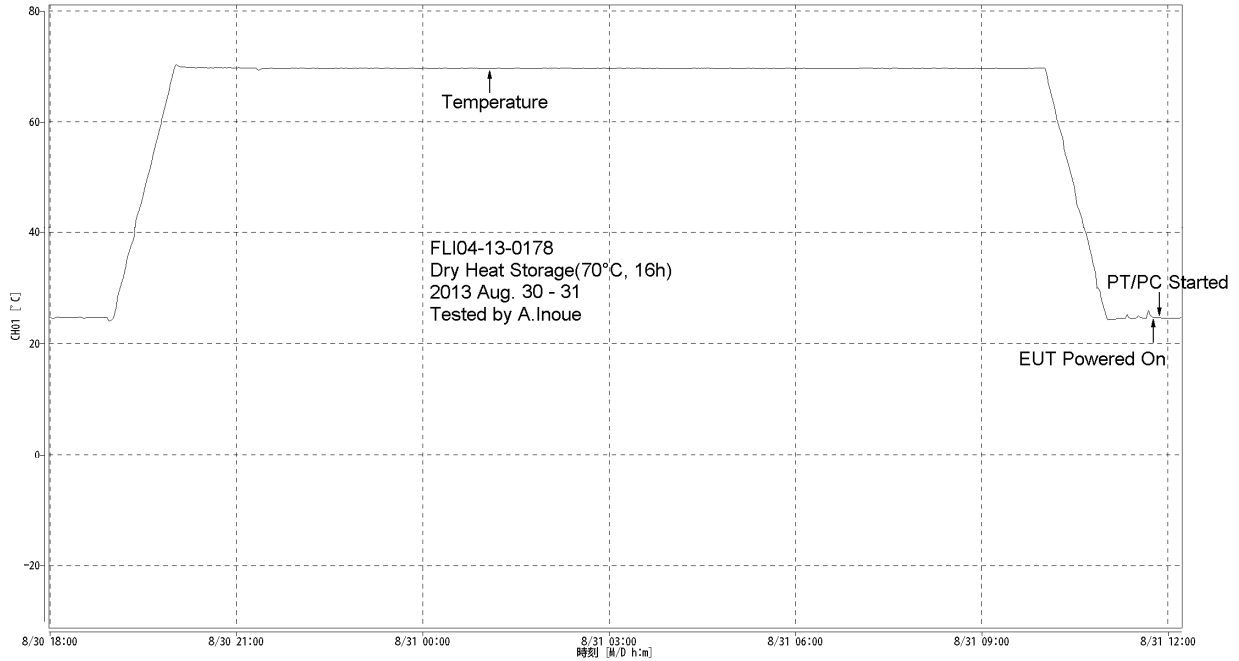
Bottom of Chassis,



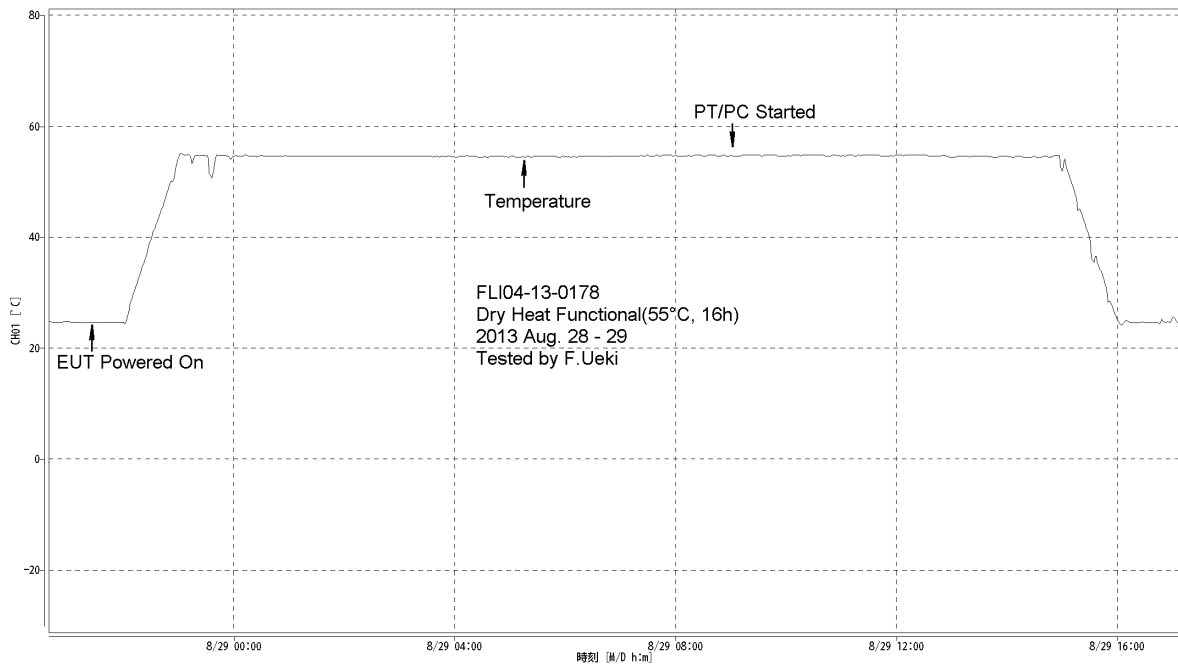
No ingress of water found in the above areas.

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

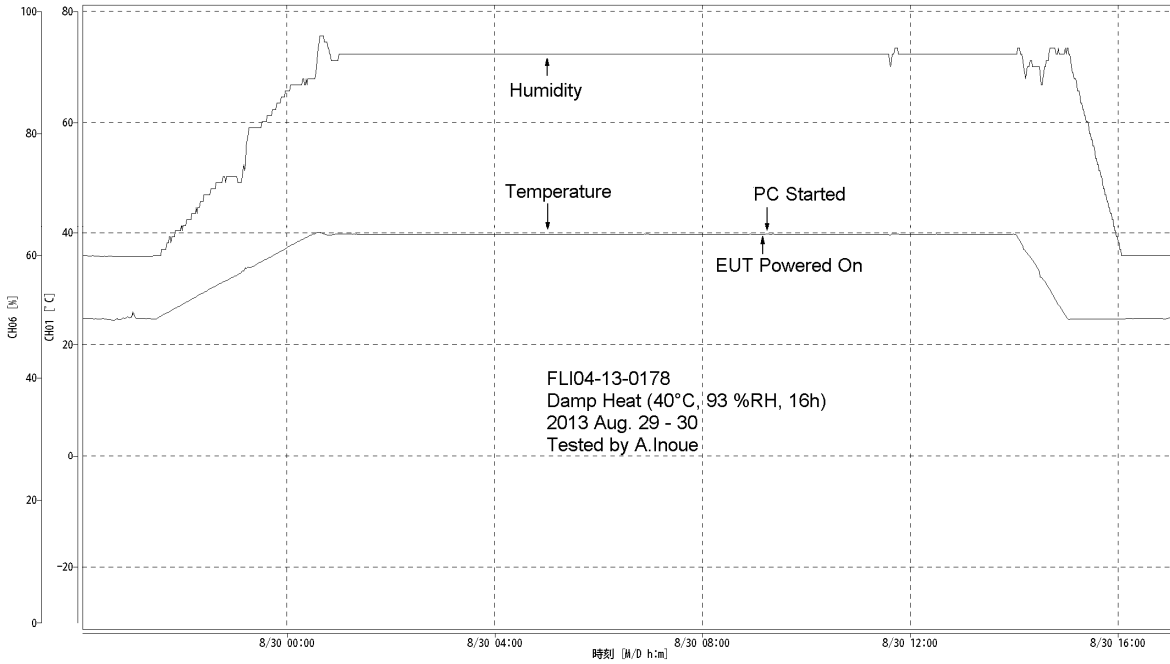
7.1 Dry heat - Storage,



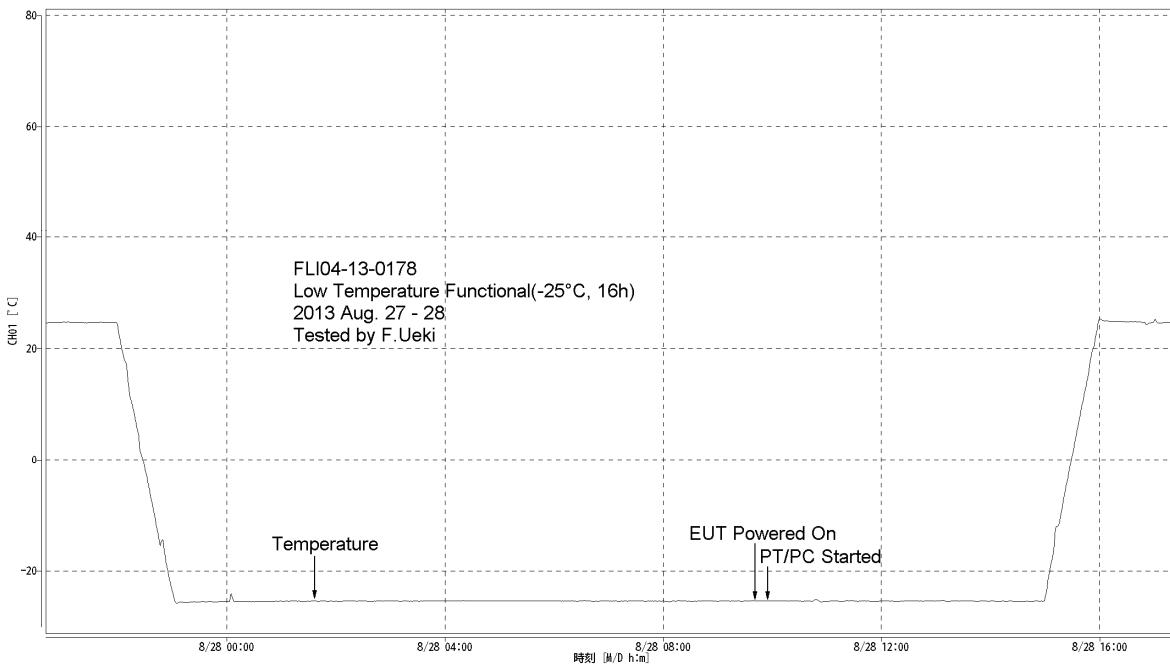
7.2 Dry heat - Functional,



7.3 Damp heat,

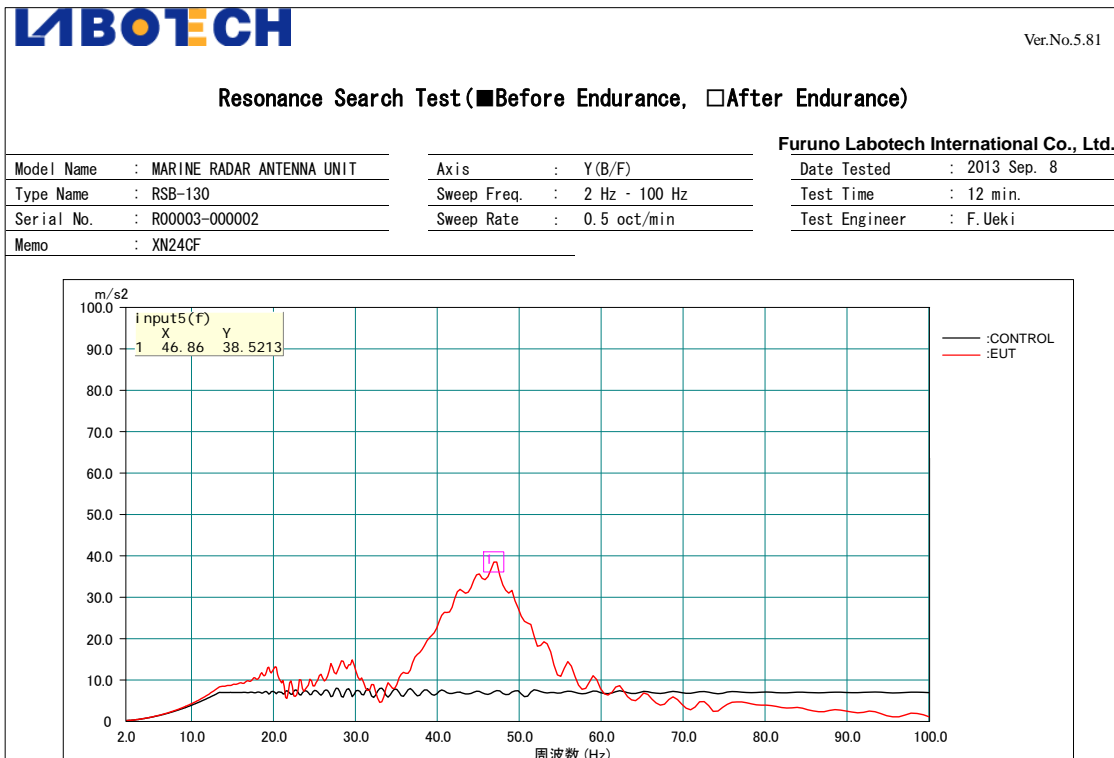
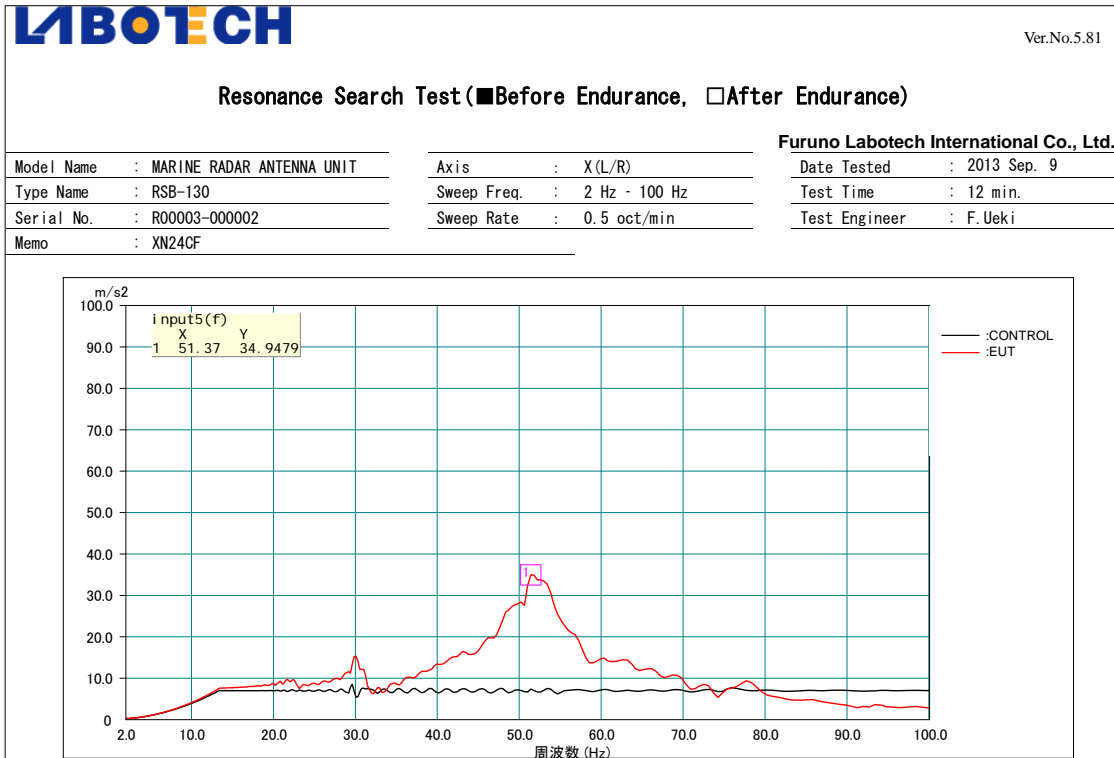


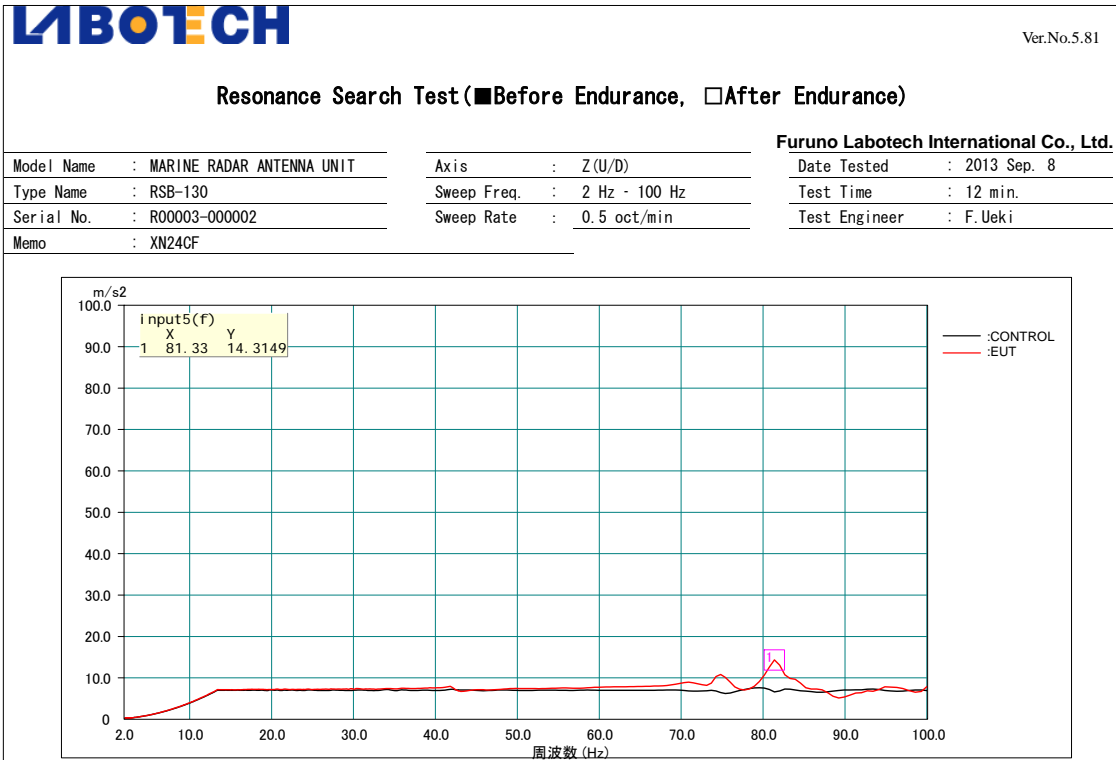
7.4 Low temperature - Functional,



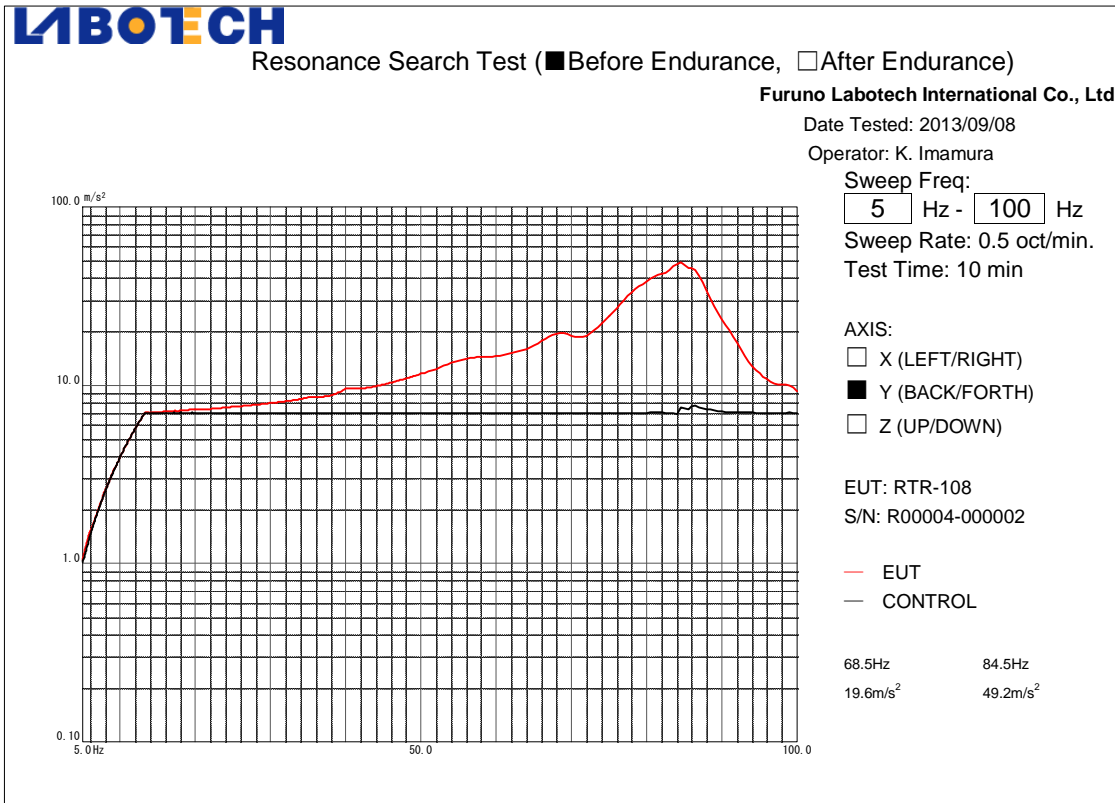
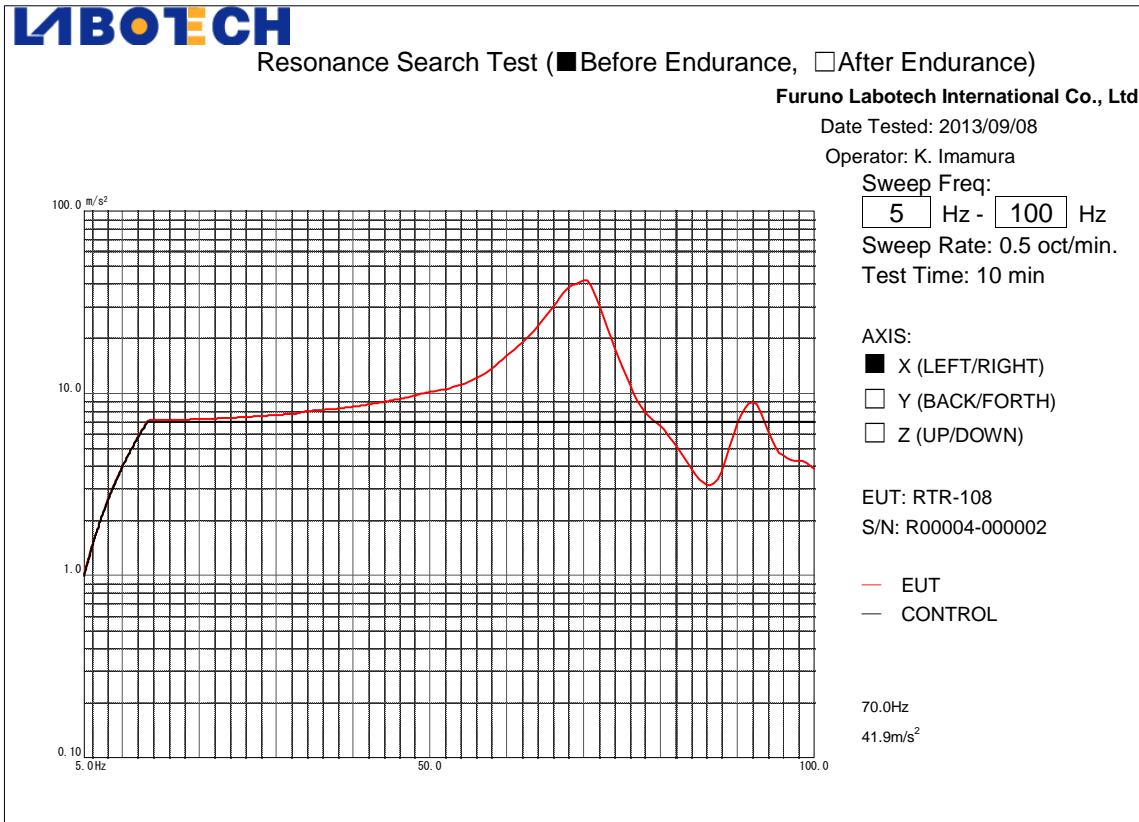
8 Vibration response plots taken during tests

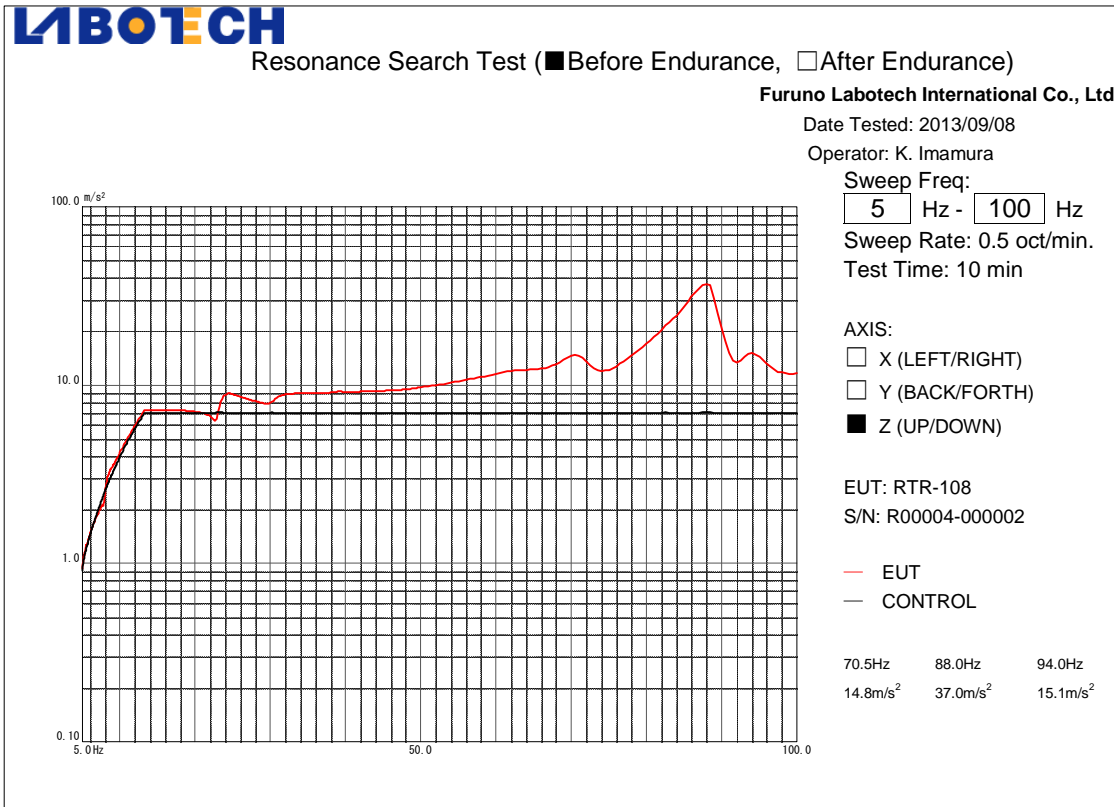
8.1 for RSB-130+XN24CF,



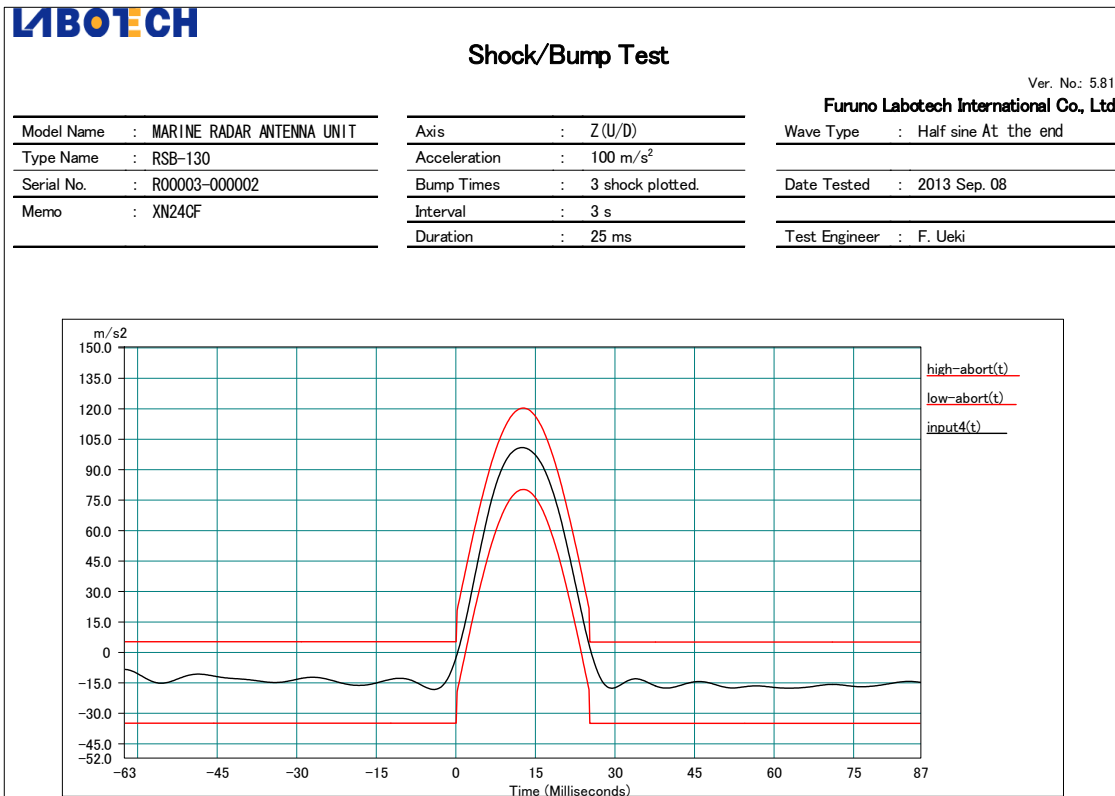


8.2 for RTR-108,





8.3 IE 62388 Shock test to RSB-130+XN24CF,



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 | | |
| | 100 VAC / 60.0 Hz | 90 VAC / 47.5 Hz | |
| 1 | Passed. | Passed. | --- |
| 2 (rpm) | 42.1 | 42.1 | ≥ 40 |
| 3 | Passed. | Passed. | -- |
| 4 | Passed. | Passed. | --- |
| 5 | Passed. | Passed. | --- |
| 6 | Passed. | Passed. | --- |
| 7 | Passed. | Passed. | --- |
| 8 (m:s) | 2:01 | 2:00 | < 4:00 |
| 9 (A) | 8.06 | 8.06 | --- |

| Item no. | Results | | Limit |
|----------|------------------------------------|-------------------|--------|
| | Power supply voltage and frequency | | |
| | 230 VAC / 50 Hz | 253 VAC / 63.0 Hz | |
| 1 | Passed. | Passed. | --- |
| 2 (rpm) | 42.1 | 42.1 | ≥ 40 |
| 3 | Passed. | Passed. | -- |
| 4 | Passed. | Passed. | --- |
| 5 | Passed. | Passed. | --- |
| 6 | Passed. | Passed. | --- |
| 7 | Passed. | Passed. | --- |
| 8 (m:s) | 2:01 | 2:01 | ≤ 4:00 |
| 9 (A) | 8.06 | 8.06 | --- |

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 | | |
| | 100 VAC / 60.0 Hz | 90 VAC / 47.5 Hz | |
| 1 | Passed. | Passed. | --- |
| 2 (rpm) | 42.1 | 42.1 | ≥ 40 |
| 3 | Passed. | Passed. | -- |
| 4 | Passed. | Passed. | --- |
| 5 | Passed. | Passed. | --- |
| 6 | Passed. | Passed. | --- |
| 7 | Passed. | Passed. | --- |
| 8 (m:s) | 2:01 | 2:00 | < 4:00 |
| 9 (A) | 8.02 | 8.01 | --- |

| Item no. | Results | | Limit |
|----------|------------------------------------|------------------|--------|
| | Power supply voltage and frequency | | |
| | 230 VAC / 50 Hz | 253 VAC / 63.0Hz | |
| 1 | Passed. | Passed. | --- |
| 2 (rpm) | 42.1 | 42.1 | ≥ 40 |
| 3 | Passed. | Passed. | -- |
| 4 | Passed. | Passed. | --- |
| 5 | Passed. | Passed. | --- |
| 6 | Passed. | Passed. | --- |
| 7 | Passed. | Passed. | --- |
| 8 (m:s) | 1:55 | 1:30 | < 4:00 |
| 9 (A) | 8.04 | 8.01 | --- |

9.3 Damp heat – Functional test

| Item no. | Results | | Limit |
|----------|------------------------------------|-----------------|--------|
| | Power supply voltage and frequency | | |
| | 100 VAC / 60.0 Hz | 90 VAC/ 47.5 Hz | |
| 1 | Passed. | NA | --- |
| 2 (rpm) | 42.0 | | ≥ 40 |
| 3 | Passed. | | -- |
| 4 | Passed. | | --- |
| 5 | Passed. | | --- |
| 6 | Passed. | | --- |
| 7 | Passed. | | --- |
| 8 (m:s) | 2:01 | | < 4:00 |
| 9 (A) | 8.01 | | --- |

Note: NA - Not applicable.

| Item no. | Results | | Limit |
|----------|------------------------------------|-------------------|--------|
| | Power supply voltage and frequency | | |
| | 230 VAC / 50 Hz | 253 VAC / 63.0 Hz | |
| 1 | Passed. | NA | --- |
| 2 (rpm) | 42.1 | | ≥ 40 |
| 3 | Passed. | | -- |
| 4 | Passed. | | --- |
| 5 | Passed. | | --- |
| 6 | Passed. | | --- |
| 7 | Passed. | | --- |
| 8 (m:s) | 2:01 | | ≤ 4:00 |
| 9 (A) | 8.20 | | --- |

Note: NA - Not applicable.

9.4 Low temperature – Functional test

| Item no. | Results | | Limit |
|----------|------------------------------------|-----------------|--------|
| | Power supply voltage and frequency | | |
| | 100 VAC / 60.0 Hz | 90 VAC/ 47.5 Hz | |
| 1 | Passed. | Passed. | --- |
| 2 (rpm) | 41.8 | 41.9 | ≥ 40 |
| 3 | Passed. | Passed. | -- |
| 4 | Passed. | Passed. | --- |
| 5 | Passed. | Passed. | --- |
| 6 | Passed. | Passed. | --- |
| 7 | Passed. | Passed. | --- |
| 8 (m:s) | 2:01 | 2:01 | < 4:00 |
| 9 (A) | 7.94 | 7.91 | --- |

| Item no. | Results | | Limit |
|----------|------------------------------------|-------------------|--------|
| | Power supply voltage and frequency | | |
| | 230 VAC / 50 Hz | 253 VAC / 63.0 Hz | |
| 1 | Passed. | Passed. | --- |
| 2 (rpm) | 41.9 | 41.9 | ≥ 40 |
| 3 | Passed. | Passed. | -- |
| 4 | Passed. | Passed. | --- |
| 5 | Passed. | Passed. | --- |
| 6 | Passed. | Passed. | --- |
| 7 | Passed. | Passed. | < 4:00 |
| 8 (m:s) | 2:01 | 2:01 | --- |
| 9 (A) | 7.94 | 7.94 | --- |

9.5 Vibration

| Item no. | Results | | Limit |
|----------|------------------------------------|-----------------|--------|
| | Power supply voltage and frequency | | |
| | 100 VAC / 60.0 Hz | 90 VAC/ 47.5 Hz | |
| 1 | Passed. | --- | --- |
| 2 (rpm) | 42.1 | --- | > 40 |
| 3 | Not performed. | | |
| 4 | Passed. | --- | -- |
| 5 | Passed. | --- | --- |
| 6 | Passed. | --- | --- |
| 7 | Passed. | --- | --- |
| 8 (m:s) | 2:01 | --- | < 4:00 |
| 9 | Not performed. | | |