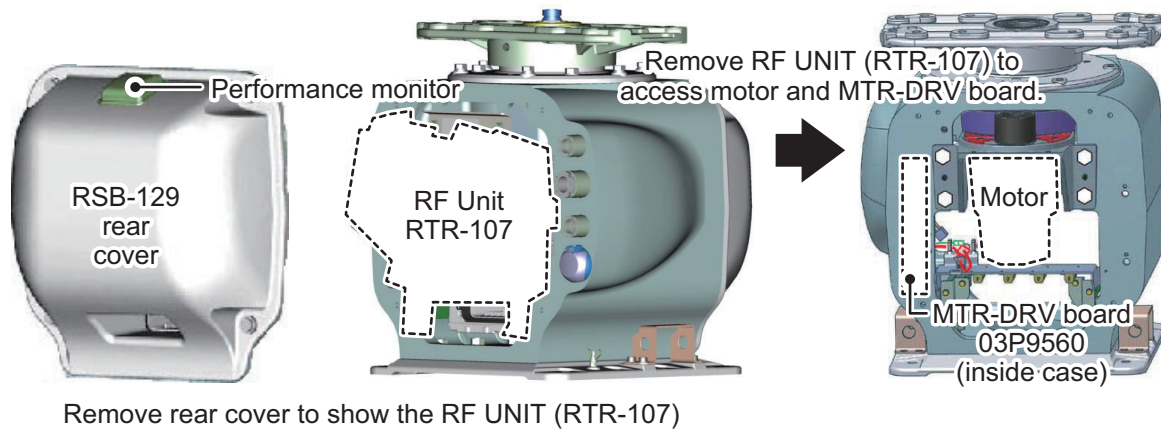
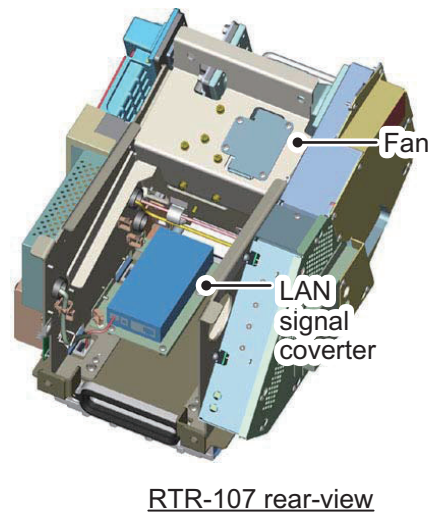
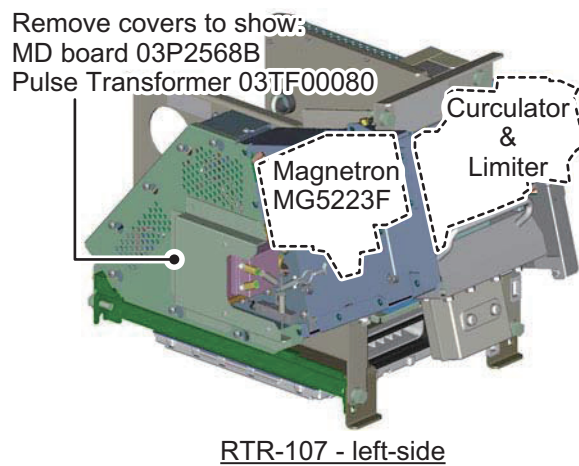
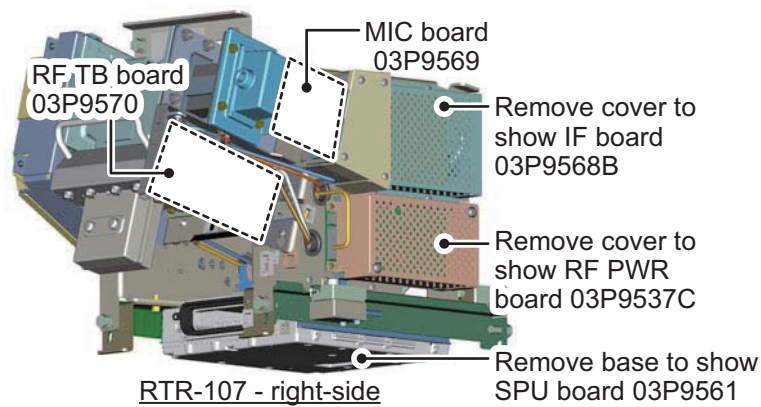
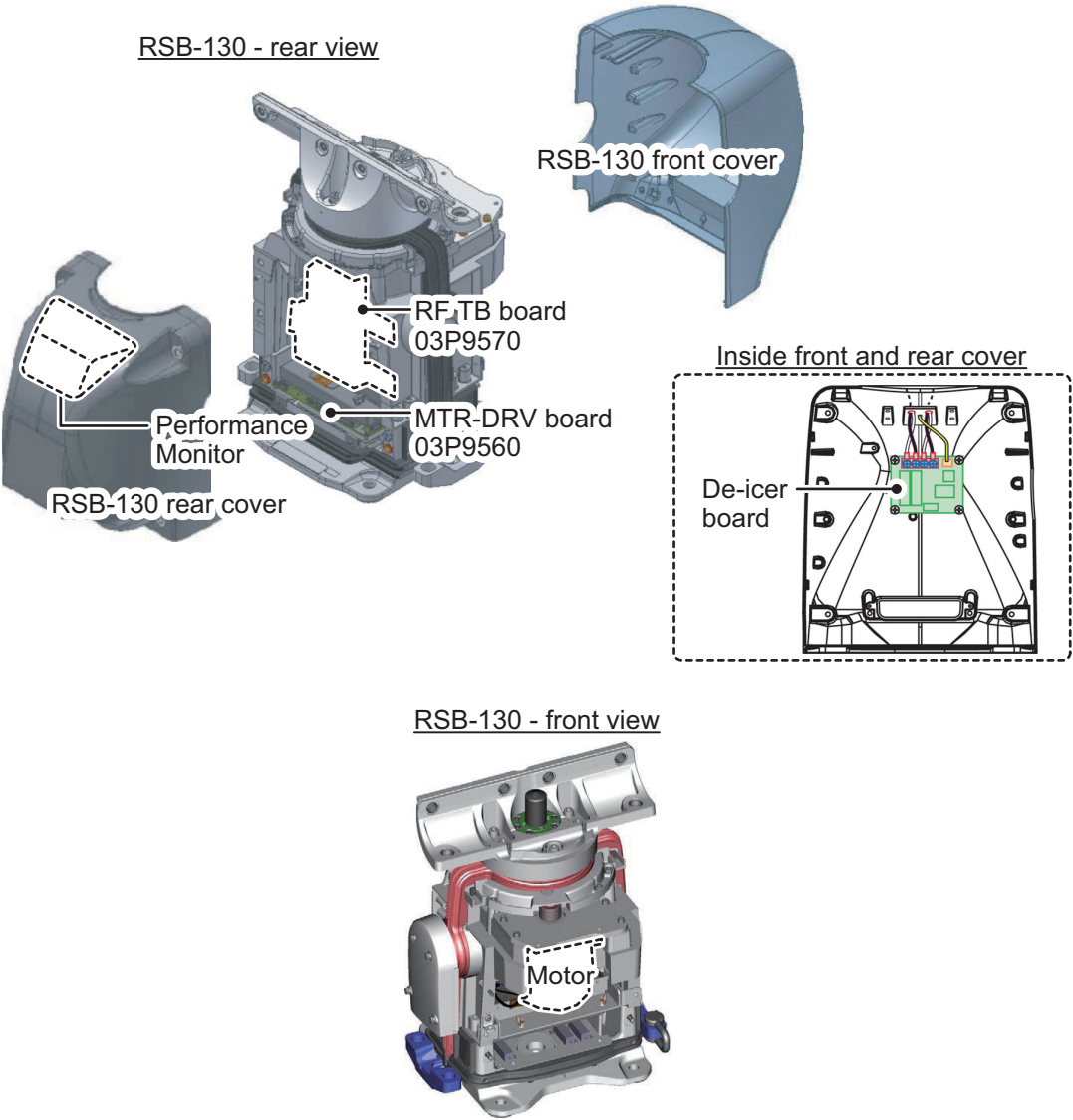
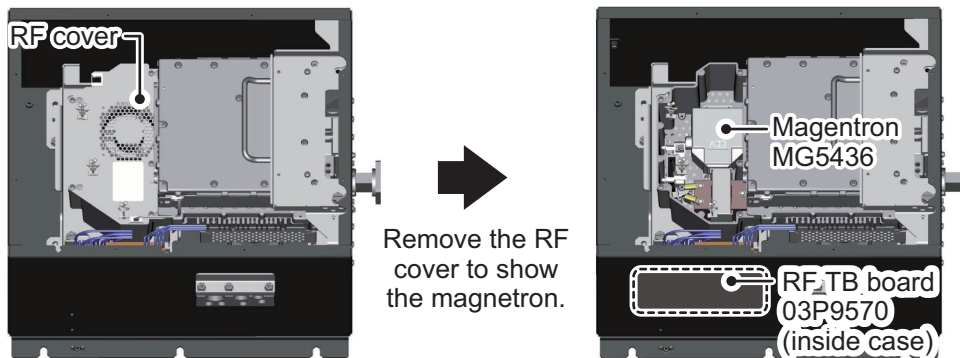
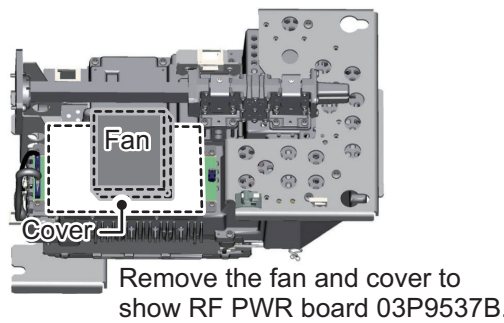
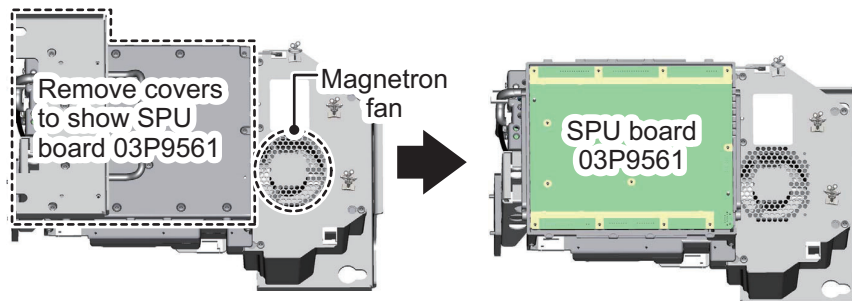


Scanner Unit RSB-129 (FAR-2238S(-BB), FAR-2338S)RF Unit RTR-107 (FAR-2238S(-BB), FAR-2338S)

Scanner Unit RSB-130 (FAR-2328W)

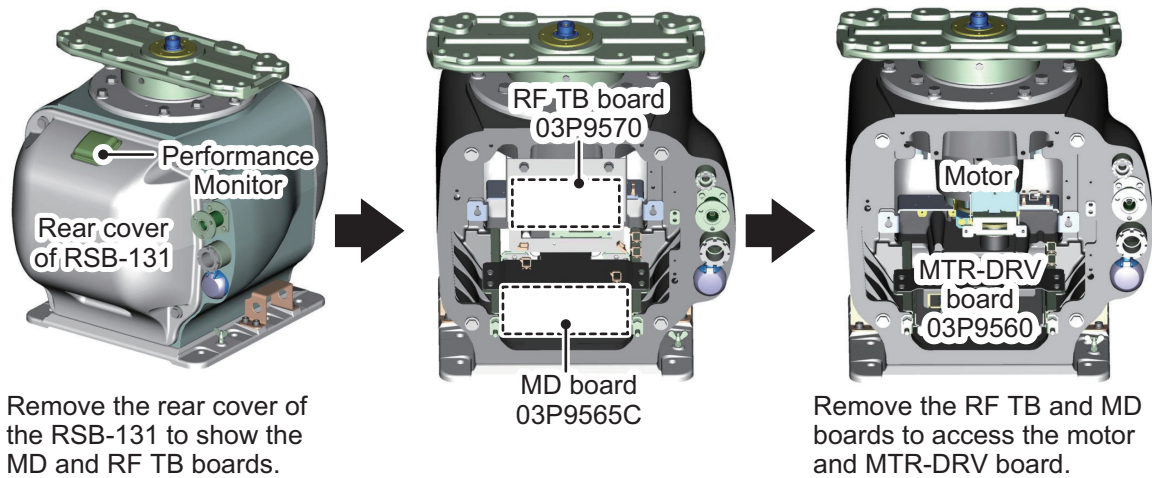


RF Unit RTR-108 (FAR-2328W)RTR-108 - Case cover removedRTR-108 - RF Unit removed from case (top view)RTR-108 - RF Unit removed from case (bottom view)

Remove the SPU board to show:  
 MD board 03P9565B  
 IF board 03P9568A  
 MMIC board 03P9567  
 Pulse Transformer 03TF00073

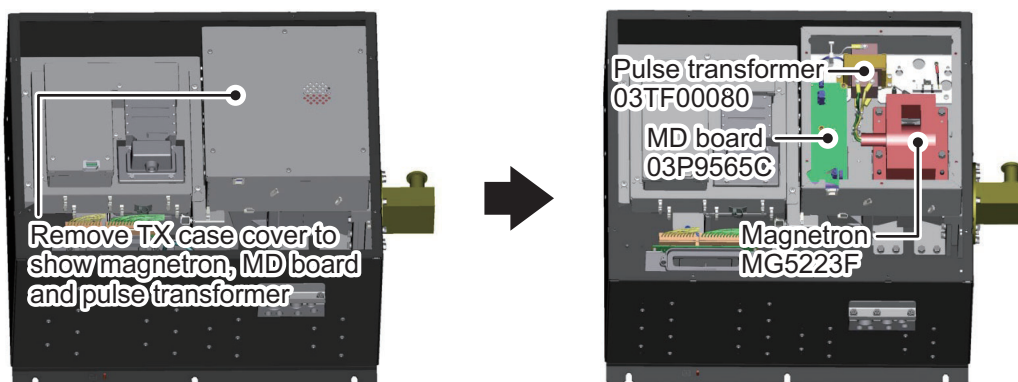
## Scanner Unit RSB-131 (FAR-2338SW)

RSB-131 - rear view

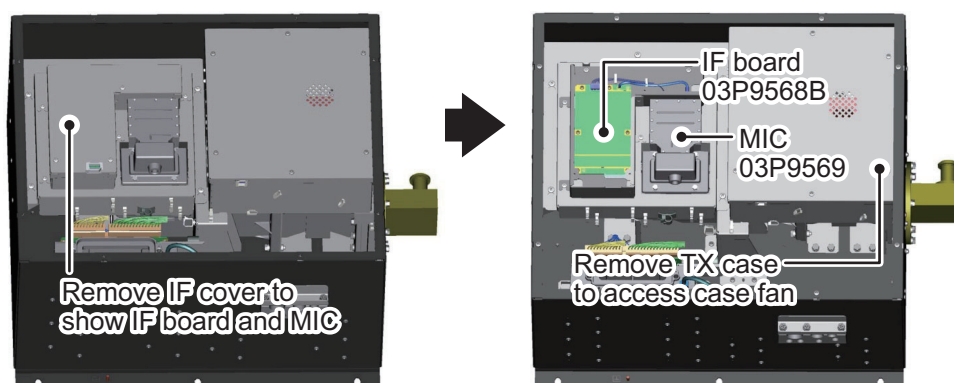


## RF Unit RTR-109 (FAR-2338SW)

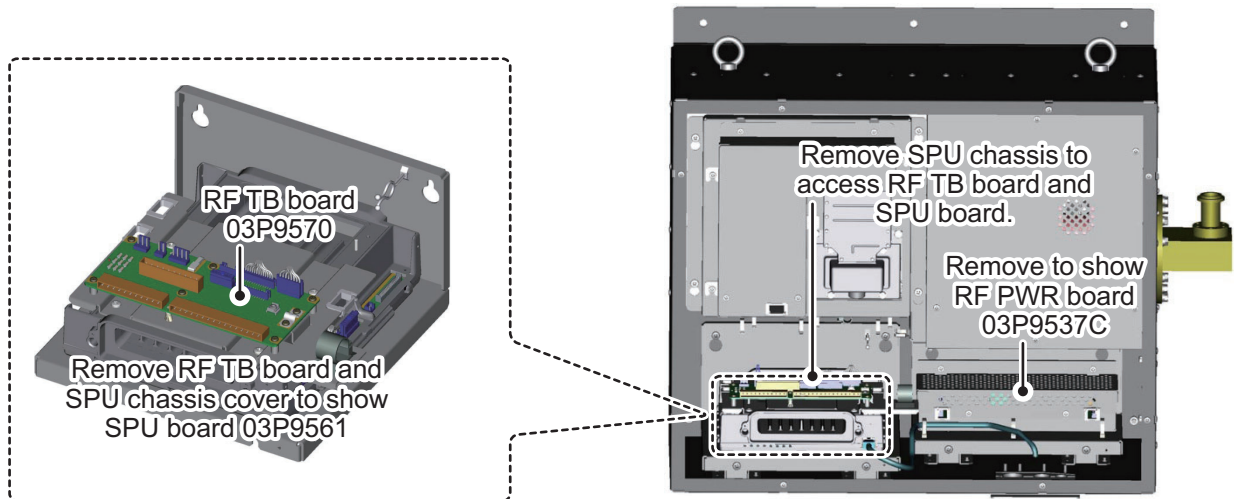
RTR-109 - case cover removed



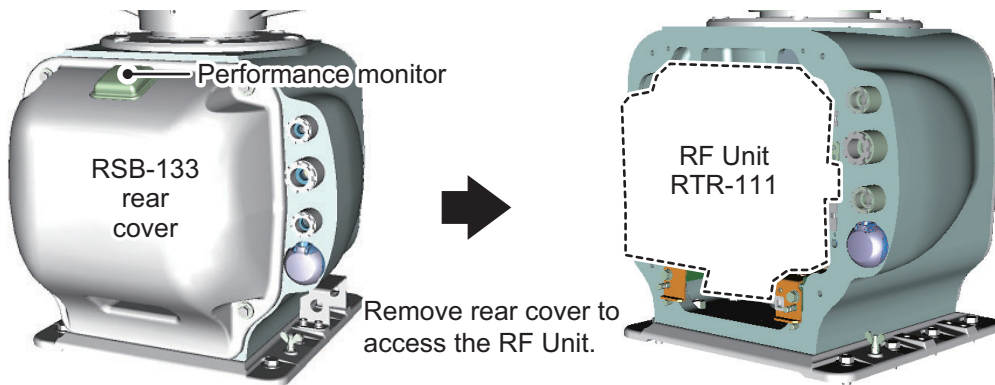
RTR-109 - case cover removed



RTR-109 - Top view, case cover removed

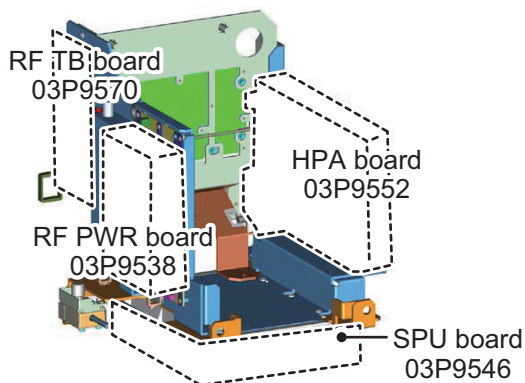


Scanner Unit RSB-133 (FAR-2238S-NXT(-BB)/2338S-NXT)

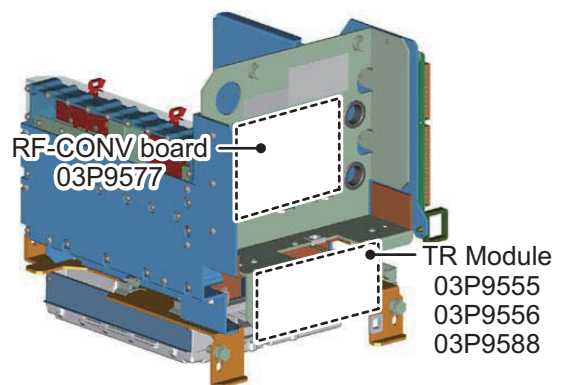


RF Unit RTR-111 (FAR-2238S-NXT(-BB)/2338S-NXT)

RTR-111 - rear view



RTR-111 - front view



# APPX. 8 RADIO REGULATORY INFORMATION

## USA-Federal Communications Commission (FCC)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **Caution: Exposure to Radio Frequency Radiation**

- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65.
- This equipment should be installed and operated keeping the radiator at least XX cm or more away from person's body.
- This device must not be co-located or operating in conjunction with any other antenna or transmitter.

## Innovation, Science and Economic Development Canada (ISED)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient un ou plusieurs émetteurs / récepteurs exempts de licence qui sont conformes à la norme « exempts de licence RSS (s) » Canadienne d'Innovation, Sciences et Développement économique. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage.
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### **Caution: Exposure to Radio Frequency Radiation**

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least XX cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'ISED. Cet équipement doit être installé et utilisé en gardant une distance de XX cm ou plus entre le dispositif rayonnant et le corps.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

XX cm

|                             |         |        |                                     |         |        |
|-----------------------------|---------|--------|-------------------------------------|---------|--------|
| FAR-2218(-BB)<br>FAR-2318   | RTR-105 | 440 cm | FAR-2338SW                          | RTR-109 | 230 cm |
| FAR-2228(-BB)<br>FAR-2328   | RTR-106 | 950 cm | FAR-2228-NXT(-BB)<br>FAR-2328-NXT   | RTR-123 | 330 cm |
| FAR-2328W                   | RTR-108 | 550 cm | FAR-2238S-NXT(-BB)<br>FAR-2338S-NXT | RTR-111 | 100 cm |
| FAR-2238S(-BB)<br>FAR-2338S | RTR-107 | 460 cm | FAR-2018-MARK-2                     | RTR-131 | 420 cm |
|                             |         |        | FAR-2028-MARK-2                     | RTR-132 | 884 cm |

## 1 ANTENNA RADIATOR

- | Radiator type                   | X-band |        |          | S-band  |         |        |
|---------------------------------|--------|--------|----------|---------|---------|--------|
|                                 | XN12CF | XN20CF | XN24CF** | SN24CF* | SN30CF* | SN36CF |
| Length                          | 4 ft   | 6.5 ft | 8 ft     | 8 ft    | 10 ft   | 12 ft  |
| Horizontal beam width           | 1.9°   | 1.23°  | 0.95°    | 2.6°    | 2.3°    | 1.8°   |
| Vertical beam width             | 20°    |        |          | 25°     |         |        |
| Sideline within $\pm 10^\circ$  | -24 dB | -28 dB | -28 dB   | —       |         | -24 dB |
| Sideline outside $\pm 10^\circ$ | -30 dB | -32 dB | -32 dB   |         |         | -30 dB |
| Sideline within $\pm 20^\circ$  | —      |        |          | -23 dB  | -24 dB  | —      |
| Sideline outside $\pm 20^\circ$ |        |        |          | -27 dB  | -30 dB  |        |

|     |                  |                                                                                |
|-----|------------------|--------------------------------------------------------------------------------|
| 1.3 | Polarization     | Horizontal                                                                     |
| 1.4 | Rotation         | 24 rpm or 42 rpm (for high speed craft)                                        |
| 1.5 | Wind load        | 100 kn relative                                                                |
| 1.6 | De-icer (option) | On: when temperature goes down to 0°C<br>Off: when temperature goes up to +5°C |

|                      |                                                                                                             |
|----------------------|-------------------------------------------------------------------------------------------------------------|
| X-band (Magnetron)   | 9410 MHz $\pm$ 30 MHz, P0N                                                                                  |
| X-band (Solid state) | CH1 P0N: 9403.75 MHz/ Q0N: 9423.75 MHz $\pm$ 5 MHz or<br>CH2 P0N: 9413.75 MHz/ Q0N: 9433.75 MHz $\pm$ 5 MHz |
| S-band (Magnetron)   | 3050 MHz $\pm$ 30 MHz, P0N                                                                                  |
| S-band (Solid state) | CH1 P0N: 3043.75 MHz/ Q0N: 3063.75 MHz $\pm$ 5 MHz or<br>CH2 P0N: 3053.75 MHz/ Q0N: 3073.75 MHz $\pm$ 5 MHz |

- FAR-2238S-NXT(BB)/2338S-NXT 250 W

- | PRR<br>(Hz approx.) | Range scale (NM) |      |     |      |    |     |    |   |   |   |   |    |    |    |    |    |    |  |  |
|---------------------|------------------|------|-----|------|----|-----|----|---|---|---|---|----|----|----|----|----|----|--|--|
|                     | 0.125            | 0.25 | 0.5 | 0.75 | 1  | 1.5 | 2  | 3 | 4 | 6 | 8 | 12 | 16 | 24 | 32 | 48 | 96 |  |  |
| 3000*               | S1               |      |     |      |    |     |    |   |   |   |   |    |    |    |    |    |    |  |  |
| 3000*               |                  |      | S2  |      |    |     |    |   |   |   |   |    |    |    |    |    |    |  |  |
| 1500                |                  |      | M1  |      |    |     |    |   |   |   |   |    |    |    |    |    |    |  |  |
| 1200                |                  |      |     |      | M2 |     |    |   |   |   |   |    |    |    |    |    |    |  |  |
| 1000                |                  |      |     |      |    |     | M3 |   |   |   |   |    |    |    |    |    |    |  |  |
| 600**               |                  |      |     |      |    |     |    | L |   |   |   |    |    |    |    |    |    |  |  |

\*: 2200 Hz with TT range on 32 NM. \*\*: 500 Hz on 96 NM range.

**X-band Solid state radar**

| PRR<br>(Hz approx.) | Range scale (NM) |      |     |      |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
|---------------------|------------------|------|-----|------|---|-----|---|----|---|---|---|----|----|----|----|----|----|--|--|
|                     | 0.125            | 0.25 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3  | 4 | 6 | 8 | 12 | 16 | 24 | 32 | 48 | 96 |  |  |
| 1500                | S1               |      |     |      |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 1500                |                  |      | S2  |      |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 1200                |                  |      |     | M1   |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 1000                |                  |      |     |      |   | M2  |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 1000                |                  |      |     |      |   |     |   | M3 |   |   |   |    |    |    |    |    |    |  |  |
| 600                 |                  |      |     |      |   |     |   |    |   | L |   |    |    |    |    |    |    |  |  |

1/2/4/8/16/32 NM ranges: B/W-type radar only

**S-band Solid state radar**

| PRR<br>(Hz approx.) | Range scale (NM) |      |     |      |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
|---------------------|------------------|------|-----|------|---|-----|---|----|---|---|---|----|----|----|----|----|----|--|--|
|                     | 0.125            | 0.25 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3  | 4 | 6 | 8 | 12 | 16 | 24 | 32 | 48 | 96 |  |  |
| 2400*               | S1               |      |     |      |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 2000*               |                  |      | S2  |      |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 1500                |                  |      | M1  |      |   |     |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 1060                |                  |      |     |      |   | M2  |   |    |   |   |   |    |    |    |    |    |    |  |  |
| 1000                |                  |      |     |      |   |     |   | M3 |   |   |   |    |    |    |    |    |    |  |  |
| 600                 |                  |      |     |      |   |     |   |    |   | L |   |    |    |    |    |    |    |  |  |

1/2/4/8/16/32 NM ranges: B/W-type radar only

\*: 1800 Hz (S1) and 1500 Hz (S2) with TT range on 32 NM.

**3 PROCESSOR UNIT**

- 3.1 Minimum range 22 m
- 3.2 Range discrimination 26 m
- 3.3 Range accuracy 1% of the maximum range of the scale in use or 10 m, whichever is the greater
- 3.4 Bearing discrimination  
 X-band: 2.1° (XN12CF), 1.5° (XN20CF), 1.2° (XN24CF),  
 S-band: 2.8° (SN24CF), 2.5° (SN30CF), 2.0° (SN36CF)
- 3.5 Bearing accuracy  $\pm 1^\circ$
- 3.6 Range scale and Range ring interval (RI)

| Range (NM)      | 0.125 | 0.25 | 0.5 | 0.75 | 1    | 1.5  | 2   | 3   | 4 | 6 | 8 | 12 | 16 | 24 | 32 | 48 | 96 |
|-----------------|-------|------|-----|------|------|------|-----|-----|---|---|---|----|----|----|----|----|----|
| RI (NM)         | 0.025 | 0.05 | 0.1 | 0.25 | 0.25 | 0.25 | 0.5 | 0.5 | 1 | 1 | 2 | 2  | 4  | 4  | 8  | 8  | 16 |
| Number of rings | 5     | 5    | 5   | 3    | 4    | 6    | 4   | 6   | 4 | 6 | 4 | 6  | 4  | 6  | 4  | 6  | 6  |

- 3.7 Warm-up time  
 Magnetron radar 3 min. approx.  
 Solid state radar Nil
- 3.8 Presentation mode Head-up, STAB head-up, Course-up, North-up (RM/TM), Stern-up
- 3.9 Marks Cursor, Range ring, Heading mark, North mark, Bearing mark, VRM, EBL, Acquisition zone
- 3.10 Target tracking (TT) Auto or manual acquisition: 100 targets in 24/32 NM (range selected from menu for maintenance)  
 Auto tracking on all acquired targets,  
 Tracking: 5/10 pts on all activated targets  
 Vector time: Off, 30 s, 1-60 min
- 3.11 AIS Display capacity: 350 targets,  
 Tracking: 5/10 pts on all activated targets

|      |                      |                                                                                                                                |
|------|----------------------|--------------------------------------------------------------------------------------------------------------------------------|
|      |                      | Vector time: Off, 30 s, 1-60 min                                                                                               |
| 3.12 | Echo trail           | True/Relative, Trail length: 0 to 30 minutes (30 s steps) or continue<br>Maximum 48 hours setting available for B/W-type radar |
| 3.13 | Radar map            | 20,000 pts                                                                                                                     |
| 3.14 | Acquisition zone     | 2 zones                                                                                                                        |
| 3.15 | Interswitch function | Selectable from menu                                                                                                           |

## 4 MONITOR UNIT

|     |                          |                                         |
|-----|--------------------------|-----------------------------------------|
| 4.1 | Screen type              |                                         |
|     | MU-190/190HD/192HD       | 19-inch color LCD, 1280 x 1024 (SXGA)   |
|     | MU-231                   | 23.1-inch color LCD, 1600 x 1200 (UXGA) |
|     | MU-270W                  | 27-inch color LCD, 1920 x 1200 (WUXGA)  |
| 4.2 | Brightness               |                                         |
|     | MU-190                   | 450 cd/m <sup>2</sup> typical           |
|     | MU-190HD/192HD           | 1000 cd/m <sup>2</sup> typical          |
|     | MU-231/270W              | 400 cd/m <sup>2</sup> typical           |
| 4.3 | Visible distance         |                                         |
|     | MU-190/190HD/192HD/270W  | 1.02 m nominal                          |
|     | MU-231                   | 1.2 m nominal                           |
| 4.4 | Radar effective diameter |                                         |
|     | MU-190/190HD/192HD       | 282 mm                                  |
|     | MU-231                   | 331 mm                                  |
|     | MU-270W                  | 349 mm                                  |

## 5 INTERFACE

|     |                                     |                                                                                                                                                                                                                                                                                  |
|-----|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.1 | Number of port (processor unit)     |                                                                                                                                                                                                                                                                                  |
|     | Serial                              | 7 ports (IEC61162-1/2: 2 ports, IEC61162-1: 4 ports, AD-10: 1 port)                                                                                                                                                                                                              |
|     | Alarm output                        | 6 ports: contact signal, load current 250mA<br>(Normal close/ open: 4, System fail: 1, Power fail: 1)                                                                                                                                                                            |
|     | DVI output                          | 2 ports: DVI-D, DVI-I or RGB picture data (for VDR)<br>(RGB resolution 1280x1024 (SXGA), 60.0Hz or<br>1440x900 (WXGA+), 59.9Hz)                                                                                                                                                  |
|     | LAN                                 | 2 ports: Ethernet 100Base-TX                                                                                                                                                                                                                                                     |
|     | RS-232C                             | 1 port: brilliance control                                                                                                                                                                                                                                                       |
|     | Sub display (for ECDIS)             | 2 ports: HD, BP, Trigger and Video signal                                                                                                                                                                                                                                        |
| 5.2 | Data sentences (IEC61162-1/2)       |                                                                                                                                                                                                                                                                                  |
|     | Input                               | ABK, ACK, ACN, ALR, BWC, BWR, CUR, DBK* <sup>1</sup> , DBS* <sup>1</sup> , DBT,<br>DDC, DPT, DTM, GGA, GLL, GNS, HBT, HDT* <sup>1</sup> , MTW, MWV,<br>OSD, RAQ, RMB, RMC, ROT, RTE, THS, VBW, VDM, VDO,<br>VDR, VHW, VSD, VTG, VWR* <sup>1</sup> , VWT* <sup>1</sup> , WPL, ZDA |
|     | Output                              | ABM, AIQ, ALC, ALF, ALR, ARC, BBM, DDC, EVE, HBT,<br>OSD, RSD, TLB, TLL* <sup>2</sup> , TTD, TTM, VSD<br>* <sup>1</sup> : for retrofit. * <sup>2</sup> : for B/W-type radar                                                                                                      |
| 5.3 | Ethernet interface for IEC61162-450 |                                                                                                                                                                                                                                                                                  |
|     | Port (LAN2)                         | 100Base-TX, IPv4, 8P8C connector                                                                                                                                                                                                                                                 |
|     | Data sentences                      | Same as 5.2 sentences                                                                                                                                                                                                                                                            |
|     | IEC61162-450 transmission group     |                                                                                                                                                                                                                                                                                  |
|     | Input                               | MISC, TGTD, SATD, NAVD, TIME, PROP, CAM1, CAM2, NETA                                                                                                                                                                                                                             |

- |                                                                                                      |                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output                                                                                               | ALC, ALF, ALR, HBT sentence: TGTD, BAM1, BAM2<br>(default: TGTD)<br>other sentences: MISC, TGTD, SATD, NAVD, VDRD, RCOM,<br>TIME, PROP, USER1 to USER8 (default: TGTD) |
| Multicast address                                                                                    | 239.192.0.1 to 239.192.0.18, 239.192.0.56                                                                                                                              |
| Destination port                                                                                     | 60001 to 60018, 60056                                                                                                                                                  |
| Re-transmittable binary image transfer                                                               |                                                                                                                                                                        |
| Multicast address                                                                                    | 239.192.0.26 to 239.192.0.30                                                                                                                                           |
| Destination port                                                                                     | 60026 to 60030                                                                                                                                                         |
| Other network function excepted IEC61162-450<br>SNMP, HTTP, Syslog, Furuno Management Protocol (FMP) |                                                                                                                                                                        |
- 5.4 Output port on antenna unit
- Sub display (for radar) 1 port: HD, BP, Trigger and Video signal

## 6 POWER SUPPLY

- 6.1 Processor unit (w/ antenna and transceiver unit)
- |                         |                                                                                                 |
|-------------------------|-------------------------------------------------------------------------------------------------|
| FAR-2218/2318           | 100-230 VAC: 2.1-1.0 A (2.9-1.3 A), 1 phase, 50-60 Hz or<br>24 VDC (21.6-31.2V): 5.4 A (9.0 A)  |
| FAR-2228/2328           | 100-230 VAC: 2.3-1.1 A (3.2-1.4 A), 1 phase, 50-60 Hz or<br>24 VDC (21.6-31.2V): 8.9 A (12.4 A) |
| FAR-2228-NXT/2328-NXT   | 100-230 VAC: 2.1-1.1 A (2.9-1.3 A), 1 phase, 50-60 Hz or<br>24 VDC (21.6-31.2V): 8.2 A (11.1 A) |
| FAR-2328W               | 100-230 VAC: 2.3-1.1 A (3.2-1.4 A), 1 phase, 50-60 Hz                                           |
| FAR-2238S/2338S/2338SW  | 100-230 VAC: 3.2-1.5 A (5.6-2.5 A), 1 phase, 50-60 Hz                                           |
| FAR-2238S-NXT/2338S-NXT | 100-230 VAC: 2.6-1.2 A (5.1-2.2 A), 1 phase, 50-60 Hz<br>( A): 42 rpm                           |
- 6.2 Monitor unit
- |          |                                           |
|----------|-------------------------------------------|
| MU-190   | 100-230 VAC: 0.5-0.4 A, 1 phase, 50-60 Hz |
| MU-190HD | 12-24 VDC (10.8-31.2V): 8.4-3.9 A         |
| MU-192HD | 12-24 VDC (10.8-31.2V): 4.9-2.3 A         |
| MU-231   | 100-230 VAC: 0.7-0.4 A, 1 phase, 50-60 Hz |
| MU-270W  | 100-230 VAC: 0.6-0.4 A, 1 phase, 50-60 Hz |
- 6.3 HUB (option) 100-230 VAC: 0.1 A max. 1 phase, 50/60 Hz
- 6.4 De-icer (option) 100-115/220-230 VAC: 2.6/1.3 A, 1 phase, 50-60 Hz

## 7 ENVIRONMENTAL CONDITIONS

- 7.1 Ambient temperature
- |              |                                          |
|--------------|------------------------------------------|
| Antenna unit | -25°C to +55°C (storage: -25°C to +70°C) |
| Indoor units | -15°C to +55°C (storage: -20°C to +70°C) |
- 7.2 Relative humidity 93% or less at +40°C
- 7.3 Degree of protection
- |                           |                                 |
|---------------------------|---------------------------------|
| Antenna unit              | IP56                            |
| Processor/ monitor unit   | IP22                            |
| Transceiver/ control unit | IP20                            |
| HUB                       | IP20 (HUB-100), IP22 (HUB-3000) |
- 7.4 Vibration IEC 60945 Ed.4

**8 UNIT COLOR**

- |     |                             |                                                |
|-----|-----------------------------|------------------------------------------------|
| 8.1 | Antenna unit                | N9.5                                           |
| 8.2 | Processor/ transceiver unit | N2.5                                           |
| 8.3 | Control/ monitor unit       | N2.5                                           |
| 8.4 | HUB                         | N3.0 (HUB-100), N2.5 (HUB-3000)                |
| 8.5 | Radar console               | 2.5GY5/1.5 (standard), 7.5BG7/2, 2.5G7/2, N7.5 |

**9 PERFORMANCE MONITOR**

- |     |                      |                                                                                          |
|-----|----------------------|------------------------------------------------------------------------------------------|
| 9.1 | PM-32A (X-band, MAG) |                                                                                          |
|     | Frequency range      | 9380 to 9440 MHz                                                                         |
|     | Input power          | +18 dBm to +30 dBm                                                                       |
|     | Output power         | -21 dBm (1 <sup>st</sup> pulse max. output), -41 dBm (1 <sup>st</sup> pulse min. output) |
|     | Step level           | 8 to 12 dB (1 <sup>st</sup> pulse to last pulse)                                         |
| 9.2 | PM-32B (X-band, SSD) |                                                                                          |
|     | Frequency range      | 9423.75 ±1.6 MHz                                                                         |
|     | Input power          | +6 dBm to +26 dBm                                                                        |
|     | Output power         | -35 dBm (1 <sup>st</sup> pulse max. output), -66 dBm (1 <sup>st</sup> pulse min. output) |
|     | Step level           | 8 to 12 dB (1 <sup>st</sup> pulse to last pulse)                                         |
| 9.3 | PM-52A (S-band, MAG) |                                                                                          |
|     | Frequency range      | 3040 to 3080 MHz                                                                         |
|     | Input power          | +25 dBm to +40 dBm                                                                       |
|     | Output power         | -38 dBm (1 <sup>st</sup> pulse max. output), -58 dBm (1 <sup>st</sup> pulse min. output) |
|     | Step level           | 8 to 12 dB (1 <sup>st</sup> pulse to last pulse)                                         |
| 9.4 | PM-52B (S-band, SSD) |                                                                                          |
|     | Frequency range      | 3063.75 ±2 MHz                                                                           |
|     | Input power          | +5 dBm to +25 dBm                                                                        |
|     | Output power         | -52 dBm (1 <sup>st</sup> pulse max. output), -72 dBm (1 <sup>st</sup> pulse min. output) |
|     | Step level           | 8 to 12 dB (1 <sup>st</sup> pulse to last pulse)                                         |

## 1 ANTENNA RADIATOR

- | Radiator type                   | X-band |        |         |
|---------------------------------|--------|--------|---------|
|                                 | XN12AF | XN20AF | XN24AF* |
| Length                          | 4 ft   | 6.5 ft | 8 ft    |
| Horizontal beam width           | 1.9°   | 1.23°  | 0.95°   |
| Vertical beam width             | 20°    |        |         |
| Sidelobe within $\pm 10^\circ$  | -24 dB | -28 dB | -28 dB  |
| Sidelobe outside $\pm 10^\circ$ | -30 dB | -32 dB | -32 dB  |

|     |                  |                                                                                |
|-----|------------------|--------------------------------------------------------------------------------|
| 1.3 | Polarization     | Horizontal                                                                     |
| 1.4 | Rotation         | 24 rpm or 42 rpm (for high speed craft)                                        |
| 1.5 | Wind load        | 100 kn relative                                                                |
| 1.6 | De-icer (option) | On: when temperature goes down to 0°C<br>Off: when temperature goes up to +5°C |

|     |                 |       |
|-----|-----------------|-------|
| 2.2 | Output power    |       |
|     | FAR-2018-MARK-2 | 12 kW |
|     | FAR-2028-MARK-2 | 25 kW |

- | PRR<br>(Hz approx.) | Range scale (NM) |      |     |      |   |     |   |    |    |   |   |    |    |    |    |    |    |  |  |
|---------------------|------------------|------|-----|------|---|-----|---|----|----|---|---|----|----|----|----|----|----|--|--|
|                     | 0.125            | 0.25 | 0.5 | 0.75 | 1 | 1.5 | 2 | 3  | 4  | 6 | 8 | 12 | 16 | 24 | 32 | 48 | 96 |  |  |
| 3000*               | S1               |      |     |      |   |     |   |    |    |   |   |    |    |    |    |    |    |  |  |
| 3000*               |                  |      | S2  |      |   |     |   |    |    |   |   |    |    |    |    |    |    |  |  |
| 1500                |                  |      | M1  |      |   |     |   |    |    |   |   |    |    |    |    |    |    |  |  |
| 1200                |                  |      |     |      |   |     |   |    | M2 |   |   |    |    |    |    |    |    |  |  |
| 1000                |                  |      |     |      |   |     |   | M3 |    |   |   |    |    |    |    |    |    |  |  |
| 600**               |                  |      |     |      |   |     |   |    |    | L |   |    |    |    |    |    |    |  |  |

\*: 2200 Hz with TT range on 32 NM. \*\*: 500 Hz on 96 NM range.

|     |                                          |                                                                               |
|-----|------------------------------------------|-------------------------------------------------------------------------------|
| 3.1 | Minimum range                            | 22 m                                                                          |
| 3.2 | Range discrimination                     | 26 m                                                                          |
| 3.3 | Range accuracy                           | 1% of the maximum range of the scale in use or 10 m, whichever is the greater |
| 3.4 | Bearing discrimination                   | 2.1° (XN12AF), 1.5° (XN20AF), 1.2° (XN24AF)                                   |
| 3.5 | Bearing accuracy                         | ±1°                                                                           |
| 3.6 | Range scale and Range ring interval (RI) |                                                                               |

|                 |       |      |     |      |      |      |     |     |   |   |   |    |    |    |    |    |    |
|-----------------|-------|------|-----|------|------|------|-----|-----|---|---|---|----|----|----|----|----|----|
| Range (NM)      | 0.125 | 0.25 | 0.5 | 0.75 | 1    | 1.5  | 2   | 3   | 4 | 6 | 8 | 12 | 16 | 24 | 32 | 48 | 96 |
| RI (NM)         | 0.025 | 0.05 | 0.1 | 0.25 | 0.25 | 0.25 | 0.5 | 0.5 | 1 | 1 | 2 | 2  | 4  | 4  | 8  | 8  | 16 |
| Number of rings | 5     | 5    | 5   | 3    | 4    | 6    | 4   | 6   | 4 | 6 | 4 | 6  | 4  | 6  | 4  | 6  | 6  |

|     |              |                |
|-----|--------------|----------------|
| 3.7 | Warm-up time | 3 min. approx. |
|-----|--------------|----------------|

|      |                      |                                                                                                                                                                                                                                |
|------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.8  | Presentation mode    | Head-up, STAB head-up, Course-up, North-up (RM/TM), Stern-up                                                                                                                                                                   |
| 3.9  | Marks                | Cursor, Range ring, Heading mark, North mark, Bearing mark, VRM, EBL, Acquisition zone                                                                                                                                         |
| 3.10 | Target tracking (TT) | Auto or manual acquisition: 100 targets in 24/32 NM<br>(range selected from menu for maintenance)<br>Auto tracking on all acquired targets,<br>Tracking: 5/10 pts on all activated targets<br>Vector time: Off, 30 s, 1-60 min |
| 3.11 | AIS                  | Display capacity: 350 targets,<br>Tracking: 5/10 pts on all activated targets<br>Vector time: Off, 30 s, 1-60 min                                                                                                              |
| 3.12 | Echo trail           | True/Relative, Trail length: 0 to 30 minutes (30 s steps) or continue<br>Maximum 48 hours setting available for B/W-type radar                                                                                                 |
| 3.13 | Radar map            | 20,000 pts                                                                                                                                                                                                                     |
| 3.14 | Acquisition zone     | 2 zones                                                                                                                                                                                                                        |
| 3.15 | Interswitch function | Selectable from menu                                                                                                                                                                                                           |

## 4 MONITOR UNIT

|     |                          |                                        |
|-----|--------------------------|----------------------------------------|
| 4.1 | Screen type              |                                        |
|     | MU-190/190HD/192HD       | 19-inch color LCD, 1280 x 1024 (SXGA)  |
|     | MU-270W                  | 27-inch color LCD, 1920 x 1200 (WUXGA) |
| 4.2 | Brightness               |                                        |
|     | MU-190                   | 450 cd/m <sup>2</sup> typical          |
|     | MU-190HD/192HD           | 1000 cd/m <sup>2</sup> typical         |
|     | MU-270W                  | 400 cd/m <sup>2</sup> typical          |
| 4.3 | Visible distance         | 1.02 m nominal                         |
| 4.4 | Radar effective diameter |                                        |
|     | MU-190/190HD/192HD       | 282 mm                                 |
|     | MU-270W                  | 349 mm                                 |

## 5 INTERFACE

|     |                                 |                                                                                                                                                                                                                                                                         |
|-----|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.1 | Number of port (processor unit) |                                                                                                                                                                                                                                                                         |
|     | Serial                          | 7 ports (IEC61162-1/2: 2 ports, IEC61162-1: 4 ports, AD-10: 1 port)                                                                                                                                                                                                     |
|     | Alarm output                    | 6 ports: contact signal, load current 250mA<br>(Normal close/ open: 4, System fail: 1, Power fail: 1)                                                                                                                                                                   |
|     | DVI output                      | 2 ports: DVI-D, DVI-I or RGB picture data (for VDR)<br>(RGB resolution 1280x1024 (SXGA), 60.0Hz or<br>1440x900 (WXGA+), 59.9Hz)                                                                                                                                         |
|     | LAN                             | 2 ports: Ethernet 100Base-TX                                                                                                                                                                                                                                            |
|     | RS-232C                         | 1 port: brilliance control                                                                                                                                                                                                                                              |
|     | Sub display (for ECDIS)         | 2 ports: HD, BP, Trigger and Video signal                                                                                                                                                                                                                               |
| 5.2 | Data sentences (IEC61162-1/2)   |                                                                                                                                                                                                                                                                         |
|     | Input                           | ABK, ACK, ACN, ALR, BWC, BWR, CUR, DBK* <sup>1</sup> , DBS* <sup>1</sup> , DBT, DDC, DPT, DTM, GGA, GLL, GNS, HBT, HDT* <sup>1</sup> , MTW, MWV, OSD, RAQ, RMB, RMC, ROT, RTE, THS, VBW, VDM, VDO, VDR, VHW, VSD, VTG, VWR* <sup>1</sup> , VWT* <sup>1</sup> , WPL, ZDA |
|     | Output                          | ABM, AIQ, ALC, ALF, ALR, ARC, BBM, DDC, EVE, HBT, OSD, RSD, TLB, TLL* <sup>2</sup> , TTD, TTM, VSD                                                                                                                                                                      |
|     |                                 | * <sup>1</sup> : for retrofit. * <sup>2</sup> : for B/W-type radar                                                                                                                                                                                                      |

### 5.3 Ethernet interface for IEC61162-450

|                                              |                                                                                                                                                                        |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port (LAN2)                                  | 100Base-TX, IPv4, 8P8C connector                                                                                                                                       |
| Data sentences                               | Same as 5.2 sentences                                                                                                                                                  |
| IEC61162-450 transmission group              |                                                                                                                                                                        |
| Input                                        | MISC, TGTD, SATD, NAVD, TIME, PROP, CAM1, CAM2, NETA                                                                                                                   |
| Output                                       | ALC, ALF, ALR, HBT sentence: TGTD, BAM1, BAM2<br>(default: TGTD)<br>other sentences: MISC, TGTD, SATD, NAVD, VDRD, RCOM,<br>TIME, PROP, USER1 to USER8 (default: TGTD) |
| Multicast address                            | 239.192.0.1 to 239.192.0.18, 239.192.0.56                                                                                                                              |
| Destination port                             | 60001 to 60018, 60056                                                                                                                                                  |
| Re-transmittable binary image transfer       |                                                                                                                                                                        |
| Multicast address                            | 239.192.0.26 to 239.192.0.30                                                                                                                                           |
| Destination port                             | 60026 to 60030                                                                                                                                                         |
| Other network function excepted IEC61162-450 |                                                                                                                                                                        |
|                                              | SNMP, HTTP, Syslog, Furuno Management Protocol (FMP)                                                                                                                   |

### 5.4 Output port on antenna unit

|                         |                                          |
|-------------------------|------------------------------------------|
| Sub display (for radar) | 1 port: HD, BP, Trigger and Video signal |
|-------------------------|------------------------------------------|

## 6 POWER SUPPLY

### 6.1 Processor unit (w/ antenna and transceiver unit)

|                 |                                                                                                                     |
|-----------------|---------------------------------------------------------------------------------------------------------------------|
| FAR-2018-MARK-2 | 100-230 VAC: 2.1-1.0 A (2.8-1.2 A), 1 phase, 50-60 Hz or<br>24 VDC (21.6-31.2V): 7.7 A (10.6 A)                     |
| FAR-2028-MARK-2 | 100-230 VAC: 2.2-1.0 A (2.8-1.3 A), 1 phase, 50-60 Hz or<br>24 VDC (21.6-31.2V): 8.1 A (11.2 A)<br>( A): for 42 rpm |

### 6.2 Monitor unit

|          |                                           |
|----------|-------------------------------------------|
| MU-190   | 100-230 VAC: 0.5-0.4 A, 1 phase, 50-60 Hz |
| MU-190HD | 12-24 VDC (10.8-31.2V): 8.4-3.9 A         |
| MU-192HD | 12-24 VDC (10.8-31.2V): 4.9-2.3 A         |
| MU-270W  | 100-230 VAC: 0.6-0.4 A, 1 phase, 50-60 Hz |

### 6.3 HUB (option)

|  |                                           |
|--|-------------------------------------------|
|  | 100-230 VAC: 0.1 A max. 1 phase, 50/60 Hz |
|--|-------------------------------------------|

### 6.4 De-icer (option)

|  |                                                   |
|--|---------------------------------------------------|
|  | 100-115/220-230 VAC: 2.6/1.3 A, 1 phase, 50-60 Hz |
|--|---------------------------------------------------|

## 7 ENVIRONMENTAL CONDITIONS

### 7.1 Ambient temperature

|              |                                          |
|--------------|------------------------------------------|
| Antenna unit | -25°C to +55°C (storage: -25°C to +70°C) |
| Indoor units | -15°C to +55°C (storage: -20°C to +70°C) |

### 7.2 Relative humidity

|  |                      |
|--|----------------------|
|  | 93% or less at +40°C |
|--|----------------------|

### 7.3 Degree of protection

|                         |                                 |
|-------------------------|---------------------------------|
| Antenna unit            | IP56                            |
| Processor/ monitor unit | IP22                            |
| Control unit            | IP20                            |
| HUB                     | IP20 (HUB-100), IP22 (HUB-3000) |

### 7.4 Vibration

|  |                |
|--|----------------|
|  | IEC 60945 Ed.4 |
|--|----------------|

## 8 UNIT COLOR

|                    |      |
|--------------------|------|
| 8.1 Antenna unit   | N9.5 |
| 8.2 Processor unit | N2.5 |

- 8.3 Control/ monitor unit N2.5
- 8.4 HUB N3.0 (HUB-100), N2.5 (HUB-3000)
- 8.5 Radar console 2.5GY5/1.5 (standard), 7.5BG7/2, 2.5G7/2, N7.5

## **9 PERFORMANCE MONITOR**

- 9.1 Frequency range 9380 to 9440 MHz
- 9.2 Input power +18 dBm to +30 dBm
- 9.3 Output power -21 dBm (1<sup>st</sup> pulse max. output), -41 dBm (1<sup>st</sup> pulse min. output)
- 9.4 Step level 8 to 12 dB (1<sup>st</sup> pulse to last pulse)

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## Declaration of Conformity

[FAR-2218/FAR-2218-BB/FAR-2228/FAR-2228-BB/FAR-2228-NXT/FAR-2228-NXT-BB/FAR-2238S/  
FAR-2238S-BB/FAR-2238S-NXT/FAR-2238S-NXT-BB/FAR-2318/FAR-2328/FAR-2328-NXT/  
FAR-2328W/FAR-2338SW/FAR-2338S/FAR-2338S-NXT/FAR-2018-MARK-2/FAR-2028-MARK-2]

|                   |                                                                                                                                                                                                                                                                                        |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bulgarian<br>(BG) | С настоящото Furuno Electric Co., Ltd. декларира, че гореспоменат тип радиосъоръжение е в съответствие с Директива 2014/53/ЕС, СИ 2017/1206.<br>Цялостният текст на ЕС/УК декларацията за съответствие може да се намери на следния интернет адрес:                                    |
| Spanish<br>(ES)   | Por la presente, Furuno Electric Co., Ltd. declara que el tipo de equipo radioeléctrico arriba mencionado es conforme con la Directiva 2014/53/UE, SI 2017/1206.<br>El texto completo de la declaración de conformidad de la EU/UK está disponible en la siguiente dirección Internet: |
| Czech<br>(CS)     | Tímto Furuno Electric Co., Ltd. prohlašuje, že výše zmíněný typ rádiového zařízení je v souladu se směrnicí 2014/53/EU, SI 2017/1206.<br>Úplné znění EU/SK prohlášení o shodě je k dispozici na této internetové adrese:                                                               |
| Danish<br>(DA)    | Hermed erklærer Furuno Electric Co., Ltd., at ovennævnte radioudstyr er i overensstemmelse med direktiv 2014/53/EU, SI 2017/1206.<br>EU/UK-overensstemmelseserklæringens fulde tekst kan findes på følgende internetadresse:                                                           |
| German<br>(DE)    | Hiermit erklärt die Furuno Electric Co., Ltd., dass der oben genannte Funkanlagentyp der Richtlinie 2014/53/EU, SI 2017/1206 entspricht.<br>Der vollständige Text der EU/UK-Konformitätserklärung ist unter der folgenden Internetadresse verfügbar:                                   |
| Estonian<br>(ET)  | Käesolevaga deklareerib Furuno Electric Co., Ltd., et ülalmainitud raadioseadme tüüp vastab direktiivi 2014/53/EL, SI 2017/1206 nõuetele.<br>EL/GB vastavusdeklaratsiooni täielik tekst on kättesaadav järgmisel internetiaadressil:                                                   |
| Greek<br>(EL)     | Με την παρούσα η Furuno Electric Co., Ltd., δηλώνει ότι ο προαναφερθέντας ραδιοεξοπλισμός πληροί την οδηγία 2014/53/ΕΕ, SI 2017/1206.<br>Το πλήρες κείμενο της δήλωσης συμμόρφωσης ΕΕ/ΥΚ διατίθεται στην ακόλουθη ιστοσελίδα στο διαδίκτυο:                                            |
| English<br>(EN)   | Hereby, Furuno Electric Co., Ltd. declares that the above-mentioned radio equipment type is in compliance with Directive 2014/53/EU, SI 2017/1206.<br>The full text of the EU/UK declaration of conformity is available at the following internet address:                             |
| French<br>(FR)    | Le soussigné, Furuno Electric Co., Ltd., déclare que l'équipement radioélectrique du type mentionné ci-dessus est conforme à la directive 2014/53/UE, SI 2017/1206.<br>Le texte complet de la déclaration UE/RU de conformité est disponible à l'adresse internet suivante:            |
| Croatian<br>(HR)  | Furuno Electric Co., Ltd. ovime izjavljuje da je gore rečeno radijska oprema tipa u skladu s Direktivom 2014/53/EU, SI 2017/1206.<br>Cjeloviti tekst EU/UK izjave o sukladnosti dostupan je na sljedećoj internetskoj adresi:                                                          |
| Italian<br>(IT)   | Il fabbricante, Furuno Electric Co., Ltd., dichiara che il tipo di apparecchiatura radio menzionato sopra è conforme alla direttiva 2014/53/UE, SI 2017/1206.<br>Il testo completo della dichiarazione di conformità UE/RU è disponibile al seguente indirizzo Internet:               |
| Latvian<br>(LV)   | Ar šo Furuno Electric Co., Ltd. deklarē, ka augstāk minēts radioiekārta atbilst Direktīvai 2014/53/ES, SI 2017/1206.<br>Pilns ES/AK atbilstības deklarācijas teksts ir pieejams šādā interneta vietnē:                                                                                 |

|                 |                                                                                                                                                                                                                                                                                          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lithuanian (LT) | Aš, Furuno Electric Co., Ltd., patvirtinu, kad pirmiau minėta radijo įrenginių tipas atitinka Direktyvą 2014/53/ES, SI 2017/1206.<br>Visas ES/JK atitikties deklaracijos tekstas prieinamas šiuo interneto adresu:                                                                       |
| Hungarian (HU)  | Furuno Electric Co., Ltd. igazolja, hogy fent említett típusú rádióberendezés megfelel a 2014/53/EU, SI 2017/1206 irányelvnek.<br>Az EU/EK-megfelelőségi nyilatkozat teljes szövege elérhető a következő internetes címen:                                                               |
| Maltese (MT)    | B'dan, Furuno Electric Co., Ltd., niddikjara li msemmija hawn fuq-tip ta' tag ħmir tar-radju huwa konformi mad-Direttiva 2014/53/UE, SI 2017/1206.<br>It-test kollu tad-dikjarazzjoni ta' konformità tal-UE/RU huwa disponibbli f'dan l-indirizz tal-Internet li ġej:                    |
| Dutch (NL)      | Hierbij verklaar ik, Furuno Electric Co., Ltd., dat het hierboven genoemde type radioapparaat conform is met Richtlijn 2014/53/EU, SI 2017/1206.<br>De volledige tekst van de EU/VK-conformiteitsverklaring kan worden geraadpleegd op het volgende internetadres:                       |
| Polish (PL)     | Furuno Electric Co., Ltd. niniejszym oświadczam, że wyżej wymieniony typ urządzenia radiowego jest zgodny z dyrektywą 2014/53/UE, SI 2017/1206.<br>Pełny tekst deklaracji zgodności UE/UK jest dostępny pod następującym adresem internetowym:                                           |
| Portuguese (PT) | O(a) abaixo assinado(a) Furuno Electric Co., Ltd. declara que o mencionado acima tipo de equipamento de rádio está em conformidade com a Diretiva 2014/53/UE, SI 2017/1206.<br>O texto integral da declaração de conformidade da EU/UK está disponível no seguinte endereço de Internet: |
| Romanian (RO)   | Prin prezenta, Furuno Electric Co., Ltd. declară că echipamentul radio menționat mai sus este în conformitate cu Directiva 2014/53/UE, SI 2017/1206.<br>Textul integral al declarației de conformitate UE/RU este disponibil la următoarea adresă internet:                              |
| Slovak (SK)     | Furuno Electric Co., Ltd. týmto vyhlasuje, že vyššie spomínané rádiové zariadenie typu je v súlade so smernicou 2014/53/EÚ, SI 2017/1206.<br>Úplné EÚ/SK vyhlásenie o zhode je k dispozícii na tejto internetovej adrese:                                                                |
| Slovenian (SL)  | Furuno Electric Co., Ltd. potrjuje, da je zgoraj omenjeno tip radijske opreme skladen z Direktivo 2014/53/EU, SI 2017/1206.<br>Celotno besedilo izjave EU/ZK o skladnosti je na voljo na naslednjem spletnem naslovu:                                                                    |
| Finnish (FI)    | Furuno Electric Co., Ltd. vakuuttaa, että yllä mainittu radiolaitetyyppi on direktiivin 2014/53/EU, SI 2017/1206 mukainen.<br>EU/UK-vaatimustenmukaisuusvakuutuksen täysimittainen teksti on saatavilla seuraavassa internetosoitteessa:                                                 |
| Swedish (SV)    | Härmed försäkrar Furuno Electric Co., Ltd. att ovan nämnda typ av radioutrustning överensstämmer med direktiv 2014/53/EU, SI 2017/1206.<br>Den fullständiga texten till EU/Storbritannien-försäkran om överensstämmelse finns på följande webbadress:                                    |

#### Online Resource

[http://www.furuno.com/en/support/red\\_doc](http://www.furuno.com/en/support/red_doc)

#### **Notice for radiated immunity**

**The test for the radiated immunity is performed up to 2.7 GHz only without the special condition of spot frequency being applied. There is a chance that this equipment may interfere with allocated services in the frequency range of 2.7 GHz to 6 GHz, particularly in harbors, rivers, lake banks, etc.**

## Declaration of Conformity



# 0560

We **FURUNO ELECTRIC CO., LTD.**

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(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

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(Address)

declare under our sole responsibility that the product

### MARINE RADAR

FAR-2218, FAR-2218-BB, FAR-2228, FAR-2228-BB, FAR-2228-NXT, FAR-2228-NXT-BB,  
FAR-2238S, FAR-2238S-BB, FAR-2238S-NXT, FAR-2238S-NXT-BB, FAR-2318, FAR-2328,  
FAR-2328-NXT, FAR-2328W, FAR-2338SW, FAR-2338S and FAR-2338S-NXT

(Serial No.1000-79xx/1001-34xx-xxxx)

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(Model name, type number)

to which this declaration relates conforms to the following standard(s) or normative document(s)

IMO Resolution A.278(VIII), A.694(17)  
IMO Resolution MSC.36(63), MSC.97(73)  
IMO Resolution MSC.191(79), MSC.192(79)  
IMO Resolution MSC.302(87)  
IMO MSC.1/Circ.1349  
ITU-R M.1177-4

IEC 60945 Ed. 4.0: 2002 incl. Corr. 1, 2008  
IEC 61162-1 Ed. 5.0: 2016  
IEC 61162-2 Ed. 1.0: 1998  
IEC 61162-450 Ed. 2.0: 2018  
IEC 62288 Ed. 2.0: 2014  
IEC 62388 Ed. 2.0: 2013  
IEC 61996-1 Ed. 2.0: 2013  
IEC 62923-1/2 Ed.1.0: 2018

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(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- EC Type Examination (Module B) certificates No. MEDB00002AU Rev.8 issued by DNV AS (0575), Norway.
- Product Quality System (Module D) certificate No. P 112 (Issue 67) issued by Telefication, The Netherlands.

This declaration is issued according to the Directive 2014/90/EU of the European Parliament and of the Council on marine equipment, and the Implementing Regulation (EU) 2022/1157.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan  
2 December 2022

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(Place and date of issue)

Akihiko Kanechika  
Department General Manager  
Quality Assurance Department

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(name and signature or equivalent marking of authorized person)