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R60 Station

Product Specification

TABLE OF CONTENTS

1 Scope

This document is the product specification for the R60 VDES Base Station product line.

This specification describes various R60 Station configurations and following products:

- *R60 Receiving Station, P/N 7000 120-203*
- *R60 AtoN Station, P/N 7000 120-204*
- *R60 VDES Base Station - Standard, P/N 7000 120-200*
- *R60 VDES Base Station - Full, P/N 7000 120-201*

The configuration is defined by the unique product number, which fully defines each specific product together with the additionally included deliverables. The order numbers for the sales objects are specified in the R60 pricelist.

In order to get an overview of the various versions of the R60, please see section 8 of this document, which summarises the functionality included in each version.

IMPORTANT:

The VHF Data Exchange System (VDES) consist of AIS, ASM and VDE, where the AIS functionality is defined by IEC 62320-1 and the ASM functionality by the temporary standard IEC PAS 63343. The VDE standard work is planned to be finalized 2024/2025, meanwhile will the definition of the VDE be found in IALA G.1139 edition 3 and ITU-R M.2092-1.

The VDE operation and VDE interface specifications is subject to change during the standardisation work and therefore subject to frequent changes. The R60 VDE operation and VDE interface is described in the document, *R60 VDES Base Station VDE Operation and Interface Specification, 7000 120-017.*

Note: This specification is subject to change without any further notice

2 References

[1] R60 VDES Base Station Installation Manual 7000 120-008
[2] R60 VDES Base Station User Manual 7000 120-009
[3] R60 VDES Base Station Interface Specification 7000 120-010
[4] R60 VDES Base Station VDE Operation and Interface Specification 7000 120-017

3 Introduction

The R60 Station is the new generation AIS/VDES station from Saab for fixed shore and offshore installations and the successor to the well-known R40 AIS Base Station. The R60 offers backwards compatibility to the R40 allowing for mixed installations in shore networks, as well as support for new communication modes using the VDES standard and a range of powerful new features.

Saab was the first company ever to get a type approval for an AIS product and has since the market establishment been a major supplier of AIS base stations. Based upon this experience, the R60 has been developed using our new in-house developed 5th generation Software Defined Radio (SDR) platform, ensuring best in class radio performance, plenty of headroom to add additional communication channels in the marine VHF bands, and great flexibility to adopt to new future waveforms and protocols.

Ensuring a high degree of reliability and availability has been a key design goal during the development of the R60. In addition to supporting hot standby installations and local storage data recording, the R60 has new advanced hardware watchdog functions and built-in remote power control.

The VDES system, “next generation of AIS”, reached a conclusion regarding frequency allocation at the ITU World Radio Conference in 2019, and will be an important enabler for future e-navigation applications. VDES offers significantly higher bandwidth, better security and integrity than AIS, as well as a solution for truly global coverage through two-way satellite communication.

The R60 provides a modular design and include AIS, ASM and VDE modules according to the customer’s requirements. This approach together with an advanced Software Defined Radio (SDR) design leads to a future proof solution, which can continuously adopt the evolution and updates of AIS and VDES standards.

The R60 HW exist in the following product configurations:

- R60 VDES Base Station - Standard
- R60 VDES Base Station - Full
- R60 Receiver Station
- R60 AtoN Station

Note: VDE functionality is offered as an option, pending the VDES standard approval.

Figure 3-1 Front of the R60 VDES Base Station

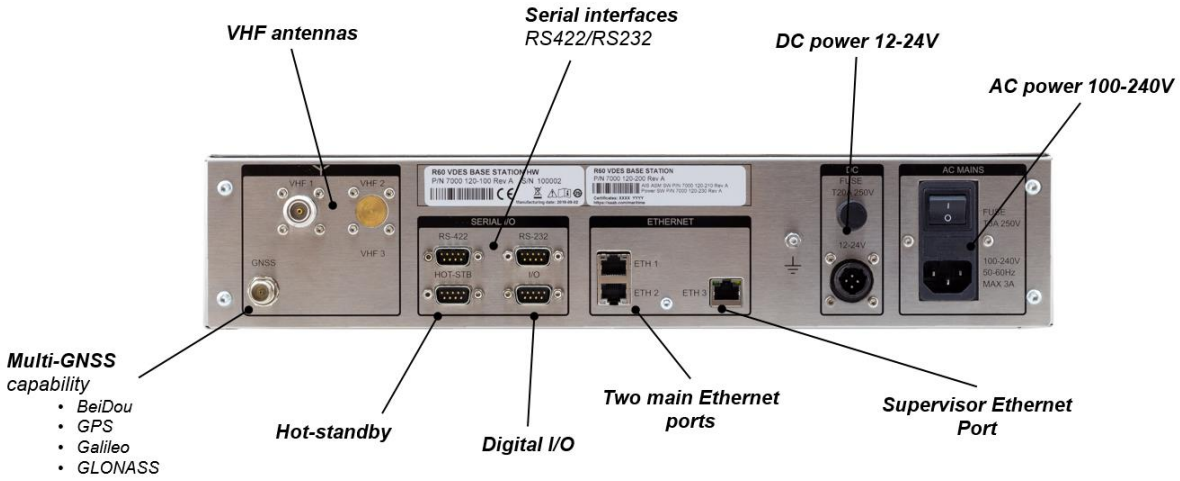


Figure 3-2 Rear of the R60 VDES Base Station

3.1 General

The R60 consists of a VHF Software Defined Radio (SDR) transceiver, communication and monitoring processors, an internal GNSS receiver providing time synchronization and an advanced built-in power supply unit. No separate Base Station Controller (BSC) hardware is necessary, since the R60 has a built-in BSC and all relevant monitoring and configuration functions integrated.

Monitoring of system status and network setup can easily be done from the front mounted touch display, as well as from the built-in web server, without any specialized software or tools.

3.2 Open System Architecture

The R60 is designed to ensure maximum interoperability with external system by supporting all relevant standardised protocols. For communication associated with additional functionality not yet described in any international standard, documented proprietary messages are used.

The open system architecture is obtained by:

1. The use of Ethernet LAN as primary interconnection.
2. The AIS operation is fully compliant with the IEC 62320-1 specification, ensuring the base station protocol for configuration parameters, output data and alarms are standardised.
3. The ASM operation is fully compliant to IEC PAS 63343.
4. Full Interface Control Document (ICD) is available for AIS, ASM and proprietary control/monitoring messages.
5. A living operation and interface description covering the currently implemented VDE functionality.

3.3 Qualification

The R60 has been thoroughly tested and certified to relevant international standards for AIS Base Stations and AIS AtoN Stations. It is qualified to meet international EMC, Radio, Electrical Safety and other relevant regulations and standards for international sales.

The R60 is certified according to the RED and RoHS III directive within EU and carries the CE-mark. The compliance to relevant AIS Base Station and AIS AtoN standards is ensured by a certifications from accredited third party TCB:s.

4 R60 Details

This section describes in detail the special features and characteristics of the R60. For further information, please also refer to the R60 VDES Base Station Installation Manual [1], R60 VDES Base Station User manual [2].

4.1 Overview

The R60 Station is available in following basic versions.

- Receiver Station
- AtoN Station
- Standard Base Station
- Full Base Station

These versions are based on the same hardware platform and share all basic HW features and characteristics. The coming sections detail the functions that are available in each of the different versions. The functionality of each versions is locked by a dedicated license key.

Furthermore, the R60 is also available with following hardware options:

- Separated RX and TX antenna interfaces
- VDE transceiver (Future option)

The hardware options are detailed in section 4.7.

4.2 R60 Receiver Station

This section describes the characteristics for the R60 Receiving station. The following table gives an overview of what is included.

R60 Receiving Station - Basic Features and Characteristics
• AIS and ASM Reception • Receiver using SDR technology • Embedded GNSS Receiver supporting > 50 channels • Ethernet Network access using both IPv4 and IPv6 • Built-in web servers for configuration and monitoring • Integrated colour touch display • SNMP support • Self-Surveyed position support • Advanced built-in test and monitoring • Digital Input and Output port • Remote Software Upgrade support • Remote Power management • VDL Analysis

4.3 R60 AtoN Station

This section describes the characteristics for the R60 AIS AtoN station. The following table gives an overview of what is included.

R60 AtoN Station- Basic Features and Characteristics

• AIS and ASM Receptions
• AIS Transmissions, AtoN specific according to IEC 62320-2
• AtoN message scheduling
  • FATDMA (Mode A, B and C)
  • RATDMA (Mode A)
• Transmission of up to 30 synthetic or virtual AtoN
• AIS AtoN Repeater function
• Transceiver using SDR technology
• Embedded GNSS Receiver supporting > 50 channels
• Ethernet Network access using both IPv4 and IPv6
• Built-in web servers for configuration and monitoring
• Integrated colour touch display
• SNMP support
• Self-Surveyed position support
• Advanced built-in test and monitoring
• Digital Input and Output port
• Remote Software Upgrade support
• Remote Power management
• Hot standby
• VDL Analysis

4.4 R60 Standard Base Station Version

This section describes the basic features and characteristics that are common for all versions of the R60 Base Stations. The following table gives an overview of what is included; more detailed information is available in the coming sections.

R60 Standard Base Station- Basic Features and Characteristics
• AIS and ASM channel support • Transceiver using SDR technology • Embedded GNSS Receiver supporting > 50 channels • Ethernet Network access using both IPv4 and IPv6 • Built-in web servers for configuration and monitoring • Integrated colour touch display • SNMP support • Self Surveyed position support • Advanced built-in test and monitoring • Digital Input and Output port • Remote Software Upgrade support • Dependent or Independent Operation • Remote Power management • Hot standby • VDL Analysis

4.4.1 AIS and ASM channel support (All Base Station versions)

In addition to being a type approved AIS base station, the R60 Base Station features embedded support for additional communication channels designated ASM1 and ASM2. The ASM channels are defined by the ITU VDES recommendation ITU-R M.2092, IEC PAS 63343 and the IALA Guideline G1139 for VDES.

The VDES ASM support allows for extended communication capabilities. With VDES, a base station can transmit data such as defined by IMO SN.1/Circ.289 to any VDES ASM capable receiver within range, without causing additional load on the AIS VHF Data Link (VDL).

VDES ASM channels are also used for ship to ship and ship to shore communication. The R60 base station will receive information on all four VHF channels in parallel; AIS1, AIS2, ASM1 and ASM2.

4.4.2 Transceiver using SDR technology (All versions)

The R60 includes an advanced transceiver based upon Software Defined Radio (SDR) technology. This gives outstanding performance both on the transmitter and receiver side. For instance, the receiver has a superior detection range due to its extremely good sensitivity, better than -118 dBm (AIS) and -115 dBm (ASM), compared to the required -107 dBm according to the international performance standard. The use of SDR technology also makes it possible to upgrade the transceiver with new software that enables new functionality such as the capability to support several parallel VDES channels.

4.4.3 Embedded GNSS receiver (All versions)

The main task for the built in GNSS receiver is to provide accurate timing within the base station. The receiver can also be used to determine the base station position that is sent out on the VDL, see 4.4.8.

The built in GNSS receiver supports the following systems: GPS, GLONASS, BeiDou and Galileo.

4.4.4 Ethernet Network access (All versions)

The R60 is equipped with two Main Ethernet ports supporting 10/100/1000 Mbit/s using TCP protocol. In addition the R60 features one additional Supervisor Ethernet port supporting 10/100 Mbit/s using TCP protocol.

4.4.5 Built-in web servers for configuration, monitoring and power management (All versions)

The R60 has built-in web servers for quick and easy access to monitoring functions such as alarms, status, hardware/software info, etc. Furthermore, the web servers provides the possibility to do configuration via a standard web browser. It is also possible to load new software via web server. See section 5.2

4.4.6 Integrated colour touch display (All versions)

The R60 is equipped with a front display presenting status information and other operational related information. It is also possible to configure network communication settings, i.e. IP-configuration to enable access via the local Ethernet LAN. The display layout and buttons configuration can be redesigned and reconfigured as new future functions are implemented.

4.4.7 SNMP support (All versions)

The R60 base station is an SNMP enabled device which allows it to be remotely monitored by an SNMP Manager. The SNMP implementation is SNMPv1, SNMPv 2c and SNMPv3 compatible. The SNMP agent is embedded in the R60 and its capabilities is defined by the MIB below.

- *iso.org.dod.internet.private.enterprise.transpondertech.r40.basestation*
  This MIB defines properties that can be monitored in the base station such as alarms status, input voltage, channel load, used satellites, number of satellites found, hot standby status, connection state etc.

  (**Note**: The same MIB is used for R40 and R60 for compatibility reasons.)

4.4.8 Self-surveyed position (All versions)

The self-surveyed position is an average GNSS position over the last 24 hours, which result in a more accurate and reliable position information. In addition to the position, an accuracy value is output from the base station that indicates the accuracy of the position. The position can be used as the base station surveyed position, i.e. GNSS (antenna) position.

4.4.9 Built-in test and monitoring (All versions)

4.4.9.1 Temperature monitoring

The internal temperature is constantly monitored and alarms are generated if the temperature becomes too high.

4.4.9.2 Power supply monitoring and control

The R60 can be operated on AC as well as on DC power. If both AC and DC power is available, AC power will be used.
If the AC power should fail the R60 will automatically fall back to DC-operation without interruption or degradation of functionality. The selected power source is presented on the front panel display as well as on the external interfaces.
DC voltage is constantly monitored to trigger an alarm in case the power becomes critically low. The voltage of the DC power can be monitored for remote assessment of the DC power source.

4.4.9.3 Fault detection and handling (All versions)

The fault detection capability of the R60 is excellent, as built-in testing and several watchdogs monitor the operation of the unit. For instance there is a dedicated hardware watchdog processor that continuously monitors the R60 functionality and if needed can initialise a unit re-boot. The generated alarms can be monitored remotely or by other equipment at the base station site, and the R60 also has a digital output port, see section 4.4.10.

4.4.10 Digital Input and Output port (All versions)

For monitoring and control of external equipment the R60 has one digital output and one digital input port. Via the output port it is possible to control other equipment such as alarm relays. The input port can be used for monitoring status of external equipment.

4.4.11 Remote Software Upgrade Support (All versions)

The R60 is prepared for future upgrades and easy maintainability of all software components, via the Ethernet LAN interface.

4.4.12 Dependent or Independent Operation (All Base Station versions)

IEC 62320-1 defines two types of R60 Base Stations, dependent and independent. Independent is the more advanced type and can work as a stand-alone unit, i.e. it

does not require an external application to be able to function. The dependent version requires that it is connected to an external application that continuously controls and commands the base station, and determines how the R60 shall transmit messages. The R60 can be configured to operate in any of these modes.

4.4.13 Remote Power management (All versions)

The R60 offers an advanced embedded power control module, which supports remote power cycling and activation of a power saving mode.

This function is handled by a separate watchdog processor and toggles the main radio board(s) on/off. This is a valuable feature in a troubleshooting situation and may save a trip to the remote site due to operational issues e.g. an interrupted configuration save or interrupted software upgrade due to power outage. Also see section 5.3

4.4.14 Hot standby (AtoN and Base Station)

If the availability of the Base Station is of prime importance, two R60 VDES Base Stations can be installed in a hot standby configuration. In this configuration only one of the base stations will be used for transmissions, whereas the hot standby base station will monitor the integrity of the transmitting unit. No external device is required to set up the base stations as hot standby, just an RS422 cable between the two base stations is needed.

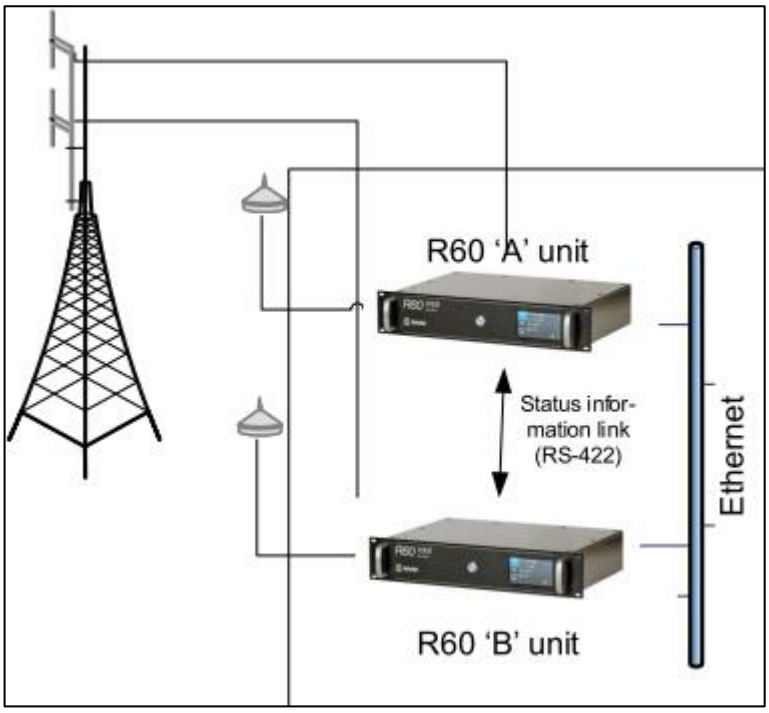


Figure 4-1 Hot standby configuration

In case of a failure in the active base station, the standby base station will immediately take on the role of the active base station without any degradation of performance. The failure can then be addressed without the need of immediate actions and without discontinuity of the service provided.

4.4.15 VDL Analysis (All versions)

Furthermore it supports extensive possibilities for VDL analysis via FSR/VSI-message information, giving details such as Received Signal Strength, Time of Arrival and Signal to Noise Ratio.

4.5 R60 Full Base Station Version

In addition to the features and characteristics included in the R60 Standard Base Station version, the R60 Full version offers the following additional features.

R60 Full – Standard + Additional Features and Characteristics

• VHF TX Integrity monitoring (Hot Standby Installation Only)
• AIS Transmissions, AtoN specific according to IEC 62320-2
• AtoN message scheduling
  ◦ FATDMA (Mode A, B and C)
  ◦ RATDMA (Mode A)
• Transmission of up to 30 synthetic or virtual AtoN
• AIS AtoN Repeater function
• AIS Repeater functionality (IEC 62320-3)
• Local storage of VDL and status data
• DSC Channel Management
• External UTC Synchronization via 1PPS and IRIG-B 003
• Third AIS Receiver
• NTP Server
• AMRD
• Long-Range

4.5.1 VHF TX Integrity monitoring (Hot Standby Installation Only)

The VHF transmission monitoring function is used in a hot standby configuration to make the standby base station listen to the VHF radio signals transmitted by the active base station. The transmissions received by the standby base station are interpreted and compared with the information that the active base station has transmitted. If the received and transmitted data differ, a VHF transmission monitoring alarm will be raised.

4.5.2 AIS Repeater functionality (IEC 62320-3)

The Repeater functionality is used to support area coverage extension, in compliance with IEC62320-3. A Repeater is normally used only when there is no

network connection for a remote site, but when coverage of the area is necessary. The Repeater will retransmit received AIS messages so they can be received by other base stations, being connected to the network system. Mobile transponders within range will also receive the retransmitted messages.

The repeater functionality also includes the possibility to configure which type of messages it shall repeat, based upon for example AIS message number, distance, MMSI and area.

The R60 can use either FATDMA or RATDMA access schemes for the retransmission, see section 4.2.14.

4.5.3 Aids to navigation functionality (IEC 62320-2) (AtoN version, Full version)

The R60 is compliant to a subset of AtoN requirements for a Type 1 (Mode A, B and C) or Type 3 (Mode A) AtoN as specified in IEC 62320-2. This means that the R60 can be configured to transmit Aids to Navigation (AtoN) for up to 30 synthetic or virtual unique entities. By doing this, the AIS users can receive information about AtoNs although the AtoNs themselves are not equipped with any AIS transmitters.

4.5.4 Aids to navigation repeater (Full version)

The Aids to Navigation (AtoN) repeater functionality is used to multiply the rate of a remote AtoN target. Example use case: An AtoN target is transmitting once per hour. The R60 detects the AtoN target's MMSI, saves the latest received AtoN message and broadcasts the message once every 60 seconds.

4.5.5 Local storage of VDL and status data (Full version)

The R60 Base Station includes built in memory capacity for temporary storage of VDL and status data. This function is used if the base station temporary loses its connection to the network. When the network connection comes back up the temporary stored data is transferred from the internal base station memory to the network, for further processing. The data transfer is a mix of real time information and stored data. Real time data has the highest priority and stored data is transferred when there is available capacity on the network connection. The standard size of internal storage memory is a 32 GB SD-card, which gives a storage capacity sufficient for several months of AIS operation.

4.5.6 DSC Channel Management (Full version)

The R60 transceiver has a built in DSC capability. This can be used for transmitting DSC channel management messages.

4.5.7 External UTC Synchronization via 1PPS and IRIG-B 003 (Full version)

In order to facilitate installations where the internal GPS cannot be used for synchronisation or a synchronization backup is required the R60 can use an external UTC source. The external UTC source either needs to provide a 1 PSS signal and NMEA time messages or it can be an IRIG-B 003 digital time signal.

4.5.8 Third AIS Receiver (Full version)

The R60 has an additional active AIS receiver operating in parallel with the two standard AIS receivers. The main purpose is to support reception of encrypted messages on a separate channel, such as the Saab Secure AIS functionality. Since Saab Secure AIS operates on a dedicated VHF frequency, the encrypted communication does not affect the communication on standard AIS channels. The Secure AIS is an integrated part of all Saab's AIS products, thus enabling secure communication between any equipped platform, such as control centres, ships, aircraft, etc.

Note: The R60 Full version requires support from an external Saab software application to enable the encryption functionality. The external software application can be either a complete AIS network solution or Saabs Secure Module Stand-alone.

4.5.9 Built-in NTP server (Full version)

The R60 full is equipped with NTP server to provide synchronized time for NTP and SNTP clients. The NTP server calculates the time from the built in GPS receiver.

Configuration and status is available on built in web server where alerts are also displayed.

4.5.10 AMRD support (Full version)

Following decision of ITU WRC-19, VHF channel 2006 (160.900 MHz) has been assigned to AMRD group B devices as well as experimental use for future AIS

applications. The R60 Base station has the capability to operate a separate receiving process on this channel. VHF data following AIS protocol format can then be received and output, allowing authorities to monitor for AMRD devices in the area or operating a testbed for future AIS equipment without causing interference with standard AIS users.

4.5.11 Long-range reception (Full version)

Class A AIS systems operate primarily on channels AIS1 and AIS2, where alternating position reports are sent at least once every 10s while underway. This is optimal for ship-ship and ship-shore monitoring of AIS, as data can easily be correlated with radar tracks.

However, satellite detection of AIS struggles with satellite perceived AIS data collisions in busy areas. This is partly due to frequent vessels transmissions and the large reception area of the satellites where most received transmissions are of similar strength.

In order to increase satellite based AIS detection performance, ITU has added a new type of position report for Class A AIS devices, message 27. Once every three minutes a special position report is sent alternatingly on channel 75 (156.775 MHz) and 76 (156.825 MHz). This report is sent infrequently and with slightly shortened content compared to standard AIS reports, for improved satellite detection.

The R60 is capable to operate separate receiving processes on channels 75 and 76, with the potential to dramatically increase detection range in areas where there is heavy AIS data channel loading, resulting in garbled messages and increased channel noise.

4.6 Options

This section gives an overview of the hardware options that are available for the R60.

4.6.1 Separated Rx and Tx antenna ports

In order to enable installation at sites where the VHF antenna is shared with other co-located radio equipment, the R60 can be equipped with separate antenna connectors for reception and transmission.

4.6.2 VDE transceiver (Future option)

The R60 is prepared for VDES VDE channel support as defined by the ITU VDES recommendation ITU-R M.2092 and the IALA Guideline G1139 for VDES.

With the VDE option, the R60 Base station supports communication over the VDE Frequencies allowing for up to 302.7 kbps raw data rate. With VDE support users will have the option to providing data services simply not possible using a standard AIS infrastructure.

The VDE operation and interface specification is described in a separate document, see Ref [4].

Further information regarding VDES is found in Section 0.

5 Service and Configuration Interfaces

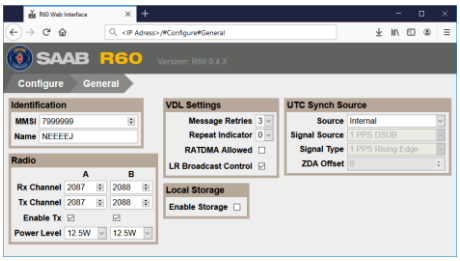
The R60 is delivered with advanced built in web servers which enables Ethernet access via a standard web browser for configuration, control and monitoring of the base station.

The web interface provides detailed information regarding operational status and alarms. It also offers an embedded display functionality where e.g. received tracks and the detailed time slot allocation of the VHF link can be monitored.

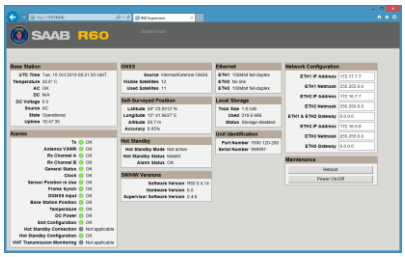
Besides access to the specific hardware and software configuration, the web-server also supports upload of new software to the base station, i.e. no external applications are required.

The R60 has the following user interfaces.

- Colour capacitive touch display on the front
- Configuration and monitoring web interface
- Supervisor web interface
- AIS Configuration and monitoring via serial interface



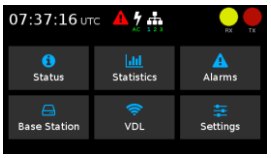
Configuration and monitoring web interface



Supervisor web interface

ETH 1, ETH 2
(Rear)

ETH 3
(Rear)



Front display

Figure 5-1 User interfaces

5.1 Front Display

The R60 is equipped with a 4.3” colour capacitive touch display, showing status information and other operational related information. It is also possible to configure network communication settings, i.e. IP-configuration, to enable access via the local Ethernet LAN.

The graphical user interface is navigated by pressing the soft buttons in the display or by pressing and dragging finger to scroll through lists. Input is done via a virtual keyboard showing when a parameter value field is pressed.

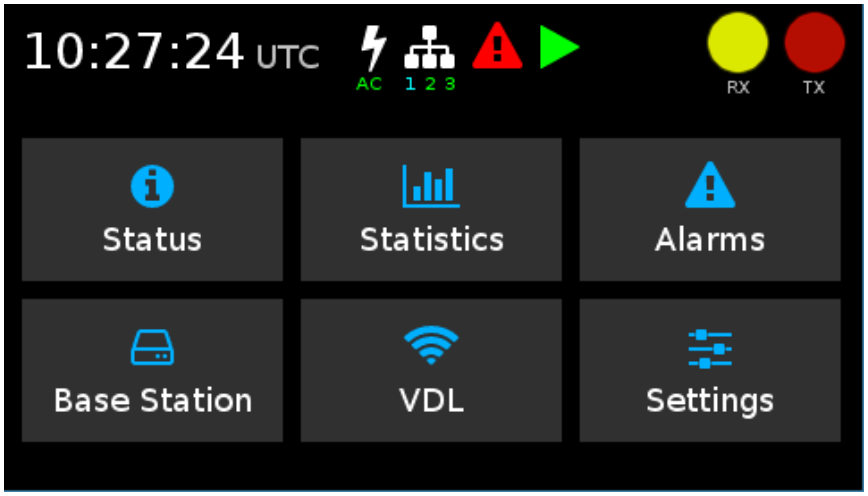


Figure 5-2: Front display main menu

5.2 Configuration and Monitoring Web Interface

The R60 is delivered with an advanced web based configuration and monitoring facility. Examples of operations performed are configuration, upload of new software and monitoring of base station status. The web interface can be used locally connected directly to the R60 or remotely via a TCP/IP network.

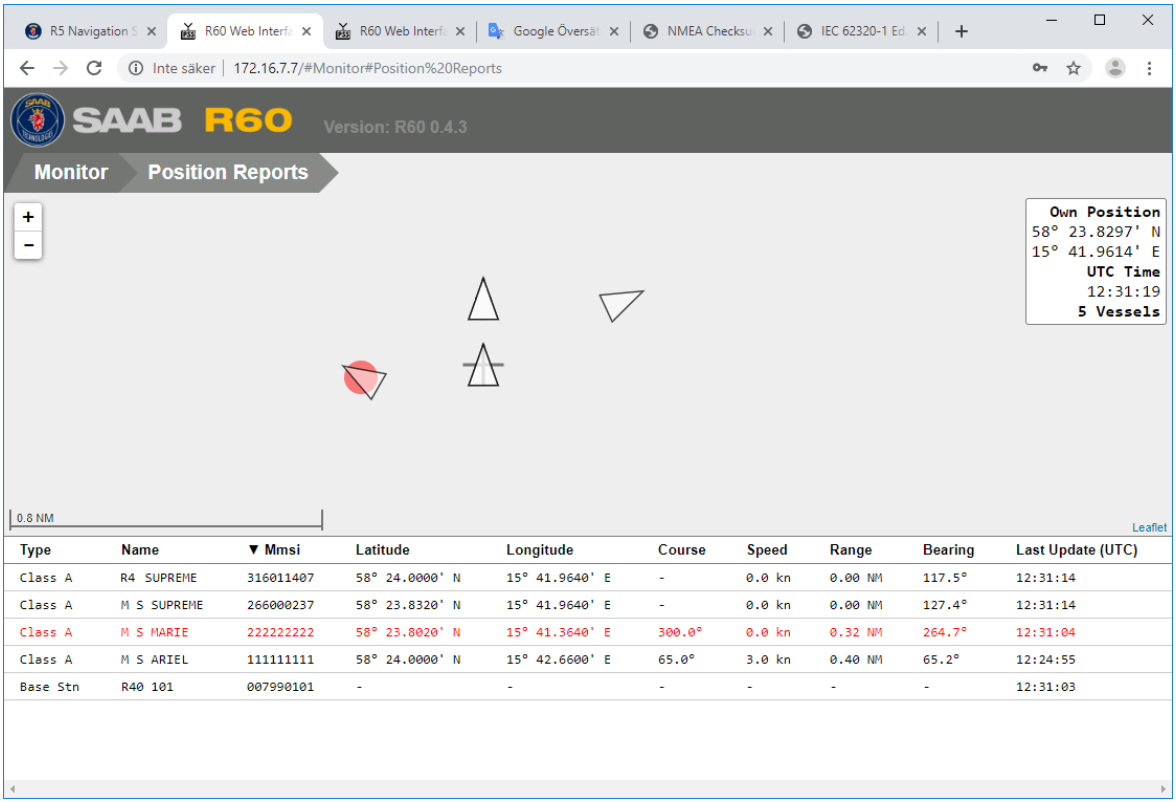


Figure 5-3 Monitoring of position reports

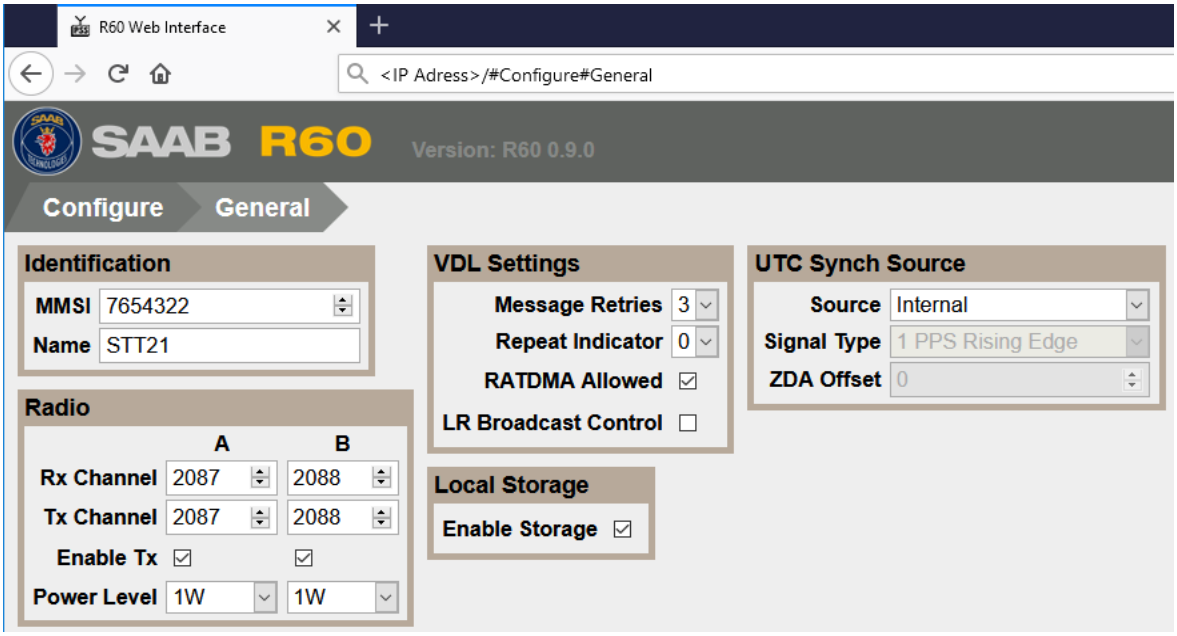


Figure 5-4 Configuration interface

The R60 web interface provides a graphical view of the VDL Link displaying sent/received messages and reservations. The user can select specific slots to view detailed information on which unit is using the slot and the type of message.

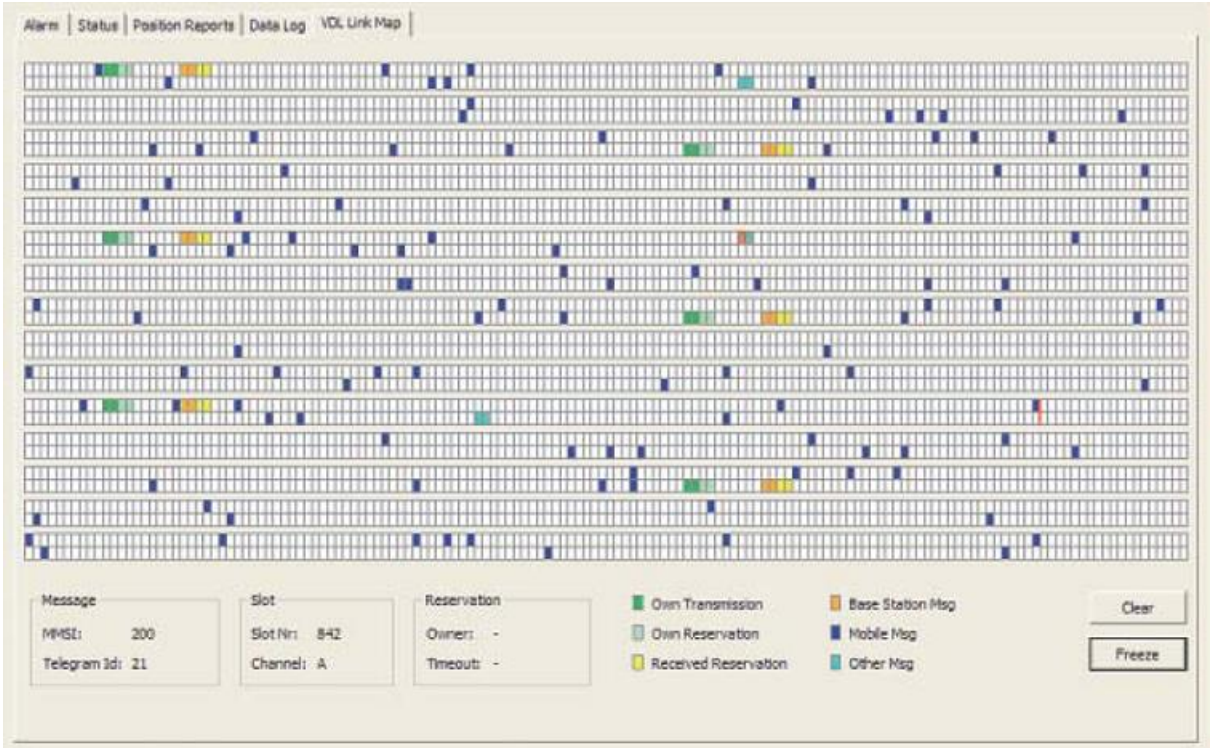


Figure 5-5 Slot map presentation

5.3 R60 Supervisor Web Interface

The R60 is additionally equipped with an Ethernet based service interface which can be accessed via a dedicated Supervisor Port (ETH 3).

This service interface is provided for supervision and configuration of the R60 itself and provides e.g. functions for hard reboot.

Figure 5-6 Supervisor web interface

A typical use case is when a remote site has a need to configure the IP-settings on the Main Ports after network changes or an IT-failure. The Supervisor Port (ETH 3) connected to a separate network provides full control of the Main Port IP-settings in any scenario and minimizes site visits.

The R60 offers an advanced embedded power control module, which supports remote power cycling and activation of a sleep mode.

- The sleep mode extends the operating time significantly for sites where low power consumption is essential. This could e.g. be the case in an emergency situation where only battery back-up is available.

6 VHF Data Exchange System (VDES) Operation

AIS was successfully introduced by the International Maritime Organization (IMO) for maritime navigation in 2002. Since then, virtually all commercial ships have been equipped with AIS worldwide. The expansion of AIS has caused significant load on the capacity of the VHF Data Link (VDL) and today it is frequently overloaded in some busy areas.

The next generation AIS – denoted VHF Data Exchange System (VDES) – will take into consideration the future requirements for more data exchange capabilities by utilizing additional channels in combination with more efficient radio protocols.

Thereby, the AIS radio channels (VHF Data Link VDL) will be better protected from overload as AIS populations increase further.

Nominally VDES channels may provide up to 32 times higher bandwidth compared to AIS channels. The technical architecture of the fully developed VDES system will though be able to provide essentially higher increase in bandwidth in many use cases. In addition, it will also provide satellite to ship two-way communication offering a platform for worldwide point-to-point transmissions via the VDES system.

VDES is in initial operation holds potentials also for being an alternative to significant parts of GMDSS, including NAVTEX, VHF, MF and HF coastal stations over time.

The picture below shows the various communication patterns and frequency channels for shipborne, shore-based and satellite VDES.

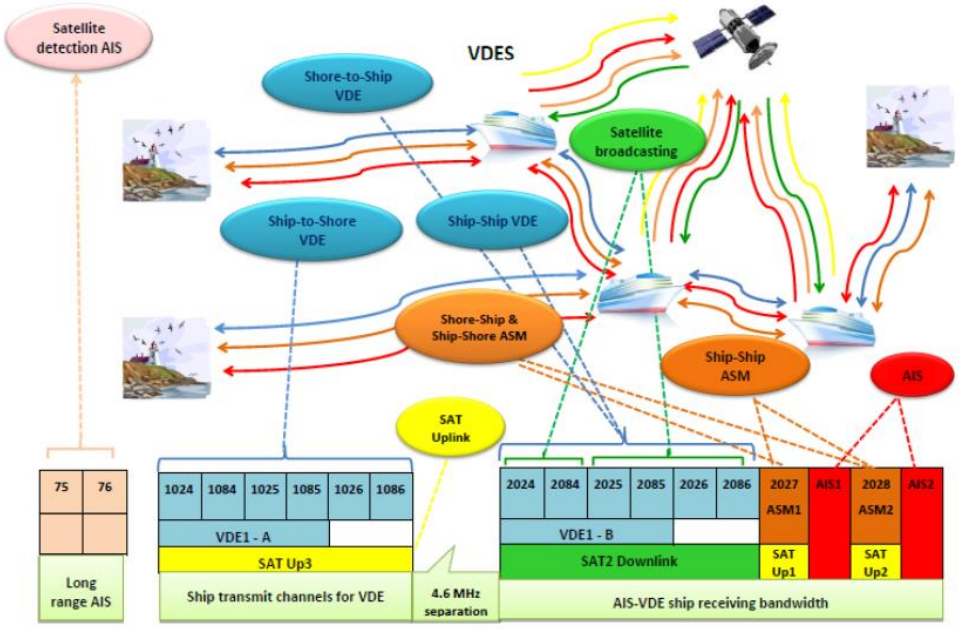


Figure 6-1 VDES functions and frequency use – full system.

6.1 R60 VDES Base Station – Implemented VDE functionality

The VDE operation and VDE interface specifications will change during the standardisation work within IALA and IEC work and will therefore be subject to frequent changes. The currently supported functionality in the R60 is therefore described in a separate document, Ref [4], that will regularly be updated based upon the progress in the standardisation organisations and implementations from Saab.

7 Compliance to international standards and Regulations

The R60 complies with all the relevant international AIS and VDES (ASM) specifications and recommendations as applicable:

- IALA GUIDELINE G1139 THE TECHNICAL SPECIFICATION OF VDES
- ITU VDES recommendation ITU-R M.2092
- IEC 62320-1 Ed.2.0: Maritime navigation and radiocommunication equipment and systems - Automatic identification systems (AIS) - Part 1: R60 Base Stations - Minimum operational and performance requirements, methods of testing and required test results.
- IEC 62320-2 Ed.1: Maritime navigation and radiocommunication equipment and systems - Automatic identification system (AIS) - Part 2: AIS AtoN Stations - Operational and performance requirements, methods of testing and required test results
- IEC 62320-3 Ed 1: Maritime navigation and radiocommunication equipment and systems – Automatic identification systems (AIS) – Part 3: Repeater station – Minimum operational and performance requirements – Methods of test and required test results
- IEC 61993-2: Universal Ship Borne Automatic Identification System (AIS) Operational and Performance Requirements, Methods of Testing and Required Test Results.
- IEC 62287-1 and -2, Maritime navigation and radiocommunication equipment and systems – Class B shipborne equipment of the automatic identification system (AIS)
- IEC 61162-1, Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners
- IEC 61162-2, Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission
- Radio Equipment Directive (RED) -(2014/53/EU)
- Technical Characteristics for a Universal Ship Borne Automatic Identification System Using Time Division Multiple Access in the VHF Maritime Mobile Band, ITU-R M.1371-1, 1371-2, 1371-3, 1371-4 and 1371-5
- ITU Recommendation ITU-R M. 825
- IALA Technical Clarifications of Recommendation ITU-R M.1371-1, 2, 3, 4 and 5

- IALA Guidelines on Universal Shipborne Automatic System (AIS)
- IALA Recommendations A-123, A-124, A-126
- Recommendation on Performance Standards for a Universal Ship Borne Automatic Identification System, IMO Resolution Msc.74 (69) adopted on 12 May 1998
- IMO Recommendation on Performance Standards for a ship-borne AIS, (MSC 74(69) Annex 3)
- IMO SN/Circular 217, SN.1/Circ.236, SN.1/Circ.289
- RoHS III
- EFUP 25 (Environment Friendly Use Period, China RoHS)

8 R60 Functionality Overview

	R60 Versions			
Functionality	**Rx**	**AtoN**	**Std.**	**Full**
Transmission of all types of AIS messages and ASM messages	-	-	X	X
AIS Repeater Function	-	-	-	X
Reception of all types of AIS messages and ASM messages	X	X	X	X
Embedded Base Station Controller (BSC) including Ethernet connection	X	X	X	X
Transceiver using SDR technology	X	X	X	X
Embedded GNSS Receiver	X	X	X	X
Network access using both IPv4 and IPv6	X	X	X	X
Built-in web server for configuration and monitoring	X	X	X	X
SNMP (V1,V2C,V3) support	X	X	X	X
Self Surveyed position support	X	X	X	X
Temperature Monitoring	X	X	X	X
Power Supply Monitoring and Control	X	X	X	X
Fault Detection and Handling	X	X	X	X
Digital Input and Output port	X	X	X	X
Remote Software Upgrade support	X	X	X	X
VSWR Monitoring	-	X	X	X
External RTCM input	-	-	-	X
Hot Standby Support	-	X	X	X
VHF TX Integrity monitoring (Hot Standby Installation Only)	-	-	-	X
Aids to Navigation Functionality (AtoN) msg 21	-	X	-	X
Local Storage of VDL and Status Data	X	-	-	X
DSC Channel Management	-	-	-	X
External UTC Synchronization	-	-	-	X
Third AIS Channel	-	-	-	X
Built-in NTP server	-	-	-	X
AMRD support	-	-	-	X
Long-range reception	-	X	-	X
VDES functionality (Rx or Rx+Tx) *	O	O	O	O

(*) Option to the R60 configuration

9 Technical Specification

DIMENSIONS/WEIGHT

Type	19" Rack-mount 2HU
Height	89 millimetres (3.51")
Width	483 millimetres (19")
Depth	357 millimetres (14.06")
Weight	6 kilograms (13 Lbs)

DATA INTERFACES

RS 232/422 V11	Bit rate up to 115 200 bps
Connector	9-Pin D-sub (male)
TCP/IP Network	3 x Ethernet (TCP, UDP, UDP Multicast)
Connector	RJ45
Simultaneous network connections	≤ 10
Digital Input/output	Via 9-Pin D-sub
1 PPS and IRIG-B 003	Via 9-Pin D-sub

RADIO MODULE

VHF Transmitter	1 W – 12.5 W
Channel Bandwidth	25kHz
Receiver Sensitivity	Better than -118 dBm (AIS) Better than -115 dBm (ASM)
Number of Rx processes	Up to 64 parallel
Frequencies	155 – 163 MHz

STANDARDS

AIS Functionality	IEC 62320-1 IEC 62320-2 R0124 / R0126
Electrical Safety	IEC/UL/EN 62368-1
EMC	FCC/RED 2014/53/EU
Radio	IEC 62320-1/2 RED 2014/53/EU

ENVIRONMENTAL

Temperature	-20°C to +55°C
Humidity	0 – 95 %
MTBF	>100 000 hours

DISPLAY

Colour Display	4.3" WQVGA with touch interface

TEMPERATURE -15°C to +55°C

COOLING

Fan less Design	No forced cooling required

POWER INPUT

DC Input Voltage	12-24 VDC (nominal)
DC Connector	AMP CPC Type III+
AC Input Voltage	100-240 VAC @ 50/60 Hz
AC Connector	IEC 320 connector

REC. FUSE SIZE

DC Input	20 Amp. (T20A 50VDC)
AC Input	3 Amp. (T3A 250 VDC)
Physical size	5x20 millimetres

GNSS RECEIVER

No: channels	>50
Supported system	GPS, Galileo, BeiDou, GLONASS
Sensitivity	Better than -162 dBm
Frequency	L1 (1575 MHz)

VHF ANTENNA 50 Ohm (Type N)

GNSS ANTENNA 50 Ohm (TNC)

Antenna Pre-Amp. feed	5 VDC, ≤40 mA

10 Declarations, Approvals and Certificates

10.1 AIS Base Station Statement of Conformity

BSH · Postfach 30 12 20 · 20305 Hamburg

Saab AB (publ) TransponderTech
Läsblecksgatan 3
58941 Linköping

SWEDEN

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Dienstsitz Hamburg

Konformitätsbestätigung/ Statement of Conformity No.

Nr. BSH/454.AIS Base/Saab R60 VDES Base Station

Datum
22.04.2020
Durchwahl
+ 49 (0) 40 3190 - 7300
Aktenzeichen
(bitte bei Antwort angeben)
Nr. BSH/454.AIS Base/Saab R60 VDES Base Station

Die nautische Ausrüstung **AIS Basisstation**
The nautical equipment ***AIS Base Station***

mit der Typbezeichnung **R60 VDES Base Station**
with the type designation

des Herstellers **Saab AB (publ)**
manufactured by **TransponderTech**
Låsblecksgatan 3
58941 Linköping
SWEDEN

ist nach den folgenden Normen/Standards, soweit für diesen Ausrüstungsgegenstand anwendbar, erfolgreich geprüft worden.
has been tested successfully according to the following standards as applicable for this equipment:

Norm/Standard	Prüfnorm/Test Standard
IMO MSC.74 (69) Annex 3	IEC 61162-1 Ed. 5.0 (2016)[1]
ITU-R M. 1084-5, 2012	IEC 61162-2 Ed.1.0, 1998 [1]
ITU-R M. 1371-5, 2014 [1]	IEC 62320-1 Ed.2.0, 2015

[1] as far as applicable for an AIS base station

Dem Antragsteller wie oben / *as above*
it is hereby confirmed to the applicant

wird die Eignung für den nachstehenden Verwendungszweck bestätigt:
AIS Basisstation
that the equipment is suitable for use as: ***AIS base station***

Bernhard-Nocht-Str. 75
20359 Hamburg
Tel.: + 49 (0) 40 3190 – 0
Fax: + 49 (0) 40 3190 – 5000
posteingang@bsh.de
www.bsh.de

Bankverbindung:
Bundeskasse – Dienstort Kiel –

IBAN:
DE15 2000 0000 0020 0010 66
BIC: MARKDEF1200

Umsatzsteuer-Identifikations-nummer:
DE 511239341

1. Bestandteile der Ausrüstung
Components of the equipment

1.1 Bestandteile, die zum Betrieb erforderlich sind
Components necessary for operation

Component	Type or part number	Remarks
AIS Base Station	R60 VDES Base Station	Software version under test: 0.9.7
GPS antenna	MA-700	Or equivalent
VHF antenna	---	

1.2 Zusätzliche Optionen / Anlagenkombinationen
Additional options / combinations of the equipment

- Independent operation
- External and internal position source
- Support of Edition 1 legacy sentences
- DGNSS RTCM input
- External UTC Sync source

2. Ausnahmen
Exceptions

TAG blocks are implemented only for the network interface.

3. Dokumentation
Documentation

Installation Manual	**Document id: 7000 120-008**
User Manual	**Document id: 7000 120-009**
Test report Base station protocol tests	**Document id: 75947098-1**
Assessment report (Physical radio tests)	**Document id: F190480E1**
Saab R60 - EMC reports	**Document id: F190480E2**
Environmental report	**Document id: U190480E1**
Environmental report	**Document id: U200305E1**
Safety report	**Document id: S190480E1**

Im Auftrag
For the Federal Maritime and Hydrographic Agency

Doreen Thoma

10.2 Module B Certificate

PHOENIX TESTLAB

EU-TYPE EXAMINATION (MODULE B) CERTIFICATE

Radio Equipment Directive (RED) 2014/53/EU

PHOENIX TESTLAB
Notified Body Number 0700

Recognised by Bundesnetzagentur

BNetzA-bS-02/51-55

This is to certify that:
PHOENIX TESTLAB did undertake the relevant type examination procedures for the radio equipment identified below which was found to be in compliance with the essential requirements of Radio Equipment Directive (RED) 2014/53/EU subject to any conditions in the annex attached hereto.

Certificate No.	19-112199
Manufacturer	Saab AB (publ) TransponderTech
Address	Låsblecksgatan 3 589 41 Linköping SWEDEN
Product Description	VDES Base Station, AIS Base Station
Brand Name / Model Name	Saab / R60

The radio equipment meets the following essential requirements

Article 3.1 a): Health and Safety	**Conform**
Article 3.1 b): Electromagnetic Compatibility	**Conform**
Article 3.2: Effective and Efficient Use of Radio Spectrum	**Conform**
Additional Essential Requirements:	
Article 3.3 g) Access to emergency services	**Conform**

Date of issue:	**2020-05-05**	Expiry date:	**2025-05-04**

This certificate remains valid unless cancelled or revoked, provided the conditions in the attached annex are complied with. The conditions for the validity of this certificate are listed in the Annex.

The attached Annex forms part of this certificate. This certificate consists of 3 pages.

BENANNTE STELLE PHOENIX TESTLAB NOTIFIED BODY

Signed by Klaus Knörig
Notified Body

Phone +49(0)5235-9500-24
Fax +49(0)5235-9500-28
notifiedbody@phoenix-testlab.de

PHOENIX TESTLAB GmbH
Königswinkel 10
D-32825 Blomberg, Germany
www.phoenix-testlab.de

Annex

Technical description

Frequency Range	156.025 MHz to 162.025 MHz
Transmit Power	1.0 W / 30 dBm (low power) 12.5 W / 41 dBm (high power)
Operational Temperature Range	-20°C to +55°C
Hardware Version	7000 120-100
Software Version	1.x.x

System Components

AIS Base Station	R60 VDES Base Station

Optional Components

GNSS Antenna	External
VHF Antenna	External

Approval documentation

Technical Documentation	Block Diagram, Circuit Diagram, PCB Layout, Parts Placement, Parts List
External / Internal Photos	Contained in Test Reports
Instruction Manual	Saab AB (publ.) TransponderTech R60 VDES Base Station User Manual
Operational Description	Operational Description R60 for FCC and RED
EU Declaration of Conformity	Draft EU Declaration of Conformity R60 Base Station
Explanation of compliance Article 10(2) and Article 10(10)	Declaration in User Manual, R60 Spectrum License Label
Risk Assessment	R60 Safety Assessment, RF Exposure Calculation according to Council Recommendation 1999/519/EC

Applied Standards and Test Reports

Specification	Laboratory	Test Report Number / Version
EN 62368-1:2014 +AC:2015 + A11:2017	PHOENIX TESTLAB	S190480E1
EN 301 489-1 V2.1.1 EN 301 489-1 V2.2.0	PHOENIX TESTLAB	F190480E2
IEC 62320-1 Ed. 2.0 (2015)	PHOENIX TESTLAB	F190480E1
IEC 62320-1 Ed. 2.0 (2015)	TÜV SÜD	Document 75947098-01, Issue 02

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EU-TYPE EXAMINATION CERTIFICATE No. 19-112199 Page 3 of 3
Date 2020-05-05

Applied Standards and Test Reports

Specification	Laboratory	Test Report Number / Version
IMO MSC.74 (69) Annex 3 ITU-R M.1084-5, 2012 ITU-R M.1371-5, 2014 IEC 61162-1 Ed. 5.0 (2016) IEC 61162-2 Ed. 1.0, 1998 IEC 62320-1 Ed. 2.0, 2015	BSH	Statement of Conformity BSH/454.AIS Base/Saab R60 VDES Base Station
DIN EN 60945 Ed. 4.0 (2003-07), IEC 60945 Ed. 4.0 (2002) incl. Corr. 1 (2008)	PHOENIX TESTLAB	U190480E1, U200305E1

Application / Limitation

The Saab R60 is approved as an AIS Base Station. The position source shall be "surveyed position".

Notes

1. This certificate will not be valid if the manufacturer makes any changes or modifications to the approved equipment, which have not been notified to, and agreed with PHOENIX TESTLAB.

2. Should the specified regulations or standards be amended during the validity of this certificate, the product(s) is/are to be re-approved prior to it/them being placed on the market.

3. The manufacturer shall take all measures necessary so that the manufacturing process and its monitoring ensure conformity of the manufactured radio equipment with the approved type described in the EU-type examination certificate and with the requirements of Directive 2014/53/EU that apply to it.

4. CE The manufacturer shall affix the CE marking to each item of radio equipment that is in conformity with the type described in the EU-type examination certificate and satisfies the applicable requirements of the Directive.

5. The manufacturer shall draw up a written EU declaration of conformity for each radio equipment type and keep it at the disposal of the national authorities for 10 years after the radio equipment has been placed on the market. The EU declaration of conformity shall identify the radio equipment type for which it has been drawn up. A copy of the EU declaration of conformity shall be made available to the relevant authorities upon request.

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10.3 REACH and RoHS declaration

7000 120-073,A

R60 VDES Base Station/OSNT R60 VDES Base Station Compliance statement REACH and RoHS

Product No. 7000 120-100
7000 120-320

We hereby confirm that the R60 VDES Base Station HW, P/N 7000 120-100, and the OSNT VDES Base Station HW, P/N 7000 120-320 is in compliance with Regulation EC No 1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) and of the 2011/65/EU Directive of the European Parliament and of the Council on the use of certain hazardous substances in electrical and in electronic equipment (RoHS), including Amendment (EU) 2015/863, as follows:

The hardware structural assembly and all electrical components included in the product are REACH/RoHS compliant.

- The product does not contain any banned substances (Annex XIV to REACH)

- Some electrical components have been identified to contain more than 0,1% weight content of Lead (CAS number 7439-92-1) which is a Substance of Very High Concern and has been included on the REACH Candidates list for eventual inclusion to Annex XIV. The total amount used of the substance in Saab AB (publ) TransponderTech products does not exceed the limit of 1 ton/year. Lead has been included on the Candidates list because of toxicity for reproduction.

- The components containing Lead are compliant with RoHS via exemptions.

This information is based in reasonable inquiry of our suppliers and represents our current actual knowledge on the information they provided. This information may be subject to change. It is the Saab policy to avoid, where possible, using substances on the SVHC list in our products.

Linköping, 2019-12-11
Place and Date

Signed for and on behalf of Saab

Product Area Owner
Title

Johanna Gustafsson
Clarification of signature

Saab AB (publ)
TransponderTech

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Company Identity no. 556036-0793

11 Abbreviations

AC	Alternate Current
AIS	Automatic Identification System
ASM	Application Specific Messaging (on additional channels)
AtoN	Aids to Navigation
bps	Bits Per Second
BSC	Base Station Controller
COG	Course Over Ground
CRC	Cyclic Redundancy Check
DAC	Designated Area Code
DC	Direct Current
DGNSS	Differential Global Navigation Satellite System
DIO	*Digital Input/output*
DSC	Digital Selective Calling
EPFS	Electronic Position Fixing Device
FI	Function Identifier
Frame	One UTC minute on the AIS TDMA link, this is divided into 2250 slots.
FSI	*Frequency Set Information*
FSR	Frame Summary of AIS Reception
GLONASS	Global Navigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GUI	Graphical User Interface
HW	Hardware
HS	Hot Standby
IEC	International Electro-technical Commission
IP	Internet Protocol
ITDMA	Incremantal Time-Division Multiple Access

LED	Light Emitting Diode
MIB	Management Information Base
MMSI	Maritime Mobile Service Identity
N/A	Not Applicable
NM	Nautical Miles
NMEA	National Marine Electronics Association
NTP	Network Time Protocol
NWK	*Network*
P/N	Part Number
PSS	Physical Shore Station
RACON	Radar Beacon
RAIM	Receiver Autonomous Integrity Monitoring
RATDMA	Random Access Time Division Multiple Access. The way unscheduled messages are handled by a base station or transponder.
RGB	Red Green Blue
RTCM	Radio Technical Commission for Maritime Services
Rx	Receive
SAR	Search and Rescue
SART	Search and Rescue Transmitter
SNMP	Simple Network Management Protocol
SOG	Speed Over Ground
SOTDMA	Self-Organized Time-Division Multiple Access
SW	Software
TAG	Transport, Annotate and Group. Message blocks used together with NMEA sentences
TBS	TAG block configuration, accepted sources
TCP	Transmission Control Protocol
Tx	Transmit
UTC	Universal Time Co-ordinated
VDES	VHF Data Exchange System

VDL	VHF Data Link
VDM	VHF Data Link Message
VDO	VHF Data Link Own-vessel Message
VHF	Very High Frequency – Frequencies in the range: 3 – 300 MHz
VSI	VDL Signal Information
VSWR	Voltage Standing Wave Ratio