Kongsberg Seatex AS

VDE-SAT Applications and Services Platform (VASP)

Vessel Installation

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CHANGE RECORDS

ISSUE	DATE	CHANGE DESCRIPTION Also specify pages and paragraphs affected and reason for change	AUTHOR
1A	04.01.2021	Created document based on VDESatDemo-KSX-RS-037	ANB
1B	18.02.2021	Review	ANB
1C	02.03.2021	Added example images of installation in section 3	ANB

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1. INTRODUCTION

The VHF Data Exchange System (VDES), also referred to as the next generation of the Automatic Identification System (AIS), has been under development [RD1, RD3] the last years and is now entering the deployment phase.

The VDE-SAT Applications and Services Platform (VASP) project, sponsored by the European Space Agency (ESA), is carried out by a Norwegian consortium led by Space Norway with Kongsberg Seatex (KSX), the Norwegian Coastal Administration (NCA) and European Maritime Safety Agency (EMSA) as partners.

The objective of the test campaign is to demonstrate three VDES services:

1. Ice chart distribution
2. Search and rescue service
3. Mandatory reporting system service

The signals will be transmitted and received from a VDE-SAT transceiver on-board the Norwegian NorSat-2 satellite. Kongsberg Seatex is the manufacturer of the satellite transmitter as well as the ship terminal described in this document.

1.1 Purpose and Scope of the document

The purpose of this document is to present the vessel installation for the VDES ship terminal that will be used in the VASP test campaign.

1.2 Change forecast

None.

1.3 References

1.3.1 Applicable Documents

None.

1.3.2 Reference Documents

Acronym	Title	Reference
RD1	*Technical characteristics for a VHF data exchange system in the VHF maritime mobile band*, ITU, 2015	M.2092-0
RD2	*Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*, IEC, 2002	IEC 60945:2002
RD3	*IALA Guideline G1139, The Technical Specification of VDES, 2019*	G1139 Ed. 3

1.4 Acronyms, Abbreviations, and Definitions

This section includes the acronyms, abbreviations and definitions used in this document.

AIS	Automatic Identification System
COTS	Commercial Off The Shelf
EMSA	European Maritime Safety Agency
ESA	European Space Agency
GNSS	Global Navigation Satellite System
KSX	Kongsberg Seatex
NCA	Norwegian Coastal Administration
NA	Not Applicable
RHCP	Right-hand Circular Polarization
SPN	Space Norway
TBC	To Be Confirmed
TBD	To Be Decided
VASP	VDE-SAT Applications and Services Platform
VDES	VHF Data Exchange System
VHF	Very High Frequency

2. SHIP TERMINAL

The VDES 300 ship terminal unit is shown in Figure 2-1 .

Figure 2-1: Mechanics for the terminal

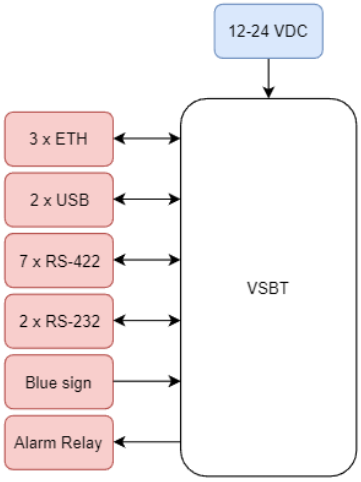

Figure 2-2: Interfaces

The terminal is featuring the following external data interfaces:

- 2 x 10/100/1000 Mbps Ethernet for interface with ship bridge systems and optionally connecting multiple terminals
- 1 x 10/100 Mbps Ethernet for interface with ship bridge systems
- 7 x RS-422 for interface with ship bridge system and sensors
- 2 x RS-232 for debug and time reference
- 1 x USB host for software/firmware update
- 1 x Alarm relay output
- 1 x Blue sign switch interface for inland waterways

And the following RF interfaces:

- 1 x N connector to VHF antenna
- 1 x TNC connector to GNSS antenna

A diagram of the interfaces can be seen in **Figure 2-2**. The design has multiple RS-232/RS-422 I/O's and LEDs for system status. Note that some of the interfaces are only available internally in the terminal enclosure. Three Ethernet ports are provided for connection to multiple vessel networks for increased reliability. The backplane connectors organization is provided in Figure 2-3.

Figure 2-3: Terminal connectors backplane

3. VESSEL INSTALLATION

The ship installation consists of a Kongsberg Seatex VDES 300 transceiver connected to a VHF antenna, an active GNSS antenna and a laptop computer. A cellular 4G modem and 4G antenna is also included for remote connectivity. All equipment is connected to a power distribution unit (PDU) with Ethernet connection that can remotely turn off the power.

The laptop computer is responsible for user interface. A block chart of the generic ship equipment installation is shown in Figure 3-1. Note that some variation between the vessels is expected, due to deviations in the installation environment.

The laptop computer is a commercial-of-the-shelf (COTS) unit running Microsoft Windows as the operating system. The laptop is installed on the bridge, for easy access by the vessel crew. Ethernet connection to the terminal is used. Depending on terminal installation location, fiber extenders might be used if available for use on the vessel. The ship installation can be reached externally by a 4G modem for remote configuration and status monitoring.

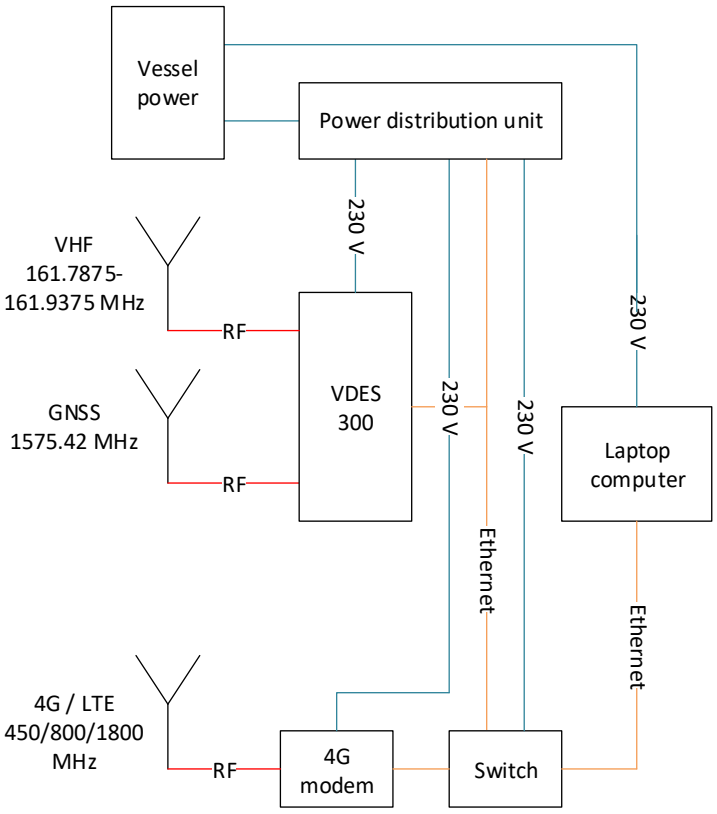

Figure 3-1: Block chart of VASP ship equipment installation

For the vessel installations the baseline option is to mount the equipment internally on the vessel in a technical room or similar (Figure 3-3). If that is not possible, the equipment will be installed in a waterproof box on the vessel deck as shown in Figure 3-2.

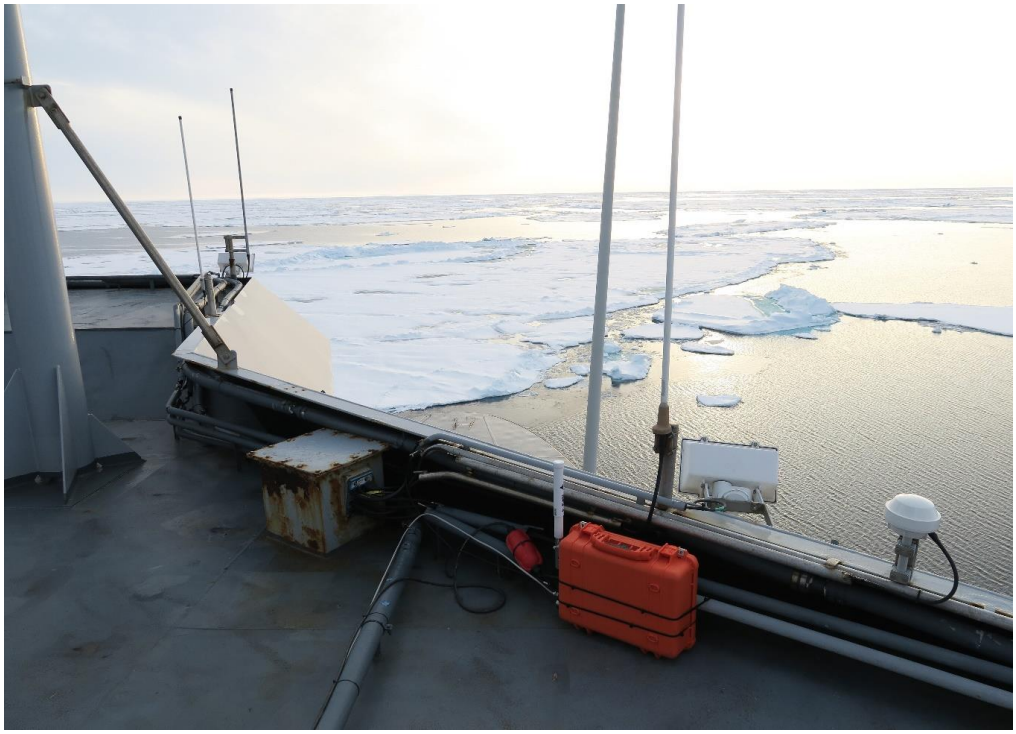

Figure 3-2: Equipment mounted in waterproof box on vessel deck

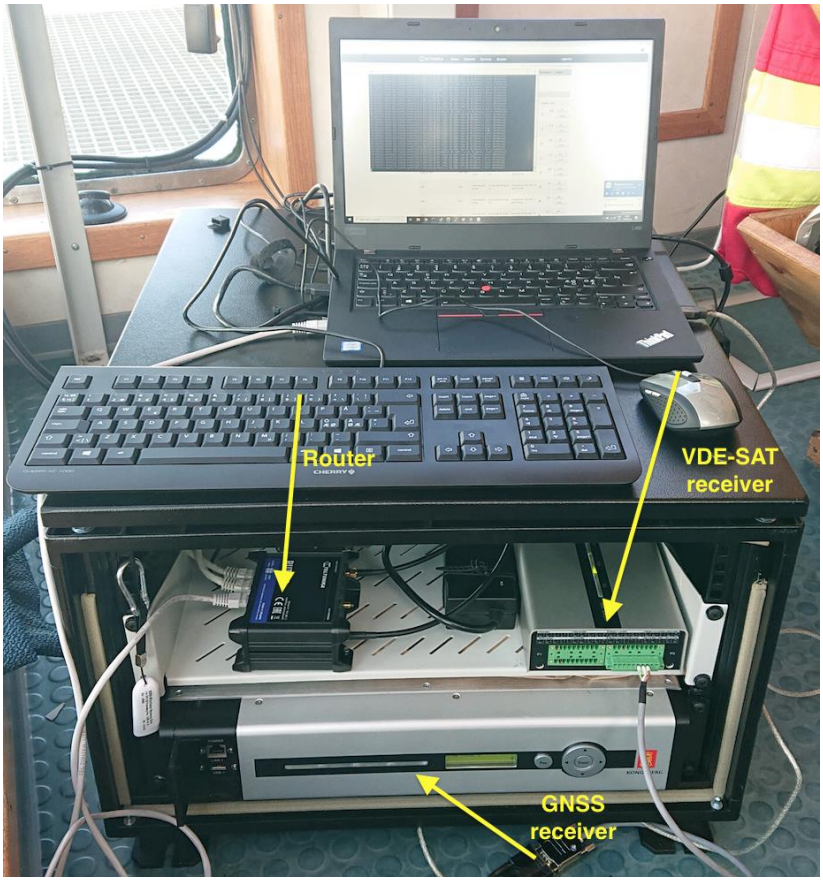

Figure 3-3: Example installation of equipment in small rack (image courtesy SPN)

3.1 Requirements

3.1.1 GNSS antenna

An antenna with the parameters Table 3-1 will be used for the vessel installation

Table 3-1: GNSS antenna parameters

Parameter	Value
Model	Procom GPS 4
Height	23 cm
Weight	150 g
Connector	FME male
Mounting	Vertical on pipe, as shown in Figure 3-4

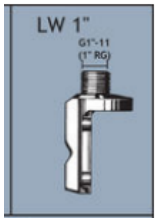

Figure 3-4: **Mounting bracket for Procom GPS 4 antenna**

If the vessel has a GNSS distribution system, the ship terminal can also use this as the GNSS signal source.

3.1.2 VHF antenna

An antenna with the parameters shown in Table 3-2 will be used. The radiation pattern is shown in Figure 3-6.

Table 3-2: VHF antenna parameters

Parameter	Value
Model	AV7M
Height	1.25 m
Connector interface	Female N connector
Mounting	Attached to a mast or tube using the supplied M6 stainless steel U-bolts. The mounting tube can be horizontal or vertical. See Figure 3-5.

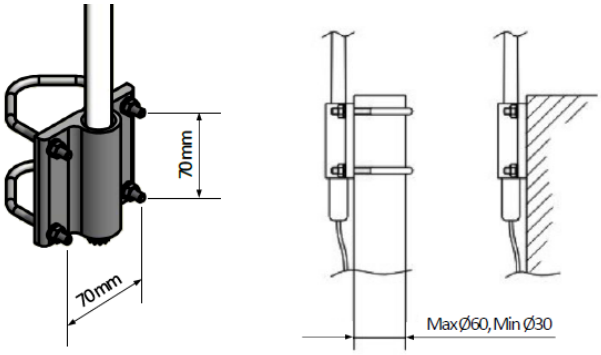

Figure 3-5: VHF antenna mounting

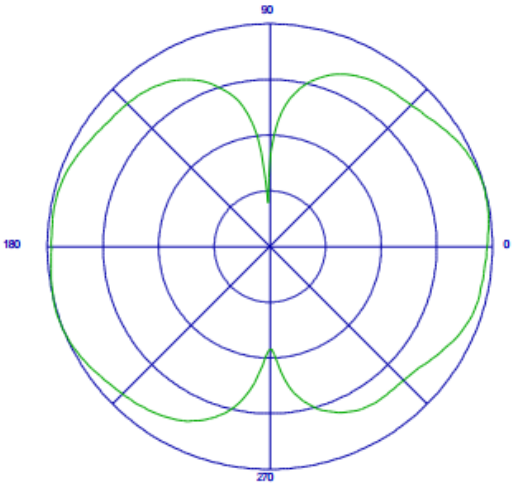

Figure 3-6: VHF antenna radiation pattern

3.1.3 4G antenna

A 4G antenna with the parameters shown in Table 3-3 will be used for the remote access.

Table 3-3: 4G antenna parameters

Parameter	Value
Model	OMNI-402 4g
Height	75 cm
Gain	410-470 MHz, 0.8 dBi max. 690-960 MHz, 2.1 dBi max. 1710-2170 MHz, 6.1 dBi max. 2300-2700 MHz, 6.2 dBi max.

Connector interface	SMA male
Mounting	Attached to a mast or tube using the supplied stainless steel U-bolts. The mounting tube can be horizontal or vertical.

3.1.4 Cables

Cables of the following type will be used for the installation:

Parameter	Value
Cable VHF	RG214: max 30 meters ½" superflex: max 50 meters Cable type is dependent on the required cable run
Cable GNSS	RG214: max 50 meters

3.1.5 Power

Power is delivered to the equipment through a power distribution unit (PDU) with Ethernet access. The power consumption of the ship terminal is as follows:

Parameter	Value
Voltage	12-24 VDC provided by AC/DC converter
Interface	2 pins Phoenix connector
Power consumption	16 W (average) 72W (peak)

3.1.6 Mounting

The ship terminal can be mounted on DIN rail (Figure 3-8), on a wall (Figure 3-7) or in a 19" rack on a shelf. It is desirable to mount the equipment in a technical room or similar that is close to the antennas, to limit the cable runs. In case it is not possible to mount the equipment indoor on the vessel, it will be mounted outside in a waterproof box.

The laptop computer is mounted on the vessel bridge for easy access by the crew. It is used for the reporting services and showing received ice charts on the screen.

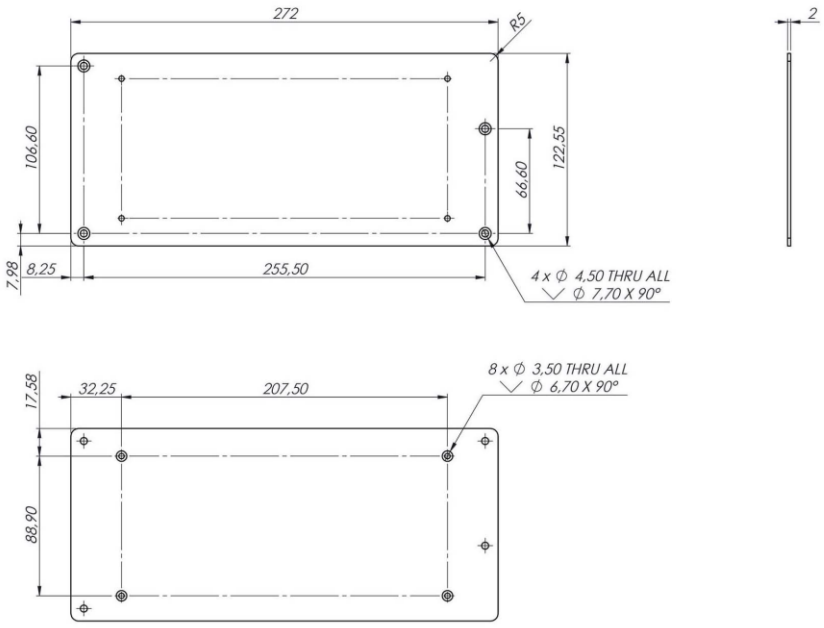

Figure 3-7: Bracket for wall mounting

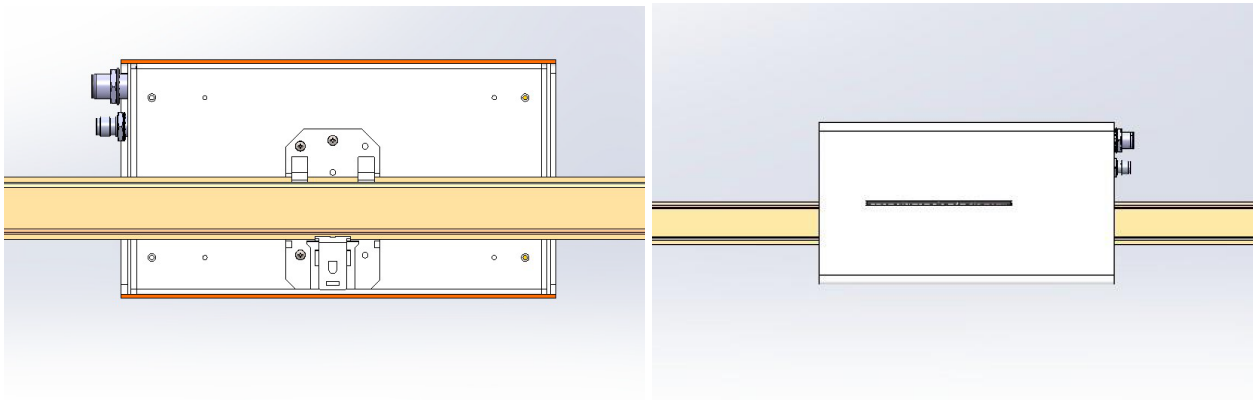

Figure 3-8: DIN rail mounting bracket

3.1.7 Network

Ethernet network connectivity is needed between the bridge and the ship terminal installation site. Dependent on the vessel constraints, this can be done by twisted pair copper or fibre optic cables. If none of those are an option, wireless connectivity will be considered.

3.2 Radio Frequencies

3.2.1 GNSS Receiver

Frequency L1, 1575.42 MHz

3.2.2 VHF Receiver

Frequency 161.8125 to 161.9125 MHz

3.2.3 VHF Transmitter

Frequency 157.2125 to 157.3125 or 161.8125 to 161.9125 MHz

3.2.4 4G

Frequency Bands at 800, 900, 1800, 2100 and 2600 MHz (as available)

Technology LTE