# Test Report
# for
# VDES/MMS Integration

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# 1. General

## 1.1. Scope and Executive Summary

This Test Report is used for integration of MMS and VDES equipment, including end-to-end testing of a real S-124 Navigational Warning service.

Execution and Documentation of test results in this template documents the successful integration of MMS and VDES equipment.

The <yellow> marked text areas are to be adapted to the actual used conditions & equipment in the test. Users of the template are highly welcome to amend all other text to match the actual test.

All blue *italic text* are just explanations on how to use the document; they should be removed before submission/storage of the document.

Any improvements to this document, please send to admininstration@vdes-alliance.org.

## 1.2. Thanks

The VDES Alliance thanks AiVeNautics and the VOOST project for giving a project related test specification to the VDES Alliance for making it a generic document.

## 1.3. Revision Information

| Date | Version | Author [email] | Change |
| --- | --- | --- | --- |
| 2025-08-12 | Draft 1 | sp@albatros-tech.eu | 1st version |
| 2026-05-06 | Draft 2 | sp@albatros-tech.eu | Removing all company names except for examples. |
| 2026-05-22 | Draft 3 | hiwatanabe@toyoshingo.co.jp | Updated to include: 1) SECOM terminal, 2) MMS discovery process |
| 2026-09-07 | 1.0 | administration@vdes-alliance.org | Approval by the board. Final editorial edits. |

## 1.4. Glossary

| | |
| --- | --- |
| VDES | VHF Data Exchange System |
| MCP | Maritime Connectivity Platform, see https://maritimeconnectivity.net |
| MCP-PD | MCP Public Demonstrator, a platform of MSR and MIR publicly available for tests |
| MIR | Maritime Identity Registry, see https://maritimeconnectivity.net/mcp-documents#MIR |
| MMS | Maritime Messaging Service (an upcoming maritime communication standard by the MCP and RTCM, initially thought out by the EfficienSea Project), see also [MMS] |
| MSR | Maritime Service Registry, see https://maritimeconnectivity.net/mcp-documents#MSR |
| ODI | Open Digital Incubator (an initiative by MCP and IALA) |
| OSS | Open Source Software |
| PKI | Public Key Infrastructure, providing cybersecure cryptographic identities |
| S-124 | Navigational Warnings in the IHO S-100 Framework, see https://iho.int/en/s-100-based-product-specifications |

## 1.5. References

[G-VDES-M] IALA Guideline on VDES measurements G1193

[MMS] MMS Standard RTCM 13900.0

[SECOM] IEC63173-2 ED2 Maritime navigation and radiocommunication equipment and systems - Data interfaces - Part 2: Secure communication between ship and shore (SECOM)

[Niord] Open Source Nautical Information Directory, see https://niord.org

[VDES] ITU Recommendation ITU-R M.2092-2, Technical characteristics for a VHF data exchange system in the VHF maritime mobile band

## 2. Motivation

S-100 as data structure for maritime data exchange is adopted by IMO as of MSC.1/Circ. 1595 and IMO adopted the introduction of S-100 in its MSC 106 session leading to resolution MSC.530(106) which among others asks for implementation of the IHO's S-100 standard.

The demonstrated architecture uses [SECOM] as service interface, because the MCC work with ODI showed that [SECOM] has a high adoption rate by maritime administrations, i.e. Korea, Japan, Australia, Sweden, Denmark, Finland and Canada are actively driving S-100 over SECOM. Most administrations use the open-source [Niord] platform, and the MCP public demonstrator (MCP-PD) MIR as PKI.

For the transport of S-100 over VDES, the [MMS] is chosen, because it is developed by the MCP Consortium, IALA and RTCM to integrate with the MCP authentication and trust schemes and supports seamless transport over different carriers, IP- and non-IP based to support interoperability between many applications and ships in the future, without excluding some transports, nations or ship types, allowing great scalability.

## 3. System Overview

The deployed system overview is shown in Figure 1.

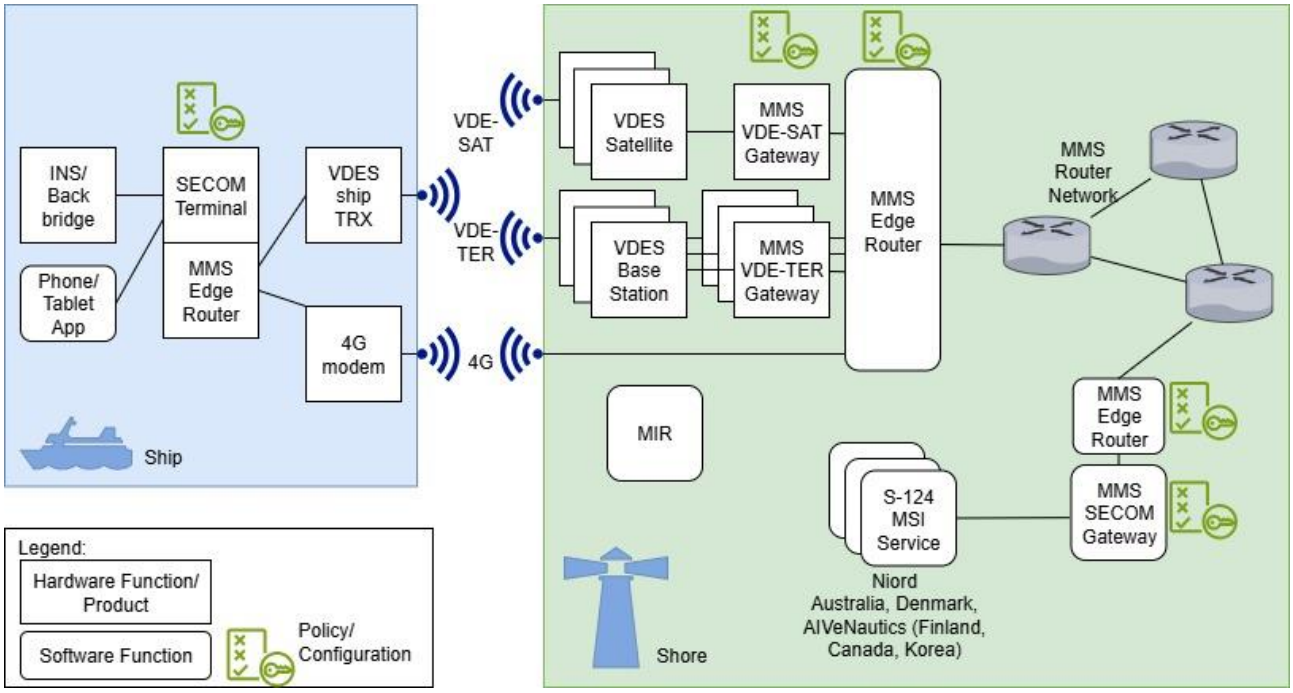


*Figure 1 Overview over the Phase 1 VDES/MMS Test bed, company names and locations are examples. The architecture also shows VDE-SAT, for which test cases may be added later to this document.*

Identified subsystems are shown in Table 1.

| **Subsystem** | **Description** | **Chosen Equipment/Operator/software & hardware version, serial numbers** |
| --- | --- | --- |

| | | |
|---|---|---|
| S-124 MSI Service | Service platform provided navigational warnings in S-124 | <available as Open Source, or existing deployments can be used, e.g. Danmark, Finland, Australia, Korea, etc.> |
| MMS-SECOM Gateway | ODI [SECOM] service consumer as of [MMS] Appendix I Consuming SECOM services for S-124 navigational warnings, connecting them to MMS. | <e.g. AIVeNautics MMS-SECOM Gateway> |
| MMS Edge Router | Interfacing the MMS Router Network with<br>(a) the SECOM Gateway,<br>(b) the VDE-TER Gateway, and<br>(c) any IP clients that connect over internet, e.g. 4G | <e.g. MCP Consortium Open Source> |
| VDE-TER Gateway | MMS VDE-TER Gateway to bridge MMS over VDES from shore to ship according to [MMS] Appendix C | <e.g. Sternula MMS Proxy Shore> |
| VDES Base Station | implements ITU-R M.2092-2 | <e.g. FLIR TransponderTech R60, CML VDES 1000> |
| VDES ship TRX | VDES Ship Transceiver that implements ITU-R M.2092-2 | <e.g. FLIR TransponderTech R6, CML VDES 1000> |
| Ship 4G modem | Ship grade outdoor 4G antenna with modem to access 3GPP standardized mobile internet. | <e.g. Sternula ADU> |
| Ship Edge Router | Ship grade MMS Edge Router<br>supporting VDE-TER according to [MMS] Appendix C | <e.g. Sternula MMS Proxy Ship> |
| INS/Back Bridge Display Application | Navigational warnings Display of S-124 dataset. | <Can be done by using OpenCPN with an Open Source SECOM Terminal> |
| SECOM Terminal | Endpoint between the shore SECOM interface and the shipborne equipment (e.g. Display Application), as per [SECOM] Chapter 11. | < Open Source version of SECOM Terminal with an MMS-Agent built-in expected in the future> |
| MIR | Maritime Identity Registry | <Can be Open Source version of MIR by MCP Public Demonstrator> |
| MMS Router Network | MMS Routers, connected according to [MMS]. | <Can be Open Source version of MCP, or commercial by Sternula or AIVeNautics > |

*Table 1 Components of the test system.*

The identified terms used in the descriptions are shown in Figure 2.

# 4. Test Scenarios

## 4.1. Scenario 1: Shore to Ship broadcast via 4G

Reference: Figure 1 Overview over the Phase 1 VDES/MMS Test bed

Involved subsystems: see *Figure 2*, the red crossed systems are not relevant for this test.

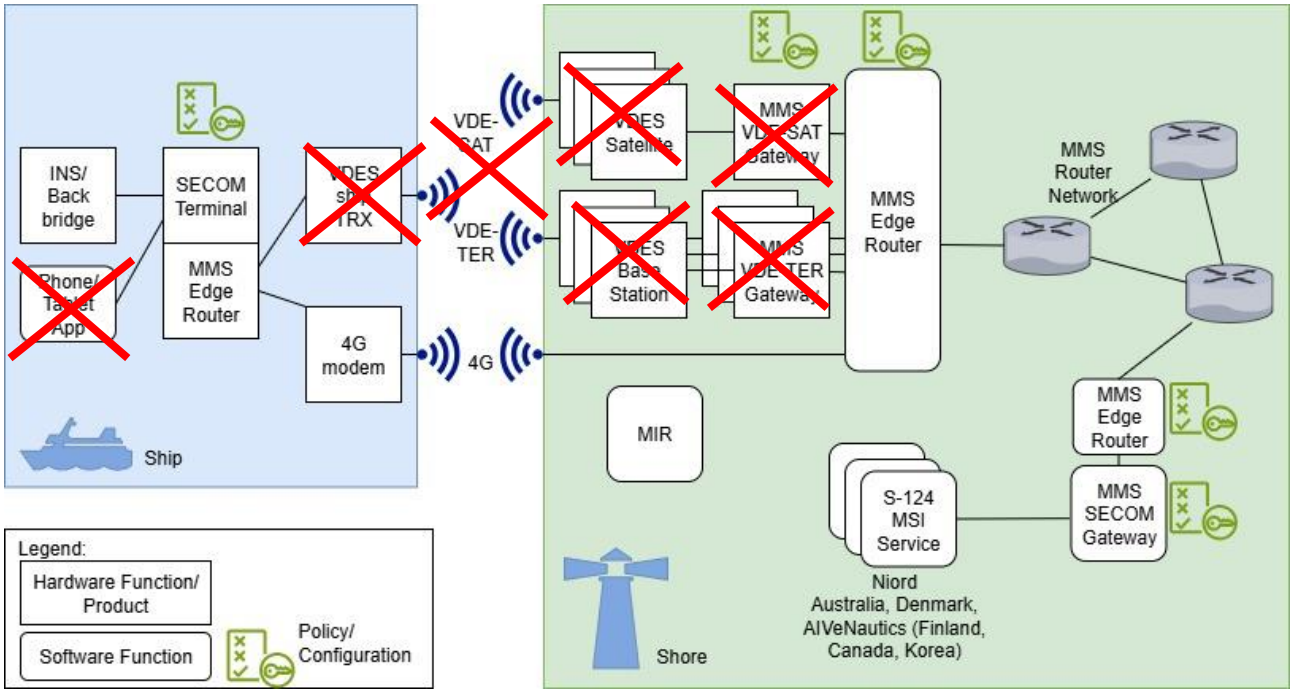


*Figure 2 Shore to Ship broadcast via 4G, involved subsystems*

### 4.1.1. Purpose

The purpose of this test is to verify that the SECOM Service, SECOM Gateway, and the MMS system components are properly integrated and can deliver data over an 4G internet connection to the <Chart Display> application.

### 4.1.2. Test Log

The test was executed on the <DATE> at <location>.

Following preparations were taken:

(a) The VDES ship equipment was disconnected from the ship side Edge Router.

(b) It was verified that the 4G modem was connected to the ship side Edge Router.

(c) The ship side equipment was powered on.

(d) The MMS Edge routers were initialized with maritime identities registered in the MIR.

(e) The MMS-SECOM Gateway was initialized to pull the list of active navigational warnings from the <Australian> S-124 service in 5-minute intervals and send them to the MMS router network.

(f) The SECOM Terminal was initiated with its built-in MMS-Agent. The MMS Agent was connected to the Ship side Edge Router (and authenticated by the Edge Router)

(g) The INS/Backbridge display Application was started, and it was verified that the INS/Backbridge display application did not show any previously downloaded data (<Australian> map is free from S-124 data).

(h) The INS/Backbridge display application subscribed to the S-124 navigational warning service via SECOM Terminal[1].

[1] The shipborne equipment uses binary file transfer with a metadata file (ref: [SECOM] Chapter 11). Verification of SECOM protocol is done apart from this VDES/MMS test.

(i) Wait maximum 5 minutes to allow for the updated display.

The following results were observed:

(j) The INS/Backbridge display Application's subscribe can be verified in logs of the ship side edge router and the shore side edge router, and the Router Network.

(k) The currently active navigational warnings from <Australia> were received and displayed on the INS/Backbridge display application.

(l) The displayed navigational warnings were compared to the ones seen on the S-124 platform and found to be identical.

Based on the above observations, the test was deemed to be successful. <**[PASS]|[FAIL]**>

## 4.2. Scenario 2: Shore to Ship via terrestrial VDES (VDE-TER)

Reference: Figure 1 Overview over the Phase 1 VDES/MMS Test bed.

Involved subsystems: see *Figure 3*, the red crossed systems are not relevant for this test.

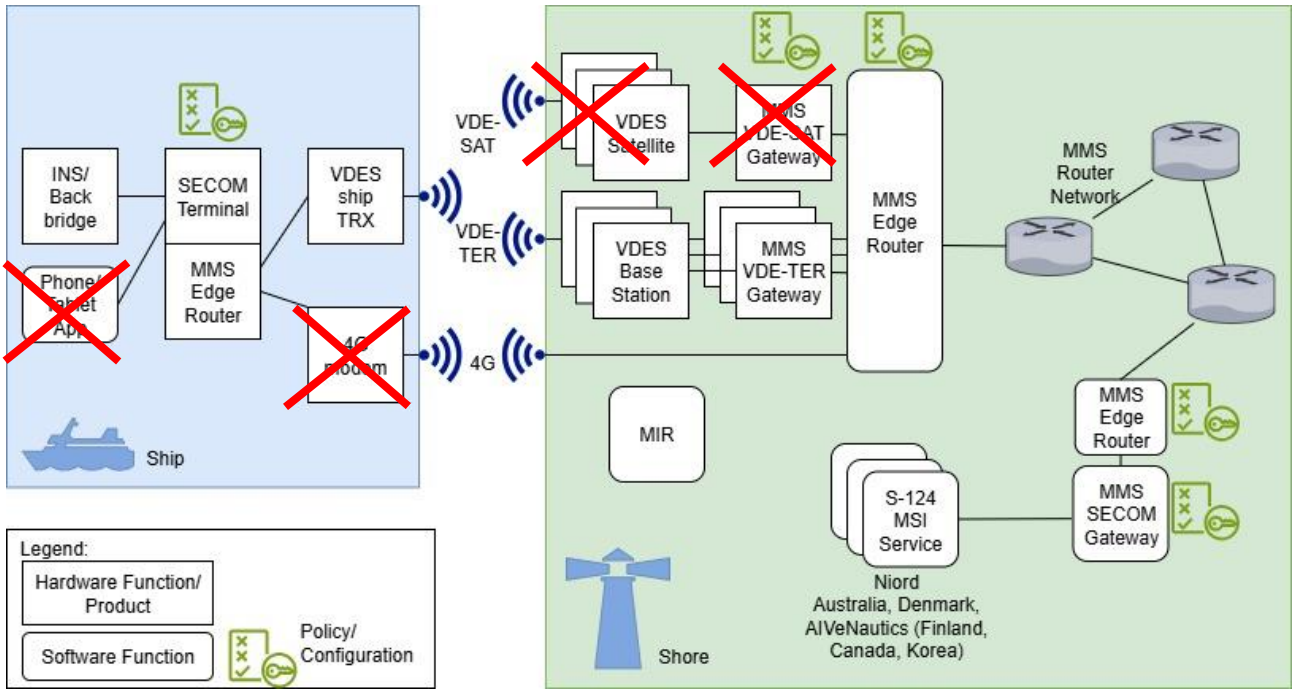


*Figure 3 Shore to Ship via terrestrial VDES (VDE-TER)*

### 4.2.1. Purpose

The purpose of this test is to verify the proper integration of terrestrial VDES (VDE-TER) into the MMS, for the use case of subject cast data, utilizing VDE-TER broadcast according to [MMS] Appendix C.

### 4.2.2. Test Log

The test was executed on the <DATE>

Following preparations were taken:

(a) The VDES ship TRX was switched on, as it would be in a realistic ship setup.

(b) The 4G modem ship equipment was disconnected from the ship side Edge Router.

(c) It was verified that the VDES ship TRX was connected to the ship side Edge Router.

(d) It was verified that the VDES ship TRX and the VDES Base Station were connected through a cable with a 30 dB attenuation at each of the transceivers and a 40dB in-between, totaling to 100 dB attenuation. The attenuator on the VDES Base Station side was of a 10W rating. All attenuators were rated for up to 1GHz or higher and therefore matched the test setup that uses 160MHz VHF maritime band. Cables are RG51 with BNC connectors, adapters were used to use SMA style attenuators.

(e) The remaining ship side equipment was powered on.

(f) The shore side VDES Base Station and VDE-TER Gateway was powered on.

(g) Configure the VDES Base Station such that LinkID 17 is used for the transmission of the data between the VDES Base Station (shore side) and the VDES ship TRX.

(h) The MMS Edge routers were initialized with maritime identities registered in the MIR.

(i) The VDE-TER Gateway started broadcasting MMS discovery message, following terrestrial bulletin board.

(j) The ship side Edge Router received the discovery message via the VDES Ship TRX and realized reachability to the VDE-TER shore network.

(k) The MMS-SECOM Gateway was initialized to pull the list of active navigational warnings from the <Australian > S-124 service in 5-minute intervals and send them to the MMS router network.

(l) The SECOM Terminal was initiated with its built-in MMS-Agent. The MMS Agent was connected to the Ship side Edge Router (and authenticated by the Edge Router)

(m) The INS/Backbridge display Application was started, and it was verified that the INS/Backbridge display Application did not show any previously downloaded data.

(n) The INS/Backbridge display Application subscribed to the S-124 navigational warning service from <Australia> via SECOM Terminal.

(o) Wait maximum 5 minutes to allow for the updated list to penetrate to the ship side edge router.

The following results were observed:

(p) The INS/Backbridge display Application's subscribe can be verified in logs of the SECOM Terminal, and the MMS-SECOM Gateway, and the Router Network.

(q) The currently active navigational warnings from <Australia> were received and displayed on the INS/Backbridge display Application.

(r) The displayed navigational warnings were compared to the ones seen on <NavUI> and found to be identical.

The above tests were repeated using LinkID 19 in step (f).

Based on the above observations, the test was deemed to be successful. <**[PASS]|[FAIL]>**

### 4.2.3. [VDES Measurements]

*Note remove this section if not executed. These measurements, however, contribute highly to the credibility and documentation of the test. Test houses that use this template should not omit this section.*

[During the above test, following measurements were executed:

- Spectrum mask measurement for the VDE-TER transmissions from the shore side VDES Base Station for LinkID 19.

- Spectrum mask measurement for the VDE-TER transmissions from the shore side VDES Base Station for LinkID 17.
- Waterfall plot with time axis downwards and spectrum heat colors horizontally for LinkID 19.
- Waterfall plot with time axis downwards and spectrum heat colors horizontally for LinkID 17.
- from the VDES Ship TRX:
    - The RSSI before the test (noise level, for the SNR calculation)
    - The RSSI for the received VDES base station signals throughout the test (plot)
    - List of VDL packets received and CRC
- From the above, calculation of:
    - Packet Error Rate (PER)
    - Signal to Noise Ratio at the ship side receiver input (SNR)

Based on these measurements following verification was performed:

(a) Check that the used VDE-TER frequencies were used according to the radio regulations, see [VDES]. **<[PASS]|[FAIL]>**

(b) Check that the transmitter spectrum mask was obeyed according to [VDES], for all LinkID's in use. **<[PASS]|[FAIL]>**

(c) Check that the ship side receiver did receive all packets (error rate 0), as no interference is possible in the cable. **<[PASS]|[FAIL]>**

## 4.3. Scenario 3: Shore to Ship via multiple connections

Reference: Figure 1 Overview over the Phase 1 VDES/MMS Test bed.

Involved subsystems: see *Figure 4*, the red crossed systems are not relevant for this test.

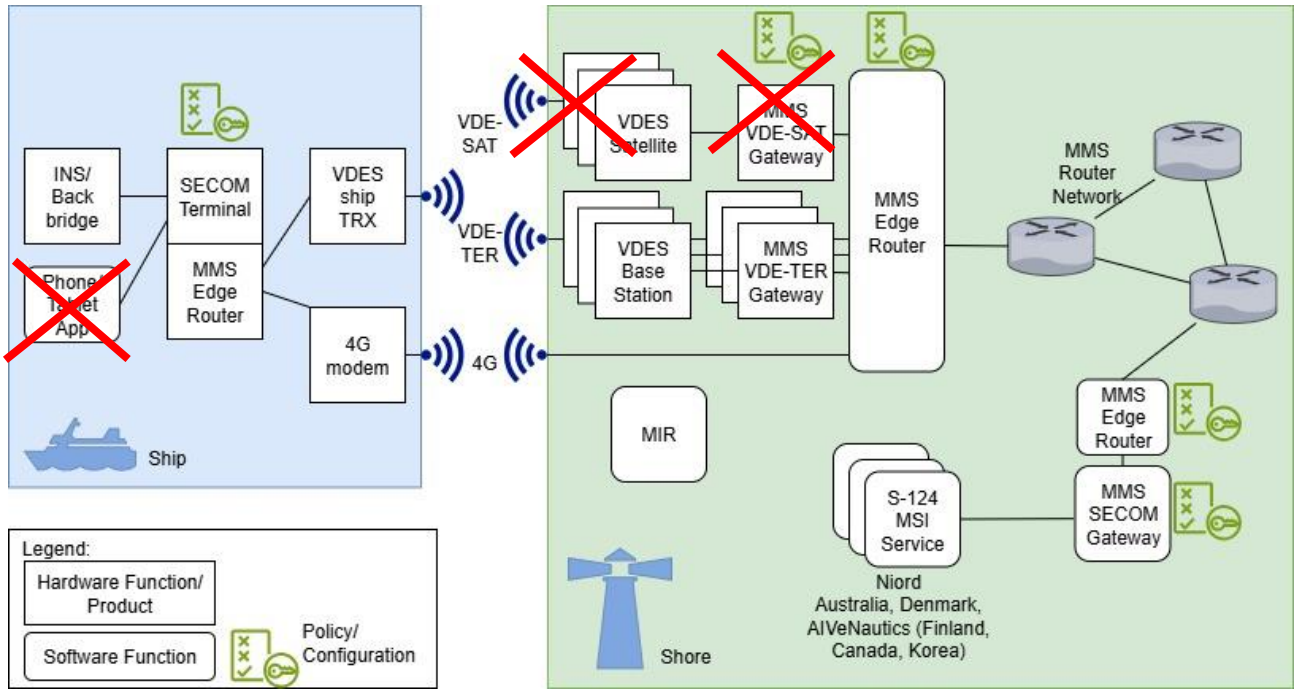

*Figure 4 Shore to Ship via multiple connections*

### 4.3.1. Purpose

The purpose of this test is to verify the proper integration of VDES and internet access in the ship side edge router, for the use case of receiving subject cast data from a S-124 service, both utilizing VDES and 4G internet connection, simulating change of connectivity between two S-124 updates.

### 4.3.2. Test Log

The test was executed on the <DATE>.

Following preparations were taken:

(a) Use same VDES setup as in 4.2.2 (a) and (c-f)

(b) It was verified that the Ship 4G modem was connected to the ship side Edge Router.

(c) Configure the VDES Base Station such that LinkID 19 is used for the transmission of the data between the VDES Base Station (shore side) and the VDES Ship TRX.

(d) The MMS Edge routers were initialized with maritime identities registered in the MIR.

(e) The VDE-TER Gateway started broadcasting MMS discovery message, following terrestrial bulletin board.

(f) The ship side Edge Router received the discovery message via the VDES Ship TRX and realized reachability to the VDE-TER shore network. This connection is set as a 1st priority

(g) The ship MMS Edge Router was configured to use 4G connectivity when it is available and use VDES as a 2nd priority.

(h) Initialize the S-124 warning service with 2 initial test warnings in the <Region> area.

(i) The MMS-SECOM Gateway was initialized to pull the list of active navigational warnings from the S-124 service in 5-minute intervals and send them to the MMS router network.

(j) The SECOM Terminal was initiated with its built-in MMS-Agent. The MMS Agent was connected to the Ship side Edge Router (and authenticated by the Edge Router).

(k) The INS/Backbridge display Application was started, and it was verified that the INS/Backbridge display Application did not show any previously downloaded data (shown map is free from S-124 data from the S-124 service).

(l) The INS/Backbridge display Application subscribed to the S-124 navigational warning service via SECOM Terminal.

(m) Wait maximum 5 minutes to allow for the updated display.

The following results were observed:

(n) The 2 navigational warnings from the S-124 service were received and displayed on the INS/Backbridge display Application.

(o) In the log of the ship side MMS Edge Router, it was checked that the data was transported through 4G.

Then, following changes were performed to the test setup:

(p) The 4G connection was disconnected from the ship side MMS Edge Router.

(q) 1 more navigational warning was added to the S-124 service.

(r) Wait maximum 5 minutes

The following results were observed:

(s) The 3 navigational warnings from the S-124 service were now received and displayed on the INS/Backbridge display Application. It was checked that one more navigational warning was seen compared to step (n).

(t) In the log of the ship side MMS Edge Router, it was checked that the data was transported through terrestrial VDES.

Based on the above observations, the test was deemed to be successful. <**[PASS]|[FAIL]>**