Prepare Ships

HORIZON 2020

Use of VDES in the Prepare Ships Project

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PREPARE SHIPS PARTNERS

Prepare Ships

RISE	• Project Management • Dynamic Predictor • Measurement Science and Technology
ANavS	• GNSS receiver – Galileo, GPS, GLONASS • Three antennas – 6 dimensions of motion
LMV	• GNSS continuously operating reference station (CORS) network • N-RTK correction data from Virtual Reference Stations (VRS) • Integrity check
SAAB	• VDES shipborne receiver & base stations • Interface protocol for exchange of Ships prediction over VDES
Telko	• Integration of RISE dynamic predictor in ECDIS • Interface for exchange of prediction ship-to-ship over VDES • Integration of ANavS motion data in ECDIS

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Project abstract

Prepare Ships is creating a smart positioning solution by developing and demonstrating a data fusion of different sensor and signal sources to enable a robust navigation application. The idea is that vessels with accurate positioning based on EGNSS, data and machine-learning should be able to predict future positions of nearby vessels.

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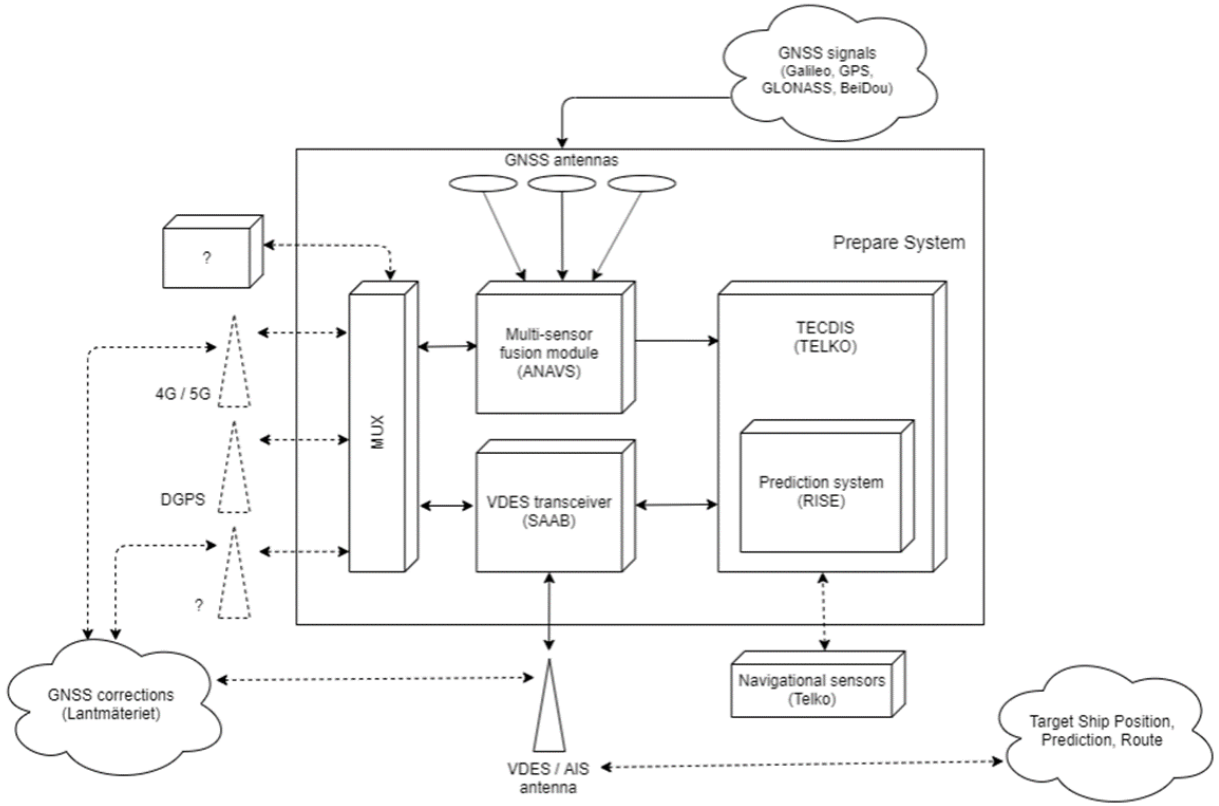
Prepare Ships background

The goal of the Prepare Ships project is to dramatically reduce the uncertainty regarding the present and **future** positions of ships.

To achieve that goal, a system that leverages highly accurate global positioning, position predictions, as well as ship-to-shore and ship-to-ship communication through VDES, is employed.

System elements



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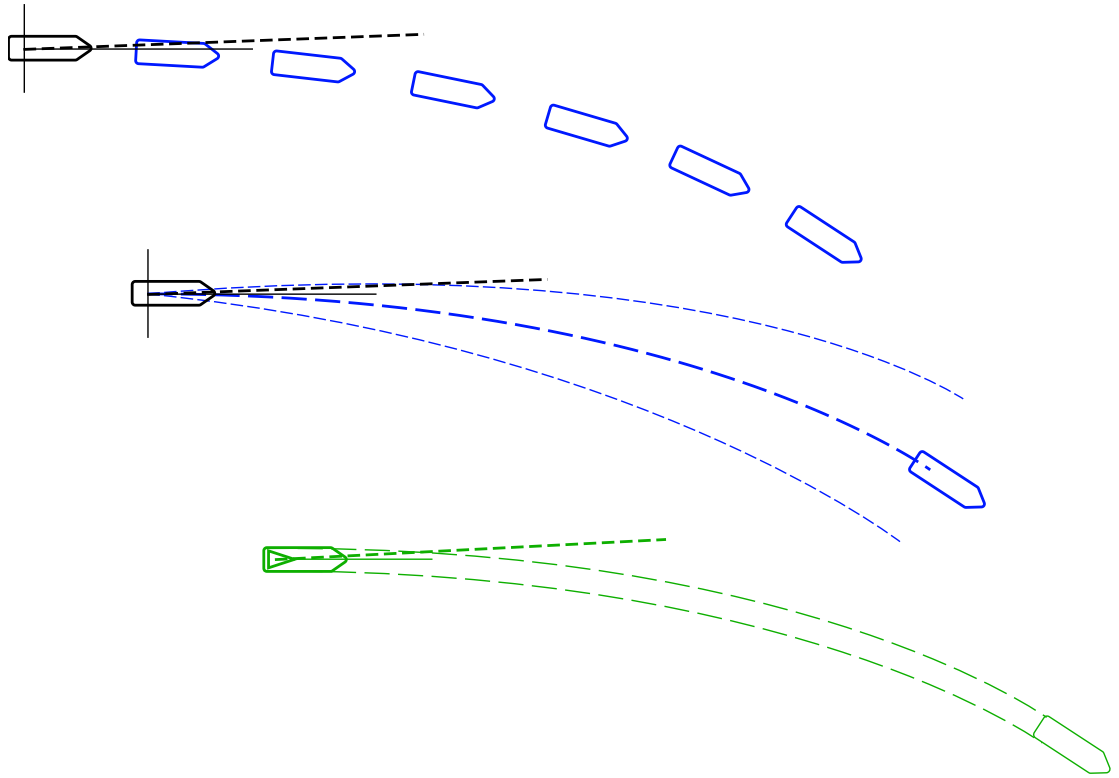
Ship Predictor

- Mooring operation – Dynamic Route Navigation – Simplified or Dynamic



GUI & Tools

- Display ON/OFF
- Style, Time and No of Predictions
- Exchange of Predictions
- Exchange of Route data (WP)

Learning Mode

Saab TransponderTech

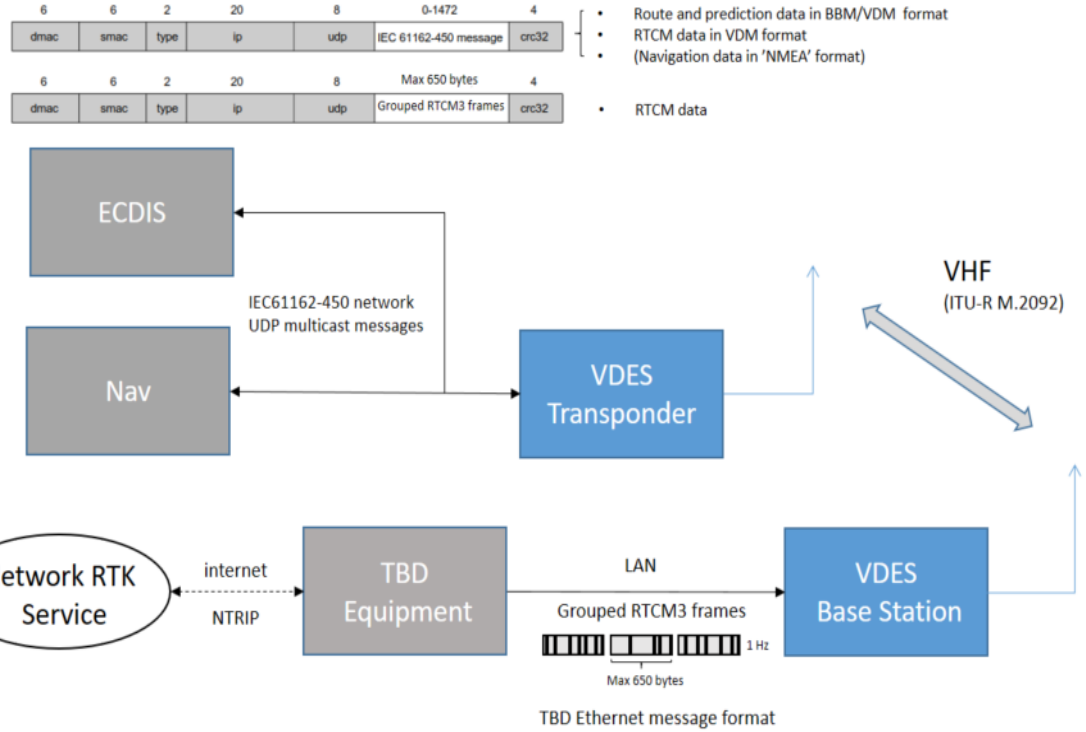
Shiporne VDES (AIS 2.0)

R6 SUPREME AIS/VDES

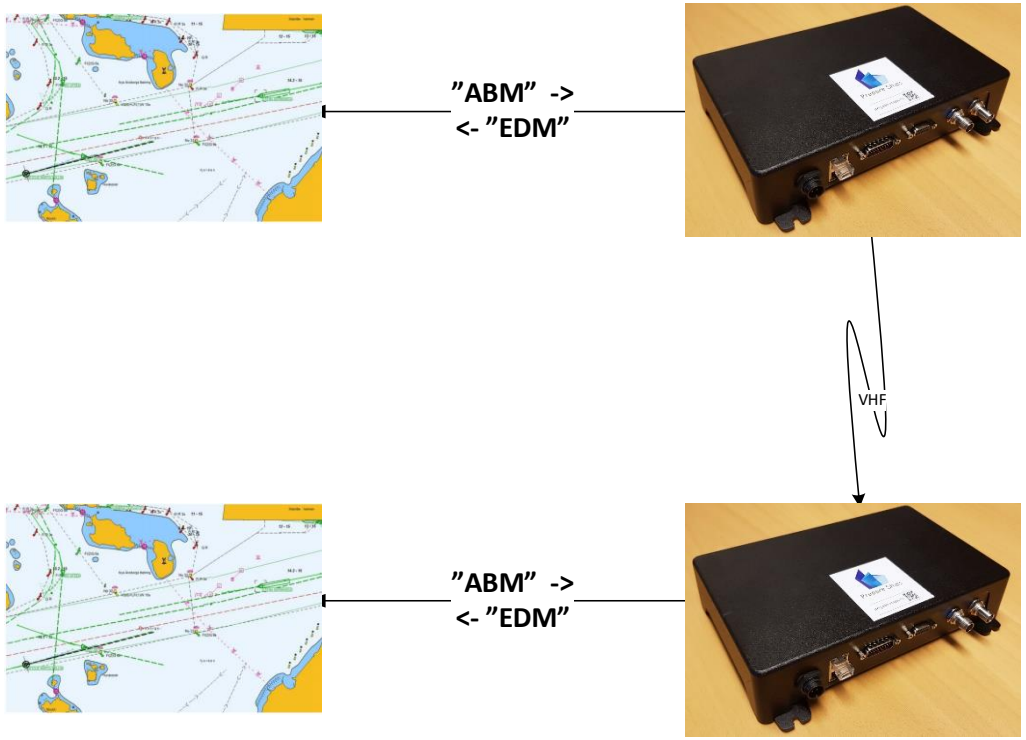
Shore VDES (AIS 2.0)

R60 AIS/VDES Base station

Communication overview, VDES components



TBD Ethernet message format



"ABM" : Correspond to BBM in AIS i.e. input of a Binary Broadcast Message
"EDM" : Correspond to VDM in AIS

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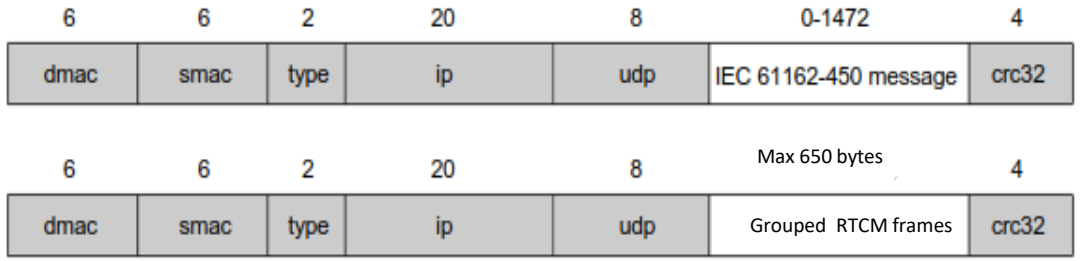
Distribution of VDES on board

- It is assumed that network interface (IEC61162-450) is the preferred method (in general) for distribution of data between shipborne equipment
- RTK correction data can be provided from communication equipment on the ships in the general (“NMEA”) VDM format. However, this is not a legacy format for navigation systems. In this case it seems reasonable for the communication equipment to extract the payload from the transport format and make it available in its original format.
- It is suggested that RTK correction data could be distributed from communication equipment on the ships as general UDP multicast based on the transport framework of IEC61162-450.



- Route and prediction data in BBM/VDM format (ABM/EDM)
- RTCM data in VDM format
- (Navigation data in ’NMEA’ format)

- RTCM data

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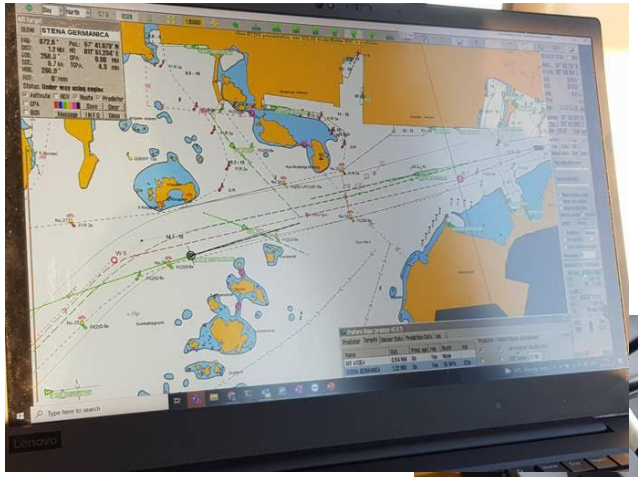
Final test campaign Gothenburg april 19-22 2022



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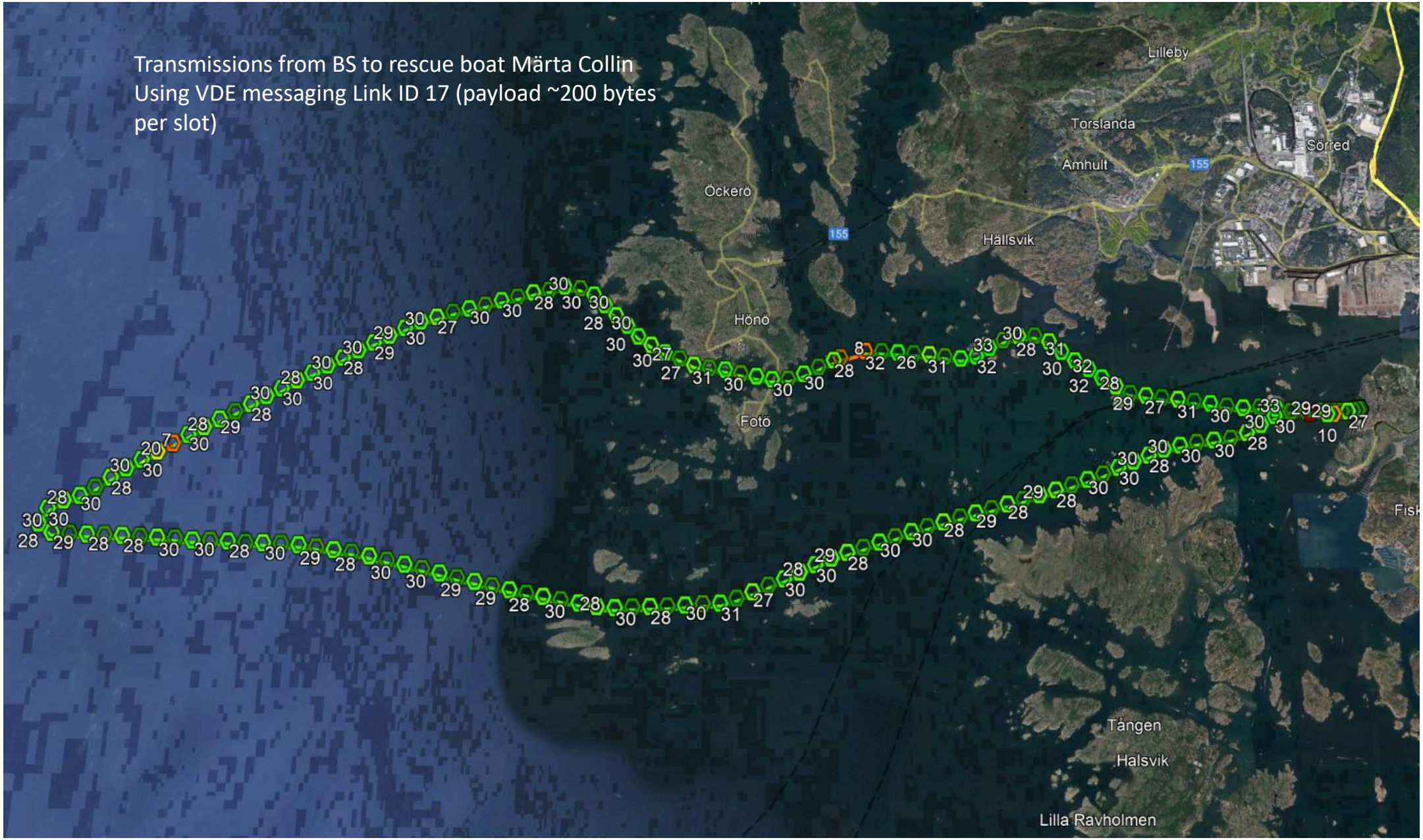

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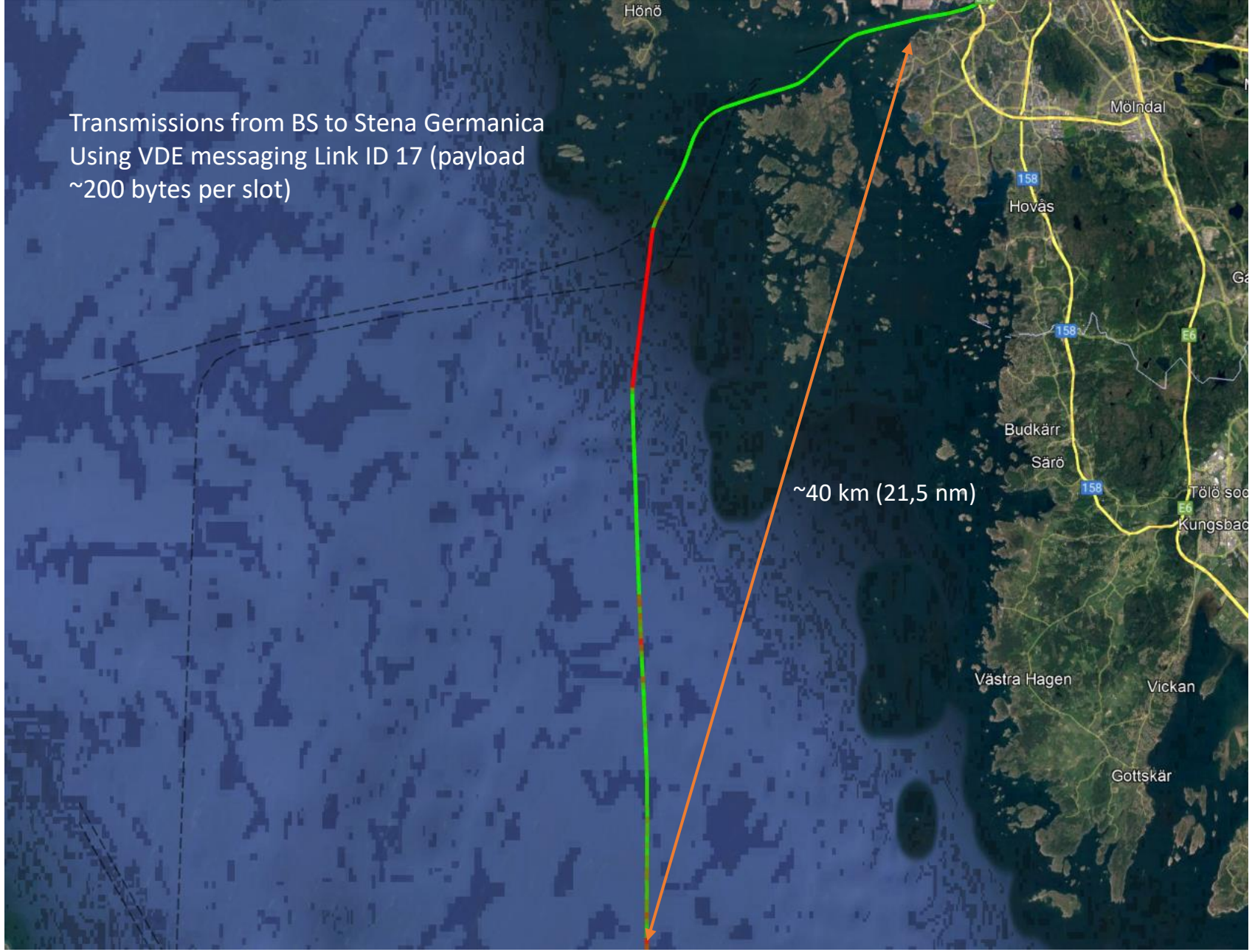

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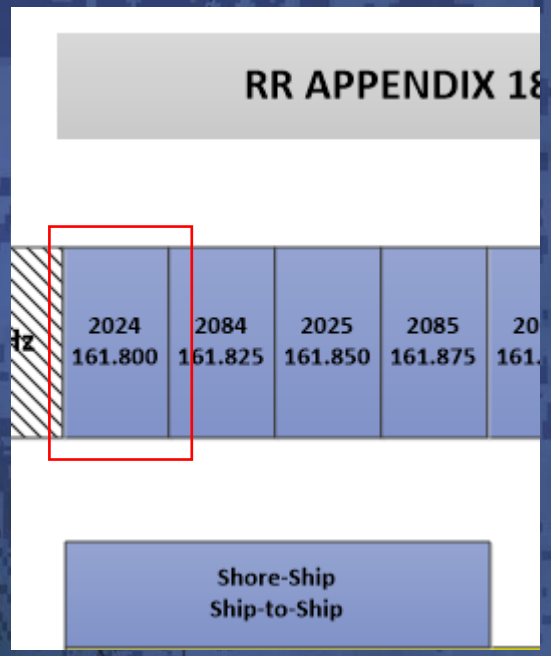
No reception of VDES data during specific time periods due to continued usage of some of the VDES-channels during a transition period.



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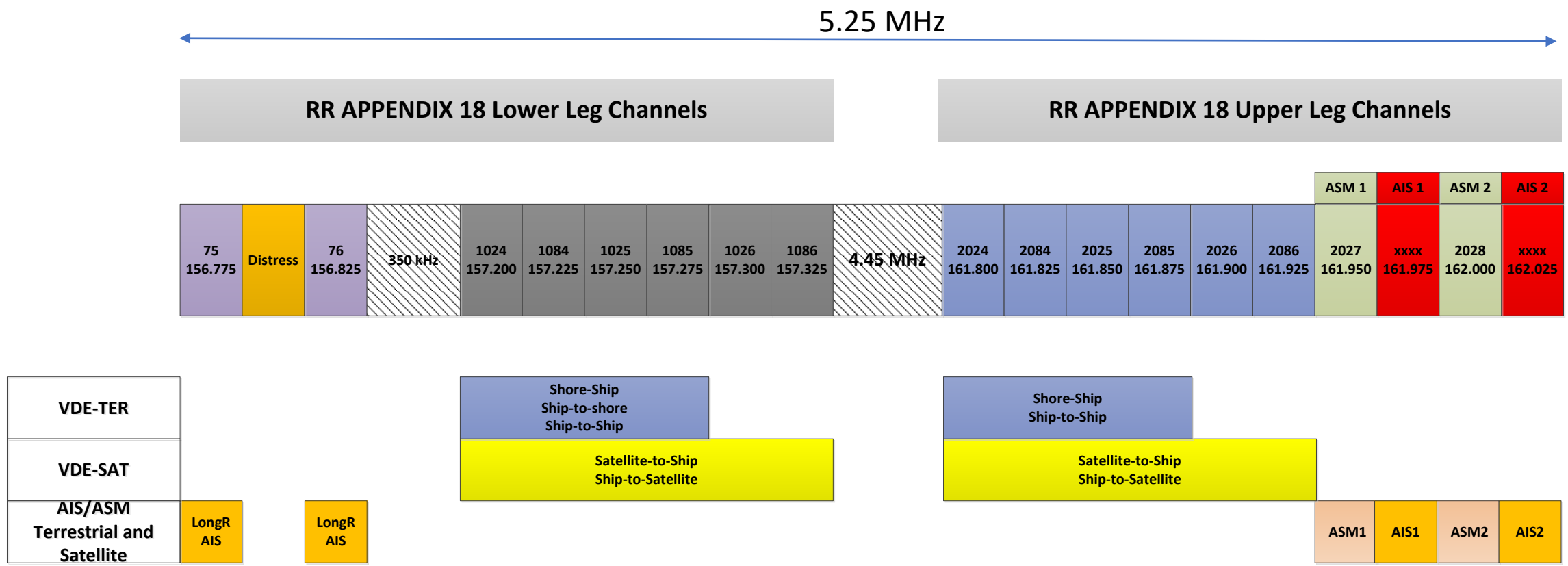
VDES frequency plan

According to Radio Regulations (RR appendix 18) - ensures global compatibility in the maritime band



The latest frequency plan for VDES after WRC-19 including the latest addendum for ASM 2.

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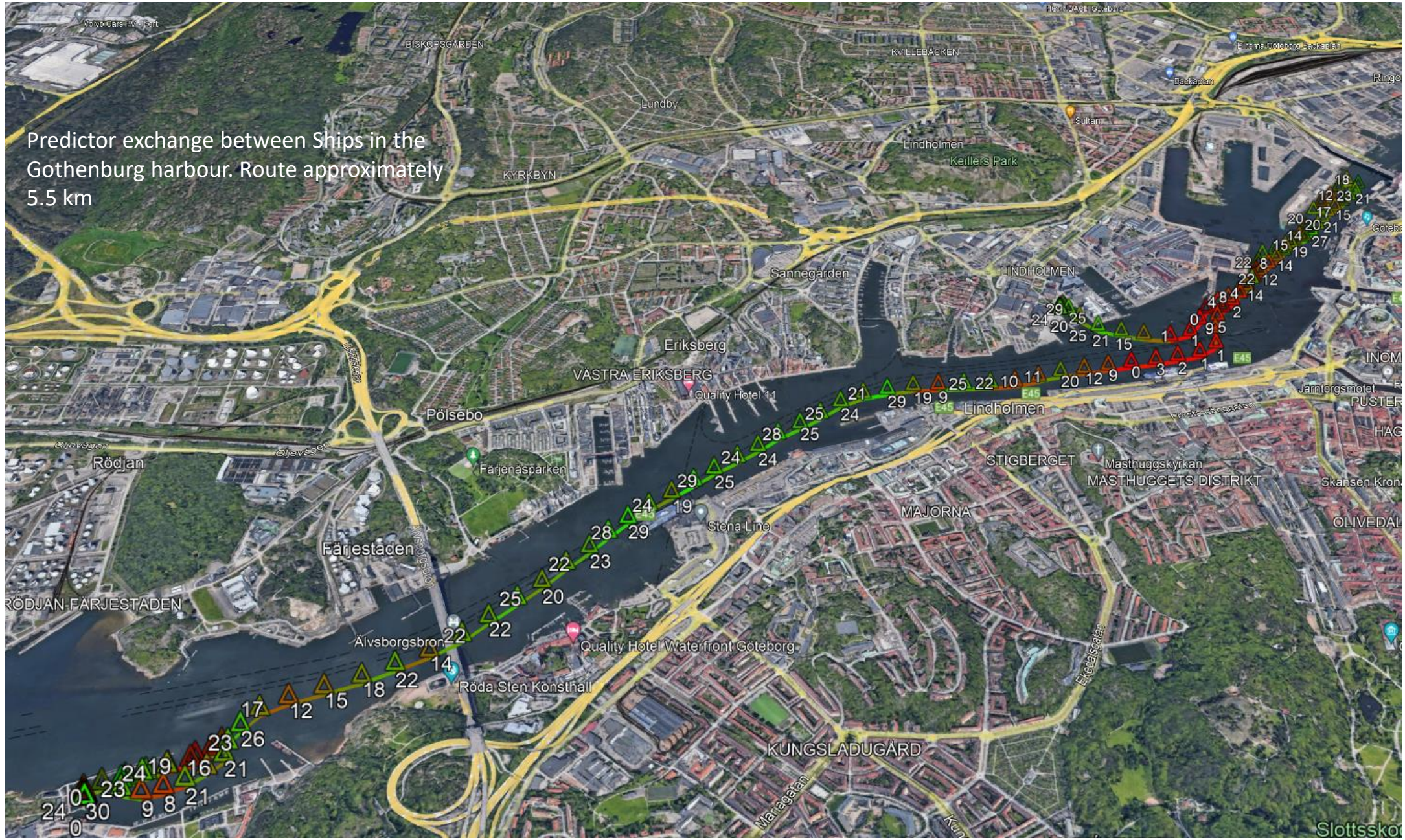

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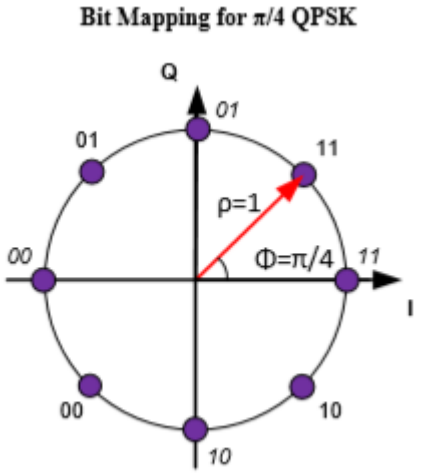
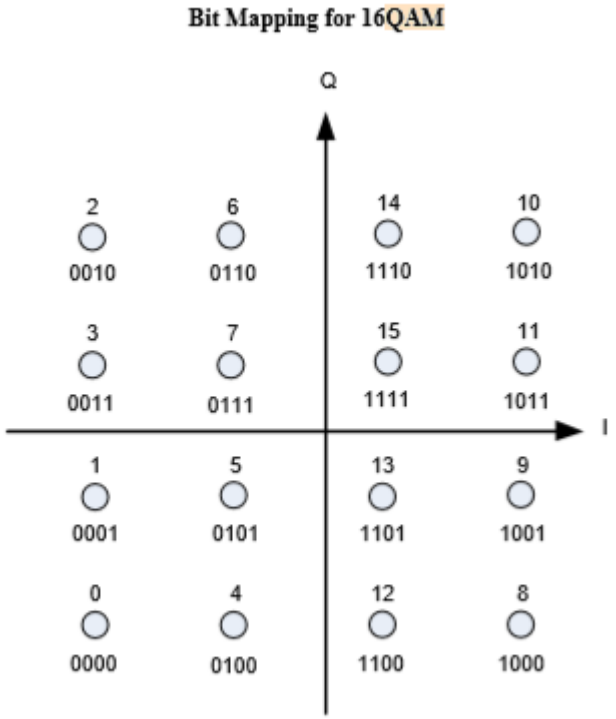
Modulation and detection

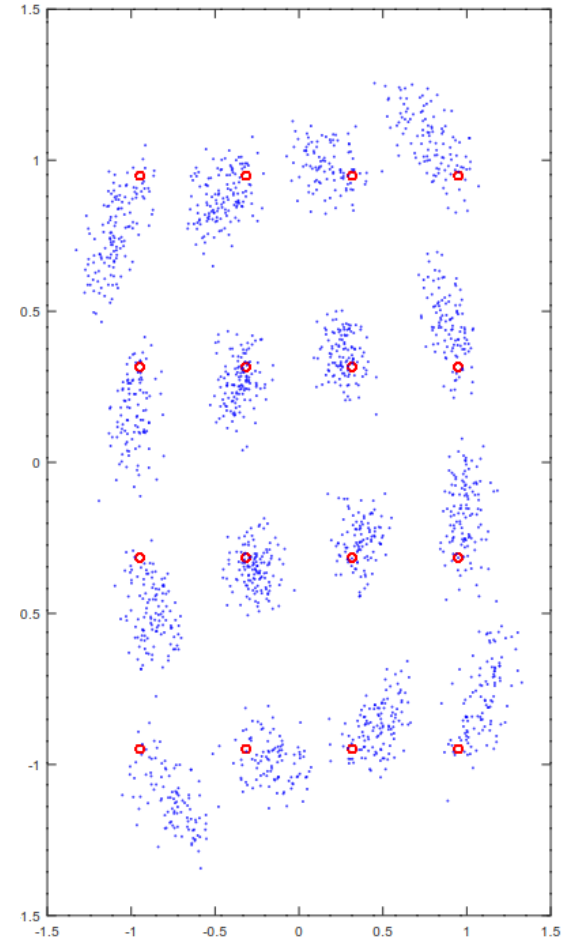
π/4 QPSK (Link ID 17)



16QAM (Link ID 19)



IRL



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Conclusion

- The practical line-of-sight range with Link ID 17 was approx 50 km and for Link ID 19 roughly 25 km. This with standard 2 dBi dipole-antennas at both ends.
- Ter-VDE is working satisfactory and we can expect some more dB/Range for Link ID 19
- VHF Antenna installations need to be in good condition.
- Receiver sensitivity in lab test was -99 dBm for prototype equipment used in Prepare Ships (in-house test with newer versions, indicates 3-4 dB better performance) for Link ID 19. For Link ID 17 the corresponding value was -109 dBm.

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Considerations for future development

- Predictor exchange; Link ID 17 is more reliable and robust regarding disturbances, obstacles etc but can only transfer around 200 bytes in each slot compared to 650 bytes for Link ID 19. For the Prepare Ships application the predictor exchange will fit into 200 bytes and will give a more reliable data exchange.
- Limited bandwidth to one slot/second corresponding to 2.7% of total BW for each application was assumed in the project. Is this ok?
- N-RTK broadcast; The quality of the corrections will be a trade-off between VHF link load and range. If more than one slot/s can be reserved for the corrections it may be possible to use Link ID 17 instead without losing quality.