Maritime VHF Data Exchange System (VDES)

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Data Transmission in the VHF Marine Bands

Available VHF Marine channels globally for **digital data communications** in VHF Mobile Band

- **Existing Data Channels**: CH 70 (DSC), CH 75,76 (AIS Long Range), CH 87B, 88B (AIS)
- **Proposed New Channels**: CH 24,84,25,85,26, 86 (VDE)
- **Proposed New Channels**: CH27, 28 (Application Specific Message-ASM)
Satellite: An integrated part of VHF Data Exchange System

- Access beyond Line of Sight at shore
- Wide Coverage Area
- Unique Communication access at high sea
- Reuse the existing ship-borne VHF infrastructure
  - Cost Effective
  - Larger population of users

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<th>Scenario</th>
<th>Application</th>
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<tr>
<td>Massive Uncoordinated Access (Uplink)</td>
<td>Machine-to-Machine, Global Sensor</td>
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<td>Point-to-Point</td>
<td>ACK, NACK (Downlink), File Transfer (uplink)</td>
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<td>Point-to-multipoint (Multicast)</td>
<td>Fleet Management, Ice Map, Fishing Map Distribution</td>
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<td>Broadcast</td>
<td>Distress Message, Alarm</td>
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Resource Sharing in VDES (1)

Shared Frequencies

- Ship-to-Shore and Ship-to-Satellite
- Shore-to-Ship, ship-to-ship and satellite-to-ship (Frequency Plan 1)
- Multiple Satellites - Overlapping Coverage
- Multiple ships to satellite (Random Access Channel)

![Diagram showing shared frequencies for VDES]
Resource Sharing in VDES (2)

Common Elements are Applicable to ASM, VDE Terrestrial and VDE Satellite Components

**Ship-borne Common RF infrastructure**

- Ship-borne Antenna, Cables
- RF Transceiver units (Power Amplifiers, pre amplifiers)

**Common Baseband Units**

- Common air interface sub-systems, Forward Error Correction, Error Checking, Headers
VDES Resource Sharing Principles

Common Time Frame Structure for ALL VDES Components
- frame duration is 60 seconds. Each frame consists of 2250 slots
- each slot can be uniquely identified per frame
- Frame 0 starts at 00:00:00 UTC, and there are 1440 distinct frames in a day

AIS Priority
- AIS Transmission and reception has the highest priority

Shore Station VDES Control Area
- Resource Assignment in proximity of a shore station is monitored and controlled by the shore station.
- Terrestrial Bulletin Board and Announcement channels are used to assign resources.

VDE-SAT Resource Assignment
- Each satellite should use bulletin board and announcement channels to communicate the VDE-SAT resource assignments
Frequency and Timeslot Coordination

- Satellite Bulletin Board and Announcement Channels are part of Exclusive Satellite Channels (2026 and 2086)

- Dedicated Timeslots for Terrestrial Signaling Channels.

- Channels 2024, 2084, 2025 and 2085 are shared between VDE-SAT Downlink and VDE terrestrial.

- Depending on the satellite coverage area and the shore control areas, the resource assignment may vary.
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Initial Resource Sharing Configuration

- Channels 2024 and 2084 are exclusively used for terrestrial VDE,
- Channels 2026 and 2086 are exclusively used for VDE-SAT downlink
- Channels 2025 and 2085 are time-shared between VDE-SAT downlink and VDE terrestrial services.

The time sharing is based on time intervals of 2.4 s (90 slots) that are assigned periodically to VDE-SAT and VDE terrestrial services.
Sharing between Multiple VDE-SAT systems

- Resource sharing is coordinated using Bulletin Board

- **Bulletin Board Provides:**
  - Satellite and constellation ID, Satellite ephemeris;
  - Downlink communication characteristics,
  - Uplink communication characteristics

- From Bulletin Board, ships can determine:
  - Visibility schedule of the satellites
  - Transmission Characteristics
  - Downlink and uplink time-frequency plans

- A ship can decode bulletin board message from multiple satellites (thanks to the spread spectrum waveform)
Sharing VDE-SAT Uplink and VDE Ship-Shore

- The exclusive VDE-SAT uplink channels may be used for dedicated (demand assigned) or random access to satellite.

- The exclusive VDE-SAT uplink channels should be used for higher priority messages.

- The coordination between the VDE terrestrial (ship to shore) and VDE-SAT uplink is achieved using the bulletin board.

- The use of direct sequence spreading for VDE-SAT uplink channel may provide a higher level of resilience in the presence of VDE ship-to-shore interfering signals.
THANKS FOR YOUR ATTENTION

Interest to know more?

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