Route Message system requirements, G1.docx
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DOCUMENT STATUS

Authors

Name	Organisation
Johan Lindborg (JL)	Saab AB
Daniel Ferm (DF)	Saab AB
Mikhail Andrianov (MA)	Transas Marine Limited

Review

Name	Organisation
Håkan Heurlin (HH)	SMA

Approval

Name	Organisation	Signature	Date

Document History

Version	Date	Status	Initials	Description
A	2016-03-03			
B	2016-03-23		HH	Second Revision
C	2016-11-03		JL	AIS DAC and FI defined
D	2017-04-26		JL/HH	VDES DAC and FI defined
E	2017-09-01		HH/DF/PT/PB/MA	Annex A and Annex B revised regarding passing of waypoint criteria
F	2017-10-13		HH/DF/PT/MA	Final revision
G1	2019-05-28		BA	To stop broadcast if speed <1knot for more than 6 min added

Table of contents

1 Sharing and receiving Monitored Routes

This document describes a method for sharing route data between ships, with an STM compliant system using VDES or AIS equipment for communication.

The Route Message Broadcast is used as a means to indicate intended navigation and route information to nearby ships, allowing ships to avoid ending up in a close quarter situation where the involved ships have to comply with the COLREG rules. The current and a fixed number of coming route legs of the monitored route is shared with other ships.

The use of this message requires that both the receiving and transmitting ship has the appropriate communication equipment as well as presentation and navigation systems.

2 System components

2.1 HMI and operational equipment

The Route Message sharing system presentation and is done through an ECDIS or similar system. The ECDIS is also responsible for assembly, disassembly, and interpretation of Route Message data.

> *Note: ECDIS in all parts of this document may also be INS or other systems with the STM functional module integrated.*

2.2 Communication Device

The ECDIS shall be connected to a VDES unit supporting both AIS and ASM-channel communication*. This communication device will function only as a modem in this system.

The VDES unit shall employ a carrier sense technique to avoid VHF broadcast at the same time and channel as coastal VHF stations.

The maximum length of one broadcast shall not exceed three AIS TDMA slots (<80 ms), to ensure compliance to AIS and VDES equipment standards.

> **Note: Standalone AIS may be used where VDES is not available. Loss of route message data fidelity will occur (fewer legs and no leg XTD values).*

2.3 Interfaces

The ECDIS shall communicate with the Communication Device using IEC 61162-2 or IEC 61162-450 compliant interfaces.

2.3.1 Data formats

Incoming Data will be presented to the ECDIS using standard VDM messages as defined in above referenced interface standards.

Data sent from ECDIS to the communication device unit shall be using ABM and BBM messages, as defined in the same interface standards.

3 Route Messages

3.1 On-board message flow

The ECDIS initiates any Route Message broadcast to be transmitted by the Communication Device, as well as any Route Message interrogations. The ECDIS will compile the Route Message data payload, or interrogation message payload, as defined in section 4, and send a BBM or ABM message with the payload to the Communication Device.

The Communication Device will provide the ECDIS with VDM-message data as they are received on the VHF data links.

VDM message payloads may be:

- Remote AIS target dynamic, static and voyage data (AIS Msg 1,2,3,5,9,18,19,24A,24B)
- Remote ship route message data (AIS msg 8 or VDES ASM msgs)
- Route Message interrogation messages (AIS msg 6 or VDES ASM msgs)

3.2 Message broadcast trigger events

The message shall be broadcast so that ships in receiving range has accurate information at a reasonable delay, without creating unnecessary load on the VHF datalinks.

A new Route Message broadcast shall be initiated by ECDIS when any of the below events occurs:

- Six minutes have passed since last Route Message broadcast
- A Route Message interrogation was received and over one minute has passed since last Route Message broadcast on that channel
- Any of the data in the last Route Message broadcast has been changed
- When passing a waypoint (after completing the turn, see Annex A for definition)
- The Monitored Route has been deactivated
- A Monitored Route is activated

The Route Message broadcast shall be initiated by the ECDIS as soon as possible after any of the above broadcast triggers.

There shall be no autonomous Route Message broadcasts when there is no Monitored Route active in ECDIS, except for one additional Route Message transmission after stopping a Monitored Route. The system shall however respond to interrogations, with an empty route message. If the ship has had a speed below 1 (one) knot for more than 6 minutes no route message shall be broadcasted

3.3 Route segmentation for AIS broadcasts

The Route Message-payload is defined such that up to seven legs can be shared. The first leg shared during a turn shall be the leg leading up to the turn, otherwise it shall be the current leg. If any of the waypoints within the seven legs are over 200 NM (max ±209.7151') from the previous waypoint, this will be treated as the last WP in the currently shared monitored route segment, or a virtual FROM waypoint inserted (see 5.2 in Annex A for details).

3.4 Route segmentation for VDES ASM broadcasts

The Route Message-payload is defined such that the current leg as well as up to twelve additional legs can be shared, with Cross Track Distance (XTD) parameters for each leg.

4 Route Message structure

The Route Message structures are defined in the following tables.

When no Monitored Route is active, the Route Message shall have an empty payload.

Two Route Messages are defined, depending on the communication system used. VDES ASM channel communication allows for a higher bitrate, and more data within the three timeslot limit.

Leg parameters (planned speed, XTD, geometry) are for the leg ending at the waypoint following those parameters. Turn radius is for the next waypoint.

4.1 AIS Route Message

The first and last waypoints are fully qualified, while intermediate waypoints are defined as the difference from the previous waypoint in the route. This way of defining intermediate waypoints saves bits but limits the maximum length of those legs. In cases where representable length is insufficient, the total route segment reported in a message is cut short and the "intermediate" waypoint becomes the last waypoint in the message.

Parameter	Bits	Description	Comment
Message ID	6	Identifier for Message 8; always 8	
Repeat indicator	2	Used by the repeater to indicate how many times a message has been repeated.	
Source ID	30	MMSI number of source station	
Spare	2	Not used. Should be set to zero. Reserved for future use	
DAC	10	DAC = 265_{10} = 0100001001_2	
FI	6	Function identifier = 1_{10} = 000001_2	
If no monitored route is available the message ends here			
First waypoint type	1	0 = Navigating away from first waypoint (on route) 1 = Navigating towards first waypoint (start of route)	
First waypoint longitude	28	Longitude in 1/10 000 min (±180°, East = positive (as per 2's complement), West = negative (as per 2's complement). 181° = (6791AC0h) = not available = default)	Standard AIS format
First waypoint latitude	27	Latitude in 1/10 000 min (±90°, North = positive (as per 2's complement), South = negative (as per 2's complement). 91° (3412140h) = not available = default)	Standard AIS format
Intermediate legs	**(64)**	**Repeats 0 … 6 times depending on total number of legs**	
Leg geometry	1	0 = Loxodrome (Rhumb line) 1 = Orthodrome (Great circle)	
Planned speed	10	Planned speed over ground in 1/10 knot steps (0-102.2 knots) 1 023 = not available, 1 022 = 102.2 knots or higher	Standard AIS format
Turn radius	9	Turn radius in 1/100 NM. 0 = not available	Max 5.11 NM
Longitude delta	22	Longitude difference from previous waypoint in 1/10 000 min. East = positive, West = negative (as per 2's complement).	Max ±209.7151'
Latitude delta	22	Latitude difference from previous waypoint in 1/10 000 min. East = positive, West = negative (as per 2's complement).	Max ±209.7151'
Final reported leg	**(66)**		
Leg geometry	1	0 = Loxodrome (Rhumb line) 1 = Orthodrome (Great circle)	
Planned speed	10	Planned speed over ground in 1/10 knot steps (0-102.2 knots) 1 023 = not available, 1 022 = 102.2 knots or higher	Standard AIS format

Parameter	Bits	Description	Comment
Last waypoint longitude	28	Longitude in 1/10 000 min (±180°, East = positive (as per 2's complement), West = negative (as per 2's complement). 181° = (6791AC0h) = not available = default)	Standard AIS format
Last waypoint latitude	27	Latitude in 1/10 000 min (±90°, North = positive (as per 2's complement), South = negative (as per 2's complement). 91° (3412140h) = not available = default)	Standard AIS format
Steering mode	2	0 = Manual (default) 1 = Heading control 2 = Track control 3 = Reserved for future use	
Spare	4	Padding to bring total message length to a byte boundary. Always 0	Required for AIS

4.2 VDES ASM Route Message

Parameter	Bits	Description	Comment
Message ID	6	Identifier for Message 8; always 8	To be defined by VDES standard
Repeat indicator	2	Used by the repeater to indicate how many times a message has been repeated.	
Source ID	30	MMSI number of source station	
Spare	2	Not used. Should be set to zero. Reserved for future use	
DAC	10	DAC = 265_{10} = 0100001001_2	
FI	6	Function identifier = 2_{10} = 000010_2	
If no monitored route is available the message ends here			
First waypoint type	1	0 = Navigating away from first waypoint (on route) 1 = Navigating towards first waypoint (start of route)	
First waypoint longitude	28	Longitude in 1/10 000 min (±180°, East = positive (as per 2's complement), West = negative (as per 2's complement). 181° = (6791AC0h) = not available = default)	Standard AIS format
First waypoint latitude	27	Latitude in 1/10 000 min (±90°, North = positive (as per 2's complement), South = negative (as per 2's complement). 91° (3412140h) = not available = default)	Standard AIS format
Intermediate legs	**(97)**	**Repeats 0 … 12 times depending on total number of legs**	
XTD port side	11	XTD port side in 1/1000 NM. 0 = not available	Max 2.047 NM
XTD starboard	11	XTD starboard in 1/1000 NM. 0 = not available	Max 2.047 NM
Leg geometry	1	0 = Loxodrome (Rhumb line) 1 = Orthodrome (Great circle)	
Planned speed	10	Planned speed over ground in 1/10 knot steps (0-102.2 knots) 1 023 = not available, 1 022 = 102.2 knots or higher	Standard AIS format
Turn radius	9	Turn radius in 1/100 NM. 0 = not available	Max 5.11 NM
Waypoint longitude	28	Longitude in 1/10 000 min (±180°, East = positive (as per 2's complement), West = negative (as per 2's complement). 181° = (6791AC0h) = not available = default)	Standard AIS format
Waypoint latitude	27	Latitude in 1/10 000 min (±90°, North = positive (as per 2's complement), South = negative (as per 2's complement). 91° (3412140h) = not available = default)	Standard AIS format
Final reported leg	**(88)**		

Parameter	Bits	Description	Comment
XTD port side	11	XTD port side in 1/1000 NM. 0 = not available	Max 2.047 NM
XTD starboard	11	XTD starboard in 1/1000 NM. 0 = not available	Max 2.047 NM
Leg geometry	1	0 = Loxodrome (Rhumb line) 1 = Orthodrome (Great circle)	
Planned speed	10	Planned speed over ground in 1/10 knot steps (0-102.2 knots) 1 023 = not available, 1 022 = 102.2 knots or higher	Standard AIS format
Last waypoint longitude	28	Longitude in 1/10 000 min (±180°, East = positive (as per 2's complement), West = negative (as per 2's complement). 181° = (6791AC0h) = not available = default)	Standard AIS format
Last waypoint latitude	27	Latitude in 1/10 000 min (±90°, North = positive (as per 2's complement), South = negative (as per 2's complement). 91° (3412140h) = not available = default)	Standard AIS format
Steering mode	2	0 = Manual (default) 1 = Heading control 2 = Track control 3 = Reserved for future use	
Spare	0..7	Padding to bring total message length to a byte boundary. Always 0	For byte alignment

4.3 Interrogation

Standard AIS/VDES interrogation for a specific functional message shall be used to initiate a request of a Route Message from a remote ship. The reply shall always be as defined above (broadcast), to allow all ships within range to receive the message. The reply should be sent with empty content when there is no monitored route in use.

| Parameter	Bits	Description
Message ID	6	Identifier for Message 6; always 6
Repeat indicator	2	Used by the repeater to indicate how many times a message has been repeated.
Source ID	30	MMSI number of source station
Sequence number	2	0-3
Destination ID	30	MMSI number of destination station
Retransmit flag	1	Retransmit flag should be set upon retransmission: 0 = no retransmission = default; 1 = retransmitted
Spare	1	Not used. Should be zero
DAC	10	International DAC = 1_{10} = 0000000001_2
FI	6	Function identifier = 2_{10} = 000010_2
Requested DAC code	10	DAC = 265_{10} = 0100001001_2
Requested FI code	6	Function identifier = 1_{10} = 000001_2 or Function identifier = 2_{10} = 000010_2
Total length	104	The resulting Message 6 occupies 1 slot.

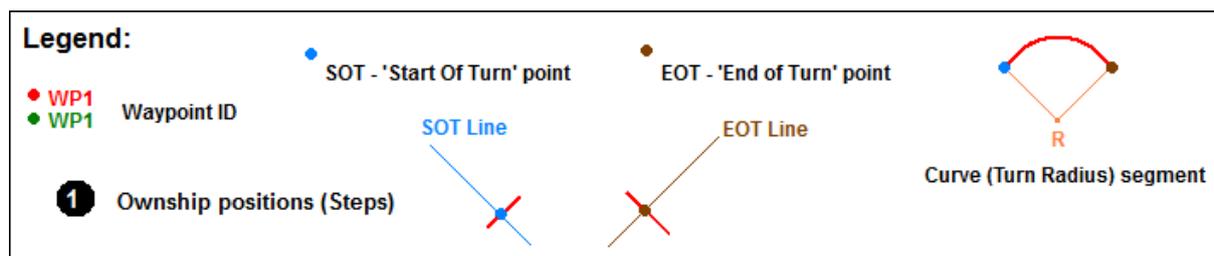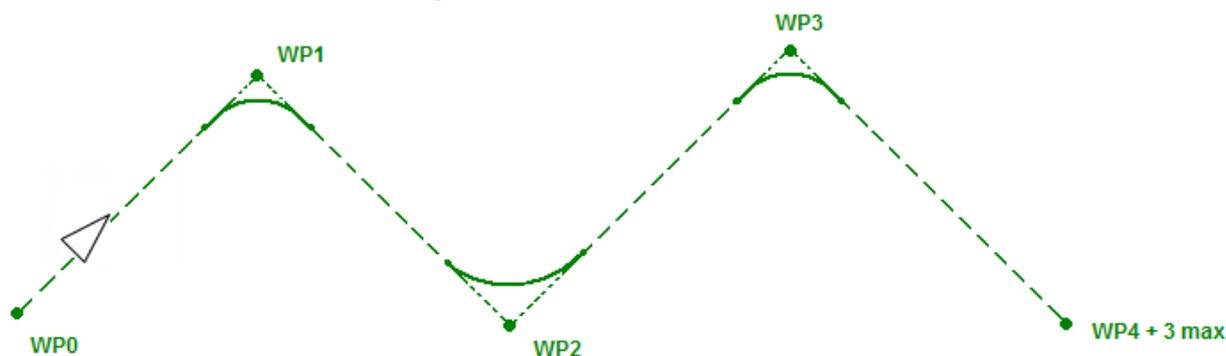# 5 ANNEX A – AIS Route Broadcast Logic

5.1 Standard AIS Route Broadcasts

Standard AIS route broadcast are used when all route segments are less than delta LAT & LON limits (max ±209.7151'), otherwise see 5.2 nedan.

Regular Conditions
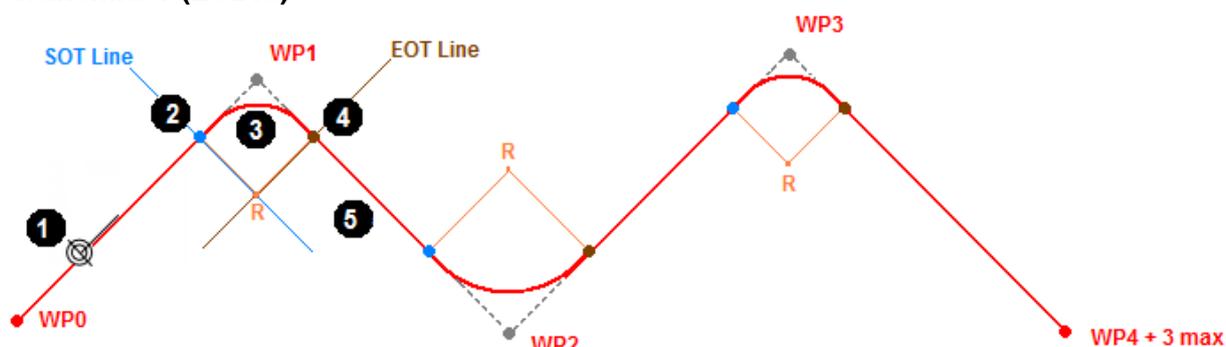
Transmitter (ECDIS)

Receiver (ECDIS): Transmitting ship at step 1

Step 1. Own ship position is on the straight part of leg. Transmitter (ECDIS) uses the standard broadcast trigger events:
- FIRST WP: "**WP0**"
- Following WPs: Max 7 Waypoints / 6 Route legs ahead, including turn radiuses (if available).

Step 2. Own ship passing '**SOT**' (Start Of Turn line):
- No additional broadcast event.

Step 3. Own ship sailing on curve (i.e. on turn radius). No additional broadcast events, except the periodic broadcast interval (*every 6 minutes*) which may be reached since last Route Message broadcast, in that case (same as Step 1):

- FIRST WP: "**WP0**"
- Following WPs: Max 7 Waypoints / 6 Route legs ahead, including turn radiuses (if available).

Receiver (ECDIS): Transmitting ship at step 3

Step 4. Own ship passing '**EOT**' (End Of Turn line). The 'WP passing' event is triggered, resulting in:

- FIRST WP: "**WP1**"
- Following WPs: Max 7 Waypoints / 6 Route legs ahead, including turn radiuses (if available).
- Previous "**WP0**" is not broadcast anymore and removed from the receiver ECDIS chart area including the WP1 radius.

Receiver (ECDIS): Transmitting ship at step 5
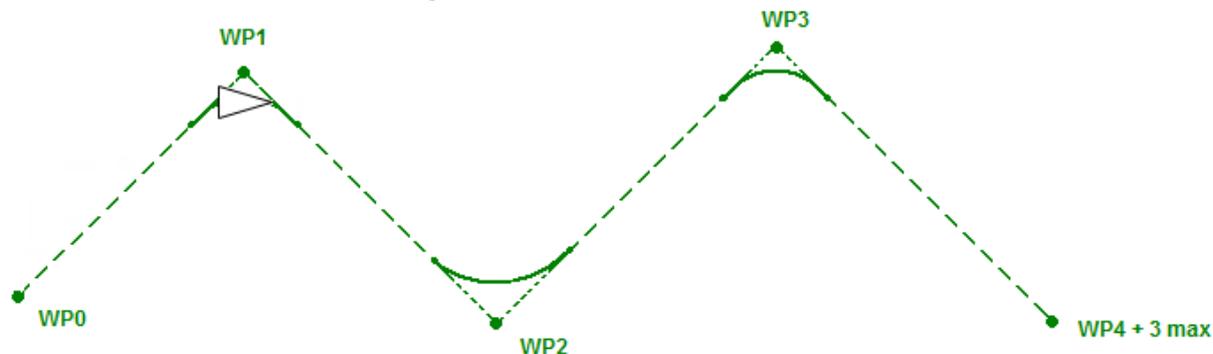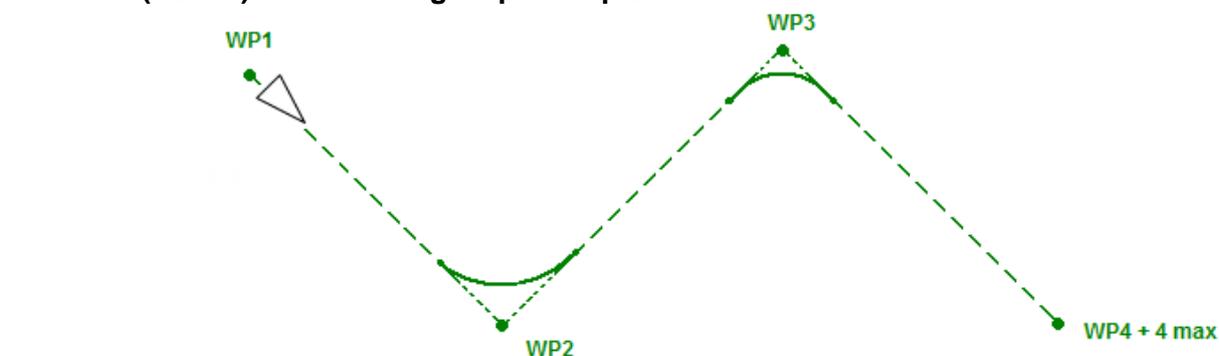
Step 5. Same as **Step 1** above.

## 5.2 AIS Route Exceptions for Long Legs

Due to the AIS Route message representation of intermediate waypoints in delta LAT & LON format very long legs (> ±209.7151') must be reported differently. Depending on the ship position either the broadcast AIS route contains fewer legs, or a virtual waypoint on the current leg is used to allow additional legs to be reported, in accordance the sections below.

The virtual waypoint shall be inserted on the current leg so that future legs can be reported in ample time before reaching them, ideally as far away from the leg end waypoint as the delta LAT & LON format (≤ ±209.7151') allows.
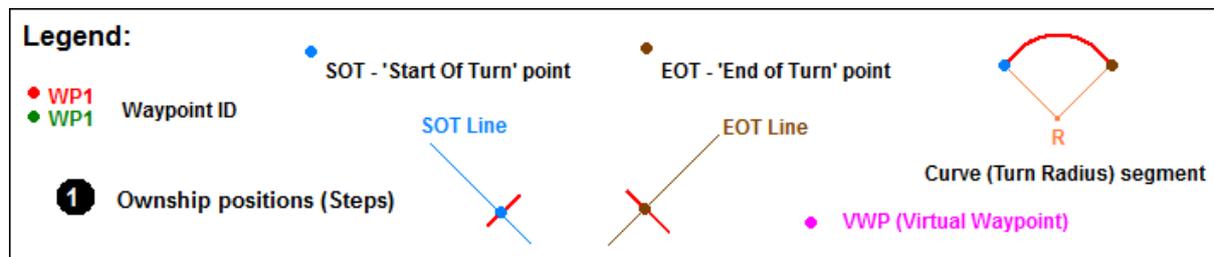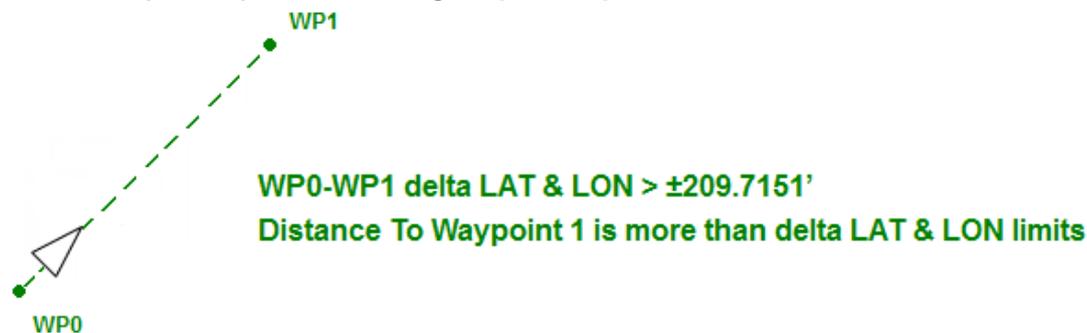
5.2.1 Length of the current route leg is more than delta LAT & LON limits. Own ship distance to WP1 is more than delta LAT & LON limits.

WP0-WP1: Delta LAT & LON > ±209.7151'

Transmitter (ECDIS)

Receiver (ECDIS): Transmitting ship at step 1

WP0-WP1 delta LAT & LON > ±209.7151'
Distance To Waypoint 1 is more than delta LAT & LON limits
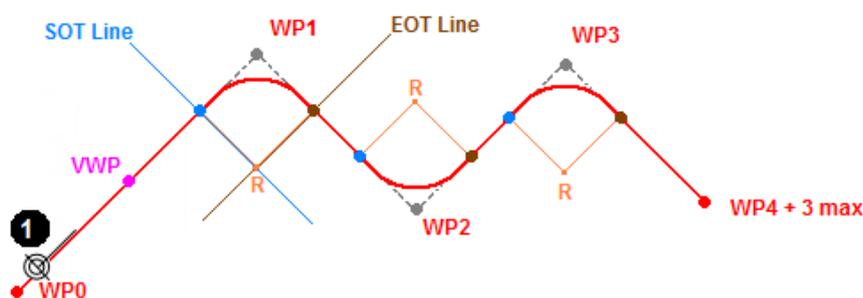
Step 1. Own ship position is on the straight leg, WP0-WP1 delta LAT & LON > ±209.7151'. Ship's distance to WP1 is also more than LAT & LON > ±209.7151'. Transmitter (ECDIS) uses the standard broadcast trigger events (*every 6 minutes*). AIS Route Message broadcast:
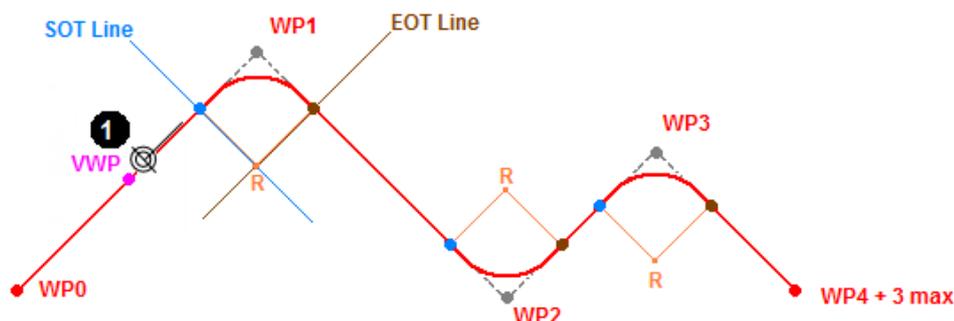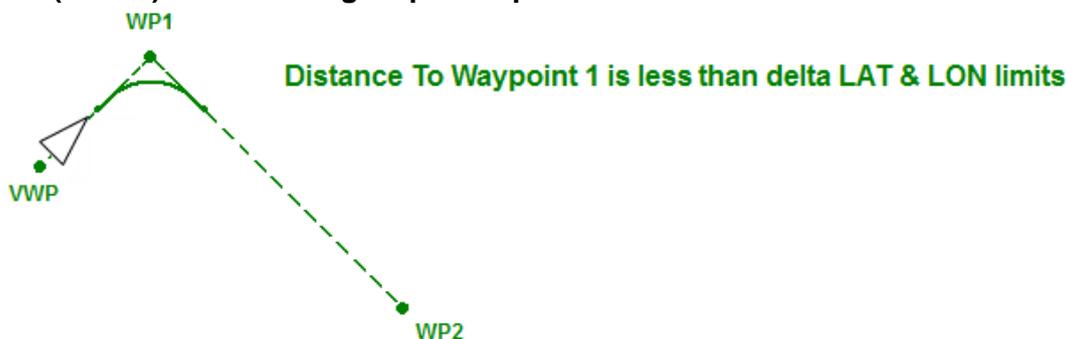- FIRST WP: "**WP0**"
- LAST WP: "**WP1**"

5.2.2 Length of the current route leg is more than delta LAT & LON limits. Own ship distance to WP1 is less than delta LAN & LON limits. WP1-WP2 delta LAT & LON > ±209.7151' limits.

<p align="center">**WP0-WP1:** Delta LAT & LON > ±209.7151'
WP1-WP2: Delta LAT & LON > ±209.7151'</p>

Transmitter (ECDIS)

Receiver (ECDIS): Transmitting ship at step 1

Distance To Waypoint 1 is less than delta LAT & LON limits

Step 1. A regular broadcast event occurs and the own ship has passed the Virtual Waypoint (the ship's distance to Waypoint 1 is less than LAT & LON ±209.7151'). There shall be no additional broadcast due to passing the Virtual Waypoint, but any broadcast after passing the waypoint shall use the Virtual Waypoint as the FIRST WP:

- FIRST WP: "**VWP**"
- SECOND WP: "**WP1**", delta LAT & LON between VWP and WP1 is less than ±209.7151'
- LAST WP: "**WP2**"

Step 2. Own ship passing '**SOT**' (Start Of Turn line):

- No additional broadcast event.

Step 3. Own ship sailing on curve (i.e. on turn radius). No additional broadcast events, except the periodic broadcast interval (*every 6 minutes*) which may be reached since last Route Message broadcast, in that case:

- FIRST WP: "**VWP**"
- SECOND WP: "**WP1**", delta LAT & LON between VWP and WP1 is less than ±209.7151'
- LAST WP: "**WP2**"

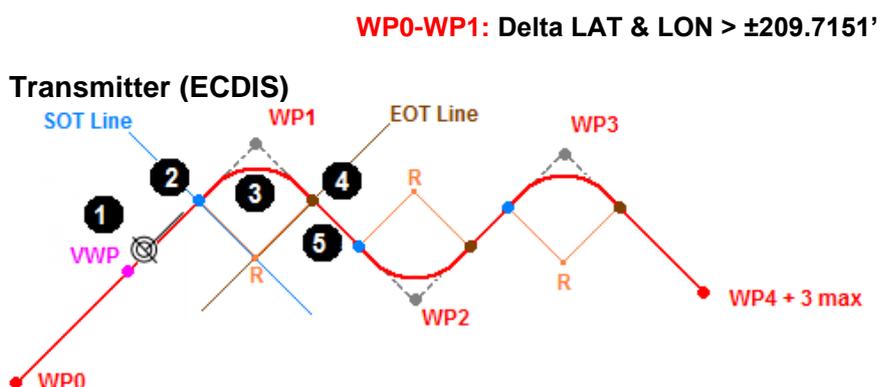**Step 4.** Own ship passing '**EOT**' (End Of Turn line). The 'WP passing' event is triggered resulting in:
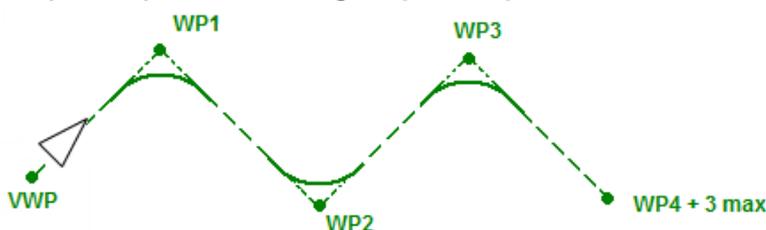
- FIRST WP: "**WP1**"

- LAST WP: "**WP2**", no more waypoints because delta LAT & LON between WP1 and WP2 is more than ±209.7151'
- Previous "**VWP**" is not broadcast anymore and removed from the receiver ECDIS chart area including the WP1 radius.

Step 5. Same as 5.2.1 ovan.

5.2.3 Length of the current route leg is more than delta LAT & LON limits. Own ship distance to WP1 is less than delta LAT & LON limits. WP1-WP2 delta LAT & LON is less than ±209.7151' limits.

WP0-WP1: **Delta LAT & LON > ±209.7151'**

Transmitter (ECDIS)

Receiver (ECDIS): Transmitting ship at step 1

Distance To Waypoint 1 is less than delta LAT & LON limits

Step 1. A regular broadcast event occurs and the own ship has passed the Virtual Waypoint (the ship's distance to Waypoint 1 is less than LAT & LON ±209.7151'). There shall be no additional broadcast due to passing the Virtual Waypoint, but any broadcast after passing the waypoint shall use the Virtual Waypoint as the FIRST WP:
- FIRST WP: "**VWP**"
- Following WPs: Max 7 Waypoints / 6 Route legs ahead, including turn radiuses (if available).

Step 2. Own ship passing '**SOT**' (Start Of Turn line):
- No additional broadcast event.

Step 3. Own ship sailing on curve (i.e. on turn radius). No additional broadcast event, except the periodic broadcast interval (*every 6 minutes*) which may be reached since last Route Message broadcast, in that case:
- FIRST WP: "**VWP**"
- Following WPs: Max 7 Waypoints / 6 Route legs ahead, including turn radiuses (if available).

Step 4. Own ship passing '**EOT**' (End Of Turn line). The 'WP passing' event is triggered, resulting in:

- FIRST WP: "**WP1**"
- Following WPs: Max 7 Waypoints / 6 Route legs ahead, including turn radiuses (if available).
- Previous "**VWP**" is not broadcast anymore and removed from the receiver ECDIS chart area including the WP1 radius.
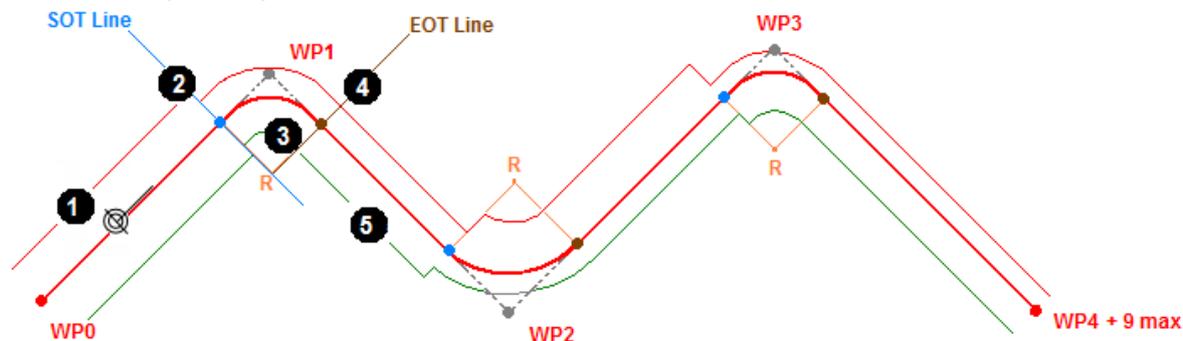
Receiver (ECDIS): Transmitting ship at step 5
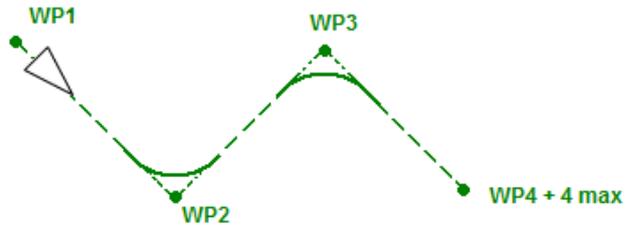
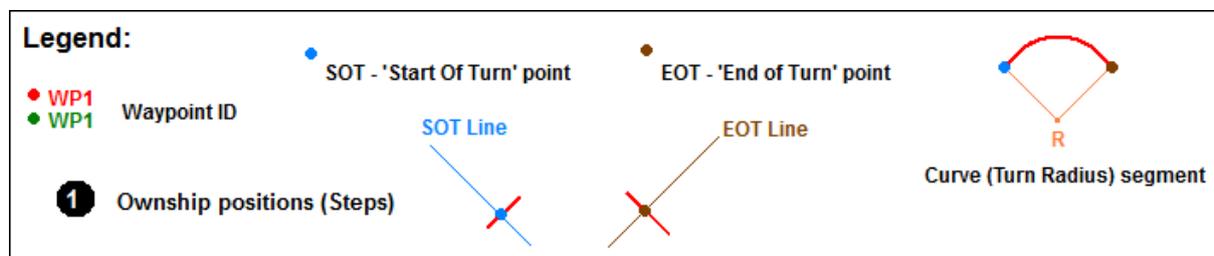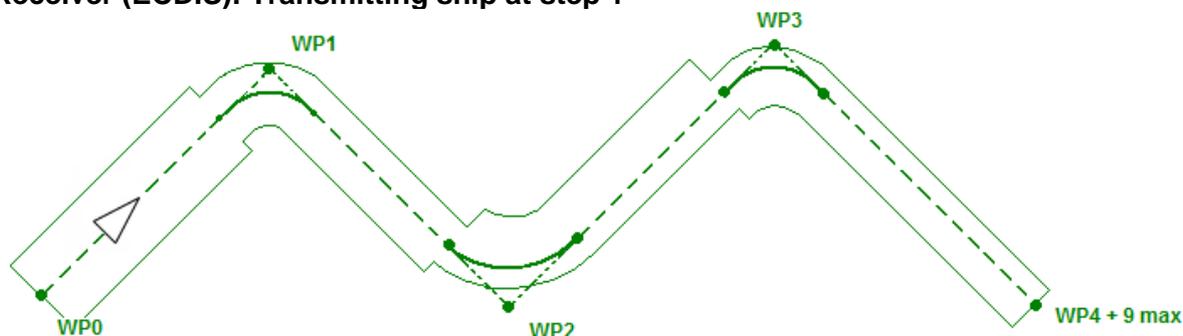**Step 5.** Standard broadcast rules, see 5.1 ovan.

6 ANNEX B – VDES ASM Route Broadcast Logic

Regular Conditions

Transmitter (ECDIS)

Receiver (ECDIS): Transmitting ship at step 1

Legend:
- ● WP1
- ● WP1   Waypoint ID
- ● SOT - 'Start Of Turn' point
- ● EOT - 'End of Turn' point
- **①** Ownship positions (Steps)
- SOT Line
- EOT Line
- Curve (Turn Radius) segment

Step 1. Own ship position is on the straight leg. Transmitter (ECDIS) uses the standard broadcast trigger events.
- FIRST WP: "**WP0**"
- Following WPs: Max 13 Waypoints / 12 Route legs ahead, including Port & Starboard cross track distances and turn radiuses (if available).

Step 2. Own ship passing '**SOT**' (Start Of Turn line):
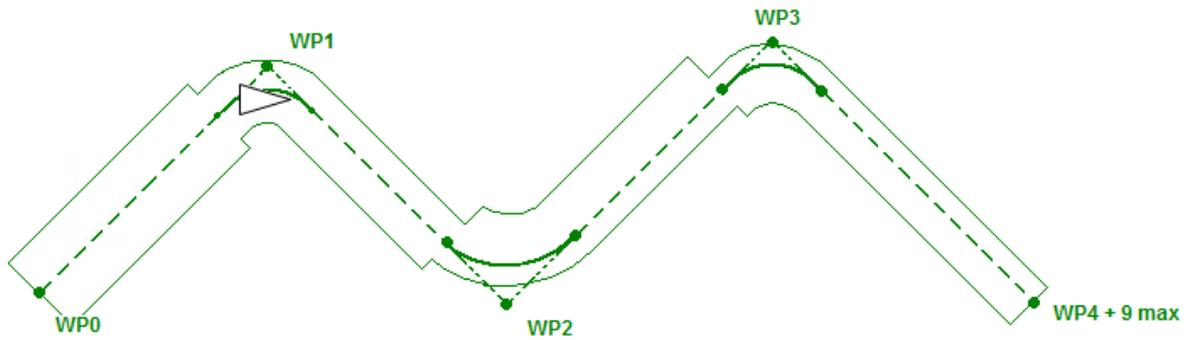- No additional broadcast event.

Step 3. Own ship sailing on curve (i.e. on turn radius). No additional broadcast event, except the periodic broadcast interval (*every 6 minutes*) which may be reached since last Route Message broadcast, in that case:
- FIRST WP: "**WP0**"
- Following WPs: Max 13 Waypoints / 12 Route legs ahead, including Port & Starboard cross track distances and turn radiuses (if available).

Receiver (ECDIS): Transmitting ship at step 3

Step 4. Own ship passing '**EOT**' (End Of Turn line). The 'WP passing' event is triggered, resulting in:

- FIRST WP: "**WP1**"
- Following WPs: Max 13 Waypoints / 12 Route legs ahead, including Port & Starboard cross track distances and turn radiuses (if available).
- Previous "**WP0**" is not broadcast anymore and removed from the receiver ECDIS chart area including the WP1 radius.

Receiver (ECDIS): Transmitting ship at step 5
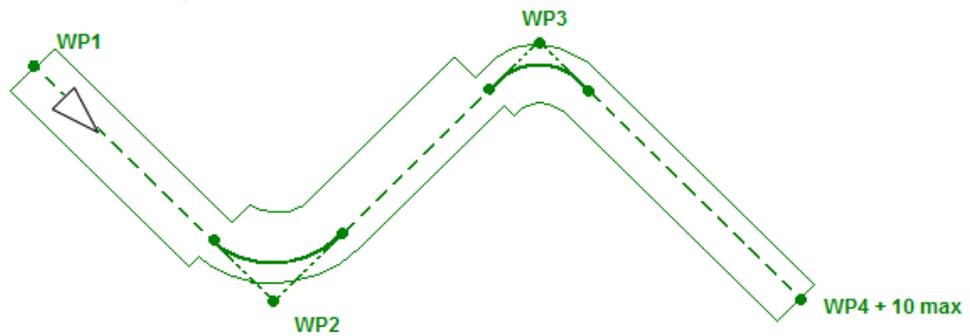
Step 5. Same as **Step 1** above.

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