Input paper: [[1]](#footnote-1) DTEC2-5.2.3.1

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Technical Domain / Task Number 2 …………………………………

Author(s) / Submitter(s) …China MSA……………

Proposal on the Supplement of ASM FATDMA Mechanism

# Summary

The TDMA scheme of ASM, including MITDMA, RATDMA and FATDMA, is defined in the official ITU Technical Characteristics Recommendation ITU-R M.2092-1 for VDES. The current implementation of FATDMA adversely impacts the communication capacity of AIS and has low efficiency. Therefore, a proposal for modification is presented for consideration by DTEC 2.

## Purpose of the document

The purpose of this document is to provide recommendations on the improvement of ASM FATDMA mechanism.

## Related documents

[1] ITU-R M.2092-1, *Technical characteristics for a VHF data exchange system in the VHF maritime mobile band, February 2022*

[2] ITU-R M.1371-5, *Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band, February 2014*

# Background

ITU-R M.2092-1 was published in Feb. 2022 by ITU. At IALA DTEC 1, the Committee participants were requested to present proposals on ITU-R M.2092-1, which would be submitted to ITU in a liaison note after discussion. Hence, China MSA proposes some changes on ASM FATDMA mechanism.

# Discussion

## Current ASM FATDMA mechanism

According to the description in Section 4.5.7 Channel access schemes in ITU-R M.2092-1, the access schemes, as defined below, should coexist and operate simultaneously on the TDMA channel. The access scheme FATDMA is as defined in Recommendation ITU-R M.1371. The reservation of fixed time slots on ASM is implemented through the AIS Message 20. Stations with ASM, upon the reception of Message 20 transmitted over AIS 1 or AIS 2, will suppress signal transmission on FATDAMA reserved time slots based on the current slot's Offset number, Number of slots, and Time-out Increment. This approach enables stations using the FATDMA scheme to transmit through these reserved slots without signal interference.

## Problems in current ASM FATDMA mechanism

1. Based on the aforementioned mechanism, when reserving time slots on the ASM channel, the Message 20 simultaneously suppresses transmissions on the AIS channel. This implies that the utilization of the FATDMA scheme on ASM will detrimentally affect the communication capacity of AIS.
2. Due to the ambiguous slot reservation mechanism on ASM, reserving time slot on one ASM channel may result in the suppression of transmissions on the other channel, adversely impacting the communication capacity of ASM.
3. In accordance with standard guidelines, transmissions of VDE at the lowest priority will avoid transmission over AIS time slots that utilize FATDMA if possible. With the prospective introduction of ASM FATDMA, the lack of distinct allocation of reserved time slots for AIS and ASM, could potentially affect the communication capacity of VDE.

## Proposed changes for current ASM FATDMA mechanism

It is recommended to revise relevant sections of ITU-R M.2092-1 and ITU-R M.1371-5 to differentiate the reservation of time slots for AIS and for various ASM channels.

### Amendments to ITU-R M.1371-5

According to ITU-R M.1371-5, regarding to AIS, Message 20 should be used by base stations to pre-announce the fixed allocation schedule (FATDMA) for one or more base stations and it should be repeated as needed.

To realize the rational use of FATDMA in ASM in Section 3.2, the “Spare” field in Message 20 should be redefined as “FATDMA indicator”, which is used to indicate the allocation of the four groups of time slots reserved for the message as follows:

0 indicates that the reserved time slots for groups 1-4 are all allocated for AIS channels.

1 indicates that the reserved time slot for the first group is allocated for an ASM channel, while the remaining three groups are reserved for AIS channels.

2 indicates that the reserved time slots for the first and second groups are allocated for ASM channels, with the third and fourth groups reserved for AIS channels.

3 indicates that the reserved time slots for groups 1-3 are allocated for ASM channels, with the fourth group reserved for an AIS channel.

The ASM channel number reserved with Message 20 is the same as the AIS channel number from which the message is transmitted, namely, ASM 1 corresponds to AIS 1 and ASM 2 corresponds to AIS 2.

Refer to Annex 1 for details.

### Amendments to ITU-R M.2092-1

Considering that the fixed time slots on the ASM are reserved through the AIS Message 20, the timeout value is set for the corresponding AIS/ASM channel time slots to determine when the FATDMA time slots become available according to the function of the "FATDMA indicator" defined in Message 20 above, as follows:

When time slots on AIS 1 or AIS 2 channel are designated as FATDMA reservation, stations (other than those using this FATDMA reservation) shall not use the FATDMA reserved time slots on the corresponding AIS channel and all ASM channels;

When time slots on ASM 1 or ASM 2 channel are designated as FATDMA reservation, stations (other than those using this FATDMA reservation) shall not use the FATDMA reserved time slots on the corresponding ASM channel, while AIS 1 and AIS 2 channels are unaffected.

The mapping relationship between ASM channel and AIS Message 20 transmitting channel is as follows: ASM 1 corresponds to AIS 1 and ASM 2 corresponds to AIS 2.

* 1. **Considerations for Compatibility**

For AIS stations supporting ITU-R M.1371-5 and earlier versions, since they are unable to recognize the “FATDMA indicator” field, the transmission of corresponding slots on the AIS channel will be suppressed upon receiving the message, regardless of whether the FATDMA slot reservation applies to the AIS channel. This is consistent with the unmodified FATDMA mechanism.

For AIS stations supporting versions subsequent to ITU-R M.1371-5, due to their capability to recognize the “FATDMA indicator” field, their transmissions on the AIS channel remain unaffected when the reserved slots are on the ASM channel. For new ship stations supporting both AIS and ASM, their ability to identify the FATDMA indicator field enables them to distinguish the channel (AIS 1, AIS 2, ASM 1, ASM 2) for which the slot reservation is applied, thus allowing more efficient utilization of the VDL for data transmission.

Compared to the existing mechanism, the proposed modifications to the FATDMA mechanism will not introduce additional compatibility issues. Furthermore, they are expected to enhance the communication capacities of both AIS and ASM. This improvement is anticipated to become increasingly significant as the proportion of shipboard equipment supporting the new version of the FATDMA mechanism increases.

1. **References**
2. ITU-R M.2092-1, *Technical characteristics for a VHF data exchange system in the VHF maritime mobile band, February 2022*
3. ITU-R M.1371-5, *Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band, February 2014*
4. **Action requested of the Committee**

The Committee is invited to consider the proposal in this document and take actions as appropriate.

1. **AnneX 1**

The modifications to table 72 in Annex 8 Section 3.18 in ITU-R M.1371-5 are as follows:

TABLE 72

| Parameter | Number of bits | Description |
| --- | --- | --- |
| Message ID | 6 | Identifier for Message 20; always 20 |
| Repeat indicator | 2 | Used by the repeater to indicate how many times a message has been repeated. See § 4.6.1, Annex 2; 0-3; 0 = default; 3 = do not repeat any more |
| Source ID | 30 | Identity (in the MMS) of the source of the message (see Article **19** of the RR and Recommendation ITU R M.585) |
| FATDMA indicator | 2 | 0 indicates that the reserved time slots for groups 1-4 are all allocated for AIS channels.  1 indicates that the reserved time slot for the first group is allocated for an ASM channel, while the remaining three groups are reserved for AIS channels.  2 indicates that the reserved time slots for the first and second groups are allocated for ASM channels, with the third and fourth groups reserved for AIS channels.  3 indicates that the reserved time slots for groups 1-3 are allocated for ASM channels, with the fourth group reserved for an AIS channel. |
| Offset number 1 | 12 | Reserved offset number; 0 = not available(1) |
| Number of slots 1 | 4 | Number of reserved consecutive slots: 1-15;  0 = not available(1) |
| Time-out 1 | 3 | Time-out value in minutes; 0 = not available(1) |
| Increment 1 | 11 | Increment to repeat reservation block 1;  0 = one reservation block per frame(1) |
| Offset number 2 | 12 | Reserved offset number (optional) |
| Number of slots 2 | 4 | Number of reserved consecutive slots: 1-15; optional |
| Time-out 2 | 3 | Time-out value in minutes (optional) |
| Increment 2 | 11 | Increment to repeat reservation block 2 (optional) |
| Offset number 3 | 12 | Reserved offset number (optional) |
| Number of slots 3 | 4 | Number of reserved consecutive slots: 1-15; optional |
| Time-out 3 | 3 | Time-out value in minutes (optional) |
| Increment 3 | 11 | Increment to repeat reservation block 3 (optional) |
| Offset number 4 | 12 | Reserved offset number (optional) |
| Number of slots 4 | 4 | Number of reserved consecutive slots: 1-15; optional |
| Time-out 4 | 3 | Time-out value in minutes (optional) |
| Increment 4 | 11 | Increment to repeat reservation block 4 (optional) |
| Spare | Maximum 6 | [Not used]. Should be set to zero. The number of spare bits which may be 0, 2, 4 or 6 should be adjusted in order to observe byte boundaries. [] |
| Number of bits | 72-160 |  |
| 1. If interrogated and no data link management information is available, only Offset number 1, number of slots 1, time-out 1, and increment 1 should be sent. These fields should all be set to zero. 2. If the FATDMA indicator equals 0, it applies to the same AIS channel as this message. If the FATDMA indicator equals 1, 2, or 3, the mapping relationship between ASM channel and message transmitting channel is as follows: ASM 1 corresponds to AIS 1 and ASM 2 corresponds to AIS 2. | | |

1. **AnneX 2**

The modifications to ITU-R M.2092-1 Annex 3 4.5.7 are as follows:

**4.5.7 Channel access schemes**

The access schemes, as defined below, should coexist and operate simultaneously on the TDMA channel.

**4.5.7.1 Fixed access time division multiple access**

FATDMA reservations should be done by base stations with AIS function only. FATDMA reserved slots should be used for repetitive ASM messages. The access scheme FATDMA is as defined in Recommendation ITU-R M.1371.

**4.5.7.2 Fixed access time division multiple access algorithm**

Access to the data link should be aligned with the start of the reference frame. Each allocation should be pre-configured by the competent authority and remain constant during station operation or until reconfigured unless there is a specific timeout value. The receiver of Data Link Management Messages (Message 20) should set the slot timeout values for the respective channels according to the FATDMA indicator, to determine if the FATDMA slots is available. The slot timeout should be reset according to the received content each time this message is received.

FATDMA reservations should include base station reports (Message 4) in conjunction with Data Link Management Messages with the same base station ID (MMSI). FATDMA reservations are applicable within a range of 120 nautical miles from the reserving base station. When slots on AIS 1 or AIS 2 channels are designated for FATDMA reservation, stations (other than stations using this FATDMA reservation) should not use the corresponding AIS channel and any ASM channels for FATDMA reserved slots. When slots on ASM 1 or ASM 2 channels are designated for FATDMA reservation, stations (other than stations using this FATDMA reservation) should not use the FATDMA reserved slots on the corresponding ASM channels. This reservation does not affect the AIS 1 and AIS 2 channels.

The mapping relationship between ASM channels and the AIS Message 20 transmission channels is as follows: AIS 1 corresponds to ASM 1, and AIS 2 corresponds to ASM 2.

**4.5.7.3 Multiple incremental time division multiple access**

The MITDMA access schemes allows a station to pre-announce transmission slots that the station will use in the future. A single MITDMA transmission may be used to schedule up to three future transmissions with each transmission occupying up to three slots.

**4.5.7.4 Multiple incremental time division multiple access algorithm**

MITDMA is a method of chaining slot allocations together for the purpose of transmitting messages. The first transmission within a MITDMA chain will be a single slot transmission using RATDMA access. Further transmissions will be allocated by the MITDMA communication state.

Receiving stations should mark these slot allocations as unavailable.

MITDMA may chain up to 15 transmissions together in a single frame. See § 6.4.

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