

**12<sup>th</sup> Mediterranean AIS Expert Working Group**  
**Rome, 22<sup>nd</sup> October 2014**

**MAREΣ 12/10/1**  
**19 September 2014**

**Adoption of a FATDMA plan**  
**Submitted by Italy**

<i>Executive summary</i>	Study document related to the adoption of a Fixed Allocation TDMA as defined in the IALA Recommendation A-124 on the "AIS Service".
<i>Action to be taken</i>	As per paragraph 7.
<i>Related documents</i>	a. IALA Recommendation A-124 APP. 14 FATDMA Planning and Operation of an AIS Service - Edition 2 - December 2011. b. Recommendation ITU-R M.1371-5 c. 11 <sup>th</sup> Mediterranean AIS EWG Workshop report

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## **1. Introduction**

The purpose of the adoption of the FATDMA management plan in a given area is to optimize the use of the VDL avoiding any interference between the AIS transmission schedules of the Base Stations managed by the same and neighboring competent Authorities.

The FATDMA planning is an aspect of VDL usage by the AIS Service. In details, the BS FATDMA reservation is defined as an **Internal Basic AIS Service (BAS)** used for management of the AIS and the VDL by the IALA Recommendation A-124.

During the 11<sup>th</sup> meeting, the EWG agreed to carry out a study, by the ICG, for the possible adoption of a FATDMA management plan using the IALA grid scheme.

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## **2. FTDMA planning**

A **FATDMA plan** is the highest level of FATDMA reservation planning and it comprises all FATDMA schedules, which are considered relevant to the FATDMA plan. The FATDMA plan consists of a static allocation of some VDL slots to support the transmission operation of the Base Stations within a geographic area.

A **FATDMA schedule** comprises the relevant FATDMA schemes of one or more AIS PSS Controlling Units (AIS-PCU) in the area under consideration. The FATDMA schemes combined in a FATDMA schedule may be of the same or different competent Authorities.

Any FATDMA schedule needs to be consistent at its interfaces to adjacent FATDMA schedules.

A **FATDMA scheme** comprises the relevant FATDMA reservations of one AIS-PCU. Hence, a FATDMA scheme may comprise the FATDMA reservations of one or more transmitting AIS Base station(s) of that AIS-PCU.

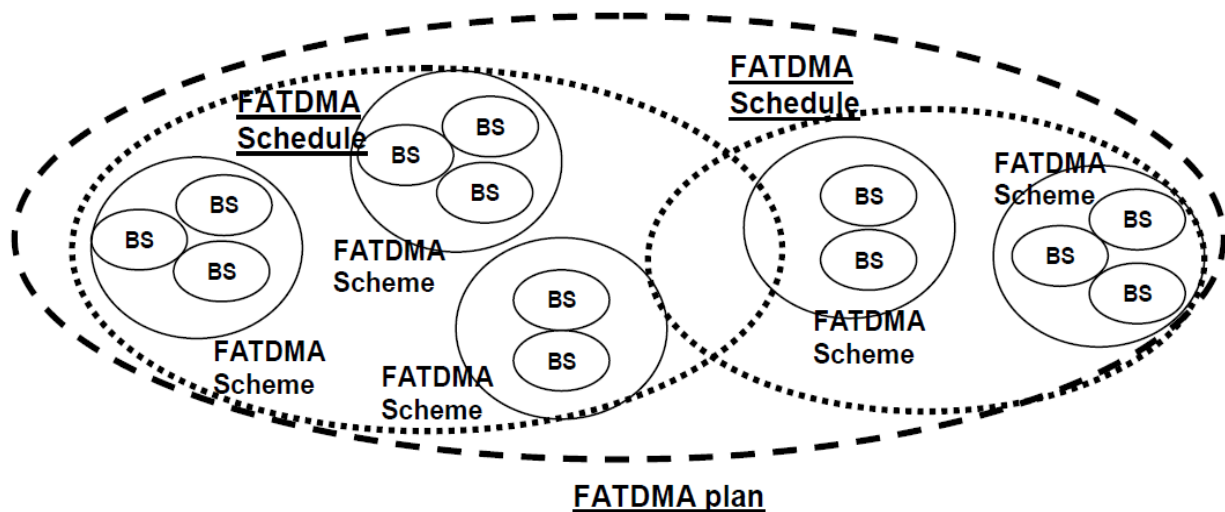


Figure 1: Hierarchy of FATDMA plan, FATDMA schedule and FATDMA scheme

### 3. FATDMA reservation rules

The **FATDMA reservation** is an announcement of a base station to create one or more FATDMA block(s) (consecutive slots) using the FATDMA reservation parameters. It is both an activity of a base station as well as the stationary knowledge of receiving mobile AIS stations, namely that the slots contained within the blocks have been reserved by a base station and then they have to exclude FATDMA reserved slots from own Candidate Slot Set.

Actual FATDMA reservations are being made by transmitting the **Data Link Management message (message 20)** from an AIS Base station to mobile AIS stations.

A FATDMA reservation can **only be made by an AIS Base station of a competent Authority**. The BS FATDMA reservation is defined as an **Internal Basic AIS Service (BAS)** by the IALA Recommendation A-124 (Appendix 14).

The BAS Category I-1 FATDMA provides a means to the technical operation personnel to reserve time slots from the autonomous use by other AIS stations. Those time slots are available for specific use as determined by the technical operation personnel, e.g. for AIS base station or AIS AtoN station transmissions. The BAS FATDMA automatically broadcast a FATDMA reservation command into the identified area immediately after reception of the data from the technical operation personnel. The mobile AIS stations will exclude the reserved time slots from autonomous use.

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The usages of FATDMA reserved slots can be categorized into the following categories:

- a. AIS VDL management. These FATDMA reserved slots will be used for the transmission of any message, which is necessary for the management of the AIS VDL (i.e. messages 20, 22, 24).
- b. High timing requirements slots. These FATDMA reserved slots will be used for the transmission of messages, which need to comply with high timing requirements (i.e. messages 4, 12, 14, 7, 13, 17).
- c. General purpose pre-reserved slots. These FATDMA reserved slots will be used for the transmission of any message, which does not fall under FATDMA reservation usage category 1 or 2.

Detailed rules for FATDMA reservations requirements are provided by Recommendation ITU-R M.1371-5.

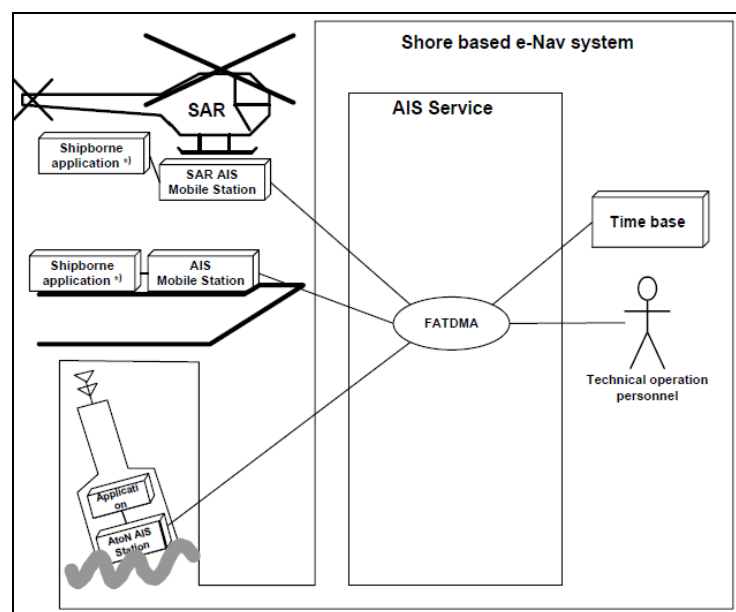


Figure 2: BAS Category I-1 FATDMA

## 4. FATDMA geographical grid

### 4.1. Separation by space and frequency

The geographical grid defines a global method for selecting a default FATDMA scheme for any area under consideration.

Its goal is to ensure, that identical FATDMA schemes by default are sufficiently geographically separated, by arranging a set of FATDMA schemes in a geographical grid in such a manner, that by default, no FATDMA scheme is reused within 150 nautical miles.

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The geographical grid is meant as a geographical starting point from which further planning and co-ordination within Participant Countries must take place, if required, when defining which part of the timeslot resource of the AIS VHF Datalink is available to specific competent authorities (bi-lateral or tri-lateral coordination would be required in areas, where on the geographical grid cell falls into more than one country).

The geographical grid is created by dividing the world into cells by an algorithm, based on the WGS84 datum. The grid consist of a repetitive pattern of 36 different cells in an 6x6 matrix (called master cell), where each individual cell is approximately 30x30 nautical miles in size, and referenced by a cell number.

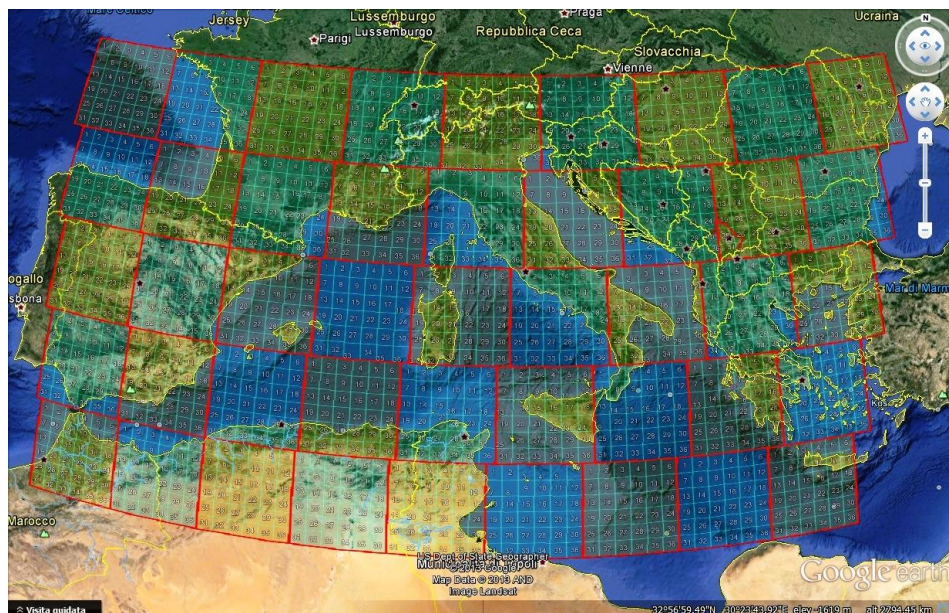


Figure 3: IALA grid scheme within the MAREΣ region



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Figure 4: An example of Master Cell

Two default FATDMA schemes are assigned to each individual cell number. Thus, identical FATDMA schemes are generally repeated at a distance of 6 cells x 30 nm, i.e. at 180 nautical miles.

Employing the two working frequencies A and B of the AIS, by allowing two 'mirrored' default FATDMA schemes in each cell, using the very same time slot reservation pattern on the opposite working frequency, yields **72 different FATDMA schemes for each Master cell**.

#### 4.2. Separation in time

It is desirable that the sum of the FATDMA schemes used by fixed AIS stations in any given area, are confined to a certain part of the time domain of the AIS VDL in order to provide sufficient free time slots for mobiles to allocate under all dynamical situations.

### 5. Analysis of possible FTDMA schemes and conflicts

The allocation of the AIS MAREΣ Base Stations within a FTDMA IALA grid scheme, their occurrences inside each cell and all the possible transmission conflicts, interesting two or more neighbouring participant Countries (which necessary need of an international agreement), are reported in **Annex 1**.

The analysis was conducted on the basis of the BSs information known (location).

The two following kinds of possible conflicts are been analysed for all the AIS BSs located:

- 1) in the same cell of the same master cell;

- 2) in the same cell of adjacent master cell (if the territorial orography conditions are able to create possible interferences due to duct effect, high coverages, high transmission power level, etc.).

It is understood that, as default approach, the BSs referred to the above item 1) will necessary implement the FATDMA scheme selecting their transmissions schedules on the two different AIS frequencies.

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## **6. A proposal for the implementation of a FATDMA schemes within the MAREΣ region**

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A FATDMA plan could be implemented within the MAREΣ region taking in account that:

- a. the coverage planning and the statutory rights of the competent Authorities of each Participant Country involved have to be considered to arrive at the optimum FATDMA plan or FATDMA schedule for a given area;
- b. it will be the responsibility of such Authorities to guarantee that an upper limit of VDL loading, due to FATDMA reservations, will be respected to leave sufficient available timeslots for the population of mobile AIS stations.

Therefore, BSs have to select their transmission schedules conveniently when they operate in the same area of transmitting stations which:

- are planned to inject a larger number of messages;
- operate with an high antenna height or using higher transmission power levels;
- provide advanced broadcast services or operate as repeater;
- operate in areas where an hard impact of ducting effect during the summer season is noted.

The goal would be to keep the injected message confined to confined areas if at all possible. However, the mitigation measures for the above mentioned problems could be:

- Choosing to contribute an unused and immediately adjacent FATDMA scheme from within its planning area to be used in another cell, when it can be guaranteed by the competent Authority that this cell will remain unused (e.g. due to topology);
- Using queuing capability of the base station (if available);
- Employing directional antennas, lower antenna heights of the transmitting station(s) and even transmission power attenuation of the transmitting station(s), making use of or at least taking into account the local topography;
- Using different frequencies also for the same cells in adjacent master cells (to avoid possible interferences due to the duct effect).

Based on the above precautions, the following simple approach for planning can be taken:

- The FATDMA schemes which fall completely – judging by the area of their geographical grid cell - within the territory and/or Territorial Waters of the same Country belong to that Country and they are immediately subject to domestic allocation rules (see step 2 below).

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- The FATDMA schemes, which fall - by the geographical area of their geographical grid cell into the adjacent Territory and/or Territorial Waters of different Countries need of a negotiation for the allocation on a peer-to-peer basis and of a memorandum of understanding (or similar document) between that Countries on the usage of the FATDMA scheme in question.

As options to the previous approach:

- one or more than one Country can contribute an unused and immediately adjacent FATDMA scheme from within its own area (TW), where it can be guaranteed by that Country that this cell will remain unused (e. g. due to topology).
- The cell management is assigned solely to one of the two Countries, while both may use the FATDMA scheme on a mutually agreed basis.
- Both Countries set up a detailed usage allocation based on the usage categories of the slots of the FATDMA scheme.
- There may be an alternating use (e. g. based on epoch) of the same slots of a FATDMA scheme. In this case the countries need to agree on the time schedule for the alternating in advance.

FATDMA configuration data exchange between Administrations at run-time needs to support a possible exchange run-time data on actual FATDMA schedules (or maybe even FATDMA schemes) to take into account, as possible, the change of “real life” conditions.

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## **7. Action required**

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Participating Countries are invited to note the above analysis and provide their comments.