AISM Association Internationale de Signalisation Maritime
IALA International Association of Marine Aids to Navigation and Lighthouse Authorities

IALA Recommendation A-124

APPENDIX 14

FATDMA Planning and Operation of an AIS Service

Edition 2

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Document Revisions

Revisions to the IALA Document are to be noted in the table prior to the issue of a revised document.

Date	Page / Section Revised	Requirement for Revision

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1 INTRODUCTION

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1.2 Purpose of the Appendix

This Appendix introduces the configuration of FATDMA of AIS PSS Controlling Units (AIS-PCU) by one or more competent authorities in a given area together with guidance to ensure that FATDMA

schemes do not result in interference between the schedules for the same and neighbouring competent authorities.

The purpose of this Appendix can be summarized as providing:

- to competent authorities a comprehensive 'cookbook-like' recipe **for creating a FATDMA plan;**
- to adjacent and affected national competent authorities **guidance to co-ordinate their joint FATDMA plan** in the adjacent area;
- to (national / other domestic) competent authorities **guidance how to operate their coordinated FATDMA plan correctly** and **optimize the benefit** of both mobile AIS stations and the competent authorities in a given area;
- a basis for required and / or stipulated type(s) of components of a competent authority.

A range of AIS stations make use of FATDMA reserved timeslots for their transmissions. Taking IMO resolution MSC.140(76) into consideration, which states, that 'Administrations should take steps necessary to ensure the integrity of the radio channels used for AIS in their waters', and since FATDMA reservations in general affect the bandwidth availability of the AIS VDL, proper management of FATDMA is required to protect the VDL.

The complexity of FATDMA management increases in proportion to:

- the slot usage requirements by different competent authorities in their envisaged coverage areas;
- the number of transmitting entities using the FATDMA reserved slots; and
- their relative geographical proximity.

Therefore, fundamental usage rules for *FATDMA plans*, *FATDMA schemes* and *FATDMA schedules* need to be established to resolve the complexity of FATDMA configuration in any given area.

This Appendix provides general guidance (sections 4, 5 and 6) and rules (sections 7 and 8) for the efficient use of FATDMA and the creation of a FATDMA plan.

It also presents a recommended global IALA FATDMA plan (sections 9 and 10) developed with all the considerations in the Appendix in mind.

Administrations are encouraged to use the global IALA FATDMA plan for their FATDMA configuration as is. The IALA recommended FATDMA plan can also be used as a basis if additional considerations require a different FATDMA plan.

2 GENERAL

When setting up a FATDMA plan, there are four dominating aspects which need to be introduced:

1 The required ***usage of FATDMA reserved slots***, answering the questions: What would the FATDMA reserved slots be used for by AIS stations?

2 What ***geographical criteria*** apply to coordination of FATDMA schedules and schemes when using FATDMA reserved slots in a (larger) given area of a FATDMA plan?

3 What rules are applicable for ***allocating FATDMA reserved slots*** to national competent authorities and other (domestic) competent authorities? In particular, what rule base governs the allocation of FATDMA schemes internationally?

4 What will be the consequences to VDL loading by implementing a FATDMA plan in any given area?

These four aspects will be dealt with in the following sections after the introduction of important definitions.

3 FUNDAMENTAL PHILOSOPHY STATEMENTS FOR FATDMA PLANNING - GUIDING PRINCIPLES

There are several possibilities to create an FATDMA plan. The following principles were adhered to when developing the IALA recommended FATDMA plan presented in sections and 10 of this Appendix.

3.1 Rules to minimise the load on the VDL by FATDMA reservations

- The number of FATDMA reserved slots should be minimised in any given area;

  This would translate into the following consecutive rules:

  - The FATDMA Configuration should be such, that FATDMA reservations are only done when there is a continuously **justified need** for FATDMA reserved slots;
  - The FATDMA block size should **not exceed 5 consecutive slots**.

- A **maximum of stationary FATDMA reservations** should be achieved through continuously repeated reservations;

  Dynamic changes to the reservations should be minimised.

- The FATDMA plan should provide for all capabilities of the AIS;
- The FATDMA plan should **provide a maximum flexibility** for mobiles of AIS stations to participate on the VDL;
- FATDMA reservations should be done, taking the frequency separation of the two working channels of the AIS (A and B) for the same slots into account.

  By default, mobile stations include the slots in the opposite working channel in the same slot only as a last resort into their candidate slot set, hence acting as if a de-facto FATDMA reservation was made in these other slots as well. Not to use these slots for FATDMA reservations would be a waste of available slots.

3.2 Rules in regard to the applicability of the FATDMA plan

1 The rules underlying the FATDMA plan should be **as simple as possible**;

2 The rules underlying the FATDMA plan should be **globally applicable**;

The global applicability would provide for a fair and equal basis for setting up the FATDMA plans.

3 The resulting FATDMA plan should **cover the overwhelming majority** of FATDMA configurations world-wide **in just one planning step**;

4 When adjacent countries are required to co-ordinate this should require **only the minimum number of parties involved**, i. e. only the countries actually affected by the FATDMA plan would treat the co-ordination issue independently of other co-ordination issues with other countries in a different area;

5 There should not be a need for frequent or even run-time co-ordination between adjacent and affected countries;

6 The most fundamental assumption to be made is that adjacent and affected national administrations are **willing** to protect the joint operation of the AIS VDL and to achieve its smooth operation in their area of (joint) responsibility;

It is essential that all affected national administrations will exhibit **due diligence** to arrive at a solution where co-ordination is needed.

7 Other aspects than FATMDA planning may be needed in coordinating VDL management.

4 DEFINITIONS

This section defines relevant terminology used for FATDMA Configuration.

4.1 Fundamental considerations for terminology

In order to make efficient usage of the available AIS VDL time slots in a given area an 'area specific plan' is needed. This 'area specific plan' may be called the **FATDMA Area Slot Map**. It has two aspects:

1 **Setting up** the FATMDA Area Slot Map (*at planning time*).

2 **Using** the FATDMA Area Slot Map (*at run-time*).

These aspects and the composition of the FATMDA Area Slot Map are illustrated in Figure 1. An explanation of the various aspects will be given afterwards (the figure employs the UML notation).

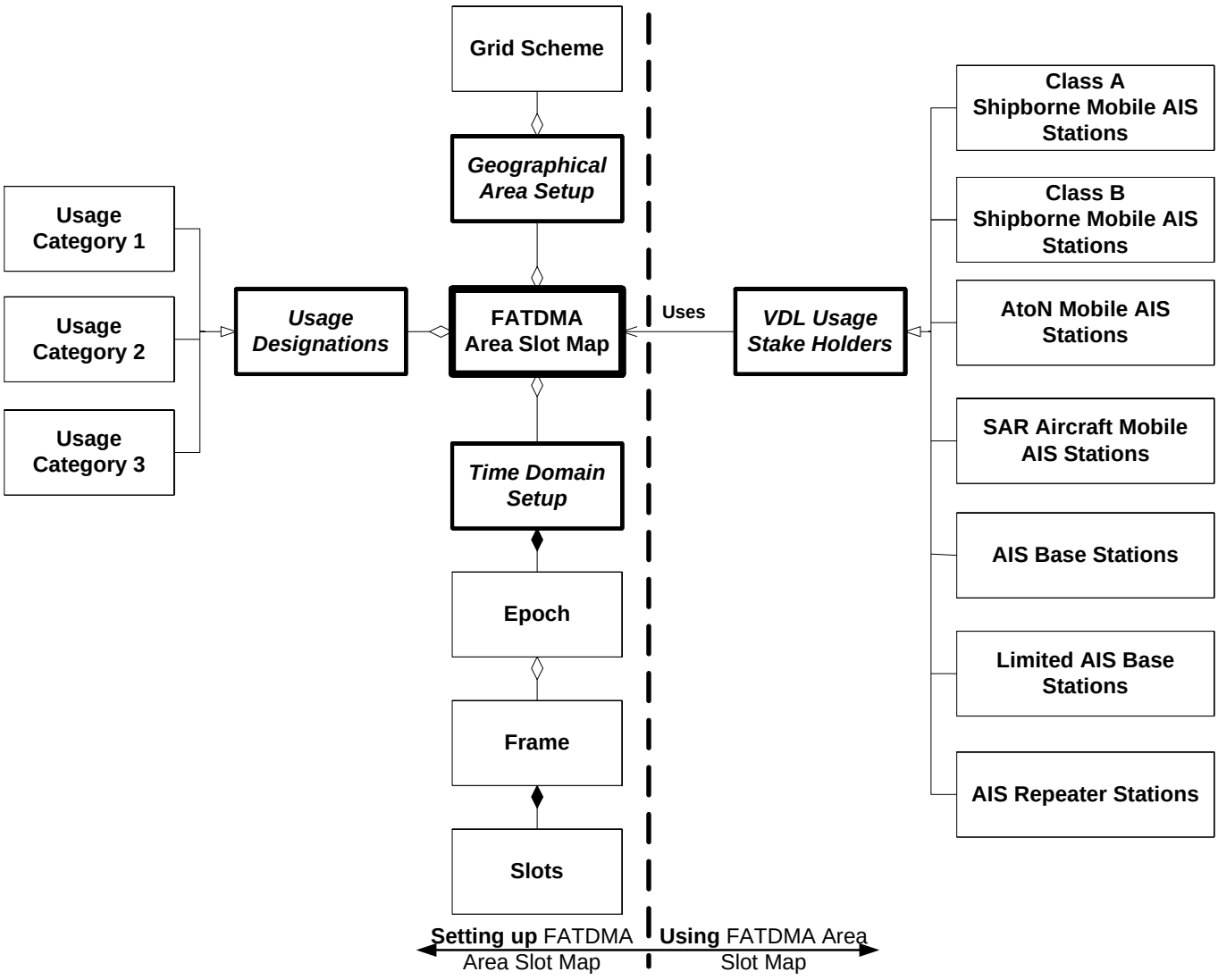

Figure 1 FATDMA Area slot map

The aspects which should be considered when planning FATDMA reservations on the AIS VDL in a given area are described below.

1 **Geographical area aspect:** Every FATDMA reservation is done within a defined area.

2 **Time domain aspect:** The actual FATDMA reservations are done using the time domain. The time domain in the AIS is subdivided into time slots. Every FATDMA reservation consists of time slots reserved for a specific use. These FATDMA reservations can be

described in terms using absolute time slot terminology and relative time slot terminology as follows:

a Absolute slot numbers of FATDMA reservations

At planning time, the FATDMA reservations can only be planned using absolute slot numbers within the slot frame epoch. This requires an absolute reference point, which is the start of a specific frame epoch which in turn is related to the start of an UTC minute or hour. Since UTC is a universal concept, any absolute point in time can be determined thereby.

b Terms related to the relative slot numbers used for actual transmissions of FATDMA reservations

At run-time, the FATDMA reservation is being done by transmitting the Data Link Management Command (message 20). The parameters given by this command determine the number and location of the slots reserved by base stations. The parameters given determine the absolute position of the FATDMA allocated slots by reference to the absolute slot number of that slot, in which the Data Link Management Command was received. Therefore, these terms are **relative** by nature.

3 **Usage domain aspects:** The usage domain is subdivided into two aspects:

a At planning time

Every FATDMA reservation is used for a purpose. Therefore, the usage aspect of FATDMA reservations must be considered. Each and every FATDMA reserved slot can and must have a designated usage allocated to it; otherwise its reservation would not be justified. This concept is called **'Usage Designation'**. It is further subdivided into **Usage Categories**.

b At run-time

The different potential users of FATDMA reservations **('VDL usage stake holders'**) are identified as – by default and in accordance with the rules of the AIS VDL – all defined varieties of AIS stations, mobile or fixed. Their usage requirements as well as the overall requirement to maintain the viability of the AIS VDL need to be reflected in the Usage Designations at planning time.

4 Roles of participating entities:

a At planning time

The national competent authorities of individual countries set up their FATDMA plan in accordance with the rules in this Appendix. Should there be more than one national competent authority adjacent to the same geographical area, co-ordination would be done to guarantee the inter-operability of the individual FATDMA plans and create one joint FATDMA plan.

b At run-time

Every FATDMA reservation is done by an AIS base station. Every time slot within this FATDMA reservation can be used by a variety of different entities participating in the AIS VDL, i.e. the reserving AIS base station itself, AIS simplex repeaters and the different classes of AIS stations other than AIS base station.

In the following sections, the precise terms will be introduced.

4.2 Terms related to FATDMA reservations in the time domain in general

The following terms are related to FATDMA reservations in the time domain in general, i.e. those terms are part of both the relative as well as the absolute FATMA terminology sets:

- **FATDMA block:** A *FATDMA block* consists of consecutive slots;
- **FATDMA block size:** The *FATDMA block size* is the number of consecutive slots of a block.

The *FATDMA block size* can be between 1 and 5;

- **FATDMA reservation:** A *FATDMA reservation* is an announcement of a base station to create one or more *FATDMA block(s)* using the *FATDMA reservation parameters*.

  The *FATDMA reservation* 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.

- **FATDMA reservation parameters:** Each *FATDMA reservation* is described by the following parameters (see Figure 2).

  The FATDMA offset number is a relative term exclusively and will be explained in the next section.

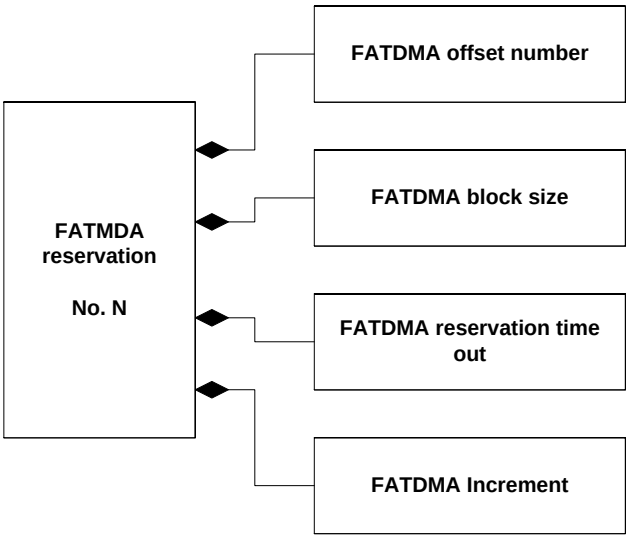

Figure 2 Composition of FATDMA reservation

- **FATDMA reservation time out**: This value indicates, how many minutes the *FATDMA reservation* should be considered valid by the mobile AIS stations.

  The number of minutes results by adding one (1) to the values 0 to 7 in the *FATDMA reservation(s)* in message 20. Therefore, a *FATMDA reservation* can be made with a *FATDMA reservation time out* between 1 and 8 minutes.

- **FATDMA increment:** The *FATDMA increment* is the offset of slots between the first slot of the first *FATDMA block* and the first slot of the next *FATDMA block* of the **same** *FATDMA reservation* in the **same** frame.

  The *FATDMA increment* is then used repeatedly to create further *FATDMA blocks* in the same frame until the end of this frame is reached and no further *FATDMA block* could be accommodated. If the FATDMA increment is set to zero (0), then there will be just one *FATDMA block* reserved by this *FATDMA reservation*.

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

- **FATDMA reservation Number N:** Each *Data Link Management message* can include up to four (4) *FATDMA reservations*.

  Within the *Data Link Management message*, the *FATDMA reservations* are numbered from 1 to 4. Figure 3 illustrates, that all four *FATDMA reservations* in one *Data Link Management message* inherit the above qualities of a *FATDMA reservation*, but may be different in terms of actual parameter setting.

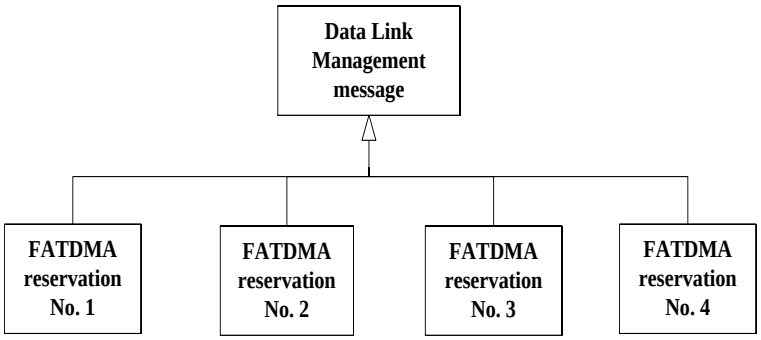

Figure 3 Inheritance relationship between FATDMA reservation definition in general and individual FATDMA reservations

- **Message-20-slot:** The Message-20-slot is the slot, in which the *Data Link Management Message* (message 20) was transmitted.

  It has an absolute slot number. Starting with the Message-20-slot number the *FATDMA offset number* is counted (see below; relative terminology).

4.2.1 Terms exclusively related to the relative slot number used for actual transmissions of FATDMA reservations

The following terms are exclusively related to the relative slot number used for actual transmission of FATDMA reservations.

- **FATDMA offset number:** Every *FATDMA reservation* has a parameter *FATDMA offset number*. The *FATDMA offset number* denotes the offset from the slot in which *Data Link Management Message* (message 20) was received to the first slot of the first *FATDMA block* to be reserved by the receiving station.

The relative composition of one (1) *FATDMA reservation* is illustrated by the following example, figure 4. In this example the parameters are as follows:

- Message 20 is transmitted in the slot with an absolute number of **n** (numbered 1 to n relative to frame start.

  Hence the Message-20-slot has the absolute slot number **n**. Note: The absolute number of the start slot of the first *FATDMA block* can only be determined, if the absolute value of the *Message-20-slot* is known (which is **n+25** in this example).

- FATDMA offset number: **25**
- FATDMA block size: **5**
- FATDMA reservation time-out: **3**
- FATDMA increment: **375**

This is illustrated in Figure 4.

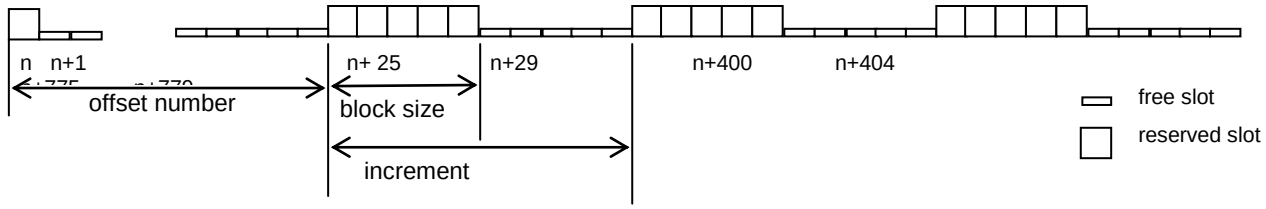

Figure 4 Example for one FATDMA reservation within a Data Link Management message transmitted in Message-20-slot n

Additional *FATDMA blocks* are reserved in this example, each of which has a *FATDMA block size* of 5, starting at absolute slot numbers: **n**+1150, **n**+1525, **n**+1900 (if end of frame is not reached by then).

4.2.2 Terms exclusively related to the absolute slot numbers of FATDMA reservations

Certain FATDMA related terms refer to an absolute framework of time and / or slot numbers. In addition, there are FATDMA related terms defined for areas, which may also be considered absolute (see next section).

- **FATDMA start slot:** The *FATDMA start slot* is the slot number of the first slot of the first *FATDMA block* within a frame (refer to Table 15 of Recommendation ITU-R M.1371-3).

  Therefore, the *FATDMA start slot* is an absolute term.

- **FATDMA epoch:** Due to the time out behaviour of *FATDMA reservations* and due to the need to devise *FATDMA plans* which minimise the actual number of *FATDMA reservations* (see next sections), a time span of more than a frame (i.e. one UTC-based minute) needs to be considered.

  These larger time spans are called *FATDMA epochs*. Each *FATDMA epoch* is **6** minutes long. The start of a *FATDMA epoch* is correlated with the beginning of the UTC hour as indicated by the *FATDMA epoch number*. Any *FATDMA epoch* starts with the first second of the first minute correlated with the UTC hour as given by the *FATDMA epoch number* and ends with the end of second 59 of the **6**th minute after the start minute of the epoch.

- **FATDMA epoch number:** Each *FATDMA epoch* is assigned a unique number within the duration of one (1) hour.

  The *FATDMA epoch number* is correlated to an absolute start minute within the UTC hour as given in Table 1.

Table 1 Detail of the FATDMA epoch number in relation to their start and end times

FATDMA epoch number x	**Start minute of FATDMA epoch Number x**	**End minute of FATDMA epoch Number x**
0	0	5 (included in epoch 0)
1	6	11 (included in epoch 1)
2	12	17 (included in epoch 2)
3	18	23 (included in epoch 3)
4	24	29 (included in epoch 4)
5	30	35 (included in epoch 5)
6	36	41 (included in epoch 6)
7	42	47 (included in epoch 7)
8	48	53 (included in epoch 8)
9	54	59 (included in epoch 9)

4.2.3 Relationship between absolute and relative FATDMA terms

The following relationships exist between the above absolute and relative FATDMA related terms. Some FATDMA related terms are used identically, in an absolute as well as a relative context. In those cases, the term appears twice in the same line of the table. If there are different terms used in the same line of the table, the two terms correspond to each other, and a transformation / correlation is needed or performed at least at run-time. Table 2 gives the appropriate correspondence.

Table 2 Correspondence between absolute and relative FATDMA terminology

Absolute terms used for FATDMA reservations	**Relative terms used for FATDMA reservations**
FATDMA plan	*- no equivalent -*
FATDMA schedule	*- no equivalent -*
FATDMA scheme	*- no equivalent -*
FATDMA epoch	*- no equivalent -*
FATDMA reservation	FATDMA reservation
FATDMA block	FATDMA block
FATDMA start slot	FATDMA offset number
FATDMA increment	FATDMA increment
FATDMA block size	FATDMA block size
Message20-slot	Message20-Slot
- no equivalent -	Message20

4.3 Terms related to the geographical areas for which FATDMA reservation planning is done

The terms related to the geographical areas for which *FATDMA reservations* are planned and performed at run-time are arranged in order to assist in the structured mutual *FATDMA reservation* planning of neighbouring administrations:

1 FATDMA plan

A FATDMA plan is the highest level of FATDMA reservation planning.

A FATDMA plan comprises all FATDMA schedules (see below), which are considered relevant to the FATDMA plan. Therefore, a FATDMA plan also comprises the area covered by the FATDMA schedules relevant to the FATDMA plan. It is the purpose of this Appendix to describe a global FATDMA plan recommended by IALA, which translates seamlessly to FATDMA schedules (regional or national) and FATDMA schemes (see below). This recommended IALA FATDMA plan is discussed in sections 9 and 10.

2 FATDMA schedule

A FATDMA schedule comprises the relevant FATDMA schemes of one (1) 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.

3 FATDMA scheme

A FATDMA scheme comprises the relevant FATDMA reservations of one (1) AIS-PCU.

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

4 FATDMA Configuration

This general term denotes *all aspects* of FATDMA planning and FATDMA reservations made at run-time to be done by one or more competent authorities in a given area; it is an umbrella term.

Figure 5 is a schematic drawing that illustrates the relationship between the various terms **related to areas** (note: each transmitting base station (BS) transmits Data Link Management Message (message 20) to set up FATDMA reservation(s).

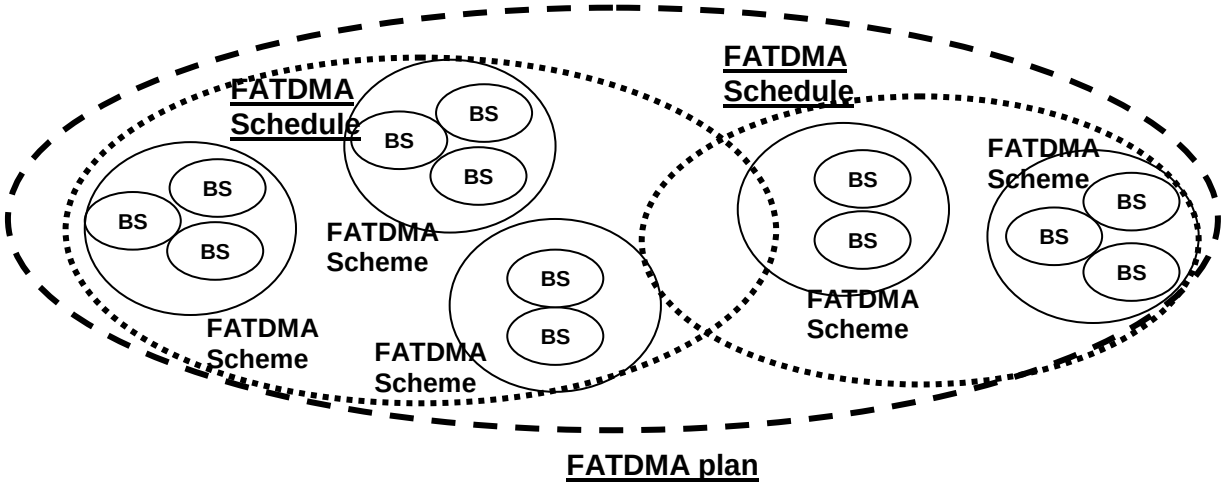

Figure 5 Hierarchy of FATDMA plan, FATDMA schedule and FATDMA scheme

4.4 Terms related to the usage of FATDMA reserved slots ('Usage Designation')

This section introduces the different terms for usage of FATDMA reserved slots.

4.4.1 General considerations in regard to periodicity of transmissions using FATDMA reserved slots

When setting up a FATDMA plan, the required periodicity of a transmission needs to be considered. In regard to periodicity the reserved FATDMA slots can be used for:

- Short term repetitive pattern spanning a number of time slots within the same frame;
- Intermediate term repetitive pattern spanning one frame;
- Long term repetitive pattern spanning one (1) FATDMA epoch.

There may be also one-shot transmissions, which are called **spurious transmissions**.

4.4.2 General considerations in regard to timing of transmissions using FATDMA reserved slots

The timing of transmissions using FATDMA reserved slots is largely independent of the periodicity aspect introduced above, and needs to be considered in following ways:

5 Urgency of transmission of a message(s)

Regardless of their periodicity some AIS messages need to be transmitted with a very short delay.

Besides the requirement to provide for prioritised queuing on the PSS Controlling Unit level, the urgency of transmission using FATDMA reserved slots requires the FATDMA plan to provide sufficient closely spaced, general-purpose FATDMA reserved time slots to allow for urgent transmissions.

6 Timely availability of FATDMA reserved slots when allowing for dynamic features of FATDMA plans

When introducing dynamic features of a FATDMA plan, there is a requirement to provide additional FATDMA reserved slots before the actual net data transmission can be made in these FATDMA reserved slots.

Additional FATDMA reservations are to be considered 'timely', in regard to the intended net data transmission, only if they allow for the following transient processes to be completed:

a Transmission of additional FATDMA reservation(s) by AIS Base station(s) to be completed = initiation of dynamic FATDMA reservation.

b Allow AIS mobile stations to clear the slots previously allocated by their own transmissions on both AIS channels completely. This process cannot be fastened and – for un-garbled operation – will require 8 minutes from transmission of the additional FATDMA reservation.

This consideration substantiates the introductory general rule that dynamic FATDMA reservations should be avoided or should be minimised.

4.4.3 Terminology for categories for usage of FATDMA reserved slots

All of the above considerations are simplified when categorising the usages of FATDMA reserved slots into the following categories.

1 FATDMA reservation usage category 1: AIS VDL management slots;

These FATDMA reserved slots will be used for the transmission of any message, which is necessary for the management of the AIS VDL.

2 FATDMA reservation usage category 2: High timing requirements slots;

These FATDMA reserved slots will be used for the transmission of messages, which need to comply with high timing requirements.

3 FATDMA reservation usage category 3: 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.

4.5 Terms related to activities of entities involved in the FATDMA ('VDL Usage Stake Holders')

4.5.1 Roles and activities involved in making and using FATDMA reservations

The FATDMA reservation, as viewed as an announcement, is an activity of a transmitting AIS Base station. A FATDMA reservation can be made by one entity participating in the AIS VDL and it will be used by one or more entities participating in the AIS VDL.

A FATDMA reservation can only be **made** by an AIS Base station of a competent authority.

- FATDMA reservation for transmissions of its own data and when acting as a semaphore;
- FATDMA reservation for transmissions of other AIS Base station/Limited Base Station (LBS);
- FATDMA reservation for transmissions of simplex repeater station(s);
- FATDMA reservation for transmissions for mobile AIS stations.

An existing FATDMA reservation can therefore be used by one of the following entities participating in the AIS VDL:

- own AIS Base station;
- other AIS Base station(s) (of own or other competent authority);
- other Limited AIS Base station(s) (of own or other competent authority);
- other simplex repeater station(s) (of own or other competent authority);
- mobile AIS stations operating either in:
  - assigned mode, hard assignment (Class A, Class B, AtoN AIS stations); or
  - responding to an interrogation (assigned by an AIS Base station).
- fixed-slot usage AtoN mobile AIS stations.

Figure 6 provides an overview of the different roles in regard to the FATDMA.

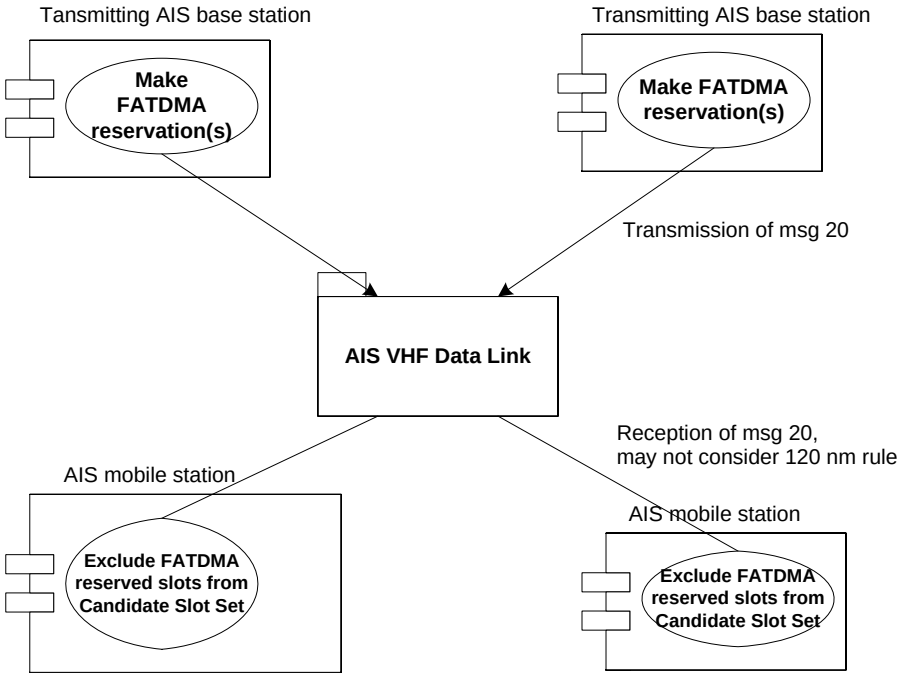

Figure 6 Activity of AIS Base stations and AIS mobile stations for FATDMA reservation

4.6 Mapping of FATDMA related aspects to Layers of the AIS Service

The terms defined in this section can be associated to the different hierarchical layers of the AIS Service. This association indicates on what hierarchical layer of the AIS Service certain correlations between the 'absolute' and 'relative' realms need to be performed.

In accordance with the definition of the AIS Base station in IEC 62320-1 there are two principal modes of operation for base stations:

1 The independent mode

The base station in independent mode is independently, i.e. autonomously, performing tasks delegated to it from the AIS-PCU layer, such as autonomously creation and transmission of message 20 upon configuration from the AIS-PCU layer. To that end certain configuration PI sentences are used by the AIS-PCU. The configuration comprises the generally pre-programmed transmission timing, which is also given in absolute terms. If the independent mode of base stations is employed by a competent authority the AIS-PCU needs to set up and supervise the appropriate operation of all of its AIS Base station(s) in independent mode.

2 The dependent mode

The AIS Base station in dependent mode transmits only pre-composed messages of whatever kind, which it receives from the AIS-PCU at an individually pre-determined time slot, the number of which is given in absolute terms. The AIS Base station does not compose messages itself when operating in dependent mode. Certain PI sentences are used by the AIS-PCU to forward the messages to be transmitted as well as the individually pre-determined time slot for transmission.

In both cases the task of translating from the absolute FATDMA-related terminology used throughout the AIS Service and the relative FATDMA-related terminology used on the AIS VDL is a task of the AIS-PCU, which may be delegated completely to the AIS Base station when operating in independent mode. When operating in dependent mode, the AIS Base station still translates the transmission timing from the pre-determined absolute slot number it receives to the (relative) point in time, when the pre-determined transmission slot actually occurs.

Table 3 Association of terms related to FATDMA and Layers of the AIS and the AIS Service

Term related to FATDMA	**AIS VDL**	**AIS Base station**	**PSS Controlling Unit ('AIS-PCU')**	**AIS Service Management**	**AIS Service as a whole**	**Remarks**
FATDMA Reservation (**relative** point of view)	**X**	**X**	-	**-**	**-**	Reservation announcement by base station on the AIS VDL ***as such***; therefore only known to AIS VDL and AIS Base station; similar to message 20
FATDMA Reservation (**absolute** point of view)	**-**	**X**	**X**	**X**	**X**	Absolute equivalent of reservation
Message 20	**X**	**X** (when AIS Base station operates in independent mode)	**X** (only when AIS base station operates in dependent mode)	**-**	**-**	Consists of a set of 4 reservations; message 20 will be composed in AIS Base station upon configuration settings from AIS-PCU when operating in independent mode or will be composed in AIS-PCU when AIS Base station operates in dependent mode.
Message-20-slot	**X**	**X**	**-**	**-**	**-**	Message-20-slot is determined by the start slot
FATDMA start slot	**-**	**X**	**X**	**X**	**X**	Absolute term to be known for FATDMA scheme, schedule and plan; refer to Table 15 of Rec. ITU-R M.1371-4 LME.FTST
FATDMA offset number	**X**	**X** (when AIS Base station operates in independent mode)	**X** (only when AIS base station operates in dependent mode)	**-**	**-**	Relative term; refer to ANNEX 8, section 3.18 of Rec. ITU-R M.1371-4
FATDMA block	**X**	**X**	**X**	**X**	**X**	FATDMA blocks are known both in relative and absolute terminology throughout the AIS Service and the AIS VDL
FATDMA increment	**X**	**X**	**X**	**X**	**X**	If FATDMA increments are used at all, they are known to all layers; refer to Rec. ITU-R M.1371-4 Table 15, LME.FTI

Term related to FATDMA	**AIS VDL**	**AIS Base station**	**PSS Controlling Unit ('AIS-PCU')**	**AIS Service Management**	**AIS Service as a whole**	**Remarks**
FATDMA block size	**X**	**X**	**X**	**X**	**X**	FATDMA block size is known both in relative and absolute terminology throughout the AIS Service and the AIS VDL (refer to Table 15 Rec. ITU-R M.1371-4; LME.FTBS)
FATDMA plan	**-**	**--**	**-**	**X**	**X**	AIS VDL only recognizes the effects in terms of concrete reservations
FATDMA scheme	**-**	**-**	**X**	**X**	**X**	Group of all reservations of one AIS-PCU
FATDMA schedule	**-**	**-**	**-**	**X**	**X**	Group of all reservations of one or all AIS-PCU in given area

5 INTRODUCTION TO RELEVANT ASPECTS OF THE FATDMA RESERVATIONS

The following rules for FATDMA reservations are taken from Recommendation ITU-R M.1371 (current revision and IALA Technical Clarifications).

A FATDMA reservation is made by a base station transmitting Data Link Management Message, message 20.

A FATDMA reservation consists of:

- a start slot, the slot where the FATDMA reservation starts in the frame;
- the block size, the number of consecutive reserved slots;
- an increment, the number of slots between the start of each reserved block; and
- a time out value, how long the FATDMA reservation is valid.

The term FATDMA block denotes the effect of a FATDMA reservation on the AIS VDL.

Each Data Link Management Message (message 20) can reserve up to four (4) independent and different FATDMA reservations on one channel.

The blocks of FATDMA reservations should be evenly distributed across the frame. The values recommended for 'increment' are as follows: 2, 3, 5, 6, 9, 10, 15, 18, 25, 30, 45, 50, 75, 90, 125, 225, 250, 375, 450, 750, 1125.[1] Use of one of these values guarantees symmetric slots reservations throughout each frame.

Using the value 0 for 'increment' means that only one reservation is made in the frame.

The *lower* the 'increment' value, the *more* slots will be reserved.

In normal operation the base station should use FATDMA for its own transmissions. For this, slots have to be reserved by a base station using Data Link Management Message (message 20). If there are no reserved FATDMA slots available within 4s, the AIS Base station will transmit using RATDMA if RATDMA transmission is enabled, otherwise the transmission will be dropped.

The FATDMA reservation is timed out after 3 minutes (default) in the mobile AIS stations. The time out value for the FATDMA reservation within the mobile AIS station can be configured between 1 and 8 minutes by the Data Link Management Message (message 20). The FATDMA reservation should be repeated before a time out occurs, if the FATDMA reservation is to be maintained.

The Data Link Management Message applies only to the AIS channel on which it is transmitted.

The effects of an FATDMA reservation on other AIS stations is as follows:

1 Mobile stations will not include any FATDMA reserved slots in their candidate slot map at all, if the reserving base station is within 120 nautical miles. If the position of the reserving base station, as derived from message 4, is more than 120 nautical miles away from the mobile, Class A mobile stations should ignore the reservation.

2 Other base stations will not include any FATDMA reserved slots in their candidate slot map when using RATDMA. However, at the discretion of the competent authority, a base station may intentionally FATDMA reserve and use the same time slots within 120 nautical miles, if no interference is likely.[2]

When assessing the effect of FATDMA reservation, 3 different considerations should be made:

1 The FATDMA protection of transmissions should be considered to be effective, within the nominal transmission coverage range (it is intended that this be described in a future Appendix 3) of the base station(s) transmitting the FATDMA reservation.

[1] The value 2250 should not be used, as it implies a once per frame transmission; the value zero results in the same.
[2] Means to avoid interference could include low, directional antennas and taking advantage of local land topography.

2 The transmitted FATDMA reservation should generally be considered to affect the VDL loading experienced by mobile AIS stations within the interference range (it is intended that this be described in a future Appendix 3) of the base station(s) transmitting the FATDMA reservation, except where the interference range exceeds the 120nm.

3 Due to the effect of occasional extended VHF radio propagation (which may in certain regions last for months at a time), the consequences of a worst case scenario of all mobile AIS stations within 120nm from transmitting base stations should be considered, regardless of the nominal coverage range.

6 FATDMA RESERVED SLOT USE CASES

This section describes the functional cases that require FATDMA reservations, the parameters that need to be considered, how to go about deciding the slot reservation profile and proposes usage recommendations for each case. The selection of the actual AIS Base station reserving the slots will be discussed in another section.

6.1 Rules for usage categories

The following rules, developed from the fundamental rules described in section 4 apply to the usage category definitions:

4 All FATDMA reserved slots of a FATDMA plan, reserved for a given usage-category, should be reserved in such a way, that the appropriate FATDMA reservations *comply exactly with the anticipated periodicity* of the messages to be transmitted. The FATDMA plan should take into account:

   a The required periodicity within one frame, which translates into the appropriate FATDMA increment; and

   b The usage of the individual minutes of a FATDMA epoch.

5 In a single FATDMA reservation with more than one FATDMA reserved slot, the available slots can be used for different categories of usage independently of each other. This means that slots reserved for different usage-categories can be bundled together in one FATDMA reservation, while their respective individual usage may be completely different.

6.2 Use Cases for FATDMA reservation usage category 1 - AIS VDL management slots

The FATDMA reserved slots of usage category 1 will be used for the transmission of any message, which is necessary for the management of the AIS VDL.

The following use cases have been identified for FATDMA reservation usage category 1:

- Transmission of Data Link Management message (message 20) by AIS Base station(s);
- Transmission of Base Station Report (message 4) with default reporting rate by AIS Base station(s);
- Transmission of Channel Management message (message 22) by AIS Base station(s).

Each of the above use cases will be dealt with in more detail in consecutive sections.

6.2.1 Transmission of Data Link Management Messages (message 20)

When defining the usage of Data Link Management messages (message 20), the following aspects should be taken into account:

1 At least one FATDMA reservation must be made before FATDMA reserved slots become available.

2 When starting a new FATDMA reservation, i.e. when there has been none previously:

   a The FATDMA reserved slots will be available in the next frame after the frame during which the transmission of message 20 occurred.

b The FATDMA reserved slots can only safely be used after 8 frames have elapsed because mobile AIS stations need to clear the FATDMA reserved slots.

3 Depending on the total number of FATDMA reservations needed for a given geographical area, there may be more than one transmission of Data Link Management message 20 needed to accommodate all required FATDMA reservations in that area.

4 Every FATDMA reservation times out after 3 minutes (default), if no different time out value is given within the FATDMA reservation. A different value may be between 1 and 8 minutes.

5 Should a particular FATDMA reservation be maintained continuously longer than the above pre-set time out value, the FATDMA reservation needs to be refreshed periodically before the FATDMA reservation expires.

6 Due to the time out value up to 8 minutes, one refreshment transmission of message 20 per FATDMA epoch would be sufficient to maintain that FATDMA reservation.

7 The overlap of 2 minutes between maximum time out pre-set and FATDMA epoch length, would allow the distribution of the required transmissions of message 20 over the first two frames of any FATDMA epoch, hence allowing for an even distribution of message 20 transmissions in the first two frames of the first FATDMA epoch of any new continuous FATDMA reservation.

8 When updating the refreshment of a continuous FATDMA reservation at the minimum rate, i.e. once per epoch, AIS mobile stations entering the area under consideration would learn about this FATDMA reservation with a delay of up to nearly 6 minutes.

Note: The periodicity of transmissions of message 20 should not be confused with the FATDMA increment of one FATDMA reservation. One FATDMA reservation may reserve many FATDMA blocks throughout the same frame, but may time-out after 8 minutes maximum because it was not refreshed.

Based on the above aspects two different use cases of transmission of message20 can be identified:

6.2.1.1 Transmission of Data Link Management message 20 to establish a short-lived FATDMA reservation (no repetitive pattern)

Short-lived FATDMA reservations could be used to accommodate dynamic demand for FATDMA reserved slots.

6.2.1.1.1 Usage recommendation

1 When using a short-lived FATDMA reservation, its time-out should be pre-set to the duration of a FATDMA epoch, i.e. 6 minutes (or time-out value 5), maximum.

2 Due to the purpose of short-lived FATDMA reservations, it should be carefully considered whether more than one FATDMA block should be reserved by this short lived FATDMA reservation, i.e. the FATDMA increment parameter should be used with care.

6.2.1.2 Transmission of Data Link Management message 20 to establish a continuous FATDMA reservation (long term repetitive pattern)

Continuous FATDMA reservations should be used to accommodate the stationary demand for FATDMA reserved slots.

6.2.1.2.1 Usage recommendation

1 Data Link Management message (message 20) should be transmitted at least once per epoch to maintain a continuous FATDMA reservation.

2 When transmitting message 20, the time-out value should be set to 7 or 8 minutes, thus spanning one entire FATDMA epoch while also protecting the next message 20 transmission(s) in the next epoch.

3 The transmissions of message 20 for different continuous FATDMA reservations should be evenly distributed over the FATDMA epoch.

4 Depending on the general risk assessment of message loss due to VDL traffic loading and / or interference in the given area, there should be up to 6 transmissions of the Data Link Management message (message 20) in one FATDMA epoch to maintain the same continuous FATDMA reservation, thus creating redundancy and providing for a more rapid reaction of new mobile AIS stations entering the given area to the FATMDA reservations. Those transmissions of message 20 for the same continuous FATDMA reservation should also be evenly distributed over the FATDMA epoch, i.e. one message 20 per 3 frames (2 transmissions per epoch), one message 20 per 2 frames (3 transmissions per epoch), one message 20 per one frame (6 transmissions per epoch).

6.2.2 Transmission of Base station Report (message 4) at the default reporting rate

Assignment of the transmission of Base Station Report (message 4) at the default reporting rate is justified, because a message 4 with a valid position allows all mobile AIS stations to correlate this position with the transmission(s) of Data Link Management message 20 using the same MMSI. The correlation is used by a mobile AIS station to determine whether the 120 NM intentional slot reuse rule should be used. This is an essential AIS VDL management rule because it effectively counteracts the potential blocking of a large number of slots by the reception of non-relevant message 20 from distant base stations during times of good RF propagation.[3]

When defining the usage of Base Station Report (message 4) at the default reporting rate, the following aspects should be taken into account:

- Recommendation ITU-R M.1371 states, that the default reporting rate by a base station should be **once per 10 seconds**;
- Therefore, the transmission of Base Station Reports exhibits a **short-term repetitive pattern**;
- This translates into **six (6) slots** reserved for that purpose per frame for a reporting interval of 375 slots, this translates into a FATDMA **increment of** 750 (message 20) in one FATDMA reservation on each channel.

6.2.2.1 Usage recommendation

When transmitting Base Station Reports (message 4) with default reporting rate by one base station:

- there should be **one (1)** slot reserved with an **increment of** 750 on each channel; and
- the required FATDMA reserved slots should be allocated by a **Continuous FATDMA reservation** (see above).

6.2.3 Transmission of Channel Management Messages (message 22)

When defining the usage of Channel Management messages (message 22), the following aspects should be considered (refer to APPENDIX 17):

1 The Channel Management message (message 22) provides the capability to change the fundamental operation settings of the AIS frequency channels A and B.

2 The transient characteristics of a change in Channel Management settings involve at least the time span of two FATDMA epochs. Therefore, the transmission of Channel Management messages should be considered to exhibit long-term repetitive pattern.

3 The timing requirements for the transmission of Channel Management messages as such are relaxed, i.e. the mobile AIS stations act upon a Channel Management setting when they

[3] When acting as a semaphore, the reporting rate of a base station increases to a higher update rate. Therefore more FATDMA reserved slots would be needed and the timing requirements for transmissions of Base Station Reports in semaphore mode would be much more stringent. Therefore, this case is being dealt with at FATDMA usage category 2 ('High timing requirements slots' in the section below.

enter the area designated by the Channel Management setting regardless of when they received the Channel Management setting.

4 To ensure, that all mobile AIS stations operate on the default AIS operating settings, a competent authority should transmit Channel Management messages on a regular basis with the default operating settings for its area of responsibility. These transmissions would instruct the mobile AIS stations to 'return to default'. Due to the long-term repetitive pattern of the Channel Management message the VDL load created by these transmissions will be low.

6.2.3.1 Usage Recommendation

1 Channel Management messages should be transmitted at least once per FATDMA epoch.

2 Depending on the general risk assessment of message loss due to VDL traffic loading and / or interference in the given area, there could be up to 6 transmissions of the Channel Management message (message 22) in one FATDMA epoch, thus creating redundancy and providing for a more rapid reaction of new mobile AIS stations entering the given area. Those transmissions of message 22 should also be evenly distributed over the FATDMA epoch, i.e. one message per 3 frames (2 transmissions per epoch), one message per 2 frames (3 transmissions per epoch) and / or one message per one frame (6 transmissions per epoch).

3 The required FATDMA reserved slots should be allocated by a Continuous FATDMA reservation (see above).

4 Even when there is no channel management scheme in place, which deviates from the default Channel Management settings in any regard, the Channel Management message should be transmitted by administrations with default Channel Management settings (return to AIS1 and AIS2 in the geographical area) to erase 'wrong' and 'old' frequency settings in mobile AIS station's memories.

6.3 Use Cases for FATDMA reservation usage category 2 - High timing requirements slots

These FATDMA reserved slots will be used for the transmission of messages, which need to be transmitted within a defined time period.

The following use cases have been identified for FATDMA reservation usage category 2:

- Transmission of Base Station Report (message 4) when a base station in the given area is acting as a semaphore;
- Transmission of Position Reports of any kind of AIS mobile stations, when assigned a 'FATDMA protected' slot ('safe slot' concept);
- Transmission of Safety Related message (message 12 and 14);
- Transmission of Acknowledgements on received addressed messages (message 7 and 13) by base station(s);
- Transmission of DGNSS broadcast binary messages (message 17) with high timing requirements contents, such as integrity alerts, by base station(s);
- Re-transmission of Position Reports (and other messages) of any kind of AIS mobile stations.

6.3.1 Transmission of Base Station Reports when a base station (in the given area) is acting as a semaphore

The assignment of the transmission of Base Station Report (message 4) *with increased reporting rate due to a base station switching into semaphore mode* is justified, because the reporting interval is decreased to a value below 4 seconds. This constitutes a high timing requirement.

When defining the usage of Base Station Report (message 4) *with increased reporting rate* due to a base station acting as a semaphore, the following aspects should be taken into account:

1 Recommendation ITU-R M.1371 states, that the increased reporting rate by a base station should be once per 3 1/3 seconds.

2 Therefore, the transmission of Base Station Reports exhibits a short-term repetitive pattern.

3 This translates into eighteen (18) slots reserved for that purpose per frame for a reporting interval of 125 slots or into a FATDMA increment of 250 (message 20) in one FATDMA reservation on each channel.

4 Since the requirement for a base station to act as a semaphore is infrequent and transient in nature, one or several short-lived FATDMA reservations may suffice for the duration of the base station acting as a semaphore.

5 When transmitting Base Station Reports (message 4) with an increased reporting rate due:

   a there should be one (1) slot reserved with an increment of 250 on each channel, and

   b the required FATDMA reserved slots could be allocated by one Short-Lived FATDMA reservation with time-out value pre-set to maximum, i. e. 8 minutes, and consecutive Short-Lived FATDMA reservations with the same parameters as long as the base station is acting as a semaphore (see above).

   c Instead, the required FATDMA reserved slots may be taken from a continuously and in advance reserved pool of usage category 2 or 3 slots within the same FATDMA scheme, FATDMA schedule or FATDMA plan. Although the latter option would smooth the operation of the VDL by avoiding transient FATDMA reservations, more VDL capacity will be used when it will not actually be needed.

6.3.2 Position Reports of any kind of AIS mobile stations, when assigned a 'FATDMA protected' slot ('safe slot' concept)

To assign the transmission of Position Reports of any kind of mobile AIS stations, which have been assigned to specific 'FATDMA protected' slots given by a previous assignment command, to the FATDMA usage category 2 ('High timing requirements slots') is justified, because the position reports will invariably occur in the slots pre-determined by the previous assignment command, but the resulting reporting rate of the mobile AIS station may still be high (Class A mobile stations will allow only to increase the reporting rate up to once per second). This constitutes a high timing requirement.

When defining the usage the following aspects need to be taken into consideration:

- assigned transmissions of mobile stations either hard assignment (message 2, 18).

6.3.2.1 Usage recommendation

- The number of slots and the increment required depend on the defined reporting rate;
- The required amount of slots could be allocated by one short lived FATDMA reservation pre-set to a timeout identical to the assignment.

6.3.3 Transmission of Safety Related Messages (messages 12 and 14) by base station(s)

The assignment of the transmission of Safety Related Messages (messages 12 and 14) is justified, because it is a general operational requirement that safety related messages are being transmitted to the VDL with minimum latency after being released. This constitutes a high timing requirement[4].

[4] According to the IEC 62320-1 section 6.3.4.8, a base station receiving an encapsulated VDM for transmission, should transmit on a FATDMA reserved slot if available within 4 seconds, otherwise use RATDMA if RATDMA is enabled. If RATDMA is not enabled, the message will be transmitted if a FATDMA slot is available within the next epoch, otherwise the transmission will be dropped. An implementation specific discrepancy between initiating a transmission by an encapsulated VDM contrary to using ABM or BBM has been observed, causing transmissions initiated by ABM's or BBM's to be dropped if RATDMA is not enabled and an FATDMA timeslot is not available within 4 seconds.

When defining the usage the following aspects need to be taken into consideration:

Safety related message transmissions are of a non-periodic nature. Repeated broadcast of safety related messages within a timeframe of epoch magnitude may well be considered a nuisance rather than relevant information.

The number of slots required for safety related messages can dynamically vary between 1 and 5, however reserving blocks of timeslots larger than 3 on a continuous basis is generally discouraged.

6.3.3.1 Usage recommendation

1 Reserving FATDMA protected slots for Safety Related Messages specifically, is not recommended, due to the non-periodic nature.

2 If a pool of general purpose timeslots is reserved and available within the selection interval, they should be used.

3 Addressed messages may be transmitted (up to 3 times) using RATDMA, since the acknowledge message will indicate whether or not the message was received. When the acknowledge is received, no repeated transmissions are necessary.

6.3.4 Transmission of Acknowledgements on received addressed messages (message 7 and 13) by base station(s)

The assignment of the transmission of Acknowledgements on received addressed messages (message 7 and 13) is justified, because the acknowledgement on a correctly received addressed message is required and must be received within 4 seconds by the originating station of the addressed message in order to prevent re-transmission of the same addressed message by the originating station, which would result in unnecessary VDL load. This constitutes a high timing requirement.

When defining the usage the following aspects need to be taken into consideration:

- Acknowledgements are non-periodic of nature, and most likely occur infrequently.

Usage recommendation:

1 Acknowledgement messages should be transmitted using available high timing or general purpose FATDMA reserved timeslots if possible.

2 RATDMA may be used if no FATDMA slots are available – to stop the addressed message from being repeated.

3 If FATDMA reserved slots are required, they should be allocated by a Continuous FATDMA reservation.

6.3.5 Transmission of DGNSS broadcast binary messages (message 17) with high timing requirements contents, such as integrity alerts, by base station(s)

This service is described in detail in Appendix 16.

The assignment of the transmission of DGNSS broadcast binary messages (message 17) with high timing requirements contents, such as integrity alerts, is justified, because of the relevant operational requirement in the field of GNSS.

Note: While the transmission of e.g. integrity alerts of DGNSS message to mobile AIS stations may exhibit a high timing requirement, this may not be true to any other DGNSS message content. Therefore, all DGNSS messages contents should be examined with regards to their timing requirements. DGNSS Message contents identified not to exhibit high timing requirements for transmission should be treated under the usage category 3 (‘General purpose pre-reserved slots’).

6.3.5.1 Usage recommendation

1 Provisions should be made to have high timing requirements timeslots available for transmitting a DGNSS broadcast message containing a DGNSS integrity alert, one slot every 3 1/3 seconds, requiring an **increment of 250 per channel.**

2 Provisions should be made to have enough time slots available in usage category 3, general purpose usage timeslots, to transmit a full set of DGNSS corrections at least twice every 30 seconds – this should be possible using 3 timeslots per GNSS system on each channel every 30 seconds.

3 The required FATDMA reserved slots should be allocated by a **Continuous FATDMA reservation**.

6.3.6 Re-transmission of Position Reports (and other high-timing requirement messages) of any kind of AIS mobile stations

The VDL access schemes for Simplex Repeater Stations are either FATDMA or RATDMA. There are 3 types of Simplex Repeater Station

1 FATDMA only

2 RATDMA only

3 FATDMA and RATDMA

Simplex Repeater Stations can be configured to repeat either all received messages or selected sub-sets of the received messages.

When defining the usage the following aspects need to be taken into consideration:

1 A Simplex Repeater Station should repeat the message within 4 seconds (150 slots) and if it cannot find free slots within 4 seconds the message should not be repeated.

2 The greatest impact on the VDL is when a Simplex Repeater Station is configured to repeat all messages – this will double the load on the VDL.

3 Above 50% VDL loading starts to have an impact on Mobile AIS Stations ability to find free slots. Hence it is considered that the Simplex Repeater Station should not use more than 25% of the VDL bandwidth for its transmissions.

4 RATDMA enabled devices should monitor that the total VDL load does not exceed 50%, and reduce its transmissions if this occurs.

6.3.6.1 Usage recommendation

1 The required FATDMA reserved slots should be allocated by a Continuous FATDMA reservation.

2 A Competent Authority should exercise great care when implementing a Simplex Repeater Station as inappropriate configuration could have a detrimental effect on the VDL.

3 The sum of FATDMA reservations across both channels should not exceed 1125 timeslots per frame (25% of the VDL bandwidth)

4 The Competent Authority should monitor the use of FATDMA Simplex Repeater Stations to ensure that the VDL loading does not exceed 50% in the vicinity of the Station for any significant period as this would adversely affect the ability of mobile stations to find free slots for their own transmissions.

6.4 Use Cases for FATDMA reservation usage category 3 - 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.

The following use cases have been identified for FATDMA reservation usage category 3;

- Transmission of any assignment command (message 16, 23) by base station(s);
- Transmission of UTC and Date Inquiry message (message 10) by base station(s);
- Transmission of DGNSS broadcast binary messages (message 17) with relaxed timing requirements contents by base station(s);

- Transmission of Application Specific Messages (message 6, 8, 25, 26) by base station(s);[5]
- Transmission of Interrogation message (message 15) by base station(s);
- Transmission of Aids-to-Navigation reports (message 21);
- Transmission of static data (message 24) Re-transmission of messages other than position reports.

6.4.1 Transmission of any assignment command (message 16; message 23) by base station(s)

When defining the usage of any assignment command (message 16 or message 23), the following aspects should be considered:

1 There are two possible options of the assignment command which impact the behaviour of mobile AIS stations: assignment of a new reporting rate behaviour while leaving the actual slot selection to the mobile AIS station (so called 'soft' assignment) and assignment of the usage of specific pre-determined slots by the assigned mobile AIS station (so called 'hard' assignment).

2 Assignment Command (message 16) and Group Assignment Command (message 23) differ in that the Assignment Command applies to individual mobile AIS stations and provides for both 'soft' and 'hard' assignment, while the Group Assignment Command provides the capabilities to address group of mobile AIS stations determined by their respective device class.

3 Every assignment times out after 3 minutes (default), if no different time out value is given within the assignment command. A different value may be between 1 and 8 minutes. The effect of the 'Go Silent' parameter for Class B mobile AIS stations within the Group Assignment Command (message 23) will last for up to 15 minutes, however.

4 All transmissions of assignment commands do not – by default – exhibit a repetitive pattern. Therefore the transmission of assignment commands would require slot reserved in the usage category 3 ('General purpose pre-reserved slots').

5 Should a particular assignment be **maintained over a longer period than 8 minutes**, the assignment needs to be refreshed periodically before the present assignment expires. In this case, the following should be considered:

   a Due to the time out value up to 8 minutes, one refreshment transmission of the assignment command per FATDMA epoch would be sufficient to maintain that assignment.

   b When updating the refreshment of an assignment at the minimum rate, i.e. once per epoch, AIS mobile stations entering the area under consideration would learn about this assignment with a delay of up to nearly 6 minutes.

While a mobile AIS station commanded to change into slot assignment mode ('hard' assignment) exhibits a high timing requirement for the pre-reserved slots, the assignment command, as such, has no high timing requirement for transmission.[6]

6.4.1.1 Usage recommendation

1 Assignment commands should be transmitted in one of the next available slots reserved in the usage category 3 ('General purpose pre-reserved slots').

[5] Note of Caution: At the time of writing, the ITU in the next revision of ITU-R M.1371 is considering requiring transmissions larger than 3 consecutive timeslots to be protected by FATDMA, in order to be transmitted.

[6] The following should be moved to Appendix 15 in a future release of this document: The latency between the trigger event (assignment request) and the reaction shown by the assigned mobile AIS station(s) will be determined not by the timing of the transmission of the assignment command (message 16 or message 23) but by the present frame. Any assignment will be effective with the next frame earliest. Hence the latency can be up to one minute, which is the duration of one frame. NOTE: this should be checked with Class A, Class B etc. to provide clarification in a future release of this document.

2 Should a particular assignment be maintained over a longer period than 8 minutes, the assignment needs to be refreshed periodically before the present assignment expires. In this case, the following recommendation applies:

a The assignment command (message 16 or message 23) should be transmitted at least once per epoch for a un-interrupted assignment as long as the desired duration of the assignment.

b When transmitting the assignment command, the time-out value should be set to 6 minutes, thus spanning one entire FATDMA epoch.

c Depending on the general risk assessment of message loss due to VDL traffic loading and / or interference in the given area, there could be up to 6 transmissions of the assignment command to maintain the un-interrupted assignment, thus creating redundancy and providing for a more rapid reaction of new mobile AIS stations entering the given area to the assignments. Those transmissions of assignment command for the same desired assignment should also be evenly distributed over the FATDMA epoch, i.e. one assignment command per 3 frames (2 transmissions per epoch), one assignment command per 2 frames (3 transmissions per epoch), one assignment command per one frame (6 transmissions per epoch).

6.4.2 Transmission of UTC and Date inquiry message (message 10) by base station(s)

UTC and Date inquiry message may be used to query a mobile stations time synchronisation.

When defining the usage the following aspects need to be taken into consideration:

- The transmission has relaxed timing requirements

6.4.2.1 Usage recommendation

1 Reserving FATDMA timeslots for this purpose is not recommended.

2 If a pool of general purpose FATDMA timeslots are available such a timeslot should be used, otherwise RATDMA can be used.

6.4.3 Transmission of DGNSS broadcast binary messages (message 17) with relaxed timing requirements contents by base station(s)

Please refer to Appendix 16.[7]

6.4.4 Transmission of Interrogation message (message 15) by base station(s)

Interrogation may be used to request a mobile station to transmit specific message types, e.g. message 4.

When defining the usage the following aspects need to be taken into consideration:

- The transmission has relaxed timing requirements

6.4.4.1 Usage recommendation

1 Reserving FATDMA timeslots for this purpose is not recommended.

2 If a pool of general purpose FATDMA timeslots are available such a timeslot should be used, otherwise RATDMA can be used.

Refer to ITU 1371-4, Appendix 8, section 3.13

6.4.5 Transmission of Binary Messages (message 6, 8, 25 or 26) by base station(s)

When defining the usage the following aspects need to be taken into consideration:

[7] Note of Caution: At the time of writing, the ITU in the next revision of ITU-R M.1371 is considering requiring transmissions larger than 3 consecutive timeslots to be protected by FATDMA, in order to be transmitted.

- The transmission may have either high or relaxed timing requirements;
- The number of slots required for binary messages can dynamically vary between 1 and 5 – however message sizes above 3 timeslots are discouraged.

6.4.5.1 Usage recommendation

1 Reserving FATDMA protected slots for Binary Messages specifically, of non-periodic nature is not recommended.

2 If a pool of general purpose timeslots are reserved and are available within the selection interval, they can be used.

3 Addressed messages may be transmitted (up to 3 times) using RATDMA, since the acknowledge message will indicate whether or not the message was received. When the acknowledgement is received, no repeated transmissions are necessary.

6.4.6 Transmission of Aids-to-Navigation Reports (message 21)

A detailed description of the use of AIS on AtoN is available in IALA recommendation A-126 on The Use of the Automatic Identification System (AIS) in Marine AtoN Services.

When defining the usage the following aspects need to be taken into consideration:

- Two slots required for each AtoN message;
- Update rate may vary, refer to A-126;[8]
- AtoN AIS stations may use slots, which have been reserved by a base station by FATDMA; therefore the AtoN AIS station could be configured to broadcast in fixed slots assigned by competent authority.

Usage recommendation:

1 FATDMA reservations for AtoN should use a Continuous FATDMA reservation.

2 To reduce bandwidth loading of the VDL, AtoN transmissions should be coordinated such that several AtoN may use the same timeslots within different frames of the epoch.

6.4.7 Designing a FATDMA schedule

The use cases concerning VDL management transmissions and periodic transmissions with high timing requirements require dedicated patterns of timeslots available in the FATDMA schedule for a given AIS PSS Controlling Unit. However, the use cases regarding high timing requirement transmissions with non-periodic nature, and general purpose use with relaxed timing requirements, indicate that these transmissions could actually make more efficient use of a pool of Pre-Reserved Slots and a priority transmission queue.

When designing the layout of such a pool, the following considerations should be taken:

- The pool must have sufficient size to accommodate the required usage capacity within one frame to minimize the latency of the actual transmission and provide for relaxed queuing;
- It must have sufficient repetitive occurrence to accommodate the high timing requirements;
- The transmission queue must be capable of giving high timing transmissions priority over relaxed timing transmissions.

[8] Some ECDIS systems have been noted to delete 'and AtoN', unless a refresh rate of no more than 3 minutes is maintained.

7 THE DEFINITION OF A GLOBAL IALA FATDMA PLAN BY SPACE, TIME AND FREQUENCY USAGE SEPARATION

This section deals with the question: What should be the geographical criteria to determine co-ordinated operation?

7.1 The universal IALA grid scheme – separation by space and frequency

The geographical grid defines a global method for selecting a default FATDMA scheme for any area under consideration. It should be noted that the area is the most important aspect, not the actual location of the transmitting entities using FATDMA reserved slots. It is the total of transmitted, i.e. injected, messages of all relevant AIS stations using FATDMA reserved slots, that count in a given area, i.e. cell, not the station and its location as such in the first place.

It is the goal of the geographical grid 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.

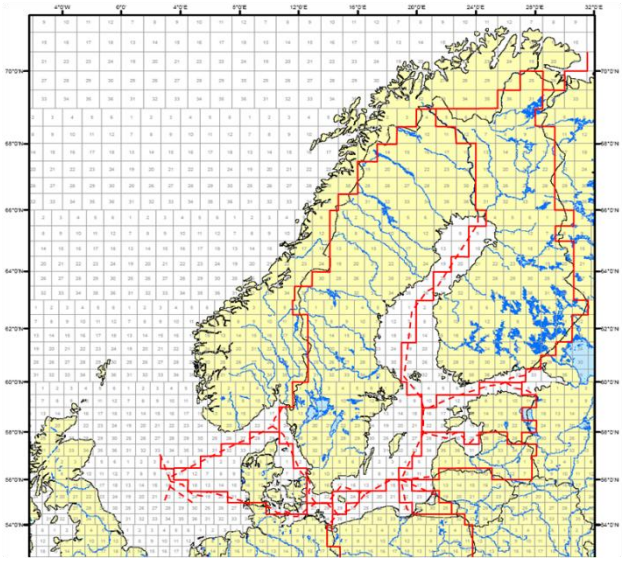

Figure 7 A geographical grid

The geographical grid allows competent national competent authorities a simple means of agreeing which timeslot ressources should be allocated to the planning responsibility of a particular nation, in bordering areas.

The geographical grid is meant as a geographical starting point from which further planning and co-ordination must take place, if required.

In particular, the grid scheme is useful as a simple starting point when defining which part of the timeslot resource of the AIS VHF Datalink is available to specific competent authorities.

The geographical grid is created by dividing the world into cells by an algorithm, based on the WGS84 datum, ensuring that any point on the globe will be inside a specific cell. The precise algorithm for calculating the geographical grid is given in ANNEX A to this Appendix.

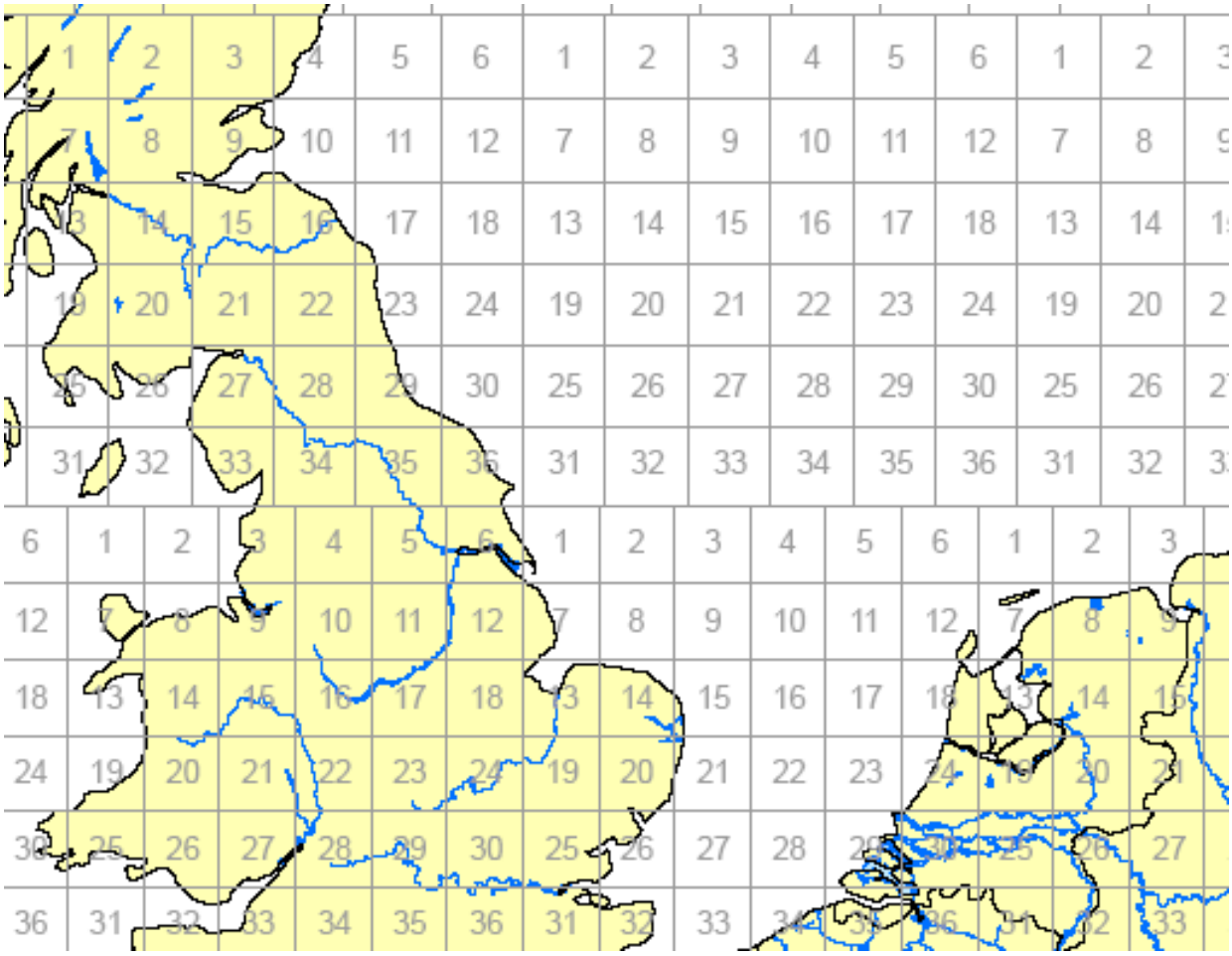

Figure 8 Details of a geographical grid

Error! Reference source not found. illustrates the grid with a repetitive pattern of 36 different cells in an 6 x 6 matrix (called a 'master cell'), where each individual cell is approximately 30 x 30 nautical miles in size, and referenced by a cell number.

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.

To denote the frequency separation, the two 'mirrored' FATDMA schemes are identified by adding the Roman numerals 'I' and 'II' to the number, e. g. 59-I and 59-II. It should be noted that neither FATDMA scheme works exclusively on AIS working channel A or B but alternate between these working channels constantly, to accommodate the transmission patterns alternating between the frequencies of for instance base station reports. The Roman numerals were chosen to avoid confusion with the working channel designation A and B.

7.2 IALA FATDMA schemes – separation in time

Both of the 'mirrored' FATDMA schemes associated with any given cell of the IALA geographical grid are identical in regard to their time slot capacity, pattern and usage characteristics, but employ these on mutually mirrored frequencies.

A definition of the absolute FATDMA reservations and the precise usage categories of the above FATDMA scheme numbers is given in ANNEX B to this Appendix, in accordance with the following rationale:

As described in the section on usage categories, 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. The sum of all default FATDMA schemes defined here constitute a repetitive pattern of 5 + 5 + 4 timeslots for every 25 timeslots:

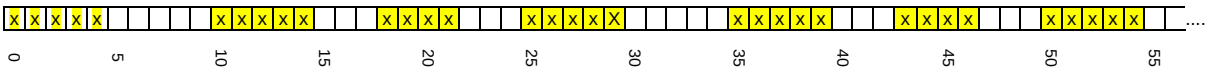

Figure 9 FATDMA timeslot pattern

This repetitive pattern of every 25 timeslots ensures, that mobiles' transmissions fits neatly into the remaining timeslots, since the associated reporting rates of 2 seconds, 3 1/3 seconds, 6 seconds, 10 seconds... like the reporting rates defined for Class A mobiles translate into one transmission every 75, 125, 225, 375. timeslots.

These FATDMA slot reservations are the theoretical maximum at planning time and will not be used all simultaneously in the same area, for the overwhelming majority of cases globally. For the few remaining cases, where special considerations are needed, see below.

The IALA FATDMA schemes are designed to accommodate specific usage categories as given in the Attachment B. The assignment to usage categories rests upon the following rationale.

Each FATDMA scheme consists of:

1 Usage category 1 time slots – VDL management:

  a Three (3) timeslots per frame and working channel for Base Station report in non-semaphore mode.

  b One (1) timeslot per frame and working channel for Data Link Management and / or Channel Management messages

2 Usage category 2 time slots – High Timing requirements

  Six (6) timeslots per frame and working channel for Base Station reports in semaphore mode or other high timing requirement transmissions; these time slots can be used for Usage category 3 (General purpose) in the absence of Usage category 2 messages.

3 Usage category 3 time slots – General purpose

  Seven (7) timeslots per frame and working channel for general purpose use or possibly for Usage Categories 1 or 2 (if urgent need should appear).

To re-iterate; only time slots needed at run-time should be actually reserved.

Consequential action in particular in those (few) cases when the above FATDMA reservations would not suffice: The requirement for implementing queuing techniques (including priority schemes) as a mitigation measure on the part of the sources for transmission (not necessarily the AIS base stations of the national competent authority alone) is obvious.

After this definition part, the following sections will introduce the rules for allocating the above IALA FATDMA schemes, referenced by their number, to competent authorities, both national and domestic competent authorities.

8 ALLOCATION OF THE IALA FATDMA SCHEMES TO COMPETENT AUTHORITIES

8.1 Summary of the previous definitions and their consequences

The sections so far have introduced the definitions and concepts needed for a FATDMA plan. The means developed for setting up the FATDMA plan can be summarised by the following two parts:

1 The geographical grid scheme introduced in the previous section provides for separation of FATDMA reservations in space, taking into account the 120 nautical mile rule.

2 The IALA FATDMA schemes, identified by their cell reference number, provide the combination of separation of FATDMA reservations in time, i.e. different time slots, and frequency, i.e. different working channels A and B, while preserving the alternating use of – those two working channels. The FATDMA scheme layouts have been informed by usage considerations as well, i.e. they assign certain usage categories to certain slots in the FATDMA schemes.

As a consequence, the IALA FATDMA schemes, identified by their FATDMA cell reference number, together with the geographical grid, provide a means to allocate FATDMA schemes for each geographical area, isolated from other geographical areas and their allocated FATDMA schemes – at least in a first, and in most cases sufficient planning step. Also, this is globally applicable.

Also the means exhibit a certain simplicity as it is built only on the concept of an area, as opposed to location: transmitting stations, using FATDMA reservations, inject their messages into that given *area*, i.e. one geographical grid cell, while the precise location from where this transmission occurs within that geographical grid cell is less relevant due to the separations in space introduced by the geographical grid scheme.

From a practical point of view, this means that there will be minimum effort required to coordinate between adjacent countries and their national competent authorities because of the isolation of the IALA FATDMA schemes in a given area. By introducing the geographical grid, only bi-lateral or tri-lateral co-ordination would be required in areas, where on the geographical grid cell falls into more than one country.

There are considerations that need to be discussed at a later planning stage, if they are relevant at all:

1 An upper limit of VDL loading due to FATDMA reservations must be respected, to leave sufficient available timeslots for the population of mobile AIS stations in the same area to select their transmission schedules. Ensuring this is the responsibility of the national competent authority.

2 The effect of the VDL loading due to FATDMA reservations can only be assessed in a given area after the concrete FATDMA plan for that area, including the effect of neighbouring fixed stations, has been established.

3 There may be restrictions on the usage of FATDMA reserved slots over time in areas, where transmitting stations are planned to inject a larger number of messages. These restrictions are due to the very nature of the AIS.

4 A national competent authority may choose 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 that competent authority that this cell will remain unused (e.g. due to topology), however caution should be applied to ensure that sufficient geographical spacing to other transmitting stations using the same FATDMA scheme(s) are maintained to avoid interference.

5 Not every message may need to be transmitted at once - there may be the need for queuing. Some limited queuing capability is available in the base station itself; more advanced queuing capabilities will be the responsibility of the AIS-PCU. (A mitigation measure in the long run could be to increase the number of working frequencies of the AIS; however this would require more than two receiving processes in mobile AIS stations).

6 Should the need be relevant for more FATDMA protected timeslots in a certain area than the default FATDMA schemes designated to that area can provide alternative planning will be needed, e.g. for advanced broadcast services, or a repeater. In that case, it is recommended that the timeslots allocated should remain within the boundaries of the repetitive pattern described in section 8.2. This should ensure sufficient available timeslots in a suitable pattern to accommodate the need for mobiles to select their transmission schedules. This may to some degree be achieved by combining unused default FATDMA schemes from across the master cell. Caution should however be applied to ensure that

sufficient geographical spacing to other transmitting stations using the same timeslots are maintained to avoid interference.

7 Area specific, and even sophisticated coverage planning would be needed in some cases, 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. The goal would be to keep the injected message confined to confined areas if at all possible.

However, it is anticipated that these consequences will only be relevant to a few places globally, thus justifying extra planning efforts at those places (instead of not having a simple global plan for the large majority of cases). In addition, it is good to know that there are mitigation measures in place for areas where the most simple measures would no longer work.

8.2 Stepwise allocation of the IALA FATDMA schemes to competent authorities

Based on the above definitions and having considered the consequences, the following simple two-step approach for planning can be taken.

8.2.1 Step 1: International allocation of FATDMA schemes

8.2.1.1 Step 1A: Check need for international co-ordination

All IALA FATDMA schemes that fall completely – judging by the area of their geographical grid cell - within the EEZ (Exclusive Economic Zone) of a country belong to that country. They are immediately subject to domestic allocation rules (see step 2 below).

By means of the IALA FATDMA scheme definition of the previous section this should cover the overwhelming majority of cases globally already in just one step.

8.2.1.2 Step 1B: When need for international co-ordination arises

There are FATDMA schemes, which fall - by the geographical area of their geographical grid cell - into the *adjacent* EEZ of *different* countries. To these schemes only the following rules apply.

1 Thus affected countries and only the thus affected countries need to negotiate the allocation on a peer-to-peer basis and create a memorandum of understanding (or similar document) on the usage of the FATDMA scheme in question. They may use one or more of the following options, combining them as deemed necessary.

2 Option A: One or more than one country can contribute an unused and immediately adjacent FATDMA scheme from within its own area (EEZ), where it can be guaranteed by that country that this cell will remain unused (e. g. due to topology).

3 Option B: The cell management is assigned solely to one of the two countries, while both may use the FATDMA scheme on a mutually agreed basis.

4 Option C: Both countries set up a detailed usage allocation based on the usage categories of the slots of the FATDMA scheme.

5 Option D: 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.

6 The result of the international allocation co-ordination is communicated internationally and appropriately.

7 The affected countries are encouraged to do a maximum of co-ordination at planning time; there should not be a large need for run-time exchange of FATDMA scheduling data between countries.

8.2.2 Step 2: Domestic allocation of slots out of the FATMA schemes for that country

- The national competent authority uses the internationally allocated FATDMA scheme on a primary basis; other competent authorities of that country use individual slots as a subset out of that FATDMA scheme due to allocation by the national competent authority on a secondary basis;
- The national authority represents the complete set of usage requirements (also of other competent authorities) to the international co-ordination (see step 1);
- The VDL management capabilities of the AIS (by AIS base stations) as well as the usage of AIS repeater stations are completely reserved to the national competent authority. They are exclusively considered part of the primary allocation domain;
- The other competent authorities should exclusively use other classes of AIS stations, such as the AIS AtoN station and / or Limited AIS Base Station, the definition of which are currently under development at IEC;
- There should be memorandum of understanding (or some similar document) between the national competent authority and other domestic competent authority stating the distribution of individual slots and their intended usage within the FATDMA schemes assigned to that country by international allocation.

8.3 FATDMA configuration data exchange between Administrations at run-time

The previous sections have shown that careful considerations between adjacent competent authorities are needed at planning time. Furthermore, a FATDMA set-up may not be changed frequently under 'real life' conditions: coverage planning and statutory rights of the competent authorities have been taken into account to arrive at the optimum FATDMA plan or FATDMA schedule for a given area.

While a theoretical possibility to exchange run-time data on actual FATDMA schedules (or maybe even FATDMA schemes) exists on the level of the ASM, the use this option is discouraged.

ANNEX A ALGORITHM TO CALCULATE THE IALA FATDMA GEOGRAPHICAL GRID SCHEME ON A GLOBAL BASIS

In order to achieve a well-defined global geographical distribution an algorithm is used for calculating the position of each individual cell in the geographical grid. Upon input of any geographical position the algorithm will render the number of the FATDMA scheme valid for that geographical position, i.e. the number of the FATDMA scheme used in that cell.

The reference point of the geographical cell would be the [top left] corner for cells on the northern hemisphere, and the [bottom left] corner for cells on the southern hemisphere.

LAT = (WGS 84 latitude in decimal degrees)
LON = (WGS 84 latitude in decimal degrees)
// Note: The grid consists of a repeated pattern of 6 x 6 cells, each cell 30 x 30 nautical miles in size.

SingleCellSizeInNauticalMiles = 30;
NoOfSingleCellsAlongOneSideOfMasterCell = 6;
// Note: The repeatable pattern of 6 x 6 cells is denoted a 'master cell'
MasterCellSizeInNauticalMiles =
SingleCellSizeInNauticalMiles * NoOfSingleCellsAlongOneSideOfMasterCell;
// Note: At Equator, one degree longitude approximately resembles 60 nm i.e. one minute longitude resembles one nautical mile
NoOfMasterCellsAroundEquator = 360 * 60 / MasterCellSizeInNauticalMiles;
//Note: At any latitude, one minute latitude resembles one nautical mile
MasterCellSizeInDegreesLatitude = MasterCellSizeInNauticalMiles / 60.0d;
//Note: abs(x) denotes the absolute value of x; int(x) denotes truncated integer value of x
MasterCellRowNo = int(abs(LAT) / MasterCellSizeInDegreesLatitude);
MasterCellMeanLatitude = (MasterCellRowNo+0.5) * MasterCellSizeInDegreesLatitude
//Note: cos(x) denotes cosine of x in radians

NoOfMasterCellsAroundMasterCellRow =
int(NoOfMasterCellsAroundEquator * cos(2 * π * MasterCellMeanLatitude / 360));

SingleCellWidthInDegrees =
360 / (NoOfSingleCellsAlongOneSideOfMasterCell * NoOfMasterCellsAroundMasterCellRow);

RowNumberInsideMasterCell =
int (abs(LAT) * 60 / SingleCellSizeInNauticalMiles) - NoOfSingleCellsAlongOneSideOfMasterCell * MasterCellRowNo;

// Note: first Southern Hemisphere is assumed, then compensate if Northern Hemisphere

if (LAT>0)

{ RowNumberInsideMasterCell =

NoOfSingleCellsAlongOneSideOfMasterCell - RowNumberInsideMasterCell - 1;

};
ColumnNumberInsideMasterCell = int (abs(LON) / SingleCellWidthInDegrees);

while (ColumnNumberInsideMasterCell > (NoOfSingleCellsAlongOneSideOfMasterCell – 1))

{ColumnNumberInsideMasterCell =
ColumnNumberInsideMasterCell – NoOfSingleCellsAlongOneSideOfMasterCell

};

// Note: first positive longitude is assumed, compensate if negative longitude (west of Greenwich)

if (LON<0)

{ ColumnNumberInsideMasterCell =
(NoOfSingleCellsAlongOneSideOfMasterCell - 1) - ColumnNumberInsideMasterCell

};

ResultingCellNumber =
RowNumberInsideMasterCell * NoOfSingleCellsAlongOneSideOfMasterCell + ColumnNumberInsideMasterCell + 1

ANNEX B ABSOLUTE SLOT NUMBER AND USAGE CATEGORY DESIGNATION FOR THE IALA FATDMA SCHEMES

Cell Reference	Channel A			Channel B			Usage Configuration	Base station report starting slot (CBM sentence)
	starting slot	reservation block size	Increment 1: semaphore mode 2: non – semaphore mode	starting slot 1: semaphore mode 2: non – semaphore mode	reservation block size	Increment 1: semaphore mode 2: non – semaphore mode		
1-I	0	1	250[1] or 750[2]	125[1] or 375[2]	1	250[1] or 750[2]	Base Station report*	0
	312	1	0 or 1125	877	1	0 or 1125	Data Link Management + general purpose *	
	602	0, 1, 2 or 3	0 or 1125	12	0, 1, 2 or 3	0 or 1125	General purpose *	
1-II	125	1	250[1] or 750[2]	0[1] or 500[2]	1	250[1] or 750[2]	Base Station report*	125
	877	1	0 or 1125	312	1	0 or 1125	Data Link Management + general purpose *	
	12	0, 1, 2 or 3	0 or 1125	602	0, 1, 2 or 3	0 or 1125	General purpose *	
2-I	1	1	250[1] or 750[2]	126[1] or 376[2]	1	250[1] or 750[2]	Base Station report*	1
	313	1	0 or 1125	878	1	0 or 1125	Data Link Management + general purpose *	
	612	0, 1, 2 or 3	0 or 1125	27	0, 1, 2 or 3	0 or 1125	General purpose *	
2-II	126	1	250[1] or 750[2]	1[1] or 501[2]	1	250[1] or 750[2]	Base Station report*	126
	878	1	0 or 1125	313	1	0 or 1125	Data Link Management + general purpose *	
	27	0, 1, 2 or 3	0 or 1125	612	0, 1, 2 or 3	0 or 1125	General purpose *	
3-I	10	1	250[1] or 750[2]	135[1] or 385[2]	1	250[1] or 750[2]	Base Station report*	10
	314	1	0 or 1125	879	1	0 or 1125	Data Link Management + general purpose *	
	619	0, 1, 2 or 3	0 or 1125	37	0, 1, 2 or 3	0 or 1125	General purpose *	
3-II	135	1	250[1] or 750[2]	10[1] or 510[2]	1	250[1] or 750[2]	Base Station report*	135
	879	1	0 or 1125	314	1	0 or 1125	Data Link Management + general purpose *	
	37	0, 1, 2 or 3	0 or 1125	619	0, 1, 2 or 3	0 or 1125	General purpose *	
4-I	11	1	250[1] or 750[2]	136[1] or 386[2]	1	250[1] or 750[2]	Base Station report*	11
	627	1	0 or 1125	52	1	0 or 1125	Data Link Management + general purpose *	
	327	0, 1, 2 or 3	0 or 1125	902	0, 1, 2 or 3	0 or 1125	General purpose *	
4-II	136	1	250[1] or 750[2]	11[1] or 511[2]	1	250[1] or 750[2]	Base Station report*	136
	52	1	0 or 1125	627	1	0 or 1125	Data Link Management + general purpose *	
	902	0, 1, 2 or 3	0 or 1125	327	0, 1, 2 or 3	0 or 1125	General purpose *	
5-I	19	1	250[1] or 750[2]	144[1] or 394[2]	1	250[1] or 750[2]	Base Station report*	19
	628	1	0 or 1125	53	1	0 or 1125	Data Link Management + general purpose *	
	337	0, 1, 2 or 3	0 or 1125	912	0, 1, 2 or 3	0 or 1125	General purpose *	
5-II	144	1	250[1] or 750[2]	19[1] or 519[2]	1	250[1] or 750[2]	Base Station report*	144
	53	1	0 or 1125	628	1	0 or 1125	Data Link Management + general purpose *	
	912	0, 1, 2 or 3	0 or 1125	337	0, 1, 2 or 3	0 or 1125	General purpose *	
6-I	20	1	250[1] or 750[2]	145[1] or 395[2]	1	250[1] or 750[2]	Base Station report*	20
	629	1	0 or 1125	54	1	0 or 1125	Data Link Management + general purpose *	
	352	0, 1, 2 or 3	0 or 1125	887	0, 1, 2 or 3	0 or 1125	General purpose *	
6-II	145	1	250[1] or 750[2]	20[1] or 520[2]	1	250[1] or 750[2]	Base Station report*	145
	54	1	0 or 1125	629	1	0 or 1125	Data Link Management + general purpose *	
	887	0, 1, 2 or 3	0 or 1125	352	0, 1, 2 or 3	0 or 1125	General purpose *	
7-I	21	1	250[1] or 750[2]	146[1] or 396[2]	1	250[1] or 750[2]	Base Station report*	21
	362	1	0 or 1125	927	1	0 or 1125	Data Link Management + general purpose *	
	637	0, 1, 2 or 3	0 or 1125	62	0, 1, 2 or 3	0 or 1125	General purpose *	
7-II	146	1	250[1] or 750[2]	21[1] or 521[2]	1	250[1] or 750[2]	Base Station report*	146
	927	1	0 or 1125	362	1	0 or 1125	Data Link Management + general purpose *	
	62	0, 1, 2 or 3	0 or 1125	637	0, 1, 2 or 3	0 or 1125	General purpose *	
8-I	25	1	250[1] or 750[2]	150[1] or 400[2]	1	250[1] or 750[2]	Base Station report*	25
	363	1	0 or 1125	928	1	0 or 1125	Data Link Management + general purpose *	
	652	0, 1, 2 or 3	0 or 1125	77	0, 1, 2 or 3	0 or 1125	General purpose *	
8-II	150	1	250[1] or 750[2]	25[1] or 525[2]	1	250[1] or 750[2]	Base Station report*	150
	928	1	0 or 1125	363	1	0 or 1125	Data Link Management + general purpose *	
	77	0, 1, 2 or 3	0 or 1125	652	0, 1, 2 or 3	0 or 1125	General purpose *	

Default FATDMA schemes / 2

Cell Reference	Channel A			Channel B			Usage Configuration	Base station report starting slot (CBM sentence)
	starting slot	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode	starting slot [1]: semaphore mode [2]: non – semaphore mode	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode		
9-I	26	1	250[1] or 750[2]	151[1] or 401[2]	1	250[1] or 750[2]	Base Station report*	26
	364	1	0 or 1125	929	1	0 or 1125	Data Link Management + general purpose *	
	662	0, 1, 2 or 3	0 or 1125	87	0, 1, 2 or 3	0 or 1125	General purpose *	
9-II	151	1	250[1] or 750[2]	26[1] or 526[2]	1	250[1] or 750[2]	Base Station report*	151
	929	1	0 or 1125	364	1	0 or 1125	Data Link Management + general purpose *	
	87	0, 1, 2 or 3	0 or 1125	662	0, 1, 2 or 3	0 or 1125	General purpose *	
10-I	35	1	250[1] or 750[2]	160[1] or 410[2]	1	250[1] or 750[2]	Base Station report*	35
	677	1	0 or 1125	102	1	0 or 1125	Data Link Management + general purpose *	
	369	0, 1, 2 or 3	0 or 1125	937	0, 1, 2 or 3	0 or 1125	General purpose *	
10-II	160	1	250[1] or 750[2]	35[1] or 535[2]	1	250[1] or 750[2]	Base Station report*	160
	102	1	0 or 1125	677	1	0 or 1125	Data Link Management + general purpose *	
	937	0, 1, 2 or 3	0 or 1125	369	0, 1, 2 or 3	0 or 1125	General purpose *	
11-I	36	1	250[1] or 750[2]	161[1] or 411[2]	1	250[1] or 750[2]	Base Station report*	36
	678	1	0 or 1125	103	1	0 or 1125	Data Link Management + general purpose *	
	377	0, 1, 2 or 3	0 or 1125	952	0, 1, 2 or 3	0 or 1125	General purpose *	
11-II	161	1	250[1] or 750[2]	36[1] or 536[2]	1	250[1] or 750[2]	Base Station report*	161
	103	1	0 or 1125	678	1	0 or 1125	Data Link Management + general purpose *	
	952	0, 1, 2 or 3	0 or 1125	377	0, 1, 2 or 3	0 or 1125	General purpose *	
12-I	44	1	250[1] or 750[2]	169[1] or 419[2]	1	250[1] or 750[2]	Base Station report*	44
	679	1	0 or 1125	104	1	0 or 1125	Data Link Management + general purpose *	
	387	0, 1, 2 or 3	0 or 1125	962	0, 1, 2 or 3	0 or 1125	General purpose *	
12-II	169	1	250[1] or 750[2]	44[1] or 544[2]	1	250[1] or 750[2]	Base Station report*	169
	104	1	0 or 1125	679	1	0 or 1125	Data Link Management + general purpose *	
	962	0, 1, 2 or 3	0 or 1125	387	0, 1, 2 or 3	0 or 1125	General purpose *	
13-I	45	1	250[1] or 750[2]	170[1] or 420[2]	1	250[1] or 750[2]	Base Station report*	45
	402	1	0 or 1125	977	1	0 or 1125	Data Link Management + general purpose *	
	687	0, 1, 2 or 3	0 or 1125	112	0, 1, 2 or 3	0 or 1125	General purpose *	
13-II	170	1	250[1] or 750[2]	45[1] or 545[2]	1	250[1] or 750[2]	Base Station report*	170
	977	1	0 or 1125	402	1	0 or 1125	Data Link Management + general purpose *	
	112	0, 1, 2 or 3	0 or 1125	687	0, 1, 2 or 3	0 or 1125	General purpose *	
14-I	46	1	250[1] or 750[2]	171[1] or 421[2]	1	250[1] or 750[2]	Base Station report*	46
	403	1	0 or 1125	978	1	0 or 1125	Data Link Management + general purpose *	
	702	0, 1, 2 or 3	0 or 1125	119	0, 1, 2 or 3	0 or 1125	General purpose *	
14-II	171	1	250[1] or 750[2]	46[1] or 546[2]	1	250[1] or 750[2]	Base Station report*	171
	978	1	0 or 1125	403	1	0 or 1125	Data Link Management + general purpose *	
	119	0, 1, 2 or 3	0 or 1125	702	0, 1, 2 or 3	0 or 1125	General purpose *	
15-I	50	1	250[1] or 750[2]	175[1] or 425[2]	1	250[1] or 750[2]	Base Station report*	50
	404	1	0 or 1125	979	1	0 or 1125	Data Link Management + general purpose *	
	712	0, 1, 2 or 3	0 or 1125	127	0, 1, 2 or 3	0 or 1125	General purpose *	
15-II	175	1	250[1] or 750[2]	50[1] or 550[2]	1	250[1] or 750[2]	Base Station report*	175
	979	1	0 or 1125	404	1	0 or 1125	Data Link Management + general purpose *	
	127	0, 1, 2 or 3	0 or 1125	712	0, 1, 2 or 3	0 or 1125	General purpose *	
16-I	51	1	250[1] or 750[2]	176[1] or 426[2]	1	250[1] or 750[2]	Base Station report*	51
	727	1	0 or 1125	137	1	0 or 1125	Data Link Management + general purpose *	
	412	0, 1, 2 or 3	0 or 1125	987	0, 1, 2 or 3	0 or 1125	General purpose *	
16-II	176	1	250[1] or 750[2]	51[1] or 551[2]	1	250[1] or 750[2]	Base Station report*	176
	137	1	0 or 1125	727	1	0 or 1125	Data Link Management + general purpose *	
	987	0, 1, 2 or 3	0 or 1125	412	0, 1, 2 or 3	0 or 1125	General purpose *	

Default FATDMA schemes / 3

Cell Reference	Channel A			Channel B			Usage Configuration	Base station report starting slot (CBM sentence)
	starting slot	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode	starting slot [1]: semaphore mode [2]: non – semaphore mode	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode		
17-I	60	1	250[1] or 750[2]	185[1] or 435[2]	1	250[1] or 750[2]	Base Station report*	60
	728	1	0 or 1125	138	1	0 or 1125	Data Link Management + general purpose *	
	427	0, 1, 2 or 3	0 or 1125	994	0, 1, 2 or 3	0 or 1125	General purpose *	
17-II	185	1	250[1] or 750[2]	60[1] or 560[2]	1	250[1] or 750[2]	Base Station report*	185
	138	1	0 or 1125	728	1	0 or 1125	Data Link Management + general purpose *	
	994	0, 1, 2 or 3	0 or 1125	427	0, 1, 2 or 3	0 or 1125	General purpose *	
18-I	61	1	250[1] or 750[2]	186[1] or 436[2]	1	250[1] or 750[2]	Base Station report*	61
	729	1	0 or 1125	139	1	0 or 1125	Data Link Management + general purpose *	
	452	0, 1, 2 or 3	0 or 1125	1002	0, 1, 2 or 3	0 or 1125	General purpose *	
18-II	186	1	250[1] or 750[2]	61[1] or 561[2]	1	250[1] or 750[2]	Base Station report*	186
	139	1	0 or 1125	729	1	0 or 1125	Data Link Management + general purpose *	
	1002	0, 1, 2 or 3	0 or 1125	452	0, 1, 2 or 3	0 or 1125	General purpose *	
19-I	69	1	250[1] or 750[2]	194[1] or 444[2]	1	250[1] or 750[2]	Base Station report*	69
	462	1	0 or 1125	1012	1	0 or 1125	Data Link Management + general purpose *	
	737	0, 1, 2 or 3	0 or 1125	152	0, 1, 2 or 3	0 or 1125	General purpose *	
19-II	194	1	250[1] or 750[2]	69[1] or 569[2]	1	250[1] or 750[2]	Base Station report*	194
	1012	1	0 or 1125	462	1	0 or 1125	Data Link Management + general purpose *	
	152	0, 1, 2 or 3	0 or 1125	737	0, 1, 2 or 3	0 or 1125	General purpose *	
20-I	70	1	250[1] or 750[2]	195[1] or 445[2]	1	250[1] or 750[2]	Base Station report*	70
	463	1	0 or 1125	1013	1	0 or 1125	Data Link Management + general purpose *	
	744	0, 1, 2 or 3	0 or 1125	162	0, 1, 2 or 3	0 or 1125	General purpose *	
20-II	195	1	250[1] or 750[2]	70[1] or 570[2]	1	250[1] or 750[2]	Base Station report*	195
	1013	1	0 or 1125	463	1	0 or 1125	Data Link Management + general purpose *	
	162	0, 1, 2 or 3	0 or 1125	744	0, 1, 2 or 3	0 or 1125	General purpose *	
21-I	71	1	250[1] or 750[2]	196[1] or 446[2]	1	250[1] or 750[2]	Base Station report*	71
	464	1	0 or 1125	1014	1	0 or 1125	Data Link Management + general purpose *	
	752	0, 1, 2 or 3	0 or 1125	177	0, 1, 2 or 3	0 or 1125	General purpose *	
21-II	196	1	250[1] or 750[2]	71[1] or 571[2]	1	250[1] or 750[2]	Base Station report*	196
	1014	1	0 or 1125	464	1	0 or 1125	Data Link Management + general purpose *	
	177	0, 1, 2 or 3	0 or 1125	752	0, 1, 2 or 3	0 or 1125	General purpose *	
22-I	75	1	250[1] or 750[2]	200[1] or 450[2]	1	250[1] or 750[2]	Base Station report*	75
	762	1	0 or 1125	187	1	0 or 1125	Data Link Management + general purpose *	
	437	0, 1, 2 or 3	0 or 1125	1027	0, 1, 2 or 3	0 or 1125	General purpose *	
22-II	200	1	250[1] or 750[2]	75[1] or 575[2]	1	250[1] or 750[2]	Base Station report*	200
	187	1	0 or 1125	762	1	0 or 1125	Data Link Management + general purpose *	
	1027	0, 1, 2 or 3	0 or 1125	437	0, 1, 2 or 3	0 or 1125	General purpose *	
23-I	76	1	250[1] or 750[2]	201[1] or 451[2]	1	250[1] or 750[2]	Base Station report*	76
	763	1	0 or 1125	188	1	0 or 1125	Data Link Management + general purpose *	
	477	0, 1, 2 or 3	0 or 1125	1037	0, 1, 2 or 3	0 or 1125	General purpose *	
23-II	201	1	250[1] or 750[2]	76[1] or 576[2]	1	250[1] or 750[2]	Base Station report*	201
	188	1	0 or 1125	763	1	0 or 1125	Data Link Management + general purpose *	
	1037	0, 1, 2 or 3	0 or 1125	477	0, 1, 2 or 3	0 or 1125	General purpose *	
24-I	85	1	250[1] or 750[2]	210[1] or 460[2]	1	250[1] or 750[2]	Base Station report*	85
	764	1	0 or 1125	189	1	0 or 1125	Data Link Management + general purpose *	
	487	0, 1, 2 or 3	0 or 1125	1052	0, 1, 2 or 3	0 or 1125	General purpose *	
24-II	210	1	250[1] or 750[2]	85[1] or 585[2]	1	250[1] or 750[2]	Base Station report*	210
	189	1	0 or 1125	764	1	0 or 1125	Data Link Management + general purpose *	
	1052	0, 1, 2 or 3	0 or 1125	487	0, 1, 2 or 3	0 or 1125	General purpose *	

Default FATDMA schemes / 4

Cell Reference	Channel A			Channel B			Usage Configuration	Base station report starting slot (CBM sentence)
	starting slot	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode	starting slot [1]: semaphore mode [2]: non – semaphore mode	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode		
25-I	86	1	250[1] or 750[2]	211[1] or 461[2]	1	250[1] or 750[2]	Base Station report*	86
	494	1	0 or 1125	1062	1	0 or 1125	Data Link Management + general purpose *	
	777	0, 1, 2 or 3	0 or 1125	202	0, 1, 2 or 3	0 or 1125	General purpose *	
25-II	211	1	250[1] or 750[2]	86[1] or 586[2]	1	250[1] or 750[2]	Base Station report*	211
	1062	1	0 or 1125	494	1	0 or 1125	Data Link Management + general purpose *	
	202	0, 1, 2 or 3	0 or 1125	777	0, 1, 2 or 3	0 or 1125	General purpose *	
26-I	94	1	250[1] or 750[2]	219[1] or 469[2]	1	250[1] or 750[2]	Base Station report*	94
	495	1	0 or 1125	1063	1	0 or 1125	Data Link Management + general purpose *	
	787	0, 1, 2 or 3	0 or 1125	212	0, 1, 2 or 3	0 or 1125	General purpose *	
26-II	219	1	250[1] or 750[2]	94[1] or 594[2]	1	250[1] or 750[2]	Base Station report*	219
	1063	1	0 or 1125	495	1	0 or 1125	Data Link Management + general purpose *	
	212	0, 1, 2 or 3	0 or 1125	787	0, 1, 2 or 3	0 or 1125	General purpose *	
27-I	95	1	250[1] or 750[2]	220[1] or 470[2]	1	250[1] or 750[2]	Base Station report*	95
	496	1	0 or 1125	1064	1	0 or 1125	Data Link Management + general purpose *	
	802	0, 1, 2 or 3	0 or 1125	227	0, 1, 2 or 3	0 or 1125	General purpose *	
27-II	220	1	250[1] or 750[2]	95[1] or 595[2]	1	250[1] or 750[2]	Base Station report*	220
	1064	1	0 or 1125	496	1	0 or 1125	Data Link Management + general purpose *	
	227	0, 1, 2 or 3	0 or 1125	802	0, 1, 2 or 3	0 or 1125	General purpose *	
28-I	96	1	250[1] or 750[2]	221[1] or 471[2]	1	250[1] or 750[2]	Base Station report*	96
	812	1	0 or 1125	237	1	0 or 1125	Data Link Management + general purpose *	
	502	0, 1, 2 or 3	0 or 1125	1102	0, 1, 2 or 3	0 or 1125	General purpose *	
28-II	221	1	250[1] or 750[2]	96[1] or 596[2]	1	250[1] or 750[2]	Base Station report*	221
	237	1	0 or 1125	812	1	0 or 1125	Data Link Management + general purpose *	
	1102	0, 1, 2 or 3	0 or 1125	502	0, 1, 2 or 3	0 or 1125	General purpose *	
29-I	100	1	250[1] or 750[2]	225[1] or 475[2]	1	250[1] or 750[2]	Base Station report*	100
	813	1	0 or 1125	238	1	0 or 1125	Data Link Management + general purpose *	
	512	0, 1, 2 or 3	0 or 1125	1087	0, 1, 2 or 3	0 or 1125	General purpose *	
29-II	225	1	250[1] or 750[2]	100[1] or 600[2]	1	250[1] or 750[2]	Base Station report*	225
	238	1	0 or 1125	813	1	0 or 1125	Data Link Management + general purpose *	
	1087	0, 1, 2 or 3	0 or 1125	512	0, 1, 2 or 3	0 or 1125	General purpose *	
30-I	101	1	250[1] or 750[2]	226[1] or 476[2]	1	250[1] or 750[2]	Base Station report*	101
	814	1	0 or 1125	239	1	0 or 1125	Data Link Management + general purpose *	
	527	0, 1, 2 or 3	0 or 1125	1077	0, 1, 2 or 3	0 or 1125	General purpose *	
30-II	226	1	250[1] or 750[2]	101[1] or 601[2]	1	250[1] or 750[2]	Base Station report*	226
	239	1	0 or 1125	814	1	0 or 1125	Data Link Management + general purpose *	
	1077	0, 1, 2 or 3	0 or 1125	527	0, 1, 2 or 3	0 or 1125	General purpose *	
31-I	110	1	250[1] or 750[2]	235[1] or 485[2]	1	250[1] or 750[2]	Base Station report*	110
	537	1	0 or 1125	1113	1	0 or 1125	Data Link Management + general purpose *	
	827	0, 1, 2 or 3	0 or 1125	244	0, 1, 2 or 3	0 or 1125	General purpose *	
31-II	235	1	250[1] or 750[2]	110[1] or 610[2]	1	250[1] or 750[2]	Base Station report*	235
	1113	1	0 or 1125	537	1	0 or 1125	Data Link Management + general purpose *	
	244	0, 1, 2 or 3	0 or 1125	827	0, 1, 2 or 3	0 or 1125	General purpose *	
32-I	111	1	250[1] or 750[2]	236[1] or 486[2]	1	250[1] or 750[2]	Base Station report*	111
	538	1	0 or 1125	1114	1	0 or 1125	Data Link Management + general purpose *	
	837	0, 1, 2 or 3	0 or 1125	252	0, 1, 2 or 3	0 or 1125	General purpose *	
32-II	236	1	250[1] or 750[2]	111[1] or 611[2]	1	250[1] or 750[2]	Base Station report*	236
	1114	1	0 or 1125	538	1	0 or 1125	Data Link Management + general purpose *	
	252	0, 1, 2 or 3	0 or 1125	837	0, 1, 2 or 3	0 or 1125	General purpose *	

Default FATDMA schemes / 5

Cell Reference	Channel A			Channel B			Usage Configuration	Base station report starting slot (CBM sentence)
	starting slot	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode	starting slot [1]: semaphore mode [2]: non – semaphore mode	reservation block size	Increment [1]: semaphore mode [2]: non – semaphore mode		
33-I	18	1	250[1] or 750[2]	143[1] or 393[2]	1	250[1] or 750[2]	Base Station report*	18
	552	1	0 or 1125	1112	1	0 or 1125	Data Link Management + general purpose *	
	2	0, 1, 2 or 3	0 or 1125	852	0, 1, 2 or 3	0 or 1125	General purpose *	
33-II	143	1	250[1] or 750[2]	18[1] or 518[2]	1	250[1] or 750[2]	Base Station report*	143
	1112	1 or 2	0 or 1125	552	1 or 2	0 or 1125	Data Link Management + general purpose *	
	852	0, 1, 2 or 3	0 or 1125	2	0, 1, 2 or 3	0 or 1125	General purpose *	
34-I	43	1	250[1] or 750[2]	168[1] or 418[2]	1	250[1] or 750[2]	Base Station report*	43
	562	1	0 or 1125	553	1	0 or 1125	Data Link Management + general purpose *	
	262	0, 1, 2 or 3	0 or 1125	862	0, 1, 2 or 3	0 or 1125	General purpose *	
34-II	168	1	250[1] or 750[2]	43[1] or 543[2]	1	250[1] or 750[2]	Base Station report*	168
	553	1	0 or 1125	562	1	0 or 1125	Data Link Management + general purpose *	
	862	0, 1, 2 or 3	0 or 1125	262	0, 1, 2 or 3	0 or 1125	General purpose *	
35-I	68	1	250[1] or 750[2]	193[1] or 443[2]	1	250[1] or 750[2]	Base Station report*	68
	577	1	0 or 1125	1118	1	0 or 1125	Data Link Management + general purpose *	
	277	0, 1, 2 or 3	0 or 1125	869	0, 1, 2 or 3	0 or 1125	General purpose *	
35-II	193	1	250[1] or 750[2]	68[1] or 568[2]	1	250[1] or 750[2]	Base Station report*	193
	1118	1	0 or 1125	577	1	0 or 1125	Data Link Management + general purpose *	
	869	0, 1, 2 or 3	0 or 1125	277	0, 1, 2 or 3	0 or 1125	General purpose *	
36-I	93	1	250[1] or 750[2]	218[1] or 468[2]	1	250[1] or 750[2]	Base Station report*	93
	587	1	0 or 1125	993	1	0 or 1125	Data Link Management + general purpose *	
	302	0, 1, 2 or 3	0 or 1125	1119	0, 1, 2 or 3	0 or 1125	General purpose *	
36-II	218	1	250[1] or 750[2]	93 or 593	1	250[1] or 750[2]	Base Station report*	218
	993	1	0 or 1125	587	1	0 or 1125	Data Link Management + general purpose *	
	1119	0, 1, 2 or 3	0 or 1125	302	0, 1, 2 or 3	0 or 1125	General purpose *	