18. Channel Management

Not every single aspect of channel management is not well understood at this stage of the development of the AIS. This chapter provides an *introduction* to Channel Management for competent authorities. Some recommendations will be derived at the end of the chapter.
A section introducing most fundamental definitions and concepts is presented first, This introduction starts with the mobile AIS station and assumes that it is this station has to operate in accordance with regional operating settings that are different from the default operating settings. It then moves on to the consequential requirements for the shore infrastructure set up by the competent authority.

18.1 Introduction and fundamental concepts

In response to a request from IMO seeking global channels for AIS, the ITU designated two worldwide channels from the VHF maritime mobile band for this purpose (refer to ITU-R Radio Regulations (RR) Appendix S18). The channels are AIS1 – No. 2087 (161.975 MHz) and AIS2 – No. 2088 (162.025 MHz) - with 25kHz bandwidth, and in accordance with Recommendation ITU-R M.1084. Two channels were selected to increase capacity and mitigate Radio Frequency (RF) interference. AIS1 is the "primary channel" and AIS2 the "secondary channel" in "high seas" areas. This distinction will become relevant when considering some details of the transition between regions.

By default every mobile AIS station operates on these two channels, AIS 1 and AIS 2, as defined in Recommendation ITU-R M1371-1. A mobile AIS station is thus capable of receiving two messages, from two different stations concurrently, provided that it does not transmit at the same time. Every mobile AIS station transmits at its "*nominal reporting rate*". This nominal reporting rate is given in tables for the respective class of mobile AIS station (refer to the appropriate chapters of these AIS Guidelines). *Each of the two channels by default is used to transmit scheduled transmissions*, such as autonomous and continuous position reports, *at half of the "nominal reporting rate."* E. g. a Class A shipborne mobile AIS station moving at a speed of more than 23 knots is supposed to report its position in intervals of 2 seconds. Therefore the nominal reporting rate would be once per two seconds. This means, that each of the two channels AIS1 and AIS2 will receive a scheduled position report from this mobile AIS station once every four seconds, i. e. at half the rate of the nominal reporting rate. To understand this fact is crucial for the understanding of the impact of channel management on reporting rates. This behaviour is called dual channel operation.

18.1.1 Reasons for Channel Management

The ITU also provided for administrations to designate "regional frequency channels for AIS" *where channels 2087 and 2088 are unavailable* and, if necessary, to derive new S18 channels using Recommendation ITU-R M.1084 (simplex use of duplex channels and/or 12.5 kHz narrow-band channels).

In addition channel management may be used to mitigate throughput breakdown caused by (local) RF interference on or blocking of one or both of the default operating channels by locally switching over to alternate operating channels.

A channel management scheme is also required when duplex AIS repeaters are used. The justification for duplex repeating may be derived from local unavailability of the default operating channels.

18.1.2 Parameters subject to channel management and their default settings

The following operating parameters (of any mobile AIS station) may be changed by channel management. Also their default setting and range of possible settings are given (see Recommendation ITU-R M.1371-1, Annex 2, §4.1):

- frequency / nominal bandwidth of the primary operating channel = channel A (as expressed by channel number in accordance with Recommendation ITU-R M.1084).
  Default: channel number 2087 = AIS1, 25 kHz bandwidth
  Possible range: all channels of 25kHz or 12.5kHz nominal bandwidth which can be identified by a channel number given in Recommendation ITU-R M.1084. Local possibilities may be depending on regulatory considerations.
-
- frequency / nominal bandwidth of the secondary operating channel = channel B.
  Default: channel number 2088 = AIS2, 25 kHz bandwidth
  Possible range: refer to primary operating channel
- Transmitter power level setting
- Default: high power level setting
  Possible range: low power level setting = 2W; high power level settings = 12.5W
-
- Transmit/Receive mode:
  Default: Dual channel operation (receive on both channels A and B simultaneously; transmit on channels A and B alternately, using half the nominal reporting rate on both channels A and B. Assigned mode may change the reporting rate of a mobile station without affecting the use of dual channels alternately.) = TxA/TxB; RxA/RxB
  Possible range:
  (TxA/TxB, RxA/RxB);
  (TxA, RxA/RxB) = transmit only on primary operating channel (channel A) and receive on both channels simultaneously (while not transmitting);
  (TxB, RxA/RxB) = transmit only on secondary operating channel (channel B) and receive on both channels simultaneously (while not transmitting);
-
- Narrow-band mode for primary channel A:
  Default: nominal bandwidth as specified by channel number (see above)
  Possible range: nominal bandwidth as specified by channel number; reduced to 12.5 kHz (when channel number designates a channel with 25kHz nominal bandwidth)
  Note: It should be observed that the optional use of 12.5 kHz bandwidth reduces somewhat the receiver sensitivity and FM discrimination (slot sharing capability), but still gives the required transmission rate of 9600 bits per second.
-
- Narrow-band mode for secondary channel B: refer to Narrow-band mode for primary channel A
-

- Transition zone size:
  Default: 5 nautical miles
  Possible range: 1 to 8 nautical miles in steps of 1 nautical mile
-
- Addressed mode: A base station can command specific channel management behaviour, using the above parameters, to an individual mobile AIS station.
-
- Geographical region: Region defining latitudes and longitudes - not only do these values establish the location and size of the region, they are also used to identify the region and the station characteristics data for that region. See below.

Channel management is performed, when mobile AIS stations are switched from their default operating settings to any different operating setting, which may only differ in one parameter.

Channel management can be performed over the VDL using AIS Message 22 or via VHF-FM Ch 70 by using DSC. The parameters that can be set by the DSC-based AIS Channel Management has the limitation that it cannot modify the Transition Zone Size. A parameter-by-parameter comparison is shown in Table 18.1. Competent authorities need to be aware of these differences if implementing the DSC-Based AIS Channel Management capability. Appropriate coordination of the contents of AIS Message 22 transmitted over the VDL with the DSC-based AIS Channel Management is necessary.

Table 18.1 Channel Management Parameter Comparison of DSC-Based vs TDMA-Based

Parameter	AIS Message 22 (TDMA)	DSC-Based AIS Channel Mgmt
Channel A Frequency & Nominal Bandwidth	X	X
Channel B Frequency & Nominal Bandwidth	X	X
Transmit/Receive Mode	X	X
Transmitter Power Mode	X	X
Longitude of NE Corner	X	X
Latitude of NE Corner	X	X
Longitude of SW Corner	X	X
Latitude of SW Corner	X	X
Addressed or Broadcast Message Indicator	X	X
Channel A Bandwidth	X	X
Channel B Bandwidth	X	X
Transition Zone Size	X	N/A

The whole set of channel management settings and region specification is called *"regional operating settings"*.

The above list highlights that channel management is not just about changing operating frequencies. *Channel management should rather be understood as a walk in a*

multi-dimensional channel parameter space. The complexity of channel management results from the many inter-dependencies between these parameters.

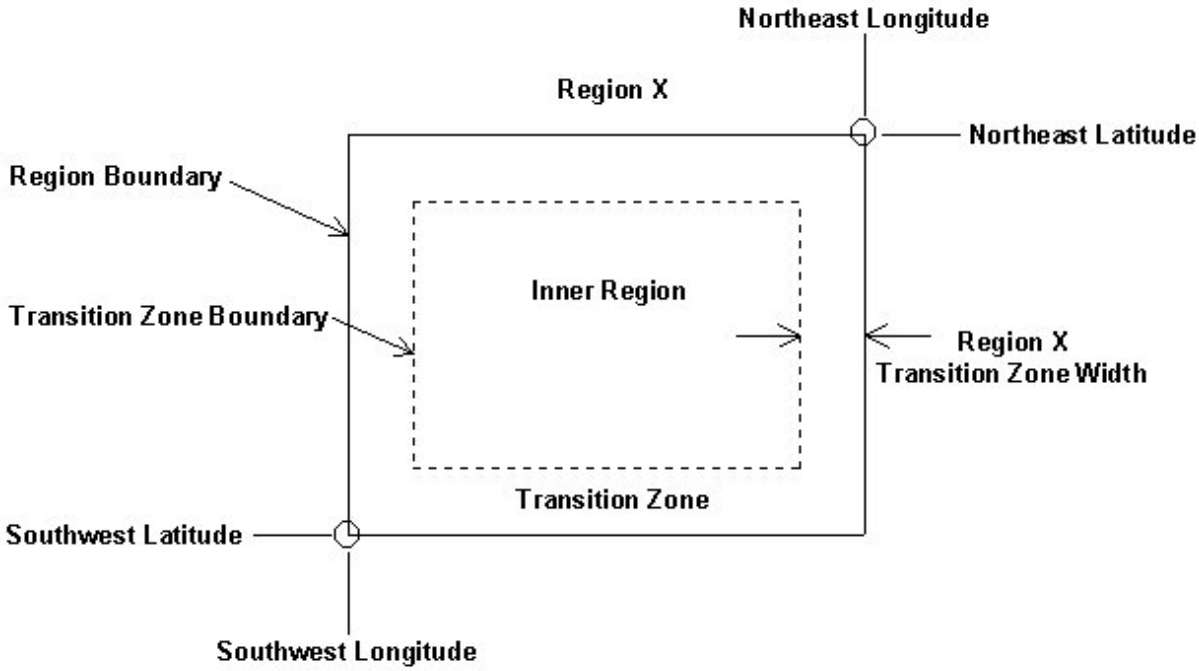
18.1.3 The definition of a region and its transitional zone

Depending upon the geographic location of the station and the regional operating settings stored in memory, a mobile AIS station is supposed to automatically change several fundamental operating characteristics from their default values. This feature is designed into the operation of every mobile AIS station. This feature allows local authorities to automatically manage mobile AIS stations' use of the VHF marine band.

Channel management data is organised by geographic regions. This section describes how these geographic regions are defined. In fact, channel management in effect is *only* possible within *precisely defined geographical regions*. This means, that any channel management operation applies to the specified region, only. Mobile stations outside all regions, to which channel management settings apply, will stay in or return to the default settings.

The regional operating areas are designated by a Mercator projection rectangle with two reference points using WGS84 datum. The first reference point is the geographical co-ordinate address of the north-eastern corner (to the nearest tenth of a minute) and the second point is the geographical co-ordinate address of the south-western corner (to the nearest tenth of a minute) of the rectangle. Since it is an area on the curved surface of the earth, a region is not a true rectangle in shape. The sides of the region follow either constant latitude or longitude lines. A rectangular representation of this area is shown in Figure 18.1.

Figure 18.1 Rectangular representation of a region and its components



Inside every region's boundary there exists a "transition zone." The width of the transition zone is also part of the data that defines the region. The transition zone for a

region is the area between the "Transition Zone Boundary" and "Region Boundary" as shown in Figure 18.1. The transition zone width is specified in increments of one nautical mile and range of one to eight nautical miles. If no value is given in the region's definition, the default width is five nautical miles. The zone size is the same on the 4 inside boarders of a region.

While the transition zone is expressively defined in ITU-R M.1371-1, the portion of the region that is not inside the transition zone is not given a special name. In order to simplify the discussion below, the term "Inner Region" will be used to refer to the portion of a region that is not the transition zone. This means that the area of a region can be described as being equal to the area of the transition zone plus the area of the inner region.

When the mobile AIS station receives different channel management commands for the same geographical region, the information received latest will be used in accordance with an algorithm described below.

Any Class A shipborne mobile AIS station can internally store information for eight different regions. This gives the possibility to “download” to Class A shipborne mobile AIS stations information for several regions (for example covering inland waterways) from one shore station.

The AIS automatically changes to a transitional mode of operation when it is within the specified transitional zone which surrounds the region boundaries. In this zone ships transmit and receive on one of the channels for the area it is leaving and one of the channels for the area it is entering. Within the transitional zone, the reporting rate will be the nominal reporting rate for *both* channels (as opposed to just half the nominal reporting rate in each individual channel during default dual channel operation).

Within the transitional zone, Class A shipborne mobile AIS stations will ignore any assignment of higher nominal reporting rates by shore stations. This guarantees that the broadcasts of mobile AIS stations operating in the transition zone will be received at nominal reporting rate for the benefit of other mobile stations in the immediate vicinity of that station.

The precise details of the behaviour of a mobile AIS station within a transition zone are described below.

18.1.4 A Region's relationship to the high seas (or default) region

The "high seas" or default region has the primary channel of AIS1, and the secondary channel of AIS2 with a bandwidth of 25kHz on both channels. The size of the transition zone is 5 nautical miles. The power level is "high power" and all of the mobile AIS station‘s receivers and the frequency-agile transmitter are used. Figure 18.2 shows the relationship of the Figure 18.1, Region X, and the high seas region.

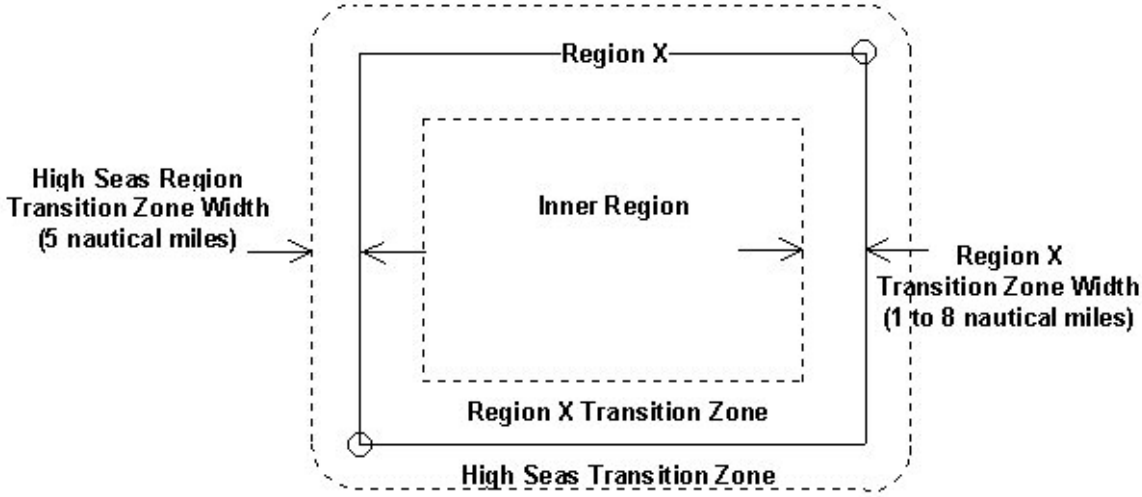


Figure 19.2 - Relationship of region X to the High Seas Region.

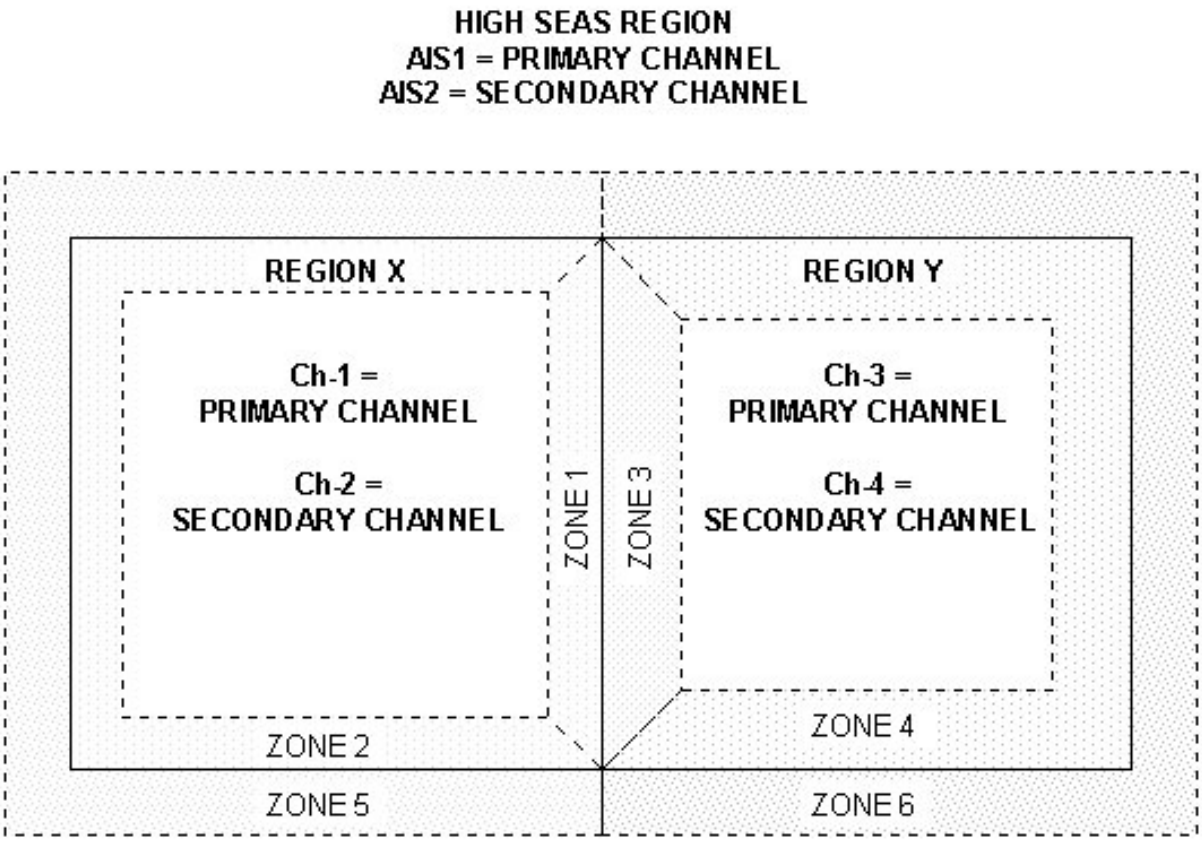


Figure 18.3 Breakdown of operating zones for two adjacent regions

The high seas region's regional operating settings are all equal to the default values. They cannot be changed by channel management. Channel management data can only create additional regions that exist within the high seas region. Wherever a defined region is created, if not adjacent to another defined region, this relationship with the high seas region is automatically created.[4]

18.1.5 Two Regions' relationship including the High Seas Region

If two regions are defined with either a latitude or longitude boundary exactly the same, to 1/10 minute, the two regions exist adjacent to each other, see the common side of Region X and Region Y in Figure 18.3. If the boundary of a region falls inside the boundary of another region, the regions conflict and a decision about which to region to use must be made by the mobile AIS station. Recommendation ITU-R M.1371-1, § 4.1.8, states, "*The most current and applicable commands received should override previous channel management commands.*" Applying this rule would mean the more current regional definition would apply and the older definition ignored. This also implies that the data and time that a region's data is received should be retained along with the region's data.

4 Note: There is a slight ambiguity at the corners of the High Seas Transition Zone Boundary. Figure 19-2 is drawn using the 5 nautical mile distance from the region X boundary. Some equipment designers may use lines of constant latitude and longitude that are 5 nautical miles from the region X boundary. This would result in 90 degree corners rather than constant radius corners. These optional interpretations do not represent a significant operational safety issue. Because accurate curved lines are difficult to draw, the remaining diagrams will use "square" corners on the high seas transition zone boundary - with this ambiguity implied.

Figure 18.3 shows two adjacent regions, Region X and Region Y, surrounded by the high seas region. The Region X transition zone is further broken down into zone 1 and zone 2. Zone 1 is the portion of the Region X transition zone nearest to the boundary in common with Region Y. Zone 2 is the portion of the Region X transition zone nearest to the boundary in common with the high seas region. Recognition, that the transition zone may be sub-divided depending on the relationship it has with adjacent regions, is key to understanding how a mobile AIS station will safely operate as it travels between and among regions that use different radio frequencies, signal bandwidths, power, etc. In a similar fashion, the Region Y transition zone is broken down into zone 3 and zone 4; and the high seas region's transition zone is broken down into zone 5 and zone 6.

How a mobile AIS station will safely operate as it travels between and among regions will be described in detail below, using the above definitions.

18.1.6 IMO requires maximum extent of automated channel management

The AIS is designed as an automatic system. Accordingly, even operating conditions that differ from the default, *such as channel management should be automated as much as possible*. This is in full accordance with the appropriate IMO guidance (refer to IMO/NAV47 "Draft Liaison Statement to ITU-R Working Party 8B", which is Annex 15 of document NAV47/13, 26 July 2001, paragraph 1.2):

> "IMO notes that there may be areas where alternative frequencies are in use but where no base stations exist. This should be an unusual situation, however where it exists, information should be available to all ships sailing in these areas. Therefore, IMO requests that all Administrations notify IMO of these areas for the circulation by the appropriate IMO circulars as well as promulgate this information to shipping in these areas by a suitable means. Also IMO recognises that from the viewpoint of avoiding accidents due to human error, automatic switching should be the normal procedure and manual switching should be limited to specific purposes such as maintenance for the equipment."

This statement clearly applies to both shipboard and shore side.

18.1.7 Overview on means for automatic and manual channel management

Automatic switching of regional operating settings for mobile AIS stations can be done by one of the three means described below. Automatic switching is considered a safer way than manual switching. Among the automatic means, there are two ways to switch regional operating settings from the shore by the competent authority and one automated way to switch regional operating settings on board the ship.

A competent authority may set up AIS shore stations utilising Basic AIS Service "Switch AIS VDL channels via AIS VDL", that uses Message 22 ("Channel Management message") and that gives information of region boundaries, channels and other parameters to be used within the region. The Basic AIS Service "Switch AIS VDL channels via DSC Channel 70" can also be used for this purpose.

In addition, a shipborne information system, which may be connected to the AIS, may input regional operating settings to the AIS. This information may be derived automatically from i.e. a database or from a manual input to this shipborne information system.

Manual channel switching by the AIS operator on the ship can be performed via any suitable interface. The Class A shipborne mobile AIS station provides for manual inputs via the Minimum Keyboard and Display.

Manual channel switching should be avoided if possible in normal operation and should only be based on information issued by the competent authority of that region (compare IMO statement).

The database of the shipborne information system may not fully reflect the current regional operating settings required for the particular region, or the manual input may be flawed.

Therefore, regional operating settings received from a shipborne information system or by manual input, will not be accepted by a Class A shipborne mobile AIS station, if a regional operating setting was received for the same region from a shore station recently.

18.1.8 Channel management as a privilege and as a responsibility for competent authorities

Since the exchange of navigational data between ships and between ship and shore can only be done when both the transmitting and the receiving station use the same channel with compatible operating settings, *a wrong operating setting in just one mobile AIS station may result in it being "invisible" as far as the AIS is concerned*. This may be a safety issue. Therefore, *ITU only allowed competent authorities to do channel management.*

Since channel management is one of the most complex functionality of the whole of the AIS and since channel management, when done wrongly, thus can be potential hazardous to safety, it is strongly recommend that every competent authority should consider the use of channel management carefully before implementing it: *Careful planning is required before a Competent Authority implements a Channel Management scheme.*

18.2 Channel management commands to a Class A shipborne mobile AIS station

All Class A shipborne mobile AIS stations are using the following algorithm to keep the internal eight store memory up to date and to accept new regional operating settings. This algorithm, in general, has three different stages:

- continuous checking of store regional operating settings, and possibly automatic erasure of remote or old settings.
- checking of input before accepting it as new regional operating settings. It should be noted, that this is an exception from one fundamental concept of shipborne equipment design, i. e. that the receiving device normally does not check the data it is receiving. For example, the mobile AIS station does not check the sensor data it receives for reporting.
- operations performed after a new regional operating setting has been accepted.

In detail the Class A shipborne mobile AIS station will perform the following steps (in the following order, if applicable):

- All stored regional operating settings will be time/date-tagged and they will be tagged with information by what input means this regional operating setting was received onboard (via AIS VDL, DSC telecommand, Manual input via Minimum Keyboard and Display (MKD), input via Presentation Interface).
- The Class A shipborne mobile AIS station constantly checks, if the nearest boundary of the region of any stored regional operating setting is more than 500 miles away from the current position of its own position, or if any stored regional operating setting was older than five weeks. Any stored regional operating setting which fulfils any one of these conditions will be erased from the memory. This means, that the AIS station automatically "forgets".

- Any regional operating settings will be handled as a whole, i. e. a change requested for any parameter of the regional operating settings will be interpreted as a new regional operating setting input to the device.
- When the mariner requests to manually input a regional operating setting via the MKD, the regional operating settings in use, which may be the default operating settings, will be presented to the user on the MKD. The mariner will then be allowed to edit these settings partly or in full. The Class A shipborne mobile AIS station will ensure, that a region is always input and that it conforms to the most fundamental rules for regions. After completion of input of an acceptable regional operating settings set, the Class A shipborne AIS station will require the mariner to confirm a second time that the input data shall be stored and possibly used instantaneously.
- Regardless of means of input, automatic or manual, the Class A shipborne AIS station will not accept, i. e. ignore, any new regional operating setting which includes a region, which does not conform to the most fundamental rules for regions. In addition, it will not accept a new regional operating setting, which was input to it via its Presentation Interface (interface to other shipboard equipment; see following chapters), if the region of this new regional operating setting partly or totally overlaps or matches the regions of any of the stored regional operating settings, which were received from a base station via AIS VDL or by DSC telecommand within the last two hours.
- A channel management command or a DSC telecommand addressed to one individual Class A shipborne mobile AIS station will be accepted only if the Class A shipborne mobile AIS station is in a region defined by one of the stored regional operating settings. In this case the set of regional operating settings will be composed by combining the received parameters with the region in use. An channel management command addressed to an individual Class A shipborne mobile AIS station will not be accepted for the high seas area.
- If the region of the new, accepted regional operating setting overlaps in part or in total or matches the region of one or more older regional operating settings, this or these older regions will be erased instantaneously from the memory ("overlap" rule). The region of the new, accepted regional operating setting may be neighbouring tightly and may thus have the same boundaries as older regional operating settings. This will not lead to the erasure of the older regional operating settings.
- Subsequently the Class A shipborne mobile AIS station will store a new, accepted regional operating setting in one free memory location of the eight memories for regional operating settings. If there is no free memory location, the oldest regional operating setting will be replaced by the new, accepted one.
- No means other then defined herein are allowed to clear any or all of the stored regional operating settings of the Class A shipborne AIS station. In particular, it is not possible to solely clear any or all of the stored regional operating settings by a manual input via the MKD or by an input via the Presentation Interface without input of a new regional operating setting.

There is not yet a similar algorithm developed for other classes of mobile equipment, except the most fundamental rules in Recommendation ITU-R M.1371-1. The IEC has begun work on Class B standardisation, however. IALA will begin work on A-to-N AIS stations in 2002.

18.3 Behaviour of a shipborne mobile AIS station entering or moving in a channel management scheme

When a mobile AIS station enters a transition zone, it changes operation to the "two-channel transitional operating mode." How the mobile AIS station operates among zones and regions will now be discussed. In particular, how the mobile AIS station schedules periodic repeated messages.

"Two-channel transitional operating mode" is entered when there is a change of either operating frequency or bandwidth, or both, from one region to the next. This mode of operation begins when a transition zone is entered. There are three exceptions to this rule:

1. If the regional operating settings in both regions use the same channels and bandwidths, operation in the "two-channel transitional operating mode" is not necessary. However, when the region boundaries are crossed, there may be an internal "virtual switch" of the primary and secondary channel designations within the mobile AIS station
2. If the primary channel is the same in both regions, the mobile AIS station should use only that single primary channel at nominal reporting rate while operating in the "two-channel transitional operating mode.
3. If the primary channel in one region is the same as the secondary channel in the other region and that secondary channel is a simplex channel, the mobile AIS station should use only that channel at the nominal reporting rate while operating in the "two-channel transitional operating mode."

18.3.1 Description of mobile AIS station operation in the "two-channel transitional operating mode"

The following describes the operation of a mobile AIS station as it moves between Regions X and Y through zones 1 and 3 of Figure 18.3. The possible movements of the station are shown in Figure 18.4 with notes describing changes to the stations operation.

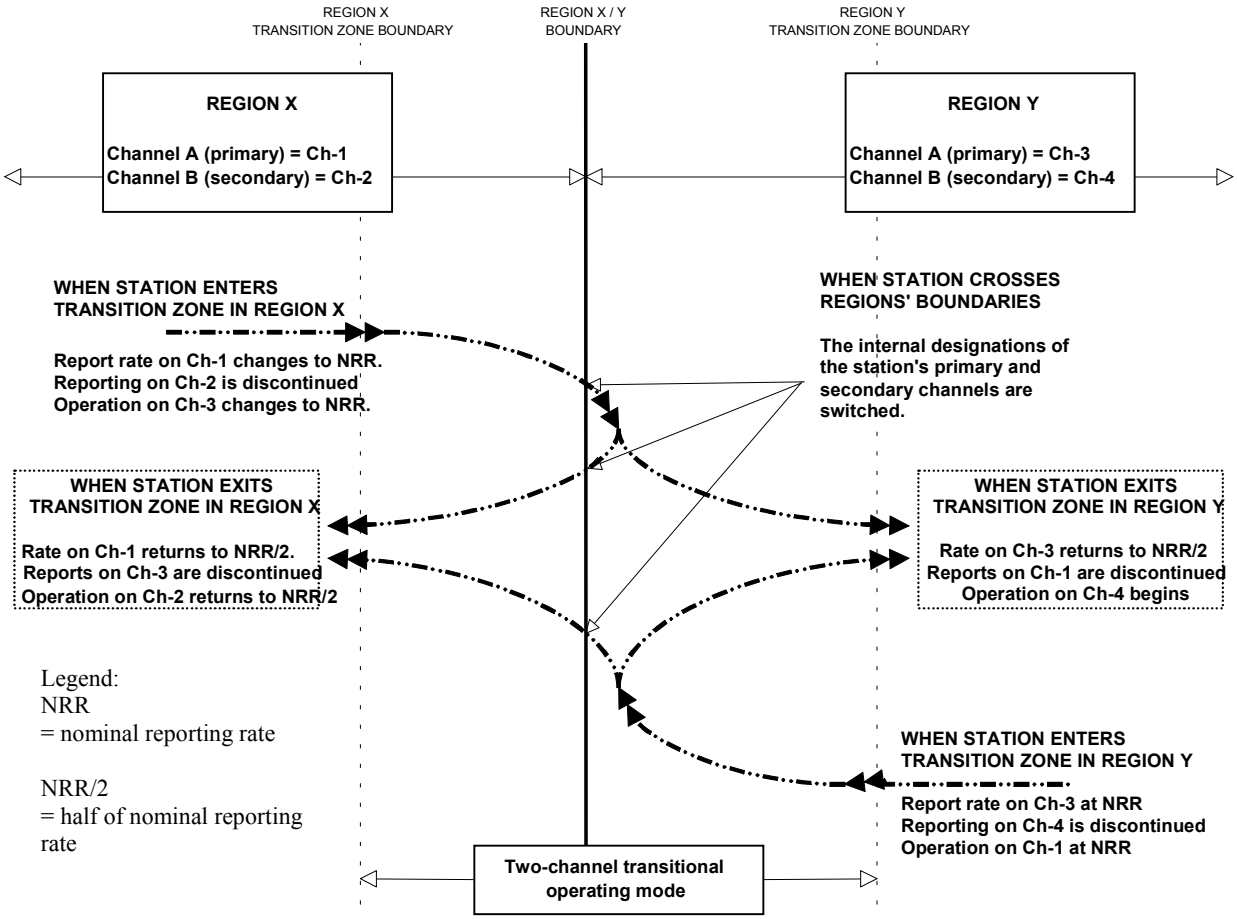


Figure 18.4 - Expected operation of a mobile AIS station in "two-channel transitional operating mode".

Upon entering the transition zones between two regions, the mobile AIS station should switch to the "two-channel transitional operating mode" by:

1. Switching the secondary receiver channel to the primary channel of the adjacent region and begin initialisation phase, while
2. Continuing to broadcast and receive on the primary channel (channel A) for the occupied region for one minute, and broadcast on the secondary channel (channel B) for one minute closing out the previously reserved slots,
3. Increasing the reporting rate on channel A to the nominal reporting rate after the first minute,
4. beginning broadcasts on the adjacent region's primary channel - at the nominal reporting rate.

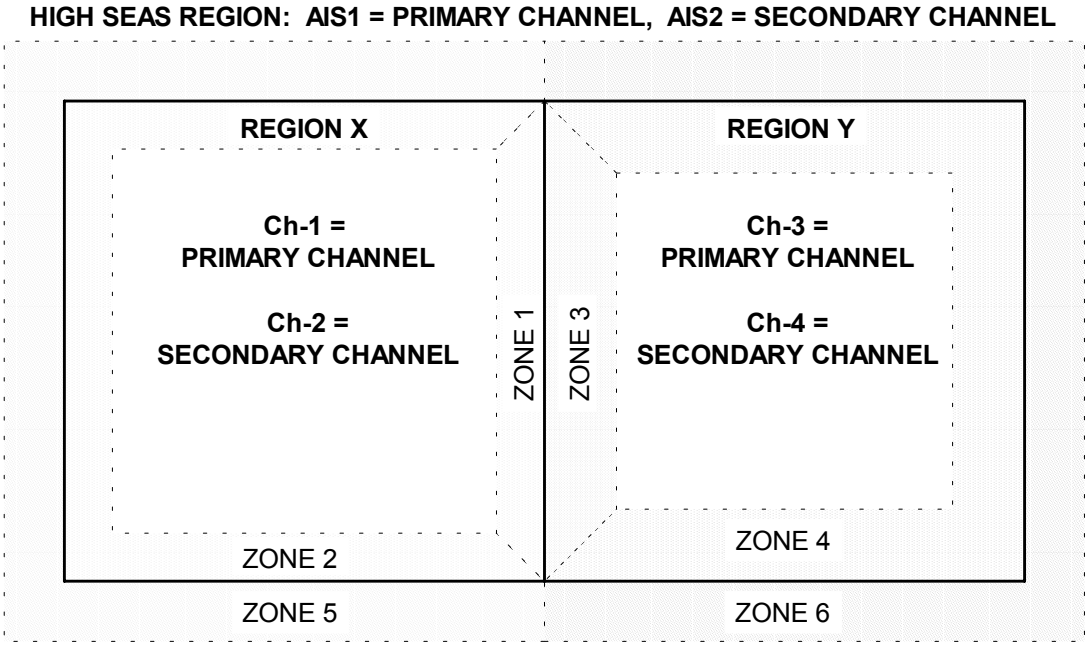
   Note: While inside the transition zones, the mobile AIS station's primary channel (channel A) is defined as the primary channel for the region that the mobile AIS station is inside at any given moment. The mobile AIS station should use this rule to change the primary channel, as needed, while it is in the "two-channel transitional operating mode." While inside the transition zones, the mobile AIS station's secondary channel (channel B) is defined to be the primary channel (channel A) of the nearest adjacent region. This rule should be used, as needed, to change the secondary channel while the mobile AIS station is in the "two-channel transitional operating mode."

Upon exit of the transition zones, the mobile AIS station should discontinue "two-channel transitional operating mode" by:

1. Switching the secondary receiver channel to the secondary channel of the occupied region and begin initialisation phase,
2. Decreasing the reporting rate on the primary channel (channel A) for the occupied region to half of the normal channel reporting rate (This will take about one minute.), and broadcast on the secondary channel (channel B) for one minute closing out the previously reserved slots,
3. Beginning broadcast on the secondary channel - at half of the nominal reporting rate.

18.3.2 Operation of a mobile AIS station moving between and among three regions

The description of mobile AIS station operation during movement between two regions can be used to describe more complex relationships. As described above, once a mobile AIS station enters the transition zone, it operates at nominal reporting rate on both the primary channel for the region it is in, and the primary channel for the next closest region. This is the rule used to draw the zones of Figure 18.5. Figure 18.5 contains both Figure 18.3 and a table indicating the proper operating channels for each of the zones in the figure.



Location of mobile AIS station	Double rate primary channel	Double rate secondary channel
ZONE 1	Ch-1	Ch-3
ZONE 2	Ch-1	AIS1
ZONE 3	Ch-3	Ch-1
ZONE 4	Ch-3	AIS1
ZONE 5	AIS1	Ch-1
ZONE 6	AIS1	Ch-3

Figure 18.5 - Channel selection for transition zone operation.

Using the table in Figure 18.5 and the concepts described in Figure 18.4, the operation of a mobile AIS station can be described for any of the possible tracks between and among the three regions of Figure 18.5. For example, if the station enters zone 1, crosses into zone 3, travels down zone 3 and crosses into zone 4, continues into zone 6, and exits into the high seas region, the following channel combinations well be used (first channel is "primary" / second is "secondary"):

1. Start in Region X, Ch-1 / Ch-2,
2. Enter zone 1, nominal reporting rate on Ch-1 / Ch-2 replaced by Ch-3 at nominal reporting rate,
3. Cross into zone 3, nominal reporting rate on Ch-3 / nominal reporting rate on Ch-1; a virtual switch of channel designations,
4. Cross into zone 4, nominal reporting rate on Ch-3 / Ch-1 replaced by nominal reporting rate AIS1,
5. Cross into zone 6, nominal reporting rate AIS1 / nominal reporting rate Ch-3; a virtual switch of channel designations,
6. Exit into high seas, half of the nominal reporting rate AIS1 / Ch-3 replaced by half the nominal reporting rate AIS2.

Other examples can be similarly constructed and analysed. Under all combinations and circumstances, the station must have one channel in common with nearby stations.

18.3.3 Single-channel operation

The possibility of single-channel AIS operation is briefly addressed under the parameter Tx/Rx Mode. Little, if any, information is given elsewhere in the ITU recommendations. Conditions that may warrant single-channel operation include limited, continued operation after a duplex repeater failure, areas with severe spectrum limitations, and remote waterways with little marine traffic.

If the Region Y secondary channel (Ch-4) is not defined, Figure 18.5 can be used to describe how the mobile AIS station should operate as it moves from any location in Figure 18.5 into the inner region of Region Y. For example, if the mobile AIS station moved from Region X to Region Y, the sequence of channels used might be the following (first channel is "primary" / second is "secondary"):

1. Start in Region X, Ch-1 / Ch-2,
2. Enter zone 1, nominal reporting rate on Ch-1 / Ch-2 replaced by Ch-3 on nominal reporting rate,
3. Cross into zone 3, nominal reporting rate on Ch-3 / nominal reporting rate on Ch-1; virtual switch of channel designations,
4. Exit into Region Y's inner region, continue nominal reporting rate Ch-3 / discontinue Ch-1.

18.4 Requirements and recommendations for competent authorities with regard to channel management

After this description on how the mobile stations operate within a given frequency management scheme, it becomes obvious, that the regional operating settings should be set up by the competent authority in such a way that the transition between the different regions is safe. The onus for a safe and proper channel management is on the competent authority.

18.4.1 Fundamental layout rules for when planning regions

In order to fulfil this requirement the competent authority should make sure that the following conditions are met (requirements taken directly from Recommendation ITU-R M.1371-1 or inferred from description above):

1. Regions should be *as large as possible*. For practical reasons, in order to provide safe transitions between regions, these should not be smaller than 20 nautical miles but not larger than 200 nautical miles on any boundary side. (from ITU-R M.1371-1)

2. The boundaries of each region, *which are meant to be adjacent to each other in the strict sense of the word, should be identical*. A “small” gap between “adjacent” regions, however small, will be interpreted by mobile AIS stations as a combination of three regions in total: two regions with regional operating settings different from default separated by “high sea”, i. e. by a region with default settings. Therefore, the mobile station will enter the transition zone behaviour of three different regions when moving from one region to the other through the alleged region with default settings.

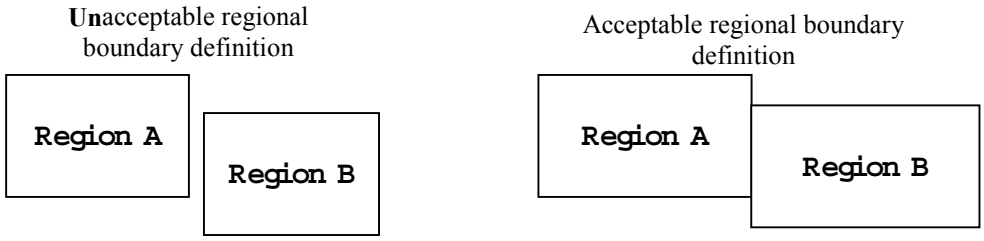


Figure 18.6

3. The distance between regions, *which are meant to be neighbouring, but not to be strictly adjacent*, should be at least the sum of the size of the transition zones of the two regions plus one nautical mile.

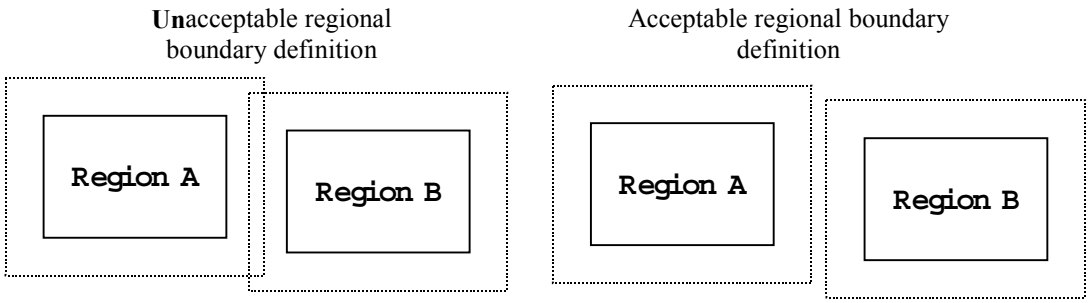


Figure 18.7

Having more than three adjacent regions at any regional boundary intersection must be avoided. In this context, the high seas area should be considered to be a region where default operating settings apply. When there are three or more adjacent regions, the minimum distance between the first and the second adjacent corners on one side and any other corner should be at least 8 nautical miles (which is the maximum size of a transition zone). This 8-miles-distance rule will be checked by the Class A ship-borne mobile station before accepting a new regional operating setting.

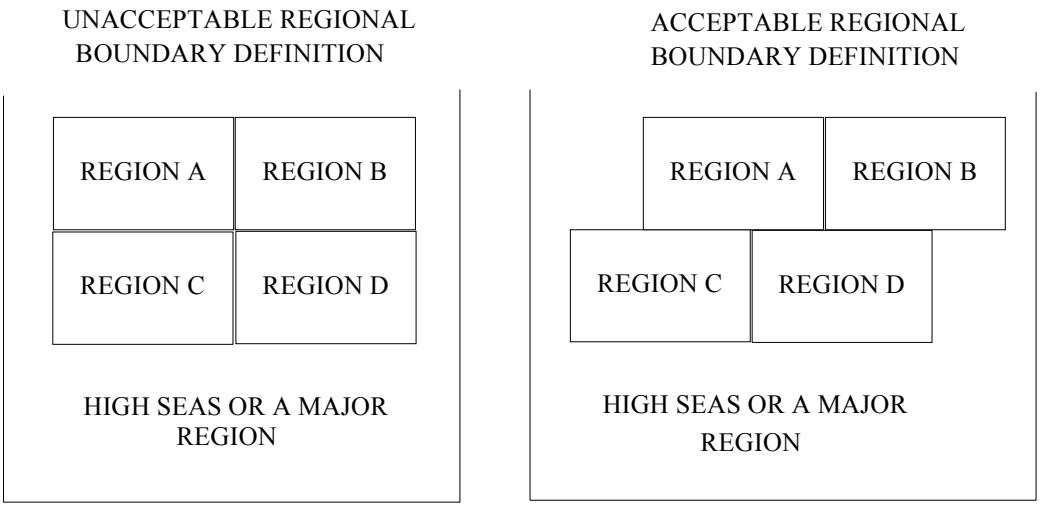


Figure 18.8

The region rules and general operation of the mobile AIS station are designed to successfully operate under the "worse case" conditions where every channel in every re-

gion is different. Although the AIS technology and methods adequately deal with these possible conditions, the actual application of channel management should recognise that AIS channel management is the safest when the primary channel of the regions is either AIS1 or AIS2.

18.4.2 Channel management by automatic means, i. e. by base stations

It is strongly recommended – in full accordance with the IMO guidance cited above - *that all areas where the default operating settings does not apply should be covered by AIS shore stations* utilising Basic AIS Service "Switch AIS VDL channels via AIS VDL", that uses Message 22 ("Channel Management message"), and that gives information of region boundaries, channels and other parameters to be used within the region. The Basic AIS Service "Switch AIS VDL channels via DSC Channel 70" can also be used for this purpose.
Base Stations that provide service in regional operating areas should use one of the above Basic AIS Services *also for all regions surrounding the actual regional areas.* It is recommended that Basic AIS Service "Switch AIS VDL channels via AIS VDL" should be used by a competent authority for all regions *at least every 10 minutes*. The actual rate should *depend upon the speed of vessels within regional transition zones*. With regard to the Basic AIS Service "Switch AIS VDL channels via DSC Channel 70" similar considerations should take place. It should be noted, however, that the ITU restricts the use of DSC Channel 70 for AIS related purposes, such as channel management, to 0.0375 Erlang in total (refer to Annex 3 of Recommendation ITU-R M.1371-1, §1.3). Therefore, this Basic AIS Service may not be adequate for all situations where channel management is required.

18.4.3 Change of regional operating settings over time

The change of regional operating settings over time may be required in some situations. Although this potential of the AIS needs much more investigation, some fundamental principles can be stated already.

18.4.3.1 Fundamental rules

Since the Class A mobile AIS station stores regional operating settings for up to five weeks, *carefully planned overwriting of the older, stored regional operating settings is needed when there are changes required for the same area over time.*

Channel management regions should only be changed – for safety reasons - *over a longer period of time, i. e. in the order of half-hours instead of minutes*.

The steps should be carefully planned beforehand, and the effects of any change should be well understood before implementing it. After one change step the system should be allowed to return to a stationary mode, i. e. all transitional states should have had time to subside. When there is a need to change operating frequencies within a region, there should be a minimum time period of 9 minutes after the first operating frequency has been changed before the second operating frequency is changed (refer to Recommendation ITU-R M.1371-1, Annex 2, §4.1.9).

Base stations should never change two channels (A and B) simultaneously within any region.

18.4.3.2 Preliminary procedures to change regions over time: Changes in region boundaries

Two possible changes of regional boundaries apply:

A region will be deleted, i. e. operation is intended to return to default

If the competent authority determines, that a region should no longer exist as a defined region, and the settings of that region should be changed to the default settings, the procedure as described as follows should be applied for that particular region: A channel management command must be transmitted by a base station to change the first operational frequency and all other parameters except the second operating frequency set to the default values, followed by a second channel management message after at least 9 minutes to change the second operational frequency. The region (geographical area) should be identical in size and location as the region to be deleted. If all AIS stations in that region are using the new operational frequencies, periodical channel management messages are no longer needed if the new operational settings are all equal to the default settings. The regional operating settings, which are stored in the memory of the Class A shipborne mobile AIS stations, will then be deleted in accordance with the algorithm given above, i. e. after five weeks latest.

A region will be moved or a new region will overlap the current region.

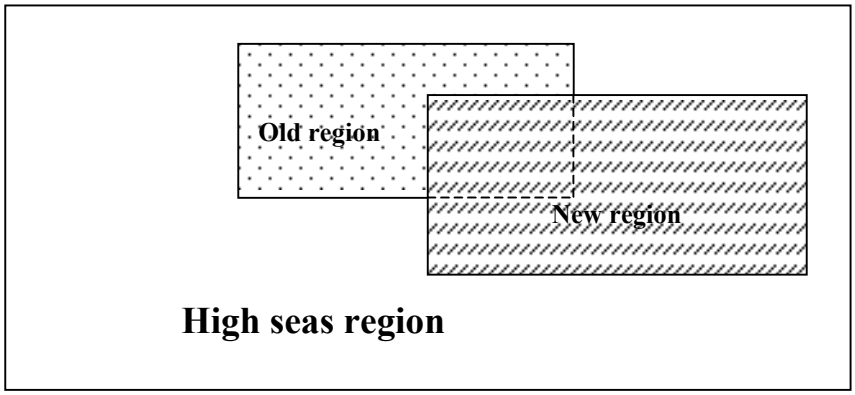


Figure 18.9

The picture illustrates the possible movement of a region from the old position to the new position. The same applies if a new region overlaps the old region. Any new region overwrites the stored old region as a whole immediately (refer to description of memory algorithm above). Therefore, the change from old to new could be accomplished in one step, i. e. all mobiles, which have been in an old region and are no longer in any specifically region – because the old region has been overwritten – would automatically be in “high seas” and would thus use default settings for *all* parameters immediately.

While this may be desired with some parameters other than operating frequency or just one operating frequency to be returned to default, this would not be a safe procedure, if more than one operating frequency different from AIS1 and AIS2 would need to return to default. Instead a step-by-step approach should be planned as explained before.

19. Co-Location of DSC Functionality

19.1 Inroduction

Digital Selective Calling (DSC) functionality is a significant part of the ITU 1371-1 AIS standard. The intention of this inclusion was two-fold. To provide a bridge between the ITU 825-3 standard and AIS as well as a method to provide all mobile AIS stations access to regional AIS operating frequencies. DSC also can provide DSC-based AIS channel management that adds some useful additional functionality that may be of particular interest both to countries that cannot easily implement the system using the designated international frequencies, and those who anticipate a very high traffic density.

Indiscriminate use of DSC functionality, however, can negatively impact an AIS system and reduce its safety value. It can also negatively impact the primary function of DSC as an aid to search and rescue. Because of these inherent problems, shore-based DSC implementation for an AIS system must be carefully planned and operated. A competent authority must consider traffic flow and traffic density before implementation. The overall safety of the waterway, including both the control of obvious threats, such as hazardous cargo, and less obvious threats, such as waterborne terrorism, must be paramount.

19.2 Overview of AIS DSC Functionality

NOTE: ITU-R M.1371-1, Annex 3, and the standards cited in that document, must be consulted for a complete description. The following summary is provided to allow this discussion to be read without referral to other documents.

The DSC functionality described in ITU-R M.1371-1 is a subset of DSC functionality described in ITU-R M.825-3 and ITU-R M.493-10. For mobile AIS stations, the AIS standard specifically excludes all distress-related functionality and limits the dedicated AIS DSC receiver to Channel 70. Shore based DSC commands for an AIS shore station are of two types: DSC-based AIS channel management and DSC polling. DSC-based channel management commands allow a competent authority a method to change all mobile AIS stations AIS working frequencies on a regional basis, and they may be output in the form of geographical area command or a command to an individual ship. Polling commands implement a limited polling function that may be utilized by a competent authority. These commands include the following:

101: switch to VHF channel x for subsequent AIS communications

102: report position at intervals of x minutes

103: report position

104: VTS expansion messages

108: report length of ship

109: report course of ship

111: report ship's name or identification

112: acknowledge message

116: report speed of ship

VTS expansion messages (104) supported include:

00: frequency channel

01: transmit power level

09: primary regional channel

10: secondary regional channel

11: regional guard channel

12: Northeast corner of region

13: Southwest corner of region

The ITU 1371-1 specification places two restrictions on the use of these messages:

> Any DSC traffic on Channel 70 must be limited to 0.075 Erlangs to prevent any interference with DSC distress-related calls.
>
> The implementation of DSC by a competent authority must not impair AIS channel monitoring and information reporting.

19.3 Benefits of DSC Implementation

DSC functionality is supported by the Class A broadcast unit, but there is no requirement that a competent authority implement it. When is this implementation necessary or desirable? It may be necessary when the international channels (87B and 88B) are not available in a region. If a competent authority may not use the default channels, DSC-based AIS channel management messages will provide access to those ships via DSC rather than some other less automatic form of communication.

DSC-based AIS channel management messages also are the only universal method for transmission of AIS data both to ships on default channels and those on regional channels. This should not be necessary when operating under normal conditions, but it may be useful if part of a shore system fails or shipboard equipment does not respond normally. With proper planning the former situation should not occur, but the use of DSC could be used as a failsafe mechanism.

19.4 Possible Conflicts Between DSC and AIS Functionality

Two major conflicts can occur when AIS DSC messages are implemented. These are loss of AIS messages on the broadcast unit and at the shore station, and loss of avail-

ability on channel 70 for DSC distress-related messages. Both of these conflicts result in a lessening of the overall maritime safety that both DSC and AIS were designed to enhance. The competent authority can ensure that this does not occur.

Although possible within the supported AIS messages, switching AIS frequencies on either a single ship or a group of ships must not be implemented. This would cause that ship or ships to no longer receive position reports on the VHF data link from other vessels not included in the message. The use of these messages would make the output of an AIS display on the affected ships misleading.

Loss of AIS messages can occur when the competent authority implements any message requiring a response from a broadcast unit. ITU 1371-1 does not require that a broadcast unit simultaneously receive information on the working frequencies while transmitting its own position information. A single antenna system can meet all of the requirements. It is possible both to transmit and receive simultaneously on a single antenna, but receiver sensitivity is reduced when this is implemented (limiting the range of the unit and therefore increasing the possibility that messages will be lost). The use of automatic position reporting on channel 70 (message 102) is especially problematic, since it may cause continual disruptions in the reception of messages on the AIS working frequencies.

When does this become disruptive? Many factors can play a part. Traffic density relates directly to the likelihood that messages may be lost when the broadcast unit is transmitting on channel 70. An installed shore system that produces few conflicts when the number of vessels carrying broadcast units is low, may cause future problems as the number of ships carrying AIS equipment increases. Vessels with high reporting rates (high-speed vessels, vessels carrying passengers) exacerbate the problem. Segmentation of the coverage area into regional channels, with resulting higher reporting rates during transitions, can also contribute.

Loss of channel 70 availability obviously is related to traffic on that channel generated by AIS messages. Again, any AIS messages have an impact. Increases in the number of AIS broadcast units will increase the probability that distress-related messages may be lost.

19.5 Harmonization of DSC and AIS Functionality

Since the conflicts are all related to transmission of messages on channel 70, minimizing those messages will ensure that neither the Shore Station or Mobile Station's AIS VHF data link nor DSC-related distress functions are impaired. In areas where the default international channels are available (87b and 88b), regional channels may be implemented using channel messages built into the AIS standard (Message 22). This is obviously the preferred method. In areas where this is not an option, channel switching via DSC may be formatted so that no reply is required (command 112 should not be used). The acceptable transmission frequency of these messages must be based on the propagation and the speed of participating vessels: an interval of 10-15 minutes between broadcasts should be sufficient in most cases. Receipt of these messages by broadcast units must occur at least 5 NM before a vessel reaches the regional area. This will allow the switch to occur as specified in 1371-1.

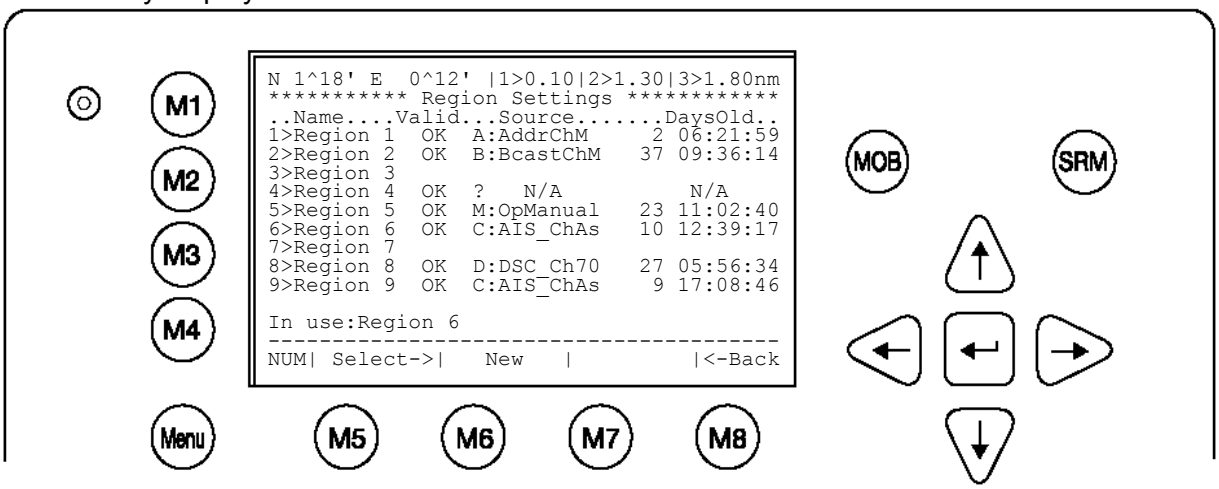
Polling using AIS' DSC commands is, as has already been discussed, a possible source of disruption to DSC and AIS functionality. Its use makes sense only when the number of participants is low, the required reporting rate is at lower intervals, and using the AIS VHF Data Link is not possible. Before implementation, a competent authority must calculate the probability that disruptions will occur and then determine the possible impact on safety. In an area where the number of participants is steadily or dramatically increasing (as carriage requirements are implemented), this may be a difficult task. Active monitoring of the VHF data link is the safest and most predictable way to receive position reports.

b) Region Settings

A Region is a defined area, with specific VHF parameters, which are sent out by Vessel Traffic Service Stations (VTS), and received via Digital Selective Calling (DSC) or AIS.

The screen shows a list of Regions, and their input sources. When the vessel enters into one of the pre-defined Regions, the GlobalWatch$_2$™ AIS automatically switches to the relevant Region Setting. If a Region Number is vacant, then the relevant Region Name Slot is currently unoccupied.

Tip**:** For fast Region Selection, press the Region Number on the keyboard and the selected region is immediately displayed.

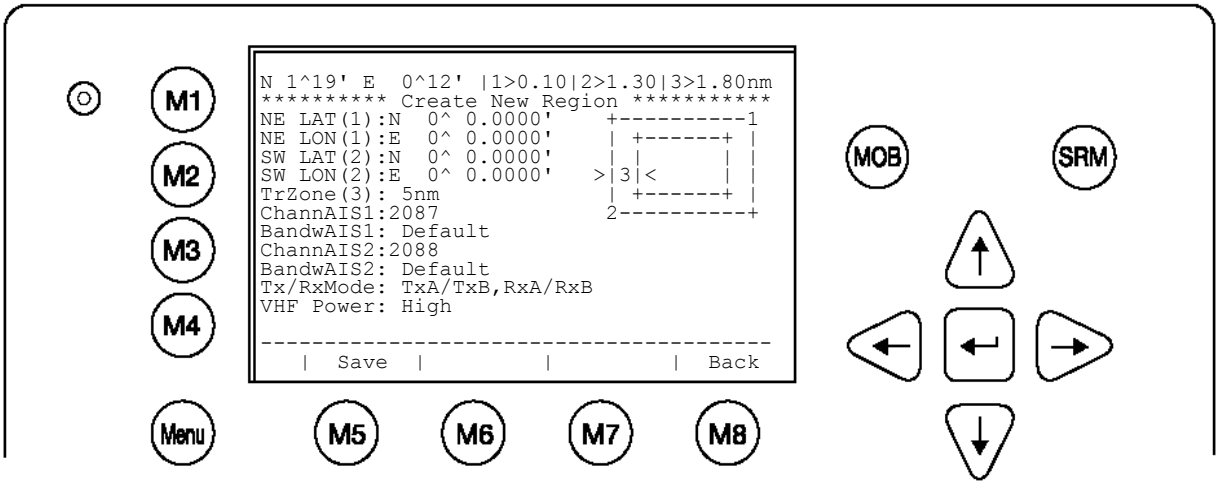


Dynamic Keys: Region Settings				
[M5]	**[Select]**	Confirm Region Number Selection	**[Back]**	Return to Menu Configuration
[M6]	**[New]**	Create New Region		

Overview of Region Settings		
Name	Region Number	Number of pre-defined Region
Valid	OK	Status of Region Setting - OK: Stored and Valid
Source	A:AddrChM	A: Addressed Channel Management (Msge. 22) Source: VTS via AIS
	B:BcastChM	B: Broadcast Channel Management (Msge. 22) Source: VTS via AIS
	C:AIS_ChAs	C: AIS Channel Assignment Sentence Source: Manual ECDIS Input
	D:DSC_Ch70	D: Channel 70 Telecommand Source: Digital Selective Calling
	M:OpManual	M: Operator Manual Input Source: Via Display
DaysOld	Period of time Region Setting is stored	Days, hours, minutes, seconds (dd hh:mm:ss)
In use	Region 6	Region Setting of vessel current operation

Creating a New Region

Parameters for setting up a new Region can be entered and saved here.



Dynamic Keys: Initial User Password Setting					
[M5]	**[Save]**	Confirm Region Data Input	**[M8]**	**[Back]**	Return to Region Listing

Inputting Region Settings: Mode of Latitude and Longitude Input:
Example: 44 Degrees, 13.1234 minutes, North
Input Format: N 44-13.1234

Input Modes for New Regions			
Data Field	**Field Description**	**Input Modus**	**Additional Information**
NE LAT(1)	Latitude N/E corner	Manual Input	Degrees and minutes
NE LON(1)	Longitude of N/E corner	Manual Input	Degrees and minutes
SW LAT(2)	Latitude of S/W corner	Manual Input	Degrees and minutes
SW LON(2)	Longitude of S/W corner	Manual Input	Degrees and minutes
TrZone(3)	Transitional Zone Size	<Selection>	Nautical Miles
ChannAIS1	Primary AIS Channel	Manual Input	Channel Number
BandwAIS1	Bandwidth for Primary AIS Channel	<Selection>	Default Setting as defined by the channel number
ChannAIS2	Secondary AIS Channel	Manual Input	Channel Number
BandwAIS2	Bandwidth for Secondary AIS Channel	<Selection>	Default Setting as defined by the channel number
Tx/RxMode	Channel Modes	<Selection>	Tx : Transmitting Mode Rx: Receiving Mode
VHF Power	VHF Power Settings	<Selection>	**Low** = 2 Watt (Default for Ports) **High** = 12,5 Watt (Default for High Sea Regions)

1.11 Regional Operating Channels

AIS operates primarily on two dedicated VHF channels, CH 2087 and CH2088. Where these channels are not available regionally, the AIS is capable of being automatically switching to designated alternate channels by means of a message from a shore facility. Where no shore based AIS or GMDSS sea area A1 station is in place, the AIS should be switched manually as in paragraph 1.11.2.

A regional operating area is set with the procedure below. The most recent eight areas are memorized.

- Automatic setting of VHF DSC (channel 70) from shore-based AIS
- Automatic setting by AIS message from shore-based AIS
- Setting by shipboard system such as ECDIS
- Manual setting

The default area is as follows:

- Tx power: 12.5 W
- Channel no. 2087, 2088
- Frequency bandwidth: 25 kHz
- Tx/Rx mode: Tx/Rx

1.11.1 Viewing channels, Tx power

Do the following to view current channels.

1. Press the [MENU] key to open the menu.
2. Press the [6] key to open the SYSTEM SETTINGS sub-menu.
3. Press the [2] key to choose SET CHANNEL.

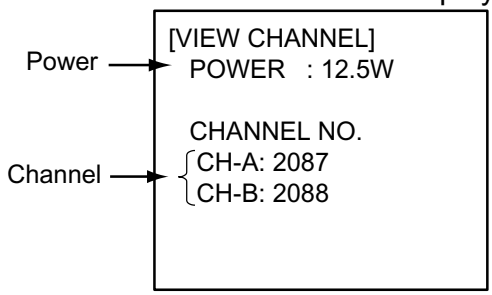
```
[SET CHANNEL]

* 1 VIEW CHANNEL

  2 CHANNEL EDIT
```

SET CHANNEL menu

4. Press the [1] key to show the VIEW CHANNEL display.



VIEW CHANNEL display

5. Press the [MENU] key to close the display.

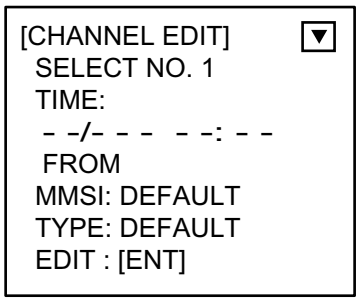
1.11.2 Displaying, editing regional operating area status

You may display the status of regional operating areas currently memorized in the equipment. Nine of any combination of AIS message from shore-based AIS, DSC message, manual settings and commands from ECDIS or a PC may be registered and one will be a default value.

About registering areas

- AIS and DSC messages registered within last two hours cannot be edited.
- An item labeled DEFAULT cannot be registered. (“DEFAULT” are data used for international waters not controlled by shore-based AIS.)
- If two areas overlap one another the oldest data is deleted.
- Data older than five weeks is deleted.
- Area data is deleted when it is more than 500 miles from the area for which it was registered.

1. Press the [MENU] key to open the menu.
2. Press the [6] key to open the SYSTEM SETTINGS sub-menu.
3. Press the [2] key to choose SET CHANNEL.
4. Press the [2] key to open the CHANNEL EDIT sub-menu.



CHANNEL EDIT sub-menu, page 1

SELECT NO.: File number, 1-9. In order of distance from own ship, from closest to furthest.

TIME: Data and time equipment controlled by external source.

MMSI: MMSI displayed for control by DSC or shore-based AIS. Dashes or “EMPTY” (no data) otherwise.

TYPE: How channel is controlled:
AIS, AIS message; PI, ECDIS or PC; DSC, DSC, MANUAL, manual control

Note: MMSI and TYPE must be set to other DEFAULT to edit.

5. Use the [▲] or [▼] key to choose file number from SELECT NO.
6. Press the [ENT] key to show details.

```
[CHANNEL EDIT]
 FROM MMSI:_ _ _ _ _ _ _ _
 * POWER : 12.5W
   CH NO.CH-A: 2087
         CH-B: 2088
   MODE  CH-A: TX/RX
         CH-B: TX/RX
   ZONE:  5nm
```

CHANNEL EDIT sub-menu, page 2

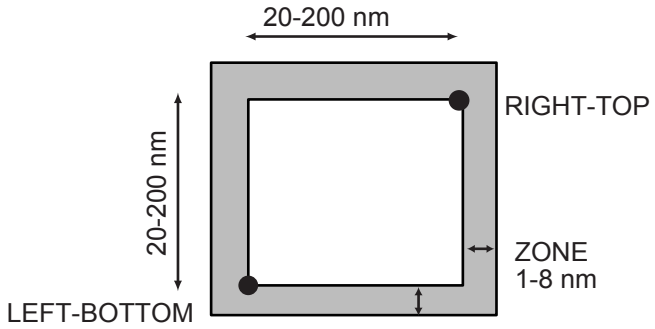
7. POWER is selected; press the [SFT/ +/-] key to choose power: 12.5 W or 2 W.
8. Press the [NEXT] key to choose CH NO.
9. Key in channel number for channel A and B with the numeric keys.
10. Press the [NEXT] key to choose MODE.
11. Press the [SFT/ +/-] key to assign mode for channel A and B. Each time the key is pressed the selection changes in the sequence of TX/RX, TX/RX; TX/RX, RX; RX, TX/RX; RX, RX; RX, UNUSED; UNUSED, RX.
12. Press the [NEXT] key to choose ZONE. In this zone, the #1 channel in selected area and the #1 channel in the adjacent zone are used for communications.
13. Key in the zone distance. The setting range is 0 to 8 (nm), and the default setting is 5 nm.
14. Press the [NEXT] key to go to the next page.

```
[CHANNEL EDIT]
CH-AREA
    RIGHT-TOP
  * LAT:   00°00.0'N
    LON: 000°00.0'E
    LEFT-BOTTOM
    LAT:   00°00.0'N
    LON: 000°00.0'E
```

CHANNEL EDIT sub-menu, page 3

15. Key in the latitude and longitude for the right-top position (northeast point) of the AIS operating area. Use the [SFT/ +/-] key to switch coordinate, if necessary.
16. Press the [NEXT] key to choose LEFT-BOTTOM.
17. Key in the latitude and longitude for the left-bottom position (southwest position) of the AIS operating area. Use the [SFT/ +/-] key to switch coordinate, if necessary.

Note: The available range is 20-200 nm. If the area contains overlapping data the older data will be erased.



Description of RIGHT-TOP, LEFT-BOTTOM, ZONE

Note: To check or edit settings on previous page, press the [NEXT] key while pressing the [SFT +/-] key.

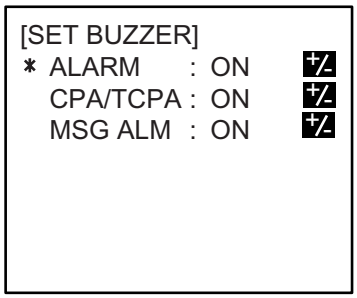
18. Press the [ENT] key.
19. YES is selected; press the [ENT] key to register settings. (If the password entry screen is displayed, MMSI is set to DEFAULT. This cannot be changed.)
20. Press the [MENU] key several times to close the menu.

Note: If you enter invalid data an appropriate error message appears. Press the [ENT] key and then reenter data.

1.12 Enabling/Disabling the Buzzer

The buzzer that sounds against CPA or TCPA violation, message reception and system trouble may be enabled or disabled as below. Note that this buzzer is not related to a radar or ECDIS alarm.

1. Press the [MENU] key to open the menu.
2. Press the [6] key to open the SYSTEM SETTINGS menu.
3. Press the [5] key to choose SET BUZZER.



SET BUZZER menu

4. ALARM is selected; press the [SFT/ +/-] key to choose ON or OFF as appropriate. This alarm is given to system trouble.
5. Press the [NEXT] key to choose CPA/TCPA or MSG ALM, and then press the [SFT/ +/-] key to choose ON or OFF as appropriate.
6. Press the [ENT] key to register settings.
7. Press the [MENU] key several times to close the menu.

1.9 Regional Operating Channels

AIS operates primarily on two dedicated VHF channels, CH 2087 and CH2088. Where these channels are not available regionally, the AIS is capable of being automatically switched to designated alternate channels by means of a message from a shore facility. Where no shore based AIS or GMDSS sea area A1 station is in place, the AIS should be switched manually as in paragraph 1.9.2.

A regional operating area is set with the procedure shown below. The most recent eight areas are memorized.

- Automatic setting of VHF DSC (channel 70) from shore-based AIS
- Automatic setting by AIS message from shore-based AIS
- Setting by shipboard system such as ECDIS
- Manual setting

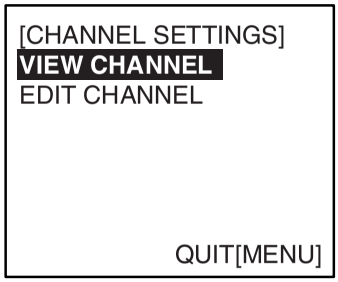
The default area is as follows:

- Tx power: 12.5 W
- Channel no. 2087, 2088
- Frequency bandwidth: 25 kHz
- Tx/Rx mode: Tx/Rx

1.9.1 Viewing channels, Tx power

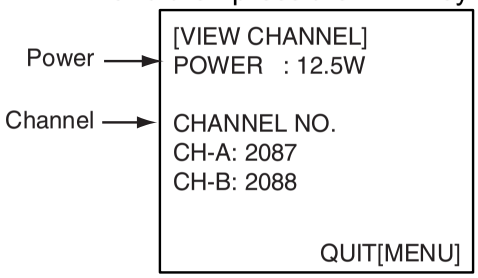
Do the following to view current channels.

1. Press the **MENU** key to open the menu.
2. Choose CHANNEL SETTINGS and then press the **ENT** key.



CHANNEL SETTINGS menu

3. Choose VIEW CHANNEL and then press the **ENT** key.



VIEW CHANNEL display

4. Press the **DISP** key to close the display.

1.9.2 Displaying, editing regional operating area status

You may display the status of regional operating areas currently memorized in the equipment. Nine of any combination of AIS message from shore-based AIS, DSC message, manual settings and commands from ECDIS or a PC may be registered and one will be HIGH SEA.

About registering areas

- AIS and DSC messages registered within last two hours cannot be edited.
- An item labeled HIGH SEA cannot be registered. (“HIGH SEA” are data used for international waters not controlled by shore-based AIS.)
- If two areas overlap one another the older data is deleted.
- Data older than five weeks is deleted.
- Area data is deleted when it is more than 500 miles from the area for which it was registered.

1. Press the **MENU** key to open the menu.
2. Choose CHANNEL SETTINGS and then press the **ENT** key.
3. Choose EDIT CHANNEL and then press the **ENT** key.

```
[EDIT CHANNEL]
SELECT NO. : [0]
TIME
  - -/- - -  - -: - -: - -
FROM
MMSI: - - - - - - - - -
 TYPE: MANUAL
QUIT [MENU]  EDIT[ENT]
```

EDIT CHANNEL sub-menu, page 1

SELECT NO.:	File number, 0-9. In order of distance from own ship, from closest to furthest.
TIME:	Data and time equipment controlled by external source.
MMSI:	MMSI displayed for control by DSC or shore-based AIS. Dashes or “EMPTY” (no data) otherwise.
TYPE:	How channel is controlled: AIS, AIS message; HIGH SEA (for reference setting) PI, ECDIS or PC; DSC, DSC, MANUAL, manual control

Note: MMSI and TYPE must be set to other than “HIGH SEA” to edit.

4. Use ▼ or ▲ to choose desired file number from SELECT NO.

5. Press the **ENT** key to show details.

```
[EDIT CHANNEL]        1/2
FROM MMSI: _________
POWER : 12.5W
CH NO.    CH-A: 2087
          CH-B: 2088
MODE      CH-A: TX/RX
          CH-B: TX/RX
ZONE:     1nm
```

EDIT CHANNEL sub-menu, page 1

6. POWER is selected; press the **ENT** key to show the channel power options.

```
2W
12.5W
```

7. Use ▼ or ▲ to choose power desired and then press the **ENT** key.
8. CH NO. CH-A is selected; press the **ENT** key.
9. Use the **CursorPad** to choose channel number for CH-A and then press the **ENT** key.
10. CH NO. CH-B is selected; press the **ENT** key.
11. Use the **CursorPad** to choose channel number for CH-B and then press the **ENT** key.
12. MODE CH-A is selected; press the **ENT** key.

```
TX/RX
RX
UNUSED
```

13. Use the **CursorPad** to choose desired mode for CH-A and then press the **ENT** key.

Mode	1	2	3	4	5	6
CH-A	TX/RX	TX/RX	RX	RX	RX	UNUSED
CH-B	TX/RX	RX	TX/RX	RX	UNUSED	RX

Note: If a combination other than shown above is chosen, the message "ILLEGAL MODE WAS SELECTED PRESS ANY KEY." appears.

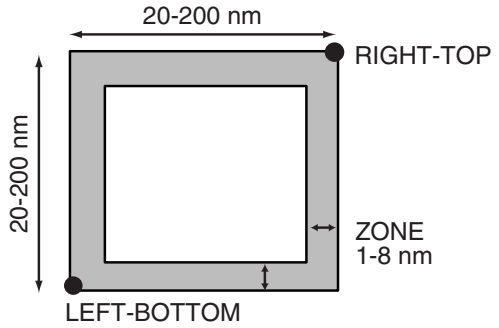
14. MODE CH-B is selected; press the **ENT** key.
15. Use the **CursorPad** to choose desired mode for CH-B and then press the **ENT** key.
16. ZONE is selected; press the **ENT** key.
17. Key in the zone distance and then press the **ENT** key. (The setting range is 1 to 8 (nm)).
18. Use ▼ or ▲ to show page 2 of the [EDIT CHANNEL] sub menu.

```
[EDIT CHANNEL]        2/2
CH AREA
  RIGHT TOP
  LAT:   0°00.0'N
  LON:   0°00.0'E
  LEFT BOTTOM
  LAT:   0°00.0'N
  LON:   0°00.0'E
```

EDIT CHANNEL sub-menu, page 2

19. LAT of RIGHT TOP is selected; press the **ENT** key. Use the **CursorPad** to enter latitude for the right-top position (northeast point) of the AIS operating area and then press the **ENT** key.
20. LON of RIGHT TOP is selected; press the **ENT** key. Use the **CursorPad** to enter longitude for the right-top position (northeast point) of the AIS operating area and then press the **ENT** key.
21. LAT of LEFT BOTTOM is selected; press the **ENT** key. Use the **CursorPad** to enter latitude for the left-bottom position (southwest point) of the AIS operating area and then press the **ENT** key.
22. LON of LEFT BOTTOM is selected; press the **ENT** key. Use the **CursorPad** to enter longitude for the left-bottom position (southeast point) of the AIS operating area and then press the **ENT** key.

    Note: The available range is 20-200 nm. If the area contains overlapping data the older data will be erased.



Description of RIGHT-TOP, LEFT-BOTTOM and ZONE items

23. Press the **MENU** key. The prompt shown below appears.

```
SAVE CHANNEL.

  ARE YOU SURE?
    YES      NO
```

24. Press ◄ to choose YES and then press the **ENT** key.
25. Press the **DISP** key to close the menu.

Note: If you enter invalid data, the message “OUT OF RANGE!: OO” appears. Press any key to escape. Reenter data.

5.3.6.2 Channel Management Setting

"Channel Management" setting menu can be displayed by pressing [2] in the "Set Up" menu.
Eight channel management settings can be memorized in the transponder as maximum.

("Channel Management" setting menu)

```
CH MANAGEMENT                    UTC11:43
 BRG  :  RANGE        NAME/MMSI
 270° :  0.18NM       JRC MARU1
  35° :  0.29NM       JRC MARU2
  22° :  0.92NM       JRC MARU1
1. CH A:2087 WIDE      TX/RX
2. CH B:2088 NARROW       RX
3. TX POWER :HIGH
4. ZONE SIZE:5nm
5. AREA N 35° 33.3870 ‘CHECK>
   (NE) E139° 54.5780 ‘
6. AREA N 35° 33.3870 ‘
   (SW) E139° 54.5780 ‘ LIST>
```

○ Pressing this select key checks whether or not the inputted detail can be set to the transponder.

○ Pressing this select key displays the channel management setting of the transponder.

Pressing up-arrow key or down-arrow key selects the sub menu.
Pressing [ENT] moves the cursor to the selected sub menu field.
Pressing numerical key [1] – [6] selects the sub menu and moves the cursor to the selected sub menu field.
Pressing [ALM/CLR] returns to "Set Up" menu.

(1) Inputting of the Channel Management

"Channel A" and "Channel B"
The cursor appears in the "Channel" number field.
Pressing numerical keys inputs the channel number.
Pressing up-arrow key or down-arrow key selects the detail.
("WIDE" or "NALLOW", "TX/RX" or "RX")
Pressing [ALM/CLR] quits the inputting and returns to the "Channel Management" setting menu.
Pressing [ENT] entries the inputted number or detail and moves the cursor to the next field.

"TX Power"
The cursor appears in the "TX Power" field.
Pressing up-arrow key or down-arrow key inputs the "TX power" detail from "High" or "Low"
Pressing [ALM/CLR] quits the inputting and returns to the "Channel Management" setting menu.
Pressing [ENT] entries the inputted detail and returns to the "Channel Management" setting menu.

"Zone Size"
The cursor appears in the "Zone Size" field.
Pressing numerical keys inputs value of the "Zone Size" .
The value can be input "1" as minimum and "8" as maximum.
Pressing [ALM/CLR] quits the inputting and returns to the "Channel Management" setting menu.
Pressing [ENT] entries the inputted value and moves the cursor to the next field.

"Northeast" corner and "Southwest" corner of the Area
The cursor appears in the "Area(NE)"/"Area(SW)".
Pressing up-arrow key or down-arrow key inputs "N" or "S" and "E" or "W".
Pressing numerical keys inputs the value of the latitude / longitude.
Pressing [ALM/CLR] quits the inputting and returns to the "Channel Management" setting menu.
Pressing [ENT] entries the inputted value and moves the cursor to the next field.

(2) Check and Set the Channel Management

The inputted Channel Management detail has to be registered to the transponder for channel management operation.
Pressing the "[Check]" select key checks whether or not the inputted detail can be set to the transponder, and display "OK" or "NG" as the result.
When the check result was "OK", then select key function "[Set]" is appears on the "[List] " position.

(Checked Channel Management detail : "OK")

```
CH MANAGEMENT                UTC11:43
 BRG  :  RANGE      NAME/MMSI
 270° :  0.18NM     JRC MARU1
  35° :  0.29NM     JRC MARU2
  22° :  0.92NM     JRC MARU1
1. CH A:2087 WIDE      TX/RX
2. CH B:2088 NARROW       RX
3. TX POWER  :HIGH
4. ZONE SIZE:5nm
5. AREA N 35° 33.3870 'CHECK>
   (NE) E139° 54.5780 'OK
6. AREA N 35° 33.3870 '
   (SW) E139° 54.5780 '   SET>
```

Pressing this select key checks whether or not the inputted detail can be registered to the transponder.

Check result "OK"

Pressing this select key registers the inputted channel management detail to the transponder.

(Checked Channel Management detail : "NG")

```
CH MANAGEMENT                UTC11:43
 BRG  :  RANGE      NAME/MMSI
 270° :  0.18NM     JRC MARU1
  35° :  0.29NM     JRC MARU2
  22° :  0.92NM     JRC MARU1
1. CH A:2087 WIDE      TX/RX
2. CH B:2088 NARROW       RX
3. TX POWER  :HIGH
4. ZONE SIZE:5nm
5. AREA N 35° 33.3870 'CHECK>
   (NE) E139° 54.5780 'NG
6. AREA N 35° 33.3870 '
   (SW) E139° 54.5780 '   SET>
NG:AREA CONRNER ER NG
```

Pressing this select key checks whether or not the inputted detail can be registered to the transponder.

Pressing this select key registers the inputted channel management detail to the transponder.

Reason about check result "NG"

(3) Channel Management list

Display and Confirm the registered Channel Management detail list from the transponder to input manually the channel management detail.
Pressing the "[List]" select key displays the channel management setting of the transponder.

(Channel Management List)

```
CH MANAGE LIST          UTC11:43
 BRG  :  RANGE     | NAME/MMSI
 270° :  0.18NM    | JRC MARU1
  35° :  0.29NM    | JRC MARU2
  22° :  0.92NM    | JRC MARU1

1. CH A:2087 DEFAULT TX/RX
   CH B:2088 NARROW     RX
   TX POWER :HIGH
   ZONE SIZE:5nm
   AREA N 35° 33.387
   (NE) E139° 54.578
   AREA N 35° 33.387     [EXIT>]
↓  (SW) E139° 54.578
↑
2. CH A:2087 DEFAULT TX/RX
   CH B:2088 NARROW     RX
   TX POWER :HIGH
   ZONE SIZE:5nm
   AREA N: 35° 33.387 '
   (NE) E:139° 54.578 '
   AREA N: 35° 33.387 '  [EXIT>]
↓  (SW) E:139° 54.578 '
```

○ Pressing this select key closes the "Cannel Management List" and returns to the "Channel Management" setting menu.

○ Pressing this select key closes the "Cannel Management List" and returns to the "Channel Management" setting menu.

Pressing down-arrow key displays next page of the "Channel Management List".
Pressing up-arrow key displays previous page of the "Channel Management List".
Pressing [ALM/CLR] closes the "Cannel Management List" and returns to the "Channel Management" setting menu.

2.1.4.5 Channel Management

This page displays all of the relevant information regarding the regions established either by manual entry, a governing authority's VTS station broadcasting region information, or another Universal AIS broadcasting the data. These regions determine the authorized operating frequencies for the coverage area. The user can set these different configurations at the initial setup; however, the L-3 ProTec Transponder will acquire the data for a new region once it has entered the region.

Edit Chan Mgmt Settings
NE: N 91'00.0 E 181'00.0
SW: N 91'00.0 E 181'00.0
ChA: 2087 Bw0 ChB:2088 Bw0
PLvl:H Md:TxRxAB TZn: Nm
Src:Intrnl MMSI:---------
FNC: ← Prv. → Nxt. FNC Save

Press FNC → NAV button from any menu and use the up (↑) or down (↓) arrow keys.

NE:	Indicates the North East corner of the region.
SW:	Indicates the South West corner of the region.
ChA:	Channel Frequency for Channel A.
Bw:	Bandwidth 0 = 25 kHz, 1 = 12.5 kHz.
ChB:	Channel Frequency for Channel B.
Bw:	Bandwidth 0 = 25 kHz, 1 = 12.5 kHz.
Plvl:	Power Level H = high power (12.5 Watts), L = low power (2 Watts)
Md:	TxRxAB, TARxAB, TBRxAB, RxAB, RAOnly, and RBOnly.
TZn:	Transition zone size, defined in nautical miles.
Src:	Intrnl = Internal command, Extrnl = External command (governing authority).
MMSI:	MMSI of the authority that has issued the command (blank if internal).

For the initial setup perform the following:

(1) Press the FNC key.

(2) Press the NAV key. The AIS Main System Menu screen will appear.

(3) Using the down Arrow key, select "Edit Chan Mgmt Settings", and press the ENT key. The Channel Management Table Entry screen will appear. (Refer to Figure 2–8.)

(4) Use the up and down arrow keys and the left and right arrow keys to highlight an entry point, and press the ENT key.

(5) Enter the data, press the ENT key, and move to the next data entry point.

(6) After all of the data is entered for that region, press the FNC key twice and then press the ENT key to save the data.

(7) Press the ESC key to return to the AIS Main System Menu screen.

```
 High Seas Region Actv

NE: N 91°00.0 E 181°00.0
SW: N 91°00.0 E 181°00.0
ChA:2087 Bw0 ChB:2088 Bw0
PLvl:H Md:TxRxAB TZn:5 Nm
Src:Intrnl MMSI:0123456789
Fnc:< Prv. > Nxt. Fnc Save
```

Figure 2–8. Channel Management Settings Screen

2.1.4.6 Antenna Position

This setup provides for data entry of location of the antenna for each of the GPS antennas required for the system. The ‘Int’ refers to the antenna dedicated to the AIS’ internal GPS and the ‘Ext’ refers to the antenna dedicated to the ship’s external GPS. The screen layout is as follows:

```
  Antenna Position Ref

INT A:47  B:14  C:3   D:5
EXT A:250 B:250 C:50  D:50


 Dimensions in Meters
 See ITU-R M.1371 Doc
```

Figure 2–9. Antenna Position Screen

3.18 VHF Regions Menu

UAIS works on two radio channels at any time and may select those channels depending on the geographical area. A list of up to 10 regions with their associated channels can be stored in the permanent memory; if not in any of these regions, UAIS uses the default channels of 2087 and 2088.

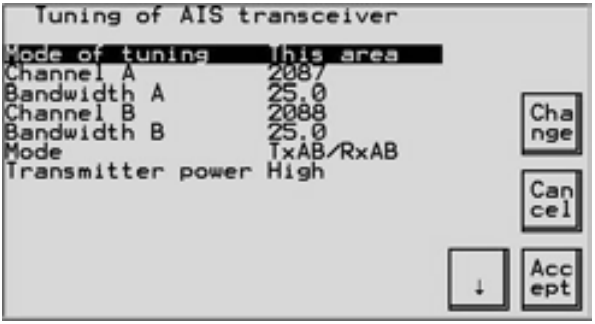
To view the region list stored in memory, select **VHF regions** option from the **Main set-up** menu. The top item as highlighted above) indicates the frequencies used outside the specified regions (ie at sea). Successive items, where present, show manually entered frequencies and their parameters (eg transmitter power). The station uses these entered frequencies within that specific region. “R” indicates the frequency is used for receiving, similarly “T” is for transmitting.

Information on a particular region is shown at the top of the screen: geographical co-ordinates, bandwidth and power of transmitter and time of entering or leaving the region.

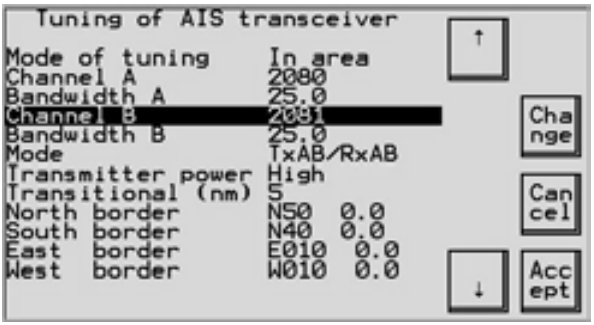
There are several ways a station can acquire region information: -

From a base station on the AIS channels.
From external devices through the input interfaces.
From a coastal station on CH70 DSC.
From an operator using the VDU.

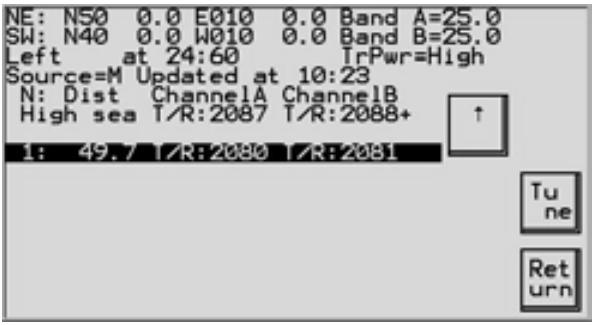
Normally it is not necessary to enter the regions manually, as the station should pick them up automatically, however it can still be done as shown in the following section by selecting **Tune** in the previous screen



Changing the geographical location defines the region, and the associated parameters may then be set.



A confirmation screen appears, then the new region and information is displayed on the main screen.



3.19 DSC Tuning Menu

UAIS can receive and process DSC information sent by Base stations. Periodically lists of geographical regions and their associated parameters are transmitted on the DSC channel. DSC is normally set to Channel 70.

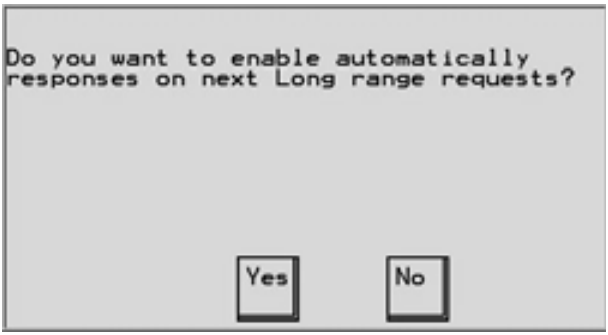
Methods of tuning DSC:

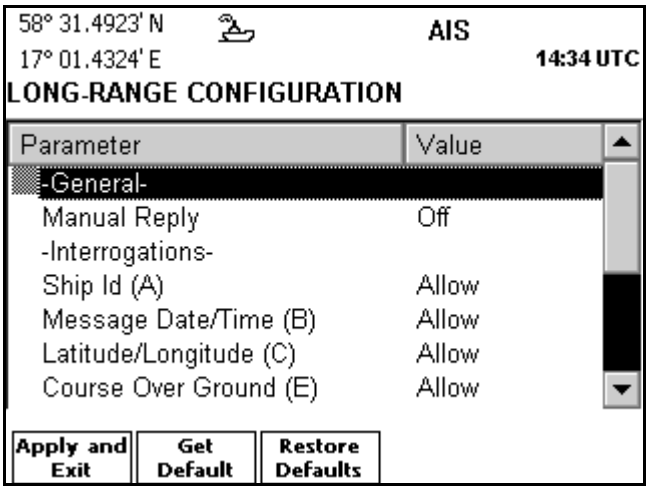
DSC command from coastal station.

Manually from the VDU.

3.20 Long Range Request Menu

This feature is only available with a specialised interface to a suitable source.





Change setting

1. Use ∧ ∨ to select the parameter to modify and press ***ENTER.***
2. Select the desired value in the drop-down list using ∧ ∨**,** and press ***ENTER.***
3. Press function key **Apply and Exit** to save the changes.

Restore a parameter to factory default

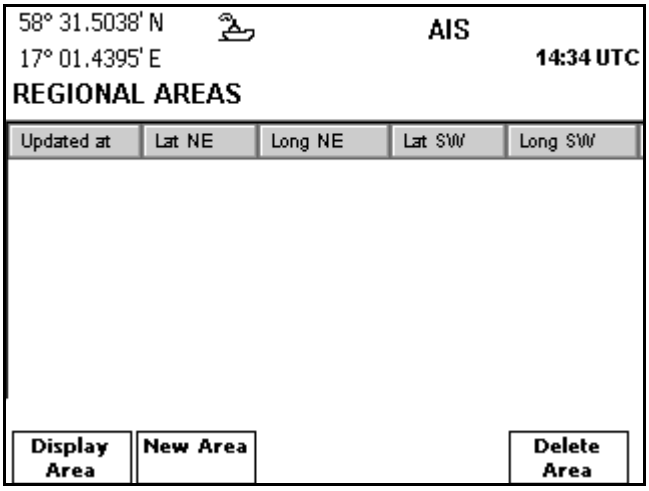
1. Use ∧ ∨ to select the parameter to return to the factory default setting.
2. Press function key **Get Default.**
3. Press function key **Apply and Exit** to save the changes.

Restore all parameters to factory defaults

1. Press function key **Restore**.
2. Answer yes to the confirmation dialog by pressing ***OK.***

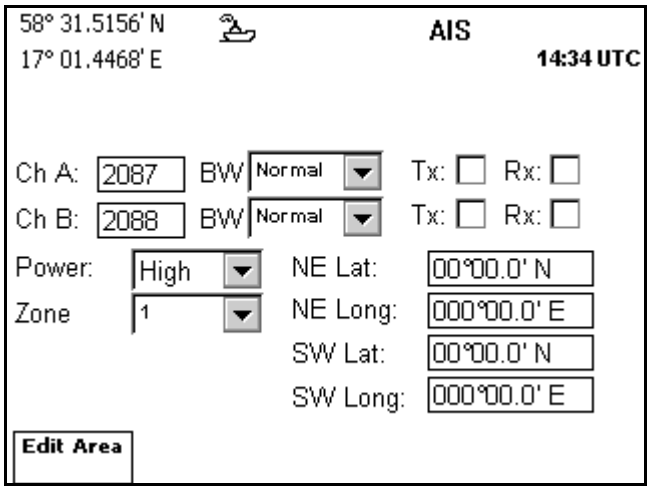
Regional Areas

The *Regional Areas* view allows the user to list, add and edit regional areas definitions.



Create a new Regional Area

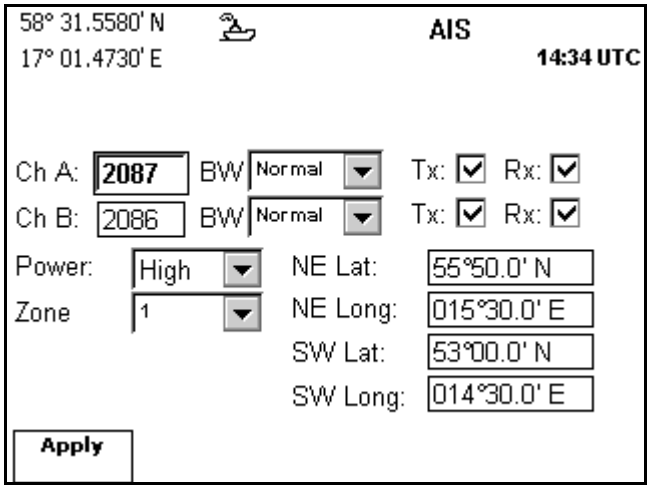
1. Press function key **New Area**. The below view is shown.



2. Press function key **Edit Area** to enter information for the new area.
3. Use ∧ ∨ < > to select the parameter to be entered and press ***ENTER***.
4. Enter the value using the keypad, or if it is a drop down list, select a value using ∧ ∨ and press ***ENTER***. To check the Tx and Rx check boxes, press ***ENTER*** when having the correct check box selected.
5. Repeat steps 3 and 4 for each parameter to enter.
6. Press function key **Apply** when done.
7. Press **OK** to confirm the entry of the area.
8. Press ***ESC*** to return to the *Regional Areas* view.

Edit a Regional Area

1. Select the Regional Area to edit using ∧ ∨.
2. Press function key **Display Area**.
3. Press function key **Edit Area**. The below view is shown.



4. Use ∧ ∨ < > to select the parameter to be edited and press ***ENTER***.
5. Enter the new value using the keypad, or if it is a drop down list, select a value using ∧ ∨ and press ***ENTER***. To check the Tx and Rx check boxes, press ***ENTER*** when having the correct check box selected.
6. Repeat steps 4 and 5 for each parameter to edit.
7. Press function key **Apply** when done.
8. Press **OK** to confirm the entry of the area.

9. Press ***ESC*** to return to the *Regional Areas* view.

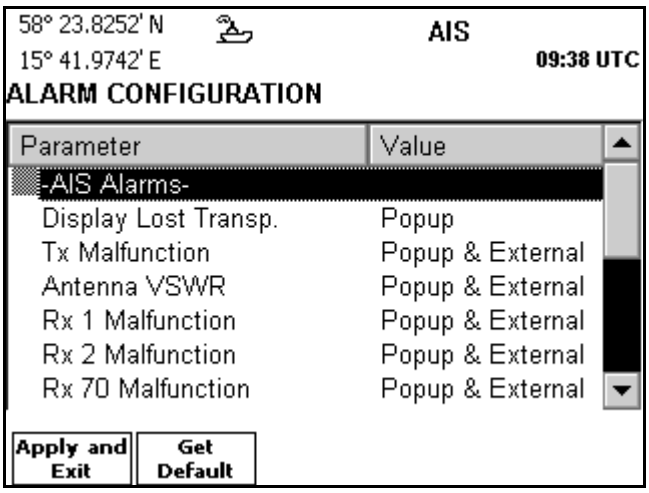
Alarm Config

The *Alarm Configuration* view is used to configure the action the system should perform when a specific alarm is raised. The possible settings for each alarm is:

- *Disabled.* The alarm will not be indicated when active.
- *Popup*. An alarm pop-up will be displayed when the alarm becomes active. See section "Alarm and Alert Pop-ups" on page 24.
- *External.* The AIS Alarm Relay will be activated when the alarm is active.
- *Popup & External.* The alarm will result in both an alarm pop-up dialog and the AIS Alarm Relay being activated.

It is possible to disable alarms that are of no interest for the operator by setting them to *Disabled.*

The view shows abbreviations for some alarms with long alarm names. The different alarms and their abbreviations (if any) are described in the Appendix on page 61.



Change setting

1. Use ∧ ∨ to select the parameter to modify and press ***ENTER.***
2. Select the desired value in the drop-down list using ∧ ∨**,** and press ***ENTER.***
3. Press function key **Apply and Exit** to save the changes.

Restore factory default setting

1. Use ∧ ∨ to select the parameter to return to the factory default setting.
2. Press function key **Get Default.**
3. Press function key **Apply and Exit** to save the changes.

Units Config

The *Units Configuration* view is used to configure the used units of measurements in the system. The configurable types of units are described below.

Range Unit

The unit used when displaying range values. Can be set to one of *Nautical Mile, Kilometers* and *Statute Mile.*

7.7 Configuring Radio Channels

AIS systems operate normally on two AIS channels: channel 2087 and channel 2088. Where these channels not are available regionally, other channels may be configured by using the **Chn.Management** submenu. Maximum 8 zones may be configured.

```
=== Main Menu ======== P1
6.Chn.Management
```

Press the **MENU** button to activate the **Main** menu, and select **Chn.Management**.

The **Chn.Management** submenu has three options for channel management, described in the next pages.

```
=== Chn.Management == P16
1.Edit Cur.Reg.
2.View Regions
3.Add Region
```

Adding a Region

```
=== Add Region ===== P163
 REGION-1
-------------------------
ChnA     :143
ChnB     :144
RxTxMode:TxA/TxB/RxA/RxB
TxPower  :High
LAT NE   :000°00´00.00N
LON NE   :000°00´00.00E
LAT SW   :000°00´00.00N
LON SW   :000°00´00.00E
BW A     :Default
BW B     :Default
Zone     :2
```

The **Add regions** option is used for defining new regions.

When regions are defined, the AI70 system will automatically jump to the defined VHF channels when the vessel enters this region.

The following parameters have to be defined:

ChnA/ChnB: VHF channels used for transmitting.

RxTxMode: Channels (A/B) used for transmitting/receiving

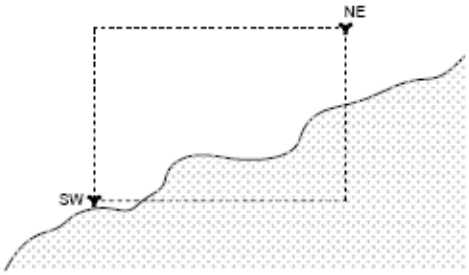
TxPower: Transmission power. Selectable options: **High** (12.5 W) and **Low** (2 W).

LAT NE: North-East latitude coordinates for the defined area.

LON NE: North-East longitudinal coordinates for the defined area.

LAT SW: South-West latitude coordinates for the defined area.

LON NE: South-West longitudinal coordinates for the defined area.



BW A/BW B: Bandwidth for the VHF channels used in this area. Selectable options: **Default** (maximum bandwidth allowed in this area) and **Narrow** (12,5 kHz).

Zone: The size of the transition area in nautical miles outside the region.

Editing Current Region

```
=== Edit Cur.Reg == P161
 REGION-1
------------------------
ChnA     :143
ChnB     :144
RxTxMode:TxA/TxB/RxA/RxB
TxPower  :High
LAT NE   :012°13´23.56N
LON NE   :132°36´14.02E
LAT SW   :034°56´21.06N
LON SW   :125°56´12.21E
BW A     :Default
BW B     :Default
Zone     :2
```

The **Edit Cur.Reg.** option enables the operator to change parameters for the current AIS channels.

Viewing a Region's Settings

```
=== View Cur.Reg === P162
 REGION-1              2/6
------------------------
ChnA     :143
ChnB     :144
RxTxMode:TxA/TxB/RxA/RxB
TxPower  :High
LAT NE   :012°13´23.56N
LON NE   :132°36´14.02E
LAT SW   :034°56´21.06N
LON SW   :125°56´12.21E
BW A     :Default
BW B     :Default
Zone     :2            ▲▼
```

The **View Regions** option displays all defined regions. This is a read only page and no configuration changes can be made.

The view regions may consist of up to 8 pages, indicated in the upper left corner as e.g. 1/6. The ▲ and ▼-buttons are used for displaying available regions.

5.5.6 Regional Settings

The “Channel Management” is to define areas around the world that use specific frequencies and power output for that area only.
From the “Main Menu” select “Channel Management” by pressing numeric key [6] or [arrow down] key and [Enter] key.

```
Menu: Reg. Settings        1/4
▶1 View Current Region      ◀
 2 View Defined Regions
 3 Edit Defined Regions
 4 Add Region
```

Select “View Current Region” by pressing the numeric key [1], or press [arrow down] key and [enter] key.

5.5.6.1 View Current Region

```
Menu: Current Regio        1/7
▶ Ch.  A:  2087             ◀
  BW: Narrow
  Ch. B  2088
  BW: Narrow
  Mode:  Tx:A+B   Rx:A+B
  Power Low
  Zone  :  4
```

This menu shows the settings for the current region.
Press [Esc] to go one step back.
Select “View Defined Regions” by pressing the numeric key [2], or press [arrow down] key and [enter] key.

5.5.6.2 View Defined Regions

```
Menu: Ch. Manag.           1/9
▶ 1 *N59 E010 N58 E009      ◀
  2  N62 E011 N61 E010
```

This menu shows defined regional settings for various regions.
For more specific information, press [Enter] key.

This menu shows the specific information for one region.

```
Ch.  A:  2087                1/16
BW: Narrow
Ch. B  2088
BW: Narrow
Mode:  Tx:A+B   Rx:A+B
Power Low
----------------
Zone  :  4
NE LAT:   ----.--
Direction:  South
NE LON: -----.--
Direction: West
SW LAT: ----.--
Direction: South
SW LON: ----.--
Direction: West
```

Press [Esc] twice to return to “Reg. Settings” menu
Select “Add Regions” by pressing the numeric key [4], or press [arrow down] key and [Enter] key.
When you try to “Add Regions”, you must enter password A. (see chapter 5.2.1)

```
Password        1              0/7
_
```

Type password A and press [Enter] key.

Then you will be able to add a new region, as shown in next sub chapter:

5.5.7 Add Regions

```
Ch.  A:  2087
BW: Narrow
Ch. B  2088
BW: Narrow
Mode:  TX:A+B   RX:A+B
Power Low

Zone  :  4
NE LAT:   ----.--
Direction:  South
NE LON: -----.--
Direction: West
SW LAT: ----.--
Direction: South
SW LON: ----.--
Direction: West
```

In this menu all data can be edited by selecting the actual line, by [arrow up/down] key and [Enter] key.
Press [Esc] key to go one step back, and repeat procedure for all lines.
Press [Esc] key twice to return to “Main Menu”.

Regions should be as large as possible. The minimum limit is 20 nautical miles and maximum limit is 200 nautical miles.

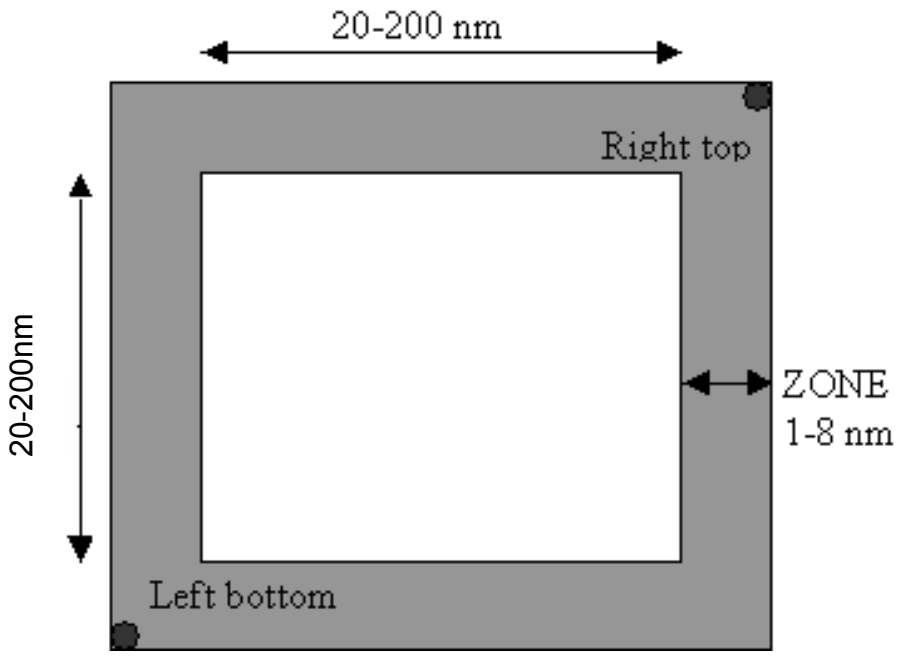


Figure 5.5.7.a, Region definition

In addition to the limits of the region, a transition zone must be defined between 1 and 8 nautical miles.

This is done in the menu line marked “ZONE”

This zone is used for frequency transition so only one frequency is changed at a time. There are defined rules for how the AIS will behave through this zone.

The AIS will continuously monitor for its own position and range to the regional areas defined.

When entering transition zone for Region 1, frequency is changed on the primary channel. The AIS is now sending the primary frequency defined for each of the regions.

When the boundary for the Region 1 is crossed, the second frequency shall be changed. Then the primary frequency for the old region (or default setting) is switched with the secondary frequency for the new region. Then both frequencies have changed.

When entering another region, frequency transition is performed as described above with the frequencies (settings) of the new region.
When leaving a region, frequency transition is performed back to default values.

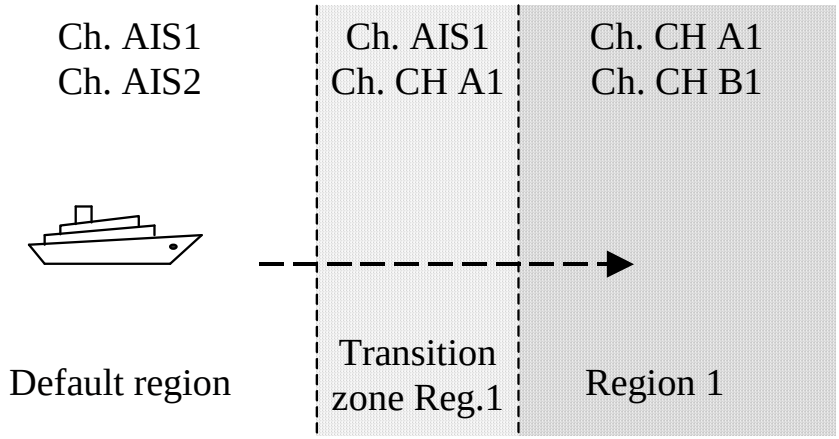


Figure 5.5.7.b, Frequencies used when entering a new region