R4A MkII
Airborne AIS Transponder system

Product Specification

CONTENTS

1 SCOPE

1.1 Identification

This document is the product specification for the R4A MkII product line.

It describes the R4A MkII Airborne AIS transponder system and the related Saab Secure AIS (S) and Nato Warship AIS (N) options.

This specification covers the following products:

- R4A MkII – Standard R4A MkII airborne AIS transponder, P/N 7000 119-121
- R4AS MkII – Additional Secure functionality using encryption (Export restricted), P/N 7000 119-122
- R4AS L MkII – Additional Secure functionality using encryption which is not export restricted, P/N 7000 119-123
- R4ASN MkII – Additional Secure NATO Warship AIS functions (Export restricted), P/N 7000 119-125
- R4A MkII/R5A Configuration and Management Tool, P/N 7000 119-108

The sales packages for R4A MkII, R4AS MkII, R4AS L MkII and R4ASN MkII are defined by one top level order number which covers the relevant product version together with the additional deliverables.

Each order number corresponds to a sales package containing:

- R4A MkII Airborne AIS Transponder unit of the specified version
- Configuration and Management Tool software on CD
- Document set including
    - R4A MkII Installation and Maintenance manual
    - Acceptance Test Report
    - Certificate of Conformity

Sales Kit	Order number	Description
R4A MkII System Kit	7001 000-131	Standard Airborne AIS
R4AS MkII System Kit	7001 000-132	Saab Secure Airborne AIS (Export restricted)
R4AS L MkII System Kit	7001 000-133	Saab Secure Airborne AIS (Not Export restricted)
R4ASN MkII System Kit	7001 000-135	Saab Secure and NATO W-AIS Airborne AIS (Export restricted)

1.2 Introduction

Saab TransponderTech (STT) has a long and successful track record in supplying products and systems related to the Automatic Identification System (AIS).

In order to provide AIS functionality in qualified avionics to professional users, STT offers AIS transponders specifically developed for airborne use.

To fulfil requirements from qualified user groups like Navy, Coast Guard, Police and other entities who may have a need to exchange encrypted information between their own units and still be able to receive the open AIS information, STT has developed the unique **Saab Secure AIS concept**.

Additionally within the NATO activities the STANAG 4668 (Ed 2) has defined principles for encrypted communication over the standard AIS channels.

For interoperability with vendors using these principles, STT has included a function in the airborne portfolio as an option to our Secure AIS products denoted **NATO Warship AIS**.

General information regarding the AIS system is found in section 4.

In order to demonstrate compliance for the R4A MkII towards the governing AIS standard ITU-R M.1371-5, STT has contracted the highly renowned test institute BSH in Hamburg for an external compliance assessment, see section 7.3

1.3 Definitions, Acronyms and Abbreviations

AES	Advanced Encryption Standard
AIS	Automatic Identification System
BFT	Blue Force Tracking
BSH	Bundesamt für Seeschifffahrt und Hydrographie (Federal Maritime and Hydrographic Agency of Germany)
CMT	Configuration and Monitoring Tool
DES	Data Encryption Standard
DSC	Digital Selective Calling
FMS	Flight Management System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System

PPS	Pulse Per Second
PS	Presentation System consists of one or more computers to monitor, display information and operate the AIS transponder.
SAR	Search and Rescue
SOLAS	Safety Of Life At Sea
SOTDMA	Self Organised Time Division Multiple Access
STEDS	Sensitive but unclassified Tactical information Exchange and Display System
UTC	Universal Time Coordinated
VHF	Very High Frequency
VTS	Vessel Traffic Service

2 REFERENCES

[1] IEC 61162-1,2010 - Maritime navigation and radio communication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners

[2] ITU-R M.1371-5,2014 – Technical characteristics for a universal shipborne identification system using time division multiple access in the VHF maritime mobile band

[3] IEC 61993-2, Ed.2, 2012 – Maritime navigation and radio communication equipment and systems – Automatic identification systems (AIS) – Part 2: Class A shipborne equipment of the universal automatic identification system (AIS) – Operational and performance requirements, methods of test and required test results

[4] 7000 119-017, R4A MkII Airborne AIS transponder, Interface Control Document, ICD

[5] 7000 119-030, R4A MkII Airborne AIS transponder, Interface Control Document (Secure)

[6] 7000 119-028, R4A MkII Installation and Maintenance Manual

[7] 7000 119-039, R4A MkII performed qualification

[8] 7000 119-037, R4A MkII/R5A Configuration & Monitoring Tool User Manual

[9] BSH/4542/002/4322935/15, R4A MkII Airborne AIS Statement of Conformity

[10] PT-09-0044, Saab Secure AIS System Overview

3 SYSTEM OVERVIEW

3.1 Airborne AIS

The primary function of the Airborne AIS transponder is to identify and locate ships with AIS equipment, but messages from all other types of AIS stations are equally processed and forwarded to any connected external system. Besides tracking of other AIS stations, the Airborne AIS also transmits its own position and identification if desired along with the capability to communicate between participating stations via bi-directional text messages.

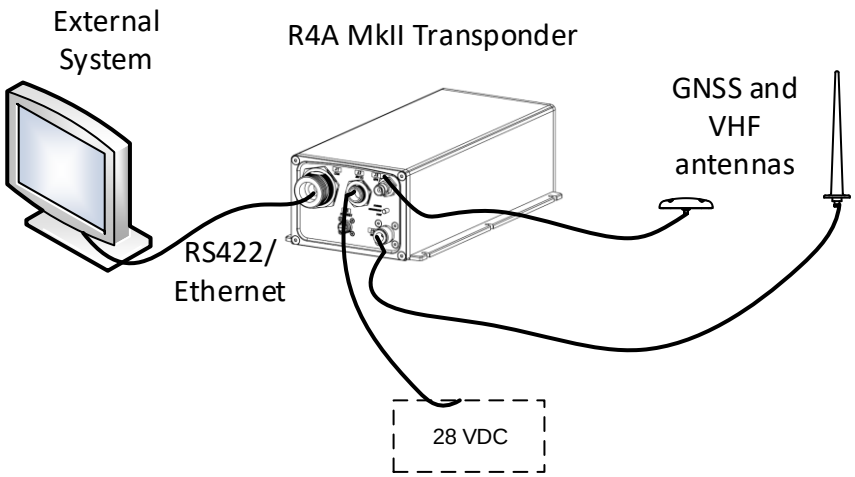

Figure 3-1, System Overview

The AIS transponder is typically connected to an external on-board system such as a digital map or mission management system via a bi-directional RS-422 or Ethernet connection.

The equipment is powered by 28 VDC and normally two antennas are needed, one GNSS antenna for timing and positioning and one VHF antenna for communication on the VHF data link. Alternative means for providing timing and positioning information exists which makes it possible to omit the GNSS antenna if desired.

The AIS transponder has an ARINC 429 bi-directional connection as well which is mainly intended for the supply of external positioning data to the transponder. Depending on the level of integration, the external system can also handle the transponder's configuration and operation. AIS data received by the transponder is forwarded to the external system and transmission of messages to other AIS stations can be initiated via the same system.

For transmission of own position data the transponder requires up to date navigational data to perform its function. It can use navigational data from either an external source (such as the FMS or main GNSS), or from its built-in GNSS receiver.

The transponder can optionally be upgraded to support the Saab Secure AIS, which provides the capability to exchange encrypted information over a separate radio channel. The transponder can operate either in normal AIS mode, or in one of several secure modes.

Apart from being an AIS transponder system the R4A MkII is capable of receiving and transmitting digital selective calling (DSC) messages. The R4A MkII can also receive and transmit DSC messages transparently enabling the external system to become a full featured DSC station, depending on its implemented level of DSC support.

One of the most apparent benefits of airborne AIS is the extended communication range. It is not possible to give exact statements about the performance of the link, since many factors affects the result, such as installation, ducting, participants and geography. AIS as a system is constructed to have a maximum range of 200 nautical miles, based upon the specified guard time between individual slots which assures proper reception also of weaker signals. Previous flight trials, as shown below, have shown that such ranges are practically achieved as long as line of sight permits it.

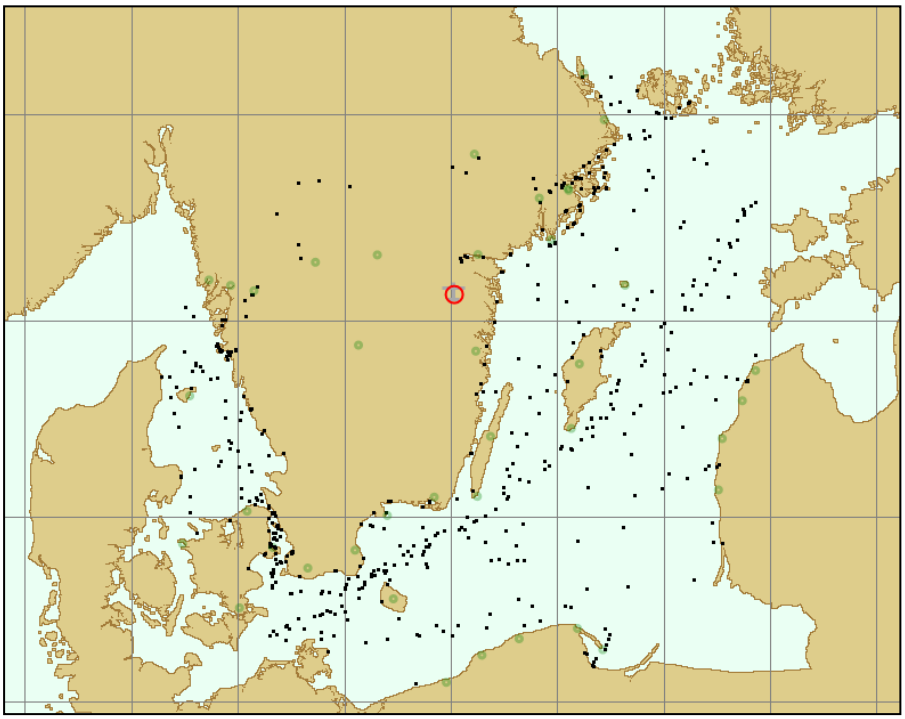

Figure 3-2 , R4A Airborne AIS transponder range

The picture above is from a flight with a Swedish surveillance aircraft flying at 20 000 ft. (6000 m). The black dots are ships and the green circles are ground stations. The red circle is own position. The total range is more than 200 nautical miles. This means that the AIS detection range from a helicopter perspective will normally only be limited by line of sight.

3.1.1 Features

The main features of the R4A MkII AIS Transponder are the following:

- Reception of position and identification data from AIS stations
- Transmission of own AIS data (selectable)

- Reception and transmission of text and binary messages
- Interrogation of specific AIS stations for immediate update of detailed information
- Reception and transmission of DSC messages

3.2 AIS Applications

The AIS system provides a basis for different types of applications such as:

- Search and Rescue (SAR); locate vessels in distress and communicate with them while help is on the way.
- Monitoring of Surface Traffic; to be able to keep track of AIS equipped vessels and their destinations.
- Maritime Surveillance/Coast Guard Patrol; together with radar systems, naval authorities can find vessels without AIS or with faulty AIS parameters, thus increasing security.
- Homing for Maritime Helicopter Operations; find the ship that the helicopters is supposed to land on.
- Fleet Management; to keep track of a fleet of helicopters serving for example oil-rigs. Mission Control and Coordination; supports SAR and military operations involving several helicopters and vessels.

3.3 Saab Secure AIS (option)

The core capability of the Saab Secure AIS system version is to provide encrypted data link communication in addition to the standard AIS operation. The Saab Secure AIS system has been designed specifically for optimal data transmission performance while the NATO Warship function described in section 3.4 has been included for compatibility reasons and is best suited for exchange of position reports.

The main features of the Saab Secure AIS system are, (for further details see Ref [10]):

- Utilisation of a dedicated internal receiver for non-AIS functionality while maintaining full performance on the AIS 1 & 2 channels - No unsolicited use of standard AIS data link capacity is needed.
- Secure functionality without a need of external on-board equipment
- Full situational overview of Secure AIS equipped vessels/aircraft and standard AIS equipped vessels while remaining invisible to standard AIS users
- Fully supported by all Saab's AIS products including network and presentation systems
- Encryption cipher, user selectable to AES or Blowfish.
- Encryption key size options of 128, 196 or 256 bits.

- Encryption key is freely generated by the user. The encryption key is input via the R4A MkII CMT Software running on an external Windows PC.
- Input encryption key can never be extracted again.
- A quick erase command can be issued to remove any encryption keys in the system.

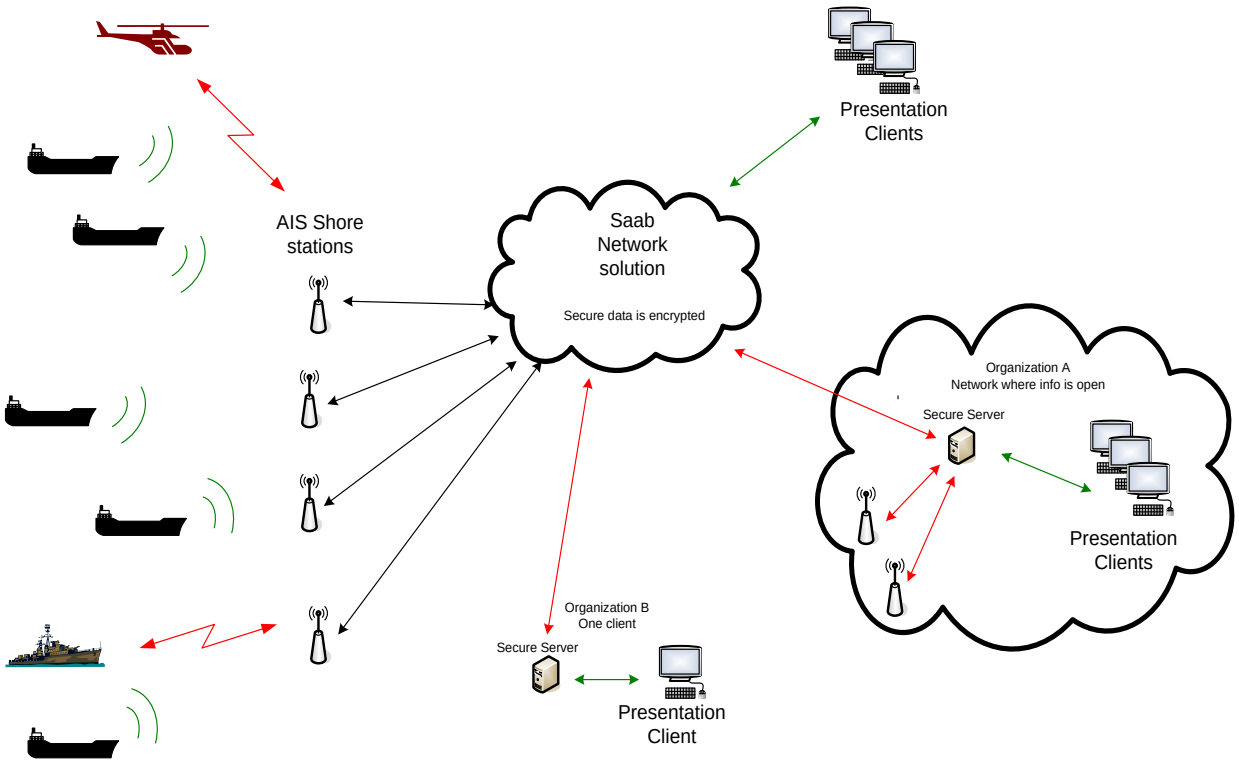

Figure 3-3 , Saab Secure AIS solution

3.3.1 Application examples

The encrypted data communication provided by Saab Secure AIS can be used in various applications.

The most common application is fleet tracking, giving the user real time data including identity, position, speed and course of other Secure AIS users. Applications also include protected exchange of:

- Text messages
- Relayed AIS and radar tracks, see figure below
- Points of interest

- Tracks of interest
- Search patterns
- General binary data

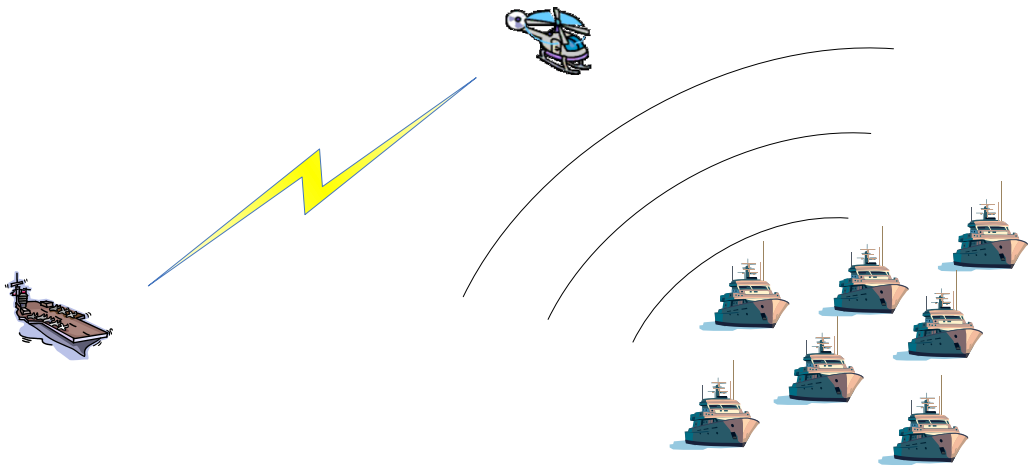

Figure 3-4, Helicopter relaying the information about its view back to mother ship.

3.4 NATO Warship function (option)

The NATO package is an option for Saab secure AIS transponder systems which basically enables encrypted transmissions over the standard AIS channels as specified in STANAG 4668 Ed.2. The package provides two different types of encrypted communication over AIS 1 and AIS 2 referred to as BFT and STEDS.

3.4.1 Features

Main features of the R4ASN MkII NATO solution are (for further details see Ref [10]):

- Fixed encrypted position message reporting rate of 2 or 4 reports per minute.
- There are four different modes of operations available when BFT or STEDS operational type has been selected:

  AIS – Normal Class A functions

  Passive – No transmissions.

  Protected – Only encrypted transmissions

  External –For external cipher solutions. Transmits only externally input binary messages.

4 AIS INTRODUCTION

4.1 Overview of AIS Functionality

The main purpose of the AIS system is to automatically exchange position and identification information between all participating stations. However, the AIS system also provides other functionality. This section gives a general overview of AIS functionality.

4.2 The AIS System

The AIS system consists of different kinds of units equipped with AIS transponders, called *AIS stations*. Examples are shipborne stations, airborne stations (e.g. SAR or surveillance aircraft) and land-based stations. Shipborne units are divided into two classes – Class A and Class B. A common type of land-based station is *Base Station*, which are used by a country's authorities to monitor and control the AIS system.

All AIS stations use two VHF channels for exchange of AIS information. These channels comprise the VHF Data Link, *VDL*. The channel frequencies used in most parts of the world are 161.975 MHz (also known as channel 87B or 2087), and 162.025 MHz (also known as channel 88B or 2088).

All AIS stations, including ground-based and airborne stations, are uniquely identified by their *Maritime Mobile Service Identity (MMSI).*

4.2.1 Position Reports

Most AIS stations continuously broadcast Position Report messages on the VDL. The rate with which a station broadcasts these reports is called *Reporting Rate*, which may vary over time

and differ from station to station. Some stations report different data items in different types of position reports, using different reporting rates. The reporting rate of an AIS station is typically between 3 and 600 reports per 10 minutes, depending on station type, speed, navigational status and rate of turn. An AIS transponder autonomously broadcasts position reports.

Position report messages received on the VDL by the transponder is typically fed to an external system, such as an electronic charting system.

The information that is exchanged in position reports messages varies depending on the type of station, and includes a subset of the following data items:

- MMSI (Station ID)
- Position (Latitude / Longitude, Altitude for aircraft)
- Speed over Ground
- Course over Ground
- Heading
- Rate of Turn
- Ship's Name
- Ship's Call Sign
- Type of Ship
- Cargo Type
- Ship's dimension and reference for position
- Time stamp (UTC) of the position

4.2.2 Binary Messages

The AIS system contains functionality for transmission of application-specific data between stations. This allows external applications (e.g. systems connected to AIS transponders) to use the AIS system as a data carrier. There are four types of messages:

- Addressed Messages
- Broadcast Messages
- Addressed Safety Related Messages
- Safety Related Broadcast Messages

In Addressed-type messages, a target MMSI (station ID) is specified. Although all AIS stations within broadcast range of the transmitting transponder will receive this message, only the station that has the specified MMSI shall regard the contents of the message. If the destination MMSI for an addressed message differs from own MMSI, the message will be filtered out (e.g. not output to the external application). On the contrary, Broadcast-type messages are regarded by all stations that receive them. The contents of received binary and Safety Related messages are not decoded by the AIS transponder (except for the filtering of addressed messages). Instead, it outputs the contents to the external system connected to it (PS).

Binary messages contain an "Application Identifier", and variable length binary data (up to approximately 0.6 kilobits). The Application identifier is a unique number that indicates to external systems how the binary data is encoded. This is further described in [2], Annex 5.

Safety Related messages contain variable-length ASCII text. Safety Related messages have higher priority on the VDL than binary messages.

4.2.3 Interrogation

All AIS stations broadcast position reports containing the station's position and other data items. Some data items are broadcast with a slow rate (for example, Class A and Class B shipborne stations only broadcast the Ship's Name and Cargo Type every six minutes or when changed). The Interrogation functionality of the AIS system can be used to interactively request a station to broadcast a specific message. This can be useful, for example, in a situation where a SAR aircraft rapidly approaches an area containing unknown stations (i.e. that were previously out of VHF range).

Most types of stations, including airborne stations and base stations, can be interrogated for specific types of information.

4.2.4 Other Functionality

In this section, other, less commonly used, functionality of the AIS system is briefly described.

- *Assigned Mode* is a special mode of operation, which a mobile station enters on command of a base station. The base station can control several parameters of a mobile station's behavior, i.e. its reporting rate and in which time slots it is allowed to transmit.
- *Synchronization using Semaphore.* The AIS system is based on the fact that all stations are time synchronized. Normally, each station uses its internal GNSS receiver for time synchronization (this is called *UTC direct synchronization*). Should a station's GNSS receiver fail, it synchronizes to the transmissions of other stations. Should, in an area, all stations lose UTC Direct Synchronization, one station becomes *Semaphore* - the source of synchronization in the area. The Semaphore station automatically increases its reporting rate to two seconds.
- *UTC/Date inquiry* is a function supported by all AIS stations. Any station can be queried for its current UTC Time (and, for some stations, also UTC Date), using an UTC/Date Inquiry VDL message.
- *Channel Management* allows the AIS system (e.g. via base stations) to control mobile stations channel frequencies, transmit power and bandwidth settings within specified geographical regions.

4.2.5 Overview of VDL Messages

The VDL messages are output in a binary format using VDM sentences, and must be decoded by the external application according to [4].

Normally, all received VDL messages are output to a connected external system. However, some messages contain information that is usable for the external application, and some messages contain information usable only for the transponder itself (e.g. AIS management information). For clarity, in this description, the VDL messages are divided into three categories:

- *System Control Messages*. These messages are either handled autonomously by the transponder, or the contents of the message is decoded by the transponder and the external system is informed using a separate message.

- *AIS Target Display Information Messages*. These messages contain AIS station information that is usable by an external system. Most of them are broadcast periodically by AIS stations. The AIS transponder does not care about the station-related information in these messages.
- *Binary and Safety Related messages.* These messages contain application-specific information, exchanged between external systems. The AIS transponder does not care about the application-specific information contained in these messages.

5 EQUIPMENT DESCRIPTION

5.1 General

Functionally the Airborne AIS Transponder consists of the following main sub systems; Global Navigation Satellite System (GNSS) receiver, Controller and a Time Division Multiple Access (TDMA) VHF transceiver. The transceiver is divided into three receivers and one transmitter in conjunction with a transmit/receive switch.

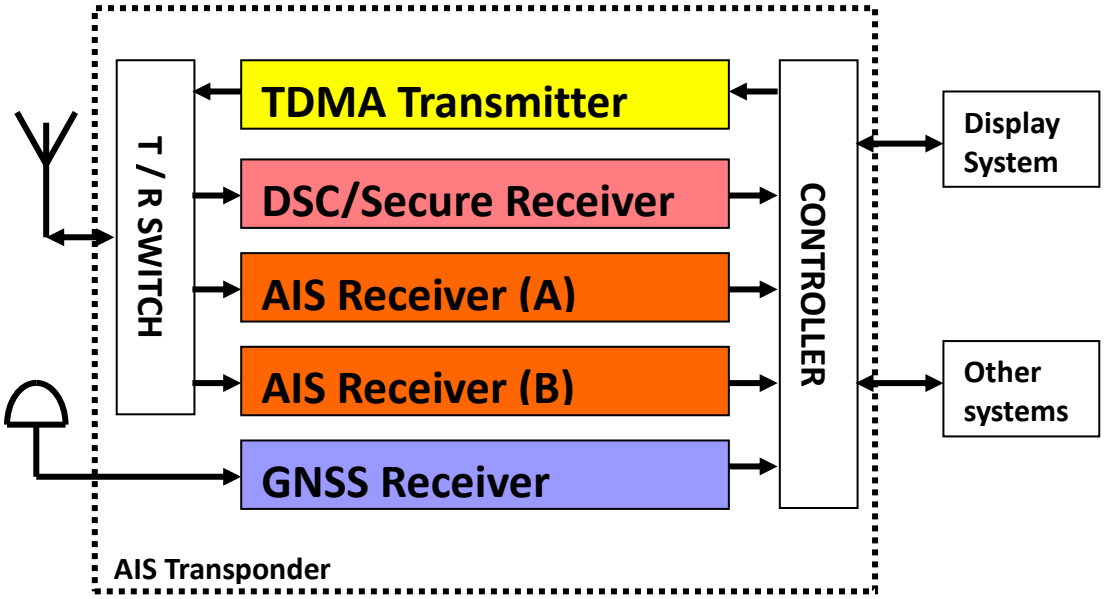

Figure 5-1 , Transponder Block Diagram

5.2 GNSS receiver

This subsystem handles the navigation and timing accuracy of the system. Position information can be provided either from the internal GNSS receiver or from an external navigation source. Even though the GNSS receiver is one main part, should it fail the transponder will go to a degraded timing mode. The position can be maintained if an external navigation source is used. It is possible to use an external position source, but the internal GNSS is still needed for time accuracy. If the internal GNSS is not connected, an accurate one pulse per second (1PPS) must be provided to the transponder.

5.3 Controller

This subsystem handles all protocols used in the transponder. The Controller includes all external interfaces. The Controller handles the slot allocation for the transponder transmission. It continuously updates its own slot map, and allocates transmission slots from free slots in the slot map or re-uses slots from distant transponders**.**

5.4 Transceiver

The VHF data radio or transceiver is used both to communicate the transponders own position and other relevant information to other users (including ground stations), and to receive data from other users. The transceiver is capable of operating on channels with 25 kHz spacing. The transmitter power is selectable to 1 or 12.5 Watts, depending on what application the transponder is used for. The VHF transceiver comprises one transmitter and three receivers capable of monitoring different channels, typically the AIS default channels (2087, 87B and 2088, 88B) simultaneously. The transponder can be set to silent mode as well which means that the transponder can be used as a monitoring station only.

5.5 Interface identification and diagrams

An overview of installation in a helicopter is illustrated in **Figure 5-2 , Helicopter** installation below. For complete information about the interfaces of an R4A MkII transponder see ref [4].

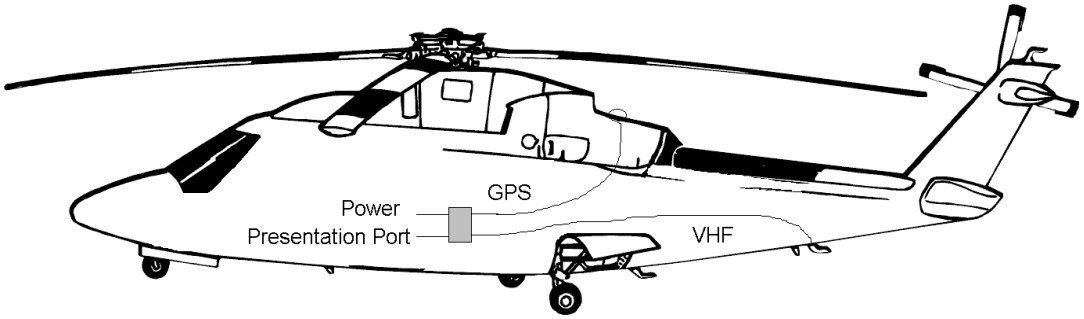

Figure 5-2 , Helicopter installation

Note. The selection of antenna location is very vital to operational performance. The figure above is an example and shall not be seen as optimal antenna location. Aircraft specific factors such as co-site interference and helicopter structure etc. should be taken into account.

5.5.1 GNSS Interface

The GNSS antenna interface is described in Table 1 - GNSS Interface below.

Parameter	Characteristic
Type	Active antenna interface, 50 ohm
Power supply	5V DC and 40 mA
Connector	TNC, female
Frequency	1.5 GHz (GPS L1)
Gain	Between 0 dB and +26 dB (as the resulting gain after subtraction of cable losses)

Table 1 - GNSS Interface

5.5.2 VHF Interface

The VHF antenna interface is described in Table 2 - VHF interface below.

Parameter	Characteristic
VHF	Transmit/Receive antenna interface.
Impedance	50 Ohm.
Connector	N, female.
Cable attenuation	Maximum 3 dB (see note).
Antenna type	Certified aircraft VHF-antenna designed for the selected frequency band, omni-directional coverage.

Table 2 - VHF interface

Note. The attenuation is between transponder output and antenna input.

5.5.3 RS422 Ports

There are 4 serial ports available for connections to other systems. These ports are used to interface one or more Presentation Systems [Input/Output]. The ports are located on connector J1, see **Figure 10-1**. Any of these ports can be used for configuration.

5.5.4 ARINC 429 port

The most common use of this port is to connect it to an external position source, e.g. FMS or GNSS. The port can be configured to use either fast or slow transmissions. The port is located on connector J1, see **Figure 10-1**, and consists of a single Tx and dual Rx channels.

5.5.5 Ethernet port

The Ethernet port can be used to interface one or more Presentation Systems [Input/Output] using either TCP/IP or LWE (Light Weight Ethernet). Additionally the Ethernet port can be used for configuration and software upgrade. The Ethernet port is located on connector J5, see **Figure 10-1**.

5.6 Power Supply

The transponder is powered by 28 volts DC with a power need of approximate 60 Watts when transmitting. The transponder shall be externally fused (slow-blow fuse or circuit breaker) for up to 5 Amperes.
Power is supplied via connector J2 on the transponder unit, see **Figure 10-1**.

5.7 Technical Data Airborne AIS Transponder

PHYSICAL DATA	
Dimensions Height: Width: Depth:	Transponder: 85 millimetres 144 millimetres 280 millimetres
Weight:	Less than 2.3 kilograms

INPUT POWER	
Power input requirements	28 volts (Nominal)
Grounding	The primary side of the transponder is floating with reference to chassis.
Current need (typical): TX-On TX-Off	@ 28 volts 2.0 Amperes (60 Watts) 0.8 Amperes (21 Watts)
Recommended fuse/Circuit Breaker	5 Amperes

GNSS RECEIVER	
Receiver	50 channel differential
Frequency	L1 (1575.42 MHz), C/A code
Update Rate	Once per/sec, continuously
Accuracy: Position <2.5 meters (CEP) Position <2 meter (CEP)	 w/o DGPS w/o SA imposed w DGPS w/o SA imposed
Dynamics: Velocity Acceleration Altitude	 500 m/s <4 g 50000 m

VHF TRANSCEIVER	
Frequency	155 – 163 MHz (optionally 136 – 166 MHz)
Channel Bandwidth	25 kHz
Channel Selection	25 kHz steps
Output power	1, 12.5 Watts (Selectable)
Receiver sensitivity	<-115dBm Marine Band (<-111dBm full frequency range)
Bite rate (TX/RX)	9600 bps
Standard interval between position reports	1 - 60 sec
Modulation	GMSK/FSK

ELECTRICAL INTERFACES	
4 Data Ports	RS-422
	Bit rate: 9.6 - 115.2 kbit/sec
1 Data Port	ARINC 429 (2 Rx, 1 Tx)
	Speed: High/Low
1 Data Port	Ethernet 10/100/1000 Mbit/s
GNSS-Antenna Power feeding to Preamplifier	Type TNC Female 5 VDC, maximum 40mA load
VHF-Antenna	N-Female
Power & Data Port (COM)	MIL-C-38999 series 3
Data Port (Ethernet)	Glenair, Series 801or compatible

AVAILABILITY (Method used MIL-HDBK-217F)	
MTBF ARW (Air Rotary Winged)	14 000 flight hours @ 40°C
MTBF AIC (Air Inhabited Cargo)	38 500 flight hours @ 40°C

6 UTILITIES

6.1 R4A MkII/R5A CMT, Configuration and Monitoring Tool

To enable configuration and general management of the equipment a configuration and monitoring tool, denoted R4A MkII/R5A CMT, is distributed with each R4A MkII transponder unit. The R4A MkII/R5A CMT is a PC application (MS Windows) which allows for configuration and control of R4A MkII and R5A Airborne AIS transponders. The CMT also contains features to load/save the transponder configuration parameters as well as the ability to load/upgrade the transponder software and product capability (secure modes).

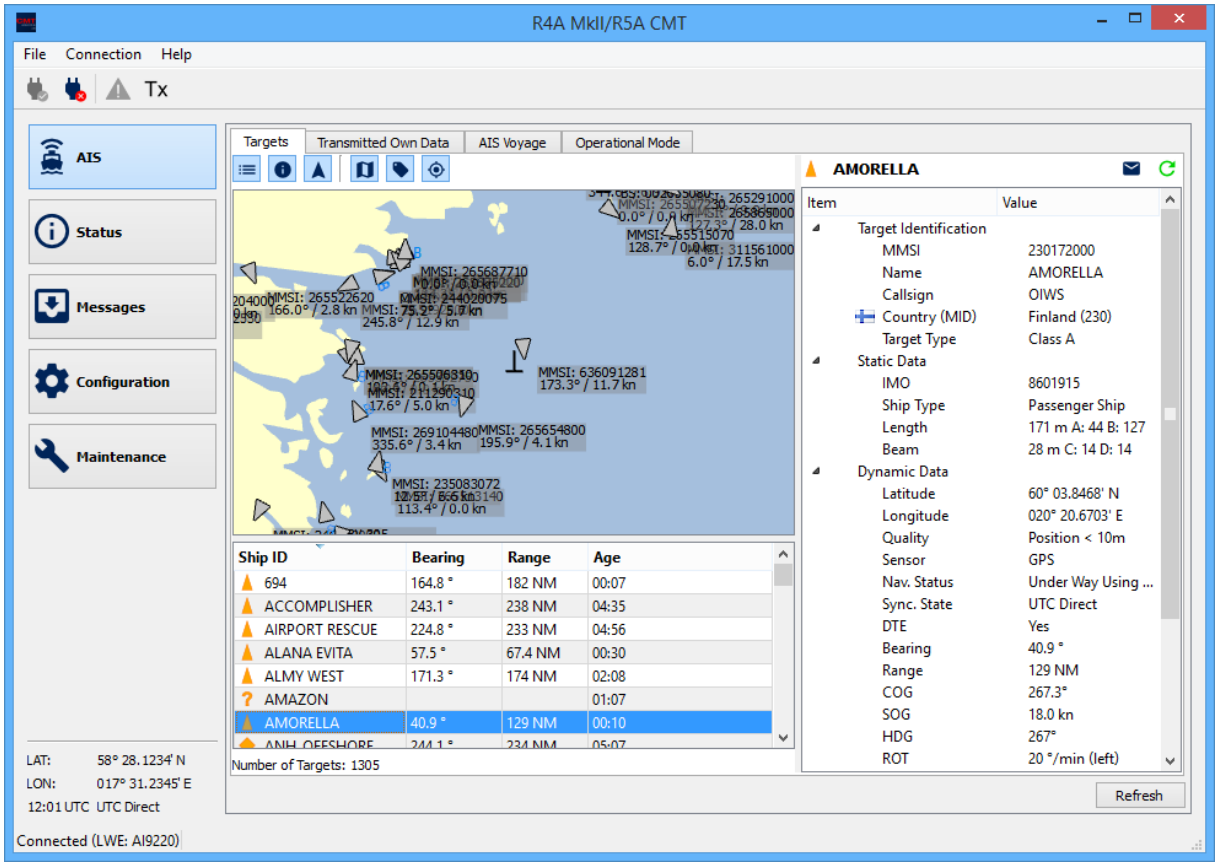

Figure 6-1 , R4A MkII/R5A CMT graphical interface

The R4A MkII/R5A CMT provide these main features:

- Support for Saab airborne transponders
  - R4A MkII, R4AS MkII, R4ASN MkII, R4AS L MkII
  - R5A, R5AS, R5ASN, R5AS L
  - R4A, R4AS, R4ASN, R4AS L (with limitations)

- Monitoring of AIS traffic
- Configuration of (as available in connected unit)
    - AIS parameters
    - Interface parameters
    - Secure parameters
    - NATO parameters
- Status monitoring
    - Alarms
    - Internal GNSS status
    - VHF transceiver status
    - Operational Time
- Support for sending and receiving AIS text messages
- Handling of secure functions
    - Encryption key management
    - Manage Situation Relay transmissions
- Maintenance
    - Factory reset of parameters
    - Load/Save configuration parameters
    - Update transponder software
    - Product upgrade

Details are found in R4A MkII/R5A Configuration & Monitoring Tool User Manual, Ref [8]

7 INTEGRATION CONSIDERATIONS

7.1 Certification

1. The Airborne AIS Transponder is designed for non-essential operational use only and shall therefore not be connected to aircraft or helicopter safety critical systems, nor be connected to a system or equipment performing a function necessary for the continued safe flight and landing of the aircraft/helicopter.

2. Software and hardware is developed to a criticality level suitable for non-essential operational applications.

3. Information provided by the system shall not be used for the safe operation of an aircraft.

7.2 Environmental Testing and Qualification

The R4A MkII AIS transponder is Qualified against, RTCA DO160G categories for ”Helicopter” and “Fixed wing, Turbojet and Turbofan (subsonic and supersonic)” in conjunction with “Fuselage” and “Instrument Panel, console and Equipment Rack”.
For details regarding qualification see Ref [7].

7.3 Functional Interfaces

To enable full onboard integration of the R4A MkII, interface control documents (ICD:s) describing the details of the functional interfaces available via the connectors J1 and J5 can be provided, see Ref [4] and [5]. Details regarding the ITU-R M.1371 message formats are found in Ref [2] which can be freely downloaded from the ITU (International Telecommunications Union) official web site.

7.4 Saab Secure AIS

Saab Secure AIS messages follow the structure of standard AIS messages and are available in R4AS MkII, R4AS L MkII and R4ASN MkII when the third channel is configured to use secure link. From an integration point of view, one only needs to keep track of messages received on the secure channel, denoted channel C. Encrypted messages are only sent on this channel in Saab Secure AIS mode.

7.5 NATO Warship function

All NATO messages decrypted by the R4ASN MkII system will have Talker ID ‘NM’ to separate encrypted communication from open communication on the RS422 and Ethernet ports.

7.6 DSC Messages

DSC messages are available if the R4A MkII enables the third channel as DSC (not Saab Secure AIS). All the messages received on the DSC channel are output transparently to the external presentation system. Typical messages which can be heard on the DSC are:

- *Distress calls.*
- *Target display information messages.*
- *VTS area messages*
- *Channel management messages*

Note. The R4AMkII will only output the DSC data stream. Parsing of the messages must be handled by the external system.

7.7 Thermal Dissipation

It is assumed that the unit is installed in a ventilated avionics rack/bay. The thermal dissipation for the equipment, excluding interface loads, is specified in table below.

OFF MODE	POWER UP	POWER ON	TEST
0W	< 30 W	< 30 W	< 30 W

7.8 Cooling/Ventilation

No forced air-cooling required.

8 EXPORT CONTROL

The R4AS MkII and R4ASN MkII are subjected to export control as dual use equipment, ECCN 5A002, and cannot be exported globally without authority approvals. The R4AS MkII exists in a version denoted R4AS L MkII which does not require export control.

9 COMPLIANCE TO INTERNATIONAL STANDARDS AND REGULATIONS

The R4A MkII Airborne AIS Transponders comply with all the relevant international AIS specifications and recommendations as applicable, see BSH Statement of Conformity and list below:

Bundesrepublik Deutschland
Federal Republic of Germany

Bundesamt für Seeschifffahrt und Hydrographie
Federal Maritime and Hydrographic Agency

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Konformitätsbestätigung
Statement of Conformity No.
Nr. BSH/4542/002/4322935/15

Die nautische Ausrüstung *The nautical equipment* — ***Airborne AIS***

mit der Typbezeichnung *with the type designation* — **R4A MKII Airborne AIS**

des Herstellers *manufactured by* — **Saab TransponderTech AB**
Låsblecksgatan 3
58941 Linköping
SWEDEN

ist nach den folgenden Normen/Standards, soweit für diesen Ausrüstungsgegenstand anwendbar, erfolgreich geprüft worden.
has been tested successfully according to the following standards as applicable for this equipment:

Norm/Standard	Prüfnorm/Test Standard
ITU-R M.1371-5 (as far as relevant for Airborne AIS)	IEC 61993-2 Ed.2 (as far as relevant for Airborne AIS, see table on page 3
	IEC 61108-1 (2003)
	IEC 61162-1 Ed. 4 (2010)

Dem Antragsteller wie oben / *as above*
It is hereby confirmed to the applicant

wird die Eignung für den nachstehenden Verwendungszweck bestätigt: Airborne AIS
that the equipment is suitable for use as: Airborne AIS

Hamburg, 2015-12-01

Im Auftrag
For the Federal Maritime and Hydrographic Agency

Dienstsiegel
Official seal

Doreen Thoma

List of applicable standards;

- IEC 61993-2 ed 2.0: Universal Ship Borne Automatic Identification System (AIS) Operational and Performance Requirements, Methods of Testing and Required Test Results, IEC 61993-2.
- ITU-R M. 1371-5, Technical Characteristics for a Universal Ship Borne Automatic Identification System Using Time Division Multiple Access in the VHF Maritime Mobile Band, 1371-5.
- ITU Recommendation ITU-R M. 825, Characteristics of a Transponder System Using Digital Selective Calling Techniques for use with Vessel Traffic Services and Ship-To-Ship Identification
- ITU Recommendation ITU-R M. 493, Digital selective-calling system for use in the maritime mobile service
- ITU Recommendation ITU-R M. 541, Operational procedures for the use of digital selective-calling equipment in the maritime mobile service
- ITU-R M. 1084-3, Interim Solutions for Improved Efficiency in the use of The Band 156-174 Mhz by Stations in the Maritime Mobile Service
- IEC 61108-1 Ed. 2.0 2003, Maritime navigation and radiocommunication equipment and systems - Global navigation satellite systems (GNSS) – Part 1: Global positioning system (GPS) – Receiver equipment – Performance standards, methods of testing and required test results
- IEC 61162-1 Ed. 4.0 2010, Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners
- IEC 61162-2 Ed. 1.0 1998, Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission
- ARINC 743A-4 GNSS Sensor

9.1 Deviations of Airborne AIS from the AIS Class A standard.

Currently there is no test standard for AIS Airborne equipment. Therefore the Airborne AIS equipment Saab R4A MKII has been tested for conformance to the Class A test standard IEC 61993 with some exceptions. Some deviations are defined by ITU-R M.1371-5. Other deviations which are not covered by ITU-R M.1371-5 are defined by the manufacturer according to the requirements of an Airborne AIS.

Item (IEC 61993-2)	Description	Definition source
MKD (6.11.1)	No MKD is implemented	Defined by manufacturer
Position report	Message 9 transmitted as position report instead of Message 1, 2, 3	ITU-R M.1371 A8 3.7, Table 59
Reporting interval	Message 9 is transmitted with a fixed reporting interval of 10 s, independent of speed and heading change and Nav. Status	ITU-R M.1371 A8 3.7
Reporting interval	lt is configurable to 6 s, 3.33 s and 2 s.	Defined by manufacturer
Interrogation response (18.2)	The AlS Airborne station responds on interrogation for Message 9.	Resulting from Position report = Message 9
Nav status (14.2.2)	A Navigational status is not supported because it is not included in message 9.	ITU-R M.1371 A8 3.7, Table 59
Heading, ROT (14.6.3.3, 19.5.7, 19.5.8)	Heading and ROT are not supported because Message 9 does not include Heading and ROT.	ITU-R M.1371 A8 3.7, Table 59
Altitude	Altitude is supported because Message 9 includes the Altitude. The GNS and GGA Sentences are evaluated for Altitude.	ITU-R M.1371 A8 3.7, Table 59
Dim/Ref	The Dimension/ reference values of Message 5 are not supported. They are always set to 0. Consequently Message 5 is not transmitted at change of position source	ITU-R M.1371 A8 3.3, Table 52, Defined by manufacturer not to use the field.
Draught	The Maximum present static draught field of Message 5 is not supported. lt is always set to 0.	ITU-R M.1371 A8 3.3, Table 52 , row “Maximum present static draught“
Type of ship and cargo	The Type of ship and Cargo field of Message 5 is not supported. lt is always Set to 0.	ITU-R M.1371 A8 3.3, Table 52 , row “Type of ship and cargo type“
Automatic power setting (14.5.3)	The automatic power setting (14.5.3) for tanker in loading mode is not	Defined by manufacturer

Item (IEC 61993-2)	Description	Definition source
	implemented. lt is not applicable for a SAR airborne station	
Group Assignment	A selection by Type of ship and cargo is not supported because Type of ship and cargo is not applicable for SAR aircraft	ITU-R M.1371 A8 3.3, Table 52 , row “Type of ship and cargo type“
Group Assignment	The AlS Airborne station accepts a Group assignment (Message 23) to station type 3 instead of station type 1.	ITU-R M.1 371 A8 3.21, Table 76
Semaphore mode (16.1.3)	The EUT does not become a semaphore.	Defined by manufacturer
Event log (14.3)	The event log is not supported	Defined by manufacturer
Alarm relay	An alarm relay is not implemented	Defined by manufacturer
Alarm ID 009 (14.6.3.5)	The alarm ID 009 (Position mismatch) is not implemented	Defined by manufacturer
Interface requirements	The interface requirements are not defined. The manufacturer implemented 4 interface ports according to IEC 61162-2 with identical Pl port and Sensor input functionality.	Defined by manufacturer
Long range	The long range application by two-way interface is not implemented.	Defined by manufacturer

10 DRAWINGS AND PICTURES

10.1 Outline Drawing R4A MkII

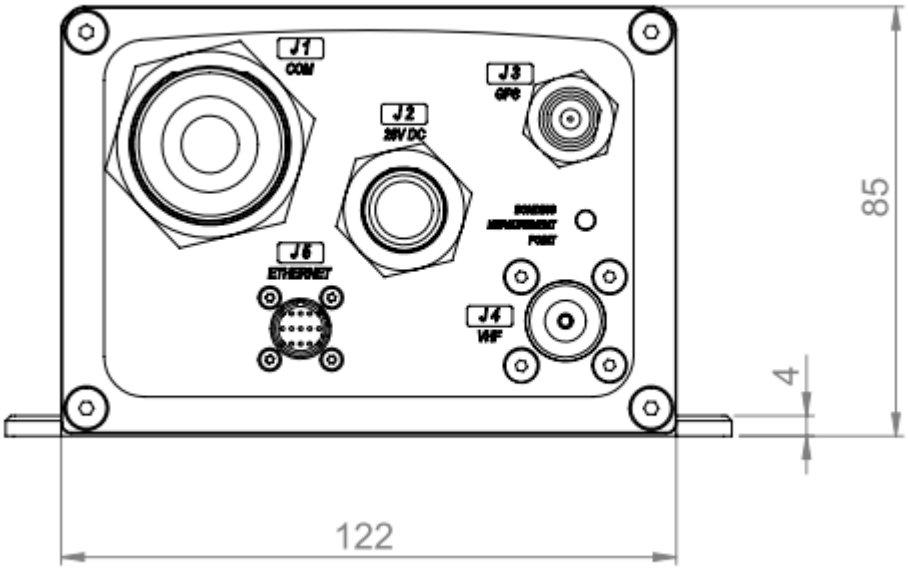

Figure 10-1 , Connectors

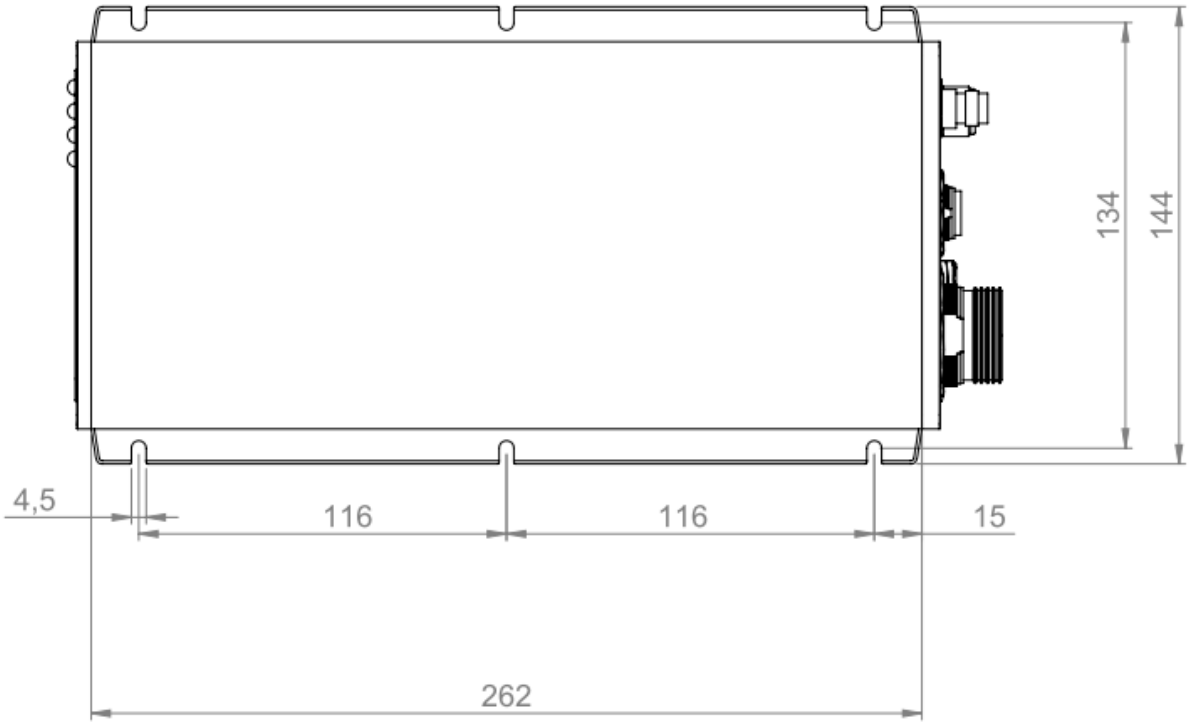

Figure 10-2 , Foot print

10.2 Center of Gravity

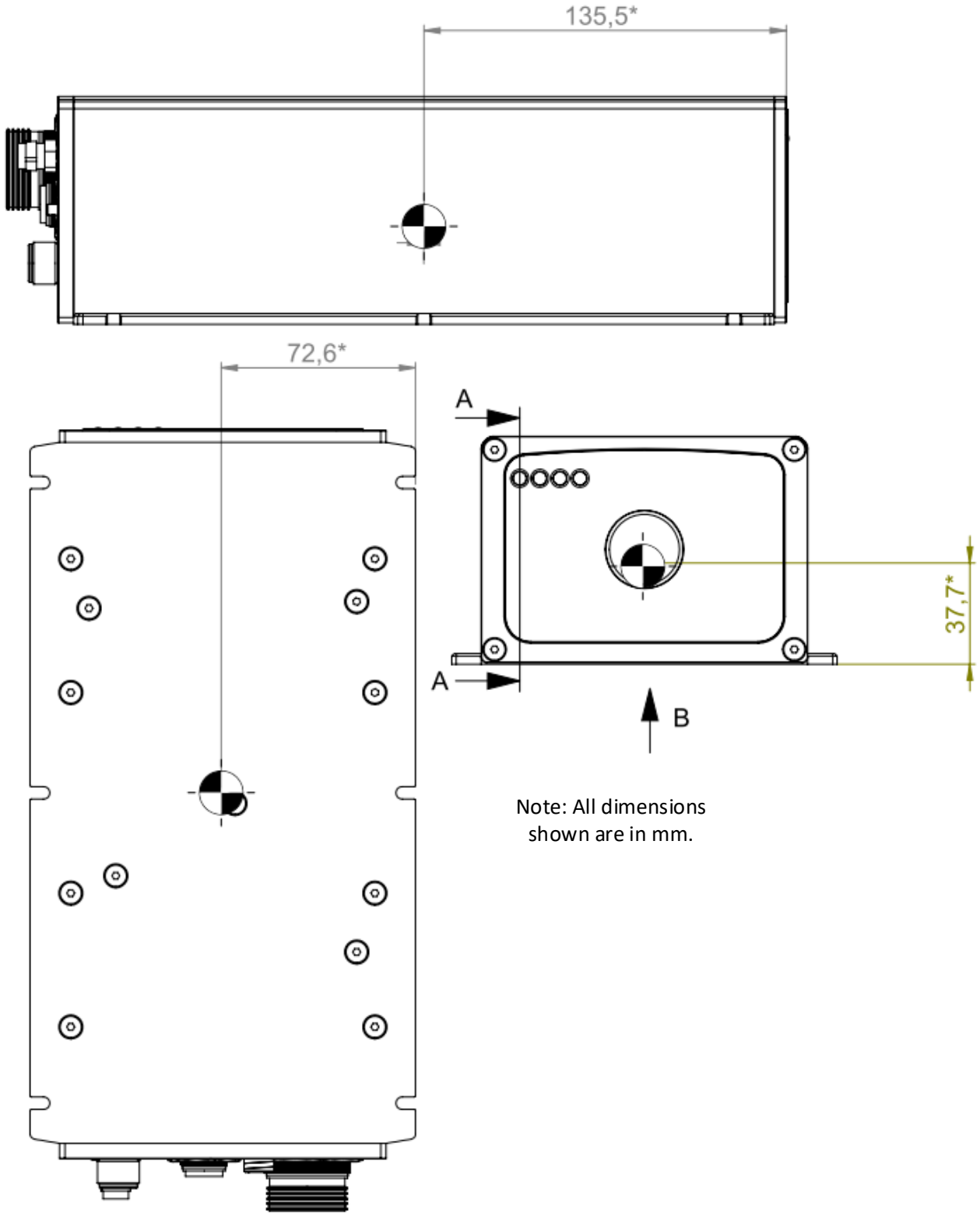

Figure 10-3 , Center of Gravity

10.3 Front

The front panel of the R4A MkII Airborne AIS Transponder, shown in **Figure 10-4**, has four LEDs with the following functions:

1. Green LED:
   The LED is lit when the transponder is connected to an Ethernet port and flashes when data is transferred.
2. Yellow LED:
   This flashes to show that the transponder is receiving data on the radio link.
3. Red LED:
   This flashes to show that the transponder is transmitting on the radio link (autonomous transmission starts approximately 1 minute after power on).
4. Green LED:
   This comes on and stays on, to show that electrical power (28V DC) is supplied to the R4A MkII Airborne AIS Transponder.

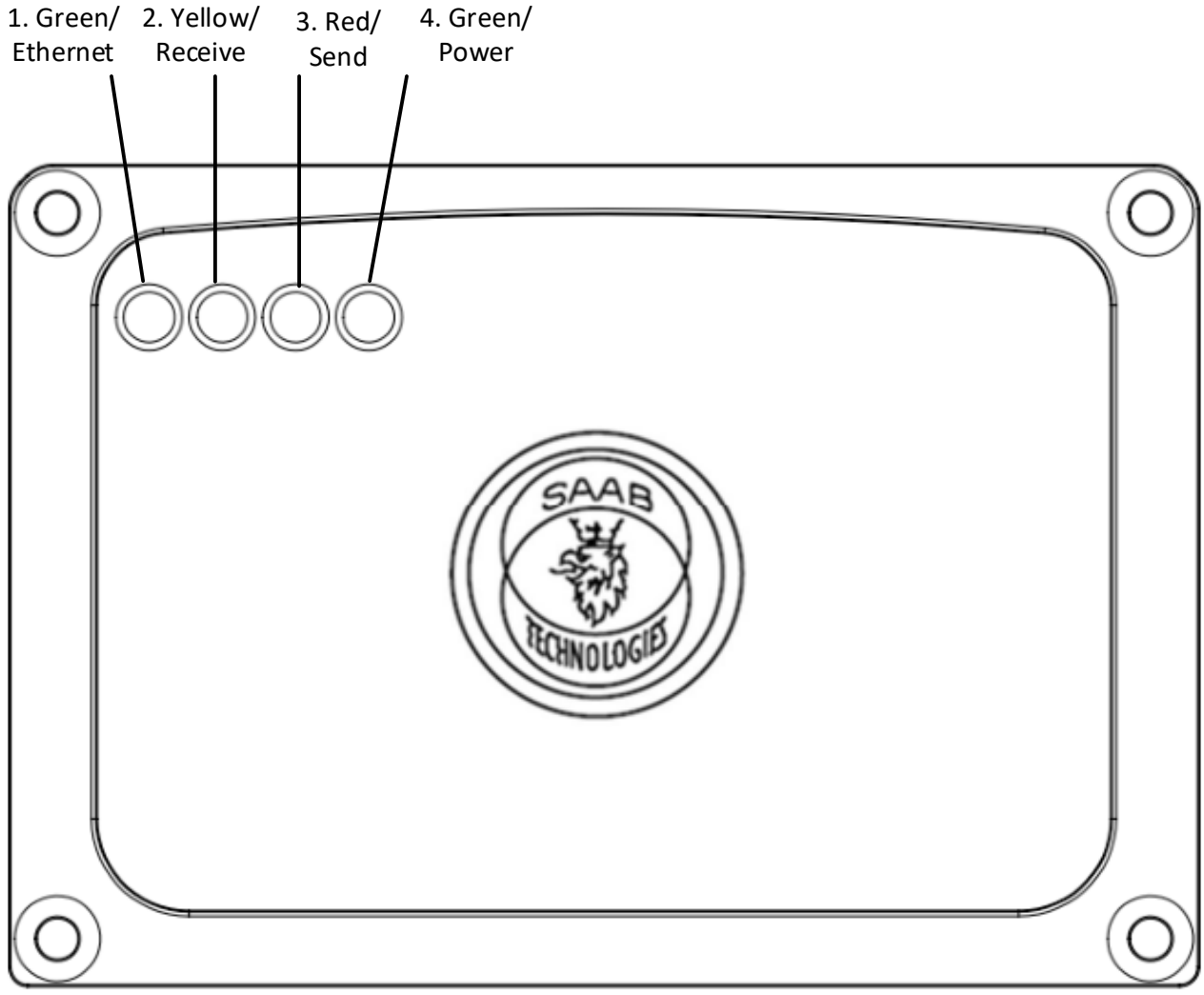

Figure 10-4 , Front LEDs and function