



**SICOMM**

# SCT7033

## AIS Class B Protocol Stack Processor - CSTDMA

### SCT7033 AIS Class B Protocol Stack Processor - CSTDMA

D/7033/3 December 2019

#### DATASHEET

Advance Information

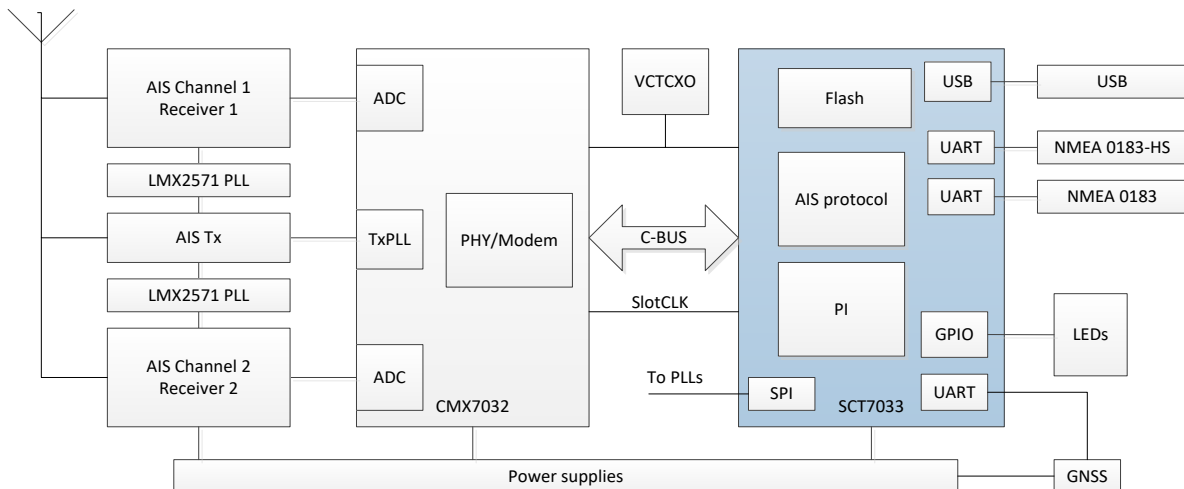
#### Features

- Class B CSTDMA protocol stack
- CMX7032 / DE70322TC compatible
- uBlox GNSS interface
- USB and UART Presentation Interfaces
- DSC decoder included
- IEC 62287-1 edition 3 compatible

- ITU-R M.1371-5 compliant
- Runs directly on DE70322TC
- Small 100LQFP Package

#### Applications

- Low-cost Class B CSTDMA AIS transponder
- exactTrax asset tracking and monitoring



## 1 Brief Description

The SCT7033 implements a full AIS Class-B CSTDMA protocol stack on a low-cost microcontroller. This provides the higher protocol layers to implement a complete Class B AIS transponder when used in the hardware architecture provided by the DE70322TC demonstration / evaluation kit (which includes the CMX7032 AIS Baseband Processor and CMX902 RF PA device) coupled with customer-specific power supplies and interface conditioning. The SCT7033 is provided in a LQFP100 14 x 14 mm package.

The SCT7033 provides:

- C-BUS interface and controller for the CMX7032 AIS Baseband Processor
- SPI interface and controller for dual LMX2571 frequency synthesisers and VCOs.
- UART interface and controller to uBlox M8M GNSS module
- USB and UART interfaces and drivers for the Presentation Interface
- Additional UART for dedicated GNSS interface
- LED indicator drivers for channel and operational status
- Optional GPIO for future customisation
- GNSS aligned Slot Clock output for synchronising CMX7032

The SCT7033 is available with GUI software to allow:

- Factory set-up and adjustment of DE70322TC parameters
- User-specific programming (MMSI and other vessel-specific parameters)
- Support for exactTrax operation

The SCT7033 is delivered with the MMSI set to zero and so will not be able to transmit until programmed with a valid and appropriate MMSI, which must be obtained from the local regulatory body<sup>1</sup>. The GUI is provided in two modes, one for manufacturer / factory only and the second for dealer use, it should not be made available to the end user / mariner. In particular, re-programming the MMSI is not possible without first executing a manufacturer-only sequence.

The DE70322TC provides the serial interfaces as CMOS-digital compatible UARTs, the customer must provide suitable interface driver/protection to implement either RS232 or NMEA-0183 compatible interfaces. Other interface options can be implemented at the customer's discretion – WiFi, Bluetooth etc. but are outside the scope of this document.

---

<sup>1</sup> In the UK this is OFCOM. In the USA this is the FCC / BOATUS / SEA-TOW / Shine

## CONTENTS

| <u>Section</u> |                                                 | <u>Page</u> |
|----------------|-------------------------------------------------|-------------|
| <b>1</b>       | <b>Brief Description .....</b>                  | <b>1</b>    |
| <b>2</b>       | <b>Block Diagram.....</b>                       | <b>5</b>    |
| <b>3</b>       | <b>Performance Specification .....</b>          | <b>6</b>    |
| 3.1            | Electrical Performance.....                     | 6           |
| 3.1.1          | Absolute Maximum Ratings – typical figures..... | 6           |
| 3.1.2          | Operating Characteristics .....                 | 6           |
| <b>4</b>       | <b>Pin and Signal List .....</b>                | <b>7</b>    |
| <b>5</b>       | <b>Component and PCB Recommendations .....</b>  | <b>10</b>   |
| 5.1            | Recommended External Components .....           | 10          |
| <b>6</b>       | <b>Detailed Description .....</b>               | <b>11</b>   |
| 6.1            | Hardware Interfaces .....                       | 11          |
| 6.2            | Protocol Support.....                           | 11          |
| 6.3            | Flash Memory .....                              | 12          |
| 6.4            | Clocks and Synchronisation .....                | 12          |
| 6.5            | Power Supply Schemes .....                      | 12          |
| 6.6            | Boot Modes .....                                | 12          |
| <b>7</b>       | <b>Operation .....</b>                          | <b>13</b>   |
| 7.1            | Start-up .....                                  | 13          |
| 7.2            | Transmitter .....                               | 13          |
| 7.3            | Receiver .....                                  | 13          |
| 7.4            | LED Indicators .....                            | 13          |
| 7.5            | GNSS Support.....                               | 14          |
| 7.6            | NMEA Format .....                               | 14          |
| 7.7            | Software GUI Set-Up.....                        | 14          |
| <b>8</b>       | <b>Factory Settings and Alignment .....</b>     | <b>15</b>   |
| 8.1            | Commands Tab .....                              | 15          |
| 8.1.1          | Select / Exit BSH Test Modes .....              | 15          |
| 8.1.2          | Debug Modes.....                                | 15          |
| 8.1.3          | MMSI Programming.....                           | 15          |
| 8.2            | CMX Setup Tab .....                             | 15          |
| 8.2.1          | Tx Modulation Settings .....                    | 16          |
| 8.2.2          | Tx RF Power and Profile .....                   | 16          |
| 8.2.3          | Tx Carrier Frequency.....                       | 16          |
| 8.2.4          | Rx RSSI Settings.....                           | 16          |
| 8.2.5          | Default Channel Settings .....                  | 16          |
| 8.2.6          | Manufacturing Information .....                 | 16          |
| 8.2.7          | Activation Code / exactTrax Options .....       | 17          |
| 8.3            | Simulated GPRMC Tab .....                       | 17          |
| 8.4            | ACA Message Tab .....                           | 17          |
| <b>9</b>       | <b>Operational Settings .....</b>               | <b>18</b>   |
| 9.1            | Vessel Data Tab.....                            | 18          |
| 9.1.1          | Ship / Vessel Data .....                        | 18          |
| 9.1.2          | MMSI Settings.....                              | 18          |
| 9.1.3          | Reflash .....                                   | 18          |
| 9.1.4          | Options .....                                   | 18          |
| 9.2            | Received AIS Data Tab .....                     | 19          |
| 9.3            | Serial Messages Tab.....                        | 19          |
| 9.4            | GPS Tab .....                                   | 20          |
| <b>10</b>      | <b>Approvals .....</b>                          | <b>21</b>   |
| <b>11</b>      | <b>Packaging .....</b>                          | <b>72</b>   |

| <u>Table</u>                     | <u>Page</u> |
|----------------------------------|-------------|
| Table 1 Pin and Signal List..... | 7           |
| Table 2 Protocol Support .....   | 11          |

|                              |    |
|------------------------------|----|
| Table 3 LED Indicators ..... | 14 |
|------------------------------|----|

|                                                                        |             |
|------------------------------------------------------------------------|-------------|
| <u>Figure</u>                                                          | <u>Page</u> |
| Figure 1 Block Diagram .....                                           | 5           |
| Figure 2 SCT7033 Recommended External Components.....                  | 10          |
| Figure 3 Windows Device Manager COM Port Allocation .....              | 14          |
| Figure 4 COM Port Number .....                                         | 14          |
| Figure 5 Commands Tab .....                                            | 15          |
| Figure 6 CMX Setup Tab.....                                            | 16          |
| Figure 7 Simulated GPRMC Tab .....                                     | 17          |
| Figure 8 ACA Message Tab.....                                          | 17          |
| Figure 9 Vessel Data Tab.....                                          | 18          |
| Figure 10 Received AIS Data Tab .....                                  | 19          |
| Figure 11 Serial Messages Tab.....                                     | 19          |
| Figure 12 GPS Tab .....                                                | 20          |
| <b>Figure 13 – Configuration for Carrier-Sense threshold test.....</b> | <b>51</b>   |
| <b>Figure 14 – Regional area scenario.....</b>                         | <b>63</b>   |
| Figure 15 Mechanical Outline of 100LQFP .....                          | 72          |

### History

| Version | Changes                                         | Date           |
|---------|-------------------------------------------------|----------------|
| 3       | Updated GUI screen shots                        | December 2019  |
| 2       | All references to DE70322T changed to DE70322TC | October 2019   |
| 1       | First release, Advance Information              | September 2019 |

This is Advance Information; changes and additions may be made to this specification. Parameters marked TBD or left blank will be included in later issues. Items that are highlighted or greyed out should be ignored. These will be clarified in later issues of this document.

## 2 Block Diagram

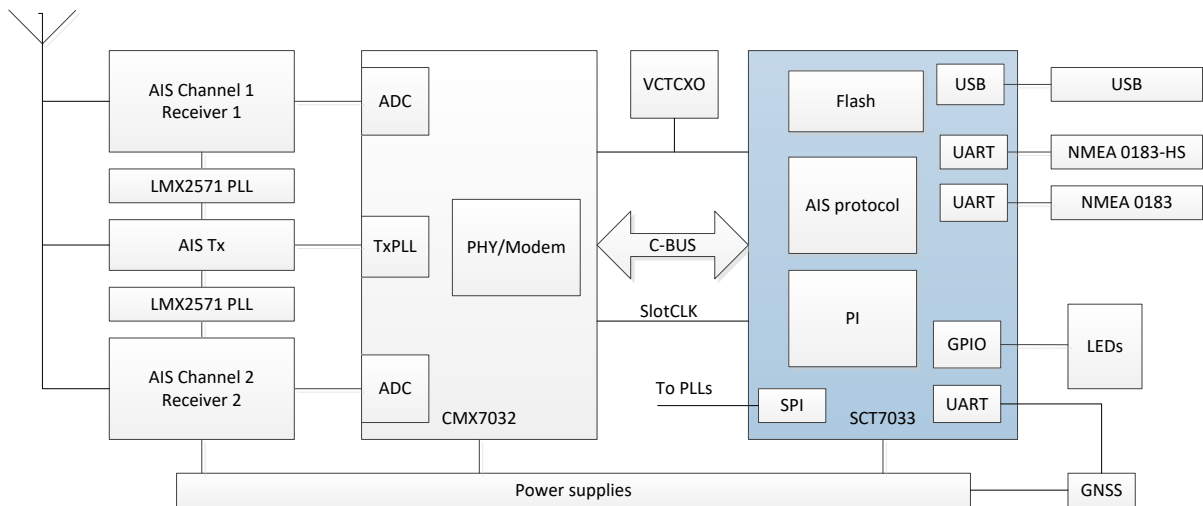


Figure 1 Block Diagram

### 3 Performance Specification

#### 3.1 Electrical Performance

##### 3.1.1 Absolute Maximum Ratings – typical figures

Exceeding these maximum ratings can result in damage to the device.

|                                                    | Min. | Max. | Unit |
|----------------------------------------------------|------|------|------|
| Supply: $DV_{DD} - DV_{SS}$                        | -0.3 | 4.0  | V    |
| $AV_{DD} - AV_{SS}$                                | -0.3 | 4.0  | V    |
| Voltage on any pin to $DV_{SS}$                    | -0.3 | 4.0  | V    |
| Voltage on any pin to $AV_{SS}$                    | -0.3 | 4.0  | V    |
| Current into or out of any power supply pin        |      | 100  | mA   |
| Total current into sum of all $DV_{DD}$ pins       |      | 160  | mA   |
| Current into or out of any I/O or control pin      |      | 25   | mA   |
| Total current into sum of all I/O and control pins |      | 120  | mA   |

| 100LQFP Package                                                     | Min. | Max. | Unit                   |
|---------------------------------------------------------------------|------|------|------------------------|
| Total Allowable Power Dissipation at $T_{AMB} = 25^{\circ}\text{C}$ | –    | 1300 | mW                     |
| ... Derating                                                        | –    | 27   | mW/ $^{\circ}\text{C}$ |
| Storage Temperature                                                 | -55  | +125 | $^{\circ}\text{C}$     |
| Operating Temperature                                               | -40  | +85  | $^{\circ}\text{C}$     |

##### 3.1.2 Operating Characteristics

For the following conditions unless otherwise specified:

Current consumption figures quoted in this section apply to the device when loaded with FI-3.x only. The use of other SCT7033 Function Images can modify the current consumption of the device.

| DC Parameters           | Notes | Min. | Typ. | Max. | Unit |
|-------------------------|-------|------|------|------|------|
| <b>Supply Current</b>   |       |      |      |      |      |
| <b>Operational Mode</b> |       |      |      |      |      |
| $DI_{DD}$               | 11    | –    | 62   | –    | mA   |
| $AI_{DD}$               |       | –    | 1.8  | –    | mA   |

**Notes:** 11  $T_{AMB} = 25^{\circ}\text{C}$ : measured on DE70322TC across L4, assumes GNSS unit takes 23 mA. Includes external pull-up/pull-down resistors.

| AC Parameters                  | Notes         | Min. | Typ. | Max.          | Unit |
|--------------------------------|---------------|------|------|---------------|------|
| <b>CLK Input</b>               |               |      |      |               |      |
| Frequency                      |               | –    | 19.2 | –             | MHz  |
| Duty cycle                     |               | 45   |      | 55            | %    |
| Input Impedance                |               |      |      |               |      |
| Capacitance                    |               | –    | 5    | –             | pF   |
| Start-up Time (from powersave) |               | –    | 20   | –             | ms   |
| Input pin hi level             | 0.7 $DV_{DD}$ |      | –    | $DV_{DD}$     |      |
| Input pin lo level             | $DV_{SS}$     |      | –    | 0.3 $DV_{DD}$ |      |
| High or low time               | 5             |      | –    | –             | ns   |
| Rise or fall time              | –             |      | –    | 10            | ns   |

## 4 Pin and Signal List

**Table 1 Pin and Signal List**

| SCT7033<br>LQFP100 | Pin Function  | Type | Description                                         |
|--------------------|---------------|------|-----------------------------------------------------|
| 1                  | LED_ERROR     | OP   | Active high                                         |
| 2                  | LED_CH2_GREEN | OP   | Active high                                         |
| 3                  | LED_CH1_RED   | OP   | Active high                                         |
| 4                  | LED_CH1_GREEN | OP   | Active high                                         |
| 5                  | Not used      |      |                                                     |
| 6                  | VBAT          | PWR  | Connect to DVDD via 10k                             |
| 7                  | Not used      |      |                                                     |
| 8                  | Not used      | IP   |                                                     |
| 9                  | Not used      | OP   |                                                     |
| 10                 | GND           | PWR  |                                                     |
| 11                 | +3.3          | PWR  |                                                     |
| 12                 | CLOCK         | IP   | 19.2 MHz Clock input                                |
| 13                 | Not used      | OP   |                                                     |
| 14                 | RESET         | IP   | Hold low during power-on, high for normal operation |
| 15                 | 7032_IRQN     | IP   | IRQ from CMX7032                                    |
| 16                 | GPS_1PPS      | IP   | 1PPS signal from GNSS unit                          |
| 17                 | Not used      |      |                                                     |
| 18                 | GPS_Ant_ok    | IP   | Input from GNSS antenna fault detector              |
| 19                 | +3.3          | PWR  |                                                     |
| 20                 | GND           | PWR  |                                                     |
| 21                 | VREFP         | PWR  | Connect to VDPA                                     |
| 22                 | VDPA          | PWR  | Connect to VREFP, decouple with 10u and 10n         |
| 23                 | Not used      |      |                                                     |
| 24                 | GPS_Enable    | OP   | Enable for GNSS unit                                |
| 25                 | GPS_UART2_Tx  | OP   | Tx connection from UART2 to GNSS unit               |
| 26                 | GPS_UART2_Rx  | IP   | Rx connection to UART2 from GNSS unit               |
| 27                 | GND           | PWR  |                                                     |
| 28                 | +3.3          | PWR  |                                                     |
| 29                 | 7032_CSN      | OP   | C-BUS connection from SPI1 to CMX7032               |
| 30                 | 7032_SCLK     | OP   | C-BUS connection from SPI1 to CMX7032               |
| 31                 | 7032_RDATA    | OP   | C-BUS connection from SPI1 to CMX7032               |
| 32                 | 7032_CDATA    | OP   | C-BUS connection from SPI1 to CMX7032               |
| 33                 | Tx_INHIBIT    | IP   | Low signal will inhibit AIS Transmit functionality  |
| 34                 | Not used      |      |                                                     |
| 35                 | 7032_SLOTCLK  | OP   | 37.5 Hz AIS Slot Clock to CMX7032                   |
| 36                 | Not connected |      |                                                     |
| 37                 | Not connected |      |                                                     |
| 38                 | Not used      |      |                                                     |
| 39                 | RF_PA_ON      | OP   | Enable for RF PA section for test                   |
| 40                 | RF_TXVCOEN    | OP   | Enable for RF Tx VCO section                        |
| 41                 | Not used      |      |                                                     |
| 42                 | Not used      |      |                                                     |
| 43                 | Not used      |      |                                                     |
| 44                 | Not used      |      |                                                     |
| 45                 | Not used      |      |                                                     |
| 46                 | Not used      |      |                                                     |
| 47                 | LOCKDET_RXB   | IP   | PLL Lock detect from LMX2571 on RXB                 |
| 48                 | VCAP1         | IP   | Connect to AVSS via 2.2uF                           |
| 49                 | GND           | PWR  |                                                     |
| 50                 | +3.3          | PWR  |                                                     |
| 51                 | LOCKDET_RXA   | IP   | PLL Lock detect from LMX2571 on RXA                 |

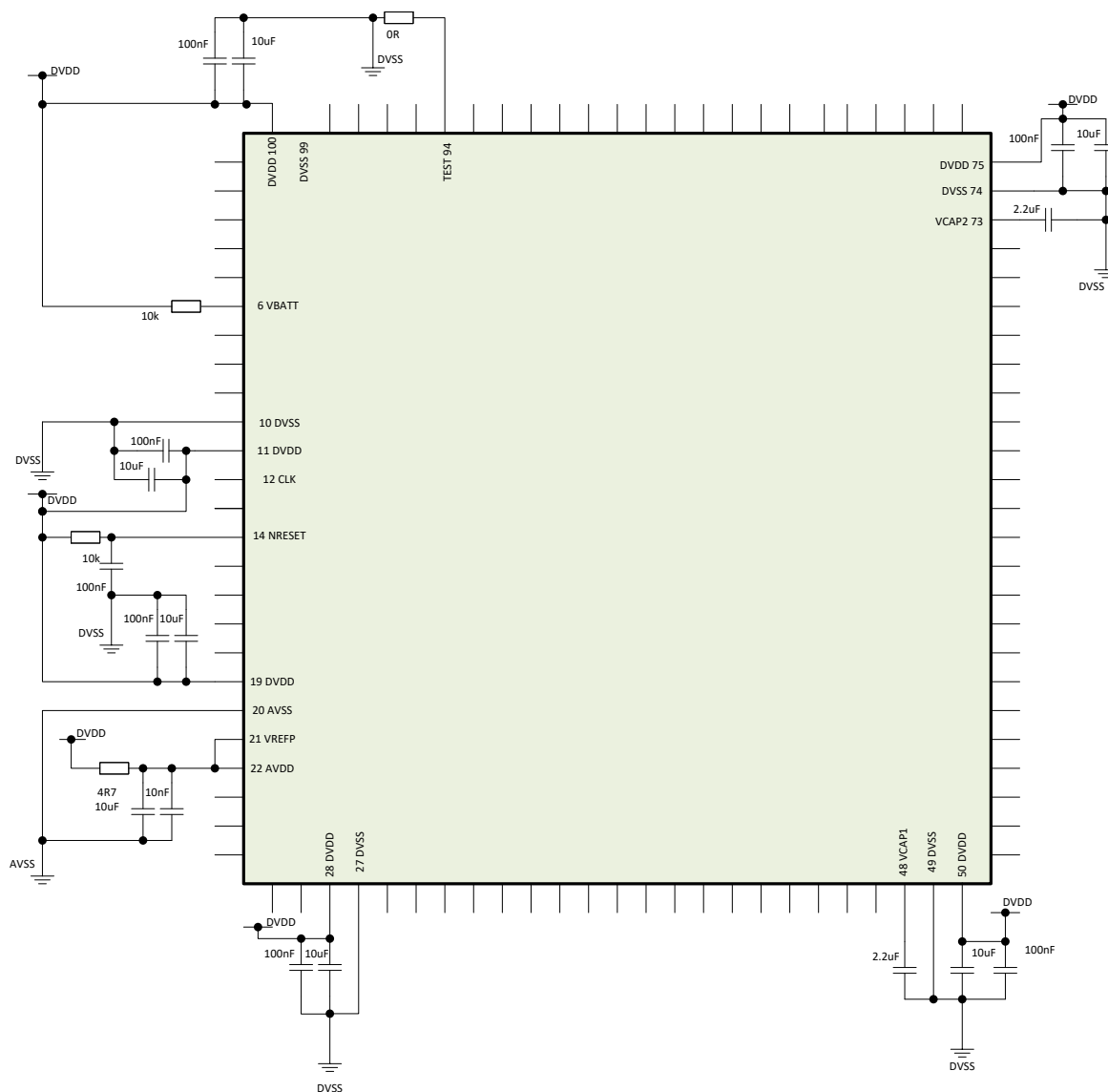
| <b>SCT7033<br/>LQFP100</b> | <b>Pin Function</b> | <b>Type</b> | <b>Description</b>                                  |
|----------------------------|---------------------|-------------|-----------------------------------------------------|
| 52                         | PLL_SCLK            | OP          | SPI2 SCLK to LMX2571's                              |
| 53                         | PLL_MISO            | IP          | SPI2 Data Input (not used)                          |
| 54                         | PLL_MOSI            | OP          | SPI2 Data output to LMX2571's                       |
| 55                         | Not used            |             |                                                     |
| 56                         | Not used            |             |                                                     |
| 57                         | USB_CON             | IP          | Input from USB detect circuit                       |
| 58                         | Not used            |             |                                                     |
| 59                         | Not used            |             |                                                     |
| 60                         | Not used            |             |                                                     |
| 61                         | Not used            |             |                                                     |
| 62                         | ALARM               | OP          | Output to indicate an alarm condition (active high) |
| 63                         | USART6_Tx           | OP          | 4800 8N1 GNSS output                                |
| 64                         | USART6_Rx           | IP          | 4800 8N1 GNSS input (used for test only)            |
| 65                         | Not used            |             |                                                     |
| 66                         | Not used            |             |                                                     |
| 67                         | USB_RESET           |             | USB Pull up / soft reset                            |
| 68                         | UART1_Tx_PI         | OP          | 38400 8N1 Presentation Interface UART               |
| 69                         | UART1_Rx_PI         | OP          | 38400 8N1 Presentation Interface UART               |
| 70                         | USB_DM              |             | USB Interface                                       |
| 71                         | USB_DP              |             | USB Interface                                       |
| 72                         | JTAG_JTMS_SWDIO     |             | Reserved for test                                   |
| 73                         | VCAP2               | IP          | Connect to AVSS via 2.2uF                           |
| 74                         | GND                 | PWR         |                                                     |
| 75                         | +3.3                | PWR         |                                                     |
| 76                         | JTAG_JTCK_SWCLK     |             | Reserved for test                                   |
| 77                         | JTAG_JTDI           |             | Reserved for test                                   |
| 78                         | Not used            |             |                                                     |
| 79                         | Not used            |             |                                                     |
| 80                         | Not used            |             |                                                     |
| 81                         | PLL_SSEL1           | OP          | SPI2 LMX2571 RxA CSN                                |
| 82                         | PLL_SSEL2           | OP          | SPI2 LMX2571 RxB CSN                                |
| 83                         | Not used            |             |                                                     |
| 84                         | Not used            |             |                                                     |
| 85                         | Not connected       |             |                                                     |
| 86                         | Not connected       |             |                                                     |
| 87                         | Not connected       |             |                                                     |
| 88                         | Not connected       |             |                                                     |
| 89                         | JTAG_JTDO_SWO       |             | Reserved for test                                   |
| 90                         | JTAG_JTRST          |             | Reserved for test                                   |
| 91                         | RxON                | OP          | Enable for RF Rx section                            |
| 92                         | Not Used            |             |                                                     |
| 93                         | Not used            |             |                                                     |
| 94                         | GND                 | IP          | Reserved for test, connect to VSS                   |
| 95                         | Not used            |             |                                                     |
| 96                         | Not used            |             |                                                     |
| 97                         | LED_CH2_RED         | OP          | Active high                                         |
| 98                         | LED_TX_TIMEOUT      | OP          | Active high                                         |
| 99                         | GND                 | PWR         |                                                     |
| 100                        | +3.3                | PWR         |                                                     |

---

|     |   |                                                        |
|-----|---|--------------------------------------------------------|
| IP  | = | Input (+ PU/PD = internal pullup / pulldown resistor)  |
| OP  | = | Output                                                 |
| PWR | = | Power Connection                                       |
| NC  | = | No Connection - should NOT be connected to any signal. |
| NU  | = | Not used in this implementation                        |

## 5 Component and PCB Recommendations

### 5.1 Recommended External Components



**Figure 2 SCT7033 Recommended External Components**

Resistors  $\pm 5\%$ , capacitors and inductors  $\pm 20\%$  unless otherwise stated.

#### Notes:

The decoupling capacitors should be as close as possible to the device. Use of a multi-layer printed circuit board will facilitate the provision of ground planes on separate layers. The DE70322TC can be used as an example of a suitable pcb layout.

## 6 Detailed Description

The SCT7033 implements a full Class B CSTDMA protocol stack compliant with IEC 62287-1 and ITU-R M.1371-5 international standards for non-SOLAS vessels. The core protocol is designed specifically to operate with the CMX7032 baseband AIS processor using Function Image 3.0.0.9 or later, uBlox M8M GNSS receiver and LMX2571 PLL/VCO devices as implemented on the DE70322TC evaluation pcb. All references in this document refer to this implementation.

### 6.1 Hardware Interfaces

The SCT7033 interfaces with:

- AIS Baseband processor      CMX7032    C-BUS/SPI1
- RxChannel A Synthesiser      LMX2571    SPI2
- RxChannel B Synthesiser      LMX2571    SPI2
- GNSS receiver                  uBlox M8M    UART2 (9600 8N1)
- Presentation Interface          USB or UART1 (38400 8N1)
- GNSS pass-through              UART6 (4800 8N1)
- LED indicators
  - ChanA/B Rx/Tx/DSC (dual colour)
  - Error
  - TxTimeout
- RF controls                      Enables for Rx, TxVCO and GNSS
- Digital Outputs                  Alarm output
- Digital Inputs                    Tx Inhibit

In order to operate, the SCT7033 requires:

- Power Supply: 3.3 V dc
- 19.2 MHz clock input (derived from common 38.4 MHz VCTCXO on DE70322TC)
- Reset - held low at power on (an RC network is sufficient)

The USB port implements device-mode only and is used for factory set-up and initial configuration of the device in conjunction with the ES70322TC GUI software available from the CML Technical Portal. It functions as the Presentation Interface whilst connected. If no USB connection is detected, the Presentation Interface will use UART1 instead.

### 6.2 Protocol Support

The SCT7033 supports all mandatory functions required by IEC 62287-1 edition 3 and ITU-R M.1371-5:

**Table 2 Protocol Support**

|    | Name of message                       | 1371-5 Annex 8 | Receive & process | Transmit | Remark                                    |
|----|---------------------------------------|----------------|-------------------|----------|-------------------------------------------|
| 0  | Undefined                             |                | No                | No       | Ignored by CMX7032                        |
| 1  | Position report (Scheduled)           | § 3.1          | Yes               | No       | Optional in 1371-5                        |
| 2  | Position report (Assigned)            | § 3.1          | Yes               | No       | Optional in 1371-5                        |
| 3  | Position report (When interrogated)   | § 3.1          | Yes               | No       | Optional in 1371-5                        |
| 4  | Base station report                   | § 3.2          | Yes               | No       | Class B "CS" should obey the 120 NM rule. |
| 5  | Static and voyage related data        | § 3.3          | Yes               | No       | Optional in 1371-5                        |
| 6  | Addressed binary message              | § 3.4          | No                | No       |                                           |
| 7  | Binary acknowledge                    | § 3.5          | No                | No       |                                           |
| 8  | Binary broadcast message              | § 3.6          | Yes               | No       | Optional in 1371-5                        |
| 9  | Standard SAR aircraft position report | § 3.7          | Yes               | No       | Optional in 1371-5                        |
| 10 | UTC and date inquiry                  | § 3.8          | No                | No       |                                           |
| 11 | UTC/Date response                     | § 3.2          | Yes               | No       | Optional in 1371-5                        |

|    |                                                     |        |          |          |                                                                                   |
|----|-----------------------------------------------------|--------|----------|----------|-----------------------------------------------------------------------------------|
| 12 | Safety related addressed message                    | § 3.10 | Yes      | No       | Information can also be transferred via Message 14                                |
| 13 | Safety related acknowledge                          | § 3.5  | No       | Optional | Should be transmitted if the option to process Message 12 is implemented          |
| 14 | Safety related broadcast message                    | § 3.12 | Yes      | Optional | Transmit with predefined text only, see § 4.3.3.7                                 |
| 15 | Interrogation                                       | § 3.13 | Yes      | No       | respond to interrogations for Msg 18 and 24.                                      |
| 16 | Assigned mode command                               | § 3.21 | No       | No       | Msg 23 is applicable to the "CS"                                                  |
| 17 | DGNSS broadcast binary message                      | § 3.15 | Yes      | No       |                                                                                   |
| 18 | Standard Class B equipment position report          | § 3.16 | Yes      | Yes      | A Class B "CS" AIS should indicate "1" for "CS" in flag bit 143                   |
| 19 | Extended Class B position report                    | § 3.17 | Optional | Yes      | Transmit ONLY as response on base station interrogation                           |
| 20 | Data link management message                        | § 3.18 | Yes      | No       | Message 4 should be received and evaluated for the 120 NM rule before responding. |
| 21 | Aids-to-navigation report                           | § 3.19 | Yes      | No       | Optional in 1371-5                                                                |
| 22 | Channel management message                          | § 3.20 | Yes      | No       | The 120 NM rule does not apply                                                    |
| 23 | Group assignment                                    | § 3.21 | Yes      | No       | Message 4 should be received and evaluated for the 120 NM rule before responding. |
| 24 | Class B "CS" static data                            | § 3.22 | Yes      | Yes      | Part A and Part B                                                                 |
| 25 | Single slot binary message                          | § 3.23 | Yes      | No       | Optional in 1371-5                                                                |
| 26 | Mult. slot binary message with Communications State | § 3.24 | Yes      | No       |                                                                                   |
| 27 | Position report for long-range applications         | § 3.25 | No       | No       |                                                                                   |
|    | Undefined                                           | None   | No       | No       | Reserved for future use                                                           |

### 6.3 Flash Memory

The SCT7033 provides 512 kB of built-in flash memory which is split up into separate pages. It is delivered with Protocol Stack and CMX7032 Function Image for a Class-B CSTDMA AIS unit already programmed in. Space in the flash is reserved for configuration and calibration data.

### 6.4 Clocks and Synchronisation

On reset, the 16 MHz internal RC oscillator is selected as the default CPU clock. Following the successful boot from the internal Flash memory, the external 19.2 MHz clock is selected and the internal PLL set to produce the maximum CPU clock speed of 96 MHz.

The AIS system requires all transmissions to be aligned to UTC. On the SCT7033 this is achieved by using the 1 pps signal from the uBlox M8 GNSS device, with reference to the data in the accompanying data stream to ensure that the 37.5 Hz SlotCLK signal is correctly aligned to the minute boundary. If the GNSS signal is lost, then the time-of-arrival of AIS messages from other stations is used to estimate the correct timing.

### 6.5 Power Supply Schemes

DVDD = 3.0 to 3.6 V (3.3 typical)

AVDD = 3.0 to 3.6 V: external analogue power supplies for Reset blocks, RCs and PLL. DVDD and VSSA must be decoupled to VDD and VSS, respectively.

VBAT = 1.65 to 3.6 V: power supply for RTC, external clock 32 kHz oscillator and backup registers (through power switch) when DVDD is not present.

### 6.6 Boot Modes

At startup, the device will automatically boot from the internal flash. Re-programming can only be performed using the built in bootloader. It is not possible to read the executable code out of the Flash memory. The bootloader can be invoked from the GUI, and new firmware downloaded into flash.

## 7 Operation

### 7.1 Start-up

On startup, the SCT7033 implements an embedded RTOS which will load the CMX7032 with its Function Image and initialise it with the appropriate data (for Tx PLL, RF PA ramp profile, Tx Timing tables etc) for use on the DE70322TC. It will then read the calibration and configuration data from the Flash and load the data into the external devices and internal memory as appropriate. It will then initialise the GNSS module and perform a Built-In-Self-Test to ensure that all devices are performing normally. If this is not the case, then the ERROR LED will be activated and an Alarm message sent over the Presentation Interface (PI).

The SCT7033 will output a 37.5 Hz SLOTCLK to allow the CMX7032 to synchronise to the AIS messages by analysing both the 1PPS signal from the GNSS device in conjunction with the timing data provided over UART2 to compensate for differences between UTC and GPS time. It is essential that the unit be power-cycled after every change in UTC leap second (usually 1<sup>st</sup> January) to ensure continued synchronisation to other units on the AIS system. If a valid UTC signal cannot be detected, then the SCT7033 will attempt to synchronise with other AIS traffic heard over the AIS channels as defined in IEC 62287-1. Note that the initial cold start GNSS time to first fix requires an unobstructed view of the satellites for long enough to allow the almanac data to be downloaded – this may take up to 15 minutes.

On the DE70322TC, a battery back-up is provided to save this data so that subsequent cold starts should take approximately 28s. See the uBlox datasheet for further information.

The SCT7033 will monitor the RSSI levels on the RF channels for the first minute to establish the current CS-Threshold level and allow the GNSS unit to achieve a fix. After this period it will, by default, transmit msg18 at either 30s or 3 minute intervals (depending on the current value of SOG from the GNSS) and msg24a and ms24b at the appropriate times according to the protocol in ITU-R M.1371-5. These values can be affected by the reception of msg22 and msg23 transmitted by a “competent authority” according to the protocol described in ITU-R M.1371-5.

### 7.2 Transmitter

The AIS transmit data packet is generated from the data held in the configuration memory and the position/speed/time data provided by the GNSS unit, assembled into the appropriate AIS message 18, 24a or 24b and provided to the CMX7032 baseband processor at the appropriate time over the C-BUS interface. The CMX7032 will then transmit this data in AIS format following the next slot clock edge based on the CS-TDMA protocol. If the transmission attempt fails due to the CS mechanism, then the TxTimeout LED will be activated and an Alarm message sent over the PI. The SCT7033 also programs the CMX7032 TX PLL to the correct frequency for the AIS transmission and provides the correct timing and PA ramping profiles(s) to suit the CMX902 RF Power Amplifier.

The Tx\_VCO\_ENABLE line is activated 10ms before the slot edge for the intended transmission occurs, to allow time for the Tx PLL and VCO implemented in the CMX7032 to lock to the correct frequency. The remaining Tx control signals are implemented by the CMX7032.

exactTrax operation is available if the appropriate activation code / manufacturer ID is used and enabled. The SCT7033 will automatically defer any CS transmissions if the CMX7032 / CMX7042 is actively transmitting an exactTrax message. exactTrax message generation and timing is executed within the CMX7032 / CMX7042 device (see the CML datasheet for details) by using the information in the msg18s generated by the SCT7033.

### 7.3 Receiver

The SCT7033 programs the LMX2571 PLL devices to the appropriate frequencies for AIS1 and AIS2 (161.975 MHz and 162.025 MHz by default). AIS data received by the CMX7032 is transferred to the SCT7033 over the C-BUS interface and formatted into the appropriate NMEA 0183-HS data string and presented to either the serial UART or the USB port. The CMX7032 can assert an IRQ line to the SCT7033 to indicate that it has data available. In addition, the channel management messages received from a base station will be acted on appropriately to change the operation characteristics of the device as defined in IEC 62287-1 edition 2 (RF power, reporting rate, RF channel frequency etc). It is also possible to enter channel management data over the UART or USB ports from a validated source.

If enabled, the SCT7033 will command the CMX7032 to change to DSC receive mode at the appropriate times and implement any channel management commands as appropriate. Whilst the SCT7033 is in DSC Rx mode, the LED for the appropriate channel will be activated.

### 7.4 LED Indicators

The function of the LED indicators is shown in the following table (Dx references correspond with the implementation on the DE70322TC).

**Table 3 LED Indicators**

| LED          | Colour | Function                                                             |
|--------------|--------|----------------------------------------------------------------------|
| D2 - CH2_LED | Red    | Indicates channel A is in DSC Rx mode                                |
|              | Green  | Indicates successful reception of a packet on channel A              |
|              | Amber  | Indicates a transmission on channel A.                               |
| D3 - CH1_LED | Red    | Indicates channel B is in DSC Rx mode                                |
|              | Green  | Indicates successful reception of a packet on channel B              |
|              | Amber  | Indicates a transmission on channel B                                |
| D4 - ERROR   | Amber  | This is lit if an error occurs                                       |
| D5 - TX_TOUT | Amber  | This is lit if the transmitter times out or a CSTDMA Tx is deferred. |

## 7.5 GNSS Support

The SCT7033 is designed to support the uBlox M8M module. This defaults to GPS + GLONASS with SBAS enabled. The module can also be ordered from the manufacturer to default to GPS + Beidou for use in China. Note that the NMEA output strings will use the appropriate identifier depending on which system is in use - \$GN, \$GP, \$GL, \$GB.

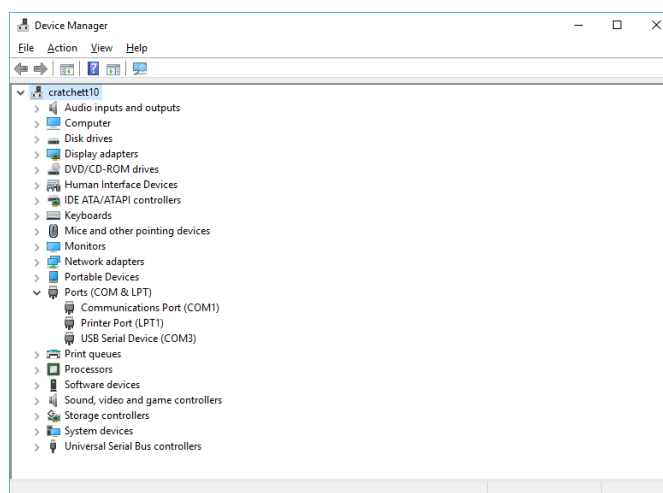
Note that DGNSS support using msg 17 is available on the Presentation Interface, but is not automatically applied to the M8M module as this will automatically disable SBAS operation. See the uBlox datasheet and programming manuals for further details.

## 7.6 NMEA Format

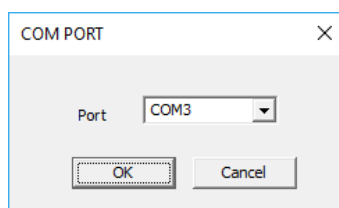
The SCT7033 supports NMEA-0183-HS which uses 38400 baud. Multi-sentence messages are supported.

## 7.7 Software GUI Set-Up

The SCT7033 is designed to use the built-in USB port to connect with the ES70322TC GUI software which provides configuration and control features. Installation of device drivers is similar to the procedure for the CML PE0003 Universal Interface Card. If running on Windows 10, the drivers will install automatically without the prompt for driver signing. Open the Windows Device Manager as shown in Figure 3.

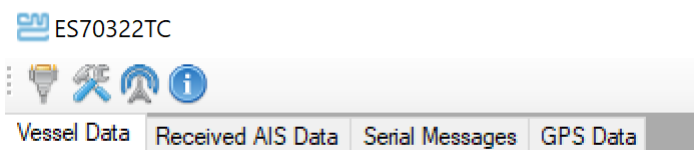
**Figure 3 Windows Device Manager COM Port Allocation**

Click on the Ports (COM & LPT) entry and note the COM port allocated to the device. Start the GUI by clicking on the icon. The COM Port Number dialogue shown in Figure 4 will be displayed. Select the allocated COM port and click OK.

**Figure 4 COM Port Number**

## 8 Factory Settings and Alignment

For DE70322TC-style designs, a number of variables need to be set to ensure the correct operation of the system. These are made available on the “Commands” and “CMX setup” screens of the ES70322TC GUI. They are accessed by selecting the “settings” icon in the menu bar. This option should not be made available outside of the factory environment. This tab is enabled by invoking the ES70322TC GUI with the command line argument “ /factory”.



To aid test and alignment, a number of test modes can be implemented through these pages. Additional test modes are provided to facilitate approvals testing to IEC 62287-1 only, which should not be required in normal use.

### 8.1 Commands Tab

This enables various test and debug modes that can be used during development or testing. They should not be used outside of a lab / factory environment.

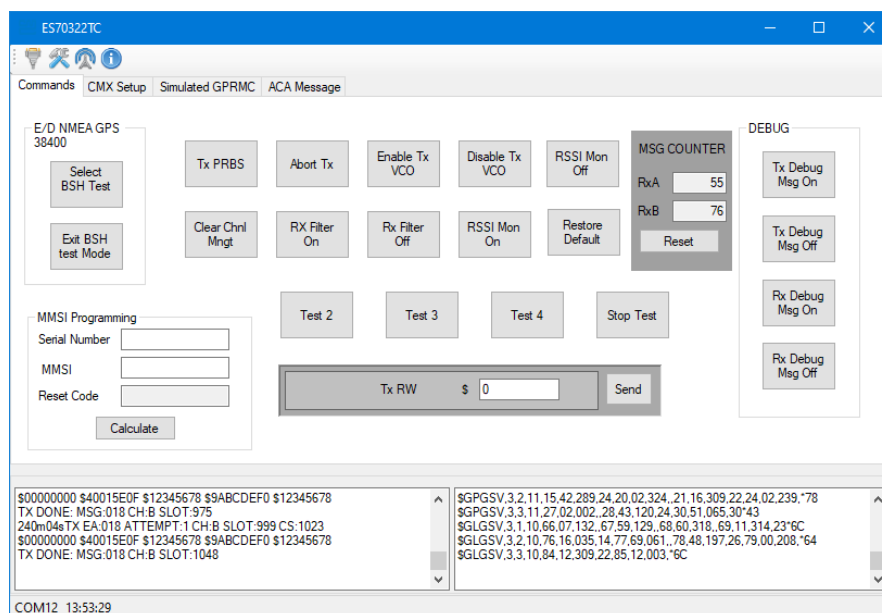


Figure 5 Commands Tab

#### 8.1.1 Select / Exit BSH Test Modes

When enabled, allows GNSS data to be fed externally via the PI instead of the internal GNSS unit. This is required for type approvals process.

#### 8.1.2 Debug Modes

Selection of these features enables the selected messages to appear in the debug window so that they are easier to be seen.

#### 8.1.3 MMSI Programming

Entering the Serial Number and the current MMSI here will generate a reset code that the dealer can use to reset the MMSI of units in the field using the Operational Settings page.

### 8.2 CMX Setup Tab

The CMX7032 and its associated circuits require alignment to ensure that the AIS messages are transmitted and received correctly. The datasheets for the CMX7032/CMX7042 and DE70322TC provide details on the tests and methods.

The current settings can be recalled from the flash memory of the SCT7033 using the “Read MFG Data” key and should be saved, when finally adjusted, by the “Update Mfg Data” key.

Figure 6 CMX Setup Tab

#### 8.2.1 Tx Modulation Settings

Use “Tx RW” (repeated word) with data 0x00FF and adjust “Tx ModLevel1” and “TxModLevel2” for “flattest” signal on the transmitted waveform.

#### 8.2.2 Tx RF Power and Profile

Generate an Excel .csv file with the required values of the RAMDAC table and load into the SCT7033 using the “Send RAMDAC Table” button. Values should be in hexadecimal with no prefix.

#### 8.2.3 Tx Carrier Frequency

Use “Tx RW” (repeated word) with data 0x5555 and adjust “OscRef” to centre the RF frequency on channel. This adjusts the output level on DAC2 of the CMX7032.

#### 8.2.4 Rx RSSI Settings

The Carrier-Sensing operation relies on the RSSI levels being aligned with the characteristics of the chosen IF components and Limiter/Discriminator circuits. These default to the settings used on the DE70322TC but can be adjusted to take account of component or design variations.

The RSSI profile can be loaded using an Excel .csv file using the “Send RSSI Table”. Values should be in hexadecimal with no prefix.

The RSSI level at -77dBm level can be set by the “RSSI77dB” keys. This can be set per-channel, in case the gains are different.

#### 8.2.5 Default Channel Settings

These should be set to 2087 and 2088 to correspond to the internationally agreed AIS1 and AIS2 channels. In exceptional circumstances, and only with the permission of the local regulatory authority, these can be changed using the “Ais1ChDefault” and “Ais2ChanDefault” keys. Possible uses for this may include test and installation when it is desired to transmit without disturbing or participating in the operational AIS network.

#### 8.2.6 Manufacturing Information

The fields for “Vendor ID”, “Part Number” and “Hardware Version” may be set by the equipment manufacturer as appropriate. Note the format shown in ITU-R M.1371-5:

Manufacturers ID: Three 6-bit ASCII characters

Unit Model Code: 4-bit binary field

Unit Serial Number: 20-bit hexadecimal field

### 8.2.7 Activation Code / exactTrax Options

The activation code allocated by CML / ExactEarth should be entered here to enable exactTrax operation. The exactTrax Manufacturers ID will be displayed as confirmation on the “Operational Settings / Vessel Data” tab. The default activation code supplied (\$0x0E28 0x2FBF) will disable all exactTrax modes and report manufactures id \$01. Once enabled, exactTrax operation can be started/stopped via the “Operational Settings / Vessel Data” tab.

### 8.3 Simulated GPRMC Tab

This page can be used to generate specific GNSS data for test and debug, used with “BSH Test” modes in the command tab.

Figure 7 Simulated GPRMC Tab

### 8.4 ACA Message Tab

This page can be used to generate specific ACA sentences for test and debug.

Figure 8 ACA Message Tab

## 9 Operational Settings

Before the unit can be used on an active AIS network a number of operational settings must be programmed from the “evaluation” icon in the ES70322TC menu bar. The principal one is the MMSI which must be programmed to an appropriate value before the unit will transmit. The unit will not transmit if the MMSI is 000 000 000, in which case the TX Error LED will become active after a short timeout. Note that it is a requirement in ITU-R M.1371-5 that the end user should NOT be able to re-program the MMSI once it has been set without reference to the manufacturer.

### 9.1 Vessel Data Tab

The current settings can be recalled from the flash memory using the “Read AIS” button and the new values saved into flash using the “Update AIS” button whenever they are changed.

All settings should be set appropriately to the installation / vessel to ensure that the AIS network performs correctly. Any incorrect values in these fields could cause misleading information to be presented to other AIS users in the network. It should be noted that some regulatory bodies monitor AIS transmissions for incorrect data and have been known to impose fines or restrictions on vessels found to be transmitting erroneous data.

Figure 9 Vessel Data Tab

#### 9.1.1 Ship / Vessel Data

The values for “Ships Name”, “Call Sign” and “Ship Dimensions” should be set appropriately.

“Vessel Type” should be set according to the table in ITU-R M.1371-5. For most pleasure / leisure craft this would be 36 or 37.

#### 9.1.2 MMSI Settings

The MMSI should be entered here – it can only be updated if the existing MMSI is zero. The dealer can supply the serial number and current MMSI value to the manufacturer from this page, who can then generate a reset code which can be entered on this page to reset the MMSI back to 000-000-000. The dealer can then re-program the MMSI to the correct value.

#### 9.1.3 Reflash

Allows the firmware in the SCT7033 to be updated from the file provided by the manufacturer. The default SCT7033 firmware is available on the CML Technical Portal.

#### 9.1.4 Options

“Has display” should be set if the SCT7033 is connected to a display. This state is reflected in the msg18 data “Class B display flag” bit.

“Disable TX” inhibits transmit operation for use where the DE70322TC does not have a Transmit Power supply or where Rx-only operation is desired.

“DSC monitoring” enables the DSC monitoring protocol as defined in IEC 62287-1.

“exactTrax Tx” enables exactTrax mode if it is available (specific activation codes are required for this feature).



## 9.4 GPS Tab

Displays the current status of the GNSS module.

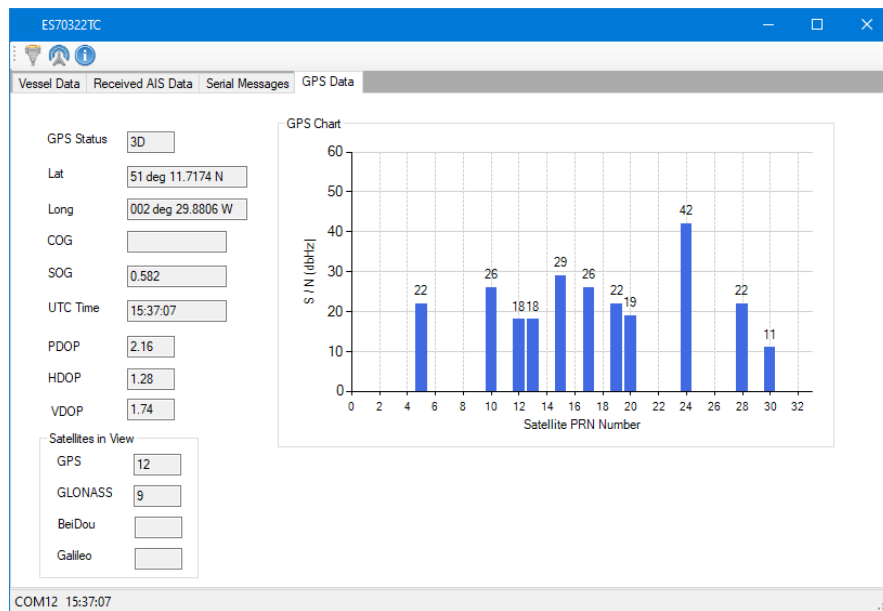


Figure 12 GPS Tab

## 10 Approvals

The protocol used in the SCT7033 has previously been used on AIS units that have been successfully tested to IEC 62287-1 and was approved for use in the EU, USA and elsewhere. In this product, it has been further developed to incorporate the latest version of the appropriate standards, ported to the SCT7033 processor architecture and supports the DE70322TC hardware design. Manufacturers are responsible for the final approvals of units that incorporate the SCT7033 and approval from the local regulatory authority should be obtained before deploying on an active AIS network. The test report from the independent test house for the original release is included below for information only.

## Test of Class-B CS Protocol Stack

This is summary of the Test Results performed by an external accredited test house on the software used as the basis for the SCT7033 Class-B CS Protocol Engine. There should be no significant differences between this report and the current release of the SCT7033.

### Summary

| Test No. | Reference | Section                            | Result<br>(passed/ not<br>passed / not<br>applicable / not<br>tested) |
|----------|-----------|------------------------------------|-----------------------------------------------------------------------|
| 2        | IEC 62287 | 10 Operational tests               | pass                                                                  |
| 3        | IEC 62287 | 11 Physical tests                  | Not included                                                          |
| 4        | IEC 62287 | 12 Specific tests of link layer    | pass                                                                  |
| 5        | IEC 62287 | 13 Specific tests of network layer | pass                                                                  |
| 6        | IEC 62287 | C.3 DSC functionality tests        | pass                                                                  |

### Remarks:

**Compass Safe Distance cannot be tested until production enclosure is available.**

|          |                                                 |           |
|----------|-------------------------------------------------|-----------|
| <b>0</b> | <b>Introduction .....</b>                       | <b>ii</b> |
| <b>1</b> | <b>Brief Description .....</b>                  | <b>1</b>  |
| <b>2</b> | <b>Block Diagram.....</b>                       | <b>5</b>  |
| <b>3</b> | <b>Performance Specification .....</b>          | <b>6</b>  |
| 3.1      | Electrical Performance.....                     | 6         |
| 3.1.1    | Absolute Maximum Ratings – typical figures..... | 6         |
| 3.1.2    | Operating Characteristics .....                 | 6         |
| <b>4</b> | <b>Pin and Signal List .....</b>                | <b>7</b>  |
| <b>5</b> | <b>Component and PCB Recommendations .....</b>  | <b>10</b> |
| 5.1      | Recommended External Components .....           | 10        |
| <b>6</b> | <b>Detailed Description .....</b>               | <b>11</b> |
| 6.1      | Hardware Interfaces .....                       | 11        |
| 6.2      | Protocol Support.....                           | 11        |
| 6.3      | Flash Memory .....                              | 12        |
| 6.4      | Clocks and Synchronisation .....                | 12        |
| 6.5      | Power Supply Schemes .....                      | 12        |
| 6.6      | Boot Modes .....                                | 12        |
| <b>7</b> | <b>Operation .....</b>                          | <b>13</b> |
| 7.1      | Start-up 13                                     |           |
| 7.2      | Transmitter .....                               | 13        |
| 7.3      | Receiver 13                                     |           |
| 7.4      | LED Indicators .....                            | 13        |

|           |                                             |           |
|-----------|---------------------------------------------|-----------|
| 7.5       | GNSS Support.....                           | 14        |
| 7.6       | NMEA Format .....                           | 14        |
| 7.7       | Software GUI Set-Up.....                    | 14        |
| <b>8</b>  | <b>Factory Settings and Alignment .....</b> | <b>15</b> |
| 8.1       | Commands Tab .....                          | 15        |
| 8.1.1     | Select / Exit BSH Test Modes .....          | 15        |
| 8.1.2     | Debug Modes.....                            | 15        |
| 8.1.3     | MMSI Programming.....                       | 15        |
| 8.2       | CMX Setup Tab .....                         | 15        |
| 8.2.1     | Tx Modulation Settings .....                | 16        |
| 8.2.2     | Tx RF Power and Profile .....               | 16        |
| 8.2.3     | Tx Carrier Frequency.....                   | 16        |
| 8.2.4     | Rx RSSI Settings.....                       | 16        |
| 8.2.5     | Default Channel Settings .....              | 16        |
| 8.2.6     | Manufacturing Information .....             | 16        |
| 8.2.7     | Activation Code / exactTrax Options .....   | 17        |
| 8.3       | Simulated GPRMC Tab .....                   | 17        |
| 8.4       | ACA Message Tab .....                       | 17        |
| <b>9</b>  | <b>Operational Settings .....</b>           | <b>18</b> |
| 9.1       | Vessel Data Tab.....                        | 18        |
| 9.1.1     | Ship / Vessel Data .....                    | 18        |
| 9.1.2     | MMSI Settings.....                          | 18        |
| 9.1.3     | Reflash 18                                  |           |
| 9.1.4     | Options 18                                  |           |
| 9.2       | Received AIS Data Tab .....                 | 19        |
| 9.3       | Serial Messages Tab.....                    | 19        |
| 9.4       | GPS Tab 20                                  |           |
| <b>10</b> | <b>Approvals .....</b>                      | <b>21</b> |
| <b>11</b> | <b>Packaging .....</b>                      | <b>72</b> |
| <b>12</b> | <b>Development.....</b>                     | <b>1</b>  |
| 12.1      | Security 1                                  |           |
| 12.2      | Code release and Programming.....           | 1         |
| 12.3      | Pin and Signal List .....                   | 1         |
| 12.4      | Customer Specific Features .....            | 3         |
| 12.5      | Test Facilities .....                       | 3         |

- **General information**

- **Composition**

**Display**

☐ Internal ☐ Remote ☒ not available

**DSC**

☐ Dedicated DSC Rx ☒ Time sharing with TDMA Rx

**RF Band ability**

☒ Only upper band ☐ upper and lower band can be used

**Channel management by msg 22**

☒ Msg 22 implemented ☐ Only AIS 1 and AIS 2 can be used

**Serial Interface**

☒ Available ☐ Not available

|                               |              |
|-------------------------------|--------------|
| Standard of serial interface: | RS232, RS422 |
|-------------------------------|--------------|

If not available, a serial test interface is required

**Sync signal for Carrier sense test**

Required for testing

| Parameters |          |
|------------|----------|
| Polarity:  | positive |
| Level      | 3 V      |

## • 4. General requirements

### • 4.2 Manuals

The manuals shall include:

- the type of external connectors if applicable;
- the required information for correct siting of the antennas;
- the required information for compass safe distance.

| Test details – Requirements of IEC 62287 |                                                                      |                          |        |
|------------------------------------------|----------------------------------------------------------------------|--------------------------|--------|
| Test item                                | Check                                                                | Remark                   | Result |
| Type of external Connectors              | Check that type of external connectors is included                   | Manual not yet available | N/T    |
| Siting of antennas                       | Check that information about siting the GPS antenna is included      |                          | N/T    |
|                                          | Check that information about siting the VHF antenna is included      |                          | N/T    |
| Compass safety distance                  | Check that information about the compass safety distance is included |                          | N/T    |

### • 4.3 Marking and identification

Each unit of the equipment shall be marked externally with the following information which, where practicable, shall be clearly visible when the equipment is installed in its recommended position:

- identification of the manufacturer;
- equipment type number or model identification;
- serial number of the unit;
- power supply requirements; and
- compass safe distance.

Alternatively, the marking may be presented on a display at equipment start-up.

The version of software shall be either marked or displayed on command on the equipment.

When the marking and the title and version of the software are presented only on the display, such information shall also be included in the equipment manual.

| Test details – Marking and identification |                                                                                                  |                                                                         |        |
|-------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------|
| Test item                                 | Check                                                                                            | Remark                                                                  | Result |
| Type of marking and identification        | Check if the equipment is marked                                                                 |                                                                         | Ok     |
|                                           | Check if the marking and identification is shown on a display                                    | No display                                                              | N/A    |
| Marking items                             | Check that the Identification of the manufacturer is available                                   |                                                                         | Ok     |
|                                           | Check that the equipment type number or model identification is available                        |                                                                         | Ok     |
|                                           | Check that the serial number of the unit is available                                            |                                                                         | Ok     |
|                                           | Check that power supply requirements information is available                                    |                                                                         | Ok     |
|                                           | Check that the compass safety distance is available                                              | Missing<br>The CSD measurement will be performed after this test phase. | Nok    |
| Software version                          | Check that the software version is displayed                                                     |                                                                         | Ok     |
|                                           | Note if the software version is displayed on the equipment or on the display                     | On the equipment<br>It is also available                                | Ok     |
|                                           | If displayed only on the display: check that the software version is also included in the manual |                                                                         | N/A    |



- **10 Operational tests**

- **10.2 Modes of operating**

(see 4.1.5)

- **10.2.1 Autonomous mode**

(see 4.1.5.1)

- **10.2.1.1 Transmit Position reports**

- **10.2.1.1.1 Method of measurement**

Set up standard test environment. Record the VDL communication and check for messages transmitted by the EUT.

- **10.2.1.1.2 Required results**

Confirm that the EUT transmits Messages 18 and 24 following the nominal schedule and alternates between channel A and channel B.

| Test details – Transmission of Position reports |                                                      |        |        |
|-------------------------------------------------|------------------------------------------------------|--------|--------|
| Test item                                       | Check                                                | Remark | Result |
| Set up standard test environment                |                                                      |        |        |
| Msg 18                                          | Check that message 18 is transmitted continuously    |        | Ok     |
|                                                 | Check the transmission schedule of msg 18            |        | Ok     |
|                                                 | Check that msg 18 alternates between channel A and B |        | Ok     |
| Msg 24                                          | Check that message 24 is transmitted continuously    |        | Ok     |
|                                                 | Check that msg 24 part A and B are transmitted.      |        | Ok     |
|                                                 | Check the transmission schedule of msg 24            |        | Ok     |
|                                                 | Check that msg 24 alternates between channel A and B |        | Ok     |

- **10.2.1.2 Receive Class A position reports**

- **10.2.1.2.1 Method of measurement**

Set up standard test environment.

Switch on test targets, then start operation of the EUT.

Start operation of the EUT, then switch on test targets.

Transmit test targets using same time periods on channel A and channel B.

Check the VDL communication, test output, and where provided, display or external interface of the EUT.

- **10.2.1.2.2 Required results**

Confirm that EUT receives continuously under conditions 10.2.1.2.1 a), b) and c) and, where provided, outputs the received messages on the external interface or display.

| Test details a)– Receive Position reports, Target started first                                                        |                                                           |                                   |        |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------|--------|
| Test item                                                                                                              | Check                                                     | Remark                            | Result |
| Switch on Test targets, then start operation of the EUT<br>Check the following items on external interface and display |                                                           |                                   |        |
| Check for continues receiving                                                                                          | On test output                                            | Not implemented                   | N/A    |
|                                                                                                                        | On external interface                                     |                                   | Ok     |
|                                                                                                                        | On display                                                | If implemented<br>Not implemented | N/A    |
| Channels                                                                                                               | Check that the position reports are received on channel A |                                   | Ok     |
|                                                                                                                        | Check that the position reports are received on channel B |                                   | Ok     |

| Test details a)– Receive Position reports, EUT started first                                          |                                                           |                                   |        |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------|--------|
| Test item                                                                                             | Check                                                     | Remark                            | Result |
| Switch on EUT, then start Test targets<br>Check the following items on external interface and display |                                                           |                                   |        |
| Check for continuous receiving                                                                        | On test output                                            | Not implemented                   | N/A    |
|                                                                                                       | On external interface                                     |                                   | Ok     |
|                                                                                                       | On display                                                | If implemented<br>Not implemented | N/A    |
| Channels                                                                                              | Check that the position reports are received on channel A |                                   | Ok     |
|                                                                                                       | Check that the position reports are received on channel B |                                   | Ok     |

| Test details a)– Receive Position reports in same time periods                                                                   |                                                                                                                                                       |                                   |        |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------|
| Test item                                                                                                                        | Check                                                                                                                                                 | Remark                            | Result |
| Start 2 test targets using the same time slots on channel A and B<br>Check the following items on external interface and display |                                                                                                                                                       |                                   |        |
| Check for continuous receiving                                                                                                   | On test output                                                                                                                                        | Not implemented                   | N/A    |
|                                                                                                                                  | On external interface                                                                                                                                 |                                   | Ok     |
|                                                                                                                                  | On display                                                                                                                                            | If implemented<br>Not implemented | N/A    |
| Channels                                                                                                                         | Check that the position reports of one target are received on channel A                                                                               |                                   | Ok     |
|                                                                                                                                  | Check that the position reports of the other target are received on channel B                                                                         |                                   | Ok     |
| Remark:                                                                                                                          | This test result has been derived from the Rx performance test (□) because in this test the EUT is receiving in the same time slots on both channels. |                                   |        |

- **10.2.1.3 Receive Class B"CS" position reports**

*This test is only applicable if a display or display interface for the received messages is provided.*

**10.2.1.3.1 Method of measurement**

*Set up standard test environment. Simulate at least one additional Class B"CS" test target (bit stuffing shall not increase 4 bit)*

*Check the VDL communication, test output, and display or external interface of the EUT.*

**10.2.1.3.2 Required results**

*Confirm that EUT receives the Class B"CS" test target continuously and, where provided, outputs the received Messages 18 and 24 on the external interface.*

| Test details a)– Receive Class B "CS" position reports                                                                 |                                                           |                                   |        |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------|--------|
| Test item                                                                                                              | Check                                                     | Remark                            | Result |
| Switch on Test targets, then start operation of the EUT<br>Check the following items on external interface and display |                                                           |                                   |        |
| Check for continuous receiving of msg 18                                                                               | On test output                                            | Not implemented                   | N/A    |
|                                                                                                                        | On external interface                                     |                                   | Ok     |
|                                                                                                                        | On display                                                | If implemented<br>Not implemented | N/A    |
| Check for continuous receiving of msg 24                                                                               | On test output                                            | Not implemented                   | N/A    |
|                                                                                                                        | On external interface                                     |                                   | Ok     |
|                                                                                                                        | On display                                                | If implemented<br>Not implemented | N/A    |
|                                                                                                                        | Check that msg 24 A and B are received                    |                                   | Ok     |
| Channels                                                                                                               | Check that the position reports are received on channel A |                                   | Ok     |
|                                                                                                                        | Check that the position reports are received on channel B |                                   | Ok     |

- **10.2.1.4 Receive in adjacent time periods**

**10.2.1.4.1 Method of measurement**

*Set up standard test environment. Simulate additional targets so that the first 4 of each 5 time periods are used. The reporting rate may be increased for the purpose of this test.*

*Check the VDL communication, test output, and where provided, display or external interface of the EUT.*

**10.2.1.4.2 Required results**

*Confirm that EUT continuously receives messages in the time periods adjacent to own transmission period with an acceptable loss of 5 %.*

| Test details - Receive in adjacent time periods                                                                                               |                                                                                                       |                                                                                                                                                                                                                                                       |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Test item                                                                                                                                     | Check                                                                                                 | Remark                                                                                                                                                                                                                                                | Result         |
| Simulate targets in 4 of 5 time periods (80 % channel load, VDL tester set "test 80% 4-1")<br>Check the following items on external interface |                                                                                                       |                                                                                                                                                                                                                                                       |                |
| Received targets                                                                                                                              | Check that the targets transmitting in the time periods before the EUT transmission slot are received |                                                                                                                                                                                                                                                       | Ok             |
|                                                                                                                                               | Check that the targets transmitting in the time periods after the EUT transmission slot are received  |                                                                                                                                                                                                                                                       | Ok             |
|                                                                                                                                               | Check that the Rx loss is < 5 %                                                                       | <ul style="list-style-type: none"> <li>There are no stops of operation.</li> <li>All message on channel A in the slot after the own transmission are received.</li> <li>All messages in the slot before the own transmission are received.</li> </ul> | Ok<br>Ok<br>Ok |

### • **10.2.1.5 Rx performance test**

#### **10.2.1.5.1 Method of measurement**

Set up standard test environment. Simulate additional targets so that 9 of 10 time periods are used.

Check the VDL communication, test output, and where provided, display or external interface of the EUT.

#### **10.2.1.5.2 Required results**

Confirm that EUT continuously receives messages and, where provided, outputs the received messages on the external interface with a loss of not more than 5 %.

| Test details - Receive in adjacent time periods                                                     |                                                                      |                                                                       |        |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------|--------|
| Test item                                                                                           | Check                                                                | Remark                                                                | Result |
| Simulate targets in 9 of 10 time periods (90 % channel load), record the test or external interface |                                                                      |                                                                       |        |
| Rx probability                                                                                      | Check that at least 95 % of the target position reports are received | The Rx probability is about 99.5 %. There is no stop of transmission. | Ok     |

### • **10.2.2 Assigned mode**

(see 4.1.5.2)

#### • **10.2.2.1 Group assignment**

##### **10.2.2.1.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Transmit a group assignment command Message 23 to the EUT addressing stations by

- region,
- station type and
- type of ship

and commanding for

- Tx/Rx mode,
- reporting rate,
- quiet time.

Record transmitted messages.

**10.2.2.1.2 Required results**

Confirm that the EUT transmits position reports Message 18 according to the defined parameters and reverts to standard reporting rate after 4 min to 8 min.

Confirm that the operation of the EUT is not affected when not addressed.

| Test details - Group assignment, addressed                                                                                                                                                                                      |                                                                   |                                                   |        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------|--------|
| Test item                                                                                                                                                                                                                       | Check                                                             | Remark                                            | Result |
| Test 1: Send a msg 23 with the following parameters: speed = 10 kn                                                                                                                                                              |                                                                   |                                                   |        |
| Region: inside<br>Station type: 0 = all types<br>Type of ship: 0 = all types<br>Tx/ Rx mode = 0: Tx A and B<br>Reporting interval: 8 = 5 s<br>Quiet time: 0 = no quiet time<br>Msg "B Msg 23 Test 10.2.2.1 T1"                  | check that the reporting rate = 5 s                               | UTC 11:20                                         | Ok     |
|                                                                                                                                                                                                                                 | Check that EUT reverts to standard reporting rate after 4...8 min | UTC 11:28                                         | Ok     |
| Test 2: Send a msg 23 with the following parameters:                                                                                                                                                                            |                                                                   |                                                   |        |
| Region: inside<br>Station type: 2 = all class B<br>Type of ship: 37 = pleasure craft<br>Tx/ Rx mode = 0: Tx A and B<br>Reporting interval: 9 = next shorter<br>Quiet time: 0 = no quiet time<br>Msg "B Msg 23 Test 10.2.2.1 T2" | check that the reporting rate = 15 s                              | UTC 11:31<br>No transmission                      | Ok     |
|                                                                                                                                                                                                                                 | Check that EUT reverts to standard reporting rate after 4...8 min |                                                   | Ok     |
| Test 3: Send a msg 23 with the following parameters:                                                                                                                                                                            |                                                                   |                                                   |        |
| Region: inside<br>Station type: 5 = all class B CS<br>Type of ship: 37 = pleasure craft<br>Tx/ Rx mode = 0: Tx A and B<br>Reporting interval: 7 = 10 s<br>Quiet time: 0 = no quiet time<br>Msg "B Msg 23 Test 10.2.2.1 T3"      | check that the reporting rate = 10 s                              | UTC 12:35                                         | Ok     |
|                                                                                                                                                                                                                                 | Check that EUT reverts to standard reporting rate after 4...8 min | UTC 12:41                                         | Ok     |
| Test 4: Send a msg 23 with the following parameters:                                                                                                                                                                            |                                                                   |                                                   |        |
| Region: inside<br>Station type: 5 = all class B CS<br>Type of ship: 37 = pleasure craft<br>Tx/ Rx mode = 1: Tx A<br>Reporting interval: 6 = 15 s<br>Quiet time: 0 = no quiet time<br>Msg "B Msg 23 Test 10.2.2.1 T4"            | check that the reporting rate = 30 s (Ed.1) or 15 s (Ed.2)        | UTC 2010-08-19 08:38<br>Reporting interval = 15 s | Ok     |
|                                                                                                                                                                                                                                 | Check that all transmissions are on channel A                     | All transmissions are on channel A                | Ok     |
| After 3 minutes send the same msg 23 but<br>Tx/ Rx mode = 2: Tx B<br>Msg "B Msg 23 Test 10.2.2.1 T4", manually change Tx/Rx mode to 2                                                                                           | check that the reporting rate = 30 s (Ed.1) or 15 s (Ed.2)        | 08:41<br>Reporting interval = 15 s                | Ok     |
|                                                                                                                                                                                                                                 | Check that all transmissions are on channel B                     | All transmissions are on channel B                | Ok     |

| Test 5: Send a msg 23 with the following parameters:                                                                                                                                                                |                                                                |           |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------|----|
| Region: inside<br>Station type: 5 = all class B CS<br>Type of ship: 37 = pleasure craft<br>Tx/ Rx mode = 0: Tx A and B<br>Reporting interval: 0 = auto.<br>Quiet time: 8 = 8 min<br>Msg "B Msg 23 Test 10.2.2.1 T5" | Check that EUT stops transmission for 8 min                    | UTC 09:05 | Ok |
|                                                                                                                                                                                                                     | Check that the EUT reverts to 30 s reporting rate after 8 min. | UTC 09:13 | Ok |

| Test details - Group assignment, not addressed                                                                                                                               |                                          |                                                                                                          |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------|--------|
| Test item                                                                                                                                                                    | Check                                    | Remark                                                                                                   | Result |
| Send a msg 23 with the following parameters: speed = 10 kn, EUT ship type = 0<br>Tx/ Rx mode = 0: Tx A and B<br>Reporting interval: 8 = 5 s<br>Quiet time: 0 = no quiet time |                                          |                                                                                                          |        |
| Test 6: Region: <u>outside</u><br>Station type: 0 = all types<br>Type of ship: 0 = all types<br>Msg "B Msg 23 Test 10.2.2.1 T6"                                              | check that the reporting interval = 30 s | 2010-08-18 UTC 13:18                                                                                     | Ok     |
| Test 7: Region: inside<br><u>Station type: 4 = AtoN</u><br>Type of ship: 0 = all types<br>Msg "B Msg 23 Test 10.2.2.1 T7"                                                    | check that the reporting interval = 30 s | UTC 09:20<br>Tested with 1, 3,4,6<br>UTC 09:24<br>Crosscheck with type 2 that the assignment is accepted | Ok     |
| Test 8: Region: inside<br>Station type: 0 = all types<br>Type of ship: 70 = cargo vessel<br>Msg "B Msg 23 Test 10.2.2.1 T8"                                                  | check that the reporting interval = 30 s |                                                                                                          | Ok     |

- **10.2.2.2 Base station reservations**

**10.2.2.2.1 Method of measurement**

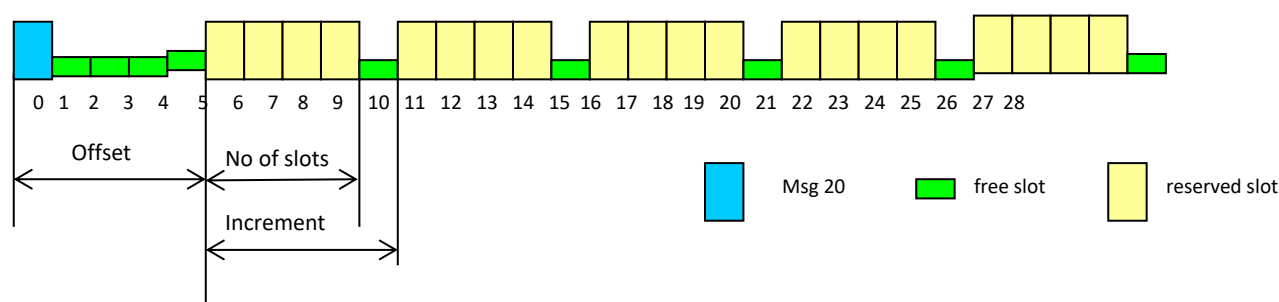
Set up standard test environment and operate EUT in autonomous mode. Transmit a reservation Message 20 to the EUT specifying reserved time periods.

Record transmitted messages.

**10.2.2.2.2 Required results**

Confirm that the EUT transmits position reports Message 18 without using reserved time periods.

| Test details - Base station reservations                                                                                    |                                                                                                   |                                                  |        |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------|--------|
| Test item                                                                                                                   | Check                                                                                             | Remark                                           | Result |
| Test 1: Send a msg 20 with the following parameters:<br>Msg: "B Msg 20 Test 10.2.2.2"                                       |                                                                                                   |                                                  |        |
| Tx-slot: 0<br>offset number: 5<br>number of slots: 4<br>slot increment: 5<br>time-out = 7<br>Repetition of msg 20: 10 times | Check that only the time periods 0,1..4, 9, 14, 19 ... are used for transmissions                 | The reserved slots are not used for transmission | Ok     |
|                                                                                                                             | check that after 18 minutes (Tx of msg 20 + time-out) all time periods are used for transmissions | All slots are used for transmission              | Ok     |



- **10.2.3 Polled mode/interrogation response**

(see 4.1.5.3)

- **10.2.3.1 Interrogation for Messages 18 and 24**

**10.2.3.1.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Apply an interrogation message (Message 15; EUT as destination) to the VDL according to message table (ITU-R M.1371 table13) for responses with Message 18, Message 24:

- with transmission offset = 0,
- with transmission offset = defined value,
- with a Message 23 “quiet time” command transmitted before the interrogation.

Record transmitted messages and frame structure.

**10.2.3.1.2 Required results**

Check that the EUT transmits the appropriate interrogation response message as requested after defined transmission offset. Confirm that the EUT transmits the response to the interrogation on the same channel as that received.

| Test details - Interrogation for msg 18, 20                                                                                                                                                         |                                                          |                                                                                                                     |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------|
| Test item                                                                                                                                                                                           | Check                                                    | Remark                                                                                                              | Result |
| a) Test 1: Send a msg 15 transmission offset = 0:                                                                                                                                                   |                                                          |                                                                                                                     |        |
| Interrogation for msg 18 and 24 for destination 1, on channel A<br>Msg: “B Msg15 Test 10.2.3.1 T1”,                                                                                                 | Check that msg 18 is responded                           |                                                                                                                     | Ok     |
|                                                                                                                                                                                                     | Check that the response was within 30 s                  |                                                                                                                     | Ok     |
|                                                                                                                                                                                                     | Check that the response is transmitted on channel A      |                                                                                                                     | Ok     |
|                                                                                                                                                                                                     | Check that msg 24 A is responded within 60 s             |                                                                                                                     | Ok     |
|                                                                                                                                                                                                     | Check that msg 24 B is responded within 90 s             |                                                                                                                     | Ok     |
| b) Test 2: Send a msg 15 transmission offset = 10:                                                                                                                                                  |                                                          |                                                                                                                     |        |
| Interrogation for 24 for destination 1, offset = 20, 30 and for msg 18, destination 2, offset = 10<br>Request on channel B<br>Msg: “B Msg15 Test 10.2.3.1 T2”,                                      | Check that msg 18 is responded with the defined offset   | The response is transmitted in the correct slot (if it is not the first transmission after the request – see below) | Ok     |
|                                                                                                                                                                                                     | Check that msg 24 A is responded with the defined offset | The response is transmitted in the correct slot                                                                     | Ok     |
|                                                                                                                                                                                                     | Check that msg 24 B is responded with the defined offset | The response is transmitted in the correct slot                                                                     | Ok     |
|                                                                                                                                                                                                     | Other problems                                           | The first response is also transmitted using the correct slot.                                                      | Ok     |
|                                                                                                                                                                                                     |                                                          | The VDM output is correct                                                                                           | Ok     |
|                                                                                                                                                                                                     | Check that the responses are transmitted on channel B    |                                                                                                                     | Ok     |
| c) Test 3: Send a msg 23 commanding quiet time for 8 min, (setting “B Msg23 Test 10.2.2.1 T5”)<br>Send a msg 15 with transmission offset = 10: (setting “B Msg15 Test 10.2.3.1 T2”, same as Test 2) |                                                          |                                                                                                                     |        |
| Interrogation for msg 18 for destination 2                                                                                                                                                          | Check that msg 18 is responded with the defined offset   | Message 18 and 24 are responded<br>The offset error is the same as in b)                                            | Ok     |

- **10.2.3.2 Interrogation for Message 19**

**10.2.3.2.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Apply an interrogation message (Message 15; EUT as destination) to the VDL according to message table (M.1371 Table13) for responses with Message 19:

- a) with transmission offset = 0,  
 b) with transmission offset = defined value.

Record transmitted messages and frame structure.

#### 10.2.3.2.1 Required results

Check that

- a) the EUT does not respond,  
 b) the EUT transmits the appropriate interrogation response message as requested after defined transmission offset.

Confirm that the EUT transmits the response on the same channel as that received and the data content is identical with that in Message 24.

| Test details - Interrogation for msg 19                                                                |                                                        |                                                                               |        |
|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------|--------|
| Test item                                                                                              | Check                                                  | Remark                                                                        | Result |
| Test 1: Send a msg 15 transmission with interrogation for msg 19: (setting "B Msg 15 Test 10.2.3.2" ); |                                                        |                                                                               |        |
| Offset = 0,<br>destination 1                                                                           | Check that msg 19 is not responded                     |                                                                               | Ok     |
| Offset = 15,<br>destination 1<br>channel = B                                                           | Check that msg 19 is responded                         |                                                                               | Ok     |
|                                                                                                        | Check that msg 19 is responded with the defined offset | Message 19 is responded also if it is the first or single requested response. | Ok     |
|                                                                                                        | Check that the response is transmitted on channel B    |                                                                               | Ok     |

### • 10.3 Messages extending one time period

(see 4.1.5)

#### 10.3.1 Method of measurement

Check the documentation for a possibility to initiate transmission of messages longer than one time period.

#### 10.3.2 Required results

It shall not be possible for the user to initiate the transmission of messages longer than one time period.

| Test details - Tx of msg with more than 1 slot |                                                                                              |                                                                |        |
|------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------|--------|
| Test item                                      | Check                                                                                        | Remark                                                         | Result |
| Check documentation                            | Check that there is no way to initiate the transmission of message longer than 1 time period | The EUT does not transmit messages applied on the serial port. | Ok     |

### • 10.4 Channel selection

(see 6.2)

#### • 10.4.1 Valid channels

##### 10.4.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Switch the EUT to different channels within the operating band as specified in 6.2 by transmission of channel management message (Message 22) broadcast and addressed to EUT,

Record the VDL messages on the designated channels and check "band flag" and "Message 22 flag" in Message 18. (note that DSC command is covered in Annex C)

##### 10.4.1.2 Required results

Confirm that the EUT switches to the required channel accordingly.

| Test details - Channel selection by msg 22 |  |  |  |
|--------------------------------------------|--|--|--|
|--------------------------------------------|--|--|--|

| Test item                                                                                  | Check                                             | Remark                                                                               | Result |
|--------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------|--------|
| Test 1: Send a msg 22 broadcast, EUT inside the area                                       |                                                   |                                                                                      |        |
| Channels 2020, 2022<br>(msg "B Msg 22 Test 10.4.1 a")                                      | Check that EUT transmits on the assigned channels | Tx on channel 2018, 2020, 2022 and 2024 ok                                           | Ok     |
|                                                                                            | Check that EUT receives on the assigned channels  |                                                                                      | Ok     |
|                                                                                            | Check and note the band flag                      | Band flag = 0 (upper 500 kHz only)<br>This is according to Manufacturers Declaration | Ok     |
|                                                                                            | Check that the Msg 22 flag = 1                    | Msg 22 flag = 1                                                                      | Ok     |
| Send an addressed msg 22 to the EUT, channels 2084, 2086<br>(msg "B Msg 22 Test 10.4.1 b") | Check that EUT transmits on the assigned channels |                                                                                      | Ok     |
|                                                                                            | Check that EUT receives on the assigned channels  |                                                                                      | Ok     |

- **10.4.2 Invalid channels**

**10.4.2.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Check units capability on the "band flag" and "Message 22 flag" in Message 18. Switch the EUT to channels outside the operating band as specified in 6.2..

Record the VDL messages on the designated channels.

**10.4.2.2 Required results**

Confirm that the EUT does not switch to the respective channels and stops transmissions.

| Test details - Channel selection by msg 22                                                                                                                                                                 |                                                      |                                                                              |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------|--------|
| Test item                                                                                                                                                                                                  | Check                                                | Remark                                                                       | Result |
| Test 1: Send a msg 22 broadcast, EUT inside the area                                                                                                                                                       |                                                      |                                                                              |        |
| If the EUT is able to operate in the lower band:<br>Channels 1084, 2084<br>(msg "B Msg 22 Test 10.4.1 a"),<br>modify channels manually                                                                     | Check that EUT transmits on the assigned channels    | The EUT is not able to operate in the lower band (Manufacturers Declaration) | N/A    |
|                                                                                                                                                                                                            | Check that EUT receives on the assigned channels     |                                                                              | N/A    |
|                                                                                                                                                                                                            | Check the band flag = 1                              |                                                                              | N/A    |
|                                                                                                                                                                                                            | Check that the Msg 22 flag = 1                       |                                                                              | N/A    |
| If the EUT is not able to operate in the lower band:<br>Send a msg 22 broadcast with channels outside the upper band<br>Channels 1001, 2005<br>(msg "B Msg 22 Test 10.4.1 a"),<br>modify channels manually | Check that EUT stops transmission                    | UTC 08:45                                                                    | Ok     |
|                                                                                                                                                                                                            | Check that EUT receives on AIS 1 and AIS 2 (default) |                                                                              | Ok     |
|                                                                                                                                                                                                            | Check the band flag = 0                              | Band flag = 0                                                                | Ok     |
|                                                                                                                                                                                                            | Check that the Msg 22 flag = 1                       | Message 22 flag = 1                                                          | Ok     |

- **10.5 Internal GNSS receiver**

(see 6.3)

Relevant tests according to IEC 61108-1 shall be performed with regard to

- *position accuracy, static;*
- *position accuracy, dynamic;*
- *COG/SOG accuracy;*
- *position update;*
- *status indications (including RAIM, where fitted).*

**Note:** The GNSS receiver test is not part of this test report. The GNSS receiver is tested in a separate test with a separate test report.

- **10.6 AIS information**

(see 6.5)

- **10.6.1 Information content**

(see 6.5.1)

- **10.6.1.1 Defaults**

**10.6.1.1.1 Method of measurement**

Set up the standard test environment and reset the equipment to enable the manufacturers static data delivery defaults. Attempt to set the equipment to operate in autonomous mode.

**10.6.1.1.2 Required results**

Confirm that the default MMSI is set at 000000000 and that other static data defaults unambiguously identify that the equipment has been properly initialised. Confirm that the transmissions are inhibited and that an indication is given that transmissions are inhibited.

| Test details - Defaults               |                                                            |                                                     |        |
|---------------------------------------|------------------------------------------------------------|-----------------------------------------------------|--------|
| Test item                             | Check                                                      | Remark                                              | Result |
| Reset the EUT to the default settings |                                                            |                                                     |        |
| Default settings                      | Check that the MMSI is 00000000                            | The MMSI is 0 (displayed by the configuration tool) | Ok     |
|                                       | Check that the other static data are set to default values | Name:testbase01,<br>Ship type: 37                   | Ok     |
|                                       | Check that the EUT does not transmit                       |                                                     | Ok     |
|                                       | Check that the transmission stop is indicated on the EUT   |                                                     | Ok     |

- **10.6.1.2 Required information**

**10.6.1.2.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Apply all static data to the EUT.

Record all messages on VDL and check the contents of position report Message 18 and static data report Messages 24 A and B.

**10.6.1.2.2 Required results**

Confirm that data transmitted by the EUT complies with static data and position sensor data.

| Test details - Required information |                                                                  |                                                                                                  |        |
|-------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------|
| Test item                           | Check                                                            | Remark                                                                                           | Result |
| Apply all necessary data to the EUT |                                                                  |                                                                                                  |        |
| Required information of msg 18      | Check the MMSI                                                   |                                                                                                  | Ok     |
|                                     | Check the SOG                                                    |                                                                                                  | Ok     |
|                                     | Check the PA-flag                                                |                                                                                                  | Ok     |
|                                     | Check the Longitude                                              |                                                                                                  | Ok     |
|                                     | Check the Latitude                                               |                                                                                                  | Ok     |
|                                     | Check the COG                                                    |                                                                                                  | Ok     |
|                                     | Check the Heading                                                | = default. HDT input is not supported<br>Not required because external sensor input is optional, | Ok     |
|                                     | Check the Time stamp                                             | The time stamp is correct (tested with internal and external position)                           | Ok     |
|                                     | Check the class B unit flag                                      | = 1 (= CS)                                                                                       | Ok     |
|                                     | Check the Display flag                                           | = 0 (no display)                                                                                 | Ok     |
|                                     | Check the DSC flag                                               | = 0 (currently DSC disabled)                                                                     | Ok     |
|                                     | Check the band flag                                              | = 0 (only upper band)                                                                            | Ok     |
|                                     | Check the msg 22 flag                                            | = 1 (Msg 22 is supported)                                                                        | Ok     |
|                                     | Check the Mode flag                                              |                                                                                                  | Ok     |
|                                     | Check the RAIM flag                                              | = 0                                                                                              | Ok     |
| Required information of msg 24A     | Check the MMSI                                                   |                                                                                                  | Ok     |
|                                     | Check the Part number = 0                                        |                                                                                                  | Ok     |
|                                     | Check the Name                                                   |                                                                                                  | Ok     |
| Required information of msg 24B     | Check the MMSI                                                   |                                                                                                  | Ok     |
|                                     | Check the Part number = 1                                        |                                                                                                  | Ok     |
|                                     | Check the Type of ship and cargo                                 |                                                                                                  | Ok     |
|                                     | Check the Vendor ID                                              |                                                                                                  | Ok     |
|                                     | Check the Call Sign                                              |                                                                                                  | Ok     |
|                                     | Check the Dimension of ship/ reference for position (A, B, C, D) |                                                                                                  | Ok     |

- **10.6.1.3 External sensor information**

(see 6.3, 6.6.3)

This test is applicable if an **optional** interface for external sensors is provided.

#### 10.6.1.3.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode.

- Apply external position data with expected error <10m (from GBS sentence) and within 26 m of internal position.
- Simulate unavailable/invalid external sensor data and missing/incorrect checksum.
- Apply a non-WGS-84 or unspecified (no DTM) position input.
- Apply a low accuracy position input with expected error >10m or without RAIM information (no GBS).
- Apply position data with more than 26 m apart from internal position

Record all messages on VDL and check the contents of position report Message 18 for position and COG/SOG.

#### 10.6.1.3.2 Required results

- Confirm that data transmitted by the EUT complies with external sensor inputs.
- , c), d), e) Confirm that external data is not used.

Confirm that accuracy and RAIM flags are set accordingly; confirm that position and COG/SOG are of the same source.

| Test details - Check for implementation |                                                           |                                                                                  |        |
|-----------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------------------|--------|
| Test item                               | Check                                                     | Remark                                                                           | Result |
| Check the manufacturers documentation   |                                                           |                                                                                  |        |
| Implementation of optional function     | Check if the input of external sensor data is implemented | Input of external sensor data is not implemented.<br>(Manufacturers Declaration) | Ok     |

| Test details - External sensor input not implemented                                                                                                                                                                                                                                                       |                                          |        |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------|--------|
| Test item                                                                                                                                                                                                                                                                                                  | Check                                    | Remark | Result |
| This test is applicable only if external sensor input is not implemented<br>Apply Position sentences, GBS and DTM sentence to the EUT: <ul style="list-style-type: none"> <li>Valid position data,</li> <li>Position within 26 m from internal GPS</li> <li>GBS &lt; 10 m</li> <li>GBS = WGS 84</li> </ul> |                                          |        |        |
| Apply GLL sentence                                                                                                                                                                                                                                                                                         | Check that external position is not used |        | Ok     |
|                                                                                                                                                                                                                                                                                                            | Check that external speed is not used    |        | Ok     |
|                                                                                                                                                                                                                                                                                                            | Check that external heading is not used  |        | Ok     |
| Apply GGA sentence                                                                                                                                                                                                                                                                                         | Check that external position is not used |        | Ok     |
|                                                                                                                                                                                                                                                                                                            | Check that external speed is not used    |        | Ok     |
| Apply GNS sentence                                                                                                                                                                                                                                                                                         | Check that external position is not used |        | Ok     |
|                                                                                                                                                                                                                                                                                                            | Check that external speed is not used    |        | Ok     |
| Apply RMC sentence                                                                                                                                                                                                                                                                                         | Check that external position is not used |        | Ok     |
|                                                                                                                                                                                                                                                                                                            | Check that external speed is not used    |        | Ok     |

- **10.6.2 Information update rates**

(see 6.5.2)

- **10.6.2.1 Nominal reporting interval**

#### 10.6.2.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode.

| Test details - Autonomous reporting rate |  |  |  |
|------------------------------------------|--|--|--|
|------------------------------------------|--|--|--|

| Test item                                                          | Check                                                                                        | Remark | Result |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------|--------|
| Apply SOG according to the test items and check the reporting rate |                                                                                              |        |        |
| a) SOG = 1 kn for 10 min                                           | Check that the reporting rate = 3 min +/- 10s                                                |        | Ok     |
| b) Change SOG to 10 kn for 15 min                                  | Check that the reporting rate = 30 s +/- 5s                                                  |        | Ok     |
|                                                                    | Check that the reporting rate is established after the next transmission of the old schedule |        | Ok     |
|                                                                    | Change of reporting rate                                                                     |        | Ok     |
|                                                                    | Check that the average reporting rate of 25 Tx = 30 s +/- 2s                                 | 30.0 s | Ok     |
| c) SOG = 1 kn for 10 min                                           | Check that the reporting rate = 3 min +/- 10s                                                |        | Ok     |
|                                                                    | Check that the reporting rate is reduced after 3 min                                         |        | Ok     |

a) Start with own SOG of 1 kn; record all messages on VDL for 10 min and evaluate reporting rate for position report of EUT by calculating average transmission offset over test period.

b) Increase speed to 10 kn.

c) Reduce speed to 1 kn.

Record all messages on VDL and check transmission offset between two consecutive transmissions.

#### 10.6.2.1.2 Required results

a) Reporting interval shall be 3 min ( $\pm 10$  s).

b) Confirm that the reporting interval of 30 s ( $\pm 5$  s) has been established after the next transmission in the old schedule at the latest. The average reporting interval calculated over at least 25 transmissions shall be 30 s ( $\pm 2$  s).

c) Confirm that the reporting rate is reduced after 3 min (speed reduction).

#### • 10.6.2.2 Assigned reporting interval

##### 10.6.2.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode.

a) Transmit an assigned mode command Message 23 to the EUT with designated reporting intervals of 5 s to 3 min according to Table 17.

b) Transmit an assigned mode command Message 23 to the EUT with designated reporting interval of 10 min.

c) Transmit Messages 23 with a refresh rate of 1 min with designated reporting intervals of 6 min and 10 min.

d) Transmit Messages 23 designated reporting interval field settings of 11-15

e) Change course, speed. Record transmitted messages.

##### 10.6.2.2.2 Required results

a) Confirm that the EUT transmits position reports Message 18 according to the parameters defined by Message 23. The EUT shall revert to autonomous mode with nominal reporting interval after 4 min to 8 min.

b) Confirm that the EUT reverts to autonomous mode with nominal reporting interval after 4 min to 8 min.

c) Confirm that the EUT transmits position reports Message 18 according to the parameters defined by Message 23.

d) Confirm that the EUT does not change its nominal behaviour.

e) The reporting interval shall not be affected by course or speed.

Remark: Reporting rates 5, 10, 15 s are tested in 10.2.2.1

| Test details - Assigned reporting interval                        |                                          |           |        |
|-------------------------------------------------------------------|------------------------------------------|-----------|--------|
| Test item                                                         | Check                                    | Remark    | Result |
| Test a: Send a msg 23 with the following parameters: speed = 1 kn |                                          |           |        |
| Region: inside                                                    | Check that the reporting interval = 30 s | UTC 10:29 | Ok     |

|                                                                                                                     |                                                                               |                                                                   |     |
|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------|-----|
| Reporting interval: 5 = 30 s<br>Msg "B Msg 23 Test 10.6.2.2. Ta1"                                                   | Check that EUT reverts to standard reporting rate after 4...8 min             | UTC 10:33<br>(4 min)                                              | Ok  |
| Test a: Send a msg 23 with the following parameters: speed = 10 kn                                                  |                                                                               |                                                                   |     |
| Region: inside<br>Reporting interval: 3 = 3 min<br>Msg "B Msg 23 Test 10.6.2.2. Ta2"                                | check that the reporting interval = 3 min                                     | UTC 10:58 – 11:02                                                 | Ok  |
|                                                                                                                     | Check that EUT reverts to standard reporting rate after 4...8 min             | UTC 11:08<br>(6 min)                                              | Ok  |
| Test b: Send a msg 23 with the following parameters:                                                                |                                                                               |                                                                   |     |
| Reporting interval: 1 = 10 min<br>Msg "B Msg 23 Test 10.6.2.2. Tb"                                                  | Check that EUT reverts to standard reporting rate after 4...8 min             | UTC 10:15<br>UTC 10:22                                            | Ok  |
| Test c1: Send a msg 23 with the following parameters and repeat it every minute for at least 15 minutes             |                                                                               |                                                                   |     |
| Reporting interval: 2 = 6 min<br>Msg "B Msg 23 Test 10.6.2.2. Tc1"                                                  | check that the reporting rate = 6 min                                         | Msg 23 UTC 13:04 – 13:19<br>Tx: 13:04, 13:10, 13:16, 13:22        | Ok  |
|                                                                                                                     | Check that EUT reverts to standard reporting rate 4...8 min after last msg 23 | UTC 13:16 (7 min)                                                 | Ok  |
| Test c2: Send a msg 23 with the following parameters and repeat it every minute for at least 22 minutes             |                                                                               |                                                                   |     |
| Reporting interval: 1 = 10 min<br>Msg "B Msg 23 Test 10.6.2.2. Tc2"                                                 | check that the reporting rate = 10 min                                        | Msg 23 UTC 12:33 – 12:55<br>Tx: 12:32, 12:42, 12:52               | Ok  |
|                                                                                                                     | Check that EUT reverts to standard reporting rate 4...8 min after last msg 23 | UTC 13:00 (5 min)                                                 | Ok  |
| Test d: Send a msg 23 with the following parameters:                                                                |                                                                               |                                                                   |     |
| Reporting interval:11<br>Msg "B Msg 23 Test 10.6.2.2. Td1"                                                          | check that the reporting rate is not affected                                 | Reporting interval = 30 s, the reporting interval is not affected | Ok  |
| Reporting interval:15<br>Msg "B Msg 23 Test 10.6.2.2. Td2"                                                          | check that the reporting rate is not affected                                 | Reporting interval = 30 s, the reporting interval is not affected | Ok  |
| Test e: Send a msg 23 with the following parameters: Reporting rate: 4 = 1 min,<br>Msg "B Msg 23 Test 10.6.2.2. Te" |                                                                               |                                                                   |     |
| Speed = 1 kn                                                                                                        | Check that the reporting rate is 1 min                                        | UTC 14:47                                                         | Ok  |
| Change speed to 15 kn                                                                                               | check that the reporting rate is not affected                                 | UTC 14:49<br>UTC 14:53 reverting to 30 s interval                 | Ok  |
| Change heading with 20 deg/min                                                                                      | check that the reporting rate is not affected                                 | Not applicable, EUT does not use external heading                 | N/A |

### • **10.6.2.3 Static data reporting interval**

#### **10.6.2.3.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Record the transmitted messages and check for static data (Message 24).

Repeat the test at an assigned reporting interval of 5 s.

#### **10.6.2.3.2 Required results**

Confirm that the EUT transmits submessages 24A and 24B every 6 min (24B following 24A within 1 min). Transmission shall alternate between channel A and channel B and be independent of the Message 18 reporting interval.

### • **10.7 Initialisation period**

(see 6.5.3)

**10.7.1 Method of measurement**

Set up standard test environment with  $SOG > 2$  kn.

- Switch on the EUT from cold (off-time minimum 1 h) with EUT operating in autonomous mode.
- Switch off the EUT for a period of time between 15 min to 60 min and switch on again.
- Make the GNSS sensor unavailable for a period of time between 1 min to 5 min

Record transmitted messages.

**10.7.2 Required results**

Confirm that the EUT starts regular transmission of Message 18 including valid position:

- within 30 min after switch on;
- within 5 min;
- stops transmitting after the next transmission and resumes within 1 min after enabling the position source.

| Test details - Initialisation period                  |                                                |                                                                                                    |        |
|-------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------|--------|
| Test item                                             | Check                                          | Remark                                                                                             | Result |
| Switch the On and Off according to the test items     |                                                |                                                                                                    |        |
| a) Switch the EUT on in the morning (> 1 h off)       | Check that the EUT starts msg 18 within 30 min | Transmission starts about 2 min after switching on                                                 | Ok     |
| b) Switch the unit off for 15 ... 60 min and on again | Check that the EUT starts msg 18 within 5 min  | Transmission starts about 1:20 min after switching on                                              | Ok     |
| c) Disable GNSS for 1 ... 5 min                       | Check that the EUT stops transmission          |                                                                                                    | Ok     |
| Enable GNSS again                                     | Check that the EUT starts msg 18 within 60 s   | The EUT starts transmission within 1 min if there is a transmission scheduled for the next minute. | Ok     |

- 10.8 Alarms and indications, fall-back arrangements**

(see 6.6)

- 10.8.1 Built in integrity test**

(see 6.6.1)

**10.8.1.1 Method of measurement**

Check manufacturer's documentation on built-in integrity test.

**10.8.1.2 Required result**

Verify that an indication is provided if a malfunction is detected.

| Test details - Built in integrity test |                                                             |                        |        |
|----------------------------------------|-------------------------------------------------------------|------------------------|--------|
| Test item                              | Check                                                       | Remark                 | Result |
| Check manufacturer's documentation     |                                                             |                        |        |
| Malfunction detection                  | Check that the EUT indicates the detection of a malfunction | Documentation required | N/T    |
|                                        | Note the kind of indication                                 |                        | N/T    |

- 10.8.2 Transceiver protection**

**10.8.2.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Open-circuit and short-circuit VHF antenna terminals of the EUT for at least 5 min each.

**10.8.2.2 Required results**

The EUT shall be operative again within 2 min after refitting the antenna without damage to the transceiver.

| Test details - Transceiver protection |       |        |        |
|---------------------------------------|-------|--------|--------|
| Test item                             | Check | Remark | Result |

|                                                   |                                                                             |                                                                                             |    |
|---------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----|
| Open circuit of VHF antenna terminal for > 5 min  | Check if the EUT generates an antenna VSWR exceeded alarm                   | No alarm, not required                                                                      | Ok |
|                                                   | Check that EUT starts transmission within 2 min after refitting the antenna | The next scheduled transmission (10 s after reconnection) has been received by VDL analyser | Ok |
| Short circuit of VHF antenna terminal for > 5 min | Check that the EUT generates an antenna VSWR exceeded alarm                 | No alarm, not required                                                                      | Ok |
|                                                   | Check that EUT starts transmission within 2 min after refitting the antenna |                                                                                             | Ok |
|                                                   |                                                                             |                                                                                             |    |

- **10.8.3 Transmitter shutdown procedure**

(see 6.6.2)

#### 10.8.3.1 Method of measurement

Check manufacturer's documentation on transmitter shutdown procedure.

#### 10.8.3.2 Required result

Verify that a transmitter shutdown procedure independent of the operating software is provided.

| Test details - Transmitter shutdown procedure |                                                                              |                         |        |
|-----------------------------------------------|------------------------------------------------------------------------------|-------------------------|--------|
| Test item                                     | Check                                                                        | Remark                  | Result |
| Check manufacturer's documentation            |                                                                              |                         |        |
| Malfunction detection                         | Check that the transmitter shutdown procedure is described                   | Documentation required: | N/T    |
|                                               | Check that the transmitter shutdown procedure is independent of the software |                         | N/T    |

- **10.8.3.4 Position sensor fallback conditions**

(see 6.6.3)

#### 10.8.3.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Where an option for an external GNSS sensor is not provided, then the respective tests shall be omitted.

Apply position sensor data in a way that the EUT operates in the states defined below:

- external DGNSS in use if implemented;
- internal DGNSS in use (corrected by Message 17) if implemented;
- internal DGNSS in use (corrected by a beacon) if implemented;
- external GNSS in use if implemented;
- internal GNSS in use ;
- no sensor position in use.

Check the position accuracy and RAIM flag in the VDL Message 18 and, where provided, the ALR sentence.

**10.8.4.2 Required result**

Verify that the use of position source, position accuracy flag, RAIM flag and position information complies with Table 1

Verify that the position sensor status is maintained for the next scheduled report and changed after that.

| Test details - Position priority – Position sensor fallback without external sensor input                                                                                    |                                                                                               |                                                                                                                                                                                                |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Test item                                                                                                                                                                    | Check                                                                                         | Remark                                                                                                                                                                                         | Result   |
| Connect sensor inputs and correction data according to the test items.<br>Sensor input file name: AIS01_gll_vtg_hdt_near.sst<br>Internal GPS: RAIM expected, external: RAIM. |                                                                                               |                                                                                                                                                                                                |          |
| Changing downwards                                                                                                                                                           |                                                                                               |                                                                                                                                                                                                |          |
| b) Internal DGNSS available msg 17                                                                                                                                           | Check that the internal position is used                                                      | Not applicable because correction by message 17 is not implemented (Manufacturers Declaration)                                                                                                 | N/A      |
|                                                                                                                                                                              | Check that position accuracy flag = 1                                                         |                                                                                                                                                                                                | N/A      |
|                                                                                                                                                                              | Check the RAIM flag                                                                           |                                                                                                                                                                                                | N/A      |
| c) Internal DGNSS available beacon input                                                                                                                                     | Check that the internal position is used                                                      | Not applicable because beacon input is not supported                                                                                                                                           | N/A      |
|                                                                                                                                                                              | Check that position accuracy flag = 1                                                         |                                                                                                                                                                                                | N/A      |
|                                                                                                                                                                              | Check the RAIM flag                                                                           |                                                                                                                                                                                                | N/A      |
| d) Change from b:<br>• Internal GNSS                                                                                                                                         | Check that the internal position is used                                                      |                                                                                                                                                                                                | Ok       |
|                                                                                                                                                                              | Check that position accuracy flag = 0<br>(Depending on the RAIM result it can also be 1)      |                                                                                                                                                                                                | Ok       |
|                                                                                                                                                                              | Check if there is an source change indication – optional                                      |                                                                                                                                                                                                | N/A      |
|                                                                                                                                                                              | Check the RAIM flag                                                                           | RAIM flag = 0                                                                                                                                                                                  | Ok       |
| f) Change from e:<br>• Inhibit internal GNSS                                                                                                                                 | Check that there is an ALR output ID 026 (no sensor position in use)                          | If implemented<br>There is an error output:<br>\$PPJB,ER,GPS ANTENNA<br>FAULT                                                                                                                  | Ok       |
|                                                                                                                                                                              | Check that EUT stops transmission of position report after the next scheduled position report | The transmission stops<br>The EUT transmits one further message with the last valid position. Then it stops transmission.<br>The antenna disconnection is indicated by an alarm and error LED. | Ok<br>Ok |

| Changing upwards                                           |                                                                                          |                                                                  |     |
|------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------|-----|
| d) Change from f:<br>• Internal GNSS                       | Check that the EUT starts transmission                                                   | At the time according to the previous schedule                   | Ok  |
|                                                            | Check that the ALR output is updated                                                     | If implemented<br>The GPS antenna fault error message is stopped | Ok  |
|                                                            | Check if there is a source change indication - optional                                  |                                                                  | N/A |
|                                                            | Check that position accuracy flag = 0<br>(Depending on the RAIM result it can also be 1) |                                                                  | Ok  |
|                                                            | Check the RAIM flag                                                                      | RAIM flag = 0                                                    | Ok  |
| b) Change from d)<br>Internal DGNSS available msg 17       | Check that the internal position is used                                                 | If implemented                                                   | N/A |
|                                                            | Check if there is a source change indication - optional                                  |                                                                  | N/A |
|                                                            | Check that position accuracy flag = 1                                                    |                                                                  | N/A |
|                                                            | Check the RAIM flag                                                                      |                                                                  | N/A |
| c) Change from d)<br>Internal DGNSS available beacon input | Check that the internal position is used                                                 | If implemented                                                   | N/A |
|                                                            | Check if there is a source change indication - optional                                  |                                                                  | N/A |
|                                                            | Check that position accuracy flag = 1                                                    |                                                                  | N/A |
|                                                            | Check the RAIM flag                                                                      |                                                                  | N/A |

- **10.8.5 Speed sensors**

(see 6.6.4)

**10.8.5.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Where an option for an external GNSS sensor is not provided, this test shall be omitted.

Apply valid external DGNSS position and speed data.

Make external DGNSS position invalid (for example. by wrong checksum, "valid/invalid" flag) .

**10.8.5.1 Required result**

Check that the external data for SOG/COG is transmitted in Message 18.

Check that the internal data for SOG/COG is transmitted in Message 18.

| Test details - Speed sensors                                                                                                                                                        |                                 |                                                                                  |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------------------------------------------|--------|
| Test item                                                                                                                                                                           | Check                           | Remark                                                                           | Result |
| Connect sensor inputs and correction data according to the test items.<br>Sensor input file name: AIS01_gll_vtg_hdt_near.sst<br>Internal GPS: RAIM expected, external: RAIM active. |                                 |                                                                                  |        |
| Set:<br>• Internal GNSS available<br>• External DGNSS                                                                                                                               | Check that external SOG is used | Not applicable, external sensor data are not used<br>(Manufacturers Declaration) | N/A    |
|                                                                                                                                                                                     | Check that external COG is used |                                                                                  | N/A    |
| Change to:<br>• Internal GNSS available<br>• External DGNSS invalid                                                                                                                 | Check that internal SOG is used |                                                                                  | Ok     |
|                                                                                                                                                                                     | Check that internal COG is used |                                                                                  | Ok     |

- **10.9 User interface**

(see 6.7)

- **10.9.1 Display**

(see 6.7.1)

**10.9.1.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode.

- Check status indications for power, Tx timeout, Error.
- Apply Message 23 "quiet time" of >7 min.
- Simulate VDL load in order to make it impossible for the EUT to find free candidate periods.

**10.9.1.2 Required results**

- Indicators shall be available and working correctly according to manufacturer's documentation.
- Check that the Tx timeout indication is activated.
- Check that the Tx timeout indication is activated.

| Test details - Display                                                    |                                                |                                                                 |        |
|---------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------|--------|
| Test item                                                                 | Check                                          | Remark                                                          | Result |
| Operate EUT in autonomous mode                                            |                                                |                                                                 |        |
| a) Check for indicators                                                   | Check that a power indicator is available      |                                                                 | Ok     |
|                                                                           | Check that the power indicator is on           |                                                                 | Ok     |
|                                                                           | Check that a TX timeout indicator is available |                                                                 | Ok     |
|                                                                           | Check that an error indicator is available.    |                                                                 | Ok     |
| b) Apply msg 23 for quiet time > 7 min<br>Msg "B Msg 23 Test 10.2.2.1 T5" | Check that the Tx indicator is on              | 8 min quiet time<br>The Tx indicator is on                      | Ok     |
| c) Simulate high channel load to disable transmission                     | Check that the Tx indicator is on              | The Tx indicator is switched on.                                | Ok     |
| Disable position                                                          | Check that the Tx indicator is on              | The Tx indicator LED is on                                      | Ok     |
| Simulate an error according to documentation, if possible                 | Check that the error indicator is on           | The error LED is blinking when the GPS antenna has been removed | Ok     |

- 10.9.2 Message display**

*This test is only applicable if a message display is provided.*

**10.9.2.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode.

Transmit a Message 14.

**10.9.2.2 Required results**

Verify that the EUT displays the message.

| Test details - Message display                   |                                              |                                             |        |
|--------------------------------------------------|----------------------------------------------|---------------------------------------------|--------|
| Test item                                        | Check                                        | Remark                                      | Result |
| Only applicable if a message display is provided |                                              |                                             |        |
| Send a msg 14 from another station               | Check that the msg 14 is correctly displayed | Not applicable, there is no message display | N/A    |

- 10.9.3 Static data input**

(see 6.7.2)

**10.9.3.1 Method of measurement**

Verify that static data can be input to the unit according to the manufacturer's documentation. Set up standard test environment and operate EUT in autonomous mode.

**10.9.3.2 Required results**

Check that static data are transmitted correctly by the EUT and that the MMSI cannot be altered by the user.

| Test details - Static data input                                                                      |                          |                     |        |
|-------------------------------------------------------------------------------------------------------|--------------------------|---------------------|--------|
| Test item                                                                                             | Check                    | Remark              | Result |
| Input static data according to manufacturers documentation, as far as not yet set by the manufacturer |                          |                     |        |
| Check the static data                                                                                 | Check the User ID (MMSI) | Can input only once | Ok     |

|                              |                                                                               |                                                                                  |     |
|------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----|
| transmitted in msg 18 and 24 | Check the Name                                                                |                                                                                  | Ok  |
|                              | Check the Type of ship and cargo                                              | Only the types 36 (pleasure craft sailing) and 37 (pleasure craft) are available | Ok  |
|                              | Check the Vendor ID                                                           | The vendor ID                                                                    | Ok  |
|                              | Check the call sign                                                           |                                                                                  | Ok  |
|                              | Check the dimension of ship/reference for position                            |                                                                                  | Ok  |
| Input protection             | Check that the MMSI cannot be altered by the user                             | Can input only once                                                              | Ok  |
|                              | Check that the Vendor ID cannot be changed by the user                        |                                                                                  | Ok  |
| Manufacturing setup          | Check that the manufacturing setup cannot be accessed by the normal installer |                                                                                  | N/A |

- **10.9.4 External interfaces**

(see 6.7.3)

- **10.9.4.1 Display interface**

*This test only applies if a display interface is provided.*

#### 10.9.4.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Apply a safety related broadcast Message 14 through the VDL to the EUT.

Check the output on the display interface.

#### 10.9.4.1.2 Required results

The interface shall be compliant with IEC 61162 series protocol and the manufacturer's documentation of interface hardware.

| Test details - Display interface                   |                                                                    |        |        |
|----------------------------------------------------|--------------------------------------------------------------------|--------|--------|
| Test item                                          | Check                                                              | Remark | Result |
| Only applicable if a display interface is provided |                                                                    |        |        |
| Send a msg 14 from another station                 | Check that the msg 14 is correctly output on the display interface |        | Ok     |
|                                                    | Check that the format is according to IEC 61162                    |        | Ok     |

- **11 Physical tests**

Physical test are not part of this test document.

The physical tests are covered by the notification according to R&TTE

## • **12 Specific tests of Link Layer**

(see 7.3)

### • **12.1 TDMA synchronisation**

#### • **12.1.1 Synchronisation test sync mode 1**

##### **12.1.1.1 Definition**

*Synchronisation jitter (transmission timing error) is the time between nominal start of the transmission time period as determined by a UTC synchronisation source ( $T_{o\_ref}$ ) and  $T_o$  of the EUT ( $T_{o\_EUT}$ ).*

##### **12.1.1.2 Method of measurement**

*Set up standard test environment and set the EUT to assigned mode for a reporting rate of 5 s. Enable test conditions for the following:*

- a) *station transmitting Message 1 or 2, 3, 4, 18, 19 not subject to a CS-delay, with repeat indicator = 0, with no propagation delay and with position available is received by the EUT;*
- b) *no sync source (switched off);*
- c) *with the internal clock of the EUT out of sync (sync jitter > 1000  $\mu$ s), transmit messages not to be used as sync source (see 7.3.1.1) to the EUT;*
- d) *repeat test a) using a sync source transmitting Message 4; simulate the position of the station providing the sync source (for example a base station 60 NM = 416  $\mu$ s away from EUT position) in order to simulate a propagation delay;*
- e) *Repeat test d) with an additional source transmitting Message 1 or 2, 3, 4, 18 not subject to a CS-delay, with repeat indicator = 0, with no propagation delay and with position available is received by the EUT.*

*Record VDL messages and measure the time between  $T_{o\_ref}$  of the synchronisation source and the initiation of the "transmitter on" function  $T_A$  and calculate back to  $T_{o\_EUT}$  (a sync output may be used for the purpose of this test). Alternative methods, for example by evaluating the start flag are allowed.*

##### **12.1.1.3 Required results**

- a) *The EUT shall synchronise on the received source and the synchronisation jitter shall not exceed  $\pm 312 \mu$ s (sync mode 1).*
- b) *The synchronisation jitter shall not exceed  $\pm 312 \mu$ s during a 30 s period from the time a proper sync source was last received.*
- c) *The EUT shall not synchronise on these received messages.*
- d) *The synchronisation jitter of the EUT shall be within  $-416 \mu$ s  $\pm 312 \mu$ s.*
- e) *The synchronisation jitter of the EUT shall be  $-208 \mu$ s  $\pm 312 \mu$ s within 60 s.*

| Test details - Synchronisation test sync mode 1                                                                                                        |                                                                                                                   |                                                                                                                                                             |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Test item                                                                                                                                              | Check                                                                                                             | Remark                                                                                                                                                      | Result |
| Setup an assigned reporting rate of 5 s<br>The correct timing is $T_{\text{classA}} + 1568 \mu\text{s}$                                                |                                                                                                                   |                                                                                                                                                             |        |
| a) Transmit an appropriate position report as sync source<br>Msg "B Msg 23 Test 10.2.2.1 T1"                                                           | Check that the EUT does synchronise to the sync source                                                            |                                                                                                                                                             | Ok     |
|                                                                                                                                                        | Check that the sync jitter does not exceed $\pm 312 \mu\text{s}$ from the sync source                             | The basic synchronisation is very good and inside the limits.<br>The sync timing was ok, with and without GPS available.<br>Confirmed by a test over night. | Ok     |
|                                                                                                                                                        | Check that the sync mode value in the comm state is 3                                                             |                                                                                                                                                             | Ok     |
| b) Remove sync source                                                                                                                                  | Check that the sync jitter does not exceed $\pm 312 \mu\text{s}$ for the next 30 s after last received sync msg   |                                                                                                                                                             | Ok     |
|                                                                                                                                                        | Check that the sync mode value in the comm state is 3                                                             |                                                                                                                                                             | Ok     |
| c) Restart the EUT to get it out of sync ( $>1000\mu\text{s}$ ) Transmit a position report with repeat indicator not 0.<br>Msg "B Msg 1 Test 12.1.1 c" | Check that EUT does not synchronise to the msg                                                                    | The EUT does not synchronize to the position report                                                                                                         | Ok     |
| d) Transmit msg 4, range to EUT = 60 NM<br>Msg "B Msg 4 Test 12.1.1 d"                                                                                 | Check that the sync jitter of the EUT is within $-416 \mu\text{s} \pm 312 \mu\text{s}$ from the msg 4             | The timing is correct                                                                                                                                       | Ok     |
| e) Transmit msg 4, range to EUT = 60 NM, and msg 1/3, range = 0<br>Msg "B Msg 1 Test 12.1.1 d"                                                         | Check that the sync jitter of the EUT is within $-208 \mu\text{s} \pm 312 \mu\text{s}$ from the msg 1, after 60 s | The timing is correct                                                                                                                                       | Ok     |

- **12.1.2 Synchronisation test sync mode 2**

#### 12.1.2.1 Method of measurement

Set up standard test environment and enable test conditions for the following:

- operate EUT in sync mode 2 for more than 5 min.
- Switch on sync source immediately after scheduled transmission of EUT. Sync source shall be a station transmitting Message 1 or 2,3,4,18,19 not subject to a CS-delay, with repeat indicator = 0 and with position available with a reporting rate of 10 s.

Record VDL messages and measure the time between  $T_{\text{ref}}$  of the synchronisation source and the initiation of the "transmitter on" function  $T_A$  and calculate back to  $T_{\text{EUT}}$  (a sync output may be used for the purpose of this test). Alternative methods, for example by evaluating the start flag are allowed.

#### 12.1.2.2 Required results

Verify that the EUT synchronises its next scheduled transmission on the sync source. The synchronisation jitter shall not exceed  $\pm 312 \mu\text{s}$ .

| Test details - Synchronisation test sync mode 2                                            |                                                                                                                |                                                                                                                                      |        |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------|
| Test item                                                                                  | Check                                                                                                          | Remark                                                                                                                               | Result |
| Operate in autonomous mode<br>The correct timing is $T_{\text{classA}} + 1568 \mu\text{s}$ |                                                                                                                |                                                                                                                                      |        |
| a) Operate in sync mode 2 for more than 5 min                                              | Check that the EUT is not synchronised                                                                         |                                                                                                                                      | Ok     |
| b) After scheduled transmission start appropriate sync source                              | Check that the sync jitter of the next transmission does not exceed $\pm 312 \mu\text{s}$ from the sync source | There is no break in the transmission schedule.<br>The second transmission after the start of sync source does not exceed the limits | Ok     |

- **12.1.3 Synchronisation test with UTC**

*This test is only relevant if optional synchronisation sources providing UTC are implemented.*

### 12.1.3.1 Method of measurement

Set up standard test environment and enable test conditions in a way that EUT operates in UTC synchronised mode.

### 12.1.3.2 Required results

The synchronisation jitter shall not exceed  $\pm 312 \mu\text{s}$ .

| Test details - Synchronisation test sync mode 1                                                                                 |                                                                                       |                                   |        |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------|--------|
| Test item                                                                                                                       | Check                                                                                 | Remark                            | Result |
| Connect the optional synchronisation source<br>The correct timing is $T_{\text{classA}} + 20 \text{ bit}$ (2083 $\mu\text{s}$ ) |                                                                                       |                                   |        |
| Optional synchronisation                                                                                                        | Check that the sync does not exceed $\pm 312 \mu\text{s}$ from the correct UTC timing | If implemented<br>Not implemented | N/A    |

## 12.2 Carrier-Sense tests

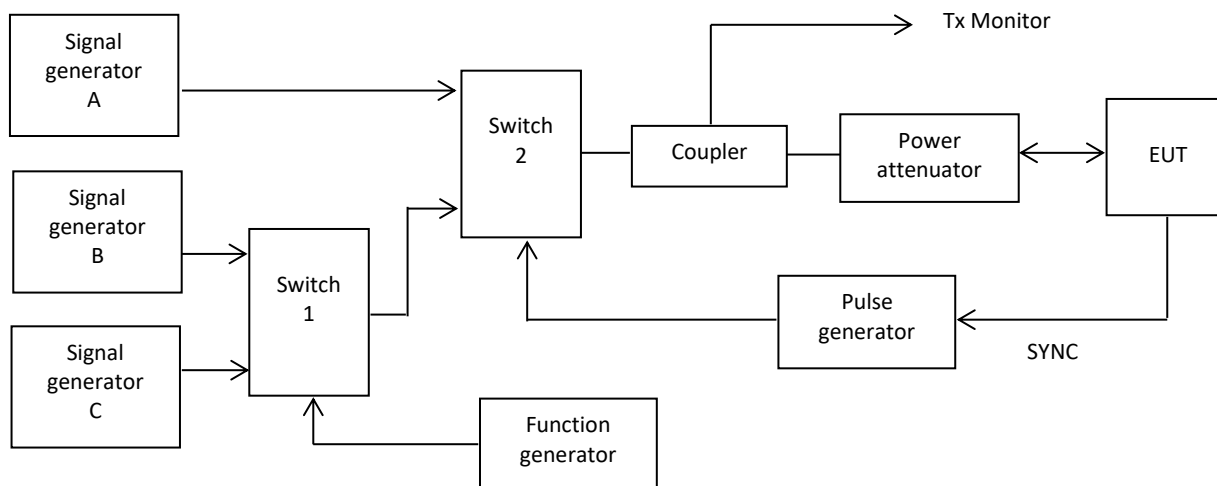
### 12.2.1 Threshold level

#### 12.2.1.1 Definition

Carrier-Sense threshold is the signal level below that which a time period shall be regarded as unused and a transmission may take place.

#### 12.2.1.2 Method of measurement

The test configuration is described here in its most basic form, using three signal sources with RF (PIN) switches selecting when each signal is applied to the EUT. Other equipment configurations may be used if they fulfil the same requirements (for example a single RF source fed via a switched attenuator, which is controlled by a timing circuit).



**Figure 13 – Configuration for Carrier-Sense threshold test**

- Signal C is a carrier modulated with a 400 Hz FM signal with a deviation of 3 kHz equivalent to  $-60 \text{ dBm}$  at the EUT. The switches connect this signal to the EUT most of the time to mimic 100 % channel loading with strong traffic.
- Signal B is a carrier modulated with a 400 Hz FM signal with a deviation of 3 kHz equivalent to  $-87 \text{ dBm}$  at the EUT. Switch 1 replaces signal C with signal B for 26,67 ms. The function generator makes this happen once every 2 s. This imitates one vacant time period in a 99 % loaded channel. The level of Signal B can be manually switched between  $-87 \text{ dBm}$  and OFF to mimic high and low background levels (resulting in a threshold level of  $-77 \text{ dBm}$  and  $-107 \text{ dBm}$ ).

- c) *Signal A is a carrier modulated with a 400 Hz FM signal with a deviation of 3 kHz equivalent to –104 dBm at the EUT. When the EUT attempts a transmission, switch 2 replaces the ‘background traffic’ with signal A to imitate an incoming message intended to inhibit the transmission attempt. The level of signal A can be manually set to –74 dBm, –104 dBm and OFF (defined as less than –117 dBm).*
- d) *All three signal generators are tuned to the same frequency. The test shall be carried out on the lowest frequency declared by the manufacturer and AIS 2 (162,025 MHz).*
- e) *For the purposes of this test, the EUT will be equipped with a test signal (SYNC) indicating the start of each time period that it intends to transmit into. This is used to trigger the pulse generator which after a delay of 0,8 ms (8 bits) generates a 23,3 ms (224 bits) pulse for switch 2.*
- f) *With the signal levels set to the levels shown in the first row of the following table, the EUT shall be observed making routine scheduled position reports. Levels shall then be adjusted as per subsequent steps and the EUT monitored for 10 min (or at least 20 reporting attempts) to confirm if transmission has ceased.*

### 12.2.1.3 Required results

• **Table 24 – Required threshold test results**

| Step | Description       | Signal A ( dBm) | Signal B ( dBm) | EUT transmission |
|------|-------------------|-----------------|-----------------|------------------|
| 1    | Time period free  | OFF             | OFF             | Yes              |
| 2    | Time period used  | –104            | OFF             | Ceased           |
| 3    | Recovery          | OFF             | OFF             | Yes              |
| 4    | Raised background | OFF             | –87             | Yes              |
| 5    | Time period used  | –74             | –87             | Ceased           |
| 6    | Recovery          | OFF             | –87             | Yes              |

| Test details - Threshold level                                                                                                                                          |                                        |                             |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------|--------|
| Test item                                                                                                                                                               | Check                                  | Remark                      | Result |
| Run the test automatically with all steps, using the automatic test adapter.<br>Record the transmissions of the EUT and the step information output of the test adapter |                                        |                             |        |
| Step 1                                                                                                                                                                  | Check that the EUT has transmitted     | The EUT has transmitted     | Ok     |
| Step 2                                                                                                                                                                  | Check that the EUT has not transmitted | The EUT has not transmitted | Ok     |
| Step 3                                                                                                                                                                  | Check that the EUT has transmitted     | The EUT has transmitted     | Ok     |
| Step 4                                                                                                                                                                  | Check that the EUT has transmitted     |                             | Ok     |
| Step 5                                                                                                                                                                  | Check that the EUT has not transmitted | The EUT has not transmitted | Ok     |
| Step 6                                                                                                                                                                  | Check that the EUT has transmitted     | The EUT has transmitted     | Ok     |

- **12.2.2 Carrier sense timing**

#### 12.2.2.1 Definition

This test is to verify that signals that are received before the CS detection window starts are not used for the detection of used time periods.

#### 12.2.2.2 Method of measurement

Use the test configuration and signals of test 12.2.1.

Signal B is switched off, signal A can be manually set to -74 dBm, -104 dBm and OFF.

The SYNC signal of the EUT indicating the start of each time period that it intends to transmit into is used to trigger the pulse generator to generate a 0,7 ms (7 bits) pulse for switch 2 starting at the SYNC signal (this pulse ends 1 bit before start of the CS detection window of the EUT)

f) Levels shall be adjusted as per the steps given in Table 25 and the EUT monitored for 10 min (or at least 20 reporting attempts) to confirm if EUT transmits.

#### 12.2.2.3 Required results

1 Table 25 Required carrier sense timing results

| Step | Description      | Signal A (dBm) | Signal B (dBm) | EUT transmission |
|------|------------------|----------------|----------------|------------------|
| 1    | Time period free | OFF            | OFF            | Yes              |
| 2    | Time period free | -104           | OFF            | Yes              |
| 3    | Time period free | -74            | OFF            | Yes              |

| Test details - Carrier sense timing                                                                                                                                     |                                    |        |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------|--------|
| Test item                                                                                                                                                               | Check                              | Remark | Result |
| Run the test automatically with all steps, using the automatic test adapter.<br>Record the transmissions of the EUT and the step information output of the test adapter |                                    |        |        |
| Step 1                                                                                                                                                                  | Check that the EUT has transmitted |        | Ok     |
| Step 2                                                                                                                                                                  | Check that the EUT has transmitted |        | Ok     |
| Step 3                                                                                                                                                                  | Check that the EUT has transmitted |        | Ok     |

- **12.3 VDL state/reservations**

#### 12.3.1 Method of measurement

Set up standard test environment and operate EUT with assigned reporting interval of 10 s. Record transmitted scheduled position reports Message 18 and check time periods used for transmission.

- Transmit a Message 20 to the EUT reserving a block of time periods including timeout.
- Transmit a Message 20 to the EUT reserving a block of time periods without timeout.

#### 12.3.2 Required results

- Verify that the reserved block is not used and used again after the timeout specified in Message 20.
- Verify that the reserved block is not used and used again after a timeout of 3 min.

| Test details – VDL state/ reservations |       |        |        |
|----------------------------------------|-------|--------|--------|
| Test item                              | Check | Remark | Result |

|                                                                                                                                                                                                                   |                                                                           |                                                                                                            |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----|
| Send a message 20 from VDL Generator with slot offset and increment for slot reservation according to the description below. Set time-out according to the test item.<br>Set assigned reporting interval of 10 s. |                                                                           |                                                                                                            |    |
| a) Timeout = 6<br><br>Msg "B Msg 20 Test 12.3 a"<br>Msg "B Msg 23 Test 12.3"                                                                                                                                      | Check that the reserved slots are not used by the EUT within the time-out | The reserved slots are not used if there is a message 4 from the same basestation with a distance < 120 NM | Ok |
|                                                                                                                                                                                                                   | Check that after end of reservation all slots are used again.             |                                                                                                            | Ok |
| b) Timeout = 0 (not available)<br><br>Msg "B Msg 20 Test 12.3 b"<br>Msg "B Msg 23 Test 12.3"                                                                                                                      | Check that the reserved slots are not used by the EUT within 3 min        |                                                                                                            | Ok |
|                                                                                                                                                                                                                   | Check that after end of reservation all slots are used again.             |                                                                                                            | Ok |

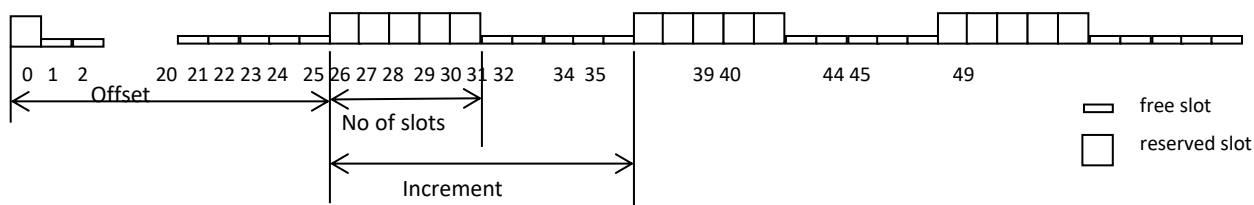
Test scenario: Msg 20 transmission by test system.

Msg 20 reserves slots which should not be used by mobile stations.

Msg 20 parameters:

- Msg 20 is transmitted in slot 0 in each frame
- Offset number 1: 25
- Number of slots: 5
- Time out 1: 6 / 0 depending on test item
- Increment: 10

### FATDMA reservation



## • **12.4 Data encoding (bit stuffing)**

### 12.4.1 Method of measurement

Set up standard test environment.

Set ships name to a value that requires bit-stuffing for example “wwwwww” and check the VDL (note that this might require that the manufacturer provides means to input this data).

### 12.4.2 Required results

Confirm that transmitted VDL Message 24 conforms to data input.

| Test details - Data encoding (bit stuffing)      |                                                       |        |        |
|--------------------------------------------------|-------------------------------------------------------|--------|--------|
| Test item                                        | Check                                                 | Remark | Result |
| Set ships name to a value requiring bit stuffing |                                                       |        |        |
| Msg 24 content                                   | Check that the ships name in msg 24 on VDL is correct |        | Ok     |

## • **12.5 Frame check sequence**

### 12.5.1 Method of measurement

Apply simulated position report messages with wrong CRC bit sequence to the VDL.

- Check test output; if a display interface is provided, check this.
- Repeat test 12.1.1 and check that a station transmitting messages with wrong CRC are not used for synchronisation.

### 12.5.2 Required results

Confirm that messages with invalid CRC are not accepted by the EUT in cases a) and b).

| Test details - Frame check sequence                                                 |                                                                  |                                                        |        |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------|--------|
| Test item                                                                           | Check                                                            | Remark                                                 | Result |
| Transmit position report message from VDL generator                                 |                                                                  |                                                        |        |
| Set CRC bit sequence to ok<br>Msg “B Msg 1”                                         | Check that position report is received from EUT (VDM output)     |                                                        | Ok     |
| a) Set CRC bit sequence to false                                                    | Check that position report is not received from EUT (VDM output) |                                                        | Ok     |
|                                                                                     | Check that the target is not displayed on the display            | If implemented<br>Not implemented                      | N/A    |
| b) Disable GPS, apply external position.<br>Transmit position report with wrong CRC | Check that the EUT does not synchronise to the incorrect message | The EUT does not synchronize to reports with wrong CRC | Ok     |

## • **12.6 Slot allocation (channel access protocol)**

### • **12.6.1 Autonomous mode allocation**

#### 12.6.1.1 Method of measurement

Set up standard test environment and operate EUT with assigned reporting interval of 10 s. Record transmitted scheduled position reports Message 18 and check time periods used for transmission. Check the Communication State of transmitted messages.

Repeat the test with additional simulated channel load of 80 % (4 time periods used, 1 time period unused).

#### 12.6.1.2 Required results

The time periods used for transmission shall in both tests

- not exceed the transmission interval TI;
- not always use the same time period;
- not always use the first unused time period.

Check that the Communication state of Message 18 is the default value as defined in 7.3.3.5.

| Test details - Autonomous mode allocation                                                                                                       |                                                                     |                                                        |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------|--------|
| Test item                                                                                                                                       | Check                                                               | Remark                                                 | Result |
| Set assigned reporting rate of 10 s (Msg "B Msg 23 Test 12.3")<br>Record the transmission slots for at least 30 min and evaluate the used slots |                                                                     |                                                        |        |
| Test 1:<br>No channel load                                                                                                                      | Check that the slots do not exceed the TI                           |                                                        | Ok     |
|                                                                                                                                                 | Check that the EUT does not always use the same time period         |                                                        | Ok     |
|                                                                                                                                                 | Check that the EUT not always uses the first unused time period     |                                                        | Ok     |
| Test 1:<br>80% channel load                                                                                                                     | Check that the slots do not exceed the TI                           |                                                        | Ok     |
|                                                                                                                                                 | Check that the EUT does not always use the same time period         |                                                        | Ok     |
|                                                                                                                                                 | Check that the EUT does not always use the first unused time period |                                                        | Ok     |
|                                                                                                                                                 | Check that the EUT does not use slot used by the received targets   | The EUT does not use slot used by the received targets | Ok     |
| Communication state                                                                                                                             | Check that the com state of msg 18 is always as defined in 7.3.3.5  |                                                        | Ok     |

- **12.6.2 DSC listening periods**

**12.6.2.1 Method of measurement**

*This test is applicable only if DSC functionality is implemented.*

Set up standard test environment and operate EUT with assigned reporting interval of 10 s. Enable DSC functionality. Record transmitted scheduled position reports Message 18 and check time periods used for transmission.

**12.6.2.2 Required results**

*During the DSC monitoring times, scheduled transmissions of Message 18 shall continue.*

| Test details - DSC listening periods                            |                                                 |        |        |
|-----------------------------------------------------------------|-------------------------------------------------|--------|--------|
| Test item                                                       | Check                                           | Remark | Result |
| Set assigned reporting rate of 10 s<br>Enable DSC functionality |                                                 |        |        |
| Tx of msg 18                                                    | Check that the scheduled Tx of msg 18 continues |        | Ok     |

- **12.7 Assigned operation**

- **12.7.1 Assignment priority**

**12.7.1.2 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Transmit an Assigned mode command (Message 23) to the EUT with Tx/Rx mode 1.

- Transmit a Message 22 defining a region with the EUT inside that region. Transmit a Message 22 to the EUT individually addressed and specifying Tx/Rx mode 2.
- Repeat the test, clear the region defined by Message 22 under a) <sup>2</sup>. Transmit Message 22 to the EUT with regional settings specifying Tx/Rx mode 2.

Record transmitted messages.

**12.7.1.2 Required results**

- The Tx/Rx mode field setting of Message 22 shall take precedence over the Tx/Rx mode field setting of Message 23.
- The Tx/Rx mode field setting of Message 23 shall take precedence over the Tx/Rx mode field setting of Message 22. The receiving station shall revert to its previous Tx/Rx mode after a timeout value randomly chosen between 240 s and 480 s.

| Test details - Autonomous mode allocation |  |  |  |
|-------------------------------------------|--|--|--|
|-------------------------------------------|--|--|--|

<sup>2</sup> This can be carried out using the method used in 13.3.1 b) step 2 or by assigning a new simulated position to the EUT.

| Test item                                                                                               | Check                                                                           | Remark                                                                                              | Result |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------|
| Send a msg 23 with Tx/Rx mode = 1<br>Msg "B Msg 23 Test 10.2.2.1 T4"                                    |                                                                                 |                                                                                                     |        |
| a) Send a msg 22 defining a region with EUT inside<br>(Tx/Rx mode = 2)<br>Msg "B Msg 22 Test 12.7.1 a1" | Check that the EUT uses Tx/Rx mode 1 as defined by msg 23 (Tx on channel A)     | The EUT uses Tx/Rx mode as defined by msg 23, reporting interval = 15s.                             | Ok     |
| Send an addressed msg 22 to EUT with Tx/Rx mode = 2<br>Msg "B Msg 22 Test 12.7.1 a2"                    | Check that the EUT uses Tx/Rx mode 2 as defined by msg 22 (Tx on channel B)     | msg 23                                                                                              | Ok     |
|                                                                                                         |                                                                                 | Tx/Rx mode = 1                                                                                      |        |
|                                                                                                         |                                                                                 | msg 22                                                                                              |        |
|                                                                                                         |                                                                                 | Tx/ Rx mode = 2                                                                                     | Ok     |
|                                                                                                         |                                                                                 | TX/Rx mode = 0                                                                                      | Ok     |
| msg 23<br>Tx/Rx mode 2 is stored and used for transmission                                              |                                                                                 |                                                                                                     |        |
| Clear the region defined in test a)                                                                     |                                                                                 |                                                                                                     |        |
| b) Send a msg 22 defining a region with EUT inside,<br>Tx/Rx mode = 2<br>Msg "B Msg 22 Test 12.7.1 b1"  | Check that the EUT uses Tx/Rx mode 2 (Tx on channel B)                          | Tx/Rx mode 2 is correctly stored (ACA output).                                                      | Ok     |
|                                                                                                         |                                                                                 | Tx/Rx mode 2 is not used, EUT transmits with Rx/Rx mode 0 (alternating)                             |        |
|                                                                                                         |                                                                                 | Tx/Rx mode is 2 (Tx on channel B only)                                                              |        |
|                                                                                                         |                                                                                 | Tx/Rx mode 2 is used also if there was already a region stored with other corner points.            |        |
|                                                                                                         |                                                                                 | A new Tx/Rx mode is not stored and not used if the corner points are identical to an existing area. |        |
| Tx/Rx mode 2 is used also if there was already a region stored with the same corner points.             |                                                                                 |                                                                                                     | Ok     |
| Send one msg 23 to the EUT with Tx/Rx mode = 1<br>Msg "B Msg 23 Test 10.2.2.1 T4"                       | Check that the EUT uses Tx/Rx mode 1 as defined by msg 23 (Tx on channel A)     | UTC 12:56<br>Tx/Rx mode = 1                                                                         | Ok     |
|                                                                                                         | Check that the EUT reverts to Tx/Rx mode 2 after 4...8 min (time-out of msg 23) |                                                                                                     | Ok     |

- **12.7.2 Entering rate assignment**

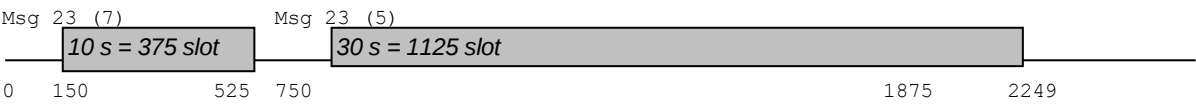
#### 12.7.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Transmit a Group Assignment command (Message 23) to the EUT with a reporting interval of 10 s assigned, monitor the VDL, reset by assigning 30 s rate; repeat 10 times.

#### 12.7.2.2 Required result

Verify that the first transmission after receiving the Message 23 is within a time randomly selected between the time the Message 23 has been received and the assigned interval.

| Test details - Entering rate assignment                                                                                                                                                             |                                                                        |                                                                 |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------|--------|
| Test item                                                                                                                                                                                           | Check                                                                  | Remark                                                          | Result |
| Send 10 times:<br>Msg 23 with 10 s reporting interval (Msg "B Msg 23 Test 12.7.2 10s")<br>After 20 s:<br>Msg 23 with 30 s reporting interval. (Msg "B Msg 23 Test 12.7.2 30s")<br>Repeat after 45 s |                                                                        |                                                                 |        |
| 10 s reporting interval                                                                                                                                                                             | Check that the first Tx is randomly selected in 0 ...10 s after msg 23 | The the first Tx is randomly selected in 0 ...10 s after msg 23 | Ok     |
| 30 s reporting interval                                                                                                                                                                             | Check that the first Tx is randomly selected in 0 ...30 s after msg 23 | The the first Tx is randomly selected in 0 ...30 s after msg 23 | Ok     |
|                                                                                                                                                                                                     |                                                                        |                                                                 |        |



- **12.7.3 Reverting from rate assignment**

**12.7.3.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Transmit a Group Assignment command (Message 23) to the EUT with a reporting interval of 10 s assigned, monitor the VDL until at least 1 min after timeout occurred; repeat 10 times (transmissions of Message 23 shall not be synchronised to the initial transmission schedule of the EUT).

Measure the time  $T_{rev}$  between the reception of Message 23 and first transmission after timeout.

**12.7.3.2 Required result**

$T_{rev}$  shall be randomly distributed between 240 s and 480 s.

| Test details - Reverting from rate assignment                                                                          |                                                                  |        |        |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------|--------|
| Test item                                                                                                              | Check                                                            | Remark | Result |
| Send 10 times:<br>Msg 23 with 10 s reporting interval, Msg "B Msg 23 Test 10.2.2.1 T3"<br>Wait until time-out + 1 min. |                                                                  |        |        |
| Measure time $T_{rev}$                                                                                                 | Check that $T_{rev}$ is randomly distributed between 4 and 8 min |        | Ok     |

- **12.7.4 Reverting from quiet mode**

**12.7.4.1 Method of measurement**

Set up standard test environment and operate EUT with a reporting interval of 10 s assigned. Transmit a Group Assignment command (Message 23) to the EUT with quiet time = 1 min.

**12.7.4.2 Required results**

Verify that the first transmission after the quiet period is within the schedule that was in place before the quiet period.

| Test details - Reverting from mode                                       |                                                                                     |        |        |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------|--------|
| Test item                                                                | Check                                                                               | Remark | Result |
| Send Msg 23 with 10 s reporting interval Msg "B Msg 23 Test 10.2.2.1 T3" |                                                                                     |        |        |
| Reporting rate                                                           | Check reporting interval = 10 s                                                     |        | Ok     |
| Send msg 23 with<br>quiet time = 1 min                                   | Check that EUT does not transmit during quiet time                                  |        | Ok     |
|                                                                          | Check that the transmissions after end of quiet time matches the previous schedule. |        | Ok     |

- **12.7.5 Retry of interrogation response**

**12.7.5.1 Method of measurement**

Set up standard test environment. Interrogate the EUT by Message 15 for a response with Message 18.

- Simulate full VDL load for the following 30 s.
- Simulate full VDL load for the following 60 s

**12.7.5.2 Required result**

- Verify that a response is transmitted between 30 s and 60 s after the transmission of Message 15.
- Verify that no response is transmitted.

| Test details - Retry of interrogation response                       |                                                                      |                     |        |
|----------------------------------------------------------------------|----------------------------------------------------------------------|---------------------|--------|
| Test item                                                            | Check                                                                | Remark              | Result |
| Send an interrogation for msg 18                                     |                                                                      |                     |        |
| Apply full channel load for 30s<br>Target simulation: "50_slotsVer2" | Check that a response is transmitted within 30 ... 60 s after msg 15 | Response after 31 s | Ok     |
| Send an interrogation for msg 18                                     |                                                                      |                     |        |
| Apply full channel load for 60s<br>Target simulation: "50_slotsVer2" | Check that no response is transmitted (because retry is inhibited)   | No responses        | Ok     |

## • 12.8 Message formats

### • 12.8.1 Received messages

#### 12.8.1.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Apply messages according to Table 11 to the VDL. Record messages output by the PI of EUT where provided.

#### 12.8.1.2 Required results

Confirm that EUT responds as appropriate. Check that EUT outputs the corresponding sentences with correct field contents and format via the PI where provided.

Verify that the EUT does not process addressed messages.

| Test details - Received messages                              |                                                                                            |                                                                                                                        |        |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------|
| Test item                                                     | Check                                                                                      | Remark                                                                                                                 | Result |
| Send all message to the EUT and check PI output               |                                                                                            |                                                                                                                        |        |
| General                                                       | The messages with number of fill bits = 0 are output correctly with the value 0 in the VDM |                                                                                                                        | Ok     |
| Msg 1,2,3 Position report                                     | Check that message is output                                                               | Optional<br>Message 1 is output, message 3 is not output.                                                              | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 4 base station report                                     | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 5 Static and voyage related data                          | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content<br>Fill bits: ,2                                                  | Message 5 is output correctly                                                                                          | Ok     |
| Msg 6 Addressed binary message                                | Check that message is not output                                                           | Message 6 is not output                                                                                                | Ok     |
| Msg 7 Binary acknowledgement                                  | Check that message is not output                                                           | Message 7 is not output                                                                                                | Ok     |
| Msg 8 Binary broadcast message                                | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content<br>Fill bits: ,4                                                  | Fill bits = 4 (correct)                                                                                                | Ok     |
| Msg 9 SAR Aircraft position report                            | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 10 UTC and date inquiry                                   | Check that message is not output                                                           | Message 10 is not output                                                                                               | Ok     |
| Msg 11 UTC/Date response                                      | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 12 Safety related addressed message, addressed to EUT     | Check that message is output                                                               | Message 12 is not output                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 12 Safety related addressed message, not addressed to EUT | Check that message is not output                                                           | Message 12 to another station is not output                                                                            | Ok     |
| Msg 13 Safety related acknowledge                             | Check that message is not output                                                           | Message 13 is not output                                                                                               | Ok     |
| Msg 14 Safety related broadcast message                       | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 15 Interrogation                                          | Check that message is output                                                               | required                                                                                                               | Ok     |
|                                                               | Check format and content<br>Fill bits: 2                                                   | <ul style="list-style-type: none"> <li>The fill bits are correct.</li> <li>The last character is incorrect.</li> </ul> | Ok     |
|                                                               |                                                                                            |                                                                                                                        | Ok     |
| Msg 16 Assigned mode command                                  | Check that message is not output                                                           | Message 16 is not output                                                                                               | Ok     |
| Msg 17 DGNSS broadcast binary message                         | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 18 Class B equipment position report                      | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 19 Extended Class B equipment position report             | Check that message is output                                                               | Optional                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 20 Data link management message                           | Check that message is output                                                               | Required                                                                                                               | Ok     |
|                                                               | Check format and content                                                                   |                                                                                                                        | Ok     |
| Msg 21 Aids to navigation report                              | Check that message is output                                                               | Optional                                                                                                               | Ok     |

|                                         |                                  |                                                               |    |
|-----------------------------------------|----------------------------------|---------------------------------------------------------------|----|
|                                         | Check format and content         |                                                               | Ok |
| Msg 22 Channel management message       | Check that message is output     | Required                                                      | Ok |
|                                         | Check format and content         |                                                               | Ok |
| Msg 23 Group assignment                 | Check that message is output     | Required                                                      | Ok |
|                                         | Check format and content         | The fill bits value is correct.                               | Ok |
| Msg 24 Class B "CS" static data, Part A | Check that message is output     | Optional                                                      | Ok |
|                                         | Check format and content         | The fill bits value is correct.                               | Ok |
| Msg 24 Class B "CS" static data, Part B | Check that message is output     | Optional                                                      | Ok |
|                                         | Check format and content         |                                                               | Ok |
| Msg 25                                  | Check that message is output     | Message 25 is output if broadcast or addressed to own station | Ok |
| Msg 26                                  | Check that message is not output | Message 26 is not output                                      | Ok |
| Msg 27                                  | Check that message is not output | Message 27 is not output                                      | Ok |
| Undefined message                       | Check that message is not output | The undefined message is not output                           | Ok |

- **12.8.2 Transmitted messages**

### 12.8.2.1 Method of measurement

Set up standard test environment and operate EUT in autonomous mode. Initiate the transmission of messages relevant for a Class B mobile station according to Table 11 by the EUT. Record transmitted messages.

### 12.8.2.2 Required results

Confirm that only messages as allowed by Table 11 are transmitted by the EUT.

| Test details - Transmitted messages                                                      |                                                                                    |                         |        |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------|--------|
| Test item                                                                                | Check                                                                              | Remark                  | Result |
| Initiate transmission of the messages according to table 11 by interrogation with msg 15 |                                                                                    |                         |        |
| Msg 1,2,3 Position report                                                                | Check that message is not transmitted                                              |                         | Ok     |
| Msg 4 base station report                                                                | Check that message is not transmitted                                              |                         | Ok     |
| Msg 5 Static and voyage related data                                                     | Check that message is not transmitted                                              |                         | Ok     |
| Msg 6 Addressed binary message                                                           | Check that message is not transmitted                                              |                         | Ok     |
| Msg 7 Binary acknowledgement                                                             | Check that message is not transmitted                                              |                         | Ok     |
| Msg 8 Binary broadcast message                                                           | Check that message is not transmitted                                              |                         | Ok     |
| Msg 9 SAR Aircraft position report                                                       | Check that message is not transmitted                                              |                         | Ok     |
| Msg 10 UTC and date inquiry                                                              | Check that message is not transmitted                                              |                         | Ok     |
| Msg 11 UTC/Date response                                                                 | Check that message is not transmitted                                              |                         | Ok     |
| Msg 12 Safety related addressed message,                                                 | Check that message is not transmitted                                              |                         | Ok     |
| Msg 13 Safety related acknowledge                                                        | Check that message is transmitted when msg 12 is processed<br>(Response on msg 12) | Optional<br>No response | Ok     |
| Msg 14 Safety related broadcast message                                                  | Check that message is not transmitted<br>(Manually initiated)                      | Optional                | Ok     |
| Msg 15 Interrogation                                                                     | Check that message is not transmitted                                              |                         | Ok     |
| Msg 16 Assigned mode command                                                             | Check that message is not transmitted                                              |                         | Ok     |
| Msg 17 DGNSS broadcast binary message                                                    | Check that message is not transmitted                                              |                         | Ok     |
| Msg 18 Class B equipment position report                                                 | Check that message is transmitted<br>(Interrogation and automatically)             |                         | Ok     |
| Msg 19 Extended Class B equipment position report                                        | Check that message is transmitted<br>(Interrogation with offset)                   |                         | Ok     |
| Msg 20 Data link management message                                                      | Check that message is not transmitted                                              |                         | Ok     |
| Msg 21 Aids to navigation report                                                         | Check that message is not transmitted                                              |                         | Ok     |
| Msg 22 Channel management message                                                        | Check that message is not transmitted                                              |                         | Ok     |
| Msg 23 Group assignment                                                                  | Check that message is not transmitted                                              |                         | Ok     |

|                                         |                                                                     |  |    |
|-----------------------------------------|---------------------------------------------------------------------|--|----|
| Msg 24 Class B "CS" static data, Part A | Check that message is transmitted (Interrogation and automatically) |  | Ok |
| Msg 24 Class B "CS" static data, Part B | Check that message is transmitted (Interrogation and automatically) |  | Ok |

- **12.8.3 Use of safety related Message 14**

*This test is only applicable if Message 14 is implemented.*

#### 12.8.3.1 Method of measurement

Check manufacturer's documentation.

- Initiate transmission of Message 14 as specified by the manufacturer.
- Repeat initiation twice a minute

#### 12.8.3.2 Required results

- Verify that the data content of Message 14 is predefined and the transmission cannot exceed one time period (see Table 12).
- Verify that the EUT only accepts the initiation of a Message 14 once a minute without automatic repetition.

| Test details - Use of safety related message 14 |                                                 |                                                                          |        |
|-------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------|--------|
| Test item                                       | Check                                           | Remark                                                                   | Result |
| Check manufacturers documentation               |                                                 |                                                                          |        |
| a) Send msg 14                                  | Check that the content of msg 14 is predefined  | Transmission of message 14 is not supported. (Manufacturers Declaration) | Ok     |
|                                                 | Check that msg 14 cannot exceed one time period |                                                                          | N/A    |
|                                                 | Check content of msg 14 on VDL                  |                                                                          | N/A    |
| b) Repeat initiation of msg 14 twice a minute   | Check that msg 14 is transmitted only once      |                                                                          | N/A    |

## • 13 Specific tests of network layer

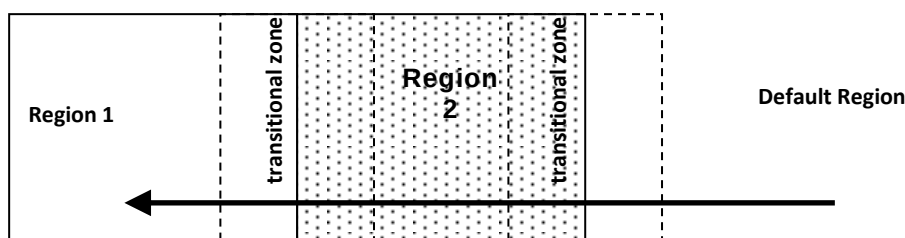
(see 7.4)

### • 13.1 Regional area designation by VDL message

#### 13.1.1 Method of measurement

Set up standard test environment. Apply channel management messages (Message 22) to the VDL defining two adjacent regional areas 1 and 2 with different channel assignments for both regions and a transitional zone extending 4 NM either side of the regional boundary

Let the EUT approach region 1 from outside region 2 more than 5 NM away from region boundary transmitting on default channels. Record transmitted messages on all 6 channels. This can be accomplished by either using a dedicated test input for simulated position information or a GNSS simulator.



|                | Primary channel | Secondary channel |
|----------------|-----------------|-------------------|
| Region 1       | CH A 1          | CH B 1            |
| Region 2       | CH A 2          | CH B 2            |
| Default region | AIS 1           | AIS 2             |

Figure 14 – Regional area scenario

#### 13.1.2 Required results

Check that the EUT transmits and receives on the primary channels assigned for each region alternating channels and doubling reporting rate when passing through the transitional zones (see Table 26). EUT shall revert to default autonomous operation on the regional channels after leaving the transitional zones.

#### • Table 26 – Required channels in use

|   | Area                     | Channels in use |
|---|--------------------------|-----------------|
| 1 | Default region           | AIS 1, AIS 2    |
| 2 | First transitional zone  | AIS 1, CH A 2   |
| 3 | Region 2                 | CH A 2, CH B 2  |
| 4 | Second transitional zone | CH A 2, CH A 1  |
| 5 | Region 1                 | CH A 1, CH B 1  |

| Test details part 1 – Channel management by VDL msg 22                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                    |                                                                                                                                                               |                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Test item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Check                                                              | Remark                                                                                                                                                        | Result         |
| Set-up EUT in autonomous mode transmitting on channel AIS 1/AIS 2, send 2 Msg 22 by VDL generator, defining 2 adjacent areas with channels A1, B1 and A2, B2. Use external sensor input to simulate a voyage through both areas. Set transitional zone to 4nm. Set the position outside the areas. "TZ" is used for "transitional zone"<br><br>Set the positions near the limits of the transitional zones to check the dimensions<br><br>Msg: "B Msg 22 Test 13.1 Area1" and "B Msg 22 Test 13.1 Area2" |                                                                    |                                                                                                                                                               |                |
| <u>Message 22 setting</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Check ACA output                                                   | <ul style="list-style-type: none"> <li>The ACA content is correct.</li> <li>The TZ size is correct (4).</li> </ul> The length of the ACA sentence is correct. | Ok<br>Ok<br>Ok |
| <u>Area 1:</u><br>In high sea area                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Check that channels AIS 1 and AIS 2 are in use                     |                                                                                                                                                               | Ok             |
| <u>Area 2:</u><br>Move position into outer TZ of region 2                                                                                                                                                                                                                                                                                                                                                                                                                                                | Check the limit of the TZ (5 NM = 8.8 minutes)                     | The limit is ok. At 12°09 the high sea channels are used, at 12°08 the TZ channels are used                                                                   | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that channel AIS 1 and A2 are used                           | Tx and Rx on AIS1 and A2 is ok                                                                                                                                | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that reporting rate is doubled                               |                                                                                                                                                               | Ok             |
| Crossing the area border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Check the border of area                                           | The in-use flag is set to 1                                                                                                                                   | Ok             |
| In Region, inside the TZ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Check that channel AIS 1 and A2 are used                           | Tx and Rx on AIS1 and A2 is ok                                                                                                                                | Ok             |
| <u>Area 3:</u><br>Move position into region 2 (out of TZ)                                                                                                                                                                                                                                                                                                                                                                                                                                                | Check the limit of the TZ (4 NM = 7 minutes)                       | The border of the TZ is ok                                                                                                                                    | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that channel A2 and B2 are used                              | A2 and B2 are used for Rx and Tx                                                                                                                              | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that reporting rate is changed back to normal reporting rate |                                                                                                                                                               | Ok             |
| <u>Area 4:</u><br>Move position into TZ between region 1 and 2, inside area 2                                                                                                                                                                                                                                                                                                                                                                                                                            | Check that channels A2 and A1 are used                             |                                                                                                                                                               | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that reporting rate is doubled                               |                                                                                                                                                               | Ok             |
| crossing the area border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Check the border of area                                           | UTC 14:30                                                                                                                                                     | Ok             |
| <u>Area 5:</u><br>Move position into region 1 (out of TZ)                                                                                                                                                                                                                                                                                                                                                                                                                                                | Check that channels A1 and B1 are used                             | UTC 14:31                                                                                                                                                     | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check the limit of the TZ (4 NM = 7 minutes)                       |                                                                                                                                                               | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that reporting rate is changed back to normal reporting rate |                                                                                                                                                               | Ok             |
| <u>Item 6:</u><br>Move position into TZ of region 1 to high sea                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that channels A1 and AIS 1 are used                          |                                                                                                                                                               | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that reporting rate is doubled                               |                                                                                                                                                               | Ok             |
| <u>Area 7:</u><br>Move position out of the TZ of region 1, into high sea                                                                                                                                                                                                                                                                                                                                                                                                                                 | Check that channels AIS 1 and AIS 2 are used                       | UTC 14:35                                                                                                                                                     | Ok             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Check that reporting rate is changed back to normal reporting rate |                                                                                                                                                               | Ok             |

## • **13.2 Regional area designation by serial message or manually**

### 13.2.1 Method of measurement

Check documentation.

### 13.1.2 Required result

Verify that the user cannot allocate channels (directly or by ACA sentence).

| Test details - Regional area designation |                                                               |        |        |
|------------------------------------------|---------------------------------------------------------------|--------|--------|
| Test item                                | Check                                                         | Remark | Result |
| Check documentation                      |                                                               |        |        |
| Serial message or manual input           | Check that the user cannot enter area settings                |        | N/T    |
|                                          | Check that the user cannot change the channels on another way |        | N/T    |

## • **13.3 Management of received regional operating settings**

### • **13.3.1 Replacement or erasure of dated or remote regional operating settings**

#### 13.3.1.1 Method of measurement

Set up standard test environment. Send a valid regional operating setting to the EUT by Message 22 with the regional operating area including the own position of the EUT. Consecutively send a total of seven valid regional operating settings to EUT, using Message 22, with regional operating areas not overlapping to the first and to each other. Perform the following in the order shown:

- send a ninth Message 22 to the EUT with valid regional operating areas not overlapping with the previous eight regional operating areas;
- Step 1: set own position of EUT into any of the regional operating areas defined by the second to the ninth Message 22 sent to the EUT previously;

Step 2: send a tenth Message 22 to the EUT, with a regional operating area which partly overlaps the regional operating area to which the EUT was set by step 1 but which does not include the own position of the EUT;

Step 1: move own position of EUT to a distance of more than 500 miles from all regions defined by previous commands;

Step 2: consecutively set own position of EUT to within all regions defined by the previous Message 22.

This test can be accomplished by either using the test input for simulated position information or a GNSS simulator (see also Annex D).

#### 13.3.2 Required results

After the initialisation, the EUT shall operate according to the regional operating settings defined by the first Message 22 sent.

- The EUT shall return to the default operating settings.
- Step 1: check that the EUT changes its operating settings to those of that region which includes own position of the EUT.

Step 2: check that the EUT reverts to the default operating settings.

**NOTE** Since the regional operating settings to which the EUT was set in Step 1 are erased due to Step 2, and since there is no other regional operating setting due to their non-overlapping definition, the EUT returns to default.

Step 1: check that the EUT operates with the default settings.

Step 2: check that the EUT operates with the default settings.

| Test details – Test of replacement or erasure of dated or remote regional operating settings                                                 |                                            |           |        |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------|--------|
| Test item                                                                                                                                    | Check                                      | Remark    | Result |
| Send by msg 22                                                                                                                               |                                            |           |        |
| <ul style="list-style-type: none"> <li>1 area including own position</li> <li>7 areas not overlapping, not including own position</li> </ul> |                                            |           |        |
| Msg: "B Msg 22 Test 13.3.1 Area1... Area8"                                                                                                   |                                            |           |        |
| Check active area                                                                                                                            | Check that EUT uses the channels of area 1 | UTC 11:30 | Ok     |

|                                                                                                                                                                       |                                                                                    |                                                                                   |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----|
| a) Send a 9. msg 22 to the EUT not overlapping the previous areas<br>Msg: "B Msg 22 Test 13.3.1 Area9"                                                                | Check that the EUT returns to the default operating settings (the area is deleted) | The default settings are used, the oldest area is deleted.                        | Ok |
| b) step 1: Set own position to any of the 7 areas                                                                                                                     | Check channels of area 2                                                           | Checked by ACA output and sample tests with setting the position inside the area. | Ok |
|                                                                                                                                                                       | Check channels of area 3                                                           |                                                                                   | Ok |
|                                                                                                                                                                       | Check channels of area 4                                                           |                                                                                   | Ok |
|                                                                                                                                                                       | Check channels of area 5                                                           |                                                                                   | Ok |
|                                                                                                                                                                       | Check channels of area 6                                                           |                                                                                   | Ok |
|                                                                                                                                                                       | Check channels of area 7                                                           |                                                                                   | Ok |
|                                                                                                                                                                       | Check channels of area 8                                                           |                                                                                   | Ok |
|                                                                                                                                                                       | Check channels of area 9                                                           |                                                                                   | Ok |
| b) step 2: Send an area 10, overlapping the area of step 1 not including own position<br>Msg: "B Msg 22 Test 13.3.1 Area10"                                           | Check that the EUT returns to the default operating settings (the area is deleted) | UTC 11:55                                                                         | Ok |
| c) Step 1: Erasure by distance:<br>Move own position of EUT to a distance of more than 500 miles from all regions defined by previous commands                        | Check that the EUT operates with the default settings                              | UTC 11:58                                                                         | Ok |
| Step 2: Check of erasure:<br>Set own position of EUT to within all regions defined by the previous telecommands.<br>b) step 1: Set own position to any of the 7 areas | Check area 2 = default                                                             | Checked by ACA output and sample tests with setting the position inside the area. | Ok |
|                                                                                                                                                                       | Check area 3 = default                                                             |                                                                                   | Ok |
|                                                                                                                                                                       | Check area 4 = default                                                             |                                                                                   | Ok |
|                                                                                                                                                                       | Check area 5 = default                                                             |                                                                                   | Ok |
|                                                                                                                                                                       | Check area 6 = default                                                             |                                                                                   | Ok |
|                                                                                                                                                                       | Check area 7 = default                                                             |                                                                                   | Ok |
|                                                                                                                                                                       | Check area 8 = default                                                             |                                                                                   | Ok |
|                                                                                                                                                                       | Check area 10 = default                                                            |                                                                                   | Ok |

### • 13.3.2 Channel management by addressed Message 22

#### 13.3.2.1 Method of measurement

Set up a standard test environment and operate EUT in autonomous mode. Perform the following tests in the following order:

- send Message 22 with valid regional operating settings that are different from the default operating settings to the EUT with a regional operating area, which contains the current position of own station;
- send an addressed Message 22 to the EUT with different regional operating settings than the previous command;
- move the EUT out of the regional operating area defined by the previous addressed command into an area without regional operating settings.

#### 13.3.2.2 Required results

- Check, that the EUT uses the regional operating settings commanded to it in a).
- Check, that the EUT uses the regional operating settings commanded to it in b).
- Check, that the EUT reverts to default.

| Test details – Test of addressed message 22                                                                        |                                                          |           |        |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------|--------|
| Test item                                                                                                          | Check                                                    | Remark    | Result |
| All areas are erased by the previous test                                                                          |                                                          |           |        |
| a) Send msg 22 with a new area, position inside<br>Msg: "B Msg 22 Test 10.4.1"                                     | Check, that the EUT uses the regional operating settings | UTC 12:00 | Ok     |
| b) Send an addressed msg 22 to the EUT with different regional operating settings<br>Msg: "B Msg 22 Test 13.3.2 b" | Check, that the EUT uses the settings of the new message | UTC 12:02 | Ok     |
| c) Move the position out of the area                                                                               | Check, that the EUT uses the default channels            | UTC 12:08 | Ok     |

- **13.3.3 Invalid regional operating areas**

This test is to check the rejection of invalid regional operating areas (three regional operating areas with same corner).

**13.3.3.1 Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Perform the following tests in the following order after completion of all other tests related to change of regional operating settings:

- send three different valid regional operating settings with adjacent regional operating areas, their corners within eight miles of each other, to the EUT by Message 22. The current own position of the EUT shall be within the regional operating area of the third regional operating setting;
- move current own position of the EUT consecutively to the regional operating areas of the first two valid regional operating settings.

**13.3.3.2 Required test results**

- Check, that the EUT uses the operating settings that were in use prior to receiving the third regional operating setting.
- Check, that the EUT consecutively uses the regional operating settings of the first two received regional operating areas.

| Test details – Test for invalid regional operating areas                                                                                                                                                               |                                                                      |           |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------|--------|
| Test item                                                                                                                                                                                                              | Check                                                                | Remark    | Result |
| a) Send three different valid regional with adjacent corners by msg 22, Position inside 3 <sup>rd</sup> area.<br>Msg: "B Msg 22 Test 13.3.1 Area6"<br>Msg: "B Msg 22 Test 13.3.1 Area7"<br>Msg: "B Msg 22 Test 13.3.3" | Check, that the default channels are used                            | UTC 10:10 | Ok     |
| b) Move own position to the first area                                                                                                                                                                                 | Check, that the EUT uses the operational settings of the first area  | UTC 12:13 | Ok     |
| Move own position to the second area                                                                                                                                                                                   | Check, that the EUT uses the operational settings of the second area | UTC 12:15 | N/T    |

- **13.3.4 Continuation of autonomous mode reporting rate**

**13.3.4.1 Method of test**

When in the presence of an assigned mode command and in a transition zone, check that the EUT continues to report at the autonomous mode reporting interval.

**13.3.4.2 Required result**

Ensure that the autonomous reporting interval is maintained.

| Test details – Continuation of autonomous mode reporting rate                                                                                                                                                                          |                                                                         |                                                                                                                   |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------|
| Test item                                                                                                                                                                                                                              | Check                                                                   | Remark                                                                                                            | Result |
| Set the EUT into a transitional zone<br>Send an assignment command using msg 23 to the EUT with a different reporting interval<br>Area setting msg Msg: "B Msg 22 Test 10.4.1"<br>Reporting interval: Msg: "B Msg 23 Test 10.2.2.1 T1" |                                                                         |                                                                                                                   |        |
| Assignment command in a transitional zone                                                                                                                                                                                              | Check that an rate assignment command is ignored in a transitional zone | UTC 12:22/12:30<br>If the EUT has recognized that it is in the transitional zone the group assignment is ignored. | Ok     |

- **13.3.5 Other conditions**

The fulfilment of all other conditions of 7.4.2 shall be self-certified by the manufacturer.

| Date | Result                        | Status |
|------|-------------------------------|--------|
|      | No selfcertification required | Ok     |
|      |                               |        |
|      |                               |        |

## • C.3 DSC functionality tests

### • C.3.1 General

For the tests in this clause (see also IEC 61993-1), set the EUT into assigned mode using channels AIS 1 and AIS 2 with a reporting interval of 10 s.

Check with a sequence of valid calls consisting of a DSC channel management test signal number 1, a geographic call from ITU-R M.493, a test signal number 1, an individual call from ITU-R M.493 and a test signal number 1 that the EUT's AIS operation is not affected by the interleaved calls.

| Test details– Sequence of 5 calls                                                                     |                                                                                                          |                                                                                                       |        |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------|
| Test item                                                                                             | Check                                                                                                    | Remark                                                                                                | Result |
| Activate DSC function<br>Set reporting interval to 10 s and record VDL                                |                                                                                                          |                                                                                                       |        |
| Start DSC transmission of test sentence<br>File: sequence_C3_1.sst"<br>Delay between the calls is 5 s | Check that the schedule of the AIS position reports is not affected by the transmission of the DSC calls | Has to be tested when the AIS transmission is not affected during DSC time sharing phases (see C.3.3) | N/T    |

### • C.3.2 Regional area designation

Perform the following tests using the DSC channel management test signal number 1.

Send to the EUT a standard test signal number 1 but with symbol numbers appropriate to the geographical regions and channels specified in the test. Note the transition boundary is 5 NM in this test.

| Test details - Regional area designation                                        |                                                                                            |        |        |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------|--------|
| Test item                                                                       | Check                                                                                      | Remark | Result |
| Activate DSC function                                                           |                                                                                            |        |        |
| Start DSC transmission of test sentence<br>File: area_set_region_2084_2086.sst" | Check that the area setting of the DSC command is correctly stored                         |        | Ok     |
|                                                                                 | Check that the transitional zone size is 5 NM                                              |        | Ok     |
| Remarks:                                                                        | More than one area settings could be applied to the EUT within one 30s time sharing phase. |        | Ok     |

### • C.3.3 Scheduling

Check that the EUT's AIS reporting is not affected during the DSC monitoring times.

Send a valid geographical call to the EUT. Check that a response is not transmitted.

| Test details (b) – Scheduling during DSC monitoring times                       |                                                                              |                                                                           |        |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------|
| Test item                                                                       | Check                                                                        | Remark                                                                    | Result |
| Set reporting interval to 10 s and record VDL<br>Msg: B Msg 23 Test 10.2.2.1 T3 |                                                                              |                                                                           |        |
| DSC monitoring times                                                            | Check that the AIS reporting is not affected during the DSC monitoring times | The transmissions (5 s interval) continue during the DSC monitoring times | Ok     |
| File: area_set_region_2084_2086.sst"                                            | Check that not response is transmitted                                       |                                                                           | Ok     |

### • C.3.4 DSC flag in Message 18

Check that the DSC flag is set properly when DSC functionality is available.

| Test details – DSC flag |                                    |        |        |
|-------------------------|------------------------------------|--------|--------|
| Test item               | Check                              | Remark | Result |
| Record VDL              |                                    |        |        |
| DSC activated           | Check that the DSC flag is set     |        | Ok     |
| DSC inactivated         | Check that the DSC flag is not set |        | Ok     |

### • C.3.5 DSC monitoring time plan

Check that DSC commands are received during DSC monitoring times and, if time-sharing is used, are not received outside those times.

| Test details (b) – DSC monitoring time plan         |                                                                                                          |                                                                                                                                                                                                                                |        |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Test item                                           | Check                                                                                                    | Remark                                                                                                                                                                                                                         | Result |
| Delete all area settings                            |                                                                                                          |                                                                                                                                                                                                                                |        |
| Send a DSC area setting outside the monitoring time | If time-sharing is used:<br>Check that the channels are not changed                                      | The correct time of the DSC receiving periods has been verified by evaluation of TDMA reception over several hours.<br><br>There was a stop of TDMA RX at the defined DSC reception times, alternating between channel A and B | Ok     |
|                                                     | If time-sharing is <b>not</b> used:<br>Check that the channels are changed according to the area setting | Time sharing is used                                                                                                                                                                                                           | N/A    |
| Send a DSC area setting inside the monitoring time  | Check that the channels are changed according to the area setting                                        |                                                                                                                                                                                                                                | Ok     |

### • C.3.6 Replacement or erasure of dated or remote regional operating settings

#### Method of measurement

Set up standard test environment. Send a valid regional operating setting to the EUT by Message 22 with the regional operating area including the own position of the EUT. Consecutively send a further seven (7) valid regional operating settings to EUT, using both Message 22 and DSC telecommands, with regional operating areas not overlapping to the first and to each other. Perform the following in the order shown:

- a) send a ninth Message 22 to the EUT with valid regional operating areas not overlapping with the previous eight regional operating areas;

Step 1: set own position of EUT into any of the regional operating areas defined by the second to the ninth telecommands sent to the EUT previously;

Step 2: send a tenth telecommand to the EUT, with a regional operating area which partly overlaps the regional operating area to which the EUT was set by Step 1 but which does not include the own position of the EUT;

Step 1: move own position of EUT to a distance of more than 500 NM from all regions defined by previous commands;

Step 2: consecutively set own position of EUT to within all regions defined by the previous telecommands.

#### Required results

After the initialisation, the EUT shall operate according to the regional operating settings defined by the first Message 22 sent.

- a) The EUT shall return to the default operating settings.  
b) Step 1: check that the EUT changes its operating settings to those of that region which includes own position of the EUT.

Step 2: check that the EUT reverts to the default operating settings.

NOTE Since the regional operating settings to which the EUT was set in Step 1 are erased due to Step 2, and since there is no other regional operating setting due to their non-overlapping definition, the EUT returns to default.

Step 1: check that the EUT operates with the default settings.

Step 2: check that the EUT operates with the default settings.

| Test details – Test of replacement or erasure of dated or remote regional operating settings                                                                                                                                    |                                                                                    |                                 |        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------|--------|
| Test item                                                                                                                                                                                                                       | Check                                                                              | Remark                          | Result |
| Send by DSC and msg 22                                                                                                                                                                                                          |                                                                                    |                                 |        |
| <ul style="list-style-type: none"> <li>1 area including own position by MSG 22 (Msg: B Msg 22 Test 13.3.1 Area 1...4)</li> <li>7 areas not overlapping, not including own position, first 3 by msg 22, last 4 by DSC</li> </ul> |                                                                                    |                                 |        |
| Check active area                                                                                                                                                                                                               | Check that EUT uses the channels of area 1                                         |                                 | Ok     |
| a) Send a 9. msg 22 to the EUT not overlapping the previous areas                                                                                                                                                               | Check that the EUT returns to the default operating settings (the area is deleted) | The first area has been deleted | Ok     |

|                                                                                                                                                                              |                                                                                    |                                                                                                                                                                                                                            |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| b) step 1: Set own position to any of the 7 areas                                                                                                                            | Check channels of area 2                                                           | Remark: in each time-sharing phase only one area could be applied.                                                                                                                                                         | Ok |
|                                                                                                                                                                              | Check channels of area 3                                                           |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check channels of area 4                                                           |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check channels of area 5                                                           |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check channels of area 6                                                           |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check channels of area 7                                                           |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check channels of area 8                                                           |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check channels of area 9                                                           |                                                                                                                                                                                                                            | Ok |
| b) step 2: Send an area 10 by DSC, overlapping the area 2 of step 1 not including own position                                                                               | Check that the EUT returns to the default operating settings (the area is deleted) | UTC 11:20                                                                                                                                                                                                                  | Ok |
| c) Step 1: Erasure by distance:<br>Move own position of EUT to a distance of more than 500 miles from all regions defined by previous commands                               | Check that the EUT operates with the default settings                              |                                                                                                                                                                                                                            | Ok |
| <u>Step 2: Check of erasure:</u><br>Set own position of EUT to within all regions defined by the previous telecommands.<br>b) step 1: Set own position to any of the 7 areas | Check area 2 = default                                                             |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check area 3 = default                                                             |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check area 4 = default                                                             |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check area 5 = default                                                             |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check area 6 = default                                                             |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check area 7 = default                                                             |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check area 8 = default                                                             |                                                                                                                                                                                                                            | Ok |
|                                                                                                                                                                              | Check area 10 = default                                                            |                                                                                                                                                                                                                            | Ok |
| ACA output                                                                                                                                                                   | Information source                                                                 | The Information source is correctly set                                                                                                                                                                                    | Ok |
|                                                                                                                                                                              | In-use flag                                                                        | The in-use flag is correctly set.<br>If a new area is received there is an ACA output with the in-use field empty (null field), independent if the position is inside or not. In the output on request it is set correctly | Ok |

### • **C.3.7 Test of addressed telecommand**

#### **Method of measurement**

Set up a standard test environment and operate EUT in autonomous mode. Perform the following tests in the following order:

- send a DSC telecommand with valid regional operating settings that are different from the default operating settings, to the EUT with a regional operating area, which contains the current position of own station;
- send an addressed DSC telecommand to the EUT with different regional operating settings than the previous command;
- Move the EUT out of the regional operating area defined by the previous addressed telecommand into an area without regional operating settings.

#### **Required results**

- Check, that the EUT uses the regional operating settings commanded to it in a).
- Check, that the EUT uses the regional operating settings commanded to it in b).
- Check, that the EUT reverts to default.

| Test details – Test of addressed telecommand                                        |                                                          |        |        |
|-------------------------------------------------------------------------------------|----------------------------------------------------------|--------|--------|
| Test item                                                                           | Check                                                    | Remark | Result |
| All areas are erased by the previous test                                           |                                                          |        |        |
| a) Send a DSC call with a new area, position inside                                 | Check, that the EUT uses the regional operating settings |        | Ok     |
| b) Send an addressed DSC call to the EUT with different regional operating settings | Check, that the EUT uses the settings of the new message |        | Ok     |
| c) Move the position out of the area                                                | Check, that the EUT uses the default channels            |        | Ok     |

### • **C.3.8 Invalid regional operating areas**

Test for invalid regional operating areas (three regional operating areas with same corner).

#### **Method of measurement**

Set up standard test environment and operate EUT in autonomous mode. Perform the following tests in the following order after completion of all other tests related to change of regional operating settings:

- a) send three different valid regional operating settings with adjacent regional operating areas, their corners within eight miles of each other, to the EUT by DSC telecommand, Presentation interface input and manual input via MKD. The current own position of the EUT shall be within the regional operating area of the third regional operating setting;
- b) move current own position of the EUT consecutively to the regional operating areas of the first two valid regional operating settings.

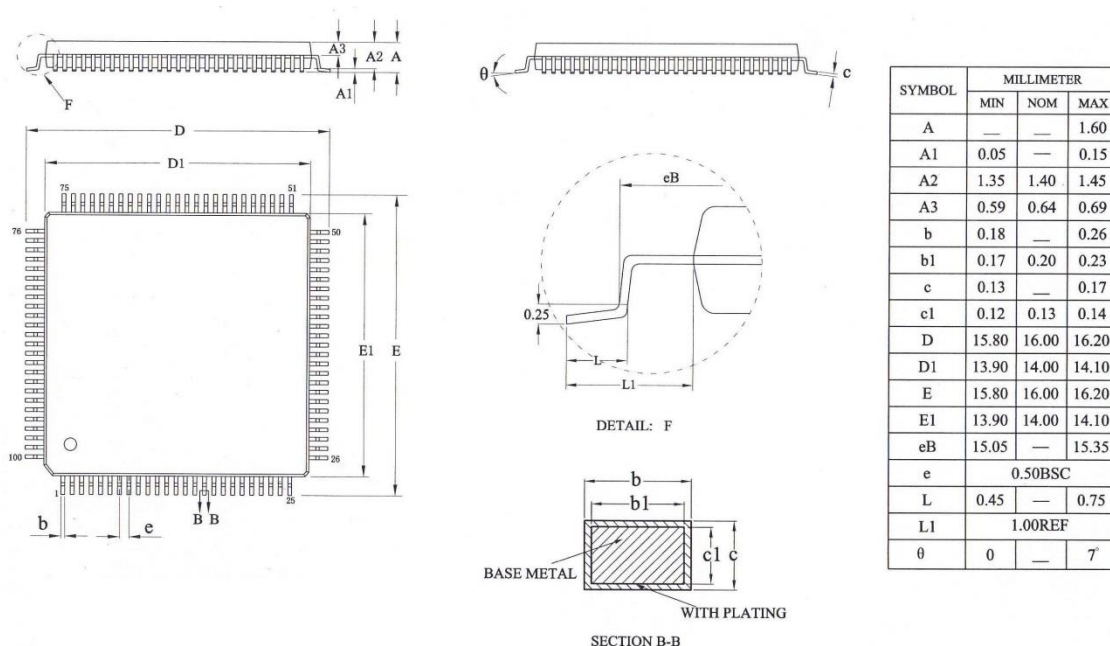
This test can be accomplished by either using a dedicated test input for simulated position information or a GNSS simulator.

#### **Required test results**

- a) Check, that the EUT uses the operating settings that were in use prior to receiving the third regional operating setting.
- b) Check, that the EUT consecutively uses the regional operating settings of the first two received regional operating areas.

| Test details – Test for invalid regional operating areas                                                             |                                                                      |        |        |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------|--------|
| Test item                                                                                                            | Check                                                                | Remark | Result |
| a) Send three different valid regional with adjacent corners by DSC area call, Position inside 3 <sup>rd</sup> area. | Check, that the default channels are used                            |        | Ok     |
| b) Move own position to the first area                                                                               | Check, that the EUT uses the operational settings of the first area  |        | Ok     |
| Move own position to the second area                                                                                 | Check, that the EUT uses the operational settings of the second area |        | Ok     |

## 11 Packaging



**Figure 15 Mechanical Outline of 100LQFP**

**Order as part no. SCT7033**

As package dimensions may change after publication of this datasheet, it is recommended that you check for the latest Packaging Information from the Design Support/Package Information page of the CML website: [www.cmlmicro.com].

**Handling precautions:** This product includes input protection, however precautions should be taken to prevent device damage from electro-static discharge. Sicomm does not assume any responsibility for the use of any circuitry described. No IPR or circuit patent licences are implied. Sicomm reserves the right at any time without notice to change the said circuitry and this product specification.

Wuxi Sicomm Communication Technologies Inc. is a CML Microsystems PLC Company and products are available through CML Microcircuits and its distributors. For information on this and other Sicomm products please contact your local CML Sales representative.



www.cmlmicro.com

United Kingdom tel: +44 (0) 1621 875500

Singapore tel: +65 62888129

United States tel: +1 336 744 5050  
800 638 5577

email: sales@cmlmicro.com

techsupport@cmlmicro.com

email: sg.sales@cmlmicro.com

sg.techsupport@cmlmicro.com

email: us.sales@cmlmicro.com

us.techsupport@cmlmicro.com

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[CML Micro:](#)

[SCT7033](#) [SCT7033-REEL](#)