



SINE QUO NON
PRODUCT

SINE QUA NON T&M MODEL AITS-RV - F

SDR Input
SDR Output

7	8 ⁺	9	Rep
4	5 ⁻	6	Send
1	2	3	
Clear	0	Next	Enter
FUNCTION			

Draft Version 1.0
ITU-R M.1371-5 Technology
AIS Test Set - Virtual Model

AIS INSTALLATION TEST SET

NOTICE

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Objective

The objective for the use of this AIS Developer Studio product model AITS-RV is to create a general VDL environment using a PC.

Where the choice of the base-band VDL, VDO, VDM, Presentation and Pilot Port data is easily generated, analyzed and defined.

As an AID to AIS, Survey, Production and Development.

This product should only be used for the purposes intended by its developers and then only according to acceptable reference standards and operating procedures.

Any deviation from this may well be in conflict with competent regional authorities in your area.

The AIS Developer Studio and or Interface/s should not be used to alter the operational status of any AIS unit unless authorized by a competent authority.

Under no circumstances should the AIS Developer Studio and or Interface/s be used to create any signal content outside the scope of this document using any procedure or method offered by the AIS Developer Studio Interface.

AIS Test.



AIS Developer Studio – AITS-RV

AIS TEST formerly Sine Qua Non would like to take this opportunity to congratulate you on the purchase of one of the AIS Developer Studio suite of products. We want to assure you that this product range is designed using over 22 Years of AIS experience and thoroughly tested to ensure your complete satisfaction.

A demonstration program is provided free of charge. AIS TEST requires that the user download the demo program and documentation from www.aiste.st and validate it for their respective use prior to placing an order for the un-encumbered licensed version.

Limited Warranty.

Where software discrepancies are identified and or module operational bugs are found. These should immediately be brought to the attention of AIS TEST. The warranty is limited to the rectification of the discrepancy or bug by software upgrade, and should not exceed the original operational and technical specification as defined by AIS TEST in the respective AIS Developer Studio module document.

If you have any questions, queries or customisation requests related to this product, please do not hesitate to contact us by email:

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Thanking you,

AIS TEST



AIS Developer Studio – AITS-RV

Installation

The installation of AITS-RV is as follows. Obtain the latest version of AITS-RV.exe from www.aiste.st.

Create a new folder.

Save the downloaded files in the folder.

Run the application. This will allow the unit to run in demo mode.

AITS_RV is not freeware.

Once you have positively evaluated it for your purpose please request purchase information from www.aiste.st.

ALL requests for support should be addressed to support@aiste.st explaining any bug or discrepancy as well as a screenshot.

It is the intention of AIS TEST through the current and further development of the AIS Developer Studio suite of components to continue to supply cost effective methods for development, production, integration and verification of protocols as used by AIS and DSC.

It is the intention of AIS TEST to supply upgrades to the AIS Developer suite user group if and when they become available.

Users may subscribe to this upgrade service.



AIS Test Set Overview

Very simply, the AIS is a broadcast system, operating in the VHF maritime mobile band. It is capable of sending ship information such as identification, position, course, speed and more, to other ships and to shore.

It can handle multiple reports at rapid update rates and uses Self-Organizing Time Division Multiple Access (SOTDMA) technology to meet these high broadcast rates and ensure reliable and robust ship-to ship operation.

The AITS-RV is a frequency agile 156 Mhz to 162.025 Mhz test set operating on the designated AIS1, AIS2 and DSC channels.

It has been designed in accordance with the listed relevant specifications as an aid to evaluating the operation of an AIS unit.

The AITS-RV AIS tester is designed for checking of class A and class B - AIS mobile, Aids To Navigation and AIS fixed stations.

It is suitable for evaluation, checking, testing, developing and manufacture of AIS hardware as well as according to the circular letter MSC.1/Circ.1252.

Operational Evaluation Of The Following AIS Equipment Under Test (EUT)

- AIS Class A
- AIS Class B (B/CS)
- AIS Base Station
- AIS Repeater Station
- AIS Aids To Navigation
- AIS Search and Rescue
- AIS Receiver
- 12.5W RF EUT Port
- 0 dBm RF Calibration Port
- Serial / Pilot / Presentation Port / Terminal.NMEA,VDO,VDM (RS422 / RS232)



AITs-RV Evaluation Table

Evaluation	EUT CONNECTOR	CALIBRATION CONNECTOR
EUT nominal TX Power	Yes	Definitely Not (Caution) 0 dBm MAX
Decode VDL	Yes Received conducted at a level of >= +30 ->+42dBm	Yes Received at a level of >= -47dBm & <= 0 dBm
Decode following AIS Messages on selected AIS channel. 1,2,3,4,5,9,11,18, 19,21,24	Yes Received via cable at a level of >= +30 ->+42dBm	Yes Received at a level of >= -47dBm & <= 0 dBm
Decode DSC channel Standard Test Signal 1 IEC 61993-2	Yes Received via cable at a level of >= +30 ->+42dBm	Yes Received at a level of >= -47dBm & <= 0 dBm
AIR and MSG 10 packet generation on both AIS channels. Request the following messages 3,4,5,9,11,18,19,21,24	Yes Generated via conducted cable at a level of -xx dBm,	Yes Generated at a level of -37dBm nominal
VDL packet generation on both AIS channels Generate the following messages using own profile data 1,2,3,4,5,9,11,18, 19,21,24	Yes Generated via conducted cable at a level of -xx dBm,	Yes Generated at a level of -37dBm nominal
DSC packet generation Standard Test Signal 1 IEC 61993-2	Yes Generated via conducted cable at a level of -xx dBm,	Yes Generated at a level of -37dBm nominal
Display NMEA RS422 Strings	Yes	Yes
Own User Profile	Yes	Yes
Pilot Plug Evaluation	Yes (Duplex RS422 modem 38400 baud) Encode functions not defined yet. Decode and display VDO packet 1,2,3,4,5,9,11,18, 19,21,24	Yes (Duplex RS422 modem 38400 baud) Encode functions not defined yet. Decode and display VDO packet 1,2,3,4,5,9,11,18, 19,21,24
VDM & VDO encoded output Of targeted MMSI VDL activity	Yes	Yes



RF Interface Connections

Two RF connectors are provided as follows.

<p>Socket marked 'EUT'</p> <p>DO NOT EXCEED 15 WATTS. DO NOT EXCEEDING 10 SECONDS CONTINUOUS CARRIER POWER</p>	<p>This socket connects the AITS-RV unit to the equipment under test. It is specified at 15-Watts Max TDMA. Under no circumstances should the transmitted power into the EUT socket exceed 10 seconds. The EUT is designed to automatically turn the EUT transmitter off after 0.5 seconds time period known as the 'time out timer'</p>
<p>Socket marked 'CALIBRATE'</p> <p>DO NOT UNDER ANY CIRCUMSTANCE CONNECT THIS SOCKET TO THE EUT.</p> <p>MAXIMUM INPUT MUST NOT EXCEED 0dBm</p>	<p>This socket can be used for short range radiated evaluation.</p> <p>This socket is used to CALIBRATE / VERIFY chosen PC (Virtual) AITS-RV</p>

WARNING

Failure to observe the above limits will result in damage to the unit.

Communication Interface Connections

WARNING: Use the RS232 cable provided. If you must extend or make your own cable for any reason then only pins DB9-2, DB9-3 and DB9-5 should be connected.

WARNING: Use the RS422 cable provided. If you must extend or intend to make your own cable for the pilot plug or any reason then only pins DB9-1, DB9-4, DB9-8, DB9-9 and optionally DB9-6 should be connected.

The other DB9 pins carry signals and voltages, which must not be connected to the standard PC or external world.

AITS-R DB9 Connections

DB9-1	RS422 RX A
DB9-2	RS232 RXD on PC
DB9-3	RS232 TXD on PC
DB9-4	RS422 RX B
DB9-5	GROUND
DB9-6	GROUND
DB9-7	Proprietary
DB9-8	RS422 TX A
DB9-9	RS422 TX B



Objective

The objective for the use of the AITS-RV is to assimilate as much VDL data and decompose it from a RF bit stream to a general database. Added to this is the RF power measurement and interrogation capability. The unit supports 'ON AIR' and 'OFF AIR' evaluation. The Pilot Plug and Presentation VDO / VDM stream is added to the general database.

This database aids the manufacturer, developer, survey or technician in making a decision as to the operational capability of the equipment under test.

This may sound daunting but is easily accomplished with the minimum of training and or human interface through the use of 'Interactive Operational Menu Flow'.

The end product is a csv word processor file or html file. The csv file and the html file can be imported into your word processor, spreadsheet program or browser across many operating systems.

Interactive Operational Menu Flow

All menu actions flow toward the final file result and are prompted by menu interactivity.

Menu Interactivity

The evaluation steps are prompted to the user by the current menu function selected as indicated on the VIRTUAL LCD. An indication of the next preferred key in the sequence is also given.

Sequence Exit

Any sequence can be exited by pressing the 'Function' function key.

General Data Base

The general database is made up of the VDO and VDM profiles. This general database holds data, which the user can use to profile a html 'report'. This HTML file can be saved on the PC and viewed and printed using any HTML browser.

Clear Key

This key will clear the current display contents.

Operational Sequence

The characters indicated in the right hand corners of the display indicate the first letter of the options available.

F	Function KEY
E	Enter KEY
S	Send KEY
N	Next KEY
C	Clear KEY
D	DIGITS 0 through 9
+	Increment Value
-	Decrement Value



Interactive Operational Menu Flow Start

Connect SDR HARDWARE USB TO PC (Virtual AITS-RV)	
Run PC Application 'AITS_RV.exe	
KEY	VIRTUAL LCD DISPLAY
	SINE QUA NON T&M MODEL AITS-RV - F
Press FNC Key Once	Next Function Item

Step 1: Select SDR Input Channel

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 0	SELECT SDR AUDIO INPUT CHANNEL - N/F
Press NEXT Key Once	Connect AITS-RV (Line-In) To PC Enumerated Sound Card Input [first]
Press NEXT Key Once	Connect AITS-RV (Line-In) To PC Enumerated Sound Card Input [last]
Press ENTER Key Once	Opening Sound Card Input Channel – PASS
Press FNC Key Once Indicates unselected channel	Next Function Item SDR Input

Step 2: Select SDR Output Channel

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 1	SELECT SDR AUDIO OUTPUT CHANNEL - N/F
Press NEXT Key Once	Connect AITS-RV (Line-Out) To PC Enumerated Sound Card Output [first]
Press NEXT Key Once	Connect AITS-RV (Line-Out) To PC Enumerated Sound Card Output [last]
Press ENTER Key Once	Opening Sound Card Output Channel - PASS
Press FNC Key Once Indicates unselected channel	Next Function Item SDR Output

Step 3: Enter EUT Target MMSI – preset in AisTestSet.txt

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 2	ENTER 9 DIGIT EUT MMSI - N/F
Press NEXT Key Once	CURRENT EUT MMSI 00000000 - N/F
Press NEXT Key Once	ENTER NEW EUT MMSI 00000000 - C/D/N/E/F
Press ENTER Key Once Press FNC Key Once	UPDATED MMSI 00000000 - N/F Next Function Item



Step 4: Enter AITS-RV MMSI – Edit / preset in AisTestSet .txt

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 3	ENTER 9 DIGIT "AITS-RV MMSI - N/F
Press NEXT Key Once	CURRENT AITS_RV MMSI 000000000 - N/F
Press NEXT Key Once	ENTER NEW AITS-RV MMSI 000000000 - C/D/N/E/F
Press ENTER Key Once Press FNC Key Once	UPDATED AITS-RV MMSI 000000000 - N/F Next Function Item

Step 5: Measure EUT RF Slot Power

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 4	MEASURE EUT SLOT RF POWER - N/F
Press NEXT Key Once	CONNECT EUT TO EUT PAD - E/F
SDR Set to 161.975Mhz *	WAITING FOR NEXT PACKET – AIS1 – N/F
SDR Set to 162.025Mhz *	WAITING FOR NEXT PACKET – AIS2 – N/F
SDR Set to 156.525Mhz *	WAITING FOR NEXT PACKET – DSC – N/F
When Packet Received via VDL(*) on EUT MMSI Press FNC Key Once	RF Power AIS1 12.8W – N/F Next Function Item

Step 6: Measure EUT RF Slot Frequency Offset

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 5	MEASURE EUT SLOT RF POWER - N/F
Press NEXT Key Once	CONNECT EUT TO EUT PAD - E/F
SDR Set to 161.975Mhz *	WAITING FOR NEXT PACKET – AIS1 – N/F
SDR Set to 162.025Mhz *	WAITING FOR NEXT PACKET – AIS2 – N/F
SDR Set to 156.525Mhz *	WAITING FOR NEXT PACKET – DSC – N/F
When Packet Received via VDL(*) on EUT MMSI Press FNC Key Once	RF Frequency AIS1 0000 Hz – N/F Next Function Item



Step 7: Monitor Received VDL Packets

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 6	MONITOR RECEIVED VDL PACKETS - N/F
Press NEXT Key Once	CONNECT EUT TO EUT PAD - E/F
SDR Set to 161.975Mhz *	WAITING FOR NEXT PACKET - AIS1 – N/F
SDR Set to 162.025Mhz *	WAITING FOR NEXT PACKET – AIS2 – N/F
SDR Set to 156.525Mhz *	WAITING FOR NEXT PACKET – DSC – N/F
When Packet Received via VDL(*) on EUT MMSI Press FNC Key Once	VDL Channel AIS1 Received MSG 01 – N/F Next Function Item

Software KEY - Edit / preset in AisTestSet .txt

Receiver Profile	
Function - Display VDM Message	
<SoftKey>	
<DisplayMsgVDM>ON</DisplayMsgVDM>	
ON	OFF
<DisplayMsgAUTO>ON</DisplayMsgAUTO>	
Auto Reset Of Message Dialog	
ON	OFF

Software KEY - Edit / preset in AisTestSet .txt

Signal Generator Profile	
Function - Display VDO Message	
<SoftKey>	
<DisplayMsgVDO>ON</DisplayMsgVDO>	
ON	OFF
<DisplayMsgAUTO>ON</DisplayMsgAUTO>	
Auto Reset Of Message Dialog	
ON	OFF

Messages 1 : Position report																	
Msg	RI	UserID	NvSt	AisRot	SOG	PA	Longitude	Latitude	COG	THead	TStmp	SpMInd	S	RAIM	SS	STO	SubMSG
1	0	990006123	15	-45	025.0	1	028*14.9718'E	25*50.8005'S	035.0	035	49	0	00	0	3	6	1234

For each VDL packet created or received a corresponding IEC61162, VDO / VDM formatted string is created and output on the RS232 / RS422 interface.



Step 8: Choose AITS-RV GPS mode

Once **Monitor Received VDL Packets** has taken place for Msg 1,2 or 3, the localized VDL EUT GPS can be cloned and used to place the AITS-RV 'on-site'.

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 7	AITS-R GPS
Press NEXT Key Once	COORDINATES - N/F
Press NEXT Key Once	CONNECT EUT TO EUT PAD - E/F
Press NEXT Key Once	USE OWN PROFILE
Press NEXT Key Once	GPS COORDS - E/N/F
Press ENTER Key Once	CLONE GPS COORDS FROM EUT - E/N/F
Press FNC Key Once	LAT : 0000.0000,S LNG : 00000.0000,E - F
	Next Function Item

AITS-RV Profile - Edit / preset in AisTestSet .txt

Own Profile
<ReferenceAndPositionFix>
<Latitude>9100.0000,N</Latitude>
<Longitude>18100.0000,E</Longitude>
<PositionAccuracy>1</PositionAccuracy>

Step 9: Interrogate Remote EUT For Requested AIS Packets

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 8	INTERROGATION
Press NEXT Key Once	- AIS - N/F
Indicates Target MMSI	CONNECT EUT TO EUT PAD - E/F
SDR Set to 161.975Mhz *	EUT MMSI 000000000 - N/F
Press SEND Key Once	MANUAL AIS1 Class A - S/N/F
Process.....	Set SDR to Signal Generator
End of Process.	Sending VDO Packet
	Sending Packet Complete
	EUT Will Process Poll Request And Transpond Requested Packets
When Packet Received via VDL(*) on EUT MMSI	Received VDM Msg 00 On 161975 Mhz - F
Press FNC Key Once	Received VDM Msg 00 On 161975 Mhz - F
	Next Function Item



Step 10: Virtual - Synthetic

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 9	VIRTUAL-SYNTHETIC - VDL - N/F
Press NEXT Key Once	CONNECT EUT TO EUT PAD - E/F
Indicates AITS-RV MMSI	AITS-RV MMSI 000000000 - N/F
SDR Set to 161.975Mhz	MANUAL VDL - AIS1 MSG TYPE 1 - S/N/F
Press SEND Key Once	Set SDR to Signal Generator
Process.....	Sending VDO Packet
End of Process.	Sending Packet Complete
Press NEXT Key Once	MANUAL VDL - AIS1 MSG SART 1 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 2 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 3 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 4 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 5 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 9 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 11 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 14 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 18A - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 18B - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 19 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 21 - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 24A - S/N/F
Press NEXT Key Once	MANUAL VDL - AIS1 MSG TYPE 24B - S/N/F
SDR Set to 162.025Mhz	MANUAL VDL – AIS2 MSG TYPE 1 - S/N/F
	As For AIS2 Above
Press FNC Key Once	Next Function Item



Step 11: Interrogate Remote EUT For Requested DSC Packets

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 10	INTERROGATION - DSC - N/F
Press NEXT Key Once	CONNECT EUT TO EUT PAD - E/F
Indicates Target MMSI	EUT MMSI 000000000 - N/F
SDR Set to 156.525Mhz *	MANUAL AIS1 Class A - S/N/F
Press SEND Key Once	Set SDR to Signal Generator
Process.....	Sending VDO Packet
End of Process.	Sending Packet Complete
EUT Will Process Poll Request And Transpond Requested Message	
When Packet Received via VDL(*) on EUT MMSI	Received DSC Msg 00 On 156.525 Mhz - F
Press FNC Key Once	Next Function Item

Step 12: Serial Port

KEY	VIRTUAL LCD DISPLAY
MENU FUNCTION 11	PRESENTATION / PILOT PORT - N/F
Press NEXT Key Once	CONNECT AITS-RV TO RS232 / RS422 PORT - N/F
Press NEXT Key Once	PRESENTATION PORT
SDR COMPORT Set to RS232	RS232 - N/F
Press NEXT Key Once	PILOT PLUG
SDR COMPORT Set to RS422	RS422 - N/F
Press FNC Key Once	Next Function Item

Software KEY - Edit / preset in AisTestSet .txt

Receiver Profile	
Function - Display VDM Message	
<SoftKey>	
<DisplayMsgSERIAL>ON</DisplayMsgSERIAL>	
ON	OFF
<DisplayMsgAUTO>ON</DisplayMsgAUTO>	
Auto Reset Of Message Dialog	
ON	OFF

Messages 1 : Position report																	
Msg	RI	UserID	NvSt	AisRot	SOG	PA	Longitude	Latitude	COG	THead	TStmp	SpMInd	S	RAIM	SS	STO	SubMSG
1	0	990006123	15	-45	025.0	1	028*14.9718'E	25*50.8005'S	035.0	035	49	0	00	0	3	6	1234



Step 13: Calibration

TBD



Abbreviations

The following is a list of abbreviations used in the AIS Developer Studio Suite

1pps	1 pulse per second
ACK	Acknowledge
AIS	Automatic Identification System
AIS1	Automatic Identification System channel 1 (161.975 MHz)
AIS2	Automatic Identification System channel 2 (162.025 MHz)
ANT	Antenna
BER	Bit Error Rate
BIT	Built In Self Test
BS	Base Station
BT	Bandwidth Time product
COG	Course over Ground
DBR	Differential Beacon Receiver
DSC	Digital Selective-Calling
DTE	Data Terminal Equipment
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
EPFS/D	Electronic Position Fixing System/Device
ETA	Estimated Time of Arrival
GPS	Global Positioning System
HDLC	High-level Data Link Control
IEC	International Electro-technical Commission
IO	Input-Output
ITU	International Telecommunication Union
KDU	Keyboard Display Unit
LR	Long Range
MMSI	Maritime Mobile Service Identities
NU	Not Used
PA	Power Amplifier
PC	Personal Computer
PER	Packet Error Rate
PI	Presentation Interface
RF	Radio Frequency
ROT	Rate of Turn
RX	Receive
SOG	Speed over Ground
TDMA	Time Division Multiple Access
TX	Transmit
UTC	Coordinated Universal Time
VDL	VHF Data Link
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
ADS	AIS Developer Studio V2
NTP	Network Time Protocol
SNTP	Simple Network Time Protocol



Reference Documents

List of standards and specifications

Document Number	Title
IEC 61162-1	Maritime Navigation and Radio Communication Equipment and Systems - Digital Interfaces: Part 1 - Single Talker and Multiple Listeners.
IEC 61162-2	Maritime Navigation and Radio Communication Equipment and Systems - Digital Interfaces: Part 2 - Single Talker and Multiple Listeners High Speed Transmission.
IEC 61993-2 IEC 62287 IEC 62320	Universal Shipborne Automatic Identification System (AIS).
ITU-R M.1084-2	Interim solutions for improved efficiency in the use of Band 156-174Mhz by stations in the Maritime Mobile Service.
ITU-R M.1371-5	Technical characteristics for a universal ship-borne automatic identification system using time division multiple access in the maritime mobile band.
ITU-R M.493	Digital Selective Calling (DSC) system for use in the Maritime Mobile Service.
ITU-R M.823-2	Technical characteristics of differential transmissions for global navigation satellite systems from maritime radio beacons in the frequency band 283.5 - 315 kHz in region 1 and 285-325 kHz in regions 2 and 3.
ITU-R M.825-3	Characteristics of a transponder system using DSC techniques for use with vessel traffic services and ship-to-ship identification.
ITU Manual	ITU Manual for use by the Maritime mobile and Maritime Mobile-Satellite Services.
IEC 61108-1	Global navigation satellite systems (GNSS) - Part 1: Global positioning system (GPS) - Receiver equipment - Performance standards, methods of testing and required test results.
IEC/EN 60945	Maritime Navigation and Radio communication equipment and systems – General requirements-methods of testing and required results
NMEA 0183	
MSC.1/Circ.1252	

List of Related Software and Manuals

Module	Description	Part number
AIS Developer Studio Software for Windows. Verified to run on WINXP and WIN10	A Windows based application for configuring and testing various AIS products. Various levels of user access available dependent on licence.	ADSV2.exe



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