



communications
Aviation Recorders

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ACCEPTANCE TEST PROCEDURE

for the

Automatic Identification System

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1 SCOPE

This procedure describes the acceptance test for the Automatic Identification System.

2 APPLICABLE DOCUMENTS

IEC 61993-2 Maritime navigation and radiocommunication equipment and systems –
Automatic identification systems (AIS)

3 TEST REQUIREMENTS

3.1 General Test Requirements

3.1.1 Upon approval this procedure will become a released document and will be under Engineering Document Center (EDC) control.

3.1.2 If errors or omissions are found which require changes to this test procedure, the current procedure shall be red-lined, dated, and signed by the cognizant Test Engineer and Quality Assurance (QA) Representative. The Test Engineer shall write an ECO in accordance with QAP 5.4 and, within 10 days, submit the ECO for incorporation. This red-lined test procedure shall be valid for only 10 days without an ECO submittal by the Test Engineer. If an ECO has been submitted by the Test Engineer, then the red-lined test procedure shall be valid until the ECO has been incorporated.

3.1.3 Before any data is recorded, the test technician is to verify he/she has the latest revision level of procedure and data record. The technician is also required to complete the first sheet of the data record except completion date. If the system under test consists of more than one unit, list all P/Ns and S/Ns on the Data Record. The data record, when completed will be stored per Operations Directory Policy 3.6 retention period for Test Records or as required per contract. All entries are to be made in INK and must be legible.

3.1.4 If more than one technician is involved in completing the procedure, the following steps will be followed:

- a. All technicians involved in testing Unit Under Test ("UUT") will stamp the first sheet of the data record next to the line "TESTED BY".
- b. At the test step where the technician begins testing he/she will stamp the data record. The stamp is to be placed at the far right side of the page, next to the test results.

3.1.5 If the results of a test are out-of-limits, the technician will write the results on the data record and circle the entry. After the out-of-limits condition has been corrected, the technician will make a single strike through the out-of-limits readings, write the new result to the side, and stamp the entry. DO NOT erase the original reading or use "white out" under any circumstances.

- 3.1.6 When an out-of-limits condition cannot be corrected through normal methods, the technician is instructed to notify his/her supervisor. The problem will be turned over to Test Engineering or Design Engineering for resolution. If management decides to ship the unit with the defect, a Management Review and Disposition form must be completed.
- 3.1.7 If an error is made while entering data onto the data record, the correction will be made in the following manner: Make a single strike through the entry such that it is still readable. Write the correction at a convenient location and initial or stamp the correction. Notify the QA Representative and she or he will also initial or stamp the correction. DO NOT erase the mistake or use "white out" under any circumstances.
- 3.1.8 Upon successful completion of testing, review the test data sheets for any out of spec. entries and missing entries. (N/A shall be entered where there is no applicability.) Paragraphs that are applicable, but for which there is no data to be recorded, shall have the word "none" or a dash entered in the space.
- 3.1.9 Test results which are to be recorded on the data record shall be indicated in the test procedure by the word "**RECORD**" or "**CHECK**".
- 3.1.10 DANGER, CAUTION and NOTE shall be used to highlight important information as follows:

DANGER-UPPER CASE BOLD LETTERING SHALL BE USED TO HIGHLIGHT PRECAUTIONARY MEASURES, WHICH IF NOT FOLLOWED, COULD RESULT IN INJURY TO PERSONNEL.

CAUTION-UPPER CASE BOLD LETTERING SHALL BE USED TO HIGHLIGHT PRECAUTIONARY MEASURES, WHICH IF NOT FOLLOWED, COULD RESULT IN EQUIPMENT DAMAGE.

NOTE: May be used to reference special instructions.

While performing all alignments, troubleshooting, and/or handling of PWAs, personnel will use static protection, including wrist-straps.

3.2 Test Equipment

- 3.2.1 Each piece of test equipment used for this procedure shall bear a calibration due label. No piece of test equipment shall be used which bears a calibration due date which has expired. All calibrations shall be performed by a facility which uses methods and procedures which ensure traceability to the National Institute of Standards and Technology (NIST). Unless otherwise specified, an alternate instrument may be used.

See Appendix A for equipment used.

3.4 Acronyms and Abbreviations

AIS	Automatic Identification System
DSC	Digital Selective Calling
ECO	Engineering Change Order
EDC	Engineering Document Center
MKD	Minimum Keyboard and Display
PER	Packet Error Rate
PI	Presentation Interface
Rx	Receive
Tx	Transmit
UUT	Unit Under Test

4 TEST PROCEDURE

4.1 General Appearance and Pre-Burn-in Setup/ Tests

Visually check the UUT for any manufacturing defects and have them corrected.

Verify that the keypad and front panel lettering are correct.

Verify that the keys do not stick when pressed.

CHECK

4.2 Setup

4.2.1 On the back of the UUT, connect the power, data link, GPS, and RF antenna cables.

On the front of the UUT, connect the pilot port cable.

Apply 24 VDC power to the UUT.

Ensure that the known-good AIS is powered on and connected to the RF network.

CHECK

4.3 Visual Check

4.3.1 Verify that the display light is working properly.

Verify that the display lettering is correct and visible.

CHECK

4.3.2 Press **FNC** and then **CLR** and record the 15 digit checksums.

RECORD

4.3.3 Pre- Burn in Tests.

Perform tests in paragraphs 4.5 and 4.6 verifying but not recording the data. If the unit meets all specs, it is ready for Burn-in.

CHECK

4.4 Burn-In

4.4.1 Burn in the UUT at 24 Vdc for a minimum of 12 hours. **RECORD** the On/Off times and dates.

RECORD

4.5 Transceiver (RF Performance) Test

4.5.1 Receiver Sensitivity (SINAD) Test

1. Turn on the Marconi 2955 test set.
2. Select **RECALL 03**
3. Connect the AIS VHF Antenna connector to the Marconi RF IN/OUT 1W connector (Type BNC), and select this connector using the switch on the front panel that is located over the RF IN/OUT connectors.
4. Connect the AIS Pilot Plug interface cable to the 9-pin front panel connector of the AIS unit
5. Connect the BNC connector of the Pilot Plug interface cable to the Marconi at the AF INPUT connector (Type BNC)
6. Connect the AIS unit to a 24VDC 10Amp Power Supply using the AIS Power Cable.
7. Turn ON the AIS unit using the rotary switch on the front panel of the AIS unit
8. Immediately push the **FNC** key of the AIS unit and then the 8 key to activate the TEST mode of the AIS unit.
9. Press **“Down-arrow”** and move to the **“TX CHAN”** field.
10. Press the **ENT** key of the AIS unit to activate the channel number edit.
11. Press the keys of the AIS unit in sequence **2, 0, 8, 8, ENT** to set the AIS TDMA TX Channel.
12. Press the **“Down-arrow”** key repeatedly to locate the cursor over the MD OFF indicator on the AIS display screen. Press the **ENT** key to activate the MD (mode) edit. Press the **“Down-arrow”** key repeatedly to select the RX1 mode. Press the **ENT** key to activate the RX1 receiver demodulator output to the Pilot Plug interface cable's BNC output connector that is connected to the AF INPUT of the Marconi
13. Οβσερπε α 1ΚΗζ σινε ωαπε ον της δισπλαψ σχρεεν οφ της Μαρχονι ανδ νοτε της ΣΙΝΑΔ παλυε ισ γρεατερ τηαν 20δΒ
14. Press the **DIST'N** key on the Marconi and note the Distortion percentage of the reciever is equal to or less than 5%.

RECORD

15. Press the SINAD key and lower the level to -77dBm on the Marconi. Note the SINAD is greater than 10dB.

RECORD

16. Following the same procedure as steps 1-15, (Select **RECALL 02** on the Marconi) measure the SINAD values for the other AIS TDMA Receiver (RX2) at 161.975 MHz. Verify that the SINAD values are at least 20dB (high power input) .

RECORD

17. Press the DIST'N key on the Marconi and note the Distortion percentage of the receiver is equal to or less than 5%.

RECORD

18. Press the SINAD key and lower the level to -77dBm on the Marconi. Note the SINAD is greater than 10dB

RECORD

Following the same procedure as steps 1-15, (Select **RECALL 04** on the Marconi) measure the SINAD values for the DSC receiver (R70) at 156.525 MHz. Verify that the SINAD values are at least 20dB (high power input)

RECORD

4.5.2 Transmitter Power, Frequency, Frequency Deviation (Modulation), and Attack Time Test

1. Select the Marconi **Transmitter Test Mode "RECALL 01"**.
2. Select the AIS Test Mode.(Press "FNC" then "8" key on the AIS)
3. Set the AIS transmitter to channel **2088**.
4. Set the AIS transmit power level to **HI**.
5. Set the AIS transmit mode to **T1**.
6. **RECORD** the current output from the power supply. The current should be less than or equal to 2.9 Amps.

RECORD

7. Measure and **RECORD** the AIS transmitter **RF high power** using the Marconi and verify that the power level is **12.5 Watts +/- 1.0 Watts**.

RECORD

8. Set the AIS transmit power level to **LO**.
9. Measure and **RECORD** the AIS transmitter **RF low power** using the Marconi and verify that the power level is **2.0 Watts +/- 0.2 Watts**.

RECORD

10. Measure and RECORD the AIS transmitter **RF frequency** using the Marconi and verify that it is **162.025 MHz +/- 405 HZ**.

RECORD

11. (25 kHz) Measure and RECORD the AIS transmitter **frequency deviation** (the modulation) using the Marconi and verify that frequency deviation value is between **2.70 +/- .15 KHz** and that the Marconi display screen (in the scope mode) indicates a nominally flat-top waveform (with minimal slope on the top).

RECORD

12. Press **ENT** in the MD field and use the up down arrow keys to select **D21**. Press **ENT**. Observe the **LEVEL** on the Marconi. If the value is not **3 KHz +/- .33 KHz**, adjust R43 on the front panel to adjust the value to 3.0 KHz as close as possible.

RECORD

13. Set Trace messages to a "0". Press the FNC key then the CLR key on the AIS keypad. Then, set the "IEC Trc" and the "VDL TRC" to 0. Press the ESC key to exit this menu.

CHECK**4.6 Internal GPS Test**

- a) Cycle power to the UUT and verify that the time/date are reported immediately
- b) Verify that the UUT shows that its time source is (I)nternal.

CHECK

- c) Measure voltage from TNC connector. Voltage should be $\geq 4.8\text{Vdc}$.
With a GPS antenna connected note the voltage and operation.

CHECK**4.7 TX/RX Test (25kHz)**

Run the PISIM5A software.. Press "**start**" and allow the units to negotiate and begin the TX/RX process. Verify that the Packet error rate is greater than 80 % after 30 packets have been transmitted.

While PISIM5A is running. With a scope, probe RX1 or RX2 of the receiving test AIS. Look at the incoming packets on the scope, making sure there are no hiccups or jitters in the packet.

NOTE: This is a visual verification CHECK, not a precise check.

CHECK

4.7.1 BBM and ABM Test

Using the **PiSim3** SW, send and receive broadcast messages as follows:

*Note: Each message sent has to be a different message to register, it is acceptable to simply add a number to the message (i.e. 1, 2, 3, ect)

1.0 Select **Broadcast**, text and Transmit channel A only, now click the ports button and enter a port of the UUT and click OK. Now select a message then click “Send ID 0” to send a broadcast. Make sure the known-good AIS received a message on the MKD.

2.0 Select **Broadcast**, text and Transmit channel: A only, now click the ports button and enter the other port of the known-good AIS and click OK. Now select a message then click “Send ID 0” to send a broadcast. Make sure the UUT received a message on the MKD.

5.0 IEC Port Test

5.1 Using the **PiSim2** SW, set the an RMC sentence with the following settings:

LAT: 27.50 LON: -82.57 STATUS: A COURSE: 10 SPEED: 30
MODE: D

Using the **PiSim2** SW, set the HDT and ROT sentences with the following settings:

HDT (heading) = 180 ROT = 5 Valid = Checked

CHECK

5.2 IEC Port Test

Wait for the UUT to stop receiving data, indicated by the status light turning red. Use the **PiSim2** SW, send an RMC sentence with the same settings as in paragraph 5.1 to **Ports 104 thru 109, pausing at each port send to verify data has been received. Change the latitude for each transmission 40 for 104, 50 for 105 following this convention to 90 for 109.**

CHECK

6.0 Final Documentation

6.1 Review the Data Record and verify that all entries are correct.

STAMP

APPENDIX A Marconi Setup

Receiver Sinad Marconi Setup

(all other parameters the same except frequency)

Select **FUNCTION, RF Gen**

Select **DATA, FREQ**

Enter **Gen Frequency, 162.025 MHz for RX1 (Recall 03)**

161.975 MHz for RX2 (Recall 02)

156.525 MHz for CH70 (Recall 04)

Select **DATA, LEVEL**

Enter **LEVEL, -17, dBm**

Select **MOD, FM**

Select **FUNCTION, SET MOD**

Select **DATA, FREQ**

Enter **MOD FREQ, 1, KHz**

Select **DATA, LEVEL**

Enter **LEVEL, 3, KHz**

Select **FUNCTION, SINAD S/N**

Select **AF FILTERS, BANDPASS**

Select **BANDPASS, 0.3-3.4 KHz**

Select **MODE, SCOPE**

APPENDIX B DATA RECORD

The following acceptance test data is supplied as evidence of product quality. Supporting records regarding inspection and tests performed will be retained by L-3 Communications, Aviation Recorders Division for seven years.

Tested P/N: 253M009200 Tested Serial No. _____
 Final P/N: _____ Final Serial No. _____
 Date Started: _____ Description: Automatic Identification System
 Date Completed: _____ Tested By: _____

Check that all measuring equipment have calibration stickers and are within their calibration periods _____. (check).

List on the Data Record the property number, calibration due dates, and alternate equipment, if used.

Equipment Description	Mfg. & Model No.	Prop. No.	Cal. Due
PC, with Windows 2000/XP	any	_____	_____ N/A
Radio Test Set	Marconi 2955	_____	_____
AIS	L-3	_____	_____ N/A
PiMonitor Sw	L-3	_____ N/A	_____ N/A
PiSim2 SW	L-3	_____ N/A	_____ N/A
PiSim3 SW	L-3	_____ N/A	_____ N/A
PiSim5 SW	L-3	_____ N/A	_____ N/A
DC Power Supply	any	_____	_____
Oscilloscope	Tektronics 2465B	_____	_____

Alternate Equipment Used:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Para.	Test Description	Expected Results	Actual Results
	General Appearance and Pre-Burn-in Setup/ Tests		
4.1	No manufacturing defects; keypad and front panel lettering correct; keys don't stick. Display light OK; display lettering correct and visible	CHECK	_____
4.2.1	Setup	CHECK	_____
4.3.1	Verify Display light OK; display lettering correct and visible	CHECK	_____
4.3.2	RECORD the three 5 digit checksums	RECORD	_____ _____ _____
4.3.3	Pre Burn-in Complete	CHECK	_____
4.4	Burn-In		
4.4.1	Burn-in at 24 Vdc for at least 12 hours. RECORD burn-in on/off dates/times.	On Time On Date Off Time Off Date	_____ __/__/____ _____ __/__/____
	Post Burn-in Marconi Setup and Tests		
4.5.1	Receiver Sensitivity (SINAD) Test		
Step 13.	RX1 (high power): RECORD SINAD > 20 dB	> 20 dB	_____dB
Step 14.	RX1 (high power): RECORD Distortion ≤ 5 %	≤ 5 %	_____%
Step 15	RX1 (low power): RECORD SINAD > 20 dB	> 10 dB	_____dB
Step 16	RX2 (high power): RECORD SINAD > 20 dB	> 20 dB	_____dB
Step 17	RX2 (high power): RECORD Distortion > ≤ 5 %	≤ 5 %	_____%
Step 18	RX2 (low power): RECORD SINAD > 10 dB	> 10 dB	_____dB
Step 19	R70 (low power): RECORD SINAD > 20 dB	> 20 dB	_____dB
4.5.2	Transmitter Power, Frequency, Frequency Deviation (Modulation), and Attack Time Test		
Step 6.	RECORD power supply current.	≤ 2.9 Amps	_____A

Para.	Test Description	Expected Results	Actual Results
Step 7.	RECORD Tx RF High Power	12.5 +/- 1.0 W	_____W
Step 9.	RECORD Tx RF Low Power	2.0 +/- 0.2 W	_____W
Step 10.	RECORD Tx RF Frequency	162.025 MHz +/- 405 Hz	_____MHz
Step 11.	(25 kHz) RECORD Tx Frequency Deviation (modulation)	2.70 +/- .15 KHz	_____KHz
Step 12	D21 Level	3 +/- .33 KHz	_____KHz
Step 13	Set trace messages to zero	CHECK	
	Computer Communications Tests		
4.6	Internal GPS Test		
a	Power cycle. Time source Internal; time/date reported immediately.	CHECK	
b	Verify Source is internal	CHECK	_____
c	Record GPS output Voltage	$\geq 4.8\text{Vdc}$	_____Vdc
4.7	Tx/Rx Test (25 kHz) Verify Packet error rate is greater than 80%	CHECK	
4.7.1	BBM Test	CHECK	
5.4	IEC Port Test`	CHECK	
6.1	Review Data Record & verify all entries are correct	STAMP	_____