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Report On

Radio Approval Testing of the
McMurdo Ltd. Z501 AIS TYPE MSLD
In accordance with RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1) Link Layer Test section E8

Document 75917326 Report 01 Issue 1 March 2012

Product Service

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March 2012

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23 March 2012

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SECTION 1

REPORT SUMMARY

Radio Approval Testing of the
McMurdo Ltd. Z501 AIS TYPE MSLD
In accordance with RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1)
Link Layer Test section E8

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Radio Approval Testing of the McMurdo Ltd. Z501 AIS TYPE MSLD to the requirements of RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1) Link Layer Test section E8.

Objective	To perform Radio Approval Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	McMurdo Ltd.
Model Number(s)	Z501
Serial Number(s)	972002289
Number of Samples Tested	One
Test Specification/Issue/Date	CCNR RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1): Edition 1.01 : 2008
Start of Test	13 March 2012
Finish of Test	15 March 2012
Name of Engineer(s)	N Forsyth

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out In accordance with RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1) is shown below.

Section	Spec Clause	Test Description	Result	Comments
2.1	E.8.1	Tests for synchronization accuracy	Pass	
2.2	E.8.2	Active mode tests	Pass	
2.3	E.8.2.1.9	Test mode tests	Satisfactory	

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a McMurdo Ltd. Z501 AIS TYPE MSLD as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

1.4 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.5 MODIFICATION RECORD

No modifications were made to the EUT during the test programme.

SECTION 2

TEST DETAILS

Radio Approval Testing of the
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Link Layer Test section E8

2.1 TESTS FOR SYNCHRONISATION ACCURACY

2.1.1 Specification Reference

RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1), Clause E.8.1

2.1.2 Equipment Under Test

Z501, 972002289

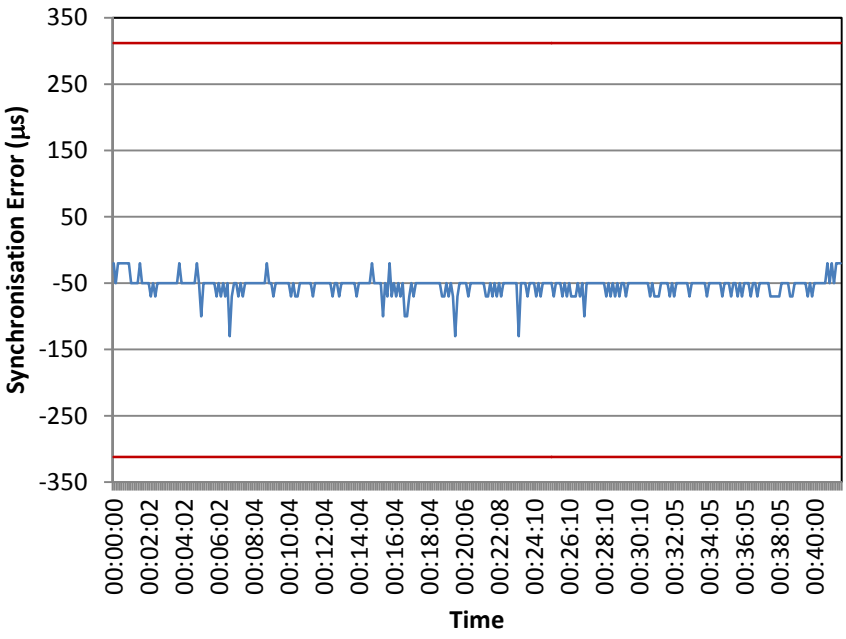
2.1.3 Date of Test and Modification State

13 March 2012 - Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Results



2.2 ACTIVE MODE TESTS

2.2.1 Specification Reference

RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1), Clause E.8.2

2.2.2 Equipment Under Test

Z501, 972002289

2.2.3 Date of Test and Modification State

13 March 2012 - Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Results

E.8.2.1.2 Initialisation Period

Requirement	Result	Verdict
The first message is transmitted within 30 sec after activation.	15 Seconds	✓
The first message with a valid position is transmitted within 5 min.	1 Minute 15 seconds	✓

E.8.2.1.3 Message content of Message 1

Requirement	Result	Verdict
Message ID = 1.	1	✓
Repeat indicator = 0.	0	✓
User ID as configured in the AU.	972002289	✓
Navigational status = 14.	14	✓
Rate of turn = default.	-128	✓
SOG = actual SOG from GNSS receiver.	SOG from GNSS receiver, 0 when stationary.	✓
Position accuracy = according to the RAIM result if provided, otherwise 0.	0	✓
Position = actual position from internal GNSS receiver.	Position from GNSS receiver.	✓
Position is updated at least once per minute, for each burst.	Updated each burst.	✓
COG = actual COG from internal GNSS receiver.	COG from GNSS receiver, 3600 when stationary.	✓
True heading = default.	511	✓
Time stamp = actual UTC second (0...59).	As per UTC second.	Note 1.
Verify correct indication according to manufacturer's documentation.	Correct, see note 2.	✓
Note 1		
The position report in each burst contains the time the GNSS generated the position, not the time when the position report is transmitted.		
Note 2		
The documentation indicates that the flash rate when GPS is available is half the rate of when no GPS data is available. However, the flash rate when a GPS fix is achieved is slower than this.		

E.8.2.1.4 Message content of Message 14

Requirement	Result	Verdict
Message ID = 14.	14	✓
Repeat indicator = 0.	0	✓
Source ID = as configured in the AU.	972002289	✓
Text = “MOB ACTIVE”.	MOB ACTIVE	✓

E.8.2.1.5 Transmission schedule for Message 1

Requirement	Result	Verdict
Verify that the AU has operated in sync mode 0 (UTC direct).	0	✓
The AU transmits one burst of messages once per minute.	One burst per minute.	✓
The duration of a burst is 14 s.	14 seconds.	✓
A burst consists of 8 messages.	8 Messages transmitted.	✓
The transmissions in a burst are alternating between AIS 1 and AIS 2.	Alternating channels.	✓
Consecutive messages are 75 slots apart and on the other channel.	Slot distance = 75.	✓
The same set of slots are used in each burst for 8 min.	Same slots used for 8 minutes.	✓
A new set of slots is randomly selected after 8 min.	New slots selected after 8 min.	✓
The first slot of the new set of slots is within the interval of 1 min ± 6 s from the first slot of the previous set of slots, that is the increment is randomly selected in the range 2 025 to 2 475 slots.	New slots within 1 min ± 6 s. Slot Offset = 2311, 2244, 2324, 2087 and 2037 over 40 minutes.	✓
The manufacturer is to provide documentation on how the increment is selected randomly.	See Annex A.	✓

E.8.2.1.6 Communication state of Message 1

Requirement	Result	Verdict
The SOTDMA communication state as defined for message 1 is used.	SOTDMA comm state used.	✓
The sync state = 0.	0	✓
The time-out starts with 7 for all messages of the first burst after a change in slots.	7	✓
The time-out value is decremented by 1 for each frame.	decremented by 1, each burst.	✓
The time-out value is reset to 7 after time-out = 0.	Reset to 7 after 0.	✓
The sub message for time-out 3,5,7 = number of received stations (0).	0	✓
The sub message for time-out 2,4,6 = slot number.	Slot number of message.	✓
The sub message for time-out 1 = UTC hour and minute.	UTC hour and minute.	✓
The sub message for time-out 0 = slot offset to the transmission slot in the next frame.	Slot offset.	✓

E.8.2.1.7 Transmission schedule of Message 14

Requirement	Result	Verdict
Message 14 is transmitted every 4 min.	Every 4 minutes.	✓
Transmissions of Message 14 are alternating between AIS 1 and AIS 2.	Alternating channels.	✓
Message 14 is transmitted in a Message 1 slot, replacing the Message 1, on the channel for which the Message 1 was scheduled.	Message 14 replaces scheduled message 1.	✓
Message 14 did not replace a Message 1 with a time-out value = 0.	Did not replace message 1.	✓

E.8.2.1.8 Transmission with lost EPFS

Requirement	Result	Verdict
The AU continues transmission.	Transmission continues.	✓
The same transmission schedule is used as with EPFS data available.	Schedule remains the same.	✓
Communication State Sync state = 3.	3	✓
SOG = last valid SOG.	Last valid SOG	✓
Position accuracy = low.	Low.	✓
Position = last valid position.	Last valid position.	✓
COG = last valid COG.	Last valid COG	✓
Time stamp = 63.	63	✓
RAIM-flag = 0.	0	✓
Verify correct indication as per manufacturer's documentation.	Correct.	Note 1.
Note 1		
After GPS is lost, the data transmitted by the AU indicates no GPS data, however, the AU does not change its flashing light indication for approximately 6 minutes. This behaviour is not documented but according to the manufacturer is intentional.		

2.3 TEST MODE TESTS

2.3.1 Specification Reference

RTCM Paper 219-2011-SC119-155 (CDV-RTCM 11901.1), Clause E.8.2.1.9

2.3.2 Equipment Under Test

Z501, 972002289

2.3.3 Date of Test and Modification State

15 March 2012 - Modification State 0

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Results

E.8.2.1.11 Transmission with EPFS data available

Requirement	Result	Verdict
The AU starts transmission after valid GNSS data is available.	Burst transmitted after GNSS data is available.	✓
A single burst of 8 messages in the correct order and correctly populated as per E.3.8.1.2.	Messages sent = 14,1,1,1,1,1,1,14	✓
User ID as configured in the AU.	972002289	✓
Navigational status = 15 (not defined).	15	✓
SOG = actual SOG from GNSS receiver.	SOG from GNSS receiver, 0 when stationary.	✓
Position accuracy = according to the RAIM result if provided, otherwise 0.	0	✓
Position = actual position from internal GNSS receiver.	Position from GNSS receiver.	✓
COG = actual COG from internal GNSS receiver.	COG from GNSS receiver, 3600 when stationary.	✓
Time stamp = actual UTC second (0...59).	As per UTC second.	Note 1.
The communication state time-out always = 0 with sub message = 0.	0, sub message = 0.	✓
RAIM-flag = 0.	0	✓
The transmission of Messages 1 and 14 stops after one burst of 8 messages.	Only one burst transmitted.	✓
The text message in Message 14 is “MOB TEST”.	MOB TEST	✓
Verify correct indication as per manufacturer’s documentation.	Correct. See Note 2.	✓
Note 1		
The position report in each burst contains the time the GNSS generated the position, not the time when the position report is transmitted.		
Note 2		
The documentation states that after 1 minute a test message is sent. According to the manufacurer this is a typical value; the AU will actually transmit as soon as a valid GNSS position is obtained.		

E.8.2.1.14 Transmission without EPFS data available

Requirement	Result	Verdict
The AU starts transmission within 5 min.	Transmission starts after 5 min.	Note 1.
A single burst of 8 messages in the correct order and correctly populated as per E.3.8.1.2.	Messages sent = 14,1,1,1,1,1,1,14	✓
User ID as configured in the AU.	972002289	✓
Navigational status = 15 (not defined).	15	✓
SOG = default value.	1023	✓
Position accuracy = low.	0	✓
Position = default values.	108600000 and 54600000	✓
COG = default value.	3600	✓
Time stamp = 63.	63	✓
The communication state time-out always = 0 with sub message = 0.	0, sub message = 0.	✓
RAIM-flag = 0.	0	✓
The transmission of Messages 1 and 14 stops after one burst of 8 messages.	Only one burst transmitted.	✓
The text message in Message 14 is “MOB TEST”.	MOB TEST	✓
Verify correct indication as per manufacturer’s documentation.	Correct.	✓
Note 1		
There is a contradiction in the test standard, in section E.3.8.1.2, it states that “If the AIS MSLD AU does not acquire position, SOG, COG and time within 5 min it shall transmit the test messages”. Therefore it is deemed satisfactory that the AU starts transmission after the 5 minute allowance of position acquisition.		

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument Description	Manufacturer	Model Type	TE Number	Cal Period (months)	Calibration Due Date
Section 2.1, 2.2 and 2.3 - Tests for Synchronisation Accuracy, Active Mode Tests and Test Mode Tests					
VDL Analyser/Generator	Attingimus	AIS Tester	4057	-	TU
Power Supply Unit	Iso-Tech	IP2302A	2437	-	TU
GPS Simulator	Spirent	STR4500	3056	-	TU

TU – Traceability Unscheduled

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Front View

Rear View

SECTION 5

DISCLAIMERS AND COPYRIGHT

5.1 DISCLAIMERS AND COPYRIGHT

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ANNEX A

CUSTOMER SUPPLIED INFORMATION

McMurdo Z501 & Z502

Statement on randomness of ‘slot offset’ selection

The MSLD specification RTCM CDV 11901.1 requires under section 8.2.1.5 j that the manufacturer provides an explanation regarding the randomness of the ‘new slot offset’ selection process. This document provides that explanation.

Software description

The product firmware uses a standard C compiler random number generation function to provide the random number used for the ‘slot offset’ value. The method used by the C compiler is a very common pseudo random generation method known as the “linear congruential generation” or LCG. This uses the formula below to scale, increment and then crop the previous random number. The choice of formula values [a, c, m] being chosen from a wide range of prime numbers to give the best performance in terms of distribution or ‘whiteness’.

The particular coefficients used by this C compiler are :

*w=(int) ((randx=randx*1103515245L + 12345)>>16) & 077777;*

As with any ‘pseudo’ random generator the choice of initial ‘seed’ value is important to ensure fast and random entry into the huge sequence of random numbers. To ensure this the firmware uses a combination of product serial number and the first available UTC time reading as a seed value. This ensures randomness even in the unlikely event of never obtaining a UTC time reading.

John Norrish
Senior Design Engineer
McMurdo

08 March 2012