



KONGSBERG

Sea Acceptance Test						
<i>Product:</i> <i>Produkt:</i>	EM 710 Multibeam Echo Sounder					
<i>Product reg.no:</i> <i>Produkt reg.nr:</i>		<i>Rev.A Created by:</i> <i>Rev.A Laget av:</i>			KEN/BHL	
<i>Doc.reg.no:</i> <i>Dokument reg.nr:</i>	840-223304		<i>Rev.A Controlled by:</i> <i>Rev.A Sjekket av:</i>		BHL	
<i>Doc.archive no:</i> <i>Dokument arkiv-nr:</i>	AA000		<i>Rev.A Approved by:</i> <i>Rev.A Godkjent av:</i>		KEN	
<i>Revision:</i> <i>Revisjon:</i>	A	B	C	D	E	F
<i>Date:</i> <i>Dato:</i>	April 18, 2005	19 Jan 2011	02 Oct 2012	08 Oct 2012		

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1 DOCUMENT HISTORY

<i>Rev</i>	<i>Description of changes</i>	<i>Created by</i>
A	Original issue.	KTU
B	Layout modifications	
C	Added Data records section	KTU
D	Corrected SAT survey recommendation	KTU

2 INTRODUCTION

The purpose of this procedure is to verify that the system as installed is fully functional at sea, and to serve as a record of the successful completion of the Sea Acceptance Test. It is to be followed to verify correct functioning of the multibeam echo sounder and the various external sensors or systems as an integrated mapping system. It will also verify that the system interfaces and peripherals are functional.

The sea trials shall establish:

- that the different EM 710 units work properly at sea
- that the heave, roll and pitch signals are correctly used
- that the heading signal is correctly used
- that the sound speed input data are correctly used
- that the positioning system data are correctly used
- that the system is capable of providing good depth data consistently
- that the system during operation produces digital data to its internal storage devices and, if available, to an external logging system connected via Ethernet

The Sea Acceptance Test shall consist of a verification of correct interfacing of external sensors, a calibration of external sensor offsets and time delays, a test survey, and assessment of the data from the test survey. In addition, as far as time and external conditions allow, limitations on system performance as a function of water depth, vessel speed and sea state shall be established.

3 REFERENCES

Factory and Harbour Acceptance Test records.

4 TEST EQUIPMENT

No special test equipment is required for the Sea Acceptance Test, but all sensors normally needed for surveying with a Multibeam echo sounder shall be available.

5 LIST OF ITEMS

The items which are to be tested, will depend on the particular configuration. Use the manufacturer type number column to indicate which items are actually included in this particular delivery or furnished by the owner to be used with the system.

<i>List of items to be tested</i>			
<i>Item</i>	<i>Manufacturer, type and/or registration number</i>	<i>Equipment</i>	<i>Serial number</i>
1	125-223159	EM 710 TRANSCEIVER UNIT	330
2	HPMP8300	HYDROGRAPHIC WORKSTATION	C2C34074BV
3	POS/MV V5	HEADING SENSOR	PCS 6514 IMU 2592
4	POS/MV V5	MOTION SENSOR	PCS 6514 IMU 2592
5	AML Smart X	FIXED SOUND SPEED SENSOR	020112
6	XBT	SOUND SPEED PROFILE SENSOR	
7	EMAT POS/MV	POSITIONING SYSTEM	PCS 6514 IMU 2592
8			
9			

6 CONFIGURATION

The modules and circuit boards included in the system and their serial numbers were noted in the Factory and Harbour Acceptance tests. Any replacement modules or circuit boards since the HAT must be noted.

<i>Replacement list</i>			
<i>Item</i>	<i>Equipment</i>	<i>Registration number</i>	<i>Serial number</i>
1			
2			
3			
4			
5			
6			

7 SOFTWARE

The system software version must be noted, including the subsystems, and reflecting any changes made during the trials.

Item	Equipment	Version number	Version date
1	BSP 67B master version	2.1.4	12/22/08
2	BSP 67B slave version	2.1.4	12/22/08
3	CPU version	2.4.0	15/4/16
4	DDS version	3.5.10	14/1/16
5	RX 32 version	1.11	Feb 15 2010
6	TX 36 version	1.89	Dec 16 2005
7	SIS Software version (press the icon located on the bottom line in the SIS window)	← 4.3.1	Dec 18 2015

8 INTERCONNECTION/ARRANGEMENT

The system shall have been installed according to the Installation Manual. Note the locations of the transducers, motion sensor(s) and positioning system(s) as entered on the Operator Station:

	X (forward pos)	Y (starboard pos)	Z (downwards)
TX transducer	-3.177	+0.285	0.989 .99
RX transducer	-4.604	+0.629	0.987
Motion sensor no 1			
Motion sensor no 2			
Positioning system no 1	-8.828	-6.791	-21.555
Positioning system no 2			
Positioning system no 3			
Pos. system Ethernet			
Waterline downward	NA	NA	-3.37

Handled in Pos/MV

Note the transducer alignment angles as entered on the Operator Station:

	Roll	Pitch	Heading
TX transducer	0.083	-0.008	359.923
RX transducer	0.051	0.027	0.008

9 TEST PROCEDURE

The test will be documented through the tables on the following pages. The tests shall generally be done in the following order:

- Interface tests
- Calibration
- Survey
- Data assessment

Assessment of the survey data collected should preferably be done on board.

Note that the noise measurements and test of performance with regard to depth and/or sea state are to be run in the order which best suits the conditions during the test period. It is not expected that many different conditions will be encountered during the limited time available for the sea acceptance test. However, it is strongly advised that as different conditions are encountered during later use of the system, the system performance as a function of external conditions is noted, for example in this record. This will be valuable for later use in survey planning and in ensuring the most efficient use of the system.

9.1 Test of Interfaces

Tests of the external sensor interfaces should have been run during the Harbour Acceptance test. However, these tests were necessarily limited (static only), and may not even have been done due to non-availability or non-functionality of external sensors. Thus the data from the external sensors should be observed on the system display during vessel maneuvering, and verified for correctness (positions and clock) or correct sign and/or reasonable magnitude (heave, roll, pitch, heading and sound speed).

Data will be logged during the test, all connected hard-copy devices should be employed, and sound speed profiles loaded into the system. Observe that this is functional. Fill in the table below to record this.

Test no.	Function to be tested	Test result	Notes
1	Position input	OK	
2	External clock input	OK	
3	Transducer depth sound speed input	OK	
4	Sound speed profile input	OK	
5	Heading input	OK	
6	Motion data input	OK	
7	Data output to internal storage	OK	
8	Data output to external storage	OK	
9	Data output to external Ethernet	OK	NADIR datagram issues, see report
10	Postscript printer	N/A	
11	Printer/plotter/recorder output	N/A	

9.2 Sensor Offset/Calibration

The offset or zero bias of the roll, pitch and heading sensors and the time delay of the position system(s) are to be measured or estimated before leaving port if possible (this is especially important with regard to the heading sensor). A calibration of these offsets shall be performed at sea as the second part of the test in accordance with the procedures given in the Operator Manual. Finally, these offsets shall be estimated from the final test survey. Fill in the table below with the offsets as entered into the Operator Station:

From patch test

	Port Estimate	Calibration result	Final Estimate
Roll offset system 1			0.03
Roll offset system 2			
Pitch offset system 1			0.05
Pitch offset system 2			
Heading offset system 1			-1.20
Heading offset system 2			
Position time delay system 1			
Position time delay system 2			
Position time delay system 3			

Note the positioning system type used during the sea acceptance test and its estimated accuracy:

Positioning system type 1: *POS/MV*

Estimated accuracy for position system: *0.087 meters*

Positioning system type 2:

Estimated accuracy for position system:

Positioning system type 3:

Estimated accuracy for position system:

9.3 Survey

The integrity of the total survey system consisting of the multibeam echo sounder as installed on the vessel, motion sensor, heading sensor, sound speed sensor(s), and positioning system(s) shall be assessed by doing a survey of a limited area and inspecting the collected data. The result should be compared against the specified accuracy of the echo sounder, taking into account the precision of the external sensors, and any limitations imposed by the vessel and its handling. Note that this test is not designed to measure the accuracy of the echo sounder itself, as this would require a much more extensive test period, and has been done on previous system installations.

The sea acceptance test's main part will be a sensor calibration followed by a system assessment survey in the calibration area. The area used for the sea trials should thus consist at least partly of a relatively flat bottom and partly of a significant slope as required for a calibration in accordance with the guidelines for calibration as given in the Operator Manual. In case this is not possible the calibration of the various sensors must be run in separate areas while the final assessment survey should be run in the flat part used for roll calibration. The depth should then ideally be in the 100 – 300 m range (not critical).

Five parallel lines should be run with line spacing equal to about one quarter of the achieved coverage in the actual area. Neighboring lines should be run in opposite directions. The line length should be in the order of twice the achieved coverage. A sixth line should be run perpendicular to and across the five previous lines.

Assess the data with the system's grid display using a grid cell size giving about 10-20 soundings per cell. Using the various display options, investigate the frequency and magnitude of outliers, discrepancies between lines, and depth differences within cells. Use also the calibration profile displays to assess any remaining errors due to roll offset or sound speed profile problems. If the performance of the system is not according to expectation, describe the results in the Comment section below, otherwise note that the system performance is accepted. Any un-resolvable performance problems should be further investigated and quantified with a post-processing system such as Neptune from Kongsberg.

Note the area with positions and depths where the Customer Acceptance Test has been performed:

CAT area: Atlantic Ocean, off the U.S. coast from Charleston SC
CAT position: ~~31.81 N 78.54 W~~ 31.81 N 78.54 W
CAT depth: 600 meters

9.4 Noise and Sea Conditions Performance Assessment

During the sea acceptance test, the performance of the whole system shall be assessed. The important factors limiting achievable accuracy and coverage are noise (vessel and environmental) and sea state. With heavy seas it is to be expected that the performance will also depend upon vessel heading with respect to wave direction. On some vessels the noise level at particular speeds and propeller revolutions may also affect coverage. It is recommended to assess achieved coverage as a function of environmental parameters both during the sea acceptance test and later operation. The results should be entered in the table below, both to document conditions during the test and later to have a record of the system's performance according to external conditions.

The noise experienced by the system may be measured from the Operator Station as described in the Operator Manual. Several measurements should be taken and the result averaged before noting it in the table below:

Date	Depth (m)	Sea State	Heading Against Waves	Speed	RPM	Noise	Comments
02/11	2000	7-10	137	2kt	46%	36dB	
02/11	2000	7-10	137	4kt	62%	36dB	
02/11	2000	7-10	137	6kt	64%	36dB	
02/11	2000	7-10	137	8kt	78%	36dB	
02/11	2000	7-10	137	10kt	94%	37dB	
02/11	2000	7-10	137	12kt	100%	37dB	

The coverage is assessed by observing the swath width on the Operator Station on a reasonably flat bottom. The average of several pings and any occurrence of missed pings should be noted in the table below:

9.5 Data records

From the Operator Station (SIS):

- **Run all Built In System Tests. Save the BIST results to file.**
- **Run the System Info test and save to file (This file contains info about registration numbers, serial numbers, software versions etc).**
- **Save PU parameters to file (this file contains information about runtime and installation parameters).**

Transfer these files to Kongsberg Maritime head office for update of the ships installation records (Archive).

10 TESTIMONIAL

WHOI, NEIL ARMSTRONG

The SEA ACCEPTANCE TEST for the EM 710, for has been performed according to the test procedure.

The SAT approval is only valid if the test is performed by an engineer certified by Kongsberg Maritime A/S.

The test is: Accepted / Not accepted. (Delete as appropriate)

Remarks:

SIS had issues with import / export of datagrams
 does not send acknowledgement of receipt of SUP.
 User defined export not working
 export of centerbeam back datagram via ethernet.

Test performed by	Position	Date
<u>Tony Dahlheim</u>	<u>Field Engineer</u>	<u>Feb 16, 2016</u>
(Please use capital letters)		

Test accepted by	Position	Date
<u>Amy Simoneau</u>	<u>SSSG Tech</u>	<u>16 Feb 2016</u>
(Please use capital letters)		

Signatures:

Tony Dahlheim Amy

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