

A RADIO TEST REPORT

FOR

Marine Rescue Technologies Ltd

ON

sMRT V100

DOCUMENT NO. TRA-013792-W-US-1

HULL

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Radio Test Report : TRA-013792W-US-1

Applicant : Marine Rescue Technologies Ltd

Specification : RTCM STANDARD 11901.1 JUNE 4, 2012

Apparatus : sMRT V100

Authorised by :



: Radio Product Manager

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Section 1: Introduction

1.1 General

This report contains an assessment of an apparatus based upon tests carried out on samples submitted to the Laboratory.

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1.2 Tests Requested By

This testing in this report was requested by :

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1.3 Manufacturer

As above

1.4 Apparatus Assessed

The following apparatus was assessed between

sMRT V100

The EUT is a personal alerting and locating device for use in the marine environment. Integrated into a Personal Flotation Device, the sMRT V100 provides alerting via VHF DSC message and tracking via AIS to provide Search and Rescue forces an accurate location and identification of any casualty or casualties in the water following a Man Overboard incident.

1.5 Equipment Test Conditions

1.	Equipment Category:	Category 1	(General)	[X]
		Category 2	(Portable)	[]
		Category 3	(Normal Indoor Use)	[]
2.	Temperatures: (see transmitter category)	Tnom	=	(See test)
		Tmin	= -25°C	[X]
			= -10°C	[]
			= 0°C	[]
		Tmax	= +60°C	[]
			= +55°C	[X]
			= +40°C	[]
			= +30°C	[]
3.	Transmitter Maximum Deviation or Shift:	kHz	=	7.4kHz
4.	Transmitter Duty Cycle:	%	=	0.000134
5.	Listen Before Talk:	Yes	=	[]
		No	=	[X]
6.	Channel Spacing:	kHz	=	N/A
		Narrowband		[]
		Wideband		[X]
7.	Receiver Class:	Class	=	2

1.6 Essential Radio Test Suite And Test Result Summary

Full details of test results are contained within Appendix A, B, C and D. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.7 to 1.9 of this test report.

This report contains an assessment of an apparatus against RTCM STANDARD 11901.1 JUNE 4, 2012, based upon tests carried out on samples submitted to the Laboratory.

Test Type	Reference clause in RTCM STANDARD 11901.1 JUNE 4, 2012	Appendix no in this report	Mod no.	Result
Function of the ON control	4.1.3	A1	0	Pass
Alerting	4.1.4.1	A2	0	Pass

Test Type	Reference clause in RTCM STANDARD 11901.1 JUNE 4, 2012	Appendix no in this report	Mod no.	Result
DSC and AIS Combination MSLD Devices	A.3.5	B1	0	Pass
Alerting signal	A.3.6	B2	0	Pass
AU using DSC 'all ships' messages	A.3.7	B3	0	Pass
AU using DSC individual station relay messages	A.3.8	B4	0	Pass
Position Data	A.3.9	B5	0	Pass
Frequency and type of signal (Summary)	A.3.10	B6	0	Pass
Radiated power output	A.3.13	B7	0	Pass
Frequency error	A.4.1	B8	0	Pass
Carrier power	A.4.4	B9	0	Pass
Adjacent channel power	A.4.7	B10	0	Pass
Conducted spurious emissions conveyed to the antenna	A.4.10	B11	0	Pass
Cabinet radiation and conducted spurious emissions other than those conveyed to the antenna	A.4.13	B12	0	Pass
Transient frequency behavior of the transmitter	A.4.16	B13	0	Pass
Residual modulation of the transmitter	A.4.19	B14	0	Pass
Frequency error (demodulated DSC signal)	A.4.22	B15	0	Pass
Modulation index for DSC	A.4.25	B16	0	Pass
Modulation rate for DSC	A.4.28	B17	0	Pass
Testing of generated call sequences	A.4.31	B18	0	Pass

Test Type	Reference clause in RTCM STANDARD 11901.1 JUNE 4, 2012	Appendix no in this report	Mod no.	Result
Unique identifier (user ID)	E.3.4	C1	0	Pass
Battery	E.3.6	C2	0	Pass
Output power	E.3.7	C3	0	Pass
Transmission performance – Active mode	E.3.8.1.1	C4	0	Pass
Transmission performance – Test mode	E.3.8.1.2	C5	0	Pass
Position Source and Data	E.3.9	C6	0	Pass
Channel	E.4.1	C7	0	Pass
Transmitter characteristics (Summary)	E.4.4	C8	0	Pass
Link layer requirements	E.4.5	C9	0	Pass
Synchronization method	E.4.5.1.6	C10	0	Pass
Synchronization accuracy	E.4.5.7	C11	0	Pass
VDL access scheme	E.4.5.1.8	C12	0	Pass
Frequency error	E.7.1.1.1	C13	0	Pass
Conducted power	E.7.2	C14	0	Pass
Radiated power	E.7.3	C15	0	Pass
Modulation spectrum slotted transmission	E.7.1.3.4	C16	0	Pass
Transmission test sequence and modulation accuracy	E.7.4	C17	0	Pass
Transmitter output power versus time function	E.7.5	C18	0	Pass
Spurious emissions from the transmitter	E.7.6	C19	0	Pass
Tests for synchronization accuracy	E.8.1	C20	0	Pass
Active mode tests	E.8.2	C21	0	Pass
Test mode tests	E.8.2.1.9	C22	0	Pass

Test Type	Reference clause in RTCM STANDARD 11901.1 JUNE 4, 2012	Appendix no in this report	Mod no.	Result
Internal Navigation Device tests	Annex F	D1	0	Pass

1.7 Summary of Compliance

The samples, as assessed, satisfied the relevant requirements of RTCM STANDARD 11901.1 JUNE 4, 2012, as detailed in section 2.1 of this test report.

1.8 Notes Relating to the Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.8 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, "Pass" indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature : 17 to 23 °C
Humidity : 45 to 75 %
Barometric Pressure : 86 to 106 kPa

Note that temperature and humidity conditions can be found in the relevant test results appendix A.

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.9 Deviations from Test Standards

There were no deviations from the test standard.

Section 2: Measurement Uncertainty

For the test data recorded, the following measurement uncertainty was calculated.

Test type	Quantity	Quantity frequency range	Uncertainty
Radiated electric field emissions 3m alternative test site Effective Radiated Power 3m alternative test site	Amplitude	30MHz to 300MHz Horizontal	±4.6dB
		30MHz to 300MHz Vertical	±5.1dB
		300MHz to 1000MHz Horizontal	±5.2dB
		300MHz to 1000MHz Vertical	±5.5dB
		1GHz to 26.5GHz Horizontal and Vertical	±4.1dB
		N/A	±0.9 dB
Conducted RF emissions	Amplitude	N/A	±0.9 dB
Absolute RF power (via antenna connector)		N/A	±0.9 dB
ACP		N/A	±0.9 dB
Frequency Range	Frequency	AF 20 Hz to 20 kHz	0.1 Hz (5ppm)
		RF 9kHz to 1 GHz	136 Hz
		RF 1GHz to 26.5GHz	3.611kHz

Section 3: Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A:**General Requirements**

Abbreviations used in the tables in this appendix:

Spec : Specification
Mod : Modification
EUT : Equipment Under Test
SE : Support Equipment
L : Live Power Line
N : Neutral Power Line
E : Earth Power Line
Pk : Peak Detector
QP : Quasi-Peak Detector
Av : Average Detector

ALSR : Absorber Lined Screened Room
OATS : Open Area Test Site
ATS : Alternative Test Site
Ref : Reference
Freq : Frequency
MD : Measurement Distance
SD : Spec Distance
Pol : Polarisation
H : Horizontal Polarisation
V : Vertical Polarisation

A1 Function of the ON Control

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	4.1.3
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
Transmission of the alert signal shall begin within 30 seconds of switching the control to the ON position.	Alerting occurred within 30s of activation of the ON control

A2 Alerting

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	4.1.4.1
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
A visual and/or audible indicator detectable by the user shall commence within 5 seconds of the device being activated (both manually and/or automatically), and shall continue until the AU is no longer transmitting its alerting signal. The visual indicator should be visible in direct sunlight, low light, and no light conditions.	A flashing beacon was fitted to the AU. The beacon was visible in all light required lighting conditions and was observed to be activated immediately on the AU being turned on.

Appendix B:**DSC type MSLD**

Abbreviations used in the tables in this appendix:

Spec : Specification
Mod : Modification
EUT : Equipment Under Test
SE : Support Equipment
L : Live Power Line
N : Neutral Power Line
E : Earth Power Line
Pk : Peak Detector
QP : Quasi-Peak Detector
Av : Average Detector

ALSR : Absorber Lined Screened Room
OATS : Open Area Test Site
ATS : Alternative Test Site
Ref : Reference
Freq : Frequency
MD : Measurement Distance
SD : Spec Distance
Pol : Polarisation
H : Horizontal Polarisation
V : Vertical Polarisation

B1 DSC and AIS Combination MSLD Devices

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.3.5
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
If a manufacturer chooses to build an MSLD system that functions as both a DSC MSLD and an AIS MSLD the AU transmitting both DSC and AIS messages shall transmit one common user ID.	Common user ID verified (see Appendix E for supporting data)

B2 Alerting signal

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.3.6
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
A DSC message shall be used for alerting the BU.	Alerting Message type verified (see Appendix E for supporting data)

B3 AU using DSC 'all ships' messages

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.3.7
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
On initial activation, the AU shall transmit a DSC message indicating Man Overboard (MOB). The message shall be formatted as a distress relay on behalf of another ship, as specified in table 4.3, line 1 of ITU-R M.493-13, with the nature of distress set to 110 (MOB) and the subsequent communications field set to symbol 126 (no information) – this is known as a 'closed loop' alert. The destination MMSI may be either an individual station or a group.	Alerting Message contents verified (see Appendix E for supporting data).

Test Requirement	Test Result
As soon as the integral GNSS receiver is able to provide an accurate position and time, the AU shall transmit a further closed loop alert with the position and time from the GNSS receiver automatically inserted into the message. The position expansion sequence of ITU-R M.821 shall also be used.	Alerting Message contents verified with correct GNSS data (see Appendix E for supporting data).

Test Requirement	Test Result
If, after a 5 minute period, a DSC Distress Alert relay acknowledgment message has not been received, the AU shall transmit a DSC message coded as an all ships Distress Alert as specified in line 1 of Table 4.1 of ITU-R M.493-13. The nature of distress field shall be set to symbol 110 (man overboard) and the subsequent communications field set to symbol 126 (no information). Position and time shall be automatically inserted from the GNSS receiver. The position expansion sequence of ITU-R M.821 shall also be used – this is known as an ‘open loop’ alert.	Alerting Message contents verified with correct GNSS data (see Appendix E for supporting data).

Test Requirement	Test Result
If a DSC Distress Alert acknowledgment message is not received, the AU shall operate with a duty cycle of at least one open loop message every 5 minutes for a period of 30 min, i.e. at least one transmission every 5 minutes for a 30 minute period (a minimum of 6 transmissions). The actual transmitter duty cycle shall be a randomly selected time of between 4.9 and 5.1 minutes.	Alerting Message contents verified with correct GNSS data and timing (see Appendix E for supporting data).

Test Requirement	Test Result
After 30 minutes have elapsed, the duty cycle may then change to 10 min. This will continue until an acknowledgment message is received, the batteries are exhausted or the MSLD transmitter is switched off. The actual transmitter duty cycle shall be a randomly selected time of between 9.9 and 10.1 minutes.	Alerting Message contents verified with correct GNSS data and timing (see Appendix E for supporting data).

B4 AU using DSC individual station relay messages

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.3.8
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
All messages shall be in accordance with ITU-R M.493-13. The message shall be a distress relay on behalf of another ship as specified in table 4.3 of ITU-R M.493-13. Format Specifier – 120 distress relay Address – Own ship MMSI Category – 112 Self-Identification = Own ship MMSI or MSLD MMSI where applicable Messages Message 0 – ID Message 1 – 110 (MOB) Message 2- Position (if used) Message 3 – Time (if used) Message 4 – 100 End of Sequence 117 The above message format shall be transmitted once every 5 min for a period of 30 min. If after this period of time the AU has not been disabled then the DSC message shall change to a message calling a group in accordance with ITU-R M.493-13.	Alerting Message contents verified (see Appendix E for supporting data).

B5 Position Data

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.3.9
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The Time To First Fix (TTFF) of the GNSS receiver in the AU shall be less than 5 minutes regardless of the start configuration of the GNSS. If a valid GNSS fix has not been obtained, then the Position field in the DSC messages shall be replaced with the digit 9 repeated as necessary (and if applicable the Time field shall be replaced with the digit 8). If and when a valid GNSS fix has been obtained then the AU commences the transmission of DSC messages containing Position (and Time) as detailed above. The same GNSS position shall be transmitted for a minimum of 2 consecutive bursts without changing. Once a fix has been obtained it shall be updated no more often than once every 10 minutes but at least once every 20 minutes and the new position shall then be encoded and transmitted for at least the next 2 consecutive bursts, whereupon the sequence repeats. If valid GNSS updates cannot be maintained, after an initial fix, then the last valid encoded position (and time) shall continue to be transmitted for a period of 3 hours. If within this time a valid fix is obtained then the new updated position shall be transmitted as described above. If however after 3 hours a valid fix has not been obtained, then the DSC message shall revert to the default values (of 9's and 8's) as if no valid fix had been obtained, until a valid fix is obtained.	Alerting Message contents verified (see Appendix E for supporting data).

B6 Frequency and type of signal (Summary)

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.3.10
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
Frequency 156.525 MHz +/- 10 parts per million	Maximum 2.3 ppm
Phase Modulated G2B class of emissions (Channel 70 DSC)	Verified
The necessary bandwidth should be less than 16 kHz.	Bandwidth measured at 14.8 kHz
Frequency modulation with a pre-emphasis characteristic of 6 dB/octave (phase modulation) with a modulating sub-carrier shall be used.	Verified
A sub-carrier of 1700 Hz with frequency shift between 1300 Hz +/-10 Hz and 2100 Hz +/- 10 Hz shall be used.	Verified
The modulation rate shall be 1200 baud and the index of modulation shall be 2.0 +/-10%.	Verified

B7 Radiated power output

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.3.13
Frequency range	S02
Application	0
EUT sample number	None
Modification state	S06/S07
SE in test environment	23
SE isolated from EUT	47
Ambient temperature °C	S02
Relative humidity %	0
EUT set up	Appendix F
Photographs (Appendix F)	Photographs 1 and 2

Measured Radiated Power (mW)	Limit (mW)
372	100 to 500

Limit RTCM STANDARD 11901.1 JUNE 4, 2012 Clause A.3.13

Not less than 100 mW and not to exceed 500 mW vertically polarized

B8 Frequency error

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.1
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Conditions		Measured Frequency (MHz)	Frequency error (kHz)	Limit (kHz)
T _{nom} : 20 deg C	V _{nom} :	156.525100	0.100	±1.5
T _{min} : -25 deg C	V _{min} :	156.525355	0.355	±1.5
	V _{max} :	156.525355	0.355	±1.5
T _{max} : 55 deg C	V _{min} :	156.525110	0.110	±1.5
	V _{max} :	156.525110	0.110	±1.5

Limit RTCM STANDARD 11901.1 JUNE 4, 2012 Clause A.4.3

The frequency error shall be within ±1.5 kHz.

B9 Carrier power

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.4
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Conditions		Power (dBm)		
		Measured power in (dBm)	Measured power in (mW)	Limit (mW)
Tnom: 20 deg C	V _{nom} :	24.2	263.0	100 to 500
Tmin: -25 deg C	V _{min} :	24.9	309.0	100 to 500
	V _{max} :	24.9	309.0	100 to 500
Tmax: 55 deg C	V _{min} :	24.0	251.2	100 to 500
	V _{max} :	24.0	251.2	100 to 500

Limits RTCM STANDARD 11901.1 JUNE 4, 2012 Clause A.4.6

Normal test conditions

With the output power set at maximum, the carrier power shall remain between 0.1 W and 0.5 W and be within ± 1.5 dB of the rated output power under normal test conditions. The output power shall never however drop below 0.1 W.

Extreme test conditions

With the output power set at maximum, the carrier power shall remain between 0.1 W and 0.5 W and be within +2 dB, -3 dB of the rated output power under extreme conditions. The output power shall never however drop below 0.1 W.

B10 Adjacent channel power

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.7
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

	Tnom Vmon	Tmax		Tmin	
		Vmax	Vmin	Vmax	Vmin
Adjacent Channel - 25 kHz	-74.2 dBc	-74.9 dBc	-74.9 dBc	-73.8 dBc	-73.8 dBc
Adjacent Channel + 25 kHz	-72.2 dBc	-73.6 dBc	-73.6 dBc	-73.1 dBc	-73.1 dBc

Limits RTCM STANDARD 11901.1 JUNE 4, 2012 Clause A4.9

The adjacent channel power shall not exceed a value of 70 dB below the carrier power of the transmitter without any need to be below 0.2 μ W.

B11 Conducted spurious emissions conveyed to the antenna

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.10
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

No emissions were detected within 10dB of the specification limit

B12 Cabinet radiation and conducted spurious emissions other than those conveyed to the antenna

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.13
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

The worst-case radiated emission measurements for spurious emissions and harmonics are listed below:

Operational

Ref No.	Freq (MHz)	Det.	Result (dBm)	Result (nW)	Spec. Limit (nW)	Margin (dB)	Summary
1	313.050	Pk	-63.3	0.47	250	-27.3	Pass
2	469.575	Pk	-54.2	3.85	250	-18.2	Pass
3	626.100	Pk	-43.7	42.85	250	-7.7	Pass
4	782.625	Pk	-42.7	53.58	250	-6.7	Pass
5	939.150	Pk	-52.4	5.75	250	-16.4	Pass
6	1252.200	Pk	-53.0	4.97	250	-17.0	Pass
7	1408.725	Pk	-48.0	15.96	250	-12.0	Pass
8	1565.250	Pk	-41.3	74.3	250	-5.3	Pass
9	1721.775	Pk	-51.0	7.89	250	-15.0	Pass
10	1878.300	Pk	-51.5	7.11	250	-15.5	Pass

No further emissions were detected within 20dB of the specification limit

Standby

No emissions were detected within 20dB of the specification limit

Limit RTCM STANDARD 11901.1 JUNE 4, 2012 Clause A.4.15

State	30 MHz to 2 GHz
Operating	250nW
Standby	2nW

Notes:

- (a) The levels may have been rounded for display purposes.
- (b) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
Effect of Position of EUT cables & samples on emission levels		✓		
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

B13 Transient frequency behavior of the transmitter

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.16
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

The worst-case transient measurements are listed below:

Time	Measured Frequency difference (kHz)	Limit (kHz)	Verdict
t1	<1.5	25.0	Pass
t2	<1.5	12.5	Pass
t2<t< t3	<1.5	1.5	Pass
t3	<1.5	25.0	Pass

Definitions

t_{on} : According to the method of measurement described in subclause A.4.17 the switch-on instant t_{on} of a transmitter occurs when the output power, measured at the antenna terminal, exceeds 0.1 % of the nominal power.

t_{off} : The switch-off instant occurs when the power falls below 0.1 % of the nominal power.

t1: Period of time starting at t_{on} and finishing at $t_{on}+5$ ms

t2: Period of time starting at the end of t1 and finishing at t1 +20 ms

t3: period of time starting at $t_{off} -5$ ms and finishing at t_{off} .

B14 Residual modulation of the transmitter

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.19
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Audio Level (Modulation on) (dBm)	Audio Level (Modulation off) (dBm)	Difference (dB)	Limit (dB)	Verdict
5.6	-58.2	63.8	>40	Pass

B15 Frequency error (demodulated DSC signal)

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.22
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Nominal Modulation Frequency (Hz)	Measured Frequency (Hz)	Difference (Hz)	Limit (Hz)	Verdict
1300	1304.6	4.6	±10	Pass
2100	2097.2	-2.8	±10	Pass

B16 Modulation index for DSC

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.25
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Nominal Modulation Frequency (Hz)	Measured Deviation (Hz)	Modulation Index	Limit	Verdict
1300	2610	2.01	2 ±0.2	Pass
2100	4216	2.01	2 ±0.2	Pass

B17 Modulation rate for DSC

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.28
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Nominal Modulation Rate (Hz)	Measured Modulation Rate (Hz)	Difference (Hz)	Difference (ppm)	Limit (ppm)	Verdict
600	600.007	0.007	11.7	±30	Pass

B18 Testing of generated call sequences

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.31
Application	Test Fixture
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	47
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The requirements of ITU-R Recommendation M.493-13 regarding message composition and content shall be met. The generated calls shall be analyzed with the calibrated apparatus for correct configuration of the signal format, including time diversity.	Alerting Message contents verified (see Appendix E for supporting data).

Appendix C:**AIS Type MSLD System**

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
EUT	: Equipment Under Test	ATS	: Alternative Test Site
SE	: Support Equipment	Ref	: Reference
L	: Live Power Line	Freq	: Frequency
N	: Neutral Power Line	MD	: Measurement Distance
E	: Earth Power Line	SD	: Spec Distance
Pk	: Peak Detector	Pol	: Polarisation
QP	: Quasi-Peak Detector	H	: Horizontal Polarisation
Av	: Average Detector	V	: Vertical Polarisation

C1 Unique identifier (user ID)

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.3.4
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The AIS MSLD AU shall have a unique identifier to ensure the integrity of the VHF data link. The user ID for an AIS MSLD AU is 972xyyyy, where xx = manufacturer ID 01 to 99; yyy = the sequence number 0000 to 9999. This reverts to 0000 once 9999 has been reached. The manufacturer ID xx = 00 is reserved for test purposes. The unique identifier used for the purposes of type approval to this standard shall be in the format 97200yyy.	Alerting Message contents verified (see Appendix E for supporting data).

C2 Battery

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.3.6
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
For an AIS MSLD, the AU shall not use a rechargeable battery.	Battery verified as a primary lithium type battery

C3 Output Power

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.3.7
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The nominal radiated power (EIRP) of the AIS MSLD AU shall be 1 W.	1.03 W

C4 Transmission performance - Active mode

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.3.8.1.1
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The message format shall be in accordance with Clause E.3.8.1.1 of RTCM STANDARD 11901.1 JUNE 4, 2012	Alerting Message contents verified (see Appendix E for supporting data).

C5 Transmission performance - Test mode

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.3.8.1.2
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The message format shall be in accordance with Clause E.3.8.1.2 of RTCM STANDARD 11901.1 JUNE 4, 2012	Alerting Message contents verified (see Appendix E for supporting data).

C6 Position Source and Data

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.3.9
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
On activation, if the GNSS receiver is unable to provide a valid position fix, then the reported position shall be longitude = 181° = not available = default and latitude = 91° = not available = default, COG = not available = default, SOG = not available = default, and the time stamp field shall be set to a value of 63. If the GNSS data is lost then the AIS MSLD AU shall continue to transmit with the last known position, COG and SOG, and the time stamp field shall be set to a value of 63 "positioning system inoperative" and with the synchronization state set to 3.	Alerting Message contents verified (see Appendix E for supporting data).

C7 Channel

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.4.1
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The AIS MSLD AU shall operate on dual channels, AIS 1 and AIS 2, in the VHF Maritime Mobile Service band, using 25 kHz bandwidth, according to the ITU Radio Regulations, Appendix 18.	Channels verified as 161.975 MHz (AIS1) and 162.025 MHz (AIS2).

C8 Transmitter characteristics (Summary)

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.4.4
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
Carrier power Nominal radiated power 1 W Carrier frequency error ± 500 Hz (normal) . +1 000 Hz (extreme) Slotted modulation mask E.4.4.1 –20 dBc $\Delta f_c > \pm 10$ kHz –40 dBc ± 25 kHz $< \Delta f_c < \pm 62.5$ kHz See Figure E.3 Transmitter test sequence and modulation accuracy < 3 400 Hz for Bit 0, 1 (normal and extreme) 2 400 Hz $\pm$ 480 Hz for Bit 2, 3 (normal and extreme) 2 400 Hz $\pm$ 240 Hz for Bit 4 ... 31 (normal, 2 400 + 480 Hz extreme) For Bits 32 ... 199 1 740 $\pm$ 175 Hz (normal, 1 740 + 350 Hz extreme) for a bit pattern of 0101 2 400 Hz $\pm$ 240 Hz (normal, 2 400 + 350 Hz extreme) for a bit pattern of 00001111 Transmitter output power versus time Power within mask shown in Figure E.5 and timings given in Table E.7 Spurious emissions Maximum 25 μW 108 MHz to 137 MHz, 156 MHz to 161.5 MHz, 406.0 MHz to 406.1 MHz and 1 525 MHz to 1 610 MHz	EUT compliant, see individual test sections for detailed results Note all references are those of RTCM STANDARD 11901.1 JUNE 4, 2012

C9 Link layer requirements

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.4.5
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
AIS Messages Message 1 format and content In active mode the AIS MSLD AU shall broadcast Message 1, as defined in Recommendation ITU-R M.1371 with the Navigational status set to "14". In test mode the AIS MSLD AU shall broadcast Message 1, as defined in Recommendation ITU-R M.1371 with the Navigational status set to "15". MHz Message 14 format and content In active mode the AIS MSLD AU shall broadcast Message 14 as defined in Recommendation ITU-R M.1371 with the text "MOB ACTIVE". In test mode the AIS MSLD AU shall broadcast Message 14, as defined in Recommendation ITUR M.1371 with the text "MOB TEST".	Alerting Message contents verified (see Appendix E for supporting data).

C10 Synchronization method

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E4.5.1.6
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
Upon activation, until the AU gets UTC it shall transmit unsynchronized, using sync state 3. If UTC direct synchronization is lost, the AIS MSLD AU shall continue to transmit with last known position, COG, SOG, and indicate that the positioning system is inoperative (Time stamp = 63) and sync state 3	Alerting Message contents verified (see Appendix E for supporting data).

C10 Synchronization accuracy

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.4.5.7
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
During UTC direct synchronization, the transmission timing error, including jitter, of the AISMSLD AU shall be +/- 3 bits (+/- 312 µs).	Timing error measured as <300µs for either AIS channel.

C10 VDL access scheme

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	A.4.5.1.8
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The AIS MSLD AU shall use modified SOTDMA for the transmission of Message 1 and Message 14. The AIS MSLD AU shall operate autonomously and determine its own schedule for transmission of its messages based on random selection of the first slot of the first burst. The other 7 slots within the first burst shall be fixed referenced to the first slot of the burst. The increment between transmission slots within a burst shall be 75 slots and the transmissions shall alternate between AIS 1 and AIS 2. In active mode, the AIS MSLD AU shall set a slot-time-out = 7 in the Communication state of all Message 1 transmissions in the first burst, and thereafter the slot time-out shall be decreased according to the rules of SOTDMA. Since the AIS MSLD AU does not have receivers, all slots shall be regarded as candidates in the selection process. When time out occurs, the offset to the next set of 8 bursts is randomly selected between 1 min +/- 6 s. In test mode, the AIS MSLD AU shall set a slot-time-out = 0 and sub-message = 0 in the Communication state of all Message 1 transmissions in the first and only burst. All slot-time-out values of the communication state of all Message 1 transmissions within every burst shall be the same. In active mode, 2 Message 14 shall be transmitted every 4th minute one on each channel, starting in the first minute (i.e. slot-time-out = 7 and 3), and shall be the 5th and 6th message in the burst. In test mode, 2 Message 14 shall be transmitted one on each channel, and shall be the 1st and 8th message in the burst. Message 14 shall be transmitted alternately on AIS 1 and AIS 2.	Alerting Message contents verified (see Appendix E for supporting data).

C11 Frequency error

Test Details: AIS1 (161.975 MHz)	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.1.1.1
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Conditions		Measured Frequency (MHz)	Frequency error (kHz)	Limit (kHz)
Tnom: 20 deg C	V _{nom} :	161.97510	0.1	±0.5
Tmin: -25 deg C	V _{min} :	161.97525	0.25	±1
	V _{max} :	161.97525	0.25	±1
Tmax: 55 deg C	V _{min} :	161.97518	0.18	±1
	V _{max} :	161.97518	0.18	±1

Test Details: AIS2 (162.025 MHz)	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.1.1.1
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Conditions		Measured Frequency (MHz)	Frequency error (kHz)	Limit (kHz)
Tnom: 20 deg C	V _{nom} :	162.02519	0.19	±0.5
Tmin: -25 deg C	V _{min} :	162.02529	0.29	±1
	V _{max} :	162.02529	0.29	±1
Tmax: 55 deg C	V _{min} :	162.02526	0.26	±1
	V _{max} :	162.02526	0.26	±1

C12 Conducted power

Test Details: AIS1 (161.975 MHz)	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.2
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Conditions		Power (dBm)	
		Measured power in (dBm)	Limit (dBm)
Tnom: 20 deg C	V _{nom} :	28.7	>27.0
Tmin: -25 deg C	V _{min} :	29.2	>27.0
	V _{max} :	29.2	>27.0
Tmax: 55 deg C	V _{min} :	28.4	>27.0
	V _{max} :	28.4	>27.0

Test Details: AIS2 (162.025 MHz)	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.2
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Conditions		Power (dBm)	
		Measured power in (dBm)	Limit (dBm)
Tnom: 20 deg C	V _{nom} :	28.9	>27.0
Tmin: -25 deg C	V _{min} :	29.5	>27.0
	V _{max} :	29.5	>27.0
Tmax: 55 deg C	V _{min} :	28.6	>27.0
	V _{max} :	28.6	>27.0

C13 Radiated power

Test Details: AIS1 (161.975 MHz)	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.3
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Conditions		Power (dBm)	
		Measured power in (dBm)	Limit (dBm)
Tnom: 20 deg C	V _{nom} :	30.3	>27.0
Tmin: -25 deg C	V _{min} :	30.8	>27.0
	V _{max} :	30.8	>27.0
Tmax: 55 deg C	V _{min} :	30.0	>27.0
	V _{max} :	30.0	>27.0

Test Details: AIS2 (162.025 MHz)	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.3
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Conditions		Power (dBm)	
		Measured power in (dBm)	Limit (dBm)
Tnom: 20 deg C	V _{nom} :	30.4	>27.0
Tmin: -25 deg C	V _{min} :	31.0	>27.0
	V _{max} :	31.0	>27.0
Tmax: 55 deg C	V _{min} :	30.1	>27.0
	V _{max} :	30.1	>27.0

C14 Modulation spectrum slotted transmission

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.1.3.4
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The spectrum for slotted transmission shall be within the emission mask as follows: in the region between the carrier and ± 10 kHz removed from the carrier, the modulation and transient sidebands shall be below 0 dBc; at ± 10 kHz removed from the carrier, the modulation and transient sidebands shall be below -20 dBc; at ± 25 kHz to $\pm 62,5$ kHz removed from the carrier, the modulation and transient sidebands shall be below the lower value of -40 dBc; in the region between ± 10 kHz and ± 25 kHz removed from the carrier, the modulation and transient sidebands shall be below a line specified between these two points.	EUT is compliant with the emissions masks (see Appendix E for supporting data).

C15 Transmitter test sequence and modulation accuracy

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.4
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Measurement period from centre to centre of each bit	Test signal 1				Test signal 2			
	Normal Measured	Limit	Extreme Measured	Limit	Normal Measured	Limit	Extreme Measured	Limit
Bit 0 to bit 1	3225	<3 400 Hz	3242	<3 400 Hz	3240	<3 400 Hz	3254	<3 400 Hz
Bit 2 to bit 3	2420	2 400 Hz ± 480 Hz	2425	2 400 Hz ± 480 Hz	2418	2 400 Hz ± 480 Hz	2431	2 400 Hz ± 480 Hz
Bit 4 to bit 31	2415	2 400 Hz ±240 Hz	2419	2 400 Hz ±480 Hz	2415	2 400 Hz ±240 Hz	2420	2 400 Hz ±480 Hz
Bit 32 to bit 199	1752	1 740 Hz ±175 Hz	1763	1 740 Hz ±350 Hz	2441	2 400 Hz ±240 Hz	2458	2 400 Hz ±480 Hz

C16 Transmitter output power versus time function

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.5
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Requirements

Reference		Bits	Time (ms)	Definition
T0		0	0	Start of transmission slot. Power shall NOT exceed –50 dB of Pss before T0
TA		0 to 6	0 to 0.625	Power exceeds –50 dB of Pss #
TB	TB1	6	0.625	Power shall be within +1.5 or –1 dB of Pss #
	TB2	8	0.833	Power shall remain within +1.5 or –1 dB of Pss during the period TB2 to TE #
TE (includes 1stuffing bit)		233	24.271	Power shall remain within +1.5 or –1 dB of Pss during the period TB2 to TE #
TF (includes 1stuffing bit)		241	25.104	Power shall be –50 dB of Pss and stay below this
TG		256	26.667	Start of next transmission time period
# There shall be no modulation of the RF after the termination of transmission (TE) until the power has reached zero and the next slot begins (TG).				

EUT is compliant with the above timing mask (see Appendix E for supporting data).

C17 Spurious emissions from the transmitter

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.7.6
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

No emissions were detected within 20dB of the specification limit

Limit RTCM STANDARD 11901.1 JUNE 4, 2012 Clause E.7.6.1.3

108 MHz to 137 MHz, 156 MHz to 161.5 MHz, 406.0 MHz to 406.1 MHz and 1 525 MHz to 1 610 MHz
25µW

C18 Tests for synchronization accuracy

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.8.1
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
The synchronization error with its additive jitter shall not exceed $\pm 312 \mu\text{s}$ between minutes 15 and 40.	Alerting Message contents verified (see Appendix E for supporting data).

C19 Active mode tests

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.8.2
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
Initialisation period – Required results The following is required. a) The first message is transmitted within 30 sec after activation. b) The first message with a valid position is transmitted within 5 min	Alerting Message contents verified (see Appendix E for supporting data).

Test Requirement	Test Result
Message content of Message 1 – Required results For position reports transmitted after 5 min and before 40 min the following is required. a) Message ID = 1. b) Repeat indicator = 0. c) User ID as configured in the AU. d) Navigational status = 14. e) Rate of turn = default. f) SOG = actual SOG from GNSS receiver. g) Position accuracy = according to the RAIM result if provided, otherwise 0. h) Position = actual position from internal GNSS receiver. i) Position is updated at least once per minute, for each burst. j) COG = actual COG from internal GNSS receiver. k) True heading = default. l) Time stamp = actual UTC second (0...59). m) Verify correct indication according to manufacturer's documentation.	Alerting Message contents verified (see Appendix E for supporting data).

Test Requirement	Test Result
Message content of Message 14 – Required results The following is required. a) Message ID = 14. b) Repeat indicator = 0. c) Source ID = as configured in the AU. d) Text = "MOB ACTIVE".	Alerting Message contents verified (see Appendix E for supporting data).

Test Requirement	Test Result
Transmission schedule for Message 1 – Required results For position reports transmitted after 15 min and before 40 min the following applies. a) Verify that the AU has operated in sync mode 0 (UTC direct). b) The AU transmits one burst of messages once per minute. c) The duration of a burst is 14 s. d) A burst consists of 8 messages. e) The transmissions in a burst are alternating between AIS 1 and AIS 2. f) Consecutive messages are 75 slots apart and on the other channel. g) The same set of slots are used in each burst for 8 min. h) A new set of slots is randomly selected after 8 min. i) The first slot of the new set of slots is within the interval of 1 min $\pm$ 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. j) The manufacturer is to provide documentation on how the increment is selected randomly	Alerting Message contents verified (see Appendix E for supporting data).

Test Requirement	Test Result
Communication state of Message 1 – Required results For position reports transmitted after 5 min and before 40 min the following applies. a) The SOTDMA communication state as defined for message 1 is used. b) The sync state = 0. c) The time-out starts with 7 for all messages of the first burst after a change in slots. d) The time-out value is decremented by 1 for each frame. e) The time-out value is reset to 7 after time-out = 0. f) The sub message for time-out 3,5,7 = number of received stations (0). g) The sub message for time-out 2,4,6 = slot number. h) The sub message for time-out 1 = UTC hour and minute. i) The sub message for time-out 0 = slot offset to the transmission slot in the next frame	Alerting Message contents verified (see Appendix E for supporting data).

Test Requirement	Test Result
Transmission with lost EPFS – Required results For position reports transmitted after 45 min the following applies. a) The AU continues transmission. b) The same transmission schedule is used as with EPFS data available. c) Communication State Sync state = 3. d) SOG = last valid SOG. e) Position accuracy = low. f) Position = last valid position. g) COG = last valid COG. h) Time stamp = 63. i) RAIM-flag = 0. j) Verify correct indication as per manufacturer's documentation	Alerting Message contents verified (see Appendix E for supporting data).

C20 Test mode tests

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	E.8.2.1.9
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	22
Relative humidity %	45
EUT set up	Refer to Appendix F

Test Requirement	Test Result
Transmission with EPFS data available Required results The following is required. a) The AU starts transmission after valid GNSS data is available. b) A single burst of 8 messages in the correct order and correctly populated as per E.3.8.1.2. c) User ID as configured in the AU. d) Navigational status = 15 (not defined). e) SOG = actual SOG from GNSS receiver. f) Position accuracy = according to the RAIM result if provided, otherwise 0. g) Position = actual position from internal GNSS receiver. h) COG = actual COG from internal GNSS receiver. i) Time stamp = actual UTC second (0...59). j) The communication state time-out always = 0 with sub message = 0. k) The transmission of Messages 1 and 14 stops after one burst of 8 messages. l) The text message in Message 14 is "MOB TEST". m) Verify correct indication as per manufacturer's documentation.	Alerting Message contents verified (see Appendix E for supporting data).

Test Requirement	Test Result
Transmission without EPFS data available Required results The following is required. a) The AU starts transmission within 5 min. b) A single burst of 8 messages in the correct order and correctly populated as per E.3.8.1.2. c) User ID as configured in the AU. d) Navigational status = 15 (not defined). e) SOG = default value. f) Position accuracy = low. g) Position = default values. h) COG = default value. i) Time stamp = 63. j) The communication state time-out always = 0 with sub message = 0. k) RAIM-flag = 0. l) The transmission of Messages 1 and 14 stops after one burst of 8 messages. m) The text message in Message 14 is "MOB TEST". n) Verify correct indication as per manufacturer's documentation.	Alerting Message contents verified (see Appendix E for supporting data).

Appendix D:**Internal Navigation Device tests**

Abbreviations used in the tables in this appendix:

Spec : Specification
Mod : Modification
EUT : Equipment Under Test
SE : Support Equipment
L : Live Power Line
N : Neutral Power Line
E : Earth Power Line
Pk : Peak Detector
QP : Quasi-Peak Detector
Av : Average Detector

ALSR : Absorber Lined Screened Room
OATS : Open Area Test Site
ATS : Alternative Test Site
Ref : Reference
Freq : Frequency
MD : Measurement Distance
SD : Spec Distance
Pol : Polarisation
H : Horizontal Polarisation
V : Vertical Polarisation

Test Details:	
Standard	RTCM STANDARD 11901.1 JUNE 4, 2012
Reference clause	Annex F.
Application	Test Fixture
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	S06/S07
Ambient temperature °C	23
Relative humidity %	40
EUT set up	Refer to Appendix F

Maritime Scenarios Test Results									
Scenario #	TTFF (hr:min:sec)	Simulator Location		Transmitted Location		Location Error (m)	TTFF Limit (hr:min:sec)	Location Error Limit (m)	Result
		N	E	N	E				
1	0:01:40	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
2	0:01:49	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
6	0:01:25	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
7	0:01:31	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
8	0:04:48	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
9	0:01:54	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
12	0:01:45	80.00000	0.00000	80.00000	0.00000	0.00	0:05:00	30	Pass
13	0:01:26	80.00000	0.00000	79.99999	0.00001	1.13	0:05:00	30	Pass
14	0:01:18	80.00000	0.00000	80.00000	0.00001	0.19	0:05:00	30	Pass
16	0:00:44	80.00000	0.00000	80.00000	0.00000	0.00	0:05:00	30	Pass
17	0:01:05	80.00000	0.00000	79.99999	0.00001	1.13	0:05:00	30	Pass
18	0:01:35	80.00000	0.00000	80.00000	0.00000	0.00	0:05:00	30	Pass
20	0:01:31	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
22	0:03:58	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
24	0:01:18	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
26	0:01:09	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
28	0:01:39	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
30	0:01:04	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
32	0:01:40	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
33	0:01:42	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
34	0:01:34	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
35	0:01:48	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
36	0:01:32	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass
37	0:01:14	-44.05000	174.15000	-44.05000	174.15000	0.00	0:05:00	30	Pass
38	0:01:41	47.35000	-8.45000	47.35000	-8.44999	0.75	0:05:00	30	Pass
39	0:01:43	0.00000	0.00000	0.00000	0.00000	0.00	0:05:00	30	Pass

Appendix E:

Supporting Test Data

SOG	POSITION ACCURACY	LONG	LAT	COG	HDG	TIME STAMP (UTC SECOND)	MANOUVRE INDICATOR	RAIM FLAG	SYNC STATE	SLOT TIME OUT	SUB MESSAGE
-918											
0	1	-0.312193	53.75128	0	511	63	0	0	0	0	0
0	1	-0.31219	53.75129	0	511	63	0	0	0	0	0
0.4	1	-0.31235	53.75107	0	511	63	0	0	0	0	0
0	1	-0.312345	53.75108	0	511	63	0	0	0	0	0
0	1	-0.312343	53.75108	0	511	63	0	0	0	0	0
0.4	1	-0.31231	53.75112	0	511	63	0	0	0	0	0
-918											

Message Data E3.8.3.1

FRAGMENTS IN THIS MSG	FRAGMENT NO	AS CHANNEL	MSG TYPE	REPEAT INDICATOR	ABRUSQUINQUE (S)	MBD	NAV STATUS	ROTTESTY BINNEN MSG (S)	SOG	POSITION ACCURACY	LONG	LAT	COG	HDS	TIME STAMP (UTC SECOND)	MANOUVRE INDICATOR	RAIM FLAG	SYNC STATE	SLOT TIME OUT	SUB MESSAGE			
				14	0	0724261396				MAJOR TEST													
NAVDM	1	B	AA	49	1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0
NAVDM	1	A	AA		1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0
NAVDM	1	B	AA		1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0
NAVDM	1	A	AA		1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0
NAVDM	1	B	AA		1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0
NAVDM	1	A	AA		1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0
NAVDM	1	B	AA		1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0
NAVDM	1	A	AA		1	0	0724261396	0	15	-128	102.3	0	181	91	360	511	63	0	0	0	3	0	0

Message Data E3.8.3.2

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Message Data E8.1Appendix F:**Additional Test and Sample Details**

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

Sample No: Sxx Mod w

where:

xx	= sample number	eg. S01
w	= modification number	eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

- Positioning of cards in a chassis.
- Setting of any internal switches.
- Circuit board jumper settings.
- Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as "single possible configuration".

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

F1) Test samples

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S02	sMRT V100	E13230633
S03	sMRT V100	E132305656

The following samples of the apparatus were submitted by the client as support equipment (SE) :

Sample No.	Description	Identification
S06	sMRT Tracker Unit	
S07	CTEK MSX2-6 Charger	5675Y02W3001798

F2) EUT Operating Mode During Testing.

During testing, the EUT was exercised as described in the following tables :

Test	Description of Operating Mode: Transmit
AIS Tests	EUT transmitting at maximum power on the nominal AIS frequencies of 161.975 MHz (AIS1) and 162.025 MHz (AIS2) using GMSK Modulation.

Test	Description of Operating Mode: Receive/Standby mode
DSC Tests	EUT transmitting at maximum power on the nominal DSC frequency of 156.525 MHz using G2B modulation.

Test	Description of Operating Mode: Receive/Standby mode
Standby Mode Tests	EUT powered but not activated

F3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

F4) List of EUT Ports

The table below describes the termination of EUT ports:

Sample : S02/S03

Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
Antenna	None	N/A	Antenna
(SMA)			

F5 Details of Equipment Used

Effective radiated power (Carrier Power e.r.p)

RFG No	Type	Description	Manufacturer	Date Calibrated
REF886	Lab 16	Large Anechoic Chamber	TRaC	10/05/13
REF910	FSU46	Spectrum analyser	R & S	21/03/13
129	3115	Horn Antennas	EMCO	14/09/11
913	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	31/01/13
RFG452	-	HF RF coaxial cable	UTIFLEX	03/07/13
REF881	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF882	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF884	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF885	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	04/07/13
REF919	219-8004-4000 0311	Type K Male to Type K Male Cable 4.0m	Teledyne Reynolds	04/07/13
REF883	-	HF RF coaxial cable 3.0m	Teledyne Reynolds	06/06/13
441	ESG E4432A	Vector Signal Generator	Hewlett Packard	01/10/12
360	SMP22	Signal Generator	R & S	08/04/13
464	6220B	dc Power supply	HP	Cal Before Use

Conducted Carrier Power

RFG No	Type	Description	Manufacturer	Date Calibrated
REF835/836	N1911A P-Series Power meter & N1922A	Power Meter/ Power Head	Agilent	27/09/12
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	04/07/13
REF887	34405A	Multi-meter	Agilent	04/09/12
REF423	S-1.2ce	Environmental Chamber	Thermotron	27/09/12
464	6220B	dc Power supply	HP	Cal Before Use

Frequency measurements

RFG No	Type	Description	Manufacturer	Date Calibrated
REF837	PSA	Spectrum Analyser	Agilent	10/05/13
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	04/07/13
REF887	34405A	Multi-meter	Agilent	04/09/12
REF423	S-1.2ce	Environmental Chamber	Thermotron	27/09/12
464	6220B	dc Power supply	HP	Cal Before Use

Transient Power/ Frequency Stability under low-voltage conditions

RFG No	Type	Description	Manufacturer	Date Calibrated
REF910	FSU46	Spectrum Analyser	R&S	21/03/13
REF887	34405A	Multi-meter	Agilent	04/09/12
RFG464	6220B	dc Power Supply	HP	Calibrate before use

Details of Equipment Used Continued:

For Radiated TX and Standby spurious emissions (e.r.p) 25MHz to 1GHz

RFG No	Type	Description	Manufacturer	Date Calibrated.
REF886	Lab 16	Large Anechoic Chamber	TRaC	10/05/13
RFG095	96002	Bicon Antenna (30-200MHz)	Eaton	09/05/13
RFG191	3146	Log Periodic Antenna (200-1000MHz)	EMCO	09/05/13
REF927	310	Pre-Amp (9kHz-1GHz)	Sonoma	15/09/11
REF910	FSU46	Spectrum Analyser	R&S	21/03/13
RFG452	-	HF RF coaxial cable	UTIFLEX	03/07/13
REF881	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF882	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF884	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF885	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF859	9117	Bicon Antenna	VUBA	08/07/13
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	04/07/13
REF919	219-8004-4000 0311	Type K Male to Type K Male Cable 4.0m	Teledyne Reynolds	04/07/13
REF883	-	HF RF coaxial cable 3.0m	Teledyne Reynolds	06/06/13
441	ESG E4432A	Vector Signal Generator	Hewlett Packard	01/10/12

Radiated TX and Standby emissions (e.r.p) 1GHz to 6GHz

RFG No	Type	Description	Manufacturer	Date Calibrated
REF886	Lab 16	Large Anechoic Chamber	TRaC	10/05/13
REF910	FSU46	Spectrum analyser	R & S	21/03/13
129	3115	Horn Antennas	EMCO	14/09/11
913	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	31/01/13
RFG452	-	HF RF coaxial cable	UTIFLEX	03/07/13
REF881	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF882	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF884	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF885	-	HF RF coaxial cable	Teledyne Reynolds	06/06/13
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	04/07/13
REF919	219-8004-4000 0311	Type K Male to Type K Male Cable 4.0m	Teledyne Reynolds	04/07/13
REF883	-	HF RF coaxial cable 3.0m	Teledyne Reynolds	06/06/13
441	ESG E4432A	Vector Signal Generator	Hewlett Packard	01/10/12
360	SMP22	Signal Generator	R & S	08/04/13

Appendix G:**Additional Information**

This appendix contains no additional information

Appendix H:**Photographs and Figures**

The following photographs were taken of the test samples:

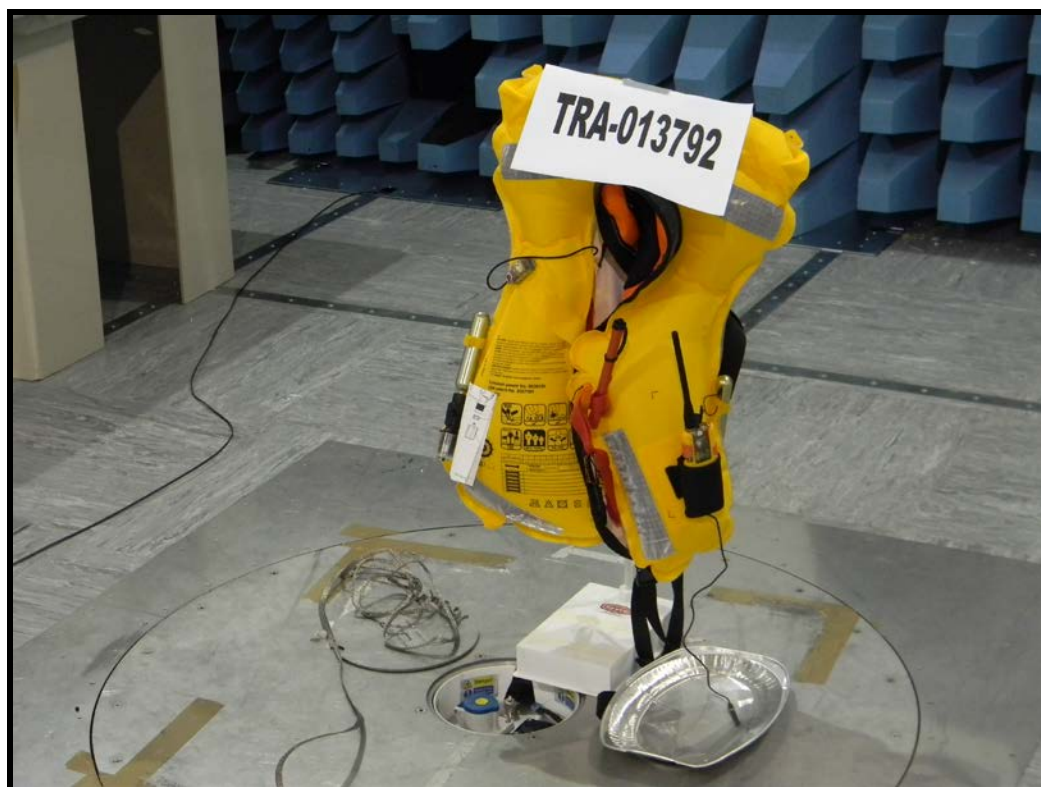
1. Radiated spurious emissions (front view)
2. Radiated spurious emissions (rear view).
3. Radiated carrier power (front view)
4. Radiated carrier power (rear view)
5. Internal navigation device tests



Photograph 1



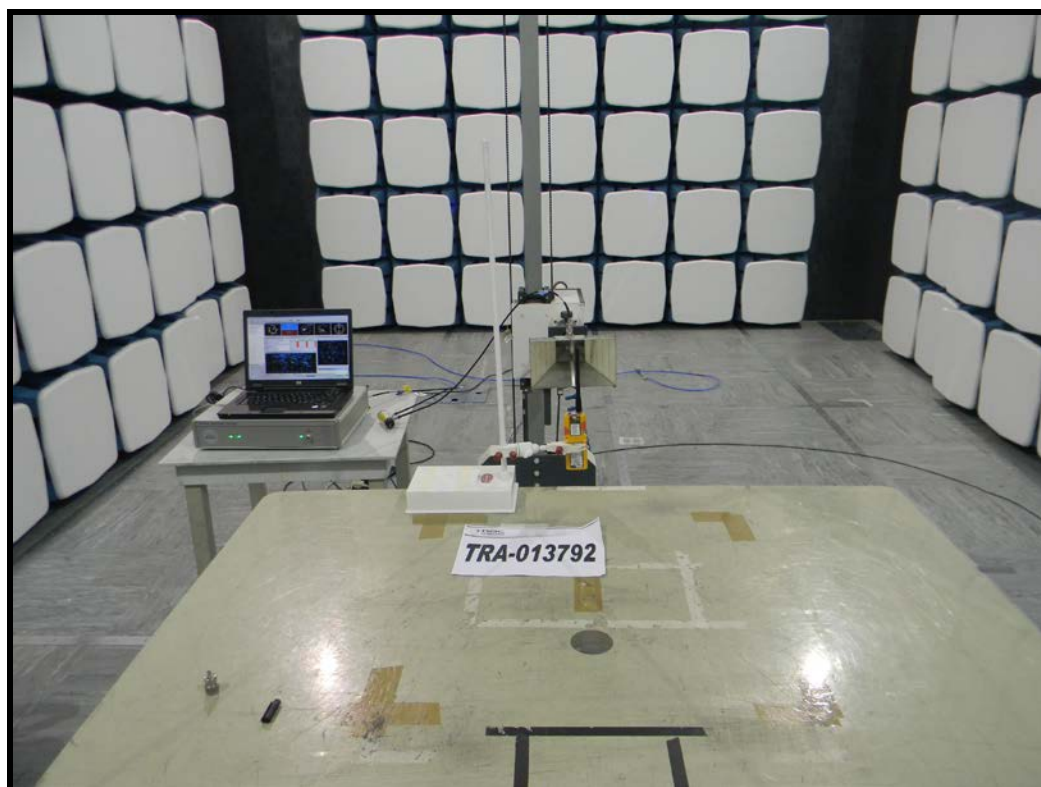
Photograph 2



Photograph 3



Photograph 4



Photograph 5



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