

Test report

20113071200

based on:
IEC 61993-2, first edition (clauses 12 and 13 only)

Automatic Identification System (AIS)
SAAB
R5 solid AIS system

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This report comprises of five modules. The total number of pages is: 66.

Main module

1 Introduction

This report contains the result of tests performed by:

Telefication B.V.
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie). The copyright of this test report is owned by Telefication bv and may not be reproduced except in full without the written approval of Telefication B.V.

Ordering party:

Company name	:	Saab TransponderTech AB
Address	:	Läsblecksgatan 3
Zipcode	:	589 41
City/town	:	Linköping
Country	:	Sweden
Date of order	:	23 June 2011

2 Product

A sample of the following product was submitted for testing:

Product category	:	Automatic Identification System (AIS)
Manufacturer	:	Saab TransponderTech AB
Trade mark	:	SAAB
Type designation	:	R5 solid AIS system
Hardware version	:	--
Software version	:	Rev. 9
Serial number	:	00000000 (all five samples bear this serial number)

The system comprises of the following units :

- R5 (transponder)
- MA700 (GPS antenna)
- AC Marine VHF/GPS (rod antenna)

The Saab R5 transponder is a category b (protected) equipment.

3 Test schedule

The tests are carried out at the following locations:

- Telefication, Zevenaar
- Thales, Hengelo (vibration test)

The sample of the product was received on:

- 19 August 2011

The tests are carried out between:

- 19 August 2011 and 18 January 2012

4 Product documentation

For production of this report no product documentation is used.

5 Observations and comments

The R5 transponder is tested in full and the MA700 and ASC Marine VHF/GPS (rod antenna) are used for the performance tests.

Additionally the MA700 antenna is tested for vibration and rain and spray.

6 Modifications to the sample

Initially the sample did not fulfil the requirement for conducted emissions (ref. EN 60945, § 9.2). After power supply filter modifications and an earth terminal, implemented by the applicant, the sample satisfies the requirement. The modified sample is used for the vibration tests.

7 Summary

The product is intended for use in the following application area:

MARINE NAVIGATIONAL EQUIPMENT

The sample is tested according to the following specification:

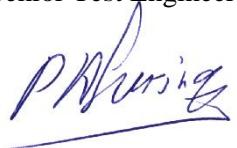
IEC 61993-2, first edition (clauses 12 and 13 only)

8 Conclusions

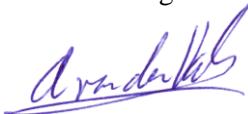
The sample of the product showed **NO NON-COMPLIANCES** to the specification stated in chapter 7 of this report.

The results of the tests as stated in this report are exclusively applicable to the product item as identified in this report. Telefication accepts no responsibility for any stated properties of product items in this test report, which are not supported by the tests as specified in section 7 "Summary".

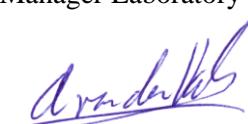
All tests are performed by:

name : ing. P.A. Suringa
function : Senior Test Engineer
signature : 

Review of test methods and report by:

name : ing. A. van der Valk
function : Senior test engineer
signature : 

The above conclusions have been verified by the following signatory:

date : 24 February 2012
name : ing. A. van der Valk
function : Manager Laboratory
signature : 

Test results module

1 Durability and resistance to environmental conditions according to EN60945 clause 8

EN 60945 sub clause	Category	Test	Phenomena	Result	Reference to remark
8.1	a b c d		Pre test and visual inspection	P	--
8.2	a c d a b c	Storage Functional	Dry heat 70°C Dry heat 55°C	NA P	-- --
8.3	a b c	Functional	Damp heat 40°C 95% rel. hum.	P	--
8.4	a a b c	Storage Functional Functional Functional	Low temperature -30°C Low temperature -20°C Low temperature -15°C Low temperature -25°C	NA NA P NA	-- -- -- --
8.5	a		Thermal shock 70°C -> 25°C	NA	--
8.6	a a		Drop on hard surface 1.00 m Drop into water 20 m	NA NA	-- --
8.7	a b c d	Functional	Vibration 2 - 13.2 Hz 1mm, ≥ 13.2 - 100Hz 7m/s ² , resonance 2h	P	--
8.8	c		Rain 100 l/m, 30 minutes	P	--
8.9	c		Immersion 600kPa 12h Immersion 100kPa 5min. Temporary immersion 1m 5min.	NA	--
8.10	a		Solar radiation 1120W/m ² 80h	NA	--
8.11	a		Oil resistance immersion 3h	NA	--
8.12	a b c d	Corrosion	Salt mist 5% NaCl 2h -> 40°C 95% humidity 7 days	NP	1

Category:

a =	portable	c =	exposed
b =	protected	d =	submerged

Legend:

P =	Pass	NA =	Not applicable
NP =	Not performed		

Remark:

- 1 The applicant provided waivers, see 'Additional information module'.

2 Environmental Tests

2.1 Vibration Test (R5 in original bracket mount)

2.1.1 Resonance frequencies

Resonance reaction: $Q = \text{Acceleration (EUT)} - \text{Acceleration (Resonator platform)}$

R5 solid in original bracket mount configuration

Vibration direction	Resonance frequency (Hz)	Resonance reaction (Q)
Vertical	83.3	5.03
1st horizontal	34.3	15
2nd horizontal	85	5.5

AC marine VHF/GPS antenna

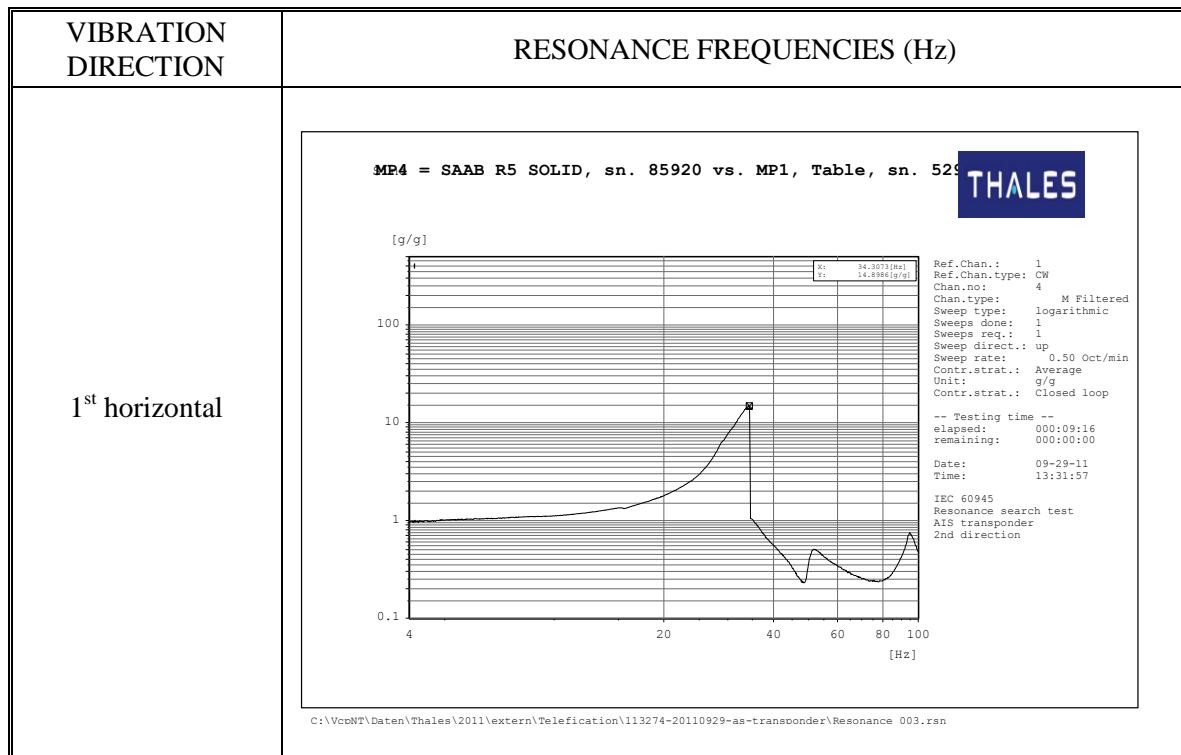
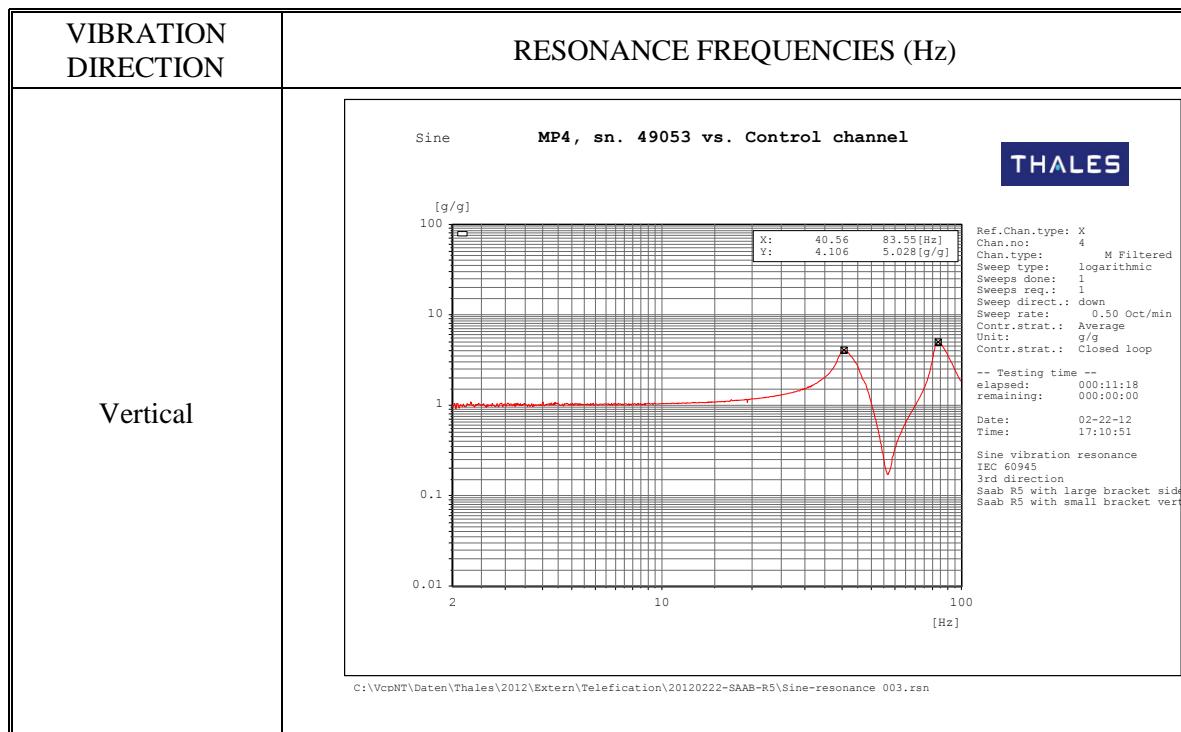
Vibration direction	Resonance frequencies (Hz)	Resonance reaction (Q)
Vertical	--	--
1st horizontal	13.2, 73.4	80.7, 31.7
2nd horizontal	12.8, 73.4	85 ,47

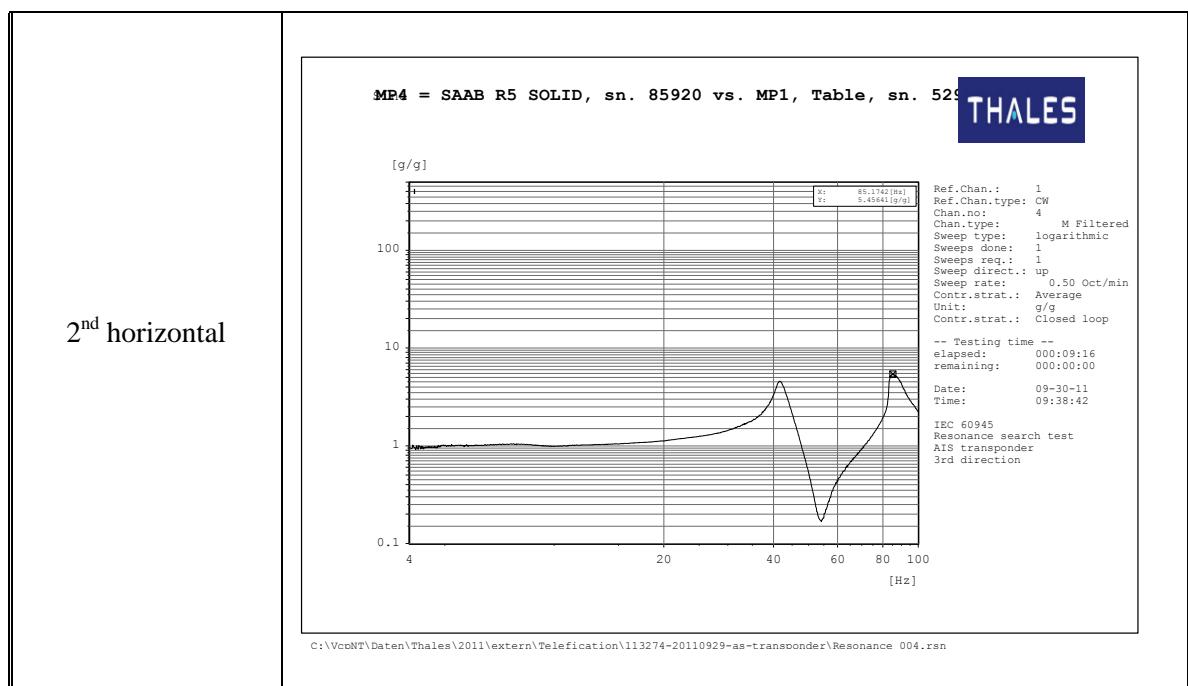
MA-700

Vibration direction	Resonance frequencies (Hz)	Resonance reaction (Q)
Vertical	--	--
1st horizontal	--	--
2nd horizontal	--	--

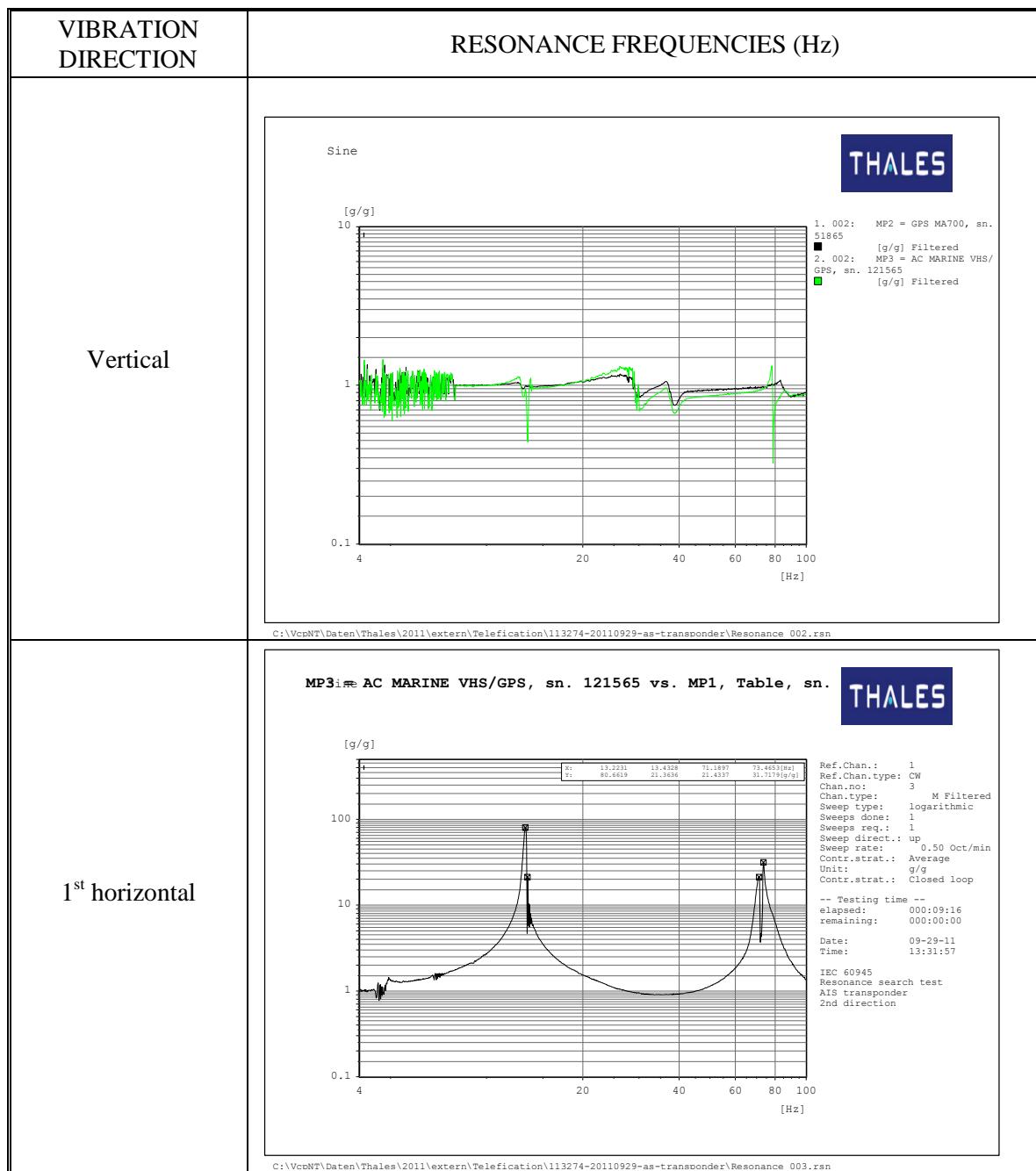
Graphs of response on vibration in vertical direction and two mutually perpendicular directions in the horizontal plane:

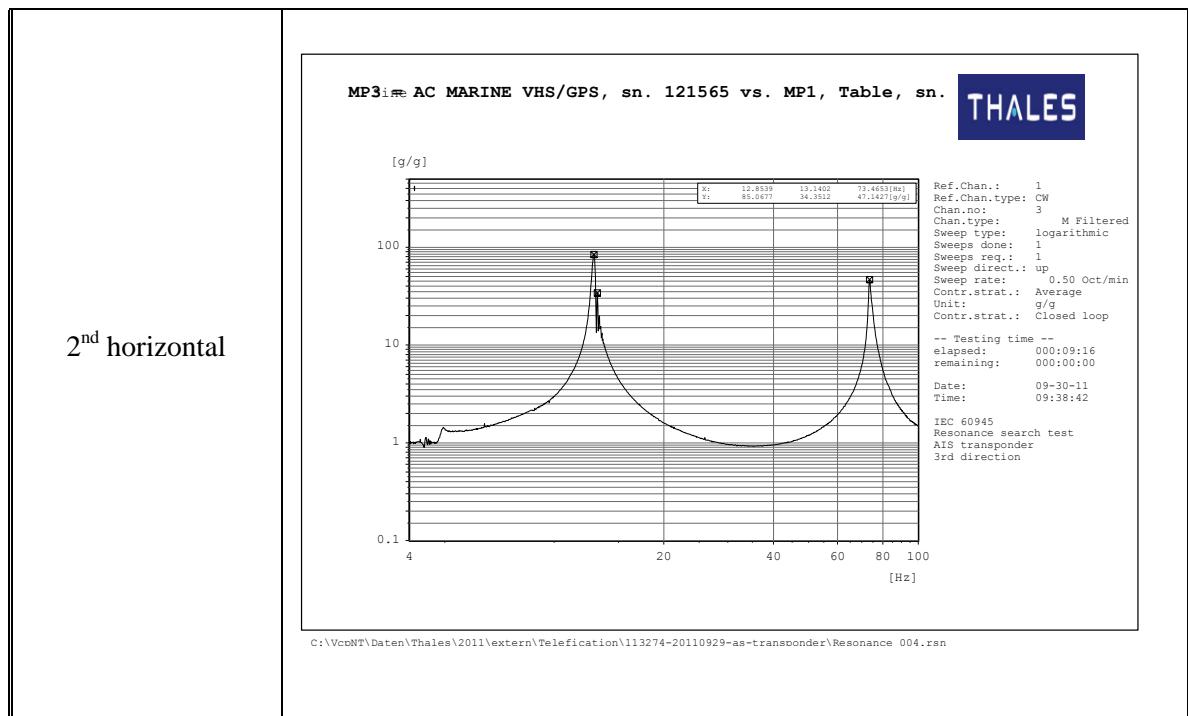
RESONANCE SEARCH (for R5 solid in original bracket mount configuration)



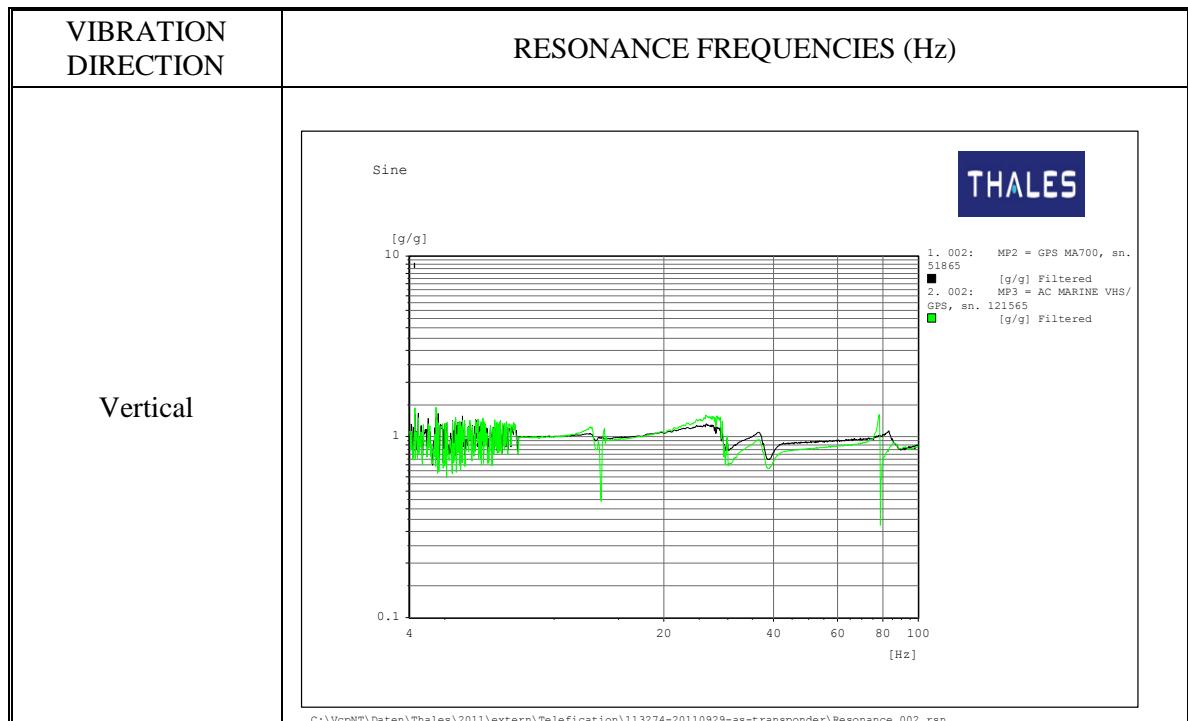


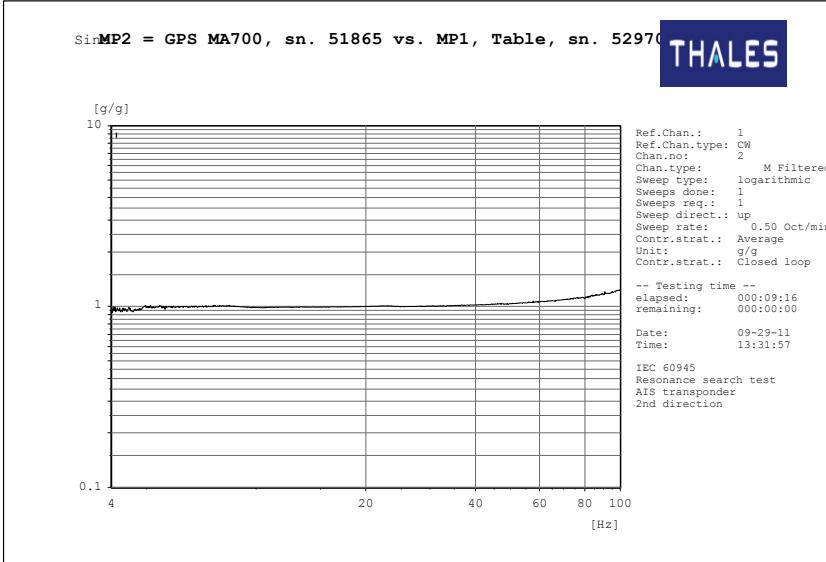
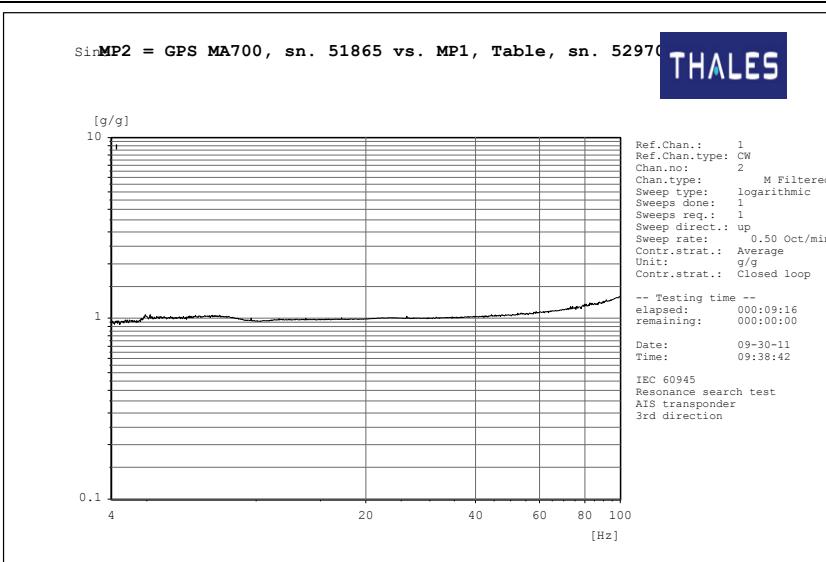
RESONANCE SEARCH (for AC marine VHF/GPS antenna)





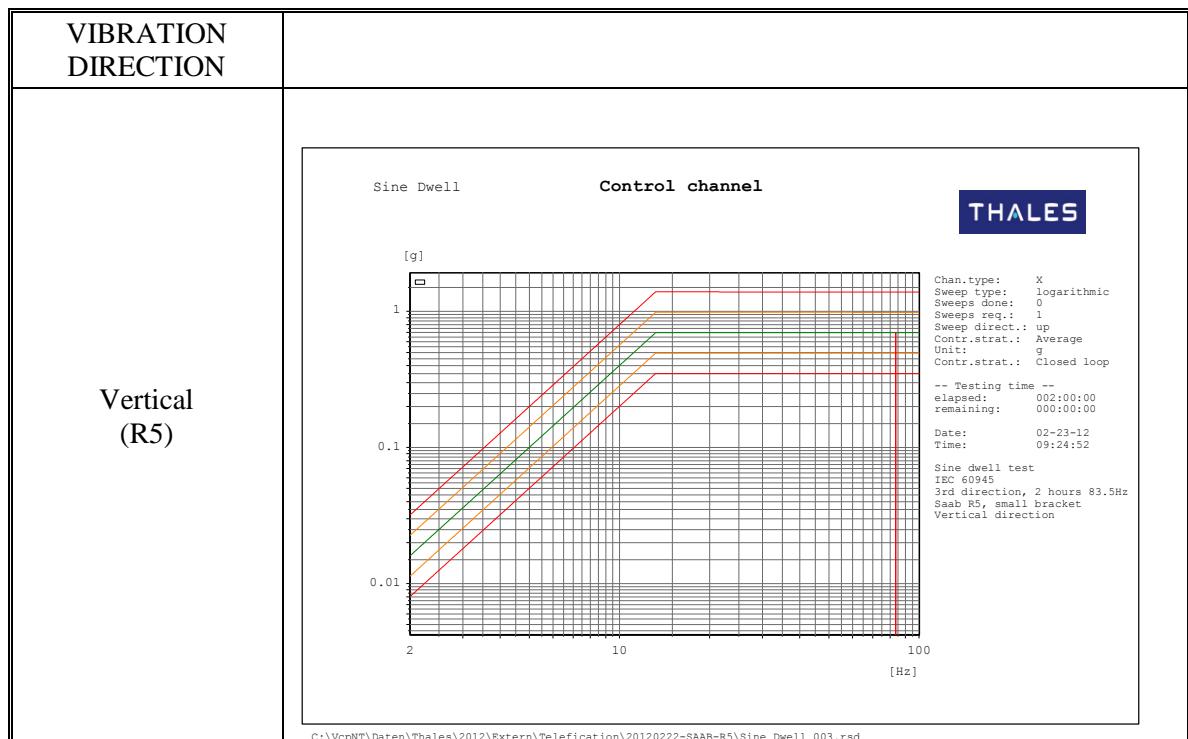
RESONANCE SEARCH (for MA-700)

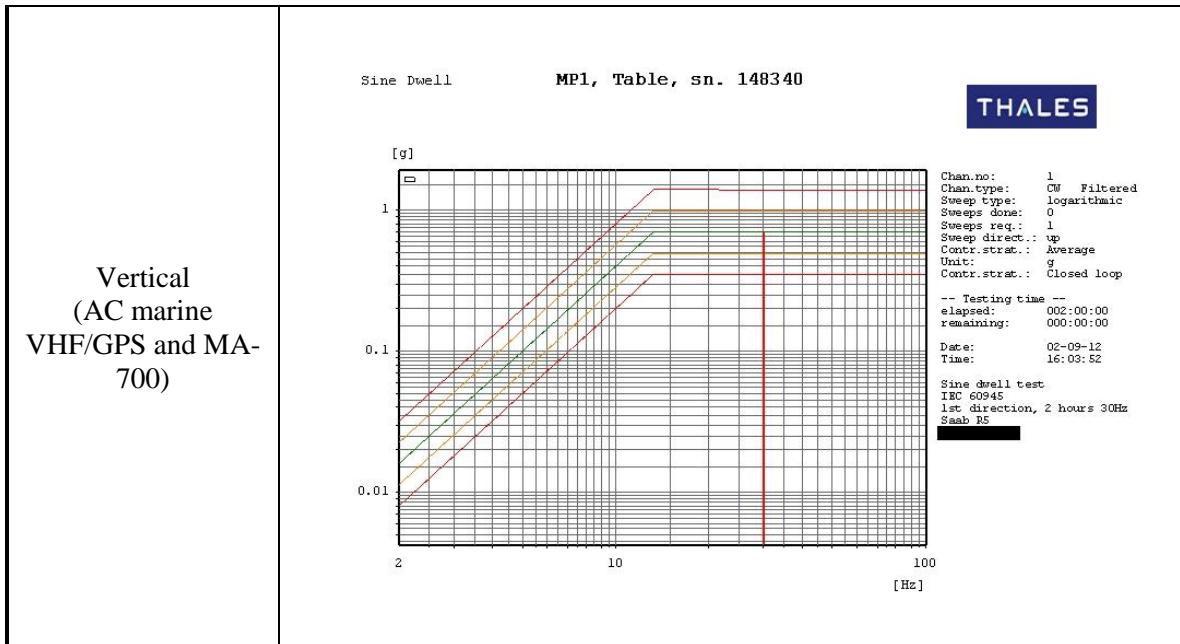


VIBRATION DIRECTION	RESONANCE FREQUENCIES (Hz)
1 st horizontal	<p>SirMP2 = GPS MA700, sn. 51865 vs. MP1, Table, sn. 52970</p>  <p>THALES</p> <p>[g/g]</p> <p>Ref.Chan.: 1 Ref.Chan.type: CW Chan.no.: 2 Chan.type: M Filtered Sweep type: logarithmic Sweeps done: 1 Sweeps req.: 1 Sweep direct.: up Sweep rate: 0.50 Oct/min Contr.strat.: Average Unit: g/g Contr.strat.: Closed loop</p> <p>-- Testing time -- elapsed: 000:09:16 remaining: 000:00:00</p> <p>Date: 09-29-11 Time: 13:31:57</p> <p>IEC 60945 Resonance search test AIS transponder 2nd direction</p> <p>C:\VcnNT\Daten\Thales\2011\extern\Telefication\113274-20110929-as-transponder\Resonance_003.rsn</p>
2 nd horizontal	<p>SirMP2 = GPS MA700, sn. 51865 vs. MP1, Table, sn. 52970</p>  <p>THALES</p> <p>[g/g]</p> <p>Ref.Chan.: 1 Ref.Chan.type: CW Chan.no.: 2 Chan.type: M Filtered Sweep type: logarithmic Sweeps done: 1 Sweeps req.: 1 Sweep direct.: up Sweep rate: 0.50 Oct/min Contr.strat.: Average Unit: g/g Contr.strat.: Closed loop</p> <p>-- Testing time -- elapsed: 000:09:16 remaining: 000:00:00</p> <p>Date: 09-30-11 Time: 09:38:42</p> <p>IEC 60945 Resonance search test AIS transponder 3rd direction</p> <p>C:\VcnNT\Daten\Thales\2011\extern\Telefication\113274-20110929-as-transponder\Resonance_004.rsn</p>

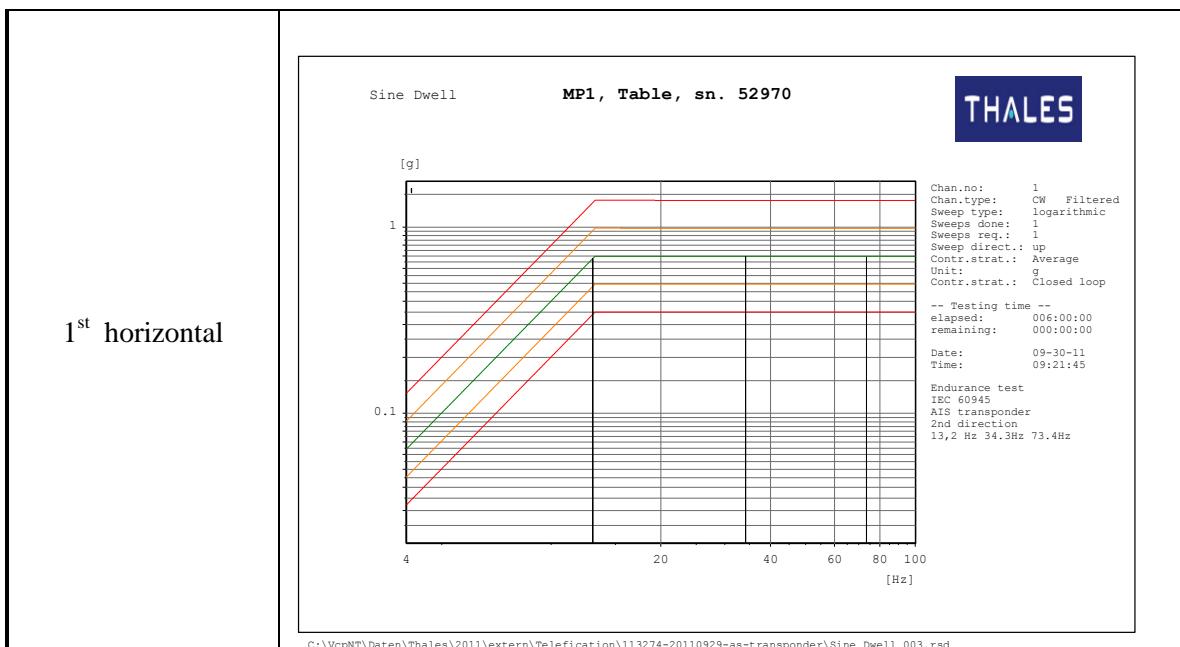
ENDURANCE TESTS (for R5 solid in original bracket mount configuration, AC marine VHF/GPS antenna and MA-700)

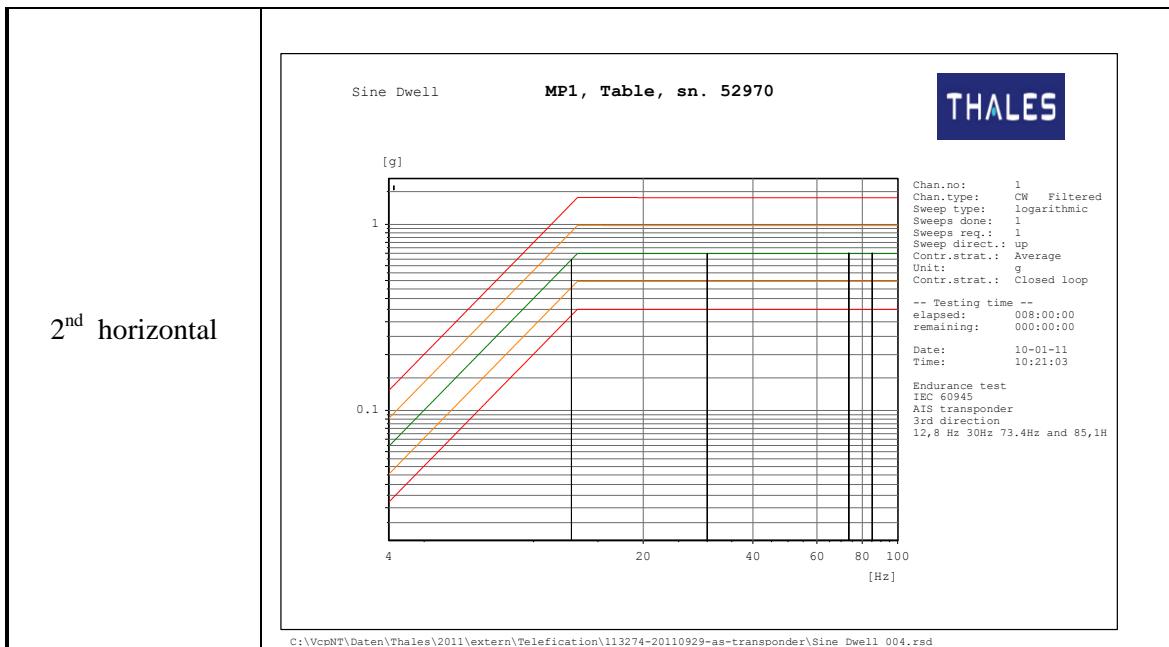
	Vibration frequencies (Hz) applied during endurance tests		
	Vertical	1 st horizontal	2 nd horizontal
R5 solid	83.5	34.3	85.1
AC marine VHF/GPS antenna	30	13.2, 73.4	12.8, 73.4
MA-700	30	30	30





The black bar in the picture is placed over the name of a product not belonging in this report.





Test equipment used: (Item numbers)	92, 93, 94, 95, 96, 97
-------------------------------------	------------------------

2.1.2 Performance checks during and at the end of the endurance test periods

Result: Pass

Comments: During the performance checks the EUT operated in accordance with its equipment standard.

2.2 Vibration test (R5 in flush mount)

2.2.1 Resonance frequencies

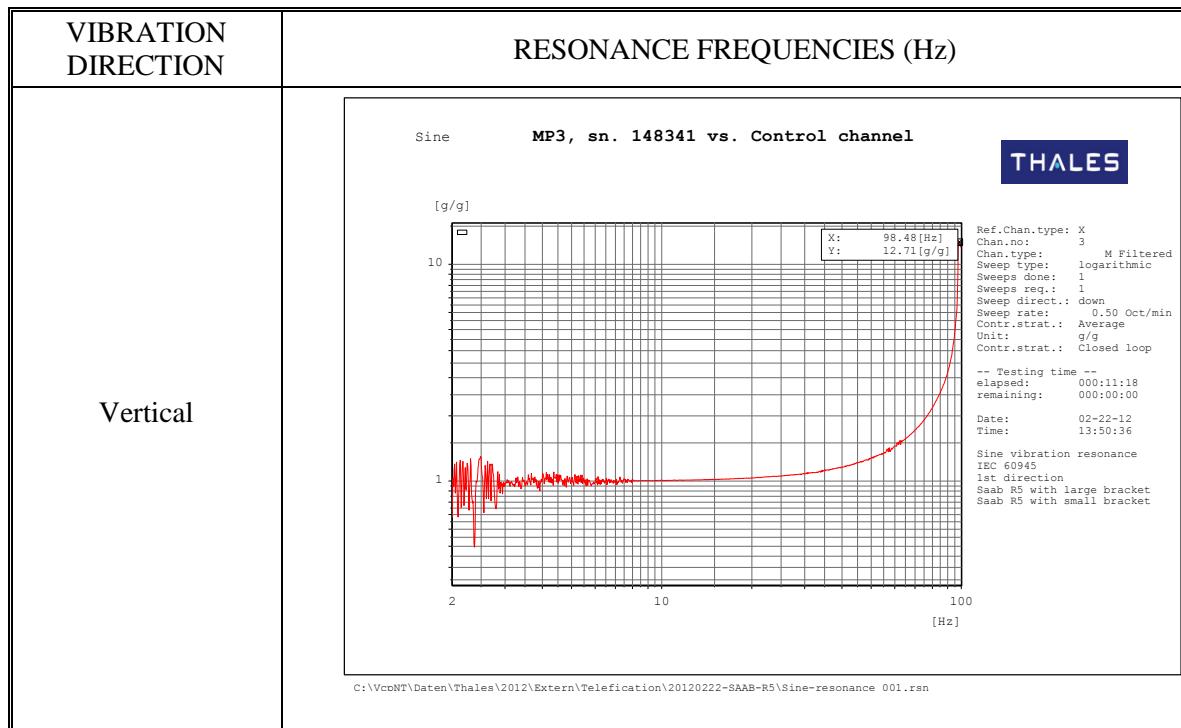
Resonance reaction: $Q = \text{Acceleration (EUT)} - \text{Acceleration (Resonator platform)}$

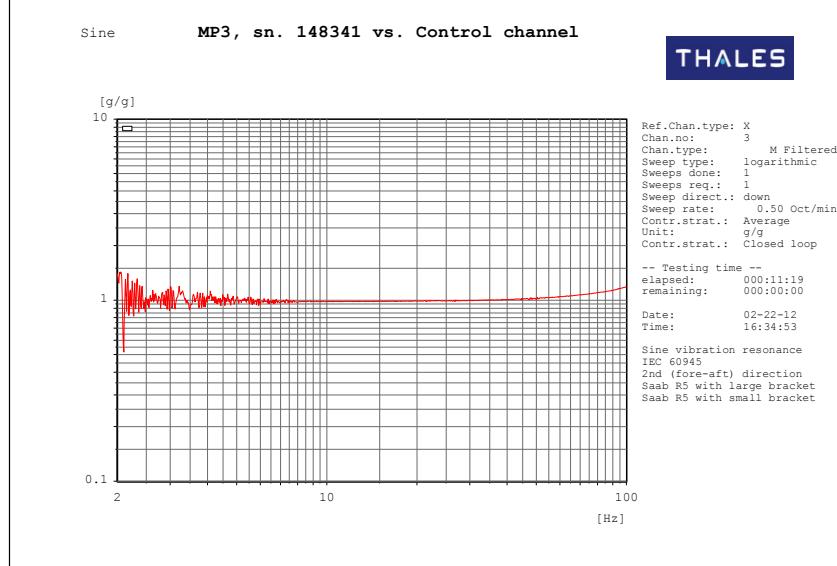
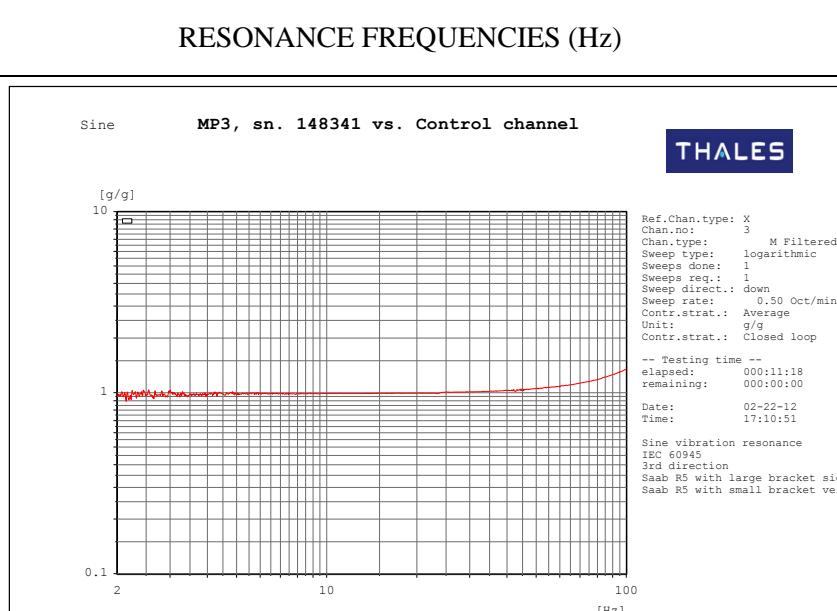
R5 solid in flush mount configuration

Vibration direction	Resonance frequency (Hz)	Resonance reaction (Q)
Vertical	98.5	12.7
1 st horizontal	--	--
2 nd horizontal	--	--

Graphs of response on vibration in vertical direction and two mutually perpendicular directions in the horizontal plane:

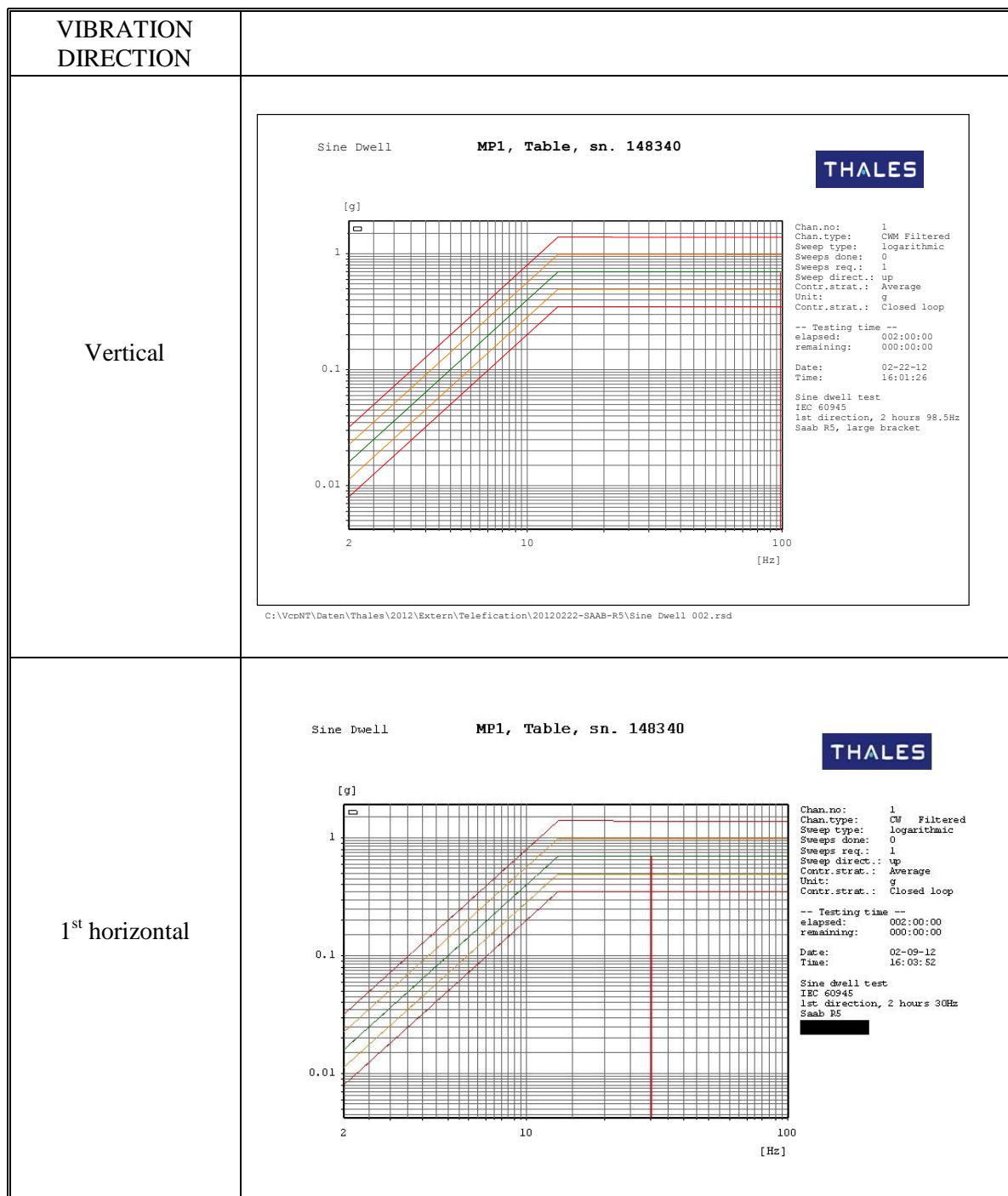
RESONANCE SEARCH (for R5 solid in flush mount configuration)



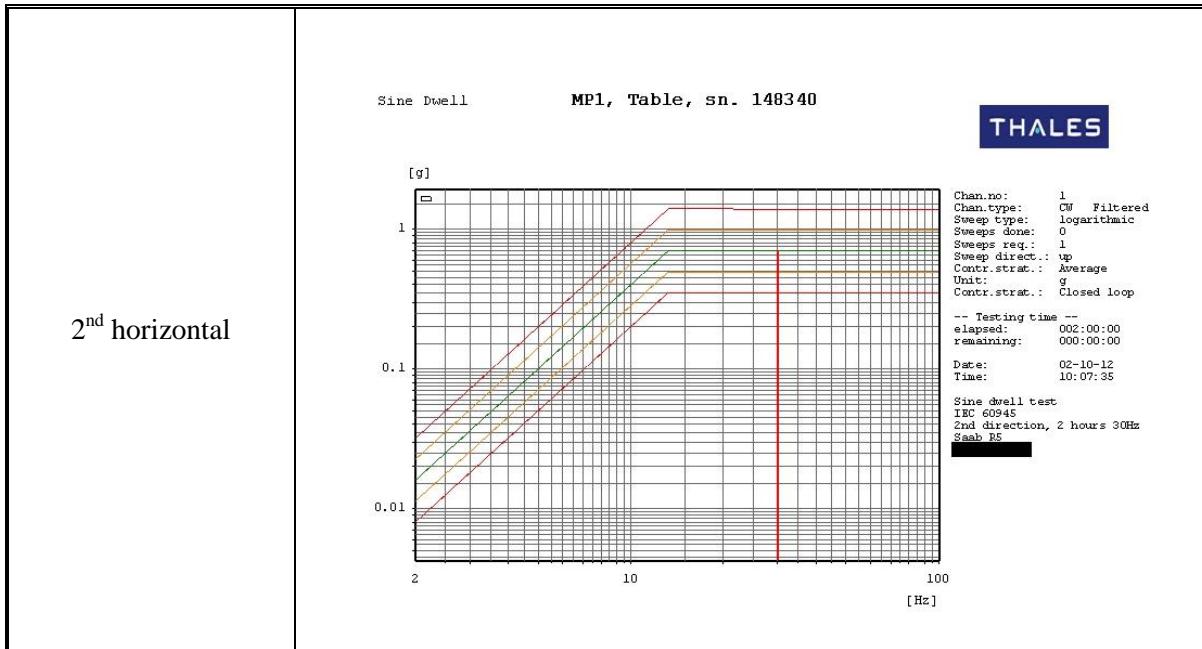
VIBRATION DIRECTION	RESONANCE FREQUENCIES (Hz)
1 st horizontal	<p style="text-align: center;">Sine MP3, sn. 148341 vs. Control channel</p>  <p>THALES</p> <p>Ref.Chan.type: X Chan.no: 3 Chan.type: M Filtered Sweep type: logarithmic Sweeps done: 1 Sweeps req: 1 Sweep direct.: down Sweep rate: 0.50 Oct/min Contr.strat.: Average Unit: g/g Contr.strat.: Closed loop</p> <p>-- Testing time -- elapsed: 000:11:19 remaining: 000:00:00</p> <p>Date: 02-22-12 Time: 16:34:53</p> <p>Sine vibration resonance IEC 60945 2nd (fore-aft) direction Saab R5 with large bracket Saab R5 with small bracket</p> <p>C:\VcpNT\Date\Thales\2012\Extern\Telefication\20120222-SAAB-R5\Sine-resonance 002.rsn</p>
2 nd horizontal	<p style="text-align: center;">Sine MP3, sn. 148341 vs. Control channel</p>  <p>THALES</p> <p>Ref.Chan.type: X Chan.no: 3 Chan.type: M Filtered Sweep type: logarithmic Sweeps done: 1 Sweeps req: 1 Sweep direct.: down Sweep rate: 0.50 Oct/min Contr.strat.: Average Unit: g/g Contr.strat.: Closed loop</p> <p>-- Testing time -- elapsed: 000:11:18 remaining: 000:00:00</p> <p>Date: 02-22-12 Time: 17:10:51</p> <p>Sine vibration resonance IEC 60945 3rd (side) direction Saab R5 with large bracket side Saab R5 with small bracket vert</p> <p>C:\VcpNT\Date\Thales\2012\Extern\Telefication\20120222-SAAB-R5\Sine-resonance 003.rsn</p>

ENDURANCE TESTS (for R5 solid in flush mount configuration):

	Vibration frequencies (Hz) applied during endurance tests		
	Vertical	1 st horizontal	2 nd horizontal
R5 solid	98.5	30	30



The black bar in the picture is placed over the name of a product not belonging in this report.



The black bar in the picture is placed over the name of a product not belonging in this report.

Test equipment used: (Item numbers)	92, 93, 94, 95, 96, 97
-------------------------------------	------------------------

2.2.2 Performance checks during and at the end of the endurance test periods

Result: Pass

Comments: During the performance checks the EUT operated in accordance with its equipment standard.

2.3 Dry heat functional test

EN 60945 reference : 8.2
Basic standard : IEC 60068-2-2

Temperature : 55°C
Duration : 10-16h
EUT : R5 transponder

Power supply : 24 Vdc

Power supply variation	Voltage (V)	Result
Normal Power supply	24	P
High voltage +30%	31.2	P
Low voltage -10%	21.6	P

Comments : The performance check was carried out with the EUT switched on and the EUT was kept operational for sixteen hours. During the performance check the EUT operated in accordance with its equipment standard.

2.4 Damp heat functional test

EN 60945 reference : 8.3
Basic standard : IEC 60068-2-30

Temperature : 40°C
Relative humidity : 95%
Duration : 10-16h
EUT : R5 transponder
Power supply : 24 Vdc

Power supply variation	Voltage (V)	Result
Normal Power supply	24	P
High voltage +30%	31.2	P
Low voltage -10%	21.6	P

Comments :

The performance check was carried out 30 minutes after the EUT was switched on and the EUT was kept operational for two hours. During the performance check the EUT operated in accordance with its equipment standard.

2.5 Low temperature functional test

EN 60945 reference : 8.4
Basic standard : IEC 60068-2-1

Temperature : -15°C
Duration : 10-16h
EUT : R5 transponder
Power supply : 24 Vdc

Power supply variation	Voltage (V)	Result
Normal Power supply	24	P
High voltage +30%	31.2	P
Low voltage -10%	21.6	P

Comments : The performance check was performed with the EUT switched on and the EUT was kept operational for two hours. During the performance test and checks the EUT operated in accordance with its equipment standard.

2.6 Rain and spray (exposed equipment)

EN 60945 reference : 8.8
Basic standard : IEC 60529, table 3, second characteristic numeral 6

Test nozzle : IEC 60529, figure 6
Internal diameter nozzle : 12.5 mm
Water delivery rate : 100 l/min.
Duration : 30 min.
Distance from nozzle : between 2.5 and 3 m.

Equipment	Result
GPS antenna type MA-700	P

Comments : There were no visible external indications of damage or of unwanted ingress of water after the test.

Measurement equipment : 98
(The numbers listed refer to the module 'Used test equipment module'.)

3 Electromagnetic emission clause 9

3.1 Summary

According to EN 60945: 2002 the following tests are performed:

Port	Sub clause	Category	Phenomenon	Result
DC-input	9.2	b c d	Conducted emissions	P
AC-input	9.2	b c d	Conducted emissions	NA
Enclosure	9.3	a b c	Radiated emissions	P

Result:

P = pass

NA = not applicable

F = fail

NP = not performed

Category:

a = portable

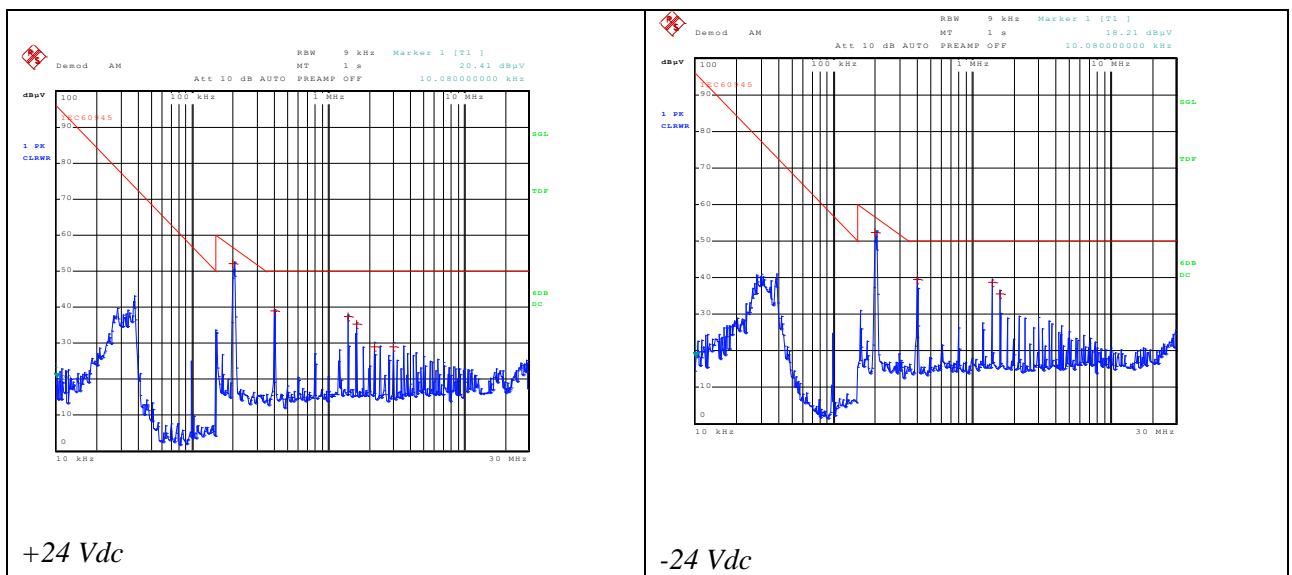
c = exposed

b = protected

d = submerged

3.2 Conducted emissions

EN 60945 ref. : 9.2
 Basic standard : CISPR 16-1-1: 2006; CISPR 16-1-4: 2007
 Cable length AMN↔ EUT : 1 m
 EUT : Operational



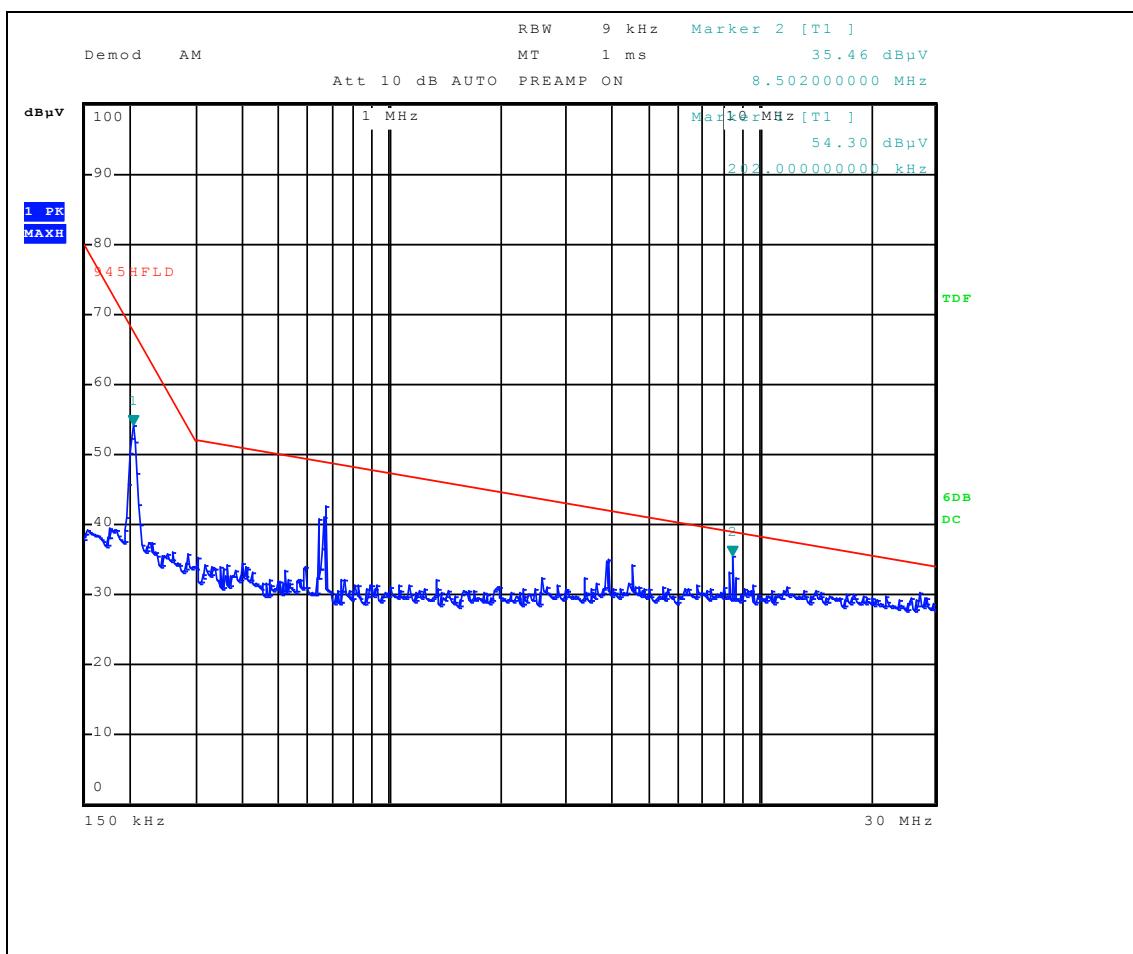
Measurement uncertainty	+3.7/-3.7 dB
Limit: see plot	

Test equipment used: (Item numbers)	24, 26, 27
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3.3 Radiated emissions 150 kHz – 30 MHz

EN 60945 ref. : 9.3
 Basic standard : CISPR 16-1-1: 2006;
 CISPR 16-1-4: 2007
 Distance ant.↔ EUT : 3m
 EUT operational mode : receiving

Field measurement results were obtained with Active Loop Antenna (units in dB μ V/m).

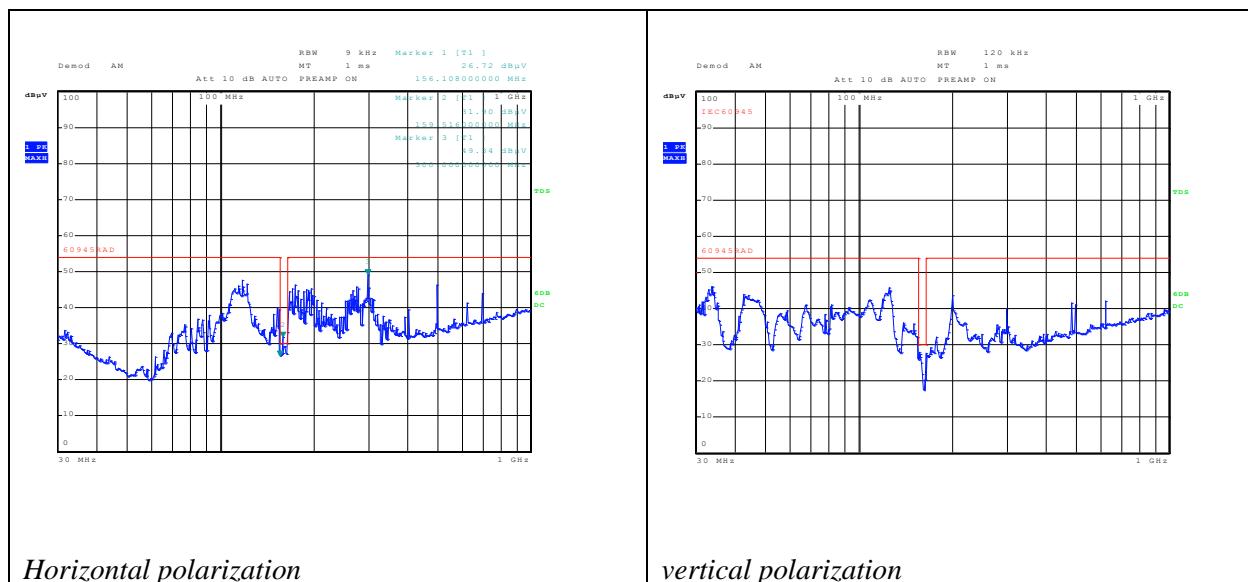


Measurement uncertainty	+1.9 / -2.1 dB
Limit: 80 dB μ V/m @ 150 kHz descending to 52 dB μ V/m @ 300 kHz 52 dB μ V/m @ 300 kHz descending to 34 dB μ V/m @ 30 MHz	

Test equipment used: (Item numbers)	81, 91
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3.4 Radiated emissions 30 MHz – 1 GHz

EN 60945 ref. : 9.3
 Basic standard : CISPR 16-1-1: 2006;
 CISPR 16-1-4: 2007
 Distance ant.↔ EUT : 3m
 EUT operational mode : receiving

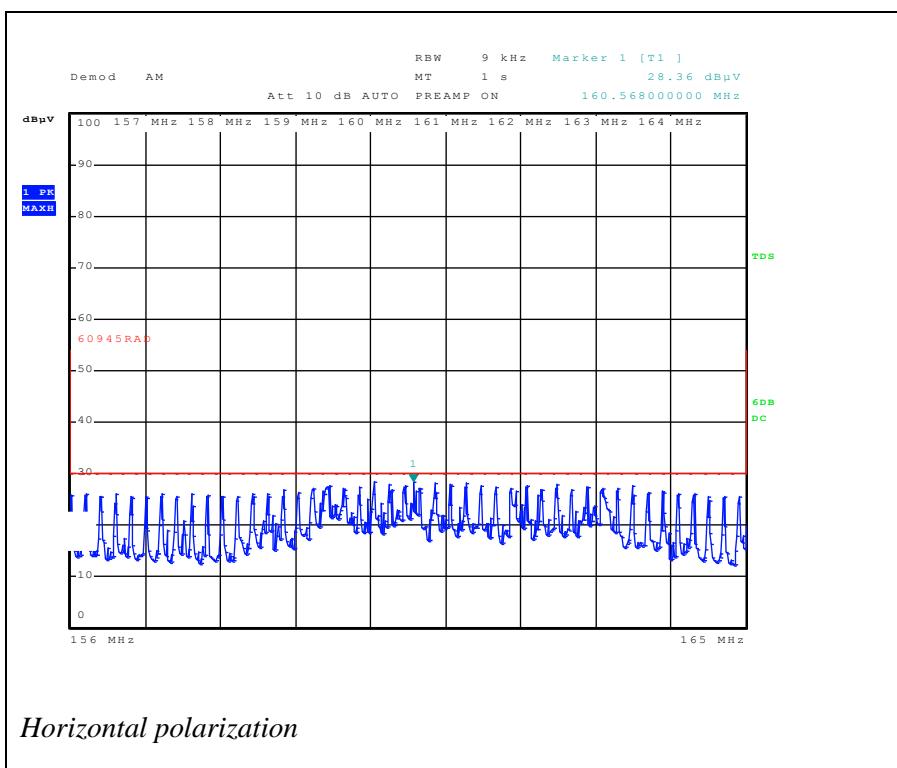


Measurement uncertainty	
Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

Test equipment used: (Item numbers)	55, 81, 87
-------------------------------------	------------

3.5 Radiated emissions 156 – 165 MHz

EN 60945 ref. : 9.3
 Basic standard : CISPR 16-1-1: 2006;
 CISPR 16-1-4: 2007
 Distance ant.↔ EUT : 3m
 EUT operational mode : receiving

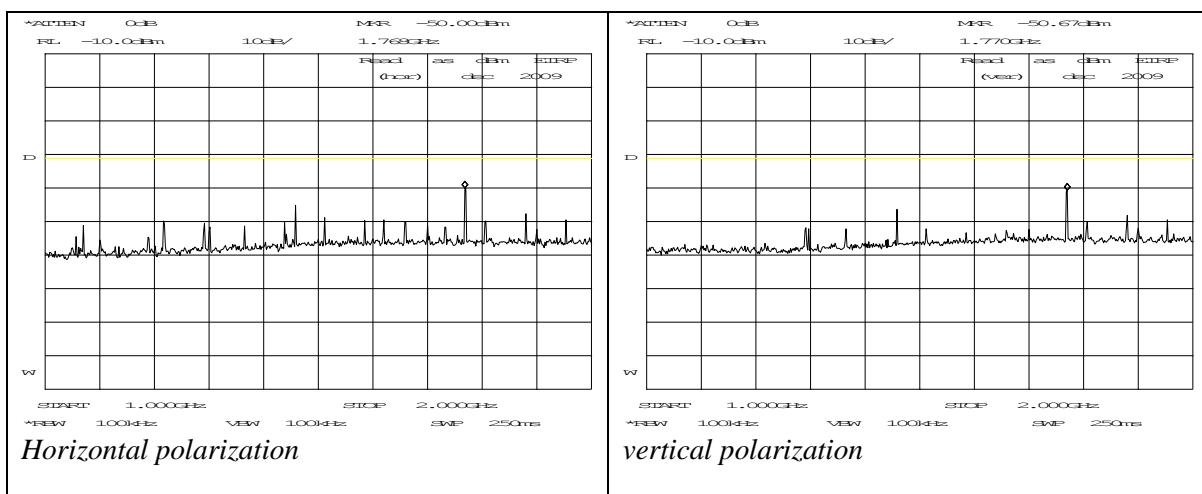


Measurement uncertainty	
Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

Test equipment used: (Item numbers)	55, 81, 87
-------------------------------------	------------

3.6 Radiated emissions 1 – 2 GHz

EN 60945 ref. : 9.3
 Basic standard : CISPR 16-1-1: 2006;
 : CISPR 16-1-4: 2007
 Distance ant.↔ EUT : 3m
 EUT operational mode : receiving



Measurement uncertainty	+4.5 dB / -6.1 dB
-------------------------	-------------------

Test equipment used: (Item numbers)	22, 25, 56, 90
-------------------------------------	----------------

Remark

As the units in the plots shown above are in dBm e.i.r.p., the limit shown is derived by subtracting 95.2 dB from the limit in dB μ V/m as stated in section 9.1, table 5 of EN 60945.

4 Immunity to electromagnetic environment clause 10

4.1 Summary

According to EN 60945: 2002 the following tests are performed:

Port	Sub clause Category	Phenomena	Performance criterion	Result
AC-input	10.3 b c d	Conducted RF CM 0.15 - 80.00 MHz, 3 V ^{*)} , AM80% 400Hz	A	NA
DC-input	10.3 b c d	Conducted RF CM 0.15 - 80.00 MHz, 3 V ^{*)} , AM80% 400Hz	A	P
Signal/control line(s)	10.3 b c d	Conducted RF CM 0.15-80.00 MHz, 3 V ^{*)} , AM80% 400Hz	A	P
Enclosure	10.4 a b c	RF-field 10 V/m, AM80% 400Hz 80 - 2000 MHz	A	P
AC-input	10.5 b c d	EFT +/- 2 kV common mode	B	NA
DC-input	10.5 b c d	EFT +/- 1 kV common mode	B	NA
Signal/control line(s)	10.5 b c d	EFT +/- 1 kV common mode	B	P
AC-input	10.6 b c d	Surges 1 kV line-earth 0.5 kV line-line	B	NA
AC-input	10.7 b c d	Power supply short-term variation volt. +/-20%, freq. +/-10%	B	NA
AC-input	10.8 b c d	Power supply failure, 60sec common mode	C	NA
DC-input	10.8 b c d	Power supply failure, 60sec common mode	C	P
Enclosure	10.9 a b c	ESD, 6 kV contact 8 kV air	B	P

^{*)} 10 V level applies to spot frequencies 2, 3, 4, 6.2, 8.2, 12.2, 16.5, 18.8, 22 & 25 MHz

Result:

P = pass

NA = not applicable

F = fail

NP = not performed

Category:

a = portable

c = exposed

b = protected

d = submerged

Performance criterion A/B

The EUT shall be set into autonomous mode using channels AIS1 and AIS2 with a reporting interval of 2 s in the standard test environment. The contents of the reports and the reporting intervals shall not be degraded during or after the test, as appropriate for the considered criterion.

Performance criterion C

Performance criterion C is to be taken to mean that the functions of the EUT are self-recoverable i.e. without operation of controls.

4.2 Immunity to conducted radio frequency disturbance

EN 60945 ref.	:	10.3
Basic standard	:	IEC 61000-4-6: 2006
Ambient temp	:	22 °C
R.H	:	27%
Modulation	:	400 Hz 80% AM
Dwell time	:	1 second
Performance criterion	:	A, ref. par 10.1 of EN 60945

Port	Frequency (MHz)	Coupl. dev.	Test Level (V _{rms})	Comments	Result
Mode of operation	Note 1	Note 2			
RS 232 Autonomous	0.15 – 80 range 1 % step size	49	3	1	P
GPS Autonomous	0.15 – 80 range 1 % step size	45	3	1	P
RS 422 Autonomous	0.15 – 80 range 1 % step size	43, 44	3	1	P
24 Vdc Autonomous	0.15 – 80 range 1 % step size	46	3	1	P

Comments:

1. There is no degradation of performance or loss of function of the EUT during and after the test.
2. There is no degradation of performance or loss of function of the EUT after the test.

Uncertainty of pre calibrated level: +/- 1.3 dB

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approx. 95%, but excluding the effect of measurement system repeatability.

Note 1: includes spot frequencies 2, 3, 4, 6.2, 8.2, 12.2, 16.5, 18.8, 22, 25 MHz

Note 2: numbers refer to the used test equipment list.

Test equipment used: (Item numbers)	23, 43, 44, 45, 46, 49, 56
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4.3 Immunity to radiated radio frequency disturbance

EN 60945 ref.	:	10.4
Basic standard	:	IEC 61000-4-3: 2006
Modulation	:	400 Hz 80% AM
Dwell time	:	1 second
Performance criterion	:	A, ref. par 10.1 of EN 60945

Mode of operation	Frequency (MHz)	Test Level (V/m)	Illuminated sides of EUT	Polarisation H/V for each side	Comments	Result
Autonomous	Range 80 – 2000 1 % frequency steps	10	Front	V	1	P
Autonomous	Range 80 – 2000 1 % frequency steps	10	Front	H	1	P
Autonomous	Range 80 – 2000 1 % frequency steps	10	Rear	H	1	P
Autonomous	Range 80 – 2000 1 % frequency steps	10	Rear	V	1	P

Comments:

1. There is no degradation of performance or loss of function of the EUT during and after the test.
2. There is no degradation of performance or loss of function of the EUT after the test.
3. The degradation of performance during the test is permissible and within the limits specified by the manufacturer.

Uncertainty of pre calibrated level: +1.8/ -1.8 dB (80 – 1000 MHz)
 +2.1/-6.1 dB (1000 – 2000 MHz)

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approx. 95 %, but excluding the effect of measurement system repeatability.

Test equipment used: (Item numbers)	21, 31, 32, 33, 35, 56, 73, 75
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4.4 Immunity to Fast Transients

EN 60945 ref. : 10.5
Basic standard : IEC 61000-4-4: 2004
Performance criterion : B, ref. par 10.1 of EN 60945

Port Mode of operation	Test duration for each polarity	Coupl. dev.	Test Volt. (kV)	Comments	Result
RS 232 Autonomous	3 min.	40	+1/-1	1, 2	P
RS 422 Autonomous	3 min.	40	+1/-1	1, 2	P

Comments:

1. There is no change of actual operating state or stored data after the test.
2. There is no degradation of performance or loss of function of the EUT after the test.

Measurement uncertainty: It has been demonstrated that EFT generator and its coupling networks meet the specified requirements in the standard with at least a 95% confidence.

Test equipment used: (Item numbers)	40, 71
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4.5 Immunity to electrostatic discharge, air

EN 60945 ref. : 10.9
Basic standard : IEC 61000-4-2: 2001
Performance criterion : B, ref. par 10.1 of EN 60945

Position	Mode of operation	Test Volt. (kV)	Number of discharges on each position	Polarity +/-	Comments	Result
Any position in front of the EUT	Autonomous	8	0	+	4	P
		8	0	-	4	P

Comments:

1. There is no change of actual operating state or stored data after the test.
2. There is no degradation of performance or loss of function of the EUT during and after the test.
3. The degradation of performance after the test is permissible and within the limits specified by the manufacturer.
4. No discharges were possible.

Measurement uncertainty: It has been demonstrated that the ESD generator meets the specified requirements in the standard with at least a 95% confidence.

Test equipment used: (Item numbers)	38, 67
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4.6 Immunity to electrostatic discharge, indirect contact

EN 60945 ref. : 10.9
Basic standard : IEC 61000-4-2: 2001
Performance criterion : B, ref. par 10.1 of EN 60945

Position	Mode of operation	Test Volt. (kV)	Number of discharges on each position	Polarity +/-	Comments	Result
Each of four sides illuminated by VCP	Autonomous	6	10	+	1, 2	P
		6	10	-	1, 2	P
Each of four sides illuminated by HCP	Autonomous	6	10	+	1, 2	P
		6	10	-	1, 2	P

Comments:

1. There is no change of actual operating state or stored data during the test.
2. There is no degradation of performance or loss of function of the EUT after the test.

Measurement uncertainty: It has been demonstrated that the ESD generator meets the specified requirements in the standard with at least a 95 % confidence.

Test equipment used: (Item numbers)	67, 68
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4.7 Immunity to electrostatic discharge, direct contact

This test was considered not applicable since metal parts are not exposed to ESD during normal usage.

Used test equipment module

Item	Description	Manufacturer	Type	ID
1	RF probe	R & S	URV5-Z2	TE 00009
2	T-network	R & S	ESH3-Z4	TE 00026
3	Signal generator	Marconi	2042	TE 00030
4	Pre-amplifier 10 dB	R & S	ESV-Z3	TE 00097
5	Pre-amplifier 10 dB	R & S	ESV-Z3	TE 00098
6	Spectrum analyser	HP	8562E	TE 00099
7	Artificial mains network	R & S	ESH2-Z5	TE 00130
8	Arbitrary waveform generator	HP	33120A	TE 00144
9	Artificial mains network	R & S	ESH3-Z5	TE 00208
10	Digital multimeter	HP	3438A	TE 00215
11	Pulse generator	HP	8012 B	TE 00225
12	Pulse limiter	R & S	ESH3-Z2	TE 00227
13	Digital multimeter	Fluke	87	TE 00329
14	Spectrum analyser	HP	8563E	TE 00359
15	Digital thermometer	Fluke	51	TE 00388
16	Modulation analyzer	R & S	FAM	TE 00412
17	Power meter	R & S	NRVS	TE 00414
18	Measurement probe	R & S	URV5-Z4	TE 00415
19	Distortion meter	HP	8903 B	TE 00416
20	Signal generator	HP	8642B	TE 00424
21	Signal generator	Marconi	2042	TE 00427
22	Spectrum analyser	HP	8563E	TE 00481
23	RF amplifier	Amplifier Research	25A250A	TE 00515
24	Audio amplifier	Solar Electronics	6552-1A	TE 00517
25	Horn antenna	EMCO	3115	TE 00531
26	Biconilog antenna	EMCO	3143	TE 00700
27	RF voltmeter	Boonton	9200B	TE 00707
28	Pulse modulator	Schaffner	CPM9830	TE 00708
29	RF power amplifier	Schaffner	CBA9546	TE 00714

Item	Description	Manufacturer	Type	ID
30	Log periodic antenna	EMCO	3147	TE 00744
31	Field probe	Holaday	HI-4422	TE 00748
32	System readout	Holaday	HI-4416	TE 00749
33	RF power amplifier	Kalmus	737FC	TE 00750
34	Attenuator 3 dB, 100 W	Tenuline	8343-030	TE 00751
35	40 dB coupler	Kalmus	DC100HHR	TE 00752
36	RF probe	Boonton	952001B	TE 00753
37	RF probe	Boonton	952001B	TE 00754
38	ESD air discharge tip	Keytek	TPA-2	TE 00755
39	Pulse limiter	R & S	ESH3-Z2	TE 00756
40	Capacitive clamp	Keytek	CCL-4/S	TE 00761
41	AC power simulator	Kikusui	PCR4000L	TE 00762
42	Power analyzer	Xitron Technologies	2501AH	TE 00763
43	EM clamp	Lüthi	EM101	TE 00764
44	Ferrite tube	Lüthi	FTC101	TE 00765
45	Coaxial coupl./dec. network	Telefication	CDN-S1	TE 00766
46	Mains coupl./dec. network	Telefication	CDN-M2/M3	TE 00767
47	Mains coupl./dec. network	Telefication	9403S1	TE 00768
48	100 µF decoupling capacitor	Telefication	JOZ	TE 00769
49	Coupl./dec. device for screened cables	MEB	CDN-S25	TE 00771
50	Audio isolation transformer	Solar	6220-2	TE 00772
51	Current probe	Eaton	93686-2	TE 00773
52	Acoustic pipe coupler	Telefication	JOZ110395	TE 00775
53	Absorbing clamp	R & S	MDS 21	TE 00777
54	Power supply	Delta Elektronika	E030-1	TE 00851
55	Biconilog antenna	Chase	CBL6112A	TE 00967
56	Full anechoic chamber	Euroshield	RFD-F-100	TE 01064
57	Triple loop antenna	Telefication	--	TE 01066
58	Coupling Decoupling Network	Schaffner	USB/p	TE 01068
59	Coupling Decoupling Network	Schaffner	A401	TE 01069
60	Multifunction synthesizer	HP	8904A	TE 01070
61	Coupling Decoupling Network	Schaffner	A201	TE 01074

Item	Description	Manufacturer	Type	ID
62	Isotropic field sensor	Holaday	HI-6005	TE 01075
63	Fibre optic RS232 interface	Holaday	HI-4460	TE 01094
64	Antistatic brush	Precision brush	55320	TE 01107
65	Signal line CDN	Keytek	CM-I/OCD	TE 01108
66	Telecom line CDN	Keytek	CM-TELCD	TE 01109
67	ESD simulator	Keytek	MiniZap	TE 01110
68	ESD contact discharge tip	Keytek	TPC-2a	TE 01111
69	ESD air discharge tip	Keytek	TPA-2	TE 01112
70	Temp / RH logger	MicroLog	EC 650	TE 01114
71	Ultra Compact Simulator	EM Test AG	UCS 500N	TE 01170
72	CDN for data/signal lines	EM Test AG	CNV 504N	TE 01170
73	Stacked double LogPer antenna	Schwarzbeck	STLP 9128D	TE 01171
74	Isotropic electric field probe	Holaday	HI-440	TE 01172
75	RF power amplifier	Teseq	CBA 3G-050	TE 01173
76	Directional 30 dB coupler	Bird	100-CC-FFN-30	TE 01175
77	Current generator	Fischer	F-1000-1000-4-8-G-125A	TE 01181
78	Loop antenna	Fischer	F-1000-4-8/9/10-1M	TE 01182
79	Antenna cable	Belden	H2000-flex	TE 01192
80	Spectrum analyser	R & S	FSP40	TE 11125
81	EMI test receiver	R & S	ESCI	TE 11128
82	Antenna tower	Heinrich Deisel	AS 620P	ANEC
83	Turntable	Heinrich Deisel	DS-412	ANEC
84	Turntable controller	Heinrich Deisel	HD-050	ANEC
85	Antenna mast	EMCO	1070	SAR
86	Turn table	EMCO	1060-2M	SAR
87	Semi Anechoic Room	Comtest	--	SAR
88	Adjustable transformer	KSL	RU8	--
89	800 mm strip line	Telefication	--	--
90	Preamplifier 1 – 26.5 GHz	HP	8449B	TE 00092
91	Active loop antenna	R & S	HFH2-Z2	TE 00746

Test equipment used for vibration testing.

This equipment is the property of Thales BV, Environmental Competence Centre, Hengelo

Ref	Description	Manufacturer	Model
92	Conditioning amplifier	Ling Dynamics	SPAK 24
93	Accelerometer	PCB Piezotronics	33353B
94	Controller	M+P International	VibPilot Oros
95	Shaker	Ling Dynamics	2860
96	Acceleration sensor	Brüel & Kjaer	4384
97	Amplifier	Kistler	5011

Test equipment used for rain and spray

This equipment is the property of Thales BV, Environmental Competence Centre, Hengelo

98	IPX6 nozzle + hose + flowmeter	Thales	--
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Photograph 1: Front view (bracket mount)



Photograph 2: Front view (flush mount)



Photograph 3: Rear view



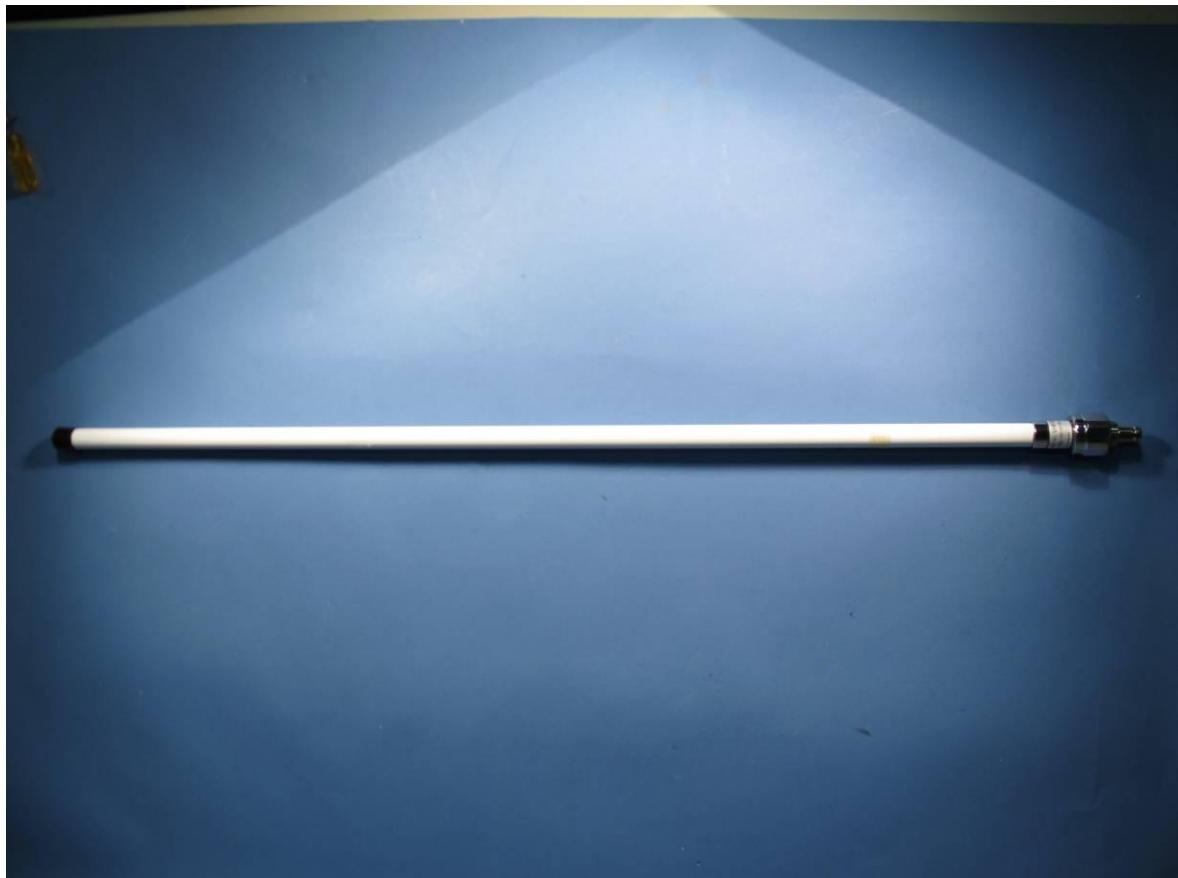
Photograph 4: antenna type MA-700



Photograph 5: antenna type MA-700 labelling



Photograph 6: antenna type VHF/GPS



Photograph 7: antenna type VHF/GPS labeling



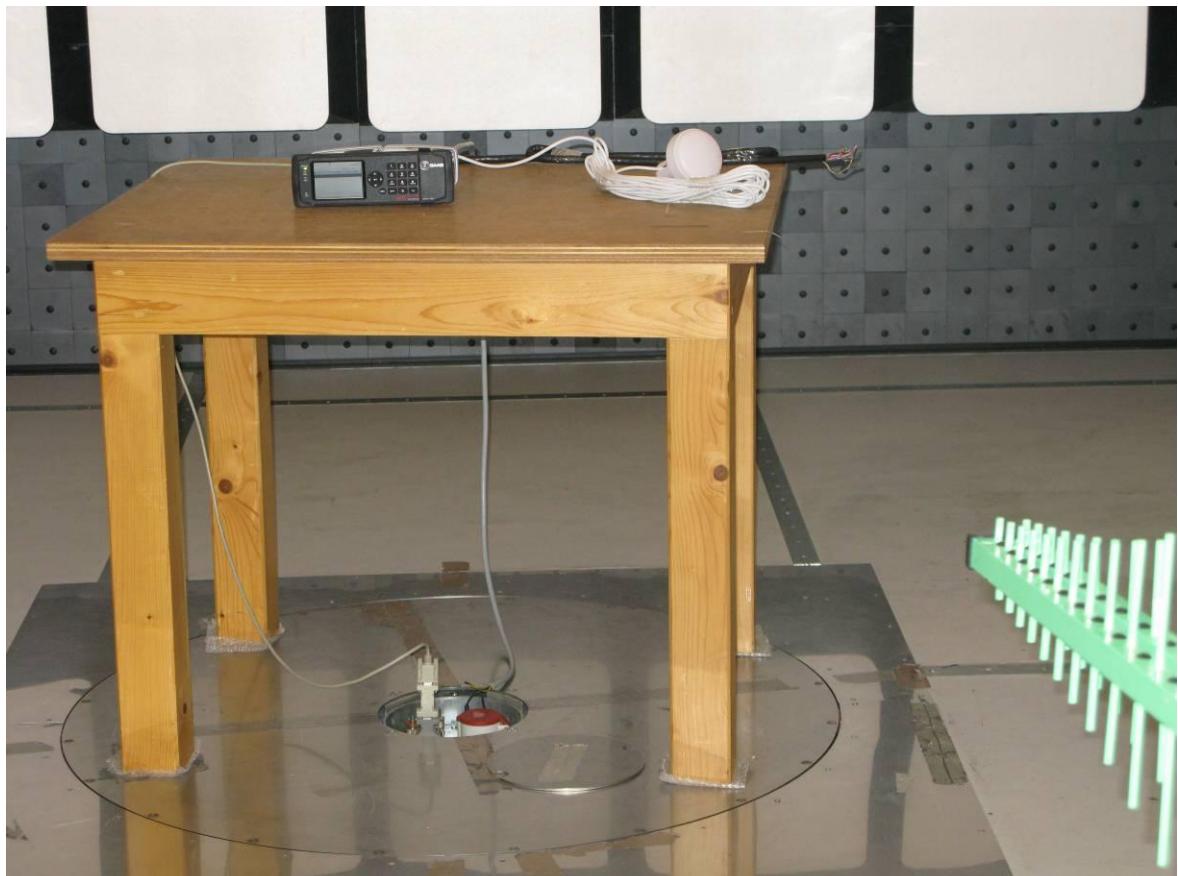
Photograph 8: conducted emissions test set up (0.01 – 30 MHz)



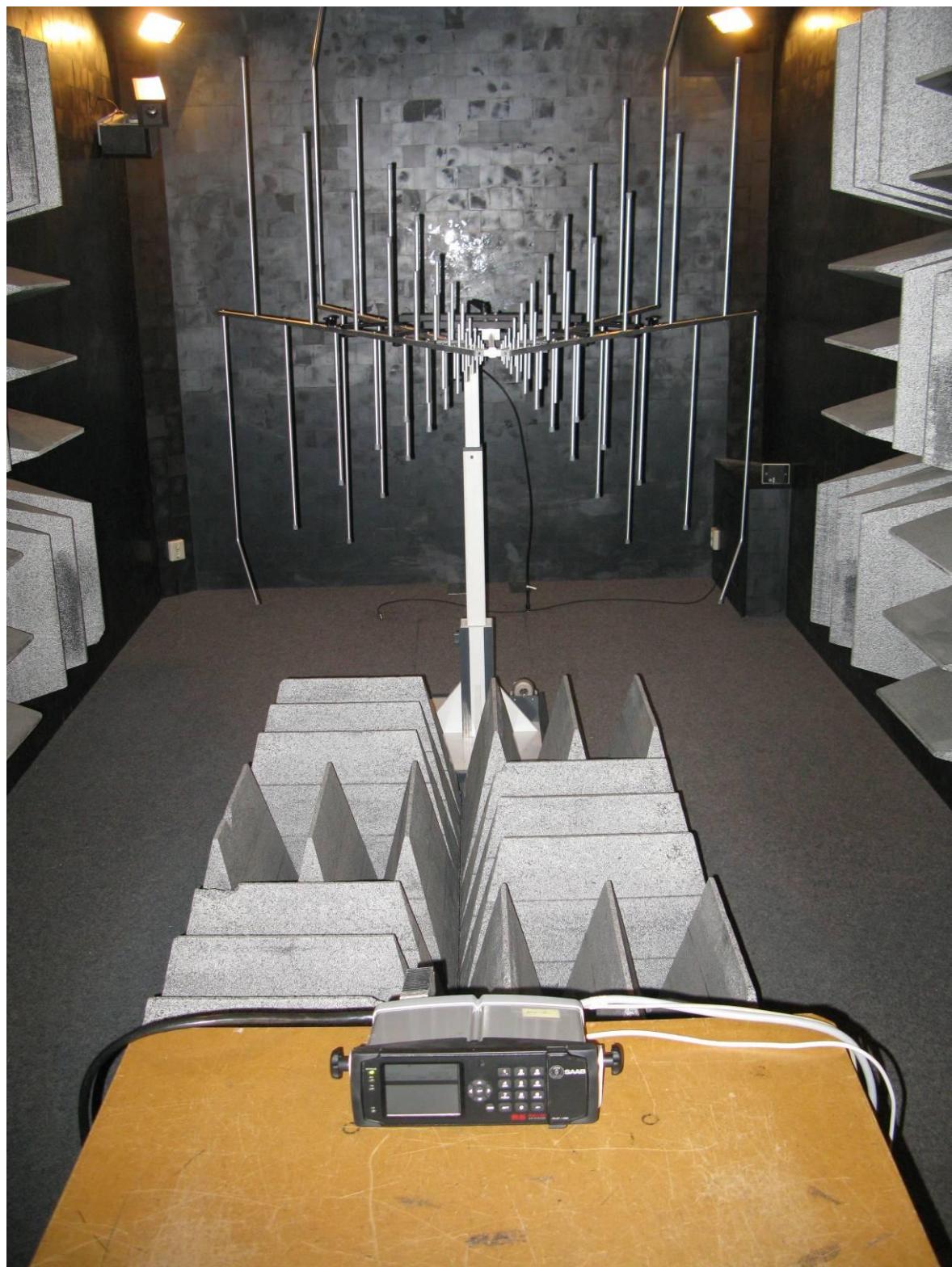
Photograph 9: radiated emissions test set up (0.15 – 30 MHz)



Photograph 10: radiated emissions test set up (0.03 – 1 GHz)



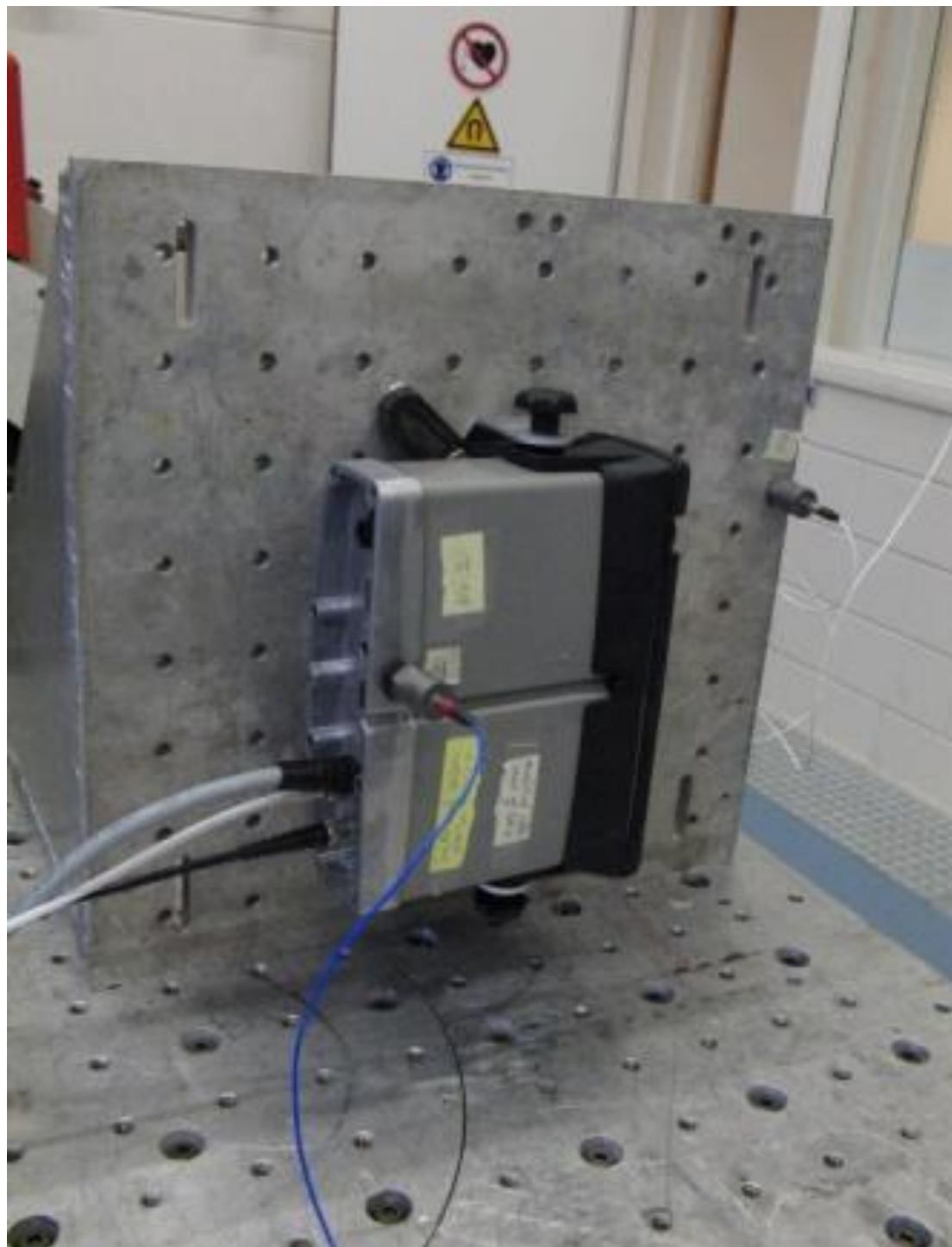
Photograph 11: radiated immunity test set up (0.08 – 1 GHz)



Photograph 12: Vibration test setup with R5 in original bracket mount (1st horizontal direction)



Photograph 13: Vibration test set up with R5 in original bracket mount (vibration direction coincides with vertical axis of R5 in normal user's position)



Photograph 14: Vibration test setup with R5 in original bracket mount (2nd horizontal direction)



Photograph 15: Vibration test set up with R5 in flush mount (vibration direction coincides with vertical axis of R5 in normal user's position)



Photograph 16: Vibration test setup with R5 in flush mount (1st horizontal direction)



Photograph 17: Vibration test setup with R5 in flush mount (2nd horizontal direction)



Photograph 18: Spray test on MA-700



Additional information module

This module contains five pages of information on corrosion (waivers) provided by the applicant.

	Report/Directive		Page 1 (3)
	Document Class		
Document Id 7000 118-285	Version A	Date 2012-02-17	
Saab TransponderTech AB			
Issued by Stefan Johansson	Approved by Christian Andersson		
To	For information	Appendix	
R5 Solid AIS Transponder			
Environmental Protection of Enclosure to IEC 60945			
<p>This document and attachments shall remain our property. They may not without our written consent, either in their original state or with any changes, be copied or reproduced, disclosed to or delivered to anyone unauthorized nor used for other purposes than what has been confirmed by Saab TransponderTech in writing. Saab TransponderTech AB, SWEDEN</p>			
PX-00-0052.4			



Report/Directive

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Document Class

Document Id
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A Date
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Saab TransponderTech AB

1 GENERAL

1.1 R5 Solid Enclosure

The R5 Solid transponder is housed in an extruded aluminium profile with aluminium alloy die-cast rear cover and a plastic front. Antenna, communication interfaces and power supply connectors are located at the rear lid. Visual indicators, buttons and a LCD are located on the front. USB and Pilot plug are placed under a hatch in the front. The cabinet is intended for flush mount in a panel or gimbal mount on a flat surface.

2 MECHANICAL

2.1 Aluminium profile

The main part of R5 Solid enclosure is an extruded aluminium profile. The thickness of the profile is 3mm and aluminium bars inside are used to hold the internal PCB in place. There are eight M4 holes in each end for fastening the front and rear covers. On the bottom side there are six 3mm holes for fastening the aluminium bars on the inside. This assures good heat transfer from the PCB to the outside of the transponder chassis.

2.2 Aluminium rear cover

The rear cover is a die-cast aluminium part with holes for connectors and eight mounting screws. The connectors include RF coaxial (VHF and GPS antenna), a 26-pin D-SUB connector for communication interfaces, a 9-pin D-SUB connector for a serial interface and a plastic circular 4 pole power connector. All connectors used are plated and/or made of non-corrosive materials to improve the corrosion resistance. There is a stainless steel M6 screw from the inside with two M6 stainless steel nuts on the outside for GND connection. Between the rear cover and the aluminium profile there is a silicone gasket. The rear cover is fastened to the profile with 8 stainless steel M4 screws.

2.3 Front assembly

The front assembly is made up from an overlay mounted on plastic front which is screwed with 12 stainless steel screws to a 3mm aluminium plate. Between the aluminium front plate and the aluminium profile there is a silicone gasket. The aluminium front plate is fastened to the profile with 8 stainless steel M4 screws. There are a silicone rubber keypad and a window for the 3.5" LCD in the polycarbonate overlay. The front hatch that covers the USB and Pilot plug is sealed with rubber sealing towards the front. In the four corners of the front plate there are holes for flush mount screws which are covered with rubber screw covers.

3 MATERIAL, SURFACE TREATMENT AND PROTECTION

3.1 Material

3.1.1 Aluminium profile

The aluminium profile is made of an extruded aluminium alloy, which has good mechanical properties and provides high resistance to seawater corrosion. The aluminium alloy used is type 6060. The aluminium bars inside the profile are CNC machined in aluminium type EN AW-6082.



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Saab TransponderTech AB

3.1.2 Rear cover

The rear cover is made of a die-cast aluminium alloy, which has good mechanical properties and provides corrosion resistance. The specification of the aluminium alloy used is INGOT ADC-12. The silicone gasket between the rear cover and the aluminium profile is made from organic silicone rubber.

3.1.3 Front assembly

The parts in the front assembly are made in a variety of materials according to the list below.

- The aluminium front plate is CNC machined in aluminium type EN AW 5005.
- The silicone gasket between the aluminium front plate and the plastic front is made from organic silicone rubber.
- The plastic front and plastic front hatch is moulded in Technyl A218V30 which is made up from Polyamide 66, reinforced with 30% of glass fibre.
- The plastic Gimbal frame is moulded in GVN-35H which is known for high stiffness and strength.
- The rubber screw covers are moulded in Santoprene 191-85PA.
- The front overlay is made of polycarbonate with a silicone rubber keypad.

3.2 Surface treatment

3.2.1 Aluminium profile and rear cover

The cleaned aluminium surface is treated with a powder coating. The coating is Freilacke Frepox powder coating PB1011L, which has very good resistance to salt spray, chemicals and solvents.

The rear cover surface is treated with a glossy powder coating; Jotun 9005 30gl Polyester.

The connector pins and socket materials are gold plated. Connector housings are made of plated, corrosion resistant materials or plastic.

4 SUMMARY

The transponder enclosure has been designed to withstand operation under harsh marine conditions. The materials and surface protection used in the design have been carefully chosen to fulfil the IEC 60945 environmental requirements and provide long and lasting protection against seawater corrosion.

AC MARINE A/S

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2011-10-06

Declaration of Non-Corrosion

To whom it may concern.

Kindly be advised that the VHF/GPS antenna series has been developed with respect to the harsh environment the antenna is exposed to thus optimizing non-corrosion of the materials.

The antenna has a PE closure at the top fitting the lacquered glass fiber radome in order to secure that there is no water penetration. The radome is sealed at the bottom by means of epoxy. The threaded bottom of the antenna is chrome brass, the optimum solution for non-corrosion of the antenna.

Upon connection of the antenna to the system AC Marine A/S recommends to seal connections for optimized weather protection.

Sincerely Yours,

AC Marine A/S

AC MARINE A/S

Pilehøjvænge 8E

3460 Birkerød

Tlf. 45 45 81 04 13, Fax 45 45 81 04 93

Linda Soleil

Manager

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Office SAAB TransponderTech AB			
Declaration of Non-Corrosion for GPS antenna MA-700			
We hereby declare the MA-700 antenna is not subject to corrosion in a marine antenna installation.			
The MA-700 GPS antenna is a completely water sealed unit tested to IP-57. See attachment MA700 & MR700 IP57 TEST.pdf			
The casing is entirely without corrosive materials and therefore not subject to corrosion. It is recommended the TNC connector is water sealed for maximum protection.			
			
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