PHOENIX TESTLAB

Königswinkel 10
32825 Blomberg
Germany
Phone: +49 (0) 52 35 95 00-0
Fax: +49 (0) 52 35 95 00-10

Test Report

Report Number:
F142199E2

Applicant:

FT-TEC Electronics GmbH

Manufacturer:

FT-TEC Electronics GmbH

Equipment under Test (EUT):

AIS Search and Rescue Transmitter SEAANGEL SA14

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

Laboratory (CAB) accredited by
Deutsche Akkreditierungsstelle GmbH (DAkkS)
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. D-PL-17186-01-02,

REFERENCES

[1] IEC 60945 (2002-08) Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results

TEST RESULT

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test.
The complete test results are presented in the following.

Test engineer:	Thomas KÜHN		16 September 2014
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		16 September 2014
	Name	Signature	Date

RESERVATION

This test report is only valid in its original form.

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The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

Contents: Page

1 Identification

1.1 Applicant

Name:	FT-TEC Electronics GmbH
Address:	Werner von Siemens-Straße 5 7343 Neutal
Country:	Austria
Name for contact purposes:	Mr. Andreas KREJCI
Phone:	+43 26 18 20 455 – 4020
Fax:	+43 26 18 20 455 – 9010
eMail Address:	a.krejci@ft-tec.com
Applicant represented during the test by the following person:	Mr. Andreas KREJCI

1.2 Manufacturer

Name:	FT-TEC Electronics GmbH
Address:	Werner von Siemens-Straße 5 7343 Neutal
Country:	Austria
Name for contact purposes:	Mr. Andreas KREJCI
Phone:	+43 26 18 20 455 – 4020
Fax:	+43 26 18 20 455 – 9010
eMail Address:	a.krejci@ft-tec.com
Manufactruer represented during the test by the following person:	-

1.3 Dates

Date of receipt of test sample:	17 July 2014
Start of test:	08 August 2014
Finish of test:	03 September 2014

2 Technical data of equipment

Type: *	AIS Search and Rescue Transmitter (AIS-SART)		
Type designation: *	SEAANGEL SA14		
Serial No.:	10000000000000000130039		
Alignment range: *	161.975 to 162.025 MHz		
Switching range: *	161.975 to 162.025 MHz		
Channel separation: *	50 kHz (Channel bandwidth: 25 kHz)		
Rated RF output power: *	1.0 W / 30 dBm		
Supply Voltage: *	U_{nom}= 9.0 V DC	U_{min}= 5.0 V DC	U_{max}= 9.2 V DC
Temperature range: *	-20 °C to +55 °C		
Printed circuit designation: *	5400013V03		
Software version: *	SA14V1.1		
Hardware version: *	V03		

* declared by the applicant.

Ports/Connectors

Identification	Connector		Length
	EUT	Ancillary	
-	-	-	-
-	No external lines are connectable to the EUT		-
-			-
-	-	-	-
-	-	-	-
-	-	-	-

3 Operational states and test setup

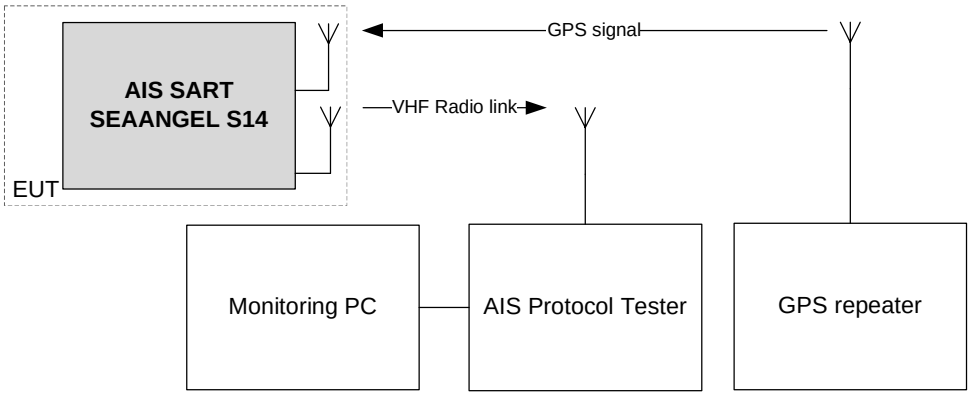
Description of the test setup and tests made for checking EUT performance:

The EUT was powered by the internal battery during all tests.

In order to reduce the testing time, the EUT was equipped with a test-firmware during the immunity tests, which transmits with a shorter interval after a start-up time of one minute after pressing the on-button. Every second an AIS message 1 was transmitted alternating on AIS 1 (161.975 MHz) and on AIS 2 (162.025 MHz). The correct function of the EUT (transmission of the correct message type on the correct channel and with the correct GPS data and message content) as required as performance test according to [1] was monitored by using the AIS protocol tester.

For the emission test the normal firmware of the EUT was used. The emission measurements were carried out after the test-button was pressed. As declared by the applicant in this mode the EUT is powered on (including the GPS receiver part, but no transmission occurs).

Test setup:



4 Overview

4.1 Radiated emissions

Radiated emission – Enclosure port				
Frequency range	Limit	Basic standard	Remark	Status
150kHz – 300kHz 300kHz – 30MHz	80 – 52 dBµV/m in 3m 52 – 34 dBµV/m in 3m	IEC 60945 Chapter 9.3	H-field	Passed
30MHz – 156MHz 156MHz– 165MHz 165MHz– 1GHz	54 dBµV/m in 3m 24 dBµV/m in 3m 54 dBµV/m in 3m	IEC 60945 Chapter 9.3	E-field	Passed
Remark:	For frequencies from 150 kHz to 30 MHz measurements shall be made of the magnetic H-field. The receiver bandwidth in the frequency ranges 150 kHz to 30 MHz and 156 MHz to 165 MHz shall be 9 kHz, and in the frequency ranges 30 MHz to 156 MHz and 165 MHz to 1 GHz shall be 120 kHz.			

Conducted emission – Power supply ports				
Frequency range	Limit	Basic standard	Remark	Status
10kHz – 150kHz 150kHz – 350kHz 350kHz – 30MHz	96 – 50 dBµV 60 – 50 dBµV 50 dBµV	IEC 60945 Chapter 9.2	EUT is battery supplied	Not applicable
Remark:	The measuring bandwidth in the frequency range 10 kHz to 150 kHz shall be 200 Hz, and in the frequency range 150 kHz to 30 MHz shall be 9 kHz			

4.2 EMC Immunity

Definition of evaluation criterion according to IEC 60945 chapter 10.1:

A: No apparent impairment of function within the tolerance limits.
B: Partial impairment of function, however self-regulating through e.g. automatic restart. Function must be restored within the tolerance limits after the test; a safe state must be guaranteed at all times.
C: Partial impairment of function, however non self-regulating, e.g. manual start-up is necessary (Reset, Program start); a safe state must be guaranteed at all times.

Immunity – Enclosure port					
Environmental phenomena	Test specification and units	Basic standard	Remark	Performance criterion	Status
Electromagnetic fields	80 – 2700 MHz 10 V/m; AM; 80 %; 400 Hz	IEC 60945 Chapter 10.4	---	A	Passed
Electrostatic discharge (ESD)	up to ±6 kV charging voltage for contact discharge	IEC 60945 Chapter 10.9	---	B	Passed
Electrostatic discharge (ESD)	up to ±8 kV charging voltage for air discharge	IEC 60945 Chapter 10.9	---	B	Passed

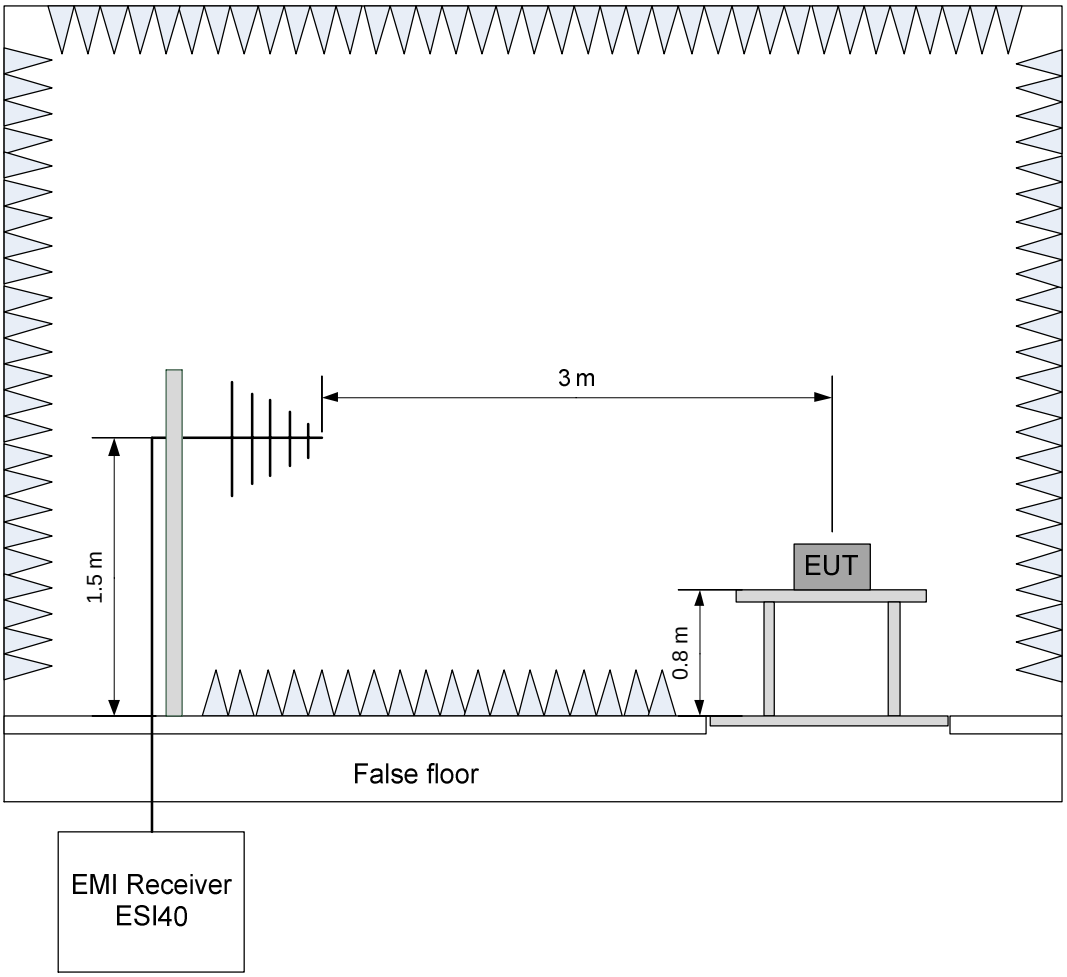
Immunity – Power supply ports, DC and AC					
Environmental phenomena	Test specification and units	Basic standard	Remark	Performance criterion	Status
Conducted high frequency interference	10 V; AM; 80%; 400 Hz 10 kHz – 80 MHz	IEC 60945 Chapter 10.3	EUT is battery supplied	A	Not applicable
Conducted high frequency interference	10 V; AM; 80%; 400 Hz 2 / 3 / 4 MHz, 6.2 / 8.2 / 12.6 MHz, 16.5 / 18.8 / 22 / 25 MHz	IEC 60945 Chapter 10.3	EUT is battery supplied	A	Not applicable
Power supply failure	3 interruptions of 60s	IEC 60945 Chapter 10.8	EUT is battery supplied	C	Not applicable
Power supply variations	U_N + 20 % for 1.5 s	IEC 60945 Chapter 10.7	EUT is battery supplied	B	Not applicable
	U_N – 20 % for 1.5 s			B	Not applicable
Fast transients (Burst)	±1 kV (peak) 5/50 ns (Tr/Th) 5 kHz repetition frequency	IEC 60945 Chapter 10.5	EUT is battery supplied	B	Not applicable
Transients (Surge)	1.2 / 50 µs up to ±0.5 kV line/line up to ±1.0 kV line/earth	IEC 60945 Chapter 10.6	EUT is battery supplied	B	Not applicable

Immunity – Data, control and communications connections					
Environmental phenomena	Test specification and units	Basic standard	Remark	Performance criterion	Status
Conducted high frequency interference	10 V; AM; 80%; 400 Hz 10 kHz – 80 MHz	IEC 60945 Chapter 10.3	No connections. available	A	Not applicable
Conducted high frequency interference	10 V; AM; 80%; 400 Hz 2 / 3 / 4 MHz, 6.2 / 8.2 / 12.6 MHz, 16.5 / 18.8 / 22 / 25 MHz	IEC 60945 Chapter 10.3	No connections. available	A	Not applicable
Fast transients (Burst)	±1 kV (peak) 5/50 ns (Tr/Th) 5 kHz repetition frequency	IEC 60945 Chapter 10.5	No connections. available	B	Not applicable

5 Test sequence and test results electromagnetic disturbances characteristics

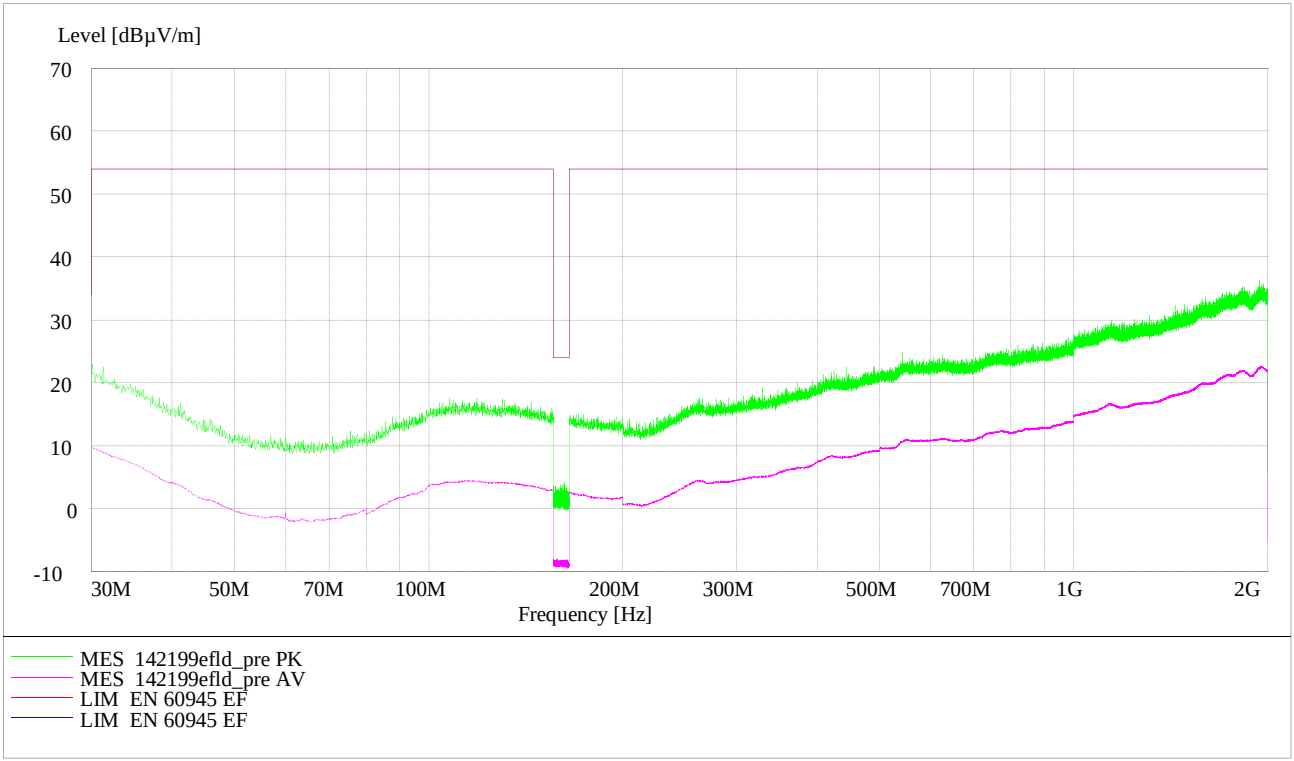
5.1 Radiated radio disturbance according to IEC 60945 chapter 9.3 (Electric E field)

Test setup: - Table setup
- The drawing below schematically shows the test setup.
- Photos of the test setup can also be referred to in the annex.



Test procedure: The radiated field strength is measured in two stages. In the first non-standard stage, preliminary measurements are made in a fully anechoic chamber. Here the equipment under test is measured from various sides in normal fitted position. This procedure makes it possible to ascertain without the effect of external interference sources and without adjusting the antenna in height whether the test object is emitting interference at certain frequencies. In the second stage, the frequencies determined in the preliminary measurements are measured in compliance with the standard on a standard open area test site with a quasi-peak detector.

Title:	Radiated emission measurement according to IEC 60945
EUT:	SEAANGEL SA14
Manufacturer:	FT-TEC Electronics GmbH
Operating Condition:	Switched on without transmission
Test site:	Fully anechoic chamber M20; PHOENIX TEST LAB GmbH
Operator:	Th. KÜHN
Comment:	-



Data record name: 142199efld

In this case it was not necessary to carry out subsequent measurements because at no frequency was a value above the noise floor of the measuring system during the preliminary measurements.

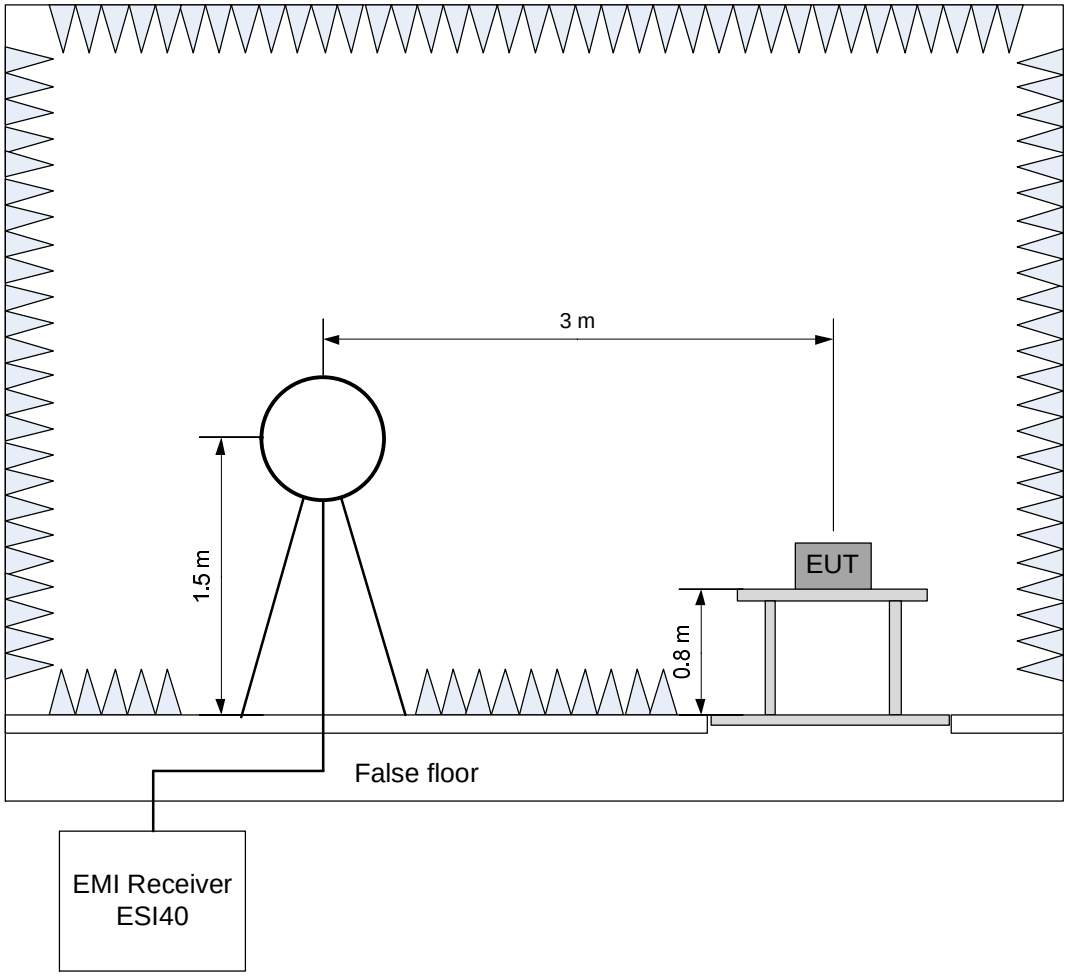
Equipment used:

Fully anechoic chamber (PM-No. 480190)
Controller Maturo MCU (PM-No. 480181)
Antenna mast (PM-No. 480187/480188)
Turntable (PM-No. 480186)
Receiver ESI 40 (PM-Nr. 480355)
EMI softwarepackage ES-K1 (PM-No. 480111)
Antenna Chase CBL 6112 (PM-No. 480185)

Test result: Passed.

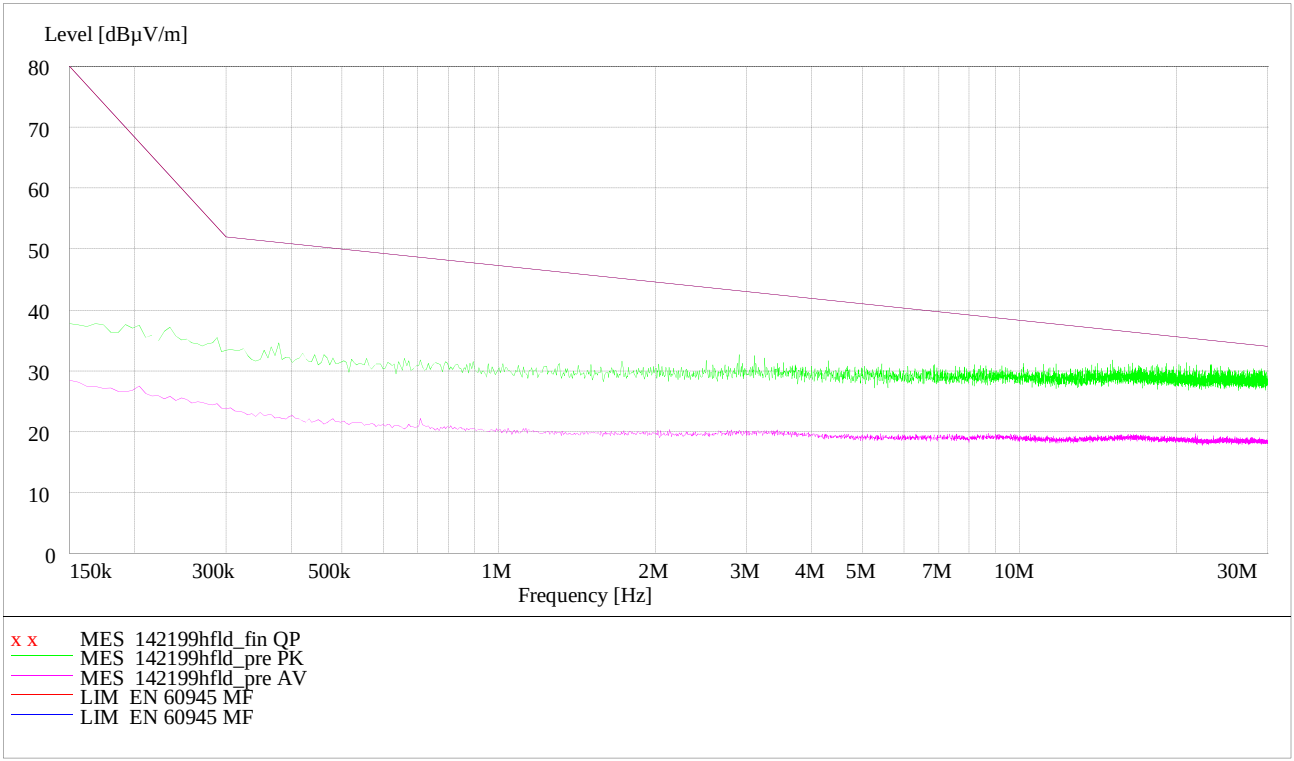
5.2 Radiated radio disturbance according to IEC 60945 chapter 9.3 (Magnetic H field)

Test setup: - Table setup
- The drawing below schematically shows the test setup.
- Photos of the test setup can also be referred to in the annex.



Test procedure: The radiated field strength is measured in two stages. In the first non-standard stage, preliminary measurements are made in a fully anechoic chamber. Here the equipment under test is measured from various sides in normal fitted position. This procedure makes it possible to ascertain without the effect of external interference sources and without adjusting the antenna in height whether the test object is emitting interference at certain frequencies. In the second stage, the frequencies determined in the preliminary measurements are measured in compliance with the standard on a standard open area test site with a quasi-peak detector.

Title:	Radiated emission measurement according to IEC 60945
EUT:	SEAANGEL SA14
Manufacturer:	FT-TEC Electronics GmbH
Operating Condition:	Switched on without transmission
Test site:	Fully anechoic chamber M20; PHOENIX TEST LAB GmbH
Operator:	Th. KÜHN
Comment:	-



Data record name: 142199hfld

In this case it was not necessary to carry out subsequent measurements because at no frequency was a value above the noise floor of the measuring system during the preliminary measurements.

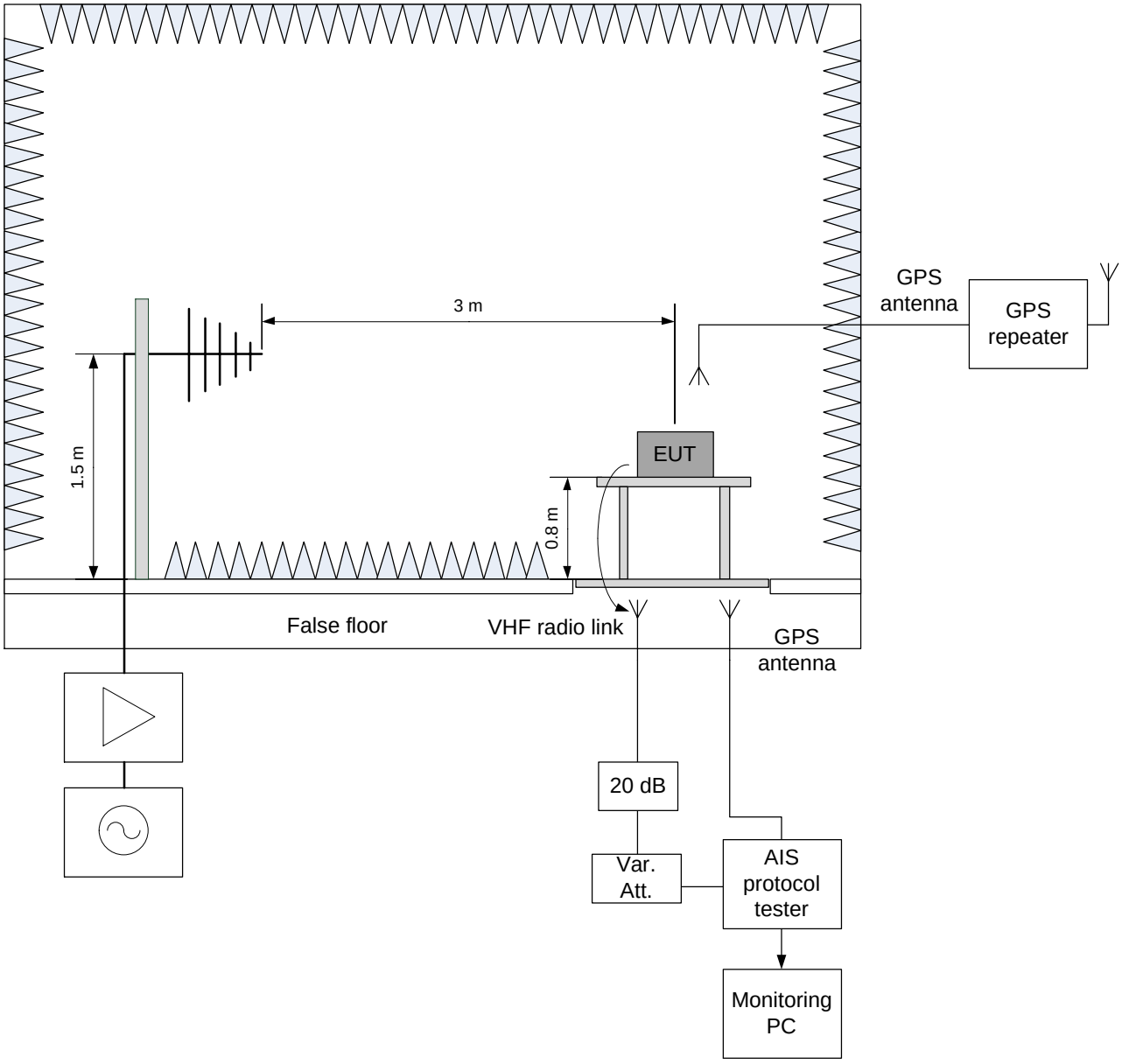
Test equipment used:
Fully anechoic chamber (PM-No. 480190)
Controller Maturo MCU (PM-No. 480181)
Antenna mast (PM-No. 480187/480188)
Turntable (PM-No. 480186)
Receiver ESI 40 (PM-Nr. 480355)
EMI software package ES-K1 (PM-No. 480111)
Antenna R+S Loop antenna HFH2-Z2 (PM-Nr. 480059)

Test result: Passed.

6 Test sequence and test results electromagnetic immunity characteristics

6.1 Immunity test for high frequency electromagnetic fields according to IEC 60945 chapter 10.4

Test setup:
- Table setup
- The drawing below schematically shows the test setup.
- Photos of the test setup can also be referred to in the annex.
- The transmitting antenna is set at 1.5m above the floor.



Monitoring of EUT: The output signals and correct timing were checked by using an AIS protocol tester.

Exclusion band: No tests were carried out in the frequency range 153.876 MHz to 170.126 MHz.

Test records: The tests in the table below were carried out.

Date of test:		13 February 2014		
Ambient conditions:		31 % F_{rel}, 21 °C		
Test level:		80-2700 MHz, 10 V/m, AM, 400 Hz, 80 %		
Increment:		log 1 %		
Dwell time:		≥ 3 s		
Distance antenna/ test object	Polarisation	Radiation direction	EUT reaction	Result
3 m	Vertical	0 °	No reaction detected	A
3 m	Vertical	90 °	No reaction detected	A
3 m	Vertical	180 °	No reaction detected	A
3 m	Vertical	270 °	No reaction detected	A
3 m	Horizontal	0 °	No reaction detected	A
3 m	Horizontal	90 °	No reaction detected	A
3 m	Horizontal	180 °	No reaction detected	A
3 m	Horizontal	270 °	No reaction detected	A

Test equipment used:
Controller Maturo MCU (PM-No. 480326)
Turntable (PM-No. 480315)
Antenna support (PM-No. 480187, 480325)
Fully anechoic chamber (PM-No. 480303)
Power amplifier AR150W1000 (PM-No. 480419)
Power amplifier AR60S1G3 (PM-No. 480418)
Signal generator SML03 (PM-No. 480421)
Power meter NRVD (PM-No. 480176, 480177)
Power probe URV5-Z2 (PM-No. 480191, 480192)
Terminating impedance RNB (PM-No. 480062, 480063)
Power probe NRV-Z2 (PM-No. 480193/480194)
Relays switch unit RSU (PM-No. 480175)
Relay switch unit (PM-N0. 480175)
EMS Software-Package EMS-K1 (PM-No. 480222)
Horn antenna Schwarzbeck 9120 (PM-No. 480082)
Log.-Per. Antenna HL046 (PM-No. 480189)
20 dB attenuator WA8 / 18-20-34 (PM No. 481450)
Variable Attenuator 0 -11 dB 8494B (PM No. 480264)
Variable Attenuator 0 - 110 dB 8496B (PM No. 480265)
AIS test unit MK II (PM No. 481422)

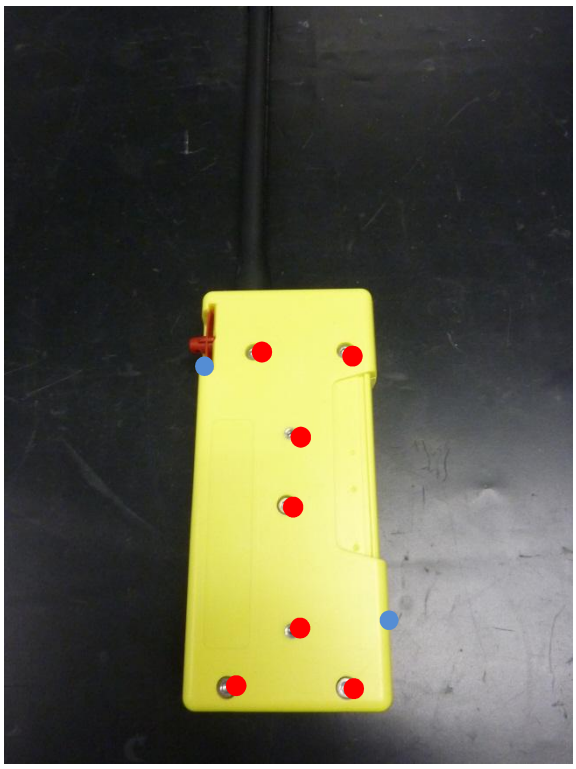
Test result: Passed.

6.2 Immunity test for discharge of static electricity according to IEC 60945 chapter 10.9

Test setup:
- Table setup
- Photos of the test setup can also be referred to in the annex.

Test plan: The equipment under test is triggered with 10 positive and negative impulses each per discharge location and test voltage.
Contact discharge (CD) was carried out up to ±6 kV.
Air discharge (AD) was carried out up to ±8 kV.
Indirect discharge (ID) was carried out on the vertical (VCP) and horizontal (HCP) coupling plate up to ±6 kV.

Points of air discharge 🔵:
Points of contact discharge 🔴:



Test records operation mode transmit

Date of test:	03 September 2014		
Ambient conditions:	45 % F_{rel}, 22 °C; Air pressure conforms to the requirements of the standard		
Number of impulses:	10 per polarity, test voltage and discharge location		
Method of discharge	Discharge location	EUT reaction	Result
Indirect discharge ±2kV	HCP	No reaction detected	A
	VCP	No reaction detected	A
Indirect discharge ±4kV	HCP	No reaction detected	A
	VCP	No reaction detected	A
Indirect discharge ±6kV	HCP	No reaction detected	A
	VCP	No reaction detected	A
Contact discharge ±2kV	CD	No reaction detected	A
Contact discharge ±4kV	CD	Transmission interrupted, restarts automatically after 1 min.	B
Contact discharge ±6kV	CD	Transmission interrupted, restarts automatically after 1 min.	B
Air discharge ±2kV	AD	No reaction detected	A
Air discharge ±4kV	AD	No reaction detected	A
Air discharge ±8kV	AD	Transmission interrupted, restarts automatically after 1 min.	B

Test records operation mode standby

Date of test:	10 March 2014		
Ambient conditions:	30 % F_{rel}, 22 °C; Air pressure conforms to the requirements of the standard		
Number of impulses:	10 per polarity, test voltage and discharge location		
Method of discharge	Discharge location	EUT reaction	Result
Indirect discharge ±2kV	HCP	No reaction detected	A
	VCP	No reaction detected	A
Indirect discharge ±4kV	HCP	No reaction detected	A
	VCP	No reaction detected	A
Indirect discharge ±6kV	HCP	No reaction detected	A
	VCP	No reaction detected	A
Contact discharge ±2kV	CD	No reaction detected	A
Contact discharge ±4kV	CD	No reaction detected	A
Contact discharge ±6kV	CD	No reaction detected	A
Air discharge ±2kV	AD	No reaction detected	A
Air discharge ±4kV	AD	No reaction detected	A
Air discharge ±8kV	AD	No reaction detected	A

Test equipment used: Schaffner ESD simulator NSG 435 (PM No. 480027)
Testing table Numerik PTi (PM No. 480049)
AIS test unit MK II (PM No. 481422)

Test result: Passed.

7 Report history

Report Number	Date	Comment
F142199E2	16 September 2014	Document created
-	-	-
-	-	-

8 Annex

Annex A Photographs 14 pages

External photographs of the test sample

142199_5.JPG: SEAANGEL SA14, front view
142199_2.JPG: SEAANGEL SA14, rear view
142199_11.JPG: SEAANGEL SA14, front view (antenna removed)
142199_3.JPG: SEAANGEL SA14, rear view (antenna removed)

Internal photographs of the test sample

142199_6.JPG: SEAANGEL SA14, internal view 1 (cover removed)
142199_7.JPG: SEAANGEL SA14, internal view 2 (PCB removed)
142199_10.JPG: SEAANGEL SA14, PCB, top view
142199_9.JPG: SEAANGEL SA14, PCB, bottom view

Test set-up photographs

142199_f.JPG: SEAANGEL SA14, test set-up fully anechoic chamber
142199_h.JPG: SEAANGEL SA14, test set-up electric E field measurement
142199_e.JPG: SEAANGEL SA14, test set-up magnetic H field measurement
142199_l.JPG: SEAANGEL SA14, test set-up immunity test for high frequency electromagnetic fields
142199_i.JPG: SEAANGEL SA14, test set-up immunity test for high frequency electromagnetic fields
142199_m.JPG: SEAANGEL SA14, test set-up electrostatic discharge immunity