

EMI - TEST REPORT

- FCC Part 15B -



Test Report No. :	T35704-00-08KJ	22. November 2012 Date of issue
--------------------------	-----------------------	------------------------------------

Type / Model Name : LOG RB-3-1-M

Product Description : Wireless reader for loggers

Applicant : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-lann-Str. 6

96148 BAUNACH, GERMANY

Manufacturer : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-lann-Str. 6

96148 BAUNACH, GERMANY

Licence holder : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-lann-Str. 6

96148 BAUNACH, GERMANY

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
--	-----------------



The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

Contents

1 TEST STANDARDS	3
2 SUMMARY	4
2.1 General remarks	4
2.2 Final assessment	4
3 EQUIPMENT UNDER TEST	5
3.1 Power supply system utilised	5
3.2 Short description of the equipment under test (EUT)	5
4 TEST ENVIRONMENT	6
4.1 Address of the test laboratory	6
4.2 Environmental conditions	6
4.3 Statement of the measurement uncertainty	6
4.4 Measurement protocol for FCC	7
5 TEST CONDITIONS AND RESULTS	9
5.1 Conducted emission	9
5.2 Radiated emission	13
6 USED TEST EQUIPMENT AND ACCESSORIES	16
7 Photo documentation	17
7.1 External photos of the EUT	17
7.2 Internal photos of the EUT	27

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart A - General (September, 2011)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (September, 2011)

Part 15, Subpart B, Section 15.107	AC Line conducted emission	<input type="checkbox"/> Class A device	<input checked="" type="checkbox"/> Class B device
Part 15, Subpart B, Section 15.109	Radiated emission, general requirements		

ANSI C63.4: 2003

Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

CISPR 16-4-2: 2003

Uncertainty in EMC measurement

CISPR 22: 2005
EN 55022: 2006

Information technology equipment

2 SUMMARY

2.1 General remarks

The measurement has been performed in receive mode.

2.2 Final assessment

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 30. November 2011

Testing concluded on : 05. June 2012

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl. Ing.(FH)
Manager: Radio Group

Josef Knab
Radio Senior Expert

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Internal Power supply voltage : 7.2 V DC (Li-ion rechargeable battery)

AC/DC Adapter supply voltage : $V_{\text{nom}} = 12.0 \text{ V}$
 $V_{\text{min}} = 10.2 \text{ V}$
 $V_{\text{max}} = 13.8 \text{ V}$

Max. current: TX mode 96 mA
RX mode 27 mA

3.2 Short description of the equipment under test (EUT)

The Reader is a portable device which is used to communicate with the other devices of the Sebalog N3 system. The Reader can be used as RF interface for a computer or as a standalone device to read out the measured data of a Logger.

The communication is done at a frequency of 913 MHz. The Reader has an external TNC socket to connect two different antennas. One for normal use in handheld mode and one for vehicle mount.

Number of tested samples: 1
Serial number: 1000041983

EuT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- cont. RX mode

-

-

EuT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- Lifebook Fujitsu Siemens

Model : C1410

-

Model :

-

Model :

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 °C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production processes may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the EUT.

4.4 Measurement protocol for FCC

4.4.1 General information

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 Details of test procedures

4.4.2.1 General standard information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.3 Conducted emission

4.4.3.1 Description of measurement

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}) \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EuT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50Ω / $50 \mu\text{H}$ (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.4.4 Radiated emission (electrical field 30 MHz - 1 GHz)

4.4.4.1 Description of measurement

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. The antenna is positioned in horizontal polarisation and is repeated vertically. To locate maximum emission from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees.

The final level in dB μ V/m is calculated by add the antenna correction factor and cable loss factor (dB) on the reading from the EMI receiver (dB μ V). The FCC or CISPR limit is subtracted from this result in order to provide the delta to limit listed in the measurement protocol.

Example:

Frequency (MHz)	Reading level (dB μ V)	+	Correction Factor (dB/m)	=	Level (dB μ V/m)	-	CISPR Limit (dB μ V/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.5 Radiated emission (electrical field 1 GHz - 40 GHz)

4.4.5.1 Description of measurement

Radiated emission from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emission under better uncertainty and is calculated to the specified test distance.

5 TEST CONDITIONS AND RESULTS

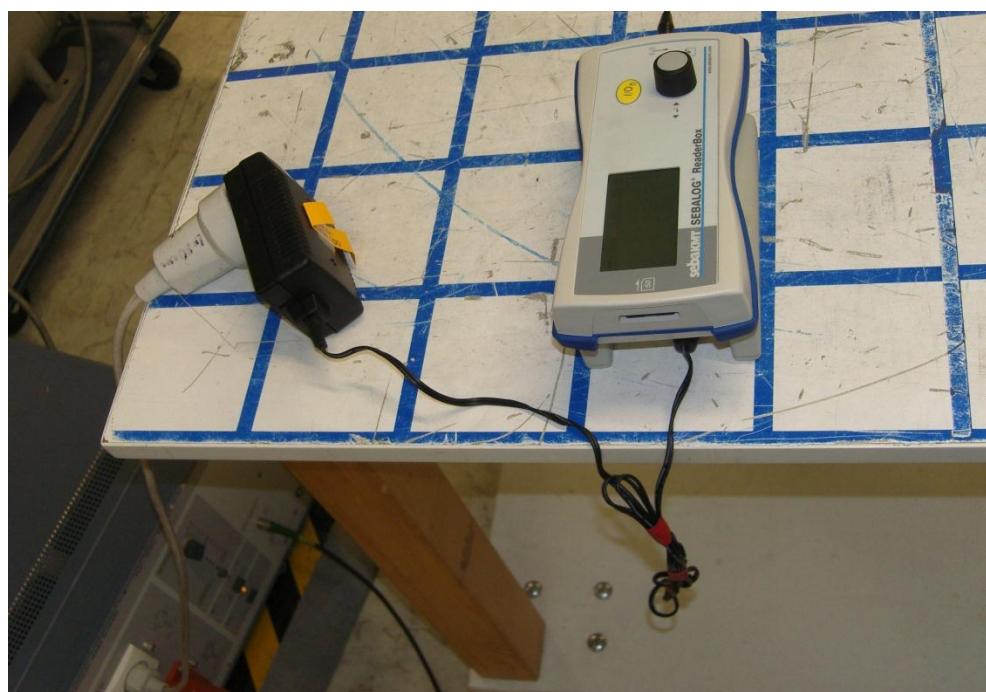
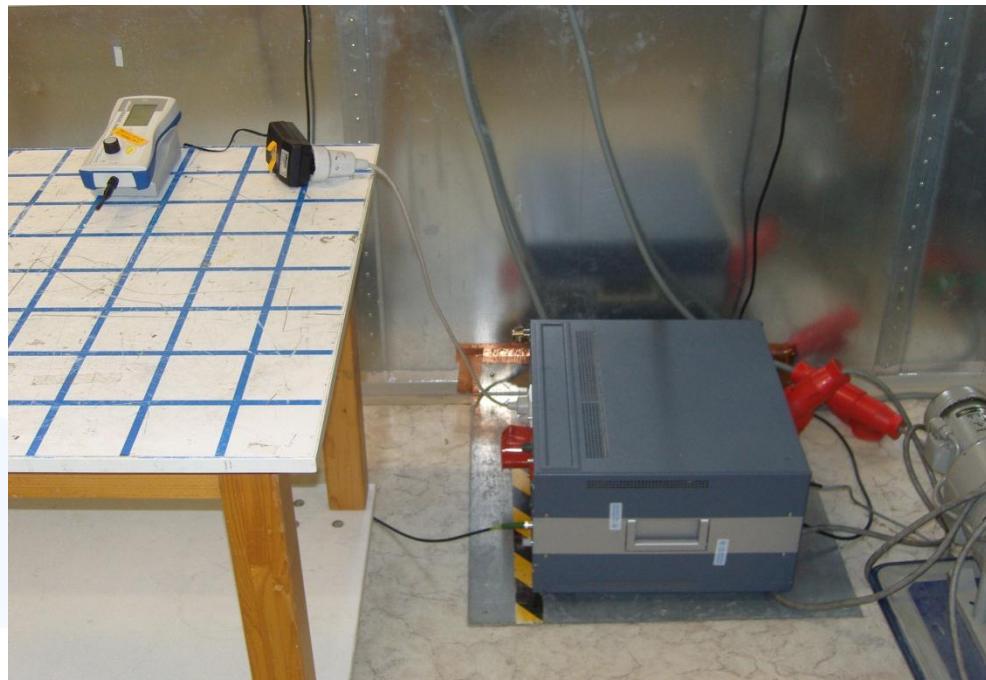
5.1 Conducted emission

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15, Section 15.107(a):

Except for Class A devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin > 10 dB

Limit according to FCC Part 15, Section 15.107(a):

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.

Remarks: For detailed test result please refer to following test protocols.

5.1.6 Test protocol

Test point: L1
Operation mode: cont. RX mode
Remarks: -

Result: passed

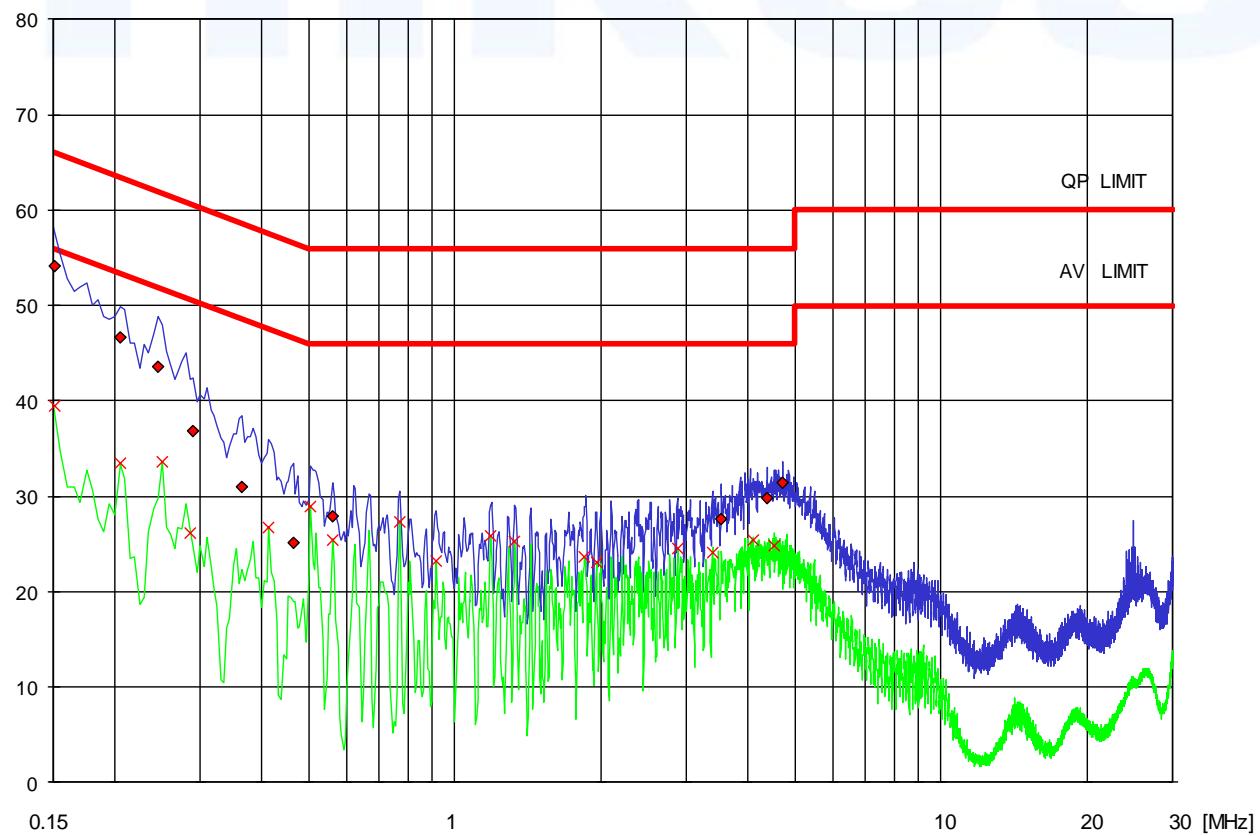
Freq kHz	QP- L dB[µV]	D -Limit QP [dB]	Freq kHz	AV-L dB[µV]	D -Limit AV [dB]
150	54,2	-11,8	150	39,5	-16,5
205	46,6	-16,8	205	33,5	-19,9
245	43,6	-18,3	250	33,7	-18,1
290	36,8	-23,7	285	26,2	-24,5
365	31	-27,6	415	26,8	-20,7
465	25,2	-31,4	505	29	-17,0
560	27,9	-28,1	560	25,5	-20,5
3530	27,6	-28,4	770	27,4	-18,6
4390	29,8	-26,2	915	23,2	-22,8
4715	31,5	-24,5	1185	25,9	-20,1
			1330	25,3	-20,7
			1850	23,6	-22,4
			1955	23,1	-22,9
			2875	24,5	-21,5
			3385	24,1	-21,9

dB [μ V]

Legend

PK:  AV: 

Detector: QP: ♦ AV: ✗



Test point: N
Operation mode: cont RX mode
Remarks: -

Result: passed

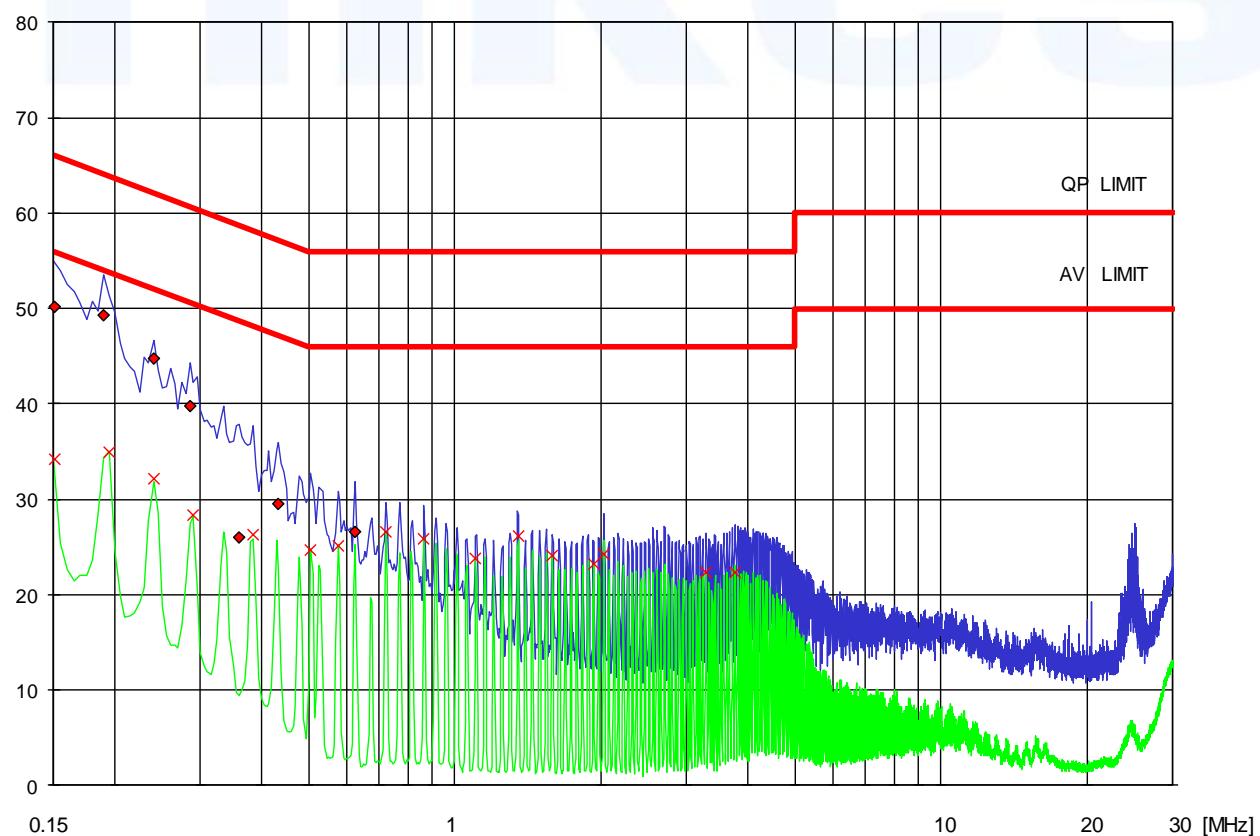
Freq kHz	QP- L dB[µV]	D -Limit QP [dB]	Freq kHz	AV-L dB[µV]	D -Limit AV [dB]
150	50,2	-15,8	150	34,2	-21,8
190	49,3	-14,7	195	35	-18,8
240	44,7	-17,4	240	32,1	-20,0
285	39,8	-20,9	290	28,3	-22,2
360	26	-32,7	385	26,3	-21,9
435	29,6	-27,6	505	24,7	-21,3
625	26,6	-29,4	575	25,2	-20,8
			720	26,6	-19,4
			865	25,8	-20,2
			1105	23,8	-22,2
			1350	26,2	-19,8
			1590	24,1	-21,9
			1930	23,3	-22,7
			2025	24,3	-21,7
			3285	22,4	-23,6

dB [μ V]

Legend

PK: AV:

Detector: QP: ♦ AV: ✗



5.2 Radiated emission

For test instruments and accessories used see section 6 Part **SER 2, SER 3**.

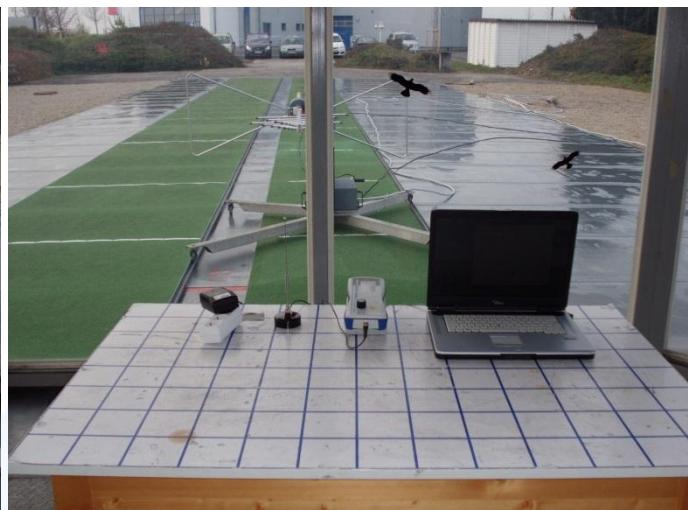
5.2.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 2
Test distance: 3 m

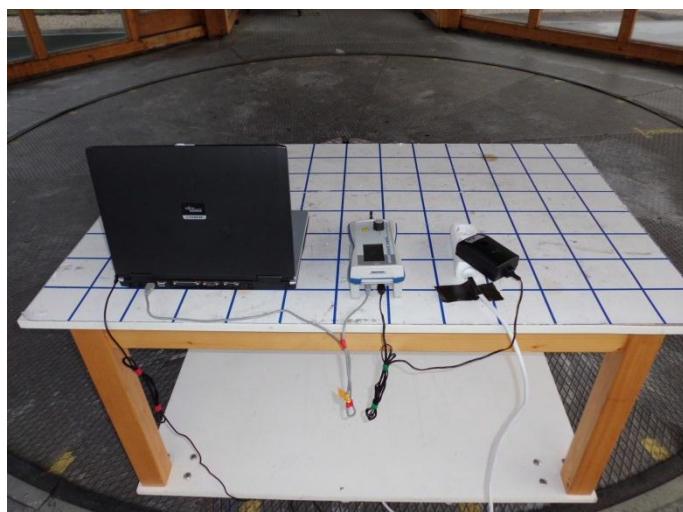
5.2.2 Photo documentation of the test setup



Dipole antenna



Magnetic socket antenna



Dipole antenna



Magnetic socket antenna



Dipole antenna



Magnetic socket antenna

5.2.3 Applicable standard

According to FCC Part 15B, Section 15.109 (a):

Except for Class A digital devices, the field strength of radiated emission from unintentional radiators at a distance of 3 m shall not exceed the given limit.

5.2.4 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average/quasipeak limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise the emission will be measured in average/quasipeak mode again and reported.

Instrument settings:

30 MHz – 1000 MHz:	RBW: 120 kHz
1000 MHz – 18000 MHz	RBW: 1 MHz

5.2.5 Test result

f < 1 GHz:

Dipole antenna / Magnetic socket antenna

Frequency (MHz)	Level QP (dB μ V)	Level AV (dB μ V)	Bandwidth (kHz)	Correct. factor (dB)	Level QP (dB μ V/m)	Level AV (dB μ V/m)	Limit (dB μ V/m)	Delta (dB)
39.99	12.50	-	120.00	14.10	26.60	-	40.00	-13.40
130.30	5.90	-	120.00	12.30	18.20	-	43.50	-25.30
192.20	10.10	-	120.00	11.50	21.60	-	43.50	-21.90
288.30	7.00	-	120.00	15.30	22.30	-	46.00	-23.70
384.40	3.20	-	120.00	18.20	21.40	-	46.00	-24.60
600.00 *	0.10	-	120.00	24.00	24.10	-	46.00	-21.90

*) Ambient noise

f > 1 GHz:

Dipole antenna / Magnetic socket antenna

Frequency (MHz)	Level PK (dB μ V)	Level AV (dB μ V)	Bandwidth (kHz)	Correct. factor (dB)	Level PK (dB μ V/m)	Level AV (dB μ V/m)	Limit AV (dB μ V/m)	Delta (dB)
1000 *	47.0	-	1000	-15.1	31.9	-	54.0	-22.1
2000 *	48.4	-	1000	-12.0	36.4	-	54.0	-17.6
3000 *	47.0	-	1000	-9.5	37.5	-	54.0	-16.5
4000 *	37.9	-	1000	3.5	41.4	-	54.0	-12.6
5000 *	37.7	-	1000	3.8	41.5	-	54.0	-12.5

*) Ambient noise

Limit according to FCC Part 15B, Section 15.109(a):

Frequency (MHz)	Limit (μ V/m)	Limit (dB μ V/m)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

Remarks: The measurement was performed according to FCC Part 15A, Section 15.33(b), up to 5 GHz.

For radiated emission measurement there are no differences between both antenna types.

6 USED TEST EQUIPMENT AND ACCESSORIES

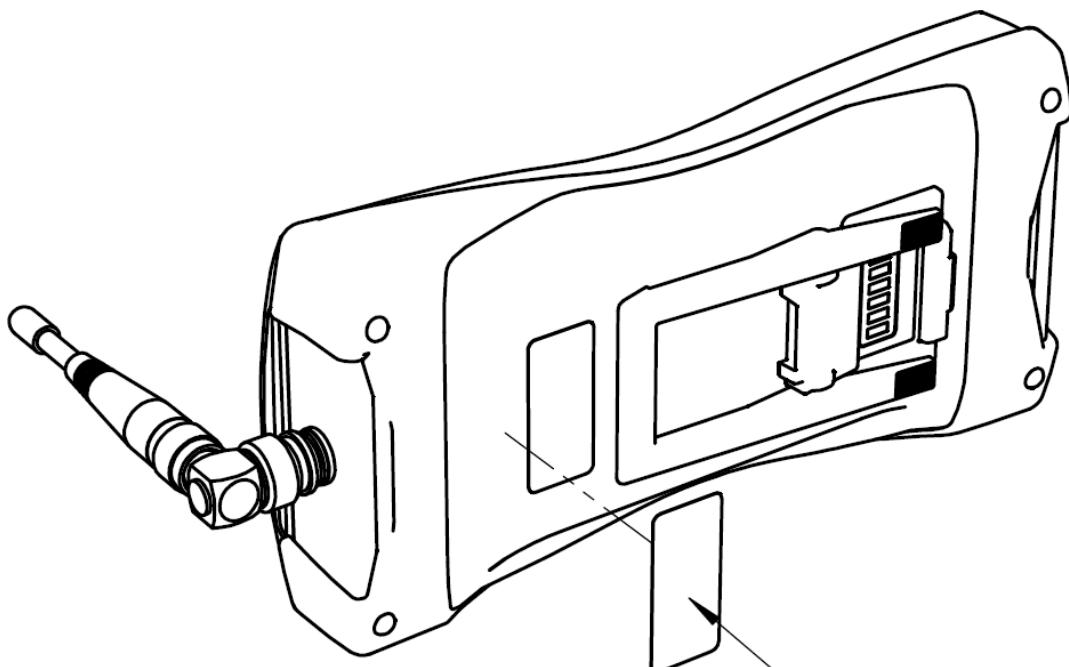
All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model / Type	Kind of Equipment	Manufacturer	Equipment No.	
A 4	ESHS 30	02-02/03-05-002	11/07/2013	11/07/2012	
	ESH 2 - Z 5	02-02/20-05-004	12/05/2013	12/05/2012	12/03/2013 12/09/2012
	N-4000-BNC	02-02/50-05-138			
	N-1500-N	02-02/50-05-140			
	ESH 3 - Z 2	02-02/50-05-155		02/04/2013	02/10/2012
	SP 103 /3.5-60	02-02/50-05-182			
SER 2	ESVS 30	02-02/03-05-006	26/06/2013	26/06/2012	
	VULB 9168	02-02/24-05-005	16/03/2013	16/03/2012	08/04/2013 08/10/2012
	S10162-B	02-02/50-05-031			
	NW-2000-NB	02-02/50-05-113			
	KK-EF393/U-16N-21N_20m	02-02/50-12-018			
SER 3	FSP 30	02-02/11-05-001	05/10/2012	05/10/2011	
	AFS4-01000400-10-10P-4	02-02/17-05-003			
	AMF-4F-04001200-15-10P	02-02/17-05-004			
	AFS5-12001800-18-10P-6	02-02/17-06-002			
	3117	02-02/24-05-009	16/02/2013	16/02/2012	
	WHJS 1000-10EE	02-02/50-05-070			
	Sucoflex N-1600-SMA	02-02/50-05-073			
	Sucoflex N-2000-SMA	02-02/50-05-075			

7 Photo documentation

7.1 External photos of the EUT

Label view / lable placement



FCC IDENT LABEL OV8-LOGRB3-1
Druckdatei: LOG RB-FCC.lbl

FCC ID: OV8-LOGRB3-1

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Test setup overview
(with AC/DC power supply, docking station and dipole antenna)



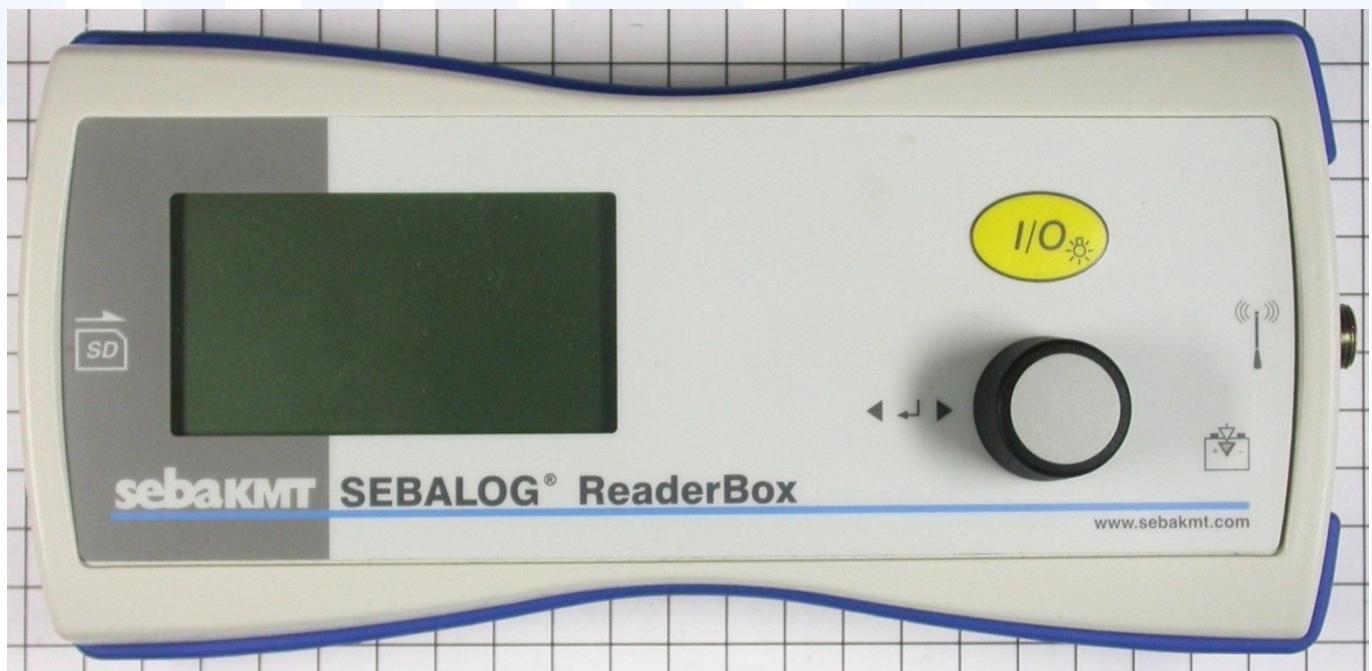
Test setup overview
(with AC/DC power supply, docking station and magnetic socket antenna)



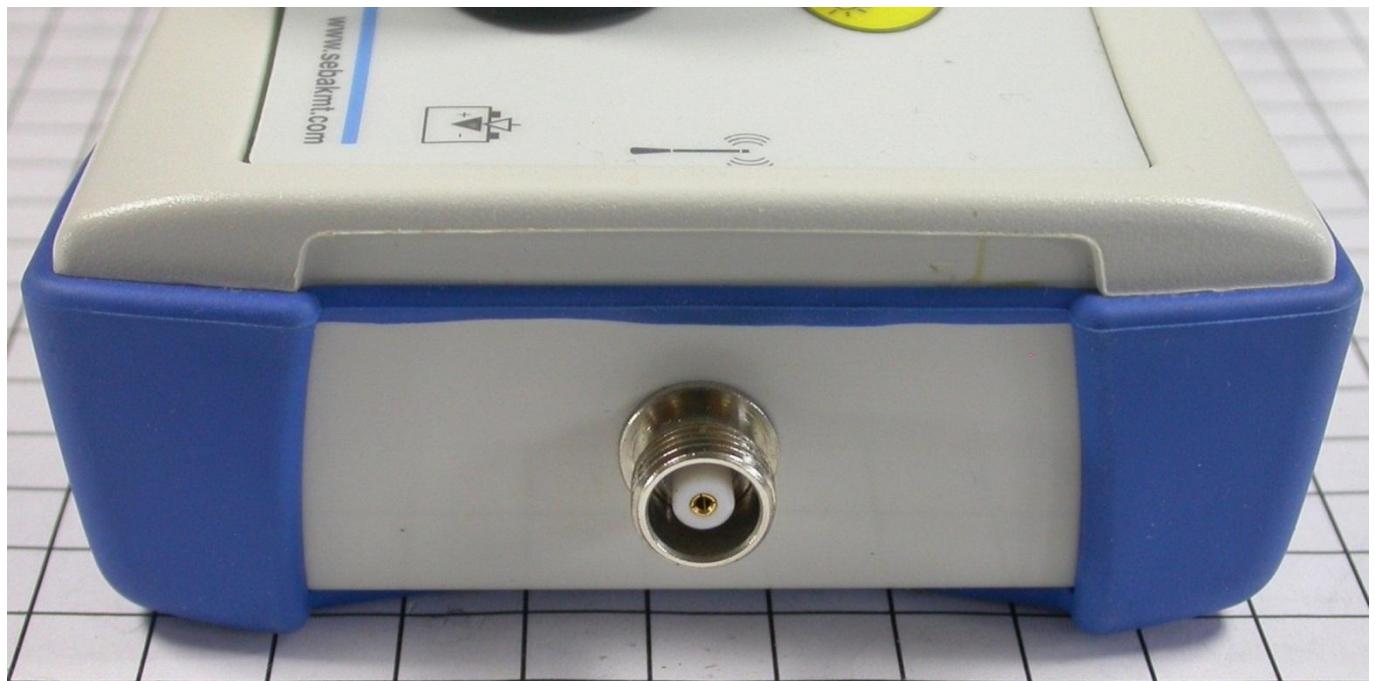
Bottom view
(Label for European market)



Top view



Front view



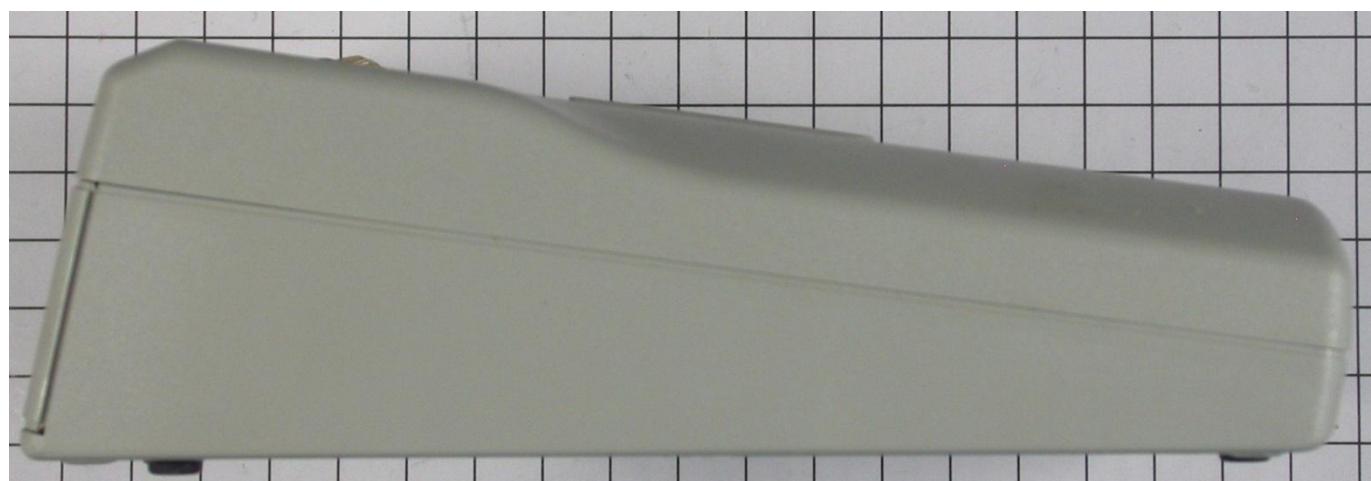
Rear view



Top view – docking station



Side view – docking station



Bottom view – docking station



Rear view – docking station



mikes

Top view – AC/DC adapter



Bottom view – AC/DC adapter



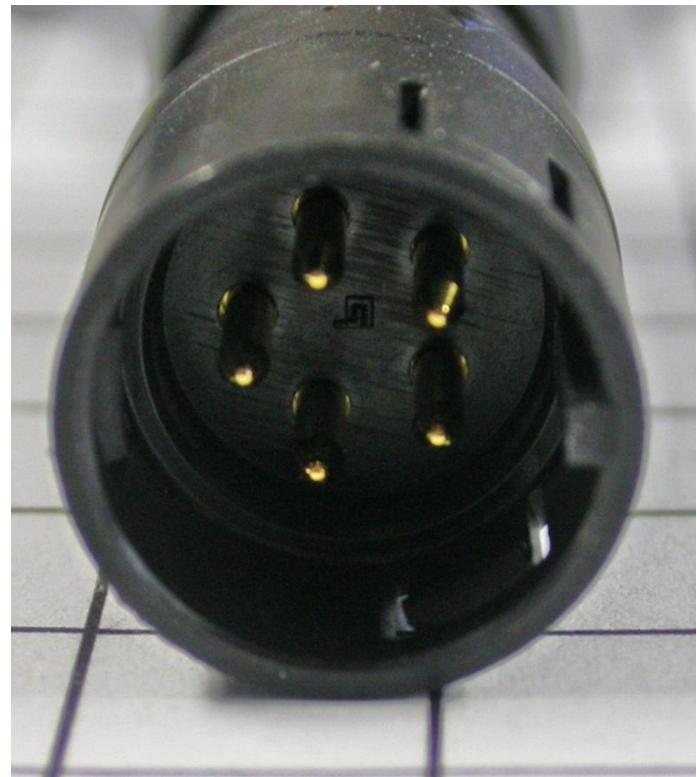
Side view – AC/DC adapter



Top view – DC plug

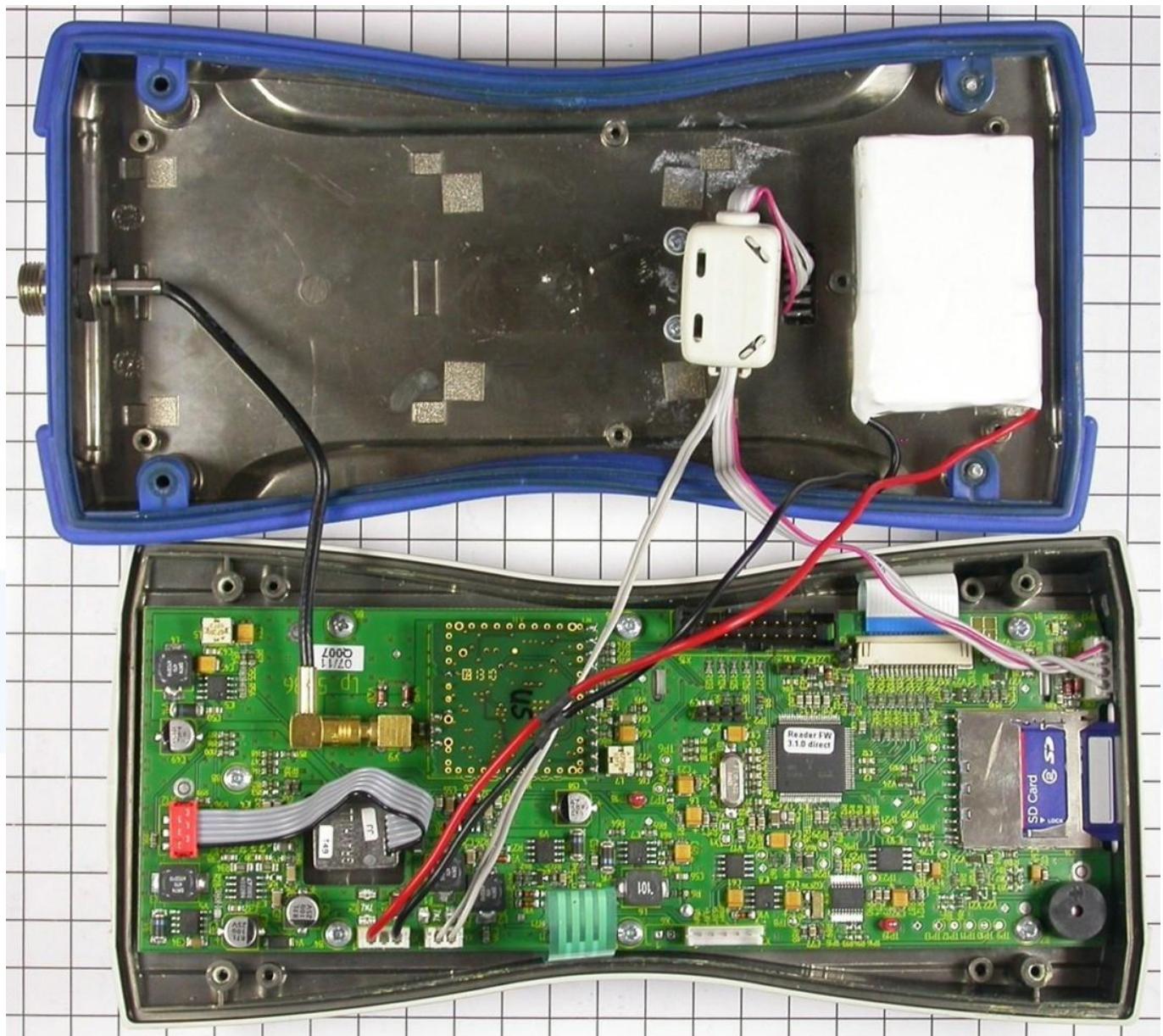


Front view – DC plug



7.2 Internal photos of the EUT

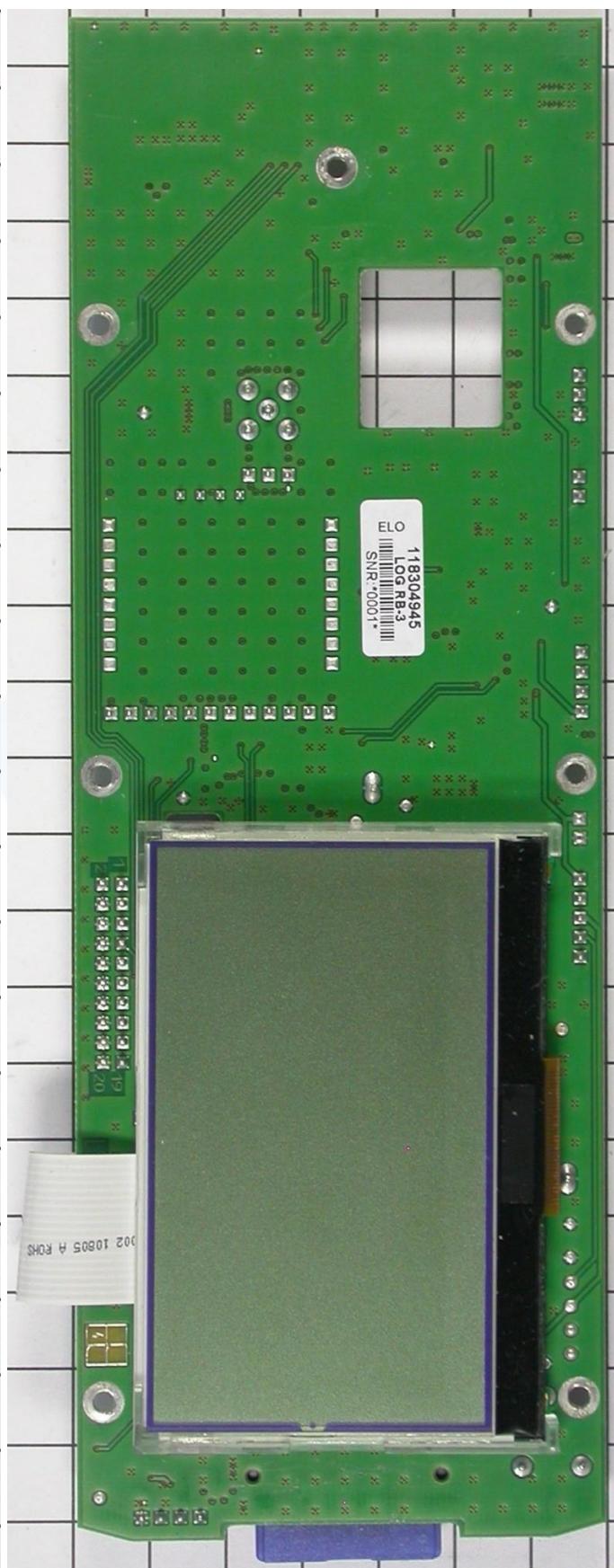
Open casing



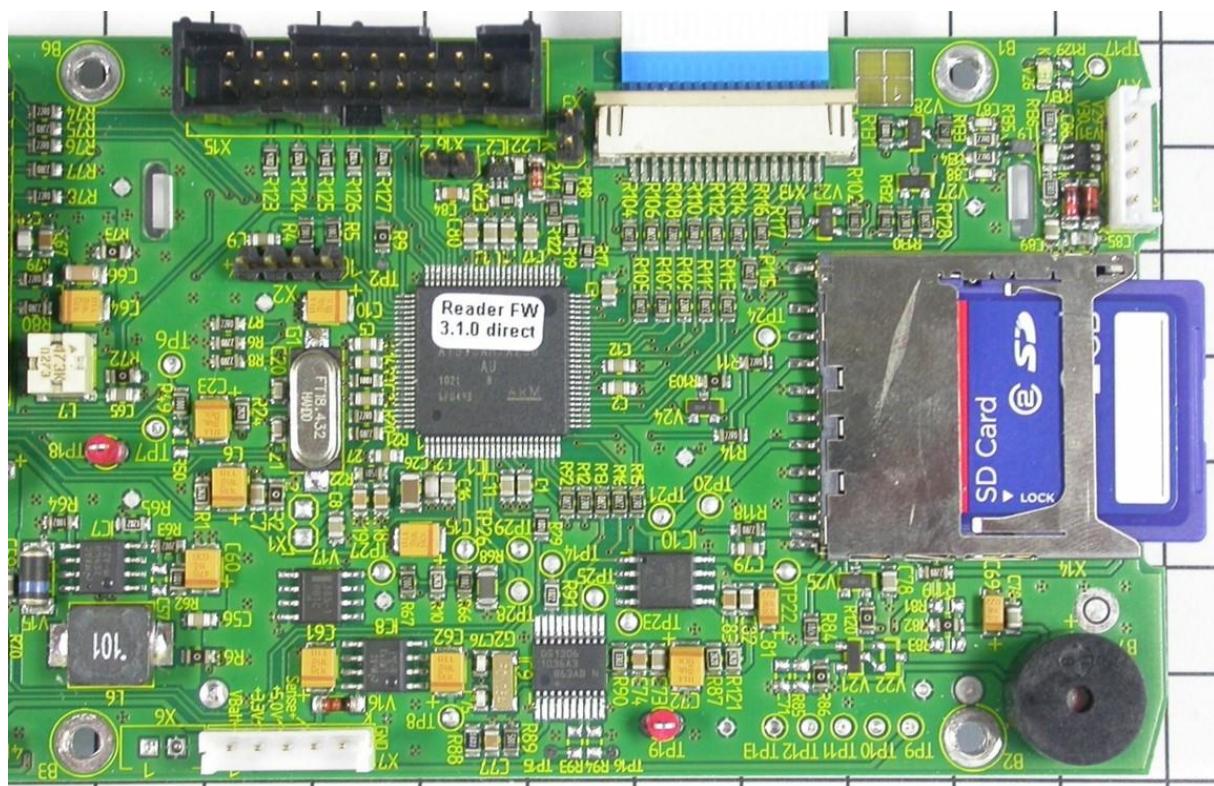
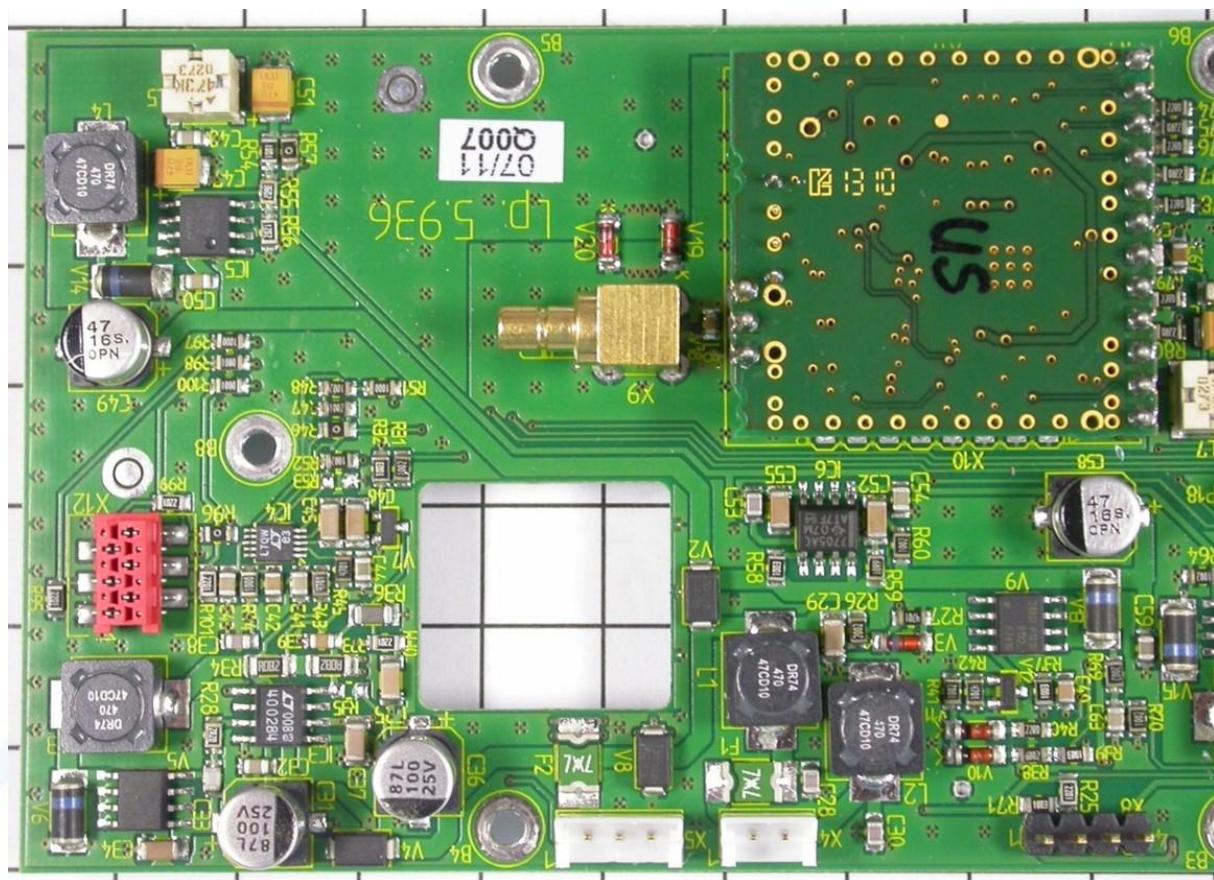
PCB top view



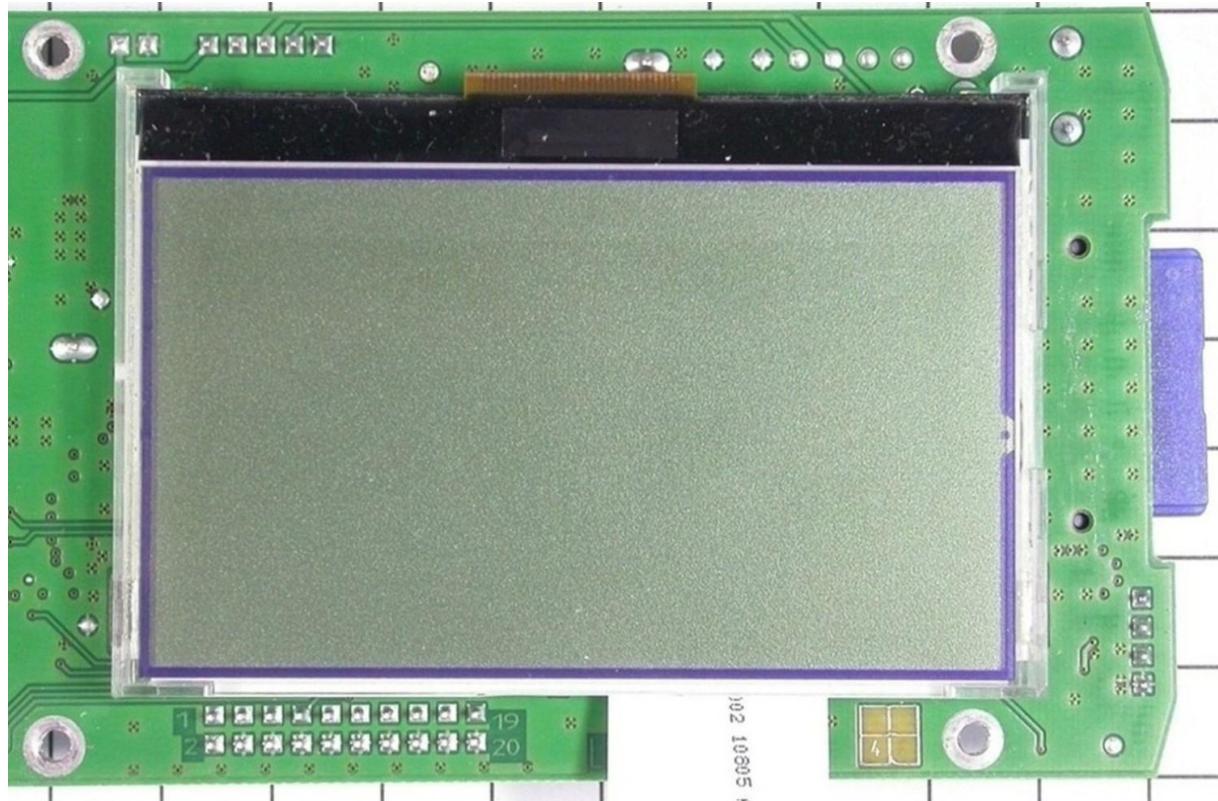
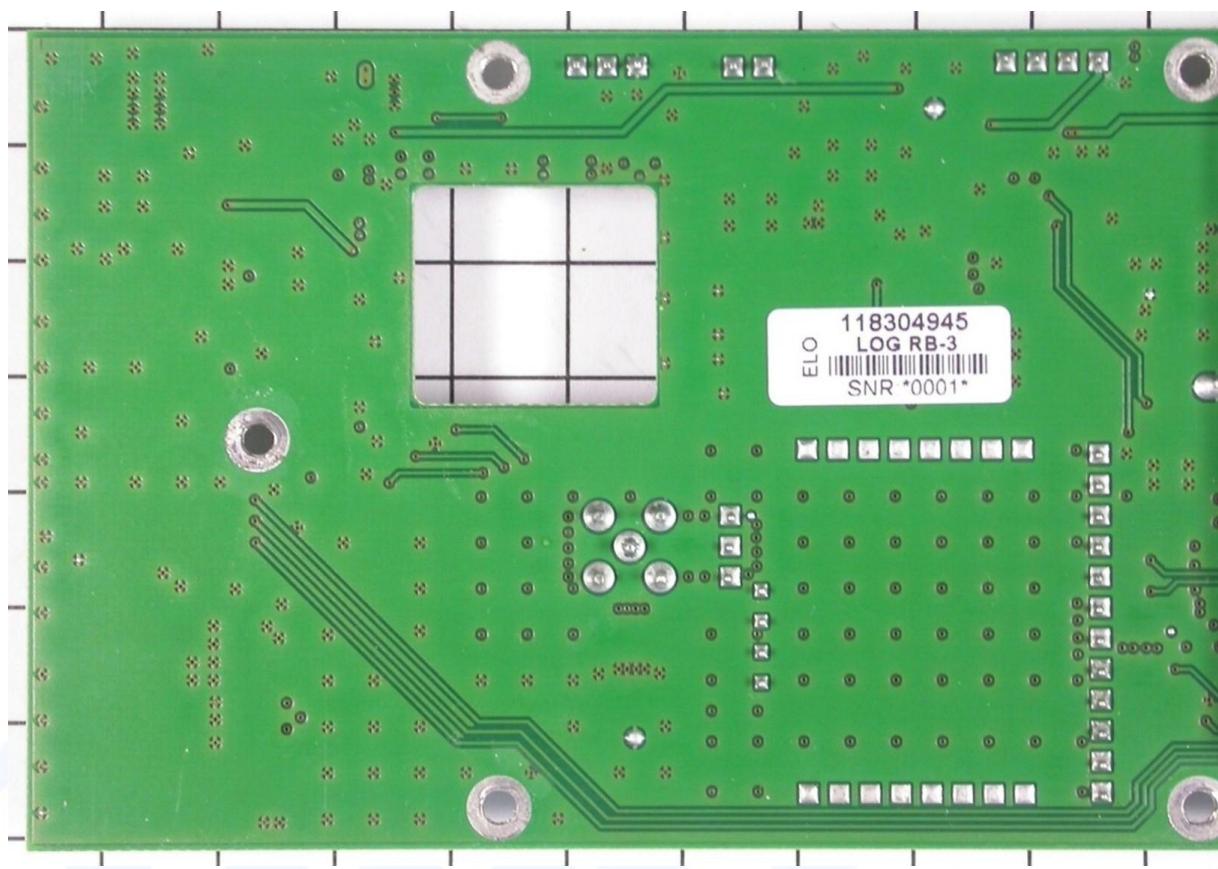
PCB bottom view



PCB top view (zoom)



PCB bottom view (zoom)



Top view – RF module



Top view – RF module

