EMI – TEST REPORT

- FCC Part 15B -

Deutsche Akkreditierungsstelle D-PL-12030-01-01

Test Report No. :	**T35704-00-07KJ**	22. November 2012 Date of issue

Type / Model Name : LOG CDR-3-M

Product Description : Portable programming, reading, analysing and recording device for loggers

Applicant : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-Iann-Str. 6
96148 BAUNACH, GERMANY

Manufacturer : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-Iann-Str. 6
96148 BAUNACH, GERMANY

Licence holder : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-Iann-Str. 6
96148 BAUNACH, GERMANY

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

Contents

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 ☐ Class A device ☒ 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:

Klaus Gegenfurtner
I confirm the correctness and Integrity of this documents
2012.11.22 13:54:21 +01'00'

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

Tested by:

Josef Knab
I'm the autor of this document
2012.11.22 13:20:42 +01'00'

Josef Knab
Radio Senior Expert

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Internal Power supply voltage : 7.4 V DC (Li-ion rechargeable battery)

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

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

3.2 Short description of the equipment under test (EUT)

The Commander is portable device which is used to communicate with the other devices of the Sebalog N3 system. With the commander it is possible to program/configure the Logger, Repeater and the GSM-Box. After programming a Logger for measurement, the measured data can be read out and analysed with the Commander.
The communication is done at a frequency of 913 MHz. The commander 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: 0815000547

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:

- _____ Model : _____
- _____ 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 dBµV, 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 dBµV and µV, the following conversions apply:

$$dB\mu V = 20*\log(\mu V)$$
$$\mu V = 10\text{^}(dB\mu V/20)$$

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 50 Ω / 50 µH (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 dBµV/m is calculated by add the antenna correction factor and cable loss factor (dB) on the reading from the EMI receiver (dBµV). 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		Reading level		Correction Factor		Level		CISPR Limit		Delta
(MHz)		(dBµV)		(dB/m)		(dBµV/m)		(dBµV/m)		(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

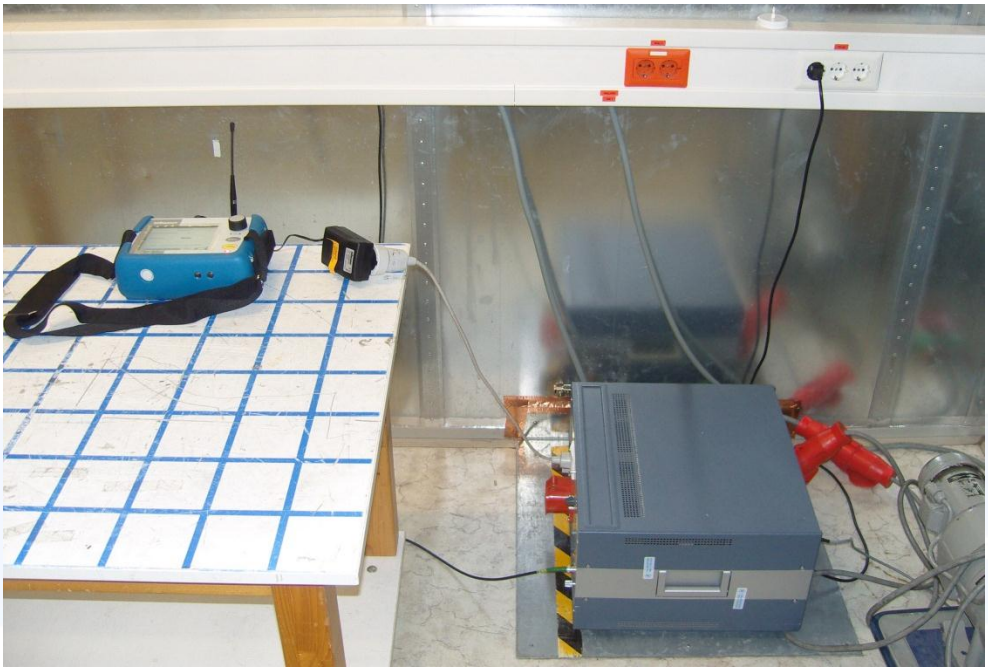
5.1 Conducted emission

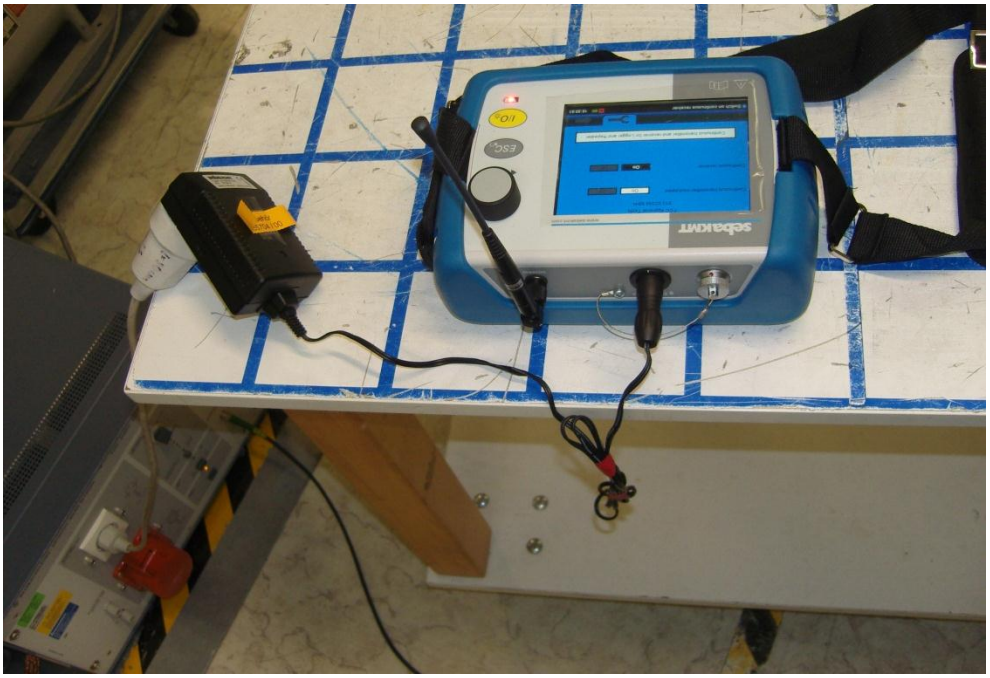
For test instruments and accessories used see section 6 Part **A 4.**

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 8.8 dB at 210 kHz

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

Frequency of emission (MHz)	Conducted limit (dBµV)	
	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.**

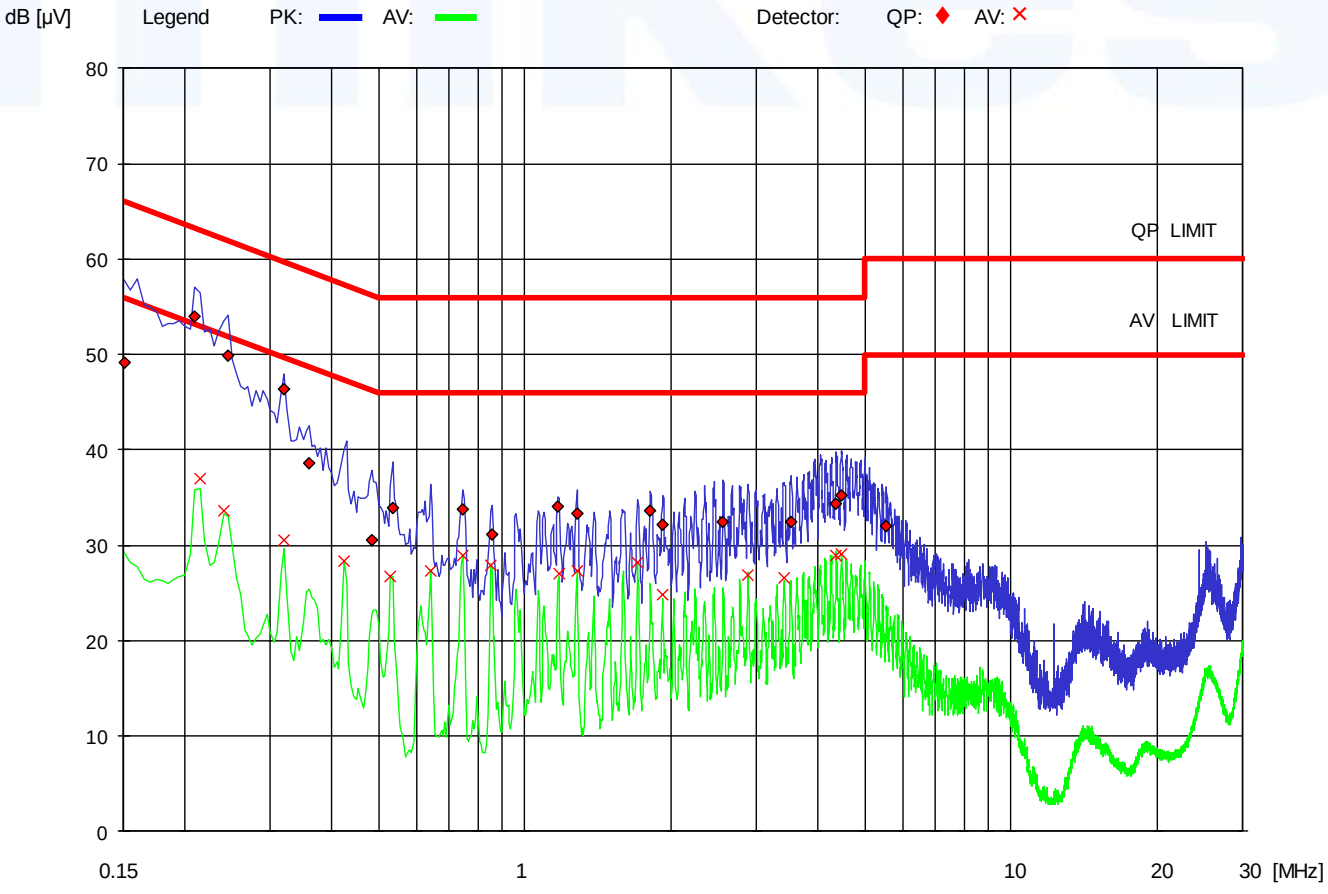
Remarks: For detailed test result please refer to following test protocols.

5.1.6 Test protocol

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

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
150	49,2	-16,8	215	37	-16,0
210	54	-9,2	240	33,6	-18,5
245	49,9	-12,0	320	30,6	-19,1
320	46,4	-13,3	425	28,3	-19,0
360	38,6	-20,1	530	26,8	-19,2
485	30,6	-25,7	640	27,3	-18,7
535	33,9	-22,1	745	29	-17,0
745	33,8	-22,2	850	27,9	-18,1
855	31,2	-24,8	1175	27	-19,0
1170	34	-22,0	1280	27,3	-18,7
1280	33,4	-22,6	1705	28,2	-17,8
1815	33,6	-22,4	1920	24,9	-21,1
1925	32,1	-23,9	2875	26,9	-19,1
2560	32,5	-23,5	3415	26,6	-19,4
3530	32,5	-23,5	4370	28,9	-17,1

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
4355	34,3	-21,7	4470	29,1	-16,9
4490	35,2	-20,8			
5535	32	-28,0			

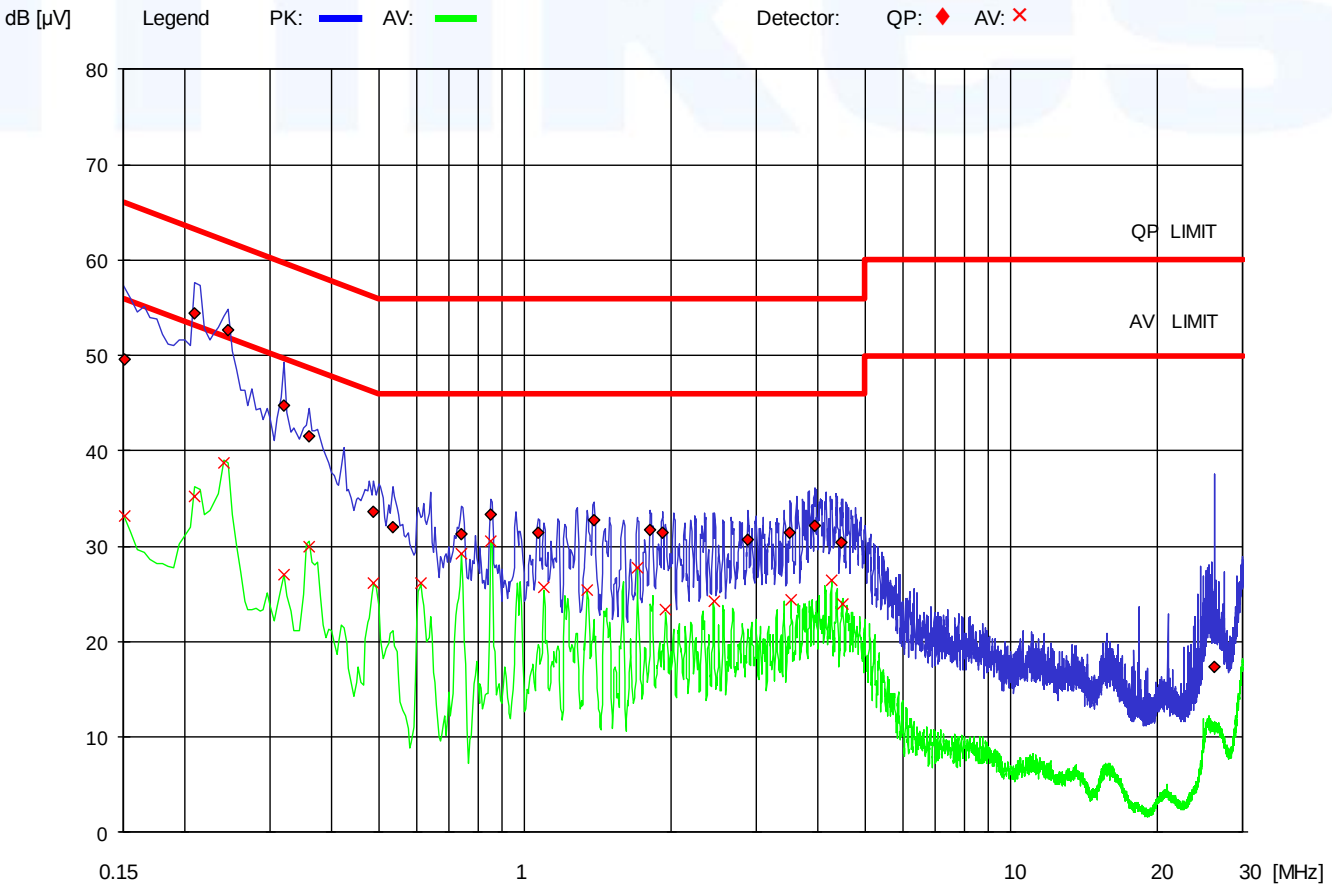


Test point: N
Operation mode: cont RX mode
Remarks: -

Result: passed

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
150	49,6	-16,4	150	33,2	-22,8
210	54,4	-8,8	210	35,3	-17,9
245	52,7	-9,2	240	38,7	-13,4
320	44,8	-14,9	320	27	-22,7
360	41,6	-17,1	360	29,9	-18,8
490	33,7	-22,5	490	26,2	-20,0
535	32	-24,0	610	26,1	-19,9
740	31,3	-24,7	740	29,2	-16,8
850	33,3	-22,7	850	30,6	-15,4
1065	31,5	-24,5	1095	25,7	-20,3
1385	32,8	-23,2	1340	25,4	-20,6
1810	31,7	-24,3	1705	27,8	-18,2
1920	31,4	-24,6	1950	23,4	-22,6
2880	30,7	-25,3	2445	24,3	-21,7
3515	31,4	-24,6	3530	24,4	-21,6

Freq	QP- L	D -Limit	Freq	AV-L	D -Limit
kHz	dB[µV]	QP [dB]	kHz	dB[µV]	AV [dB]
3950	32,1	-23,9	4270	26,5	-19,5
4490	30,4	-25,6	4500	24	-22,0
26165	17,4	-42,6			



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

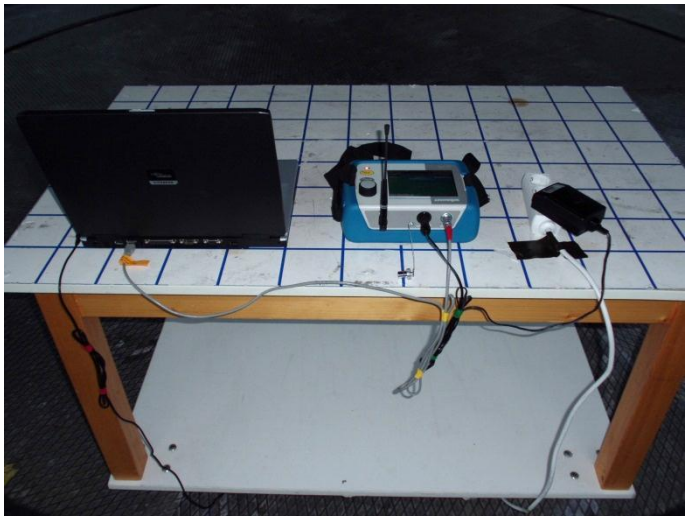
Test location: OATS 1
Test location: Anechoic chamber 2

Test distance: 3 m

5.2.2 Photo documentation of the test setup

Dipole antenna

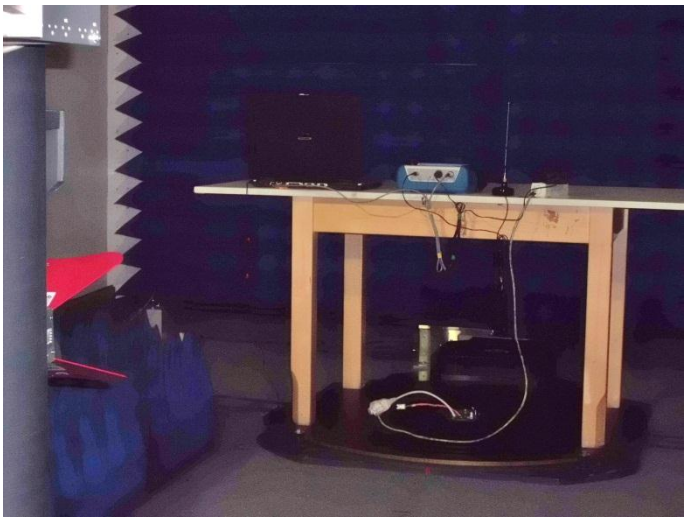
Magnetic socket antenna



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 (dBµV)	Level AV (dBµV)	Bandwidth (kHz)	Correct. factor (dB)	Level QP (dBµV/m)	Level AV (dBµV/m)	Limit (dBµV/m)	Delta (dB)
46.94	19.0	-	120	14.9	33.9	-	40.0	-6.1
174.38	18.9	-	120	13.0	31.9	-	43.5	-11.6
199.28	31.0	-	120	11.2	42.2	-	43.5	-1.3
224.19	32.1	-	120	12.3	44.4	-	46.0	-1.6
231.90	23.9	-	120	12.7	36.6	-	46.0	-9.4
274.00	21.3	-	120	14.9	36.2	-	46.0	-9.8
298.94	22.8	-	120	15.8	38.6	-	46.0	-7.4
373.64	18.5	-	120	17.9	36.4	-	46.0	-9.6
398.57	17.5	-	120	18.8	36.3	-	46.0	-9.7
597.86	12.4	-	120	24.2	36.6	-	46.0	-9.4
697.50	11.0	-	120	25.1	36.1	-	46.0	-9.9

f > 1 GHz:

Dipole antenna / Magnetic socket antenna

Frequency (MHz)	Level PK (dBµV)	Level AV (dBµV)	Bandwidth (kHz)	Correct. factor (dB)	Level PK (dBµV/m)	Level AV (dBµV/m)	Limit AV (dBµV/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 (µV/m)	Limit (dBµV/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

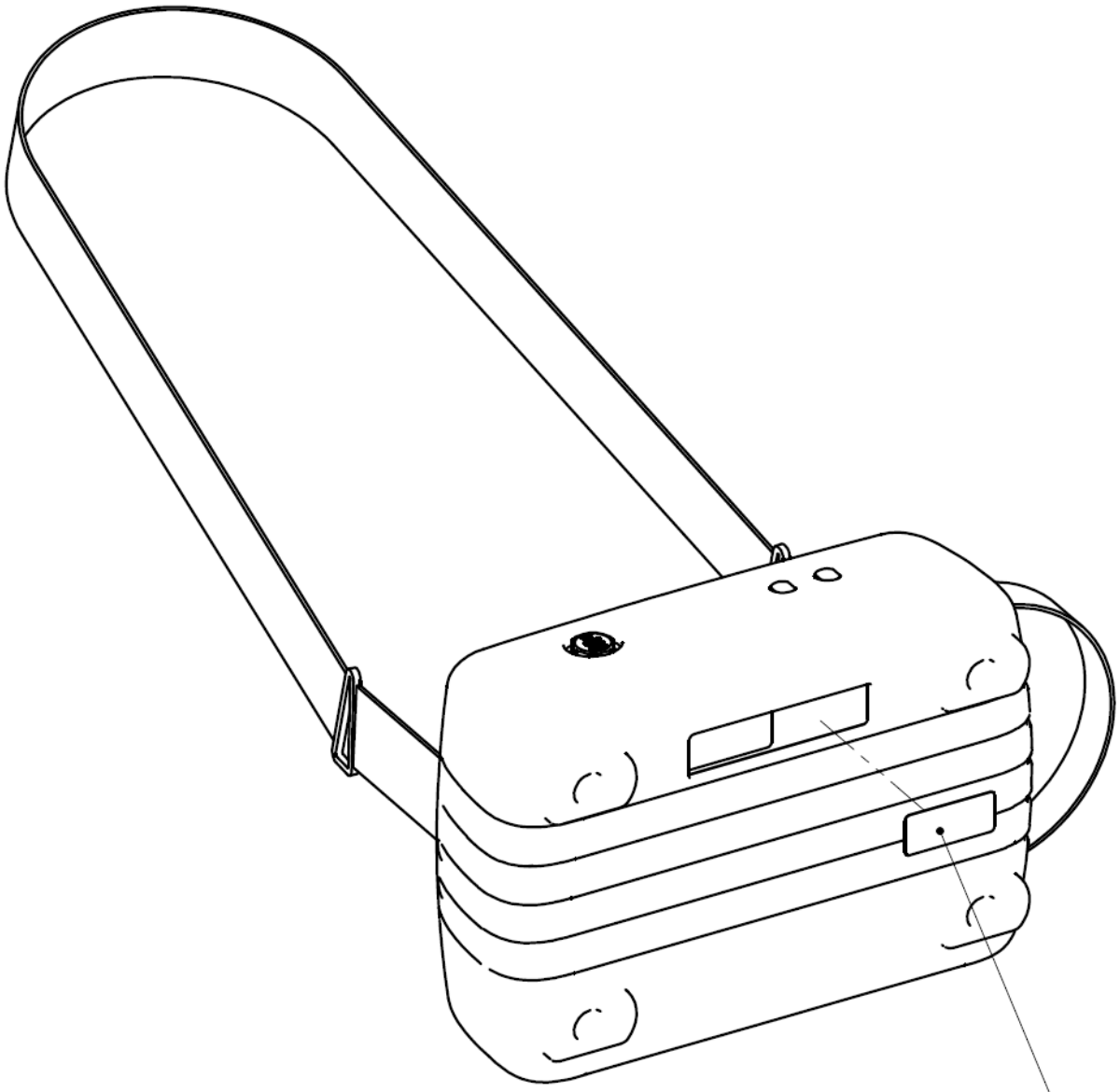
All test instruments used are calibrated and verified regularly. The calibration history is available on request.

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	12/05/2011	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	26/06/2012	26/06/2011		
	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	18/10/2012	18/10/2011		
	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				

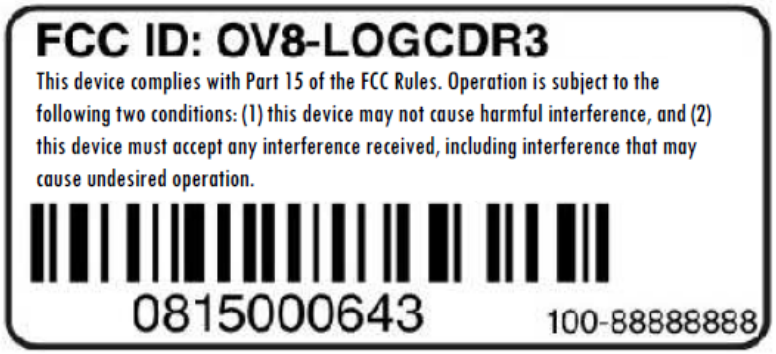
7 Photo documentation

7.1 External photos of the EUT

Label view / lable placement

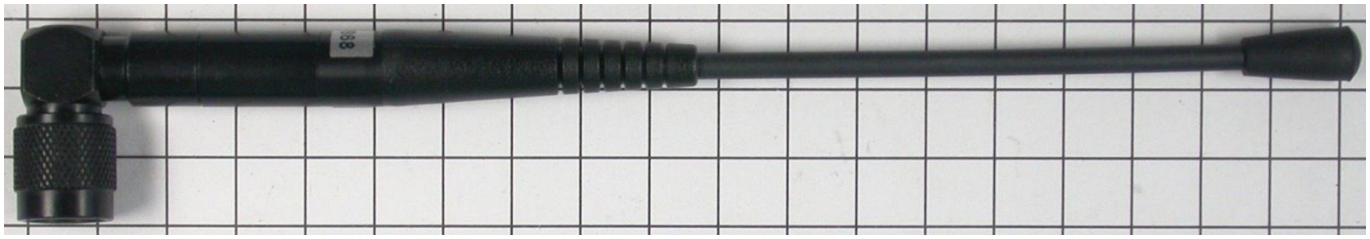


FCC IDENT LABEL OV8-LOGCDR3
Druckerdatei: SN_log_CDR3-M_FCC.lbl



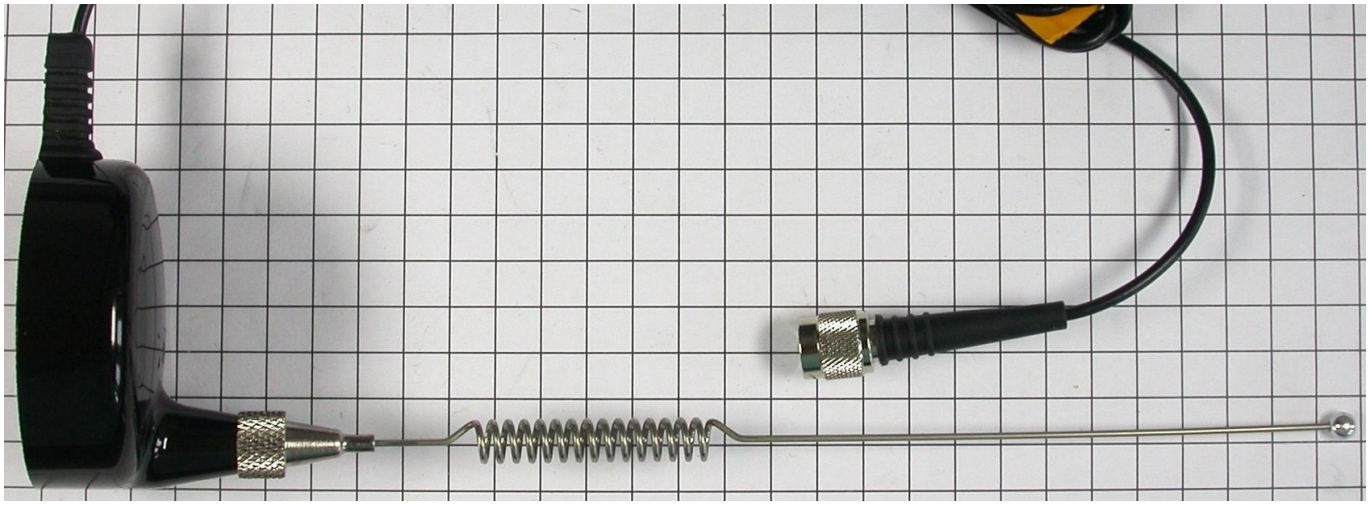
Test setup overview
(with AC/DC power supply and dipole antenna)

Dipole antenna (lambda ½)



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

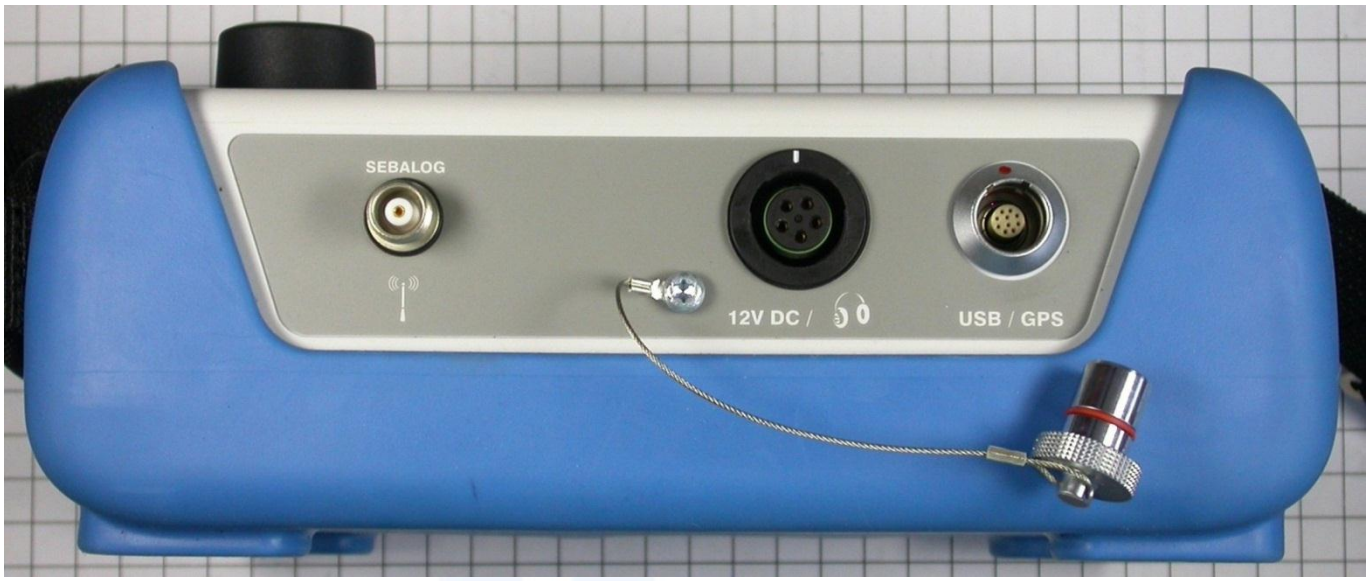
Magnetic socket antenna



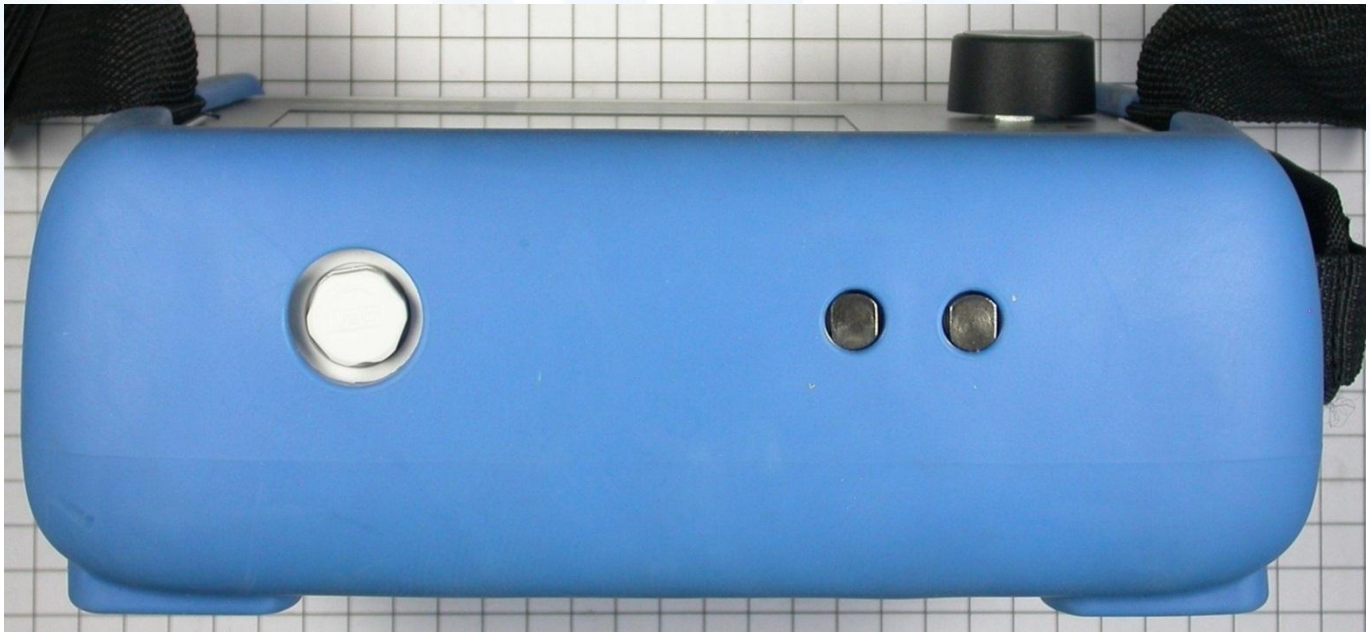
Bottom view
(Label for European market)

Top view (without protection cover)

Front view



Rear view



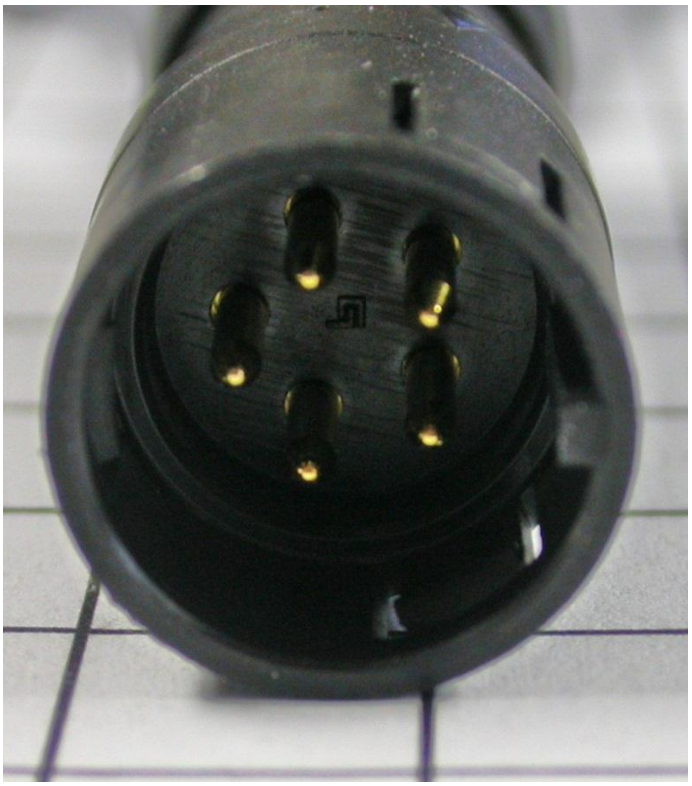
Top view – AC/DC adapter

Bottom view – AC/DC adapter

Side view – AC/DC adapter

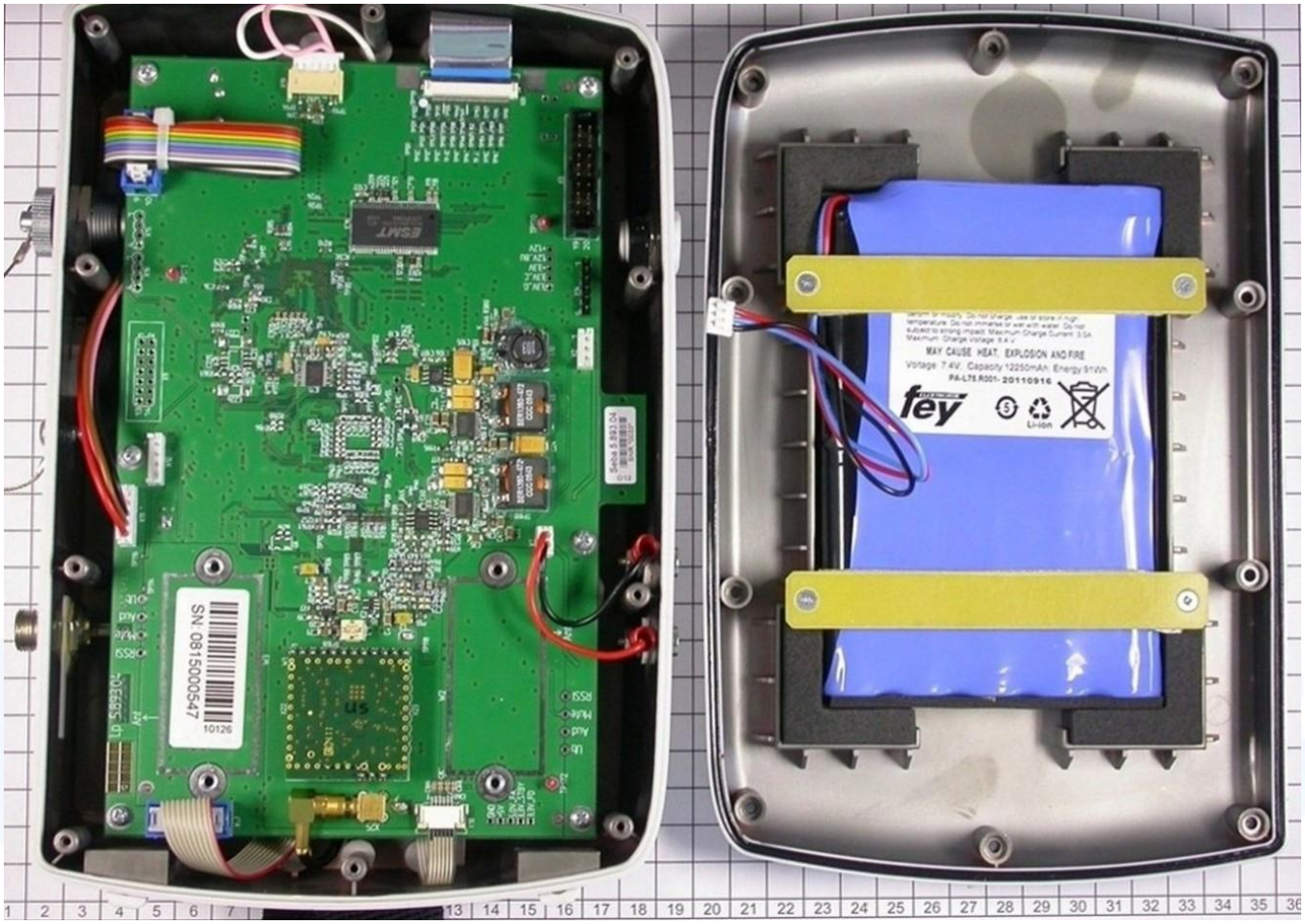
Top view – DC plug

Front view – DC plug



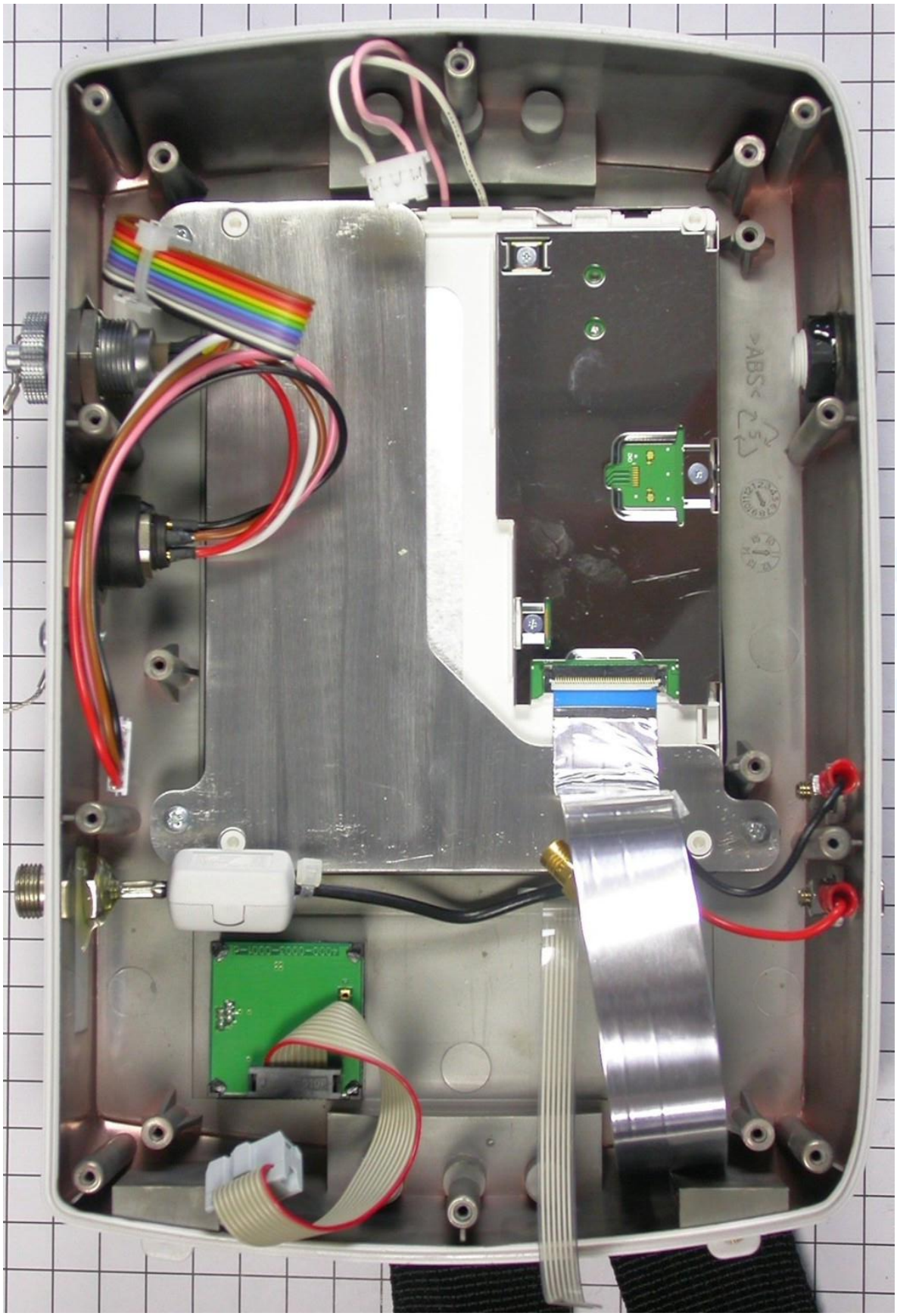
7.2 Internal photos of the EUT

Open casing

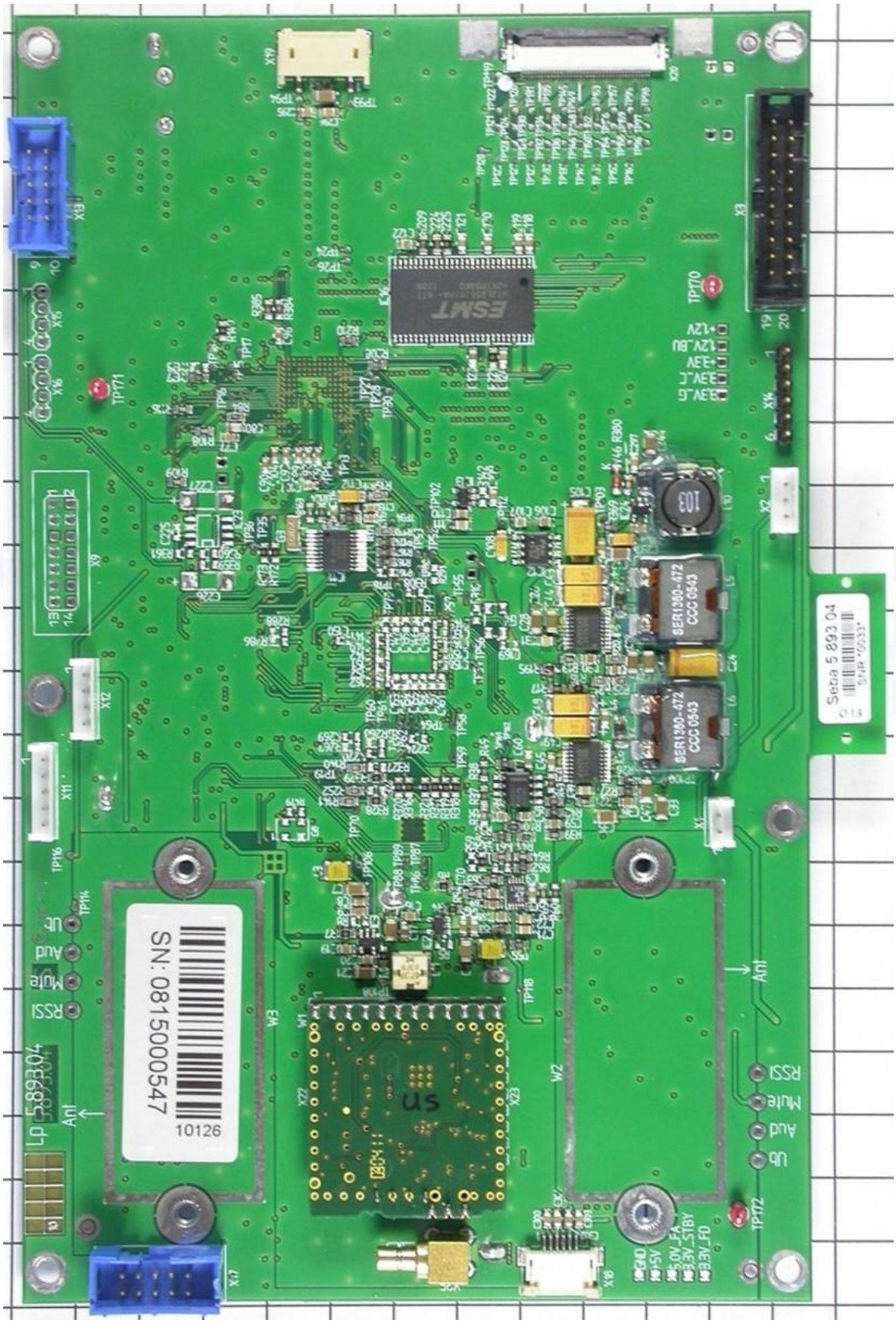


Label view – battery pack

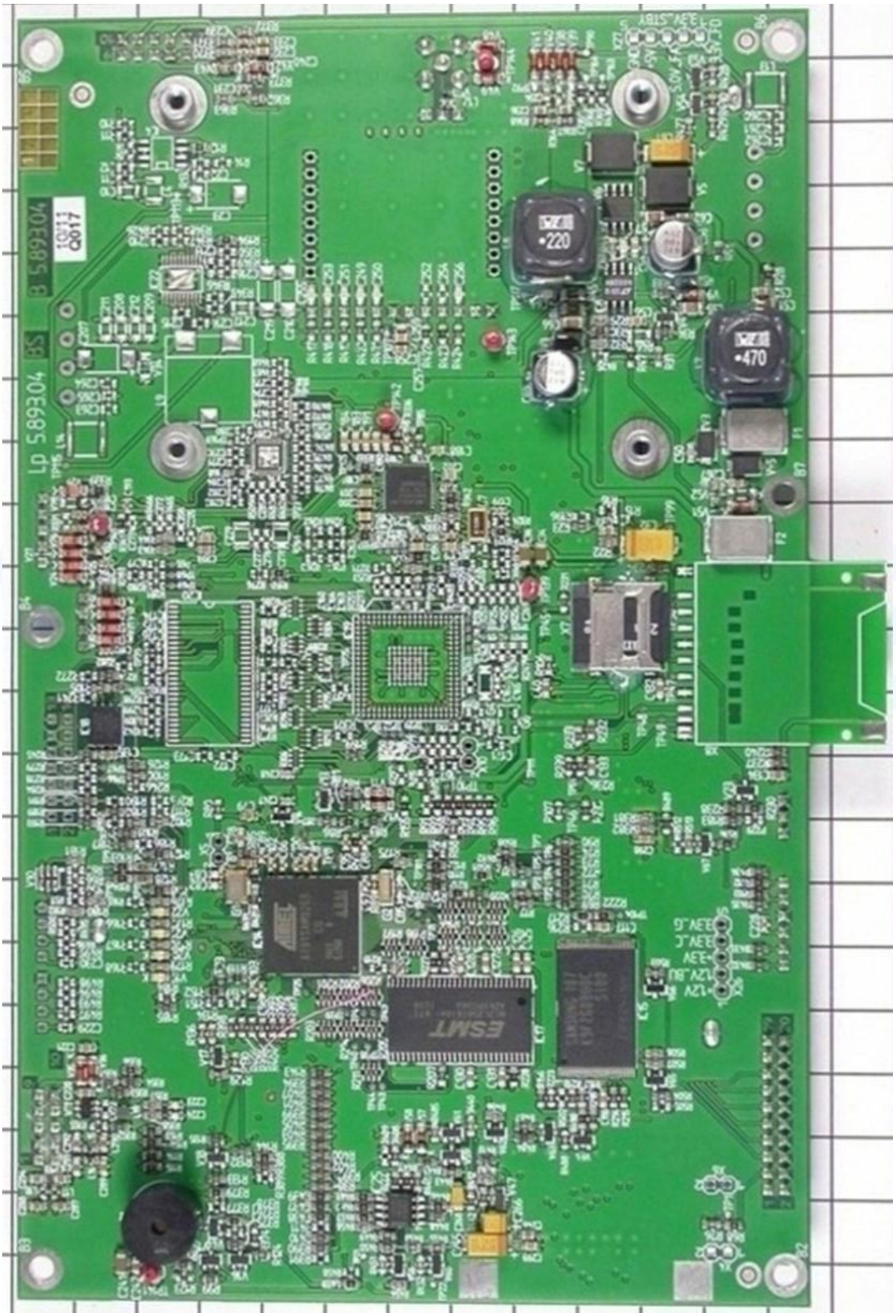
Open casing – without mainboard



PCB top view



PCB bottom view



Top view – RF module

Bottom view – RF module