



# **TEST REPORT**

Test report no.: 1-5178/12-01-06-C



### **Testing laboratory**

#### **CETECOM ICT Services GmbH**

Untertuerkheimer Strasse 6 – 10 66117 Saarbruecken / Germany Phone: + 49 681 5 98 - 0 Fax: + 49 681 5 98 - 9075 Internet: http://www.cetecom.com ict@cetecom.com

### **Accredited Testing Laboratory:**

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS) The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with

the registration number: D-PL-12076-01-01 Area of Testing: Radio/Satellite Communications

### **Applicant**

#### **Bernafon AG**

Morgenstraße 131

3018 Bern / SWITZERLAND
Phone: +41 31 9 98 15 15
Contact: Thomas Leuzinger
e-mail: tle@bernafon.ch
Phone: +41 31 998 16 92

#### Manufacturer

#### **Bernafon AG**

Morgenstraße 131

3018 Bern / SWITZERLAND

### Test standard/s

47 CFR Part 15 Title 47 of the Code of Federal Regulations; Chapter I

Part 15 - Radio frequency devices

RSS - 210 Issue 8 Spectrum Management and Telecommunications - Radio Standards Specification

Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands):

Category I Equipment

For further applied test standards please refer to section 3 of this test report.

**Test Item** 

Kind of test item: Air Conduction Hearing Aid with Wireless Functionality

Model name: AR9 NR, PC9 NR, AR7 NR, PC7 NR

FCC ID: U6XF2RITE2
IC: 7031A-F2RITE2

Frequency: 3.84 MHz

Technology tested: Magnetic coupling
Antenna: Integrated coil antenna

Power Supply: 1.4 V DC by Zinc Air Cell (312)

Temperature Range: 0°C to +40 °C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorised:	Test performed:
	p.o.
Stefan Bös Senior Testing Manager	Andreas Luckenbill  Expert

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#### 2 General information

#### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### 2.2 Application details

Date of receipt of order: 2012-09-14
Date of receipt of test item: 2012-09-17
Start of test: 2012-09-17
End of test: 2012-09-18

Person(s) present during the test: -/-

#### 3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	2010-10	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS - 210 Issue 8	2010-12	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

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### 4 Test environment

T<sub>nom</sub> +22 °C during room temperature tests

Temperature:  $T_{max}$  +40 °C during high temperature tests

T<sub>min</sub> 0 °C during low temperature tests

Relative humidity content: 52 %

Barometric pressure: not relevant for this kind of testing

V<sub>nom</sub> 1.4 V DC by Zinc Air Cell (312)

Power supply:  $V_{max}$  1.5 V

 $V_{min}$  1.1 V

### 5 Test item

Kind of test item	:	Air Conduction Hearing Aid with Wireless Functionality	
Type identification	:	AR9 NR, PC9 NR, AR7 NR, PC7 NR	
S/N serial number	:	Rad. 2061 5507, 2061 5362, 2061 5355	
HW hardware status	:	Accord 119989, PCB Rev.0	
SW software status	:	ALOHA22_1_1_SoC_Config_F	
Frequency band [MHz]	:	3.84 MHz	
Type of radio transmission	:	Single carrier	
Use of frequency spectrum	:	Single Carrier	
Type of modulation	:	A1D	
Number of channels	:	1	
Antenna	:	Integrated coil antenna	
Power supply	:	1.4 V DC by Zinc Air Cell (312)	
Temperature range	:	0°C to +40 °C	

### 6 Test laboratories sub-contracted

None

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7	Summary of measu	rement results
		No deviations from the technical specifications were ascertained
		There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
		Passed	2012-12-20	Only radiated
				spurious
RF-Testing	CFR Part 15 RSS 210, Issue 8			measurements
TXI - Leating				acc. to
				customer
				demand

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Results
§ 15.35 (c) / RSS-GEN Issue 3 Section 4.5	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal				$\boxtimes$	-
0.45.000./								
§ 15.223 / RSS-210 Issue 8	Bandwidth of the modulated carrier	Nominal	Nominal					complies
§ 15.223 / RSS-210 Issue 8	Fieldstrength of fundamental	Nominal	Nominal					complies
§ 15.209 (a) / RSS-210 Issue 8	Fieldstrength of harmonics and spurious	Nominal	Nominal					complies
§ 15.109 / RSS-210 Issue 8	Receiver spurious emissions	Nominal	Nominal	$\boxtimes$				complies
§ 15.107 / § 15.207	Conducted limits	Nominal	Nominal			$\boxtimes$		-

Note: NA = Not Applicable; NP = Not Performed

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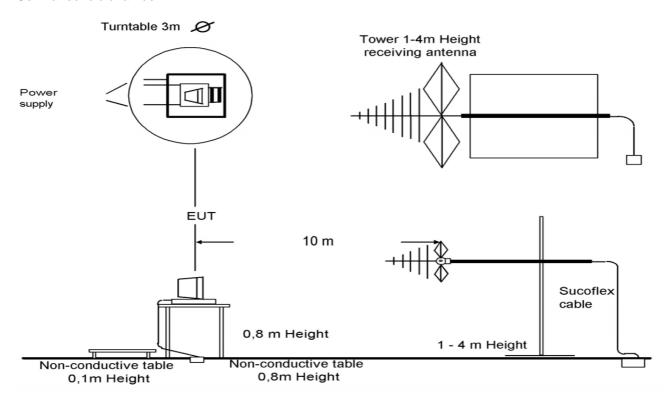
### 8 RF measurements

### 8.1 Description of test setup

#### 8.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 and ANSI C63.4-2009. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2003. Antennas are confirmed with ANSI C63.2-1996 item 15.

#### Semi anechoic chamber



Picture 1: Diagram radiated measurements

9 kHz - 30 MHz: active loop antenna

30 MHz – 1 GHz: tri-log antenna

> 1 GHz: horn antenna

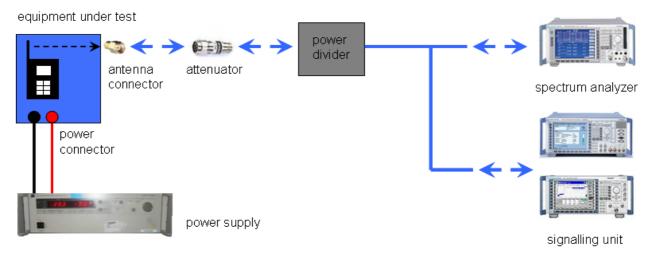
The EUT is powered by an external power supply with nominal voltage. The signalling (if needed) is performed from outside the chamber with a signalling unit by air link using signalling antenna.

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#### 8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, and the spectrum analyzer are impedance matched on 50 Ohm.



Picture 2: Diagram conducted measurements

### 8.2 Additional comments

Reference documents: None

Special test descriptions: We perform the radiated pre-scans in different spherical positions and

consolidate the results in one result plot. The test procedure includes scans in the theta axes every 120° and in phi axes @ 0° and 90° for both polarizations

vertical & horizontal or magnetic emissions.

Configuration descriptions: None

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### 8.3 RSP100 test report cover sheet / performance test data

Test Report Number	:	1-5178/12-01-06-C
Equipment Model Number	:	AR9 NR, PC9 NR, AR7 NR, PC7 NR
Certification Number	:	7031A-F2RITE2
Manufacturer (complete Address)	:	Bernafon AG Morgenstraße 131 3018 Bern / SWITZERLAND
Tested to radio standards specification no.	:	RSS 210, Issue 8, Annex 2
Open Area Test Site IC No.	:	IC 3462C-1
Frequency Range or fixed frequency	:	3.84 MHz
Field Strength [dBµV/m] (at which distance)	:	56 dBμV/m @ 1m
Occupied bandwidth (99%-BW) [kHz]	:	359 kHz
Type of modulation	:	A1D
Emission Designator (TRC-43)	:	359KA1D
Antenna Information	:	Integrated coil antenna
Transmitter Spurious (worst case) [dBµV/m 10m]:	@	22.3 @ 945.15 MHz

## ATTESTATION:

#### **DECLARATION OF COMPLIANCE:**

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

A. Cohenbill

#### **Laboratory Manager:**

2012-12-20 Andreas Luckenbill

Signature

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### 9 Measurement results

## 9.1 Timing of the transmitter

### Not performed!

### 9.2 Bandwidth of the modulated carrier

### Limits:

FCC	IC
Bandwidth of the	modulated carrier

Measured with the integrated OBW-function of the spectrum analyser Rohde & Schwarz FSIQ26 (measurement criteria is the integrated power in %)

### Result:

	Occupied Bandwidth (kHz)			
6 dB (75%)	63			
20 dB (99%)	359			

**Result: Passed** 

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## 9.3 Field strength of the fundamental

## **Measurement:**

Measurement parameter				
Detector:	Quasi Peak (CISPR)			
Resolution bandwidth:	10kHz			
Trace-Mode:	Max Hold			

## Limits:

FCC			IC
Fundamental Frequency (MHz)	Field strength of Fundamental (μV/m)		Measurement distance (m)
1.705 – 10.0	[15] [6dB-BW(kH Whichever	z) / F(MHz)	30

### Result:

TEST CO	NDITIONS	MAXIMUM POWER (dBμV/m)			
Frequ	uency	3.8 MHz	3.8 MHz		
Mo	ode	at 1 m distance	at 30 m distance		
T <sub>nom</sub>	V <sub>nom</sub>	56	-4		
Measuremer	nt uncertainty	±30	dB		

Recalculation to a measurement distance of 30m with a correction of 40 dB/decade.

**Result:** Passed

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## 9.4 Field strength of the harmonics and spurious

## **Measurement:**

Measurement parameter					
Detector:	Average / Quasi Peak				
Sweep time:	Auto				
Resolution bandwidth:	100 kHz / 1 MHz				
Video bandwidth:	1 MHz				
Span:	100 MHz steps				
Trace-Mode:	Max Hold				

## Limits:

FCC			IC						
Fi	Field strength of the harmonics and spurious.								
Frequency (MHz)	Field streng	gth (μV/m)	Measurement distance (m)						
0.009 - 0.490	2400/F	(kHz)	300						
0.490 - 1.705	24000/F	(kHz)	30						
1.705 – 30	30 (29.5 c	IBμV/m)	30						
30 – 88	100 (40 d	BμV/m)	3						
88 – 216	150 (43.5 dBµV/m)		3						
216 – 960	200 (46 d	BμV/m)	3						

## Result:

	EMISSION LIMITATIONS								
f [MHz]	Detector	Results							
		N	o critical peaks detected!						

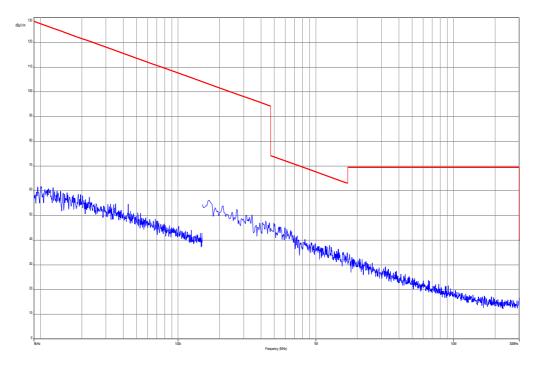
Result: Passed

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### Plots of the measurements

Plot 1: 9 kHz - 30 MHz



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Plot 2: 30 MHz - 1000 MHz

### **Common Information**

EUT: AR9 NR Serial Number: 20615362

Test Description: FCC part 15 B class B @ 10 m

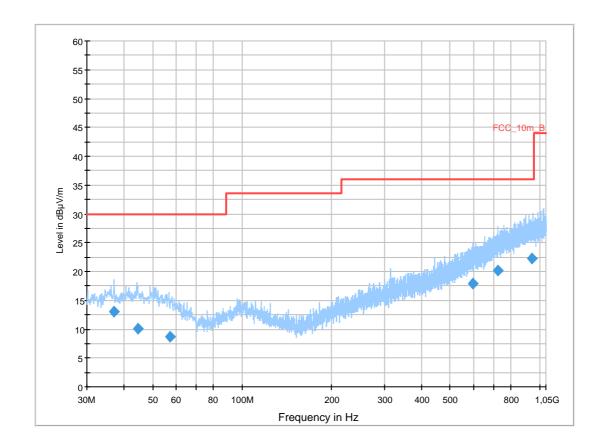
Operating Conditions: active
Operator Name: Wolsdorfer
Comment: bat powered

## Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)

Receiver: [ESCI 3] Level Unit: dBµV/m

SubrangeStep SizeDetectorsIF BWMeas. TimePreamp Time30 MHz - 2 GHz60 kHzQPK120 kHz1 s20 dB



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### **Final Result 1**

Frequency (MHz)	QuasiPeak (dΒμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Po lari zat ion	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
37.020000	13.0	1000.0	120.000	160.0	V	273.0	13.2	17.0	30.0	
44.534850	10.1	1000.0	120.000	122.0	V	268.0	13.3	19.9	30.0	
57.188700	8.8	1000.0	120.000	120.0	Н	175.0	12.3	21.2	30.0	
595.617600	17.9	1000.0	120.000	120.0	V	11.0	20.7	18.1	36.0	
723.056850	20.1	1000.0	120.000	120.0	Н	11.0	23.0	15.9	36.0	
945.151800	22.3	1000.0	120.000	124.0	V	280.0	25.3	13.7	36.0	

# Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]

@ GPIB0 (ADR 20), SN 100083/003, FW 4.42

Signal Path: without Notch

FW 1.0

Antenna: VULB 9163

SN 9163-295, FW ---

Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113

Correction Table (vertical): Cable\_EN\_1GHz (1005) Correction Table (horizontal): Cable\_EN\_1GHz (1005)

Antenna Tower: Tower [EMCO 2090 Antenna Tower]

@ GPIB0 (ADR 8), FW REV 3.12

Turntable: Turntable [EMCO Turntable]

@ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.52

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## 9.5 Receiver spurious emissions

## **Measurement:**

Measurement parameter					
Detector:	Magn: Peak - Quasi Peak / Average Below 1 GHz Peak / QuasiPeak Above 1 GHz Peak / Average				
Sweep time:	Auto				
Video bandwidth:	Magn.: F < 150 kHz: 200 Hz Magn.: F > 150 kHz: 9 kHz Below 1 GHz 100 kHz Above 1 GHz 1 MHz				
Resolution bandwidth:	Magn.: F < 150 kHz: 1 kHz Magn.: F > 150 kHz: 100 kHz Electric: 1 MHz				
Span:	Steps				
Trace-Mode:	Max Hold				

## Limits:

FCC		IC							
Fie	Field strength of the harmonics and spurious.								
Frequency (MHz)	Field streng	gth (µV/m)	Measurement distance (m)						
0.009 - 0.490	2400/F	(kHz)	300						
0.490 – 1.705	24000/F	(kHz)	30						
1.705 – 30	30 (29.5 c	IBμV/m)	30						
30 – 88	100 (40 d	BμV/m)	3						
88 – 216	150 (43.5 dBµV/m)		3						
216 – 960	200 (46 d	BμV/m)	3						

## Result:

EMISSION LIMITATIONS							
f [MHz]	f [MHz] Detector Limit max. allowed [dBμV/m] Amplitude of emission [dBμV/m] Results						
		N	o critical peaks detected!				

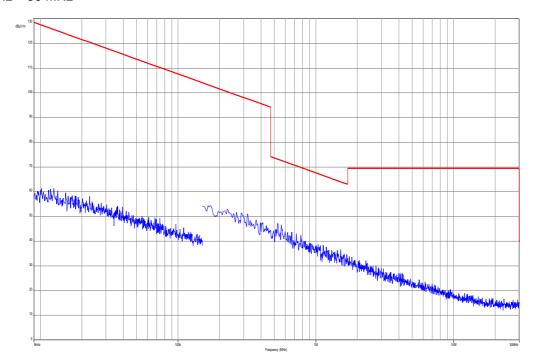
Result: Passed

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## Plots of the measurements

Plot 1: 9 kHz - 30 MHz



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Plot 2: 30 MHz - 1000 MHz

### **Common Information**

EUT: AR9 NR Serial Number: 21048241

Test Description: FCC part 15 B class B @ 10 m

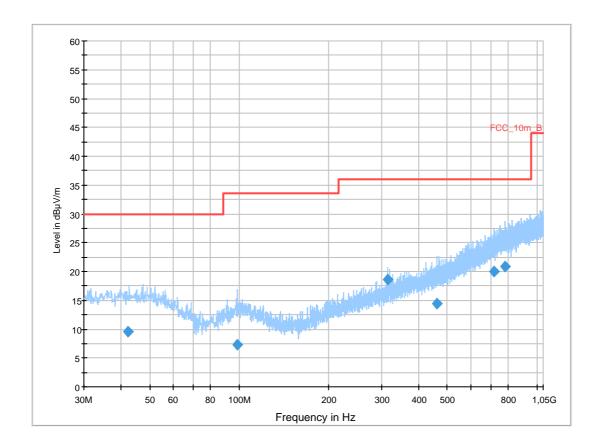
Operating Conditions: rx mode
Operator Name: Wolsdorfer
Comment: bat powered

## Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)

Receiver: [ESCI 3] Level Unit: dBµV/m

SubrangeStep SizeDetectorsIF BWMeas. Time30 MHz - 2 GHz60 kHzQPK120 kHz1 s20 dB



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### **Final Result 1**

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time	Bandwidth (kHz)	Height (cm)	Po lari	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
		(ms)			zat ion					
42.336900	9.5	1000.0	120.000	133.0	V	270.0	13.4	20.5	30.0	
98.606700	7.4	1000.0	120.000	132.0	V	261.0	11.7	26.1	33.5	
315.013500	18.5	1000.0	120.000	105.0	V	272.0	15.0	17.5	36.0	
461.638950	14.4	1000.0	120.000	170.0	Η	280.0	17.9	21.6	36.0	
717.916650	20.1	1000.0	120.000	160.0	V	-5.0	22.9	15.9	36.0	
781.293000	20.8	1000.0	120.000	170.0	Н	-4.0	23.7	15.2	36.0	

# Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]

@ GPIB0 (ADR 20), SN 100083/003, FW 4.42

Signal Path: without Notch

FW 1.0

Antenna: VULB 9163

SN 9163-295, FW ---

Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113

Correction Table (vertical): Cable\_EN\_1GHz (1005) Correction Table (horizontal): Cable\_EN\_1GHz (1005)

Antenna Tower: Tower [EMCO 2090 Antenna Tower]

@ GPIB0 (ADR 8), FW REV 3.12

Turntable: Turntable [EMCO Turntable]

@ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.52

### 9.6 Conducted limits

## Not applicable

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### 10 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Labor/Item).

No.	Lab / Item	Equipment	Туре	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	viKi!	11.05.2011	11.05.2013
2	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
4	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
5	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
6	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
7	n. a.	Amplifier	js42- 00502650- 28-5a	Parzich GMBH	928979	300003143	ne		
8	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbe ck	371	300003854	vIKI!	14.10.2011	14.10.2014
9	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologi es	MY51210197	300004405	k	19.12.2011	19.12.2012
10	n. a.	DC Power Supply 0 – 32V	1108-32	Heiden	001802	300001383	Ve	23.06.2010	23.06.2013
11	n. a.	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	Ve	20.09.2011	20.09.2013
12	n. a.	Test Receiver	ESH2	R&S	871921/095	300002505	Ve	12.01.2012	12.01.2014
13	n. a.	Loop Antenna 9 KHz - 30 MHz	HFH2-Z2	R&S	872096/61	300001824	vIKI!	09.03.2012	09.03.2015
14	n. a.	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	22.08.2012	22.08.2013

### Agenda: Kind of Calibration

vlkl! Attention: extended calibration interval

k calibration / calibrated EK limited calibration

ne not required (k, ev, izw, zw not required) zw cyclical maintenance (external cyclical maintenance)

ev periodic self verification izw internal cyclical maintenance Ve long-term stability recognized g blocked for accredited testing

JK! Attention: not calibrated \*) next calibration ordered / currently in progress

#### 11 Observations

No observations exceeding those reported with the single test cases have been made.

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# Annex A Photographs of the test setup

Photo documentation:

Photo 1:

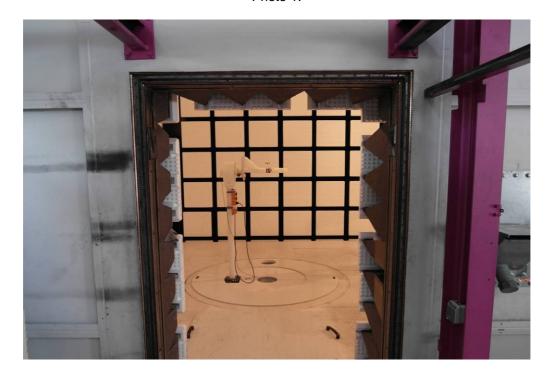


Photo 2:



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Photo 3:

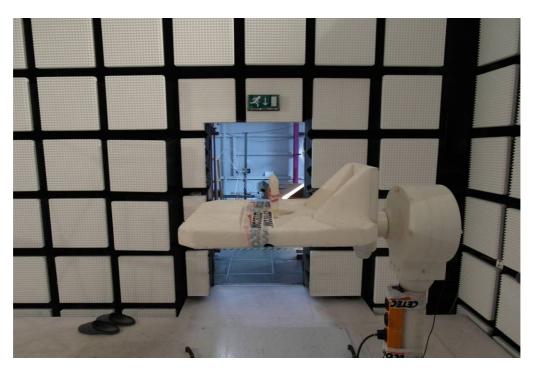


Photo 4:



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Photo 5:



Photo 6:



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## Photo 7:



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# Annex B External photographs of the EUT

Photo documentation:

Photo 1:



Photo 2:



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Photo 3:

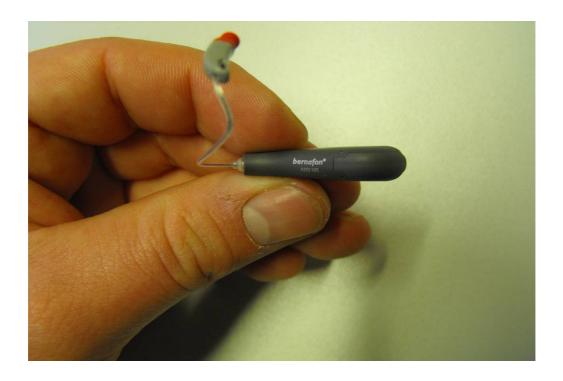
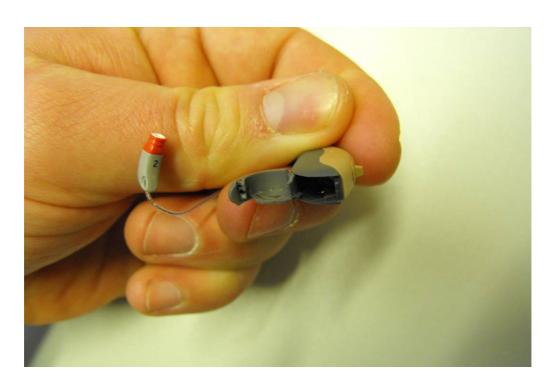


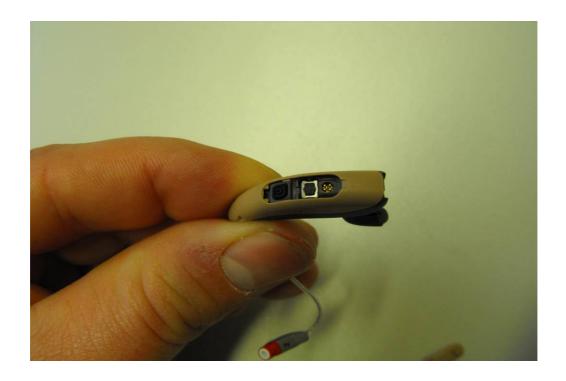
Photo 4:



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Photo 5:



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# Annex C Internal photographs of the EUT

Photo documentation:

Photo 1:



Photo 2:



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Photo 3:



Photo 4:



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Photo 5:

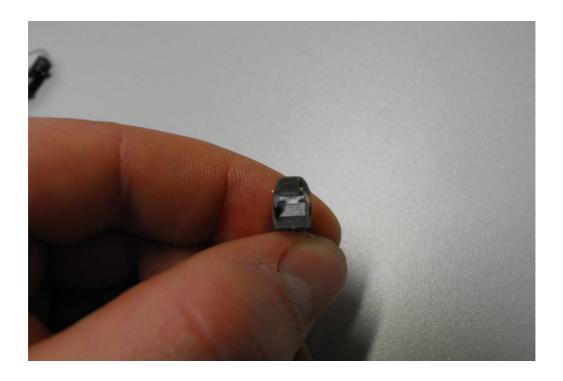
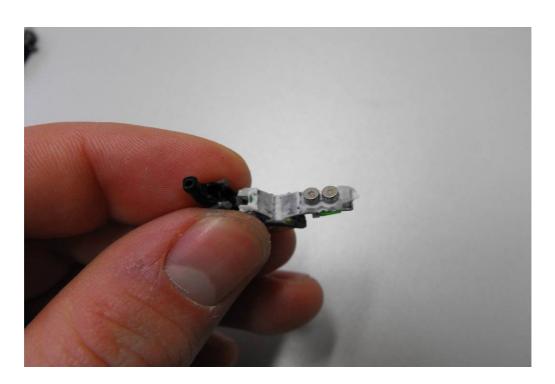


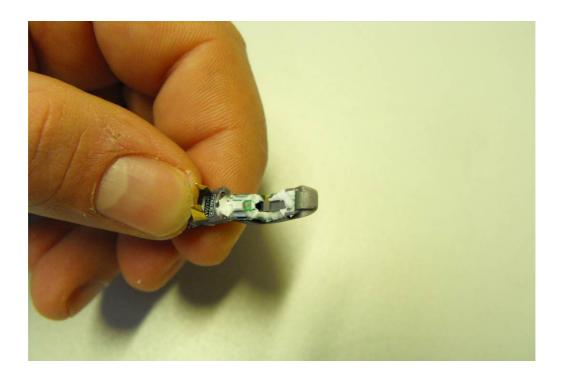
Photo 6:



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Photo 7:



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## Annex D Document history

Version	Applied changes	Date of release
1.0	Initial release	2012-09-24
-A	changed model name	2012-10-09
-B	changed model name, add internal & external photos	2012-12-14
-C	Correction of cover sheet	2012-12-19

### Annex E Further information

#### **Glossary**

AVG - Average

DUT - Device under test

EMC - Electromagnetic Compatibility

EN - European Standard EUT - Equipment under test

ETSI - European Telecommunications Standard Institute

FCC - Federal Communication Commission

FCC ID - Company Identifier at FCC

HW - Hardware

IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software

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### Annex F Accreditation Certificate



Front side of certificate

Back side of certificate

#### Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

http://www.cetecom.com/fileadmin/de/CETECOM\_D\_Saarbruecken/accreditations\_Jan\_2010/DAKKS\_Akkredi\_Urk\_EN17025-En\_incl\_Annex.pdf

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