SAR TEST REPORT
for
HONGKONG IBCAM ELECTRONIC LIMITED

Baby Monitor
Model No.: IB-810, IB-812, IB-816, IB-818, IB-819, IB-820, IB-821, IB-822, IB-823, IB-825, IB-826, IB-827, IB-828, IB-829

Prepared for : HONGKONG IBCAM ELECTRONIC LIMITED
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TEST REPORT

Applicant	:	HONGKONG IBCAM ELECTRONIC LIMITED
Manufacturer	:	HONGKONG IBCAM ELECTRONIC LIMITED
EUT	:	Baby Monitor
Model No.	:	IB-810, IB-812, IB-816, IB-818, IB-819, IB-820, IB-821, IB-822, IB-823, IB-825, IB-826, IB-827, IB-828, IB-829
Serial No.	:	N/A
Trade Mark	:	ibcam
Rating	:	DC 5.0V, 2.0A

Measurement Procedure Used:
FCC 47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices
ANSI C95.1, 1992
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz
KDB 447498 D01 General RF Exposure Guidance
KDB 616217 D04 SAR for laptop and tablets

The device described above is tested by Suzhou EMC Laboratory to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test :	Apr. 14~ 20, 2014
Prepared by :	Rock Zeng (Engineer / Rock Zeng)
Reviewer :	Amy Ding (Project Manager / Amy Ding)
Approved & Authorized Signer :	Tom Chen (Manager /Tom Chen)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Baby Monitor
Model Number	:	IB-810, IB-812, IB-816, IB-818, IB-819, IB-820, IB-821, IB-822, IB-823, IB-825, IB-826, IB-827, IB-828, IB-829 (Note: All samples are the same except the model number and appearance color, so we prepare "IB-810" for EMC test only.)
Test Power Supply	:	AC 120V/60Hz
Device Type	:	Portable Device
Exposure Category	:	Uncontrolled Environment / General Population
State of Sample	:	Prototype Unit
Hardware Version	:	HW_IB800_V1.0
Software Version	:	SW_IB800_V1.0
Antenna Type	:	Internal Antenna
Applicant	:	HONGKONG IBCAM ELECTRONIC LIMITED
Address	:	1211 West Keji Building, ShenZhen High-Tech Ind-Park, Nanshan District. ShenZhen, China
Manufacturer	:	HONGKONG IBCAM ELECTRONIC LIMITED
Address	:	1211 West Keji Building, ShenZhen High-Tech Ind-Park, Nanshan District. ShenZhen, China
Date of receiver	:	Apr. 14, 2014
Date of Test	:	Apr. 14~ 20, 2014

1.2. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS - LAB Code: L3503
Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

FCC-Registration No.: 752021
Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 10, 2013.

IC-Registration No.: 8058A-1
Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, February 22, 2013.

Test Location
All Emissions tests were performed at
Suzhou EMC Laboratory at No.99 Hongye Rd., Suzhou Industrial Park Loufeng Hi-Tech Development Zone., Suzhou, China

1.3. Operating Configurations

Equipment Under Test (EUT) is a Baby Monitor. The detail about EUT is in chapter 1.1 in this report. The EUT has an internal antenna for WiFi antenna that can be used for Tx/Rx. During SAR test of the EUT, SAR is only tested for 802.11b. SAR is not required for 802.11 g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Operating Mode(s):	802.11b (Tested)
	802.11g (Untested)
	802.11n HT20/HT40 (Untested)
Operating Frequency Range(s):	2412-2462MHz for 802.11b
Test Channel:	2412MHz, 2437MHz, 2462MHz

1.4. The Maximum SAR_{1g} Values

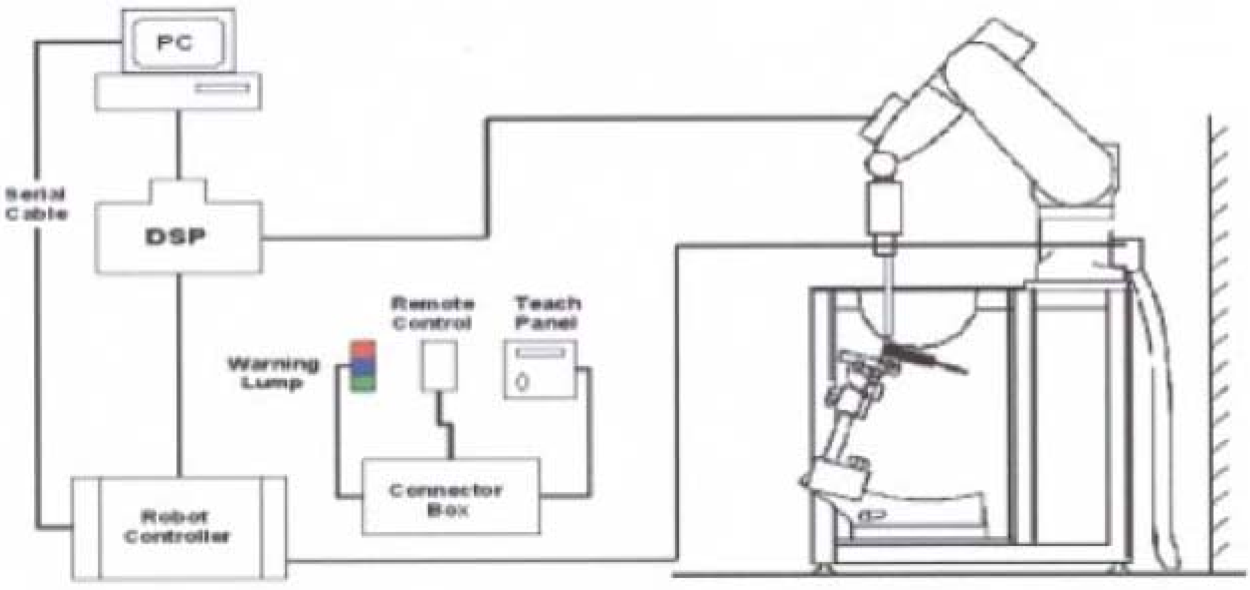
Mode	Test Position	Channel/ Frequency(MHz)	Limit SAR_{1g} 1.6W/kg
			Measured SAR_{1g} (W/kg)
802.11b	Right	1/2437	0.199

2. SAR Measurements System Configuration

2.1. SAR Measurement Set-up

The DASY5 system for performing compliance tests consists of the following items

1) A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2) A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3) A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4) A unit to operate the optical surface detector which is connected to the EOC.
5) The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6) The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003
7) DASY5 software and SEMCAD data evaluation software.
8) Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9) The generic twin phantom enabling the testing of left-hand and right-hand usage.
10) The device holder for handheld mobile phones.
11) Tissue simulating liquid mixed according to the given recipes.
12) System validation dipoles allowing to validate the proper functioning of the system.



SAR Lab Test Measurement Set-up

2.2. DASY5 E-field Probe System

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. SPEAG conducts the probe calibration in compliance with international and national standards under ISO 17025.

2.2.1. Isotropic E-Field Probe Specification

Model	EX3DV4
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

2.2.2. E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\mathbf{SAR} = \mathbf{C}\,\frac{\Delta \mathbf{T}}{\Delta \mathbf{t}}$$

Where:
Δt = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
ΔT = Temperature increase due to RF exposure.
Or

$$\mathbf{SAR} = \frac{|\mathbf{E}|^2 \sigma}{\rho}$$

Where:
σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m3).

2.3. Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 12 mm x 12 mm(2GHz ~ 3GHz) is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses.The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions. Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

2.4. Data Storage and Evaluation

2.4.1. Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DAE4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

2.4.2. Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvF
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	
	- Density	

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

Vi = Ui + Ui2 · c f / d c pi

With **Vi** = compensated signal of channel i (i = x, y, z)
Ui = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcpi = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:
E-field probes: **Ei = (Vi / Normi · ConvF)$^{1/2}$**

H-field probes: **Hi = (Vi)1/2 · (ai0 + ai1 f + ai2f2) / f**

With **Vi** = compensated signal of channel i (i = x, y, z)
Norm = sensor sensitivity of channel i (i = x, y, z)

[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m
Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$Etot = (Ex^2 + EY^2 + Ez^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot})^2 \cdot \sigma / (\rho \cdot 1000)$$

With **SAR** = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = equivalent power density of a plane wave in mW/cm2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

3. Tissue Simulating Liquid

3.1. The composition of the tissue simulating liquid

The liquid is consisted of water, salt and Glycol. The liquid has previously been proven to be suited for worst-case. The Table 3 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB 865664.

INGREDIENT (% Weight)	2450MHz Head
Water	46.7
Salt	0.00
Sugar	0.00
HEC	0.00
Preventol	0.00
DGBE	53.3

3.2. Tissue-equivalent Liquid Properties

Dielectric Performance of Body Tissue Simulating Liquid

Frequency	Description	Dielectric Parameters		Temp ℃
		ε r	σ (s/m)	
2450MHz (body)	Target value ±5% Window	39.20 37.24 to 41.16	1.80 1.62 to 1.98	N/A
	Measurement value 2014-4-14	38.6	1.84	21.0

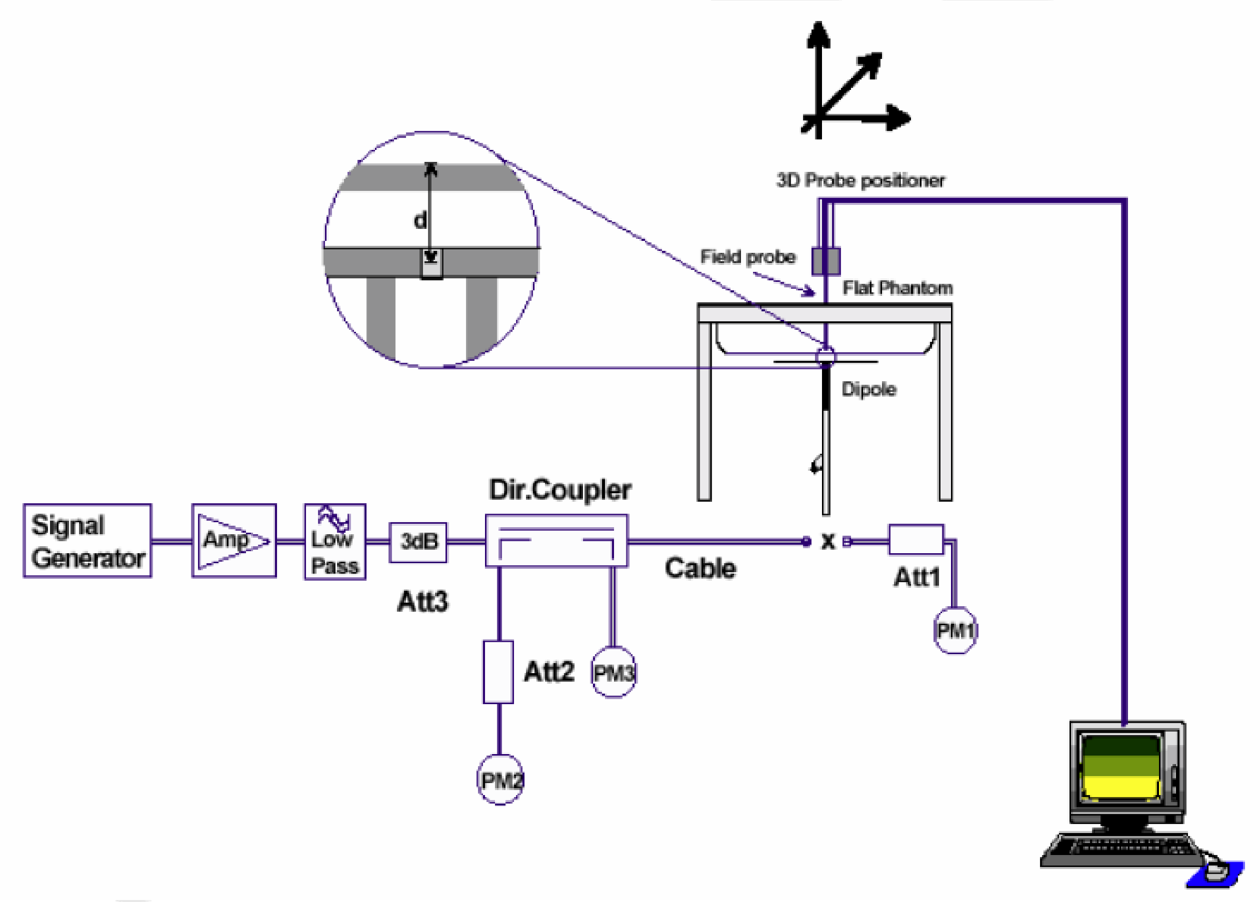
4. System Check

4.1. Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulates, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 4.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



System Check Set-up

Justification for Extended SAR Dipole Calibrations
Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824.

4.2. System Check Results

System Performance Check at 2450MHz. Validation Dipole: D2450V2-SN 839				
Frequency [MHz]	Description	SAR[W/kg] 1g	SAR[W/kg] 10g	Tissue Temp. [℃]
2450 MHz	Reference Result ±10% Window	51.9 46.71 to 57.09	24.1 21.69 to 26.51	N/A
	2014-4-14	52.0	23.16	21.0
Note: All SAR values are normalized to 1W forward power.				

5. Test Results

5.1. Conducted Power Results

Mode	Channel	Data Rate (Mbps)	AV Power (dBm)
11b	1	1	15.59
		2	15.52
		5.5	15.49
		11	15.54
	6	1	15.24
		2	15.22
		5.5	15.16
		11	15.27
	11	1	14.91
		2	14.89
		5.5	14.86
		11	14.85
11g	1	6	15.55
		9	15.49
		12	15.58
		18	15.53
		24	15.57
		36	15.56
		48	15.47
		54	15.50
	6	6	15.52
		9	15.65
		12	15.60
		18	15.51
		24	15.53
		36	15.49
		48	15.54
		54	15.62
	11	6	15.24
		9	15.18
		12	15.18
		18	15.22
		24	15.15
		36	15.16
		48	15.20
		54	15.22
11n HT20	1	MCS 0	15.28
		MCS 1	15.27
		MCS 2	15.25
		MCS 3	15.19

		MCS 4	15.20
		MCS 5	15.25
		MCS 6	15.34
		MCS 7	15.24
	6	MCS 0	15.19
		MCS 1	15.24
		MCS 2	15.15
		MCS 3	15.17
		MCS 4	15.16
		MCS 5	15.20
		MCS 6	15.24
		MCS 7	15.30
	11	MCS 0	14.99
		MCS 1	14.85
		MCS 2	14.90
		MCS 3	14.87
		MCS 4	14.85
		MCS 5	14.91
		MCS 6	14.93
		MCS 7	14.88
11n HT40	3	MCS 0	15.42
		MCS 1	15.45
		MCS 2	15.44
		MCS 3	15.42
		MCS 4	15.41
		MCS 5	15.39
		MCS 6	15.37
		MCS 7	15.40
	6	MCS 0	15.33
		MCS 1	15.31
		MCS 2	15.25
		MCS 3	15.21
		MCS 4	15.25
		MCS 5	15.30
		MCS 6	15.39
		MCS 7	15.21
	9	MCS 0	15.36
		MCS 1	15.30
		MCS 2	15.32
		MCS 3	15.21
		MCS 4	15.29
		MCS 5	15.32
		MCS 6	15.35
		MCS 7	15.28

Note: According to the output value listed above.SAR is not required for 802.11g/n channels when the maximum average output power is less than that measured on the corresponding 802.11b channels.

5.2. SAR Test Results

5.2.1. 802.11b

SAR MEASUREMENT								
Ambient Temperature (℃): 21.5 ±2					Relative Humidity (%): 52			
Liquid Temperature (℃): 21.0 ±2					Depth of Liquid (cm): ＞15			
Product: Baby Monitor								
Test Mode: 802.11b								
Test Position Body	Antenna Position	Frequency		Seperation Distance (mm)	Conducted Power (dBm)	Power Drift (< ±0.2)	SAR 1g (W/kg)	Limit (W/kg)
		Channel	MHz					
Back	Fixed	01	2412	0	15.59	-0.11	0.083	1.6
Front	Fixed	01	2412	0	15.59	-0.10	0.00748	1.6
Left	Fixed	01	2412	0	15.59	-0.08	0.011	1.6
Right	Fixed	01	2412	0	15.59	0.17	0.189	1.6
Right	Fixed	06	2437	0	15.27	-0.07	0.199	1.6
Right	Fixed	11	2462	0	14.91	0.15	0.197	1.6
Top	Fixed	01	2412	0	15.59	-0.02	0.013	1.6
Bottom	Fixed	01	2412	0	15.59	-0.12	0.0058	1.6

6. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram / 10 gram.

Error Description	Uncert. Value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(vi) Veff
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0%	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (meas.)	±2.5%	N	1	0.64	0.43	±1.6%	±1.1%	∞
Liquid Permittivity (target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (meas.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined Std. Uncertainty						±11.0%	±10.8%	387
Expanded STD Uncertainty						±22.0%	±21.5%	

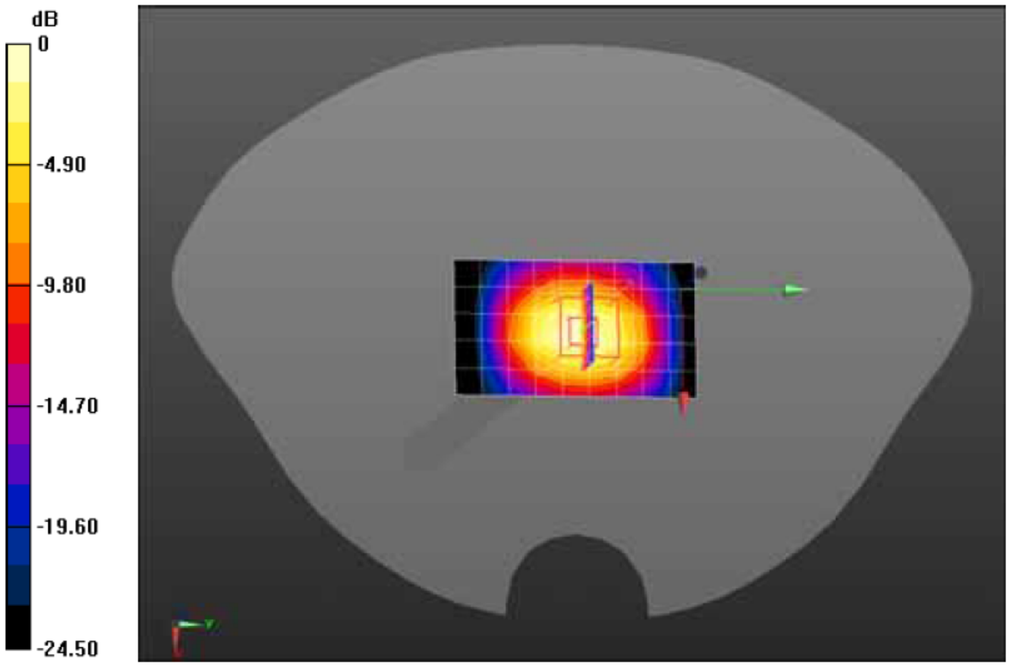
7. MEASURING DEVICE AND TEST EQUIPMENT

No.	Name	Manufacturer	Type	Serial Number	Calibration Date
1	Stäubli Robot TX60L	Stäubli	TX60L	F10/5C90A1/A/01	N/A
2	Controller	Stäubli	SP1	S-0034	N/A
3	Dipole Validation Kits	Speag	D2450V2	839	2016.02.24
4	SAM Twin Phantom	Speag	SAM	TP-1561/1562	N/A
5	Device Holder	Speag	SD 000 H01 HA	N/A	N/A
7	Data Acquisition Electronic	Speag	DAE4	1220	2015.01.22
8	E-Field Probe	Speag	EX3DV4	3710	2015.03.04
9	SAR Software	Speag	DASY5	V5.2 Build 162	N/A
10	Power Amplifier	Mini-Circuit	ZVA-183-S+	N657400950	N/A
11	Directional Coupler	Agilent	778D	20160	N/A
12	Universal Radio Communication Tester	R&S	CMU 200	117088	2015.03.28
13	Vector Network	Agilent	E5071C	MY48367267	2015.03.28
14	Signal Generator	Agilent	E4438C	MY49070163	2015.03.28
15	Power Meter	Anritsu	ML2495A	0905006	2014.11.01
16	Wide Bandwidth Sensor	Anritsu	MA2411B	0846014	2014.11.01

APPENDIX I: SAR SYSTEM VALIDATION DATA

Date/Time: 14-04-2014
System Check Head 2450MHz
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2
Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Duty Cycle: 1:1;
Frequency: 2450 MHz; Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; εr = 38.6; ρ = 1000 kg/m³ ;
Phantom section: Flat Section
Ambient temperature (°C): 21.5, Liquid temperature (°C): 21.0
DASY5 Configuration:
Probe: EX3DV4 - SN3710; ConvF(7.04, 7.04, 7.04); Calibrated: 04/03/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1220; Calibrated: 22/01/2014
Phantom: SAM1; Type: SAM; Serial: TP1561
Measurement SW: DASY52, Version 52.8 (0); SEMCAD X Version 14.6.10 (7164)

Configuration/Head 2450MHz/Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.4 W/kg
Configuration/Head 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm, Reference Value = 89.443 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 28.8 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 5.79 W/kg Maximum value of SAR (measured) = 14.9 W/kg

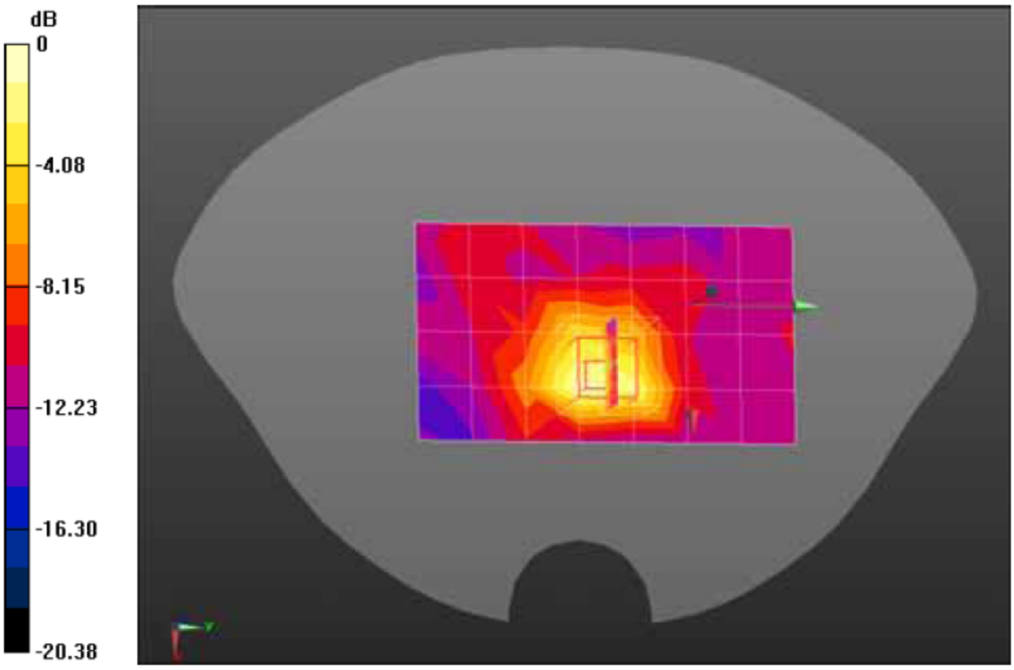


0 dB = 14.9 W/kg = 11.73 dBW/kg

APPENDIX II: SAR MEASUREMENT DATA

Date/Time: 14-04-2014
802.11b 2412MHz Body-Back
DUT: Baby monitor; Type: IB-810
Communication System: Wi-Fi; Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2412MHz; Medium parameters used: f = 2412 MHz; σ = 1.8 S/m; εr = 38.67; ρ = 1000 kg/m^3 ; Phantom section: Flat Section
Ambient temperature (°C): 21.5, Liquid temperature (°C): 21.0

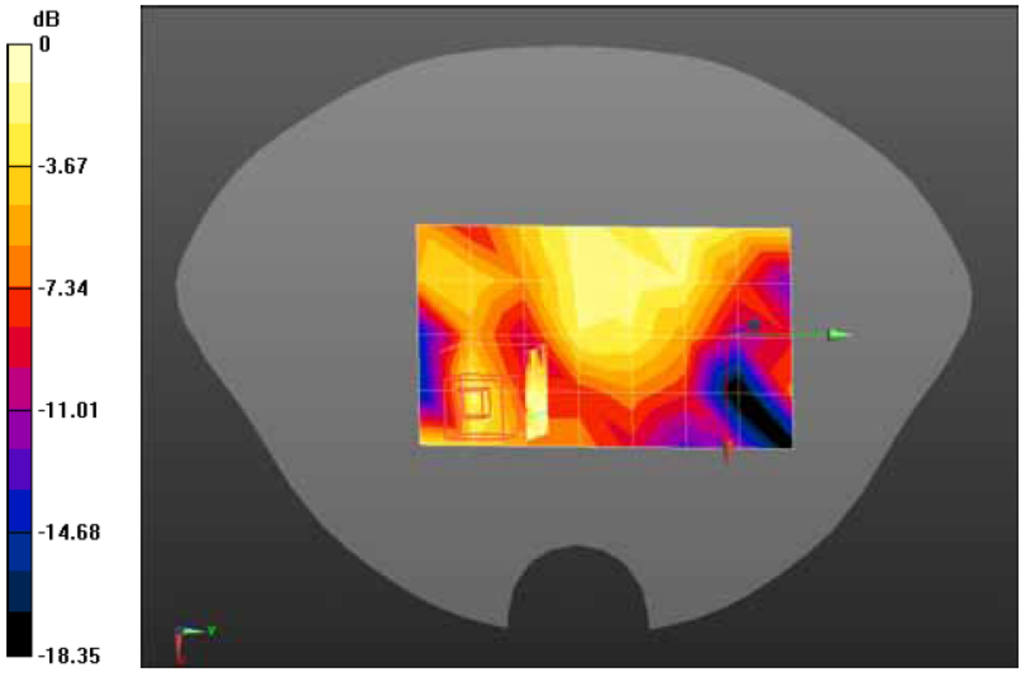
DASY5 Configuration:
Probe: EX3DV4 - SN3710; ConvF(7.04, 7.04, 7.04); Calibrated: 04/03/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1220; Calibrated: 22/01/2014
Phantom: SAM1; Type: SAM; Serial: TP1561
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)
Configuration/802.11b 2412MHz Body-Back/Area Scan (5x8x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.0762 W/kg
Configuration/802.11b 2412MHz Body-Back/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm,
dy=8mm, dz=5mm, Reference Value = 4.192 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.160 W/kg
SAR(1 g) = 0.083 W/kg; SAR(10 g) = 0.044 W/kg Maximum value of SAR (measured) = 0.0899 W/kg



0 dB = 0.0899 W/kg = -10.46 dBW/kg

802.11b 2412MHz Body-Front
DUT: Baby monitor; Type: IB-810
Communication System: Wi-Fi; Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2412 MHz; Medium parameters used: f = 2412 MHz; σ = 1.8 S/m; εr = 38.67; ρ = 1000 kg/m³ ; Phantom section: Flat Section
Ambient temperature (°C): 21.5, Liquid temperature (°C): 21.0
DASY5 Configuration:

Probe: EX3DV4 - SN3710; ConvF(7.04, 7.04, 7.04); Calibrated: 04/03/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1220; Calibrated: 22/01/2014
Phantom: SAM1; Type: SAM; Serial: TP1561
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)
Configuration/802.11b 2412MHz Body-Front/Area Scan (5x8x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.00842 W/kg
Configuration/802.11b 2412MHz Body-Front/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm, Reference Value = 2.340 V/m; Power Drift = -0.10 Db
Peak SAR (extrapolated) = 0.0120 W/kg
SAR(1 g) = 0.00748 W/kg; SAR(10 g) = 0.00582 W/kg Maximum value of SAR (measured) = 0.0110 W/kg

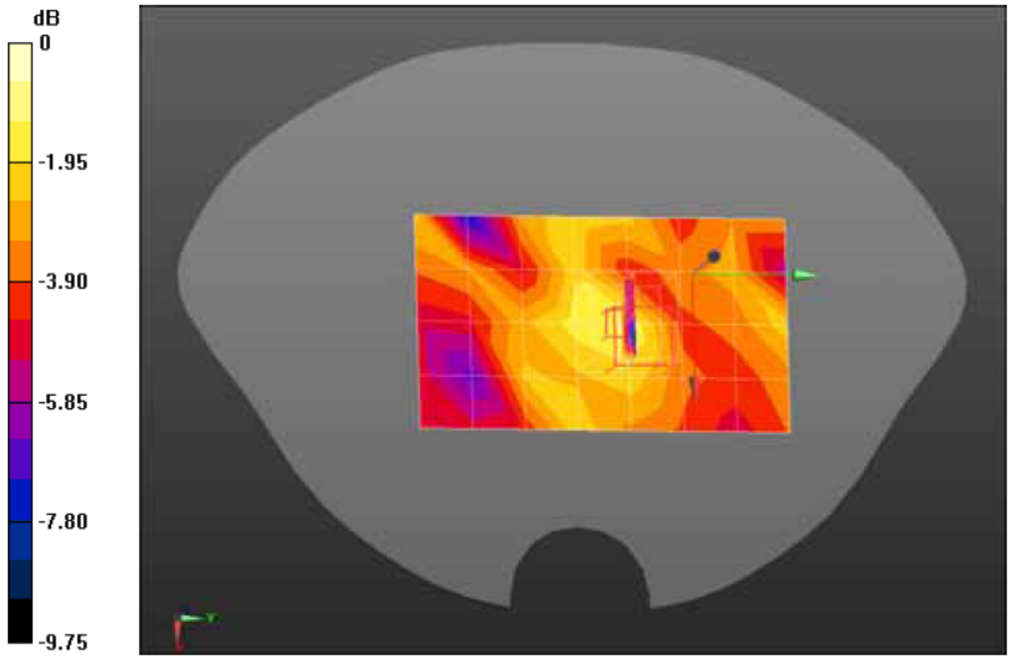


0 dB = 0.0110 W/kg = -19.59 dBW/kg

802.11b 2412MHz Body-Left side
DUT: Baby monitor; Type: IB-810
Communication System: Wi-Fi; Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2412MHz; Medium parameters used: f = 2412 MHz; σ = 1.8 S/m; εr = 38.67; ρ = 1000 kg/m³ ; Phantom section: Flat Section
Ambient temperature (°C): 21.5, Liquid temperature (°C): 21.0

DASY5 Configuration:
Probe: EX3DV4 - SN3710; ConvF(7.04, 7.04, 7.04); Calibrated: 04/03/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1220; Calibrated: 22/01/2014
Phantom: SAM1; Type: SAM; Serial: TP1561
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b 2412MHz Body-Left side/Area Scan (5x8x1): Measurement grid: dx=20mm, dy=20mm Maximum value of SAR (measured) = 0.0111 W/kg
Configuration/802.11b 2412MHz Body-Left side/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm, Reference Value = 2.517 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.0240 W/kg
SAR(1 g) = 0.011 W/kg; SAR(10 g) = 0.00825 W/kg Maximum value of SAR (measured) = 0.0147 W/kg

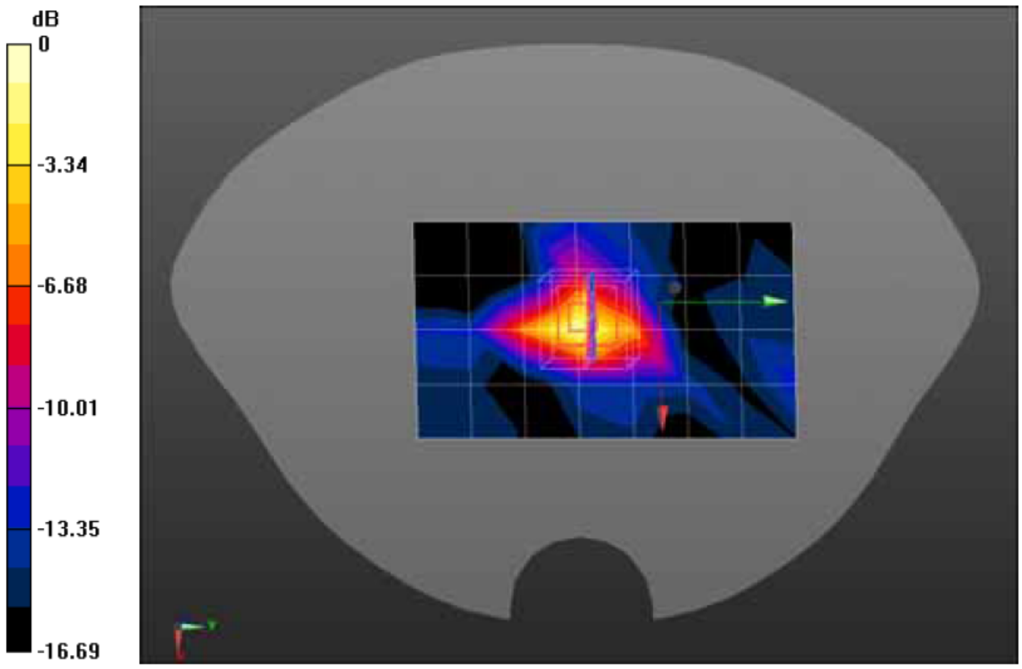


0 dB = 0.0147 W/kg = -18.33 dBW/kg

802.11b 2412MHz Body-Right side
DUT: Baby monitor; Type: IB-810
Communication System: Wi-Fi; Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2412 MHz; Medium parameters used: f = 2412 MHz; σ = 1.8 S/m; εr = 38.67; ρ = 1000 kg/m³ ; Phantom section: Flat Section
Ambient temperature (°C): 21.5, Liquid temperature (°C): 21.0

DASY5 Configuration:
Probe: EX3DV4 - SN3710; ConvF(7.04, 7.04, 7.04); Calibrated: 04/03/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1220; Calibrated: 22/01/2014
Phantom: SAM1; Type: SAM; Serial: TP1561
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b 2412MHz Body-Right side/Area Scan (5x8x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.178 W/kg
Configuration/802.11b 2412MHz Body-Right side/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm, Reference Value = 9.979 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.454 W/kg
SAR(1 g) = 0.189 W/kg; SAR(10 g) = 0.084 W/kg Maximum value of SAR (measured) = 0.204 W/kg

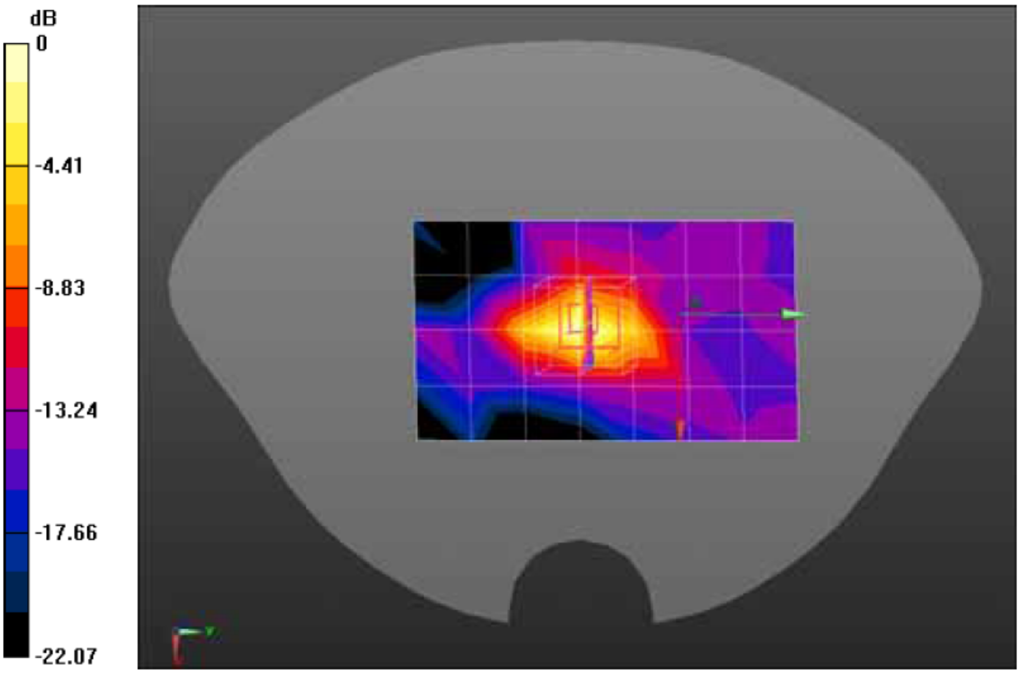


0 dB = 0.204 W/kg = -6.90 dBW/kg

802.11b 2437MHz Body-Right side
DUT: Baby monitor; Type: IB-810
Communication System: Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; σ = 1.83 S/m; εr = 38.55; ρ = 1000 kg/m³ ; Phantom section: Flat Section
Ambient temperature (°C): 21.5, Liquid temperature (°C): 21.0

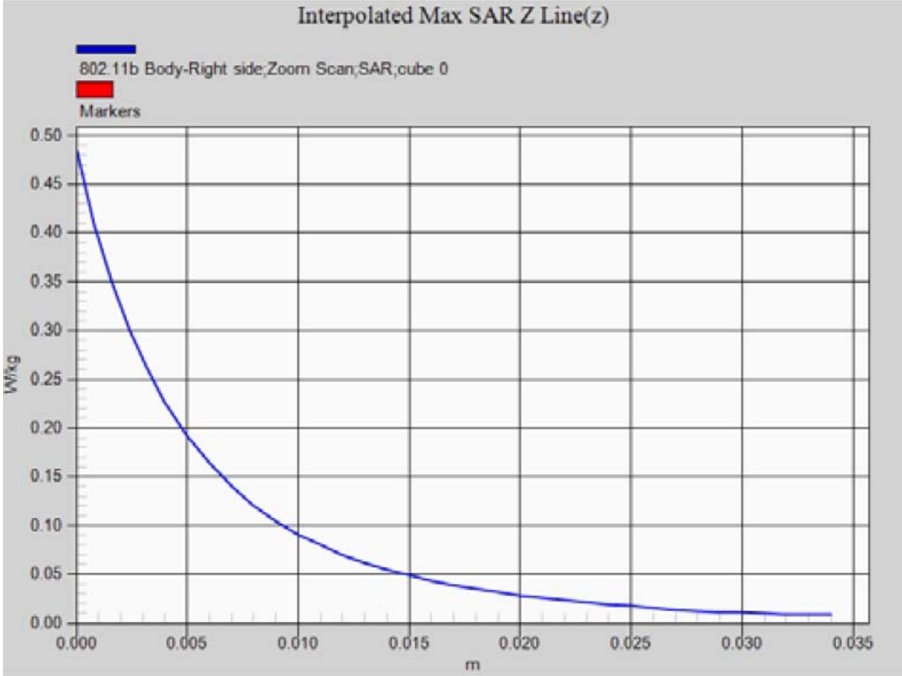
DASY5 Configuration:
Probe: EX3DV4 - SN3710; ConvF(7.04, 7.04, 7.04); Calibrated: 04/03/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1220; Calibrated: 22/01/2014
Phantom: SAM1; Type: SAM; Serial: TP1561
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b 2437MHz Body-Right side/Area Scan (5x8x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.194 W/kg Configuration/802.11b 2437MHz Body-Right side/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm, Reference Value = 10.616 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.485 W/kg
SAR(1 g) = 0.199 W/kg; SAR(10 g) = 0.088 W/kg Maximum value of SAR (measured) = 0.201 W/kg



0 dB = 0.201 W/kg = -6.97 dBW/kg

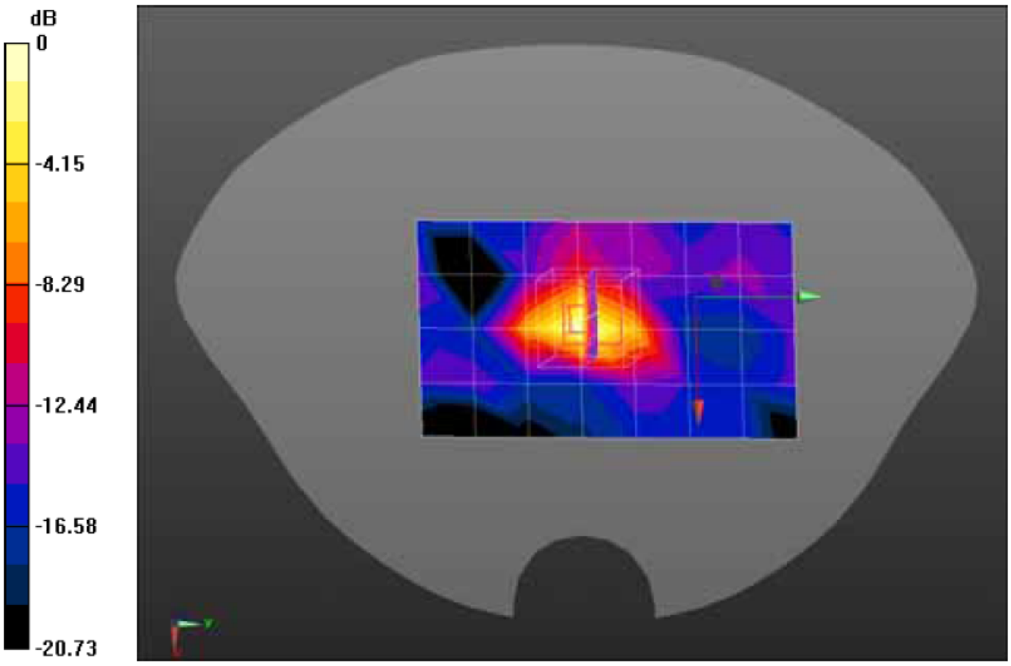
Z-Axis Plot


Interpolated Max SAR Z Line(z)
802.11b Body-Right side;Zoom Scan;SAR;cube 0
Markers
W/kg
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

802.11b 2462MHz Body-Right side
DUT: Baby monitor; Type: IB-810
Communication System: Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1;
Frequency: 2462 MHz; Medium parameters used: f = 2462 MHz; σ = 1.87 S/m; εr = 38.43; ρ = 1000 kg/m³ ; Phantom section: Flat Section
Ambient temperature (°C): 21.5, Liquid temperature (°C): 21.0

DASY5 Configuration:
Probe: EX3DV4 - SN3710; ConvF(7.04, 7.04, 7.04); Calibrated: 04/03/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1220; Calibrated: 22/01/2014
Phantom: SAM1; Type: SAM; Serial: TP1561
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/802.11b 2462MHz Body-Right side/Area Scan (5x8x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.202 W/kg
Configuration/802.11b 2462MHz Body-Right side/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm, Reference Value = 10.445 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.478 W/kg
SAR(1 g) = 0.197 W/kg; SAR(10 g) = 0.084 W/kg Maximum value of SAR (measured) = 0.220 W/kg



0 dB = 0.220 W/kg = -6.58 dBW/kg

APPENDIX III: TEST SETUP PHOTOGRAPHS

Body-Back

Body-front

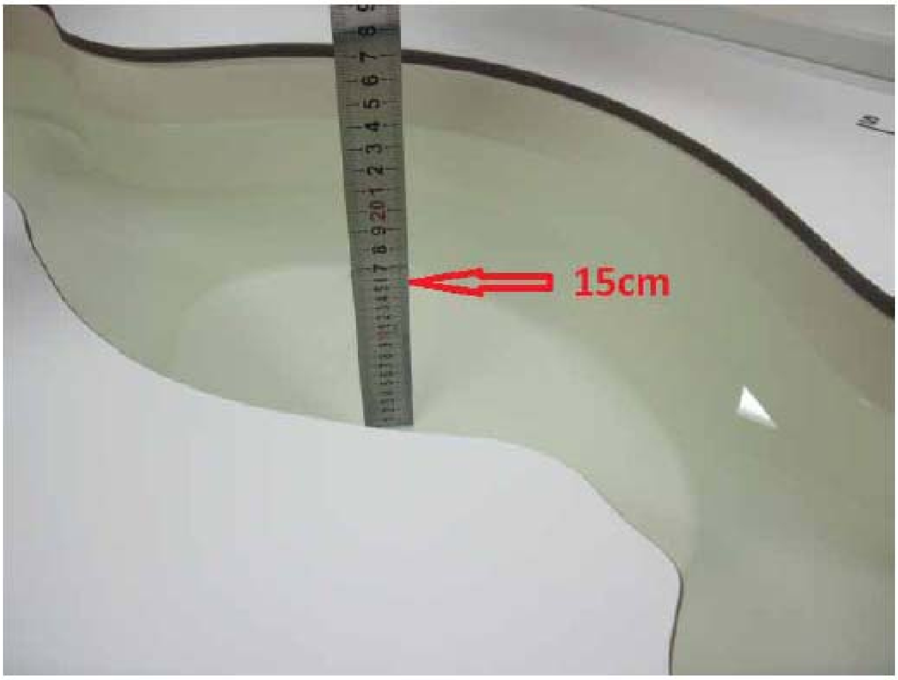
Body-left

Body-right

Body-top

Body-bottom

Depth of the liquid in the phantom – Zoom in



APPENDIX IV: PROBE CALIBRATION DATA

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Quietek (Auden)**

Certificate No: **EX3-3710_Mar14**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3710
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	March 4, 2014

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 4, 2014

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: EX3-3710_Mar14 Page 1 of 11

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3710

Manufactured: July 21, 2009
Calibrated: March 4, 2014

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.51	0.56	0.44	± 10.1 %
DCP (mV)[B]	100.3	97.6	101.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	137.9	±3.5 %
		Y	0.0	0.0	1.0		136.7	
		Z	0.0	0.0	1.0		139.8	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
450	43.5	0.87	10.42	10.42	10.42	0.17	2.22	± 13.3 %
750	41.9	0.89	9.76	9.76	9.76	0.62	0.69	± 12.0 %
835	41.5	0.90	9.56	9.56	9.56	0.57	0.69	± 12.0 %
900	41.5	0.97	9.42	9.42	9.42	0.53	0.72	± 12.0 %
1810	40.0	1.40	7.74	7.74	7.74	0.41	0.94	± 12.0 %
1900	40.0	1.40	7.72	7.72	7.72	0.49	0.85	± 12.0 %
2450	39.2	1.80	7.04	7.04	7.04	0.39	1.03	± 12.0 %
2600	39.0	1.96	6.87	6.87	6.87	0.60	0.80	± 12.0 %
3500	37.9	2.91	6.82	6.82	6.82	0.55	0.88	± 13.1 %
5200	36.0	4.66	4.91	4.91	4.91	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.63	4.63	4.63	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.43	4.43	4.43	0.40	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Calibration Parameter Determined in Body Tissue Simulating Media

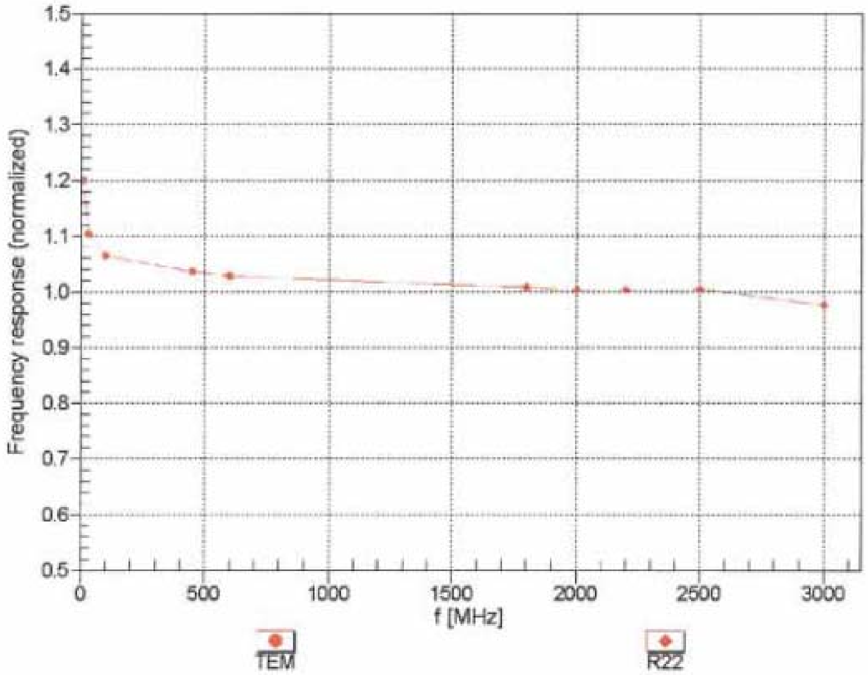
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
450	56.7	0.94	10.53	10.53	10.53	0.10	1.00	± 13.3 %
750	55.5	0.96	9.28	9.28	9.28	0.39	0.93	± 12.0 %
835	55.2	0.97	9.22	9.22	9.22	0.65	0.72	± 12.0 %
900	55.0	1.05	9.04	9.04	9.04	0.75	0.67	± 12.0 %
1810	53.3	1.52	7.36	7.36	7.36	0.80	0.62	± 12.0 %
1900	53.3	1.52	7.25	7.25	7.25	0.55	0.76	± 12.0 %
2450	52.7	1.95	6.88	6.88	6.88	0.80	0.58	± 12.0 %
2600	52.5	2.16	6.67	6.67	6.67	0.80	0.50	± 12.0 %
3500	51.3	3.31	6.29	6.29	6.29	0.44	1.02	± 13.1 %
5200	49.0	5.30	4.22	4.22	4.22	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.91	3.91	3.91	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.00	4.00	4.00	0.50	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4– SN:3710 March 4, 2014

Frequency Response of E-Field

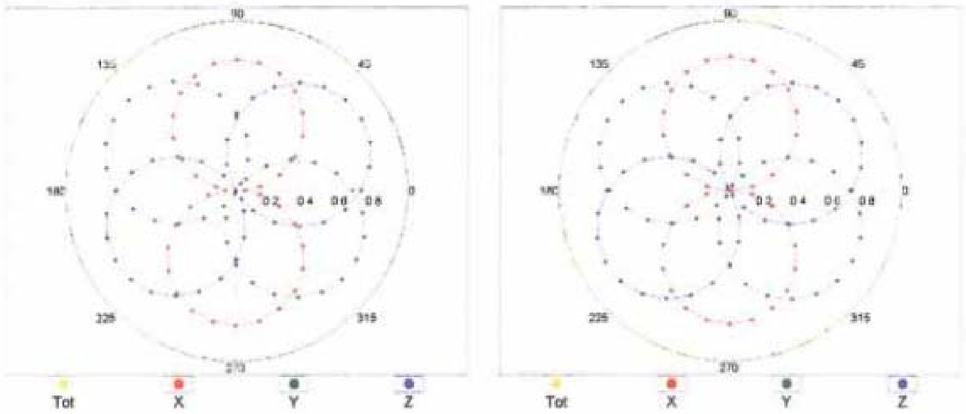
(TEM-Cell:ifi110 EXX, Waveguide: R22)

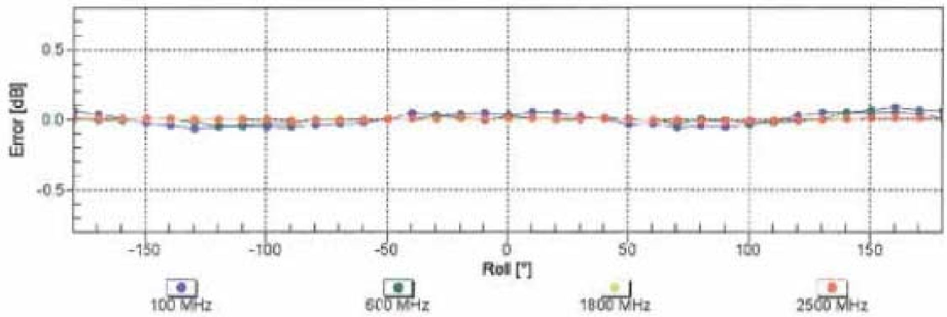


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM f=1800 MHz,R22

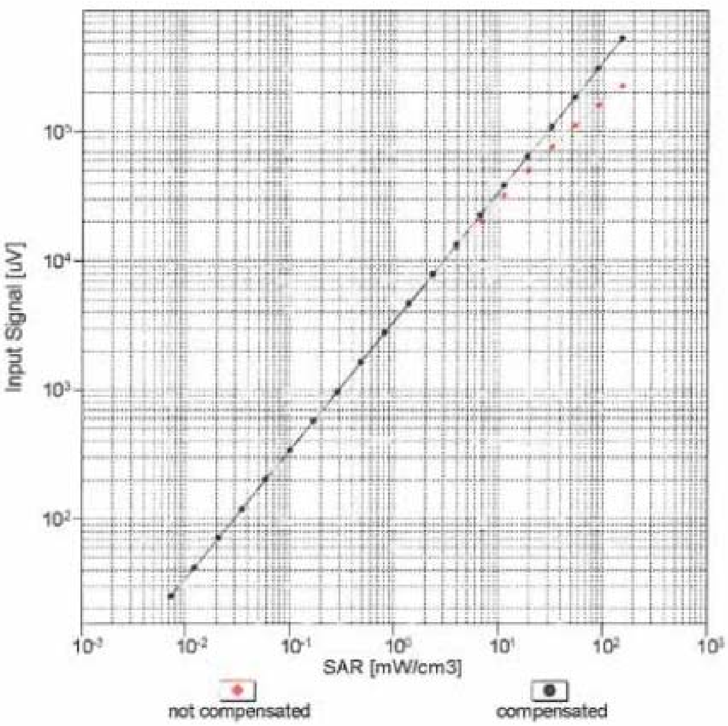


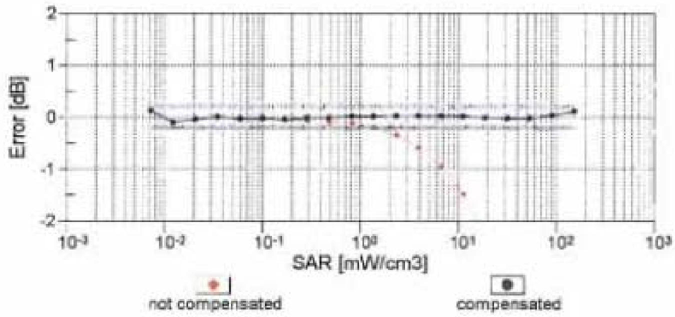


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3710 March 4, 2014

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)



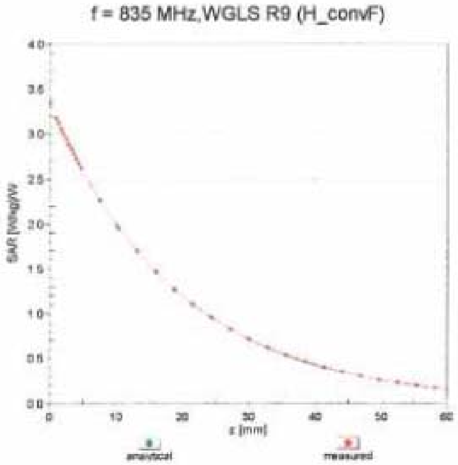


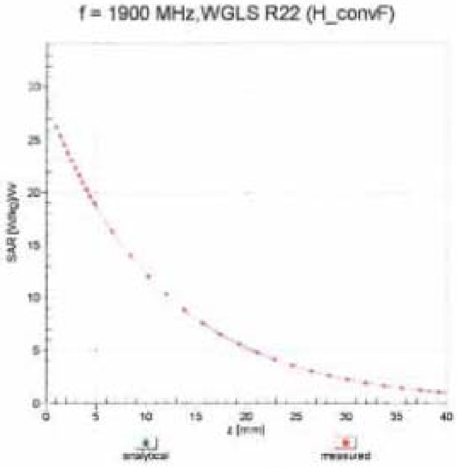
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: EX3-3710_Mar14 Page 9 of 11

EX3DV4– SN:3710 March 4, 2014

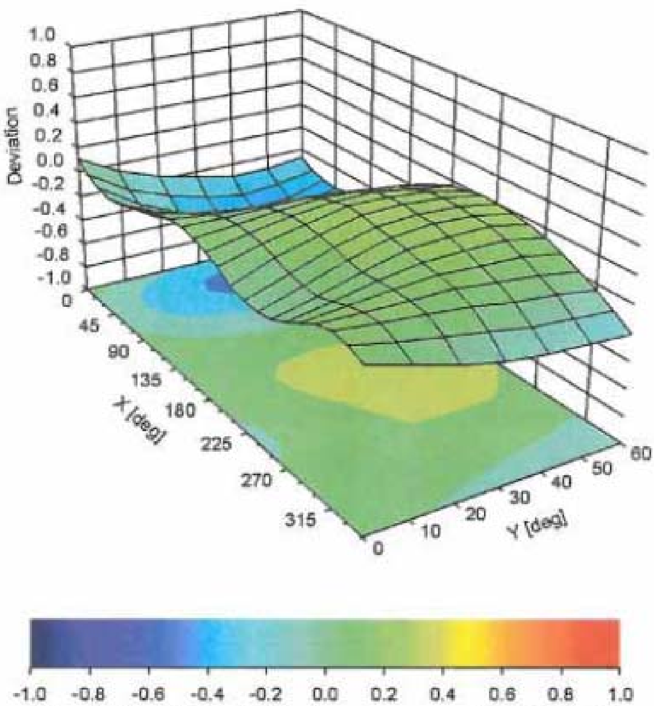
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Certificate No: EX3-3710_Mar14 Page 10 of 11

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-19.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

APPENDIX V: DIPOLE CALIBRATION DATA

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Accreditation No.: **SCS 108**

Client **Quitek-CN (Auden)**

Certificate No: **D2450V2-839_Feb14**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 839

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: February 24, 2014

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: February 24, 2014

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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.1 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.7 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω + 2.4 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.6 Ω + 4.3 jΩ
Return Loss	- 27.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 20, 2009

DASY5 Validation Report for Head TSL

Date: 24.02.2014

Test Laboratory: SPEAG, Zurich, Switzerland

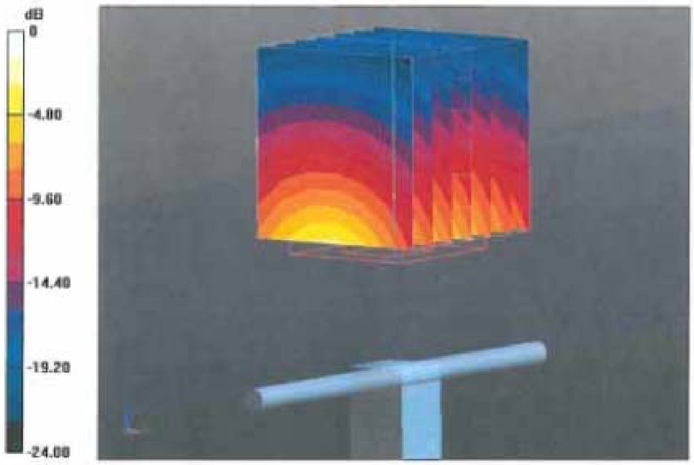
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 839

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

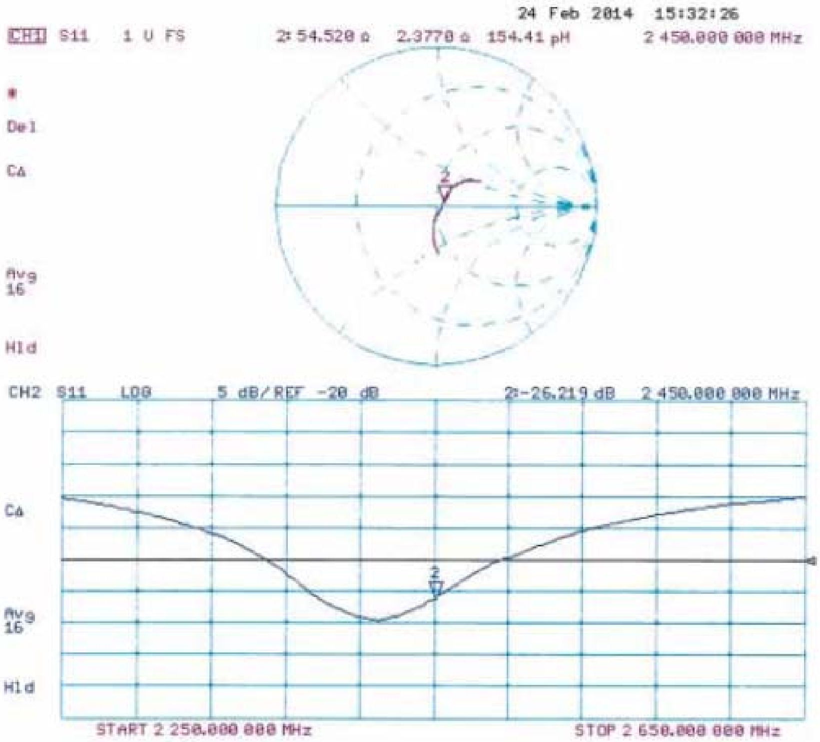
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.591 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.15 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Certificate No: D2450V2-839_Feb14 Page 5 of 8

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.02.2014

Test Laboratory: SPEAG, Zurich, Switzerland

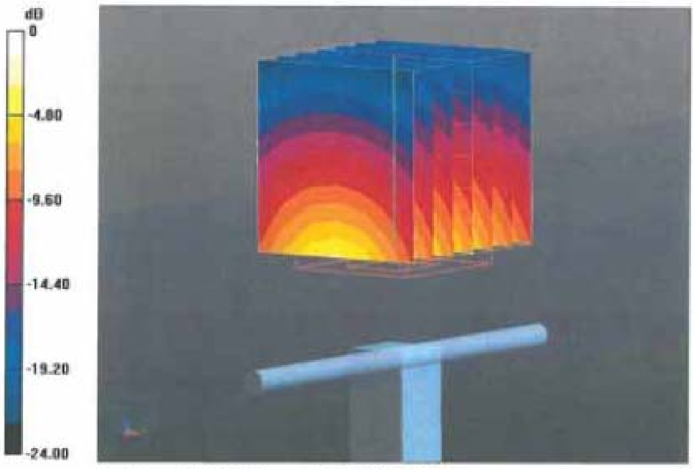
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 839

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

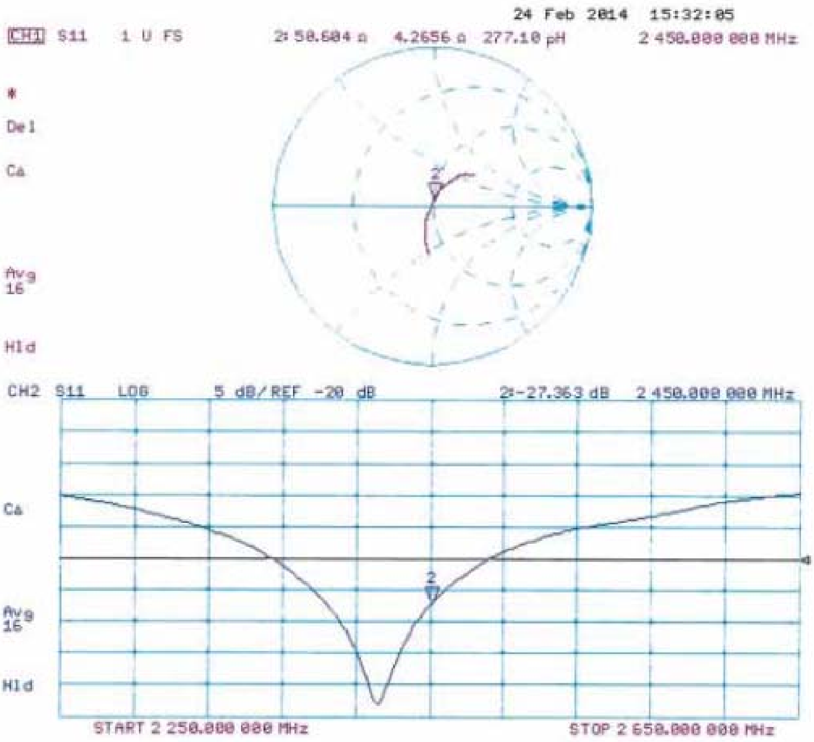
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.267 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 27.1 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.86 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Certificate No: D2450V2-839_Feb14 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-839_Feb14 Page 8 of 8

APPENDIX VI: DAE CALIBRATION DATA

Calibration Laboratory of
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Accreditation No.: **SCS 108**

Client **Quietek-CN (Auden)**

Certificate No: **DAE4-1220_Jan14**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1220
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	January 22, 2014

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	[signature]
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V. [signature]

Issued: January 22, 2014

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: DAE4-1220_Jan14 Page 1 of 5

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Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1µV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.217 ± 0.02% (k=2)	404.944 ± 0.02% (k=2)	404.170 ± 0.02% (k=2)
Low Range	3.97747 ± 1.50% (k=2)	3.99640 ± 1.50% (k=2)	3.98639 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	176.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199996.00	0.76	0.00
Channel X	+ Input	20002.66	1.98	0.01
Channel X	- Input	-19998.07	2.88	-0.01
Channel Y	+ Input	199996.91	1.60	0.00
Channel Y	+ Input	20001.20	0.56	0.00
Channel Y	- Input	-20001.74	-0.74	0.00
Channel Z	+ Input	199994.91	-0.44	-0.00
Channel Z	+ Input	20000.27	-0.23	-0.00
Channel Z	- Input	-20001.65	-0.63	0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2001.09	0.27	0.01
Channel X	+ Input	202.00	0.81	0.40
Channel X	- Input	-197.89	0.69	-0.35
Channel Y	+ Input	2000.99	0.22	0.01
Channel Y	+ Input	200.07	-1.02	-0.50
Channel Y	- Input	-201.19	-2.34	1.18
Channel Z	+ Input	2000.92	0.16	0.01
Channel Z	+ Input	200.20	-0.82	-0.41
Channel Z	- Input	-199.32	-0.45	0.23

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	10.55	8.63
	- 200	-6.76	-8.77
Channel Y	200	-9.89	-10.34
	- 200	7.59	7.71
Channel Z	200	12.72	12.38
	- 200	-13.94	-14.25

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	1.02	-3.16
Channel Y	200	8.35	-	2.35
Channel Z	200	10.56	5.06	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15888	15493
Channel Y	16012	15900
Channel Z	15706	16099

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	1.13	-0.62	2.79	0.50
Channel Y	-0.89	-2.63	0.76	0.48
Channel Z	-0.60	-2.36	0.94	0.50

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

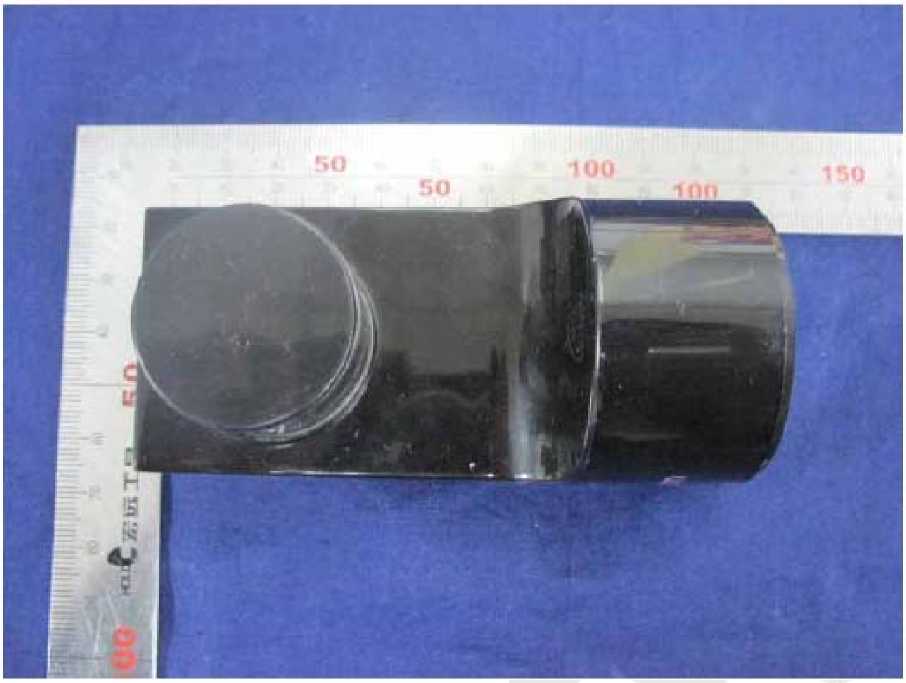
8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	–0.01	-8	-9

APPENDIX VII: PHOTOS OF EUT

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