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Libro 82, Folio 133, Hoja MA3729

ENSAYOS Nº 51/LE342

TEST REPORT

REFERENCE STANDARDS:

FCC 47CFR Part 2.1093 (10-1-12 Edition)

FCC OET Bulletin 65, Supplement C (Edition 01-01)

IC RSS-102 Issue 4 (2010-03)

NIE ..... :	36156RRF.003
Approved by (name / position & signature) ..... :	A. Llamas / RF Lab. Manager
Elaboration date ..... :	2013-05-15

Alejandro Llamas Rodríguez
Firmado digitalmente por Alejandro Llamas Rodríguez
Fecha: 2013.05.15 15:17:26 +02'00'

Identification of item tested ..... :	TEAM2 TRANSMITTER
Trademark ..... :	Polar
Model and/or type reference ..... :	TEAM2 TRANSMITTER
Serial number ..... :	C303P12086275, C303P12086278, C303P12086266
HW version ..... :	39032246.20
SW version ..... :	71037358.04
Features ..... :	Bluetooth® 2.1, Class I, Used profile SPP
Description ..... :	Special test-SW, 3 samples, continuous operation with modulated carrier, channels 2402MHz, 2441MHz, 2480MHz This device contains a WT11i-A Bluetooth module (FCC ID: QOQWT11IA, IC: 5123A-BGTWT11IA) from the company BlueGiga Technologies Inc. in which EDR capabilities has been disabled.
Applicant ..... :	POLAR ELECTRO OY
Address ..... :	Professorintie 5, 90440 Kempele, Finland
CIF/NIF/Passport ..... :	VAT FI02099112
Contact person:	Antti Häggman
Telephone / Fax ..... :	+358(0)8 5202 128 / +358(0)8 5202 220
e-mail: ..... :	antti.haggman@polar.com
Test samples supplier ..... :	Same as applicant
Manufacturer ..... :	Same as applicant

Test method requested ..... :	See Standard
Standard..... :	1. FCC 47 CFR Part 2.1093 (10-1-12 Edition). Radiofrequency radiation exposure evaluation: portable devices. 2. FCC OET Bulletin 65, Supplement C (Edition 01-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields". 3. IC RSS-102 Issue 4 (2010-03). Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Reference documents ..... :	1. FCC OET KDB 447498 D01 – General RF Exposure Guidance v05 (October 2012) 2. FCC OET KDB 865664 D01 – SAR measurement 100 MHz to 6 GHz v01 (October 2012) 3. FCC OET KDB 865664 D02 – SAR Reporting v01 (October 2012) 4. IEEE Std 1528-2003 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
Test procedure ..... :	PERF019
Non-standardized test method ..... :	N/A
Used instrumentation ..... :	1. Dosimetric E-field probe SPEAG ES3DV3 2. Data acquisition device SPEAG DAE4 3. Electro-optical converter SPEAG EOC3 4. Robot STÄUBLI RX60BL 5. Robot controller STÄUBLI CS7MB 6. Measurement server SPEAG DASY5 SE UMS 011 BS 7. Oval flat phantom SPEAG ELI 4 8. Laptop positioner SPEAG SM LH1 001 AC 9. SAR measurement software SPEAG DASY52 V52.8.2.969 10. SAR postprocessing software SPEAG SEMCAD X 11. Body Tissue Equivalent Liquid for 2450 MHz 12. RF Generator Agilent ESG E4438C 13. Power amplifier MITEQ AMF-4D-00400600-50-30P 14. DC Power supply R&S NGSM 32/10 15. Directional coupler NARDA 4227-16 16. Dual directional coupler HP 778D 17. 6dB attenuator Weinschel 75A-6-11 18. Power meter R&S NRVD 19. Power sensor R&S NRV-Z51 20. Power sensor R&S NRV-Z1 21. 2450 MHz dipole validation kit SPEAG D2450V2 22. Vector network analyzer Agilent E5071C 23. Dielectric probe kit SPEAG DAK-3.5
Report template No. ..... :	FDT08_14

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Competences and guarantees

AT4 wireless is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 342.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance programme for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the following documents:

1. PODT000 - Uncertainties calculation
2. IEEE Std 1528-2003 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample M/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
36156B/44	Transmitter	Team2	C303P12086275	2013-01-30

Sample M/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
36156B/43	Transmitter	Team2	C303P12086278	2013-01-30

Sample M/03 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
36156B/42	Transmitter	Team2	C303P12086266	2013-01-30

1. Sample M/01 has undergone the test(s) specified in subclause "Test method requested" for lowest channel.
2. Sample M/02 has undergone the test(s) specified in subclause "Test method requested" for middle channel.
3. Sample M/03 has undergone the test(s) specified in subclause "Test method requested" for highest channel.

Testing period

The performed test started on 2013-03-18 and finished on the same day.

The tests have been performed at AT4 wireless.

Environmental conditions

In the chamber for measurements, the following limits were not exceeded during the tests:

Temperature	Min. = 20.15 ºC Max. = 23.54 ºC
Relative humidity	Min. = 34.33 % Max. = 53.85 %

Summary

Considering the results of the performed test according to standards FCC 47CFR Part 2.1093, the item/s under test is/are **IN COMPLIANCE** with the requested specifications specified in the standard.

The maximum 1g volume averaged SAR found during this test has been 0.349 W/kg.

NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, "USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS".

Remarks and comments

1: Due to test mode limitations, 1 sample was needed to measure each channel.

2: Only the plots of the highest SAR for each test configuration and each chain is included in appendix C, according to FCC OET Bulletin 65, Supplement C (Edition 01-01), “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields”, appendix B.

3: See Appendix D “Photographs” for more details.

4: All the test positions of device relative to body were measured placing the device in direct contact with the phantom surface.

Testing veredicts

Not applicable .....: NA

Pass.....: P

Fail: F

Not measured.....: NM

FCC 47CFR Part 2.1093 Paragraph	VERDICT			
	NA	P	F	NM
(d)(2) Bluetooth		P		

APPENDIX A: Test Configuration

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1. GENERAL INTRODUCTION

1.1. Application Standard

The Federal Communications Commission (FCC) sets the limits for General Population / Uncontrolled exposure to radio frequency electromagnetic fields for transmitting devices designed to be used within 20 centimetres of the user body under FCC 47 CFR Part 2.1093 - "Radiofrequency radiation exposure evaluation: portable devices", paragraph (d)(2).

Specific requirements and procedure for SAR assessment are describe under FCC OET Bulletin 65, Supplement C (Edition 01-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields", and all the FCC OET Knowledge Database documents referred at the beginning of this document.

1.2. General requirements

The SAR measurement has been performed continuing the following considerations and environment conditions:

- The ambient temperature shall be in the range of 18ºC to 25ºC and the variation shall not exceed +/-2ºC during the test.
- The ambient humidity shall be in the range of and 30% - 80%.
- The device battery shall be fully charged before each measurement.

1.3. Measurement system requirements

The measurement system used for SAR tests fulfils the procedural and technical requirements described at the reference standards used.

The phantom is a simplified representation of the human anatomy and comprised of material with electrical properties similar to the corresponding tissues in human body.

1.4. Measurement Liquids requirements.

The liquids used to simulate the human tissues, must fulfils the requirements of the dielectric properties required. These dielectric properties of the liquids are indicated in the FCC OET Bulletin 65, Supplement C.

As indicated in FCC OET KDB 865664, it's allowed a 10% variation of the above mentioned level if the measured SAR results are corrected using the SAR error compensation algorithms documented in draft standard IEEE P1528-2011. If the correction ΔSAR has a negative sign, the measured SAR results are not corrected.

2. MEASUREMENT SYSTEM

2.1. Measurement System

Manufacturer	Device	Type
Schmid & Partner Engineering AG	Dosimetric E-Field Probe	ES3DV3
Schmid & Partner Engineering AG	Data Acquisition Electronics	DAE4
Schmid & Partner Engineering AG	Electro-Optical Converter	EOC3
Stäubli	Robot	RX60BL
Stäubli	Robot controller	CS7MB
Schmid & Partner Engineering AG	Measurement Server	DASY5 SE UMS 011 BS
Schmid & Partner Engineering AG	Oval flat phantom	ELI 4
Schmid & Partner Engineering AG	Laptop Positioner	SPEAG SM LH1 001 AC
Schmid & Partner Engineering AG	Measurement Software	DASY52 V52.6.2.424
Schmid & Partner Engineering AG	Postprocessing Software	SEMCAD X
Agilent	RF Generator	ESG E4438C
MITEQ	Power amplifier	AMF-4D-00400600-50-30P
Rohde & Schwarz	DC Power supply	NGSM 32/10
NARDA	Directional coupler	4227-16
Weinschel	6dB attenuator	75A-6-11
Rohde & Schwarz	Power Meter	NRVD
Rohde & Schwarz	Power Sensor	NRV-Z51
Rohde & Schwarz	Power Sensor	NRV-Z1
Schmid & Partner Engineering AG	2450 MHz System Validation Dipole	D2450V2
Agilent	Vector Network Analyser	E5071C
Schmid & Partner Engineering AG	Dielectric Probe Kit	DAK-3.5

Table 1: Measurement Equipment

2.2. Test Positions of device relative to the body

The device under test could be described as a body-worn device, so the test positions are:

- *Front face* [3]
- *Back face* [3]

3: See remarks and comments.

The device was tested using the front face position because it was confirmed being the worst case.

2.3. Test to be performed

Test shall be performed at the position previously described and using the low-end, the high-end and centre frequency of each operating band, using the transmission mode with the highest averaged output power.

If the device is also designed to transmit with other configurations (antenna fully extended/retracted, keypad cover opened/closed…), all tests described above shall be performed for each configuration. When considering multi-mode and multi-band devices, all of the above tests shall be performed at each transmitting mode/band with the corresponding maximum peak power level.

2.4. Description of interpolation/extrapolation scheme

The local SAR inside the Phantom is measured using small dipole sensing elements inside a probe element. The probe tip must not be in contact with the Phantoms surface in order to minimise measurement errors, but the highest local SAR is obtained from measurements at a certain distances from the shell trough extrapolation. The accurate assessment of the maximum SAR averaged over 1gr. requires a very fine resolution in the three dimensional scanned data array. Since the measurements have to be performed over a limited time, the measured data have to be interpolated to provide an array of sufficient resolution.

The interpolation of 2D area scan is used after the initial area scan, at a fixed distance from the Phantom shell wall. The initial scan data is collected with approx. 15 mm spatial resolution and this interpolation is used to find the location of the local maximum for positioning the subsequent 3D scanning within a 1mm resolution.

For the 3D scan, data is collected on a spatially regular 3D grid having 5 mm steps in both directions. After the data collection by the SAR probe, the data are extrapolated in the depth direction to assign values to points in the 3D array closer to the shell wall. A notional extrapolation value is also assigned to the first point outside the shell wall so that subsequent interpolation schemes will de applicable right up to the shell wall boundary.

2.5. Determination of the largest peak spatial-average SAR

To determine the maximum value of the peak spatial-average SAR of a EUT, all device positions, configurations and operational modes should be tested for each frequency band.

According to FCC 47 CFR Part 2.1093, the averaging volume shall be chosen as 1 g of contiguous tissue. The cubic volumes, over which the SAR measurements are averaged after extrapolation and interpolation, are chosen in order to include the highest values of local SAR.

The maximum SAR level for the EUT will be the maximum level obtained of the performed measurements, and indicated in the previous points.

2.6. System Check

Prior to the SAR measurements, system verification is done daily to verify the system accuracy. As FCC OET Bulletin 65 – Supplement C, Appendix D "SAR measurement procedures" Paragraph "System Verification" specifies, a complete SAR evaluation is done using a half-wavelength dipole as source with the frequency of the mid-band channel of the operating band, or within 100MHz of this channel.

The measured one-gram SAR should be within 10% of the expected target values specified in the calibration certificate of the dipole, for the specific tissue and frequency used.

3. SAR LIMIT

Having a worst case measurement, the SAR limit is valid for general population/uncontrolled exposure.

The SAR values have to be averaged over a mass of 1 gr. ($SAR_{1\ gr.}$) with the shape of a cube. This level couldn't exceed the values indicated in the application Standard:

Standard	SAR	SAR Limit (W/Kg)
FCC 47 CFR Part 2.1093 Paragraph (d)(2)	$SAR_{1\ gr.}$	1.6

Table 2: SAR limit

4. UNCERTAINTY

Uncertainty for 300 MHz – 6 GHz

ERROR SOURCES	Uncertainty value (± %)	Probability distribution	Divisor	(c_i) 1g	(c_i) 10g	Standard uncertainty (1g) (± %)	Standard uncertainty (10g) (± %)
Measurement Equipment							
Probe Calibration	6.550	N	1	1	1	6.550	6.550
Isotropy	7.558	R	√3	1	1	4.364	4.364
Linearity	4.700	R	√3	1	1	2.714	2.714
Probe modulation response	2.300	R	√3	1	1	1.328	1.328
Detection limits	0.250	R	√3	1	1	0.144	0.144
Boundary effect	2.000	R	√3	1	1	1.155	1.155
Readout electronics	0.300	N	1	1	1	0.300	0.300
Response time	0.000	R	√3	1	1	0.000	0.000
Integration time	1.900	R	√3	1	1	1.097	1.097
RF Ambien conditions - noise	3.000	R	√3	1	1	1.732	1.732
RF Ambien conditions – reflections	3.000	R	√3	1	1	1.732	1.732
Probe positioner mech. restrictions	0.400	R	√3	1	1	0.231	0.231
Probe positioning with respect to phantom shell	6.700	R	√3	1	1	3.868	3.868
Post-processing	4.000	R	√3	1	1	2.309	2.309
Test Sample Related							
Device holder uncertainty	2.900	N	1	1	1	2.900	2.900
Test sample positioning	3.600	N	1	1	1	3.600	3.600
Drift of output power	5.000	R	√3	1	1	2.887	2.887
Phantom and Setup							
Phantom uncertainty (shape and thickness tolerances)	7.900	R	√3	1	1	4.561	4.561
Algorithm for correcting SAR for deviations in permittivity and conductivity	1.900	N	1	1	0.84	1.900	1.596
Liquid conductivity (meas.)	3.350	N	1	0.78	0.71	2.613	2.379
Liquid permittivity (meas.)	1.500	N	1	0.23	0.26	0.345	0.390
Liquid conductivity – temperature uncertainty	0.440	R	√3	0.78	0.71	0.198	0.180
Liquid permittivity – temperature uncertainty	3.120	R	√3	0.23	0.26	0.414	0.468
Combined standard uncertainty	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					**12.70**	**12.62**
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**25.40**	**25.23**

Table 4: Uncertainty Assessment for 300 MHz - 6 GHz

APPENDIX B: Test results

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1. TEST CONDITIONS

1.1. Temperature (ºC):

T_n = +20.15 to +23.54

The subscript n indicates normal test conditions.

1.2. Test signal, Output Power and Frequencies

The device was put into operation by using an own control test mode required for select the continuous transmission with 100% duty cycle.

2. TISSUE PARAMETERS MEASUREMENTS

Frequency (MHz)	Target Body Tissue: Parameters used in Probe Calibration		Target Body Tissue: Parameters used in Dipole Calibration		Measured Body Tissue		Measured Date
	Permittivity	Conductivity [S/m]	Permittivity	Conductivity [S/m]	Permittivity	Conductivity [S/m]	
2450	52.7 ± 5%	1.95 ± 5%	51.8 ± 6%	2.02 ± 6%	52.24	1.92	2013-03-18

Note: The dielectric properties have been measured by the contact probe method at 22° C.

3. SYSTEM CHECK MEASUREMENTS

Frequency (MHz)	SAR	Target SAR	Measured SAR	Drift (%)	Limit (%)
2450	1 gr.	52.10	55.30	6.14	10
	10 gr.	24.40	25.21	3.33	10

4. MEASUREMENT RESULTS FOR SAR (SPECIFIC ABSORPTION RATE)

4.1. Summary maximum results

Band	Position	Mode	Channel	Frequency (MHz)	Measured SAR 1g (W/Kg)	SAR limit 1g (W/Kg)
2450 MHz	Front face	Bluetooth	0	2402	0.349	1.6

4.2. Results for 2450 MHz Band

Position	Mode	Channel	Frequency (MHz)	SAR averaged over 1g (W/Kg)	Power Drift (%)
Front face	Bluetooth	0	2402	0.349	1.04
		39	2441	0.312	0.23
		78	2480	0.230	1.04

APPENDIX C: Measurements Reports

Bluetooth / Lowest Channel

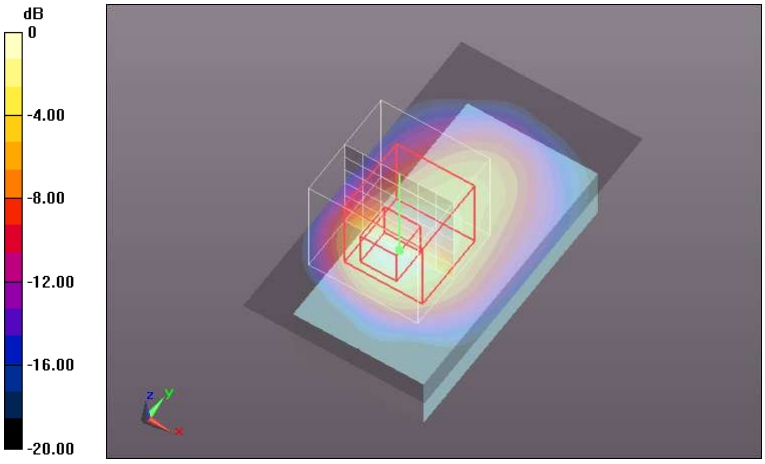
DUT: Team2 Transmitter; Type: -; Serial: C303P12086278

Communication System: Bluetooth; Frequency: 2402 MHz; Duty Cycle: 1:3.1886
Medium parameters used (interpolated): f = 2402 MHz; σ = 1.872 S/m; ε_r = 52.374; ρ = 1000 kg/m^3
Phantom section: Flat Section

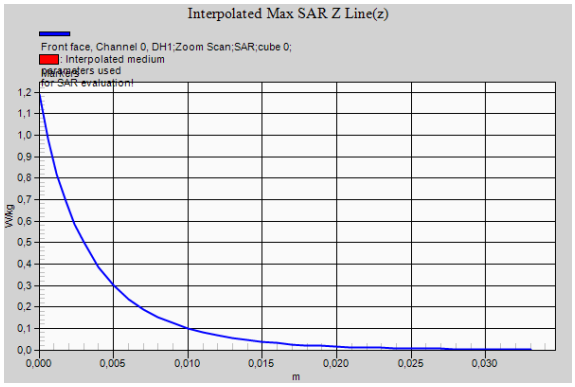
DASY5 Configuration:
- Probe: ES3DV3 - SN3052; ConvF(4.27, 4.27, 4.27); Calibrated: 15/11/2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn669; Calibrated: 24/08/2012
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

2450MHz band/Front face, Channel 0, DH1/Area Scan (51x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.573 W/kg

2450MHz band/Front face, Channel 0, DH1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.364 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.349 W/kg; SAR(10 g) = 0.141 W/kg
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.467 W/kg



0 dB = 0.573 W/kg = -2.42 dBW/kg



APPENDIX D: 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 AT4 Wireless

Certificate No: ES3-3052_Nov12

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3052

Calibration procedure(s): QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: November 15, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: November 15, 2012

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
S 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	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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
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, VRx,y,z*: *A, B, C* 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.

Probe ES3DV3

SN:3052

Manufactured: September 30, 2003
Repaired: November 8, 2012
Calibrated: November 15, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3052

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.37	1.35	1.35	± 10.1 %
DCP (mV)[B]	99.7	100.4	97.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.0	0.0	1.0	166.1	±3.3 %
			Y	0.0	0.0	1.0	168.1	
			Z	0.0	0.0	1.0	165.2	
10011	UMTS-FDD (WCDMA)	2.91	X	3.33	66.9	18.5	132.1	±0.7 %
			Y	3.37	67.4	19.0	134.9	
			Z	3.31	66.3	18.0	131.9	
10012	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	1.87	X	3.08	69.2	19.0	133.9	±0.7 %
			Y	2.95	68.6	18.9	137.8	
			Z	3.09	68.7	18.5	133.6	
10013	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	9.46	X	11.29	70.9	23.6	130.7	±4.1 %
			Y	11.84	72.6	24.8	135.8	
			Z	11.42	71.1	23.6	131.3	
10021	GSM-FDD (TDMA, GMSK)	9.39	X	19.60	99.4	28.6	137.8	±1.9 %
			Y	20.94	99.7	28.7	101.8	
			Z	21.20	99.7	28.6	142.6	
10023	GPRS-FDD (TDMA, GMSK, TN 0)	9.57	X	12.44	90.5	25.5	120.0	±2.2 %
			Y	21.93	100.0	28.7	143.0	
			Z	15.30	93.6	26.6	122.5	
10024	GPRS-FDD (TDMA, GMSK, TN 0-1)	6.56	X	28.44	100.0	26.1	116.7	±1.7 %
			Y	32.08	99.5	25.5	125.4	
			Z	13.15	87.7	22.2	111.8	
10025	EDGE-FDD (TDMA, 8PSK, TN 0)	12.62	X	13.67	99.2	39.0	122.8	±5.7 %
			Y	14.34	99.2	38.5	141.0	
			Z	14.29	99.2	38.6	121.0	
10026	EDGE-FDD (TDMA, 8PSK, TN 0-1)	9.55	X	9.84	87.3	30.9	117.7	±1.9 %
			Y	15.67	99.8	35.9	123.7	
			Z	8.66	82.7	28.5	114.0	
10027	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	4.80	X	31.61	100.0	24.9	132.9	±2.2 %
			Y	39.38	99.5	24.0	139.8	
			Z	26.98	94.9	22.7	133.4	
10028	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	3.55	X	39.61	99.9	23.3	142.0	±1.9 %
			Y	42.65	99.7	23.1	149.2	
			Z	47.75	99.6	22.7	143.0	
10029	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	7.78	X	13.06	93.8	31.8	136.9	±2.7 %
			Y	16.66	99.0	33.5	142.5	
			Z	12.03	90.6	30.2	135.9	

10048	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	13.80	X	6.65	81.0	25.6	72.0	±1.7 %
			Y	14.87	99.4	32.9	108.6	
			Z	6.75	80.7	25.6	71.5	
10049	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	10.79	X	14.13	93.5	27.6	117.0	±1.2 %
			Y	20.41	99.5	29.5	132.1	
			Z	14.30	93.2	27.6	112.5	
10058	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	6.52	X	10.32	87.7	28.3	145.3	±1.2 %
			Y	7.31	80.7	25.8	104.5	
			Z	8.98	83.8	26.6	138.6	
10098	UMTS-FDD (HSUPA, Subtest 2)	3.98	X	4.67	66.7	18.7	140.4	±0.9 %
			Y	4.77	67.4	19.2	143.7	
			Z	4.69	66.4	18.4	133.5	
10100	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	5.67	X	6.69	68.3	20.3	147.9	±1.4 %
			Y	6.26	66.9	19.6	106.5	
			Z	6.61	67.7	19.8	140.4	
10101	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	6.42	X	7.21	66.7	19.7	110.3	±1.2 %
			Y	7.36	67.3	20.1	114.6	
			Z	7.09	66.1	19.2	104.1	
10102	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	6.60	X	7.46	66.8	19.8	112.4	±1.4 %
			Y	7.68	67.7	20.5	116.2	
			Z	7.35	66.2	19.3	106.5	
10108	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	5.80	X	6.54	67.7	20.1	145.8	±1.4 %
			Y	6.16	66.6	19.6	105.8	
			Z	6.52	67.5	19.8	139.0	
10109	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	6.43	X	6.94	66.2	19.4	107.7	±1.4 %
			Y	7.11	67.0	20.0	112.0	
			Z	7.56	68.1	20.4	148.5	
10110	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	5.75	X	6.20	67.2	19.9	141.8	±1.4 %
			Y	6.37	68.1	20.5	147.1	
			Z	6.19	66.9	19.5	135.4	
10111	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	6.44	X	6.70	66.0	19.4	105.0	±1.4 %
			Y	6.86	66.7	19.9	108.9	
			Z	7.28	67.8	20.3	144.4	
10112	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	6.59	X	7.23	66.6	19.7	108.6	±1.4 %
			Y	7.40	67.3	20.3	114.0	
			Z	7.10	65.9	19.2	104.2	
10113	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	6.62	X	6.94	66.2	19.5	106.2	±1.4 %
			Y	7.13	67.1	20.2	110.5	
			Z	7.51	68.0	20.5	145.7	
10117	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	8.07	X	10.46	69.5	21.8	136.5	±2.7 %
			Y	10.81	70.5	22.5	143.5	
			Z	10.45	69.3	21.6	134.3	
10148	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	5.84	X	6.64	67.9	20.2	146.3	±1.4 %
			Y	6.26	66.7	19.7	107.3	
			Z	6.70	67.9	20.1	145.9	

10149	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	6.42	X	6.99	66.4	19.6	107.9	±1.2 %
			Y	7.12	67.0	20.0	112.8	
			Z	7.00	66.3	19.4	106.8	
10150	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	6.60	X	7.23	66.6	19.7	109.5	±1.2 %
			Y	7.41	67.4	20.3	114.0	
			Z	7.23	66.4	19.6	109.0	
10154	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	5.76	X	6.23	67.3	19.9	142.0	±1.4 %
			Y	6.36	68.0	20.5	147.2	
			Z	6.28	67.2	19.8	141.8	
10155	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	6.43	X	6.67	65.9	19.3	105.2	±1.7 %
			Y	6.88	66.9	20.0	108.9	
			Z	7.35	68.1	20.5	149.8	
10156	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	5.79	X	5.96	66.8	19.8	137.4	±1.2 %
			Y	6.10	67.7	20.4	143.2	
			Z	6.04	66.9	19.7	137.1	
10157	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	6.49	X	7.00	67.9	20.5	144.6	±1.7 %
			Y	7.15	68.7	21.2	149.4	
			Z	7.04	67.8	20.4	143.6	
10158	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	6.62	X	6.95	66.2	19.6	106.3	±1.2 %
			Y	7.14	67.1	20.2	109.8	
			Z	6.95	66.0	19.4	104.9	
10159	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	6.56	X	7.12	67.9	20.6	146.2	±1.4 %
			Y	6.73	66.7	20.0	105.9	
			Z	7.19	68.1	20.5	144.4	
10169	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	5.73	X	4.93	66.1	19.5	123.4	±1.2 %
			Y	5.10	67.3	20.3	127.3	
			Z	4.98	66.1	19.3	122.1	
10170	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	6.52	X	5.67	67.2	20.4	122.6	±1.2 %
			Y	5.87	68.4	21.2	126.9	
			Z	5.76	67.3	20.3	121.0	
10175	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	5.73	X	4.95	66.3	19.6	122.7	±0.9 %
			Y	5.08	67.2	20.3	126.9	
			Z	5.01	66.2	19.4	121.9	
10176	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	6.52	X	5.69	67.3	20.4	122.5	±1.2 %
			Y	5.87	68.3	21.2	127.2	
			Z	5.75	67.2	20.3	120.8	
10177	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	5.73	X	4.97	66.4	19.6	123.7	±0.9 %
			Y	5.10	67.3	20.3	127.2	
			Z	5.03	66.3	19.5	121.5	
10178	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	6.52	X	5.69	67.3	20.5	122.8	±1.4 %
			Y	5.94	68.7	21.4	127.3	
			Z	5.76	67.3	20.3	121.0	
10179	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	6.50	X	5.66	67.3	20.4	122.7	±1.4 %
			Y	5.87	68.5	21.2	127.3	
			Z	5.76	67.3	20.3	120.6	

10180	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	6.51	X	5.75	67.7	20.7	123.1	±1.4 %
			Y	5.91	68.6	21.3	127.3	
			Z	5.74	67.2	20.2	121.0	
10196	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	8.10	X	10.09	69.1	21.6	131.3	±2.7 %
			Y	10.38	70.1	22.4	136.5	
			Z	10.12	69.0	21.5	128.4	
10225	UMTS-FDD (HSPA+)	5.97	X	6.80	66.1	19.1	111.5	±0.9 %
			Y	7.00	66.9	19.7	115.8	
			Z	6.78	65.9	18.9	108.3	

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: ES3DV3 - SN:3052

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	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.56	6.56	6.56	0.33	1.76	± 12.0 %
835	41.5	0.90	6.29	6.29	6.29	0.27	2.00	± 12.0 %
900	41.5	0.97	6.27	6.27	6.27	0.20	2.45	± 12.0 %
1750	40.1	1.37	5.24	5.24	5.24	0.72	1.25	± 12.0 %
1900	40.0	1.40	4.99	4.99	4.99	0.63	1.32	± 12.0 %
2000	40.0	1.40	4.98	4.98	4.98	0.49	1.54	± 12.0 %
2450	39.2	1.80	4.42	4.42	4.42	0.75	1.33	± 12.0 %
2600	39.0	1.96	4.28	4.28	4.28	0.80	1.31	± 12.0 %

[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.

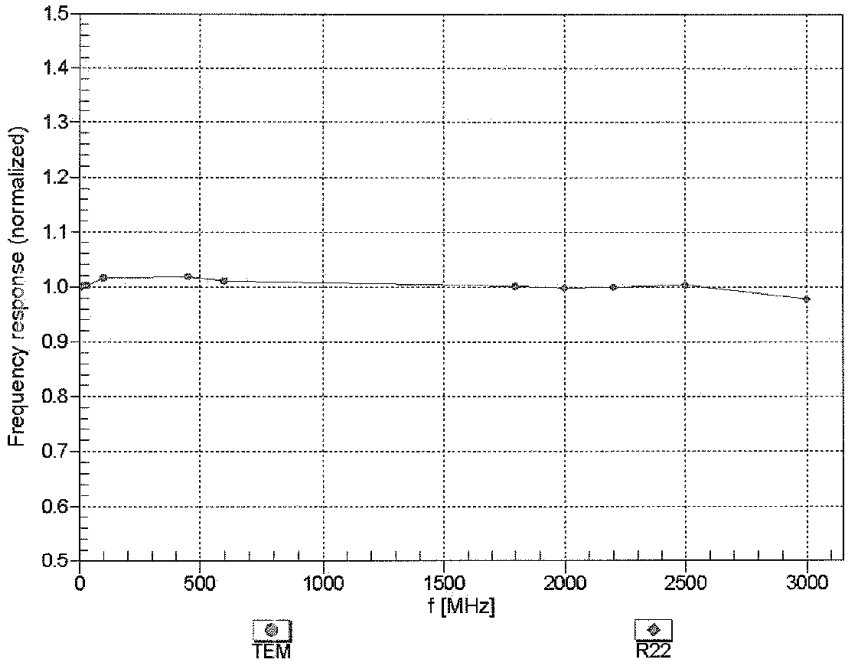
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3052

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	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.29	6.29	6.29	0.62	1.32	± 12.0 %
835	55.2	0.97	6.16	6.16	6.16	0.38	1.72	± 12.0 %
900	55.0	1.05	6.15	6.15	6.15	0.80	1.13	± 12.0 %
1750	53.4	1.49	5.00	5.00	5.00	0.47	1.61	± 12.0 %
1900	53.3	1.52	4.75	4.75	4.75	0.59	1.45	± 12.0 %
2000	53.3	1.52	4.78	4.78	4.78	0.71	1.35	± 12.0 %
2450	52.7	1.95	4.27	4.27	4.27	0.80	1.07	± 12.0 %
2600	52.5	2.16	4.07	4.07	4.07	0.66	1.00	± 12.0 %

[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.

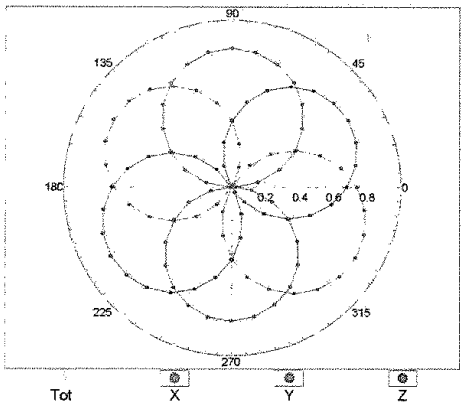
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



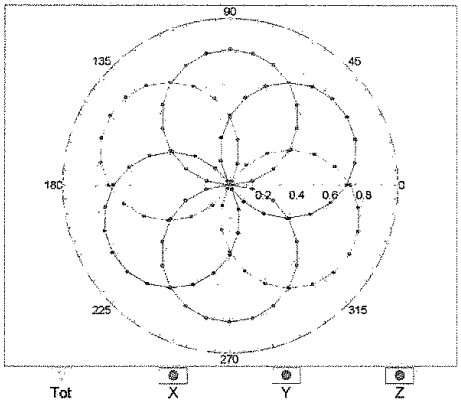
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

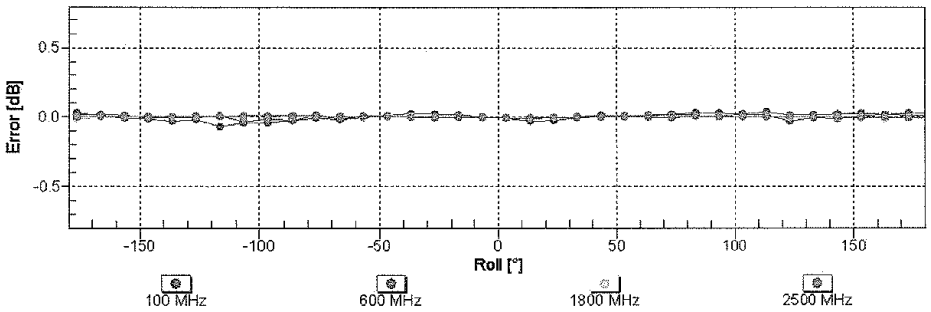
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



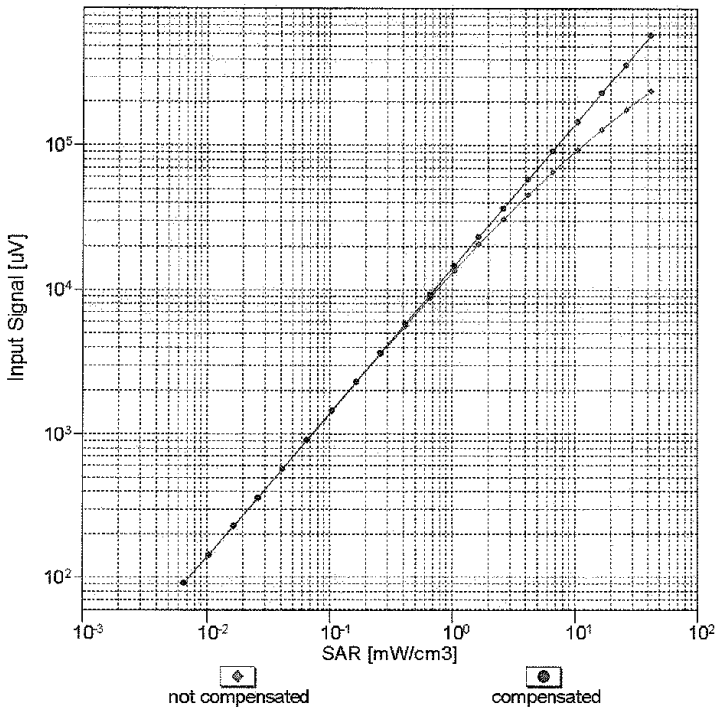
f=1800 MHz,R22

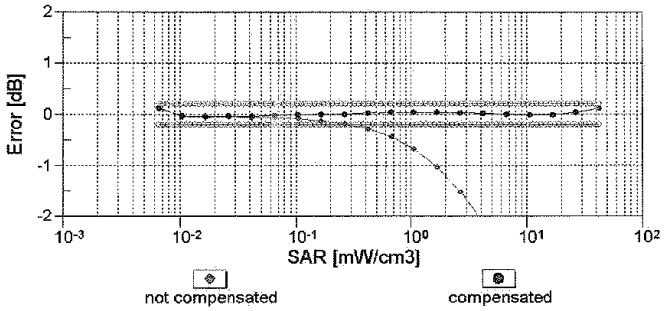




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

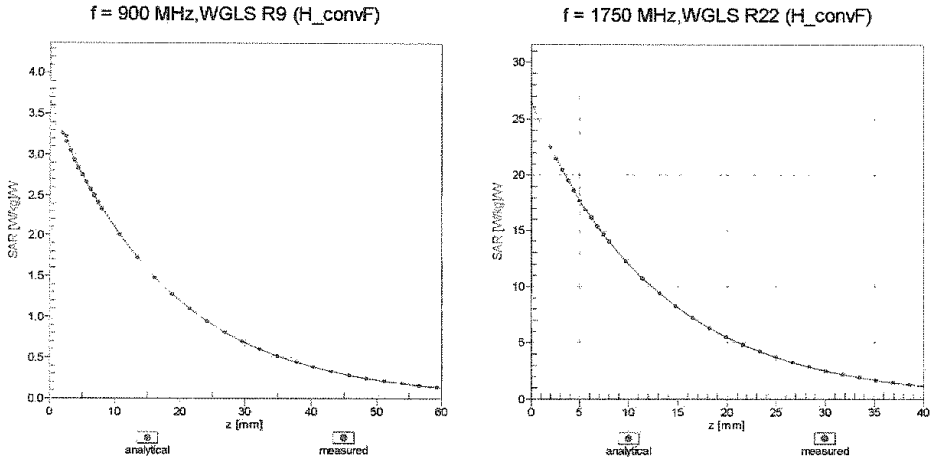
Dynamic Range f(SAR$_{head}$)
(TEM cell , f = 900 MHz)





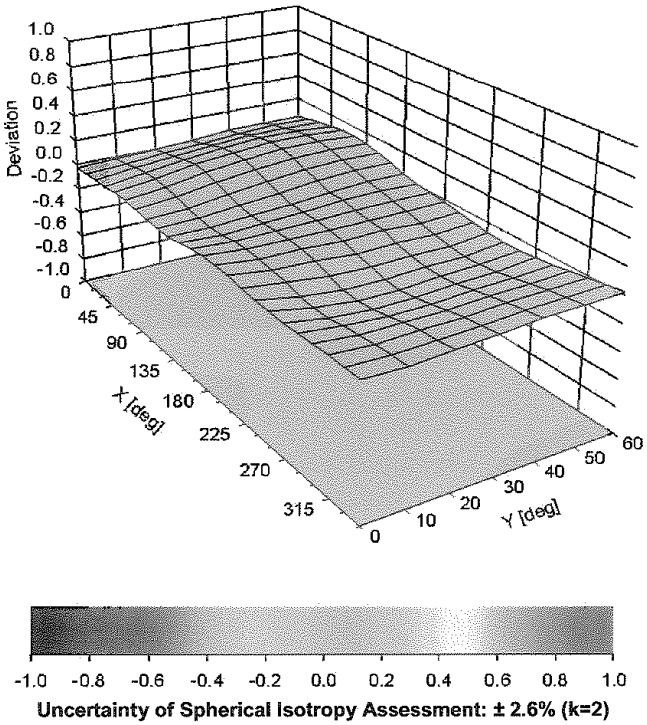
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3052

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	83.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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 AT4 wireless

Certificate No: D2450V2-756_Aug11

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 756
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 25, 2011

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: August 25, 2011

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
S 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
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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
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) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

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.

Measurement Conditions

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

DASY Version	DASY5	V52.6.2
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	

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	51.8 ± 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	13.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**52.1 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.17 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.4 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.1 Ω + 4.1 jΩ
Return Loss	- 26.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.126 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.
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	April 22, 2004

DASY5 Validation Report for Body TSL

Date: 25.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 756

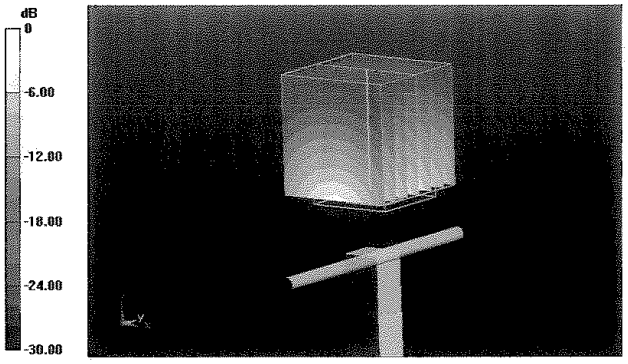
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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 = 96.700 V/m; Power Drift = 0.00061 dB
Peak SAR (extrapolated) = 27.488 W/kg
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.17 mW/g
Maximum value of SAR (measured) = 17.575 mW/g



0 dB = 17.570mW/g

Impedance Measurement Plot for Body TSL