TEST REPORT

Test of: D32CS1

To: KDB 865664 D01 SAR Measurement 100MHz to 6GHz
IEEE1528: 2003

FCC ID: UCE113059A

Test Report Serial No:

UL-SAR-RPA10036246JD05 V2.0

Version 2.0 supersedes previous report versions

This Test Report Is Issued Under The Authority Of Richelieu Quoi, SAR Technology Consultant:	 (APPROVED SIGNATORY)
Checked By: Naseer Mirza	 (APPROVED SIGNATORY)
Issue Date:	**23 August 2013**
Test Dates:	**14 August 2013 to 20 August 2013**

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TABLE OF CONTENTS

1. Customer Information

Company Name:	Panasonic Mobile Comms Dev of Europe Ltd
Address:	Panasonic House Willoughby Road Bracknell Berkshire RG12 8FP United Kingdom

2. Summary of Test Results

Test Name	Specification Reference	Result
Specific Absorption Rate - UMTS FDD 5	KDB 865664 D01 SAR Measurement 100MHz to 6 GHz ANSI C95.1-1992	
Key to Results	 = Complied  = Did not comply	

2.1. Highest Standalone Reported SAR

Individual Transmitter Evaluation per Band:

Exposure Configuration	Technology Band	Mode	Highest Reported 1g -SAR (W/kg)	Equipment Class	Max Rated Source base Avg Power + Max Tolerance [dBm]	Highest Reported 1g-SAR (W/kg)
HEAD (Separation Distance 0mm)	UMTS FDD 5	RMC	0.700	PCE	24.5	0.700
BODY-WORN (Separation Distance 15mm)	UMTS FDD 5	RMC	0.915	PCE	24.5	0.915

Note(s):

As per FCC KDB 447498 D01, Bluetooth maximum source based time average power was below the allowed threshold for both 10 and 15mm separation distances.

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- *(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x]* W/kg for *test separation distances* ≤ 50 mm;
  where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.

For the estimated SAR level calculation, the Maximum Target power + Upper tolerance for *Bluetooth* = 0.0+1.2 dBm (~1.32 mW) is considered.

- **15mm Bluetooth estimated SAR level:**

  Estimated *Bluetooth* SAR = (1.32mW/15mm)*(√2.4 / 7.5) = 0.018 W/kg

2.2. Highest Reported Simultaneous Transmission SAR:

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the *reported* standalone SAR of each applicable simultaneous transmitting antenna.

Simultaneous Transmitter Evaluation:

Exposure Configuration	Technology Band	Highest Reported 1g SAR (W/kg)	Equipment Class	Max Rated Source base Avg Power + Max Tolerance [dBm]	Highest Reported Sum-SAR 1g-SAR (W/kg)	SPLSR Ratio
BODY-WORN (Separation Distance 15mm)	UMTS FDD 5	0.915	PCE	24.5	0.933	N/A
	Bluetooth	0.018	DSS	1.2		

Note(s):

1. As per FCC KDB publication 447498 SAR peak location separation ratio (SPLSR) was not required as the sum of the combination of WWAN+WPAN <1.6 w/kg.
2. Bluetooth estimated SAR level calculation is shown in section 2.1 in this report

2.3. SAR measurement variability and measurement uncertainty analysis:

The SAR measurement variability and measurement uncertainty analysis was not required as the maximum measured SAR is < 0.8 W/kg.

Note(s):

The condition for SAR variability was met as the SAR level measured and calculated was below the specified threshold as per KDB publication 865664 D01, section 2.8.1 and 2.8.2

2.4. Location of Tests

All the measurements described in this report were performed at the premises of
UL, Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG United Kingdom

2.5.Nominal and Maximum Output power:

Bands	CS		HS	
	Max Rated Average Power (dBm)	Tolerances (dB)	Max Rated Average Power (dBm)	Tolerances (dB)
UMTS FDD 5	23.0	-2.0 ~ +1.5	23.0	-2.0 ~ +1.5

Band	Max Rated Average Power (dBm)	Tolerances (dB)
Bluetooth	0.0	-5.0 ~ +1.2

Note:

1. As per KDB865664 D02 SAR Reporting v01r01, 2.1.4(a), the nominal and maximum average source based rated power, declared by manufacturer are shown in the above tables.
2. These are specified maximum allowed average power for all the wireless modes and frequency bands supported as indicated by manufacturer.

3. Test Specification, Methods and Procedures

3.1. Test Specification

Reference:	KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz
Title:	SAR Measurement Requirements for 100 MHz to 6 GHz
Purpose of Test:	Field probes, tissue dielectric properties, SAR scans, measurement accuracy and variability of the measured results are discussed. The field probe and SAR scan requirements are derived from criteria considered in draft standard IEEE P1528-2011. The similar requirements in Supplement C 01-01 are generally superseded by the procedures in this document, and which are required to be used to qualify for TCB equipment approval.
The Equipment Under Test complied with the Specific Absorption Rate for general population/uncontrolled exposure limit of 1.6 W/kg as specified in FCC 47 CFR part 2 (2.1093) and ANSI C95.1-1992 and has been tested in accordance with the reference documents in section 3.2 of this report.	

3.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

IEEE 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

Thomas Schmid, Oliver Egger and Neils Kuster, “Automated E-field scanning system for dosimetric assessments”, IEEE Transaction on microwave theory and techniques,
Vol. 44, pp. 105-113, January 1996.

Neils Kuster, Ralph Kastle and Thomas Schmid, “Dosimetric evaluation of mobile communications equipment with know precision”, IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

FCC KDB Publication:

KDB 447498 D01 General RF Exposure Guidance v05r01

KDB 648474 D04 Handset SAR v01r01

KDB 941225 D01 SAR test for 3G devices v02

KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01

KDB 865664 D02 RF Exposure Reporting v01r01

3.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.

4. Equipment Under Test (EUT)

4.1. Identification of Equipment Under Test (EUT)

Description:	Single Mode UMTS Mobile Phone with BT	
Brand Name:	NTT docomo	
Serial Number:	C9	C10
IMEI Number:	357544050007893	357544050007901
Hardware Version Number:	Revision C	
Software Version Number:	ACPU: B-D32CS1-01.04.001 CCPU: D32CS1_Cv18112102	
FCC ID Number:	UCE113059A	
Country of Manufacture:	None Stated	
Date of Receipt:	13 August 2013	

Note(s):

1. IMEI: 357544050007893 was used to perform WWAN SAR measurements only.
2. IMEI: 357544050007901 was used to perform WWAN conducted power measurements only.

4.2. Description of EUT

The Equipment Under Test is a Flip style Smart Phone with Single Mode UMTS band. The EUT has UMTS FDD 5 With HSPA (with HSDPA Category 8 and HSUPA Category 6) and *Bluetooth* capabilities.

4.3. Modifications Incorporated in the EUT

There were no modification during the course of testing the device

4.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	Personal Hands-Free Kit (PHF)	Battery
Brand Name:	NTT Docomo	NTT Docomo
Model Name or Number:	P001	P23
Serial Number:	Accessory Sample #60	None Stated
Cable Length and Type:	~1.37 m	Not Applicable
Country of Manufacture:	None Stated	None Stated
Connected to Port	3.5mm Audio jack and custom type	3 pin contact

4.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Communication Test Set
Brand Name:	Agilent
Model Name or Number:	8960 Series 10 (E5515C)
Serial Number:	GB46311280
Cable Length and Type:	~4.0m Utiflex Cable
Connected to Port:	RF (Input / Output) Air Link

4.6. Additional Information Related to Testing

Equipment Category	3G UMTS Band 5 : RMC 12.2 kbps			
Type of Unit	Portable Transceiver			
Intended Operating Environment:	Within UMTS and Bluetooth Coverage for General Population / Uncontrolled Exposure category.			
Transmitter Maximum Output Power Characteristics:	UMTS FDD 5	Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.		
	Bluetooth	:=1.2 dBm		
Transmitter Frequency Range:	UMTS FDD 5	826 to 847 MHz		
	Bluetooth	2402 to 2480 MHz		
Transmitter Frequency Allocation of EUT When Under Test:	**Bands**	**Channel Number**	**Channel Description**	**Frequency (MHz)**
	UMTS FDD 5	4132	Low	826.4
		4183	Middle	836.6
		4233	High	846.6
Modulation(s):	QPSK(UMTS / HSDPA / HSUPA):			0 Hz
Modulation Scheme (Crest Factor for technologies SAR tested):	QPSK(UMTS / HSDPA / HSUPA):			1
Antenna Type:	Internal integral			
Antenna Length:	Unknown			
Number of Antenna Positions:	WWAN ~ UMTS			1 fixed
	WPAN ~ BT			1 fixed
Power Supply Requirement:	3.7 V (Nominal)			
Battery Type(s):	Li-ion			

5. Deviations from the Test Specification

Test was performed as per reference documents and FCC KDB publication procedures listed in section 3.2 of this report.

6. Operation and Configuration of the EUT during Testing

6.1. Operating Modes

The EUT was tested in the following operating mode(s) unless otherwise stated:

- UMTS FDD 5 - RMC 12.2kbps allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum as per KDB 941225 D01.
- UMTS FDD 5 - RMC 12.2kbps + HSDPA with Test loop mode 1 and TPC bits configured to all "1's", Sub-test 1 with Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
- UMTS FDD 5 - RMC 12.2kbps + HSUPA with Test loop mode 1 and TPC bits configured to all "1's", Sub-test 5, AG Index set to 21 and E-TFCI set to 81 with Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.

6.2. Configuration and Peripherals

The EUT was tested in the following configuration(s) unless otherwise stated:

- Standalone fully charged battery powered.
- Head and Body-worn configurations were evaluated.

Head Configuration

a) The EUT was placed in a normal operating position with the centre of the ear-piece aligned with the ear canal on the phantom.

b) With the ear-piece touching the phantom the centre line of the EUT was aligned with an imaginary plane (X and Y axis) consisting of three lines connecting both ears and the mouth.

c) For the cheek position the EUT was gradually moved towards the cheek until any point of the mouth-piece or keypad touched the cheek.

d) For the tilted position the EUT was positioned as for the cheek position, and then the horizontal angle was increased by fifteen degrees (the phone keypad was moved away from the cheek by fifteen degrees).

e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.

f) The device was keyed to operate continuously in the transmit mode for the duration of the test.

g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the EUT and its antenna.

h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.

Body Configuration

a) The EUT was placed in a normal operating position where the centre of EUT was aligned with the centre reference point on the flat section of the ‘SAM’ phantom.

b) With the EUT touching the phantom at an imaginary centre line. The EUT was aligned with a marked plane (X and Y axis) consisting of two lines.

c) For the touch-safe position the EUT was gradually moved towards the flat section of the ‘SAM’ phantom until any point of the EUT touched the phantom.

d) For position(s) greater then 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.

e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.

f) The device was keyed to operate continuously in the transmit mode for the duration of the test.

g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the EUT and its antenna.

h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.

6.3. SAR Test Exclusion Consideration

Frequency Band	Configuration(s)			
	Head	Exclusion Threshold	Body-worn	Exclusion Threshold
UMTS FDD 5	No	>3.0	No	>3.0
Bluetooth[1]	N/A	N/A	Yes	<3.0

Note:

1. As per KDB 447498 D01 General RF Exposure Guidance v05, The Frequency Bands with Rated Power including Upper tolerance, which qualify for **Standalone SAR Test Exclusion,** are as per the above table.

   The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] * [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest *mW* and *mm* before calculation
   - The result is rounded to one decimal place for comparison

   The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

   For the SAR Test Exclusion consideration, the Maximum Target power + Upper tolerance for *Bluetooth* = 0.0 + 1.2 = 1.2 dBm (~ 1.32 mW) is considered.

   Applying the above formula for *Bluetooth* Body-worn we get:
   - For 2450MHz, [(1.32)/15]*[√2.4] =0.137 ≤ 3.0

   Hence, testing is not required on *Bluetooth* Body-worn configurations.

2. The details for the ***Maximum Rated Power*** and tolerance(s) can be found in section 2.5.

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 8 for details of measurement uncertainties.

7.2. Conducted Power Measurements: 3G

Modes		HSDPA				HSUPA					WCDMA
Sets		1	2	3	4	1	2	3	4	5	Voice / RMC 12.2kbps
Band	Channel	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
850 (Band 5)	4132 4357	23.5	23.5	23.5	23.5	23.0	20.5	21.8	20.4	23.5	23.5
	4183 4408	23.5	23.5	23.5	23.5	23.1	20.6	21.8	20.4	23.5	23.5
	4233 4458	23.7	23.7	23.7	23.7	23.2	21.2	22.5	21.1	23.7	23.7
ßc		2	12	15	15	11	6	15	2	15	
ßd		15	15	8	4	15	15	9	15	15	
ΔACK, ΔNACK, ΔCQI		8	8	8	8	8	8	8	8	8	
AGV		-	-	-	-	20	12	15	17	21	

The module power levels were measured in both HSPA and 3G RMC 12.2kbps modes and compared to ensure the correct mode of operation had been established.

The following tables taken from FCC 3G SAR procedures (KDB 941225 D01 SAR test for 3G devices v02) below were applied using an Agilent 8960 series 10 wireless communications test set which supports 3G / HSDPA release 5 / HSUPA release 6.

Sub-test Setup for Release 5 HSDPA

Sub-test	β_c	β_d	B_d *(SF)*	β_c/β_d	β_{hs} (1)	SM (dB) (2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 (3)	15/15 (3)	64	12/15 (3)	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ A_{hs} = β_{hs}/β_c = 30/15 ⇔ β_{hs} = 30/15 * β_c

Note 2: CM = 1 for β_c/β_d = 12/15, B_{hs}/β_c = 24/15

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15

Sub-test Setup for Release 6 HSUPA

Sub-test	β_c	β_d	B_d *(SF)*	β_c/β_d	β_{hs} (1)	B_{oc}	B_{od}	B_{od} *(SF)*	B_{od} *(codes)*	CM (2) (dB)	MPR (dB)	AG (4) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	31/15	B_{al1}: 47/15 B_{al2}: 47/15	4	1	2.0	1.0	15	92
4	2/15	15/15	64	2/15	2/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (4)	64	15/15 (4)	24/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ A_{hs} = β_{hs}/β_c = 30/15 ⇔ β_{hs} = 30/15 * β_c

Note 2: CM = 1 for β_c/β_d = 12/15, B_{hs}/β_c = 24/15. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH AND E-DPCCH for the Power Back-off is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Tavle 5.1g.

Note 6: B_{od} can not be set directly; it is set by Absolute Grant Value.

7.3. Test Results

For All SAR measurement in this report the SAR limit tested to is 1.6 W/Kg

7.3.1.Specific Absorption Rate - UMTS-FDD 5 Head Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.582
Maximum Reported Level (W/kg):	0.700

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.7 to 22.7

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
001	Touch Left	4183	23.5	24.5	0.499	0.628	1	QPSK
002	Tilt Left	4183	23.5	24.5	0.207	0.261	1	QPSK
003	Touch Right	4183	23.5	24.5	0.444	0.559	1	QPSK
004	Tilt Right	4183	23.5	24.5	0.203	0.256	1	QPSK
005	Touch Left	4132	23.5	24.5	0.500	0.629	1, 2	QPSK
006	Touch Left	4233	23.7	24.5	0.582	0.700	1, 2	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. Worst case configuration was performed on Low and High Channels.

7.3.2.Specific Absorption Rate - UMTS-FDD 5 Body-Worn Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.738
Maximum Reported Level (W/kg):	0.915

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.7 to 23.0

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
007	Front EUT Open	4183	23.5	24.5	0.305	0.384	1, 2	QPSK
008	Back EUT Open	4183	23.5	24.5	0.593	0.747	1, 2	QPSK
009	Front EUT Close	4183	23.5	24.5	0.308	0.388	1, 2	QPSK
010	Back EUT Close	4183	23.5	24.5	0.648	0.816	1, 2	QPSK
011	Back EUT Close	4132	23.5	24.5	0.727	0.915	1, 2, 3	QPSK
012	Back EUT Close	4233	23.7	24.5	0.738	0.887	1, 2, 3	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.
3. Worst case configuration was performed on Low and High Channels

*As per KDB 941225 D02 - SAR is not required for RMC+HSPA (HSDPA/HSUPA) channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding RMC channels and 1g SAR level reported in 'RMC 12.2kbps' is <75% SAR limit.

*As per 648474 D04 SAR Handsets Multi Xmiter and Ant v01, ''When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset''. Hence, Body worn configurations were not evaluated with PHF attached.

8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Test Name	Confidence Level	Calculated Uncertainty
Specific Absorption Rate- UMTS FDD 5 Head Configuration 1g	95%	±20.08%
Specific Absorption Rate- UMTS FDD 5 Body-Worn Configurations 1g	95%	±21.09%

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

Note:

1. See Appendix 2 section A.2.3 for table calculations and parameters

Appendix 1. Test Equipment Used

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A034	Narda 20W Termination	Narda	374BNM	8706	Calibrated as part of system	-
A1097	SMA Directional Coupler	MiDISCO	MDC6223-30	None	Calibrated as part of system	-
M1755	DAK Fluid probe	Schmid & Partner Engineering AG	SM DAK 040 CA	1089	Calibrated before use	-
A1328	Handset Positioner	Schmid & Partner Engineering AG	Modification	SD 000 H01 DA	-	-
A1234	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	450	22 Jan 2013	12
A1186	Probe	Schmid & Partner Engineering AG	ET3 DV6	1529	22 April 2013	12
A1329	900 MHz Dipole Kit	Schmid & Partner Engineering AG	D900V2	185	22 May 2013	12
A1497	Amplifier	Mini-Circuits	zhl-42w (sma)	e020105	Calibrated as part of system	-
A2125	SAM Phantom	Schmid & Partner Engineering AG	SAM (Site 57)	TP-1031	Calibrated before use	-
A2252	2mm Oval Phantom	Schmid & Partner Engineering AG	Eli5 (Site 57)	1177	Calibrated before use	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1137	3dB Attenuator	Narda	779	04690	Calibrated as part of system	-
A2263	Digital Camera	Samsung	PL211	9453C90B 607487L	-	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	09 Oct 2012	12
C1145	Cable	Rosenberger MICRO-COAX	FA147A F003003030	41843-1	Calibrated as part of system	-
C1146	Cable	Rosenberger MICRO-COAX	FA147A F030003030	41752-1	Calibrated as part of system	-
G0591	Robot Power Supply	Schmid & Partner Engineering AG	DASY4	F01/5J86A1/C/01	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-
M1653	Robot Arm	Staubli	RX908 L	F01/5J8 6A1/C/01	Calibrated before use	-
M1159	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Checked 10 Aug 2013	4
M1647	Signal Generator	Hewlett Packward	8648C	3537A01598	Internal Checked 17 May 2013	4
M1270	Digital Thermometer	RS	N/A	N/A	03 May 2013	12
M1023	Dual Channel Power Meter	R & S	NRVD	863715/030	06 Jun 2013	12
S512	SAR Lab	UL	Site 57	N/A	Calibrated before use	-

Note:

All the assets were in calibration during the course of testing.

A.1.1. Calibration Certificates

This section contains the calibration certificates and data for the Probe(s) and Dipole(s) used, which are not included in the total number of pages for this report.

Checked by : Date : 2-May-2013

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) ASSET A1186 **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client RFI **Certificate No: ET3-1529_Apr13**

CALIBRATION CERTIFICATE

Object ET3DV6 - SN:1529

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

Calibration date: April 22, 2013

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	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-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-15
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: April 22, 2013

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

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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

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; 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.

Probe ET3DV6

SN:1529

Manufactured: March 21, 2000
Calibrated: April 22, 2013

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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1529

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.68	1.89	1.78	± 10.1 %
DCP (mV)[B]	109.8	99.0	97.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	149.7	±2.5 %
		Y	0.0	0.0	1.0		199.9	
		Z	0.0	0.0	1.0		195.1	

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: ET3DV6 - SN:1529

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	6.59	6.59	6.59	0.53	2.04	± 12.0 %
835	41.5	0.90	6.24	6.24	6.24	0.35	2.65	± 12.0 %
900	41.5	0.97	6.13	6.13	6.13	0.40	2.37	± 12.0 %
1450	40.5	1.20	5.20	5.20	5.20	0.46	2.90	± 12.0 %
1750	40.1	1.37	5.13	5.13	5.13	0.80	2.07	± 12.0 %
1900	40.0	1.40	4.93	4.93	4.93	0.80	2.05	± 12.0 %
2100	39.8	1.49	4.93	4.93	4.93	0.80	1.93	± 12.0 %
2450	39.2	1.80	4.30	4.30	4.30	0.80	2.10	± 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: ET3DV6 - SN:1529

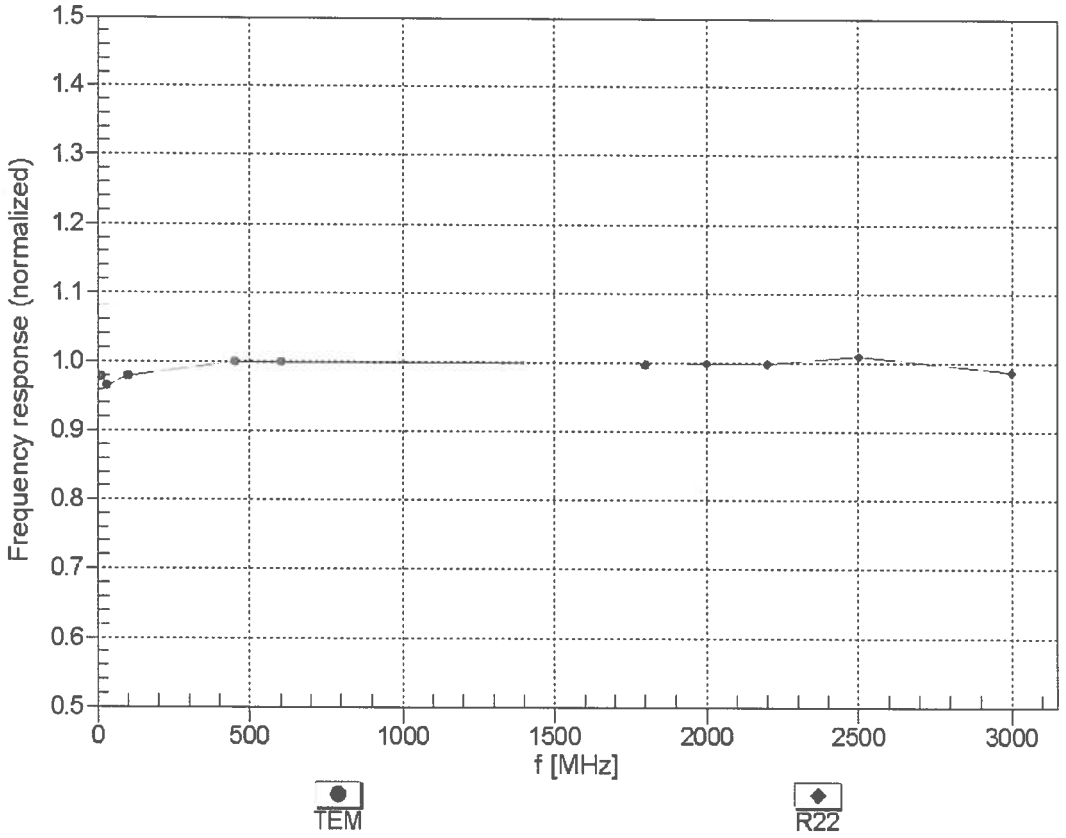
Calibration Parameter Determined in Body Tissue Simulating Media

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	6.31	6.31	6.31	0.43	2.28	± 12.0 %
835	55.2	0.97	6.16	6.16	6.16	0.44	2.29	± 12.0 %
900	55.0	1.05	6.12	6.12	6.12	0.47	2.27	± 12.0 %
1450	54.0	1.30	5.03	5.03	5.03	0.79	1.99	± 12.0 %
1750	53.4	1.49	4.68	4.68	4.68	0.80	2.40	± 12.0 %
1900	53.3	1.52	4.46	4.46	4.46	0.80	2.29	± 12.0 %
2100	53.2	1.62	4.52	4.52	4.52	0.80	2.11	± 12.0 %
2450	52.7	1.95	4.01	4.01	4.01	0.63	2.10	± 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

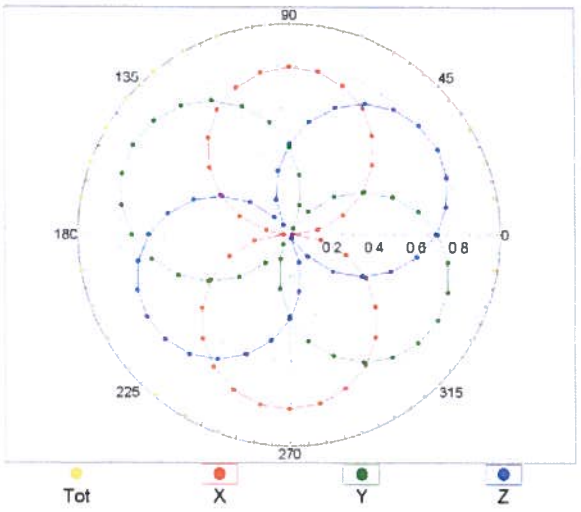
(TEM-Cell:ifi110 EXX, Waveguide: R22)



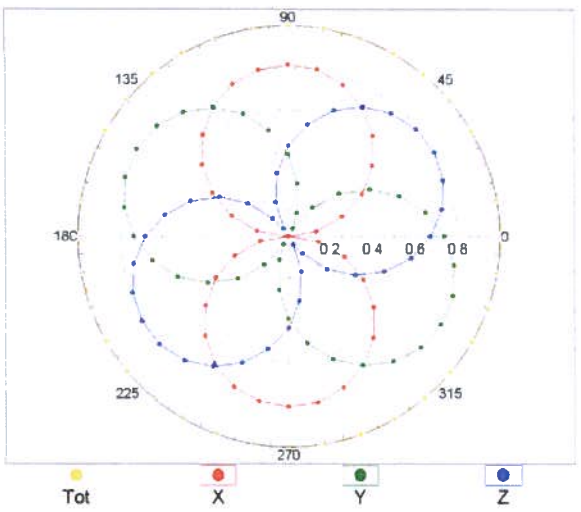
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

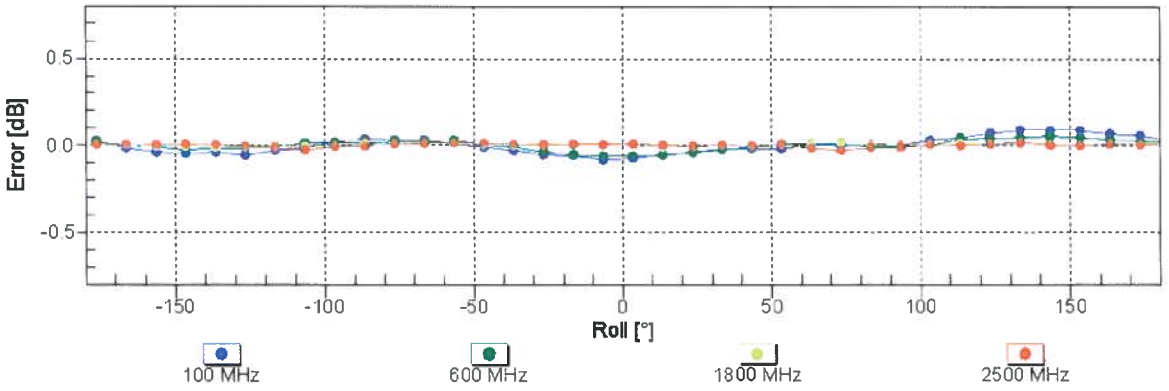
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



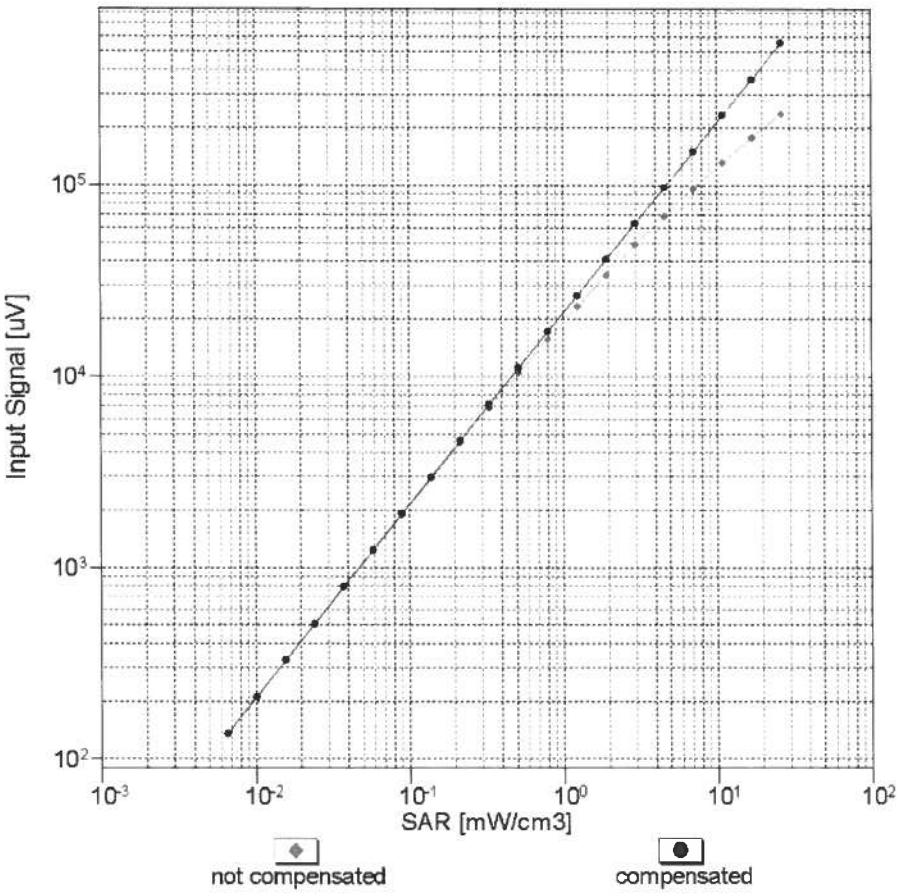
f=1800 MHz,R22

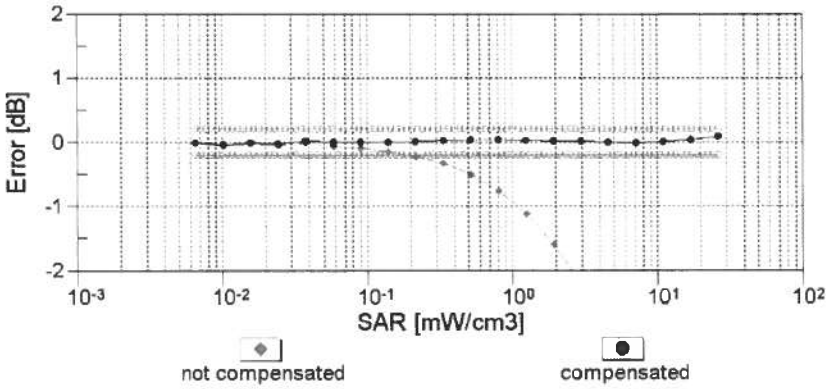




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

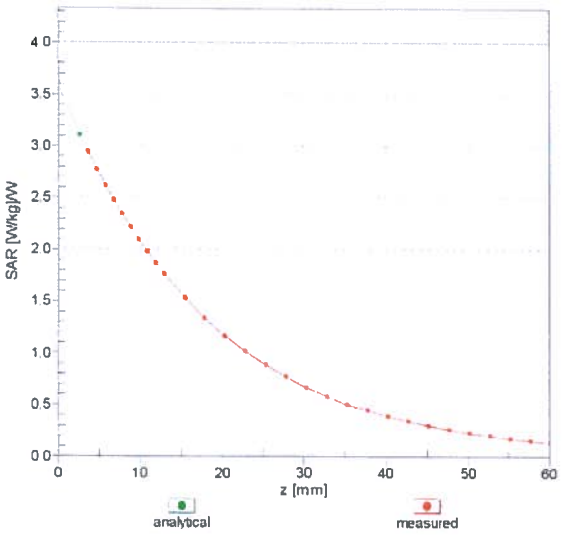




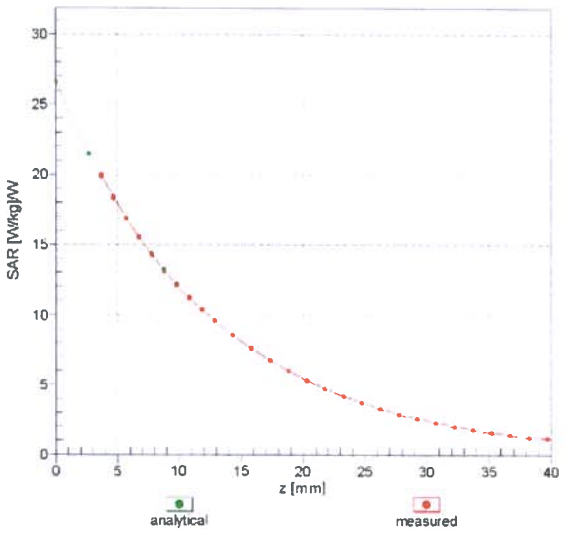
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

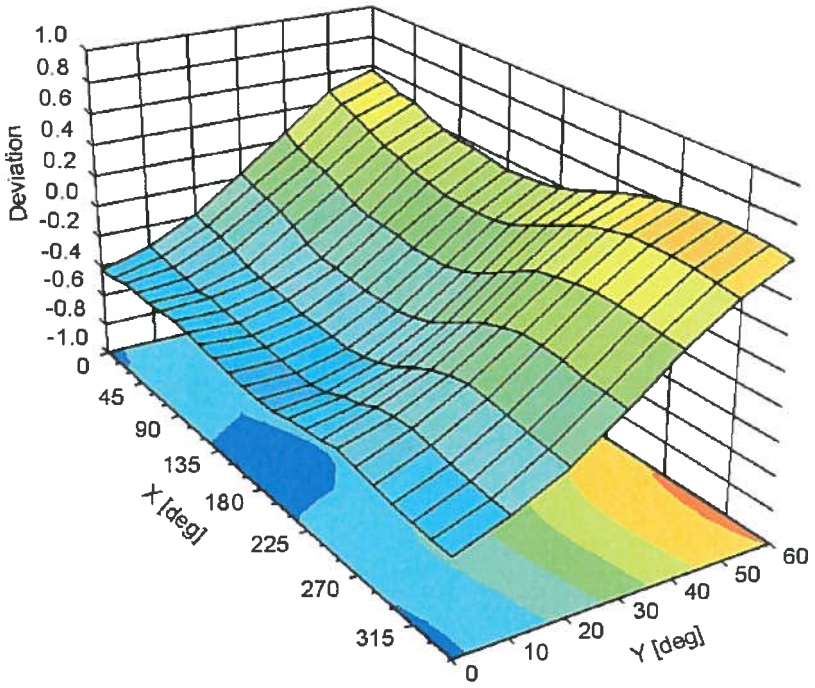


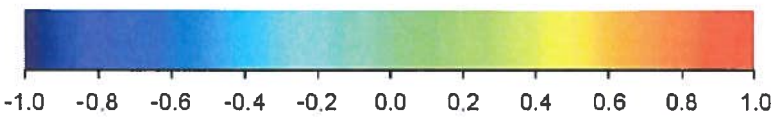
f = 1750 MHz,WGLS R22 (H_convF)



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: ET3DV6 - SN:1529

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-6.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

checked by R. Thus A1329 DATE: 21-JUNE-2013

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S Schweizerischer Kalibrierdienst
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S Swiss Calibration Service

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Accreditation No.: SCS 108

Client UL-RFI

Certificate No: D900V2-185_May13

CALIBRATION CERTIFICATE

Object: D900V2 - SN: 185

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

Calibration date: May 22, 2013

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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
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	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 22, 2013

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.

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	V52.8.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 6 %	0.97 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	2.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**10.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.97 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	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.4 ± 6 %	1.02 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	2.63 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**10.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.71 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.95 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω - 8.8 jΩ
Return Loss	- 21.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.9 Ω - 8.1 jΩ
Return Loss	- 20.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.403 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	May 27, 2003

DASY5 Validation Report for Head TSL

Date: 21.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 185

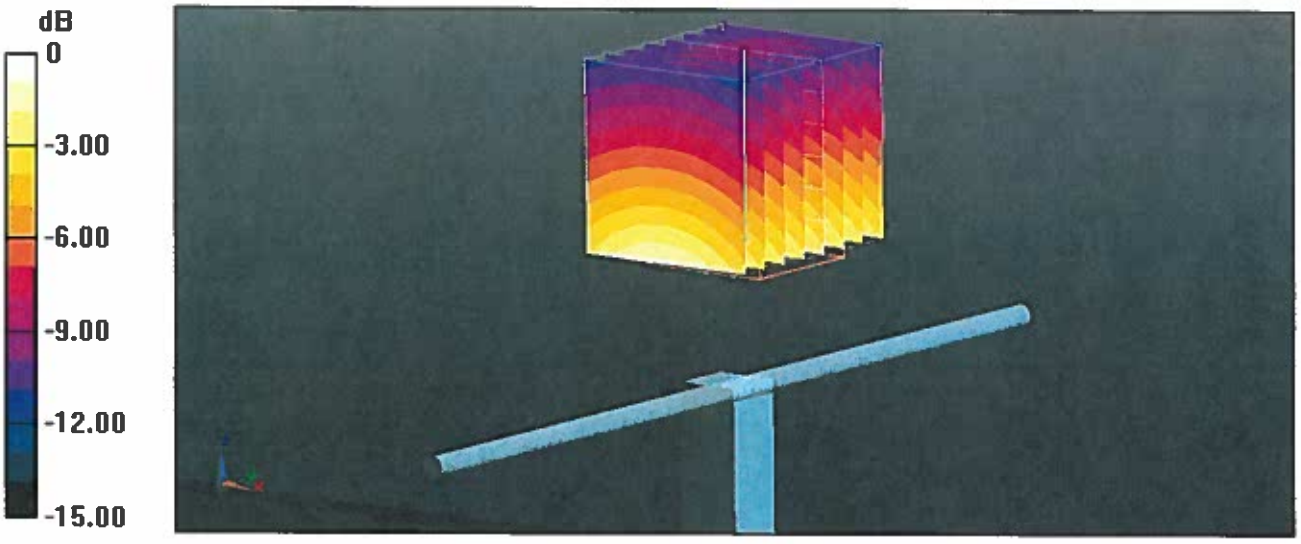
Communication System: UID 0 - CW ; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 0.97 S/m; ε_r = 40.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.95, 5.95, 5.95); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

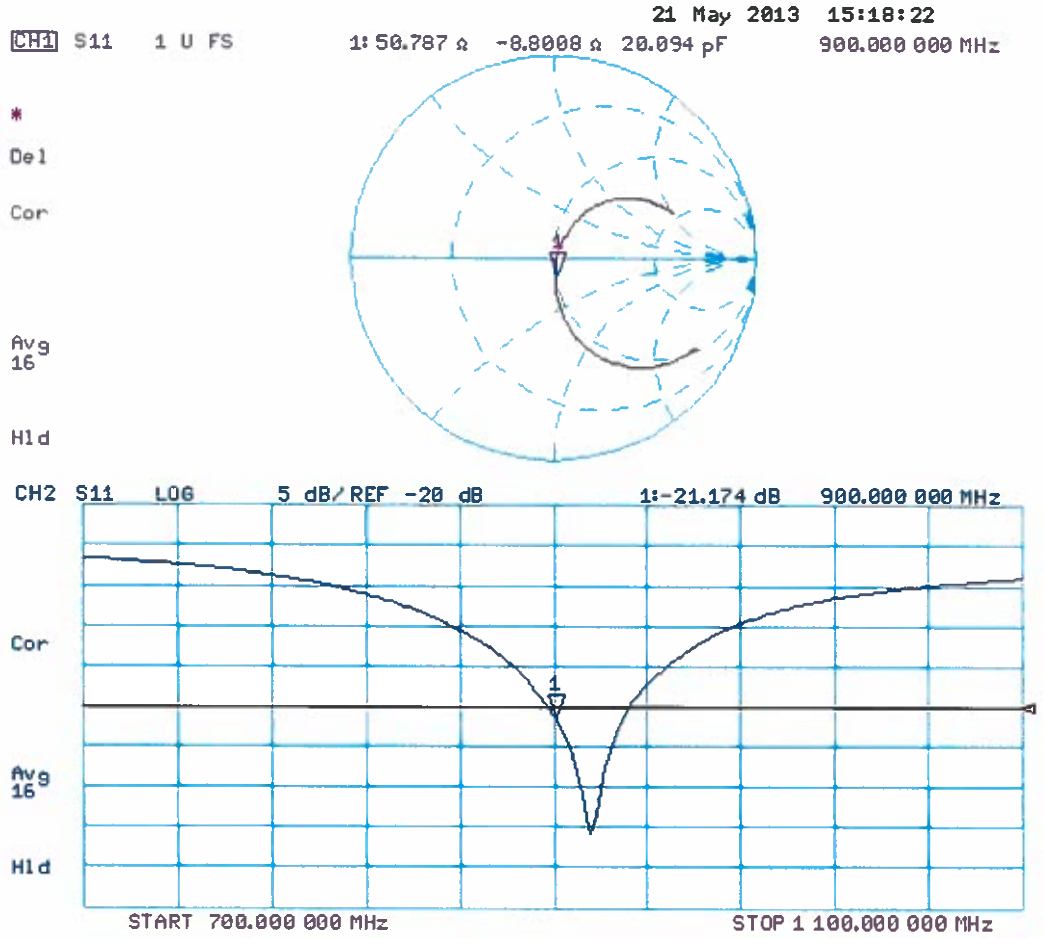
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x8x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.912 V/m; Power Drift = -0.27 dB
Peak SAR (extrapolated) = 4.18 W/kg
SAR(1 g) = 2.73 W/kg; SAR(10 g) = 1.75 W/kg
Maximum value of SAR (measured) = 3.21 W/kg



0 dB = 3.21 W/kg = 5.07 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 185

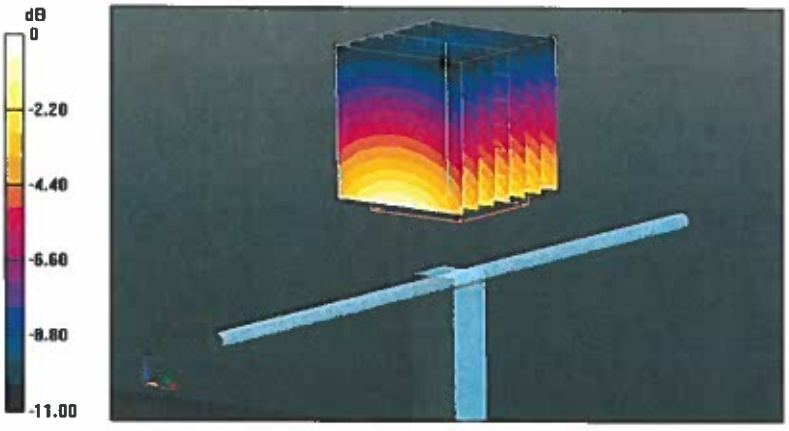
Communication System: UID 0 - CW ; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 1.02 S/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.95, 5.95, 5.95); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

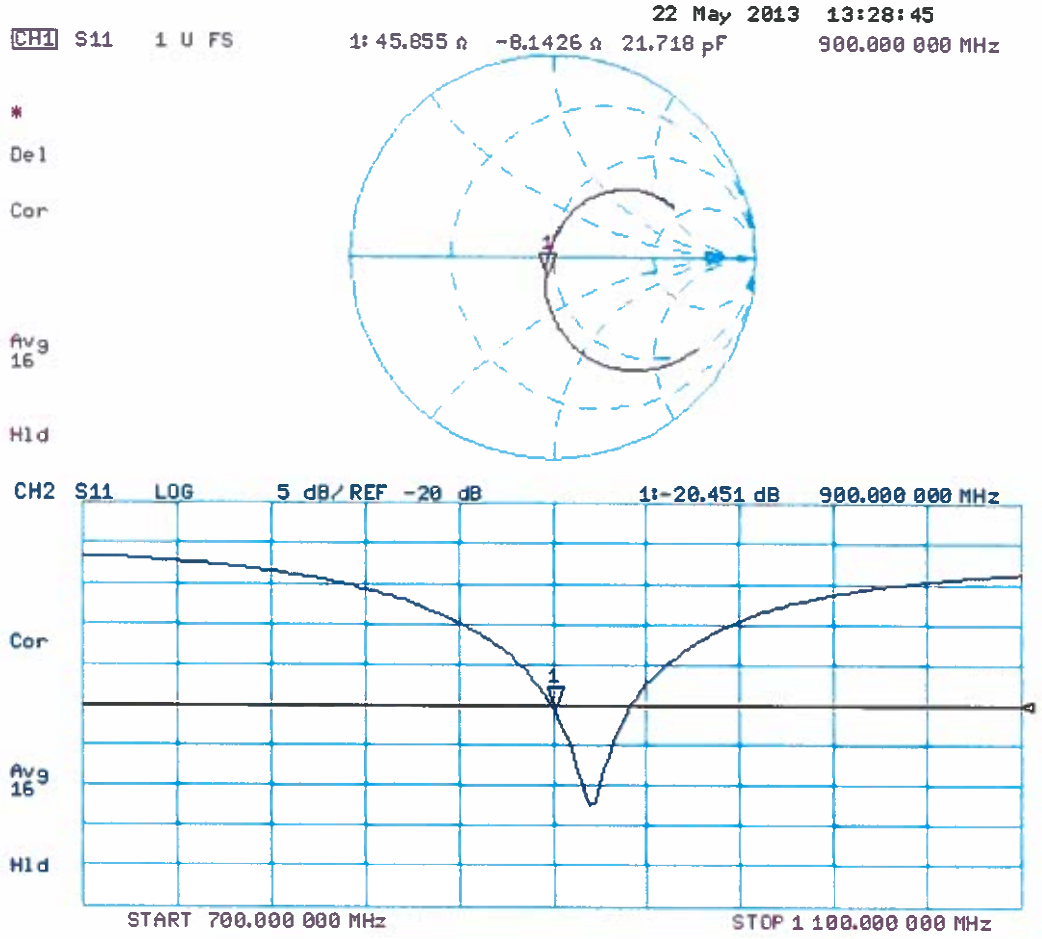
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.028 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.89 W/kg
SAR(1 g) = 2.63 W/kg; SAR(10 g) = 1.71 W/kg
Maximum value of SAR (measured) = 3.09 W/kg



0 dB = 3.09 W/kg = 4.90 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix 2. Measurement Methods

A.2.1. Evaluation Procedure

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

a) (i) The evaluation was performed in an applicable area of the phantom depending on the type of device being tested. For devices worn about the ear during normal operation, both the left and right ear positions were evaluated at the centre frequency of the band at maximum power. The side, which produced the greatest SAR, determined which side of the phantom would be used for the entire evaluation. The positioning of the head worn device relative to the phantom was dictated by the test specification identified in section 3.1 of this report.

(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the SAM phantom was used were the size of the device(s) is normal. for bigger devices and base station the 2mm Oval phantom is used for evaluation. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.

b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.

c) A 5x5x7 matrix for measurement < 2.0 GHz, 7x7x7 matrix for measurement 2.0 GHz to 3.0 GHz, and 7x7x12 for > 5.0 GHz was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.

d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

A.2.2. Specific Absorption Rate (SAR) Measurements to 865664 D01 SAR Measurement 100 MHz to 6MHz

Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

SAR measurements were performed in accordance with IEEE 1528 and FCC KDB procedures, against appropriate limits for each measurement position in accordance with the standard. In some cases the FCC was contacted using a PBA or KDB process to ensure test is performed correctly.

The test was performed in a shielded enclosure with the temperature controlled to remain between +18.0ºC and +25.0ºC. The tissue equivalent material fluid temperature was controlled to give a maximum variation of ± 2.0ºC

Prior to any SAR measurements on the EUT, system Check and material dielectric property measurements were conducted. In the absence of a detailed procedure within the specification, system Check and material dielectric property measurements were performed in accordance with FCC KDB publication 865664 D01.

Following the successful system Check and material dielectric property measurements, a SAR versus time sweep shall be performed within 10 mm of the phantom inner surface. If the EUT power output is stable after three minutes then the measurement probe will perform a coarse surface level scan at each test position in order to ascertain the location of the maximum local SAR level. Once this area had been established, a 5x5x7 cube of 175 points for frequency below 2.0 GHz, above 2.0GHz up to 3.0 GHz 7x7x7 cube of 343 points and a 7x7x12 cube of 588 points for frequency 5.0 GHz and above will be centred at the area of concern. Extrapolation and interpolation will then be carried out on the 27g of tissue and the highest averaged SAR over a 1g cube determined.

Once the maximum interpolated SAR measurement is complete; the coarse scan is visually assessed to check for secondary peaks within 50% of the maximum SAR level. If there are any further SAR measurements required, extra 5x5x7 or 7x7x7 or 7x7x12 cubes shall be centred on each of these extra local SAR maxima.

At the end of each position test case a second time sweep shall be performed to check whether the EUT has remained stable throughout the test.

A.2.3. Measurement Uncertainty Tables

A.2.3.1 Specific Absorption Rate Uncertainty - UMTS FDD 5 Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.600	2.600	normal (k=1)	1.0000	1.0000	2.600	2.600	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	5.000	5.000	normal (k=1)	1.0000	0.6400	3.200	3.200	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	5.000	5.000	normal (k=1)	1.0000	0.6000	3.000	3.000	5
	Combined standard uncertainty			t-distribution			10.24	10.24	>250
	Expanded uncertainty			k = 1.96			20.08	20.08	>250

A.2.3.2 Specific Absorption Rate- UMTS FDD 5 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	4.200	4.200	normal (k=1)	1.0000	1.0000	4.200	4.200	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	5.000	5.000	normal (k=1)	1.0000	0.6400	3.200	3.200	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	5.000	5.000	normal (k=1)	1.0000	0.6000	3.000	3.000	5
	Combined standard uncertainty			t-distribution			10.76	10.76	>250
	Expanded uncertainty			k = 1.96			21.09	21.09	>250