10607-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	4.35	66.22	16.25	0.46	130.0	± 9.6 %
		Y	4.42	66.04	16.04		130.0	
		Z	4.24	66.46	16.10		130.0	
10608-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	4.48	66.53	16.39	0.46	130.0	± 9.6 %
		Y	4.56	66.36	16.18		130.0	
		Z	4.35	66.73	16.22		130.0	
10609-AAA	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle)	X	4.38	66.34	16.19	0.46	130.0	± 9.6 %
		Y	4.46	66.19	15.99		130.0	
		Z	4.25	66.53	16.02		130.0	
10610-AAA	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle)	X	4.43	66.55	16.39	0.46	130.0	± 9.6 %
		Y	4.51	66.37	16.17		130.0	
		Z	4.31	66.77	16.23		130.0	
10611-AAA	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle)	X	4.34	66.31	16.21	0.46	130.0	± 9.6 %
		Y	4.42	66.16	16.01		130.0	
		Z	4.21	66.50	16.03		130.0	
10612-AAA	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle)	X	4.32	66.43	16.24	0.46	130.0	± 9.6 %
		Y	4.41	66.27	16.04		130.0	
		Z	4.18	66.54	16.03		130.0	
10613-AAA	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle)	X	4.31	66.21	16.06	0.46	130.0	± 9.6 %
		Y	4.40	66.08	15.88		130.0	
		Z	4.17	66.33	15.85		130.0	
10614-AAA	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle)	X	4.30	66.52	16.37	0.46	130.0	± 9.6 %
		Y	4.38	66.35	16.16		130.0	
		Z	4.18	66.74	16.22		130.0	
10615-AAA	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle)	X	4.32	66.10	15.94	0.46	130.0	± 9.6 %
		Y	4.41	65.96	15.76		130.0	
		Z	4.18	66.24	15.73		130.0	
10616-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	4.99	66.43	16.42	0.46	130.0	± 9.6 %
		Y	5.06	66.34	16.22		130.0	
		Z	4.86	66.54	16.23		130.0	
10617-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	5.03	66.54	16.45	0.46	130.0	± 9.6 %
		Y	5.10	66.46	16.25		130.0	
		Z	4.87	66.58	16.22		130.0	
10618-AAA	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle)	X	4.94	66.60	16.49	0.46	130.0	± 9.6 %
		Y	5.02	66.54	16.31		130.0	
		Z	4.80	66.71	16.31		130.0	
10619-AAA	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle)	X	4.99	66.52	16.38	0.46	130.0	± 9.6 %
		Y	5.03	66.34	16.14		130.0	
		Z	4.83	66.55	16.15		130.0	
10620-AAA	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle)	X	5.03	66.43	16.38	0.46	130.0	± 9.6 %
		Y	5.10	66.34	16.19		130.0	
		Z	4.87	66.44	16.14		130.0	
10621-AAA	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle)	X	5.04	66.55	16.58	0.46	130.0	± 9.6 %
		Y	5.11	66.48	16.39		130.0	
		Z	4.92	66.71	16.42		130.0	
10622-AAA	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle)	X	5.03	66.66	16.63	0.46	130.0	± 9.6 %
		Y	5.10	66.57	16.42		130.0	
		Z	4.89	66.76	16.44		130.0	

10623-AAA	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle)	X	4.92	66.17	16.23	0.46	130.0	± 9.6 %
		Y	4.99	66.10	16.04		130.0	
		Z	4.79	66.29	16.04		130.0	
10624-AAA	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle)	X	5.11	66.45	16.44	0.46	130.0	± 9.6 %
		Y	5.19	66.37	16.25		130.0	
		Z	4.97	66.53	16.23		130.0	
10625-AAA	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle)	X	5.22	66.67	16.62	0.46	130.0	± 9.6 %
		Y	5.28	66.51	16.38		130.0	
		Z	5.06	66.71	16.39		130.0	
10626-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	5.33	66.38	16.34	0.46	130.0	± 9.6 %
		Y	5.39	66.36	16.17		130.0	
		Z	5.21	66.49	16.15		130.0	
10627-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	5.59	67.13	16.68	0.46	130.0	± 9.6 %
		Y	5.61	66.95	16.43		130.0	
		Z	5.40	67.02	16.39		130.0	
10628-AAA	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle)	X	5.32	66.34	16.21	0.46	130.0	± 9.6 %
		Y	5.38	66.33	16.05		130.0	
		Z	5.18	66.39	16.00		130.0	
10629-AAA	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle)	X	5.47	66.71	16.39	0.46	130.0	± 9.6 %
		Y	5.48	66.50	16.13		130.0	
		Z	5.31	66.69	16.14		130.0	
10630-AAA	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle)	X	5.68	67.55	16.82	0.46	130.0	± 9.6 %
		Y	5.71	67.40	16.59		130.0	
		Z	5.39	67.16	16.39		130.0	
10631-AAA	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle)	X	5.64	67.57	17.04	0.46	130.0	± 9.6 %
		Y	5.70	67.49	16.83		130.0	
		Z	5.46	67.53	16.79		130.0	
10632-AAA	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle)	X	5.63	67.44	16.99	0.46	130.0	± 9.6 %
		Y	5.62	67.15	16.68		130.0	
		Z	5.46	67.43	16.75		130.0	
10633-AAA	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle)	X	5.33	66.40	16.29	0.46	130.0	± 9.6 %
		Y	5.42	66.45	16.15		130.0	
		Z	5.20	66.49	16.10		130.0	
10634-AAA	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle)	X	5.37	66.64	16.46	0.46	130.0	± 9.6 %
		Y	5.44	66.63	16.29		130.0	
		Z	5.25	66.79	16.30		130.0	
10635-AAA	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle)	X	5.21	65.78	15.73	0.46	130.0	± 9.6 %
		Y	5.29	65.83	15.61		130.0	
		Z	5.07	65.82	15.50		130.0	
10636-AAB	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	X	5.77	66.72	16.42	0.46	130.0	± 9.6 %
		Y	5.82	66.71	16.25		130.0	
		Z	5.64	66.78	16.21		130.0	
10637-AAB	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc duty cycle)	X	5.90	67.05	16.57	0.46	130.0	± 9.6 %
		Y	5.94	67.01	16.39		130.0	
		Z	5.72	66.99	16.30		130.0	
10638-AAB	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc duty cycle)	X	5.93	67.14	16.59	0.46	130.0	± 9.6 %
		Y	5.96	67.07	16.40		130.0	
		Z	5.77	67.13	16.35		130.0	

10639-AAB	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc duty cycle)	X	5.87	66.96	16.54	0.46	130.0	± 9.6 %
		Y	5.92	66.95	16.38		130.0	
		Z	5.72	67.01	16.33		130.0	
10640-AAB	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc duty cycle)	X	5.80	66.76	16.38	0.46	130.0	± 9.6 %
		Y	5.88	66.84	16.27		130.0	
		Z	5.64	66.74	16.13		130.0	
10641-AAB	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc duty cycle)	X	5.94	66.98	16.51	0.46	130.0	± 9.6 %
		Y	5.97	66.91	16.32		130.0	
		Z	5.75	66.87	16.22		130.0	
10642-AAB	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc duty cycle)	X	5.94	67.12	16.76	0.46	130.0	± 9.6 %
		Y	6.00	67.14	16.61		130.0	
		Z	5.80	67.17	16.56		130.0	
10643-AAB	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc duty cycle)	X	5.79	66.79	16.48	0.46	130.0	± 9.6 %
		Y	5.85	66.80	16.33		130.0	
		Z	5.62	66.75	16.21		130.0	
10644-AAB	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc duty cycle)	X	5.83	66.94	16.57	0.46	130.0	± 9.6 %
		Y	5.90	67.00	16.44		130.0	
		Z	5.67	66.93	16.32		130.0	
10645-AAB	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc duty cycle)	X	5.99	67.10	16.62	0.46	130.0	± 9.6 %
		Y	6.03	67.04	16.43		130.0	
		Z	5.79	66.98	16.32		130.0	
10646-AAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7)	X	10.99	100.29	34.81	9.30	60.0	± 9.6 %
		Y	9.88	96.69	33.11		60.0	
		Z	5.76	86.83	29.52		60.0	
10647-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7)	X	9.57	97.81	34.14	9.30	60.0	± 9.6 %
		Y	8.70	94.40	32.46		60.0	
		Z	5.05	84.45	28.75		60.0	
10648-AAA	CDMA2000 (1x Advanced)	X	0.33	60.00	5.57	0.00	150.0	± 9.6 %
		Y	0.47	61.19	7.86		150.0	
		Z	0.30	60.00	5.23		150.0	
10652-AAB	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	X	3.46	67.89	16.64	2.23	80.0	± 9.6 %
		Y	3.39	66.82	16.12		80.0	
		Z	3.15	67.36	16.00		80.0	
10653-AAB	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	X	3.92	66.65	16.80	2.23	80.0	± 9.6 %
		Y	3.92	66.10	16.41		80.0	
		Z	3.65	66.30	16.32		80.0	
10654-AAB	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	X	3.93	66.16	16.82	2.23	80.0	± 9.6 %
		Y	3.94	65.72	16.45		80.0	
		Z	3.68	65.81	16.36		80.0	
10655-AAB	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	X	4.00	66.00	16.84	2.23	80.0	± 9.6 %
		Y	4.01	65.63	16.48		80.0	
		Z	3.76	65.63	16.38		80.0	

[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Appendix E – Dipole Calibration Data Sheets

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

S	**Schweizerischer Kalibrierdienst**
C	**Service suisse d'étalonnage**
	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 0108

Client **RF Exposure Lab**

Certificate No: D2450V2-881_Aug15

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 881
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 10, 2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 12, 2015

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.1 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.4 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.6 ± 6 %	2.03 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	13.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**52.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.27 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.9 Ω + 4.4 jΩ
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 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	August 18, 2010

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D2450V2 SN: 881 - Head

Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
8/10/2015	-26.2		54.5		2.4	
8/9/2016	-25.4	-3.1	52.8	-1.7	2.9	0.5
8/10/2017	-26.8	2.3	53.4	-1.1	2.6	0.2

D2450V2 SN: 881 - Body

Date of Measurement	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
8/10/2015	-27.0		50.9		4.4	
8/9/2016	-27.5	1.9	51.6	0.7	5.2	0.8
8/10/2017	-26.4	-2.2	50.2	-0.7	4.9	0.5

DASY5 Validation Report for Head TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 881

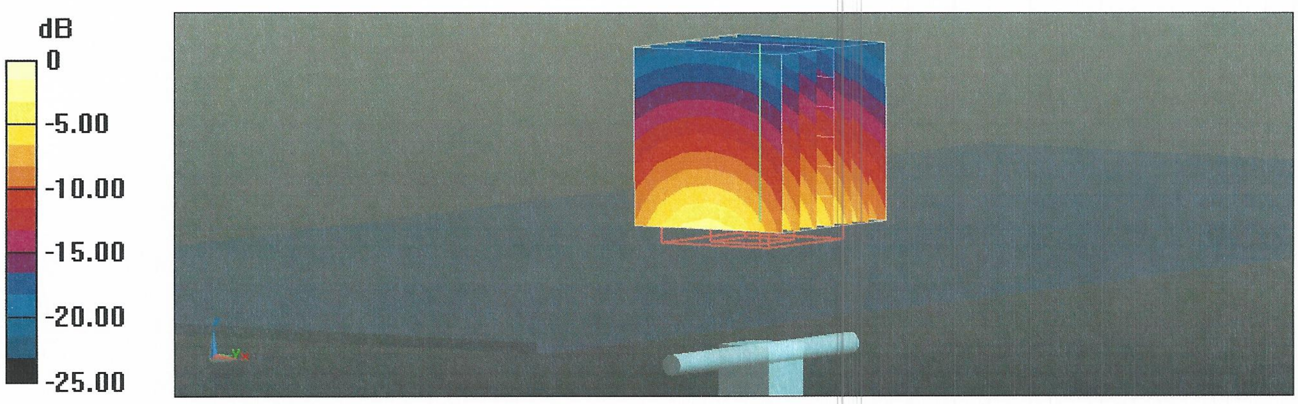
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

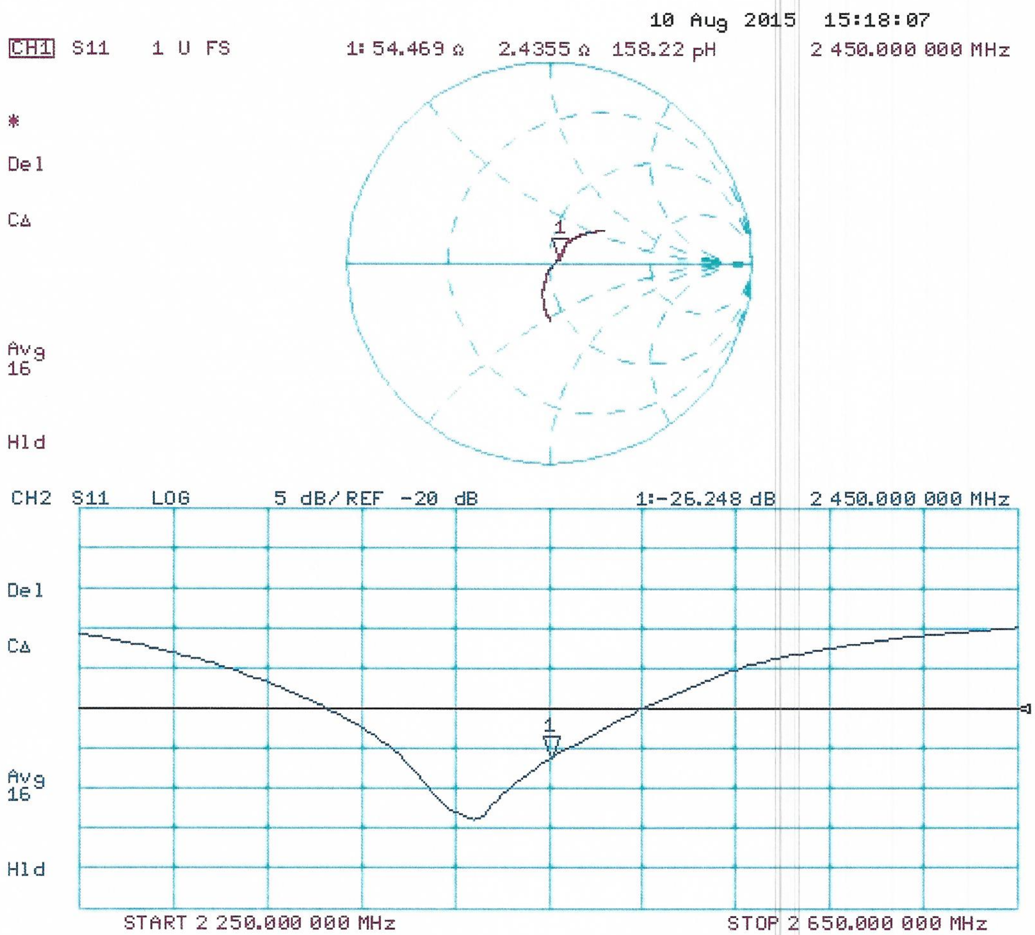
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.8 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 28.0 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.43 W/kg
Maximum value of SAR (measured) = 18.1 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

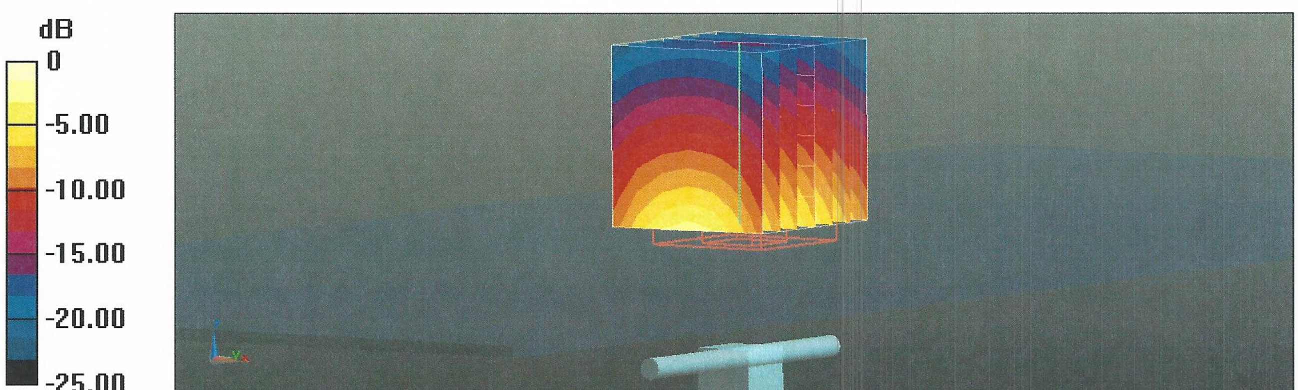
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 881

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

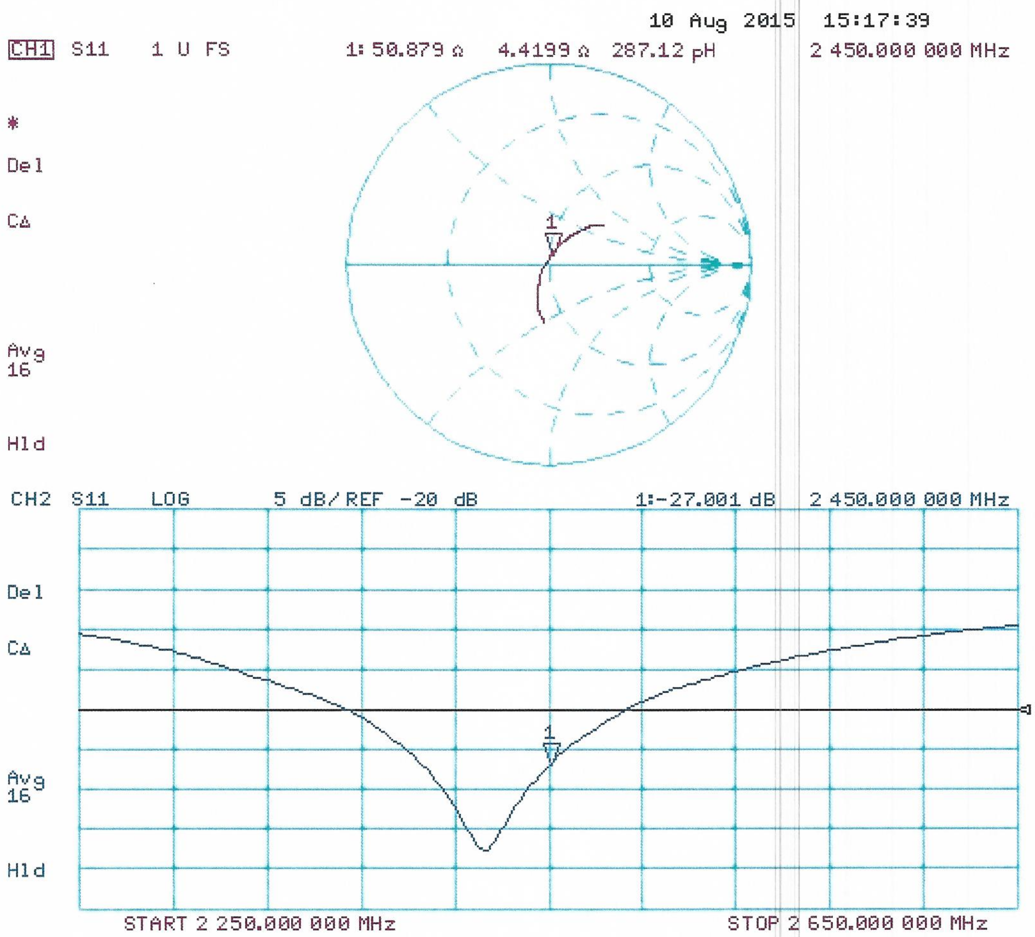
- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 96.26 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.27 W/kg
Maximum value of SAR (measured) = 17.7 W/kg



0 dB = 17.7 W/kg = 12.48 dBW/kg

Impedance Measurement Plot for Body TSL



Jm

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

S **Schweizerischer Kalibrierdienst**
C **Service suisse d'étalonnage**
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Swiss Calibration Service

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Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: D5GHzV2-1119_Aug15

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1119
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	August 11, 2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Israe Elnaouq	Laboratory Technician	Israe ElNaouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 11, 2015

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

Calibration Laboratory of
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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, June 2013
b) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
c) KDB 865664, “SAR Measurement Requirements for 100 MHz to 6 GHz”

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.63 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.3 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	4.82 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.0 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	5.14 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.9 ± 6 %	5.43 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.7 ± 6 %	5.56 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.82 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**82.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.95 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.4 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	6.23 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.91 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.8 W/kg ± 19.5 % (k=2)**

Extended Calibration

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 865664 D01 v01r04.

D5GHzV2 SN: 1119 - Head

Date of Measurement	Frequency	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
8/11/2015	5200 MHz	-21.5		51.6		-8.4	
8/10/2016		-21.3	-0.9	51.2	-0.4	-8.7	-0.3
8/11/2017		-22.1	2.8	50.8	-0.8	-8.1	0.3
8/11/2015	5300 MHz	-27.8		51.4		-3.9	
8/10/2016		-26.4	-5.0	49.8	-1.6	-4.8	-0.9
8/11/2017		-26.9	-3.2	50.2	-1.2	-4.2	-0.3
8/11/2015	5500 MHz	-25.8		54.2		-3.4	
8/10/2016		-24.3	-5.8	52.6	-1.6	-3.9	-0.5
8/11/2017		-25.2	-2.3	53.7	-0.5	-4.4	-1.0
8/11/2015	5600 MHz	-24.3		56.3		-1.5	
8/10/2016		-23.9	-1.6	55.0	-1.3	-2.1	-0.6
8/11/2017		-23.5	-3.3	55.9	-0.4	-1.8	-0.3
8/11/2015	5800 MHz	-23.4		56.6		-2.8	
8/10/2016		-24.3	3.8	54.9	-1.7	-4.1	-1.3
8/11/2017		-24.6	5.1	55.3	-1.3	-3.5	-0.7

D5GHzV2 SN: 1119 - Body

Date of Measurement	Frequency	Return Loss (dB)	Δ%	Impedance Real (Ω)	ΔΩ	Impedance Imaginary (jΩ)	ΔΩ
8/11/2015	5200 MHz	-22.8		51.6		-7.2	
8/10/2016		-21.5	-5.7	51.2	-0.4	-7.9	-0.7
8/11/2017		-22.2	-2.6	50.8	-0.8	-7.5	-0.3
8/11/2015	5300 MHz	-30.8		51.1		-2.7	
8/10/2016		-29.6	-3.9	51.3	0.2	-3.2	-0.5
8/11/2017		-29.3	-4.9	50.2	-0.9	-2.4	0.3
8/11/2015	5500 MHz	-27.4		54.3		-1.3	
8/10/2016		-26.3	-4.0	53.3	-1.0	-2.0	-0.7
8/11/2017		-27.8	1.5	52.5	-1.8	-1.7	-0.4
8/11/2015	5600 MHz	-24.4		56.4		-0.1	
8/10/2016		-23.6	-3.3	55.9	-0.5	-0.9	-0.8
8/11/2017		-24.5	0.4	56.9	0.5	-0.5	-0.4
8/11/2015	5800 MHz	-23.1		57.5		-0.9	
8/10/2016		-23.9	3.5	56.6	-0.9	-1.1	-0.2
8/11/2017		-24.2	4.8	57.6	0.1	-1.2	-0.3

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.6 Ω - 8.4 jΩ
Return Loss	- 21.5 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	51.4 Ω - 3.9 jΩ
Return Loss	- 27.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	54.2 Ω - 3.4 jΩ
Return Loss	- 25.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.3 Ω - 1.5 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.6 Ω - 2.8 jΩ
Return Loss	- 23.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.6 Ω - 7.2 jΩ
Return Loss	- 22.8 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.1 Ω - 2.7 jΩ
Return Loss	- 30.8 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	54.3 Ω - 1.3 jΩ
Return Loss	- 27.4 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.4 Ω - 0.1 jΩ
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	57.5 Ω - 0.9 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.206 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	September 08, 2011

DASY5 Validation Report for Head TSL

Date: 10.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1119

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.53 S/m; ε_r = 35.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.63 S/m; ε_r = 35.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.82 S/m; ε_r = 35.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.93 S/m; ε_r = 34.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.14 S/m; ε_r = 34.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(5.12, 5.12, 5.12); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

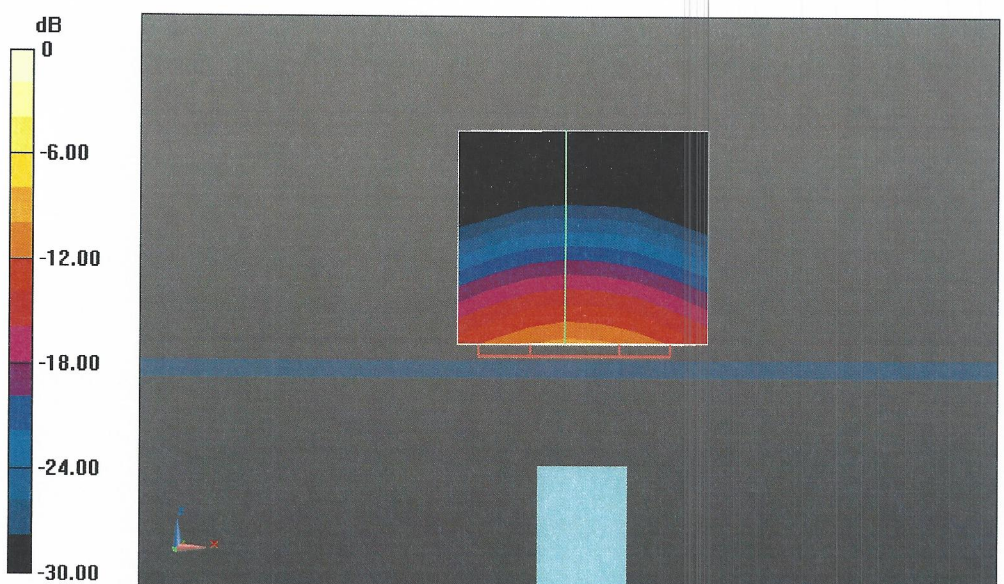
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.84 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.32 W/kg
Maximum value of SAR (measured) = 18.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.35 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 8.46 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.30 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 8.5 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 20.2 W/kg

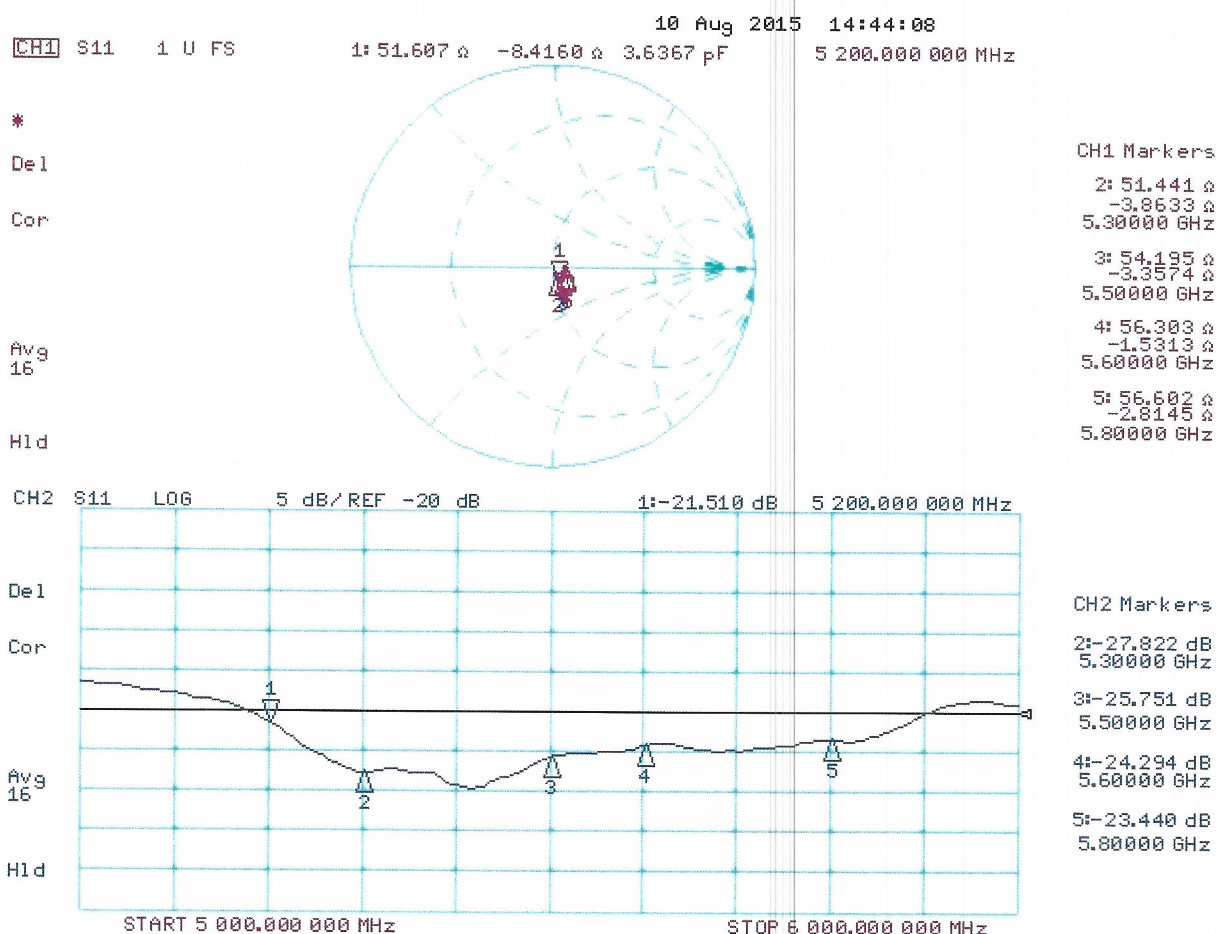
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.73 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.46 W/kg; SAR(10 g) = 2.41 W/kg
Maximum value of SAR (measured) = 20.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.40 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1119

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.43 S/m; ε_r = 47.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.56 S/m; ε_r = 47.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.82 S/m; ε_r = 47.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.95 S/m; ε_r = 47.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.23 S/m; ε_r = 46.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

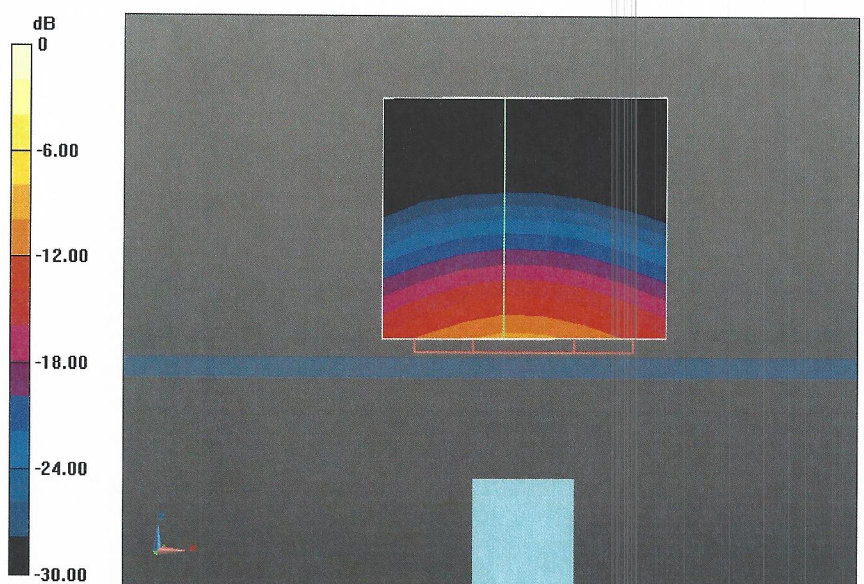
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.11 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.89 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 18.3 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.26 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 35.5 W/kg
SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 19.9 W/kg

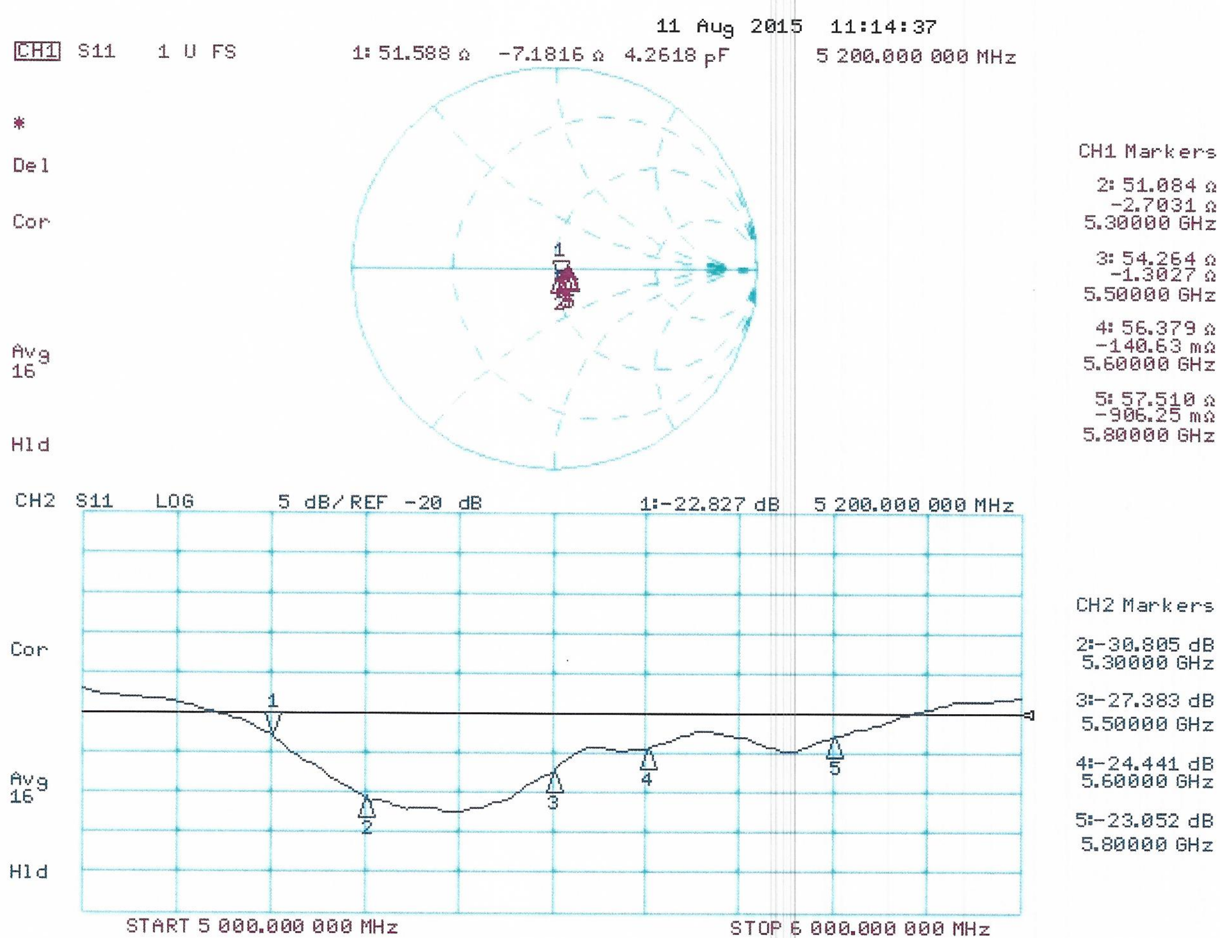
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.24 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 35.5 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.25 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.15 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 36.5 W/kg
SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.19 W/kg
Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix F – Phantom Calibration Data Sheets

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Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 4.0
Type No	QD OVA 001 B
Series No	1003 and higher
Manufacturer	Untersee Composites Knebelstrasse 8 CH-8268 Mannenbach, Switzerland

Tests

Complete tests were made on the prototype units QD OVA 001 AA 1001, QD OVA 001 AB 1002, pre-series units QD OVA 001 BA 1003-1005 as well as on the series units QD OVA 001 BB, 1006 ff.

Test	Requirement	Details	Units tested
Material thickness	Compliant with the standard requirements	Bottom plate: 2.0mm +/- 0.2mm	all
Material parameters	Dielectric parameters for required frequencies	< 6 GHz: Rel. permittivity = 4 +/-1, Loss tangent ≤ 0.05	Material sample
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions.	DGBE based simulating liquids. Observe Technical Note for material compatibility.	Equivalent phantoms, Material sample
Shape	Thickness of bottom material, Internal dimensions, Sagging compatible with standards from minimum frequency	Bottom elliptical 600 x 400 mm Depth 190 mm, Shape is within tolerance for filling height up to 155 mm, Eventual sagging is reduced or eliminated by support via DUT	Prototypes, Sample testing

Standards

[1] CENELEC EN 50361-2001, « Basic standard for the measurement of the Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz) », July 2001

[2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003

[3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005

[4] IEC 62209 – 2, Draft, "Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices – Human models, Instrumentation and Procedures – Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body.", February 2005

[5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition January 2001

Based on the tests above, we certify that this item is in compliance with the standards [1] to [5] if operated according to the specific requirements and considering the thickness. The dimensions are fully compliant with [4] from 30 MHz to 6 GHz. For the other standards, the minimum lower frequency limit is limited due to the dimensional requirements ([1]: 450 MHz, [2]: 300 MHz, [3]: 800 MHz, [5]: 375 MHz) and possibly further by the dimensions of the DUT.

Date 28.4.2008 **Signature / Stamp**

s p e a g
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Appendix G – Validation Summary

Per FCC KDB 865664 D02 v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue equivalent media for system validation according to the procedures outlined in FCC KDB 865664 D01 v01r04 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point using the system that normally operates with the probe for routine SAR measurements and according to the required tissue equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table G-1
SAR System Validation Summary

SAR System #	Freq. (MHz)	Date	Probe S/N	Probe Type	Probe Cal. Point		Cond. (σ)	Perm. (ε_r)	CW Validation			Modulation Validation		
									Sens-itivity	Probe Linearity	Probe Isotropy	Modulation Type	Duty Factor	PAR
1	2450	9/06/2017	3693	EX3DV4	2450	Body	1.96	52.64	Pass	Pass	Pass	OFDM/TDD	Pass	Pass
1	5200	9/05/2017	3693	EX3DV4	5200	Body	5.30	48.93	Pass	Pass	Pass	OFDM	N/A	Pass
1	5300	9/05/2017	3693	EX3DV4	5300	Body	5.41	48.88	Pass	Pass	Pass	OFDM	N/A	Pass
1	5500	9/05/2017	3693	EX3DV4	5500	Body	5.62	48.58	Pass	Pass	Pass	OFDM	N/A	Pass
1	5600	9/05/2017	3693	EX3DV4	5600	Body	5.74	48.43	Pass	Pass	Pass	OFDM	N/A	Pass
1	5800	9/05/2017	3693	EX3DV4	5800	Body	5.97	48.13	Pass	Pass	Pass	OFDM	N/A	Pass