2450 MHz Dipole Calibration Certificate

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

S Schweizerischer Kalibrierdienst
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Accreditation No.: SCS 0108

Client CTTL (Auden)

Certificate No: D2450V2-853_Jul19

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:853
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 17, 2019

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 NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: July 17, 2019

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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 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

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	37.6 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 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	50.8 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (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	**52.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.5 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 + 2.7 jΩ
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω + 5.6 jΩ
Return Loss	- 25.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 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

DASY5 Validation Report for Head TSL

Date: 16.07.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:853

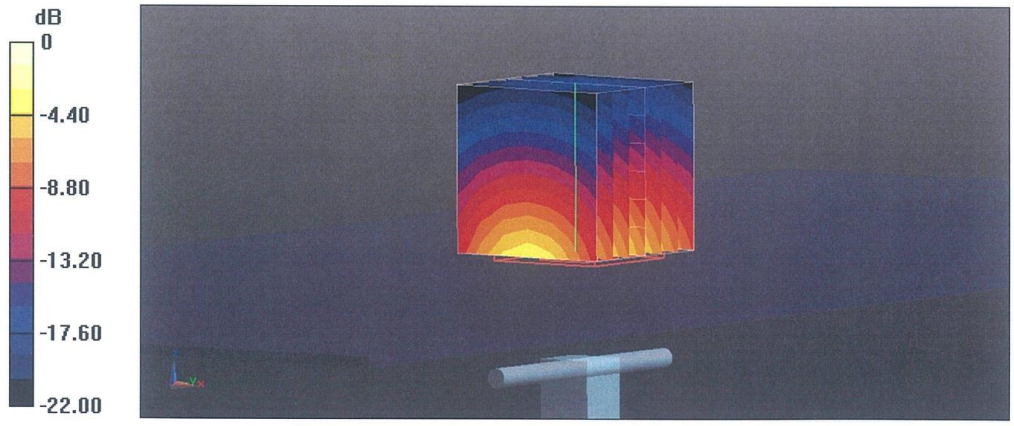
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.9, 7.9, 7.9) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

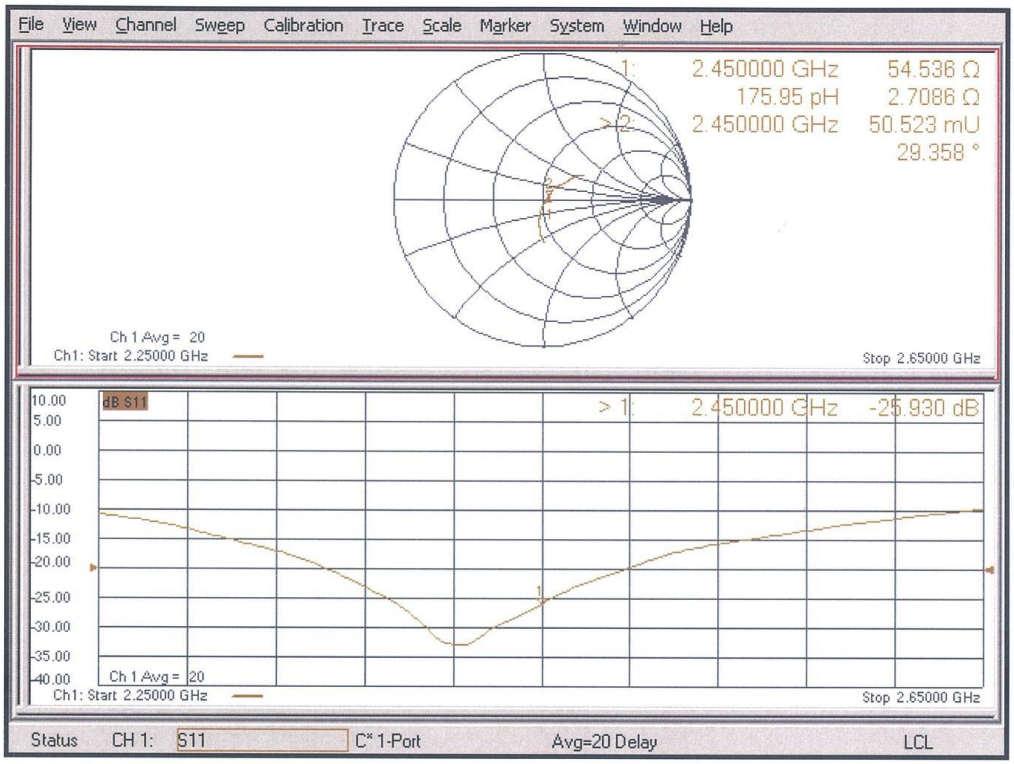
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 115.6 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 25.7 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.13 W/kg
Maximum value of SAR (measured) = 21.5 W/kg



0 dB = 21.5 W/kg = 13.32 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.07.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:853

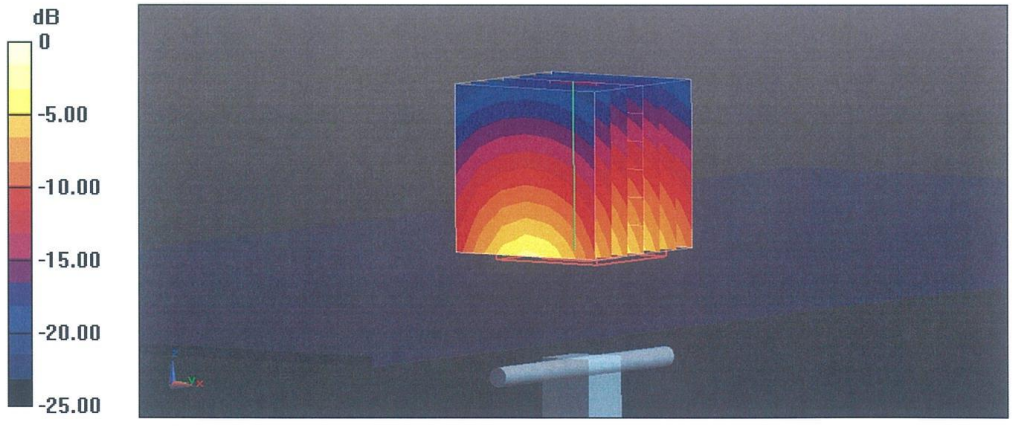
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.94, 7.94, 7.94) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

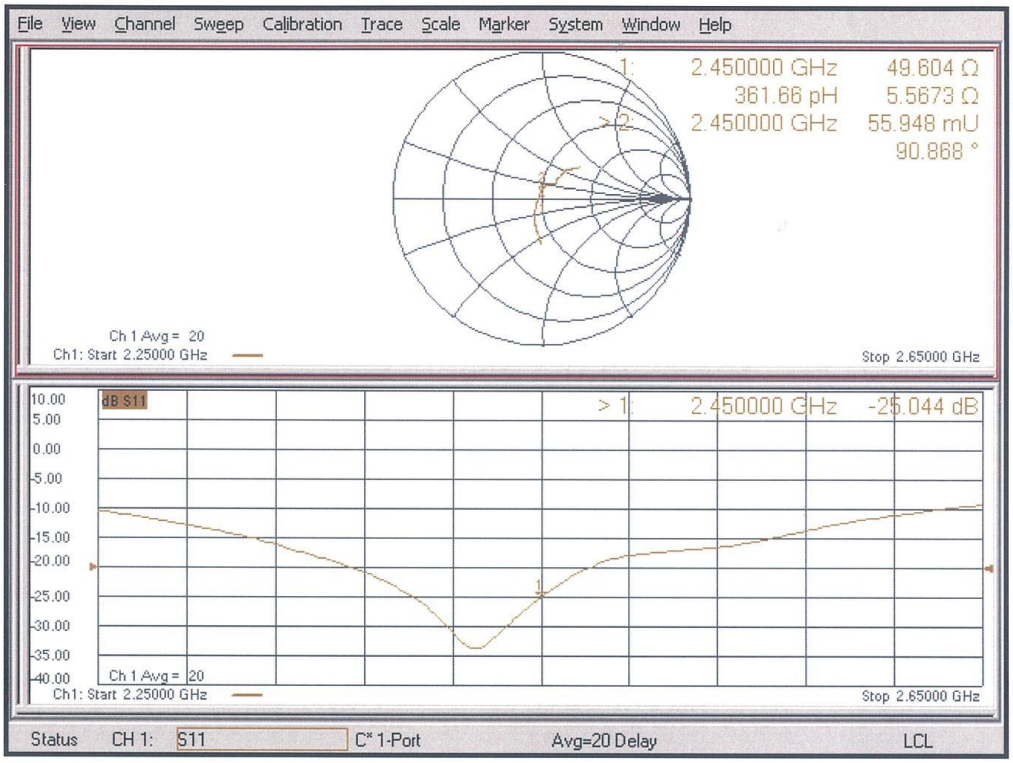
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 110.2 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 26.3 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.23 W/kg
Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

Impedance Measurement Plot for Body TSL



2600 MHz Dipole Calibration Certificate

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Accreditation No.: SCS 0108

Client CTTL (Auden)

Certificate No: D2600V2-1012_Jul19

CALIBRATION CERTIFICATE

Object	D2600V2 - SN:1012
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 17, 2019

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 NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: July 17, 2019

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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 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.1 ± 6 %	2.02 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**55.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.1 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	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.4 ± 6 %	2.20 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**55.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.8 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	47.5 Ω - 6.3 jΩ
Return Loss	- 23.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.8 Ω - 4.7 jΩ
Return Loss	- 21.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 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

DASY5 Validation Report for Head TSL

Date: 16.07.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1012

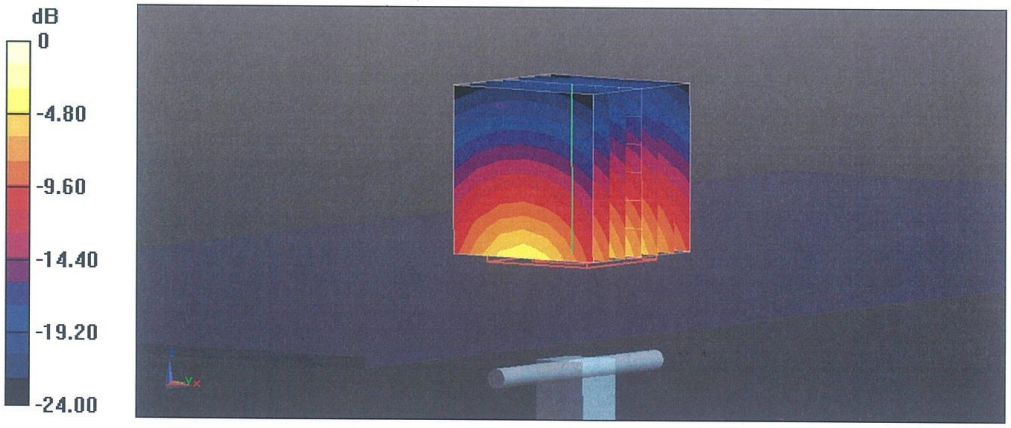
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.02 S/m; ε_r = 37.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.69, 7.69, 7.69) @ 2600 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

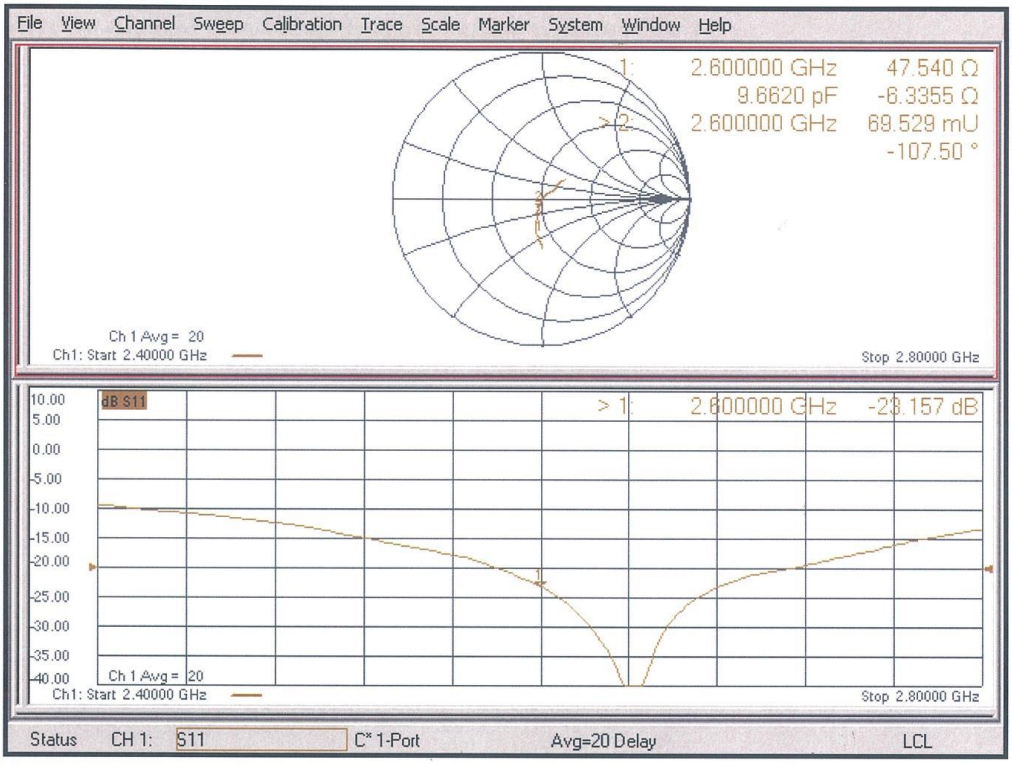
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 118.6 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 28.8 W/kg
SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.38 W/kg
Maximum value of SAR (measured) = 24.0 W/kg



0 dB = 24.0 W/kg = 13.80 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.07.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1012

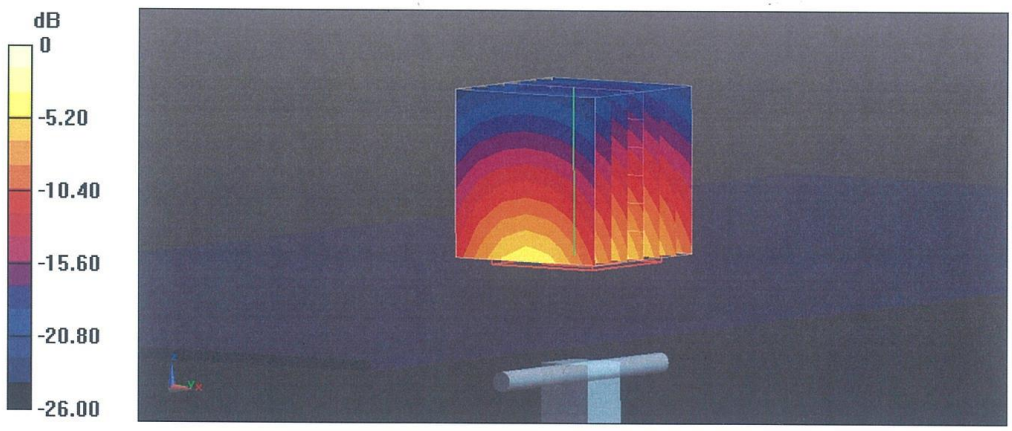
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.2 S/m; ε_r = 50.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.8, 7.8, 7.8) @ 2600 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

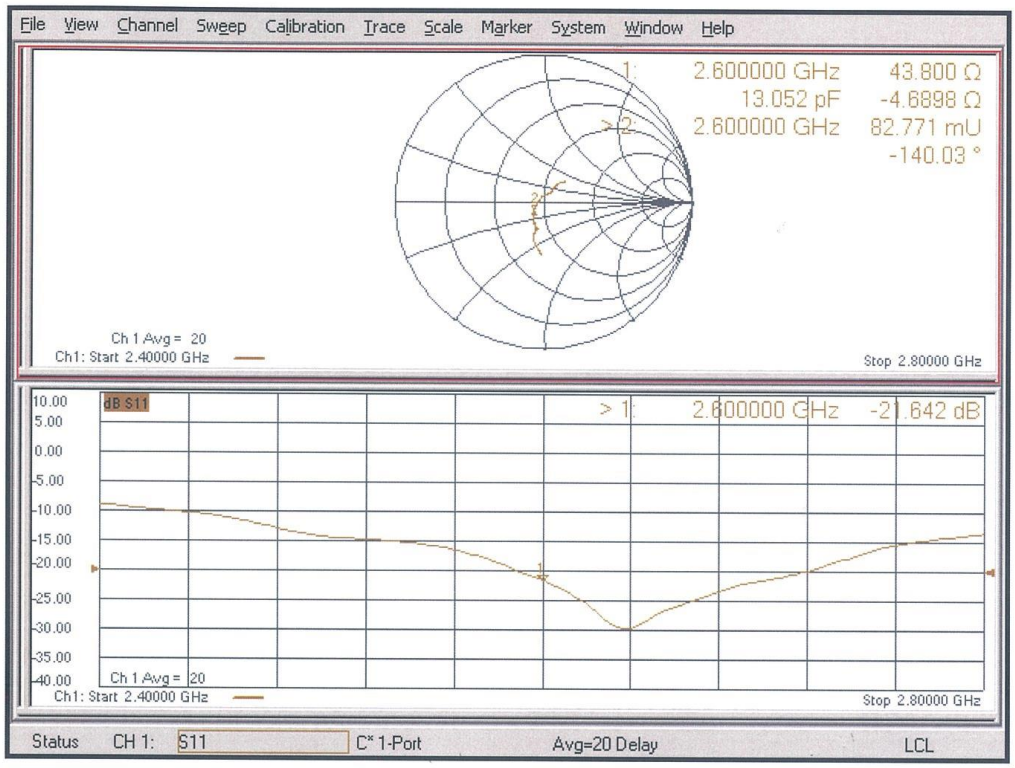
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 110.1 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 14 W/kg; SAR(10 g) = 6.26 W/kg
Maximum value of SAR (measured) = 23.3 W/kg



0 dB = 23.3 W/kg = 13.67 dBW/kg

Impedance Measurement Plot for Body TSL



ANNEX I SPOT CHECK

I.1 Dielectric Performance

Table I.1-1: Dielectric Performance of Tissue Simulating Liquid

Measurement Date yyyy/mm/dd	Frequency	Type	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2020/7/13	750 MHz	Head	41.35	-1.41	0.888	-0.22
2020/7/13	835 MHz	Head	41.1	-0.96	0.892	-0.89
2020/7/13	1750 MHz	Head	40.82	1.85	1.377	0.51
2020/7/14	1900 MHz	Head	39.99	-0.02	1.428	2.00
2020/7/15	2450 MHz	Head	38.99	-0.54	1.78	-1.11
2020/7/16	2600 MHz	Head	39.06	0.13	1.925	-1.79

Note: The liquid temperature is 22.0°C

I.2 System Verification

Table I.2-1: System Verification of Head

Measurement Date	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
(yyyy-mm-dd)		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2020/7/13	750 MHz	5.57	8.57	5.68	8.6	-0.90%	-3.38%
2020/7/13	835 MHz	6.29	9.70	6.32	9.6	-4.61%	-2.68%
2020/7/13	1750 MHz	19.3	36.6	19.32	36.68	0.10%	-1.09%
2020/7/14	1900 MHz	20.8	39.7	21.12	39.68	2.69%	0.96%
2020/7/15	2450 MHz	24.2	51.6	24.48	50.72	2.64%	-0.85%
2020/7/16	2600 MHz	25.1	55.8	25	54.72	4.54%	4.16%

I.3 Conducted power of selected case

Table I.3-1: The conducted power results for 2G- Normal Power

GSM 850MHZ	Measured Power (dBm)		
	251	190	128
GPRS(4Tx)	/	/	26.41
GSM1900MHZ	Measured Power (dBm)		
	810	661	512
GPRS(2Tx)	/	26.57	26.40

Table I.3-2: The conducted power results for 2G-Low Power

GSM1900MHZ	Measured Power (dBm)		
	810	661	512
GPRS(1Tx)	/	27.21	/

Table I.3-3: The conducted Power for WCDMA- Normal Power

Item	band	FDDII result		
	ARFCN	9538/9938	9400/9800	9262/9662
WCDMA	\	(1907.6MHz)	(1880MHz)	(1852.4MHz)
		/	22.90	/
Item	band	FDDIV result		
	ARFCN	1513/1738	1412/1637	1312/1537
WCDMA	\	(1752.6MHz)	(1732.4MHz)	(1712.4MHz)
		/	/	22.60
Item	band	FDDV result		
	ARFCN	4233/4458	4183/4408	4132/4357
WCDMA	\	(846.6MHz)	(836.6MHz)	(826.4MHz)
		/	22.79	22.82

Table I.3-4: The conducted Power for WCDMA- Low Power

Item	band	FDDII result		
	ARFCN	9538/9938	9400/9800	9262/9662
WCDMA	\	(1907.6MHz)	(1880MHz)	(1852.4MHz)
		/	/	20.81

Table I.3-5: The conducted Power for LTE-Normal Power

LTE Band2	1RB-Middle	1900(19100)	22.97
LTE Band5	1RB-Middle	836.5(20525)	22.80
LTE Band7	1RB-Middle	2560(21350)	22.65
LTE Band12	1RB-Middle	707.5 (23095)	22.82
LTE Band13	1RB-Middle	782(23230)	22.86
LTE Band66	1RB-Middle	1720 (132072)	22.78

Table I.3-6: The conducted Power for LTE-Low Power

LTE Band2	50RB-Low	1900(19100)	20.88
LTE Band7	1RB-Middle	2510(20850)	19.19

Table I.3-7: The conducted Power for WLAN

Mode / data rate	Channel	Measured Power (dBm)
802.11b – 1Mbps	6	16.21

I.4 Measurement results for spot check

Test Position	Phantom position Left/Right/F	Frequency Band	Channel Number	Frequency (MHz)	Tune up (dBm)	EUT Measured Power (dBm)	Test setup	Measured SAR 10g (W/kg)	Measured SAR 1g (W/kg)	Calculated SAR 10g (W/kg)	Calculated SAR 1g (W/kg)	Power Drift	Fig
Tilt	Left	GSM850	128	824.2	26.5	26.41	Left Tilt 4TX	0.543	0.974	**0.55**	**0.99**	0.05	Fig.1
Body	F	GSM850	128	824.2	26.5	26.41	Top Edge GPRS 10mm 4TX	0.163	0.296	**0.17**	**0.30**	-0.18	Fig.2
Cheek	Right	GSM1900	661	1880	27.5	26.57	Right Cheek 2TX	0.068	0.110	**0.08**	**0.14**	-0.16	Fig.3
Body	F	GSM1900	512	1850.2	27.5	26.40	Rear GPRS 15mm 2TX	0.170	0.294	**0.22**	**0.38**	0.01	Fig.4
Body	F	GSM1900	661	1880	27.8	27.21	Bottom Edge GPRS 10mm 1TX	0.224	0.431	**0.26**	**0.49**	0.17	Fig.5
Cheek	Right	WCDMA1900	9400	1880	23.5	22.90	Right Cheek	0.098	0.157	**0.11**	**0.18**	-0.07	Fig.6
Body	F	WCDMA1900	9262	1852.4	21.5	20.81	Bottom Edge 10mm	0.320	0.613	**0.38**	**0.72**	0.19	Fig.7
Body	F	WCDMA1900	9400	1880	23.5	22.90	Rear 15mm	0.224	0.388	**0.26**	**0.45**	0.18	Fig.8
Cheek	Right	WCDMA1700	1312	1712.4	23	22.60	Right Cheek	0.086	0.130	**0.09**	**0.14**	-0.03	Fig.9
Body	F	WCDMA1700	1312	1712.4	23	22.60	Bottom Edge 10mm	0.435	0.816	**0.48**	**0.89**	0.07	Fig.10
Tilt	Left	WCDMA 850	4132	826.4	23.5	22.82	Left Tilt	0.335	0.639	**0.39**	**0.75**	-0.04	Fig.11
Body	F	WCDMA 850	4183	836.6	23.5	22.79	Top Edge 10mm	0.133	0.241	**0.16**	**0.28**	0.18	Fig.12
Cheek	Right	LTE Band2	19100	1900	23.5	22.97	Right Cheek 1RB-Middle	0.077	0.126	**0.09**	**0.14**	0.09	Fig.13
Body	F	LTE Band2	19100	1900	21.5	20.88	50RB-Low Bottom Edge 10mm	0.317	0.620	**0.37**	**0.72**	0.12	Fig.14
Body	F	LTE Band2	19100	1900	23.5	22.97	1RB-Middle Rear 15mm	0.230	0.405	**0.26**	**0.46**	-0.18	Fig.15
Cheek	Left	LTE Band5	20525	836.5	23.5	22.80	Left Cheek 1RB-Middle	0.552	0.821	**0.65**	**0.96**	0.18	Fig.16
Body	F	LTE Band5	20525	836.5	23.5	22.80	1RB-Middle Rear 10mm	0.098	0.155	**0.13**	**0.20**	-0.09	Fig.17
Cheek	Left	LTE Band7	21350	2560	23	22.65	Left Cheek 1RB-Middle	0.212	0.041	**0.23**	**0.04**	-0.02	Fig.18
Body	F	LTE Band7	20850	2510	19.5	19.19	1RB-Middle Bottom Edge 10mm	0.42	0.903	**0.45**	**0.97**	-0.18	Fig.19
Body	F	LTE Band7	21350	2560	23	22.65	1RB-Middle Rear 15mm	0.259	0.506	**0.28**	**0.55**	0.09	Fig.20
Cheek	Left	LTE Band12	23095	707.5	23.5	22.82	Left Cheek 1RB-Middle	0.071	0.090	**0.08**	**0.11**	-0.070	Fig.21
Body	F	LTE Band12	23095	707.5	23.5	22.82	1RB-Middle Rear 10mm	0.116	0.150	**0.14**	**0.18**	0.02	Fig.22
Cheek	Right	LTE Band13	23230	782	23.5	22.86	Right Cheek 1RB-Middle	0.209	0.265	**0.24**	**0.31**	-0.14	Fig.23
Body	F	LTE Band13	23230	782	23.5	22.86	1RB-Middle Rear 10mm	0.245	0.434	**0.28**	**0.50**	-0.14	Fig.24
Cheek	Right	LTE Band66	132072	1720	23.5	22.78	Right Cheek 1RB-Middle	0.086	0.132	**0.10**	**0.16**	-0.18	Fig.25
Body	F	LTE Band66	132072	1720	23.5	22.78	1RB-Middle Rear 10mm	0.337	0.620	**0.40**	**0.73**	-0.03	Fig.26
Cheek	Right	WLAN	6	2437	16.5	16.21	Right Cheek 1M 17dB	0.174	0.341	**0.19**	**0.36**	0.16	Fig.27
Body	F	WLAN	6	2437	16.5	16.21	Rear 10mm 1M 17dB	0.063	0.137	**0.07**	**0.15**	-0.04	Fig.28

I.5 Reported SAR Comparison

Table I.5-1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Reported SAR 1g (W/Kg): spot check	Reported SAR 1g (W/Kg): original
Head (Separation Distance 0mm)	GSM 850	0.99	1.27
	PCS 1900	0.14	0.14
	WCDMA 850	0.75	0.86
	WCDMA 1700	0.14	0.16
	WCDMA 1900	0.18	0.14
	LTE Band 2	0.14	0.16
	LTE Band 5	0.96	0.92
	LTE Band 7	0.04	0.08
	LTE Band 12	0.11	0.13
	LTE Band 13	0.31	0.37
	LTE Band 66	0.16	0.11
	WLAN 2.4 GHz	0.36	0.46
Hotspot (Separation Distance 10mm)	GSM 850	0.30	0.41
	PCS 1900	0.49	0.50
	WCDMA 850	0.28	0.28
	WCDMA 1700	0.89	1.12
	WCDMA 1900	0.72	0.72
	LTE Band 2	0.72	0.84
	LTE Band 5	0.20	0.20
	LTE Band 7	0.97	0.95
	LTE Band 12	0.18	0.27

	LTE Band 13	0.50	0.60
	LTE Band 66	0.73	0.93
	WLAN 2.4 GHz	0.15	0.12
Body-worn (Separation Distance 15mm)	PCS 1900	0.38	0.38
	WCDMA1900	0.45	0.42
	LTE Band 2	0.46	0.41
	LTE Band 7	0.55	0.57

Note: All the spot check results marked blue are larger than the original result. So it replace the original results and others are shared.

I.6 Evaluation of Simultaneous

Table I.6-1: The sum of reported SAR values for main antenna and WiFi 2.4G

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Left Tilt	1.27 (GSM850)	0.27	**1.54**
Highest reported SAR value for Body	Bottom 10mm	1.12 (WCDMA1700)	0.00	**1.12**

Table I.6-2: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Right hand, Touch cheek	1.27 (GSM850)	<0.01	**1.27**
Maximum reported SAR value for Body	Bottom 10mm	1.12 (WCDMA1700)	<0.01	**1.12**

[1] – The SAR of BT is too low to get it, so the “<0.01” is used to indicate the SAR of BT.

Conclusion:

According to the above tables, the sum of reported SAR values is1.54W/kg, So the simultaneous transmission SAR with volume scans is not required.

I.7 List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	N5239A	MY46110673	January 24, 2020	One year
02	Power meter	NRP2	106277	September 4, 2019	One year
03	Power sensor	NRP8S	104291		
04	Signal Generator	E4438C	MY49070393	January 4, 2020	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	129942	February 10, 2020	One year
07	E-field Probe	SPEAG EX3DV4	3617	Jan 30, 2020	One year
08	DAE	SPEAG DAE4	777	Jan 8, 2020	One year
09	Dipole Validation Kit	SPEAG D750V3	1017	July 18,2019	One year
10	Dipole Validation Kit	SPEAG D835V2	4d069	July 18,2019	One year
11	Dipole Validation Kit	SPEAG D1750V2	1003	July 16,2019	One year
12	Dipole Validation Kit	SPEAG D1900V2	5d101	July 17,2019	One year
13	Dipole Validation Kit	SPEAG D2450V2	853	July 17,2019	One year
14	Dipole Validation Kit	SPEAG D2600V2	1012	July 17,2019	One year

I.8 GRAPH RESULTS

GSM850_CH128 Left Tilt 4TX

Date: 13/7/2020

Electronics: DAE4 Sn777

Medium: head 835 MHz

Medium parameters used: f = 824.2; σ = 0.882 mho/m; εr = 41.11; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: GSM850 824.2 Duty Cycle: 1:2

Probe: EX3DV4 – SN3617 ConvF(9.66,9.66,9.66)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 2.02 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 34.92 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 2.28 W/kg

SAR(1 g) = 0.974 W/kg; SAR(10 g) = 0.543 W/kg

Maximum value of SAR (measured) = 1.63 W/kg

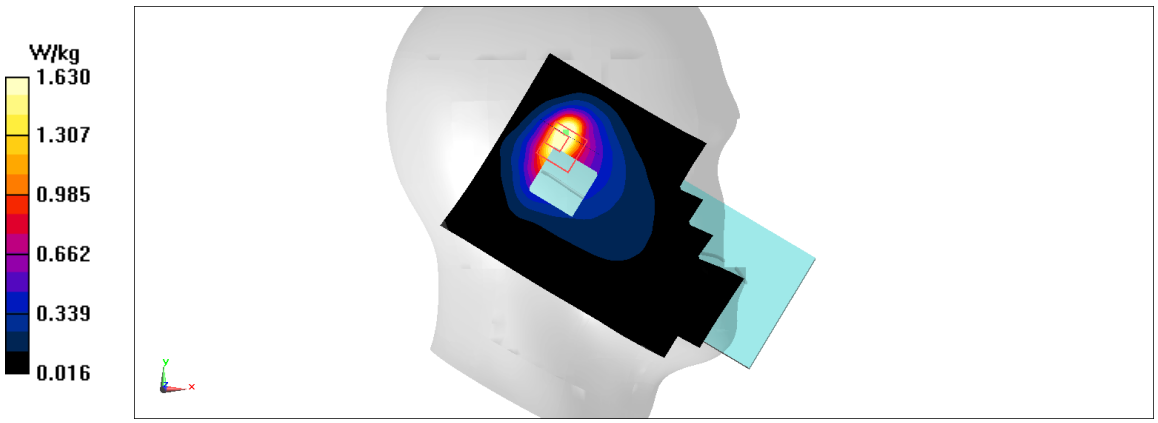


Fig.1

GSM850_CH128 Top Edge GPRS 10mm 4TX

Date: 13/7/2020

Electronics: DAE4 Sn777

Medium: body 835 MHz

Medium parameters used: f = 824.2; σ = 0.882 mho/m; εr = 41.11; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: GSM850 824.2 Duty Cycle: 1:2

Probe: EX3DV4 – SN3617 ConvF(9.66,9.66,9.66)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.474 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.59 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.624 W/kg

SAR(1 g) = 0.296 W/kg; SAR(10 g) = 0.163 W/kg

Maximum value of SAR (measured) = 0.488 W/kg

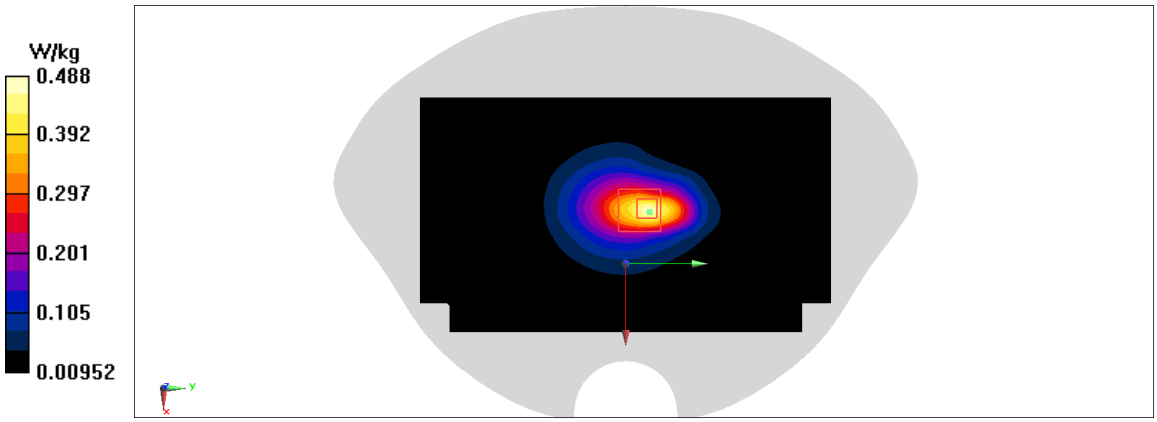


Fig.2

PCS1900_CH661 Right Cheek 2TX

Date: 14/7/2020

Electronics: DAE4 Sn777

Medium: head 1900 MHz

Medium parameters used: f = 1880; σ = 1.409 mho/m; εr = 40.01; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: PCS1900 1880 Duty Cycle: 1:4

Probe: EX3DV4 – SN3617 ConvF(8.14,8.14,8.14)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.158 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.358 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.17 W/kg

SAR(1 g) = 0.11 W/kg; SAR(10 g) = 0.068 W/kg

Maximum value of SAR (measured) =0.148 W/kg

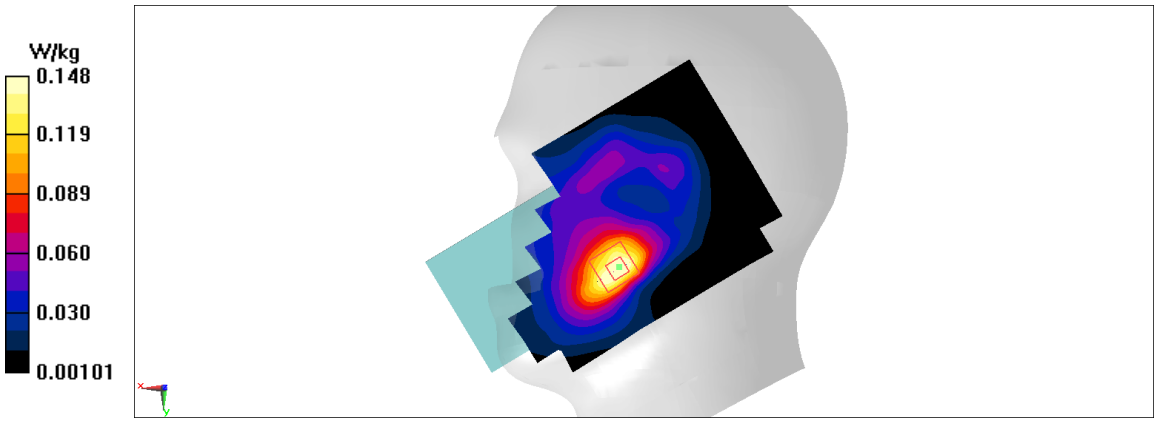


Fig.3