DASY5 Validation Report for Body TSL

Date: 21.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

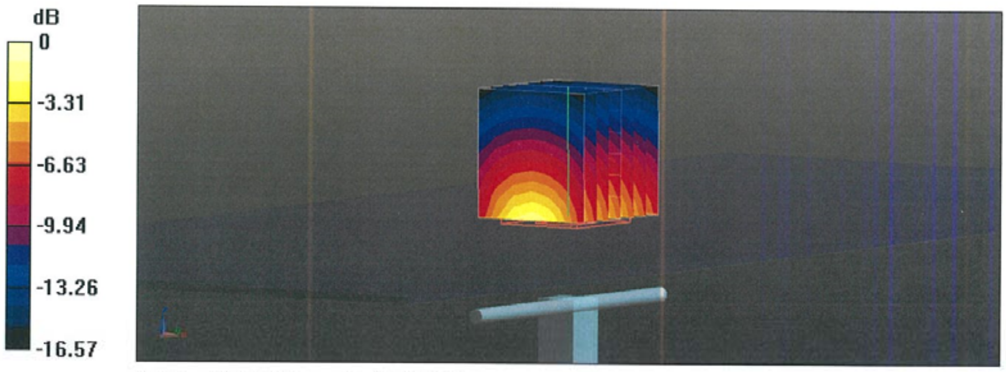
DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN: 1003

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.48 S/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

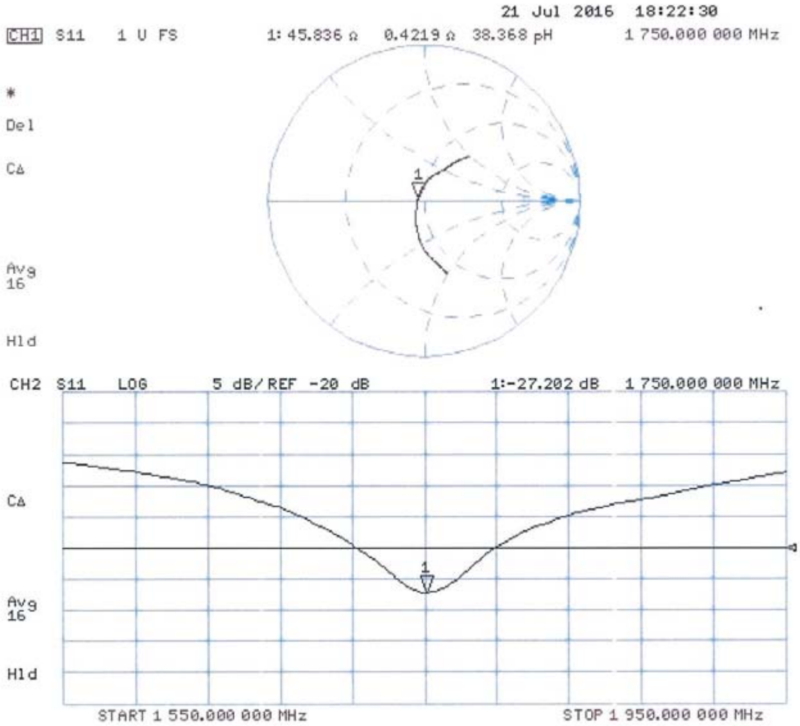
- Probe: EX3DV4 - SN7349; ConvF(8.25, 8.25, 8.25); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 101.3 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 16.3 W/kg
SAR(1 g) = 9.2 W/kg; SAR(10 g) = 4.88 W/kg
Maximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

Impedance Measurement Plot for Body TSL



1900 MHz Dipole Calibration Certificate

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 CTTL-BJ (Auden)

Certificate No: D1900V2-5d101_Jul16

CALIBRATION CERTIFICATE

Object	D1900V2 - SN:5d101
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 28, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: July 28, 2016

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

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	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.38 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.2 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.7 ± 6 %	1.51 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	10.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.3 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	50.8 Ω + 5.5 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.0 Ω + 6.7 jΩ
Return Loss	- 22.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 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	March 28, 2008

DASY5 Validation Report for Head TSL

Date: 22.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

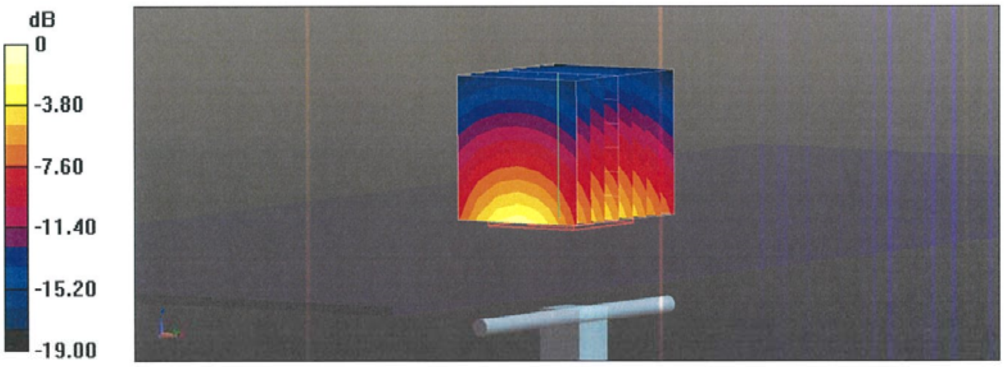
DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d101

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

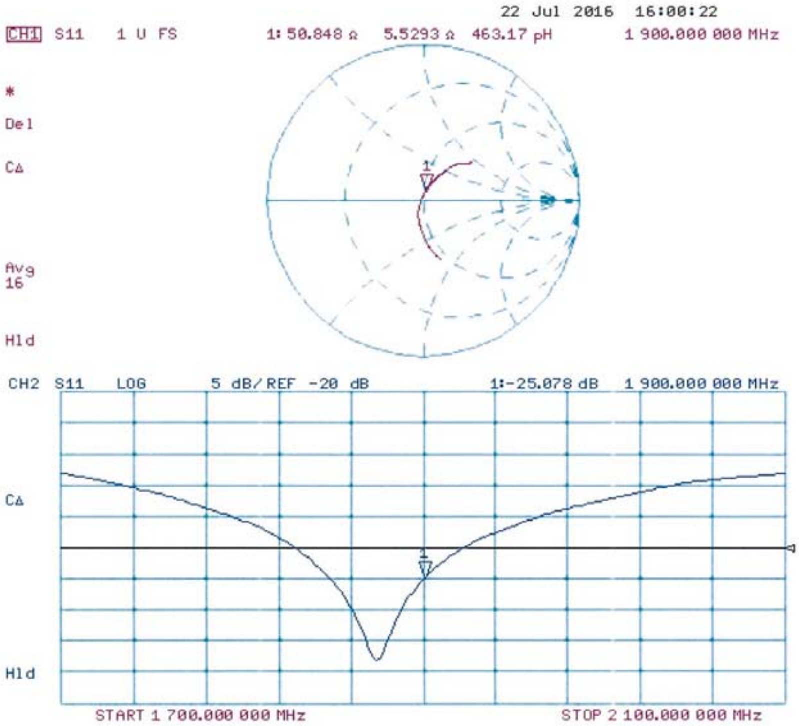
- Probe: EX3DV4 - SN7349; ConvF(7.99, 7.99, 7.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x8x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.9 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 19.0 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg
Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 28.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

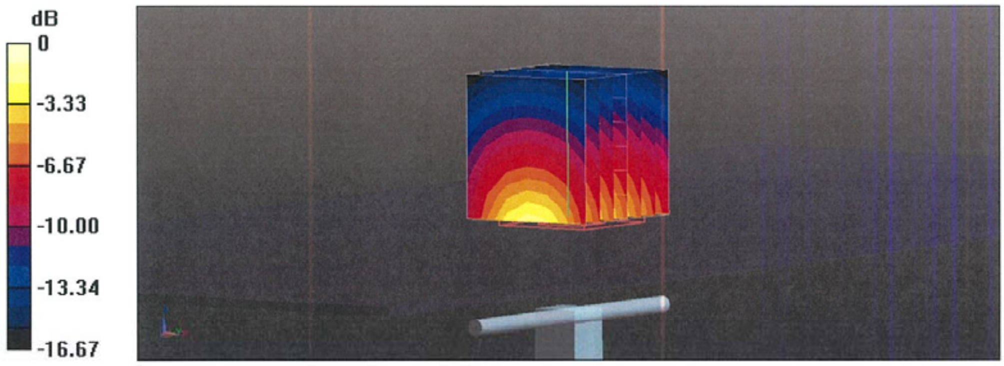
DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN: 5d101

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.51 S/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

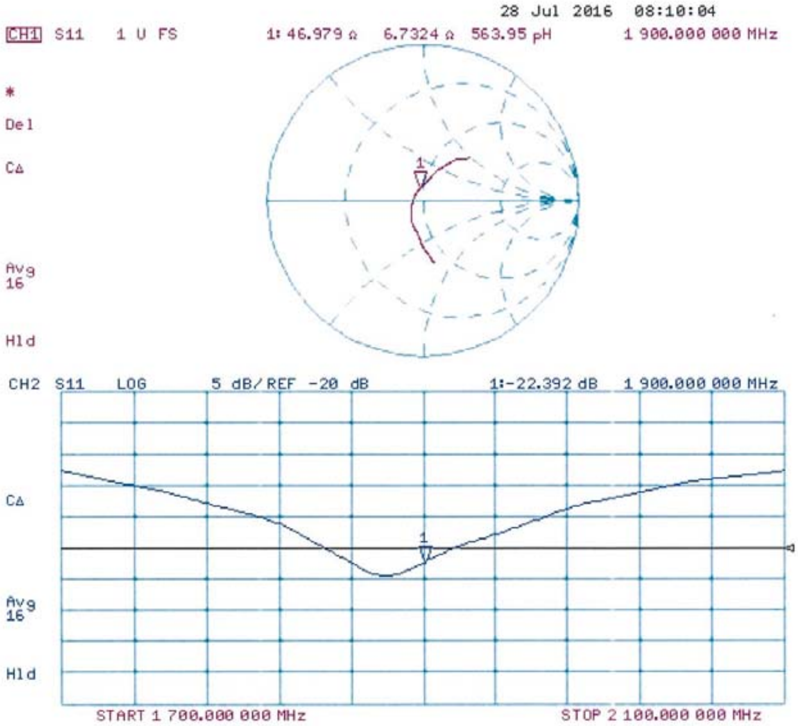
- Probe: EX3DV4 - SN7349; ConvF(8.03, 8.03, 8.03); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 104.2 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.32 W/kg
Maximum value of SAR (measured) = 15.0 W/kg



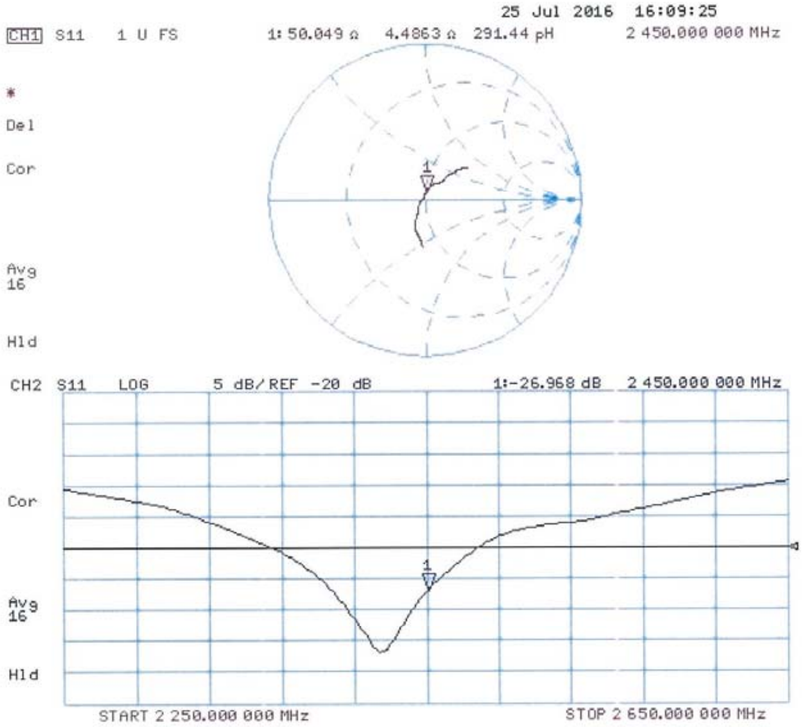
0 dB = 15.0 W/kg = 11.76 dBW/kg

Impedance Measurement Plot for Body TSL



2450 MHz Dipole Calibration Certificate

Impedance Measurement Plot for Body TSL



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 **CTTL-BJ (Auden)**

Certificate No: **D2450V2-853_Jul16**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:853
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 25, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: July 26, 2016

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

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

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

Accreditation No.: **SCS 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, "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	38.0 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.6 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	51.8 ± 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	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.1 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	53.7 Ω + 5.1 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.0 Ω + 4.5 jΩ
Return Loss	- 27.0 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
Manufactured on	November 10, 2009

DASY5 Validation Report for Head TSL

Date: 25.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

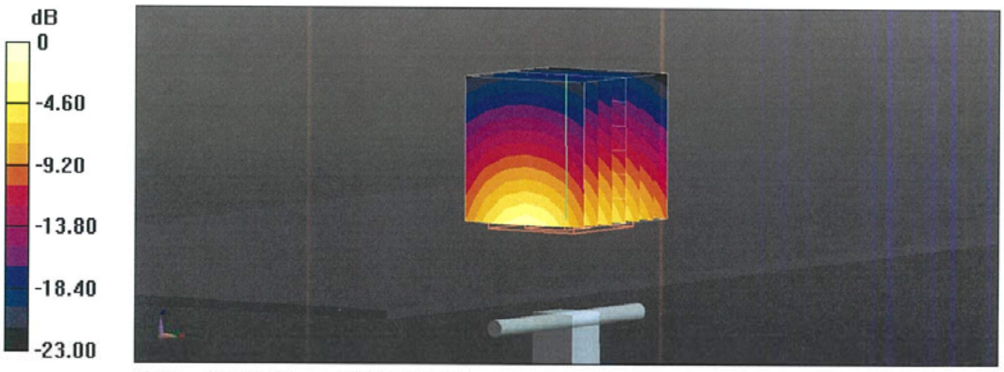
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:853

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 38; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

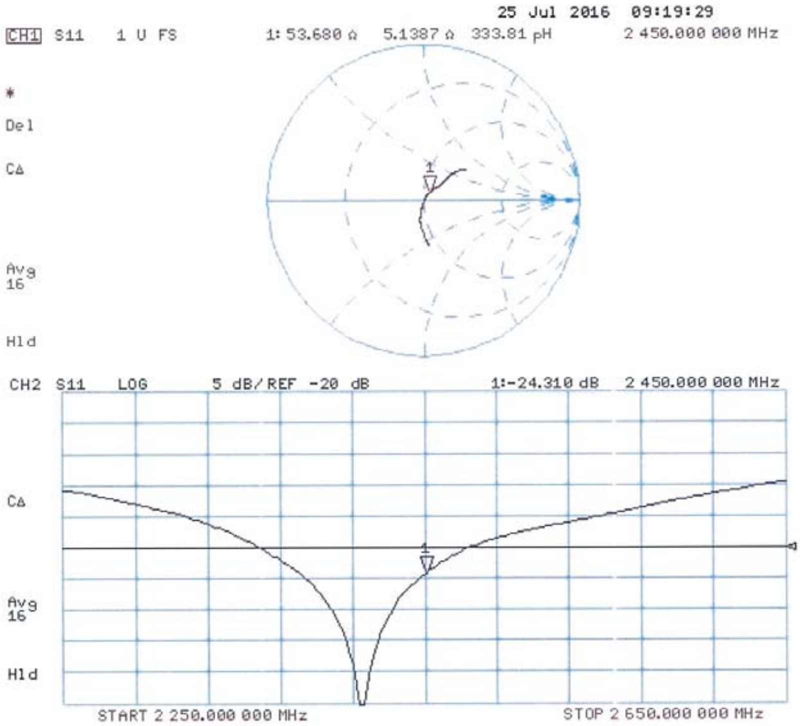
- Probe: EX3DV4 - SN7349; ConvF(7.72, 7.72, 7.72); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 115.0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 27.5 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.23 W/kg
Maximum value of SAR (measured) = 22.2 W/kg



0 dB = 22.2 W/kg = 13.46 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

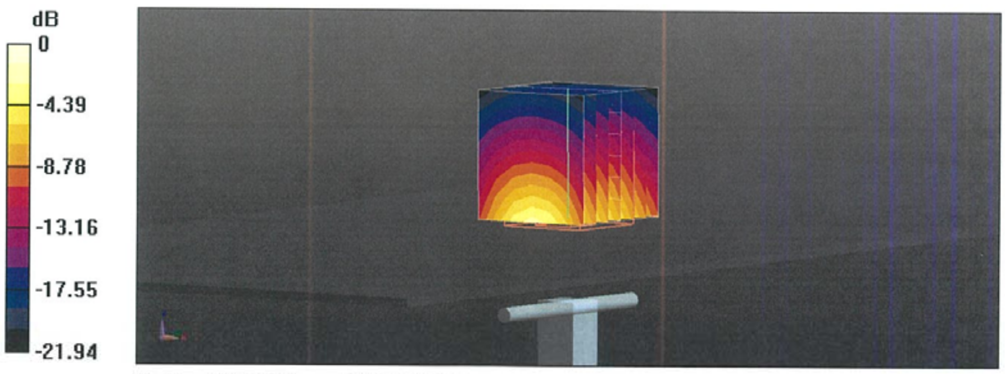
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:853

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 107.4 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 26.3 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 21.6 W/kg



0 dB = 21.6 W/kg = 13.34 dBW/kg

ANNEX I Spot Check

I.1 Measurement results

Test Position	Phantom position L/R/F	Frequency Band	Channel Number	Frequency (MHz)	Test setup	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)	Measured SAR 10g (W/kg)	Calculated SAR 10g (W/kg)	Power Drift
Cheek	L	CDMA BC0	777	848.31		23.66	24.5	0.352	**0.43**	0.267	**0.32**	0.08
Cheek	L	CDMA BC0	384	836.52		23.84	24.5	0.393	**0.46**	0.297	**0.35**	0.02
Cheek	L	CDMA BC0	1013	824.7		24	24.5	0.436	**0.49**	0.329	**0.37**	0.06
Body	F	CDMA BC0	1013	824.7	Rear 10mm	24.36	24.5	0.678	**0.70**	0.528	**0.55**	0.05
Cheek	L	CDMA BC1	25	1851.25		23.8	24.5	0.33	**0.39**	0.209	**0.25**	0.01
Body	F	CDMA BC1	1175	1908.75	Bottom Edge 10mm	20.99	22.3	0.615	**0.83**	0.319	**0.43**	-0.08
Body	F	CDMA BC1	600	1880	Rear 15mm	24.42	24.5	0.541	**0.55**	0.314	**0.32**	-0.02
Cheek	L	LTE Band4	20175	1732.5	1RB-Middle	24.17	24.7	0.332	**0.38**	0.216	**0.24**	-0.03
Body	F	LTE Band4	20300	1745	1RB-Low Front 10mm	22.97	23.7	0.862	**1.02**	0.494	**0.58**	-0.02
Body	F	LTE Band4	20175	1732.5	1RB-Middle Rear 15mm	24.17	24.7	0.577	**0.65**	0.376	**0.42**	-0.17
Cheek	L	LTE Band13	23230	782	1RB-Middle	23.58	24	0.353	**0.39**	0.274	**0.30**	0.08
Body	F	LTE Band13	23230	782	1RB-Middle Rear 10mm	23.58	24	0.461	**0.51**	0.353	**0.39**	0.03
Cheek	L	WLAN	6	2437	11b 1M 17dBm	15.68	16.1	1.24	**1.37**	0.576	**0.63**	-0.07
Cheek	L	WLAN	6	2437	11n 40M 17dBm	16.66	16.7	1.24	**1.25**	0.572	**0.58**	0.11
Body	F	WLAN	1	2412	Front 10mm	16.08	16.1	0.363	**0.36**	0.197	**0.20**	-0.03

Table I-1: SAR Values (WLAN - Head) – 802.11b 1Mbps (Scaled Reported SAR)

Ambient Temperature: 22.2℃ Liquid Temperature: 21.7℃							
Frequency		Side	Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g) (W/kg)	Scaled reported SAR (1g) (W/kg)
MHz	Ch.						
2437	6	Left	Touch	98.87%	100%	**1.37**	**1.39**

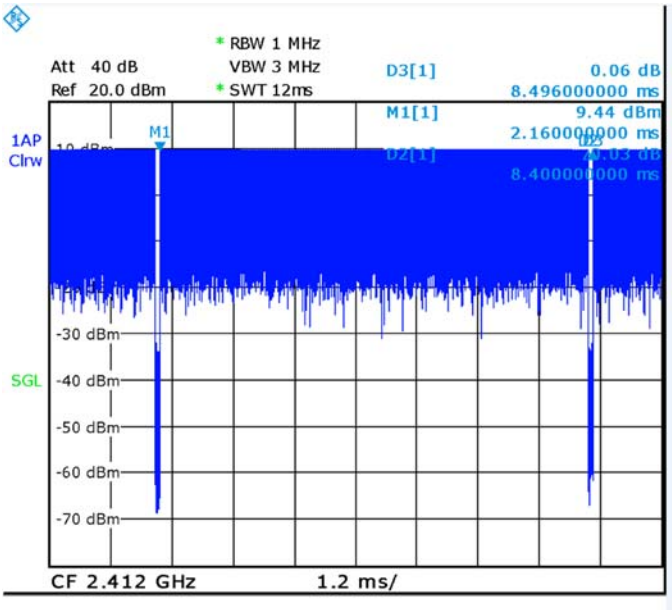
Table I-2: SAR Values (WLAN - Head) – 802.11n HT40 MCS0 (Scaled Reported SAR)

Ambient Temperature: 22.2℃ Liquid Temperature: 21.7℃							
Frequency		Side	Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g) (W/kg)	Scaled reported SAR (1g) (W/kg)
MHz	Ch.						
2437	6	Left	Touch	97.29%	100%	**1.25**	**1.28**

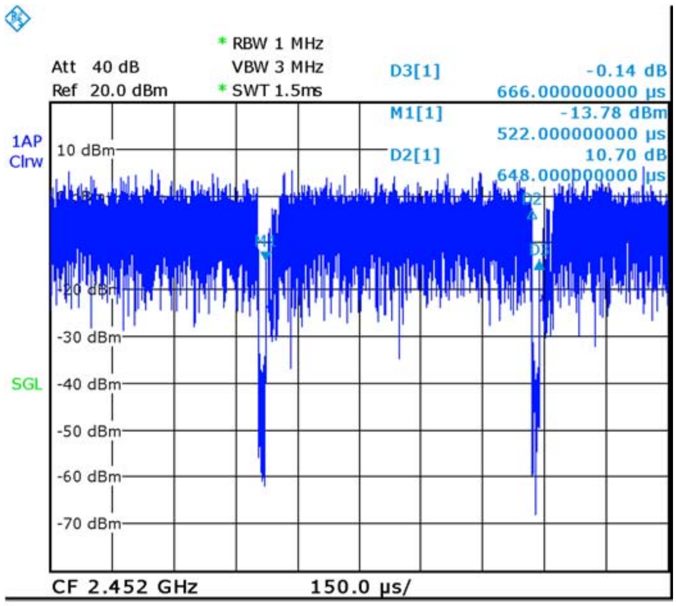
Table I-3: SAR Values (WLAN - Body) – 802.11b 1Mbps (Scaled Reported SAR)

Ambient Temperature: 22.2℃ Liquid Temperature: 21.7℃						
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g) (W/kg)	Scaled reported SAR (1g) (W/kg)
MHz	Ch.					
2412	1	Front	98.87%	100%	**0.36**	**0.36**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.



Picture I.1 The plot of duty factor for Head 802.11b



Picture I.2 The plot of duty factor for Head 802.11n HT40

I.2 Reported SAR Comparison

Exposure Configuration	Technology Band	Reported SAR 1g (W/Kg) : original	Reported SAR 1g (W/Kg)
Head (Separation Distance 0mm)	CDMA BC0	0.38	0.49
	CDMA BC1	0.60	0.39
	LTE Band 4	0.65	0.38
	LTE Band 13	0.37	0.39
	WLAN 2.4 GHz(11b)	1.39	1.39
	WLAN 2.4 GHz(11n)	1.30	1.28
Hotspot (Separation Distance 10mm)	CDMA BC0	0.67	0.70
	CDMA BC1	1.35	0.83
	LTE Band 4	1.23	1.02
	LTE Band 13	0.51	0.51
	WLAN 2.4 GHz	0.20	0.36
Body-worn (Separation Distance 15mm)	CDMA BC1	1.10	0.55
	LTE Band 4	0.59	0.65

Note: The spot check results of CDMA BC0 and LTE Band 13 for Head&CDMA BC0 ,WiFi and LTE Band 4 (15mm) for Body are Higher than the original results, so these results replace the original data.

CDMA BC0 Head Left Cheek Low

Date: 2017-5-24

Electronics: DAE4 Sn1331

Medium: Head 850 MHz

Medium parameters used: f = 824.7 MHz; σ = 0.878 mho/m; εr = 42.06; ρ = 1000 kg/m^3

Ambient Temperature: 22.2ºC Liquid Temperature: 21.7ºC

Communication System: CDMA BC0 Frequency: 824.7 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3846 ConvF(9.33, 9.33, 9.33)

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

Maximum value of SAR (interpolated) = 0.469 W/kg

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

Reference Value = 5.878 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.574 W/kg

SAR(1 g) = 0.436 W/kg; SAR(10 g) = 0.329 W/kg

Maximum value of SAR (measured) = 0.481 W/kg

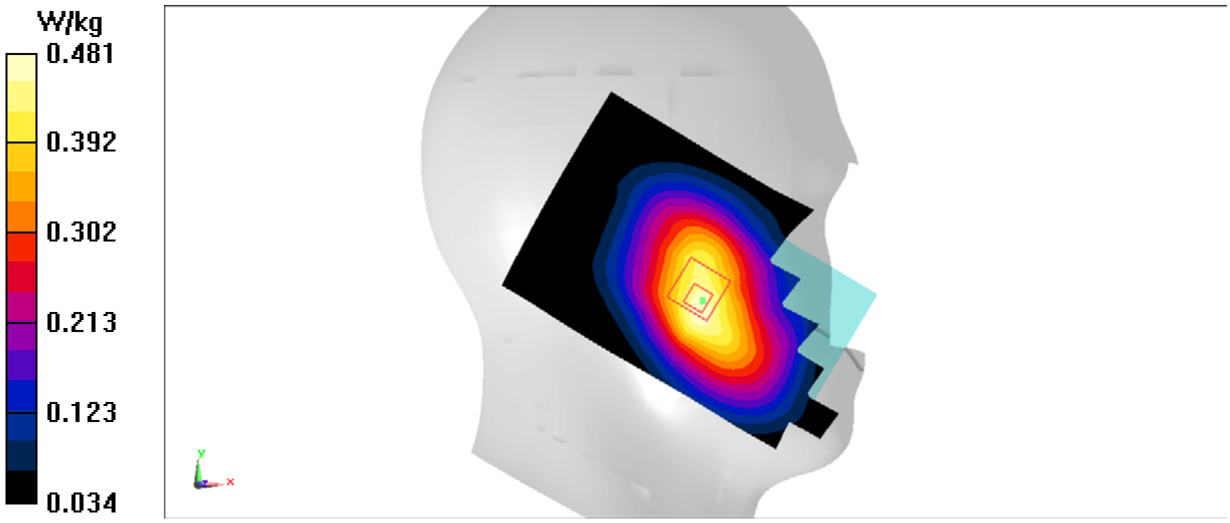


Fig.I.1 CDMA BC0

CDMA BC0 Body Rear Low

Date: 2017-5-24

Electronics: DAE4 Sn1331

Medium: Body 850 MHz

Medium parameters used: f = 824.7 MHz; σ = 0.952 S/m; εr = 54.96; ρ = 1000 kg/m^3

Ambient Temperature: 22.7°C Liquid Temperature: 22.2°C

Communication System: CDMA BC0 Frequency: 824.7 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3846 ConvF(9.52, 9.52, 9.52)

Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.739 W/kg

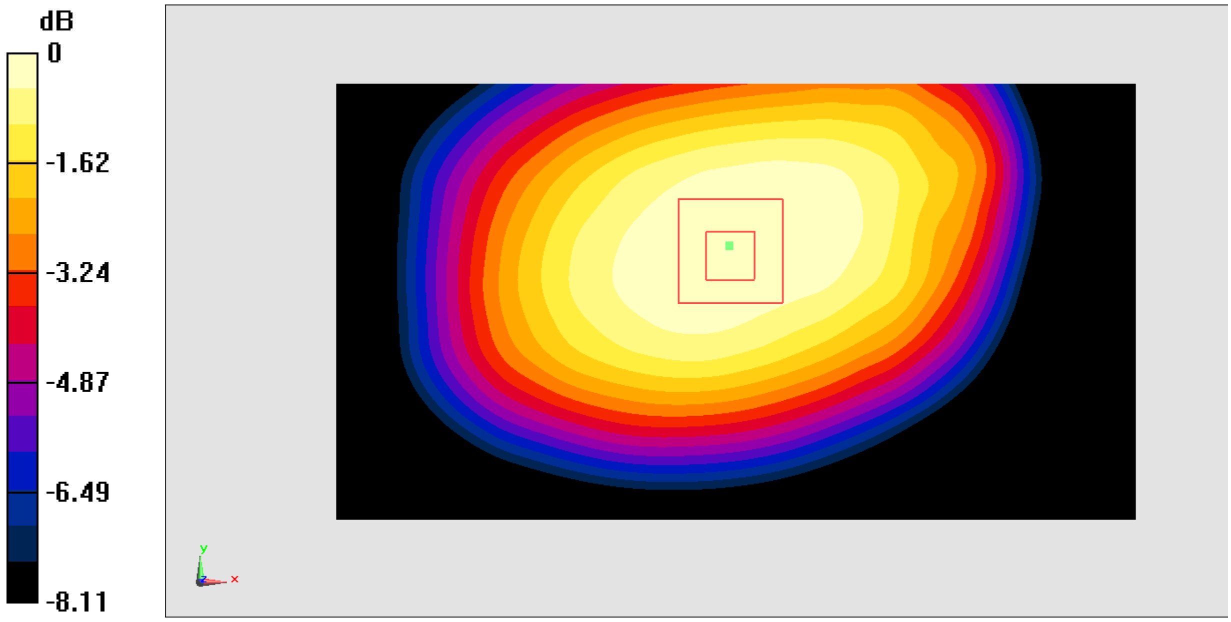
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 26.77 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.842 W/kg

SAR(1 g) = 0.678 W/kg; SAR(10 g) = 0.528 W/kg

Maximum value of SAR (measured) = 0.737 W/kg



0 dB = 0.737 W/kg = -1.33 dBW/kg

Fig.I.2 CDMA BC0

CDMA BC1 Head Left Cheek Low

Date: 2017-5-26
Electronics: DAE4 Sn1331
Medium: Head 1900 MHz
Medium parameters used (interpolated): f = 1851.3 MHz; σ = 1.359 mho/m; εr = 40.29; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C
Communication System: CDMA BC1 Frequency: 1851.3 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.89, 7.89, 7.89)

Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.436 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.111 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.503 W/kg
SAR(1 g) = 0.330 W/kg; SAR(10 g) = 0.209 W/kg
Maximum value of SAR (measured) = 0.421 W/kg

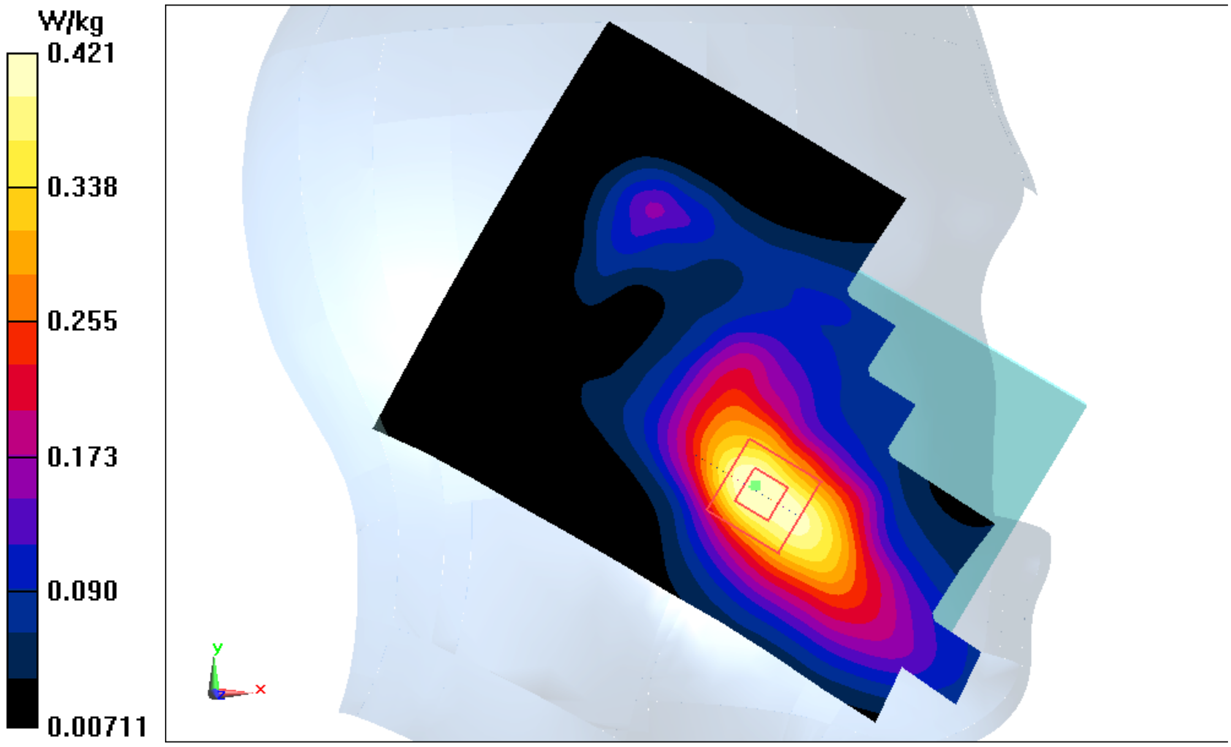
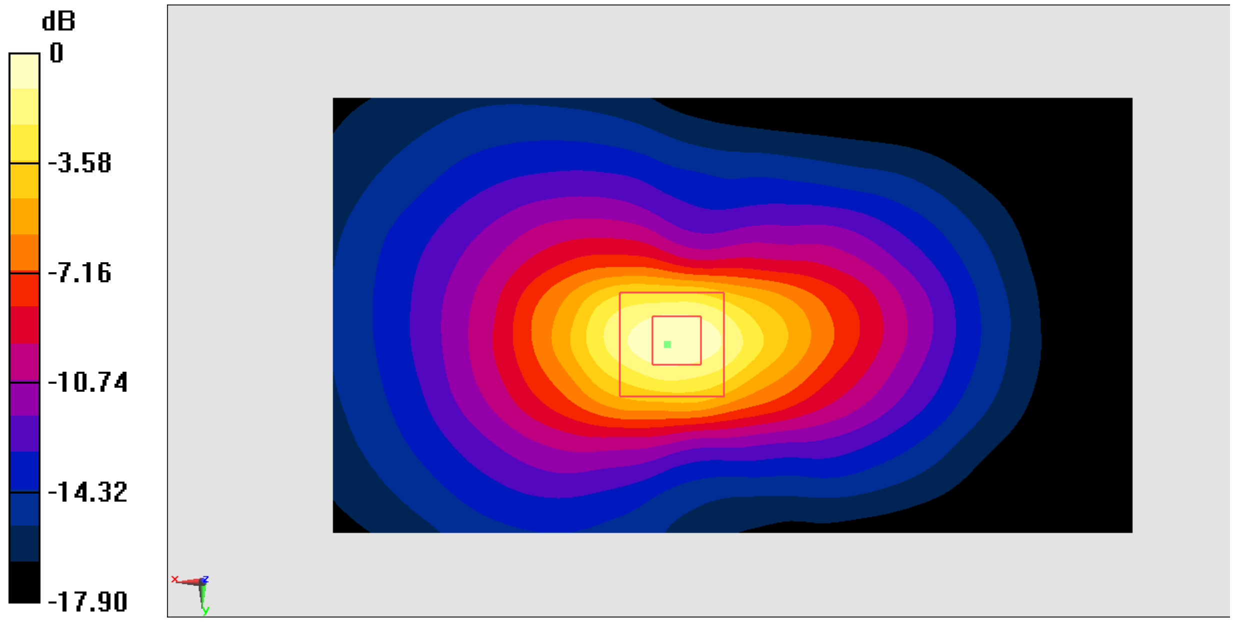


Fig.I.3 CDMA BC1

CDMA BC1 Body Bottom High – AP ON
Date: 2017-5-26
Electronics: DAE4 Sn1331
Medium: Body 1900 MHz
Medium parameters used (interpolated): f = 1908.8 MHz; σ = 1.513 mho/m; εr = 53.06; ρ = 1000 kg/m^3
Ambient Temperature: 22.7ºC Liquid Temperature: 22.2ºC
Communication System: CDMA BC1 Frequency: 1908.8 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.57, 7.57, 7.57)

Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.754 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.37 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.04 W/kg
SAR(1 g) = 0.615 W/kg; SAR(10 g) = 0.319 W/kg
Maximum value of SAR (measured) = 0.760 W/kg



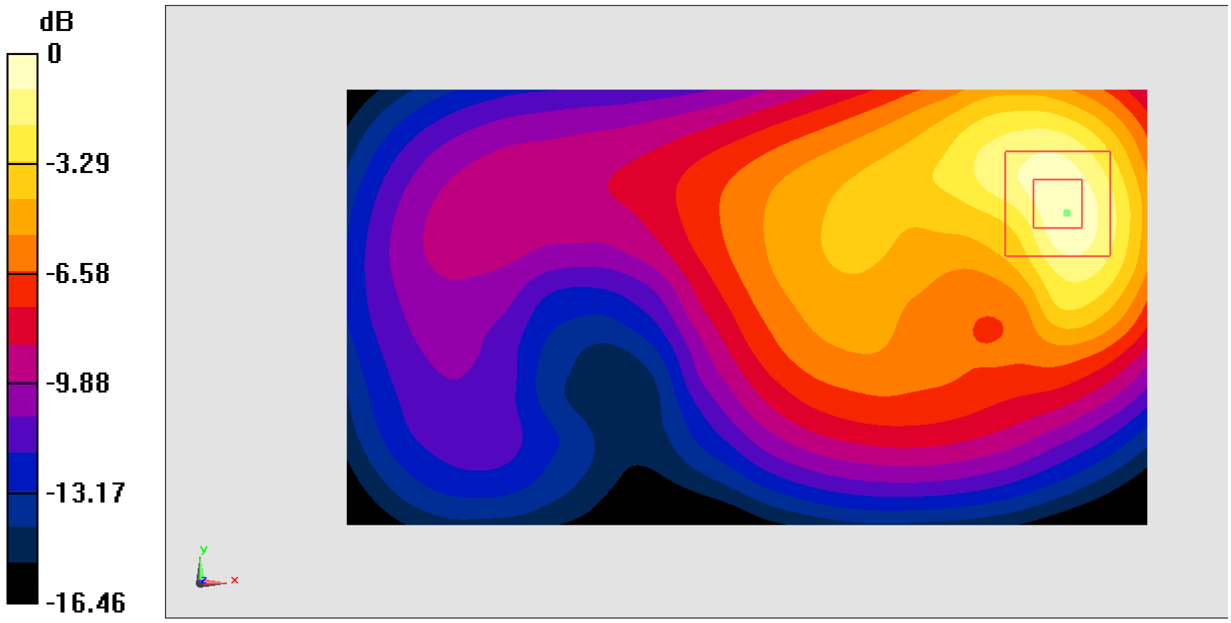
0 dB = 0.760 W/kg = -1.19 dBW/kg

Fig.I.4 CDMA BC1

CDMA BC1 Body Rear High – AP OFF
Date: 2017-5-26
Electronics: DAE4 Sn1331
Medium: Body 1900 MHz
Medium parameters used: f = 1880 MHz; σ = 1.490 mho/m; εr = 53.87; ρ = 1000 kg/m^3
Ambient Temperature: 22.7ºC Liquid Temperature: 22.2ºC
Communication System: CDMA BC1 Frequency: 1880 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.57, 7.57, 7.57)

Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.628 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.175 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.854 W/kg
SAR(1 g) = 0.541 W/kg; SAR(10 g) = 0.314 W/kg
Maximum value of SAR (measured) = 0.658 W/kg



0 dB = 0.658 W/kg = -1.82 dBW/kg

Fig.I.5 CDMA BC1

LTE Band4 Left Cheek Middle with QPSK_20M_1RB_Middle
Date: 2017-5-25
Electronics: DAE4 Sn1331
Medium: Head 1750 MHz
Medium parameters used: f = 1732.5 MHz; σ = 1.337 mho/m; εr = 40.30; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C   Liquid Temperature: 21.7°C
Communication System: LTE Band4 Frequency: 1732.5 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(8.16, 8.16, 8.16)

Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.431 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.041 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.485 W/kg
SAR(1 g) = 0.332 W/kg; SAR(10 g) = 0.216 W/kg
Maximum value of SAR (measured) = 0.415 W/kg

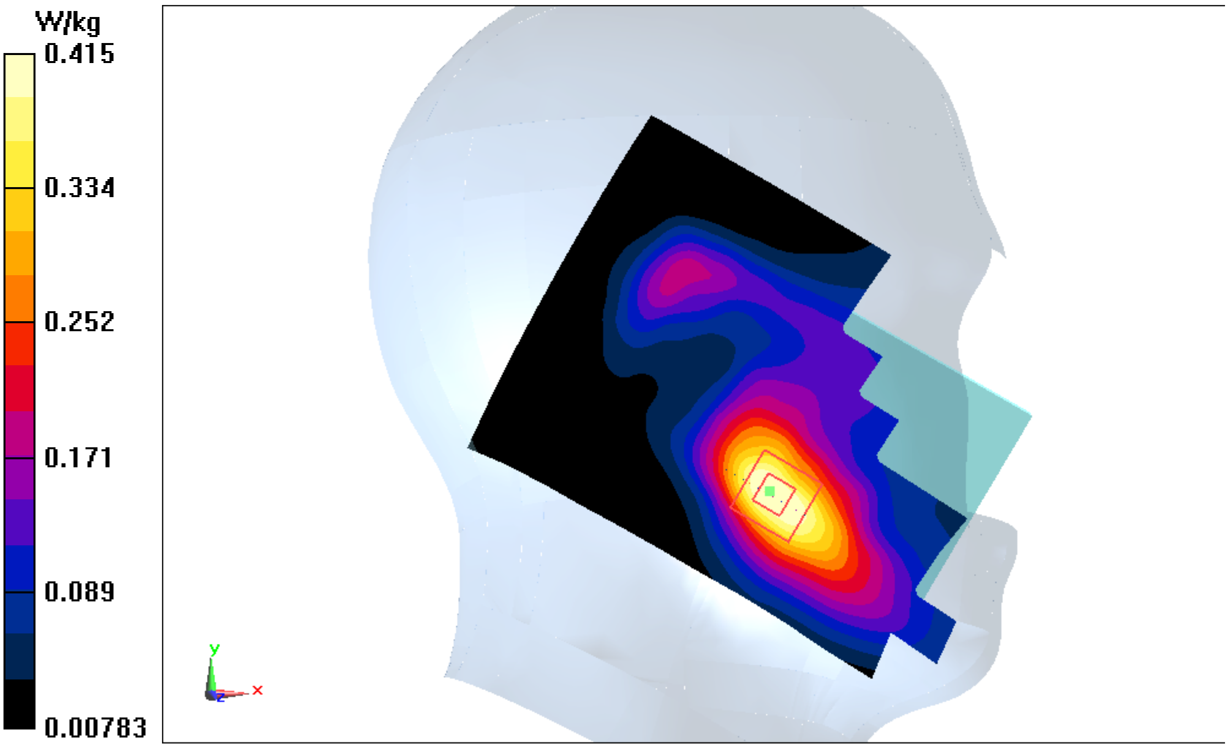
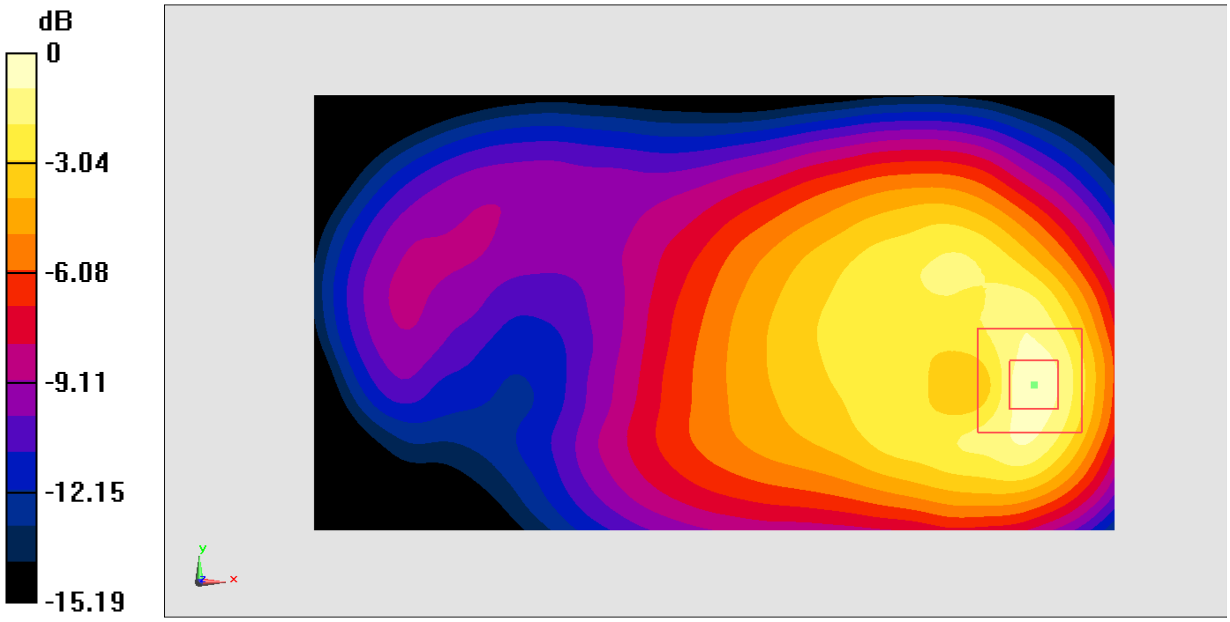


Fig.I.6 LTE Band4

LTE Band4 Body Front High with QPSK_20M_1RB_Low AP ON
Date: 2017-5-25
Electronics: DAE4 Sn1331
Medium: Body 1750 MHz
Medium parameters used: f = 1745 MHz; σ = 1.507 mho/m; εr = 53.30; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C   Liquid Temperature: 21.7°C
Communication System: LTE Band4 Frequency: 1745 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.90, 7.90, 7.90)

Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.05 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.24 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.36 W/kg
SAR(1 g) = 0.862 W/kg; SAR(10 g) = 0.494 W/kg
Maximum value of SAR (measured) = 1.07 W/kg



0 dB = 1.07 W/kg = 0.29 dBW/kg

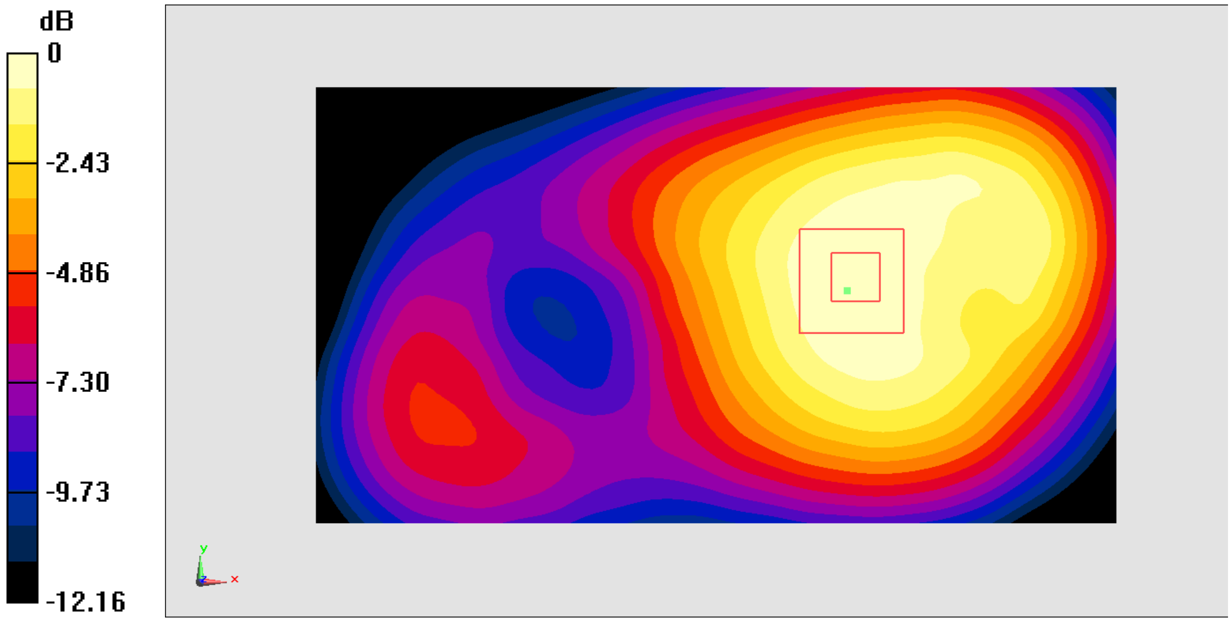
Fig.I.7 LTE Band4

LTE Band4 Body Rear Middle with QPSK_20M_1RB_Middle AP OFF

Date: 2017-5-25
Electronics: DAE4 Sn1331
Medium: Body 1750 MHz
Medium parameters used: f = 1732.5 MHz; σ = 1.496 mho/m; εr = 53.68; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C   Liquid Temperature: 21.7°C
Communication System: LTE Band4 Frequency: 1732.5 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.90, 7.90, 7.90)

Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.653 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.96 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 0.861 W/kg
SAR(1 g) = 0.577 W/kg; SAR(10 g) = 0.376 W/kg
Maximum value of SAR (measured) = 0.660 W/kg



0 dB = 0.660 W/kg = -1.80 dBW/kg

Fig.I.8 LTE Band4

LTE Band 13 Left Cheek with QPSK_10M_1RB_Middle
Date: 2017-5-23
Electronics: DAE4 Sn1331
Medium: Head 750 MHz
Medium parameters used (interpolated): f = 782 MHz; σ = 0.909 mho/m; εr = 39.75; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C
Communication System: LTE Band13 Frequency: 782 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(9.65, 9.65, 9.65)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.390 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.249 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.440 W/kg
SAR(1 g) = 0.353 W/kg; SAR(10 g) = 0.274 W/kg
Maximum value of SAR (measured) = 0.383 W/kg

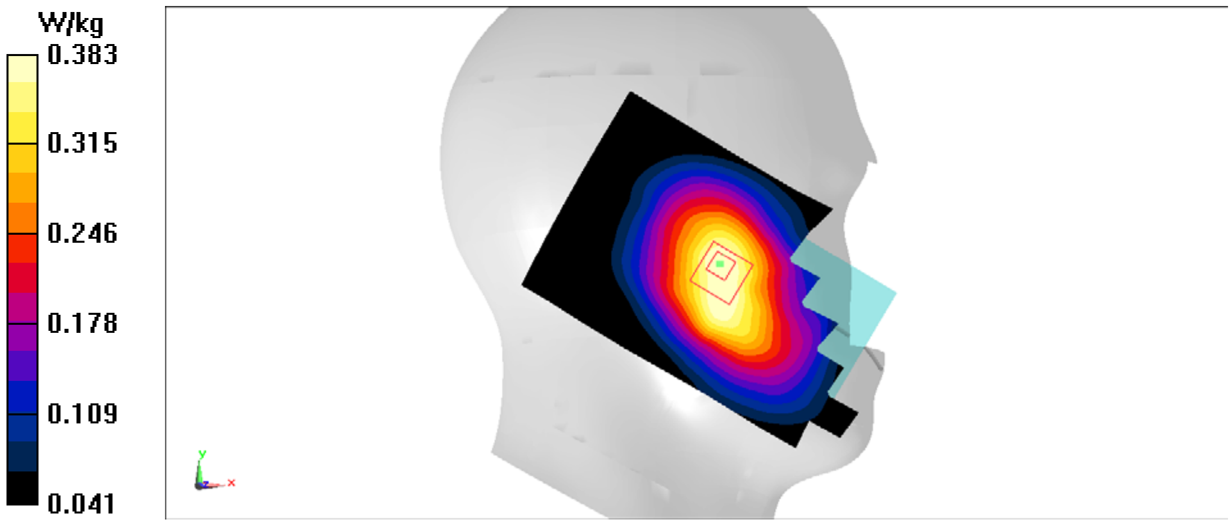
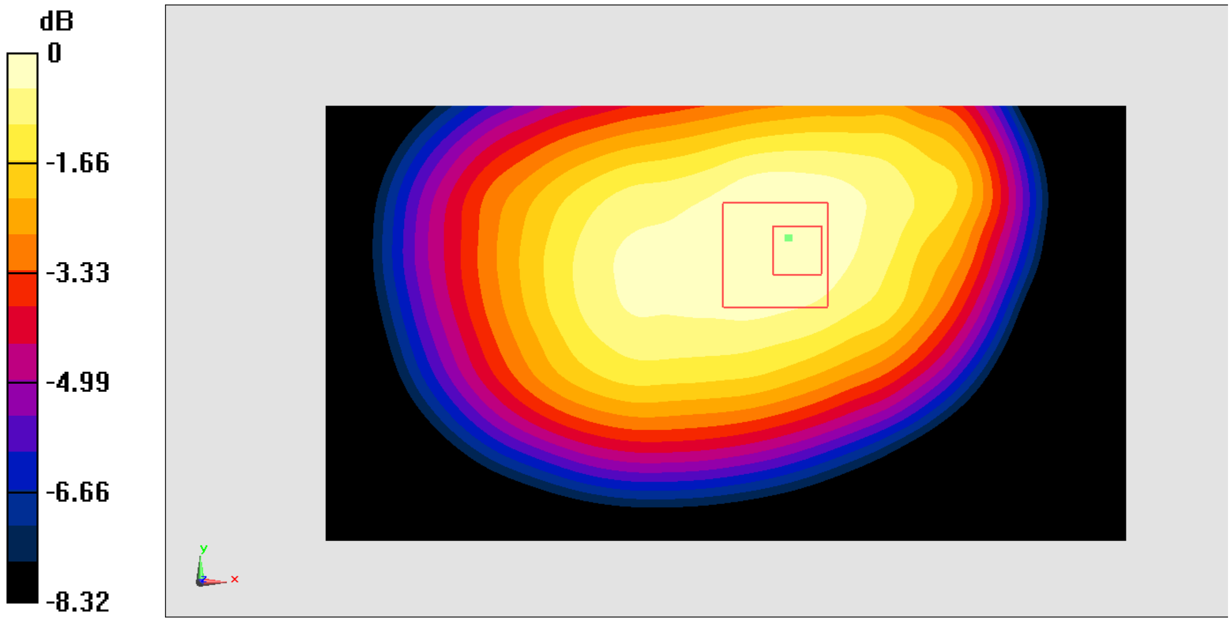


Fig.I.9 LTE Band 13

LTE Band 13 Body Rear Middle with QPSK_10M_1RB_Middle
Date: 2017-5-23
Electronics: DAE4 Sn1331
Medium: Body 750 MHz
Medium parameters used (interpolated): f = 782 MHz; σ = 1.006 mho/m; εr = 52.84; ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C Liquid Temperature: 21.7°C
Communication System: LTE Band13 Frequency: 782 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(9.96, 9.96, 9.96)

Area Scan (111x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.512 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.95 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.576 W/kg
SAR(1 g) = 0.461 W/kg; SAR(10 g) = 0.353 W/kg
Maximum value of SAR (measured) = 0.506 W/kg



0 dB = 0.506 W/kg = -2.96 dBW/kg

Fig.I.10 LTE Band 13

Wifi 802.11b Left Cheek Channel 6

Date: 2017-5-27

Electronics: DAE4 Sn1331

Medium: Head 2450 MHz

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.782 S/m; ε_r = 39.56; ρ = 1000 kg/m^3

Ambient Temperature: 22.2°C   Liquid Temperature: 21.7°C

Communication System: WLan 2450 Frequency: 2437 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3846 ConvF(7.22, 7.22, 7.22)

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

Maximum value of SAR (interpolated) = 1.74 W/kg

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

Reference Value = 19.19 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 2.77 W/kg

SAR(1 g) = 1.24 W/kg; SAR(10 g) = 0.576 W/kg

Maximum value of SAR (measured) = 1.60 W/kg

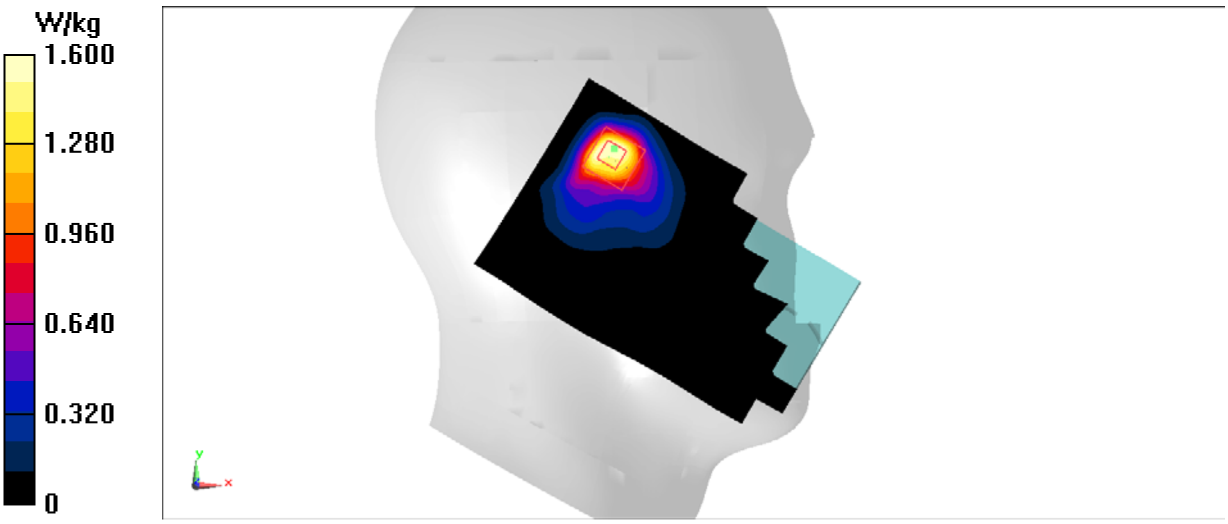


Fig.I.11 2450 MHz

Wifi 802.11n HT40 Left Cheek Channel 3

Date: 2017-5-27
Electronics: DAE4 Sn1331
Medium: Head 2450 MHz
Medium parameters used (interpolated): f = 2422 MHz; σ = 1.772 S/m; ε_r = 39.80; ρ = 1000 kg/m^3
Ambient Temperature: 22.2ºC Liquid Temperature: 21.7ºC
Communication System: WLan 2450 Frequency: 2422 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.22, 7.22, 7.22)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.60 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.41 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 2.91 W/kg
SAR(1 g) = 1.24 W/kg; SAR(10 g) = 0.572 W/kg
Maximum value of SAR (measured) = 1.64 W/kg

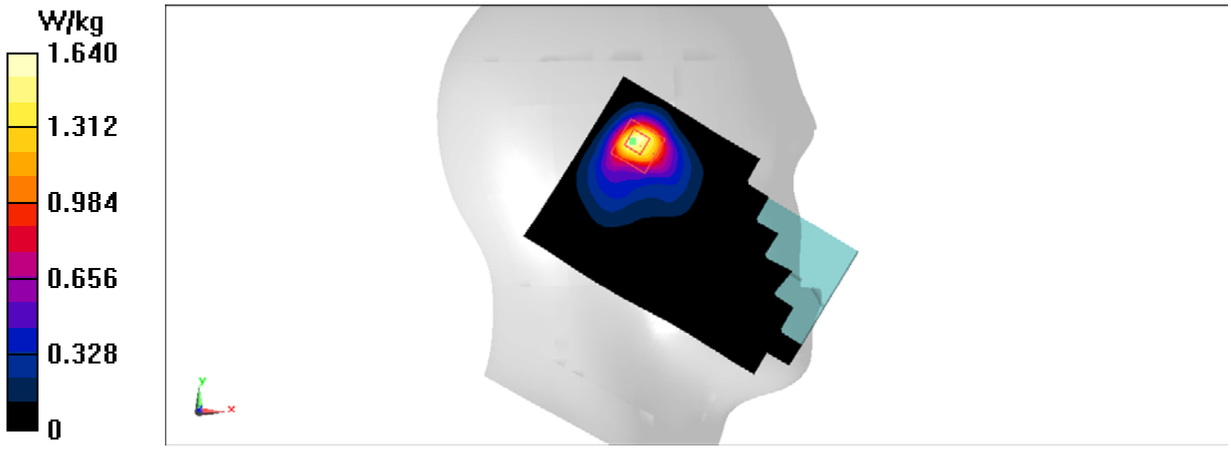


Fig.I.12 2450 MHz

Wifi 802.11b Body Front Channel 1

Date: 2017-5-27
Electronics: DAE4 Sn1331
Medium: Body 2450 MHz
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.926 S/m; ε_r = 53.02; ρ = 1000 kg/m^3
Ambient Temperature: 22.7ºC   Liquid Temperature: 22.2ºC
Communication System: WLan 2450 Frequency: 2412 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3846 ConvF(7.31, 7.31, 7.31)

Area Scan (121x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.520 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.072 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.669 W/kg
SAR(1 g) = 0.363 W/kg; SAR(10 g) = 0.197 W/kg
Maximum value of SAR (measured) = 0.502 W/kg

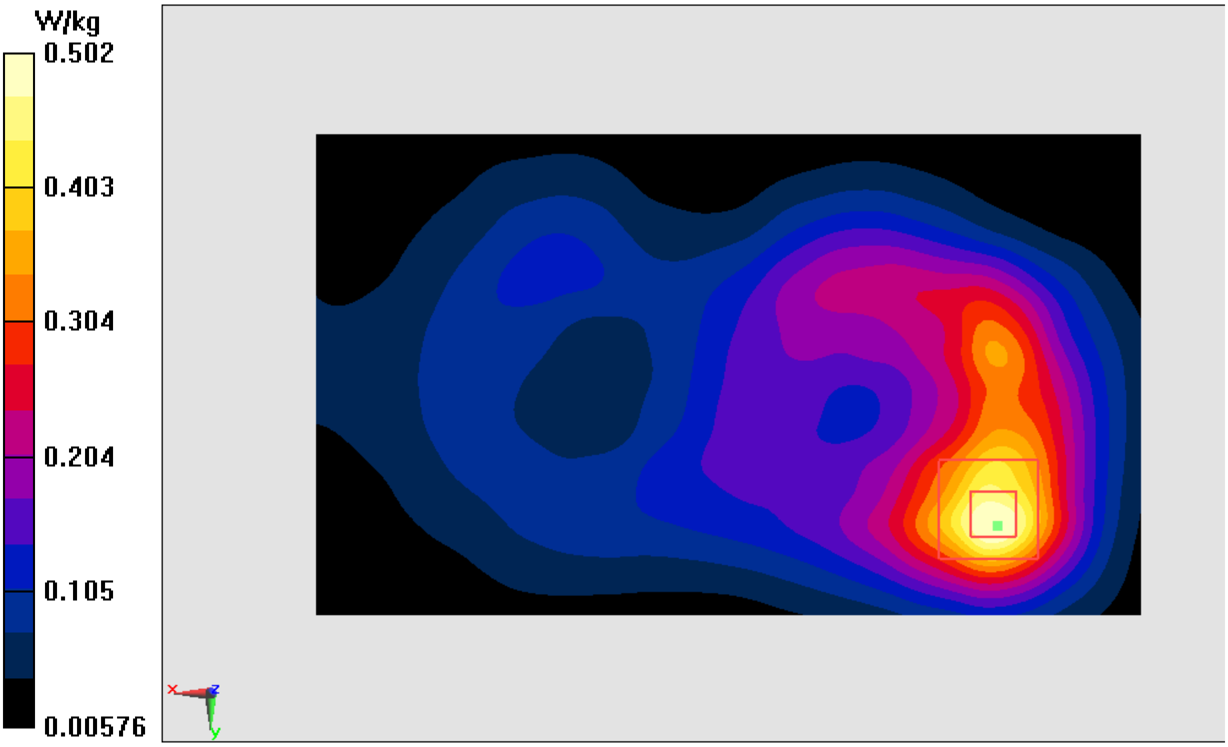


Fig.I.13 2450 MHz

ANNEX J Accreditation Certificate

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L0570)

Telecommunication Technology Labs,

Academy of Telecommunication Research, MIIT

No.52, Huayuan North Road, Haidian District, Beijing, China

No.51, Xueyuan Road, Haidian District, Beijing, China

TCL International E City, No. 1001 Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province

is accredited in accordance with ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence to undertake testing and calibration service as described in the schedule attached to this certificate.

The scope of accreditation is detailed in the attached schedule bearing the same registration number as above. The schedule form an integral part of this certificate.

Date of Issue：2015-11-13

Date of Expiry：2017-06-19

Date of Initial Accreditation：1998-07-03

Signed on behalf of China National Accreditation Service for Conformity Assessment

China National Accreditation Service for Conformity Assessment(CNAS) is authorized by Certification and Accreditation Administration of the People’s Republic of China (CNCA) to operate the national accreditation schemes for conformity assessment. CNAS is a signatory of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) and the Asia Pacific Laboratory Accreditation Cooperation Mutual Recognition Arrangement (APLAC MRA).
The validity of the certificate can be checked on CNAS website at http://www.cnas.org.cn/english/findanaccreditedbody/index.shtml