APPENDIX A: SAR TEST DATA

DUT: ZNFK200AM; Type: Portable Handset; Serial: 11886

Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15 Medium: 835 Head; Medium parameters used (interpolated): $f = 836.6 \text{ MHz}; \ \sigma = 0.944 \text{ S/m}; \ \epsilon_r = 41.077; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section

Test Date: 12/12/2020; Ambient Temp: 24.9°C; Tissue Temp: 23.1°C

Probe: EX3DV4 - SN7308; ConvF(10.17, 10.17, 10.17) @ 836.6 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: GPRS 850, Right Head, Cheek, Mid.ch, 2 Tx slots

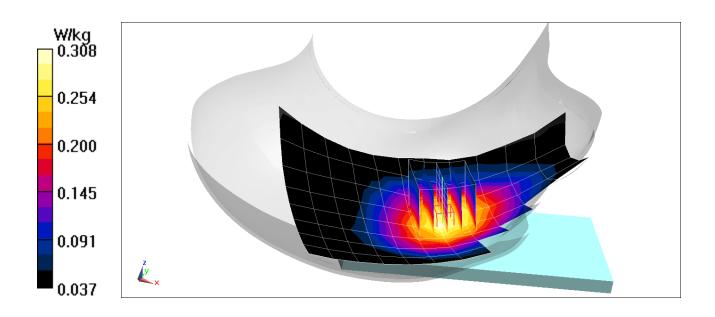
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 16.82 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.333 W/kg

SAR(1 g) = 0.260 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11910

Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15 Medium: 1900 Head; Medium parameters used: $f = 1880 \text{ MHz}; \ \sigma = 1.386 \text{ S/m}; \ \epsilon_r = 40.384; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Left Section

Test Date: 12/10/2020; Ambient Temp: 23.9°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7308; ConvF(8.2, 8.2, 8.2) @ 1880 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: GPRS 1900, Left Head, Cheek, Mid.ch, 2 Tx slots

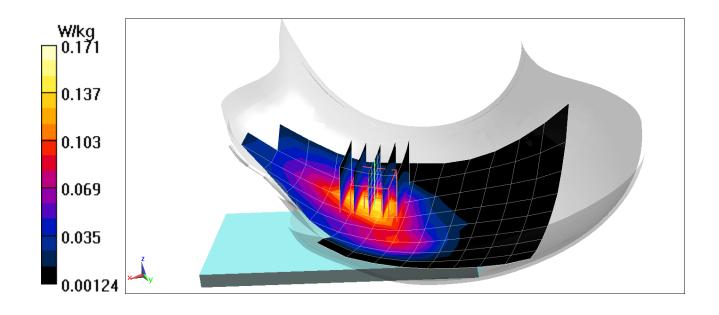
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.771 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.199 W/kg

SAR(1 g) = 0.121 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11886

Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1 Medium: 850 Head; Medium parameters used (interpolated): $f = 836.6 \text{ MHz}; \ \sigma = 0.944 \text{ S/m}; \ \epsilon_r = 41.077; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section

Test Date: 12/12/2020; Ambient Temp: 24.9°C; Tissue Temp: 23.1°C

Probe: EX3DV4 - SN7308; ConvF(10.17, 10.17, 10.17) @ 836.6 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1450; Calibrated: 8/11/2020

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 850, Right Head, Cheek, Mid.ch

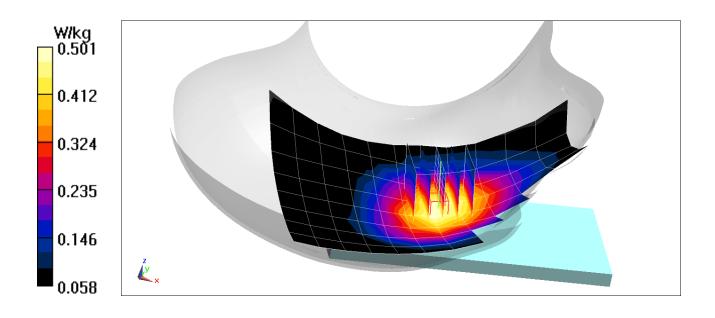
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.66 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.544 W/kg

SAR(1 g) = 0.422 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11910

Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1 Medium: 1750 Head; Medium parameters used (interpolated): $f = 1732.4 \text{ MHz}; \ \sigma = 1.377 \text{ S/m}; \ \epsilon_r = 39.888; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section

Test Date: 12/11/2020; Ambient Temp: 22.5°C; Tissue Temp: 20.9°C

Probe: EX3DV4 - SN7308; ConvF(8.55, 8.55, 8.55) @ 1732.4 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1750, Right Head, Cheek, Mid.ch

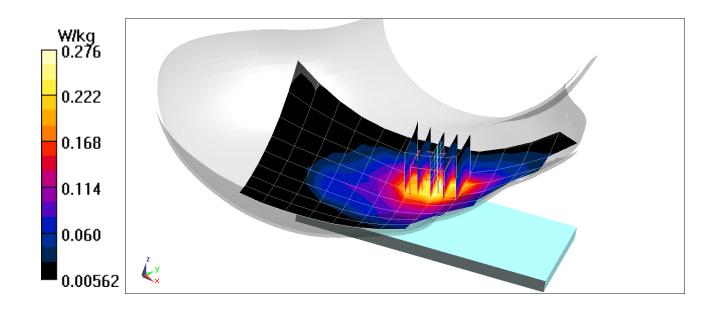
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.90 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.319 W/kg

SAR(1 g) = 0.211 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11910

Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1 Medium: 1900 Head; Medium parameters used: $f = 1880 \text{ MHz}; \ \sigma = 1.386 \text{ S/m}; \ \epsilon_r = 40.384; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Left Section

Test Date: 12/10/2020; Ambient Temp: 23.9°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7308; ConvF(8.2, 8.2, 8.2) @ 1880 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1900, Left Head, Cheek, Mid.ch

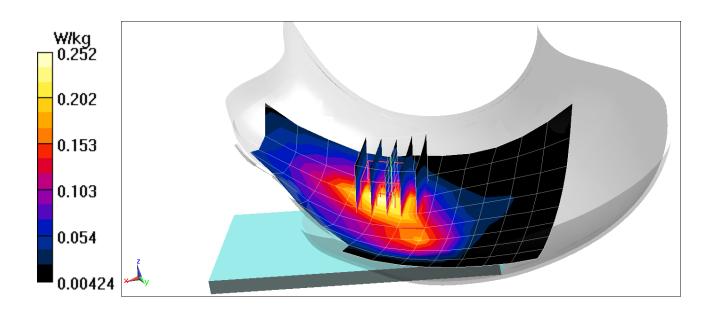
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 11.92 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.299 W/kg

SAR(1 g) = 0.186 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11894

Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1 Medium: 750 Head; Medium parameters used (interpolated): $f = 707.5 \text{ MHz}; \ \sigma = 0.899 \text{ S/m}; \ \epsilon_r = 42.283; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section

Test Date: 12/07/2020; Ambient Temp: 22.3°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7488; ConvF(10.64, 10.64, 10.64) @ 707.5 MHz; Calibrated: 1/21/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1530; Calibrated: 1/13/2020

Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1646 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 12, Right Head, Cheek, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

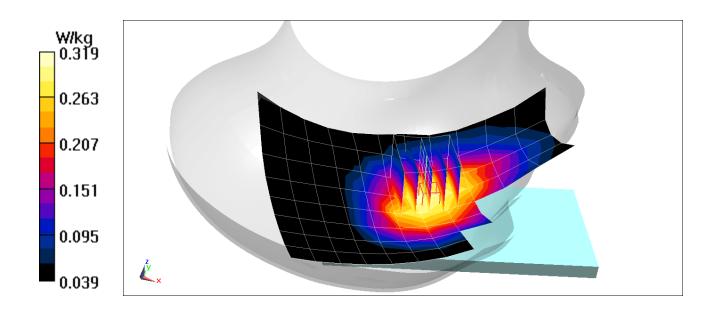
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.60 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 0.341 W/kg

SAR(1 g) = 0.279 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11902

Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1 Medium: 835 Head; Medium parameters used (interpolated): $f = 836.5 \text{ MHz}; \ \sigma = 0.916 \text{ S/m}; \ \epsilon_r = 43.413; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section

Test Date: 12/08/2020; Ambient Temp: 23.7°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7308; ConvF(10.17, 10.17, 10.17) @ 836.5 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 5 (Cell.), Right Head, Cheek, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

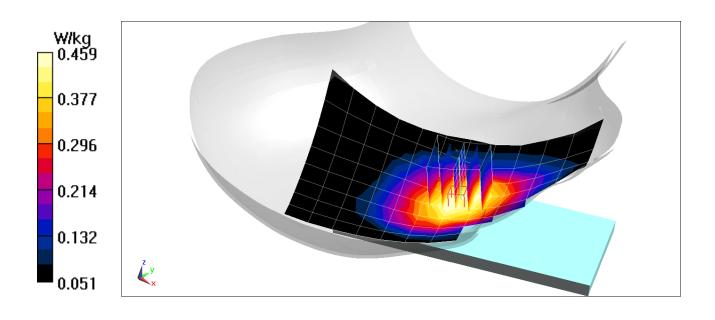
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.93 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.493 W/kg

SAR(1 g) = 0.390 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01721

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1 Medium: 1750 Head; Medium parameters used (interpolated): $f = 1732.5 \text{ MHz}; \ \sigma = 1.377 \text{ S/m}; \ \epsilon_r = 39.888; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section

Test Date: 12/11/2020; Ambient Temp: 22.5°C; Tissue Temp: 20.9°C

Probe: EX3DV4 - SN7308; ConvF(8.55, 8.55, 8.55) @ 1732.5 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 4 (AWS), Right Head, Cheek, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset

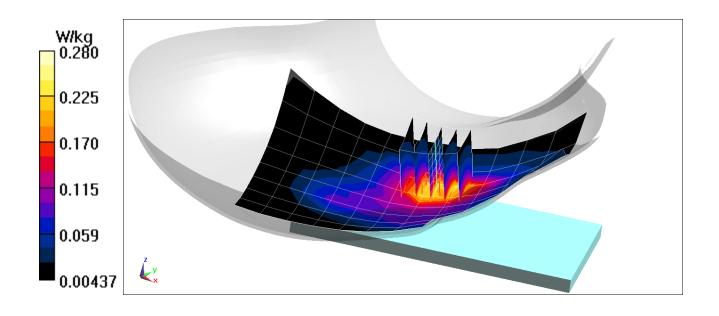
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.36 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.321 W/kg

SAR(1 g) = 0.206 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01721

Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: 1900 Head; Medium parameters used: $f = 1900 \text{ MHz}; \ \sigma = 1.405 \text{ S/m}; \ \epsilon_r = 40.301; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Left Section

Test Date: 12/10/2020; Ambient Temp: 23.9°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7308; ConvF(8.2, 8.2, 8.2) @ 1900 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 2 (PCS), Left Head, Cheek, High.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

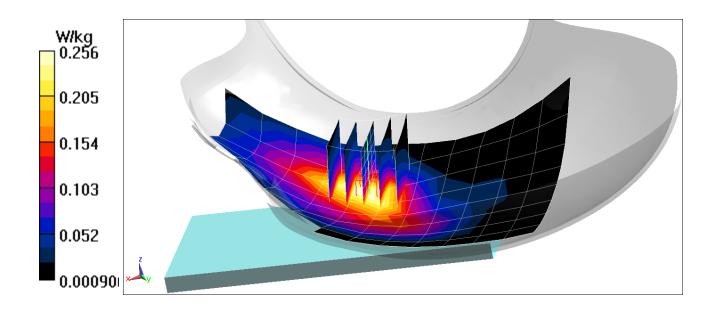
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.54 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.312 W/kg

SAR(1 g) = 0.189 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11761

Communication System: UID 0, 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1 Medium: 2450 Head; Medium parameters used (interpolated): $f = 2412 \text{ MHz}; \ \sigma = 1.779 \text{ S/m}; \ \epsilon_r = 38.57; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Left Section

Test Date: 12/14/2020; Ambient Temp: 24.6°C; Tissue Temp: 23.0°C

Probe: EX3DV4 - SN3589; ConvF(6.85, 6.85, 6.85) @ 2412 MHz; Calibrated: 1/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1558; Calibrated: 1/13/2020

Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647

Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Left Head, Cheek, Ch 1, 1 Mbps

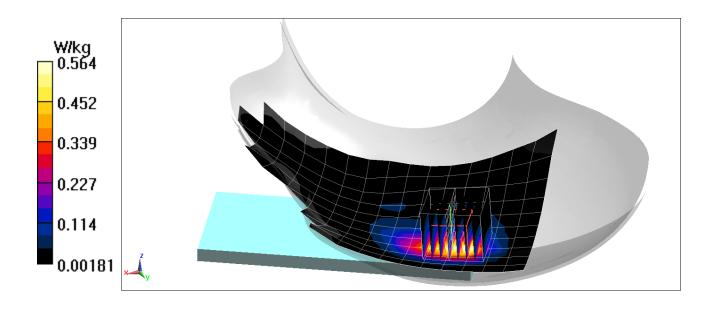
Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.856 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.751 W/kg

SAR(1 g) = 0.353 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11886

Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15 Medium: 835 Body; Medium parameters used (interpolated): $f = 836.6 \text{ MHz}; \ \sigma = 0.968 \text{ S/m}; \ \epsilon_r = 55.305; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/17/2020; Ambient Temp: 23.3°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN7539; ConvF(9.95, 9.95, 9.95) @ 836.6 MHz; Calibrated: 10/20/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn728; Calibrated: 5/20/2020

Phantom: Twin-SAM V8.0 (20); Type: QD 000 P41 Ax; Serial: 1966 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 2 Tx Slots

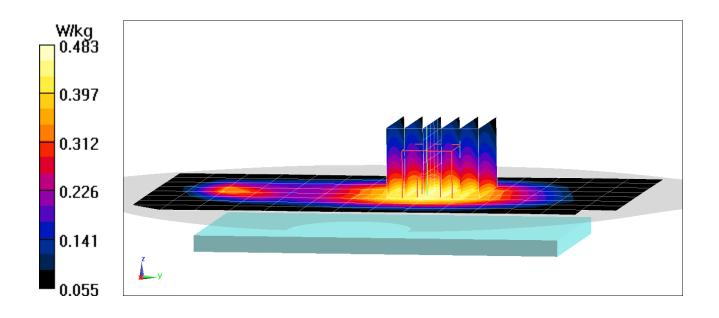
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 20.22 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 0.530 W/kg

SAR(1 g) = 0.399 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01705

Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15 Medium: 1900 Body; Medium parameters used: $f = 1880 \text{ MHz}; \ \sigma = 1.562 \text{ S/m}; \ \epsilon_r = 52.146; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1880 MHz; Calibrated: 7/20/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1322; Calibrated: 7/15/2020

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: GPRS 1900, Body SAR, Back side, Mid.ch, 2 Tx Slots

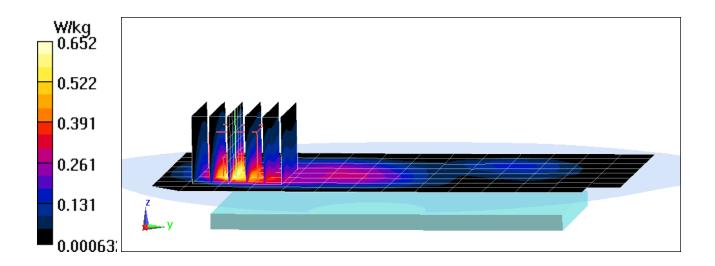
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (7x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.91 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.773 W/kg

SAR(1 g) = 0.449 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01705

Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 1909.8 MHz; Duty Cycle: 1:4.15 Medium: 1900 Body; Medium parameters used: $f = 1910 \text{ MHz}; \ \sigma = 1.595 \text{ S/m}; \ \epsilon_r = 52.044; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1909.8 MHz; Calibrated: 7/20/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/15/2020
hontom: SAM Left: Type: OD000P40CC: Serial: TB: 137

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375

Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: GPRS 1900, Body SAR, Bottom Edge, High.ch, 2 Tx Slots

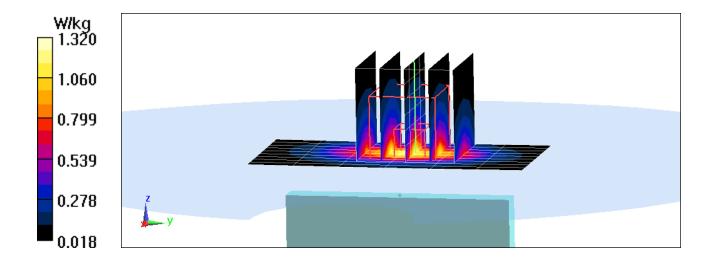
Area Scan (10x7x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.21 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.55 W/kg

SAR(1 g) = 0.890 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11878

Communication System: UID 0, UMTS; Frequency: 826.4 MHz; Duty Cycle: 1:1 Medium: 835 Body; Medium parameters used (interpolated): $f = 826.4 \text{ MHz}; \ \sigma = 0.951 \text{ S/m}; \ \epsilon_r = 53.898; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/10/2020; Ambient Temp: 22.6°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7488; ConvF(11.04, 11.04, 11.04) @ 826.4 MHz; Calibrated: 1/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1530; Calibrated: 1/13/2020

Phantom: Twin-SAM V4.0 Left 30; Type: QD 000 P40 CC; Serial: 1687 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 850, Body SAR, Back side, Low.ch

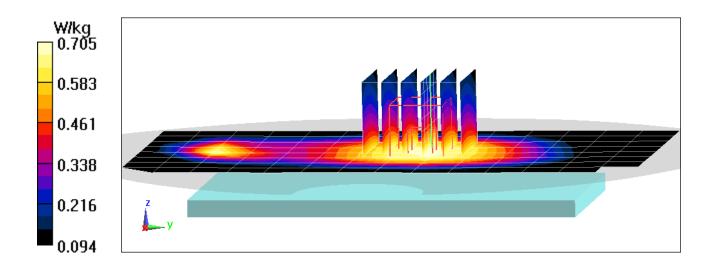
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.04 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.776 W/kg

SAR(1 g) = 0.587 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11910

Communication System: UID 0, UMTS; Frequency: 1712.4 MHz; Duty Cycle: 1:1 Medium: 1750 Body; Medium parameters used (interpolated): $f = 1712.4 \text{ MHz}; \ \sigma = 1.478 \text{ S/m}; \ \epsilon_r = 51.264; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/14/2020; Ambient Temp: 25.0°C; Tissue Temp: 24.6°C

Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1712.4 MHz; Calibrated: 4/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1407; Calibrated: 4/15/2020

Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1750, Body SAR, Back side, Low.ch

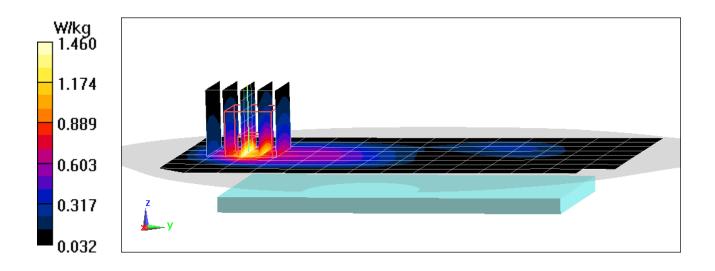
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 27.30 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.72 W/kg

SAR(1 g) = 1.06 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11910

Communication System: UID 0, UMTS; Frequency: 1712.4 MHz; Duty Cycle: 1:1 Medium: 1750 Body; Medium parameters used (interpolated): $f = 1712.4 \text{ MHz}; \ \sigma = 1.478 \text{ S/m}; \ \epsilon_r = 51.264; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/14/2020; Ambient Temp: 25.0°C; Tissue Temp: 24.6°C

Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1712.4 MHz; Calibrated: 4/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1407; Calibrated: 4/15/2020

Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1750, Body SAR, Bottom Edge, Low.ch

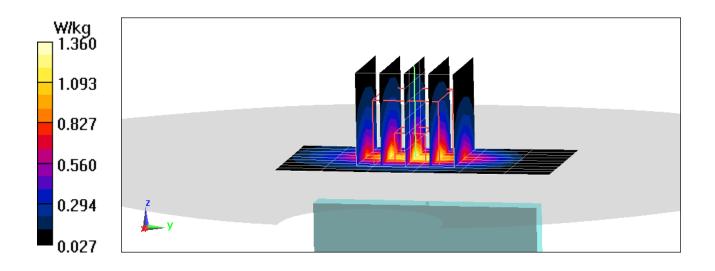
Area Scan (10x7x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.77 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.57 W/kg

SAR(1 g) = 0.945 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01705

Communication System: UID 0, UMTS; Frequency: 1907.6 MHz; Duty Cycle: 1:1 Medium: 1900 Body; Medium parameters used (interpolated): $f = 1907.6 \text{ MHz}; \ \sigma = 1.593 \text{ S/m}; \ \epsilon_r = 52.052; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1907.6 MHz; Calibrated: 7/20/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/15/2020

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1900, Body SAR, Back side, High.ch

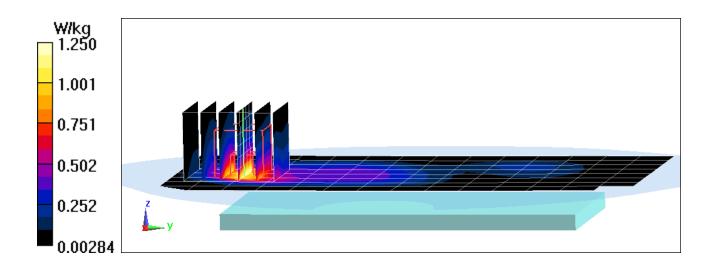
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.21 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.881 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01705

Communication System: UID 0, UMTS; Frequency: 1907.6 MHz; Duty Cycle: 1:1 Medium: 1900 Body; Medium parameters used (interpolated): $f = 1907.6 \text{ MHz}; \ \sigma = 1.593 \text{ S/m}; \ \epsilon_r = 52.052; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1907.6 MHz; Calibrated: 7/20/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 7/15/2020 Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1900, Body SAR, Bottom Edge, High.ch

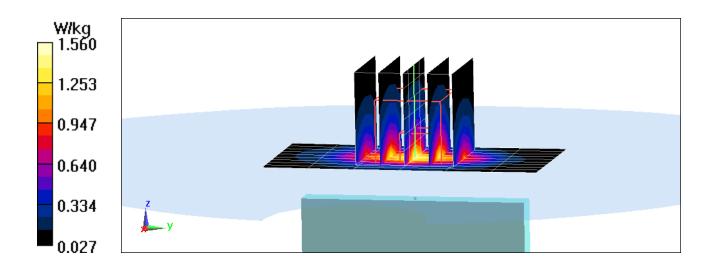
Area Scan (10x7x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 27.26 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.82 W/kg

SAR(1 g) = 1.06 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11902

Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1 Medium: 750 Body; Medium parameters used (interpolated): $f = 707.5 \text{ MHz}; \ \sigma = 0.936 \text{ S/m}; \ \epsilon_r = 54.732; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/07/2020; Ambient Temp: 22.4°C; Tissue Temp: 20.2°C

Probe: EX3DV4 - SN7547; ConvF(9.98, 9.98, 9.98) @ 707.5 MHz; Calibrated: 8/19/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 8/12/2020
Phantom: Left Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 12, Body SAR, Back side, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

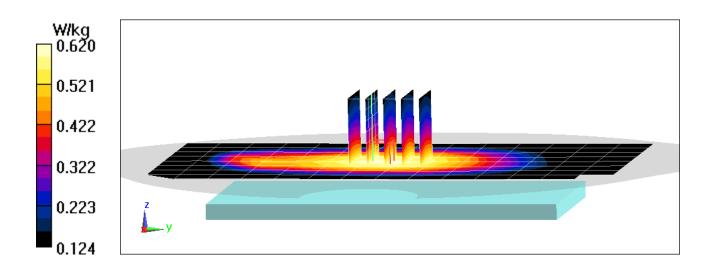
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 23.74 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.663 W/kg

SAR(1 g) = 0.526 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11902

Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1 Medium: 835 Body; Medium parameters used (interpolated): $f = 836.5 \text{ MHz}; \ \sigma = 0.963 \text{ S/m}; \ \epsilon_r = 54.126; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/02/2020; Ambient Temp: 21.2°C; Tissue Temp: 19.2°C

Probe: EX3DV4 - SN7308; ConvF(9.92, 9.92, 9.92) @ 836.5 MHz; Calibrated: 7/31/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020
Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 5 (Cell.), Body SAR, Back side, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

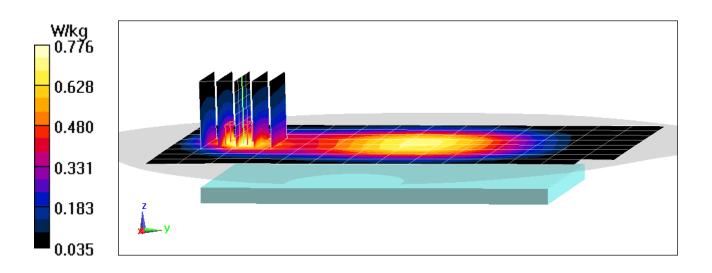
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.76 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.958 W/kg

SAR(1 g) = 0.547 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01713

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1 Medium: 1750 Body; Medium parameters used (interpolated): $f = 1732.5 \text{ MHz}; \ \sigma = 1.489 \text{ S/m}; \ \epsilon_r = 50.943; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/02/2020; Ambient Temp: 24.2°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1732.5 MHz; Calibrated: 4/21/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/15/2020
Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset

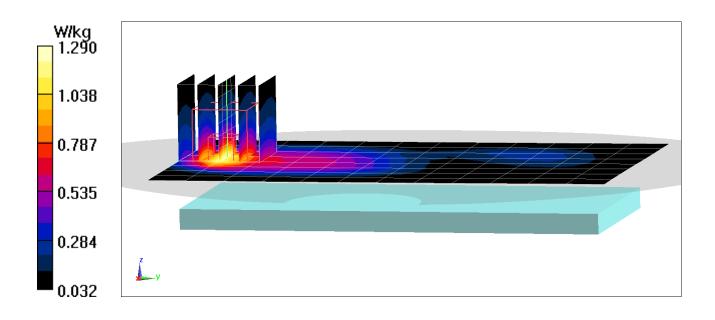
Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.56 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.920 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01721

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1 Medium: 1750 Body; Medium parameters used (interpolated): $f = 1732.5 \text{ MHz}; \ \sigma = 1.489 \text{ S/m}; \ \epsilon_r = 50.943; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/02/2020; Ambient Temp: 24.2°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1732.5 MHz; Calibrated: 4/21/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/15/2020
Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 4 (AWS), Body SAR, Bottom Edge, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

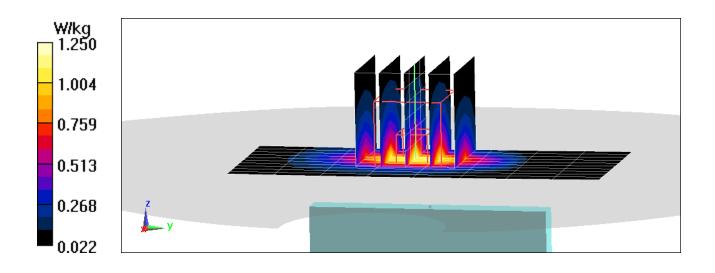
Area Scan (11x9x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.41 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 1.46 W/kg

SAR(1 g) = 0.865 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01721

Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: 1900 Body; Medium parameters used: $f = 1900 \text{ MHz}; \ \sigma = 1.584 \text{ S/m}; \ \epsilon_r = 52.078; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1900 MHz; Calibrated: 7/20/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/15/2020
Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 2 (PCS), Body SAR, Back side, High.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

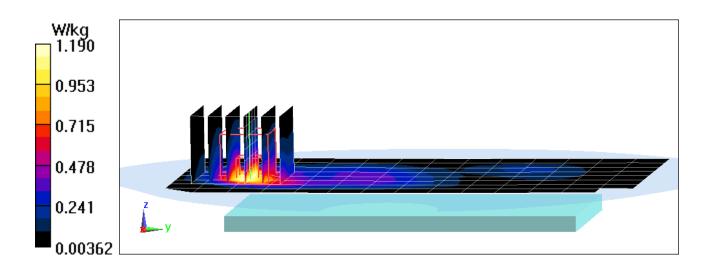
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 23.92 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.817 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01721

Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: 1900 Body; Medium parameters used: $f = 1900 \text{ MHz}; \ \sigma = 1.584 \text{ S/m}; \ \epsilon_r = 52.078; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1900 MHz; Calibrated: 7/20/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/15/2020
Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 2 (PCS), Body SAR, Bottom Edge, High.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

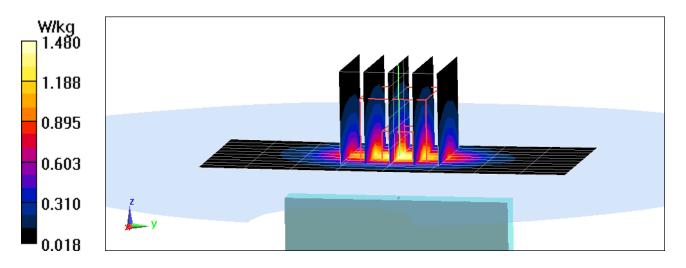
Area Scan (11x9x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.90 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 1.76 W/kg

SAR(1 g) = 0.993 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11779

Communication System: UID 0, 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1 Medium: 2450 Body; Medium parameters used (interpolated): $f = 2412 \text{ MHz}; \ \sigma = 1.997 \text{ S/m}; \ \epsilon_r = 52.139; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/14/2020; Ambient Temp: 24.2°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN7409; ConvF(7.24, 7.24, 7.24) @ 2412 MHz; Calibrated: 6/23/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 6/18/2020
Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: TP1375
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Body SAR, Ch 1, 1 Mbps, Back Side

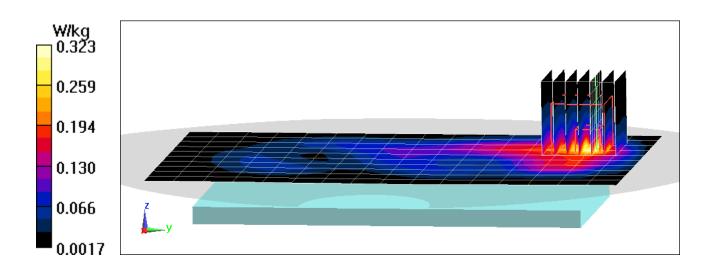
Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm

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

Reference Value = 5.696 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.415 W/kg

SAR(1 g) = 0.200 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 11910

Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1 Medium: 1750 Body; Medium parameters used (interpolated): $f = 1732.4 \text{ MHz}; \ \sigma = 1.5 \text{ S/m}; \ \epsilon_r = 51.168; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 0.0 cm

Test Date: 12/14/2020; Ambient Temp: 25.0°C; Tissue Temp: 24.6°C

Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1732.4 MHz; Calibrated: 4/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1407; Calibrated: 4/15/2020

Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1750, Phablet SAR, Bottom Edge, Mid.ch

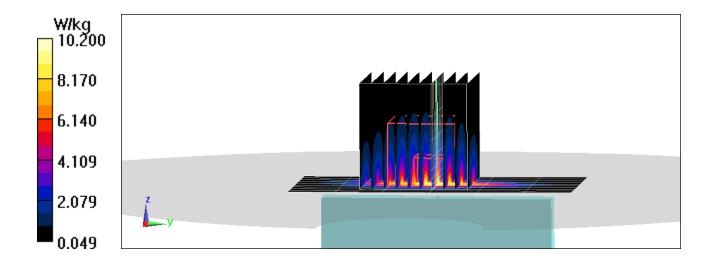
Area Scan (10x7x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (10x10x8)/Cube 0: Measurement grid: dx=3.8mm, dy=3.8mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 67.42 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 13.8 W/kg

SAR(10 g) = 2.87 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01705

Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1 Medium: 1900 Body; Medium parameters used: $f = 1880 \text{ MHz}; \ \sigma = 1.562 \text{ S/m}; \ \epsilon_r = 52.146; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 0.2 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1880 MHz; Calibrated: 7/20/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/15/2020

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375

Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1900, Phablet SAR, Bottom Edge, Mid.ch

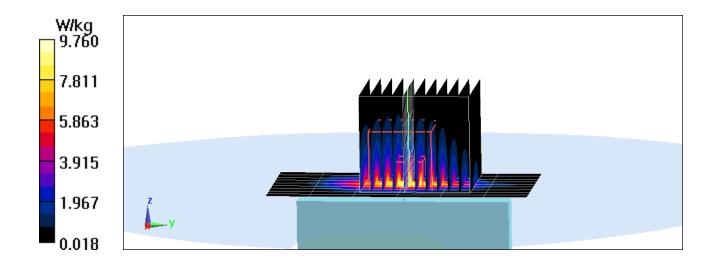
Area Scan (10x7x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (10x11x8)/Cube 0: Measurement grid: dx=3.8mm, dy=3.8mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 64.67 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 12.6 W/kg

SAR(10 g) = 2.96 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01721

Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1 Medium: 1750 Body; Medium parameters used (interpolated): $f = 1732.5 \text{ MHz}; \ \sigma = 1.489 \text{ S/m}; \ \epsilon_r = 50.943; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 0.0 cm

Test Date: 12/02/2020; Ambient Temp: 24.2°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1732.5 MHz; Calibrated: 4/21/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/15/2020
Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 4 (AWS), Phablet SAR, Bottom Edge, Mid.ch, 20 MHz Bandwidth, QPSK, 100 RB, 0 RB Offset

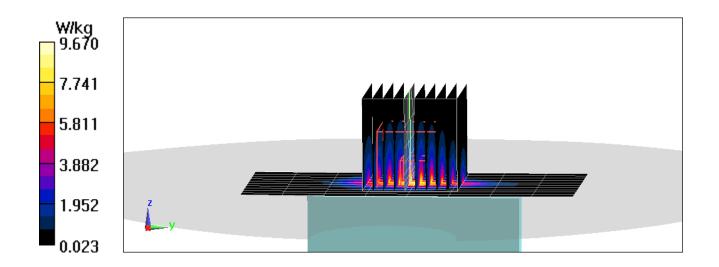
Area Scan (11x9x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (10x10x8)/Cube 0: Measurement grid: dx=3.8mm, dy=3.8mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 64.06 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 12.8 W/kg

SAR(10 g) = 2.6 W/kg



DUT: ZNFK200AM; Type: Portable Handset; Serial: 01713

Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1880 MHz; Duty Cycle: 1:1 Medium: 1900 Body; Medium parameters used: $f = 1880 \text{ MHz}; \ \sigma = 1.477 \text{ S/m}; \ \epsilon_r = 51.96; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 0.2 cm

Test Date: 12/20/2020; Ambient Temp: 20.3°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1880 MHz; Calibrated: 7/20/2020 Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 7/15/2020
Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 2 (PCS), Phablet SAR, Bottom Edge, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

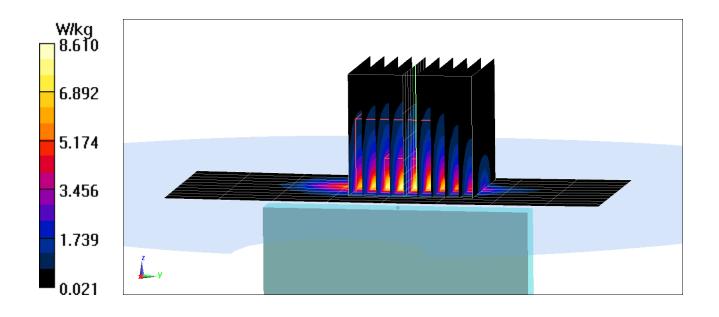
Area Scan (11x9x1): Measurement grid: dx=5mm, dy=15mm

Zoom Scan (10x10x8)/Cube 0: Measurement grid: dx=3.8mm, dy=3.8mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 65.22 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 11.0 W/kg

SAR(10 g) = 2.64 W/kg



APPENDIX B: SYSTEM VERIFICATION

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1054

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium: 750 Head Medium parameters used: $f = 750 \text{ MHz}; \ \sigma = 0.913 \text{ S/m}; \ \epsilon_r = 42.153; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12/07/2020; Ambient Temp: 22.3°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN7488; ConvF(10.64, 10.64, 10.64) @ 750 MHz; Calibrated: 1/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1530; Calibrated: 1/13/2020

Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1646 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

750 MHz System Verification at 23.0 dBm (200 mW)

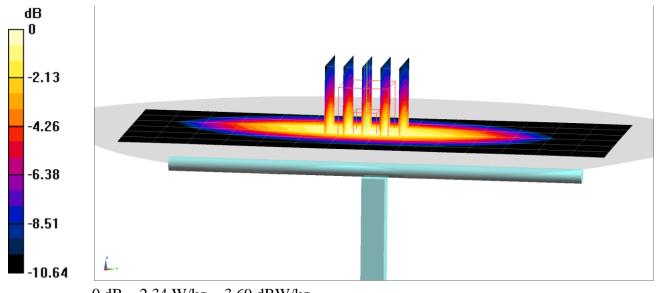
Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 2.65 W/kg

SAR(1 g) = 1.74 W/kg

Deviation(1 g) = 0.81%



DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d132

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium: 835 Head Medium parameters used: $f = 835 \text{ MHz}; \ \sigma = 0.914 \text{ S/m}; \ \epsilon_r = 43.432; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12/08/2020; Ambient Temp: 23.7°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7308; ConvF(10.17, 10.17, 10.17) @ 835 MHz; Calibrated: 7/31/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1450; Calibrated: 8/11/2020

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

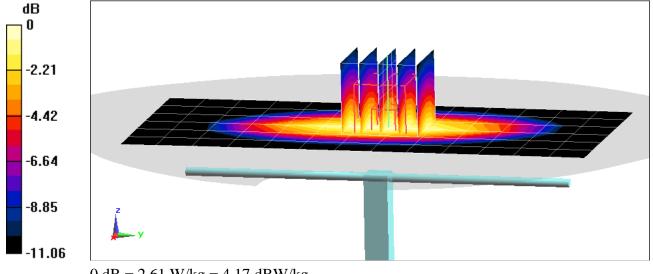
Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 2.98 W/kg

SAR(1 g) = 1.9 W/kg

Deviation(1 g) = -1.55%



0 dB = 2.61 W/kg = 4.17 dBW/kg

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d132

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium: 750 Head; Medium parameters used: f = 835 MHz; $\sigma = 0.943$ S/m; $\varepsilon_r = 41.083$; $\rho = 1000$ kg/m³ Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12/12/2020; Ambient Temp: 24.9°C; Tissue Temp: 23.1°C

Probe: EX3DV4 - SN7308; ConvF(10.17, 10.17, 10.17) @ 835 MHz; Calibrated: 7/31/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1450; Calibrated: 8/11/2020

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

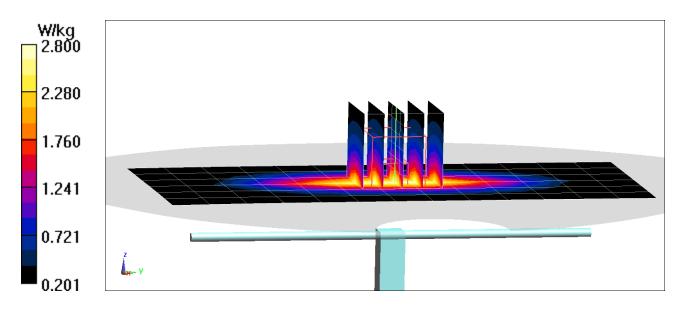
Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 3.24 W/kg

SAR(1 g) = 2.03 W/kg

Deviation(1 g) = 5.18%



DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1148

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium: 1750 Head Medium parameters used: $f = 1750 \text{ MHz}; \ \sigma = 1.395 \text{ S/m}; \ \epsilon_r = 39.809; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/11/2020; Ambient Temp: 22.5°C; Tissue Temp: 20.9°C

Probe: EX3DV4 - SN7308; ConvF(8.55, 8.55, 8.55) @ 1750 MHz; Calibrated: 7/31/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1450; Calibrated: 8/11/2020

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

1750 MHz System Verification at 20.0 dBm (100 mW)

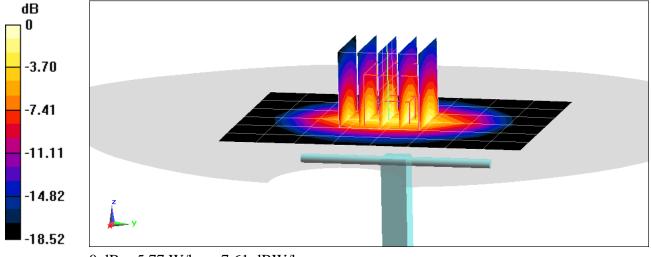
Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 7.16 W/kg

SAR(1 g) = 3.7 W/kg

Deviation(1 g) = 3.06%



0 dB = 5.77 W/kg = 7.61 dBW/kg

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d148

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: 1900 Head Medium parameters used: $f = 1900 \text{ MHz}; \ \sigma = 1.405 \text{ S/m}; \ \epsilon_r = 40.301; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/10/2020; Ambient Temp: 23.9°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN7308; ConvF(8.2, 8.2, 8.2) @ 1900 MHz; Calibrated: 7/31/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1450; Calibrated: 8/11/2020

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

1900 MHz System Verification at 20.0 dBm (100 mW)

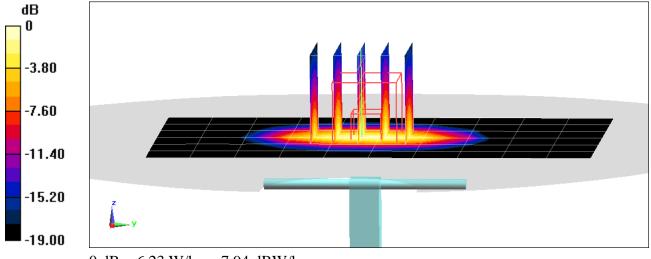
Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 7.64 W/kg

SAR(1 g) = 3.85 W/kg

Deviation(1 g) = -1.53%



0 dB = 6.23 W/kg = 7.94 dBW/kg

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 981

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium: 2450 Head; Medium parameters used: $f = 2450 \text{ MHz}; \ \sigma = 1.823 \text{ S/m}; \ \epsilon_r = 38.409; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/14/2020; Ambient Temp: 24.6°C; Tissue Temp: 23.0°C

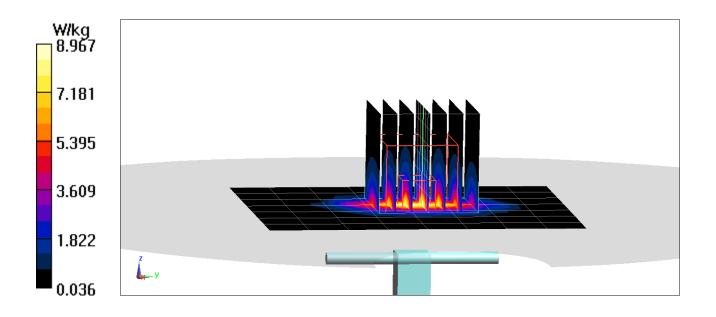
Probe: EX3DV4 - SN3589; ConvF(6.85, 6.85, 6.85) @ 2450 MHz; Calibrated: 1/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1558; Calibrated: 1/13/2020

Phantom: Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1647 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mmZoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mmPeak SAR (extrapolated) = 11.6 W/kg SAR(1 g) = 5.34 W/kg Deviation(1 g) = 2.10%



DUT: Dipole 750 MHz; Type: D750V3; Serial: 1161

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium: 750 Body Medium parameters used: $f = 750 \text{ MHz}; \ \sigma = 0.953 \text{ S/m}; \ \epsilon_r = 54.606; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12/07/2020; Ambient Temp: 22.4°C; Tissue Temp: 20.2°C

Probe: EX3DV4 - SN7547; ConvF(9.98, 9.98, 9.98) @ 750 MHz; Calibrated: 8/19/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1323; Calibrated: 8/12/2020

Phantom: Left Twin-SAM V5.0 (30); Type: QD 000 P40 CD; Serial: 1792 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

750 MHz System Verification at 23.0 dBm (200 mW)

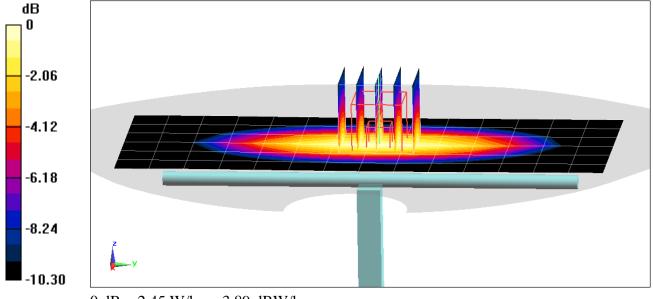
Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 2.78 W/kg

SAR(1 g) = 1.82 W/kg

Deviation(1 g) = 7.95%



0 dB = 2.45 W/kg = 3.89 dBW/kg

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d132

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium: 835 Body Medium parameters used: $f = 835 \text{ MHz}; \ \sigma = 0.961 \text{ S/m}; \ \epsilon_r = 54.142; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12/02/2020; Ambient Temp: 21.2°C; Tissue Temp: 19.2°C

Probe: EX3DV4 - SN7308; ConvF(9.92, 9.92, 9.92) @ 835 MHz; Calibrated: 7/31/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1450; Calibrated: 8/11/2020

Phantom: Twin-SAM V5.0; Type: QD 000 P40 CD; Serial: 1792

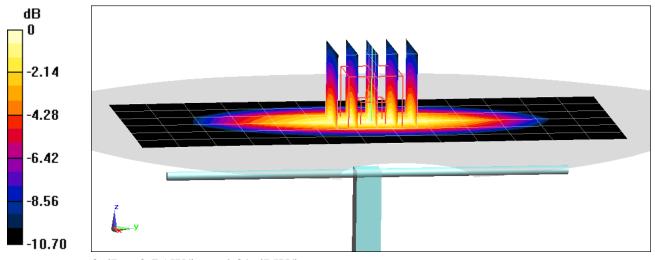
Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 3.19 W/kgSAR(1 g) = 2 W/kgDeviation(1 g) = 0.40%



0 dB = 2.75 W/kg = 4.39 dBW/kg

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d047

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium: 835 Body Medium parameters used: $f = 835 \text{ MHz}; \ \sigma = 0.96 \text{ S/m}; \ \epsilon_r = 53.803; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12/10/2020; Ambient Temp: 22.6°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN7488; ConvF(11.04, 11.04, 11.04) @ 835 MHz; Calibrated: 1/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1530; Calibrated: 1/13/2020

Phantom: Twin-SAM V4.0 Left 30; Type: QD 000 P40 CC; Serial: 1687 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

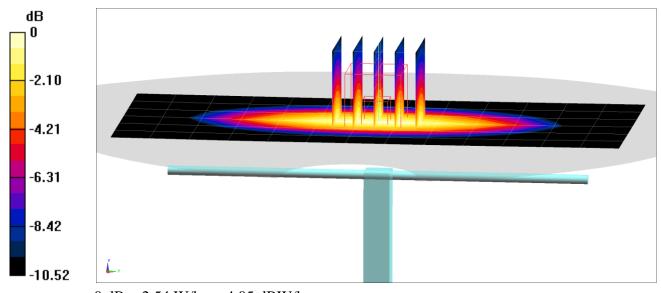
Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 2.90 W/kg

SAR(1 g) = 1.88 W/kg

Deviation(1 g) = -0.74%



0 dB = 2.54 W/kg = 4.05 dBW/kg

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d133

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium: 835 Body Medium parameters used: $f = 835 \text{ MHz}; \ \sigma = 0.967 \text{ S/m}; \ \epsilon_r = 55.324; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12/17/2020; Ambient Temp: 23.3°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN7539; ConvF(9.95, 9.95, 9.95) @ 835 MHz; Calibrated: 10/20/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn728; Calibrated: 5/20/2020

Phantom: Twin-SAM V8.0 (20); Type: QD 000 P41 Ax; Serial: 1966 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

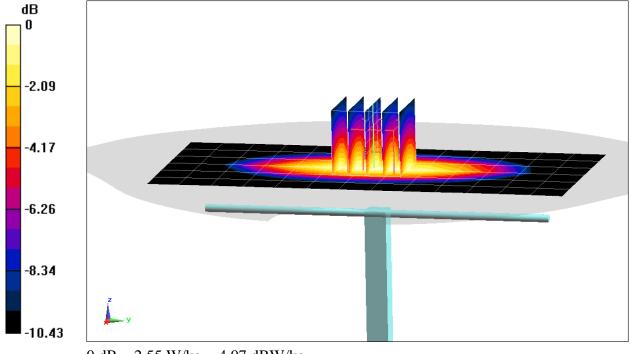
Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 2.90 W/kg

SAR(1 g) = 1.9 W/kg

Deviation(1 g) = -2.56%



0 dB = 2.55 W/kg = 4.07 dBW/kg

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1150

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium: 1750 Body Medium parameters used: $f = 1750 \text{ MHz}; \ \sigma = 1.508 \text{ S/m}; \ \epsilon_r = 50.869; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/02/2020; Ambient Temp: 24.2°C; Tissue Temp: 23.4°C

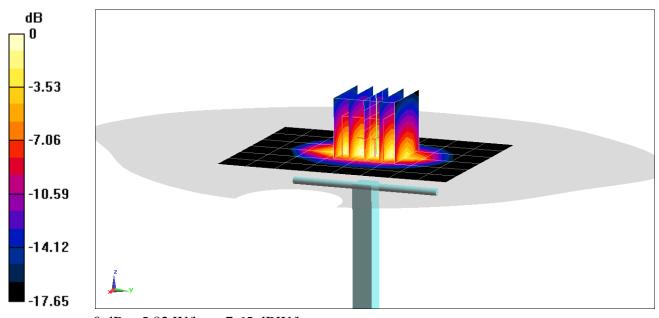
Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1750 MHz; Calibrated: 4/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1407; Calibrated: 4/15/2020

Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1750 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mmZoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mmPeak SAR (extrapolated) = 6.93 W/kg SAR(1 g) = 3.84 W/kg; SAR(10 g) = 2.03 W/kg Deviation(1 g) = 4.92%; Deviation(10 g) = 4.64%



0 dB = 5.82 W/kg = 7.65 dBW/kg

DUT: Dipole 1750 MHz; Type: D1765V2; Serial: 1008

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium: 1750 Body; Medium parameters used: $f = 1750 \text{ MHz}; \ \sigma = 1.519 \text{ S/m}; \ \epsilon_r = 51.092; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/14/2020; Ambient Temp: 25.0°C; Tissue Temp: 24.6°C

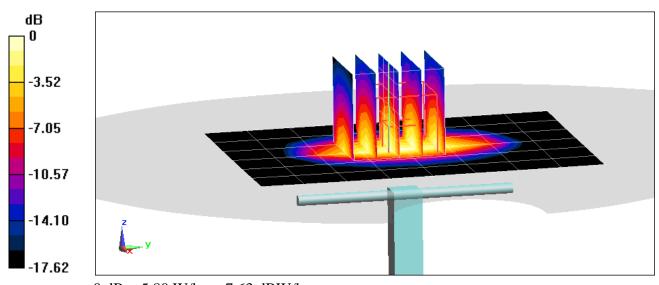
Probe: EX3DV4 - SN7357; ConvF(8.17, 8.17, 8.17) @ 1750 MHz; Calibrated: 4/21/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1407; Calibrated: 4/15/2020

Phantom: Twin-SAM V5.0 Right 30; Type: QD 000 P40 CD; Serial: 1759 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1750 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mmZoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mmPeak SAR (extrapolated) = 6.94 W/kg SAR(1 g) = 3.86 W/kg; SAR(10 g) = 2.05 W/kg Deviation(1 g) = 3.21%; Deviation(10 g) = 3.02%



0 dB = 5.80 W/kg = 7.63 dBW/kg

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d080

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: 1900 Body; Medium parameters used: $f = 1900 \text{ MHz}; \ \sigma = 1.584 \text{ S/m}; \ \epsilon_r = 52.078; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/13/2020; Ambient Temp: 24.9°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1900 MHz; Calibrated: 7/20/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1322; Calibrated: 7/15/2020

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

1900 MHz System Verification at 20.0 dBm (100 mW)

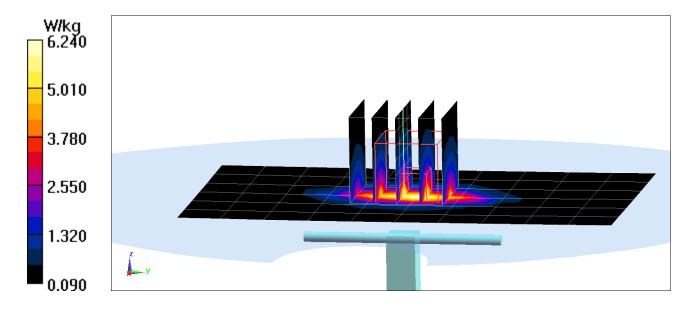
Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 7.53 W/kg

SAR(1 g) = 4.12 W/kg; SAR(10 g) = 2.13 W/kg

Deviation(1 g) = 5.10%; Deviation(10 g) = 3.40%



DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d080

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: 1900 Body Medium parameters used: $f = 1900 \text{ MHz}; \ \sigma = 1.497 \text{ S/m}; \ \epsilon_r = 51.901; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/20/2020; Ambient Temp: 20.3°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN7410; ConvF(7.76, 7.76, 7.76) @ 1900 MHz; Calibrated: 7/20/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1322; Calibrated: 7/15/2020

Phantom: SAM Left; Type: QD000P40CC; Serial: TP: 1375

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

1900 MHz System Verification at 20.0 dBm (100 mW)

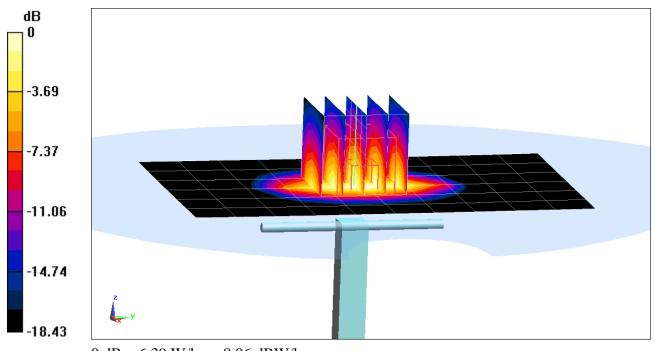
Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Peak SAR (extrapolated) = 7.60 W/kg

SAR(10 g) = 2.13 W/kg

Deviation(10 g) = 3.40%



0 dB = 6.39 W/kg = 8.06 dBW/kg

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 797

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium: 2450 Body Medium parameters used: $f = 2450 \text{ MHz}; \ \sigma = 2.042 \text{ S/m}; \ \epsilon_r = 52.036; \ \rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12/14/2020; Ambient Temp: 24.2°C; Tissue Temp: 23.5°C

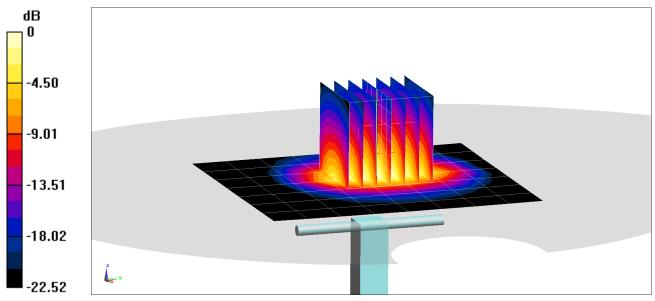
Probe: EX3DV4 - SN7409; ConvF(7.24, 7.24, 7.24) @ 2450 MHz; Calibrated: 6/23/2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1334; Calibrated: 6/18/2020

Phantom: LeftTwin-SAM V5.0; Type: QD 000 P40 CD; Serial: TP1375 Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mmZoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mmPeak SAR (extrapolated) = 10.7 W/kg SAR(1 g) = 5.1 W/kg Deviation(1 g) = 3.24%



0 dB = 8.61 W/kg = 9.35 dBW/kg

APPENDIX C: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

- The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity ε can be calculated from the below equation (Pournaropoulos

$$Y = \frac{j2\omega\varepsilon_{r}\varepsilon_{0}}{\left[\ln(b/a)\right]^{2}} \int_{a}^{b} \int_{a}^{b} \int_{0}^{\pi} \cos\phi' \frac{\exp\left[-j\omega r(\mu_{0}\varepsilon_{r}'\varepsilon_{0})^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $\dot{J} = \sqrt{-1}$.

3 Composition / Information on ingredients

Description: Aqueous solution with surfactants and inhibitors

Declarable, or hazardous components:

CAS: 107-21-1	Ethanediol	>1.0-4.9%
EINECS: 203-473-3	STOT RE 2, H373;	
Reg.nr.: 01-2119456816-28-0000	Acute Tox. 4, H302	
CAS: 68608-26-4	Sodium petroleum sulfonate	< 2.9%
EINECS: 271-781-5	Eye Irrit. 2, H319	
Reg.nr.: 01-2119527859-22-0000		
CAS: 107-41-5	Hexylene Glycol / 2-Methyl-pentane-2,4-diol	< 2.9%
EINECS: 203-489-0	Skin Irrit. 2, H315; Eye Irrit. 2, H319	
Reg.nr.: 01-2119539582-35-0000		
CAS: 68920-66-1	Alkoxylated alcohol, > C ₁₆	< 2.0%
NLP: 500-236-9	Aquatic Chronic 2, H411;	
Reg.nr.: 01-2119489407-26-0000	Skin Irrit. 2, H315; Eye Irrit. 2, H319	
Additional information:	-	-

Additional information:

For the wording of the listed risk phrases refer to section 16.

Not mentioned CAS-, EINECS- or registration numbers are to be regarded as Proprietary/Confidential The specific chemical identity and/or exact percentage concentration of proprietary components is withheld as a trade secret.

Figure C-1

Note: Liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

FCC ID: ZNFK200AM	PCTEST* Proud to be part of @ element	REPORT LG	Approved by: Quality Manager
Test Dates:	DUT Type:		APPENDIX C:
12/02/20 - 12/20/20	Portable Handset		Page 1 of 3

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s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 44 245 9700, Fax +41 44 245 9779 info@speag.com, http://www.speag.com

Measurement Certificate / Material Test

Item Name	Body Tissue Simulating Liquid (MBBL600-6000V6)	
Product No.	SL AAM U16 BC (Batch: 200803-1)	
Manufacturar	SPEAG	

Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

Target Parameters

Target parameters as defined in the KDB 865664 compliance standard.

Test Condition

Ambient Condition 22°C; 30% humidity TSL Temperature 22°C

Test Date 6-Aug-20 Operator

Additional Information
TSL Density TSL Heat-capacity

	Measu	ired	1	Targe	t	Diff.to Tare	net [%]	15.0	_						
[MHz]	e'	е"	sigma	- 0	sigma	Δ-eps	∆-sigma	10.0	1227					99.7	
600	56.3	26.8	0.89	56.1	0.95	0.3	-6.3	%							
750	55.8	22.6	0.94	55.5	0.96	0.5	-2.1	3							
800	55.7	21.6	0.96	55.3	0.97	0.7	-1.0	₹ 0.0		MES.	32	Mail Co		-	
825	55.7	21.1	0.97	55.2	0.98	8.0	-1.0		100						
835	55.7	20.9	0.98	55.1	0.99	1.0	-0.5	a -10.0	19.0		dust to	11010		a (1)	
850	55.6	20.7	0.98	55.2	0.99	0.8	-1.0	-15.0	-00	4500	0500	0500	4500		0
900	55.5	19.9	1.00	55.0	1.05	0.9	-4.8		500	1500	Freque	ncy MHz	4500	550	U
1400	54.7	15.9	1.24	54.1	1.28	1.1	-3.1	15.0	_						
1450	54.6	15.8	1.27	54.0	1.30	1.1	-2.3	10.0	7		2010	100 Per 1	100	1916	
1600	54.4	15.3	1.36	53.8	1.39	1.1	-2.2	%	1724		-				
1625	54.4	15.3	1.38	53.8	1.41	1.2	-2.1	3	1	1	1			/	
1640	54.4	15.2	1.39	53.7	1.42	1.3	-2.1	0.0	Λ	1	1		/		
1650	54.3	15.2	1.39	53.7	1.43	1.1	-2.8		10			_			
1700	54.2	15.1	1.43	53.6	1.46	1.2	-2.1	à-10.0				Mary Long		11-61	
1750	54.2	15.0	1.46	53.4	1.49	1.4	-2.0	-15.0	500	1500	2500	2500	4500	550	
1800	54.1	14.9	1.50	53.3	1.52	1.5	-1.3		500	1500	Freque	3500 ncy MHz	4500	550	
1810	54.1	14.9	1.51	53.3	1.52	1.5	-0.7	3500	51.4	16.0	3.11	51.3	3.31	0.2	-6
825	54.1	14.9	1.52	53.3	1.52	1.5	0.0	3700	51.1	16.2	3.34	51.1	3.55	0.1	-5
1850	54.0	14.9	1.53	53.3	1.52	1.3	0.7	5200	48.3	18.7	5.42	49.0	5.30	-1.5	2
	54.0	14.8	1.57	53.3	1.52	1.3	3.3	5250	48.2	18.8	5.50	49.0	5.36	-1.6	2
1900					4.50						1959 15-16				
1900 1950	53.9	14.8	1.60	53.3	1.52	1.1	5.3	5300	48.1	18.9	5.57	48.9	5.42	-1.7	2
		14.8 14.8	1.60	53.3 53.3	1.52	0.9	5.3 7.9	5300 5500	48.1	18.9 19.2	5.57 5.86	48.9 48.6	5.42 5.65	-1.7	
1950	53.9	1000	10 16 15 10	100000	37.55			200000	NO.		30.57				3
1950 2000	53.9 53.8	14.8	1.64	53.3	1.52	0.9	7.9	5500	47.7	19.2	5.86	48.6	5.65	-2.0	3
1950 2000 2050	53.9 53.8 53.8	14.8 14.7	1.64 1.68	53.3 53.2	1.52 1.57	0.9	7.9 7.0	5500 5600	47.7 47.5	19.2 19.3	5.86 6.01	48.6 48.5	5.65 5.77	-2.0 -2.1	3 4 4
1950 2000 2050 2100	53.9 53.8 53.8 53.7	14.8 14.7 14.7	1.64 1.68 1.72	53.3 53.2 53.2	1.52 1.57 1.62	0.9 1.1 1.0	7.9 7.0 6.2	5500 5600 5700	47.7 47.5 47.3	19.2 19.3 19.4	5.86 6.01 6.16	48.6 48.5 48.3	5.65 5.77 5.88	-2.0 -2.1 -2.3	3 4 4 5
1950 2000 2050 2100 2150	53.9 53.8 53.8 53.7 53.7	14.8 14.7 14.7 14.7	1.64 1.68 1.72 1.76	53.3 53.2 53.2 53.1	1.52 1.57 1.62 1.66	0.9 1.1 1.0 1.1	7.9 7.0 6.2 6.0	5500 5600 5700 5800	47.7 47.5 47.3 47.0	19.2 19.3 19.4 19.6	5.86 6.01 6.16 6.32	48.6 48.5 48.3 48.2	5.65 5.77 5.88 6.00	-2.0 -2.1 -2.3 -2.4	3 4 4 5
1950 2000 2050 2100 2150 2200	53.9 53.8 53.8 53.7 53.7 53.6	14.8 14.7 14.7 14.7 14.7	1.64 1.68 1.72 1.76 1.80	53.3 53.2 53.2 53.1 53.0	1.52 1.57 1.62 1.66 1.71	0.9 1.1 1.0 1.1 1.1	7.9 7.0 6.2 6.0 5.3	5500 5600 5700 5800 6000	47.7 47.5 47.3 47.0	19.2 19.3 19.4 19.6	5.86 6.01 6.16 6.32	48.6 48.5 48.3 48.2	5.65 5.77 5.88 6.00	-2.0 -2.1 -2.3 -2.4	3 4 4 5
1950 2000 2050 2100 2150 2200 2250	53.9 53.8 53.8 53.7 53.7 53.6 53.5	14.8 14.7 14.7 14.7 14.7 14.8	1.64 1.68 1.72 1.76 1.80 1.85	53.3 53.2 53.2 53.1 53.0 53.0	1.52 1.57 1.62 1.66 1.71 1.76	0.9 1.1 1.0 1.1 1.1	7.9 7.0 6.2 6.0 5.3 5.1	5500 5600 5700 5800 6000 6500	47.7 47.5 47.3 47.0	19.2 19.3 19.4 19.6	5.86 6.01 6.16 6.32	48.6 48.5 48.3 48.2	5.65 5.77 5.88 6.00	-2.0 -2.1 -2.3 -2.4	3
1950 2000 2050 2100 2150 2200 2250 2300	53.9 53.8 53.7 53.7 53.6 53.5	14.8 14.7 14.7 14.7 14.7 14.8 14.8	1.64 1.68 1.72 1.76 1.80 1.85 1.89	53.3 53.2 53.2 53.1 53.0 53.0 52.9	1.52 1.57 1.62 1.66 1.71 1.76 1.81	0.9 1.1 1.0 1.1 1.1 1.0 1.1	7.9 7.0 6.2 6.0 5.3 5.1 4.4	5500 5600 5700 5800 6000 6500 7000	47.7 47.5 47.3 47.0	19.2 19.3 19.4 19.6	5.86 6.01 6.16 6.32	48.6 48.5 48.3 48.2	5.65 5.77 5.88 6.00	-2.0 -2.1 -2.3 -2.4	3 4 4 5
1950 2000 2050 2100 2150 2200 2250 2300 2350	53.9 53.8 53.7 53.7 53.6 53.5 53.5	14.8 14.7 14.7 14.7 14.7 14.8 14.8	1.64 1.68 1.72 1.76 1.80 1.85 1.89	53.3 53.2 53.2 53.1 53.0 53.0 52.9 52.8	1.52 1.57 1.62 1.66 1.71 1.76 1.81 1.85	0.9 1.1 1.0 1.1 1.1 1.0 1.1	7.9 7.0 6.2 6.0 5.3 5.1 4.4	5500 5600 5700 5800 6000 6500 7000 7500	47.7 47.5 47.3 47.0	19.2 19.3 19.4 19.6	5.86 6.01 6.16 6.32	48.6 48.5 48.3 48.2	5.65 5.77 5.88 6.00	-2.0 -2.1 -2.3 -2.4	3 4 4 5
1950 2000 2050 2100 2150 2200 2250 2300 2350 2400	53.9 53.8 53.7 53.7 53.6 53.5 53.5 53.4 53.3	14.8 14.7 14.7 14.7 14.7 14.8 14.8 14.8	1.64 1.68 1.72 1.76 1.80 1.85 1.89 1.94	53.3 53.2 53.2 53.1 53.0 53.0 52.9 52.8	1.52 1.57 1.62 1.66 1.71 1.76 1.81 1.85	0.9 1.1 1.0 1.1 1.1 1.0 1.1 1.1	7.9 7.0 6.2 6.0 5.3 5.1 4.4 4.9	5500 5600 5700 5800 6000 6500 7000 7500 8000	47.7 47.5 47.3 47.0	19.2 19.3 19.4 19.6	5.86 6.01 6.16 6.32	48.6 48.5 48.3 48.2	5.65 5.77 5.88 6.00	-2.0 -2.1 -2.3 -2.4	3 4 4 5
1950 2000 2050 2100 2150 2200 2250 2300 2350 2400 2450	53.9 53.8 53.8 53.7 53.7 53.6 53.5 53.5 53.4 53.3	14.8 14.7 14.7 14.7 14.7 14.8 14.8 14.8 14.8	1.64 1.68 1.72 1.76 1.80 1.85 1.89 1.94 1.98 2.03	53.3 53.2 53.2 53.1 53.0 53.0 52.9 52.8 52.8 52.7	1.52 1.57 1.62 1.66 1.71 1.76 1.81 1.85 1.90	0.9 1.1 1.0 1.1 1.1 1.0 1.1 1.1 1.0	7.9 7.0 6.2 6.0 5.3 5.1 4.4 4.9 4.2	5500 5600 5700 5800 6000 6500 7000 7500 8000 8500	47.7 47.5 47.3 47.0	19.2 19.3 19.4 19.6	5.86 6.01 6.16 6.32	48.6 48.5 48.3 48.2	5.65 5.77 5.88 6.00	-2.0 -2.1 -2.3 -2.4	3 4 4 5

Figure C-2 600 – 5800 MHz Body Tissue Equivalent Matter

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Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 44 245 9700, Fax +41 44 245 9779 info@speag.com, http://www.speag.com

Measurement Certificate / Material Test

Head Tissue Simulating Liquid (HBBL600-10000V6) SL AAH U16 BC (Batch: 200805-4) Item Name

Product No.

Manufacturer SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

Test Condition

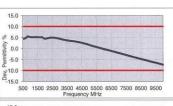
Ambient Condition 22°C; 30% humidity

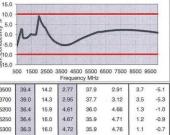
TSL Temperature 22°C 6-Aug-20 Test Date

Operator CL
Additional Information
TSL Density

TSL Heat-capacity

	Measu	ired		Targe	t	Diff.to Targ	get [%]	15.0	-
[MHz]	e'	e"	sigma	eps	sigma	Δ-eps	∆-sigma	10.0	
600	44.7	25.7	0.86	42.7	0.88	4.6	-2.5	₩ 5.0	
750	44.1	21.7	0.90	41.9	0.89	5.1	0.7		Ī
800	44.0	20.7	0.92	41.7	0.90	5.6	2.5	=	1
825	43.9	20.3	0.93	41.6	0.91	5.6	2.6	E -5.0	1
835	43.9	20.1	0.94	41.5	0.91	5.7	3.1	3 10.0 -15.0	1
850	43.8	19.9	0.94	41.5	0.92	5.5	2.6		50
900	43.7	19.1	0.96	41.5	0.97	5.3	-1.0		×
1400	42.7	15.1	1.18	40.6	1.18	5.2	0.0	15.0	
1450	42.6	14.9	1.20	40.5	1.20	5.2	0.0	10.0	l
1600	42.4	14.4	1.28	40.3	1.28	5.2	-0.3	% 5.0	J
1625	42.4	14.4	1.30	40.3	1.30	5.3	0.1	≨ 0.0	l
1640	42.4	14.3	1.31	40.3	1.31	5.3	0.3	p-5.0	1
1650	42.3	14.3	1.31	40.2	1.31	5.1	-0.2	Q _{10.0}	1
1700	42.2	14.2	1.34	40.2	1.34	5.1	-0.2	@15.0	I
1750	42.2	14.1	1.37	40.1	1.37	5.3	-0.1		0
1800	42.1	14.0	1.40	40.0	1.40	5.3	0.0		
1810	42.1	14.0	1.41	40.0	1.40	5.3	0.7	3500	
1825	42.1	13.9	1.42	40.0	1.40	5.3	1.4	3700	ı
1850	42.0	13.9	1.43	40.0	1.40	5.0	2.1	5200	ı
1900	41.9	13.8	1.46	40.0	1.40	4.7	4.3	5250	ı
1950	41.9	13.8	1.49	40.0	1.40	4.7	6.4	5300	ı
2000	41.8	13.7	1.53	40.0	1.40	4.5	9.3	5500	ı
2050	41.7	13.7	1.56	39.9	1.44	4.5	8.0	5600	ı
2100	41.7	13.7	1.60	39.8	1.49	4.7	7.5	5700	ı
2150	41.6	13.6	1.63	39.7	1.53	4.7	6.3	5800	I
2200	41.5	13.6	1.67	39.6	1.58	4.7	5.8	6000	ı
2250	41.5	13.6	1.70	39.6	1.62	4.9	4.8	6500	I
2300	41.4	13.6	1.74	39.5	1.67	4.9	4.4	7000	ı
2350	41.3	13.6	1.78	39.4	1.71	4.9	4.0	7500	١
2400	41.2	13.6	1.82	39.3	1.76	4.9	3.7	8000	١
2450	41.2	13.6	1.85	39.2	1.80	5.1	2.8	8500	
2500	41.1	13.6	1.89	39.1	1.85	5.0	1.9	9000	
2550	41.0	13.7	1.94	39.1	1.91	4.9	1.6	9500	
2600	40.9	13.7	1.98	39.0	1.96	4.8	0.8	10000	ı





5200	36.4	15.9	4.61	36.0	4.66	1.3	-1.0
5250	36.4	16.0	4.67	35.9	4.71	1.2	-0.9
5300	36.3	16.0	4.72	35.9	4.76	1.1	-0.7
5500	35.9	16.2	4.96	35.6	4.96	0.7	-0.1
5600	35.7	16.3	5.07	35.5	5.07	0.5	0.2
5700	35.5	16.4	5.19	35.4	5.17	0.3	0.4
5800	35.4	16.5	5.31	35.3	5.27	0.1	0.7
6000	35.0	16.6	5.54	35.1	5.48	-0.2	1.2
6500	34.1	17.1	6.17	34.5	6.07	-1.1	1.6
7000	33.2	17.4	6.78	33.9	6.65	-2.0	2.0
7500	32.3	17.7	7.40	33.3	7.24	-2.9	2.2
8000	31.5	18.0	8.01	32.7	7.84	-3.8	2.2
8500	30.6	18.2	8.63	32.1	8.45	-4.7	2.1
9000	29.8	18.4	9.24	31.5	9.08	-5.6	1.8
9500	29.0	18.6	9.84	31.0	9.71	-6.5	1.3
10000	28.1	18.8	10.44	30.4	10.36	-7.4	0.8

Figure C-3 600 - 5800 MHz Head Tissue Equivalent Matter

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APPENDIX D: SAR SYSTEM VALIDATION

Per FCC KDB Publication 865664 D02v01r02, 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 Publication 865664 D01v01r04 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 D-1
SAR System Validation Summary – 1g

SAR	Freg.		Probe			Cond.	Perm.	CW	VALIDATION	1	MOD.	VALIDATI	ON
System	(MHz)	Date	SN	Probe C	al Point	(σ)	(εr)	SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
D	750	3/17/2020	7488	750	Head	0.875	42.352	PASS	PASS	PASS	N/A	N/A	N/A
Р	835	9/10/2020	7308	835	Head	0.936	42.187	PASS	PASS	PASS	GMSK	PASS	N/A
Р	1750	9/9/2020	7308	1750	Head	1.384	41.983	PASS	PASS	PASS	N/A	N/A	N/A
Р	1900	9/10/2020	7308	1900	Head	1.442	40.894	PASS	PASS	PASS	GMSK	PASS	N/A
Е	2450	2/5/2020	3589	2450	Head	1.823	38.835	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
0	750	9/9/2020	7547	750	Body	0.948	54.673	PASS	PASS	PASS	N/A	N/A	N/A
Р	835	9/8/2020	7308	835	Body	0.977	54.534	PASS	PASS	PASS	GMSK	PASS	N/A
D	835	2/20/2020	7488	835	Body	1.001	53.447	PASS	PASS	PASS	GMSK	PASS	N/A
L	835	12/15/2020	7539	835	Body	0.955	55.088	PASS	PASS	PASS	GMSK	PASS	N/A
Н	1750	5/14/2020	7357	1750	Body	1.531	51.701	PASS	PASS	PASS	N/A	N/A	N/A
J	1900	12/3/2020	7410	1900	Body	1.561	52.634	PASS	PASS	PASS	GMSK	PASS	N/A
K	2450	7/7/2020	7409	2450	Body	2.018	51.176	PASS	PASS	PASS	OFDM/TDD	PASS	PASS

Table D-2 SAR System Validation Summary – 10g

OAN System validation Summary - rog													
				CW			VALIDATIO	N	MOE	D. VALIDAT	TON		
SAR System	Freq. (MHz)	Date	Probe SN	Probe C	Cal Point	Cond. (σ)	Perm. (εr)	SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
I	1750	5/14/2020	7357	1750	Body	1.531	51.701	PASS	PASS	PASS	N/A	N/A	N/A
J	1900	12/3/2020	7410	1900	Body	1.561	52.634	PASS	PASS	PASS	GMSK	PASS	N/A

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r04 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to FCC KDB Publication 865664 D01v01r04.

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POWER REDUCTION VERIFICATION **APPENDIX F**

Per the May 2017 TCBC Workshop Notes, demonstration of proper functioning of the power reduction mechanisms is required to support the corresponding SAR configurations. The verification process was divided into two parts: (1) evaluation of output power levels for individual or multiple triggering mechanisms and (2) evaluation of the triggering distances for proximity-based sensors.

Power Verification Procedure F.1

The power verification was performed according to the following procedure:

- 1. A base station simulator was used to establish a conducted RF connection and the output power was monitored. The power measurements were confirmed to be within expected tolerances for all states before and after a power reduction mechanism was triggered.
- 2. Step 1 was repeated for all relevant modes and frequency bands for the mechanism being investigated.
- 3. Steps 1 and 2 were repeated for all individual power reduction mechanisms and combinations thereof. For the combination cases, one mechanism was switched to a 'triggered' state at a time; powers were confirmed to be within tolerances after each additional mechanism was activated.

F.2 **Distance Verification Procedure**

The distance verification procedure was performed according to the following procedure:

- 1. A base station simulator was used to establish an RF connection and to monitor the power levels. The device being tested was placed below the relevant section of the phantom with the relevant side or edge of the device facing toward the phantom.
- 2. The device was moved toward and away from the phantom to determine the distance at which the mechanism triggers and the output power is reduced, per KDB Publication 616217 D04v01r02 and FCC Guidance. Each applicable test position was evaluated. The distances were confirmed to be the same or larger (more conservative) than the minimum distances provided by the manufacturer.
- 3. Steps 1 and 2 were repeated for low, mid, and high bands, as appropriate (see note below Table F-2 for more details).
- Steps 1 through 3 were repeated for all distance-based power reduction mechanisms.

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F.3 Main Antenna Verification Summary

Table F-1
Power Measurement Verification for Main Antenna

I Owel Measurement Vermoation for Main Antenna					
Mecha	Mechanism(s)		Conducted Power (dBm)		
1st	2nd	Mode/Band	Un-triggered (Max)	Mechanism #1 (Reduced)	Mechanism #2 (Reduced)
Hotspot On		LTE FDD Band 4	23.01	21.93	
Grip		LTE FDD Band 4	23.20	21.88	
Hotspot On	Grip	LTE FDD Band 4	23.02	21.85	21.84
Grip	Hotspot On	LTE FDD Band 4	23.12	21.94	21.95
Hotspot On		LTE FDD Band 2	23.48	22.96	
Grip		LTE FDD Band 2	23.52	22.99	
Hotspot On	Grip	LTE FDD Band 2	23.48	23.05	23.03
Grip	Hotspot On	LTE FDD Band 2	23.48	22.90	22.88
Hotspot On		UMTS 1750	24.20	22.19	
Grip		UMTS 1750	24.19	22.20	
Hotspot On	Grip	UMTS 1750	24.16	22.18	22.20
Grip	Hotspot On	UMTS 1750	24.20	22.17	22.19
Hotspot On		UMTS 1900	24.49	23.14	
Grip		UMTS 1900	24.55	23.09	
Hotspot On	Grip	UMTS 1900	24.47	23.13	23.12
Grip	Hotspot On	UMTS 1900	24.59	23.12	23.13

Table F-2
Distance Measurement Verification for Main Antenna

Machaniam(s)	Test Condition	Band	Distance Measurements (mm)		Minimum Distance per
Mechanism(s)	rest Condition	Вапи	Moving Toward	Moving Away	Manufacturer (mm)
Grip	Phablet - Back Side	Mid	5	7	3
Grip	Phablet - Bottom Edge	Mid	4	6	3

^{*}Note: Mid band refers to: UMTS B2/4, LTE B2/4.

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APPENDIX G: PROBE AND DIPOLE CALIBRATION CERTIFICATES

Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
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

Client

PC Test

Accreditation No.: SCS 0108

Certificate No: D750V3-1054_Mar20

CALIBRATION CERTIFICATE

Object

D750V3 - SN:1054

Calibration procedure(s)

QA CAL-05.v11

Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date:

March 11, 2020

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). V 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	31-Dec-19 (No. EX3-7349_Dec19)	Dec-20
DAE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-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-19)	In house check: Oct-20
	Name	Function	\$ignature
Calibrated by:	Claudio Leubler	Laboratory Technician	
			A CA MANAGEMENT
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 19, 2020

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

Certificate No: D750V3-1054_Mar20

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Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





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

Accreditation No.: SCS 0108

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

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%.

Certificate No: D750V3-1054 Mar20

Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.5 ± 6 %	0.88 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	Table 1
SAR measured	250 mW input power	2.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.63 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.69 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.7 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		# 43 -4

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.53 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.63 W/kg ± 16.5 % (k=2)

Certificate No: D750V3-1054_Mar20

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.6 Ω - 1.9 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.8 Ω - 4.7 ϳΩ
Return Loss	- 26.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	
Licentical Delay (one direction)	1.035 ns
	1.000 113

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
	GFEAG

DASY5 Validation Report for Head TSL

Date: 11.03.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1054

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: f = 750 MHz; $\sigma = 0.88$ S/m; $\epsilon_r = 42.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 31.12.2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 27.12.2019

Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.98 V/m; Power Drift = -0.01 dB

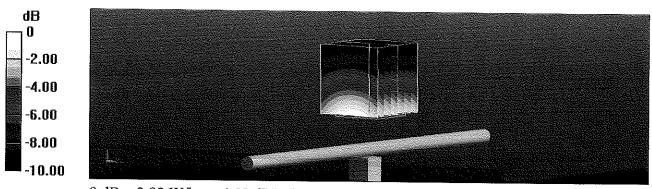
Peak SAR (extrapolated) = 3.19 W/kg

SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.41 W/kg

Smallest distance from peaks to all points 3 dB below = 17.1 mm

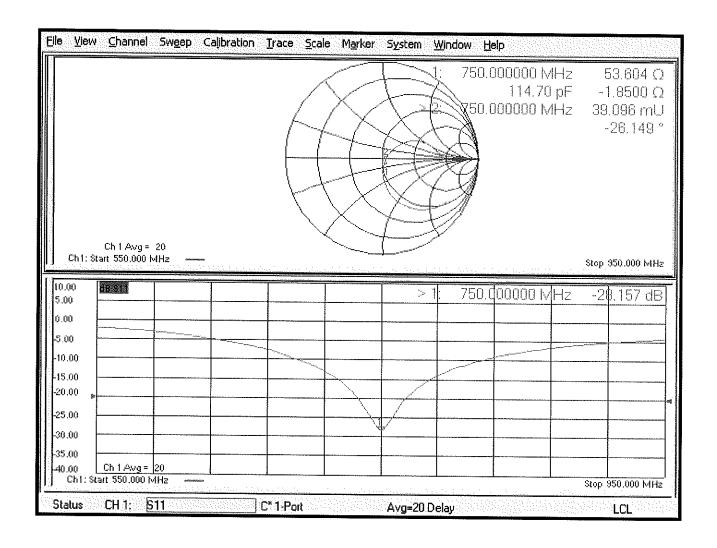
Ratio of SAR at M2 to SAR at M1 = 66.8%

Maximum value of SAR (measured) = 2.82 W/kg



0 dB = 2.82 W/kg = 4.50 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.03.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1054

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: f = 750 MHz; $\sigma = 0.96 \text{ S/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(10.61, 10.61, 10.61) @ 750 MHz; Calibrated: 31.12.2019

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 27.12.2019

Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.15 V/m; Power Drift = -0.02 dB

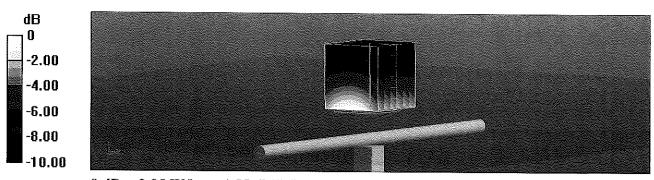
Peak SAR (extrapolated) = 3.22 W/kg

SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.41 W/kg

Smallest distance from peaks to all points 3 dB below = 16.1 mm

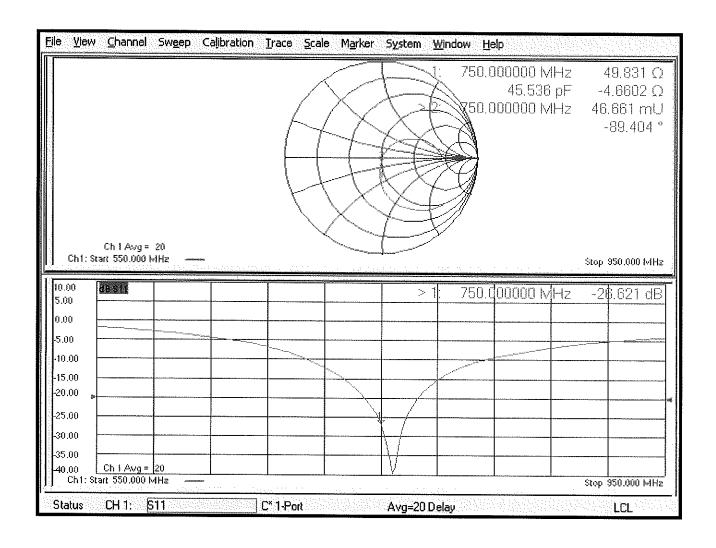
Ratio of SAR at M2 to SAR at M1 = 66.7%

Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 4.55 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix: Transfer Calibration at Four Validation Locations on SAM Head¹

Evaluation Condition

Phantom	SAM Head Phantom	For usage with cSAR3D V2 -R/L

SAR result with SAM Head (Top \cong C0)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	1000	
SAR for nominal Head TSL parameters	normalized to 1W	7.66 W/kg ± 17.5 % (k=2)	
SAR averaged over 10 cm³ (10 g) of Head TSL	condition		

SAR result with SAM Head (Mouth ≅ F90)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	8.42 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Neck \cong H0)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	7.89 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Ear ≅ D90)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	6.82 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

4.63 W/kg ± 16.9 % (k=2)

Certificate No: D750V3-1054_Mar20

 $^{^{\}mathrm{1}}$ Additional assessments outside the current scope of SCS 0108

Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst
Service sulsse d'étalonnage
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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

PC Test

Certificate No: D750V3-1161_Oct18

	D750V3 - SN:116		
alibration procedure(s)			
	QA CAL-05.v10		
	Calibration proce	dure for dipole validation kits abo	ve 700 MHz
Calibration date:	October 19, 2018	}	its of measurements (SI). BNV d are part of the certificate. 10-20-20
			10-30
		onal standards, which realize the physical un	its of measurements (SI). BNV 10-2
ne measurements and the uncert	ainties with confidence p	robability are given on the following pages an	d are part of the certificate. 10-2-
All calibrations have been conducte	ed in the closed laborator	ry facility: environment temperature (22 ± 3)°0	C and humidity < 70%. BN 10-23-20
Calibration Equipment used (M&TE	aritical for calibration		
valionation Equipment used (wat t	. Chacarior Canoradony		
Primary Standards	ID#	Cai Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Гуре-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
		04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
	SN: 601	, - ,	
DAE4	SN: 601	Check Date (in house)	Scheduled Check
DAE4 Secondary Standards			
DAE4 Secondary Standards Power meter EPM-442A	ID#	Check Date (in house)	Scheduled Check
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	ID# SN: GB37480704	Check Date (in house) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	ID # SN: GB37480704 SN: US37292783	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ID # SN: GB37480704 SN: US37292783 SN: MY41092317	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Manu Seitz	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function Laboratory Technician	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19

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

Certificate No: D750V3-1161_Oct18

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Calibration Laboratory of

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C

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

Accreditation No.: SCS 0108

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

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%.

Certificate No: D750V3-1161_Oct18 Page 2 of 8

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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	Marie Al Ma	w

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.03 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.26 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity 0.96 mho/m		
Nominal Body TSL parameters	22.0 °C	55.5			
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ± 6 %	0.96 mho/m ± 6 %		
Body TSL temperature change during test	< 0.5 °C	***			

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.43 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.55 W/kg ± 16.5 % (k=2)

Certificate No: D750V3-1161_Oct18 Page 3 of 8

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.6 Ω - 1.9 jΩ
Return Loss	- 25.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.6 Ω - 4.2 jΩ
Return Loss	- 27.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.032 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 19, 2015

Certificate No: D750V3-1161_Oct18 Page 4 of 8

DASY5 Validation Report for Head TSL

Date: 19.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: f = 750 MHz; $\sigma = 0.89 \text{ S/m}$; $\varepsilon_r = 40.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(10.22, 10.22, 10.22) @ 750 MHz; Calibrated: 30.12.2017

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 04.10.2018

• Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

• DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

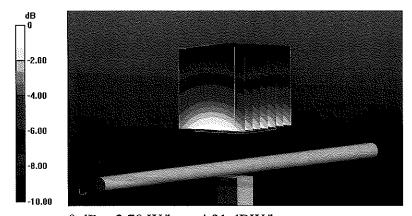
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.51 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.04 W/kg

SAR(1 g) = 2.02 W/kg; SAR(10 g) = 1.32 W/kg

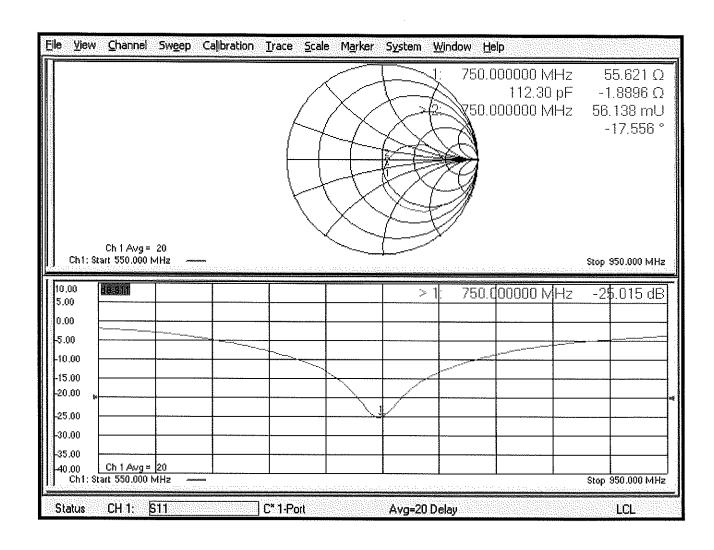
Maximum value of SAR (measured) = 2.70 W/kg



0 dB = 2.70 W/kg = 4.31 dBW/kg

Certificate No: D750V3-1161_Oct18

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: f = 750 MHz; $\sigma = 0.96 \text{ S/m}$; $\varepsilon_r = 55.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(10.19, 10.19, 10.19) @ 750 MHz; Calibrated: 30.12.2017

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 04.10.2018

• Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

• DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

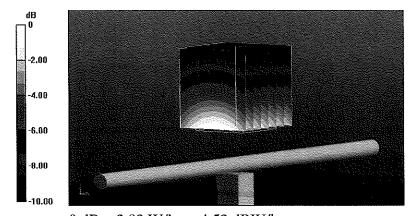
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.57 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.18 W/kg

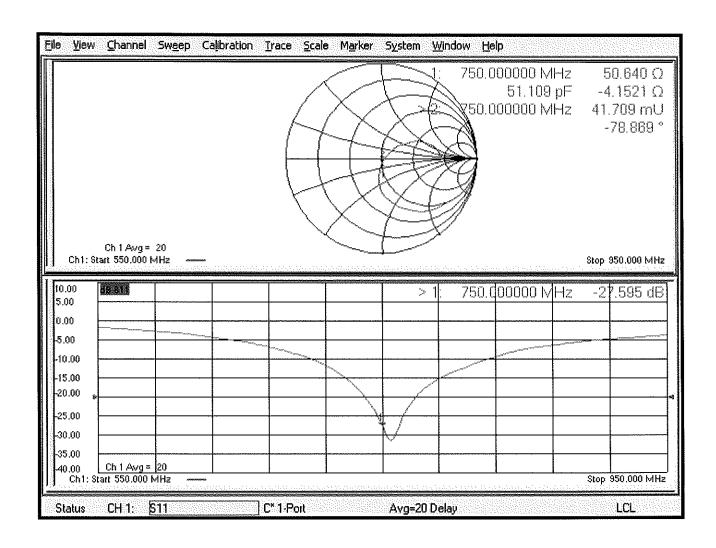
SAR(1 g) = 2.11 W/kg; SAR(10 g) = 1.39 W/kg

Maximum value of SAR (measured) = 2.83 W/kg



0 dB = 2.83 W/kg = 4.52 dBW/kg

Impedance Measurement Plot for Body TSL



PCTEST ENGINEERING LABORATORY, INC.



7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654 http://www.pctest.com



Certification of Calibration

Object D750V3 – SN:1161

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: October 18, 2019

Description: SAR Validation Dipole at 750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/13/2019	Annual	8/13/2020	1041
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	11/20/2018	Annual	11/20/2019	1039008
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	4/24/2019	Annual	4/24/2020	7357
SPEAG	EX3DV4	SAR Probe	7/16/2019	Annual	7/16/2020	7410
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/18/2019	Annual	4/18/2020	1407

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path.

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Team Lead Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	20K

Object:	Date Issued:	Page 1 of 4
D750V3 - SN:1161	10/18/2019	Page 1 of 4

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

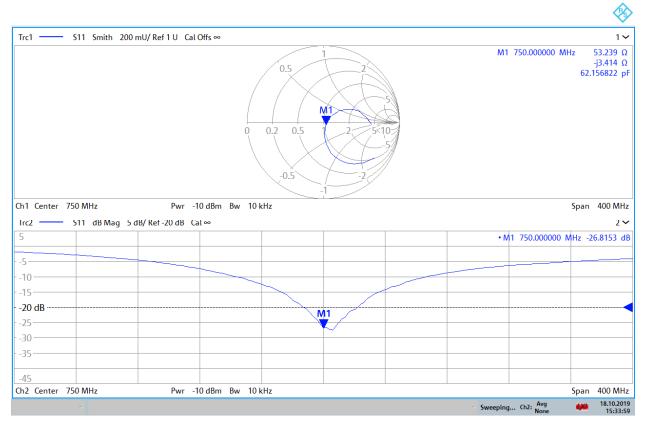
- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	(96)		(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
10/19/2018	10/18/2019	1.032	1.61	1.64	2.12%	1.05	1.08	2.66%	55.6	53.2	2.4	-1.9	-3.4	1.5	-25	-26.8	-7.30%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	(96)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	(10a) W//ka @	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
10/19/2018	10/18/2019	1.032	1.69	1.76	4.39%	1.11	1.17	5.41%	50.6	50	0.6	-4.2	-4	0.2	-27.6	-28.1	-1.60%	PASS

Object:	Date Issued:	Page 2 of 4
D750V3 - SN:1161	10/18/2019	Page 2 01 4

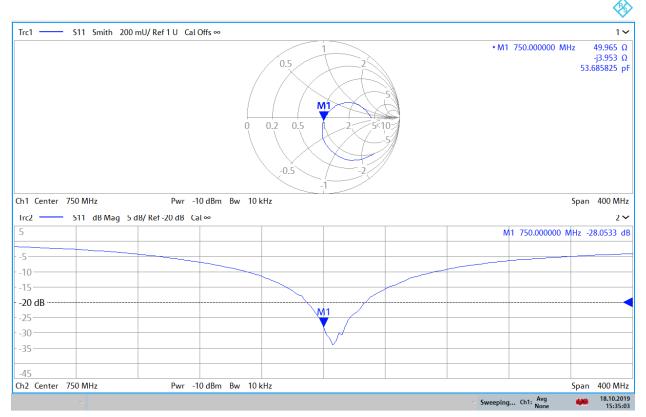
Impedance & Return-Loss Measurement Plot for Head TSL



15:34:00 18.10.2019

Object:	Date Issued:	Page 3 of 4
D750V3 - SN:1161	10/18/2019	Page 3 of 4

Impedance & Return-Loss Measurement Plot for Body TSL



15:35:04 18.10.2019

Object:	Date Issued:	Page 4 of 4
D750V3 - SN:1161	10/18/2019	Page 4 of 4

PCTEST



7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654 http://www.pctest.com



Certification of Calibration

Object D750V2 – SN: 1161

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 10/18/2020

Description: SAR Validation Dipole at 750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766816
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Agilent	85033E	3.5mm Standard Calibration Kit	6/6/2020	Annual	6/6/2021	MY53402352
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	9/29/2020	Annual	9/29/2021	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2020	Annual	5/12/2021	1070
Anritsu	MA2411B	Pulse Power Sensor	8/12/2020	Annual	8/12/2021	1207364
Anritsu	MA2411B	Pulse Power Sensor	9/22/2020	Annual	9/22/2021	1315051
Anritsu	ML2495A	Power Meter	1/15/2020	Annual	1/15/2021	1328004
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	5/13/2020	Annual	5/13/2021	MY47420603
Pasternack	NC-100	Torque Wrench	8/4/2020	Biennial	8/4/2022	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	6/23/2020	Annual	6/23/2021	7406
SPEAG	EX3DV4	SAR Probe	8/19/2020	Annual	8/19/2021	7547
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/12/2020	Annual	8/12/2021	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/14/2020	Annual	5/14/2021	1583

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	30K

Object:	Date Issued:	Page 1 of 4
D750V2 – SN: 1161	10/18/2020	rage 1014

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

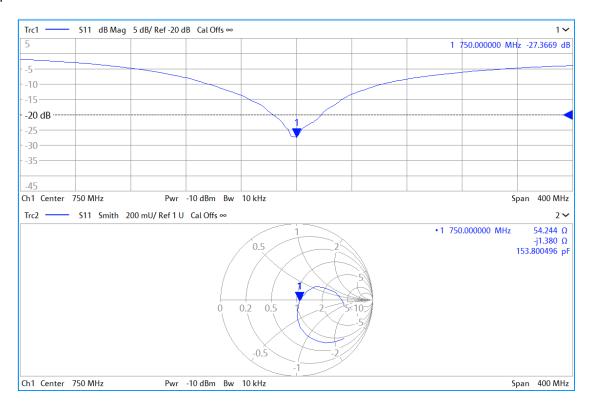
- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

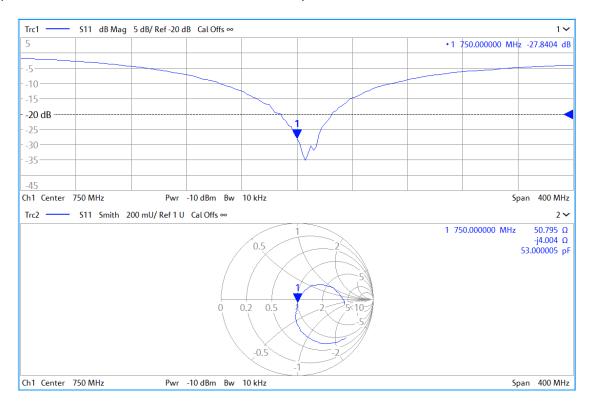
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Head SAR (1g)	(96)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
10/19/2018	10/18/2020	1.032	1.61	1.73	7.72%	1.05	1.12	6.46%	55.6	54.2	1.4	-1.9	-1.4	0.5	-25.0	-27.4	-9.50%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	(96)		Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)		Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
10/19/2018	10/18/2020	1.032	1.69	1.80	6.76%	1.11	1.18	6.31%	50.6	50.8	0.2	-4.2	-4.0	0.2	-27.6	-27.8	-0.90%	PASS

Object:	Date Issued:	Page 2 of 4
D750V2 – SN: 1161	10/18/2020	rage 2 01 4

Impedance & Return-Loss Measurement Plot for Head TSL



Impedance & Return-Loss Measurement Plot for Body TSL



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





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

Accreditation No.: SCS 0108

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

Client

PC Test

Certificate No: D835V2-4d132_Jan20

CALIBRATION CERTIFICATE

Object

D835V2 - SN:4d132

Calibration procedure(s)

QA CAL-05.v11

Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date:

January 13, 2020

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	31-Dec-19 (No. EX3-7349_Dec19)	Dec-20
DAE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-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-19)	In house check: Oct-20
	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Ed Man
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 21, 2020

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

Certificate No: D835V2-4d132 Jan20

Page 1 of 9

Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





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

Accreditation No.: SCS 0108

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

Glossary:

TSL

tissue simulating liquid

ConvF N/A sensitivity in TSL / NORM x,y,z

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	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.6 ± 6 %	0.91 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	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.65 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.30 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	PA 20 10 10	

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.96 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.68 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.64 W/kg ± 16.5 % (k=2)

Certificate No: D835V2-4d132_Jan20

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.4 Ω - 3.1 jΩ
Return Loss	- 30.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 Ω - 5.5 jΩ
Return Loss	- 24.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.385 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

anufactured by	SPEAG

Certificate No: D835V2-4d132_Jan20

DASY5 Validation Report for Head TSL

Date: 13.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d132

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: f = 835 MHz; $\sigma = 0.91$ S/m; $\varepsilon_r = 42.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(9.89, 9.89, 9.89) @ 835 MHz; Calibrated: 31.12.2019

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 27.12.2019

• Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

• DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 62.94 V/m; Power Drift = -0.02 dB

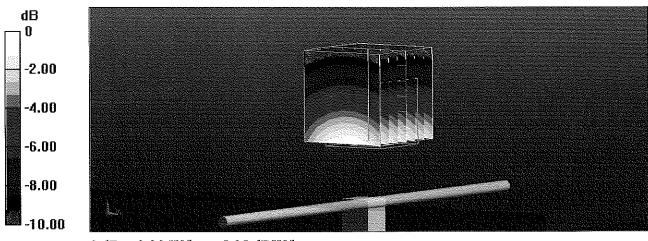
Peak SAR (extrapolated) = 3.60 W/kg

SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.58 W/kg

Smallest distance from peaks to all points 3 dB below = 16 mm

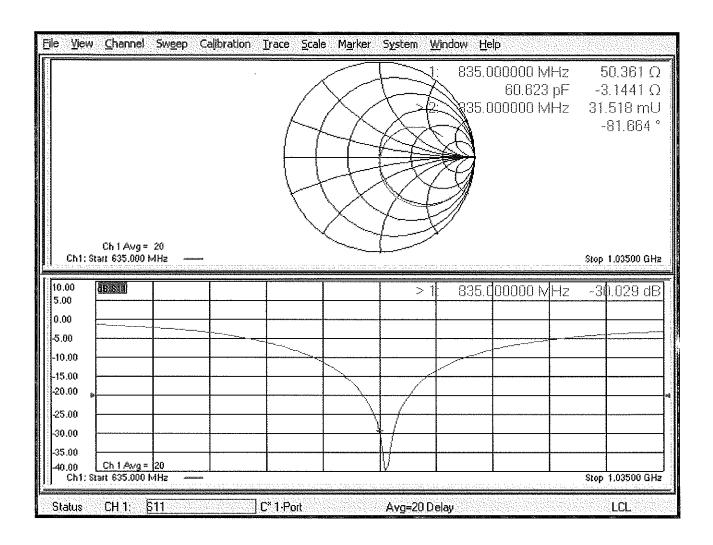
Ratio of SAR at M2 to SAR at M1 = 67.1%

Maximum value of SAR (measured) = 3.20 W/kg



0 dB = 3.20 W/kg = 5.05 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d132

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: f = 835 MHz; $\sigma = 0.99$ S/m; $\varepsilon_r = 55.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(10.16, 10.16, 10.16) @ 835 MHz; Calibrated: 31.12.2019

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 27.12.2019

• Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

• DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 60.64 V/m; Power Drift = -0.00 dB

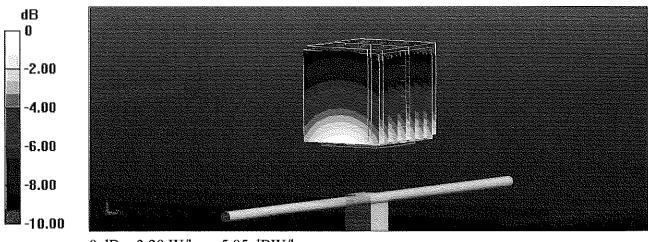
Peak SAR (extrapolated) = 3.71 W/kg

SAR(1 g) = 2.53 W/kg; SAR(10 g) = 1.68 W/kg

Smallest distance from peaks to all points 3 dB below = 16.2 mm

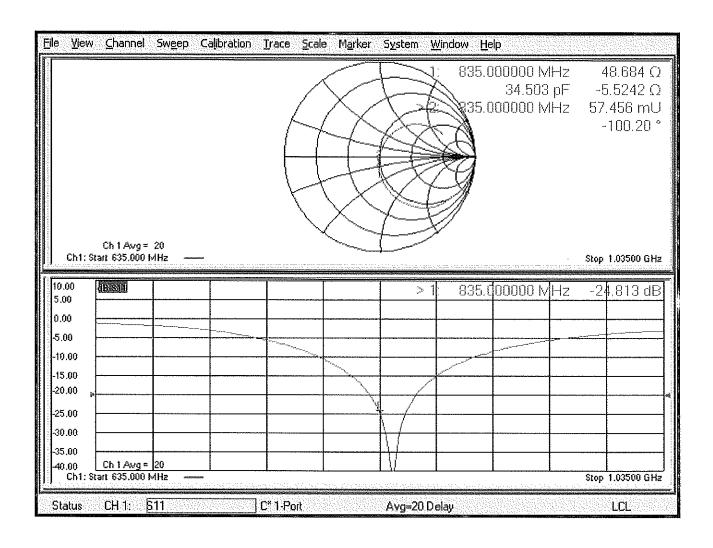
Ratio of SAR at M2 to SAR at M1 = 68.2%

Maximum value of SAR (measured) = 3.33 W/kg



0 dB = 3.20 W/kg = 5.05 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix: Transfer Calibration at Four Validation Locations on SAM Head¹

Evaluation Condition

Phantom	SAM Head Phantom	For usage with cSAR3D V2 -R/L
---------	------------------	--------------------------------------

SAR result with SAM Head (Top \cong C0)

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	9.34 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Mouth ≅ F90)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	9.80 W/kg ± 17.5 % (k=2)
	1	
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
OF TAX CATCHES OF THE OFF (10 9) OF TIOUS TOE	Condition	

SAR result with SAM Head (Neck \cong H0)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	9.32 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Ear ≅ D90)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	8.01 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	condition	

Certificate No: D835V2-4d132_Jan20

Additional assessments outside the current scope of SCS 0108

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst

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S Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client

PC Tes

Certificate No: D835V2-4d047_Mar19

Object	D835V2 - SN:4d0	947	
Calibration procedure(s)	QA CAL-05.vJ1 Calibration Proce	edure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	March 13, 2019		gN nu=n-2019
		ional standards, which realize the physical un	n.V EXT
Fhis calibration certificate documen	nts the traceability to nat	ional standards, which realize the physical un	its of measurements (SI). $\frac{101N}{1000}$
The measurements and the uncert	ainties with confidence p	robability are given on the following pages an	d are part of the certificate.
All calibrations have been conduct	ad in the algorid laborate	ry facility: environment temperature (22 ± 3)°(2 and humidity . 708/
di campiations nave been conducti	ed in the closed laborato	ry racility: environment temperature (22 ± 3) t	2 and numiday < 70%.
Calibration Equipment used (M&TE	Ecritical for calibration)		:
Primary Standards	1D#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 5047.2 / 06327 SN: 7349	31-Dec-18 (No. EX3-7349_Dec18)	Apr-19 Dec-19
Reference Probe EX3DV4	1		•
Reference Probe EX3DV4 DAE4	SN: 7349	31-Dec-18 (No. EX3-7349_Dec18)	Dec-19
Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 7349 SN: 601	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19)	Dec-19 Oct-19
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house)	Dec-19 Oct-19 Scheduled Check
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Dec-19 Oct-19 Scheduled Check In house check: Oct-20
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Dec-19 Oct-19 Scheduled Check In house check: Oct-20
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Dec-19 Oct-19 Scheduled Check In house check: Oct-20
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18)	Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Manu Seltz	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function Laboratory Technician	Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
Reference Probe EX3DV4 DAE4 Secondary Standards Fower meter E4419B Fower sensor HP 8481A Fower sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	31-Dec-18 (No. EX3-7349_Dec18) 04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house) 07-Oct-15 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18)	Dec-19 Oct-19 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19

Certificate No: D835V2-4d047_Mar19

Page 1 of 8

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

Accreditation No.: SCS 0108

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

Glossary:

TSL

tissue simulating liquid

ConvF N/A sensitivity in TSL / NORM x,y,z 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%.

Certificate No: D835V2-4d047_Mar19 Page 2 of 8

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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy , $dz = 5 mm$	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.9 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.42 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.13 W/kg ± 16.5 % (k=2)

Body TSL parametersThe following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.3 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	****	

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.47 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.27 W/kg ± 16.5 % (k=2)

Certificate No: D835V2-4d047_Mar19 Page 3 of 8

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 Ω - 2.6 jΩ
Return Loss	- 30.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω - 6.1 jΩ
Return Loss	- 22.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.387 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

Certificate No: D835V2-4d047_Mar19 Page 4 of 8

DASY5 Validation Report for Head TSL

Date: 13.03.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d047

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: f = 835 MHz; $\sigma = 0.91 \text{ S/m}$; $\varepsilon_r = 41.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(10, 10, 10) @ 835 MHz; Calibrated: 31.12.2018

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 04.10.2018

• Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

• DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

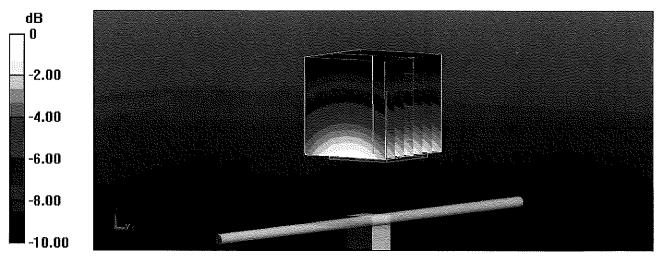
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 62.48 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 3.60 W/kg

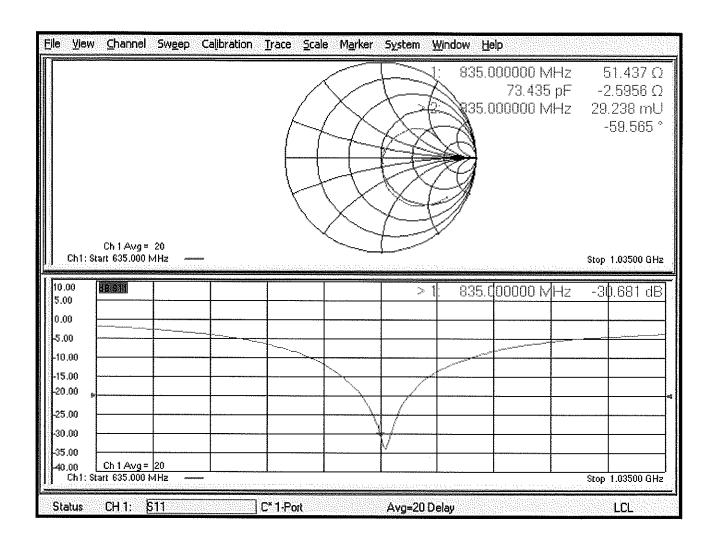
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg

Maximum value of SAR (measured) = 3.18 W/kg



0 dB = 3.18 W/kg = 5.02 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.03.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d047

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: f = 835 MHz; $\sigma = 1.01$ S/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(10.15, 10.15, 10.15) @ 835 MHz; Calibrated: 31.12.2018

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 04.10.2018

• Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

• DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

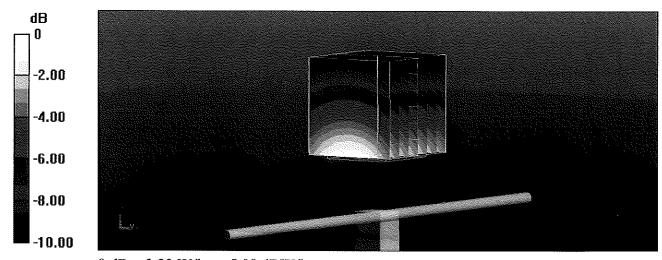
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 60.49 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.58 W/kg

SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.61 W/kg

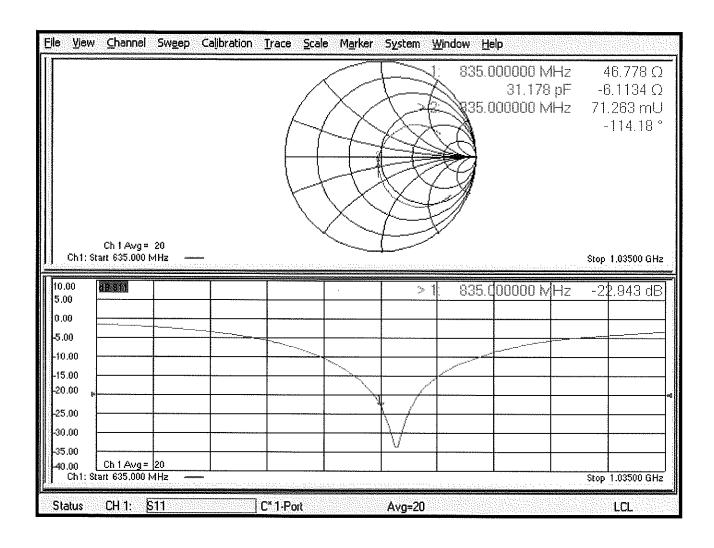
Maximum value of SAR (measured) = 3.23 W/kg



0 dB = 3.23 W/kg = 5.09 dBW/kg

Certificate No: D835V2-4d047_Mar19

Impedance Measurement Plot for Body TSL



PCTEST



7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654 http://www.pctest.com



Certification of Calibration

Object D835V2 – SN: 4d047

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 3/13/2020

Description: SAR Validation Dipole at 835 MHz

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	9/19/2019	Annual	9/19/2020	7551
SPEAG	EX3DV4	SAR Probe	1/21/2020	Annual	1/21/2021	7488
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2019	Annual	9/17/2020	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/13/2020	Annual	1/13/2021	1530

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	20K

Object:	Date Issued:	Page 1 of 4
D835V2 - SN: 4d047	03/13/2020	Page 1 of 4

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

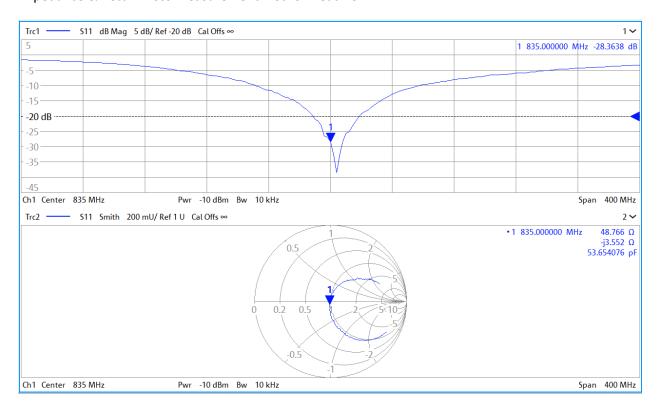
- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

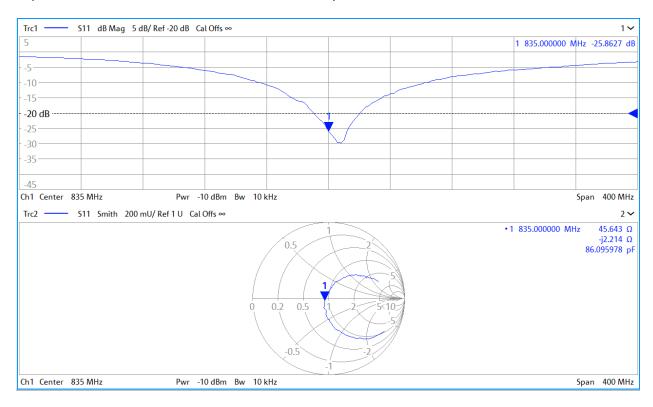
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) M(4 (C)	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
3/13/2019	3/13/2020	1.387	1.884	1.87	-0.74%	1.226	1.22	-0.49%	51.4	48.8	2.6	-2.6	-3.6	1.0	-30.7	-28.4	7.60%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
3/13/2019	3/13/2020	1.387	1.894	1.91	0.84%	1.254	1.26	0.48%	46.8	45.6	1.2	-6.1	-2.2	3.9	-22.9	-25.9	-12.90%	PASS

Object:	Date Issued:	Page 2 of 4
D835V2 - SN: 4d047	03/13/2020	Fage 2 01 4

Impedance & Return-Loss Measurement Plot for Head TSL



Impedance & Return-Loss Measurement Plot for Body TSL



Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerlscher Kalibrierdienst
Service suisse d'étalonnage
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

Client

C Tes

Certificate No: D835V2-4d133 Oct18

CALIBRATION CERTIFICATE Object D835V2 - SN:4d133 Calibration procedure(s) QA CAL-05 v10 Calibration procedure for dipole validation kits above 700 MHz Calibration date: October 19, 2018 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) $^{\circ}$ C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID# Cal Date (Certificate No.) Scheduled Calibration SN: 104778 Power meter NRP 04-Apr-18 (No. 217-02672/02673) Apr-19 Power sensor NRP-Z91 SN: 103244 04-Apr-18 (No. 217-02672) Apr-19 Power sensor NRP-Z91 SN: 103245 04-Apr-18 (No. 217-02673) Apr-19 Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-18 (No. 217-02682) Apr-19 Type-N mismatch combination SN: 5047.2 / 06327 04-Apr-18 (No. 217-02683) Apr-19 Reference Probe EX3DV4 SN: 7349 30-Dec-17 (No. EX3-7349_Dec17) Dec-18 DAE4 SN: 601 04-Oct-18 (No. DAE4-601_Oct18) Oct-19 Secondary Standards !D# Check Date (In house) Scheduled Check Power meter EPM-442A SN: GB37480704 07-Oct-15 (in house check Oct-18) 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 SN: US41080477 In house check: Oct-19 Network Analyzer Agilent E8358A 31-Mar-14 (in house check Oct-18) Name Function Calibrated by: Manu Seitz Laboratory Technician Katja Pokovic Approved by: Technical Manager Issued: October 22, 2018

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

Certificate No: D835V2-4d133_Oct18

Page 1 of 8

Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





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

Accreditation No.: SCS 0108

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

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%.

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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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.6 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.43 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.10 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	0.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		at as to to

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.75 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.40 W/kg ± 16.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6 Ω - 2.4 jΩ
Return Loss	- 32.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.0 Ω - 6.7 jΩ
Return Loss	- 21.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.397 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	July 22, 2011

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DASY5 Validation Report for Head TSL

Date: 19.10.2018

Test Laboratory: The name of your organization

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d133

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: f = 835 MHz; $\sigma = 0.91$ S/m; $\varepsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(9.9, 9.9, 9.9) @ 835 MHz; Calibrated: 30.12.2017

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 04.10.2018

• Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

• DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

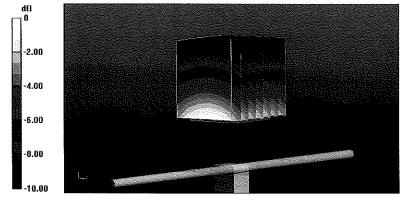
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 63.02 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.68 W/kg

SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.54 W/kg

Maximum value of SAR (measured) = 3.24 W/kg



0 dB = 3.24 W/kg = 5.11 dBW/kg

Impedance Measurement Plot for Head TSL

