

P39 LTE 12_QPSK10M_Bottom_0mm_Ch23060_1RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

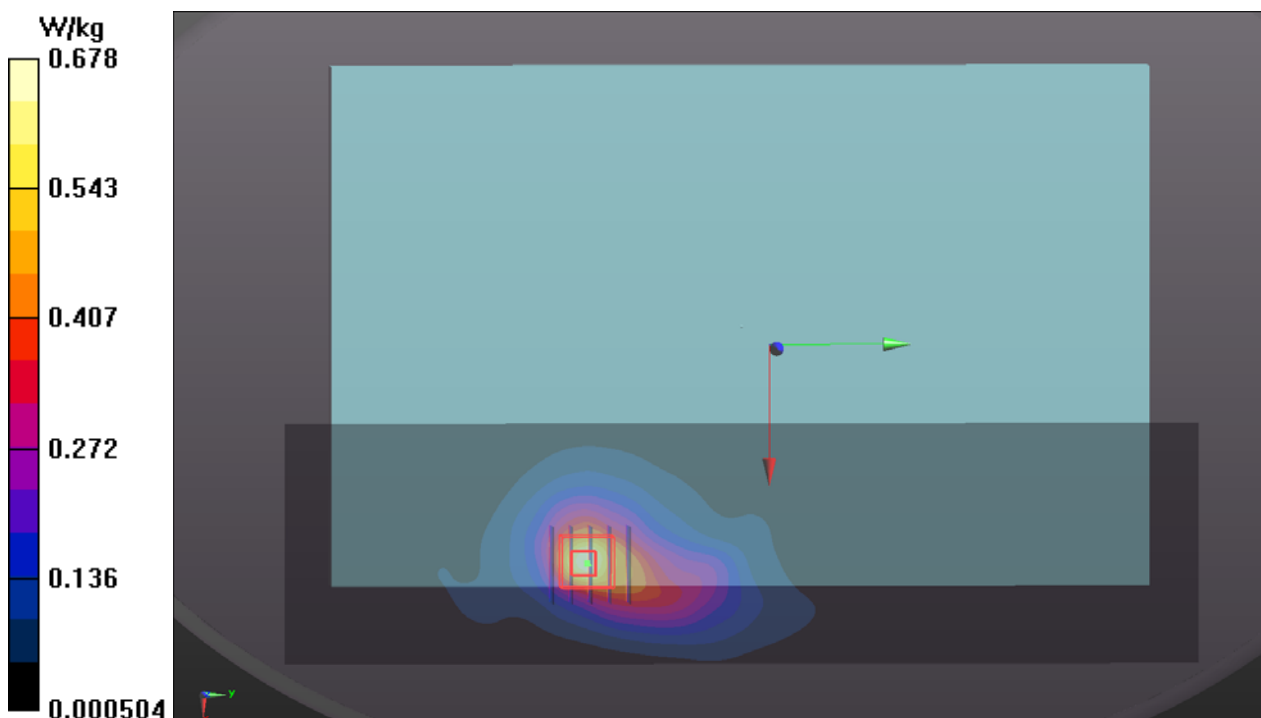
Communication System: UID 10175 - CAG, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK);
Frequency: 704 MHz; Duty Cycle: 1:3.74
Medium: H06T09N1_1126 Medium parameters used: $f = 704$ MHz; $\sigma = 0.851$ S/m; $\epsilon_r = 43.558$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C ; Liquid Temperature : 23.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(10.54, 10.54, 10.54) @ 704 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x261x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.678 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.91 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.465 W/kg; SAR(10 g) = 0.268 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 9.6 mm
Ratio of SAR at M2 to SAR at M1 = 52.7%
Maximum value of SAR (measured) = 0.874 W/kg



P40 LTE 13_QPSK10M_Bottom_0mm_Ch23230_1RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

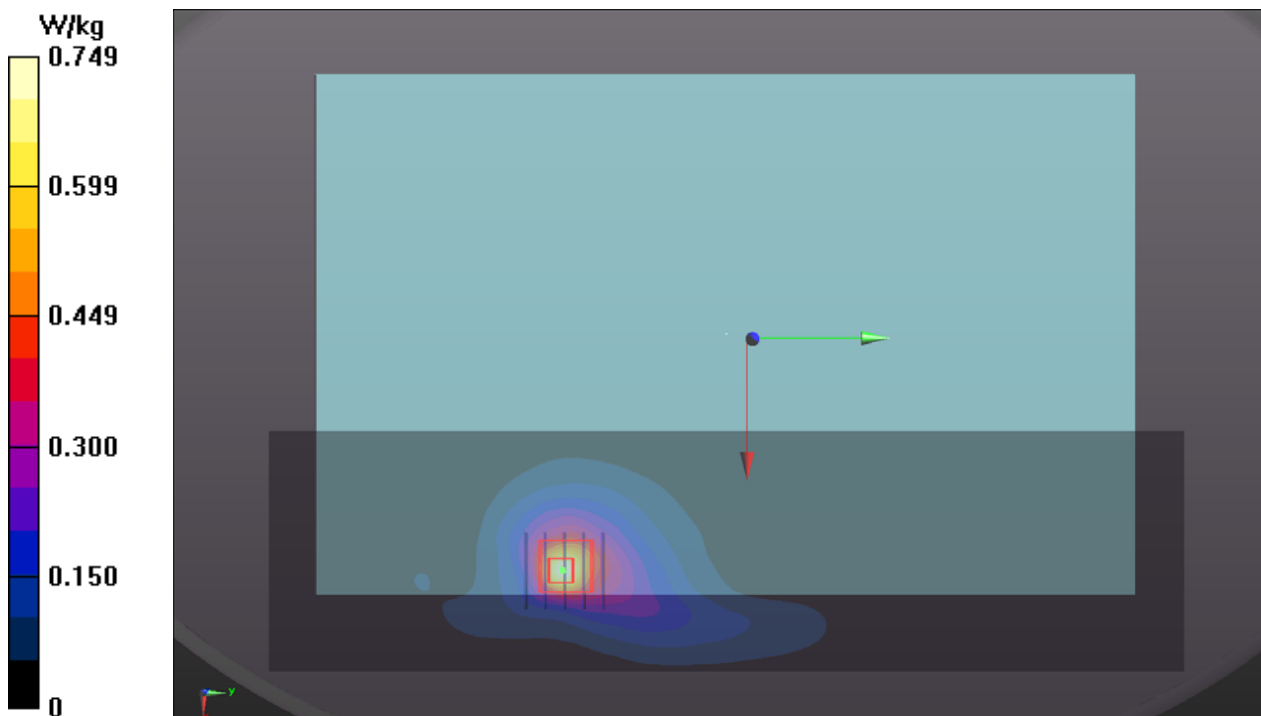
Communication System: UID 10175 - CAG, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK);
Frequency: 782 MHz; Duty Cycle: 1:3.74
Medium: H06T09N1_1126 Medium parameters used: $f = 782$ MHz; $\sigma = 0.922$ S/m; $\epsilon_r = 42.596$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C ; Liquid Temperature : 23.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(10.54, 10.54, 10.54) @ 782 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x261x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.749 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.34 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.921 W/kg
SAR(1 g) = 0.363 W/kg; SAR(10 g) = 0.2 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 11.2 mm
Ratio of SAR at M2 to SAR at M1 = 51.6%
Maximum value of SAR (measured) = 0.740 W/kg



P41 LTE 14_QPSK10M_Bottom_0mm_Ch23330_1RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

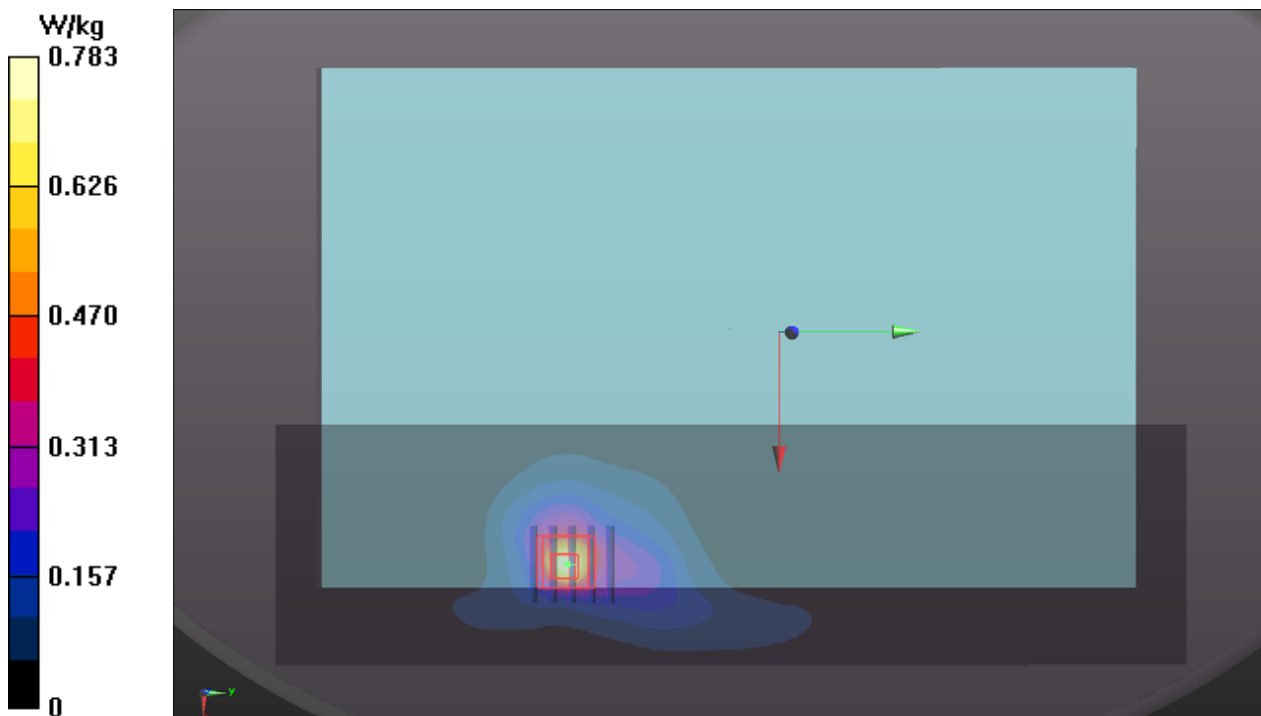
Communication System: UID 10175 - CAG, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK);
Frequency: 793 MHz; Duty Cycle: 1:3.74
Medium: H06T09N1_1126 Medium parameters used: $f = 793$ MHz; $\sigma = 0.931$ S/m; $\epsilon_r = 42.455$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C ; Liquid Temperature : 23.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(10.54, 10.54, 10.54) @ 793 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x261x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.783 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.44 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.934 W/kg
SAR(1 g) = 0.346 W/kg; SAR(10 g) = 0.182 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 11.2 mm
Ratio of SAR at M2 to SAR at M1 = 51.9%
Maximum value of SAR (measured) = 0.749 W/kg



P42 LTE 17_QPSK10M_Bottom_0mm_Ch23800_1RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

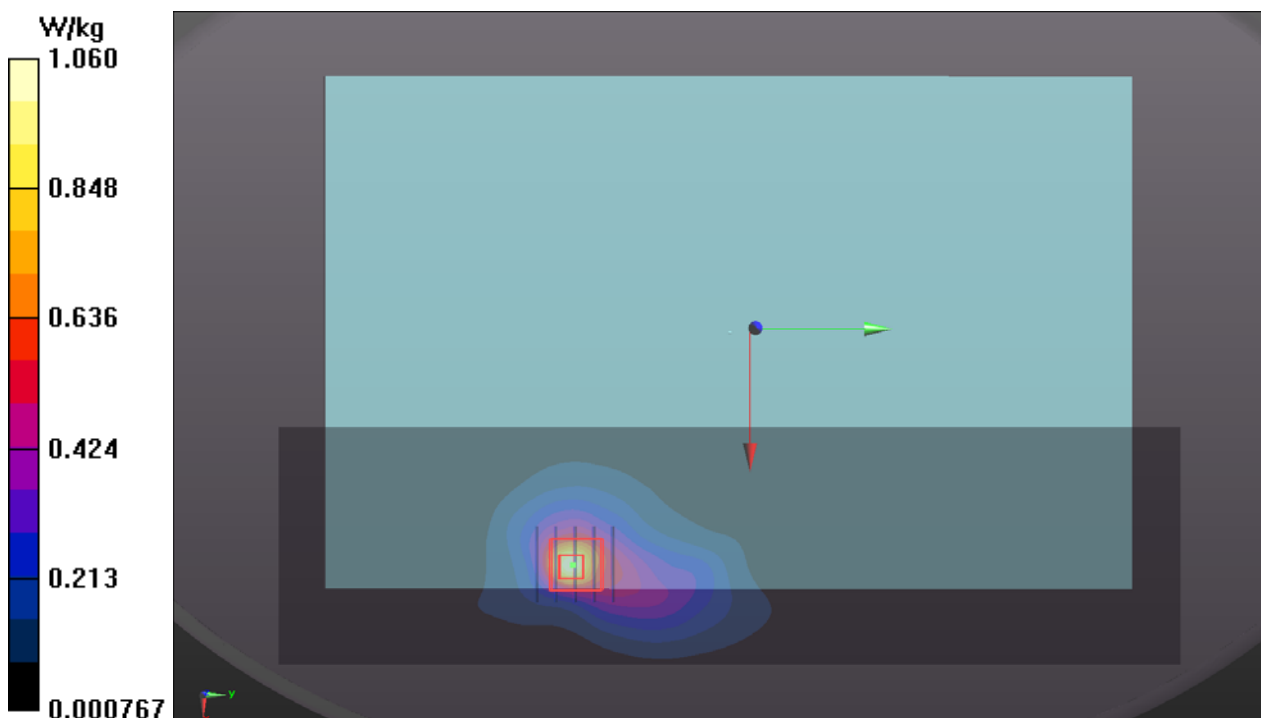
DUT: WTW-P20100318

Communication System: UID 10175 - CAG, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK);
Frequency: 711 MHz; Duty Cycle: 1:3.74
Medium: H06T09N1_1126 Medium parameters used: $f = 711$ MHz; $\sigma = 0.857$ S/m; $\epsilon_r = 43.469$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C ; Liquid Temperature : 23.3 °C

- DASY5 Configuration:
- Probe: EX3DV4 - SN7472; ConvF(10.54, 10.54, 10.54) @ 711 MHz; Calibrated: 2020/08/24
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection)
 - Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
 - Phantom: ELI Phantom_1039; Type: QDOVA;
 - Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x261x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.06 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.24 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.26 W/kg
SAR(1 g) = 0.661 W/kg; SAR(10 g) = 0.362 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 11.5 mm
Ratio of SAR at M2 to SAR at M1 = 51.5%
Maximum value of SAR (measured) = 0.994 W/kg



P43 LTE 25_QPSK20M_Bottom_0mm_Ch26140_1RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

Communication System: UID 10169 - CAE, LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK);
Frequency: 1860 MHz; Duty Cycle: 1:3.74

Medium: H16T20N2_1124 Medium parameters used: $f = 1860$ MHz; $\sigma = 1.439$ S/m; $\epsilon_r = 41.284$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(8.54, 8.54, 8.54) @ 1860 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (61x231x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.719 W/kg

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

Reference Value = 22.62 V/m; Power Drift = -0.07 dB

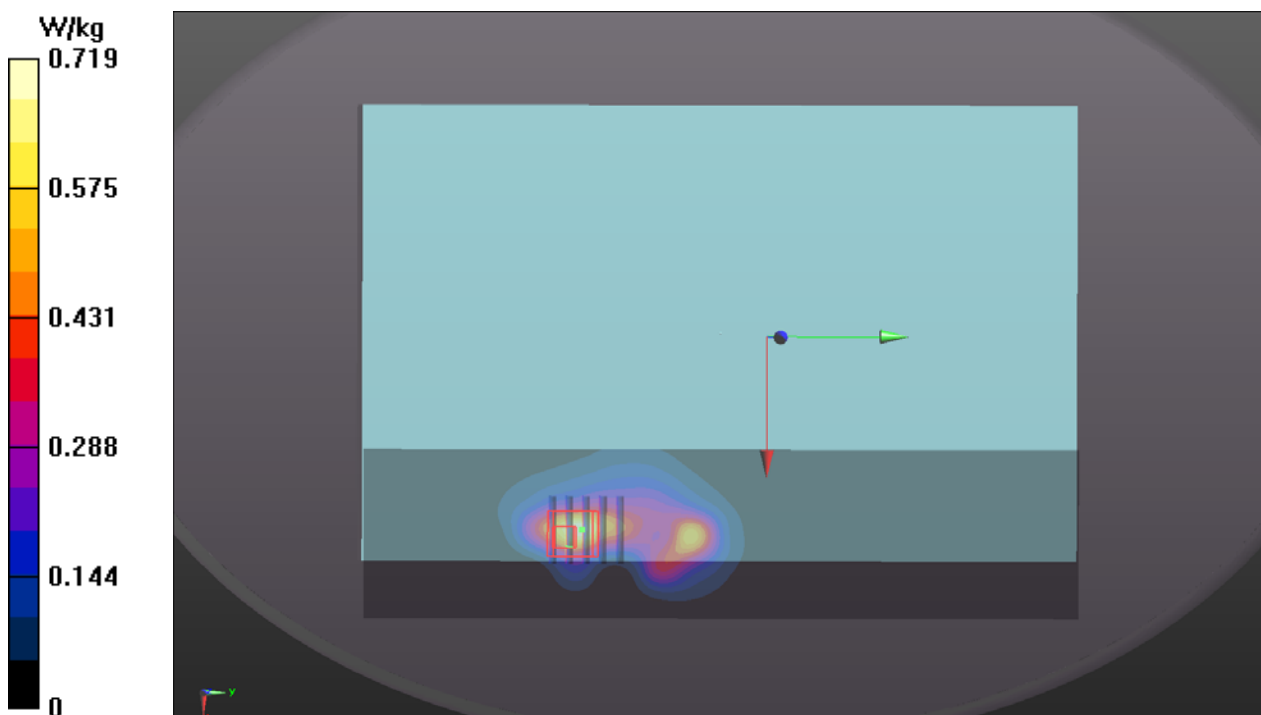
Peak SAR (extrapolated) = 1.01 W/kg

SAR(1 g) = 0.338 W/kg; SAR(10 g) = 0.158 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 8.2 mm

Ratio of SAR at M2 to SAR at M1 = 42.4%

Maximum value of SAR (measured) = 0.746 W/kg



P44 LTE 26_QPSK15M_Bottom_0mm_Ch26865_1RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

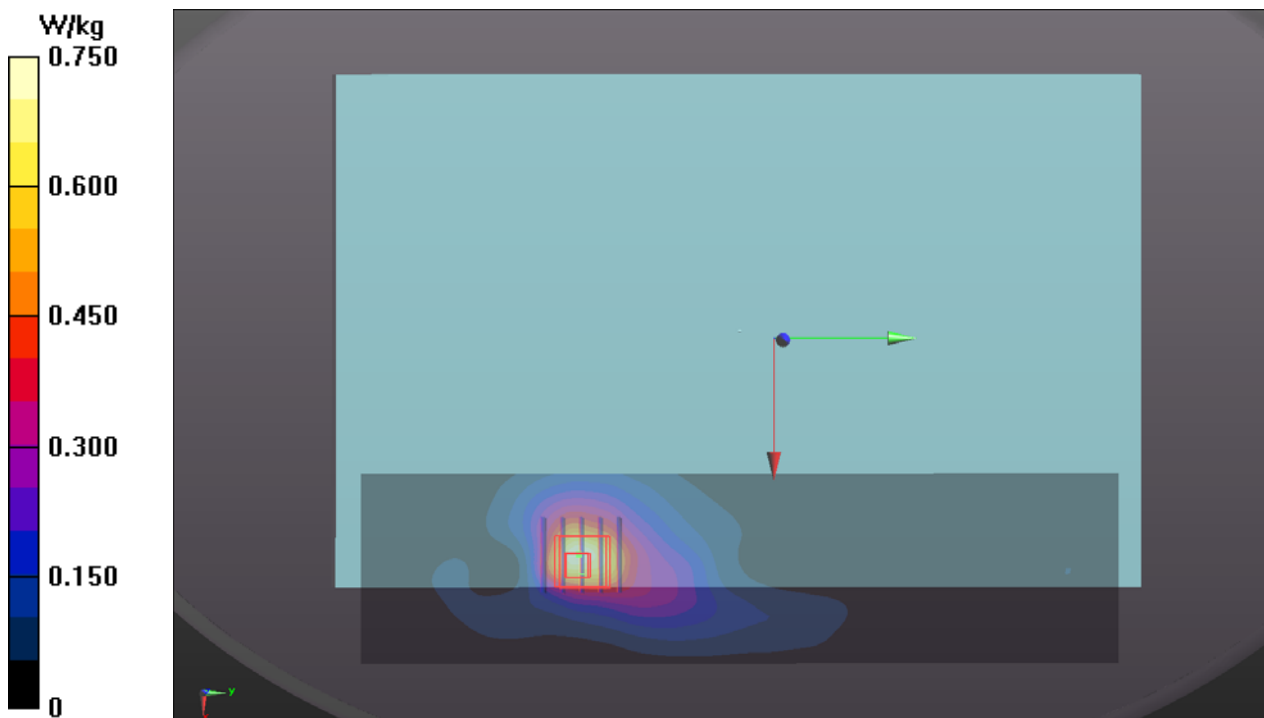
Communication System: UID 10181 - CAE, LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK);
Frequency: 831.5 MHz; Duty Cycle: 1:3.74
Medium: H07T10N1_1129 Medium parameters used (interpolated): $f = 831.5$ MHz; $\sigma = 0.916$ S/m;
 $\epsilon_r = 42.079$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C ; Liquid Temperature : 23 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(10.11, 10.11, 10.11) @ 831.5 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (61x221x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.750 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.43 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.32 W/kg
SAR(1 g) = 0.698 W/kg; SAR(10 g) = 0.388 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 9.7 mm
Ratio of SAR at M2 to SAR at M1 = 52.8%
Maximum value of SAR (measured) = 1.06 W/kg



P45 LTE 30_QPSK10M_Bottom_0mm_Ch27710_1RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

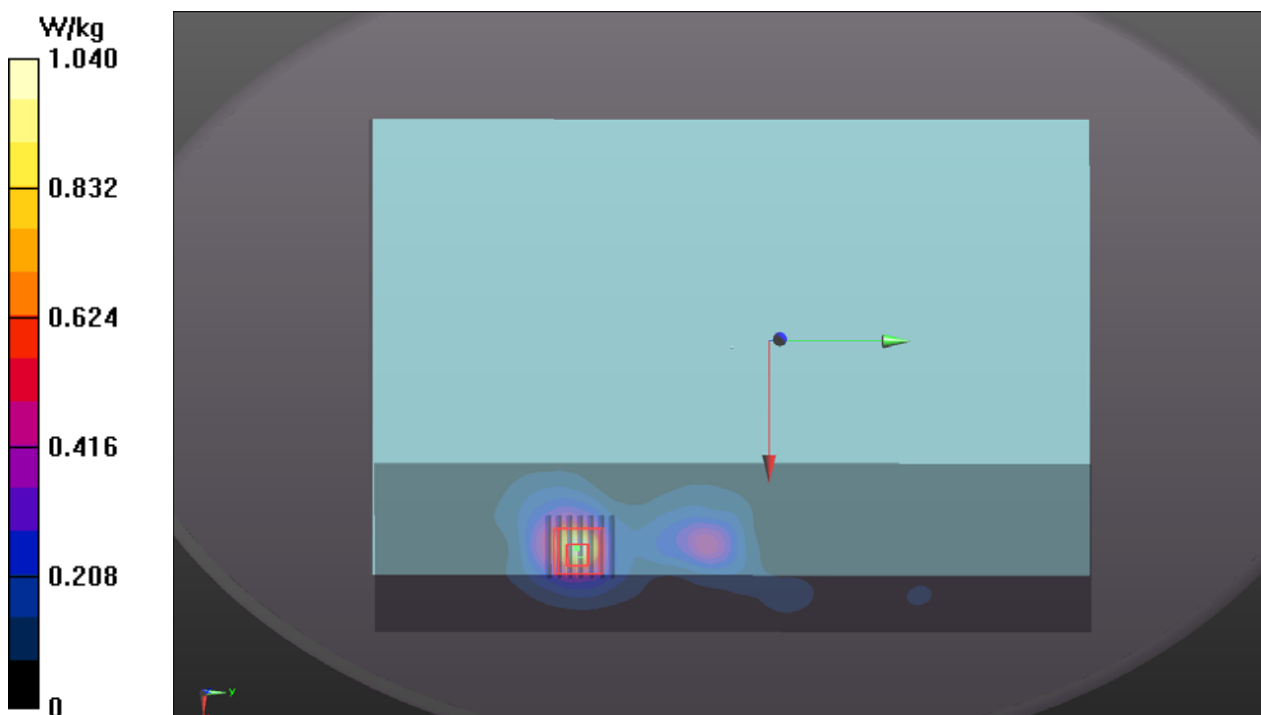
Communication System: UID 10175 - CAG, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK);
Frequency: 2310 MHz; Duty Cycle: 1:3.74
Medium: H19T27N1_1125 Medium parameters used: $f = 2310$ MHz; $\sigma = 1.74$ S/m; $\epsilon_r = 38.831$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(8.06, 8.06, 8.06) @ 2310 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x291x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm
Maximum value of SAR (interpolated) = 1.04 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm
Reference Value = 24.66 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.51 W/kg
SAR(1 g) = 0.664 W/kg; SAR(10 g) = 0.328 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 11.2 mm
Ratio of SAR at M2 to SAR at M1 = 43.2%
Maximum value of SAR (measured) = 1.17 W/kg



P46 LTE 38_QPSK20M_Bottom_0mm_Ch38000_50RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

Communication System: UID 10151 - CAG, LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK);
Frequency: 2595 MHz; Duty Cycle: 1:8.47

Medium: H19T27N1_1125 Medium parameters used (interpolated): $f = 2595$ MHz; $\sigma = 2.04$ S/m; $\epsilon_r = 37.86$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(7.71, 7.71, 7.71) @ 2595 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x291x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.56 W/kg

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

Reference Value = 27.68 V/m; Power Drift = -0.12 dB

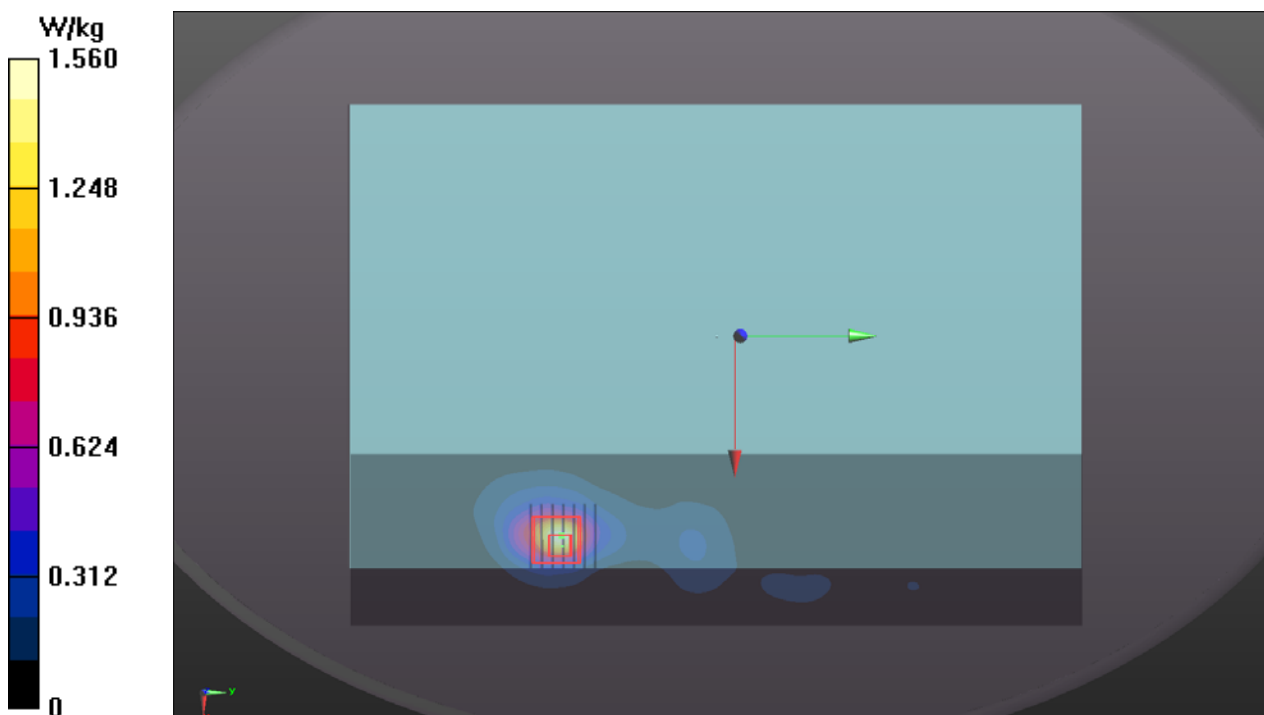
Peak SAR (extrapolated) = 2.20 W/kg

SAR(1 g) = 0.855 W/kg; SAR(10 g) = 0.392 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 8.6 mm

Ratio of SAR at M2 to SAR at M1 = 38.5%

Maximum value of SAR (measured) = 1.65 W/kg



P48 LTE 41_QPSK20M_Bottom_0mm_Ch40185_50RB_OS0_Sample1_Ant 0_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

Communication System: UID 10151 - CAG, LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK);
Frequency: 2549.5 MHz; Duty Cycle: 1:8.47

Medium: H19T27N1_1125 Medium parameters used: $f = 2550$ MHz; $\sigma = 1.991$ S/m; $\epsilon_r = 38.001$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(7.71, 7.71, 7.71) @ 2549.5 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x291x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.21 W/kg

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

Reference Value = 24.86 V/m; Power Drift = -0.15 dB

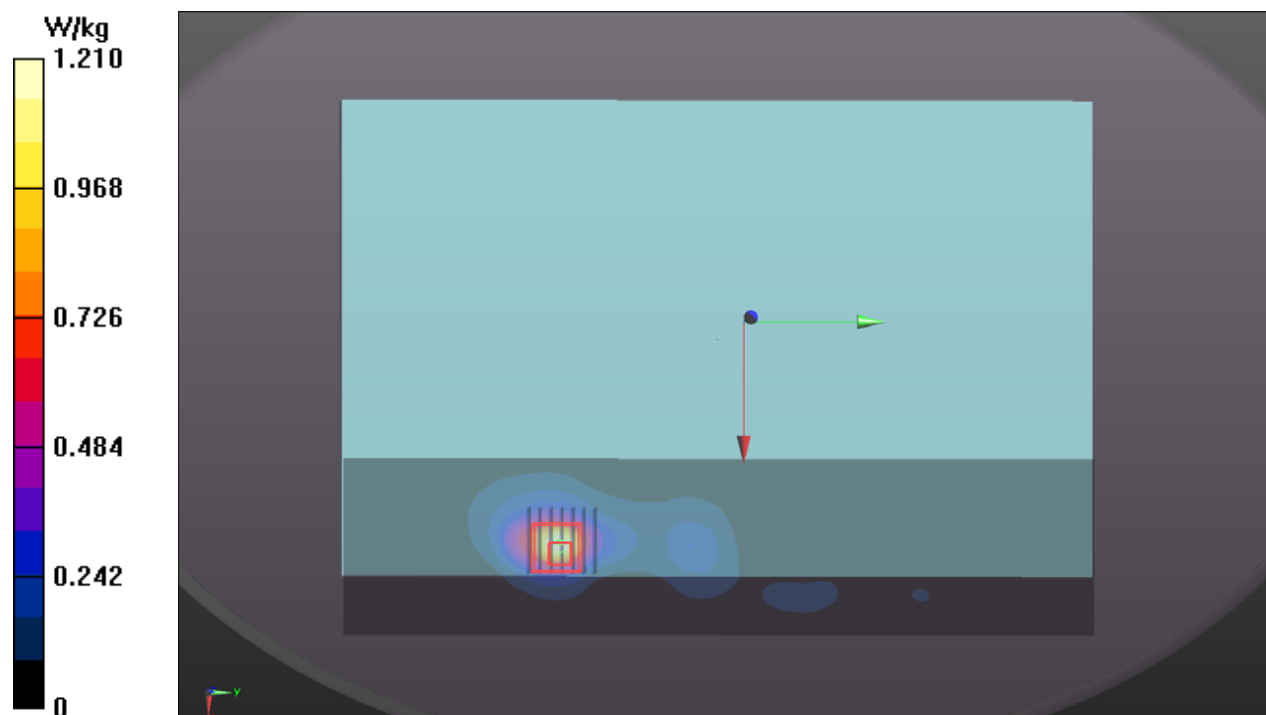
Peak SAR (extrapolated) = 1.73 W/kg

SAR(1 g) = 0.684 W/kg; SAR(10 g) = 0.319 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 8.6 mm

Ratio of SAR at M2 to SAR at M1 = 39.5%

Maximum value of SAR (measured) = 1.29 W/kg



P49 LTE 42_QPSK20M_Bottom_0mm_Ch43490_1RB_OS0_Sample1_Ant 1_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

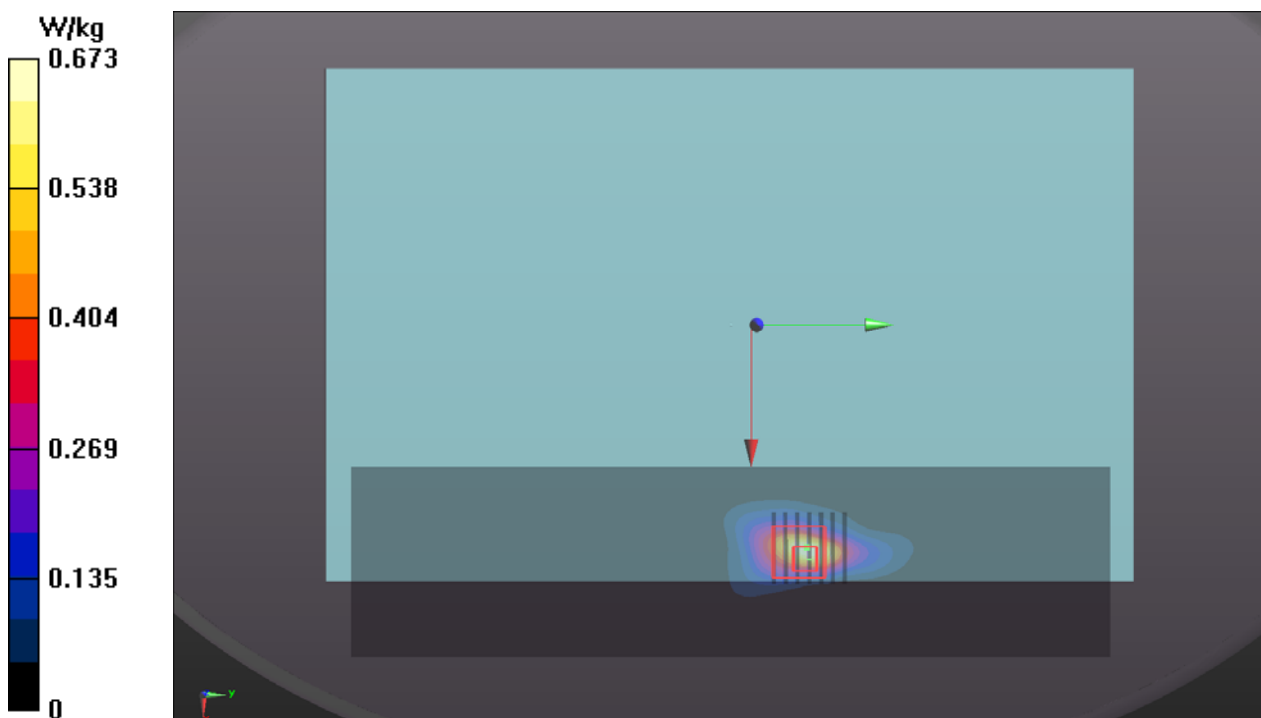
Communication System: UID 10172 - CAG, LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK);
Frequency: 3590 MHz; Duty Cycle: 1:8.33
Medium: H34T38N1_1130 Medium parameters used: $f = 3590$ MHz; $\sigma = 3.01$ S/m; $\epsilon_r = 36.936$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(7.1, 7.1, 7.1) @ 3590 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x271x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.673 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2.5mm
Reference Value = 13.37 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.347 W/kg; SAR(10 g) = 0.132 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6 mm
Ratio of SAR at M2 to SAR at M1 = 58.3%
Maximum value of SAR (measured) = 0.712 W/kg



P50 LTE 48_QPSK20M_Bottom_0mm_Ch56640_1RB_OS0_Sample1_Ant 1_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

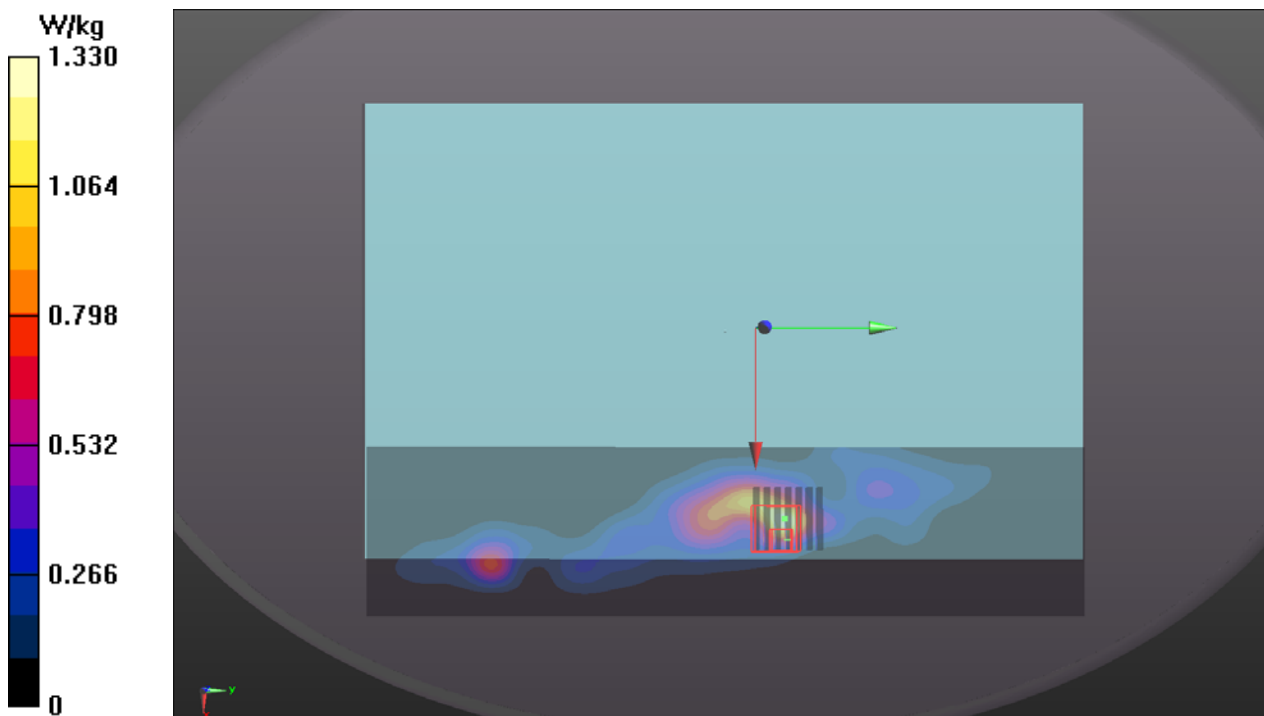
Communication System: UID 10172 - CAG, LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK);
Frequency: 3690 MHz; Duty Cycle: 1:8.33
Medium: H34T38N1_1125 Medium parameters used (interpolated): $f = 3690$ MHz; $\sigma = 3.032$ S/m;
 $\epsilon_r = 36.174$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(6.99, 6.99, 6.99) @ 3690 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x291x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.33 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2.5mm
Reference Value = 59.09 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 3.63 W/kg
SAR(1 g) = 0.708 W/kg; SAR(10 g) = 0.221 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 5.2 mm
Ratio of SAR at M2 to SAR at M1 = 56.8%
Maximum value of SAR (measured) = 1.93 W/kg



P51 LTE 66_QPSK20M_Bottom_0mm_Ch132322_1RB_OS0_Sample1_Ant 0 _Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

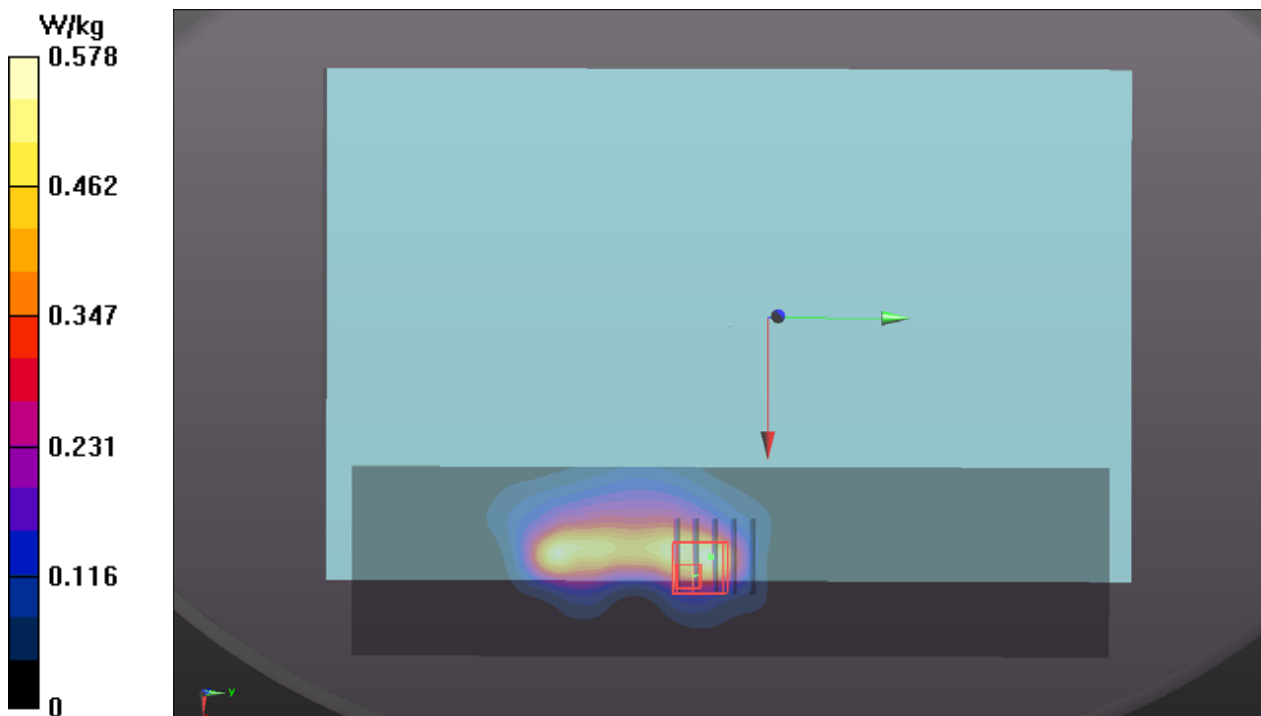
Communication System: UID 10169 - CAE, LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK);
Frequency: 1745 MHz; Duty Cycle: 1:3.74
Medium: H16T20N1_1130 Medium parameters used (interpolated): $f = 1745$ MHz; $\sigma = 1.328$ S/m;
 $\epsilon_r = 39.547$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(8.74, 8.74, 8.74) @ 1745 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (61x221x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.578 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.63 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.968 W/kg
SAR(1 g) = 0.362 W/kg; SAR(10 g) = 0.172 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 12.4 mm
Ratio of SAR at M2 to SAR at M1 = 50%
Maximum value of SAR (measured) = 0.797 W/kg



**P52 5G NR-n2_DFT-S-
15KHz_QPSK20M_Bottom_0mm_Ch372000_1RB_OS1_Sample 1_Ant
0_Battery 4cell_P-Sensor_w**

DUT: WTW-P20100318

Communication System: UID 10931 - AAB, 5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz); Frequency: 1860 MHz; Duty Cycle: 1:3.56

Medium: H16T20N1_1130 Medium parameters used: $f = 1860$ MHz; $\sigma = 1.423$ S/m; $\epsilon_r = 39.164$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(8.35, 8.35, 8.35) @ 1860 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (61x221x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.742 W/kg

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

Reference Value = 21.07 V/m; Power Drift = -0.03 dB

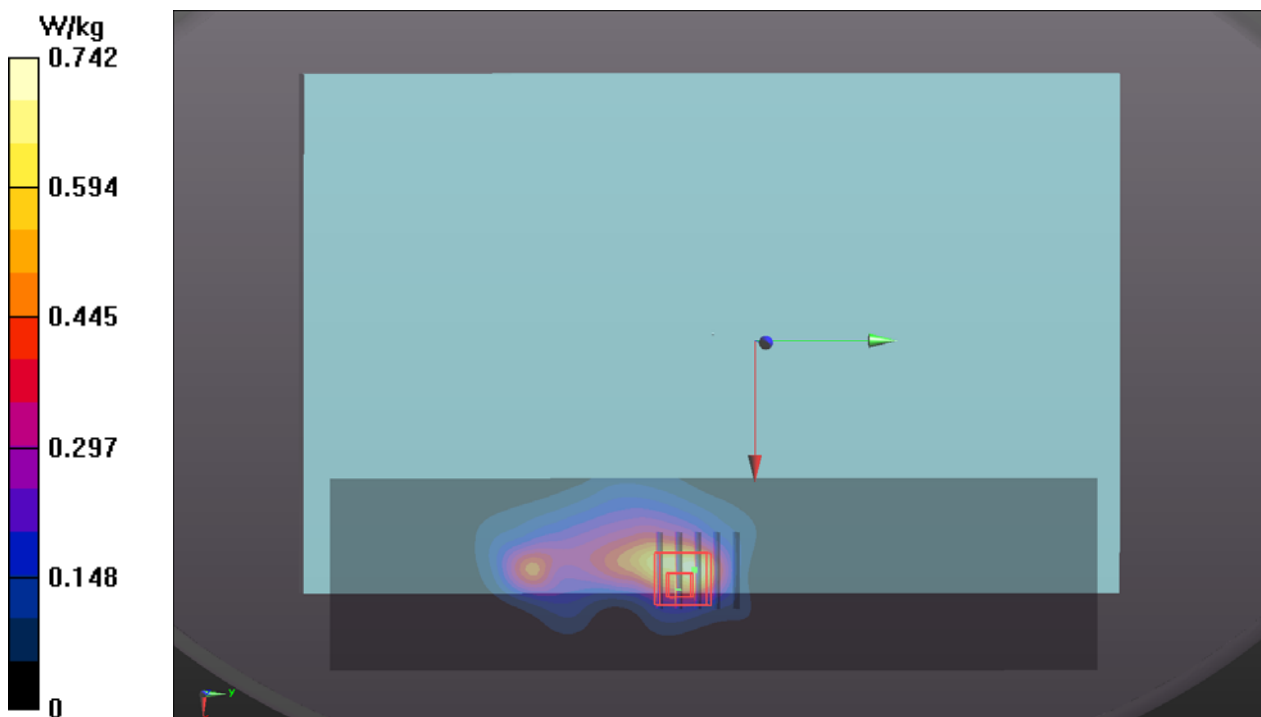
Peak SAR (extrapolated) = 1.21 W/kg

SAR(1 g) = 0.446 W/kg; SAR(10 g) = 0.22 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 14.8 mm

Ratio of SAR at M2 to SAR at M1 = 49.2%

Maximum value of SAR (measured) = 0.951 W/kg



**P53 5G NR-n5_DFT-S-
15KHz_QPSK20M_Bottom_0mm_Ch167800_1RB_OS1_Sample 1_Ant
0_Battery 4cell_P-Sensor_w**

DUT: WTW-P20100318

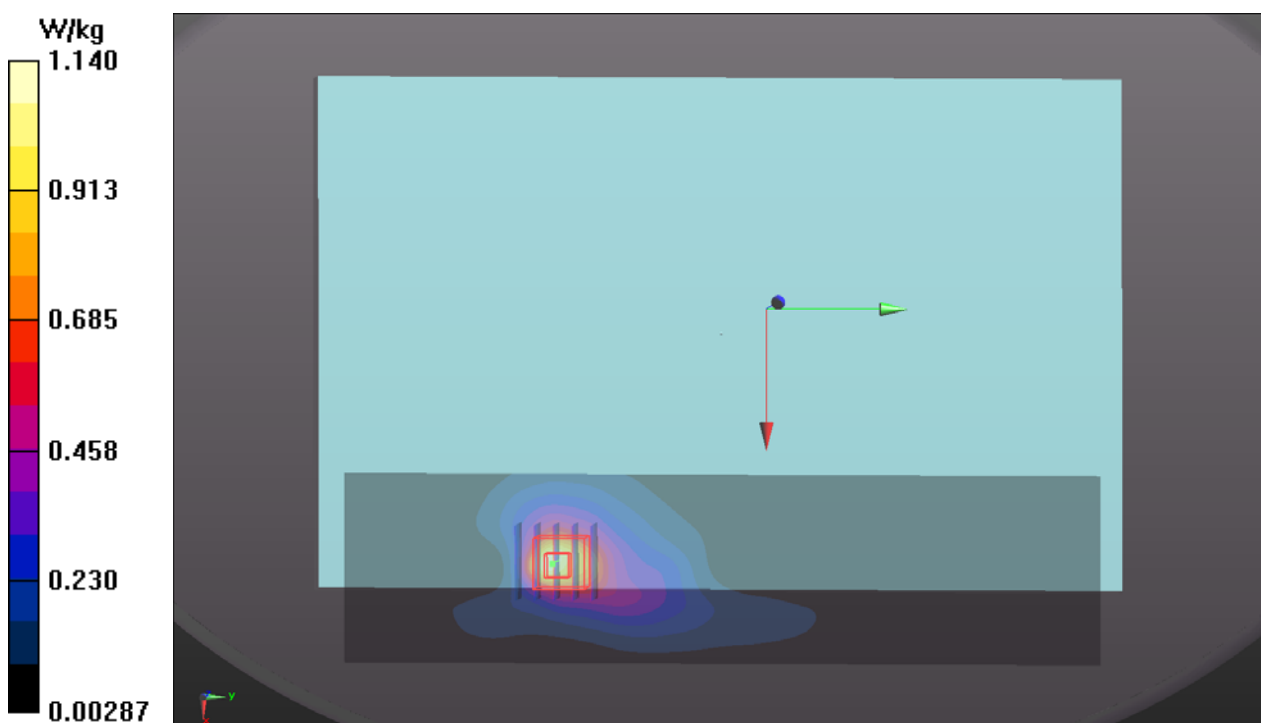
Communication System: UID 10931 - AAB, 5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz); Frequency: 839 MHz; Duty Cycle: 1:3.56
Medium: H07T10N1_1130 Medium parameters used: $f = 839$ MHz; $\sigma = 0.921$ S/m; $\epsilon_r = 41.647$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 23.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(10.11, 10.11, 10.11) @ 839 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (61x221x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.14 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.82 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.51 W/kg
SAR(1 g) = 0.557 W/kg; SAR(10 g) = 0.311 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 11.3 mm
Ratio of SAR at M2 to SAR at M1 = 55.2%
Maximum value of SAR (measured) = 1.24 W/kg



**P54 5G NR-n7_DFT-S-
15KHz_QPSK20M_Bottom_0mm_Ch507000_1RB_OS1_Sample 1_Ant
1_Battery 4cell_P-Sensor_w**

DUT: WTW-P20100318

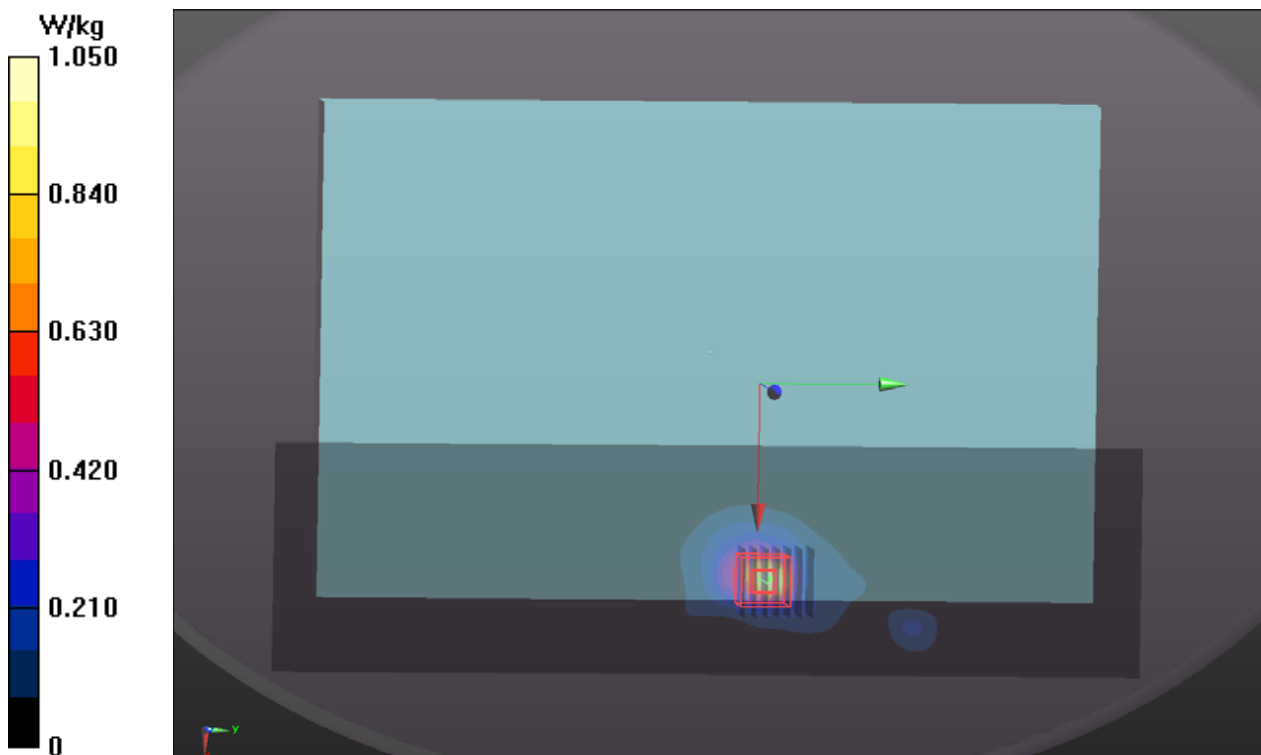
Communication System: UID 10931 - AAB, 5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz); Frequency: 2535 MHz; Duty Cycle: 1:3.56
Medium: H19T27N1_1127 Medium parameters used (interpolated): $f = 2535$ MHz; $\sigma = 1.974$ S/m;
 $\epsilon_r = 38.023$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.8 °C ; Liquid Temperature : 23.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(7.71, 7.71, 7.71) @ 2535 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (91x321x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.05 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.06 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.62 W/kg
SAR(1 g) = 0.665 W/kg; SAR(10 g) = 0.286 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6.7 mm
Ratio of SAR at M2 to SAR at M1 = 45.3%
Maximum value of SAR (measured) = 1.16 W/kg



**P55 5G NR-n12_DFT-S-
15KHz_QPSK15M_Bottom_0mm_Ch141300_1RB_OS1_Sample 1_Ant
0_Battery 4cell_P-Sensor_w**

DUT: WTW-P20100318

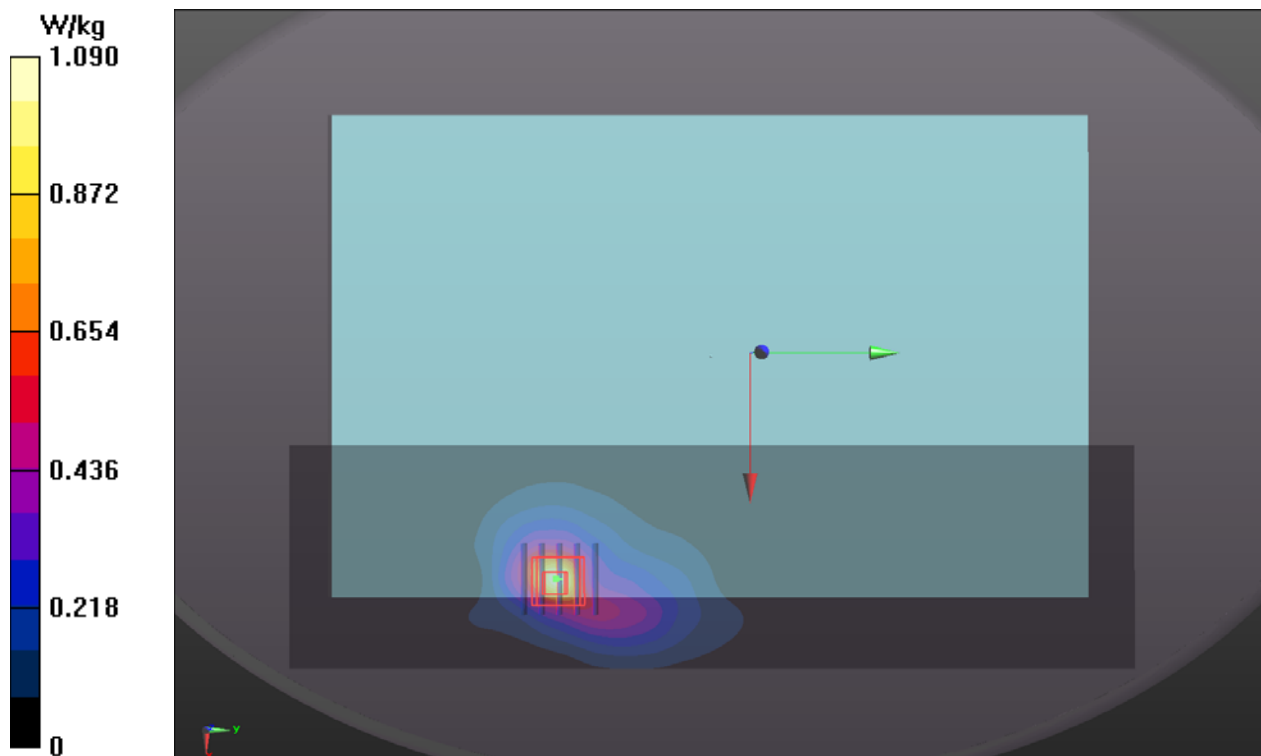
Communication System: UID 10930 - AAB, 5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz); Frequency: 706.5 MHz; Duty Cycle: 1:3.56
Medium: H06T09N1_1127 Medium parameters used (interpolated): $f = 706.5$ MHz; $\sigma = 0.855$ S/m;
 $\epsilon_r = 43.631$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.8 °C ; Liquid Temperature : 23.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(10.6, 10.6, 10.6) @ 706.5 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x261x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.09 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 37.89 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.35 W/kg
SAR(1 g) = 0.757 W/kg; SAR(10 g) = 0.407 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 10.1 mm
Ratio of SAR at M2 to SAR at M1 = 55.6%
Maximum value of SAR (measured) = 1.10 W/kg



P56 5G NR-n41_DFT-S-30KHz_QPSK100M_Bottom_0mm_Ch528000_1RB_OS1_Sample 1_Ant 1_Battery 4cell_P-Sensor_w

DUT: WTW-P20100318

Communication System: UID 10866 - AAD, 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz); Frequency: 2640 MHz; Duty Cycle: 1:3.7

Medium: H19T27N1_1127 Medium parameters used: $f = 2640$ MHz; $\sigma = 2.088$ S/m; $\epsilon_r = 37.651$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.8 °C ; Liquid Temperature : 23.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(7.71, 7.71, 7.71) @ 2640 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (91x321x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.24 W/kg

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

Reference Value = 24.05 V/m; Power Drift = -0.02 dB

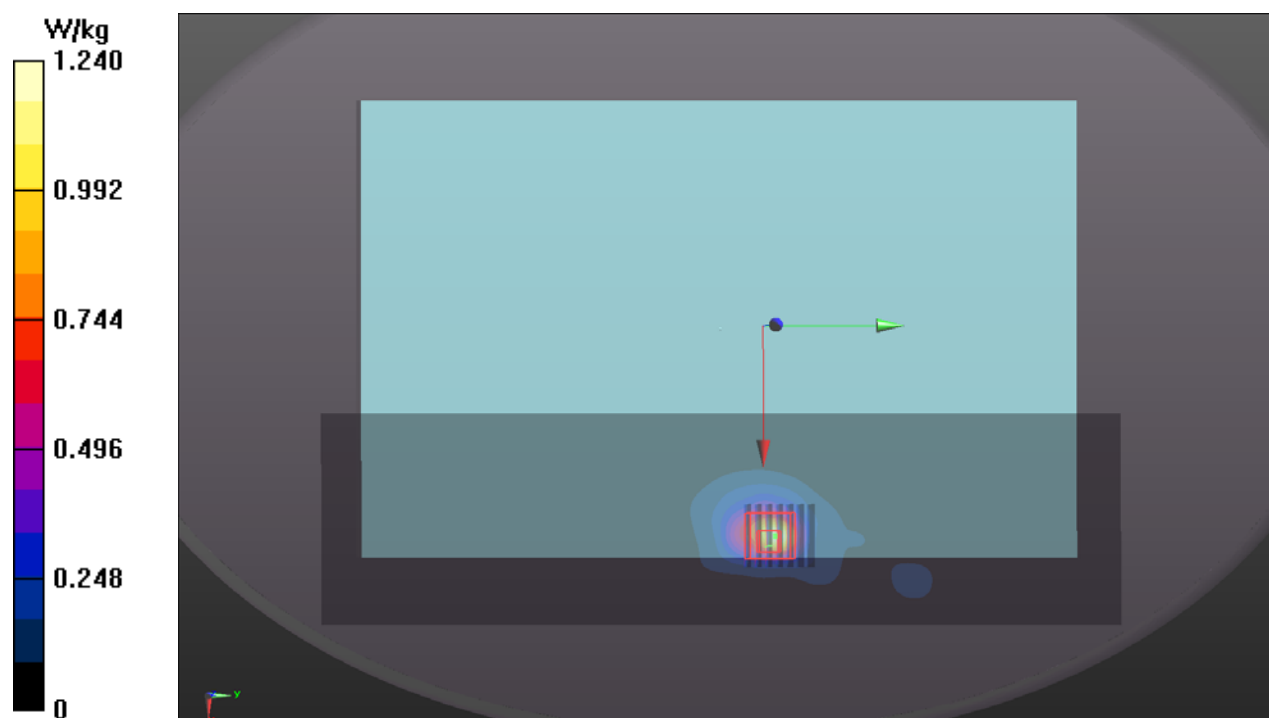
Peak SAR (extrapolated) = 1.98 W/kg

SAR(1 g) = 0.695 W/kg; SAR(10 g) = 0.301 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 7.1 mm

Ratio of SAR at M2 to SAR at M1 = 42.9%

Maximum value of SAR (measured) = 1.46 W/kg



**P57 5G NR-n66_DFT-S-
15KHz_QPSK20M_Bottom_0mm_Ch344000_1RB_OS1_Sample 1_Ant
1_Battery 4cell_P-Sensor_w**

DUT: WTW-P20100318

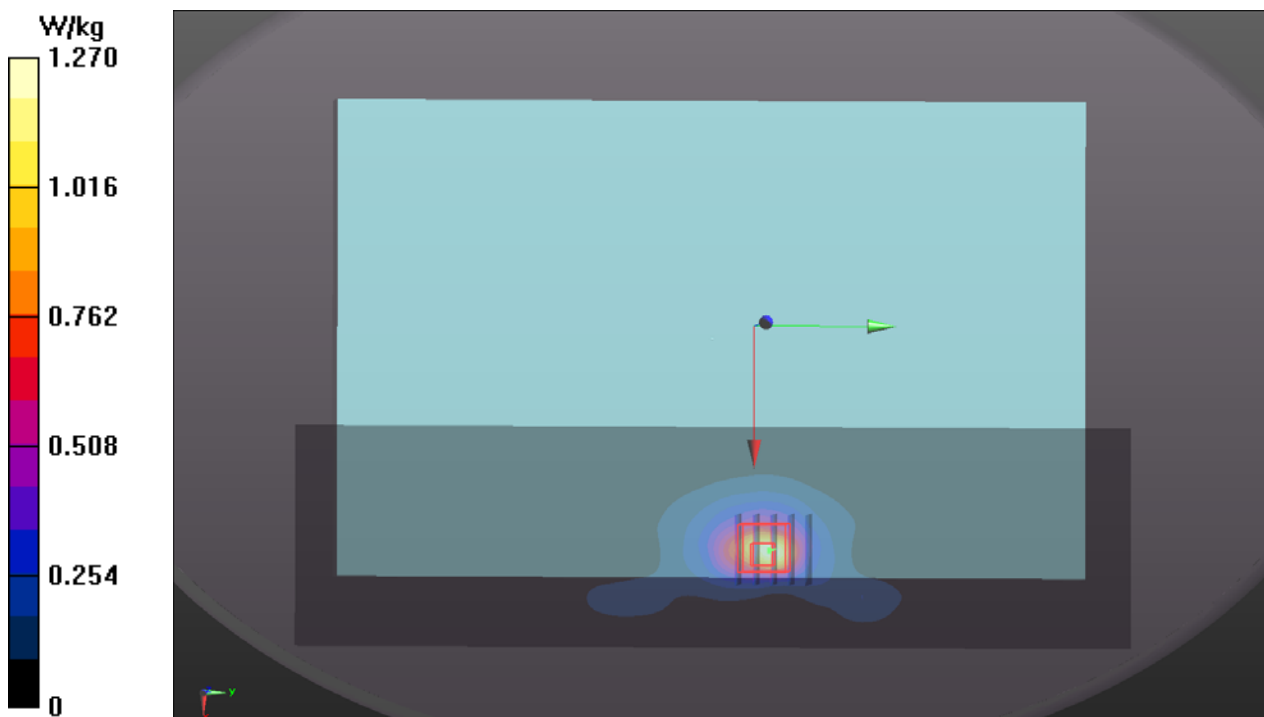
Communication System: UID 10931 - AAB, 5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz); Frequency: 1720 MHz; Duty Cycle: 1:3.56
Medium: H16T20N1_1127 Medium parameters used: $f = 1720$ MHz; $\sigma = 1.295$ S/m; $\epsilon_r = 41.029$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.8 °C ; Liquid Temperature : 23.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3971; ConvF(8.73, 8.73, 8.73) @ 1720 MHz; Calibrated: 2020/01/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn917; Calibrated: 2019/12/17
- Phantom: ELI Phantom_1206; Type: QDOVA002AA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (71x261x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.27 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.24 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.70 W/kg
SAR(1 g) = 0.749 W/kg; SAR(10 g) = 0.364 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8.6 mm
Ratio of SAR at M2 to SAR at M1 = 53.5%
Maximum value of SAR (measured) = 1.30 W/kg



P58 WLAN2.4G_802.11b_Bottom_0mm_Ch6_Sample1_Ant 1_Battery 4cell

DUT: WTW-P20100318

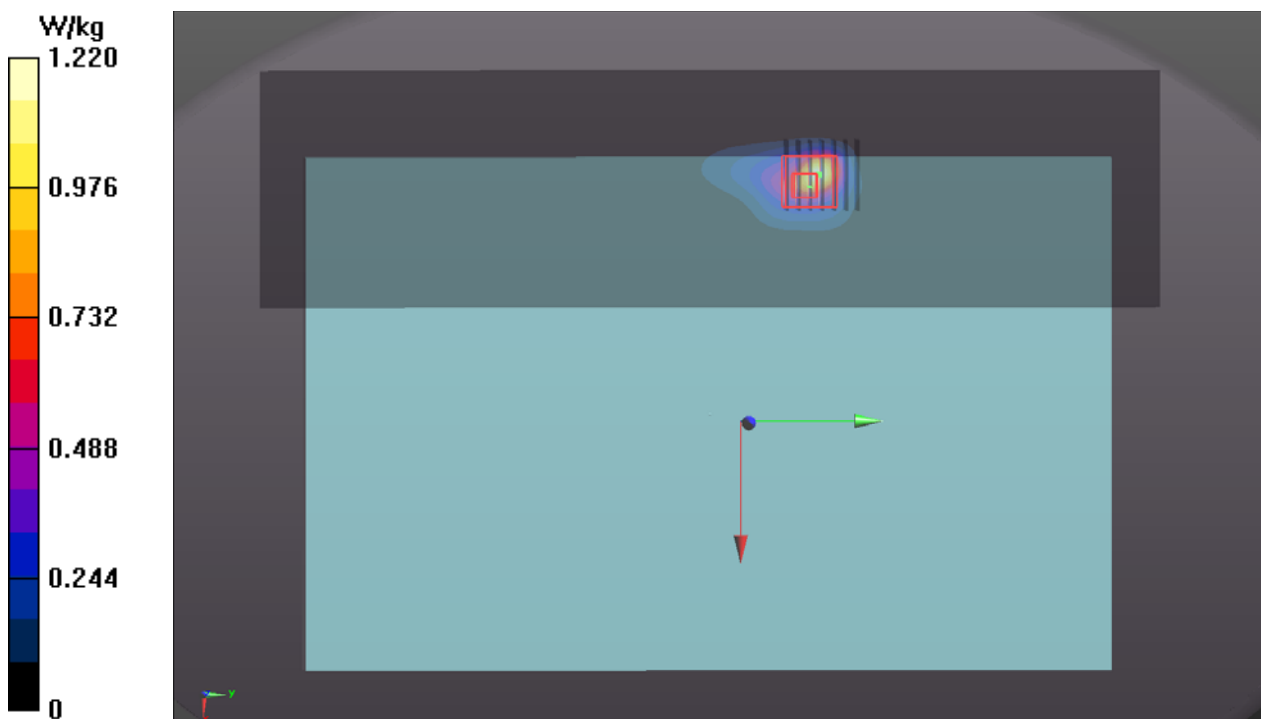
Communication System: UID 10012 - CAB, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps);
Frequency: 2437 MHz; Duty Cycle: 1:1.01
Medium: H19T27N1_1124 Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.871$ S/m;
 $\epsilon_r = 38.384$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C ; Liquid Temperature : 23.1 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7555; ConvF(7.59, 7.59, 7.59) @ 2437 MHz; Calibrated: 2020/09/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 2020/09/15
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (91x321x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.22 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.29 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 1.10 W/kg; SAR(10 g) = 0.421 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 5.8 mm
Ratio of SAR at M2 to SAR at M1 = 36.8%
Maximum value of SAR (measured) = 2.59 W/kg



P59 WLAN5.3G_802.11ac VHT160_Bottom_0mm_Ch50_Sample1_Ant 1_Battery 4cell

DUT: WTW-P20100318

Communication System: UID 10554 - AAD, IEEE 802.11ac WiFi (160MHz, MCS0); Frequency: 5250 MHz; Duty Cycle: 1:1.01

Medium: H34T60N1_1125 Medium parameters used: $f = 5250$ MHz; $\sigma = 4.682$ S/m; $\epsilon_r = 36.664$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.5 °C ; Liquid Temperature : 23.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7555; ConvF(5.41, 5.41, 5.41) @ 5250 MHz; Calibrated: 2020/09/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 2020/09/15
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (101x341x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.20 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 17.89 V/m; Power Drift = -0.08 dB

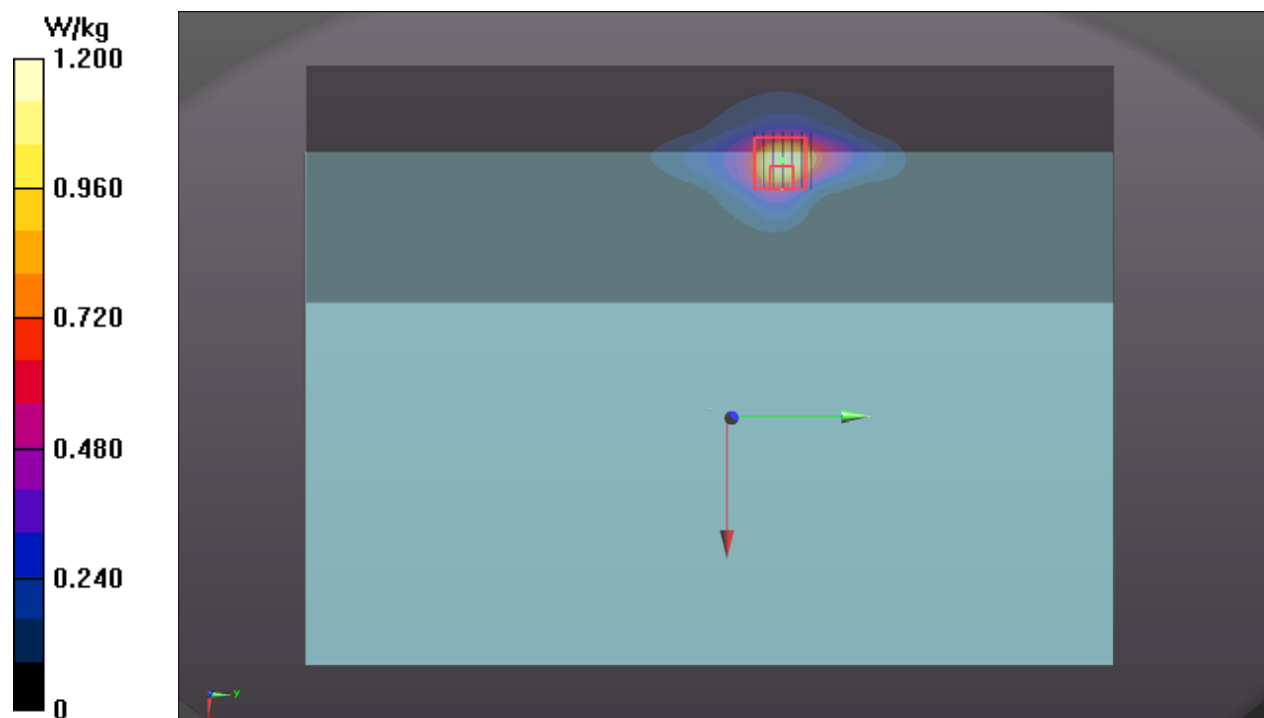
Peak SAR (extrapolated) = 4.30 W/kg

SAR(1 g) = 0.909 W/kg; SAR(10 g) = 0.271 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 6.4 mm

Ratio of SAR at M2 to SAR at M1 = 64.9%

Maximum value of SAR (measured) = 2.72 W/kg



P60 WLAN5.6G_802.11ac VHT160_Bottom_0mm_Ch114_Sample1_Ant 1_Battery 4cell

DUT: WTW-P20100318

Communication System: UID 10554 - AAD, IEEE 802.11ac WiFi (160MHz, MCS0); Frequency: 5570 MHz; Duty Cycle: 1:1.01

Medium: H34T60N1_1125 Medium parameters used: $f = 5570$ MHz; $\sigma = 4.931$ S/m; $\epsilon_r = 36.049$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.5 °C ; Liquid Temperature : 23.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7555; ConvF(4.8, 4.8, 4.8) @ 5570 MHz; Calibrated: 2020/09/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 2020/09/15
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (101x281x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.15 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 15.11 V/m; Power Drift = -0.05 dB

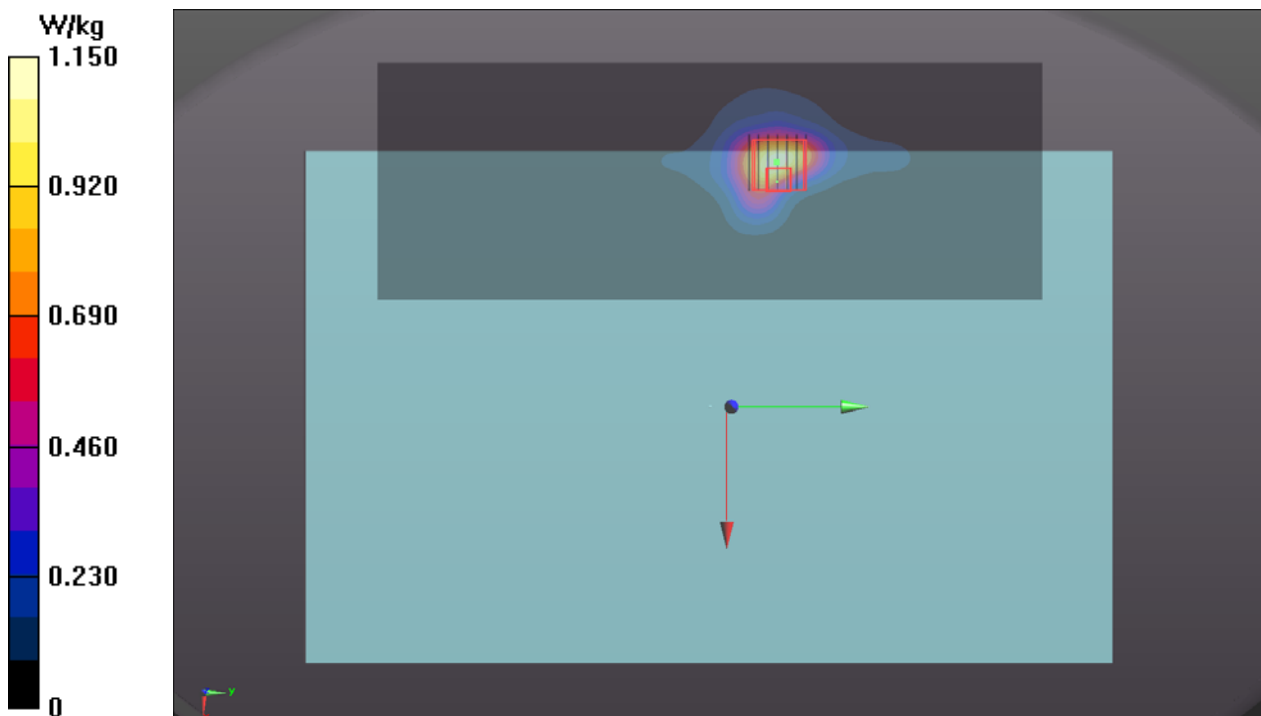
Peak SAR (extrapolated) = 4.82 W/kg

SAR(1 g) = 0.864 W/kg; SAR(10 g) = 0.246 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 4.7 mm

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

Maximum value of SAR (measured) = 2.52 W/kg



P61 WLAN5.8G_802.11ac VHT80_Bottom_0mm_Ch155_Sample1_Ant 1_Battery 4cell

DUT: WTW-P20100318

Communication System: UID 10544 - AAC, IEEE 802.11ac WiFi (80MHz, MCS0); Frequency: 5775 MHz; Duty Cycle: 1:1.03

Medium: H34T60N1_1125 Medium parameters used: $f = 5775$ MHz; $\sigma = 5.072$ S/m; $\epsilon_r = 36.114$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.4 °C ; Liquid Temperature : 23.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7472; ConvF(5.25, 5.25, 5.25) @ 5775 MHz; Calibrated: 2020/08/24
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1585; Calibrated: 2020/05/28
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (101x281x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.20 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 15.80 V/m; Power Drift = -0.08 dB

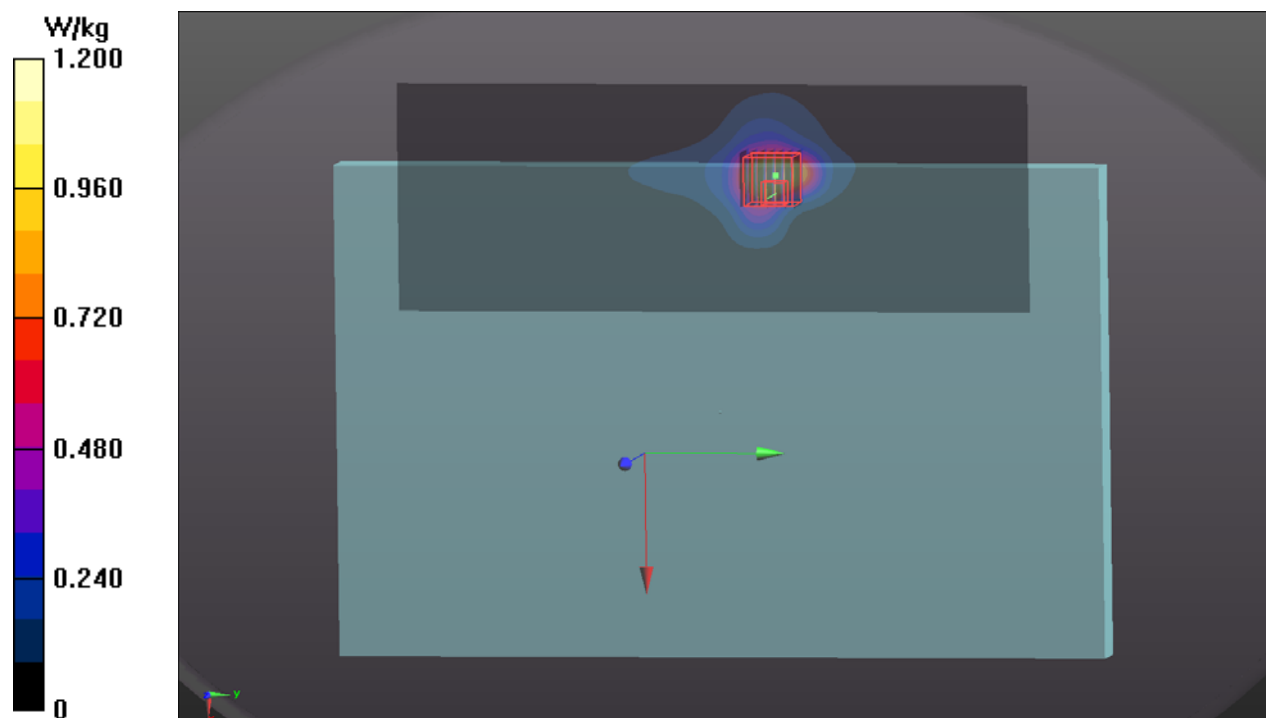
Peak SAR (extrapolated) = 4.07 W/kg

SAR(1 g) = 0.766 W/kg; SAR(10 g) = 0.248 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 5.1 mm

Ratio of SAR at M2 to SAR at M1 = 64.8%

Maximum value of SAR (measured) = 2.29 W/kg



P62 BT_BDR_Bottom_0mm_Ch0_Sample1_Ant 1_Battery 4cell

DUT: WTW-P20100318

Communication System: UID 10032 - CAA, IEEE 802.15.1 Bluetooth (GFSK, DH5); Frequency: 2402 MHz; Duty Cycle: 1:1.3

Medium: H19T27N1_1124 Medium parameters used (interpolated): $f = 2402$ MHz; $\sigma = 1.835$ S/m;

$\epsilon_r = 38.543$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.4 °C ; Liquid Temperature : 23.1 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7555; ConvF(7.59, 7.59, 7.59) @ 2402 MHz; Calibrated: 2020/09/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 2020/09/15
- Phantom: ELI Phantom_1039; Type: QDOVA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Area Scan (91x321x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.251 W/kg

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

Reference Value = 10.93 V/m; Power Drift = -0.07 dB

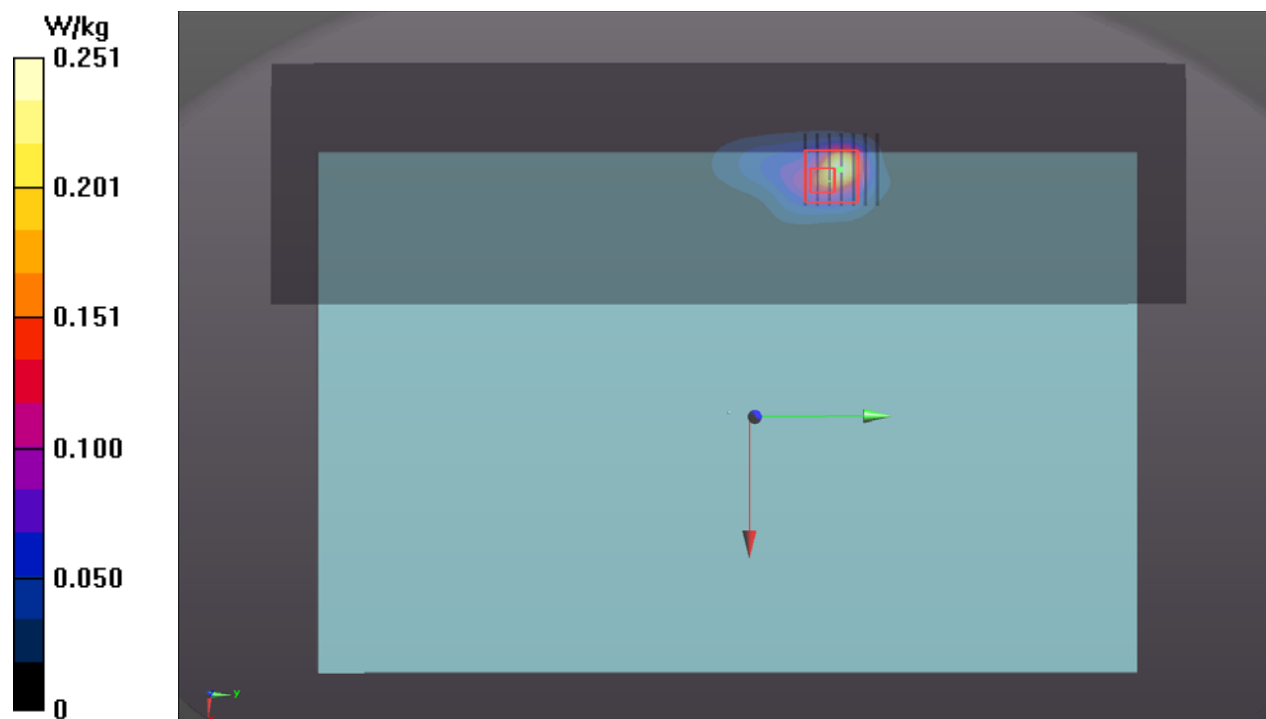
Peak SAR (extrapolated) = 0.677 W/kg

SAR(1 g) = 0.133 W/kg; SAR(10 g) = 0.049 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 5.7 mm

Ratio of SAR at M2 to SAR at M1 = 37.7%

Maximum value of SAR (measured) = 0.491 W/kg



Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.



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 **B.V. ADT (Auden)**

Certificate No: **D750V3-1013_Aug20**

CALIBRATION CERTIFICATE

Object **D750V3 - SN:1013**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **August 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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
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:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 14, 2020

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



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:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.4
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	42.4 ± 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	2.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.48 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.53 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.0 Ω - 0.8 j Ω
Return Loss	- 30.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.036 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 13.08.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1013

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

Medium parameters used: $f = 750$ MHz; $\sigma = 0.91$ S/m; $\epsilon_r = 42.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.97, 9.97, 9.97) @ 750 MHz; Calibrated: 29.06.2020
- 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 = 59.14 V/m; Power Drift = -0.06 dB

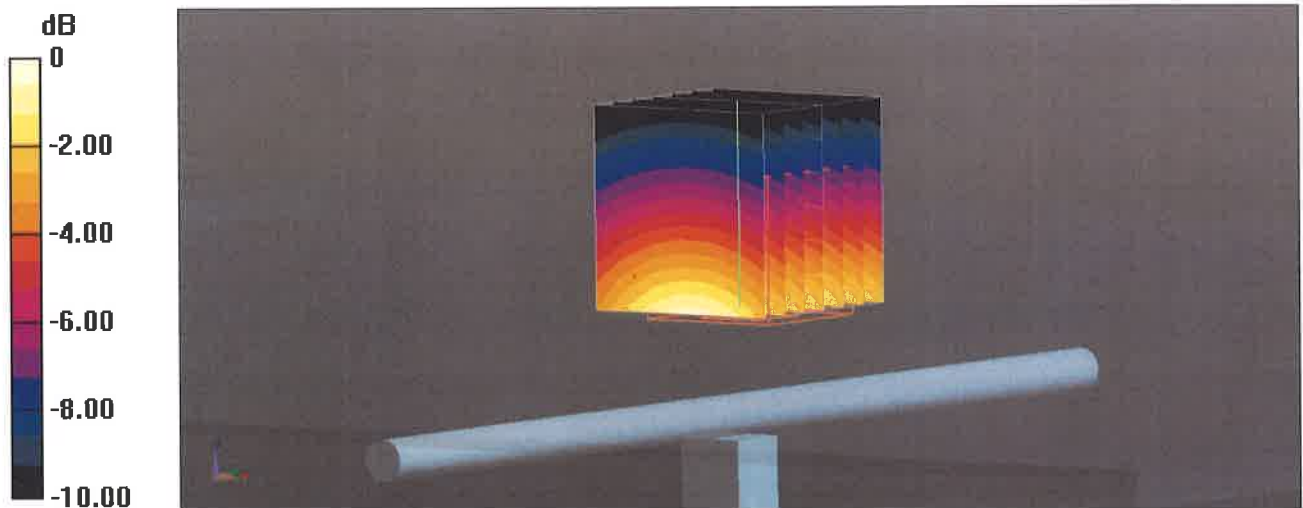
Peak SAR (extrapolated) = 3.22 W/kg

SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.4 W/kg

Smallest distance from peaks to all points 3 dB below = 17 mm

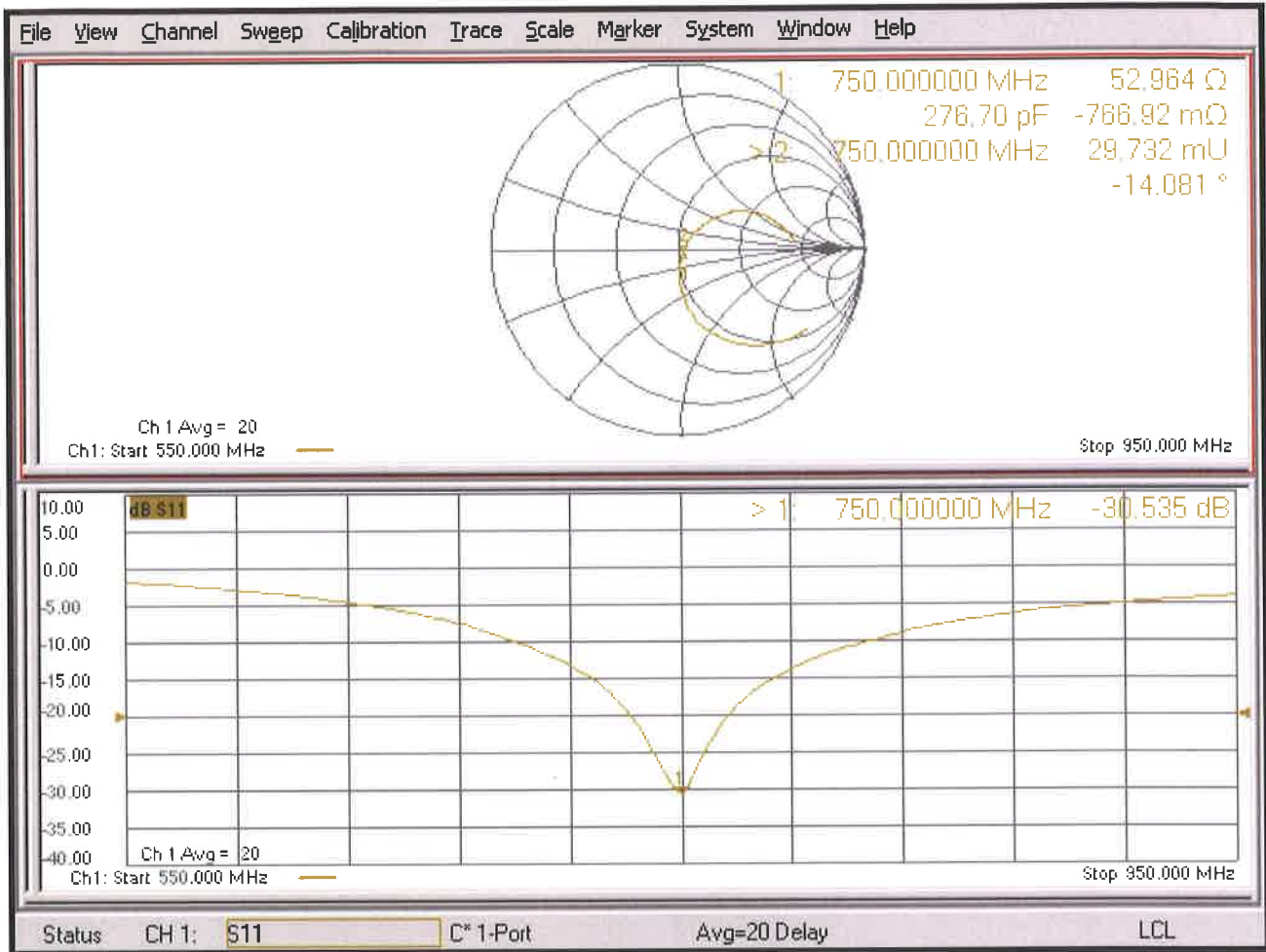
Ratio of SAR at M2 to SAR at M1 = 66.8%

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



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

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D835V2-4d121_Aug20**

CALIBRATION CERTIFICATE

Object **D835V2 - SN:4d121**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **August 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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
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

Calibrated by: **Jeffrey Katzman** Name: Jeffrey Katzman Function: Laboratory Technician

Signature:

Approved by: **Katja Pokovic** Name: Katja Pokovic Function: Technical Manager

Signature:

Issued: August 14, 2020

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



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	42.2 ± 6 %	0.93 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	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.52 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (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	6.21 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω - 3.4 j Ω
Return Loss	- 29.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.394 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 13.08.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d121

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.93$ S/m; $\epsilon_r = 42.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 29.06.2020
- 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 = 62.61 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.60 W/kg

SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.58 W/kg

Smallest distance from peaks to all points 3 dB below = 17 mm

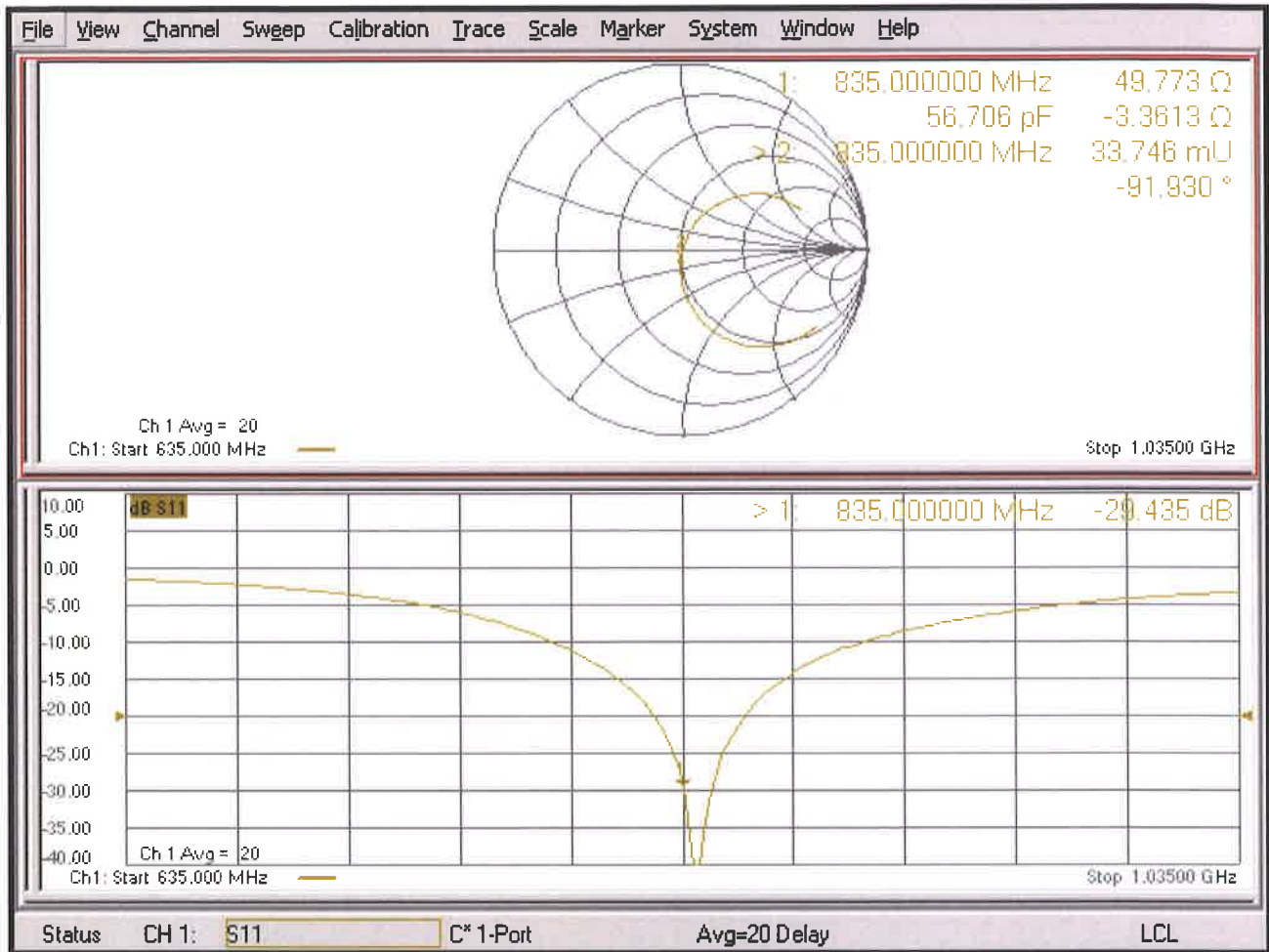
Ratio of SAR at M2 to SAR at M1 = 67.5%

Maximum value of SAR (measured) = 3.21 W/kg



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

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D1750V2-1055_Aug20**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN:1055**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **August 14, 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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
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

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: August 14, 2020

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



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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	40.4 \pm 6 %	1.35 mho/m \pm 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	8.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.0 W/kg \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.69 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	18.9 W/kg \pm 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.3 Ω + 0.8 j Ω
Return Loss	- 41.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.223 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 14.08.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1055

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.35$ S/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.58, 8.58, 8.58) @ 1750 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 105.6 V/m; Power Drift = -0.03 dB

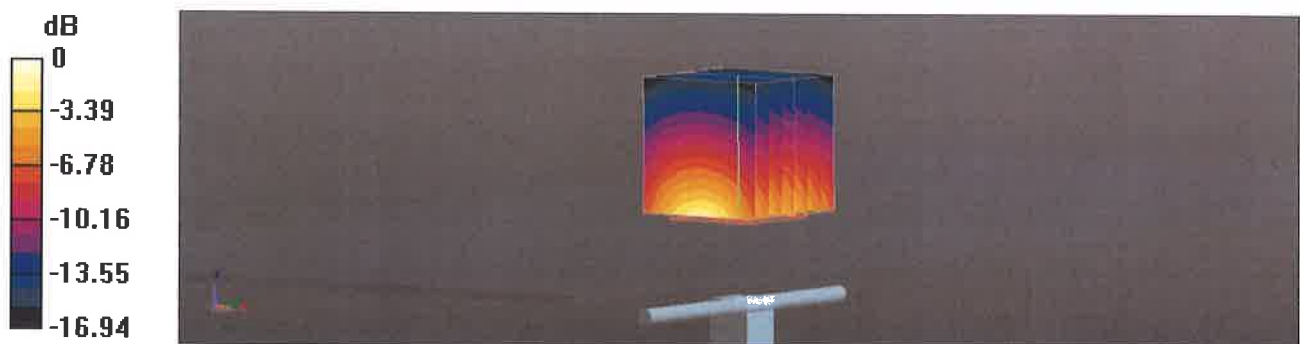
Peak SAR (extrapolated) = 16.6 W/kg

SAR(1 g) = 8.89 W/kg; SAR(10 g) = 4.69 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

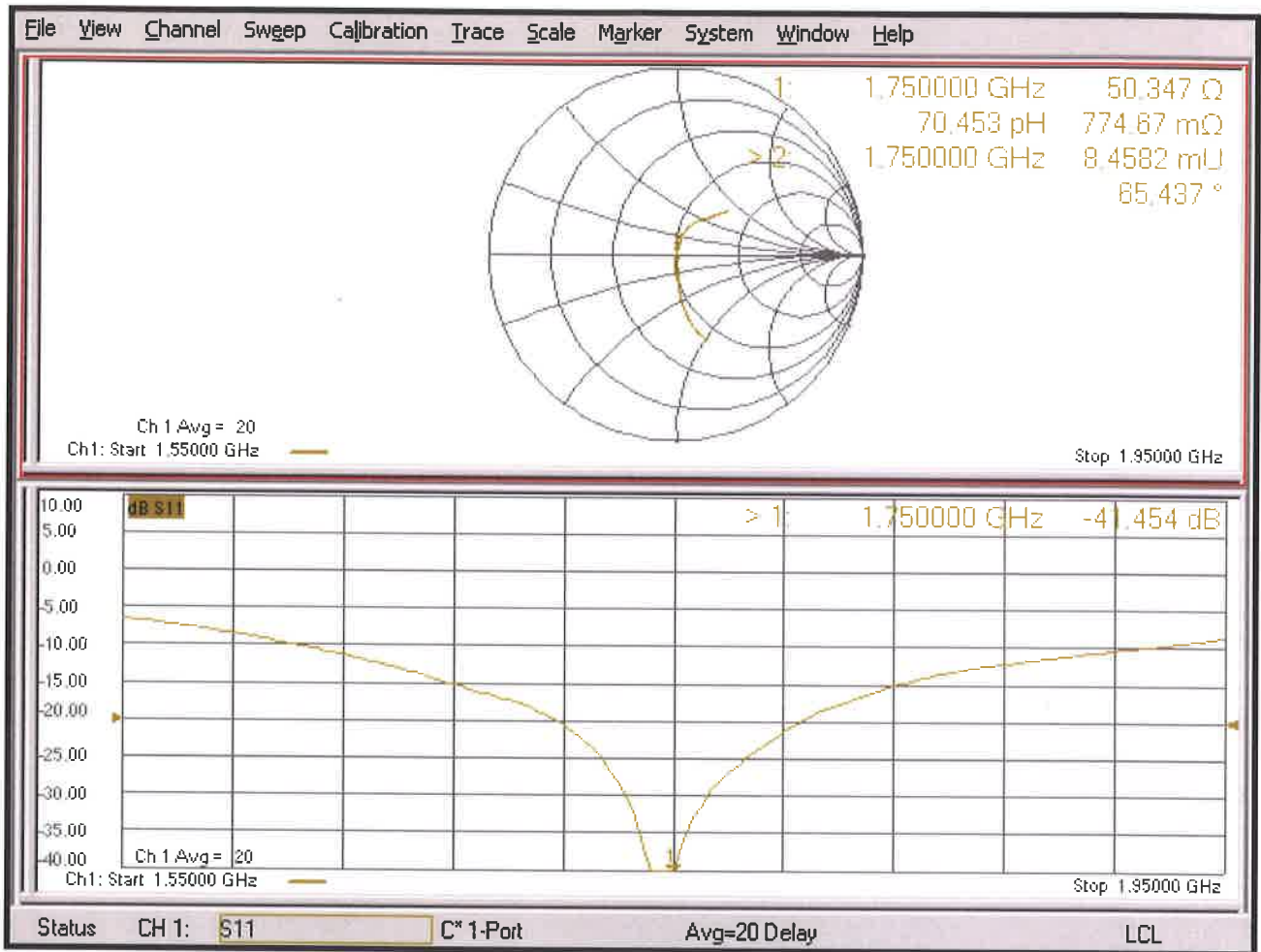
Ratio of SAR at M2 to SAR at M1 = 54%

Maximum value of SAR (measured) = 13.9 W/kg



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

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D1900V2-5d036_Jan20**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d036**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **January 21, 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

Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	

Issued: January 22, 2020

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



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:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	41.4 \pm 6 %	1.39 mho/m \pm 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	9.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.3 W/kg \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.9 W/kg \pm 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω + 5.4 j Ω
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 21.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d036

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.39$ S/m; $\epsilon_r = 41.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.6, 8.6, 8.6) @ 1900 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

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

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

Reference Value = 109.0 V/m; Power Drift = 0.02 dB

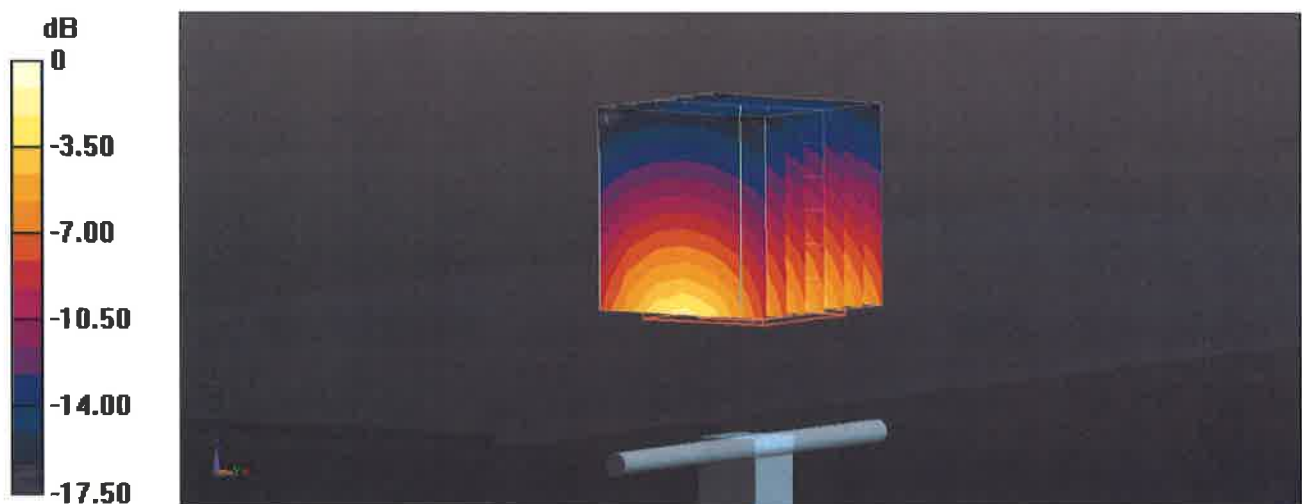
Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 9.95 W/kg; SAR(10 g) = 5.18 W/kg

Smallest distance from peaks to all points 3 dB below = 9.8 mm

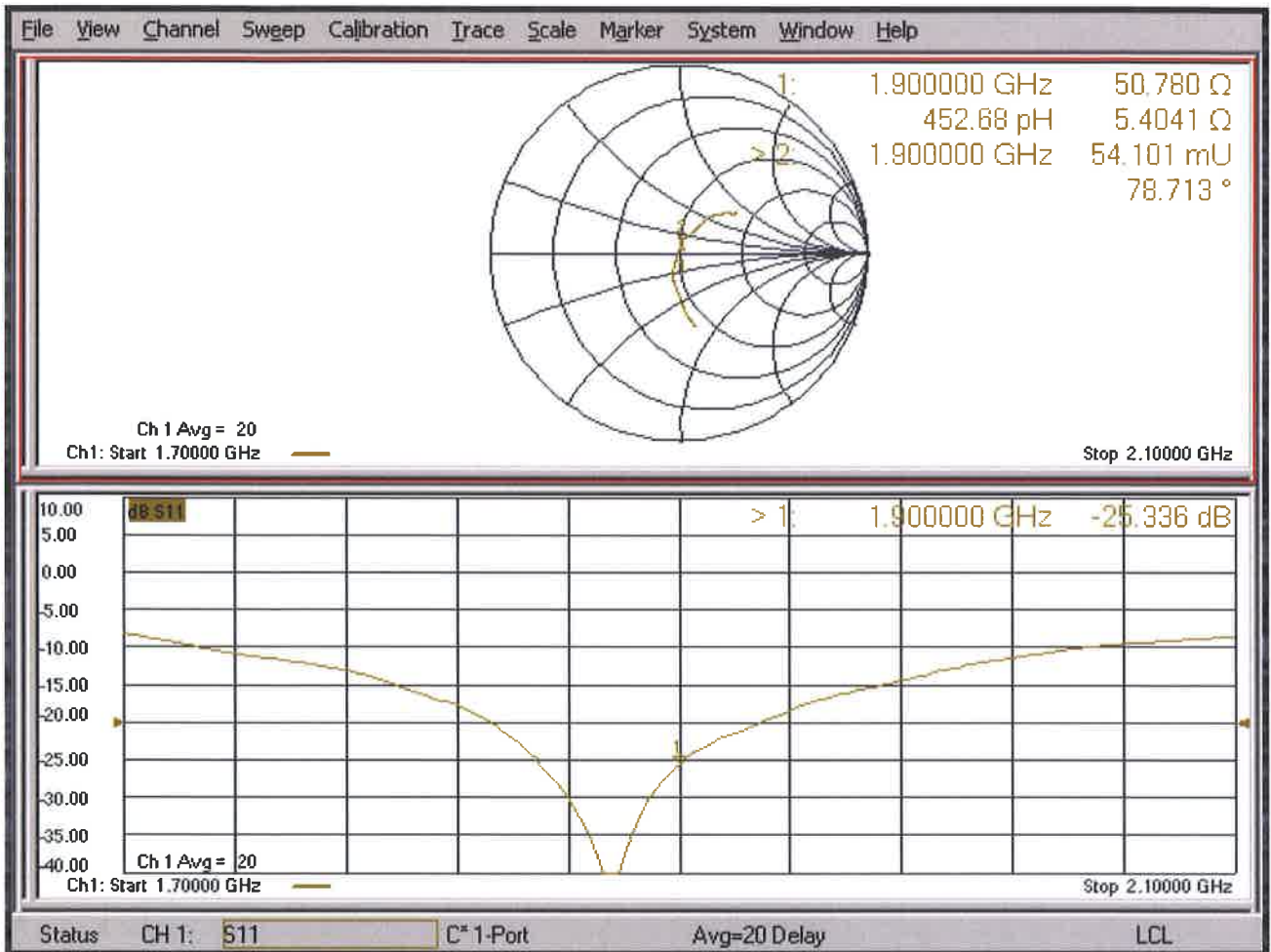
Ratio of SAR at M2 to SAR at M1 = 54.4%

Maximum value of SAR (measured) = 15.5 W/kg



0 dB = 15.5 W/kg = 11.90 dBW/kg

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D2300V2-1004_Jan20**

CALIBRATION CERTIFICATE

Object **D2300V2 - SN:1004**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **January 21, 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

Calibrated by: **Claudio Leubler** Laboratory Technician

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: January 22, 2020

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



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:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2300 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.8 \pm 6 %	1.70 mho/m \pm 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	12.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	48.8 W/kg \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg \pm 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.3 Ω - 2.6 j Ω
Return Loss	- 28.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 21.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1004

Communication System: UID 0 - CW; Frequency: 2300 MHz

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.7$ S/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.15, 8.15, 8.15) @ 2300 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

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

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

Reference Value = 115.8 V/m; Power Drift = -0.00 dB

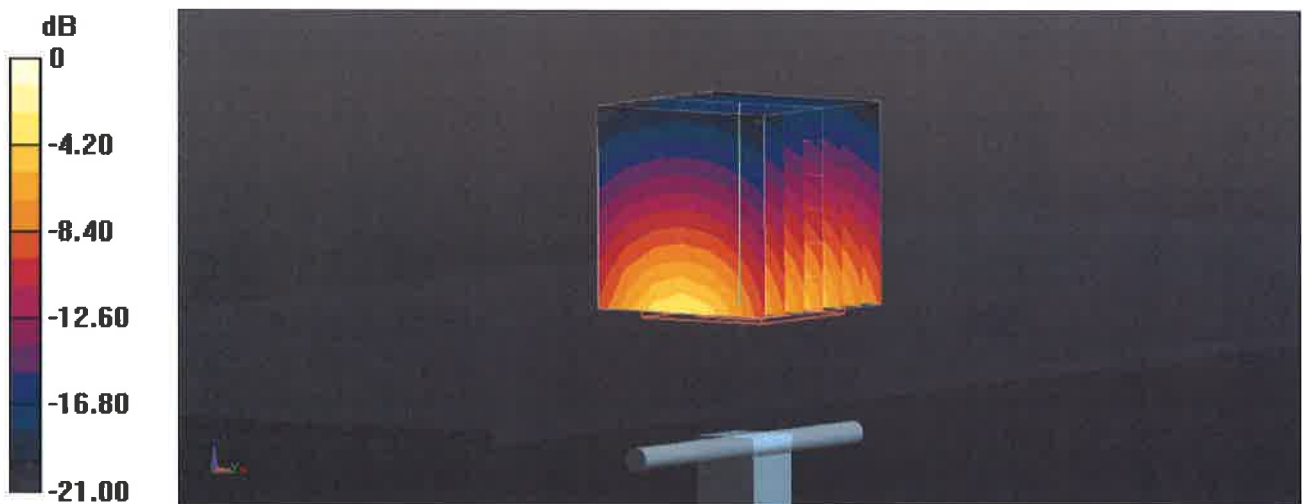
Peak SAR (extrapolated) = 23.8 W/kg

SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.85 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

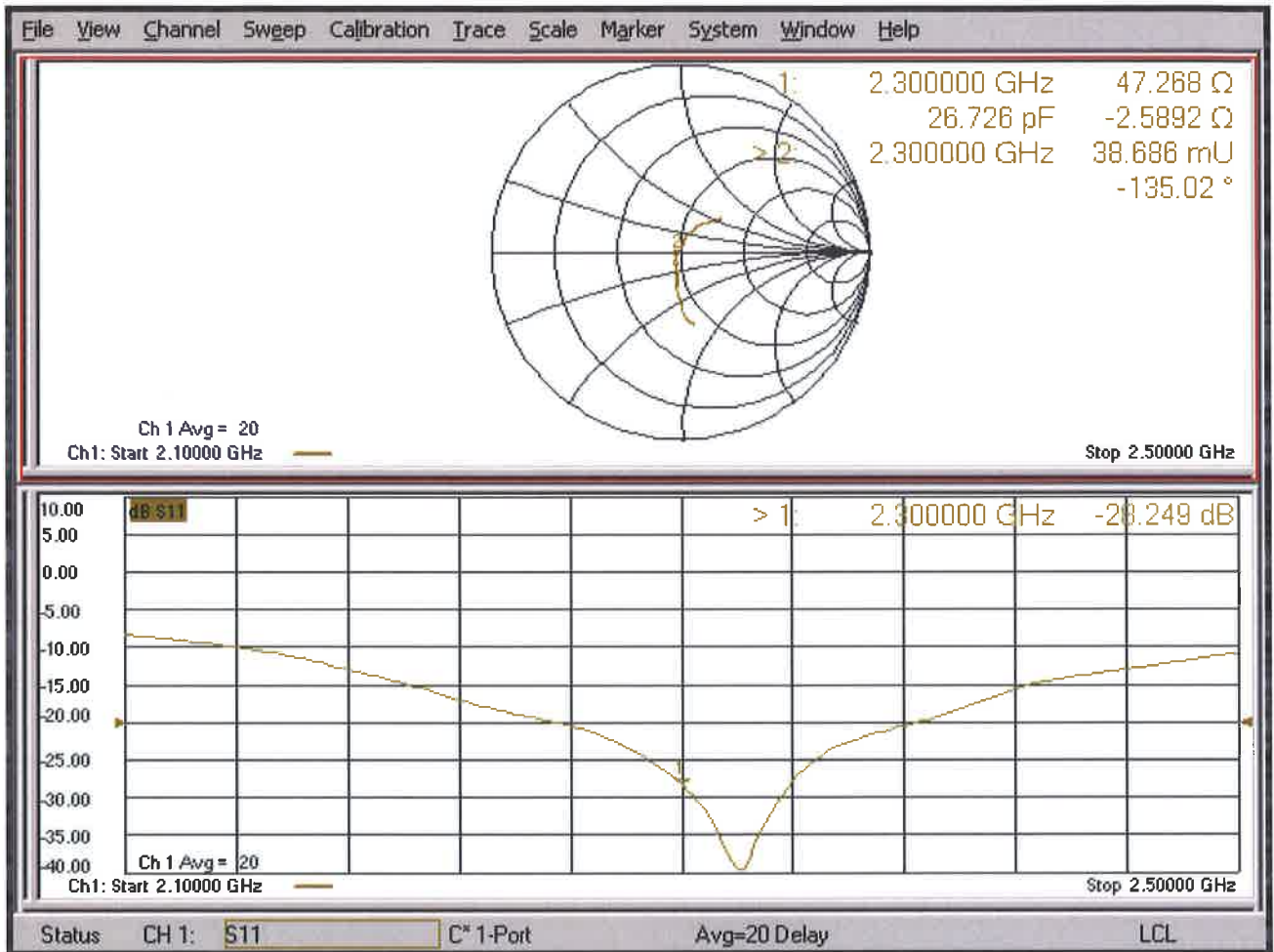
Ratio of SAR at M2 to SAR at M1 = 52%

Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D2450V2-737_Aug20**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:737**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **August 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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
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

Calibrated by: **Jeffrey Katzman** **Jeffrey Katzman** **Laboratory Technician**

Approved by: **Katja Pokovic** **Katja Pokovic** **Technical Manager**

Signature

Issued: August 14, 2020

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



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.6 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.3 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.8 Ω + 4.7 j Ω
Return Loss	- 23.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 13.08.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:737

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ S/m; $\epsilon_r = 38.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.74, 7.74, 7.74) @ 2450 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 114.4 V/m; Power Drift = -0.09 dB

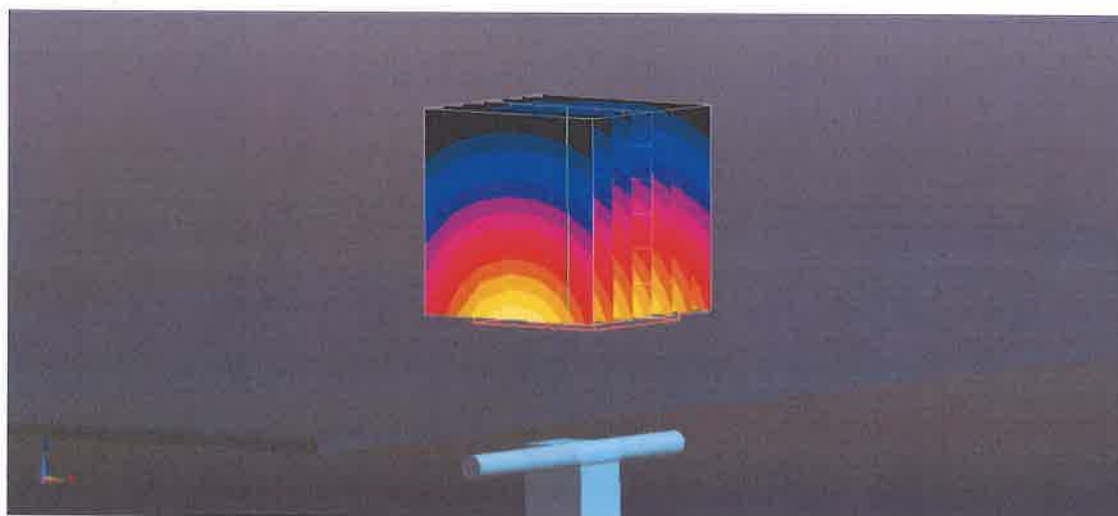
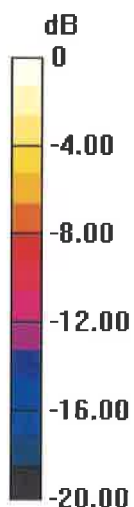
Peak SAR (extrapolated) = 25.6 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.12 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

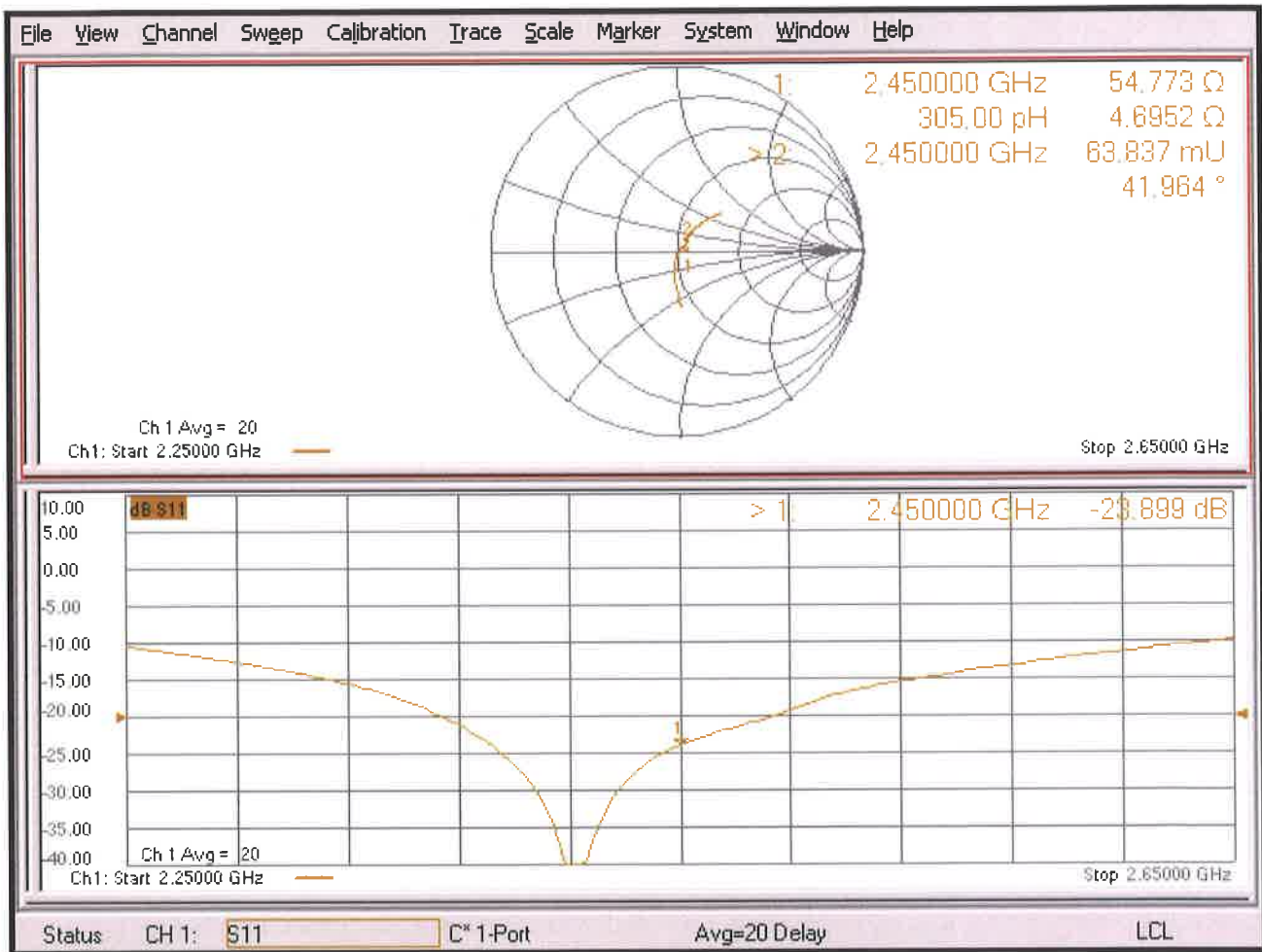
Ratio of SAR at M2 to SAR at M1 = 51.2%

Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.27 dBW/kg

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D2600V2-1020_Aug20**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN:1020**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **August 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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
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

Calibrated by:	Name Jeffrey Katzman	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature

Issued: August 14, 2020

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



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%.

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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	38.3 \pm 6 %	2.01 mho/m \pm 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.5 W/kg \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.0 W/kg \pm 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.1 Ω - 5.4 j Ω
Return Loss	- 24.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 13.08.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1020

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.01$ S/m; $\epsilon_r = 38.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.54, 7.54, 7.54) @ 2600 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 117.5 V/m; Power Drift = -0.07 dB

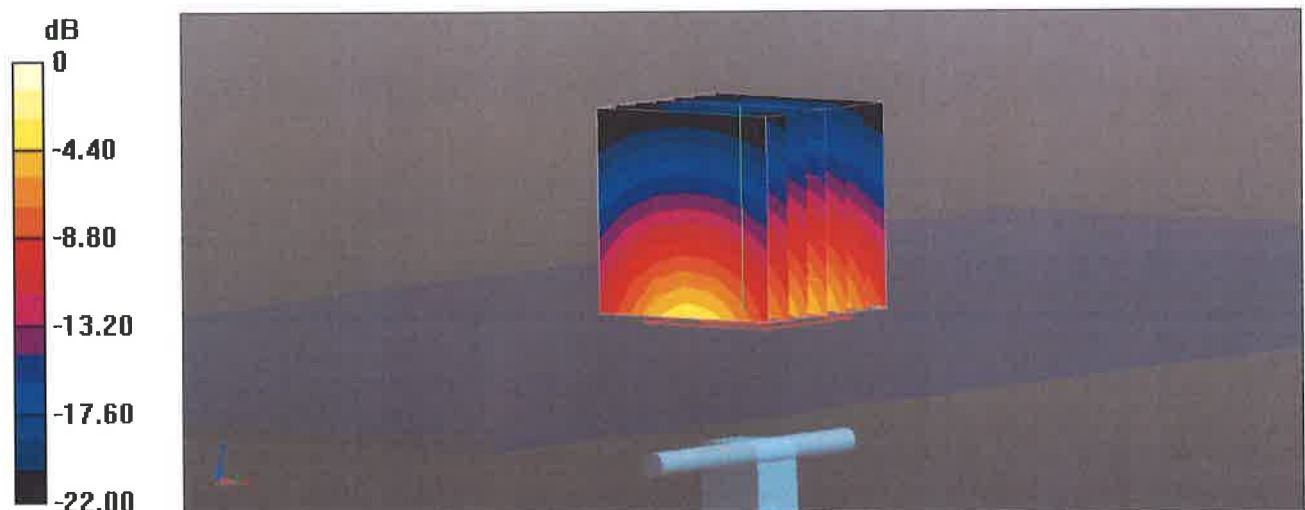
Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.30 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

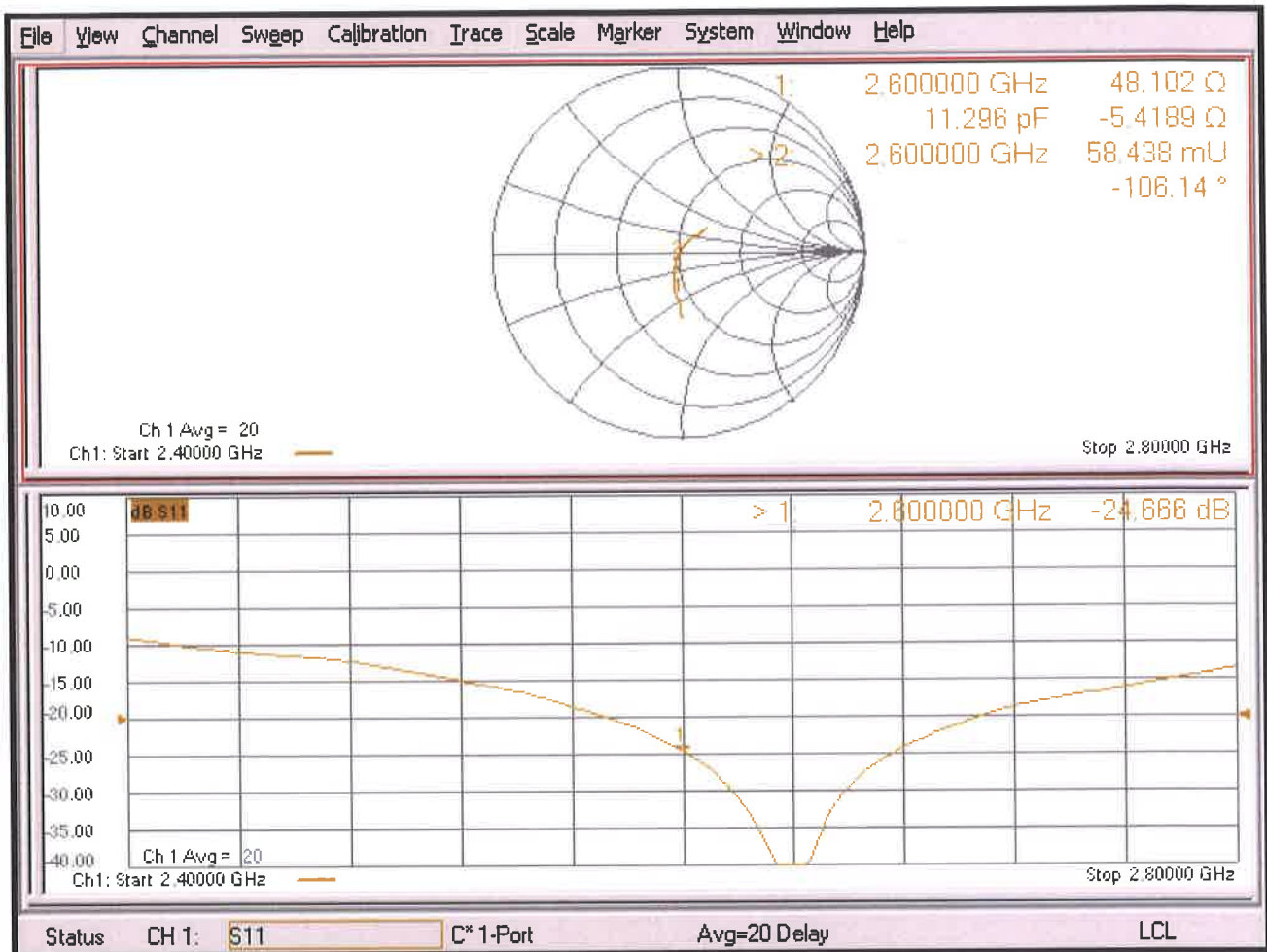
Ratio of SAR at M2 to SAR at M1 = 50.2%

Maximum value of SAR (measured) = 23.2 W/kg



0 dB = 23.2 W/kg = 13.65 dBW/kg

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D3500V2-1007_Feb20**

CALIBRATION CERTIFICATE

Object **D3500V2 - SN:1007**

Calibration procedure(s) **QA CAL-22.v4
Calibration Procedure for SAR Validation Sources between 3-6 GHz**

Calibration date: **February 25, 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: 3503	31-Dec-19 (No. EX3-3503_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:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 26, 2020

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



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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3500 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.4 ± 6 %	2.91 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	100 mW input power	6.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.0 Ω - 5.4 j Ω
Return Loss	- 23.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.138 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 25.02.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1007

Communication System: UID 0 - CW; Frequency: 3500 MHz

Medium parameters used: $f = 3500$ MHz; $\sigma = 2.91$ S/m; $\epsilon_r = 37.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.25 V/m; Power Drift = -0.07 dB

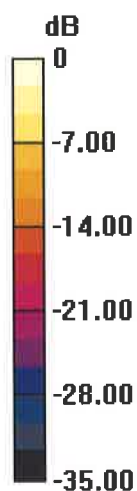
Peak SAR (extrapolated) = 18.5 W/kg

SAR(1 g) = 6.76 W/kg; SAR(10 g) = 2.53 W/kg

Smallest distance from peaks to all points 3 dB below = 8.4 mm

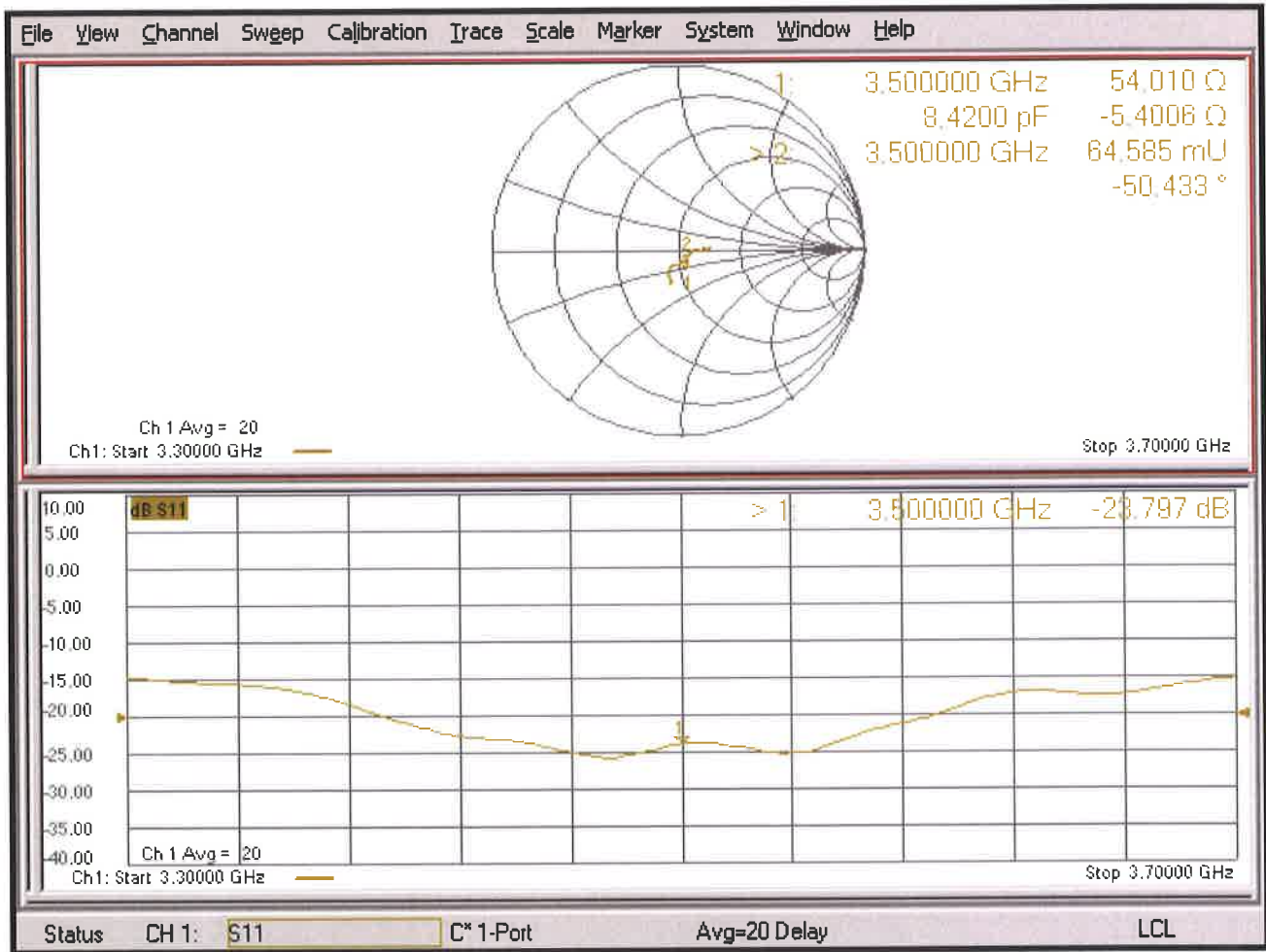
Ratio of SAR at M2 to SAR at M1 = 74.5%

Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 11.07 dBW/kg

Impedance Measurement Plot for Head TSL





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 **Auden**

Certificate No: **D3700V2-1074_May20**

CALIBRATION CERTIFICATE

Object **D3700V2 - SN:1074**

Calibration procedure(s) **QA CAL-22.v4
Calibration Procedure for SAR Validation Sources between 3-6 GHz**

Calibration date: **May 04, 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 $(22 \pm 3)^\circ\text{C}$ 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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 3503	31-Dec-19 (No. EX3-3503_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

Calibrated by: **Jeton Kastrati** Name: **Jeton Kastrati** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature

Issued: May 5, 2020

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



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3700 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	36.7 \pm 6 %	3.05 mho/m \pm 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	100 mW input power	6.66 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	66.5 W/kg \pm 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg \pm 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	43.2 Ω + 1.1 j Ω
Return Loss	- 22.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.138 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 04.05.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1074

Communication System: UID 0 - CW; Frequency: 3700 MHz

Medium parameters used: $f = 3700$ MHz; $\sigma = 3.05$ S/m; $\epsilon_r = 36.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.57 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 19.0 W/kg

SAR(1 g) = 6.66 W/kg; SAR(10 g) = 2.4 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

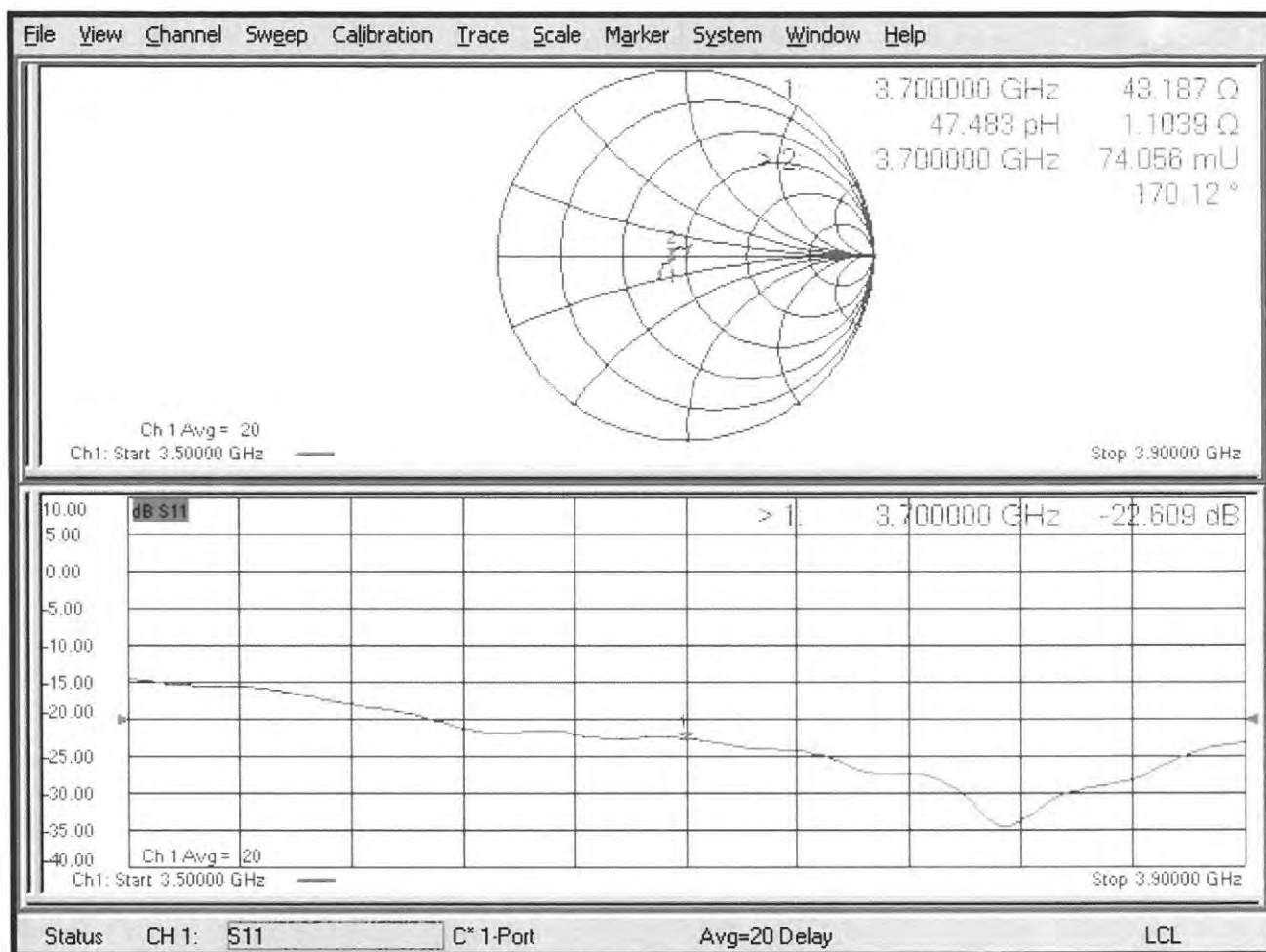
Ratio of SAR at M2 to SAR at M1 = 73%

Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **D5GHzV2-1019_Mar20**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1019**

Calibration procedure(s) **QA CAL-22.v4
Calibration Procedure for SAR Validation Sources between 3-6 GHz**

Calibration date: **March 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: 3503	31-Dec-19 (No. EX3-3503_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

Calibrated by: **Jeton Kastrati** **Function: Laboratory Technician** **Signature:**

Approved by: **Katja Pokovic** **Technical Manager**

Issued: March 13, 2020

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz 5850 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.49 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.03 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.7 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	4.99 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5850 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.2	5.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	5.10 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5850 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	54.6 Ω - 5.1 j Ω
Return Loss	- 23.7 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	58.1 Ω - 1.2 j Ω
Return Loss	- 22.4 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	58.4 Ω + 3.9 j Ω
Return Loss	- 21.3 dB

Antenna Parameters with Head TSL at 5850 MHz

Impedance, transformed to feed point	55.8 Ω + 0.6 j Ω
Return Loss	- 25.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 13.03.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1019

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5850 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.49$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5600$ MHz; $\sigma = 4.84$ S/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5750$ MHz; $\sigma = 4.99$ S/m; $\epsilon_r = 34.2$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5850$ MHz; $\sigma = 5.1$ S/m; $\epsilon_r = 34.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz, ConvF(4.99, 4.99, 4.99) @ 5850 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 77.45 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 27.9 W/kg

SAR(1 g) = 8.03 W/kg; SAR(10 g) = 2.30 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 69.7%

Maximum value of SAR (measured) = 17.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 77.30 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 31.9 W/kg

SAR(1 g) = 8.45 W/kg; SAR(10 g) = 2.39 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

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

Maximum value of SAR (measured) = 19.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 75.26 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 32.0 W/kg

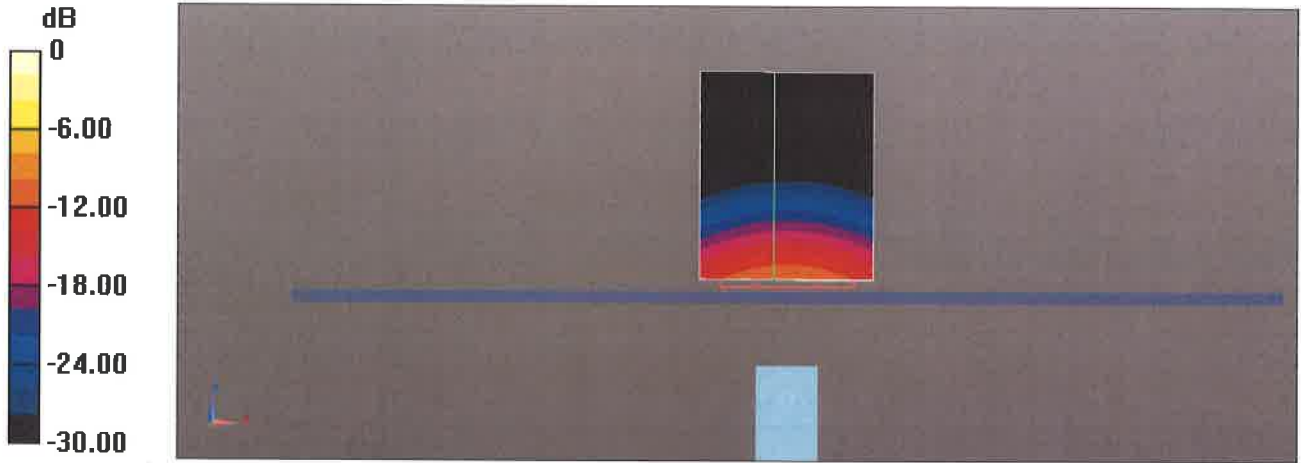
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.30 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 65.4%

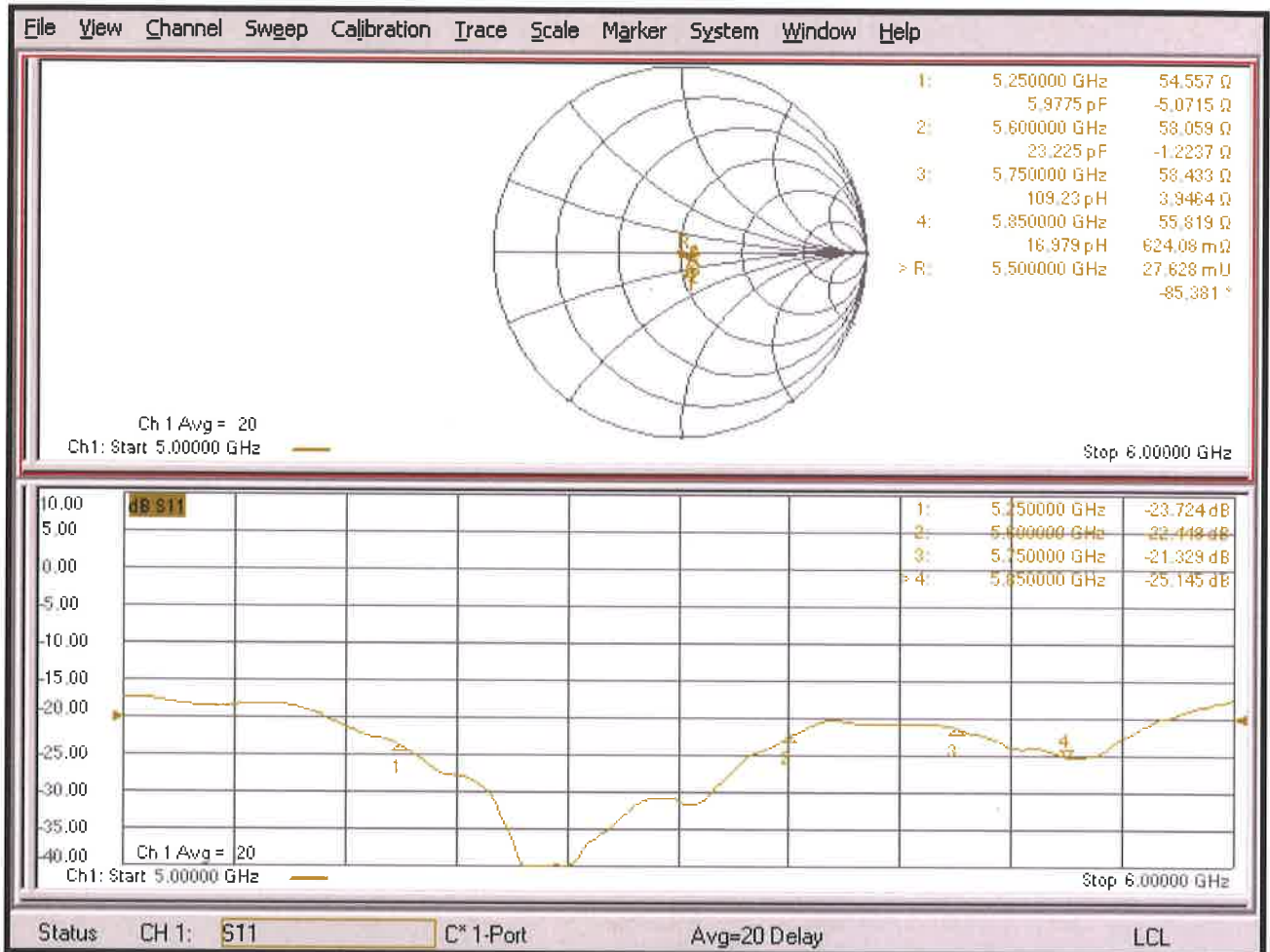
Maximum value of SAR (measured) = 19.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5850 MHz/Zoom Scan, dist=1.4mm
(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.08 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 33.4 W/kg
SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.33 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 64.7%
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg = 12.88 dBW/kg

Impedance Measurement Plot for Head TSL





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 **B.V. ADT (Auden)**

Certificate No: **EX3-3650_Mar20**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3650**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v5, QA CAL-23.v5,
QA CAL-25.v7
Calibration procedure for dosimetric E-field probes**

Calibration date: **March 25, 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: S5277 (20x)	04-Apr-19 (No. 217-02894)	Apr-20
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 27, 2020

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