

Appendix A

Detailed System Validation Results

1. System Performance Check
System Performance Check 835 MHz Head
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Date: 2019-06-24

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Head 835MHz

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: 4d166

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835$ MHz; $\sigma = 0.887$ S/m; $\epsilon_r = 40.842$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(9.46, 9.46, 9.46); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASYS 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/Pin=250 mW, dist=15 mm (EX-Probe)/Area Scan (7x12x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm
Maximum value of SAR (measured) = 2.87 W/kg

Body/Pin=250 mW, dist=15 mm (EX-Probe)/Zoom Scan (7x7x7)

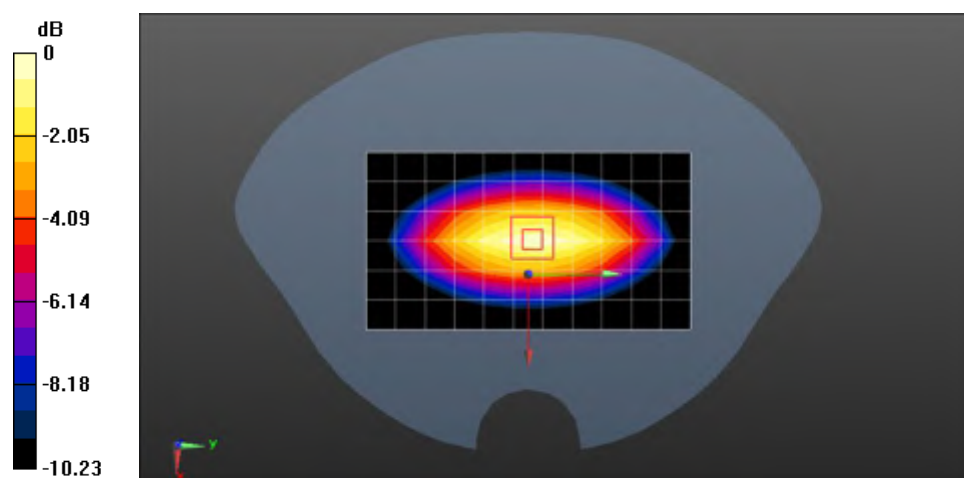
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 58.61 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.46 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (measured) = 2.95 W/kg



0 dB = 2.95 W/kg = 4.70 dBW/kg

Date: 2019-06-24

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Body 835MHz

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: 4d166

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835$ MHz; $\sigma = 1.012$ S/m; $\epsilon_r = 54.425$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(9.33, 9.33, 9.33); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/dist=15mm, Pin=250 mW(EX-Probe)/Area Scan (7x12x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm
Maximum value of SAR (measured) = 3.54 W/kg

Body/dist=15mm, Pin=250 mW(EX-Probe)/Zoom Scan (7x7x7)

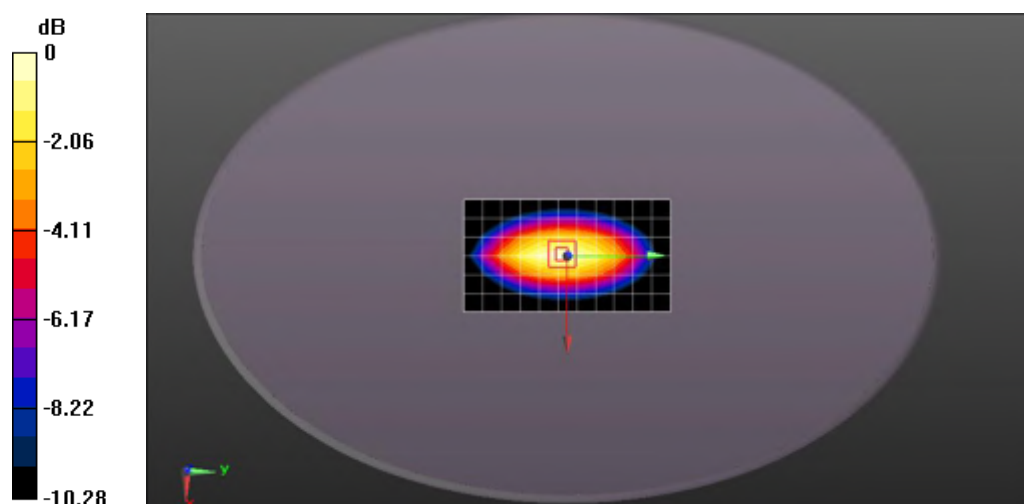
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 60.91 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 4.20 W/kg

SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.64 W/kg

Maximum value of SAR (measured) = 3.56 W/kg



0 dB = 3.56 W/kg = 5.51 dBW/kg

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Head 1800MHz

DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:2d052

Communication System: UID 10000, CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1800$ MHz; $\sigma = 1.367$ S/m; $\epsilon_r = 40.307$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(8, 8, 8); Calibrated: 2019-05-24;
- Sensor-Surface: 3mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250 mW,(EX-Probe)/Area Scan (7x7x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 9.09 W/kg

Body/d=10mm, Pin=250 mW,(EX-Probe)/Zoom Scan (7x7x7)

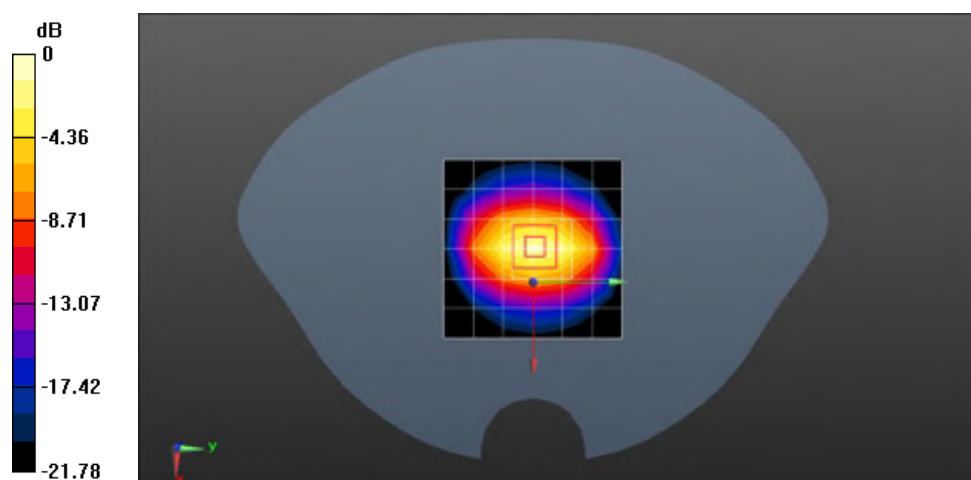
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 81.94 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 17.4 W/kg

SAR(1 g) = 8.99 W/kg; SAR(10 g) = 4.91 W/kg

Maximum value of SAR (measured) = 10.6 W/kg



0 dB = 10.6 W/kg = 10.25 dBW/kg

Date: 2019-06-23

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Body 1800MHz

DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:2d052

Communication System: UID 10000, CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1800$ MHz; $\sigma = 1.481$ S/m; $\epsilon_r = 51.142$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.81, 7.81, 7.81); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) (23.6 dBm)/Area

Scan (7x7x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 13.5 W/kg

Body/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) (23.6 dBm)/Zoom

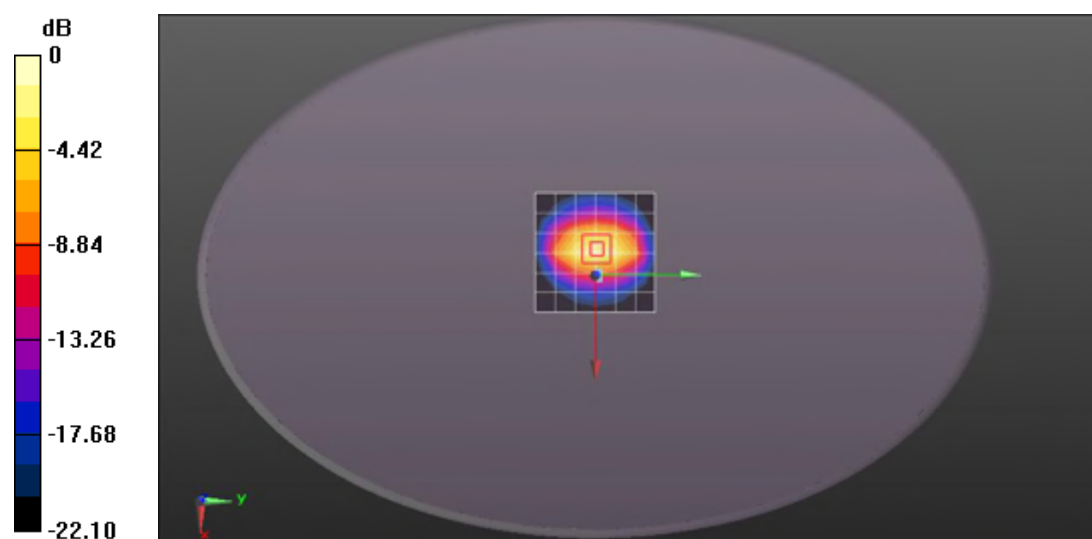
Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 108.7 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 21.4 W/kg

SAR(1 g) = 9.97 W/kg; SAR(10 g) = 4.8 W/kg

Maximum value of SAR (measured) = 16.9 W/kg



Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Head 1900MHz

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: 5d018

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.372$ S/m; $\epsilon_r = 40.64$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.9, 7.9, 7.9); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASYS 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (7x8x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 16.1 W/kg

Body/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7)

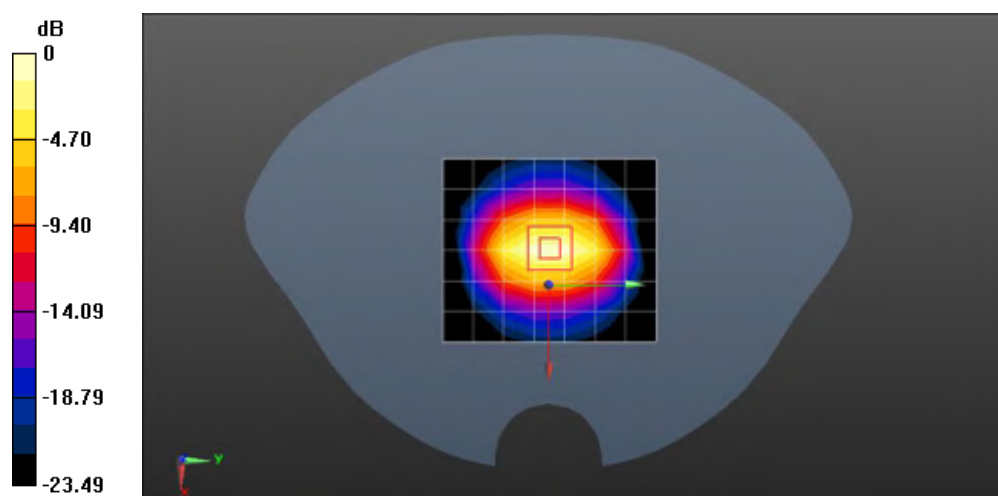
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 115.3 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 25.3 W/kg

SAR(1 g) = 10.8 W/kg; SAR(10 g) = 5.22 W/kg

Maximum value of SAR (measured) = 17.7 W/kg



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

Date: 2019-06-23

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Body 1900MHz

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: 5d018

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.513$ S/m; $\epsilon_r = 53.826$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.66, 7.66, 7.66); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (7x8x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm

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

Body/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7)

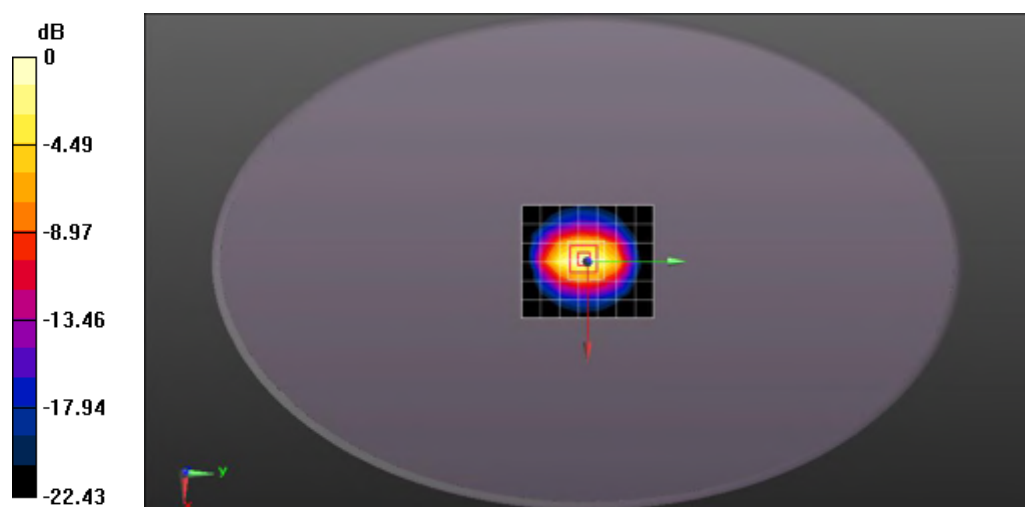
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 94.53 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 19.0 W/kg

SAR(1 g) = 9.76 W/kg; SAR(10 g) = 5.14 W/kg

Maximum value of SAR (measured) = 13.6 W/kg



0 dB = 13.6 W/kg = 11.34 dBW/kg

Date: 2019-06-21

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Head 2300MHz

DUT: Dipole 2300 MHz D2300V2; Type: D2300V2; Serial: 1096

Communication System: UID 0, CW (0); Frequency: 2300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.645$ S/m; $\epsilon_r = 40.475$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.61, 7.61, 7.61); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASYS 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (9x10x1):

Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 15.3 W/kg

Body/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7)

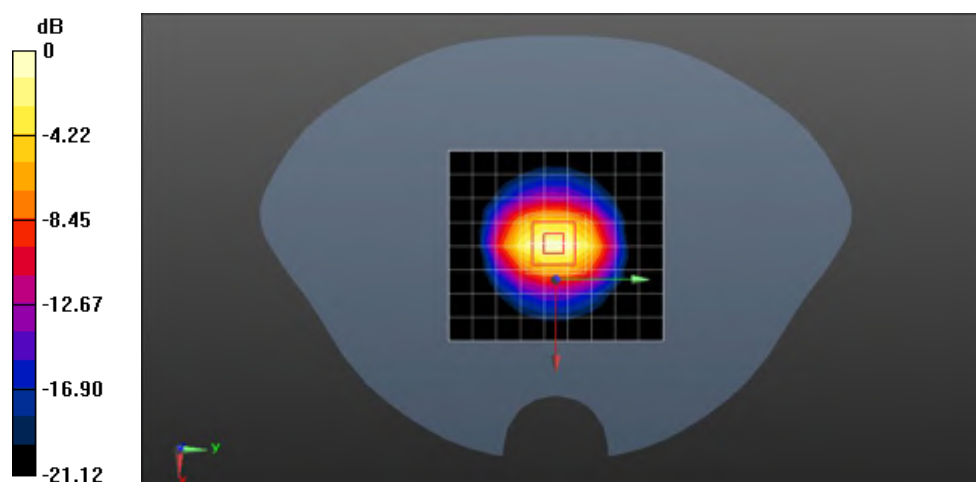
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 100.5 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 22.0 W/kg

SAR(1 g) = 10.8 W/kg; SAR(10 g) = 5.16 W/kg

Maximum value of SAR (measured) = 16.4 W/kg



0 dB = 16.4 W/kg = 12.15 dBW/kg

Date: 2019-06-22

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Body 2300MHz

DUT: Dipole 2300 MHz D2300V2; Type: D2300V2; Serial: 1096

Communication System: UID 0, CW (0); Frequency: 2300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.776$ S/m; $\epsilon_r = 53.158$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.49, 7.49, 7.49); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan

(8x9x1): Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 11.3 W/kg

Body/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan

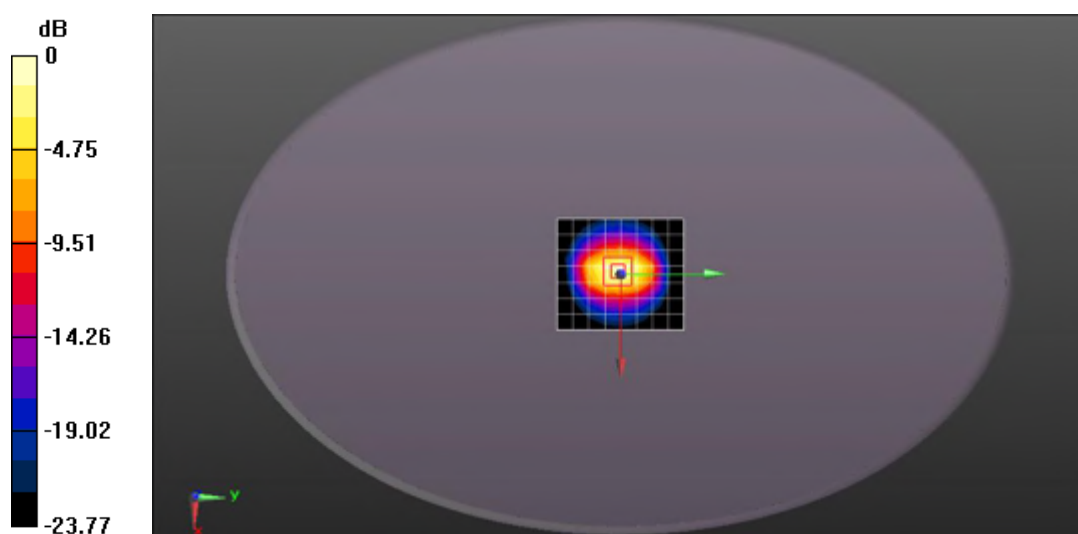
(7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 85.30 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 10.9 W/kg; SAR(10 g) = 5.4 W/kg

Maximum value of SAR (measured) = 13.0 W/kg



0 dB = 13.0 W/kg = 11.14 dBW/kg

Date: 2019-06-21

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Head 2450MHz

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: 903

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.826$ S/m; $\epsilon_r = 39.901$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.24, 7.24, 7.24); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (9x10x1):

Measurement grid: $dx=12$ mm, $dy=12$ mm
Maximum value of SAR (measured) = 17.8 W/kg

Body/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7)

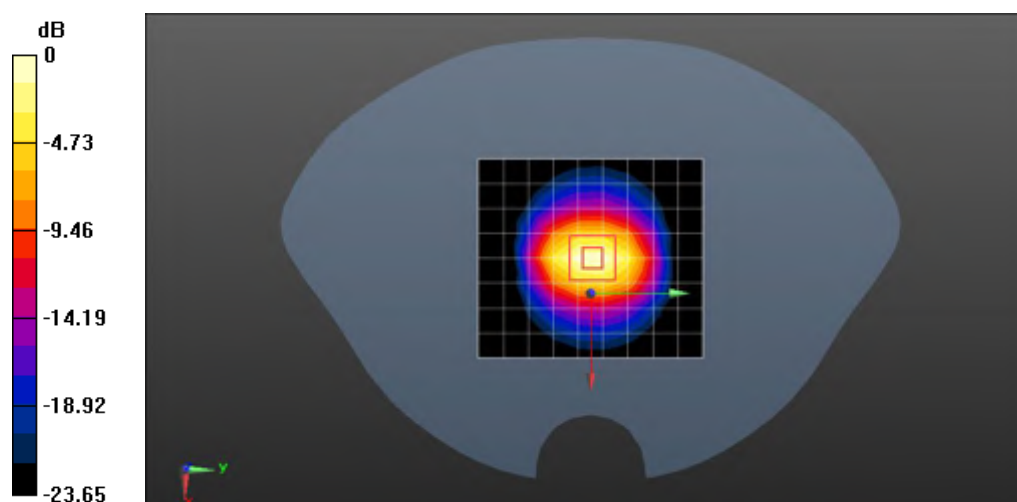
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 104.8 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.53 W/kg

Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Date: 2019-06-22

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Body 2450MHz

DUT: Dipole 2450 MHz D2450V2; Type: D24500V2; Serial: 903

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.97$ S/m; $\epsilon_r = 52.693$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.37, 7.37, 7.37); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (9x10x1):

Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 18.5 W/kg

Body/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7)

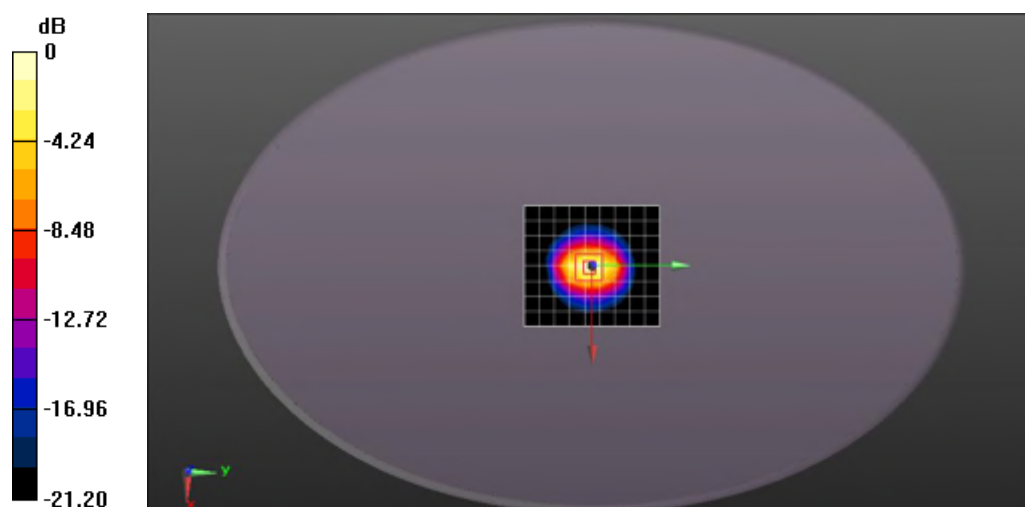
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 101.2 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 26.1 W/kg

SAR(1 g) = 13 W/kg; SAR(10 g) = 6.06 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Date: 2019-06-21

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Head 2600MHz

DUT: Dipole 2600 MHz D2600V2; Type: D2600V2; Serial: 1158

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2600$ MHz; $\sigma = 2$ S/m; $\epsilon_r = 39.388$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.11, 7.11, 7.11); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- DASYS 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (9x10x1):

Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 19.6 W/kg

Body/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7)

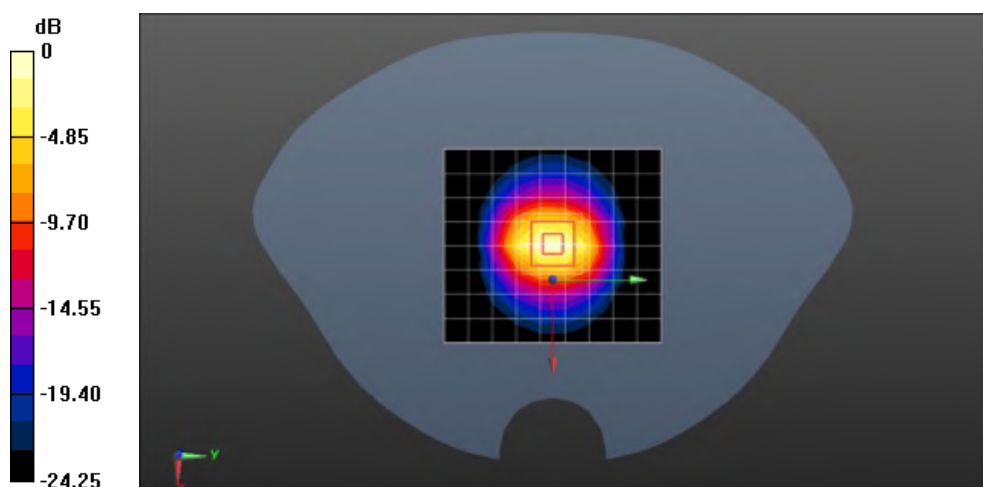
(7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 105.6 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 30.4 W/kg

SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.06 W/kg

Maximum value of SAR (measured) = 21.8 W/kg



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

Date: 2019-06-22

Test Laboratory: Compliance Certification Services Inc.

System Performance Check-Body 2600MHz

DUT: Dipole 2600 MHz D2600V2; Type: D2600V2; Serial: 1158

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.162$ S/m; $\epsilon_r = 52.234$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.09, 7.09, 7.09); Calibrated: 2019-05-24;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan

(8x9x1): Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 17.3 W/kg

Body/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan

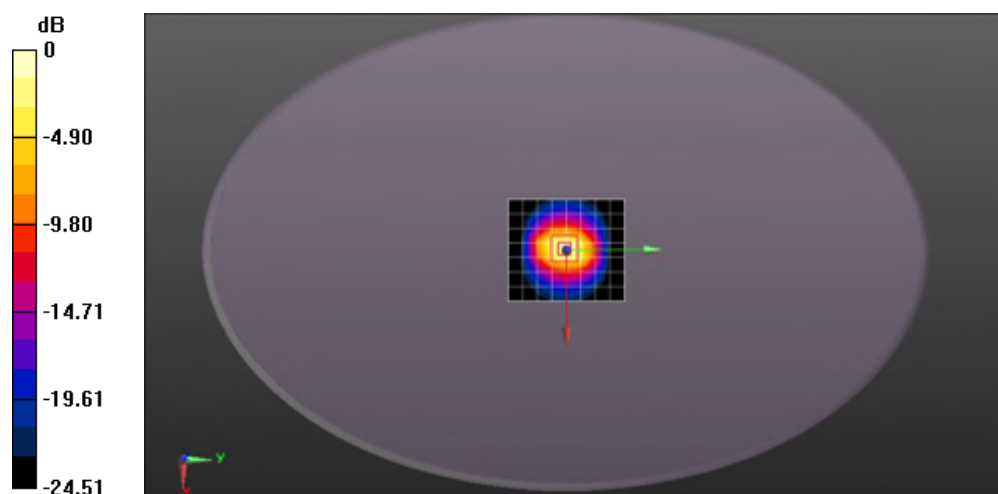
(7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 102.4 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.3 W/kg

SAR(1 g) = 14 W/kg; SAR(10 g) = 6.15 W/kg

Maximum value of SAR (measured) = 21.7 W/kg



0 dB = 21.7 W/kg = 13.36 dBW/kg