

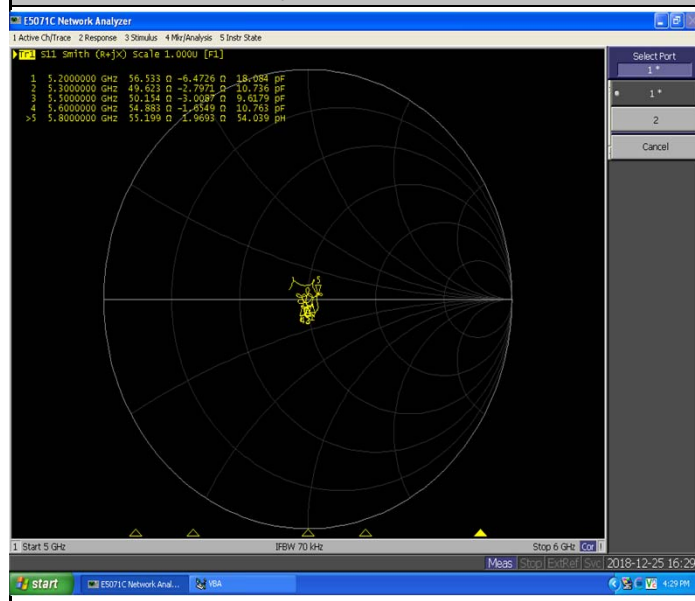


Dipole Internal Calibration Record

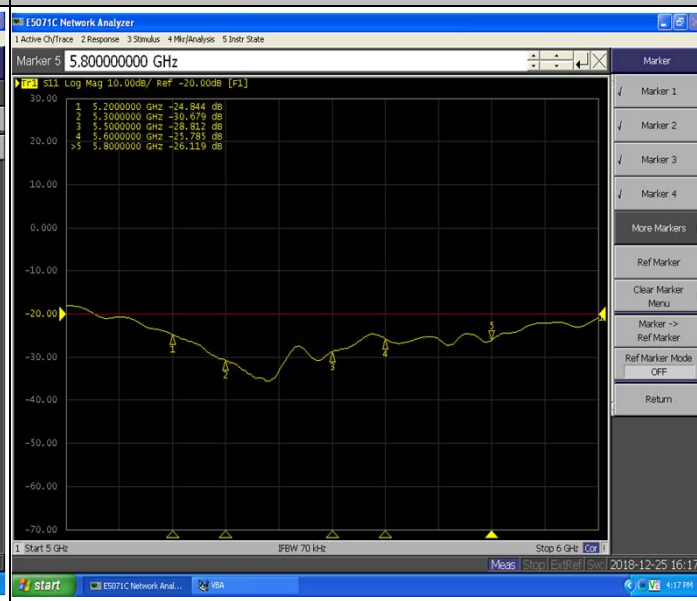
Asset No. :	E-436	Model No. :	D5GHzV2	Serial No. :	1221
Environmental	22.3°C, 55 %	Original Cal. Date :	June 20, 2018	Next Cal. Date :	June 20, 2021
Standard List					
1	IEEE Std 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorpton Rate(SAR) in the Human Head from Wireless Communication Devices: Measurement Texhniques, June 2013			
2	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			
3	KDB865664	SAR Measurement Requirements for 100 MHz to 6 GHz			
Equipment Information					
Equipment :	Manufacturer :	Model No. :	Serial No. :	Cal.Organization :	Cal. Date :
Power Amplifier	Mini-Circuits	ZVE-8G+	520701341	NA	March 9, 2018
DC Source	Iteck	OT6154	M00157	NA	October 12, 2018
P-series power meter	Agilent	N1911A	MY45100473	NA	August 11, 2018
wideband power sensor	Agilent	N1921A	MY51100041	NA	August 11, 2018
power Meter	Anritsu	ML2495A	1128009	NA	Mar. 11, 2018
Pulse Power Sensor	Anritsu	MA 2411B	1027500	NA	Mar. 11, 2018
Dual directional coupler	Woken	TS-PCC0M-05	107090019	NA	Mar. 11, 2018
MXG Analog Signal Generator	Agilent	N5181A	MY49060710	NA	August 11, 2018
ENA Network Analyzer	Agilent	E5071C	MY46102965	NA	March 11, 2018
Model No	For Head Tissue				
	Item	Originak Cal. Result	Verified on 2018/12/25	Deviation	Result
D5GHzV2(5.2GHz)	Impedance, transformed to feed point	53.5Ω-8.96jΩ	56.5Ω-6.47jΩ	<5Ω	Pass
	Return Loss(dB)	-20.7	-24.8	19.8%	Pass
	SAR Value for 1g(mW/g)	7.5	7.27	-3.1%	Pass
	SAR Value for 10g(mW/g)	2.16	2.07	-4.2%	Pass
D5GHzV2(5.3GHz)	Impedance, transformed to feed point	50.1Ω-3jΩ	49.6Ω-2.8jΩ	<5Ω	Pass
	Return Loss(dB)	-30.5	-30.7	0.7%	Pass
	SAR Value for 1g(mW/g)	7.66	7.34	-4.2%	Pass
	SAR Value for 10g(mW/g)	2.2	2.07	-5.9%	Pass
D5GHzV2(5.5GHz)	Impedance, transformed to feed point	51.4Ω-5.39jΩ	50.2Ω-3.01jΩ	<5Ω	Pass
	Return Loss(dB)	-25.2	-28.8	14.3%	Pass
	SAR Value for 1g(mW/g)	8.08	8.32	3.0%	Pass
	SAR Value for 10g(mW/g)	2.3	2.33	1.3%	Pass
D5GHzV2(5.6GHz)	Impedance, transformed to feed point	57.5Ω-2.95jΩ	54.9Ω-1.65jΩ	<5Ω	Pass
	Return Loss(dB)	-22.5	-25.8	14.7%	Pass
	SAR Value for 1g(mW/g)	7.85	7.84	-0.1%	Pass
	SAR Value for 10g(mW/g)	2.25	2.2	-2.2%	Pass
D5GHzV2(5.8GHz)	Impedance, transformed to feed point	54.5Ω-1.38jΩ	55.2Ω+1.97jΩ	<5Ω	Pass
	Return Loss(dB)	-26.9	-26.1	-3.0%	Pass
	SAR Value for 1g(mW/g)	7.78	7.89	1.4%	Pass
	SAR Value for 10a(mW/a)	2.21	2.21	0.0%	Pass

Model No	For Body Tissue				
	Item	Originak Cal. Result	Verified on 2018/12/25	Deviation	Result
D5GHzV2(5.2GHz)	Impedance, transformed to feed point	53.1 Ω -7.52j Ω	55.1 Ω -7.96j Ω	<5 Ω	Pass
	Return Loss(dB)	-22.1	-26.1	18.1%	Pass
	SAR Value for 1g(mW/g)	6.99	7.28	4.1%	Pass
	SAR Value for 10g(mW/g)	1.92	2.06	7.3%	Pass
D5GHzV2(5.3GHz)	Impedance, transformed to feed point	49.3 Ω -2.06j Ω	52.7 Ω -1.73j Ω	<5 Ω	Pass
	Return Loss(dB)	-33.1	-30.3	-8.5%	Pass
	SAR Value for 1g(mW/g)	7.25	7.16	-1.2%	Pass
	SAR Value for 10g(mW/g)	2.04	2	-2.0%	Pass
D5GHzV2(5.5GHz)	Impedance, transformed to feed point	50.9 Ω -4.94j Ω	48.2 Ω -3.03j Ω	<5 Ω	Pass
	Return Loss(dB)	-26.1	-24.8	-5.0%	Pass
	SAR Value for 1g(mW/g)	7.63	7.72	1.2%	Pass
	SAR Value for 10g(mW/g)	2.13	2.16	1.4%	Pass
D5GHzV2(5.6GHz)	Impedance, transformed to feed point	58.5 Ω -0.79j Ω	57.6 Ω -0.43j Ω	<5 Ω	Pass
	Return Loss(dB)	-22.1	-23.2	5.0%	Pass
	SAR Value for 1g(mW/g)	7.78	7.92	1.8%	Pass
	SAR Value for 10g(mW/g)	2.14	2.2	2.8%	Pass
D5GHzV2(5.8GHz)	Impedance, transformed to feed point	54.3 Ω +0.12j Ω	52.2 Ω +0.43j Ω	<5 Ω	Pass
	Return Loss(dB)	-27.6	-24.1	-12.7%	Pass
	SAR Value for 1g(mW/g)	7.66	7.79	1.7%	Pass
	SAR Value for 10g(mW/g)	2.15	2.16	0.5%	Pass

Impedance Test-Head



Return Loss-Head





Validation Report for Head TSL of 5.2GHz

Test Laboratory: BTL Inc. Date: 2018/12/25⁺

System Check_H5200_7396⁺

DUT: Dipole D5GHzV2;SN:1160⁺

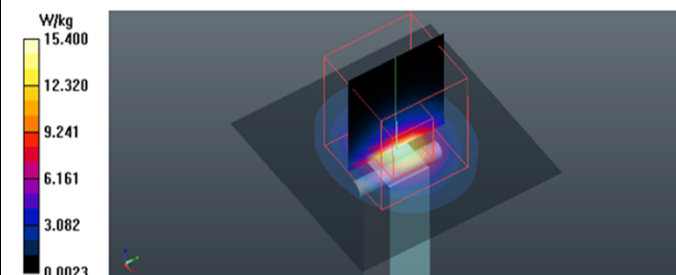
Communication System: UID 0, CW (0); Frequency: 5200 MHz; Duty Cycle: 1:1⁺
Medium parameters used: $f = 5200$ MHz; $\sigma = 4.766$ S/m; $\epsilon_r = 35.64$; $\rho = 996$ kg/m³ ⁺
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C⁺

DASY Configuration:⁺

- Probe: EX3DV4 - SN7396; ConvE(5.7, 5.7, 5.7) @ 5200 MHz; Calibrated: 2018/5/29 ⁺
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$ ⁺
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11 ⁺
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896 ⁺
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)⁺

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Area Scan (6x6x1): Interpolated grid: $dx=10$ mm, $dy=10$ mm⁺
Maximum value of SAR (interpolated) = 15.4 W/kg⁺

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Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm⁺
Reference Value = 41.93 V/m; Power Drift = -0.11 dB⁺
Peak SAR (extrapolated) = 30.7 W/kg⁺
SAR(1 g) = 7.27 W/kg; SAR(10 g) = 2.07 W/kg⁺
Maximum value of SAR (measured) = 15.4 W/kg



Validation Report for Head TSL of 5.3GHz

Test Laboratory: BTL Inc. Date: 2018/12/25⁺

System Check_H5300_7396⁺

DUT: Dipole D5GHzV2;SN:1160⁺

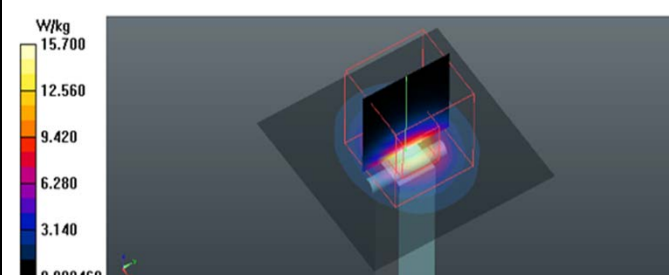
Communication System: UID 0, CW (0); Frequency: 5300 MHz; Duty Cycle: 1:1⁺
Medium parameters used (interpolated): $f = 5300$ MHz; $\sigma = 4.882$ S/m; $\epsilon_r = 35.392$; $\rho = 996$ kg/m³ ⁺
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C⁺

DASY Configuration:⁺

- Probe: EX3DV4 - SN7396; ConvE(5.35, 5.35, 5.35) @ 5300 MHz; Calibrated: 2018/5/29 ⁺
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$ ⁺
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11 ⁺
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896 ⁺
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)⁺

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Area Scan (6x6x1): Interpolated grid: $dx=10$ mm, $dy=10$ mm⁺
Maximum value of SAR (interpolated) = 16.5 W/kg⁺

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Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm⁺
Reference Value = 41.02 V/m; Power Drift = -0.06 dB⁺
Peak SAR (extrapolated) = 31.4 W/kg⁺
SAR(1 g) = 7.34 W/kg; SAR(10 g) = 2.07 W/kg⁺
Maximum value of SAR (measured) = 15.7 W/kg



Validation Report for Head TSL of 5.5GHz

Test Laboratory: BTL Inc. Date: 2018/12/25

System Check_H5500_7396

DUT: Dipole D5GHzV2;SN:1160

Communication System: UID 0, CW (0); Frequency: 5500 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.112$ S/m; $\epsilon_r = 34.912$; $\rho = 996$ kg/m³

Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C

DASY Configuration

- Probe: EX3DV4 - SN7396; ConnE(4.94, 4.94, 4.94) @ 5500 MHz; Calibrated: 2018/5/29
- Sensor-Surface: 2mm (Mechanical Surface Detection); $z = 1.0, 23.0$
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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Area Scan (6x6x1): Interpolated grid: $dx=10$ mm, $dy=10$ mm

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

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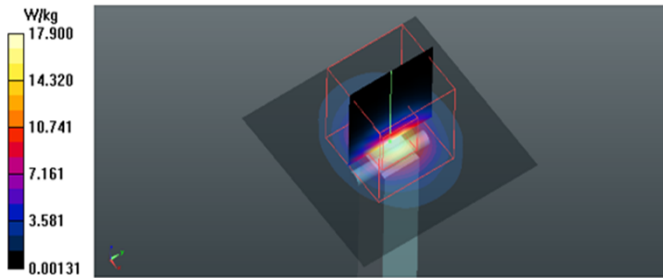
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 42.15 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 38.9 W/kg

SAR(1 g) = 8.32 W/kg; SAR(10 g) = 2.33 W/kg

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



Validation Report for Head TSL of 5.6GHz

Test Laboratory: BTL Inc. Date: 2018/12/25

System Check_H5600_7396

DUT: Dipole D5GHzV2;SN:1160

Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.235$ S/m; $\epsilon_r = 34.669$; $\rho = 996$ kg/m³

Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C

DASY Configuration

- Probe: EX3DV4 - SN7396; ConnE(4.94, 4.94, 4.94) @ 5600 MHz; Calibrated: 2018/5/29
- Sensor-Surface: 2mm (Mechanical Surface Detection); $z = 1.0, 23.0$
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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Area Scan (6x6x1): Interpolated grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (interpolated) = 17.4 W/kg

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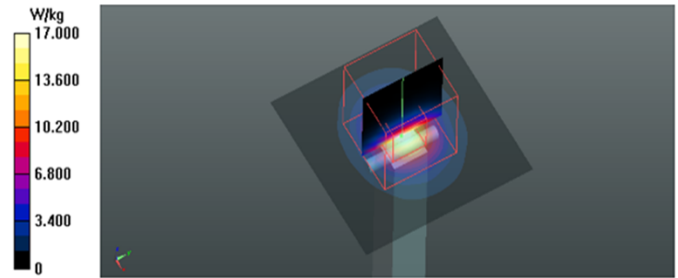
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 40.04 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 37.1 W/kg

SAR(1 g) = 7.84 W/kg; SAR(10 g) = 2.2 W/kg

Maximum value of SAR (measured) = 17.0 W/kg



Validation Report for Head TSL of 5.8GHz

Test Laboratory: BTL Inc. Date: 2018/12/25⁺System Check_H5800_7396⁺DUT: Dipole D5GHzV2;SN:1160;⁺

Communication System: UID 0, CW (0); Frequency: 5800 MHz; Duty Cycle: 1:1 ↓
 Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 5.479 \text{ S/m}$; $\epsilon_r = 34.208$; $\rho = 996 \text{ kg/m}^3$ ↓
 Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C⁺

DASY Configuration:⁺

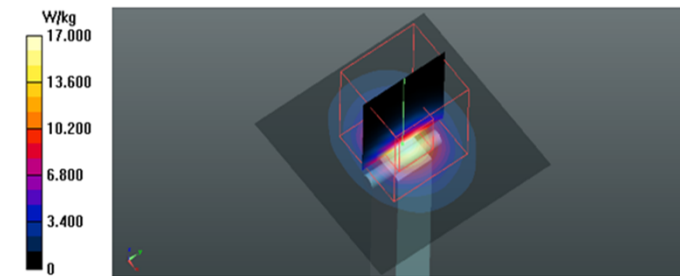
- Probe: EX3DV4 - SN7396; ConvE(5.05, 5.05, 5.05) @ 5800 MHz; Calibrated: 2018/5/29⁺
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$ ↓
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11⁺
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896⁺
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)⁺

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Area Scan (6x6x1): Interpolated grid: $dx=10 \text{ mm}$, $dy=10 \text{ mm}$ ↓
 Maximum value of SAR (interpolated) = 17.5 W/kg ↓

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Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4 \text{ mm}$, $dy=4 \text{ mm}$, $dz=2 \text{ mm}$ ↓
 Reference Value = 39.17 V/m; Power Drift = -0.06 dB ↓
 Peak SAR (extrapolated) = 37.5 W/kg ↓
 SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.21 W/kg ↓
 Maximum value of SAR (measured) = 17.0 W/kg



Validation Report for Body TSL of 5.2GHz

Test Laboratory: BTL Inc. Date: 2018/12/25⁺System Check_B5200_7396⁺DUT: Dipole D5GHzV2;SN:1160;⁺

Communication System: UID 0, CW (0); Frequency: 5200 MHz; Duty Cycle: 1:1 ↓
 Medium parameters used: $f = 5200 \text{ MHz}$; $\sigma = 5.372 \text{ S/m}$; $\epsilon_r = 47.807$; $\rho = 996 \text{ kg/m}^3$ ↓
 Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C⁺

DASY Configuration:⁺

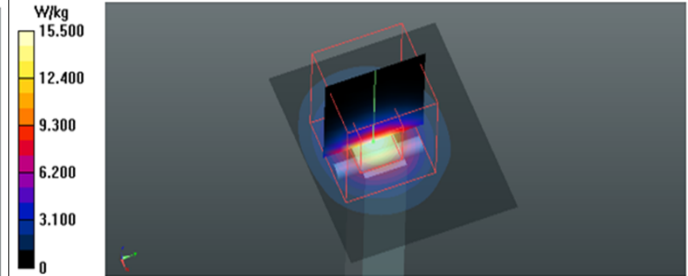
- Probe: EX3DV4 - SN7396; ConvE(5.3, 5.3, 5.3) @ 5200 MHz; Calibrated: 2018/5/29⁺
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$ ↓
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11⁺
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896⁺
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)⁺

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Area Scan (6x5x1): Interpolated grid: $dx=10 \text{ mm}$, $dy=10 \text{ mm}$ ↓
 Maximum value of SAR (interpolated) = 15.9 W/kg ↓

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Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4 \text{ mm}$, $dy=4 \text{ mm}$, $dz=2 \text{ mm}$ ↓
 Reference Value = 35.81 V/m; Power Drift = 0.06 dB ↓
 Peak SAR (extrapolated) = 31.3 W/kg ↓
 SAR(1 g) = 7.28 W/kg; SAR(10 g) = 2.06 W/kg ↓
 Maximum value of SAR (measured) = 15.5 W/kg



Validation Report for Body TSL of 5.3GHz

Test Laboratory: BTL Inc. Date: 2018/12/25[⚡]System Check_B5300_7396[⚡]DUT: Dipole D5GHZV2;SN:1160;[⚡]

Communication System: UID 0, CW (0); Frequency: 5300 MHz; Duty Cycle: 1:1 ↓
Medium parameters used: $f = 5300$ MHz; $\sigma = 5.507$ S/m; $\epsilon_r = 47.625$; $\rho = 996$ kg/m³ ↓
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C[⚡]

DASY Configuration:[⚡]

- Probe: EX3DV4 - SN7396; ConvE(5.05, 5.05, 5.05) @ 5300 MHz; Calibrated: 2018/5/29 [⚡]
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$ [⚡]
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11 [⚡]
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896 [⚡]
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)[⚡]

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Area Scan (5x5x1): Interpolated grid: $dx=10$ mm, $dy=10$ mm ↓

Maximum value of SAR (interpolated) = 14.7 W/kg ↓

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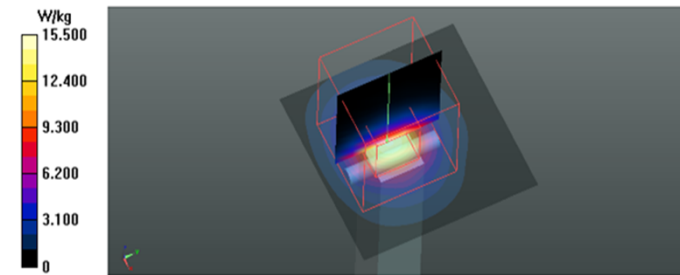
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm ↓

Reference Value = 34.45 V/m; Power Drift = 0.06 dB ↓

Peak SAR (extrapolated) = 30.9 W/kg ↓

SAR(1 g) = 7.16 W/kg; SAR(10 g) = 2 W/kg ↓

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



Validation Report for Body TSL of 5.5GHz

Test Laboratory: BTL Inc. Date: 2018/12/25[⚡]System Check_B5500_7396[⚡]DUT: Dipole D5GHZV2;SN:1160;[⚡]

Communication System: UID 0, CW (0); Frequency: 5500 MHz; Duty Cycle: 1:1 ↓
Medium parameters used: $f = 5500$ MHz; $\sigma = 5.797$ S/m; $\epsilon_r = 47.264$; $\rho = 996$ kg/m³ ↓
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C[⚡]

DASY Configuration:[⚡]

- Probe: EX3DV4 - SN7396; ConvE(4.38, 4.38, 4.38) @ 5500 MHz; Calibrated: 2018/5/29 [⚡]
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 23.0$ [⚡]
- Electronics: DAE4 Sn1390; Calibrated: 2018/5/11 [⚡]
- Phantom: SAM Right; Type: Twin SAM; Serial: 1896 [⚡]
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)[⚡]

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Area Scan (5x5x1): Interpolated grid: $dx=10$ mm, $dy=10$ mm ↓

Maximum value of SAR (interpolated) = 16.4 W/kg ↓

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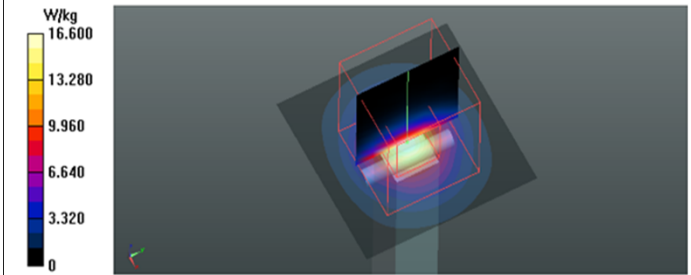
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm ↓

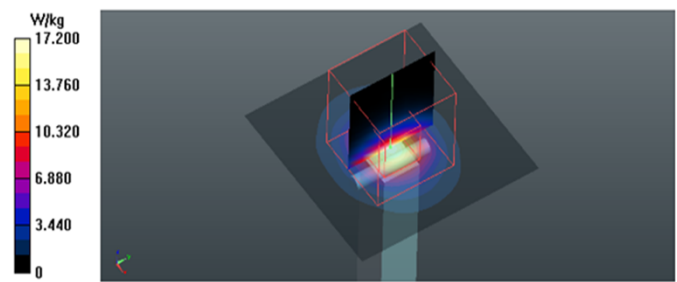
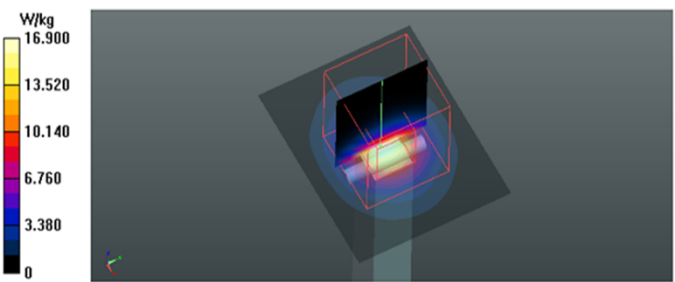
Reference Value = 38.51 V/m; Power Drift = -0.17 dB ↓

Peak SAR (extrapolated) = 33.9 W/kg ↓

SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.16 W/kg ↓

Maximum value of SAR (measured) = 16.6 W/kg



Validation Report for Body TSL of 5.6GHz	Validation Report for Body TSL of 5.8GHz
Test Laboratory: BTL Inc. Date: 2018/12/25[Ⓢ] System Check_B5600_7396[Ⓢ] DUT: Dipole D5GHzV2;SN:1160[Ⓢ] Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1[Ⓢ] Medium parameters used: f = 5600 MHz; σ = 5.947 S/m; ϵ_r = 47.073; ρ = 996 kg/m³ [Ⓢ] Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C[Ⓢ] DASY Configuration:[Ⓢ] • Probe: EX3DV4 - SN7396; ConvE(4.38, 4.38, 4.38) @ 5600 MHz; Calibrated: 2018/5/29 [Ⓢ] • Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 23.0 [Ⓢ] • Electronics: DAE4 Sn1390; Calibrated: 2018/5/11 [Ⓢ] • Phantom: SAM Right; Type: Twin SAM; Serial: 1896 [Ⓢ] • DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)[Ⓢ] ↓ Area Scan (6x6x1): Interpolated grid: dx=10 mm, dy=10 mm[Ⓢ] Maximum value of SAR (interpolated) = 16.5 W/kg[Ⓢ] ↓ Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm[Ⓢ] Reference Value = 38.11 V/m; Power Drift = -0.17 dB[Ⓢ] Peak SAR (extrapolated) = 35.4 W/kg[Ⓢ] SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.2 W/kg[Ⓢ] Maximum value of SAR (measured) = 17.2 W/kg 	Test Laboratory: BTL Inc. Date: 2018/12/25[Ⓢ] System Check_B5800_7396[Ⓢ] DUT: Dipole D5GHzV2;SN:1160[Ⓢ] Communication System: UID 0, CW (0); Frequency: 5800 MHz; Duty Cycle: 1:1[Ⓢ] Medium parameters used: f = 5800 MHz; σ = 6.239 S/m; ϵ_r = 46.673; ρ = 996 kg/m³ [Ⓢ] Ambient Temperature : 23.2 °C; Liquid Temperature : 22.5 °C[Ⓢ] DASY Configuration:[Ⓢ] • Probe: EX3DV4 - SN7396; ConvE(4.5, 4.5, 4.5) @ 5800 MHz; Calibrated: 2018/5/29 [Ⓢ] • Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 23.0 [Ⓢ] • Electronics: DAE4 Sn1390; Calibrated: 2018/5/11 [Ⓢ] • Phantom: SAM Right; Type: Twin SAM; Serial: 1896 [Ⓢ] • DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)[Ⓢ] ↓ Area Scan (6x5x1): Interpolated grid: dx=10 mm, dy=10 mm[Ⓢ] Maximum value of SAR (interpolated) = 16.6 W/kg[Ⓢ] ↓ Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm[Ⓢ] Reference Value = 37.07 V/m; Power Drift = -0.19 dB[Ⓢ] Peak SAR (extrapolated) = 35.6 W/kg[Ⓢ] SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.16 W/kg[Ⓢ] Maximum value of SAR (measured) = 16.9 W/kg 

Calibrator: *Rot - Liang*

Approver: *Herbert Lim*