



Measurement Conditions

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

DASY Version	DASY52	52.10.0.1446
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
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	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.2 ± 6 %	4.70 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.48 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	74.9 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.14 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.4 mW /g ± 24.2 % (k=2)

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Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.7 ± 6 %	4.77 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		(1222)

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.54 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	75.8 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.11 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.2 mW /g ± 24.2 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.99 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	80.0 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.26 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	22.6 mW /g ± 24.2 % (k=2)

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Head TSL parameters at 5600 MHz The following parameters and calculations w

	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	35.8 ± 6 %	5.10 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °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	7.91 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	79.3 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.21 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	22.2 mW /g ± 24.2 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	5.28 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.36 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	73.7 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.06 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 mW /g ± 24.2 % (k=2)

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Body TSL parameters at 5200 MHz
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.9 ± 6 %	5.29 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.09 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	70.9 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	1.98 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	19.8 mW /g ± 24.2 % (k=2)

Body TSL parameters at 5300 MHz
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.7 ± 6 %	5.40 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.12 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	71.1 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	1.98 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	19.8 mW /g ± 24.2 % (k=2)

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Body TSL parameters at 5500 MHz
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.2 ± 6 %	5.67 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.72 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	77.1 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.14 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.4 mW /g ± 24.2 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.1 ± 6 %	5.81 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.52 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	75.1 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.10 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.0 mW /g ± 24.2 % (k=2)

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Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.7 ± 6 %	6.09 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.27 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	72.6 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.02 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.2 mW /g ± 24.2 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	53.1Ω - 8.16jΩ
Return Loss	- 21.5dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	49.8Ω - 5.65jΩ	
Return Loss	- 25.0dB	

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	53.2Ω - 6.65jΩ	
Return Loss	- 22.9dB	

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	58.6Ω - 2.98jΩ	
Return Loss	- 21.6dB	

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.0Ω - 3.20jΩ	
Return Loss	- 24.9dB	

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	50.5Ω - 9.39jΩ
Return Loss	- 20.6dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.0Ω - 4.11jΩ	
Return Loss	- 27.6dB	

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Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	50.3Ω - 4.72jΩ	
Return Loss	- 26.5dB	

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.0Ω - 5.31jΩ	
Return Loss	- 21.7dB	

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	58.8Ω - 0.73jΩ	
Return Loss	- 21.9dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.071 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

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DASY5 Validation Report for Head TSL

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Report Issued Date: May 15, 2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1172

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz, Medium parameters used: f = 5200 MHz; $\sigma = 4.704$ mho/m; $\epsilon r = 36.22$; $\rho = 1000$ kg/m3, Medium parameters used: f = 5300 MHz; $\sigma = 4.77$ mho/m; $\epsilon r = 36.74$; $\rho = 1000$ kg/m3, Medium parameters used: f = 5500 MHz; $\sigma = 4.966$ mho/m; $\epsilon r = 35.76$; $\rho = 1000$ kg/m3, Medium parameters used: f = 5600 MHz; $\sigma = 5.104$ mho/m; $\epsilon r = 35.78$; $\rho = 1000$ kg/m3, Medium parameters used: f = 5800 MHz; $\sigma = 5.281$ mho/m; $\epsilon r = 35.62$; $\rho = 1000$ kg/m3,

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(5.82, 5.82, 5.82); Calibrated: 9/12/2017, ConvF(5.53,5.53,5.53); Calibrated: 9/12/2017, ConvF(5.21,5.21,5.21); Calibrated: 9/12/2017, ConvF(4.98,4.98); Calibrated: 9/12/2017, ConvF(5.11,5.11); Calibrated: 9/12/2017,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 2017-10-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.30 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 32.5 W/kg

SAR(1 g) = 7.48 W/kg; SAR(10 g) = 2.14 W/kg Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.18 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 34.1 W/kg

SAR(1 g) = 7.54 W/kg; SAR(10 g) = 2.11 W/kg

Maximum value of SAR (measured) = 18.7 W/kg

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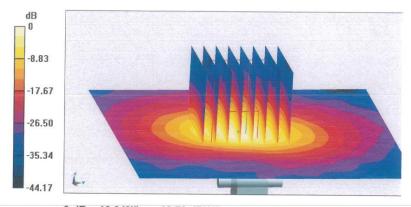


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Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 62.80 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 35.7 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 61.90 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 37.2 W/kg
SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 60.37 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 37.1 W/kg SAR(1 g) = 7.36 W/kg; SAR(10 g) = 2.06 W/kg Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 19.0 W/kg = 12.79 dBW/kg

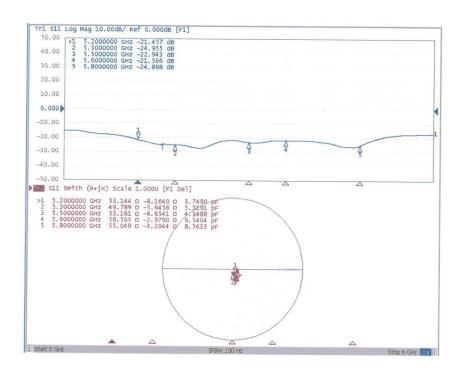
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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

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Report Issued Date: May 15, 2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1172

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz, Medium parameters used: f = 5200 MHz; $\sigma = 5.285$ mho/m; $\epsilon_T = 48.89$; $\rho = 1000$ kg/m3, Medium parameters used: f = 5300 MHz; $\sigma = 5.398$ mho/m; $\epsilon_T = 48.67$; $\rho = 1000$ kg/m3, Medium parameters used: f = 5500 MHz; $\sigma = 5.674$ mho/m; $\epsilon_T = 48.24$; $\epsilon_T = 1000$ kg/m3, Medium parameters used: $\epsilon_T = 5600$ MHz; $\epsilon_T = 5.813$ mho/m; $\epsilon_T = 48.05$; $\epsilon_T = 1000$ kg/m3, Medium parameters used: $\epsilon_T = 5600$ MHz; $\epsilon_T = 6.093$ mho/m; $\epsilon_T = 47.65$; $\epsilon_T = 1000$ kg/m3,

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(5.39, 5.39, 5.39); Calibrated: 9/12/2017, ConvF(5.19, 5.19, 5.19); Calibrated: 9/12/2017, ConvF(4.61,4.61,4.61); Calibrated: 9/12/2017, ConvF(4.5,4.5,4.5); Calibrated: 9/12/2017, ConvF(4.67,4.67,4.67); Calibrated: 9/12/2017,
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 2017-10-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.11 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 32.2 W/kg

SAR(1 g) = 7.09 W/kg; SAR(10 g) = 1.98 W/kg Maximum value of SAR (measured) = 17.3 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 62.15 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 33.3 W/kg

SAR(1 g) = 7.12 W/kg; SAR(10 g) = 1.98 W/kg Maximum value of SAR (measured) = 17.5 W/kg

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Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.49 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 37.5 W/kg

SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.14 W/kg Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.69 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 36.4 W/kg

SAR(1 g) = 7.52 W/kg; SAR(10 g) = 2.1 W/kg

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

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan,

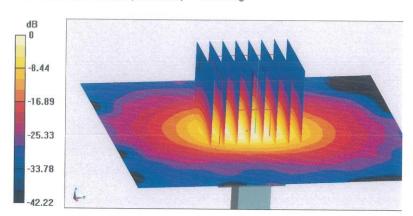
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 62.28 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 37.9 W/kg

SAR(1 g) = 7.27 W/kg; SAR(10 g) = 2.02 W/kg

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



0 dB = 18.5 W/kg = 12.67 dBW/kg

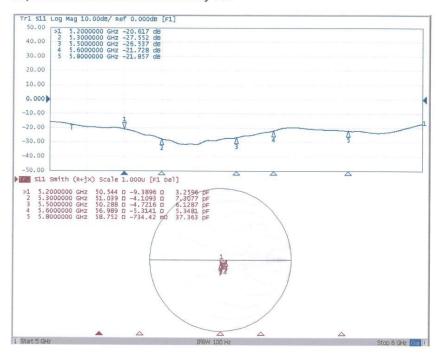
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Impedance Measurement Plot for Body TSL



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ANNEX E. Accreditation Certificate





Accredited Laboratory

A2LA has accredited

EAST CHINA INSTITUTE OF TELECOMMUNICATIONS

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005

General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 15th day of March 2017.

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President and CEO For the Accreditation Council Certificate Number 3682.01 Valid to May 31, 2019 Revised April 26, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

********End of the Report******