

D835V2 Sn:4d023 (1/2)

**TTL CALIBRATION LABORATORY**  
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Client: **SRTC** Certificate No: **Z17-07135**

### CALIBRATION CERTIFICATE

Client: **D835V2-SX 4d023**

Calibration Procedure(s): **FF-Z17-003-01**  
Calibration Procedure for liquid calibration kits

Calibration date: **September 12, 2017**

This calibration Certificate documents the conformity to national standards, which realize the physical units of measurement(s). The measurements and the conformities with confidence (probability) are given on the following pages and are part of the certificate.

All calibrations have been conducted in the stated laboratory facility, environment (temperature(s) and humidity(s)).

Calibration Equipment used (METS) (not for calibration):

Primary Standards	ID #	Cal Date/Calibrated by (Certificate No.)	Reference Certificate
Power Meter (NPLV)	100190	30-Mar-17 (TTL No. Z1701254)	Mar-16
Power sensor (NPLV)	100195	30-Mar-17 (TTL No. Z1701254)	Mar-16
Reference Plane (ERZ07)	501103	26-Sep-16 (SPLAG/No. SAG-0421_2nd/1)	Sep-17
GNSS	501101	19-Jan-17 (TTL SPM/AG/No. Z17-01010)	Jan-16

Secondary Standards	ID #	Cal Date/Calibrated by (Certificate No.)	Schedule Certificate
Signal Generator (SAG0C)	M-00011434	12-Jan-17 (TTL No. Z1703020)	Jan-15
Network Analyzer (S071E)	0704108073	15-Jan-17 (TTL No. Z1703020)	Jan-15

Calculated by: **Zhan Jinyi** SAR Test Engineer *[Signature]*

Reviewed by: **Yu Donghai** SAR Test Engineer *[Signature]*

Approved by: **Q Dongyan** SAR Project Leader *[Signature]*

Issued: September 12, 2017

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Certificate No: Z17-07135 Page 1 of 4

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Client: **SRTC** Certificate No: **Z17-07135**

### Glossary:

TSL: Neck simulating liquid  
Conduct: sensitivity in TSL / NDRMs, g.g.  
NA: not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEC 61180-2013 10.2.2: 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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-carried wireless communication devices: Part 1: Device used next to the ear (frequency range of 300MHz to 3GHz), July 2016
- IEC 62209-2: Procedure to measure the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 3GHz), March 2012
- KT2000006: SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

4) GSP450 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 surface, 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 normal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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Client: **SRTC** Certificate No: **Z17-07135**

### Measurement Conditions

SAR system configuration, as far as not given on page 1:

SAR system	SAR-TSL	52.103 1kHz
Extrapolation	Advanced Extrapolation	
Phantom	Thin Flat Phantom 1 TC	
Distance to Dipole Center - TSL	15 mm	with Spacer
Zoom State Resolution	60, 60, 30 + 5 mm	
Frequency	910 MHz ± 1 kHz	

### Head TSL parameters

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.2	0.87 mS/m
Measured Head TSL parameters	22.0 ± 0.2 °C	41.2 ± 0.1 %	0.90 mS/m ± 0.6 %
Head TSL temperature change during test	+1.0 °C	---	---

### SAR result with Head TSL

SAR averaged over 1 cm <sup>2</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	0.20 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	0.27 mW/g ± 10.8 % (k=2)
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.52 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	0.68 mW/g ± 18.7 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	51.0	0.51 mS/m
Measured Body TSL parameters	22.0 ± 0.2 °C	50.7 ± 0.6 %	0.48 mS/m ± 2.6 %
Body TSL temperature change during test	+1.0 °C	---	---

### SAR result with Body TSL

SAR averaged over 1 cm <sup>2</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.34 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	0.47 mW/g ± 10.8 % (k=2)
SAR averaged over 10 cm <sup>2</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.03 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	0.17 mW/g ± 18.7 % (k=2)

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Client: **SRTC** Certificate No: **Z17-07135**

### Appendix (Additional assessments outside the scope of CNAS LS070)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0 Ω ± 7.6 Ω
Return Loss	-22.7 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	40.0 Ω ± 3.0 Ω
Return Loss	-21.6 dB

#### General Antenna Parameters and Design

Coaxial Delay (one direction)	1.400 ns
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After long term use with 150W radiated power, only a slight warming of the dipoles near the feedpoint can be measured.

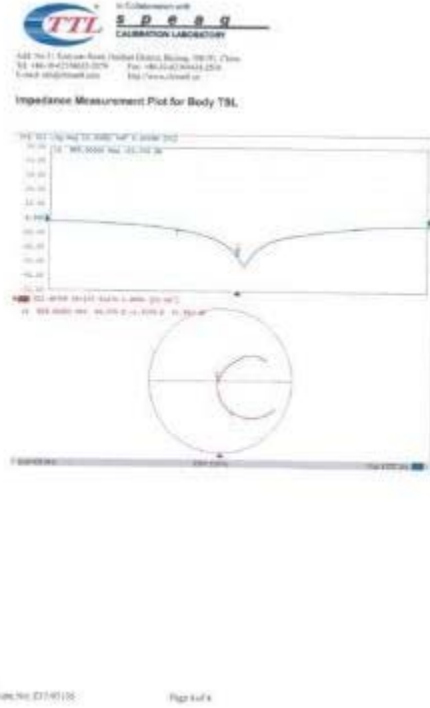
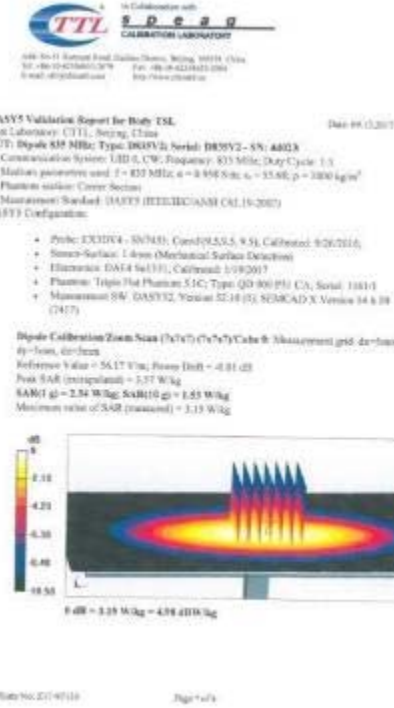
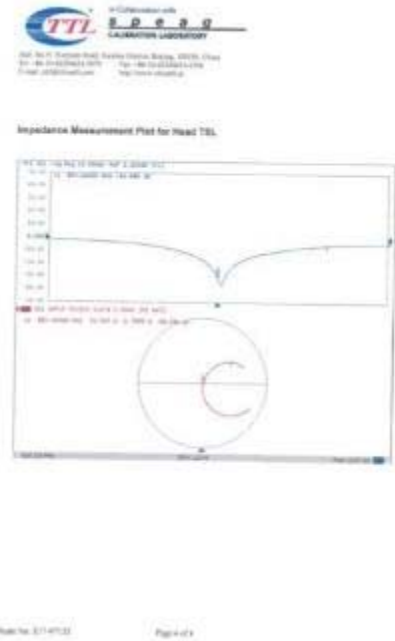
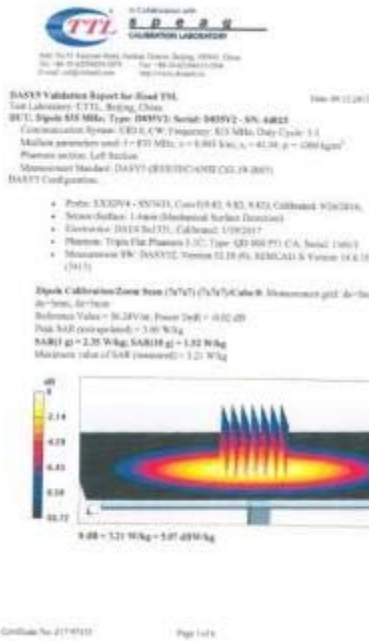
The dipole is made of standard strength coaxial cable. The center conductor of the feeding line is directly soldered to the second arm of the dipole. The antenna is therefore short-circuited for DC signals. Coils of the dipoles, arms and cables are soldered to the dipole arms in order to improve matching when loaded according to the position as depicted in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the standard. The SAR data are not affected by this change. The overall dipole length is still according to the standard. The SAR data are not affected by this change. The overall dipole length is still according to the standard.

#### Additional BUT Data

Manufactured by	SPL&S
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D835V2 Sn:4d023 (2/2)



D1800V2 Sn:2d084 (1/2)

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Client: **SRTC** Certificate No.: **Z17-01138**

### CALIBRATION CERTIFICATE

Client: **D1800V2-SN 2d084**

Calibration Procedure(s): **RF-Z11-003-01**  
Calibration Procedure for dipole reference kits

Calibration Date: **September 18, 2017**

This certificate conforms to the requirements of national standards, which realize the physical units of measurements(SI). The measurement and the uncertainty with evidence probability are given in the following paper and are part of the certificate.

All calibrations have been conducted in the class laboratory facility, environment temperature(23±1); and humidity(70%).

Calibration Equipment used (MATE critical for calibration)

Primary Standards	C#	Cal Dates/Calibrated by Certificate No.:	Scheduled Calibration
Power Sensor: HP8510	100196	02-Mar-17 (CTL, No. J1700265)	Mar-18
Power Sensor: HP8510	502006	02-Mar-17 (CTL, No. J1700265)	Mar-18
Reference Probe: EX3004	SN 7433	25-Sep-16(SPC&G, No. F051433_Spc16)	Sep-17
Probe	SN 1331	16-Jun-17(CTL, SPC&G, No. Z17-01138)	Jun-18

Secondary Standards	C#	Cal Dates/Calibrated by Certificate No.:	Scheduled Calibration
Signal Generator: E4430C	MH4601140	19-Jan-17 (CTL, No. J1700265)	Jan-18
Network Analyzer: ENA711C	MH46118073	19-Jan-17 (CTL, No. J1700265)	Jan-18

Calibrated by: **Zhai Jing** SAR Test Engineer

Reviewed by: **Yu Dongping** SAR Test Engineer

Approved by: **Qi Dongyan** SAR Project Leader

Issued: September 18, 2017

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Certificate No.: Z17-01138

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Client: **SRTC** Certificate No.: **Z17-01138**

### CALIBRATION CERTIFICATE

Client: **D1800V2-SN 2d084**

Calibration Procedure(s): **RF-Z11-003-01**  
Calibration Procedure for dipole reference kits

Calibration Date: **September 18, 2017**

This certificate conforms to the requirements of national standards, which realize the physical units of measurements(SI). The measurement and the uncertainty with evidence probability are given in the following paper and are part of the certificate.

All calibrations have been conducted in the class laboratory facility, environment temperature(23±1); and humidity(70%).

Calibration Equipment used (MATE critical for calibration)

Primary Standards	C#	Cal Dates/Calibrated by Certificate No.:	Scheduled Calibration
Power Sensor: HP8510	100196	02-Mar-17 (CTL, No. J1700265)	Mar-18
Power Sensor: HP8510	502006	02-Mar-17 (CTL, No. J1700265)	Mar-18
Reference Probe: EX3004	SN 7433	25-Sep-16(SPC&G, No. F051433_Spc16)	Sep-17
Probe	SN 1331	16-Jun-17(CTL, SPC&G, No. Z17-01138)	Jun-18

Secondary Standards	C#	Cal Dates/Calibrated by Certificate No.:	Scheduled Calibration
Signal Generator: E4430C	MH4601140	19-Jan-17 (CTL, No. J1700265)	Jan-18
Network Analyzer: ENA711C	MH46118073	19-Jan-17 (CTL, No. J1700265)	Jan-18

Calibrated by: **Zhai Jing** SAR Test Engineer

Reviewed by: **Yu Dongping** SAR Test Engineer

Approved by: **Qi Dongyan** SAR Project Leader

Issued: September 18, 2017

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**Glossary:**  
TSL: **Isotax Stimulating liquid**  
Conf#: **sensitivity in TSL / NORMs, 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 Device Measurement Techniques", June 2013  
b) EC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2009  
c) EC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 3GHz)", March 2010  
d) RDB85954, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**  
a) DAS140 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 this spacer to position its feed point exactly below the center marking of the far 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 lips of 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 normal TSL parameters: The measured TSL parameters are used to calculate the normal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No.: Z17-01138

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Client: **SRTC** Certificate No.: **Z17-01138**

### MEASUREMENT CONDITIONS

ISO 9001:2015 Certification, as per the plan given on page 1.

ISO 9001:2015	ISO 9001:2015	ISO 9001:2015
Extrapolation	Antenna Extrapolation	02-10-2, 048
Phantom	Triple Flat Phantom & TC	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	0.1 dB, 0.1° or 7 mm	
Frequency	1800 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied:

Normalized Head TSL parameters	Temperature	Permittivity	Conductivity
Measured Head TSL parameters	23.0 ± 0.2 °C	40.0	1.87 mS/m
Head TSL temperature change during test	+1.0 °C		

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> of Head TSL	Condition	
SAR measured	250 mW input power	0.19 mW/g
SAR for normal Head TSL parameters	normalized to 1W	38.8 mW/g ± 16.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> of Head TSL	Condition	
SAR measured	250 mW input power	0.12 mW/g
SAR for normal Head TSL parameters	normalized to 1W	20.4 mW/g ± 18.7 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied:

Normalized Body TSL parameters	Temperature	Permittivity	Conductivity
Measured Body TSL parameters	32.0 ± 0.2 °C	50.0	1.52 mS/m
Body TSL temperature change during test	+1.0 °C		

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> of Body TSL	Condition	
SAR measured	250 mW input power	0.04 mW/g
SAR for normal Body TSL parameters	normalized to 1W	38.7 mW/g ± 16.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> of Body TSL	Condition	
SAR measured	250 mW input power	0.18 mW/g
SAR for normal Body TSL parameters	normalized to 1W	28.8 mW/g ± 18.7 % (k=2)

Certificate No.: Z17-01138

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Client: **SRTC** Certificate No.: **Z17-01138**

### APPENDIX (Additional assessments outside the scope of CNAS LISTED)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	Return Loss
48.200 ± 1.860	-38.4dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	Return Loss
40.020 ± 1.320	-27.1dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)
1.316 ns

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

The dipole is made of abundant beryllium copper cables. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited by DC signals. On some of the dipoles, small anti-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
SPT&G

Certificate No.: Z17-01138

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D1800V2 Sn:2d084 (2/2)

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E-mail: zhang@ttd.com.cn http://www.ttd.com.cn

**DASY5 Validation Report for Head TSL** Date: 06/11/2017  
Test Laboratory: TTL, Beijing, China  
DUT: Dipole 1800 MHz, Type: D1800V2, Serial: D1800V2-SN: 2d084  
Communication System: UFD, CW, Frequency: 1800 MHz, Duty Cycle: 1:1  
Medium parameters (conf):  $f = 1800 \text{ MHz}$ ;  $\alpha = 1.025 \text{ S/m}$ ;  $\mu = 49.37$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Left Section  
Measurement Standard: DASY5 (IEC/ISO/ANSI C63-16-2007)  
DASY5 Configuration:  

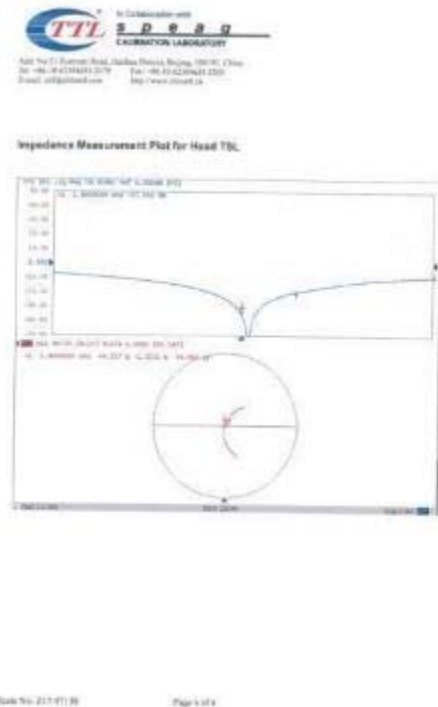
- Probe: CX320V4 - 907431, Gain: (7.97, 7.97), Calibrated: 9/26/2016
- Source Surface: 1-Axis (Mechanical Surface Detection)
- Electronics: DA14 Sa1331, Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5 IC, Type: QD 100 P31 CA, Serial: 11647
- Measurement SW: DASY52, Version: 32.10 (S), SEMCAD X Version: 14.6.10 (2417)

**System Performance Check (Zoom Scan (7x7x7) (7x7x7) Cube @ Measurement grid)**  
 $d_x = 5 \text{ mm}$ ,  $d_y = 5 \text{ mm}$ ,  $d_z = 5 \text{ mm}$   
 Reference Value = 83.80 V/m, Power Dens = 0.01 dB  
 Peak SAR (interpolated) = 28.7 W/kg  
 SAR(1 g) = 8.79 W/kg, SAR(10 g) = 8.12 W/kg  
 Maximum value of SAR (measured) = 15.3 W/kg



9 dB = 15.3 W/kg = 11.90 dBW/kg

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**DASY5 Validation Report for Body TSL** Date: 06/11/2017  
Test Laboratory: TTL, Beijing, China  
DUT: Dipole 1800 MHz, Type: D1800V2, Serial: D1800V2-SN: 2d084  
Communication System: UFD, CW, Frequency: 1800 MHz, Duty Cycle: 1:1  
Medium parameters (conf):  $f = 1800 \text{ MHz}$ ;  $\alpha = 1.263 \text{ S/m}$ ;  $\mu = 53.79$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Center Section  
Measurement Standard: DASY5 (IEC/ISO/ANSI C63-16-2007)  
DASY5 Configuration:  

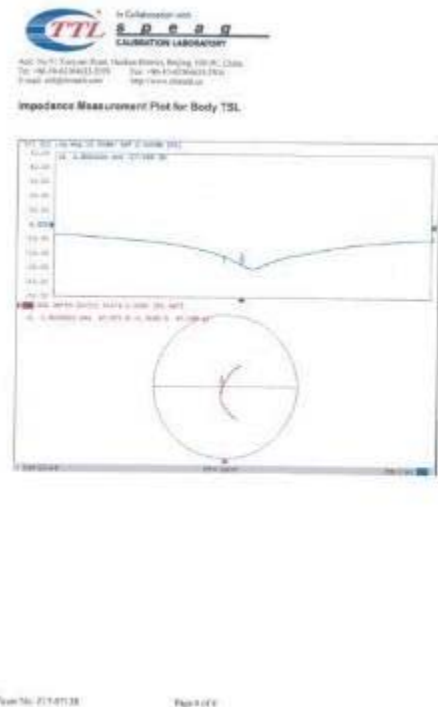
- Probe: CX320V4 - 807431, Gain: (7.75, 7.75), Calibrated: 9/26/2016
- Source Surface: 1-Axis (Mechanical Surface Detection)
- Electronics: DA14 Sa1331, Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5 IC, Type: QD 100 P31 CA, Serial: 11647
- Measurement SW: DASY52, Version: 32.10 (S), SEMCAD X Version: 14.6.10 (2417)

**System Performance Check (Zoom Scan (7x7x7) (7x7x7) Cube @ Measurement grid)**  
 $d_x = 5 \text{ mm}$ ,  $d_y = 5 \text{ mm}$ ,  $d_z = 5 \text{ mm}$   
 Reference Value = 97.37 V/m, Power Dens = 0.02 dB  
 Peak SAR (interpolated) = 18.0 W/kg  
 SAR(1 g) = 9.81 W/kg, SAR(10 g) = 8.18 W/kg  
 Maximum value of SAR (measured) = 15.2 W/kg



9 dB = 15.2 W/kg = 11.82 dBW/kg

Cert No: Z17-07138 Page 4 of 6



D2000V2 Sn:1009 (1/2)

**TTL** Calibration Laboratory  
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Certificate No: Z18-07021

Client: SRTC

### CALIBRATION CERTIFICATE

Object: D2000V2 - GH-1009

Calibration Procedure(s): FF-Z11-002-01  
Calibration Procedure for static verification table

Calibration date: February 5, 2019

The calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(s). 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: 20±0.2°C and humidity: 70%).

Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Power Meter /NIVVD	102190	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Power sensor /NIVVD	100349	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Reference Probe EX300H	SN 1964	12-Sep-17 (SPEAG/NO.242-194, Sep17)	Sep-18
EMF	SN 1928	02-Oct-17 (SPEAG/NO.242-192, Oct17)	Oct-18

Secondary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Signal Generator E4438C	MF480143C	23-Jan-18 (J.TTL, No.J18003562)	Jan-19
Network Analyzer BNC71C	MY4610073	24-Jan-18 (J.TTL, No.J18003561)	Jan-19

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Li-Han, SAR Test Engineer

Approved by: Qi Dianyan, SAR Project Leader

Issued: February 4, 2019

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Certificate No: Z18-07021

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Certificate No: Z18-07021

Client: SRTC

### CALIBRATION CERTIFICATE

Object: D2000V2 - GH-1009

Calibration Procedure(s): FF-Z11-002-01  
Calibration Procedure for static verification table

Calibration date: February 5, 2019

The calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(s). 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: 20±0.2°C and humidity: 70%).

Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Power Meter /NIVVD	102190	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Power sensor /NIVVD	100349	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Reference Probe EX300H	SN 1964	12-Sep-17 (SPEAG/NO.242-194, Sep17)	Sep-18
EMF	SN 1928	02-Oct-17 (SPEAG/NO.242-192, Oct17)	Oct-18

Secondary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Signal Generator E4438C	MF480143C	23-Jan-18 (J.TTL, No.J18003562)	Jan-19
Network Analyzer BNC71C	MY4610073	24-Jan-18 (J.TTL, No.J18003561)	Jan-19

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Li-Han, SAR Test Engineer

Approved by: Qi Dianyan, SAR Project Leader

Issued: February 4, 2019

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

Certificate No: Z18-07021

Page 1 of 8

**TTL** Calibration Laboratory  
In Collaboration with  
CNAS  
Certificate No: Z18-07021

Client: SRTC

### CALIBRATION CERTIFICATE

Object: D2000V2 - GH-1009

Calibration Procedure(s): FF-Z11-002-01  
Calibration Procedure for static verification table

Calibration date: February 5, 2019

The calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(s). 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: 20±0.2°C and humidity: 70%).

Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Power Meter /NIVVD	102190	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Power sensor /NIVVD	100349	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Reference Probe EX300H	SN 1964	12-Sep-17 (SPEAG/NO.242-194, Sep17)	Sep-18
EMF	SN 1928	02-Oct-17 (SPEAG/NO.242-192, Oct17)	Oct-18

Secondary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Signal Generator E4438C	MF480143C	23-Jan-18 (J.TTL, No.J18003562)	Jan-19
Network Analyzer BNC71C	MY4610073	24-Jan-18 (J.TTL, No.J18003561)	Jan-19

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Li-Han, SAR Test Engineer

Approved by: Qi Dianyan, SAR Project Leader

Issued: February 4, 2019

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Certificate No: Z18-07021

Page 1 of 8

**TTL** Calibration Laboratory  
In Collaboration with  
CNAS  
Certificate No: Z18-07021

Client: SRTC

### CALIBRATION CERTIFICATE

Object: D2000V2 - GH-1009

Calibration Procedure(s): FF-Z11-002-01  
Calibration Procedure for static verification table

Calibration date: February 5, 2019

The calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(s). 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: 20±0.2°C and humidity: 70%).

Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Power Meter /NIVVD	102190	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Power sensor /NIVVD	100349	02-Mar-17 (J.TTL, Mo.J17001254)	Mar-18
Reference Probe EX300H	SN 1964	12-Sep-17 (SPEAG/NO.242-194, Sep17)	Sep-18
EMF	SN 1928	02-Oct-17 (SPEAG/NO.242-192, Oct17)	Oct-18

Secondary Standards	ID#	Cal Date/Calibrated by: Certificate No.	Scheduled Calibration
Signal Generator E4438C	MF480143C	23-Jan-18 (J.TTL, No.J18003562)	Jan-19
Network Analyzer BNC71C	MY4610073	24-Jan-18 (J.TTL, No.J18003561)	Jan-19

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Li-Han, SAR Test Engineer

Approved by: Qi Dianyan, SAR Project Leader

Issued: February 4, 2019

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Certificate No: Z18-07021

Page 1 of 8

D2000V2 Sn:1009 (2/2)


**TTL** Calibration Laboratory  
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国家无线电监测中心  
CALIBRATION LABORATORY

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Email: info@ttml.com.cn http://www.ttml.com.cn

**DASY3 Validation Report for Head TSL** Date: 02.01.2019  
Test Laboratory: CTTL, Beijing, China  
DUT: Dipole 2000 MHz, Type: D2000V2, Serial: D2000V2-05K-1009  
Communication System: TD-SCDMA, Frequency: 2000 MHz, Duty Cycle: 1:1  
Medium parameters used:  $f = 2000$  MHz,  $\alpha = 1.615$  W/kg,  $a = 38.85$ ,  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom system: Left Section  
Measurement Standard: DASY3 (IEEE1528/ANSI C63.19-2007)  
DASY3 Configuration:

- Probe: EX311V6 - SN7964, Coef: (R, I, S, R, I, S), Calibrated: 9/12/2017
- Sensor Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DADA S6122, Calibrated: 09/20/17
- Phantom: Triple Flat Phantom 5.1C, Type: QD 000 P15 CA, Serial: 114811
- Measurement SW: DASY3, Version 32.10 (3), REMCAD X Version 14.6.10 (7417)

System Performance Check/Zero Scan (7x7x7) (7x7x7)Cube 6: Measurement grid:  
dx=5mm, dy=5mm, dz=5mm  
Reference Value = 95.99 W/kg, Power Dens = -0.01 dB  
Peak SAR (interpolated) = 18.2 W/kg  
SAR0 (g) = 16.2 W/kg, SAR10 (g) = 8.17 W/kg  
Maximum value of SAR (measured) = 16.2 W/kg



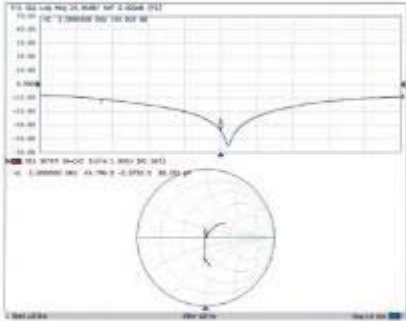
0 dB = 16.2 W/kg = 12.10 dBW/kg

Certificate No. Z18-F7022 Page 3 of 4

**TTL** Calibration Laboratory  
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**Impedance Measurement Plot for Head TSL**



Certificate No. Z18-F7021 Page 4 of 4

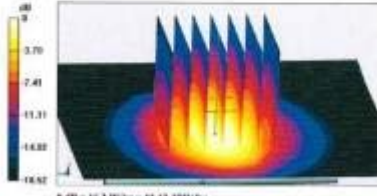
**TTL** Calibration Laboratory  
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Email: info@ttml.com.cn http://www.ttml.com.cn

**DASY3 Validation Report for Body TSL** Date: 02.01.2019  
Test Laboratory: CTTL, Beijing, China  
DUT: Dipole 2000 MHz, Type: D2000V2, Serial: D2000V2-05K-1009  
Communication System: TD-SCDMA, Frequency: 2000 MHz, Duty Cycle: 1:1  
Medium parameters used:  $f = 2000$  MHz,  $\alpha = 1.564$  W/kg,  $a = 51.83$ ,  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom system: Center Section  
Measurement Standard: DASY3 (IEEE1528/ANSI C63.19-2007)  
DASY3 Configuration:

- Probe: EX311V6 - SN7964, Coef: (R, I, S, R, I, S), Calibrated: 9/12/2017
- Sensor Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DADA S6122, Calibrated: 09/20/17
- Phantom: Triple Flat Phantom 5.1C, Type: QD 000 P15 CA, Serial: 114811
- Measurement SW: DASY3, Version 32.10 (3), REMCAD X Version 14.6.10 (7417)

System Performance Check/Zero Scan (7x7x7) (7x7x7)Cube 6: Measurement grid:  
dx=5mm, dy=5mm, dz=5mm  
Reference Value = 91.84 W/kg, Power Dens = 0.02 dB  
Peak SAR (interpolated) = 18.2 W/kg  
SAR0 (g) = 16.3 W/kg, SAR10 (g) = 8.18 W/kg  
Maximum value of SAR (measured) = 16.3 W/kg



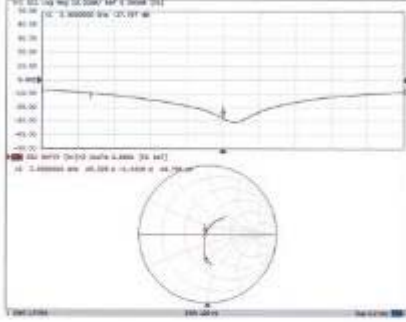
0 dB = 16.3 W/kg = 12.12 dBW/kg

Certificate No. Z18-F7022 Page 3 of 4

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**Impedance Measurement Plot for Body TSL**



Certificate No. Z18-F7021 Page 4 of 4

D2450V2 Sn:738 (1/2)

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CALIBRATION CERTIFICATE

Client: SRTC Certificate No.: Z17-07148

**CALIBRATION CERTIFICATE**

Object: D2450V2, SN: 738

Calibration Procedures: FF-215-001-01  
Calibration Procedures for dipole calibration kit

Calibration date: September 18, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(SI). The measurement and the uncertainties with confidence probability are given in the following pages and are part of the certificate.

All calibrations have been conducted in the clean laboratory facility (environment temperature(20±0.5)°C, and humidity 70%).

Calibration Equipment used (SRTC critical for calibration)

Primary Standards	ID #	Cal Date/Calibrated by Certificate No. #	Scheduled Calibration
Power Meter: NF40	102146	02-Mar-17 (C/TTL No. J17001254)	Mar-18
Power sensor: NF4-25	100566	02-Mar-17 (C/TTL No. J17001254)	Mar-18
Reference Probe EX3004	04-7433	29-Sep-16 (SFCAD No. E25-1432_Sep16)	Sep-17
SMA	SN 1321	18-Jan-17 (C/TTL SFCAD No. Z17-07015)	Jan-18

Secondary Standards	ID #	Cal Date/Calibrated by Certificate No. #	Scheduled Calibration
Signal Generator: SA330C	MF4011902	15-Jan-17 (C/TTL No. J1700285)	Jan-18
Network Analyzer: N1071C	MF40119023	15-Jan-17 (C/TTL No. J1700285)	Jan-18

Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]

Reviewed by: Yu Zongping, SAR Test Engineer, Signature: [Signature]

Approved by: Qi Tianyuan, SAR Project Leader, Signature: [Signature]

Issue: September 21, 2017

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Certificate No. Z17-07148 Page 1 of 8

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CALIBRATION CERTIFICATE

Client: SRTC Certificate No.: Z17-07148

**CALIBRATION CERTIFICATE**

Object: D2450V2, SN: 738

Calibration Procedures: FF-215-001-01  
Calibration Procedures for dipole calibration kit

Calibration date: September 18, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(SI). The measurement and the uncertainties with confidence probability are given in the following pages and are part of the certificate.

All calibrations have been conducted in the clean laboratory facility (environment temperature(20±0.5)°C, and humidity 70%).

Calibration Equipment used (SRTC critical for calibration)

Primary Standards: [Same as left page]

Secondary Standards: [Same as left page]

Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]

Reviewed by: Yu Zongping, SAR Test Engineer, Signature: [Signature]

Approved by: Qi Tianyuan, SAR Project Leader, Signature: [Signature]

Issue: September 21, 2017

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Certificate No. Z17-07148 Page 1 of 8

**Glossary:**  
TSL: Issue simulating liquid  
Consp: sensitivity in TSL NORMCY, if  
NA: not applicable or not measured

**Calibration is Performed According to the Following Standards:**  
a) IEC 61010-1:2015, "Safety Requirements for Low Voltage (50V to 1000V AC and 75V to 1500V DC) Safety Test Equipment", June 2015  
b) IEC 62209-1, "Measurement procedures for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (frequency range of 300MHz to 30GHz)", July 2015  
c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 3GHz)", March 2015  
d) GB8898-2004, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**  
a) IAS145 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 measured with the spacer to position its feed point exactly below the center marking of the flat platform 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 stand is branched 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 normal TSL parameters: The measured TSL parameters are used to calculate the normal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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CALIBRATION CERTIFICATE

Client: SRTC Certificate No.: Z17-07148

**CALIBRATION CERTIFICATE**

Object: D2450V2, SN: 738

Calibration Procedures: FF-215-001-01  
Calibration Procedures for dipole calibration kit

Calibration date: September 18, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(SI). The measurement and the uncertainties with confidence probability are given in the following pages and are part of the certificate.

All calibrations have been conducted in the clean laboratory facility (environment temperature(20±0.5)°C, and humidity 70%).

Calibration Equipment used (SRTC critical for calibration)

Primary Standards: [Same as left page]

Secondary Standards: [Same as left page]

Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]

Reviewed by: Yu Zongping, SAR Test Engineer, Signature: [Signature]

Approved by: Qi Tianyuan, SAR Project Leader, Signature: [Signature]

Issue: September 21, 2017

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Certificate No. Z17-07148 Page 1 of 8

**Measurement Conditions**  
SAR system configuration, as for SAR test plan at page 1.

SAR system	Value	Uncertainty
Exposure <td>Admitted Exposure <td>±0.10 dB</td> </td>	Admitted Exposure <td>±0.10 dB</td>	±0.10 dB
Phantom <td>Triaxial Phantom 11C <td>±0.10 dB</td> </td>	Triaxial Phantom 11C <td>±0.10 dB</td>	±0.10 dB
Distance Dipole Center - TSL <td>10 mm</td> <td>±0.10 dB</td>	10 mm	±0.10 dB
Power <td>240 mW ± 1.0%</td> <td>±0.10 dB</td>	240 mW ± 1.0%	±0.10 dB

**Head TSL parameters**  
The following parameters and calibrations were applied:

Parameter	Temperature	Permittivity	Conductivity
Normal Head TSL parameters	22.0 °C	52.0	1.80 mS/m
Measured Head TSL parameters	22.0 ± 0.2 °C	52.0 ± 0.6 %	1.80 mS/m ± 0.6 %
Head TSL temperature change during test	+1.0 °C	---	---

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	Value
SAR measured	250 mW input power	0.12 mW/kg
SAR for normal Head TSL parameters	normalized to 1W	62.4 mW/kg ± 10.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	Value
SAR measured	250 mW input power	0.10 mW/kg
SAR for normal Head TSL parameters	normalized to 1W	54.9 mW/kg ± 10.7 % (k=2)

**Body TSL parameters**  
The following parameters and calibrations were applied:

Parameter	Temperature	Permittivity	Conductivity
Normal Body TSL parameters	22.0 °C	52.0	1.80 mS/m
Measured Body TSL parameters	22.0 ± 0.2 °C	52.0 ± 0.6 %	1.80 mS/m ± 0.6 %
Body TSL temperature change during test	+1.0 °C	---	---

**SAR result with Body TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	Value
SAR measured	250 mW input power	0.12 mW/kg
SAR for normal Body TSL parameters	normalized to 1W	62.2 mW/kg ± 10.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	Value
SAR measured	250 mW input power	0.10 mW/kg
SAR for normal Body TSL parameters	normalized to 1W	54.9 mW/kg ± 10.7 % (k=2)

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CALIBRATION CERTIFICATE

Client: SRTC Certificate No.: Z17-07148

**CALIBRATION CERTIFICATE**

Object: D2450V2, SN: 738

Calibration Procedures: FF-215-001-01  
Calibration Procedures for dipole calibration kit

Calibration date: September 18, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurement(SI). The measurement and the uncertainties with confidence probability are given in the following pages and are part of the certificate.

All calibrations have been conducted in the clean laboratory facility (environment temperature(20±0.5)°C, and humidity 70%).

Calibration Equipment used (SRTC critical for calibration)

Primary Standards: [Same as left page]

Secondary Standards: [Same as left page]

Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]

Reviewed by: Yu Zongping, SAR Test Engineer, Signature: [Signature]

Approved by: Qi Tianyuan, SAR Project Leader, Signature: [Signature]

Issue: September 21, 2017

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Certificate No. Z17-07148 Page 1 of 8

**Appendix (Additional assessments outside the scope of CNAS Lab079)**

**Antenna Parameters with Head TSL**

Parameter	Value
Impedance, transformed to feed point	21.20 ± 0.20 Ω
Return Loss	≥ 24.5 dB

**Antenna Parameters with Body TSL**

Parameter	Value
Impedance, transformed to feed point	47.60 ± 0.80 Ω
Return Loss	≥ 23.1 dB

**General Antenna Parameters and Design**

Parameter	Value
Electrical Delay (one direction)	1.280 ns

After long term use with 100W isolated power, only a slight warping of the dipole near the feedpoint can be observed.

The dipole is made of stainless spring coated steel. The center conductor of the feeding line is directly connected to the tapered arm of the dipole. The antenna is therefore directly connected to DC voltage. On some of the dipoles, small steel clips are added to the dipole arms in order to increase shielding when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by the change. The overall dipole length is still according to the Standards. The SAR data are not affected by the change. The overall dipole length is still according to the Standards. The SAR data are not affected by the change. The overall dipole length is still according to the Standards.

**Additional EUT Data**

Parameter	Value
Manufactured by	SFACG

D2450V2 Sn:738 (2/2)

**TTL** Calibration Lab  
CALIBRATION LABORATORY


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E-mail: srtc@163.com Http://www.srtc.com.cn

**DASY5 Validation Report for Head TSL** Date: 09/18/2017  
Test Laboratory: TTL, Suzhou, China

**DU1: Dipole 2450 MHz**; Type: D2450V2; Serial: D2450V2 - SN: 738  
Communication System: L1/E, CW, Frequency: 2450 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2450$  MHz,  $\epsilon = 1.98$  S/m,  $\mu = 38.67$ ,  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
DASY5 Configuration:

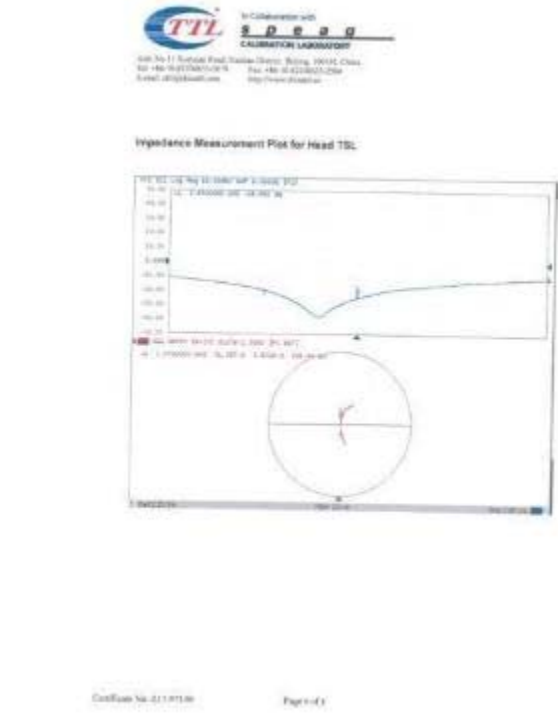
- Probe: EXD104 - 9N243, Coax: F743, 7.45, 7.45; Calibration: 9/20/2016;
- Sensor Surface: 1 Area (Mechanical Surface Detectors)
- Electronics: DASY5 Set351; Calibration: 1/18/2017
- Phantom: Triplex Flat Phantom 3.3C; Type: QD 100 P51 CA; Serial: 11611
- Measurement SW: DASY32, Version 52.10.15; SEMCADX Version 3.6.0 (7417)

**Dipole Calibration** Zoom Scan (7x7x7)/(7x7x7)/Cube @ Measurement grid: dx=7mm, dy=7mm, dz=7mm  
Reference Value = 702.1 V/m; Power Dens = 4.01 dB  
Peak SAR (extrapolated) = 22.8 W/kg  
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.3 W/kg  
Maximum value of SAR (measured) = 22.0 W/kg



0 dB = 22.8 W/kg = 13.42 dBW/kg

Certificate No: 20197348 Page 2 of 8



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E-mail: srtc@163.com Http://www.srtc.com.cn

**DASY5 Validation Report for Body TSL** Date: 09/18/2017  
Test Laboratory: TTL, Suzhou, China

**DU1: Dipole 2450 MHz**; Type: D2450V2; Serial: D2450V2 - SN: 738  
Communication System: L1/E, CW, Frequency: 2450 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2450$  MHz,  $\epsilon = 1.98$  S/m,  $\mu = 52.51$ ,  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Center Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
DASY5 Configuration:

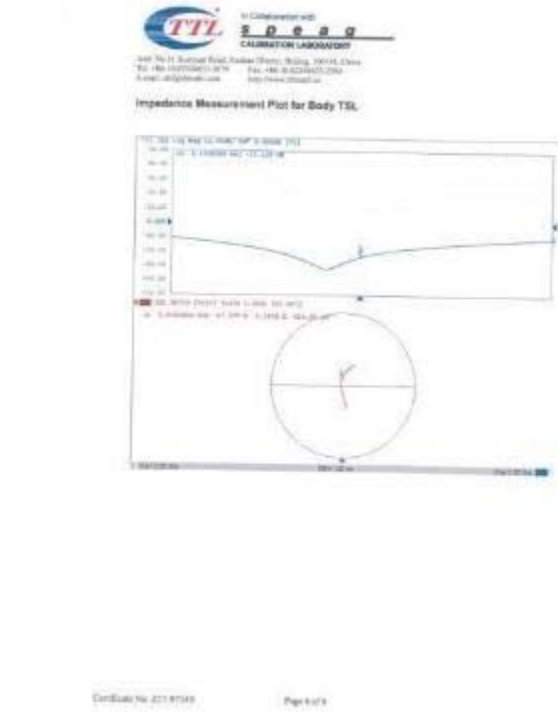
- Probe: EXD104 - 9N243, Coax: F746, 7.46, 7.46; Calibration: 9/20/2016;
- Sensor Surface: 1 Area (Mechanical Surface Detectors)
- Electronics: DASY5 Set351; Calibration: 1/18/2017
- Phantom: Triplex Flat Phantom 3.3C; Type: QD 100 P51 CA; Serial: 11611
- Measurement SW: DASY32, Version 52.10.15; SEMCADX Version 3.6.0 (7417)

**Dipole Calibration** Zoom Scan (7x7x7)/(7x7x7)/Cube @ Measurement grid: dx=7mm, dy=7mm, dz=7mm  
Reference Value = 95.41 V/m; Power Dens = 4.01 dB  
Peak SAR (extrapolated) = 27.8 W/kg  
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.3 W/kg  
Maximum value of SAR (measured) = 22.3 W/kg



0 dB = 27.8 W/kg = 13.48 dBW/kg

Certificate No: 20197348 Page 2 of 8





### D5GHzV2 Sn:1079 (1/4)

Client: SRTC Certificate No: Z17-07133

#### CALIBRATION CERTIFICATE

Client: D5GHzV2 Sn: 1079

Calibration Procedure(s): IT-211-005-01  
Calibration Procedure for dipole calibration kit

Calibration date: September 28, 2017

The calibration Certificate documents the suitability to national standards, which realize the original units of measurement(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 clean laboratory facility, environment temperature(20±1)°C and humidity 70%.

Calibration Equipment used (NISTe initial for calibration):

Primary Standards	ID #	Cal Date(Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	132196	22-May-17 (CITL No.J17K0239)	May-18
Power sensor NRP-251	130086	22-May-17 (CITL No.J17K0239)	May-18
Reference Probe EX30N	5N 2846	13-Jan-17(CITL-SPCAG No:216-87251)	Jan-18
SWA4	5N 1321	16-Jan-17(CITL-SPCAG No:217-90718)	Jan-18

Serivary Standards	ID #	Cal Date(Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	M746271439	13-Jan-17 (CITL No.J17K0239)	Jan-18
Network Analyzer EN71C	M746110673	13-Jan-17 (CITL No.J17K0239)	Jan-18

Calibrated by: Zhao Jinqi SRTC Test Engineer

Reviewed by: Yu Dongping SRTC Test Engineer

Approved by: Qi Dianyan SRTC Project Leader

Issue Date: September 29, 2017  
This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Client: SRTC Certificate No: Z17-07133

#### CALIBRATION CERTIFICATE

Client: D5GHzV2 Sn: 1079

Calibration Procedure(s): IT-211-005-01  
Calibration Procedure for dipole calibration kit

Calibration date: September 28, 2017

The calibration Certificate documents the suitability to national standards, which realize the original units of measurement(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 clean laboratory facility, environment temperature(20±1)°C and humidity 70%.

Calibration Equipment used (NISTe initial for calibration):

Primary Standards	ID #	Cal Date(Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	132196	22-May-17 (CITL No.J17K0239)	May-18
Power sensor NRP-251	130086	22-May-17 (CITL No.J17K0239)	May-18
Reference Probe EX30N	5N 2846	13-Jan-17(CITL-SPCAG No:216-87251)	Jan-18
SWA4	5N 1321	16-Jan-17(CITL-SPCAG No:217-90718)	Jan-18

Serivary Standards	ID #	Cal Date(Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	M746271439	13-Jan-17 (CITL No.J17K0239)	Jan-18
Network Analyzer EN71C	M746110673	13-Jan-17 (CITL No.J17K0239)	Jan-18

Calibrated by: Zhao Jinqi SRTC Test Engineer

Reviewed by: Yu Dongping SRTC Test Engineer

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**Summary:**  
TSL: Issue simulating liquid  
Conf: seriously in TSL/NORBIT  
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 Technique", June 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (frequency range of 300MHz to 85GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 50GHz)", March 2012
- KDB#9594, SAR Measurement Requirements for 100 MHz to 8 GHz

**Additional Documentation:**  
a) DAS745 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 this certificate are valid at the frequency indicated.
- Average 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 transferred from the measurement at the SMA connector to the feed point. The Return Loss assures 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 1W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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#### Measurement Conditions

SPEC System (configuration as far as not given on page 1)

Parameter	Value
Propagation	Advanced Propagation
Phantom	Topic Flat Phantom 6.1C
Distance Spoke Center- TSL	10 mm
Zoom Spoke Resolution	30, 40 x 4.1mm, 60 x 1.9 mm
Frequency	3300 MHz ± 1 MHz 3300 MHz ± 1 MHz 3300 MHz ± 1 MHz 3300 MHz ± 1 MHz

**Head TSL parameters at 3300 MHz**  
The following parameters and calculation were applied:

Parameter	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	38.0	4.88 mS/m
Measured Head TSL parameters	22.0 ± 0.2 °C	35.7 ± 6 %	4.82 mS/m ± 6 %
Head TSL temperature change during test	< 1.0 °C	---	---

**SAR result with Head TSL at 3300 MHz**

Parameter	Condition	Value
SAR averaged over 1 cm <sup>3</sup> of head TSL	Condition	---
SAR measured	100 mW input power	7.71 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	13.6 mW/g ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> of head TSL	Condition	---
SAR measured	100 mW input power	2.29 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	22.2 mW/g ± 24.2 % (k=2)

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#### Head TSL parameters at 5300 MHz

The following parameters and calculation were applied:

Parameter	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	38.0	4.78 mS/m
Measured Head TSL parameters	22.0 ± 0.2 °C	36.1 ± 6 %	4.67 mS/m ± 6 %
Head TSL temperature change during test	< 1.0 °C	---	---

**SAR result with Head TSL at 5300 MHz**

Parameter	Condition	Value
SAR averaged over 1 cm <sup>3</sup> of head TSL	Condition	---
SAR measured	100 mW input power	6.12 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	20.3 mW/g ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> of head TSL	Condition	---
SAR measured	100 mW input power	3.30 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	22.2 mW/g ± 24.2 % (k=2)

**Head TSL parameters at 5500 MHz**  
The following parameters and calculation were applied:

Parameter	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	38.0	4.88 mS/m
Measured Head TSL parameters	22.0 ± 0.2 °C	35.7 ± 6 %	4.82 mS/m ± 6 %
Head TSL temperature change during test	< 1.0 °C	---	---

**SAR result with Head TSL at 5500 MHz**

Parameter	Condition	Value
SAR averaged over 1 cm <sup>3</sup> of head TSL	Condition	---
SAR measured	100 mW input power	6.26 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	22.6 mW/g ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> of head TSL	Condition	---
SAR measured	100 mW input power	3.27 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	22.8 mW/g ± 24.2 % (k=2)

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**Head TSL parameters at 890 MHz**

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	0.07 mS/cm
Measured Head TSL parameters	22.0 ± 0.2 °C	38.7 ± 0.6 %	0.08 mS/cm ± 0.6 %
Head TSL temperature change during test	<± 0.2 °C	---	---

**SAR result with Head TSL at 890 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	SAR
SAR measured	100 mW input power	0.18 mW/g
SAR for nominal Head TSL parameters	normalised to 1W	81.8 mW/g ± 24.4 % (g=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	---
SAR measured	100 mW input power	0.34 mW/g
SAR for nominal Head TSL parameters	normalised to 1W	23.4 mW/g ± 24.2 % (g=2)

**Head TSL parameters at 8600 MHz**

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	0.07 mS/cm
Measured Head TSL parameters	22.0 ± 0.2 °C	38.8 ± 0.6 %	0.18 mS/cm ± 0.6 %
Head TSL temperature change during test	<± 0.2 °C	---	---

**SAR result with Head TSL at 8600 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	SAR
SAR measured	100 mW input power	7.55 mW/g
SAR for nominal Head TSL parameters	normalised to 1W	78.7 mW/g ± 24.4 % (g=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	---
SAR measured	100 mW input power	2.73 mW/g
SAR for nominal Head TSL parameters	normalised to 1W	28.8 mW/g ± 24.2 % (g=2)

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**Body TSL parameters at 890 MHz**

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	40.0	0.30 mS/cm
Measured Body TSL parameters	22.0 ± 0.2 °C	40.4 ± 0.6 %	0.38 mS/cm ± 0.6 %
Body TSL temperature change during test	<± 0.2 °C	---	---

**SAR result with Body TSL at 890 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	SAR
SAR measured	100 mW input power	7.52 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	78.4 mW/g ± 24.8 % (g=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	---
SAR measured	100 mW input power	2.12 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	21.3 mW/g ± 24.2 % (g=2)

**Body TSL parameters at 8300 MHz**

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	40.0	0.42 mS/cm
Measured Body TSL parameters	22.0 ± 0.2 °C	40.2 ± 0.6 %	0.50 mS/cm ± 0.6 %
Body TSL temperature change during test	<± 0.2 °C	---	---

**SAR result with Body TSL at 8300 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	SAR
SAR measured	100 mW input power	7.68 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	79.9 mW/g ± 24.8 % (g=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	---
SAR measured	100 mW input power	2.18 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	21.9 mW/g ± 24.2 % (g=2)

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**Body TSL parameters at 5900 MHz**

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	40.0	0.60 mS/cm
Measured Body TSL parameters	22.0 ± 0.2 °C	40.0 ± 0.6 %	0.72 mS/cm ± 0.6 %
Body TSL temperature change during test	<± 0.2 °C	---	---

**SAR result with Body TSL at 5900 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	SAR
SAR measured	100 mW input power	8.22 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	82.4 mW/g ± 24.8 % (g=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	---
SAR measured	100 mW input power	2.35 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	23.8 mW/g ± 24.2 % (g=2)

**Body TSL parameters at 5600 MHz**

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	40.0	0.77 mS/cm
Measured Body TSL parameters	22.0 ± 0.2 °C	40.4 ± 0.6 %	0.70 mS/cm ± 0.6 %
Body TSL temperature change during test	<± 0.2 °C	---	---

**SAR result with Body TSL at 5600 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	SAR
SAR measured	100 mW input power	8.05 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	88.7 mW/g ± 24.4 % (g=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	---
SAR measured	100 mW input power	2.38 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	23.6 mW/g ± 24.2 % (g=2)

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**Body TSL parameters at 8900 MHz**

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	40.0	0.60 mS/cm
Measured Body TSL parameters	22.0 ± 0.2 °C	40.0 ± 0.6 %	0.74 mS/cm ± 0.6 %
Body TSL temperature change during test	<± 0.2 °C	---	---

**SAR result with Body TSL at 8900 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	SAR
SAR measured	100 mW input power	7.73 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	77.8 mW/g ± 24.4 % (g=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	---
SAR measured	100 mW input power	2.17 mW/g
SAR for nominal Body TSL parameters	normalised to 1W	21.8 mW/g ± 24.2 % (g=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

**Antenna Parameters with Head TSL at 5800 MHz**

Impedance, transformed to feed point	47.94 - j 7.75 Ω
Return Loss	-20.1 dB

**Antenna Parameters with Head TSL at 5300 MHz**

Impedance, transformed to feed point	45.30 - j 6.60 Ω
Return Loss	-21.4 dB

**Antenna Parameters with Head TSL at 5500 MHz**

Impedance, transformed to feed point	65.70 - j 7.14 Ω
Return Loss	-23.0 dB

**Antenna Parameters with Head TSL at 6000 MHz**

Impedance, transformed to feed point	35.22 - j 4.39 Ω
Return Loss	-24.7 dB

**Antenna Parameters with Head TSL at 5000 MHz**

Impedance, transformed to feed point	12.37 - j 3.50 Ω
Return Loss	-21.5 dB

**Antenna Parameters with Body TSL at 5300 MHz**

Impedance, transformed to feed point	16.80 - j 9.10 Ω
Return Loss	-23.9 dB

**Antenna Parameters with Body TSL at 5900 MHz**

Impedance, transformed to feed point	49.33 - j 8.90 Ω
Return Loss	-21.1 dB

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**Antenna Parameters with Body TSL at 5500 MHz**

Impedance, transformed to feed point	64.80 - j 8.50 Ω
Return Loss	-21.5 dB

**Antenna Parameters with Body TSL at 5900 MHz**

Impedance, transformed to feed point	48.93 - j 2.30 Ω
Return Loss	-23.7 dB

**Antenna Parameters with Body TSL at 5800 MHz**

Impedance, transformed to feed point	65.70 - j 7.14 Ω
Return Loss	-23.0 dB

**General Antenna Parameters and Design**

Electric Area (area and position)	1.211 m <sup>2</sup>
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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 stainless steel pipe material. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is made of short circuit by DC signal. On some of the dipoles, small seal caps are added to the dipole arms in order to improve matching when tested according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by the change. The overall dipole height is set according to the Standard. No excessive force must be applied to the dipole arms, because this may lead to the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufacturer	SINAG
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**DASY5 Validation Report for Head TSL** (Date: 05/21/2017)

Test Laboratory: TTL, Beijing, China

EUT: Dipole 5GHz, Type: D5GHzV2, Serial: D5GHzV2 - SN: 1079

Communication System: CW, Frequency: 5300 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz, Frequency: 5900 MHz

Medium parameters used: f = 5300 MHz, α = 4.610 mho/m, σ = 35.72, ρ = 1200 kg/m<sup>3</sup>, Medium parameters used: f = 5500 MHz, α = 4.685 mho/m, σ = 35.86, ρ = 1200 kg/m<sup>3</sup>, Medium parameters used: f = 5600 MHz, α = 4.834 mho/m, σ = 35.92, ρ = 1200 kg/m<sup>3</sup>, Medium parameters used: f = 5800 MHz, α = 4.664 mho/m, σ = 35.73, ρ = 1200 kg/m<sup>3</sup>, Medium parameters used: f = 5900 MHz, α = 5.150 mho/m, σ = 35.83, ρ = 1200 kg/m<sup>3</sup>

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC ANSI C37.19-2007)

**DASY5 Configuration:**

- Probe: EX30V4 - 80348, Conf# (5.37.5.37.5.37), Calibrated: 1/13/2017, Conf# (5.37.5.37.5.37), Calibrated: 1/13/2017, Conf# (4.72.4.72.4.72)
- Calibrator: 1/13/2017, Conf# (4.72.4.72.4.72), Calibrated: 1/13/2017, Conf# (4.95.4.95.4.95), Calibrated: 1/13/2017
- Serial: Surface: 1.4mm (Mechanical Surface Detector)
- Electronics: DAE4 Be1331, Calibrated: 2017/1/19
- Phantom: Triple Flat Phantom 5.1C, Type: DD 000 P61 CA, Serial: 1161/8
- Measurement SW: DASY52, Version: 52.10 (B), SEMCAD X Version: 14.5.10 (7417)

**Dipole Calibration (Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan, dia=1.4mm (8x8x7)/Cube 0; Measurement grid: 3x4mm, dy=4mm, dz=1.4mm)**

Reference Value = 57.85 V/m, Power DUT = 0.02 dB

Peak SAR (extrapolated) = 34.2 W/kg

SAR(1g) = 8.24 W/kg; SAR(10g) = 2.37 W/kg

Maximum value of SAR (measured) = 19.5 W/kg

**Dipole Calibration (Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan, dia=1.4mm (8x8x7)/Cube 0; Measurement grid: 3x4mm, dy=4mm, dz=1.4mm)**

Reference Value = 57.86 V/m, Power DUT = 0.04 dB

Peak SAR (extrapolated) = 35.7 W/kg

SAR(1g) = 8.16 W/kg; SAR(10g) = 2.34 W/kg

Maximum value of SAR (measured) = 22.0 W/kg

**Dipole Calibration (Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dia=1.4mm (8x8x7)/Cube 0; Measurement grid: 3x4mm, dy=4mm, dz=1.4mm)**

Reference Value = 53.52 V/m, Power DUT = 0.08 dB

Peak SAR (extrapolated) = 35.0 W/kg

SAR(1g) = 7.85 W/kg; SAR(10g) = 2.26 W/kg

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

**Dipole Calibration (Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dia=1.4mm (8x8x7)/Cube 0; Measurement grid: 3x4mm, dy=4mm, dz=1.4mm)**

Reference Value = 65.19 V/m, Power DUT = 0.05 dB

Peak SAR (extrapolated) = 33.7 W/kg

SAR(1g) = 6.12 W/kg; SAR(10g) = 2.32 W/kg

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

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