APPENDIX D: RELEVANT PAGES FROM DAE&

DIPOLE VALIDATION KIT REPORT(S)

	In Collab	oration with	Mr. Competition		中国认可
		TION LABORATORY		PRIAC	国际互认
Add: No.51 Xueyu: Tel: +86-10-623040 E-mail: cttl@chinat	m Road, Haidian Dis i33-2079 Fax: 4	trict, Beijing, 100191, Cl +86-10-62304633-2504		GNAS	校准 CALIBRATION CNAS L0570
Client SMQ	accom nupa	/www.chinattl.cn	Certificate No:	Z18-60333	
	DTICIOAS				
CALIBRATION C	ERTIFICAT	E		a se construit	
Object	D835V	2 - SN: 4d141			
Calibration Procedure(s)		-003-01 tion Procedures for	dipole validation kits		
Calibration date:		nber 6, 2018			
This calibration Certificate measurements(SI). The me pages and are part of the ce	asurements and				
All calibrations have been humidity<70%.	conducted in	the closed laborat	ory facility: environn	nent temperature	(22±3)'C and
Calibration Equipment used	(M&TE critical f	or calibration)			
Primary Standards	ID #	Cal Date(Calibra	ed by, Certificate No.) Scheduled	Calibration
Power Meter NRVD	102083	01-Nov-17 (CTTL	No.J17X08756)	Oc	t-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL	No.J17X08756)	Oc	t-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEA	G,No.EX3-7464_Sep1	7) Se	p-18
DAE4	SN 1524	13-Sep-17(SPEA	GNo.DAE4-1524_Se	o17) Se	p-18
Secondary Standards	ID#	Cal Date/Calibrate	d by, Certificate No.)	Scheduled	Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL,			n-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL,			n-19
an a					
	Name	Function		Signa	ture
Calibrated by:	Zhao Jing	SAR Test Er	gineer	4	派
Reviewed by:	Lin Hao	SAR Test Er	ngineer	THE A	К
Approved by:	Qi Dianyuan	SAR Project	Leader	And.	3/
			leeuad C	eptember 9, 2018	
This calibration certificate sh	all not be reproc	luced except in full			

Certificate No: Z18-60333

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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for 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 6GHz)", July 2016
- 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 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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 http://www.chinattl.cn

Measurement Conditions

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

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.7 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.31 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.13 mW /g ± 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

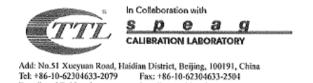
	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	56.0 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.48 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.74 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.66 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.54 mW /g ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

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Antenna Parameters with Head TSL

E-mail: ettl@chinattl.com

Impedance, transformed to feed point	50.3Ω- 5.68jΩ
Return Loss	- 24.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8Ω- 7.52jΩ
Return Loss	- 21.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.255 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	
	TTTT		

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 http://www.chinattl.en

DASY5 Validation Report for Head TSL

Date: 09.04.2018

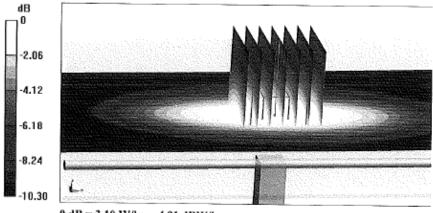
Test Laboratory: CTTL, Beijing, China **DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141** Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; $\sigma = 0.904$ S/m; $\varepsilon_r = 42.71$; $\rho = 1000$ kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(10.28, 10.28, 10.28) @ 835 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.01 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 3.49 W/kgSAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.53 W/kgMaximum value of SAR (measured) = 3.10 W/kg



0 dB = 3.10 W/kg = 4.91 dBW/kg

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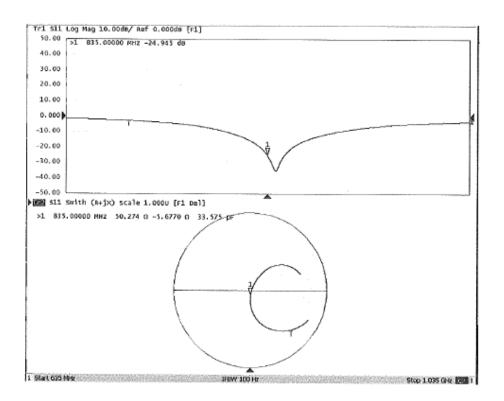


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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141

Date: 09.06.2018

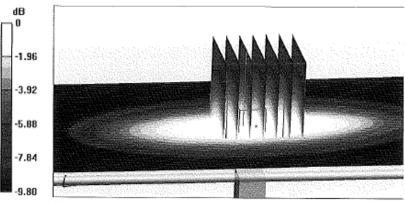
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; $\sigma = 0.998$ S/m; $\varepsilon_r = 56.04$; $\rho = 1000$ kg/m3 Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(10.21, 10.21, 10.21) @ 835 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated; 9/13/2017
- Phantom: MFP_V5.1C; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 55.80 V/m; Power Drift = -0.00 dB

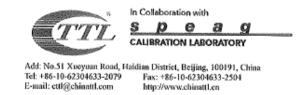
Peak SAR (extrapolated) = 3.73 W/kg SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.66 W/kg Maximum value of SAR (measured) = 3.27 W/kg



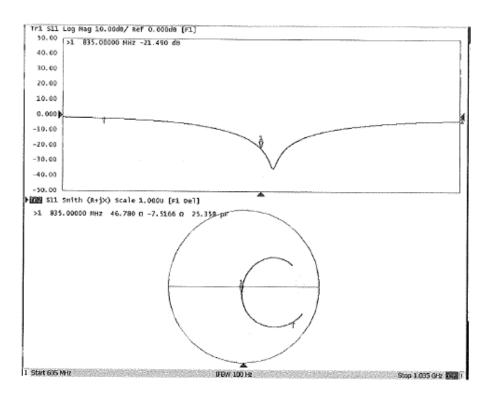
0 dB = 3.27 W/kg = 5.15 dBW/kg

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Impedance Measurement Plot for Body TSL



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	CALIBRA	TION LABORATORY	
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Client SMC	2	Certificate No: Z	18-60336
CALIBRATION C	ERTIFICAT	E	
Object	D1900	V2 - SN: 5d162	
	01000	VZ - 5N. 50102	
Calibration Procedure(s)	FE-711	-003-01	
		tion Procedures for dipole validation kits	
Collection date:			
Calibration date:	Septen	nber 11, 2018	
	asurements and	traceability to national standards, which re- the uncertainties with confidence probability	
All calibrations have been	conducted in	the closed laboratory facility: environment	temperature(22±3)℃ and
humidity<70%. Calibration Equipment used	(M&TE critical for	or calibration)	
•	(M&TE critical fo	or calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Calibration Equipment used			Scheduled Calibration Oct-18
Calibration Equipment used Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	
Calibration Equipment used Primary Standards Power Meter NRVD	ID # 102083 100542	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5	ID # 102083 100542	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756)	Oct-18 Oct-18 Sep-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-25 Reference Probe EX3DV4 DAE4	ID # 102083 100542 SN 7464 SN 1524	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Oct-18 Oct-18 Sep-18) Sep-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4	ID # 102083 100542 SN 7464	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.)	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 102083 100542 SN 7464 SN 1524 ID #	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Oct-18 Oct-18 Sep-18) Sep-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560)	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19 Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-25 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-25 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561)	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19 Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19 Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by:	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function SAR Test Engineer	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19 Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by: Reviewed by:	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name Zhao Jing Lin Jun	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function SAR Test Engineer SAR Test Engineer SAR Test Engineer	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19 Jan-19

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lossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for 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 6GHz)", July 2016
- 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 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

Certificate No: Z18-60336

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Measurement Conditions

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

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.44 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	2007	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	39.8 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.1 mW /g ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

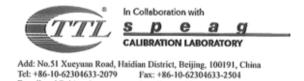
	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.3 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.97 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.3 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.38 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.7 mW /g ± 18.7 % (k=2)

Certificate No: Z18-60336

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http://www.chinattl.cn Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

E-mail: cttl@chinattl.com

Impedance, transformed to feed point	54.0Ω+ 5.00jΩ
Return Loss	- 24.2dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.4Ω+ 5.03jΩ
Return Loss	- 25.4dB

General Antenna Parameters and Design

Electrical Deley (one discrition)	
Electrical Delay (one direction)	1.061 ns

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

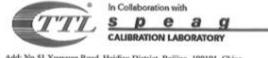
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching 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
l		OFEAG

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 E-mnil: etti@chinattl.com
 http://www.chinattl.cn

DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China

Date: 09.10.2018

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162 Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; $\sigma = 1.438$ S/m; $\epsilon_r = 40.37$; $\rho = 1000$ kg/m3 Phantom section: Center Section

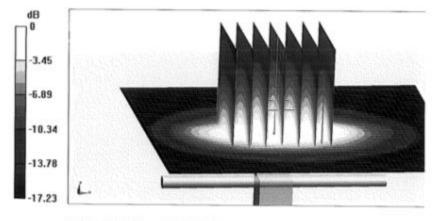
DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.39, 8.39, 8.39) @ 1900 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 97.60 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 19.0 W/kgSAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg

Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

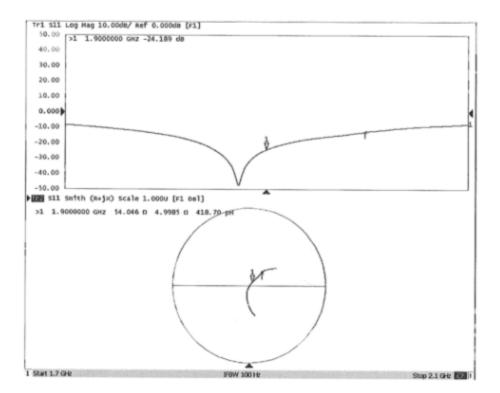
Certificate No: Z18-60336

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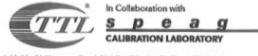
Add: No.51 Xueyuan Road, Haidiun District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: ettl@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Head TSL



Certificate No: Z18-60336

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DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China

Date: 09.10.2018

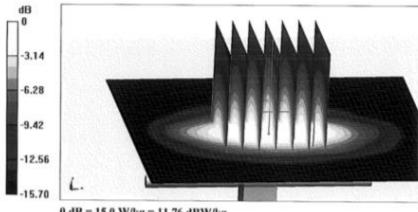
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162 Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; $\sigma = 1.493$ S/m; $\varepsilon_r = 53.34$; $\rho = 1000$ kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.32, 8.32, 8.32) @ 1900 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) ٠
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062 ٠
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 ٠ (7439))

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

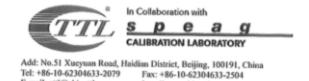
Reference Value = 94.26 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 17.5 W/kg SAR(1 g) = 9.97 W/kg; SAR(10 g) = 5.38 W/kg Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

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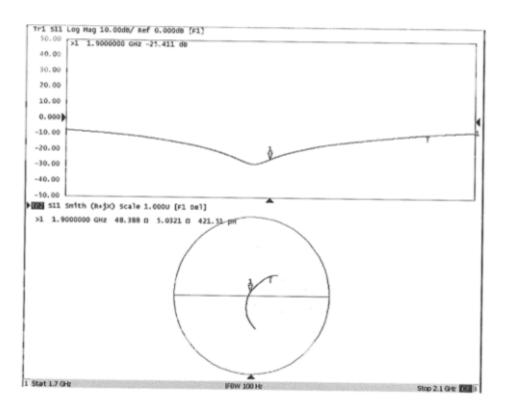
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Impedance Measurement Plot for Body TSL

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Client SMQ	SALAN SALAR	Certificate No: Z1	8-60338
CALIBRATION CI	ERTIFICAT	E	
Object	D2450	/2 - SN: 818	
Calibration Procedure(s)			
		-003-01 tion Procedures for dipole validation kits	
0-10-11-1		and the second sec	
Calibration date:	August	31, 2018	
pages and are part of the ce All calibrations have been		the closed laboratory facility: environment	temperature(22±3)℃ and
humidity<70%. Calibration Equipment used	(M&TE critical fe	or calibration)	
Calibration Equipment used	(M&TE critical fr		Scheduled Calibration
Calibration Equipment used	•	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756)	Scheduled Calibration Oct-18
Calibration Equipment used	ID#	Cal Date(Calibrated by, Certificate No.)	
Calibration Equipment used Primary Standards Power Meter NRVD	ID # 102083 100542	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5	ID # 102083 100542	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756)	Oct-18 Oct-18 Sep-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4	ID # 102083 100542 SN 7464 SN 1524	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Oct-18 Oct-18 Sep-18 Sep-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4	ID # 102083 100542 SN 7464	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.)	Oct-18 Oct-18 Sep-18
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 102083 100542 SN 7464 SN 1524 ID #	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560)	Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561)	Oct-18 Oct-18 Sep-18 Sep-18 Scheduled Calibration Jan-19 Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function	Oct-18 Oct-18 Sep-18 Sep-18 Scheduled Calibration Jan-19 Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function SAR Test Engineer	Oct-18 Oct-18 Sep-18 Sep-18 Scheduled Calibration Jan-19 Jan-19
Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by: Reviewed by:	ID # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function SAR Test Engineer SAR Test Engineer	Oct-18 Oct-18 Sep-18 Sep-18 Scheduled Calibration Jan-19 Jan-19

Certificate No: Z18-60338

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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for 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 6GHz)", July 2016
- 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 6GHz)", March 2010 d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Permittivity	Conductivity
22.0 °C	39.2	1.80 mho/m
(22.0 ± 0.2) °C	38.8 ± 6 %	1.80 mho/m ± 6 %
<1.0 °C		
	(22.0 ± 0.2) °C	(22.0 ± 0.2) °C 38.8 ± 6 %

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	53.1 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.7 mW /g ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

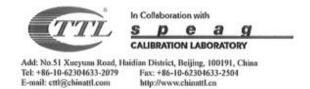
	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	1.98 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.5 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.13 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.4 mW /g ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.4Ω+ 3.63jΩ			
Return Loss	- 26.4dB			

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6Ω+ 5.36jΩ	
Return Loss	- 25.4dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.027 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

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 08.31.2018

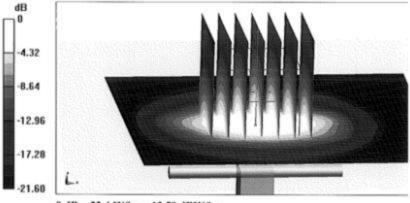
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; σ = 1.802 S/m; ε_r = 38.84; ρ = 1000 kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(7.89, 7.89, 7.89) @ 2450 MHz; Calibrated: 9/12/2017
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

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

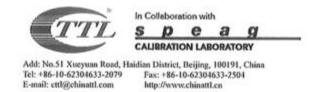
Reference Value = 100.2 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 27.7 W/kg SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.19 W/kg Maximum value of SAR (measured) = 22.4 W/kg



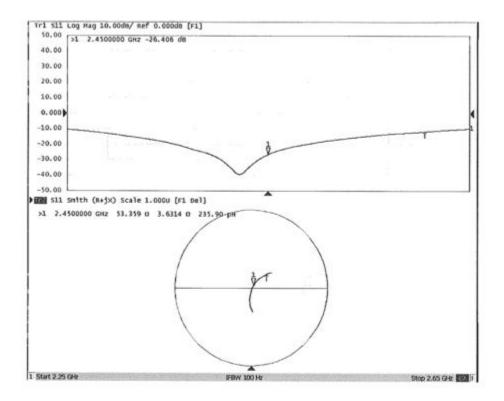
0 dB = 22.4 W/kg = 13.50 dBW/kg

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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 2450 MHz: Type: D2450V2: Se

Date: 08.30.2018

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; $\sigma = 1.982$ S/m; $\epsilon_r = 52.34$; $\rho = 1000$ kg/m3 Phantom section: Center Section

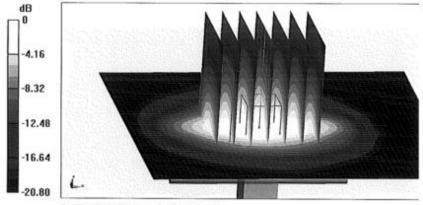
DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.09, 8.09, 8.09) @ 2450 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- · Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

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

Reference Value = 98.69 V/m; Power Drift = -0.03 dBPeak SAR (extrapolated) = 26.4 W/kg SAR(1 g) = 13 W/kg; SAR(10 g) = 6.13 W/kg

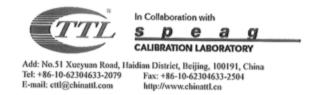
Maximum value of SAR (measured) = 21.4 W/kg



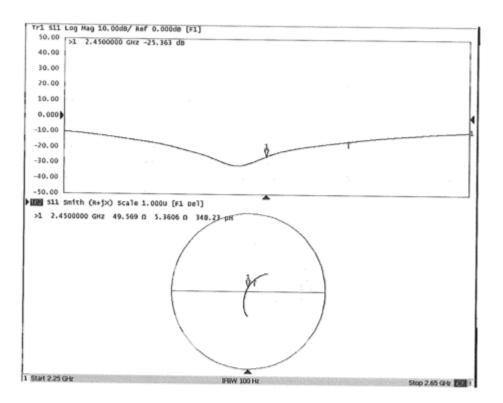
0 dB = 21.4 W/kg = 13.30 dBW/kg

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Impedance Measurement Plot for Body TSL



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Tel: +86-10-623046 E-mail: ettl/stchinat	33-2079 Fax: +	86-10-62304633-2504 www.chinattl.cn	" and adadadada		CNAS L057
Client SMC	Production of the Association		Certificate No:	Z17-970	08
CALIBRATION CI		E			
Oblast					
Object	D2600	V2 - SN: 1074			
Calibration Procedure(s)		-003-01			
	Calibra	tion Procedures for e	dipole validation kits		
Calibration date:	Januar	y 9, 2017			
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards	(M&TE critical fr	or calibration) Cal Date(Calibrate	ed by, Certificate No		eduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used	conducted in (M&TE critical fo	or calibration)	ed by, Certificate No Io.J15X04256)		
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	Conducted in (M&TE critical fr ID # 101919 101547	Cal Date(Calibration) Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N	ed by, Certificate No Io.J15X04256)	.) Sche	eduled Calibration Jun-16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291	Conducted in (M&TE critical fr ID # 101919 101547	Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG	ed by, Certificate No Io.J15X04256) Io.J15X04256)	.) Sche 16)	eduled Calibration Jun-16 Jun-16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	Conducted in (M&TE critical fr ID # 101919 101547 SN 7307	Calibration) Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG 02-Feb-16(CTTL-S	ed by, Certificate No to.J15X04256) to.J15X04256) to.EX3-7307_Feb	.) Sche 16) 11)	eduled Calibration Jun-16 Jun-16 Feb-17
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	Conducted in (M&TE critical fr ID # 101919 101547 SN 7307 SN 771	Calibration) Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG 02-Feb-16(CTTL-S	ed by, Certificate No Io.J15X04256) Io.J15X04256) INO.EX3-7307_Feb IPEAG,No.Z16-9701 d by, Certificate No.)	.) Sche 16) 11)	eduled Calibration Jun-16 Jun-16 Feb-17 Feb-17
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	Conducted in (M&TE critical for 101919 101547 SN 7307 SN 771 ID #	Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG 02-Feb-16(CTTL-S Cal Date(Calibrate	ed by, Certificate No Io.J15X04256) Io.J15X04256) (No.EX3-7307_Feb SPEAG,No.Z16-9701 d by, Certificate No. No.J16X00893)	.) Sche 16) 11)	eduled Calibration Jun-16 Jun-16 Feb-17 Feb-17 Feb-17
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	Conducted in (M&TE critical fi 101919 101547 SN 7307 SN 771 ID # MY49071430	Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG 02-Feb-16(CTTL-S Cal Date(Calibrate 01-Feb-16 (CTTL,	ed by, Certificate No Io.J15X04256) Io.J15X04256) (No.EX3-7307_Feb SPEAG,No.Z16-9701 d by, Certificate No. No.J16X00893)	.) Sche 16) 11)	eduled Calibration Jun-16 Jun-16 Feb-17 Feb-17 duled Calibration Jan-17 Jan-17
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	Conducted in (M&TE critical fr 101919 101547 SN 7307 SN 7307 SN 771 ID # MY49071430 MY46110673	Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG 02-Feb-16(CTTL-S Cal Date(Calibrate 01-Feb-16 (CTTL, 26-Jan-16 (CTTL,	ed by, Certificate No Io.J15X04256) Io.J15X04256) INO.EX3-7307_Feb IPEAG,No.Z16-9701 d by, Certificate No.J No.J16X00893) No.J16X00894)	.) Sche 16) 11)	eduled Calibration Jun-16 Jun-16 Feb-17 Feb-17 duled Calibration Jan-17
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	conducted in (M&TE critical fr 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673 Name	Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG 02-Feb-16(CTTL-S Cal Date(Calibrate 01-Feb-16 (CTTL, 26-Jan-16 (CTTL,	ed by, Certificate No to.J15X04256) to.J15X04256) (No.EX3-7307_Feb (PEAG,No.Z16-9701 d by, Certificate No.) No.J16X00893) No.J16X00894) gineer	.) Sche 16) 11)) Sche	eduled Calibration Jun-16 Jun-16 Feb-17 Feb-17 duled Calibration Jan-17 Jan-17 Signature
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	conducted in (M&TE critical fr 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrate 01-Jul-15 (CTTL, N 01-Jul-15 (CTTL, N 19-Feb-16(SPEAG 02-Feb-16(CTTL-S Cal Date(Calibrate 01-Feb-16 (CTTL, 26-Jan-16 (CTTL, Function SAR Test En SAR Project	ed by, Certificate No to.J15X04256) to.J15X04256) (No.EX3-7307_Feb (PEAG,No.Z16-9701 d by, Certificate No.) No.J16X00893) No.J16X00894) gineer	.) Sche 16) 11)) Sche	eduled Calibration Jun-16 Jun-16 Feb-17 Feb-17 duled Calibration Jan-17 Jan-17

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Glossary:	
TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "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 2005
- 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 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- · SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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 E-mail: ettl@chinattl.com
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Measurement Conditions DASY system configuration, as

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DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.1 ± 6 %	1.98 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.1 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	56.5 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.5 mW /g ± 20.4 % (k=2)

Body TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) *C	53.6 ± 6 %	2.19 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.2 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	56.8 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.33 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	25.3 mW /g ± 20.4 % (k=2)

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Add: No.51 Xueyuan Road, Haid Tel: +86-10-62304633-2079 E-mail: ettl@chinattl.com	ian District, Beijing Fax: +86-10-6230/ http://www.chinatt	4633-2504		
Appendix				
Antenna Parameters with H	lead TSL			
Impedance, transformed to feed	point		48.5Ω- 8.26jΩ	-
Return Loss			- 21.4dB	
Antenna Parameters with E			46.0Ω- 4.99jΩ	
Return Loss			- 23.5dB	
General Antenna Paramete	rs and Desig	n		
Electrical Delay (one direction)			1.253 ns	

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.

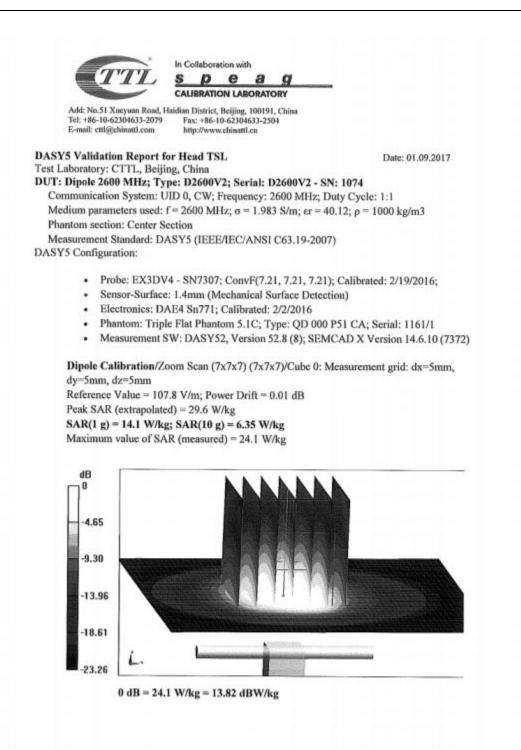
Additional EUT Data

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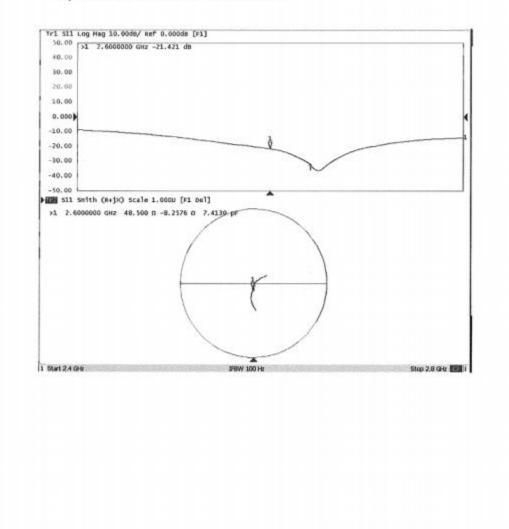


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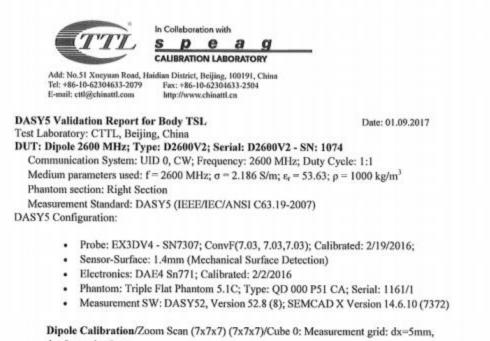
TTL	In Collaboration with	
	CALIBRATION LABORATORY	
	laidian District, Beijing, 100191, China	
Tel: +86-10-62304633-2079 E-mail: ettl@chinattl.com	Fax: +86-10-62304633-2504	
	http://www.chinattl.cn	

Impedance Measurement Plot for Head TSL

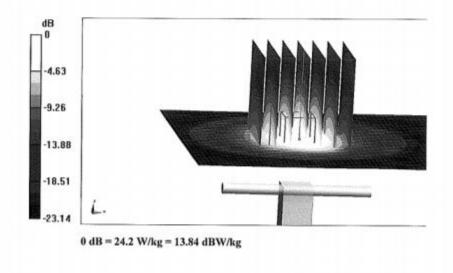


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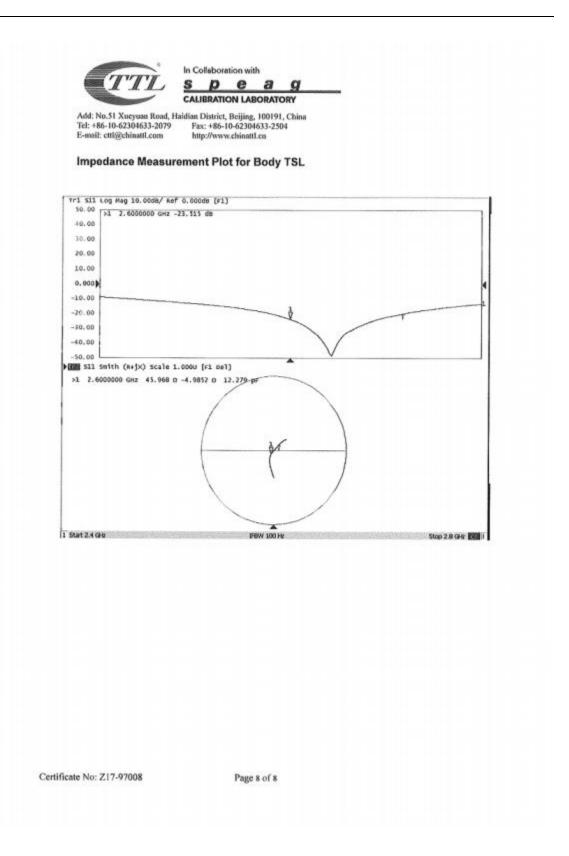


dy=5mm, dz=5mm Reference Value = 101.6 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 30.0 W/kg SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.33 W/kg Maximum value of SAR (measured) = 24.2 W/kg



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Client SMC	2	Certificate No: Z	17-97006
CALIBRATION CI	ERTIFICAT	Έ	
Object	D1750	/2 - SN: 1108	
Calibration Procedure(s)			
		-003-01 tion Procedures for dipole validation kits	
	Galibra	uon Procedures for dipole validation kits	
Calibration date:	January	y 10, 2017	
	conducted in	the closed laboratory facility: environment	t temperature(22±3)°C and
humidity<70%. Calibration Equipment used	(M&TE critical for	or calibration)	
Calibration Equipment used			Scheduled Calibration
Calibration Equipment used	(M&TE critical fo	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Calibration Equipment used Primary Standards	ID#		
Calibration Equipment used Primary Standards Power Meter NRP2	ID # 101919	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291	ID# 101919 101547	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777)	Jun-17 Jun-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	ID # 101919 101547 SN 7307 SN 771	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Jun-17 Jun-17 Feb-17 Feb-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 101919 101547 SN 7307 SN 771 ID #	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.)	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	ID # 101919 101547 SN 7307 SN 771	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Jun-17 Jun-17 Feb-17 Feb-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16 (CTTL, No.J16X04777) 02-Feb-16 (CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893)	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16 (SPEAG,No.EX3-7307_Feb16) 02-Feb-16 (CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894)	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17 Jan-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894) Function	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17 Jan-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by:	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894) Function SAR Test Engineer	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17 Jan-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by: Reviewed by:	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing Qi Dianyuan	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894) Function SAR Test Engineer SAR Project Leader	Jun-17 Jun-17 Feb-17 Scheduled Calibration Jan-17 Jan-17 Signature

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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "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 2005
- 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 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.35 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	9.23 mW / g 37.1 mW /g ± 20.8 % (k=2)	
SAR for nominal Head TSL parameters	normalized to 1W		
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	4.88 mW / g	
SAR for nominal Head TSL parameters	normalized to 1W	19.6 mW /g ± 20.4 % (k=2)	

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) *C	53.1 ± 6 %	1.48 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR measured SAR for nominal Body TSL parameters	250 mW input power normalized to 1W	4.99 mW / g 20.0 mW /g ± 20.4 % (k=2)	
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition		
SAR for nominal Body TSL parameters	normalized to 1W	9.30 mW / g 37.2 mW /g ± 20.8 % (k=2)	
SAR measured	250 mW input power		
SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition		

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.9Ω+ 0.76jΩ
Return Loss	- 42.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.8Ω- 1.27jΩ		
Return Loss	- 24.9dB		

General Antenna Parameters and Design

Electrical Delay (one direction) 1.325 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

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 01.10.2017

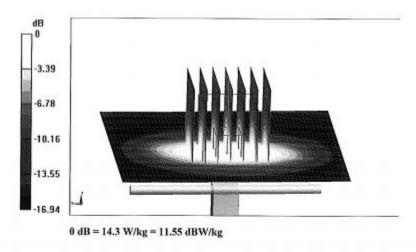
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1108 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.352$ S/m; $\epsilon r = 39.36$; $\rho = 1000$ kg/m3 Phantom section: Center Section

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

- Probe: EX3DV4 SN7307; ConvF(8.37, 8.37, 8.37); Calibrated: 2/19/2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 98.13V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 17.0W/kg SAR(1 g) = 9.23 W/kg; SAR(10 g) = 4.88 W/kg Maximum value of SAR (measured) = 14.3 W/kg



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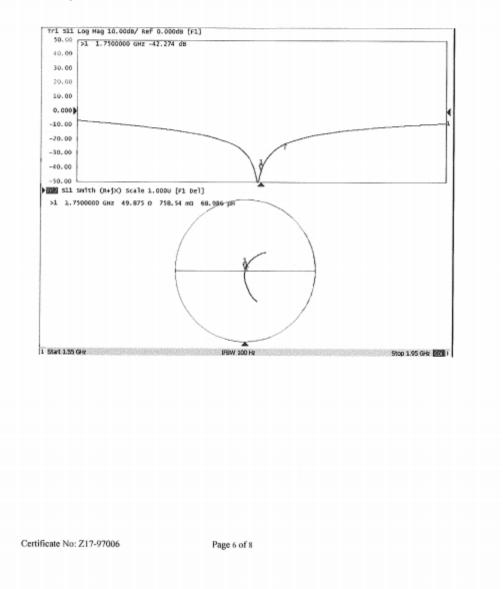


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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China Date: 01.10.2017

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1108 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; σ = 1.484 S/m; ε_r = 53.05; ρ = 1000 kg/m³ Phantom section: Left Section

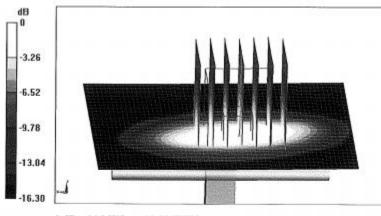
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7307; ConvF(8.18, 8.18, 8.18); Calibrated: 2/19/2016;
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- · Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- · Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 87.18 V/m; Power Drift = -0.03 dB

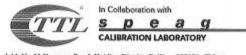
Peak SAR (extrapolated) = 16.4 W/kg SAR(1 g) = 9.3 W/kg; SAR(10 g) = 4.99 W/kg Maximum value of SAR (measured) = 14.0 W/kg



0 dB = 14.0 W/kg = 11.46 dBW/kg

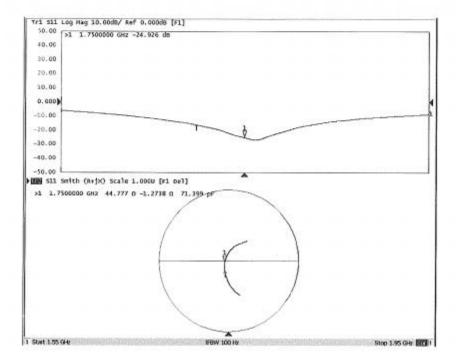
Certificate No: Z17-97006

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Impedance Measurement Plot for Body TSL



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Client SM	Construction and Second	vww.chimattl.cn Certificate No: Z1	7-97005
CALIBRATION C			1-31000
energian en e	ERTIFICAT	E	
Object	D750V3	- SN: 1103	
Calibration Procedure(s)	FD-Z11 Calibrat	-003-01 ion Procedures for dipole validation kits	
Calibration date:	January	10, 2017	
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Certificate No: Z17-97005

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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "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 2005
- 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 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

Certificate No: Z17-97005

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Measurement Conditions

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

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	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.87 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.05 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	8.29 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.37 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	5.53 mW /g ± 20.4 % (k=2)

Body TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.6 ± 6 %	0.94 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.18 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	8.89 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	5.97 mW /g ± 20.4 % (k=2)

Certificate No: Z17-97005

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0Ω- 3.23jΩ	
Return Loss	- 28.6dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.1Ω- 3.34jΩ	
Return Loss	- 29.1dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.139 ns

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

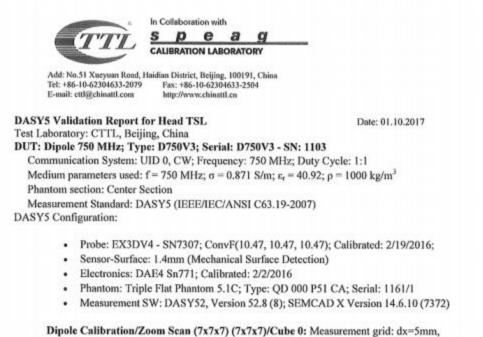
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching 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

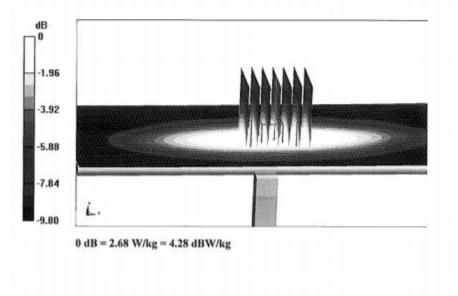
Certificate No: Z17-97005

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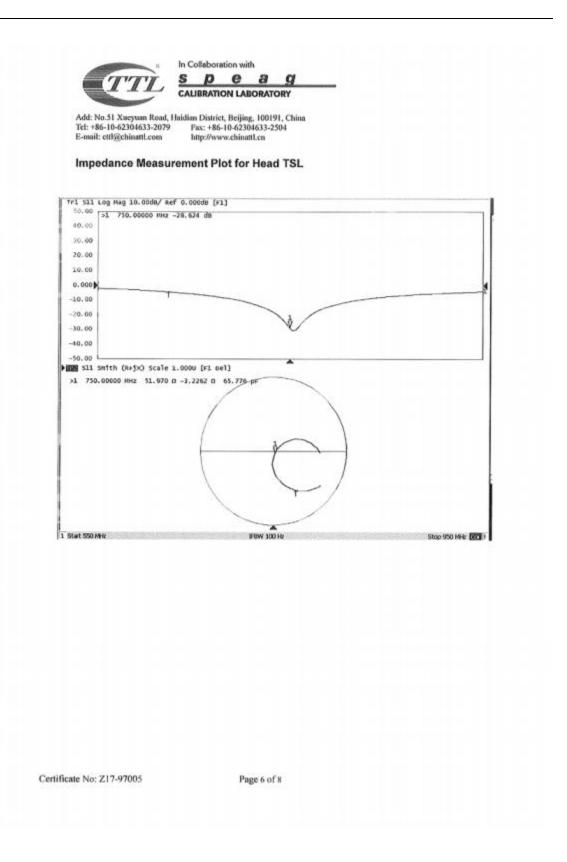
dy=5mm, dz=5mm Reference Value = 53.76 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 2.98 W/kg

SAR(1 g) = 2.05 W/kg; SAR(10 g) = 1.37 W/kg Maximum value of SAR (measured) = 2.68 W/kg



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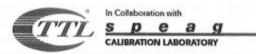
est Laboratory: CTTL, Beijing, China UT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1103 Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: $f = 750$ MHz; $\sigma = 0.936$ S/m; $e_r = 55.59$; $p = 1000$ kg/m ³ Phantom section: Left Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) ASY5 Configuration: Probe: EX3DV4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016: Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn771; Calibrated: 2/2/2016 Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1 Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372) Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 54.96 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.15 W/kg Maximum value of SAR (measured) = 2.34 W/kg Maximum value of SAR (measured) = 2.34 W/kg Maximum value of SAR (measured) = 2.34 W/kg dB dB dB dB dB dB dB dB dB dB dB dB dB dB dB dB dB D DB B = 2.84 W/kg = 4.53 dBW/kg		
UT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1103 Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 750 MHz; g = 0.936 S/m; e_r = 55.59; p = 1000 kg/m ³ Phantom section: Left Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) ASY5 Configuration: Probe: EX3DV4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016; Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn771; Calibrated: 2/2/2016 Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1 Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372) Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 54.96 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.15 W/kg SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.47 W/kg Maximum value of SAR (measured) = 2.84 W/kg Maximum value of SAR (measured) = 2.84 W/kg dB 0 0 dB = 2.84 W/kg = 4.53 dBW/kg	ASY5 Validation Report for Body TSL est Laboratory: CTTL Beijing China	Date: 01.10.2017
Medium parameters used: $f = 750$ MHz; $c = 0.936$ S/m; $e_r = 55.59$, $p = 1000$ kg/m ³ Phantom section: Left Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) ASY5 Configuration: Probe: EX3DV4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016; Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn771; Calibrated: 2/2/2016 Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1 Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372) Diple Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0 : Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value 54.96 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.15 W/kg SAR(1 g) = 2.18 W/kg ; SAR(10 g) = 1.47 W/kg Maximum value of SAR (measured) = 2.84 W/kg Maximum value of SAR (measured) = 2.84 W/kg dB dB d d d d d d d d		103
Phantom section: Left Section Messurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007) SYS Configuration: Probe: EX3DV4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016; Sensor-Surface: 1.4mm (Mechanical Surface Detection) Heatom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1 Measurement SW: DASYS2, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372) Dipte Calibration/Zoom Scan (7x7x) (7x7x)/Cube 0: Measurement grid: dx=5mm, gm, dz=5mm Reference Value 54.96 V/m; Power Drift = -0.01 dB Pak SAR (extrapolated) = 3.15 W/kg SA(1 g) = 2.18 W/kg; SAR(10 g) = 1.47 W/kg Maximum value of SAR (measured) = 2.84 W/kg M_{0}^{0} M_{0}^{1} $M_{$	- 20 M 전자	
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) ASY5 Configuration: Probe: EX3DV4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016; Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn771; Calibrated: 2/2/2016 Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1 Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372) Diple Calibration/Zoom Scan (7x77) (7x77)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 54.96 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.15 W/kg SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.47 W/kg Maximum value of SAR (measured) = 2.34 W/kg Maximum value of SAR (measured) = 2.34 W/kg	그렇는 것 같은 것 같	59; ρ = 1000 kg/m ³
ASYS Configuration: Probe: EX3DV4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016; Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn771; Calibrated: 2/2/2016 Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1 Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372) Diple Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 54.96 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.15 W/kg SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.47 W/kg Maximum value of SAR (measured) = 2.84 W/kg $dB \int 0 \int $		
 Probe: EX3DV4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016; Sensor-Surface: 1.4mm (Mechanical Surface Detection) Hectronics: DAE4 Sn771; Calibrated: 2/2/2016 Phantom: Triple Flat Phantom 5.1C; Type: glow DOD S1 CA; Serial: 1161/1. Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372) Diple Calibration/Zoom Scan (7x7x) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Rdg=5mm, dz=5mw Reference Value 54.96 V/m; Power Drift = -0.01 dB Ratk (extrapolated) = 3.15 W/kg; SAR(19)= 2.18 W/kg; SAR(10)= 1.47 W/kg Marimum value of SAR (measured) = 2.84 W/kg diamum value of B = 2.84 W/kg = 4.53 dBW/kg	- 이상 방법 방법 방법 그 가슴이 가지 않는 것이 같은 것이 아니는 것이 같아. 아이지 않는 것에서 이야지 않는 것이 가지 않는 것이 가지 않는 것이 가지 않는 것이 하는 것이 가지 않는 것이 하는 것이 않는 것이 하는 것이 하는 것이 않는 것이 없다. 것이 않는 것이 않는 것이 않는 것이 없는 것이 없다. 것이 없는 것이 없다. 것이 없는 것이 없다. 것이 없는 것이 않는 것이 없는 것이 않는 것이 없는 것이 없는 것이 없는 것이 없는 것이 않는 것이 없는 것이 없는 것이 않는 것이 않는 것이 않는 것이 없는 것이 없는 것이 없다. 않은 것이 없는 것이 않는 것이 없는 것이 없다. 않은 것이 않은 것이 않는 것이 않는 것이 없는 것이 않는 것 않는 것)
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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "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 2005
- 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 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions DASY system configuration, as

ASY system configuration, as	far as not given on page 1.	1
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DASY Version	DASY52	52.8.8.1258
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	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.65 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	76.2 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.8 mW /g ± 22.2 % (k=2)

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Head TSL parameters at 5600 MHz

	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	35.4 ± 6 %	5.02 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	8.17 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	81.6 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.2 mW /g ± 22.2 % (k=2)

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	5.17 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.06 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	80.9 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.27 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	22.8 mW /g ± 22.2 % (k=2)

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Body TSL parameters at 5250 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.8 ± 6 %	5.39 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.43 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	74.0 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.09 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.8 mW /g ± 22.2 % (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	48.4 ± 6 %	5.70 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	7.94 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	79.3 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.21 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	22.1 mW /g ± 22.2 % (k=2)

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Body TSL parameters at 5750 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.6 ± 8 %	5.83 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm3 (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	75.2 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm3 (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.11 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	21.1 mW /g ± 22.2 % (k=2)

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Appendix

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	50.8Ω - 5.86jΩ
Return Loss	- 24.9dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.7Ω + 3.39jΩ	
Return Loss	- 26.4dB	

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	54.2Ω + 0.48jΩ	
Return Loss	- 27.8dB	

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	49.5Ω - 4.15jΩ	
Return Loss	- 27.5dB	

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	55.0Ω + 2.51jΩ
Return Loss	- 25.5dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	55.5Ω + 0.57jΩ	
Return Loss	- 25.5dB	

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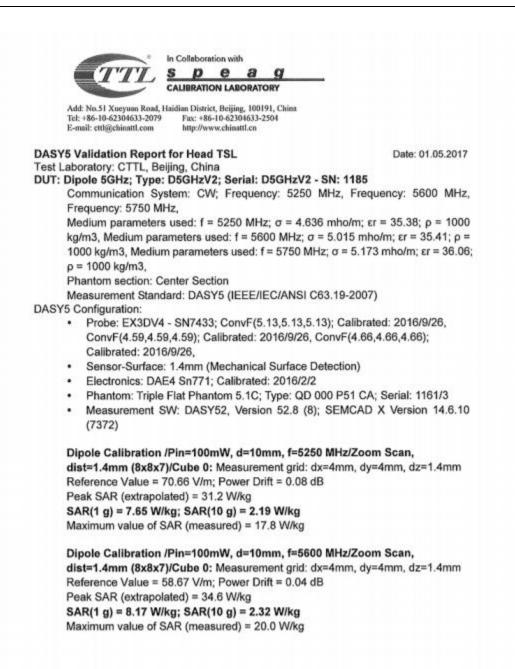
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	CALIBRATION LABORATORY	
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E-mail: cttl@chinattl.com	http://www.chinattl.cn	
	meters and Design	

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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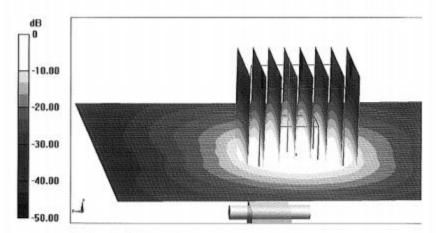


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Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 58.84 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 35.0 W/kg SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.27 W/kg Maximum value of SAR (measured) = 19.6 W/kg



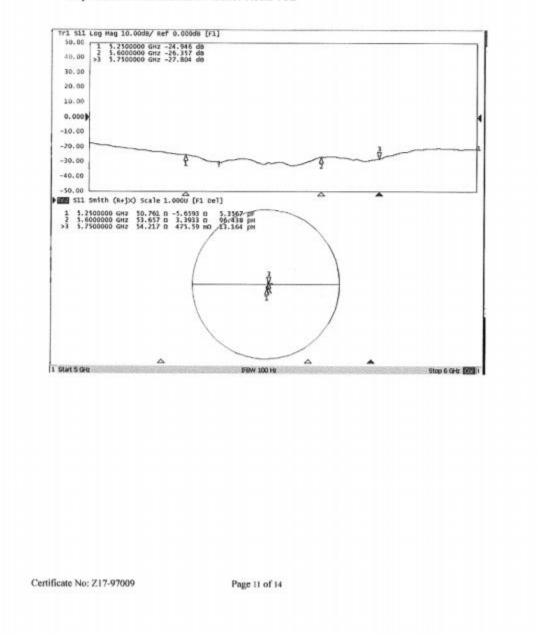
0 dB = 19.6 W/kg = 12.92 dBW/kg

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Impedance Measurement Plot for Head TSL



In Collaboration with spea a CALIBRATION LABORATORY Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: ettl@chinattl.com http://www.chinattl.cn DASY5 Validation Report for Body TSL Date: 01.04.2017 Test Laboratory: CTTL, Beijing, China DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1185 Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Medium parameters used: f = 5250 MHz; σ = 5.388 mho/m; εr = 47.81; ρ = 1000 kg/m3, Medium parameters used: f = 5600 MHz; σ = 5.704 mho/m; ϵ r = 48.39; ρ = 1000 kg/m3, Medium parameters used: f = 5750 MHz; σ = 5.833 mho/m; εr = 48.61; p = 1000 kg/m3,Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) **DASY5** Configuration: Probe: EX3DV4 - SN7433; ConvF(4.68,4.68,4.68); Calibrated: 2016/9/26, ٠ ConvF(3.98,3.98,3.98); Calibrated: 2016/9/26, ConvF(4.35,4.35,4.35); Calibrated: 2016/9/26, Sensor-Surface: 1.4mm (Mechanical Surface Detection) ٠ Electronics: DAE4 Sn771; Calibrated: 2016/2/2 ٠ Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3 Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.67 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 28.3 W/kg SAR(1 g) = 7.43 W/kg; SAR(10 g) = 2.09 W/kg Maximum value of SAR (measured) = 17.1 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 = 67.65 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 33.3 W/kg SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.21 W/kg Maximum value of SAR (measured) = 19.4 W/kg

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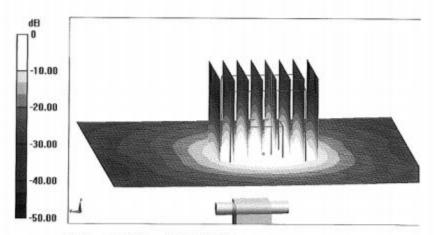


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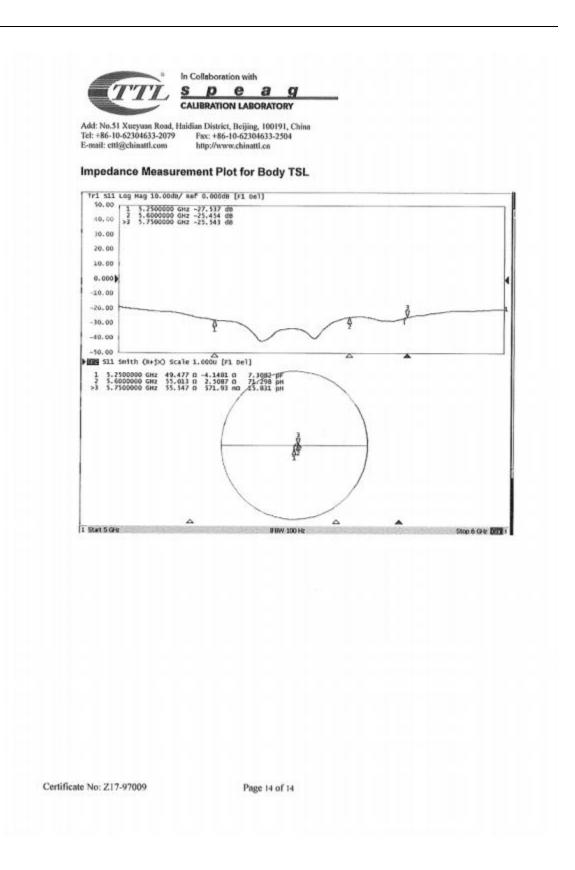
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.79 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 30.7 W/kg SAR(1 g) = 7.52 W/kg; SAR(10 g) = 2.11 W/kg Maximum value of SAR (measured) = 17.7 W/kg



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

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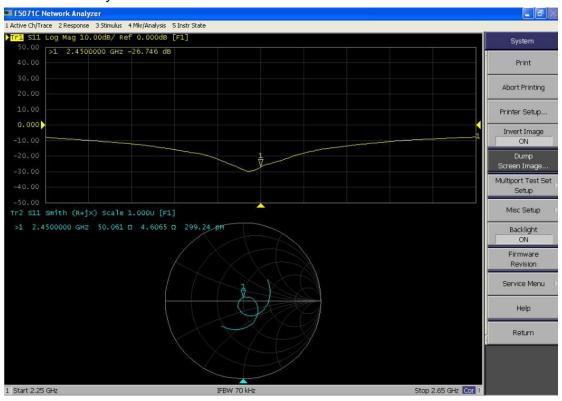


Note:

1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix D.

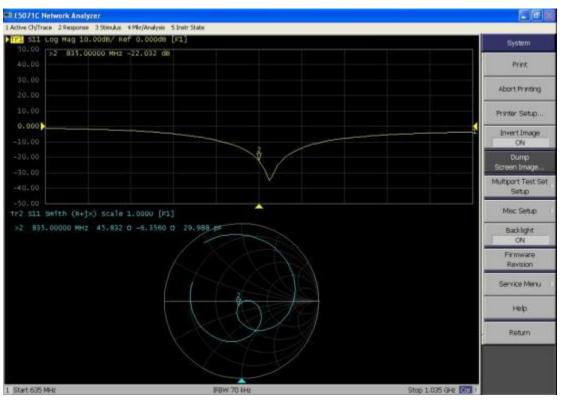
- a) There is no physical damage on the dipole;
- b) System check with specific dipole is within 10% of calibrated value;
- c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
- d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

D2450MHz Body



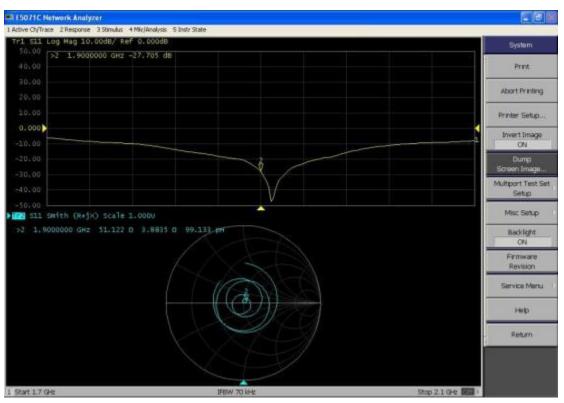
D2450V2, serial No. 818 Extended Dipole Calibrations

	2450 Body					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2015-09-14	-26.35		49.415		4.75	
2018-04-08	-26.74	0.31	50.061	0.646	4.61	0.14



D835V2, serial No. 4d141 Extended Dipole Calibrations

	835MHz Body					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2015-09-24	-22.3		45.681		-5.94	
2017-09-24	-22.0	1.36	45.832	-0.151	-6.35	0.41



D1900V2, serial No. 5d162 Extended Dipole Calibrations

	1900MHz Body					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2015-09-26	-27.259		48.392		3.955	
2017-09-26	-27.705	-1.6	51.122	-2.73	3.884	0.071

	is 5 Instr State		
r1 S11 Smith (R+j×) Scale 900.0mU	[F1]		System
>1 1.7577427 GHz 47.083 Ω 0.143	0 Ω 375.13 pH		Print
			Abort Printing rinter Setup
			Invert Image ON Dump
		s	creen Image
		Mu	ultiport Test Se Setup
2 511 Log Mag 10.00dB/ Ref 0.000			Misc Setup
20.00 >1 1.7577427 GHz -25.667 10.00			Backlight ON
0.000			Firmware
10.00		2	Revision
	i		Service Menu
30.00			Help
50.00			Return
60.00			
70.00			

D1750V2, serial No. 1108 Extended Dipole Calibrations

	1750MHz Body					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2017-01-10	-24.9		44.8		-1.27	
2018-01-10	-26.322	5.7	47.83	3.03	0.143	1.3

ctive Ch/Trace 2 Response 3 Stimulus 4 M	kr/Analysis 5 Instr State		
rl S11 Smith (R+jX) Scale 1.	000U [F1]		System
>1 2.6000000 GHz 46.688 Ω	-6.7177 Ω 9.1123 pF		Print
			Abort Printing
	(F)		Printer Setup
			Invert Image ON
			Dump Screen Image
			Multiport Test S Setup
2 511 Log Mag 5.000dB/ Ref	-20.00dB [F1]		Misc Setup
5.000 >1 2.6000000 GHz -2 0.000	.163 dB		Backlight ON
			Firmware Revision
10.00		2	Service Menu
20.00	1		Help
25.00			Return
			A BOINT
35.00			

D2600V2, serial No. 1074 Extended Dipole Calibrations

	2600MHz Body						
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta	
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)	
2017-01-09	-23.5		46.0		-4.99		
2018-01-09	-23.163	1.43	46.68	0.68	-6.71	-1.61	

	Stimulus 4 Mkr/Analysis 5 Instr St	die		
<mark>°1</mark> S11 Smith (R+jX)				System
1 5.2500000 GHz 2 5.6000000 GHz >3 5.7500000 GHz	48.240 Ω 1.0372 Ω 31 56.107 Ω -956.19 mΩ 29 56.385 Ω 6.9080 Ω 19	442 рН 9.723 рF 1.21 рН		Print
				Abort Printing
		3		Printer Setup
				Invert Image ON
				Dump Screen Image
			1	Multiport Test Si Setup
	0dB/ Ref 0.000dB [F1]			Misc Setup
50.00 1 5.25000 2 5.60000 40.00	00 GHZ -26.823 dB 00 GHZ -24.440 dB 00 GHZ -24.087 dB			Backlight
>3 5.75000	00 GHz -24.087 dB			ON
	00 GHZ -24.087 dB			
	00 GHZ -24.087 dB			ON Firmware
30,00 20,00 10,00 0,000	JO GHZ −24.087 αΒ			ON Firmware Revision
30.00 20.00 10.00 0.000	JU GHZ -24.087 08			ON Firmware Revision Service Menu
30.00 20.00 10.00 0.000 10.00 20.00 30.00	00 GHZ -24.087 dB			ON Firmware Revision Service Menu Help
30.00 20.00 10.00 20.00 10.00 20.00 30.00 40.00 50.00	00 GHZ -24.087 dB	~~~~~ § ~~		ON Firmware Revision Service Menu Help

	5.25GHz Body						
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta	
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)	
2017-01-05	-27.5		49.47		-4.14		
2018-01-05	-26.8	0.7	48.24	1.23	1.03	5.17	

	5.6GHz Body						
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta	
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)	
2017-01-05	-25.5		55.0		-2.5		
2018-01-05	-24.4	1.1	56.1	-1.1	0.9	3.4	

	5.75GHz Body						
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta	
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)	
2017-01-05	-25.5		55.5		0.5		
2018-01-05	-24.1	1.4	56.4	-0.9	6	5.5	