





### DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3754

### **Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	47.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

Certificate No: Z17-97010

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Client ECI		Certificate No: Z1	15-97165
CALIBRATION C	ERTIFICAT		10-37100
Object	D835V	2 - SN: 4d112	
Calibration Procedure(s)		-2-003-01 tion Procedures for dipole validation kits	
Calibration date:			
Canoradon dale.	Octobe	r 22, 2015	
pages and are part of the ca All calibrations have been humidity<70%.		he closed laboratory facility: environment	temperature(22±3) $\mathbb C$ and
Calibration Equipment used			
canoration equipment used	(M&TE critical fo	r calibration)	
	I (M&TE critical fo	r calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
			Scheduled Calibration Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-291	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16 Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	ID # 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Jun-16 Jun-16 Aug -16
Primary Standards Power Meter NRP2 Power sensor NRP-291	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16 Jun-16 Aug -16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	ID # 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Jun-16 Jun-16 Aug -16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15)	Jun-16 Jun-16 Aug -16 Aug -16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 28-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.)	Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Jun-16 Jun-16 Aug -16 Aug -18 Scheduled Calibration Feb-16
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00728) 03-Feb-15 (CTTL, No.J15X00728)	Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15 (SPEAG,No.EX3-3617_Aug15) 26-Aug-15 (SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function	Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function SAR Test Engineer	Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16



ЕСП

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Glossary:	
TSL ConvF	tissue simulating liquid sensitivity in TSL / NORMx.v.z
N/A	not applicable or not measured
	Performed According to the Following Standards:
<ul> <li>IEEE Std 1</li> <li>Spatial-Ave</li> </ul>	528-2013, "IEEE Recommended Practice for Determining the Peak raged Specific Absorption Rate (SAR) in the Human Head from Wireless
Communica	ations Devices: Measurement Techniques", June 2013
devices us 2005	<ol> <li>"Procedure to measure the Specific Absorption Rate (SAR) For hand-held ad in close proximity to the ear (frequency range of 300MHz to 3GHz)", February</li> </ol>
) KDB86566	4, SAR Measurement Requirements for 100 MHz to 6 GHz
the second second second second	ocumentation:
I) DAST4/5 5	ystem Handbook
Measuren of the cert	lied and Interpretation of Parameters: ment Conditions: Further details are available from the Validation Report at the end ificate. All figures stated in the certificate are valid at the frequency indicated. Parameters with TSL: The dipole is mounted with the spacer to position its feed
point exac parallel to	tly below the center marking of the flat phantom section, with the arms oriented the body axis.
positioned measuren	t Impedance and Return Loss: These parameters are measured with the dipole under the liquid filled phantom. The impedance stated is transformed from the tent at the SMA connector to the feed point. The Return Loss ensures low ower. No uncertainty required.
Electrical No uncert	Delay: One-way delay between the SMA connector and the antenna feed point. ainty required.
SAR mea SAR norm	sured: SAR measured at the stated antenna input power. alized: SAR as measured, normalized to an input power of 1 W at the antenna
connector	
SAR for n nominal S	orninal TSL parameters: The measured TSL parameters are used to calculate the AR result.
The report	ed uncertainty of measurement is stated as the standard uncertainty of
Measureme	int multiplied by the coverage factor k=2, which for a normal distribution is to a coverage probability of approximately 95%.





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### Measurement Conditions

DASY Version	DASY52	52.8.8.1222
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	42.2 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		1

#### SAR result with Head TSL

Condition	
250 mW input power	2.31 mW/g
normalized to 1W	9.22 mW /g ± 20.8 % (k=2)
Condition	
250 mW input power	1.51 mW/g
normalized to 1W	6.03 mW /g ± 20.4 % (k=2)
	250 mW input power normalized to 1W Condition 250 mW input power

#### **Body TSL parameters**

	Temperature	Permitt	ivity	Conductivity	
Nominal Body TSL parameters	22.0 °C	55.2	6	0.97 mho/m	
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ±	6 %	0.96 mho/m ± 6 %	
Body TSL temperature change during test	<1.0 °C				
R result with Body TSL				12	
SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Con	dition			
SAR measured	250 mW	input power		2.37 mW / g	
SAR for nominal Body TSL parameters	normalia	ted to 1W	9.57	mW /g ± 20.8 % (k=2)	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body T	SL Con	dition			
SAR measured	250 m/W	input power		1.56 mW / g	
SAR for nominal Body TSL parameters	normalia	normalized to 1W		6.29 mW /g ± 20.4 % (k=2	

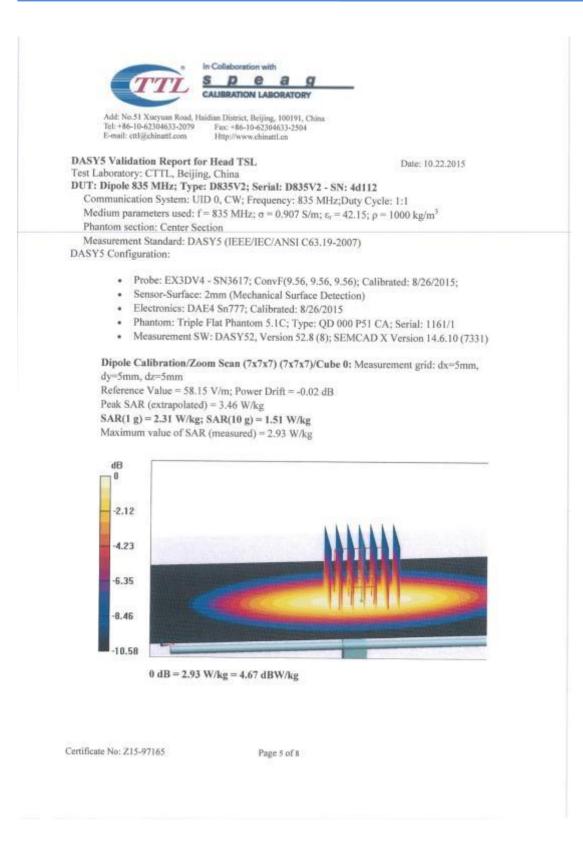
Certificate No: Z15-97165

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8	ntenna Parameters with Head TSL	
	Impedance, transformed to feed point	49.1Ω- 4.20jΩ
	Return Loss	- 27.3dB
A	ntenna Parameters with Body TSL	
	Impedance, transformed to feed point	46.2Ω- 4.79jΩ
	Return Loss	- 23.9dB
G	eneral Antenna Parameters and Desi	ign
	Electrical Delay (one direction)	1.502 ns
Th col of ac	measured. e dipole is made of standard semirigid coaxi nnected to the second arm of the dipole. The the dipoles, small end caps are added to the cording to the position as explained in the "M	only a slight warming of the dipole near the feedpoint can al cable. The center conductor of the feeding line is directly antenna is therefore short-circuited for DC-signals. On some dipole arms in order to improve matching when loaded leasurement Conditions" paragraph. The SAR data are not the still presenting the Starford.
Th coi of aci aff	measured. e dipole is made of standard semirigid coaxi nnected to the second arm of the dipole. The the dipoles, small end caps are added to the cording to the position as explained in the "M ected by this change. The overall dipole leng	al cable. The center conductor of the feeding line is directly antenna is therefore short-circuited for DC-signals. On some dipole arms in order to improve matching when loaded leasurement Conditions" paragraph. The SAR data are not th is still according to the Standard. le arms, because they might bend or the soldered
the color of action affi No color	measured. e dipole is made of standard semirigid coaxis nnected to the second arm of the dipole. The the dipoles, small end caps are added to the cording to the position as explained in the "M ected by this change. The overall dipole leng excessive force must be applied to the dipo	al cable. The center conductor of the feeding line is directly antenna is therefore short-circuited for DC-signals. On some dipole arms in order to improve matching when loaded leasurement Conditions" paragraph. The SAR data are not th is still according to the Standard. le arms, because they might bend or the soldered
the color of action affi No color	measured. e dipole is made of standard semirigid coaxi nnected to the second arm of the dipole. The the dipoles, small end caps are added to the cording to the position as explained in the "M ected by this change. The overall dipole leng excessive force must be applied to the dipo nnections near the feedpoint may be damage	al cable. The center conductor of the feeding line is directly antenna is therefore short-circuited for DC-signals. On some dipole arms in order to improve matching when loaded leasurement Conditions" paragraph. The SAR data are not th is still according to the Standard. le arms, because they might bend or the soldered

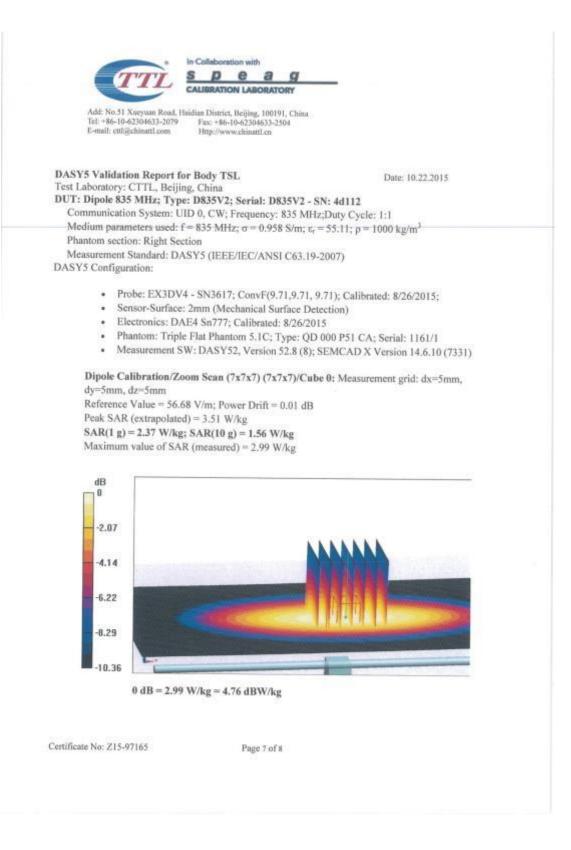




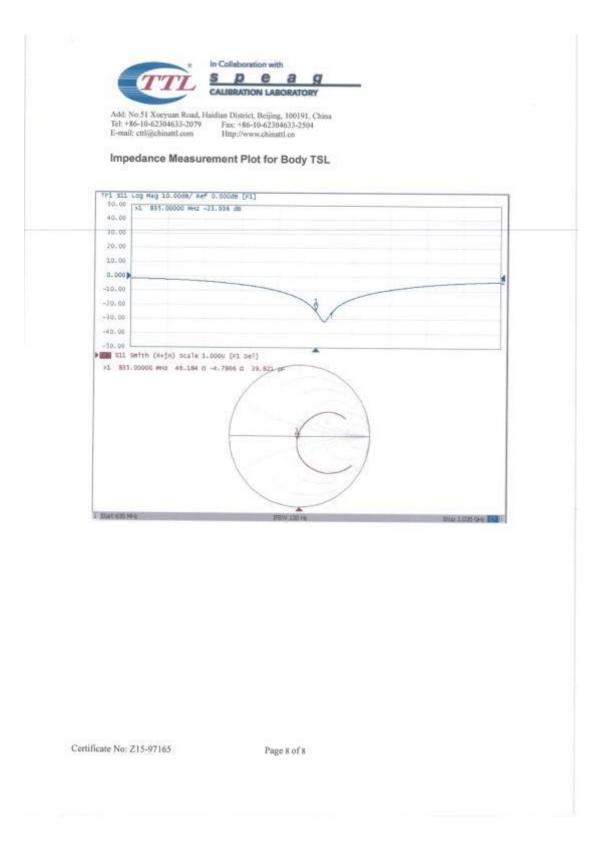


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## D835V2, Serial No.4d112 Extended Dipole Calibrations

Per IEEE Std 1528-2013, the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement.

Per KDB 865664 D01, if dipoles are verified in return loss(<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

### Justification of the extended calibration

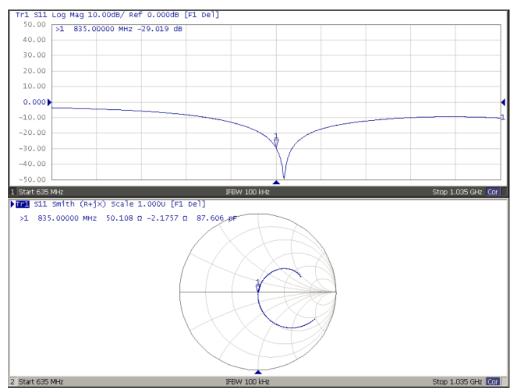
	D835V2 Serial No.4d112								
			835 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)			
10.22.2015	-27.27		49.108		-4.2018				
10.21.2016	-29.019	6.41	50.108	1	-2.1757	2.0261			

	D835V2 Serial No.4d112							
			835 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)		
10.22.2015	-23.036		46.184		-4.7866			
10.21.2016	-23.131	0.56	47.003	0.819	-2.9072	1.8794		

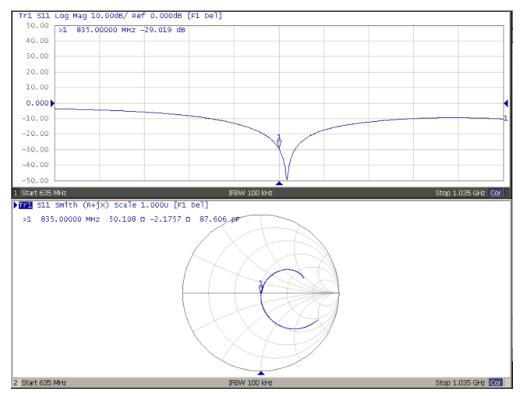
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



## Dipole Verification Data D835V2 Serial No.4d112 835MHz-Head



### 835MHz - Body





		TION LABORATORY	CNAS
Add: No.51 Xueyu Tel: +86-10-62304 E-mail: ettl@china	633-2079 Fax:	strict, Beijing, 100191, China +86-10-62304633-2504 //www.chinattl.en	CALIBRATION No. L0570
Client ECI			215-97167
CALIBRATION C	ERTIFICAT	TE	
Object	D1750	V2 - SN: 1044	
Calibration Procedure(s)		1-2-003-01 ation Procedures for dipole validation kits	
Calibration date:	Nover	iber 3, 2015	1000000000
pages and are part of the c	asurements and ertificate.	the closed laboratory facility: environme	ty are given on the following
measurements(SI). The me pages and are part of the co All calibrations have been humidity<70%. Calibration Equipment used	asurements and ertificate. conducted in (M&TE critical f	the uncertainties with confidence probabili the closed laboratory facility: environme or calibration)	ty are given on the following nt temperature(22±3)℃ and
measurements(SI). The me pages and are part of the co All calibrations have been humidity<70%.	asurements and ertificate. 1 conducted in	the uncertainties with confidence probabili the closed laboratory facility: environme or calibration) Cal Date(Calibrated by, Certificate No.)	ty are given on the following nt temperature(22±3)℃ and Scheduled Calibration
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measurements(SI). The me pages and are part of the cr All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	asurements and ertificate. conducted in (M&TE critical f ID # 101919 101547	the uncertainties with confidence probabili the closed laboratory facility: environme or calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256)	ty are given on the following nt temperature(22±3)°C and Scheduled Calibration Jun-16 Jun-16
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Certificate No: Z15-97167

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Glossar	r: tissue simulating liquid	
ConvF N/A	sensitivity in TSL / NORMx,y,z not applicable or not measured	
a) IEEE 5 Spatial Comm b) IEC 62 device	on is Performed According to the Following Standards: Std 1528-2013, "IEEE Recommended Practice for Determining the Peak -Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless unications Devices: Measurement Techniques", June 2013 2209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held s used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February	
2005 c) KDB86	35664, SAR Measurement Requirements for 100 MHz to 6 GHz	
Methods Meas of the Anter point parall Feed positi meas reflec Electi	A/5 System Handbook Applied and Interpretation of Parameters: wrement Conditions: Further details are available from the Validation Report at the end certificate. All figures stated in the certificate are valid at the frequency indicated. In a Parameters with TSL: The dipole is mounted with the spacer to position its feed exactly below the center marking of the flat phantom section, with the arms oriented lel to the body axis. Point Impedance and Return Loss: These parameters are measured with the dipole oned under the liquid filled phantom. The impedance stated is transformed from the urement at the SMA connector to the feed point. The Return Loss ensures low ted power. No uncertainty required. <i>rical Delay:</i> One-way delay between the SMA connector and the antenna feed point.	
· SAR	ncertainty required. measured: SAR measured at the stated antenna input power.	
<ul> <li>SAR</li> </ul>	normalized: SAR as measured, normalized to an input power of 1 W at the antenna actor. for nominal TSL parameters: The measured TSL parameters are used to calculate the nal SAR result.	
Measu	aported uncertainty of measurement is stated as the standard uncertainty of rement multiplied by the coverage factor k=2, which for a normal distribution ponds 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	52.8.8.1222
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	39.7 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>2</sup> (1 g) of Head TSL	Condition	0
SAR measured	250 mW input power	9.48 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	37.3 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	0
SAR measured	250 mW input power	5.09 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.1 mW /g ± 20.4 % (k=2)

#### **Body TSL parameters**

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mha/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.4±6%	1.47 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	1	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
R result with Body TSL			
SAR averaged over 1 cm3 (1 g) of Body TSL	Condit	tion	

SAR	result	with	Body	TSL

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.30 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	37.6 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.02 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.2 mW /g ± 20.4 % (k=2)

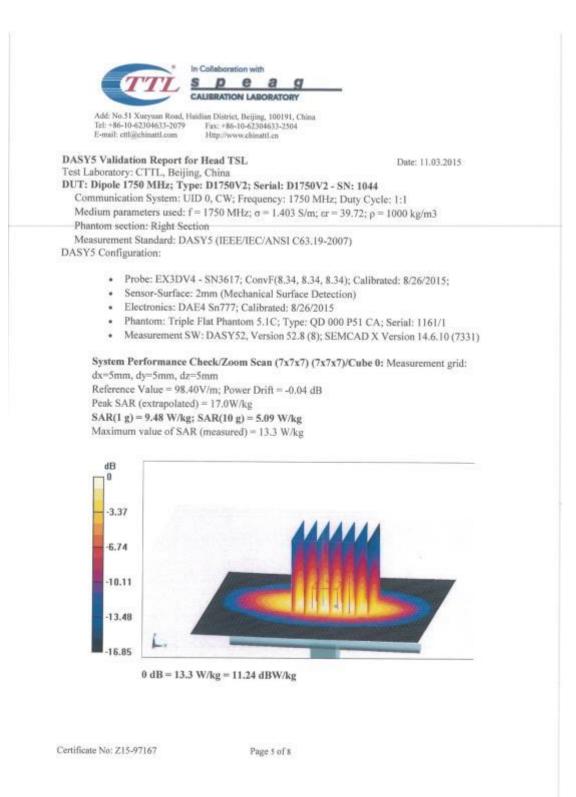
Certificate No: Z15-97167

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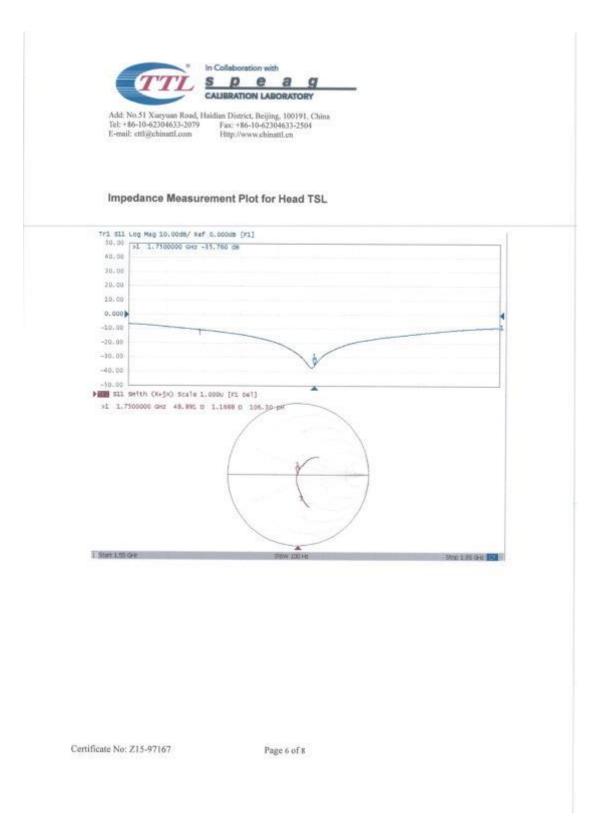


Antenna Parameters with Head TSL	
Impedance, transformed to feed point. Return Loss.	48.9Ω+ 1.17jΩ - 35.8dB
Antenna Parameters with Body TSL	
Impedance, transformed to feed point	45.5Ω+ 0.58jΩ
Return Loss	- 26.5dB
General Antenna Parameters and Design	
Electrical Delay (one direction)	1.319 ns
After long term use with 100W radiated power, only a be measured. The dipole is made of standard semirigid coaxial cabl connected to the second arm of the dipole. The anten of the dipoles, small end caps are added to the dipole according to the position as explained in the "Measure affected by this change. The overall dipole length is si No excessive force must be applied to the dipole arms	slight warming of the dipole near the feedpoint of a. The center conductor of the feeding line is dire na is therefore short-circuited for DC-signals. Or arms in order to improve matching when loaded ement Conditions" paragraph. The SAR data are ill according to the Standard
After long term use with 100W radiated power, only a be measured. The dipole is made of standard semirigid coaxial cabl connected to the second arm of the dipole. The anten of the dipoles, small end caps are added to the dipole according to the position as explained in the "Measure affected by this change. The overall dipole length is at	slight warming of the dipole near the feedpoint of a. The center conductor of the feeding line is dire na is therefore short-circuited for DC-signals. Or arms in order to improve matching when loaded ement Conditions" paragraph. The SAR data are ill according to the Standard
After long term use with 100W radiated power, only a be measured. The dipole is made of standard semingid coaxial cable connected to the second arm of the dipole. The anten of the dipoles, small end caps are added to the dipole according to the position as explained in the "Measure affected by this change. The overall dipole length is si No excessive force must be applied to the dipole arm connections near the feedpoint may be damaged.	slight warming of the dipole near the feedpoint of a. The center conductor of the feeding line is dire na is therefore short-circuited for DC-signals. Or arms in order to improve matching when loaded ement Conditions" paragraph. The SAR data are ill according to the Standard

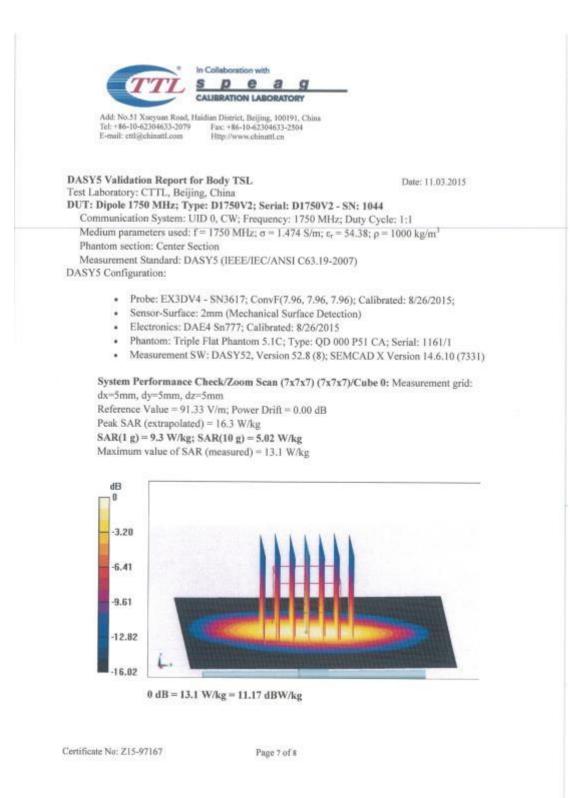














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Impedance Measure	ment Plot for Body TSL		
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Add: No.51 Xueyu Tel: +86-10-62304 E-mail: ettl@china	633-2079 Fax	strict, Beijing, 100191, China +86-10-62304633-2504 (Neww.chinatt].cn	CALIBRATION No. L0570
Client EC	IT	Certificate No: Z1	15-97168
CALIBRATION C	ERTIFICAT	ſE	
Object	D1900	V2 - SN: 5d134	
Calibration Procedure(s)			
10-00000000000000000000000000000000000		1-2-003-01	
	Calibra	ition Procedures for dipole validation kits	
Calibration date:	Novem	ber 4, 2015	Contraction,
measurements(51). The me	asurements and	the uncertainties with confidence probability	are given on the following
pages and are part of the c All calibrations have beer humidity<70%. Calibration Equipment used	ertificate.	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled Calibration Jun-16
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ЕСП

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Glossary:	
TSL ConvF	tissue simulating liquid sensitivity in TSL / NORMx.y.z
N/A	not applicable or not measured
<ul> <li>a) IEEE Std 1</li> <li>Spatial-Ave Communica</li> <li>b) IEC 62209</li> </ul>	a Performed According to the Following Standards: 528-2013, "IEEE Recommended Practice for Determining the Peak raged Specific Absorption Rate (SAR) in the Human Head from Wireless ations Devices: Measurement Techniques", June 2013 -1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held ed in close proximity to the ear (frequency range of 300MHz to 3GHz)", February
Contract of the Contract of the	4, SAR Measurement Requirements for 100 MHz to 6 GHz
	ocumentation: System Handbook
Measurer of the ceri Antenna I point exac parallel to Feed Poir positionec measuren reflected y Electrical No uncert SAR mea SAR norm connector	ominal TSL parameters: The measured TSL parameters are used to calculate the
Measureme	ed uncertainty of measurement is stated as the standard uncertainty of ant multiplied by the coverage factor k=2, which for a normal distribution is 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	52.8.8.1222
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	40.6 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	40.8 mW/g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.22 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.0 mW /g ± 20.4 % (k=2)

#### **Body TSL parameters**

	Temperature	Permitti	ivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3		1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ±	6 %	1.54 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		2	
R result with Body TSL				1
SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Cond	ition		
SAR measured	250 mW i	nput power		10.3 mW / g
SAR for nominal Body TSL parameters	normaliz	ed to 1W	41.1	mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Body T	SL Cond	ition		
SAR measured	250 mW i	250 mW input power		5.33 mW / g
SAR for nominal Body TSL parameters	normaliz	wt of be	21.3	mW /g ± 20.4 % (k=2)

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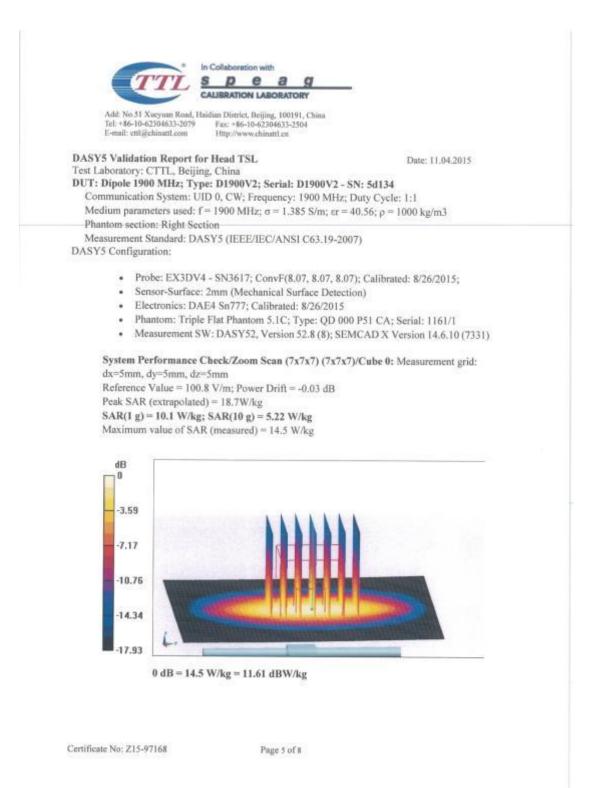
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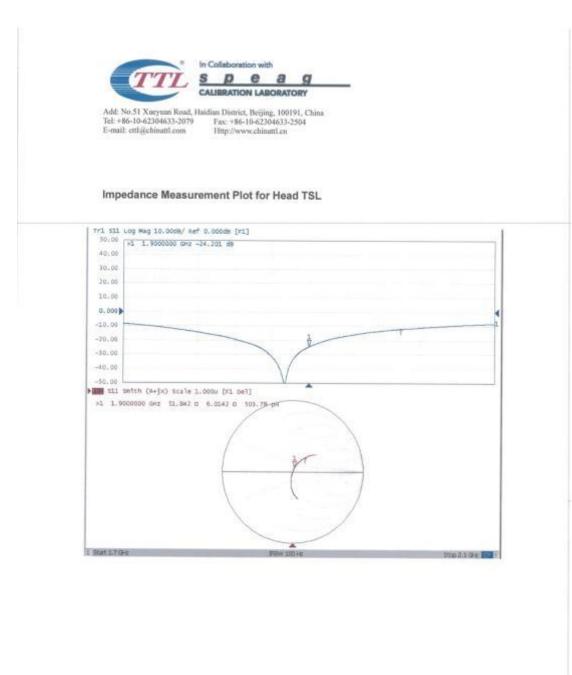
E-mail: cttl@chinatt.com Http://www.c	
Antenna Parameters with Head TSL	
Impedance, transformed to feed point	51.80+ 6.01jQ
Return Loss	- 24.2dB
Antenna Parameters with Body TSL	
Impedance, transformed to feed point	47.1Ω+ 5.41jΩ
Return Loss	- 24.0dB
After long term use with 100W radiated power be measured.	er, only a slight warming of the dipole near the feedpoint can
be measured. The dipole is made of standard semirigid cos connected to the second arm of the dipole. To of the dipoles, small end caps are added to t according to the position as explained in the affected by this change. The overall dipole le No excessive force must be applied to the di connections near the feedpoint may be dame	axial cable. The center conductor of the feeding line is directly he antenna is therefore short-circuited for DC-signals. On some he dipole arms in order to improve matching when loaded "Measurement Conditions" paragraph. The SAR data are not ength is still according to the Standard. pole arms, because they might bend or the soldered
be measured. The dipole is made of standard semirigid cos connected to the second arm of the dipole. T of the dipoles, small end caps are added to t according to the position as explained in the affected by this change. The overall dipole le	axial cable. The center conductor of the feeding line is directly he antenna is therefore short-circuited for DC-signals. On some he dipole arms in order to improve matching when loaded "Measurement Conditions" paragraph. The SAR data are not ength is still according to the Standard. pole arms, because they might bend or the soldered

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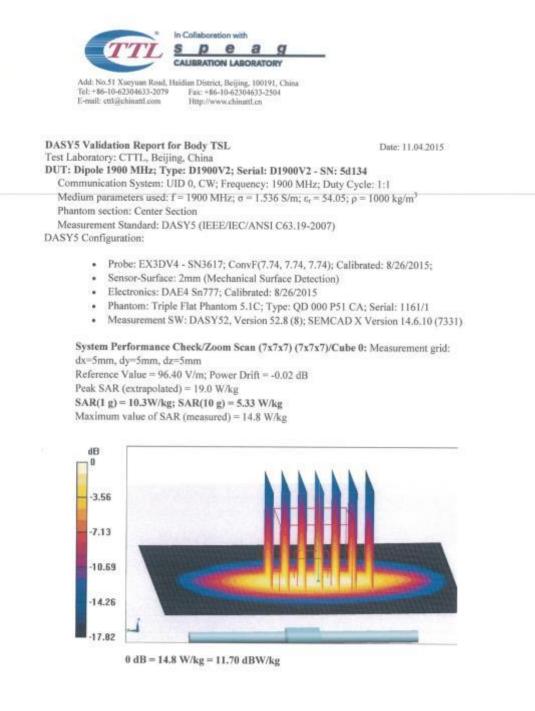






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Imp	edance Measurement Plot for Body TSL
	Log Mag 10.00ds/ Ref 0.000ds [F1]
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## D1750V2, Serial No.1044 Extended Dipole Calibrations

Per IEEE Std 1528-2013, the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement.

Per KDB 865664 D01, if dipoles are verified in return loss(<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

### Justification of the extended calibration

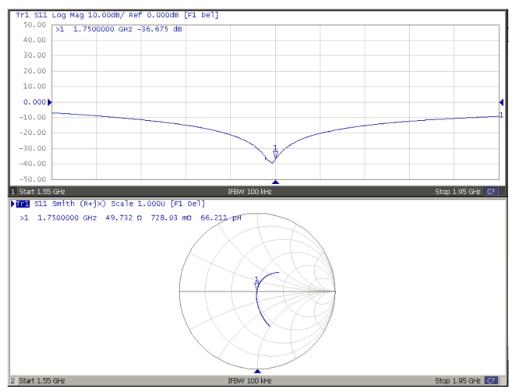
D1750V2 Serial No.1044							
1750 Head							
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	
11.03.2015	-36.76		48.891		1.1688		
11.02.2016	-36.675	0.23	49.732	0.841	0.738	0.431	

	D1750V2 Serial No.1044							
1750Body								
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)		
11.03.2015	-26.523		45.53		0.583			
11.02.2016	-25.909	2.31	47.294	1.764	0.219	0.364		

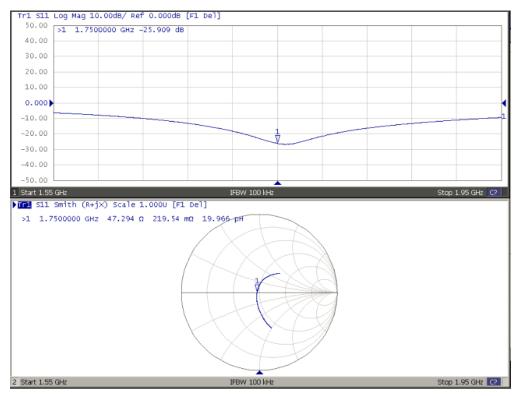
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



## Dipole Verification Data D1750V2 Serial No.1044 1750MHz-Head



### 1750MHz - Body





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Client EC	IT	Certificate No: Z1	15-97168
CALIBRATION C	ERTIFICAT	ſE	
Object	D1900	V2 - SN: 5d134	
Calibration Procedure(s)			
10-00000000000000000000000000000000000		1-2-003-01	
	Calibra	ition Procedures for dipole validation kits	
Calibration date:	Novem	ber 4, 2015	Contraction,
measurements(51). The me	asurements and	the uncertainties with confidence probability	are given on the following
pages and are part of the c All calibrations have beer humidity<70%. Calibration Equipment used	ertificate.	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled Calibration Jun-16
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Certificate No: Z15-97168

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c) KDB	865664, SAR Mea	surement Requirements for	or 100 MHz to 6 GHz
	nal Documentati Y4/5 System Hand		
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Mea	surement multiplie	nty of measurement is d by the coverage factor age probability of approxi	stated as the standard uncertainty or r k=2, which for a normal distribution mately 95%.

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Add: No.51 Xueyuan Rond, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com Http://www.chinattl.cn

### Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
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	40.6 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	40.8 mW/g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.22 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.0 mW /g ± 20.4 % (k=2)

#### **Body TSL parameters**

	Temperature	Permitt	ivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3		1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ±	6 %	1.54 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		2	
R result with Body TSL				1
SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Cond	lition		
SAR measured	250 mW i	nput power		10.3 mW / g
SAR for nominal Body TSL parameters	normaliz	ed to 1W	41.1	mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Body T	SL Cond	ition		
SAR measured	250 mW i	nput power		5.33 mW / g
SAR for nominal Body TSL parameters	normaliz	ed to 1W	21.3	mW /g ± 20.4 % (k=2)

Certificate No: Z15-97168

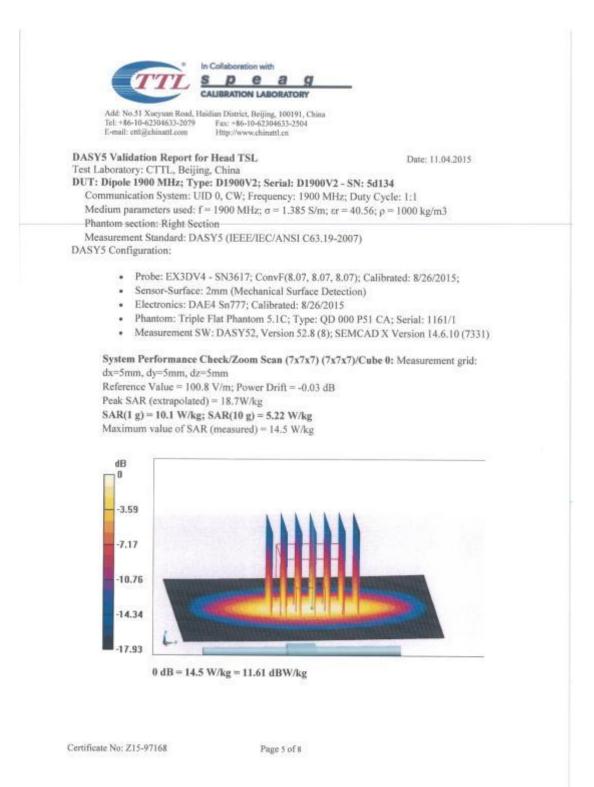
Page 3 of 8



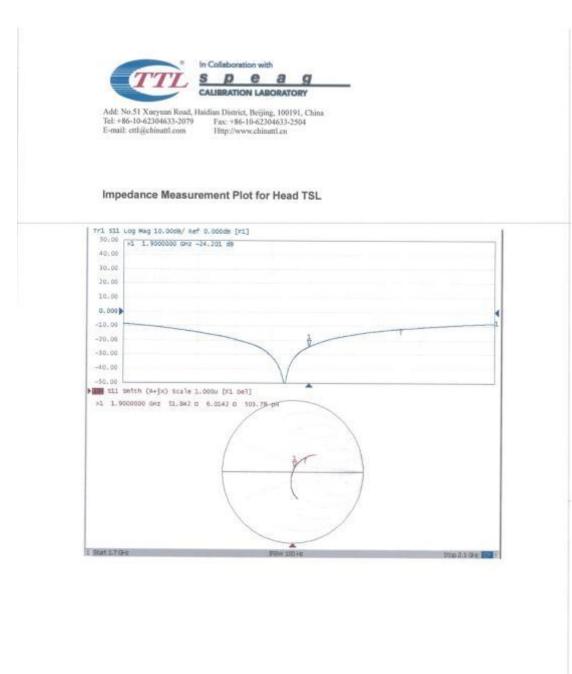
E-mail: cttl@chinatt.com Http://v	
Antenna Parameters with Head	TSL
Impedance, transformed to feed point	51.8Ω+ 6.01jΩ
Return Loss	~24.2dB
Antenna Parameters with Body	TSL
Impedance, transformed to feed point	47.1Ω+ 5.41jΩ
Return Loss	- 24.0dB
be measured.	power, only a slight warming of the dipole near the feedpoint can
be measured. The dipole is made of standard semirigin connected to the second arm of the dipo of the dipoles, small end caps are adder according to the position as explained in affected by this change. The overall dipo No excessive force must be applied to the connections near the feedpoint may be to	d coaxial cable. The center conductor of the feeding line is directly ole. The antenna is therefore short-circuited for DC-signals. On some d to the dipole arms in order to improve matching when loaded in the "Measurement Conditions" paragraph. The SAR data are not ole length is still according to the Standard. he dipole arms, because they might bend or the soldered
be measured. The dipole is made of standard semirigin connected to the second arm of the dipo of the dipoles, small end caps are adder according to the position as explained in affected by this change. The overall dipo No excessive force must be applied to the	d coaxial cable. The center conductor of the feeding line is directly ole. The antenna is therefore short-circuited for DC-signals. On some d to the dipole arms in order to improve matching when loaded in the "Measurement Conditions" paragraph. The SAR data are not ole length is still according to the Standard. he dipole arms, because they might bend or the soldered

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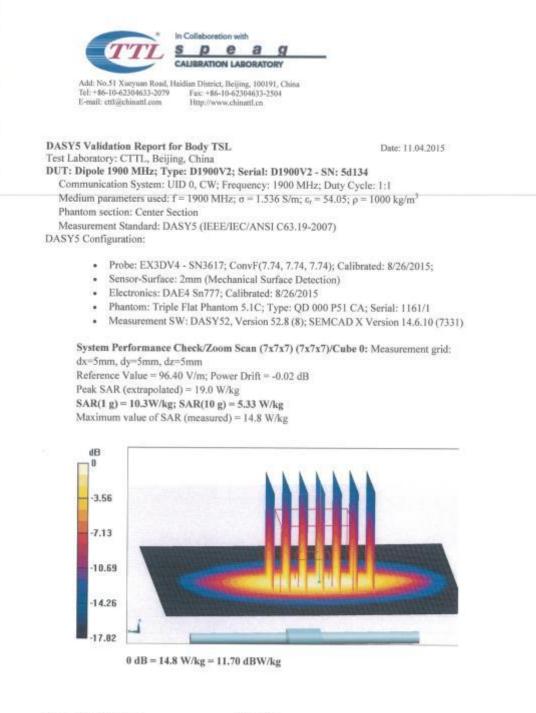






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Certificate No: Z15-97168

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	CALIBRATION LABORATORY
Tel: 1	No.51 Xueyuan Road, Hnidian District, Beijing, 100191, China 86-10-62304633-2079 Fax: =86-10-62304633-2504 il: ettl@chinattl.com Http://www.chinattl.cn
Imp	edance Measurement Plot for Body TSL
	Log Mag 10.00ds/ Ref 0.000ds [F1]
\$0.00	>1 1.9000000 GHZ -24.028 db
40.00	
30.00	
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3L L-	0000000 GHz 47.147 0 5.4132 D 453.44 pm
1 8687 2.71	PE POW 100% Stor 21.0% D

Certificate No: Z15-97168

Page 8 of 8



### D1900V2, Serial No.5d134 Extended Dipole Calibrations

Per IEEE Std 1528-2013,the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement.

Per KDB 865664 D01, if dipoles are verified in return loss(<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

#### Justification of the extended calibration

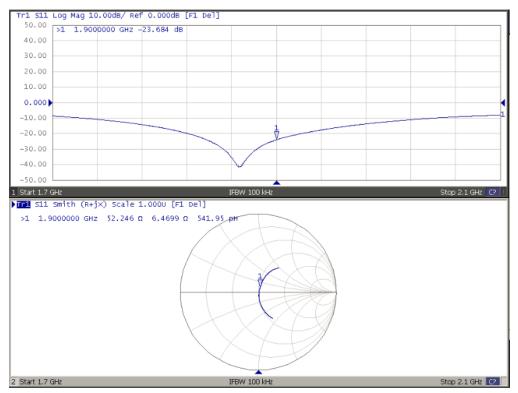
	D1900V2 Serial No.5d134								
1900 Head									
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)			
11.04.2015	-24.201		51.842		6.0142				
11.03.2016	-23.684	2.13	52.246	0.404	6.4699	0.456			

	D1900V2 Serial No.5d134							
1900 Body								
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)		
11.04.2015	-24.028		47.147		5.4132			
11.03.2016	-23.250	3.24	48.572	1.425	6.1951	0.782		

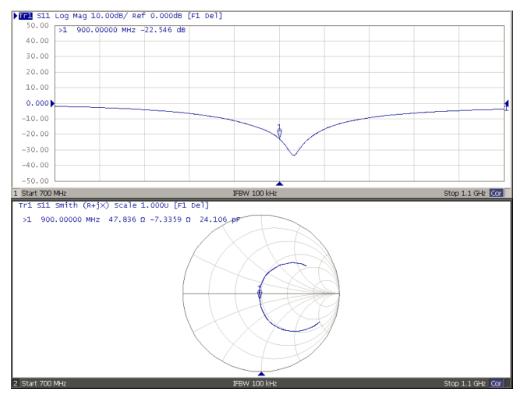
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



#### Dipole Verification Data D1900V2 Serial No.5d134 1900MHz-Head



#### 1900MHz - Body





Add: No.51 Xueyu Tel: +86-10-62304	an Road, Haidian Di 633-2079 Fax:	istrict, Beijing, 100191, China +86-10-62304633-2504	CALIBRATION No. L0570
E-mail: cttl@china Client EC		://www.chinattl.cn Certificate No: Z	15-97171
CALIBRATION C			10-9/1/1
Object	D2450	)V2 - SN: 858	
Calibration Procedure(s)	FD-71	1-2-003-01	
		ation Procedures for dipole validation kits	
Calibration date:		er 30, 2015	
	Octobe	51 50, 2015	
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humidity<70%.	i conducted in	the closed laboratory lacinty, environmen	t temperature(22±3) C and
Calibration Equipment used	(M&TE critical f		
• •	(marie ondoar)	or calibration)	
		,	
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Primary Standards Power Meter NRP2	ID # 101919	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Primary Standards	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16 Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Jun-16 Jun-16 Aug-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	ID # 101919 101547 SN 3617 SN 777	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15)	Jun-16 Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 101919 101547 SN 3617 SN 777 ID #	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.)	Jun-16 Jun-16 Aug-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 101919 101547 SN 3617 SN 777 ID #	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728)	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15 (SPEAG,No.EX3-3617_Aug15) 26-Aug-15 (SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728)	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15 (SPEAG,No.EX3-3617_Aug15) 26-Aug-15 (SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function SAR Test Engineer	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing Qi Dianyuan	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728)  Function SAR Test Engineer SAR Project Leader Deputy Director of the laboratory	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16

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	Tel: +86-10-62304 E-mail: cttl@chin	4633-2079 Fa	District, Beijing, 10 ax: +86-10-6230463 http://www.chinattl.co	3-2504			
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Mea	asurement m	ultiplied by	measuremer the coverage obability of ap	factor k=2.	which for	ndard uncert a normal dis	ainty of tribution
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 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: cttl@chinattl.com
 Http://www.chinattl.cn

#### **Measurement Conditions**

DASY Version	DASY52	52.8.8.1222
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.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.1 ± 6 %	1.82 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	13.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	52.9 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.06 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.3 mW /g ± 20.4 % (k=2)

#### **Body TSL parameters**

	Temperature	Permitti	vity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7		1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.1 ± 0	6 %	1.94 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C			
R result with Body TSL		1		
SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Cond	ition		
SAR measured	250 mW ir	nput power		13.2 mW / g
SAR for nominal Body TSL parameters	normalize	ed to 1W	53.1 1	mW /g ± 20.8 % (k=2)
SAR averaged over 10 $\ {\it cm}^3$ (10 g) of Body T	SL Condi	tion		
SAR measured	250 mW ir	nput power		6.16 mW / g
SAR for nominal Body TSL parameters	normalize	ed to 1W	24.7	mW /g ± 20.4 % (k=2)

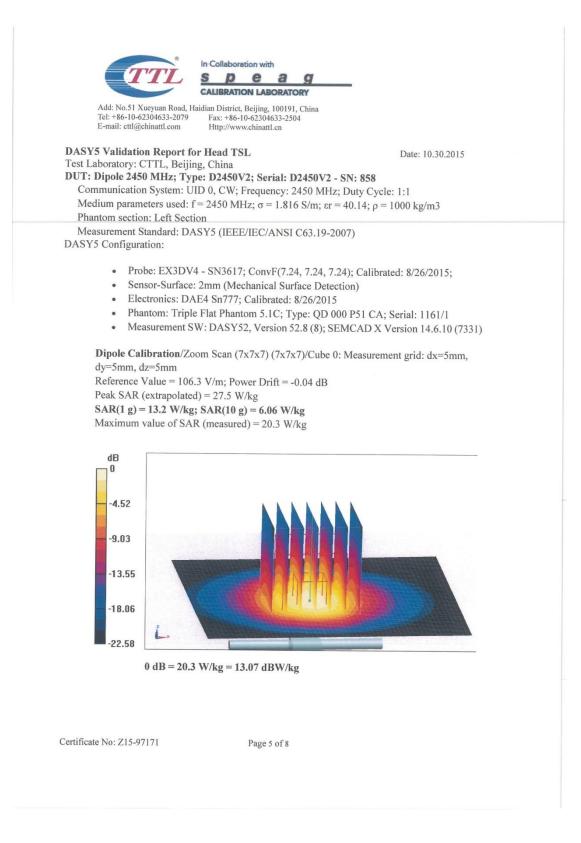
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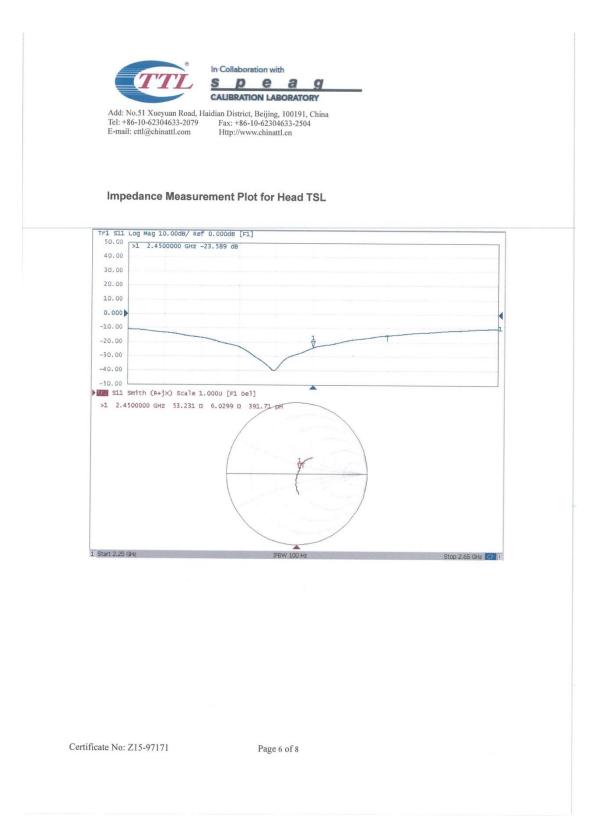


Tel: +86-10-62304633-2079 Fax: +86-10-62304 E-mail: cttl@chinattl.com Http://www.chinatt	
Appendix	
Antenna Parameters with Head TSL	
Impedance, transformed to feed point	53.2Ω+ 6.03jΩ
Return Loss	- 23.6dB
Antenna Parameters with Body TSL	
Impedance, transformed to feed point	49.9Ω+ 7.39jΩ
Return Loss	- 22.6dB
General Antenna Parameters and Design	n
Electrical Delay (one direction)	1.001
After long term use with 100W radiated power, or be measured. The dipole is made of standard semirigid coaxial connected to the second arm of the dipole. The ai of the dipoles, small end caps are added to the di according to the position as explained in the "Mea	1.261 ns Ily a slight warming of the dipole near the feedpoint can cable. The center conductor of the feeding line is directly intenna is therefore short-circuited for DC-signals. On some pole arms in order to improve matching when loaded issurement Conditions'' paragraph. The SAR data are not
After long term use with 100W radiated power, or be measured. The dipole is made of standard semirigid coaxial connected to the second arm of the dipole. The al of the dipoles, small end caps are added to the di according to the position as explained in the "Mea affected by this change. The overall dipole length No excessive force must be applied to the dipole connections near the feedpoint may be damaged.	aly a slight warming of the dipole near the feedpoint can cable. The center conductor of the feeding line is directly interna is therefore short-circuited for DC-signals. On some pole arms in order to improve matching when loaded asurement Conditions" paragraph. The SAR data are not is still according to the Standard.
After long term use with 100W radiated power, or be measured. The dipole is made of standard semirigid coaxial connected to the second arm of the dipole. The al of the dipoles, small end caps are added to the di according to the position as explained in the "Mea affected by this change. The overall dipole length No excessive force must be applied to the dipole connections near the feedpoint may be damaged.	aly a slight warming of the dipole near the feedpoint can cable. The center conductor of the feeding line is directly interna is therefore short-circuited for DC-signals. On some pole arms in order to improve matching when loaded asurement Conditions" paragraph. The SAR data are not is still according to the Standard.
After long term use with 100W radiated power, or be measured. The dipole is made of standard semirigid coaxial connected to the second arm of the dipole. The ai of the dipoles, small end caps are added to the di	aly a slight warming of the dipole near the feedpoint can cable. The center conductor of the feeding line is directly interna is therefore short-circuited for DC-signals. On some pole arms in order to improve matching when loaded asurement Conditions" paragraph. The SAR data are not is still according to the Standard.
After long term use with 100W radiated power, or be measured. The dipole is made of standard semirigid coaxial connected to the second arm of the dipole. The al of the dipoles, small end caps are added to the di according to the position as explained in the "Mea affected by this change. The overall dipole length No excessive force must be applied to the dipole connections near the feedpoint may be damaged. Additional EUT Data	aly a slight warming of the dipole near the feedpoint can cable. The center conductor of the feeding line is directly ntenna is therefore short-circuited for DC-signals. On some pole arms in order to improve matching when loaded surement Conditions" paragraph. The SAR data are not is still according to the Standard. arms, because they might bend or the soldered

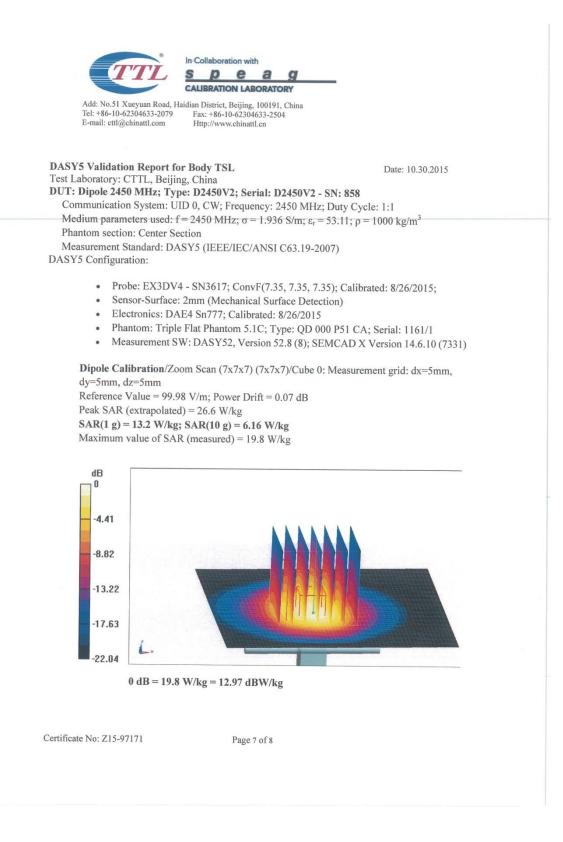




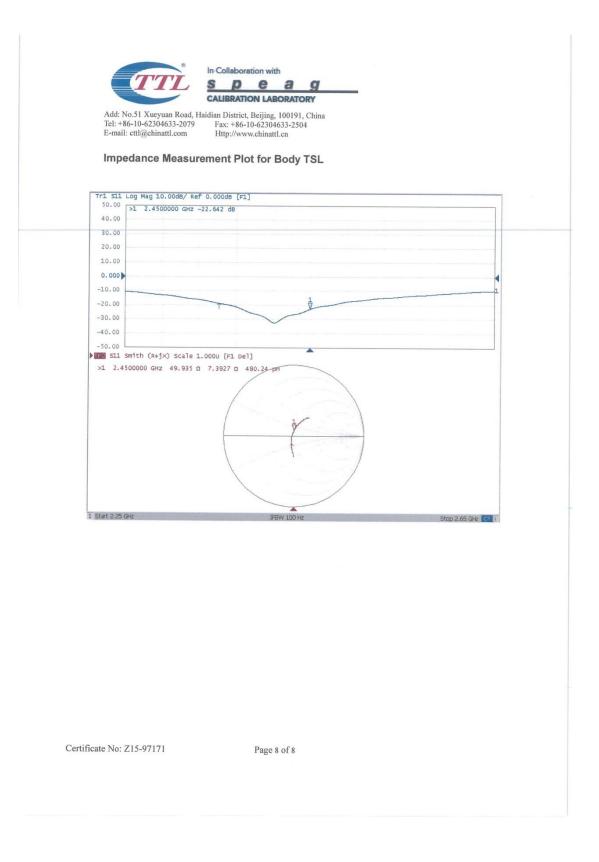














### D2450V2, Serial No.858 Extended Dipole Calibrations

Per IEEE Std 1528-2013,the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement.

Per KDB 865664 D01, if dipoles are verified in return loss(<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

#### Justification of the extended calibration

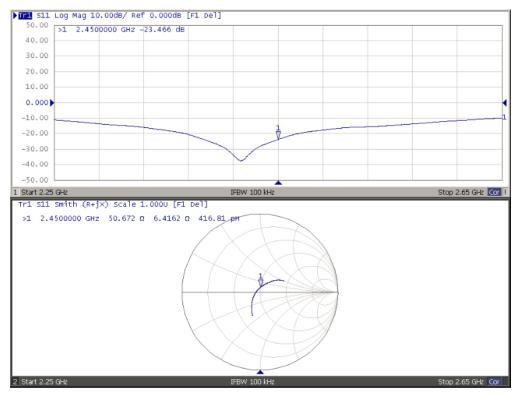
	D2450V2 Serial No.858								
2450 Head									
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)			
10.30.2015	-23.589		53.231		6.0299				
10.29.2016	-23.466	0.52	50.672	2.559	6.4162	0.386			

	D2450V2 Serial No.858						
			2450 Body				
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	
10.30.2015	-22.642		49.935		7.3927		
10.29.2016	-23.075	1.91	46.903	3.032	5.6814	1.711	

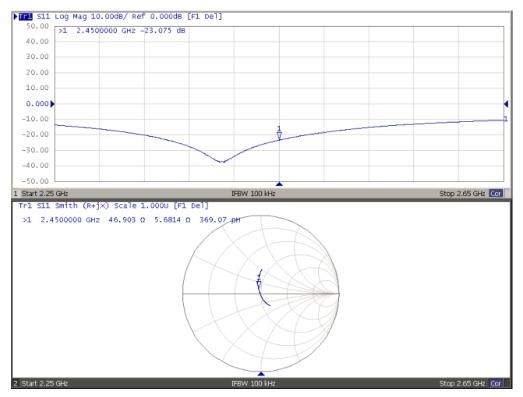
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



# Dipole Verification Data D2450V2 Serial No.858 2450MHz-Head



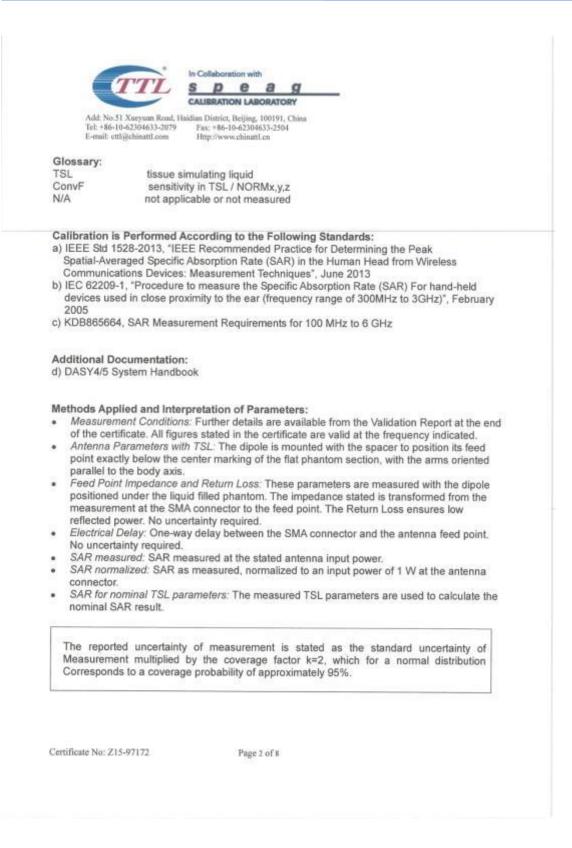
#### 2450MHz - Body





Client ECI	Ŧ	//www.chinattl.cn	No. L0570
CALIBRATION C			15-97172
CALIBITATION O	LINIFICAT		
Object	D2600	V2 - SN 1031	
Calibration Procedure(s)			
		I-2-003-01 tion Procedures for dipole validation kits	
Calibration date:		or 30, 2015	
This calibration Certificate measurements(SI). The me	documents the	traceability to national standards, which rea the uncertainties with confidence probability	alize the physical units of
pages and are part of the ce		the uncertainties with confidence probability	are given on the following
All calibrations have been humidity<70%.	conducted in	the closed laboratory facility: environment	temperature(22±3)℃ and
Calibration Equipment used	(M&TE critical fi	or calibration)	
	(M&TE critical fi	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Primary Standards Power Meter NRP2	1		Scheduled Calibration Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16 Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	ID # 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Jun-16 Jun-16 Aug-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16 Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	ID # 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Jun-16 Jun-16 Aug-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Jun-16 Jun-16 Aug-16 Aug-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 101919 101547 SN 3617 SN 777 ID #	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.)	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728)	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function SAR Test Engineer	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
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 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function SAR Test Engineer	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing Qi Dianyuan	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function SAR Test Engineer SAR Project Leader	Jun-16 Jun-16 Aug-16 Aug-16 Scheduled Calibration Feb-16 Feb-16 Signature









-	In C	ollabora	tion wit	th	
TTL	S	p	e	a	g
	CAL	IBRATI	ON LAS	ORAT	DRY
Add: No.51 Xueyuan Road, I	Iaidian	District,	Beijing.	100191	, China

Tel: +86-10-62304633-2079 E-mail: cttl@chinattl.com

в Fax: +86-10-62304633-2504 Http://www.chinattl.en

#### Measurement Conditions

DASY Version	DASY52	52.8.8.1222
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	39.9±6%	2.01 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	58.0 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.40 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.5 mW /g ± 20.4 % (k=2)
SAR for nominal Head TSL parameters	normalized to 1W	25.5 mW /g ± 20.4

#### Body TSL parameters

	Temperature	Permitti	ivity	Conductivity
Nominal Body TSL parameters	22.0.°C	52.5	5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.7 ±	6 %	2.14 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C			
R result with Body TSL		-	_	
SAR averaged over 1 cm3 (1 g) of Body TSL	Cond	tion		
SAR measured	250 mW ir	put power		14.2 mW / g
SAR for nominal Body TSL parameters	normalize	ed to 1W	57.1	mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body T	SL Condi	tion		
SAR measured	250 mW ir	put power		6.33 mW / g
SAR for nominal Body TSL parameters	normalize	d to 1W	25.4	mW /g ± 20.4 % (k=2)

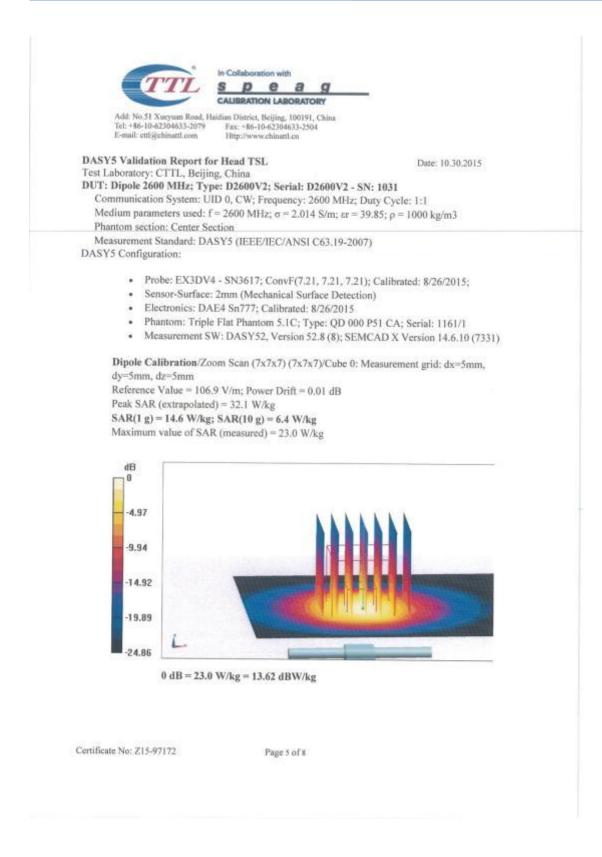
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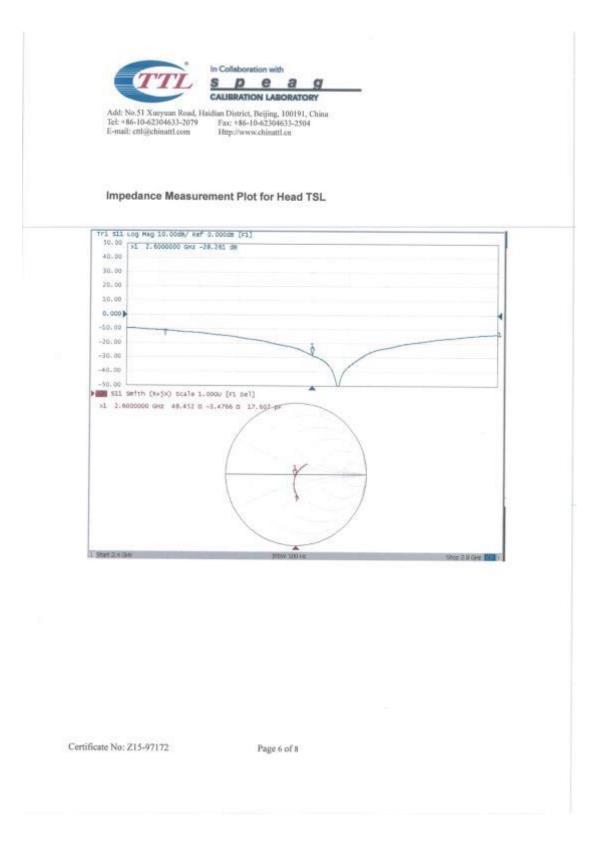


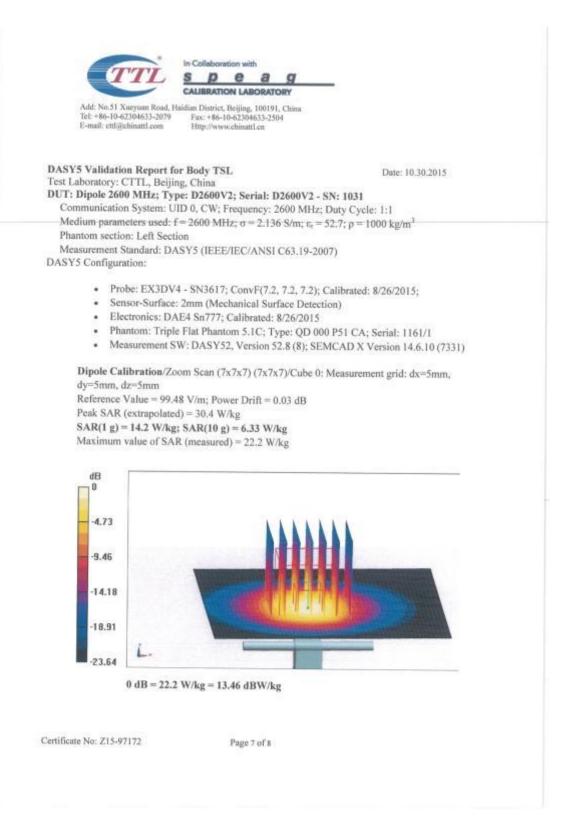
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Add: No.51 Xueyuan Ron Tel: +86-10-62304633-207 E-mail: cttl@chinattl.com	Haidian District, Beijing	100191, China 633-2504	
Appendix			
Antenna Parameters w	ith Head TSL		
Impedance, transformed to	feed point	48.5Ω- 3.48jΩ	
Return Loss		- 28.3dB	
Antenna Parameters w	ith Body TSL		
Impedance, transformed to	feed point	45.9Ω- 3.13jΩ	
Return Loss		- 25.4dB	
General Antenna Parar	neters and Desig	n	
1		0.2.2.200	
The dipole is made of stand connected to the second am of the dipoles, small end cap according to the position as affected by this change. The	W radiated power, or and semirigid coaxial n of the dipole. The is are added to the or explained in the "Me overall dipole lengt	1.253 ns nly a slight warming of the dipole near the cable. The center conductor of the feeding intenna is therefore short-circuited for DC- ipole arms in order to improve matching w asurement Conditions" paragraph. The SA is still according to the Standard.	g line is directly signals. On some hen loaded iR data are not
After long term use with 100 be measured. The dipole is made of stand connected to the second am of the dipoles, small end cap according to the position as affected by this change. The No excessive force must be connections near the feedpo	W radiated power, or and semirigid coaxial to of the dipole. The as are added to the explained in the "Me overall dipole lengt applied to the dipole	nly a slight warming of the dipole near the cable. The center conductor of the feeding intenna is therefore short-circuited for DC- ipole arms in order to improve matching w asurement Conditions" paragraph. The SA is still according to the Standard.	g line is directly signals. On some hen loaded iR data are not
After long term use with 100 be measured. The dipole is made of stand connected to the second arr of the dipoles, small end cap according to the position as affected by this change. The	W radiated power, or and semirigid coaxial to of the dipole. The as are added to the explained in the "Me overall dipole lengt applied to the dipole	nly a slight warming of the dipole near the cable. The center conductor of the feeding intenna is therefore short-circuited for DC- ipole arms in order to improve matching w asurement Conditions" paragraph. The SA is still according to the Standard.	g line is directly signals. On some hen loaded iR data are not
After long term use with 100 be measured. The dipole is made of stand connected to the second arm of the dipoles, small end cap according to the position as affected by this change. The No excessive force must be connections near the feedport Additional EUT Data	W radiated power, of and semirigid coaxial nof the dipole. The is are added to the of explained in the "Me overall dipole lengt applied to the dipole int may be damaged	nly a slight warming of the dipole near the cable. The center conductor of the feeding interna is therefore short-circuited for DC- ipole arms in order to improve matching w asurement Conditions" paragraph. The SA is still according to the Standard. arms, because they might bend or the sol	g line is directly signals. On some hen loaded iR data are not













ECIT

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1 Star 24 Ge					
î Sur 249e					
1. Stort 2.4 SHE					
1. Stort 2.4 Skit					
1. Shart 2.4 Give					
1. Shart 2.4 Give					
1. Shart 2.4 Geo					
1. Start 2.4 Sec					



### D2600V2, Serial No.1031 Extended Dipole Calibrations

Per IEEE Std 1528-2013, the dipole should have a return loss better than -20dB at the test frequency to reduce uncertainty in the power measurement.

Per KDB 865664 D01, if dipoles are verified in return loss(<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

#### Justification of the extended calibration

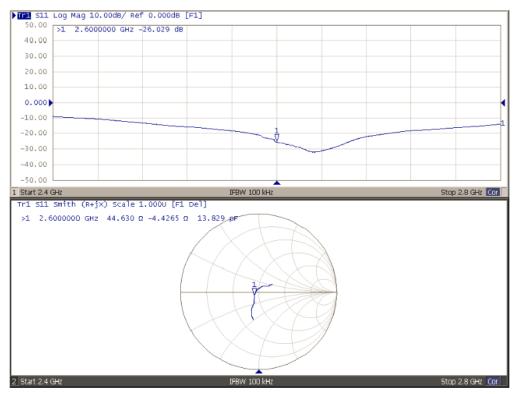
	D2600V2 Serial No.1031							
2600 Head								
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)		
10.30.2015	-28.261		48.452		-3.4766			
10.29.2016	-26.029	7.89	44.630	3.822	-4.4265	0.950		

		D260	0V2 Serial No.	.1031		
			2600 Body			
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
10.30.2015	-25.441		45.931		-3.125	
10.29.2016	-25.582	0.54	48.845	2.914	-2.163	0.962

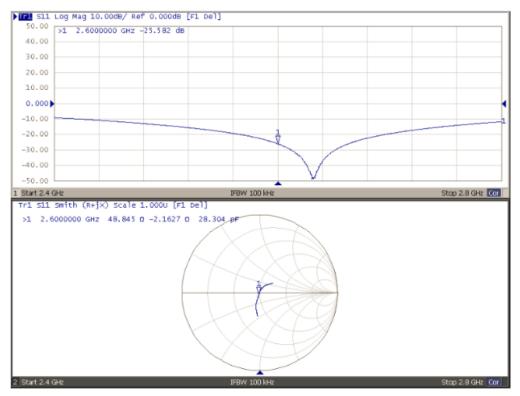
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



# Dipole Verification Data D2600V2 Serial No.1031 2600MHz-Head

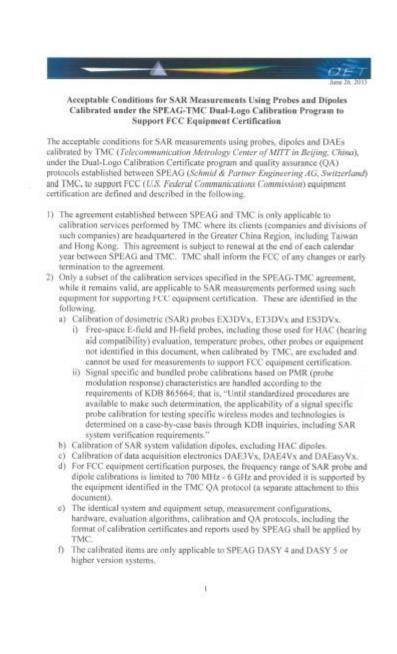


#### 2600MHz - Body











- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
  - the FCC to substantiate program implementation.
    a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
  - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
  - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
  - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

2



### ANNEX H. Accreditation Certificate





## **Accredited Laboratory**

A2LA has accredited

### EAST CHINA INSTITUTE OF TELECOMMUNICATIONS

Shanghai, People's Republic of China

for technical competence in the field of

### Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 15<sup>th</sup> day of March 2017.

President and CEO For the Accreditation Council Certificate Number 3682.01 Valid to February 28, 2019

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

\*\*\*\*\*\*\*\*\*\*End The Report\*\*\*\*\*\*\*\*