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

DC Voltage Measurement

 A/D - Converter Resolution nominal High Range:
 1LSB =
 6.1μV, full range =
 -100...+300 mV

 Low Range:
 1LSB =
 61nV, full range =
 -1.....+3mV

 DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	x	Y	z
High Range	404.141 ± 0.15% (k=2)	404.039 ± 0.15% (k=2)	404.054 ± 0.15% (k=2)
Low Range	$3.93503 \pm 0.7\%$ (k=2)	3.93694 ± 0.7% (k=2)	3.97213 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	37.5° ± 1 °
Connector Angle to be used in DASY system	37.5° ± 1 °

Certificate No: Z16-97204

Page 3 of 3



	Loom Litte://w	5-10-62304633-2209 ww.chinattl.cn	
E-mail: cttl@chinatt Client Aude	and the first state of the state	Certificate No: Z16-97	206
CALIBRATION CE			
CALIBRATION CE	RIFICATE		
Object	EX3DVA	- SN:7375	
	LX3DV4	- 514.7575	
Calibration Procedure(s)	FD-Z11-0	104.01	
		on Procedures for Dosimetric E-field Probes	
Calibration date:	Decembe	er 08, 2016	
All calibrations have been numidity<70%.	conducted in th	ne closed laboratory facility: environment	temperature(22±3)°C and
Calibration Equipment used	(M&TE critical for	calibration)	
Primary Standards	ID# (Cal Date(Calibrated by, Certificate No.)	
Primary Standards Power Meter NRP2	ID# (101919	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777)	Scheduled Calibration Jun-17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91	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
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91	ID # 0 101919 101547 101548	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777)	Jun-17 Jun-17 Jun-17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator	ID # (101919 101547 101548 18N50W-10dB	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547)	Jun-17 Jun-17 Jun-17 Mar-18
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator	ID # (101919 101547 101548 18N50W-10dB 18N50W-20dB	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator	ID # (101919 101547 101548 18N50W-10dB	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4	ID # (101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4	ID # (101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4	ID# 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4 Secondary Standards	ID# 0 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331 ID # 6201052605	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) Cal Date(Calibrated by, Certificate No.)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4 Secondary Standards SignalGeneratorMG3700A Network Analyzer E5071C	ID# 0 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331 ID # 6201052605	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04776)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17 Scheduled Calibration Jun-17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4 Secondary Standards SignalGeneratorMG3700A Network Analyzer E5071C	ID# 0 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331 ID # 6201052605 MY46110673	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04776) 26-Jan-16 (CTTL, No.J16X00894)	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17 Scheduled Calibration Jun-17 Jan -17
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4 Secondary Standards SignalGeneratorMG3700A Network Analyzer E5071C	ID# 0 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331 ID # 6201052605 MY46110673 Name Yu Zongying	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04776) 26-Jan-16 (CTTL, No.J16X00894) Function SAR Test Engineer	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17 Scheduled Calibration Jun-17 Jan -17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4 Secondary Standards SignalGeneratorMG3700A Network Analyzer E5071C Calibrated by:	ID# 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331 ID # 6201052605 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04776) 26-Jan-16 (CTTL, No.J16X00894) Function	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17 Scheduled Calibration Jun-17 Jan -17
Primary Standards Power Meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4 Secondary Standards SignalGeneratorMG3700A Network Analyzer E5071C Calibrated by: Reviewed by:	ID# 0 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331 ID # 6201052605 MY46110673 Name Yu Zongying	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04776) 26-Jan-16 (CTTL, No.J16X00894) Function SAR Test Engineer	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17 Scheduled Calibration Jun-17 Jan -17
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference10dBAttenuator Reference20dBAttenuator Reference Probe EX3DV4 DAE4 Secondary Standards SignalGeneratorMG3700A Network Analyzer E5071C Calibrated by:	ID # 101919 101547 101548 18N50W-10dB 18N50W-20dB SN 7307 SN 1331 ID # 6201052605 MY46110673 Name Yu Zongying Qi Dianyuan	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 27-Jun-16 (CTTL, No.J16X04777) 13-Mar-16(CTTL, No.J16X01547) 13-Mar-16(CTTL, No.J16X01548) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 21-Jan-16(SPEAG, No.DAE4-1331_Jan16) Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04776) 26-Jan-16 (CTTL, No.J16X04776) 26-Jan-16 (CTTL, No.J16X04776) 26-Jan-16 (CTTL, No.J16X04776) SAR Test Engineer SAR Project Leader	Jun-17 Jun-17 Jun-17 Mar-18 Mar-18 Feb-17 Jan -17 Scheduled Calibration Jun-17 Jan -17 Signature





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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization 0	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i
	$\theta=0$ is normal to probe axis

e=u is normal to probe axis
Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system
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 provingit to the act (frequency range of 200MHz to 2014)" Externary 2005

in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz" Methods Applied and Interpretation of Parameters:

- NORMx, y, z: Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E²-field uncertainty inside TSL (see below ConvF).
- $NORM(1)_{X,y,z} = NORM_{X,y,z}$; frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF
- DCPx, y, z: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- Ax, y, z; Bx, y, z; Cx, y, z; VRx, y, z: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode. ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature
- Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

Certificate No: Z16-97206

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Probe EX3DV4

SN: 7375

Calibrated: December 08, 2016

Calibrated for DASY/EASY Systems (Note: non-compatible with DASY2 system!)

Certificate No: Z16-97206

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East China Institute of Telecommunications TEL: +86 21 63843300FAX:+86 21 63843301









DASY/EASY - Parameters of Probe: EX3DV4 - SN: 7375

Basic Calibration Parameters

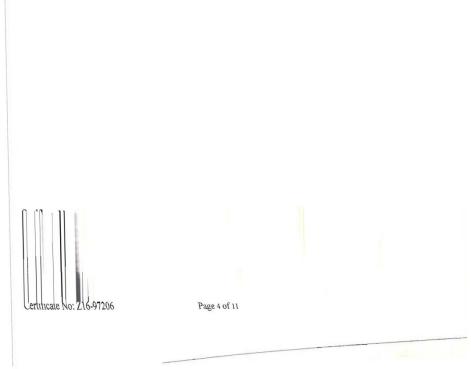
	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
$Norm(\mu V/(V/m)^2)^A$	0.52	0.42	0.46	±10.8%
DCP(mV) ^B	99.7	98.3	100.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	195.6	±2.4%
		Y	0.0	0.0	1.0		177.1	
		Z	0.0	0.0	1.0		187.8	

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%.

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 6).
 ^B Numerical linearization parameter: uncertainty not required.
 ^E Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.









DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7375

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	Сопу Ү	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	9.90	9.90	9.90	0.40	0.75	±12%
835	41.5	0.90	9.73	9.73	9.73	0.15	1.41	±12%
900	41.5	0.97	9.78	9.78	9.78	0.15	1.43	±12%
1750	40.1	1.37	8.31	8.31	8.31	0.30	0.95	±12%
1900	40.0	1.40	7.92	7.92	7.92	0.25	1.04	±12%
2000	40.0	1.40	7.99	7.99	7.99	0.26	1.04	±12%
2100	39.8	1.49	8.30	8.30	8.30	0.32	0.92	±12%
2300	39.5	1.67	7.57	7.57	7.57	0.32	1.02	±12%
2450	39.2	1.80	7.27	7.27	7.27	0.38	1.01	±12%
2600	39.0	1.96	7.25	7.25	7.25	0.49	0.81	±12%
3500	37.9	2.91	7.01	7.01	7.01	0.38	1.22	±13%
5200	36.0	4.66	5.58	5.58	5.58	0.36	1.55	±13%
5300	35.9	4.76	5.31	5.31	5.31	0.36	1.55	±13%
5500	35.6	4.96	5.09	5.09	5.09	0.36	1.55	±13%
5600	35.5	5.07	4.79	4.79	4.79	0.36	1.68	±13%
5800	35.3	5.27	4.78	4.78	4.78	0.40	1.65	±13%

^c Frequency validity above 300 MHz of \pm 100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to \pm 50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is \pm 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to \pm 110 MHz.

^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to \pm 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to \pm 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters. ^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than \pm 1% for frequencies below 3 GHz and below \pm 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7375

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	55.5	0.96	9.94	9.94	9.94	0.30	0.85	±12%
835	55.2	0.97	9.94	9.94	9.94	0.15	1.50	±12%
900	55.0	1.05	9.89	9.89	9.89	0.21	1.22	±12%
1750	53.4	1.49	8.22	8.22	8.22	0.23	1.12	±12%
1900	53.3	1.52	7.62	7.62	7.62	0.19	1.24	±12%
2000	53.3	1.52	7.90	7.90	7.90	0.16	1.62	±12%
2100	53.2	1.62	8.17	8.17	8.17	0.17	1.75	±12%
2300	52.9	1.81	7.43	7.43	7.43	0.45	0.95	±12%
2450	52.7	1.95	7.33	7.33	7.33	0.33	1.22	±12%
2600	52.5	2.16	7.16	7.16	7.16	0.48	0.92	±12%
3500	51.3	3.31	6.52	6.52	6.52	0.44	1.33	±13%
5200	49.0	5.30	4.82	4.82	4.82	0.45	1.50	±13%
5300	48.9	5.42	4.57	4.57	4.57	0.45	1.50	±13%
5500	48.6	5.65	4.20	4.20	4.20	0.48	1.60	±13%
5600	48.5	5.77	3.99	3.99	3.99	0.50	1.65	±13%
5800	48.2	6.00	4.08	4.08	4.08	0.55	1.95	±13%

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

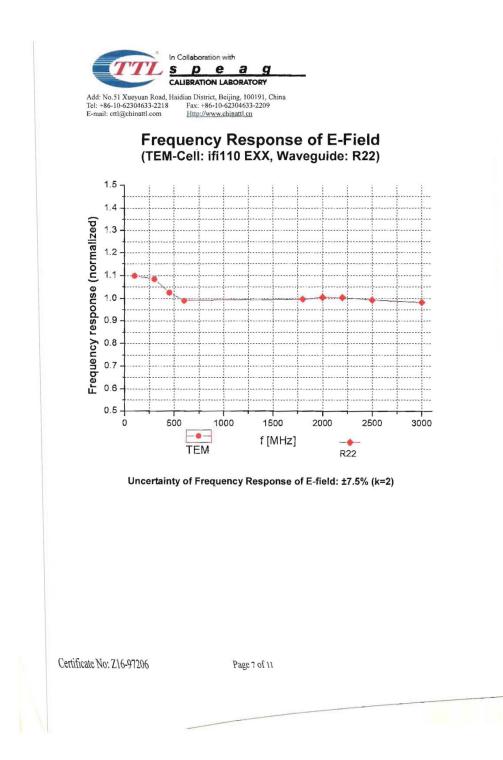
^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters. ^a Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Certificate No: Z16-97206

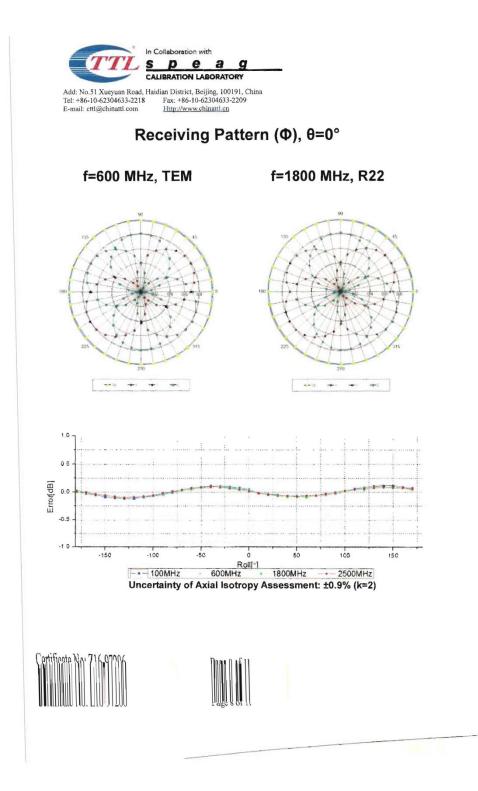
Page 6 of 11



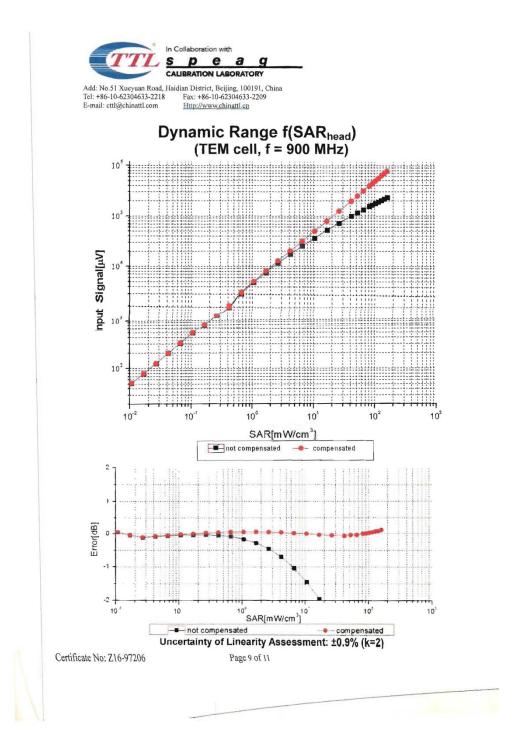




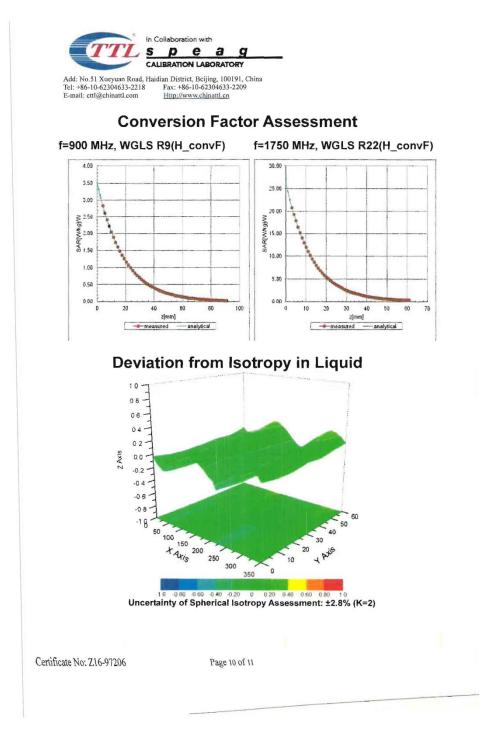
















DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7375

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	15.3
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



CALIBRATION C	-	Certificate No: Z1	5-97165
CALIBITATION O		E	
	LINII IOAI		
Object	D835V	2 - SN: 4d112	
Calibration Procedure(s)			
Galibration Procedure(s)		-2-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 22, 2015	
This calibration Certificate	documente the l	raceability to national standards, which real	ing the physical set of
measurements(SI). The me	asurements and	the uncertainties with confidence probability a	ize the physical units of
pages and are part of the cr		en entre minue minuence probability e	are given on the following
	conducted in t	he closed laboratory facility: environment	temperature(22±3) C and
humidity<70%.			
Calibration Equipment used	(M&TE critical fo	r calibration)	
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Photometric Residence Allengence			orono orono orono autori
Power Meter NRP2	101919	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16 Jun-16
Power sensor NRP-Z91 Reference Probe EX3DV4	101547 SN 3617	01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 28-Aug-15(SPEAG,No.EX3-3817_Aug15)	Jun-16 Jun-16 Aug -16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Jun-16 Jun-16
Power sensor NRP-Z91 Reference Probe EX3DV4	101547 SN 3617	01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 28-Aug-15(SPEAG,No.EX3-3817_Aug15)	Jun-16 Jun-16 Aug -16
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	101547 SN 3617 SN 777	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
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	101547 SN 3617 SN 777 ID #	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
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	101547 SN 3617 SN 777 ID # MY49071430	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
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	101547 SN 3617 SN 777 ID # MY49071430	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
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	101547 SN 3617 SN 777 ID # MY49071430 MY46110673	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
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name	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.) 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
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing Qi Dianyuan	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
Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by: Reviewed by:	101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing	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 Network Analyzer E5071C Calibrated by: Reviewed by: Approved by:	101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing Qi Dianyuan Lu Bingsong	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



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T	lossary: SL tissue simulating liquid onvF sensitivity in TSL / NORMx,y,z A not applicable or not measured
a) b)	alibration is Performed According to the Following Standards: IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013 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 KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz
	Iditional Documentation: DASY4/5 System Handbook
	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 norminal TSL parameters: The measured TSL parameters are used to calculate the norminal 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%.
2	tificate No: Z15-97165 Page 2 of 8





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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
oom Scan Resolution	dx, dy, dz = 5 mm	
requency	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		

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.31 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.22 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.51 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	6.03 mW /g ± 20.4 % (k=2)

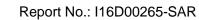
Body TSL parameters

	Temperature	Permitti	vity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	8	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			
result with Body TSL				1
SAR averaged over 1 cm ³ (1 g) of Body TSL	Cond	tion		
SAR measured	250 mW ir	250 mW input power		2.37 mW / g
SAR for nominal Body TSL parameters	normaliza	ed to 1W	9.57	mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body T	SL Condi	Condition		
SAR measured	250 mW in	250 mW input power		1.56 mW / g
SAR for nominal Body TSL parameters	normalize	d to 1W	6.29 1	nW /g ± 20.4 % (k=2)

Certificate No: Z15-97165

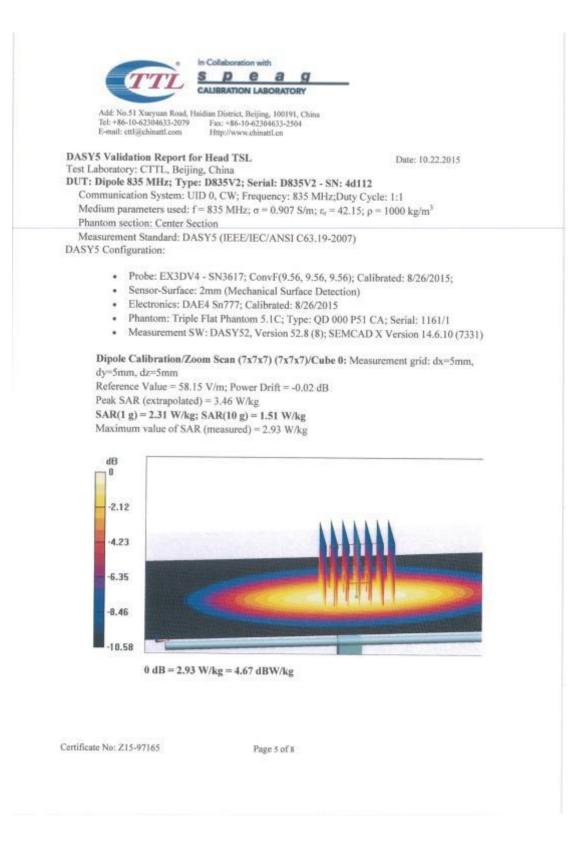
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Appendix Antenna Parameters with Head TSL	
Impedance, transformed to feed point	49.10- 4.20j0
Return Loss	- 27.3dB
Antenna Parameters with Body TSL	
Impedance, transformed to feed point	46.2Ω- 4.79jΩ
Return Loss	- 23.9dB
General Antenna Parameters and De	sign
Electrical Delay (one direction)	1.502 ns
be measured. The dipole is made of standard semirigid coa connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th according to the position as explained in the ' affected by this change. The overall dipole ler	ir, only a slight warming of the dipole near the feedpoint can xial 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 noth is still according to the Standard.
be measured. The dipole is made of standard semirigid coa connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th according to the position as explained in the ' affected by this change. The overall dipole ler No excessive force must be applied to the dip connections near the feedpoint may be dama	r, only a slight warming of the dipole near the feedpoint can xial cable. The center conductor of the feeding line is directly he antenna is therefore short-circuited for DC-signals. On some the dipole arms in order to improve matching when loaded "Measurement Conditions" paragraph. The SAR data are not ngth is still according to the Standard. pole arms, because they might bend or the soldered
be measured. The dipole is made of standard semirigid coa connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th according to the position as explained in the ' affected by this change. The overall dipole ler No excessive force must be applied to the dip connections near the feedpoint may be dama Additional EUT Data	r, only a slight warming of the dipole near the feedpoint can xial cable. The center conductor of the feeding line is directly he antenna is therefore short-circuited for DC-signals. On some the dipole arms in order to improve matching when loaded Measurement Conditions" paragraph. The SAR data are not ngth is still according to the Standard. sole arms, because they might bend or the soldered ged.
be measured. The dipole is made of standard semirigid coa connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th according to the position as explained in the ' affected by this change. The overall dipole ler No excessive force must be applied to the dip connections near the feedpoint may be dama	r, only a slight warming of the dipole near the feedpoint can xial cable. The center conductor of the feeding line is directly he antenna is therefore short-circuited for DC-signals. On some the dipole arms in order to improve matching when loaded "Measurement Conditions" paragraph. The SAR data are not ngth is still according to the Standard. pole arms, because they might bend or the soldered

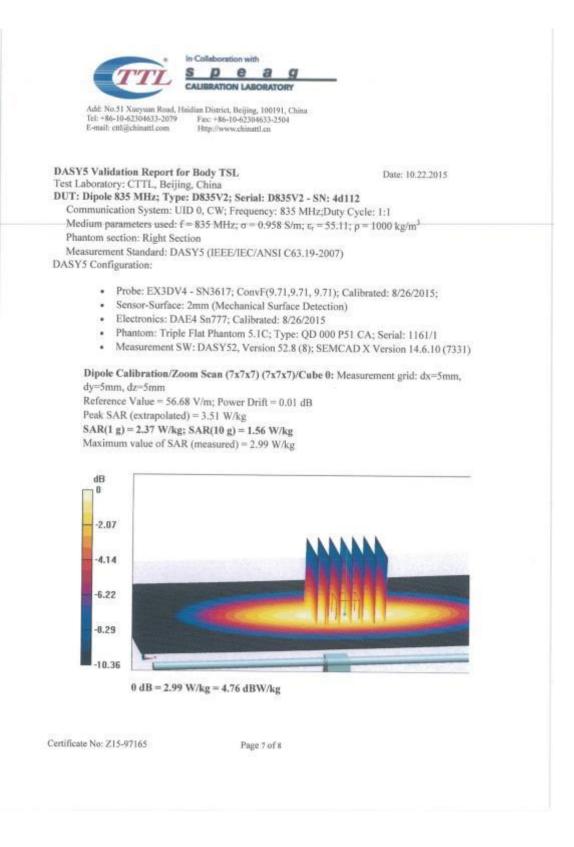




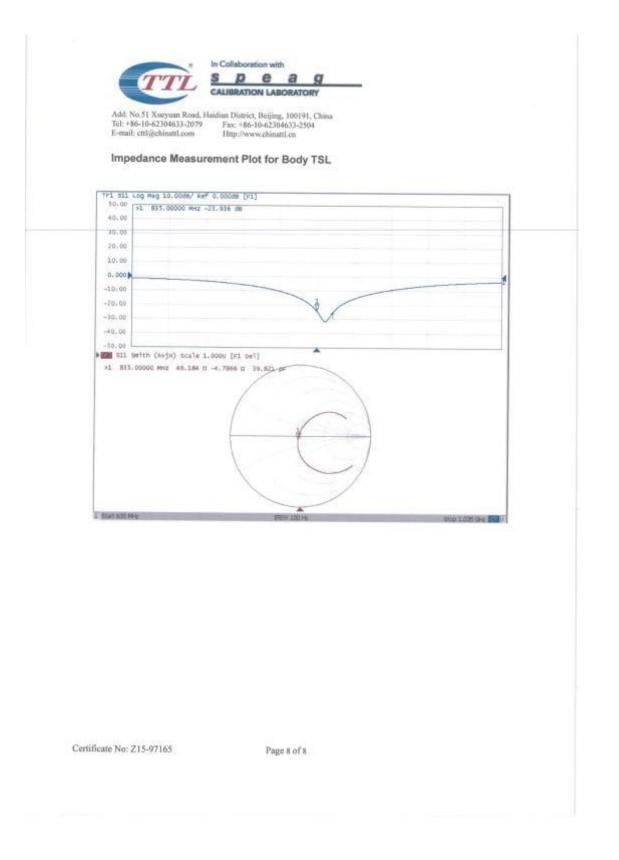


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D835V2, Serial No.4d112 Extended Dipole Calibrations

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

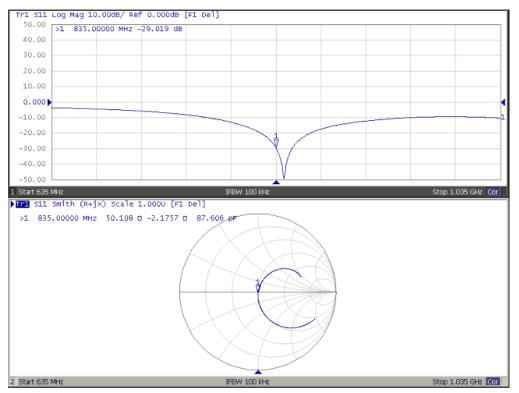
	D835V2 Serial No.4d112						
835 Head							
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	
10.22.2015	-27.27		49.108		-4.2018		
10.21.2016	-29.019	6.41	50.108	1	-2.1757	2.0261	

		D835	V2 Serial No.4 835 Body	ld112		
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

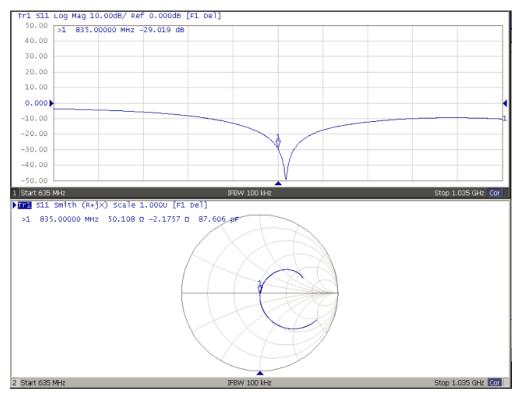
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



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



835MHz - Body





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Tel: +86-10-62304 E-mail: ettl@china	633-2079 Fax:	+86-10-62304633-2504 //www.chinuttl.en	CALIBRATION No. L0570
Client ECI	т	Certificate No: Z	15-97167
CALIBRATION C	ERTIFICAT	TE	
Object	D1750	V2 - SN: 1044	Normal Contraction
Calibration Procedure(s)		1-2-003-01 ation Procedures for dipole validation kits	
Calibration date:	Novem	iber 3, 2015	0400000000
pages and are part of the co		the closed laboratory facility, environment	temperature/22+31/2 and
	conducted in	the closed laboratory facility; environment or calibration)	t temperature(22±3) © and
All calibrations have been humidity<70%.	conducted in		t temperature(22±3) © and Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	I conducted in (M&TE critical f	or calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256)	
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91	I conducted in (M&TE critical f ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	I conducted in (M&TE critical f ID # 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 28-Aug-15(SPEAG,No.EX3-3617_Aug15)	Scheduled Calibration Jun-16 Jun-16 Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91	I conducted in (M&TE critical f ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled 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	I conducted in (M&TE critical f ID # 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 28-Aug-15(SPEAG,No.EX3-3617_Aug15)	Scheduled Calibration Jun-16 Jun-16 Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	I conducted in (M&TE critical f 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) 28-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	I conducted in (M&TE critical f 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.) 02-Feb-15 (CTTL, No.J15X00729)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration
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	I conducted in (M&TE critical f 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 (CTTL, No.J15X04256) 26-Aug-15 (SPEAG, No.DAE4-777_Aug15) 26-Aug-15 (SPEAG, No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16
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	I conducted in (M&TE critical f 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)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16
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 Network Analyzer E5071C	I conducted in I (M&TE critical f 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) 28-Aug-15(SPEAG,No.EX3-3617_Aug15) 28-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	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16
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 Network Analyzer E5071C	Conducted in (M&TE critical f 101919 101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) O1-Jul-15 (CTTL, No.J15X04256) O1-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	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16

Certificate No: Z15-97167

Page 1 of 8





 a) IEEE Std 152 Spatial-Avera Communicati b) IEC 62209-1 devices used 2005 	tissue simulating liquid sensitivity in TSL / NORMx,y,z not applicable or not measured erformed According to the Follow 8-2013, "IEEE Recommended Pract ged Specific Absorption Rate (SAR) ins Devices: Measurement Techniqu "Procedure to measure the Specific in close proximity to the ear (frequent	ice for Determining the Peak in the Human Head from Wireless ues", June 2013
 a) IEEE Std 152 Spatial-Avera Communicati b) IEC 62209-1 devices used 2005 	8-2013, "IEEE Recommended Pract ged Specific Absorption Rate (SAR) ons Devices: Measurement Techniqu "Procedure to measure the Specific	ice for Determining the Peak in the Human Head from Wireless ues", June 2013
	SAR Measurement Requirements fo	ncy range of 300MHz to 3GHz)*, February
Additional Doc d) DASY4/5 Sys		
Measureme of the certifi Antenna Pa point exactly parallel to tr Feed Point i positioned u measureme reflected po Electrical De No uncertain SAR measu SAR normal connector. SAR for non nominal SAI	ate. All figures stated in the certifica ameters with TSL: The dipole is more below the center marking of the flat a body axis. mpedance and Return Loss: These inder the liquid filled phantom. The in that the SMA connector to the feed point wer. No uncertainty required. Nay: One-way delay between the SM ty required. ed: SAR measured at the stated and zed: SAR as measured, normalized inal TSL parameters: The measured tresult.	allable from the Validation Report at the end te are valid at the frequency indicated, unted with the spacer to position its feed phantom section, with the arms oriented parameters are measured with the dipole npedance stated is transformed from the point. The Return Loss ensures low IA connector and the antenna feed point. tenna input power. to an input power of 1 W at the antenna it TSL parameters are used to calculate the stated as the standard uncertainty of r k=2, which for a normal distribution





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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
22.0 °C	40.1	1.37 mho/m
(22.0 ± 0.2) °C	39.7 ± 6 %	1.40 mho/m ± 6 %
<1.0 °C		
	22.0 °C (22.0 ± 0.2) °C	22.0 °C 40.1 (22.0 ± 0.2) °C 39.7 ± 6 %

SAR result with Head TSL

SAR averaged over 1 cm ² (1 g) of Head TSL	Condition	4
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 ³ (10 g) of Head TSL	Condition	
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 The following parameters a

	Temperature	Permitt	ivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4		1.49 mho/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	2	
R result with Body TSL				
SAR averaged over 1 cm3 (1 g) of Body TSL	Condi	tion		
SAR measured	250 mW in	put power		9.30 mW / g
SAR for nominal Body TSL parameters	normalize	d to 1W	37.6 1	mW /g ± 20.8 % (k=2
SAR averaged over 10 cm ³ (10 g) of Body T	SL Condi	tion		
SAR measured	250 mW in	put power		5.02 mW / g
SAR for nominal Body TSL parameters	normalize	d to 1W	20.2 1	mW /g ± 20.4 % (k=2)

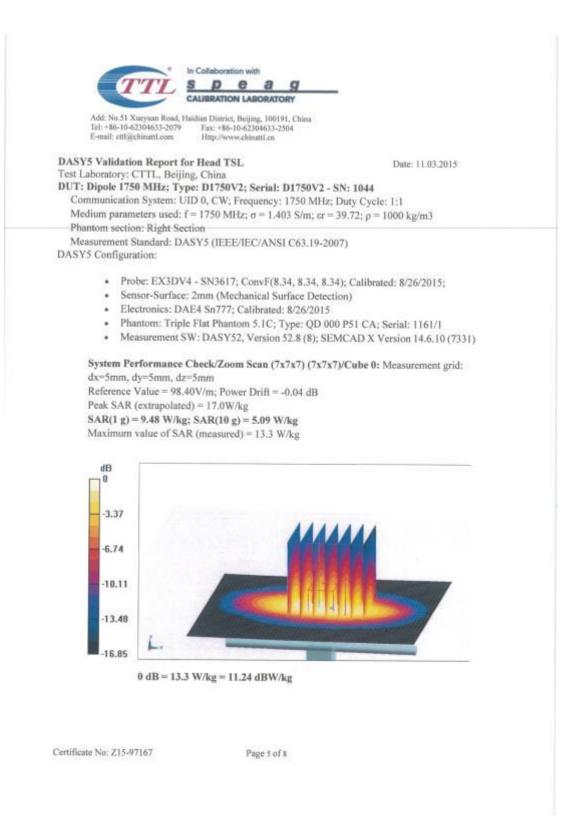
Certificate No: Z15-97167

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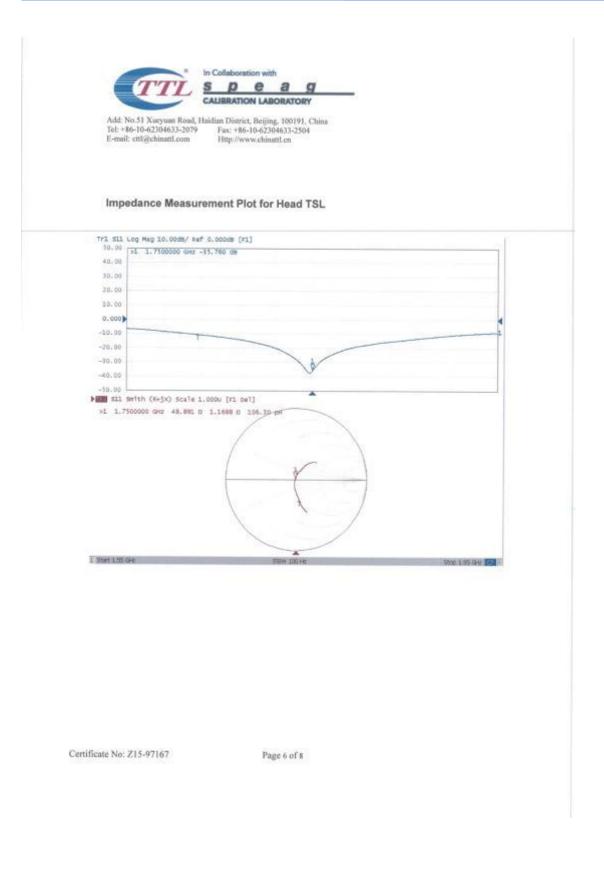


Antenna Parameters with Head T	SL	
Impedance, transformed to feed point		48.9Ω+ 1.17jΩ
Return Loss		- 35.8dB
Antenna Parameters with Body T	SL	
Impedance, transformed to feed point		45.5Ω+ 0.58jΩ
Return Loss		- 26.5dB
General Antenna Parameters and	Design	
Electrical Delay (one direction)		1.319 ns
be measured. The dipole is made of standard semirigid connected to the second arm of the dipol of the dipoles, small end caps are added according to the position as explained in affected by this change. The overall dipol	coaxial cable. The center e. The antenna is therefor to the dipole arms in orde the "Measurement Condil e length is still according	r conductor of the feeding line is direct re short-circuited for DC-signals. On s ar to improve matching when loaded ions" paragraph. The SAR data are n to the Standard.
After long term use with 100W radiated p be measured. The dipole is made of standard semirigid connected to the second arm of the dipol of the dipoles, small end caps are added according to the position as explained in affected by this change. The overall dipol No excessive force must be applied to the connections near the feedpoint may be d	coaxial cable. The center e. The antenna is therefor to the dipole arms in orde the "Measurement Condil e length is still according e dipole arms, because th	r conductor of the feeding line is direct re short-circuited for DC-signals. On s ar to improve matching when loaded ions" paragraph. The SAR data are n to the Standard.
be measured. The dipole is made of standard semirigid connected to the second arm of the dipol of the dipoles, small end caps are added according to the position as explained in affected by this change. The overall dipol No excessive force must be applied to the connections near the feedpoint may be d	coaxial cable. The center e. The antenna is therefor to the dipole arms in orde the "Measurement Condil e length is still according e dipole arms, because th	r conductor of the feeding line is direct re short-circuited for DC-signals. On s ar to improve matching when loaded ions" paragraph. The SAR data are n to the Standard.



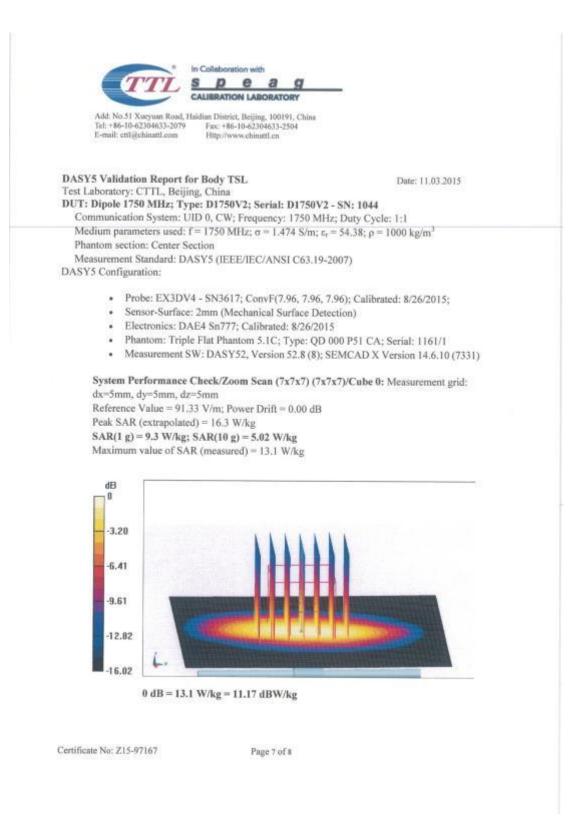














40.00 30.00 20.00 -20.00 -20.00 -30.00 -	7/1 511 50,00	Log Mag 10.000H/ HeF 0.0000H [F1] (51 1.750000 GHz -26.523 dB
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-80.00 -50.00 salt Seith (8+)x0 Scale 1.0000 [91 De1]		
-50.00		
S11 Smith (R+jx) Scale 1.0000 [F1 Del]		
1 Bart 1 35 GHz Uliw 103 Hz Stor 1 46 THz	1.000	

Certificate No: Z15-97167

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Certificate No: Z15-97168

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	51 Xueyunn Road, Haidian District, Beijing, 100191, China
	-10-62304633-2079 Fax: =86-10-62304633-2504 ttl@chinntil.com Http://www.chinattl.cn
Glossary:	All and the second and the second at
rsL ConvF	tissue simulating liquid sensitivity in TSL / NORMx,y,z
√/A	not applicable or not measured
	is Performed According to the Following Standards:
	1528-2013, "IEEE Recommended Practice for Determining the Peak eraged Specific Absorption Rate (SAR) in the Human Head from Wireless
Communic	cations Devices: Measurement Techniques*, June 2013
	9-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held sed in close proximity to the ear (frequency range of 300MHz to 3GHz)", February
2005	n na seneral de la construcción de En la construcción de la construcció
) KDB86566	54, SAR Measurement Requirements for 100 MHz to 6 GHz
	Documentation:
) DAST4/5	System Handbook
	plied and Interpretation of Parameters:
	ment Conditions: Further details are available from the Validation Report at the end rtificate. 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
	ctly below the center marking of the flat phantom section, with the arms oriented o the body axis.
Feed Poi	int Impedance and Return Loss: These parameters are measured with the dipole
measure	d under the liquid filled phantom. The impedance stated is transformed from the ment at the SMA connector to the feed point. The Return Loss ensures low
reflected	power. No uncertainty required.
	Delay: One-way delay between the SMA connector and the antenna feed point. tainty required.
SAR mea	asured: SAR measured at the stated antenna input power.
SAR non connecto	malized: SAR as measured, normalized to an input power of 1 W at the antenna
SAR for I	nominal TSL parameters: The measured TSL parameters are used to calculate the SAR result.
	ted uncertainty of measurement is stated as the standard uncertainty of ent multiplied by the coverage factor k=2, which for a normal distribution
Correspon	ds 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 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	40.8 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (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	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 ³ (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	lition		
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)

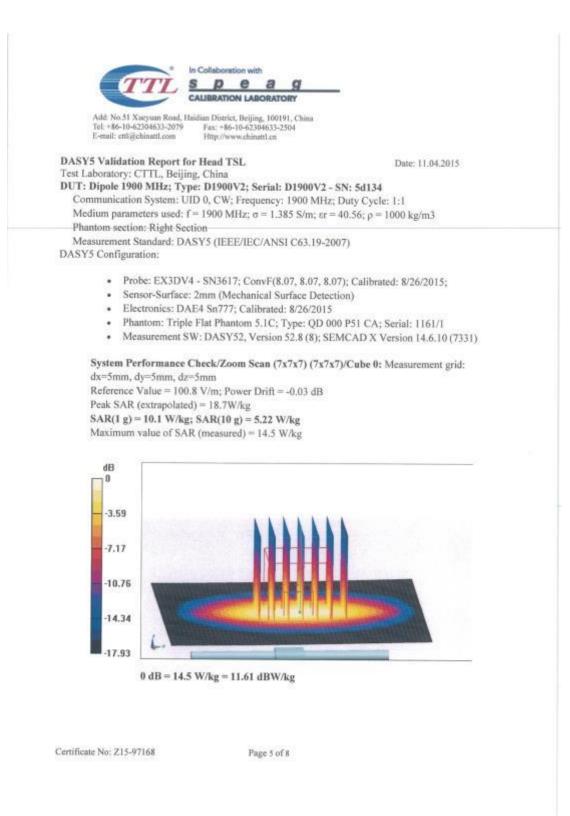
Certificate No: Z15-97168

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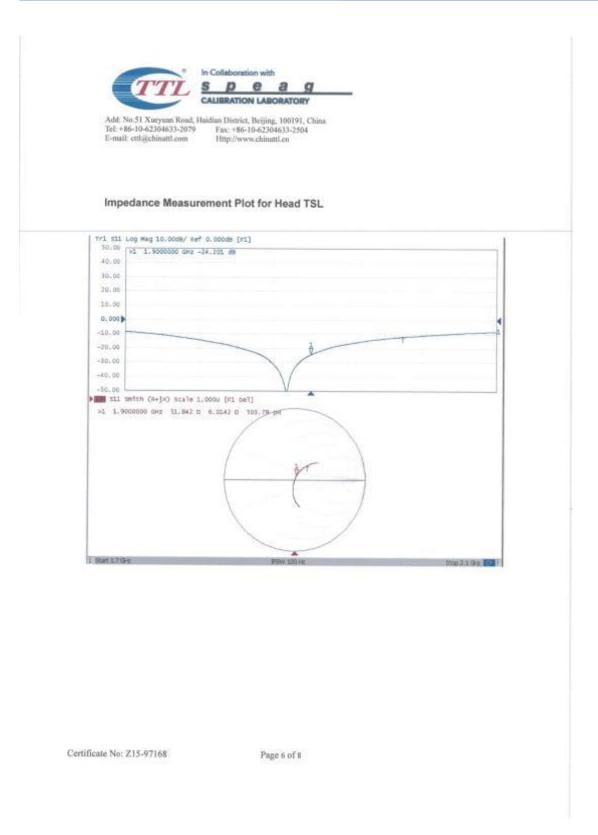


Antenna Parameters with Head TSL	
Impedance, transformed to feed point	51.8Ω+ 6.01jΩ
Return Loss	- 24.2dB
Antenna Parameters with Body TSL	
Impedance, transformed to feed point	47.1Ω+ 5.41jΩ
Return Loss	- 24.0dB
General Antenna Parameters and Des	sign
	0.522.53
be measured. The dipole is made of standard semirigid coax connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th	1.305 ns r, only a slight warming of the dipole near the feedpoint c cial cable. The center conductor of the feeding line is dire is antenna is therefore short-circuited for DC-signals. On e dipole arms in order to improve matching when loaded Measurement Conditions'' paragraph. The SAR data are
After long term use with 100W radiated power be measured. The dipole is made of standard semirigid coax connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th according to the position as explained in the "I affected by this change. The overall dipole len No excessive force must be applied to the dip connections near the feedpoint may be damage	r, only a slight warming of the dipole near the feedpoint c cial cable. The center conductor of the feeding line is dire the antenna is therefore short-circuited for DC-signals. On e dipole arms in order to improve matching when loaded Measurement Conditions" paragraph. The SAR data are tigth is still according to the Standard. ole arms, because they might bend or the soldered
After long term use with 100W radiated power be measured. The dipole is made of standard semirigid coax connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th according to the position as explained in the " affected by this change. The overall dipole len No excessive force must be applied to the dip connections near the feedpoint may be damag	r, only a slight warming of the dipole near the feedpoint c cial cable. The center conductor of the feeding line is dire the antenna is therefore short-circuited for DC-signals. On e dipole arms in order to improve matching when loaded Measurement Conditions" paragraph. The SAR data are gigth is still according to the Standard. ole arms, because they might bend or the soldered ged.
After long term use with 100W radiated power be measured. The dipole is made of standard semirigid coax connected to the second arm of the dipole. Th of the dipoles, small end caps are added to th according to the position as explained in the " affected by this change. The overall dipole len	r, only a slight warming of the dipole near the feedpoint c cial cable. The center conductor of the feeding line is dire the antenna is therefore short-circuited for DC-signals. On e dipole arms in order to improve matching when loaded Measurement Conditions" paragraph. The SAR data are tigth is still according to the Standard. ole arms, because they might bend or the soldered



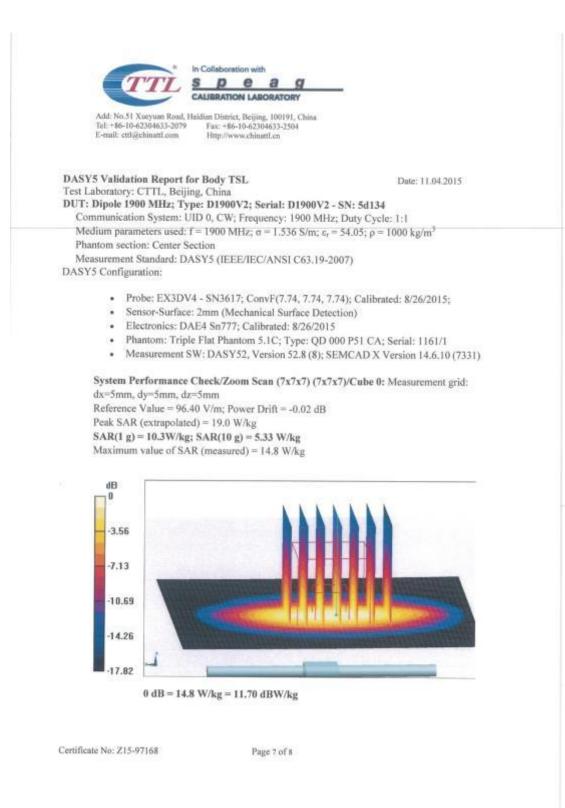














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D1750V2, Serial No.1044 Extended Dipole Calibrations

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

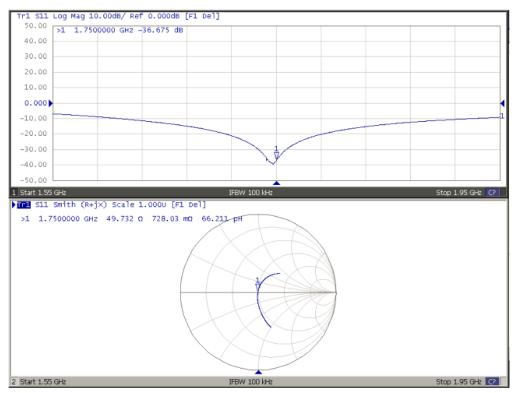
	D1750V2 Serial No.1044							
1750 Head								
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)		
11.03.2015	-36.76		48.891		1.1688			
11.02.2016	-36.675	0.23	49.732	0.841	0.738	0.431		

	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	

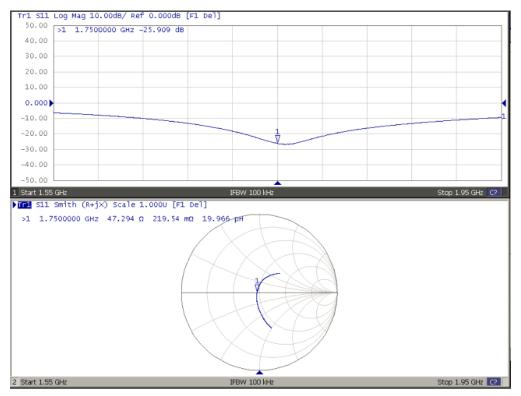
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



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



1750MHz - Body





	CALIBRA	TION LABORATORY	IC-MRA
Add: No.51 Xueyu Tel: +86-10-62304 E-mail: cttl@china	633-2079 Fax	strict, Beljing, 100191, China +86-10-62304653-2504 //www.chinattl.en	CALIBRATION No. L0570
Client EC	п	Certificate No: Z1	5-97168
CALIBRATION C	ERTIFICAT	re	
Object	D1900	V2 - SN: 5d134	
Calibration Procedure(s)	and the second second		
		1-2-003-01	
	Calibra	ation Procedures for dipole validation kits	
Calibration date:	Novem	ber 4, 2015	
pages and are part of the c			
	conducted in	the closed laboratory facility; environment or calibration)	temperature(22±3)℃ and
All calibrations have been humidity<70%.	conducted in		temperature(22±3)℃ and Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	i conducted in	or calibration)	
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91	I conducted in (M&TE critical f ID# 101919 101547	or calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	I conducted in (M&TE critical f ID # 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 28-Aug-15(SPEAG,No.EX3-3617_Aug15)	Scheduled Calibration Jun-16 Jun-16 Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91	I conducted in (M&TE critical f ID# 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled 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	I conducted in (M&TE critical f 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) 26-Aug-15(SPEAG,No.DAE4-777_Aug15)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	I conducted in (M&TE critical fi 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) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration Jun-16 Jun-16 Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	I conducted in (M&TE critical fi 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 (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)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration
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	I conducted in (M&TE critical fi 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)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16
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 Network Analyzer E5071C	I conducted in (M&TE critical fi 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) 28-Aug-15 (CTTL, No.J15X04256) 28-Aug-15 (SPEAG,No.EX3-3617_Aug15) 28-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)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16
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 Network Analyzer E5071C	Conducted in (M&TE critical fi 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) 28-Aug-15(SPEAG,No.EX3-3617_Aug15) 28-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	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16
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 IO# 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) 28-Aug-15(SPEAG,No.EX3-3617_Aug15) 28-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	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16 Scheduled Calibration Feb-16 Feb-16

Certificate No: Z15-97168

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Glossary:	
ConvF	tissue simulating liquid sensitivity in TSL / NORMx.v.z
1/A	not applicable or not measured
	is Performed According to the Following Standards:
	1528-2013, "IEEE Recommended Practice for Determining the Peak eraged Specific Absorption Rate (SAR) in the Human Head from Wireless
	ations Devices: Measurement Techniques", June 2013
) IEC 62209 devices us	9-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held sed in close proximity to the ear (frequency range of 300MHz to 3GHz)", February
2005) KDB86566	64, SAR Measurement Requirements for 100 MHz to 6 GHz
dditional D	Pocumentation:
) DASY4/5	System Handbook
	plied and Interpretation of Parameters:
of the ce	ment Conditions: Further details are available from the Validation Report at the end rtificate. 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 exa	ctly below the center marking of the flat phantom section, with the arms oriented the body axis.
positione	Int Impedance and Return Loss: These parameters are measured with the dipole d under the liquid filled phantom. The impedance stated is transformed from the ment at the SMA connector to the feed point. The Return Loss ensures low
reflected	power. No uncertainty required.
	Delay: One-way delay between the SMA connector and the antenna feed point. tainty required.
	asured: SAR measured at the stated antenna input power.
	nalized: SAR as measured, normalized to an input power of 1 W at the antenna
	nominal TSL parameters: The measured TSL parameters are used to calculate the SAR result.
1990-1000.00 VI.V	
Measurem	ted uncertainty of measurement is stated as the standard uncertainty of ent multiplied by the coverage factor k=2, which for a normal distribution ds to a coverage probability of approximately 95%.
ooneapon	as to a contrage probability of approximately 30%.





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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 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	40.8 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (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	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 ³ (1 g) of Body TSL	Cond	tion		
SAR measured	250 mW ir	put power		10.3 mW / g
SAR for nominal Body TSL parameters	normalize	ed to 1W	41.1	mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Body T	SL Cond	tion		
SAR measured	250 mW ir	put power		5.33 mW / g
SAR for nominal Body TSL parameters	normalize	d to 1W	21.3	mW /g ± 20.4 % (k=2)

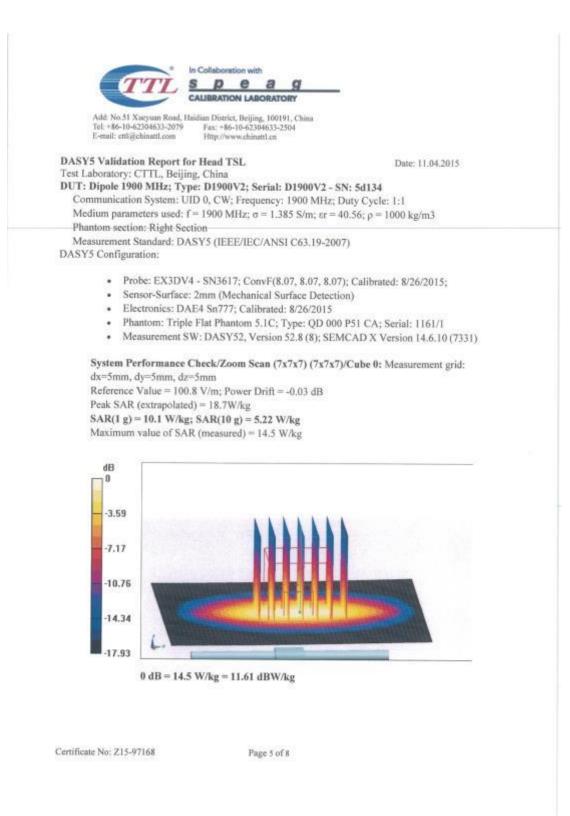
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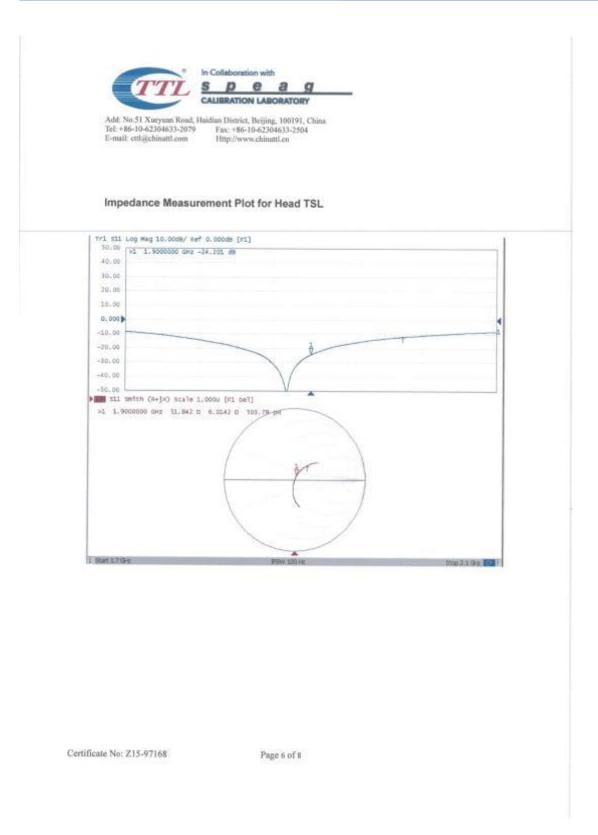


Antenna Parameters with Head TSL	
Impedance, transformed to feed point	51.8Ω+ 6.01jΩ
Return Loss	- 24.2dB
Antenna Parameters with Body TSL	
Impedance, transformed to feed point	47.1Ω+ 5.41jΩ
Return Loss	- 24.0dB
General Antenna Parameters and Desi	gn
[
be measured. The dipole is made of standard semirigid coaxis connected to the second arm of the dipole. The of the dipoles, small end caps are added to the sccording to the position as explained in the "M	1.305 ns only a slight warming of the dipole near the feedpoint can al cable. The center conductor of the feeding line is direct antenna is therefore short-circuited for DC-signals. On sc dipole arms in order to improve matching when loaded easurement Conditions' paragraph. The SAR data are no
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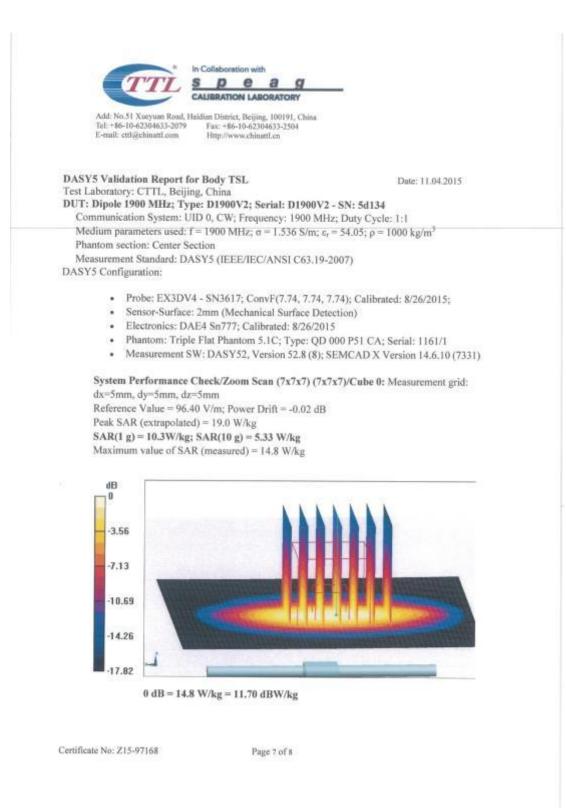














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D1900V2, Serial No.5d134 Extended Dipole Calibrations

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

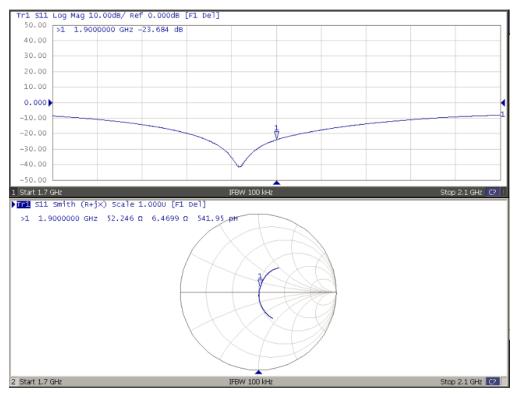
	D1900V2 Serial No.5d134							
1900 Head								
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)		
11.04.2015	-24.201		51.842		6.0142			
11.03.2016	-23.684	2.13	52.246	0.404	6.4699	0.456		

		D1900	V2 Serial No. 1900 Body	5d134		
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

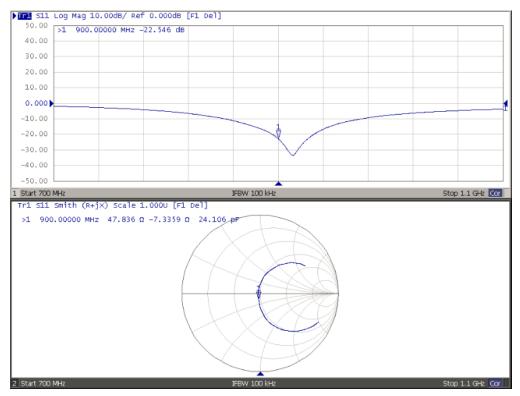
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



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



1900MHz - Body





Tel: +86-10-62304	633-2079 Fax:	istrict, Beijing, 100191, China +86-10-62304633-2504	CALIBRATION No. L0570
E-mail: cttl@china Client EC		certificate No:	Z15-97171
CALIBRATION C			215-9/1/1
o, Libio, Iloit o	ERTITIOA		
Object	D2450	0V2 - SN: 858	
Calibration Procedure(s)	FD-71	1-2-003-01	
		ation Procedures for dipole validation kits	
Calibration date:	Octob	er 30, 2015	
This collibration Cartificate	de europete de -	1	
measurements(SI). The me	asurements and	traceability to national standards, which i d the uncertainties with confidence probabili	realize the physical units of ity are given on the following
pages and are part of the ce			
All calibrations have been	conducted in	the closed laboratory facility: environme	
humidity<70%.	i conducted in	the closed laboratory lacinty, environme	ent temperature(22±3) [®] and
Calibration Equipment used			
1 1	(M&TE critical	for calibration)	
	I (M&TE critical		Scheduled Calibration
		for calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled Calibration Jun-16
Primary Standards Power Meter NRP2 Power sensor NRP-Z91	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.)	
Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	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	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 DAE4 Secondary Standards	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 i) 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) 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	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	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 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



	Add: No.51 Xueyuan Ro Tel: +86-10-62304633-2 E-mail: ettl@chinattl.con		91, China	
TS	nvF sen	ue simulating liquid Isitivity in TSL / NORMx applicable or not measu		
a) S (b) 2	EEE Std 1528-2013, Spatial-Averaged Spe Communications Dev EC 62209-1, "Proceed devices used in close 2005	ecific Absorption Rate (S ices: Measurement Tecl dure to measure the Spe proximity to the ear (fre	Practice for Determining the Peak AR) in the Human Head from Wir	reless hand-held
	ditional Documenta DASY4/5 System Ha			
•	Measurement Cond of the certificate. All Antenna Parameters point exactly below if parallel to the body a Feed Point Impedar positioned under the measurement at the reflected power. No Electrical Delay: On No uncertainty requi SAR measured: SAI SAR normalized: SA connector.	figures stated in the cer s with TSL: The dipole is the center marking of the axis. Ince and Return Loss: The e liquid filled phantom. T SMA connector to the fi uncertainty required. e-way delay between the red. R measured at the state IR as measured, normal	e available from the Validation Re tificate are valid at the frequency smounted with the spacer to posi e flat phantom section, with the a ese parameters are measured wi he impedance stated is transform eed point. The Return Loss ensure e SMA connector and the antenna	indicated. ition its feed rms oriented ith the dipole ted from the res low a feed point. the antenna
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Certi	ficate No: Z15-97171	Page 2 of §	3	





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 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	

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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 ³ (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

	Te	mperature	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 ± 6	5 %	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	-	Condi	tion		
SAR measured		250 mW in	put power		13.2 mW / g
SAR for nominal Body TSL parameters		normalize	d to 1W	53.1 r	mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body T	SL	Condit	tion		
SAR measured		250 mW in	put power		6.16 mW / g
SAR for nominal Body TSL parameters		normolizo	d to 1W	247	mW /g ± 20.4 % (k=2)



	ppendix ntenna Parameters with Head TSL	
	Impedance, transformed to feed point	53.2Ω+ 6.03jΩ
	Return Loss	- 23.6dB
An	ntenna Parameters with Body TSL	
	Impedance, transformed to feed point	49.9Ω+ 7.39jΩ
	Return Loss	- 22.6dB
Ge	eneral Antenna Parameters and Design	
Afte be The con of ti acc	Electrical Delay (one direction) er long term use with 100W radiated power, only measured. e dipole is made of standard semirigid coaxial ca nnected to the second arm of the dipole. The ante the dipoles, small end caps are added to the dipo cording to the position as explained in the "Measu	1.261 ns a slight warming of the dipole near the feedpoint can ble. The center conductor of the feeding line is directly enna is therefore short-circuited for DC-signals. On some le arms in order to improve matching when loaded irement Conditions" paragraph. The SAR data are not
After be The con of ti acc affer No con	Electrical Delay (one direction) er long term use with 100W radiated power, only measured. e dipole is made of standard semirigid coaxial ca nnected to the second arm of the dipole. The ante the dipoles, small end caps are added to the dipole cording to the position as explained in the "Measu exceted by this change. The overall dipole length is excessive force must be applied to the dipole arm nnections near the feedpoint may be damaged.	a slight warming of the dipole near the feedpoint can ble. The center conductor of the feeding line is directly enna is therefore short-circuited for DC-signals. On some le arms in order to improve matching when loaded urement Conditions'' paragraph. The SAR data are not still according to the Standard
After be The con of ti acc affer No con	Electrical Delay (one direction) er long term use with 100W radiated power, only measured. e dipole is made of standard semirigid coaxial ca nected to the second arm of the dipole. The ante the dipoles, small end caps are added to the dipole cording to the position as explained in the "Measu ected by this change. The overall dipole length is excessive force must be applied to the dipole.	a slight warming of the dipole near the feedpoint can ble. The center conductor of the feeding line is directly enna is therefore short-circuited for DC-signals. On some le arms in order to improve matching when loaded urement Conditions'' paragraph. The SAR data are not still according to the Standard
After be The con of ti acc affer No con	Electrical Delay (one direction) er long term use with 100W radiated power, only measured. e dipole is made of standard semirigid coaxial ca nnected to the second arm of the dipole. The ante the dipoles, small end caps are added to the dipo cording to the position as explained in the "Measu ected by this change. The overall dipole length is excessive force must be applied to the dipole an nnections near the feedpoint may be damaged. Iditional EUT Data	a slight warming of the dipole near the feedpoint can ble. The center conductor of the feeding line is directly enna is therefore short-circuited for DC-signals. On some le arms in order to improve matching when loaded urement Conditions" paragraph. The SAR data are not still according to the Standard. ms, because they might bend or the soldered



