



F.1 E-Field Probe

he Swiss Accreditation Servi Iultilateral Agreement for the lient Balun-SZ (Au	recognition of calibration ce	ertificates	
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lient Balun-SZ (Au	den)	Cartificate No:	
		Gertincate No.	EX3-7607_Aug20
CALIBRATION	CERTIFICATE		
Dbject	EX3DV4 - SN:760	7	
Calibration procedure(s)	04 CAL 01 10 01	CAL 14 CAL 22 CAL	CAL 25.17
Jailoration procedure(s)		A CAL-14.v6, QA CAL-23.v5, QA	GAL-25.V/
	Calibration proced	ure for dosimetric E-field probes	
	1		
Calibration date:	August 7, 2020		
Calibration Equipment used (M	BTT with all for tall boulders!		
calibration Equipment used (w	&TE critical for calibration)		
		Cal Date (Certificate No.)	Scheduled Calibration
Primary Standards	1	Cai Date (Certificate No.) 01-Apr-20 (No. 217-03100/03101)	Scheduled Calibration
Primary Standards Power meter NRP	ai		
Primary Standards	ID SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Primary Standards Power meter NRP Power sensor NRP-Z91	ID SN: 104778 SN: 103244	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100)	Apr-21 Apr-21
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	ID SN: 104778 SN: 103244 SN: 103245	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03101)	Apr-21 Apr-21 Apr-21
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x)	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106)	Apr-21 Apr-21 Apr-21 Apr-21 Apr-21
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 660 SN: 3013	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19)	Apr-21 Apr-21 Apr-21 Apr-21 Dec-20 Dec-20
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 660 SN: 3013 ID	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house)	Apr-21           Apr-21           Apr-21           Apr-21           Dec-20           Scheduled Check
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 660 SN: 3013 ID SN: GB41293874	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 31-Mar-20 (No. 217-03101) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house) 06-Apr-16 (in house check Jun-20)	Apr-21 Apr-21 Apr-21 Apr-21 Dec-20 Dec-20 Scheduled Check In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A	ID SN: 104778 SN: 103244 SN: 103245 SN: 002552 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20)	Apr-21 Apr-21 Apr-21 Apr-21 Dec-20 Dec-20 Scheduled Check In house check: Jun-22 In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A Power sensor E4412A	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 3013 ID SN: 660 SN: 3013 SN: G841293874 SN: MY41498087 SN: 000110210	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. 217-03106) 31-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20)	Apr-21 Apr-21 Apr-21 Dec-20 Dec-20 Scheduled Check In house check: Jun-22 In house check: Jun-22 In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A Power sensor E4412A RF generator HP 8648C	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 04-Aug-99 (in house check Jun-20)	Apr-21           Apr-21           Apr-21           Dec-20           Dec-20           Scheduled Check           In house check: Jun-22           In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A Power sensor E4412A	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 3013 ID SN: 660 SN: 3013 SN: G841293874 SN: MY41498087 SN: 000110210	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. 217-03106) 31-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20)	Apr-21 Apr-21 Apr-21 Dec-20 Dec-20 Scheduled Check In house check: Jun-22 In house check: Jun-22 In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A Power sensor E4412A RF generator HP 8648C	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 04-Aug-99 (in house check Jun-20)	Apr-21           Apr-21           Apr-21           Dec-20           Dec-20           Scheduled Check           In house check: Jun-22           In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A Power sensor E4412A RF generator HP 8648C Network Analyzer E8358A	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700 SN: US41080477	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 04-Aug-99 (in house check Jun-20) 31-Mar-14 (in house check Oct-19)	Apr-21 Apr-21 Apr-21 Apr-21 Dec-20 Scheduled Check In house check: Jun-22 In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power sensor E4412A Power sensor E4412A RF generator HP 8648C Network Analyzer E8358A	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 3013 ID SN: G60 SN: 3013 ID SN: G841293874 SN: MY41498087 SN: 000110210 SN: US3642U01700 SN: US3642U01700 SN: US41080477 Name	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 31-Mar-20 (No. 217-03106) 27-Dec-19 (No. 217-03106) 31-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. DAE4-660_Dec19) 06-Apr-16 (in house) 06-Apr-16 (in house) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 04-Aug-99 (in house check Jun-20) 31-Mar-14 (in house check Oct-19) Function	Apr-21 Apr-21 Apr-21 Apr-21 Dec-20 Scheduled Check In house check: Jun-22 In house check: Jun-22
Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E44198 Power sensor E4412A Power sensor E4412A RF generator HP 8648C Network Analyzer E8358A Calibrated by:	ID SN: 104778 SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700 SN: US3642U01700 SN: US3642U01700 SN: US3642U01700 SN: US3642U01700 SN: US3642U01700	01-Apr-20 (No. 217-03100/03101) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03106) 27-Dec-19 (No. DAE4-660_Dec19) 31-Dec-19 (No. ES3-3013_Dec19) Check Date (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 06-Apr-16 (in house check Jun-20) 04-Aug-99 (in house check Jun-20) 31-Mar-14 (in house check Jun-20) Function Laboratory Technician	Apr-21 Apr-21 Apr-21 Apr-21 Dec-20 Scheduled Check In house check: Jun-22 In house check: Jun-22
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



- Schweizerischer Kalibrierdienst s Service suisse d'étalonnage С
- Servizio svizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

#### Glossary:

tissue simulating liquid
sensitivity in free space
sensitivity in TSL / NORMx,y,z
diode compression point
crest factor (1/duty cycle) of the RF signal
modulation dependent linearization parameters
φ rotation around probe axis
$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e. $\vartheta = 0$ is normal to probe axis

Connector Angle

#### 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 IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from handb) held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016 IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices
- C)

information used in DASY system to align probe sensor X to the robot coordinate system

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 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,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 with CW signal (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; Dx,y,z; VRx,y,z; A, B, C, D 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  $f \le 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values 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 ± 50 MHz to ± 100 MHz.
- 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).

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# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7607

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm $(\mu V/(V/m)^2)^A$	0.61	0.66	0.66	± 10.1 %
DCP (mV) <sup>8</sup>	110.2	107.1	109.8	

#### **Calibration Results for Modulation Response**

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Max dev.	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	166.6	± 2.7 %	± 4.7 %
		Y	0.0	0.0	1.0		151.8		
		Z	0.0	0.0	1.0		146.1		

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%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 5).
 <sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7607

#### **Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	173.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3-4 mm for an Area Scan job.

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# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7607

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
750	41.9	0.89	10.84	10.84	10.84	0.53	0.80	± 12.0 %
835	41.5	0.90	10.49	10.49	10.49	0.50	0.80	± 12.0 %
1750	40.1	1.37	8.58	8.58	8.58	0.33	0.86	± 12.0 %
1900	40.0	1.40	8.26	8.26	8.26	0.34	0.86	± 12.0 %
2100	39.8	1.49	8.19	8.19	8.19	0.34	0.88	± 12.0 %
2300	39.5	1.67	8.02	8.02	8.02	0.31	0.90	± 12.0 %
2450	39.2	1.80	7.66	7.66	7.66	0.34	0.90	± 12.0 %
2600	39.0	1.96	7.50	7.50	7.50	0.36	0.90	± 12.0 %
3300	38.2	2.71	6.90	6.90	6.90	0.30	1.35	± 13.1 %
3500	37.9	2.91	6.83	6.83	6.83	0.30	1.35	± 13.1 %
3700	37.7	3.12	6.70	6.70	6.70	0.30	1.35	± 13.1 %
3900	37.5	3.32	6.49	6.49	6.49	0.35	1.50	± 13.1 %
4100	37.2	3.53	6.40	6.40	6.40	0.35	1.50	± 13.1 %
4400	36.9	3.84	6.25	6.25	6.25	0.35	1.70	± 13.1 %
4600	36.7	4.04	6.16	6.16	6.16	0.40	1.70	± 13.1 %
4800	36.4	4.25	5.89	5.89	5.89	0.40	1.80	± 13.1 %
4950	36.3	4.40	5.78	5.78	5.78	0.40	1.80	± 13.1 %
5200	36.0	4.66	5.46	5.46	5.46	0.40	1.80	± 13.1 %
5300	35.9	4.76	5.30	5.30	5.30	0.40	1.80	± 13.1 %
5500	35.6	4.96	5.00	5.00	5.00	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.85	4.85	4.85	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.86	4.86	4.86	0.40	1.80	± 13.1 %

#### Calibration Parameter Determined in Head Tissue Simulating Media

<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the 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. Validity of ConvF assessed at 6 MHz is 4-19 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity compensation formula is applied to <sup>\*</sup> At frequencies below 3 GHz, the validity of tissue parameters (s and  $\sigma$ ) 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 (s and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters. <sup>(G</sup> 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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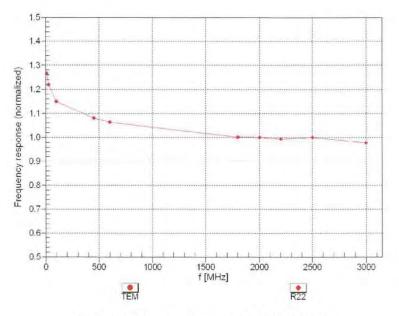




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## Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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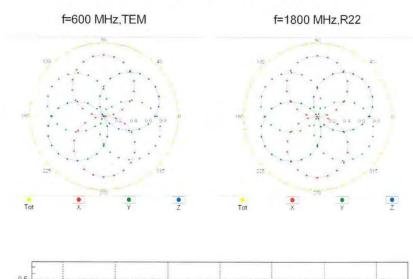
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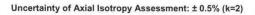


EX3DV4-SN:7607

August 7, 2020



Receiving Pattern ( $\phi$ ),  $\vartheta = 0^{\circ}$ 



Certificate No: EX3-7607\_Aug20

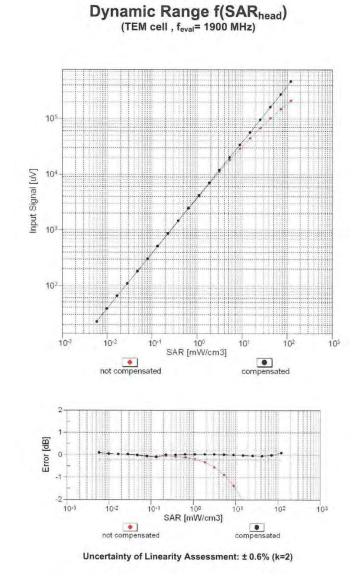
Page 7 of 9





EX3DV4- SN:7607

August 7, 2020



Certificate No: EX3-7607\_Aug20

Page 8 of 9

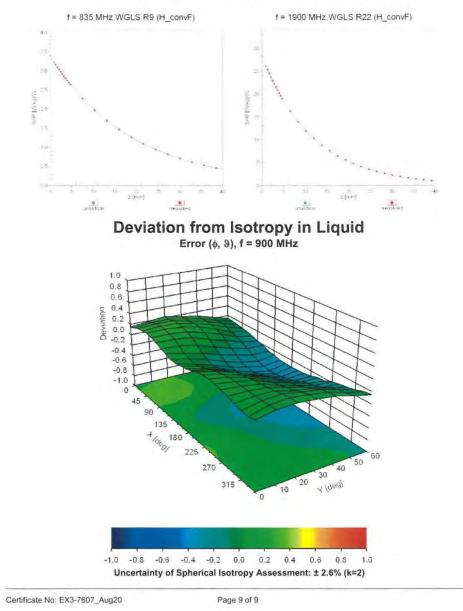




EX3DV4- SN:7607

August 7, 2020

# **Conversion Factor Assessment**





	In Collabo	ration with	S. Competition		中国认可国际互认
	S P CALIBRAT	C a g	- Hac-MRA	CNAS	校准
Add: No.51 Xuo Tel: +86-10-623 E-mail: ettl@ch	eyuan Road, Haidian Di 804633-2512 Fax:	strict, Beijing, 100191, China +86-10-62304633-2504 //www.chinattl.cn	and the state of t	-	CALIBRATION CNAS L0570
Client : bal	untek		Certificate No:	Z20-60392	
CALIBRATION	CERTIFICA	re			
Object	DAE4	- SN: 878			
Calibration Procedure(s)	FF-Z1	1-002-01			
	Calibra (DAEx	ation Procedure for the )	Data Acquisition	Electronics	
Calibration date:	Septer	mber 30, 2020			
All calibrations have be humidity<70%. Calibration Equipment us Primary Standards	sed (M&TE critical			nt temperature(2: Scheduled Calibra	
Process Calibrator 753	1971018	16-Jun-20 (CTTL, No.J	20X04342)	Jun-21	
	Name	Function		Signature	
Calibrated by:	Yu Zongying	SAR Test Enginee	er	2D	
Reviewed by:	Lin Hao	SAR Test Enginee	r II	林鸿	0
Approved by:	Qi Dianyuan	SAR Project Lead	er <	Dez	
			Issue	ed: October 02, 2	020
This calibration certificate	e shall not be repro	oduced except in full with	out written approva	I of the laborator	y.

Certificate No: Z20-60392

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Tel: +86-10-62304633-2512 E-mail: cttl@chinattl.com

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Fax: +86-10-62304633-2504 Http://www.chinattl.cn

**Glossary:** DAE Connector angle

data acquisition electronics information used in DASY system to align probe sensor X to the robot coordinate system.

### Methods Applied and Interpretation of Parameters:

- DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- Connector angle: The angle of the connector is assessed measuring the . angle mechanically by a tool inserted. Uncertainty is not required.
- . The report provide only calibration results for DAE, it does not contain other performance test results.

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#### DC Voltage Measurement A/D - Converter Resolution nor overter Resolution nominal

High Range:	1LSB =	6.1µV,	full range =	-100+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1+3mV
DASY measuremen	t parameters:	Auto Zero T	ime: 3 sec; Meas	suring time: 3 sec

Calibration Factors	х	Y	Z
High Range	405.325 ± 0.15% (k=2)	405.357 ± 0.15% (k=2)	404.808 ± 0.15% (k=2)
Low Range	3.99695 ± 0.7% (k=2)	4.01029 ± 0.7% (k=2)	3.99162 ± 0.7% (k=2)

#### **Connector Angle**

Connector Angle to be used in DASY system	329.5° ± 1 °
	deale a t

Certificate No: Z20-60392

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T	In Collabor	e a g	中国认可国际互认
	CALIBRAT	ION LABORATORY	<b>VAS</b> 校准
Add: No.51 Xueyu Tel: +86-10-62304 E-mail: ettl@china	633-2079 Fax: +8	rict, Beijing, 100191, China 86-10-62304633-2504 www.chinattl.en	CALIBRATION CNAS L0570
Client Balu	ntek	Certificate No: Z19	-60175
CALIBRATION C	ERTIFICAT	E	
Object	D835V2	2 - SN: 4d187	
Calibration Procedure(s)	FF-Z11-	003-01	
		ion Procedures for dipole validation kits	
Calibration date:	June 11	, 2019	
All calibrations have bee humidity<70%. Calibration Equipment use		the closed laboratory facility: environment	temperature(22±3)'C and
Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV	4 SN 7514		Aug-19 Aug-19
		27-Aug-18(SPEAG,No.EX3-7514_Aug18)	
DAE4	SN 1556	27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1556_Aug18)	Aug-19
DAE4 Secondary Standards	SN 1556		Aug-19 Aug-19
	ID#	20-Aug-18(SPEAG,No.DAE4-1556_Aug18)	Aug-19 Aug-19 Aug-19
Secondary Standards	ID # MY49071430	20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.)	Aug-19 Aug-19 Aug-19 Scheduled Calibration
Secondary Standards Signal Generator E44380	ID # C MY49071430 D MY46110673	20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20
Secondary Standards Signal Generator E44380 NetworkAnalyzer E50710	ID # MY49071430	20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336)	Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20
Secondary Standards Signal Generator E44380 NetworkAnalyzer E50710	ID # C MY49071430 D MY46110673	20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20
Secondary Standards Signal Generator E44380 NetworkAnalyzer E50710 Calibrated by:	ID # C MY49071430 MY46110673 Name	20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20
Secondary Standards Signal Generator E44380	ID # MY49071430 MY46110673 Name Zhao Jing	20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer	Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20
Secondary Standards Signal Generator E44380 NetworkAnalyzer E50710 Calibrated by:	ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer SAR Test Engineer	Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20 Signature

Certificate No: Z19-60175 Page 1 of 8





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 Fax: +86-10-62304633-2504

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#### Glossary: TSL ConvF

N/A

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

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to
- 6GHz)", July 2016 c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

# Additional Documentation: e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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#### Measurement Conditions

DASY52	52.10.2.1504
Advanced Extrapolation	
Triple Flat Phantom 5.1C	
15 mm	with Spacer
dx, dy, dz = 5 mm	
835 MHz ± 1 MHz	
	Triple Flat Phantom 5.1C 15 mm dx, dy, dz = 5 mm

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	41.1 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		
SAR result with Head TSL		1	

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.49 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.33 W/kg ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	0.97 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.57 W /kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.31 W/kg ± 18.7 % (k=2)

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#### Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.9Ω- 3.09jΩ
Return Loss	- 29.0dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3Ω- 4.87jΩ	
Return Loss	- 24.9dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.277 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### **Additional EUT Data**

Manufactured	by
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SPEAG

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Date: 06.11.2019

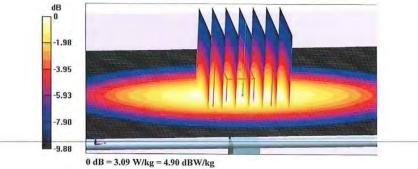
DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d187 Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz;  $\sigma = 0.886$  S/m;  $\varepsilon_r = 41.12$ ;  $\rho = 1000$  kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7514; ConvF(9.09, 9.09, 9.09) @ 835 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

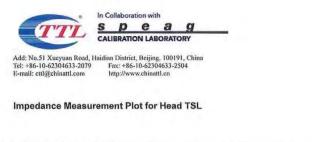
Reference Value = 58.27 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 3.45 W/kg SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.57 W/kg Maximum value of SAR (measured) = 3.09 W/kg

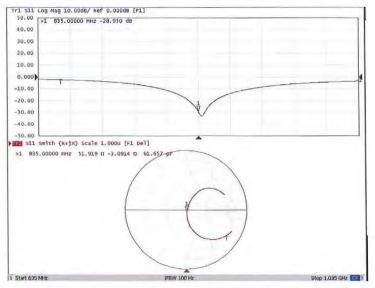


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Certificate No: Z19-60175

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Date: 06.11.2019

Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d187 Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz;  $\sigma = 0.973$  S/m;  $\varepsilon_r = 55$ ;  $\rho = 1000$  kg/m3 Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN7514; ConvF(9.47, 9.47, 9.47) @ 835 MHz; Calibrated:
- 8/27/2018

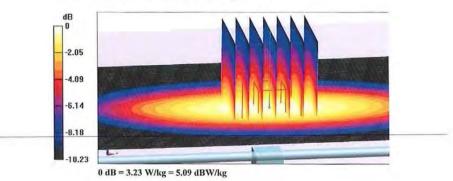
**DASY5 Validation Report for Body TSL** 

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 53.93 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.67 W/kg SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.23 W/kg



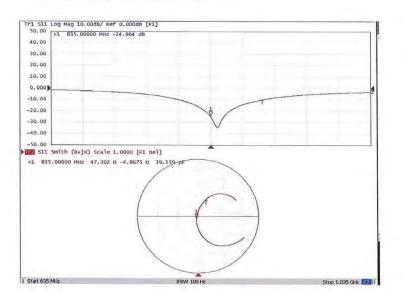
Certificate No: Z19-60175

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Impedance Measurement Plot for Body TSL



Certificate No: Z19-60175

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		Report No.: B	
50 MHz Dipole			
	<sup>®</sup> In Collabo	pration with	<b>中国</b> 社
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	CALIBRAT	TION LABORATORY	NAS
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Tel: +86-10-623046 E-mail: cttl@chinat		86-10-62304633-2504	CNAS L
Client Balun			3-60313
CALIBRATION CH			
OALIBITATION OF			
Object	D1750	√2 - SN: 1130	
Collibration Dreasdure(c)			
Calibration Procedure(s)		-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Septem	nber 13, 2018	
measurements(SI). The mean pages and are part of the ce All calibrations have been	asurements and ertificate.	traceability to national standards, which re- the uncertainties with confidence probability the closed laboratory facility: environment	are given on the follo
measurements(SI). The mean pages and are part of the ce	asurements and ertificate. conducted in	the uncertainties with confidence probability the closed laboratory facility: environment	are given on the follo
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measurements(SI). The mea pages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used	asurements and ertificate. conducted in	the uncertainties with confidence probability the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.)	are given on the follo
measurements(SI). The measurements(SI). The measurements and are part of the centre of	asurements and ertificate. conducted in (M&TE critical fo	the uncertainties with confidence probability the closed laboratory facility: environment or calibration)	are given on the follo t temperature(22±3)°C Scheduled Calibrat
measurements(SI). The measurements pages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD	asurements and ertificate. conducted in (M&TE critical for ID # 102083 100542	the uncertainties with confidence probability the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756)	are given on the follo t temperature(22±3)*C Scheduled Calibrat Oct-18
measurements(SI). The measurements(SI). The measurements pages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5	asurements and ertificate. conducted in (M&TE critical for ID # 102083 100542	the uncertainties with confidence probability the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756)	are given on the follo t temperature(22±3)*C Scheduled Calibrat Oct-18 Oct-18
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#### Glossary: TS

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

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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#### **Measurement Conditions**

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

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	40.9 ± 6 %	1.36 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	9.12 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	36.8 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.92 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	19.8 mW /g ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.62 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	38.0 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.20 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.6 mW /g ± 18.7 % (k=2)

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#### Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.2- 2.39 jΩ	
Return Loss	- 32.4 dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.2Ω- 2.61 jΩ
Return Loss	- 24.8 dB

#### **General Antenna Parameters and Design**

Electrical Delay (one direction)	1.083 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG

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Date: 09.13.2018

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1130** Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; σ = 1.361 S/m; ε<sub>r</sub> = 40.85; ρ = 1000 kg/m3

Phantom section: Center Section

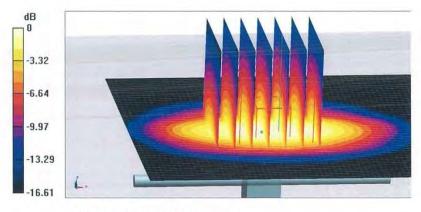
**DASY5 Validation Report for Head TSL** 

DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(8.41, 8.41, 8.41) @ 1750 MHz; Calibrated: 1/25/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 12/15/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 96.29 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 16.7 W/kg

SAR(1 g) = 9.12 W/kg; SAR(10 g) = 4.92 W/kg Maximum value of SAR (measured) = 14.0 W/kg



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

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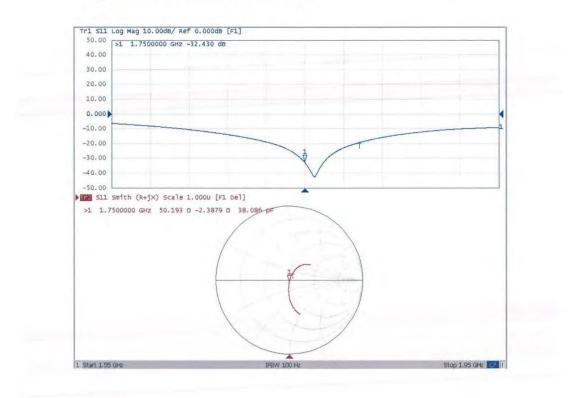


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#### Impedance Measurement Plot for Head TSL



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Date: 09.13.2018

#### Test Laboratory: CTTL, Beijing, China DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1130

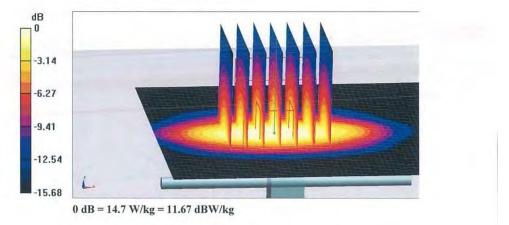
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz;  $\sigma = 1.519$  S/m;  $\varepsilon_r = 53.44$ ;  $\rho = 1000$  kg/m3 Phantom section: Left Section

DASY5 Configuration:

**DASY5 Validation Report for Body TSL** 

- Probe: EX3DV4 SN3846; ConvF(7.84, 7.84, 7.84) @ 1750 MHz; Calibrated: 1/25/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 12/15/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 93.15 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 17.3 W/kg SAR(1 g) = 9.62 W/kg; SAR(10 g) = 5.2 W/kg Maximum value of SAR (measured) = 14.7 W/kg



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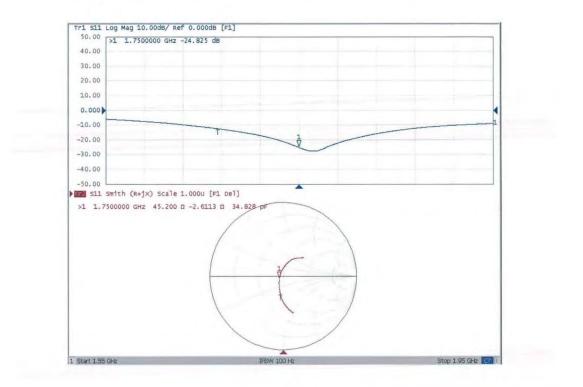


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#### Impedance Measurement Plot for Body TSL



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	CALIBRAT	ION LABORATORY	
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Client Balur	ntek	Certificate No: Z19	-60176
CALIBRATION CE	RTIFICAT	E	
Dbject	D1900V	/2 - SN: 5d193	
alibration Procedure(s)	FF-711-	-003-01	
		ion Procedures for dipole validation kits	
Calibration date:	June 11	, 2019	
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Il calibrations have been umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	conducted in t (M&TE critical fo ID # 106277 104291 SN 7514 SN 1556	Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1556_Aug18)	Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Aug-19
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Il calibrations have been umidity<70%. calibration Equipment used rrimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	conducted in t (M&TE critical fo ID # 106277 104291 SN 7514 SN 1556 ID #	Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1556_Aug18)	Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration
Il calibrations have been umidity<70%. calibration Equipment used trimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fc ID # 106277 104291 SN 7514 SN 1556 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20
Il calibrations have been umidity<70%. calibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fc ID # 106277 104291 SN 7514 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20
Il calibrations have been umidity<70%. calibration Equipment used rrimary Standards Power Meter NRP2 Power sensor NRP85 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	conducted in t (M&TE critical fo ID # 106277 104291 SN 7514 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer	Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20
Il calibrations have been umidity<70%. calibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	conducted in t (M&TE critical fc ID # 106277 104291 SN 7514 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20

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lossary: TSL ConvF N/A

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

# Calibration is Performed According to the Following Standards: a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak

- Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to approximate to the ear (Freq
- 6GHz)", July 2016 c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation: e) DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

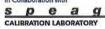
The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

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#### **Measurement Conditions**

DASY Version	DASY52	52.10.2.1504
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 d 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	40.2 ± 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	9.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.4 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg ± 18.7 % (k=2)

## Body TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

heile

#### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.5 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.0 W/kg ± 18.7 % (k=2)

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#### Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7Ω+ 5.93jΩ	
Return Loss	- 24.3dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8Ω+ 5.24jΩ	
Return Loss	- 24.7dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.064 ns
the second se	

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG	

Certificate No: Z19-60176

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

DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 06.10.2019

**DUT:** Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d193 Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz;  $\sigma = 1.387$  S/m;  $\varepsilon_r = 40.2$ ;  $\rho = 1000$  kg/m3 Phantom section: Center Section

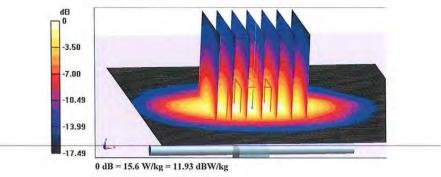
DASY5 Configuration:

- Probe: EX3DV4 SN7514; ConvF(7.73, 7.73, 7.73) @ 1900 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

Reference Value = 98.94 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 18.9 W/kg SAR(1 g) = 9.79 W/kg; SAR(10 g) = 5.07 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



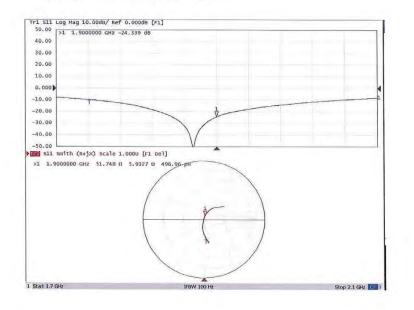
Certificate No: Z19-60176

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Impedance Measurement Plot for Head TSL



Certificate No: Z19-60176

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Date: 06.11.2019



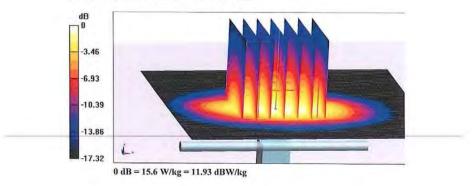
# **DASY5 Validation Report for Body TSL**

 Debratory: CTTL, Beijing, China
 DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d193
 Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.499 S/m;  $\epsilon_r$  = 52.18;  $\rho$  = 1000 kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7514; ConvF(7.53, 7.53, 7.53) @ 1900 MHz; Calibrated: 8/27/2018
- .
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- . Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- . Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 . (7470)

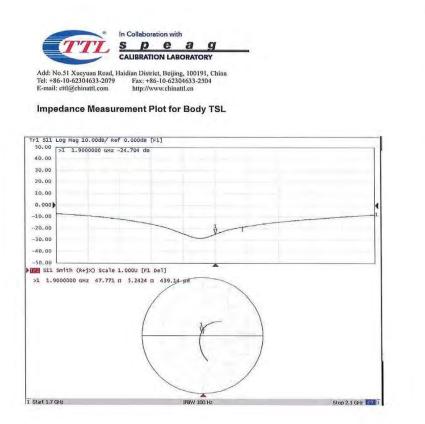
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 88.67 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 18.9 W/kg SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.23 W/kg Maximum value of SAR (measured) = 15.6 W/kg



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		TON LABORATORY	<b>VAS</b> 枚准
Tel: +86-10-623046	33-2079 Fax: +	rict, Beljing, 100191, China 5000000000000000000000000000000000000	CALIBRATION CNAS L0570
E-mail: cttl@chinat Client Balu		www.chinattl.cn Certificate No: Z19	-60177
CALIBRATION CI	ERTIFICAT	E	
Object	D2450\	/2 - SN: 952	
Calibration Procedure(s)			
	FF-Z11		
	Galibra	tion Procedures for dipole validation kits	
Calibration date:	June 10	0, 2019	
		the uncertainties with confidence probability a	ie given on the tonowing
pages and are part of the ce	ertificate. conducted in 1 (M&TE critical for ID # 106277 104291	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862)	temperature(22±3)℃ and Scheduled Calibration Aug-19 Aug-19
pages and are part of the co All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	ertificate. conducted in 1 (M&TE critical for ID # 106277 104291	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862)	temperature(22±3) © and Scheduled Calibration Aug-19
Pages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	entificate. conducted in 1 (M&TE critical for ID# 106277 104291 SN 7514 SN 1556	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG, No.EX3-7514_Aug18) 20-Aug-18 (SPEAG, No.DAE4-1556_Aug18)	Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Aug-19 Aug-19
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	entificate. conducted in 1 (M&TE critical for ID # 106277 104291 SN 7514 SN 1556 ID #	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.)	temperature(22±3)℃ and Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration
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All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ertificate. conducted in 1 (M&TE critical for 106277 104291 SN 7514 SN 1556 ID # MY49071430 MY46110673	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	temperature(22±3)℃ and Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20
bages and are part of the co All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power Sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ertificate. conducted in 1 (M&TE critical for 104291 SN 7514 SN 1556 1D # MY49071430 MY46110673 Name	the closed laboratory facility: environment in or calibration) Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	temperature(22±3)℃ and Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20
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All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	entificate. conducted in 1 (M&TE critical for 108277 104291 SN 7514 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	the closed laboratory facility: environment in or calibration) Cal Date(Calibrated by, Certificate No.) 20-Aug-18 (CTTL, No.J18X06862) 20-Aug-18 (CTTL, No.J18X06862) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1556_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	temperature(22±3)℃ and Scheduled Calibration Aug-19 Aug-19 Aug-19 Aug-19 Scheduled Calibration Jan-20 Jan-20

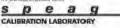
Certificate No: Z19-60177

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- dd; No.31 Xneynan Road, Haidian District, Beijing, 100191, China 21: +Mo-10-62304633-2079 Fax: +86-10-62304653-2504 -mail: ett@xhinattl.com http://www.chinattl.cn

#### Glossary:

TSL ConvF N/A

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

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to
- 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)\*, March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) DASY4/5 System Handbook

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

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

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### Measurement Conditions

DASY Version	DASY52	52.10.2.1498
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5,1C	
Distance Dipole Center - TSL	10 mm	with Space
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

the second se	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	39.6 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C.	-	

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	1
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.6 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52,7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.1 ± 6 %	1.96 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR averaged over 1 cm3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.9 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>1</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.7 W/kg ± 18.7 % (k=2)

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aan Road, )laidlau District, Beijing, 100191, China 1633-2079 Fax: +86-10-62304633-2504 attl.com h0p://www.chinattl.cn

### Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	54,10+2.51 JO	
Return Loss	- 26 8dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.3Ω+ 3,40 JΩ	
Return Loss	- 27.9dB	

#### General Antenna Parameters and Design

1.020 ns

SPEAG

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

	Manufactured	by	
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 Add: No.51 Xucyuan Road, Haidian District, Beijing, 100191, China

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

 E-mail: cttl@chinattl.com
 http://www.chinattl.en

Date: 06.10.2019

# DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 952

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz;  $\sigma = 1.825$  S/m;  $\epsilon_r = 39.75$ ;  $\rho = 1000$  kg/m3 Phantom section: Right Section

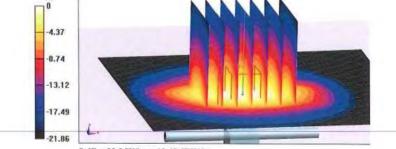
DASY5 Configuration:

- · Probe: EX3DV4 SN7514; ConvF(6.95, 6.95, 6.95) @ 2450 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- · Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C; Type: QD 000 P51CA; Serial: 1062
  Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 97.66 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 27.4 W/kg SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.11 W/kg Maximum value of SAR (measured) = 22.3 W/kg

dB

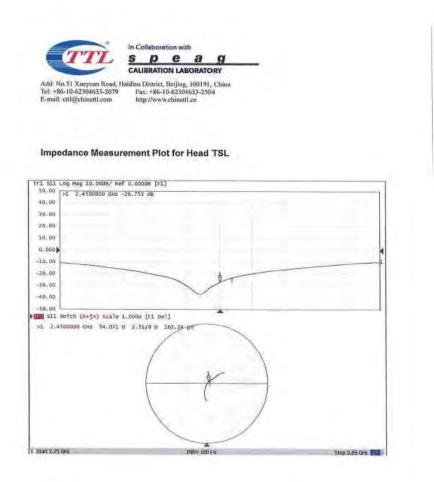


0 dB = 22.3 W/kg = 13.48 dBW/kg

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

 E-mail: cttl@chinattLcom
 http://www.chinattLcn

Date: 06.10.2019

# DASY5 Validation Report for Body TSL. Test Laboratory: CTTL, Beijing, China DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 952

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

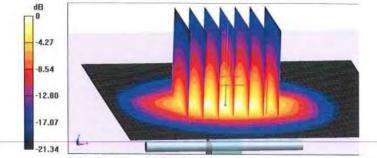
Medium parameters used: f = 2450 MHz;  $\sigma = 1.962$  S/m;  $\epsilon_r = 52.06$ ;  $\rho = 1000$  kg/m3 Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN7514; ConvF(7.13, 7.13, 7.13) @ 2450 MHz; Calibrated: 8/27/2018
- . Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- · Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C; Type: QD 000 P51CA; Serial: 1062
  Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 89.63 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 26.4 W/kg SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.94 W/kg

Maximum value of SAR (measured) = 21.3 W/kg

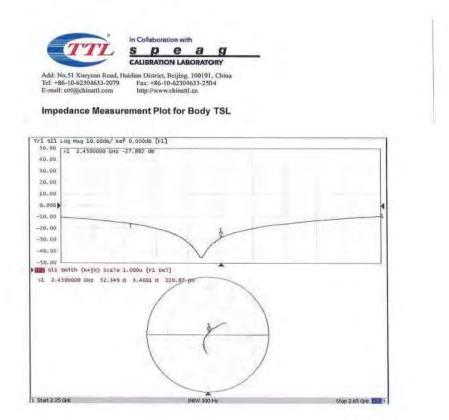


0 dB = 21.3 W/kg = 13.28 dBW/kg

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11	CALIBRAT	ION LABORATORY	VAS核准
Add: No.51 Xueyuan Tel: +86-10-6230463 E-mail: cttl@chinattl	n Road, Haidian Distr 13-2079 Fax: +8	ict, Beijing, 100191, China 16-10-62304633-2504 www.chinatl.cn	CALIBRATION CNAS L0570
Client Balun	itek	Certificate No: Z18	-60466
CALIBRATION CE	RTIFICAT	E	
bject	D2600V	/2 - SN: 1095	
alibration Procedure(s)	FF-Z11-	002.04	
		ion Procedures for dipole validation kits	
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Calibration date:	Novemb	per 5, 2018	
bages and are part of the ce			
numidity<70%.		the closed laboratory facility: environment	temperature(22±3)℃ and
numidity<70%. Calibration Equipment used	(M&TE critical fo	or calibration)	
uumidity<70%. Calibration Equipment used Primary Standards	(M&TE critical fo	or calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD	(M&TE critical fo ID # 102196	or calibration) Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510)	Scheduled Calibration Mar-19
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-25	(M&TE critical fo ID # 102196 100596	or calibration) Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510)	Scheduled Calibration Mar-19 Mar-19
uumidity<70%. Calibration Equipment used Primary Standards	(M&TE critical fo ID # 102196	or calibration) Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510)	Scheduled Calibration Mar-19
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4	(M&TE critical fo ID # 102196 100596 SN 7514	or calibration) Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Scheduled Calibration Mar-19 Mar-19 Aug-19
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fo 102196 100596 SN 7514 SN 1555 ID #	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 102198 100596 SN 7514 SN 1555 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560)	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration Jan-19
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fo 102196 100596 SN 7514 SN 1555 ID #	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 102198 100596 SN 7514 SN 1555 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560)	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration Jan-19
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	(M&TE critical fc 102196 100596 SN 7514 SN 1555 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18 (SPEAG,No.EX3-7514_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561)	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration Jan-19 Jan-19
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	(M&TE critical fc 102196 100596 SN 7514 SN 1555 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18 (SPEAG, No.EX3-7514_Aug18) 20-Aug-18 (SPEAG, No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration Jan-19 Jan-19
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by: Reviewed by:	(M&TE critical fo ID # 102198 100596 SN 7514 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18(SPEAG,No.EX3-7514_Aug18) 20-Aug-18(SPEAG,No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function SAR Test Engineer	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration Jan-19 Jan-19
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 102198 100596 SN 7514 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date(Calibrated by, Certificate No.) 07-Mar-18 (CTTL, No.J18X01510) 07-Mar-18 (CTTL, No.J18X01510) 27-Aug-18 (CTTL, No.J18X01510) 27-Aug-18 (SPEAG,No.DAE4-1555_Aug18) 20-Aug-18 (SPEAG,No.DAE4-1555_Aug18) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function SAR Test Engineer SAR Test Engineer	Scheduled Calibration Mar-19 Mar-19 Aug-19 Aug-19 Scheduled Calibration Jan-19 Jan-19 Jan-19 Signature LEI IFM

Certificate No: Z18-60466

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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@cbinattl.com
 http://www.chinattl.cn

#### Glossary:

TSL ConvF N/A

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

- Calibration is Performed According to the Following Standards: a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak
- a) IEEE Sid 1526-2013, IEEE Recommended Fractice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
   b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to eCOLD\*\*, but 2014)
- 6GHz)", July 2016 c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless
- communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010 d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

- Methods Applied and Interpretation of Parameters:

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

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

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# In Collaboration with

 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	52.10.2.1495
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	39.4 ± 6 %	1.94 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	56.3 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.1 mW /a ± 18.7 % (k=2)

Body TSL parameters

	Te	mperature	Permitti	vity	Conductivity
Nominal Body TSL parameters	- 3	22.0 °C	52.5		2.16 mho/m
Measured Body TSL parameters	(22.	.0 ± 0.2) °C	52.7 ± 0	5 %	2.21 mho/m ± 6 %
Body TSL temperature change during test		<1.0 °C			
R result with Body TSL				11	
SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL		Condi	tion		
SAR measured		250 mW in	put power	1.1	13.4 mW / g
SAR for nominal Body TSL parameters		normalize	d to 1W	53.1	mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body T	SL	Condi	tion		
SAR measured		250 mW in	put power		5.92 mW / g
SAR for nominal Body TSL parameters		normalize	ed to 1W	23.6	mW /g ± 18.7 % (k=2

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### Appendix(Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4Ω- 5.09jΩ
Return Loss	- 25.8dB

g

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7Ω- 5.55jΩ	
Return Loss	- 23.5dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.017 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG

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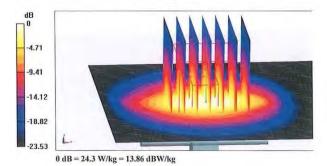
#### Date: 11.05.2018

Phantom section: Center Section

- DASY5 Configuration:
  - Probe: EX3DV4 SN7514; ConvF(6.92, 6.92, 6.92) @ 2600 MHz; Calibrated: 8/27/2018
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection)
  - Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
  - Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
  - Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

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

Reference Value = 107.5 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 30.7 W/kg SAR(1 g) = 14 W/kg; SAR(10 g) = 6.24 W/kg Maximum value of SAR (measured) = 24.3 W/kg



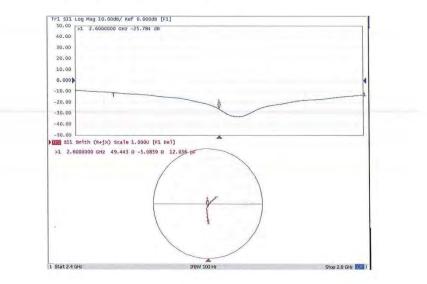
Certificate No: Z18-60466

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## Impedance Measurement Plot for Head TSL



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#### Date: 11.01.2018

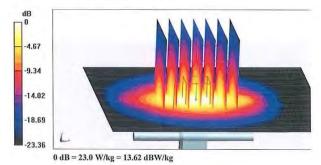
DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1095 Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2600 MHz;  $\sigma$  = 2.206 S/m;  $\epsilon_r$  = 52.65;  $\rho$  = 1000 kg/m3 Phantom section: Right Section DASY5 Configuration:

.

- Probe: EX3DV4 SN7514; ConvF(7.06, 7.06, 7.06) @ 2600 MHz; Calibrated: 8/27/2018
- . Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- .
- Electronics: DAF4 Sn1555; Calibrated: 8/20/2018 Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062 Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 .

(7450)

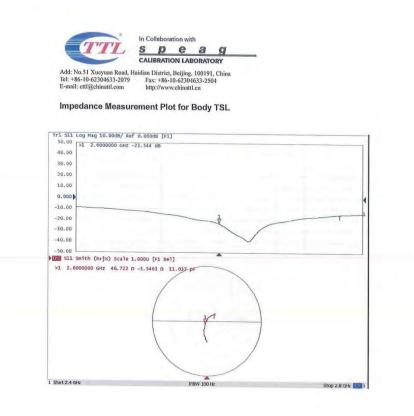
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,  $\begin{array}{l} \text{Mpote Caniford Model (MART) (MART)$ 



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Client Balu	intek	Certificate No: Z2	0-60069
CALIBRATION C	ERTIFICAT	re de la companya de	
Object	D5GHz	zV2 - SN: 1200	
Calibration Procedure(s)	FF-711	-003-01	
		ation Procedures for dipole validation kits	
Calibration date:	Februa	ary 17, 2020	
All calibrations have been	n conducted in	the closed laboratory facility: environment	temperature(22±3)°C an
humidity<70%. Calibration Equipment used	I (M&TE critical f	for calibration)	
Calibration Equipment used	I (M&TE critical f		Scheduled Calibration
Calibration Equipment used		Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration Apr-20
Calibration Equipment used	ID#		
Calibration Equipment used Primary Standards Power Meter NRP2	ID # 106276	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	ID # 106276 101369	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20 Apr-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4	ID # 106276 101369 SN 7307	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19(SPEAG,No.EX3-7307_May19)	Apr-20 May-20 Sep-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	ID # 106276 101369 SN 7307 SN 1331 ID #	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19(SPEAG,No.EX3-7307_May19) 04-Sep-19(SPEAG,No.DAE4-1331_Sep19)	Apr-20 Apr-20 May-20 Sep-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards	ID # 106276 101369 SN 7307 SN 1331 ID #	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19(SPEAG,No.EX3-7307_May19) 04-Sep-19(SPEAG,No.DAE4-1331_Sep19) Cal Date(Calibrated by, Certificate No.)	Apr-20 Apr-20 May-20 Sep-20 Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7307 SN 1331 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19 (SPEAG,No.EX3-7307_May19) 04-Sep-19 (SPEAG,No.DAE4-1331_Sep19) Cal Date(Calibrated by, Certificate No.) 10-Feb-20 (CTTL, No.J20X00516)	Apr-20 Apr-20 May-20 Sep-20 Scheduled Calibration Feb-21
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7307 SN 1331 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19(SPEAG,No.EX3-7307_May19) 04-Sep-19(SPEAG,No.DAE4-1331_Sep19) Cal Date(Calibrated by, Certificate No.) 10-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515)	Apr-20 Apr-20 May-20 Sep-20 Scheduled Calibration Feb-21 Feb-21
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	ID # 106276 101369 SN 7307 SN 1331 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19(SPEAG,No.EX3-7307_May19) 04-Sep-19(SPEAG,No.DAE4-1331_Sep19) Cal Date(Calibrated by, Certificate No.) 10-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function	Apr-20 Apr-20 May-20 Sep-20 Scheduled Calibration Feb-21 Feb-21
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C Calibrated by: Reviewed by:	ID # 106276 101369 SN 7307 SN 1331 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19(SPEAG,No.EX3-7307_May19) 04-Sep-19(SPEAG,No.DAE4-1331_Sep19) Cal Date(Calibrated by, Certificate No.) 10-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function SAR Test Engineer	Apr-20 Apr-20 May-20 Sep-20 Scheduled Calibration Feb-21 Feb-21
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	ID # 106276 101369 SN 7307 SN 1331 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 24-May-19(SPEAG,No.EX3-7307_May19) 04-Sep-19(SPEAG,No.DAE4-1331_Sep19) Cal Date(Calibrated by, Certificate No.) 10-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function SAR Test Engineer SAR Test Engineer	Apr-20 Apr-20 May-20 Sep-20 Scheduled Calibration Feb-21 Feb-21 Signature

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E-mail: cttl@chinattl.com

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 http://www.chinattl.cn

#### Glossary:

TSL ConvF N/A

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

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to
- 6GHz)", July 2016 c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2512
 Fax: +86-10-62304633-2504

 E-mail: ettl@chinattl.com
 http://www.chinattl.cn

#### **Measurement Conditions**

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

DASY Version	DASY52	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

## Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.7 ± 6 %	4.58 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	است ا	

## SAR result with Head TSL at 5200 MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	73.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.7 W/kg ± 24.2 % (k=2)

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 Tel: +86-10-62304633-2512
 Fax: +86-10-62304633-2504

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#### Head TSL parameters at 5300 MHz The follow

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.5 ± 6 %	4.69 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

### SAR result with Head TSL at 5300 MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.1 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.2 W/kg ± 24.2 % (k=2)

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

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

## SAR result with Head TSL at 5500 MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.1 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 W/kg ± 24.2 % (k=2)

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## Head TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	5.01 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.3 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 W/kg ± 24.2 % (k=2)

#### Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.7 ± 6 %	5.20 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL at 5800 MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.68 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.4 W/kg ± 24.2 % (k=2)

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## Body TSL parameters at 5200 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.5 ± 6 %	5.22 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

## SAR result with Body TSL at 5200 MHz

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	70.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	1.96 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.5 W/kg ± 24.2 % (k=2)

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

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.4 ± 6 %	5.35 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

## SAR result with Body TSL at 5300 MHz

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.50 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.8 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.9 W/kg ± 24.2 % (k=2)

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## Body TSL parameters at 5500 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.0 ± 6 %	5.61 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

applied

## SAR result with Body TSL at 5500 MHz

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	124.44
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg ± 24.2 % (k=2)

Body TSL parameters at 5600 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.8 ± 6 %	5.75 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

### SAR result with Body TSL at 5600 MHz

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.3 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.7 W/kg ± 24.2 % (k=2)

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Body TSL parameters at 5800 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	6.09 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

## SAR result with Body TSL at 5800 MHz

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.9 W/kg ± 24.2 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

### Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	48.1Ω - 4.07jΩ
Return Loss	- 26.8dB

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

Impedance, transformed to feed point	44.6Ω - 1.74jΩ	
Return Loss	- 24.5dB	

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

Impedance, transformed to feed point	51.3Ω - 5.38jΩ
Return Loss	- 25.3dB

#### Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	55.5Ω + 0.73jΩ	
Return Loss	- 25.6dB	

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

Impedance, transformed to feed point	49.5Ω - 3.86jΩ
Return Loss	- 28.2dB

## Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.6Ω - 2.14jΩ	
Return Loss	- 31.7dB	

## Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	44.4Ω - 0.49jΩ	
Return Loss	- 24.5dB	

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

Impedance, transformed to feed point	52.3Ω - 3.42jΩ	
Return Loss	- 27.9dB	

#### Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	55.8Ω + 1.14jΩ
Return Loss	- 25.1dB

## Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	51.3Ω - 4.04jΩ
Return Loss	- 27.5dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.060 ns	
----------------------------------	----------	--

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 02.12.2020

#### DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1200

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz,Frequency: 5600 MHz, Frequency: 5800 MHz, Medium parameters used: f = 5200 MHz;  $\sigma$  = 4.58 S/m;  $\epsilon_r$  = 36.67;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5300 MHz;  $\sigma$  = 4.691 S/m;  $\epsilon_r$  = 36.46;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5500 MHz;  $\sigma$  = 4.898 S/m;  $\epsilon_r$  = 36.1;  $\rho$  = 1000 kg/m3,Medium parameters used: f = 5600 MHz;  $\sigma$  = 5.009 S/m;  $\epsilon_r$  = 35.95;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5800 MHz;  $\sigma$  = 5.204 S/m;  $\epsilon_r$  = 35.67;  $\rho$  = 1000 kg/m3,

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN7307; ConvF(5.71, 5.71, 5.71) @ 5200 MHz; ConvF(5.48, 5.48, 5.48) @ 5300 MHz; ConvF(5.25, 5.25, 5.25) @ 5500 MHz; ConvF(5.12, 5.12, 5.12) @ 5600 MHz; ConvF(5.02, 5.02, 5.02) @ 5800 MHz
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2019-09-04
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 64.68 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.06 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 63.5% Maximum value of SAR (measured) = 17.5 W/kg

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

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 62.32 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 33.0 W/kg SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.21 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 63.5% Maximum value of SAR (measured) = 18.6 W/kg

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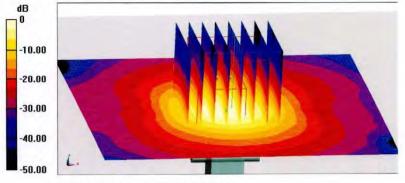
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Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.14 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 36.1 W/kg SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.27 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 61.7% Maximum value of SAR (measured) = 19.6 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.98 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 33.7 W/kg SAR(1 g) = 8.01 W/kg; SAR(10 g) = 2.25 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 64% Maximum value of SAR (measured) = 18.9 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.47 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 38.5 W/kg SAR(1 g) = 7.68 W/kg; SAR(10 g) = 2.13 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 58.9% Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg = 12.88 dBW/kg

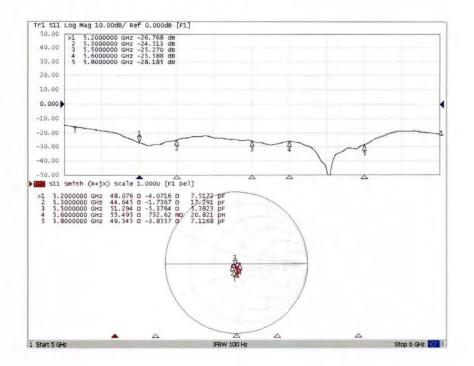
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Impedance Measurement Plot for Head TSL



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

Date: 02.17.2020

#### DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1200

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz, Medium parameters used: f = 5200 MHz;  $\sigma = 5.218$  S/m;  $\varepsilon_r = 48.51$ ;  $\rho = 1000$  kg/m3, Medium parameters used: f = 5300 MHz;  $\sigma = 5.346$  S/m;  $\varepsilon_r = 48.35$ ;  $\rho = 1000$  kg/m3, Medium parameters used: f = 5500 MHz;  $\sigma = 5.609$  S/m;  $\varepsilon_r = 47.99$ ;  $\rho = 1000$  kg/m3, Medium parameters used: f = 5600 MHz;  $\sigma = 5.752$  S/m;  $\varepsilon_r = 47.77$ ;  $\rho = 1000$  kg/m3, Medium parameters used: f = 5800 MHz;  $\sigma = 6.092$  S/m;  $\varepsilon_r = 47.33$ ;  $\rho = 1000$  kg/m3, Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7307; ConvF(4.85, 4.85, 4.85) @ 5200 MHz; ConvF(4.69, 4.69) @ 5300 MHz; ConvF(4.4, 4.4, 4.4) @ 5500 MHz; ConvF(4.3, 4.3, 4.3) @ 5600 MHz; ConvF(4.39, 4.39, 4.39) @ 5800 MHz; Calibrated: 5/24/2019,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2019-09-04
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 60.83 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 27.8 W/kg SAR(1 g) = 7.07 W/kg; SAR(10 g) = 1.96 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 66.3% Maximum value of SAR (measured) = 16.5 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.35 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 29.2 W/kg SAR(1 g) = 7.5 W/kg; SAR(10 g) = 2.1 W/kg Smallest distance from peaks to all points 3 dB below = 6.9 mm Ratio of SAR at M2 to SAR at M1 = 66.7% Maximum value of SAR (measured) = 17.1 W/kg

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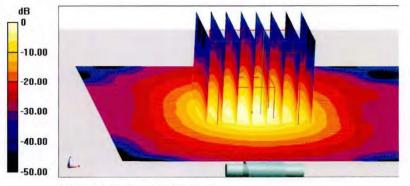
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Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 64.39 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 32.4 W/kg SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.17 W/kg Smallest distance from peaks to all points 3 dB below = 6.8 mm Ratio of SAR at M2 to SAR at M1 = 64.6% Maximum value of SAR (measured) = 18.2 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 61.29 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 33.3 W/kg SAR(1 g) = 7.45 W/kg; SAR(10 g) = 2.08 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 62.1% Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 59.16 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 34.5 W/kg SAR(1 g) = 7.28 W/kg; SAR(10 g) = 2 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 59.9% Maximum value of SAR (measured) = 18.5 W/kg



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

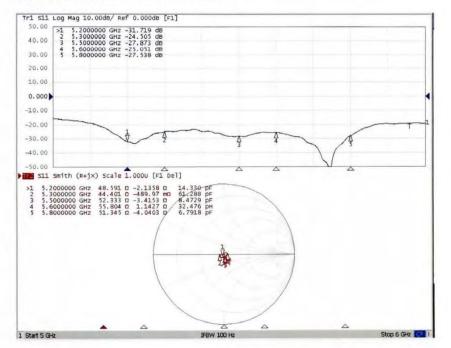
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## Impedance Measurement Plot for Body TSL





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