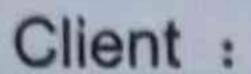


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SRTC



Certificate No: Z22-60406

CALIBRATION CERTIFICATE

Object DAE4 - SN: 546

Calibration Procedure(s) FF-Z11-002-01

Calibration Procedure for the Data Acquisition Electronics

(DAEx)

Calibration date: September 15, 2022

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	14-Jun-22 (CTTL, No.J22X04180)	Jun-23

Name Function Signature

Calibrated by:

Yu Zongying

SAR Test Engineer

Reviewed by:

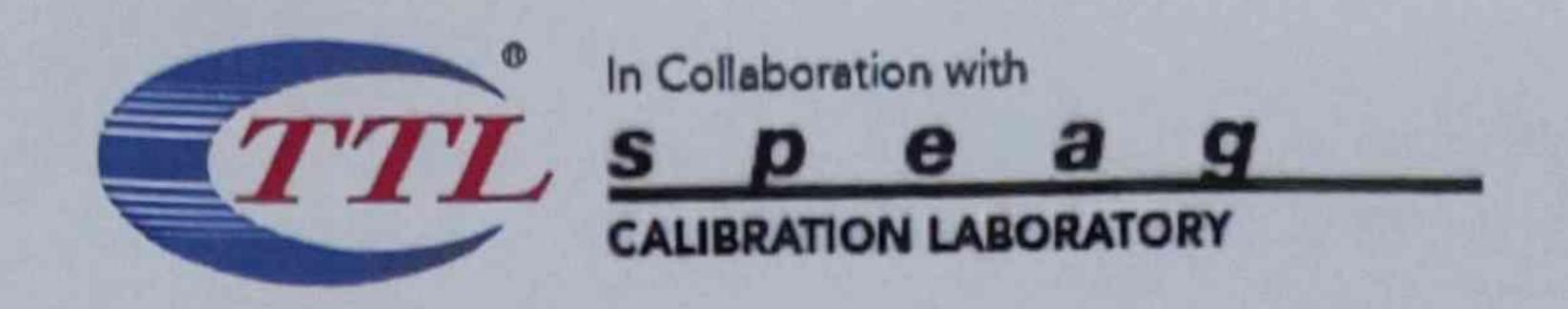
Lin Hao

SAR Test Engineer

Approved by: Qi Dianyuan SAR Project Leader

Issued: September 16, 2022

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Glossary:

DAE data acquisition electronics

Connector angle information used in DASY system to align probe sensor X

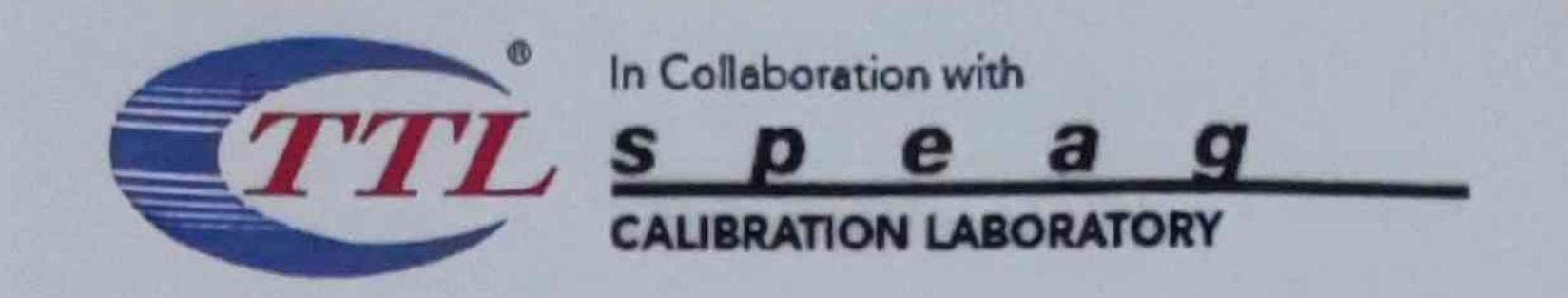
to the robot coordinate system.

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.

Certificate No: Z22-60406 Page 2 of 3





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DC Voltage Measurement

A/D - Converter Resolution nominal

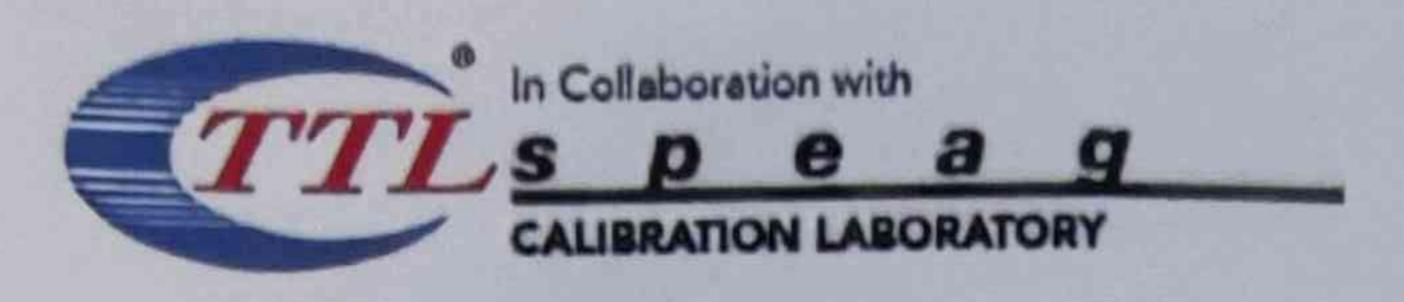
High Range: 1LSB = 6.1μV, full range = -100...+300 mV Low Range: 1LSB = 61nV, full range = -1.....+3mV DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.367 ± 0.15% (k=2)	404.116 ± 0.15% (k=2)	404.236 ± 0.15% (k=2)
Low Range	3.98597 ± 0.7% (k=2)	3.95583 ± 0.7% (k=2)	3.97743 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	247.5° ± 1°
---	-------------

Certificate No: Z22-60406 Page 3 of 3



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Client

SRTC

Certificate No: Z22-60407

CALIBRATION CERTIFICATE

Object ES3DV3 - SN: 3127

Calibration Procedure(s)

Certificate No: Z22-60407

FF-Z11-004-02
Calibration Procedures for Dosimetric E-field Probes

Calibration date: September 23, 2022

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

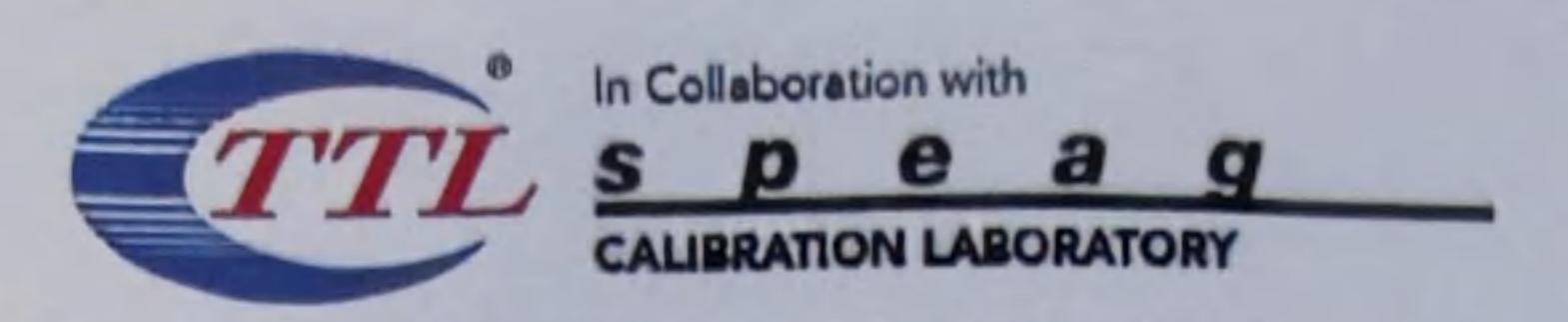
All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards		ID#	Cal Date(Calibrated by, Certificate I	No.) Scheduled Calibration	
Power Meter NRP2		101919	14-Jun-22(CTTL, No.J22X04181)	Jun-23	
Power sensor NRP-Z91	ower sensor NRP-Z91 101547		14-Jun-22(CTTL, No.J22X04181)	Jun-23	
Power sensor NRP-Z91		101548	14-Jun-22(CTTL, No.J22X04181)	Jun-23	
Reference 10dBAttenua	ator	18N50W-10dB	20-Jan-21(CTTL, No.J21X00486)	Jan-23	
Reference 20dBAttenua	ator	18N50W-20dB	20-Jan-21(CTTL, No.J21X00485)	Jan-23	
Reference Probe EX3D	V4	SN 3846	20-May-22(SPEAG, No.EX3-3846_	May22) May-23	
DAE4		SN 771	20-Jan-22(SPEAG, No.DAE4-771_	Jan22) Jan-23	
Secondary Standards		ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration	
SignalGenerator MG37	00A	6201052605	14-Jun-22(CTTL, No.J22X04182)	Jun-23	
Network Analyzer E507	1C	MY46110673	14-Jan-22(CTTL, No.J22X00406)	Jan-23	
	Nam	e	Function	Signature	
Calibrated by:	Yu	Zongying	SAR Test Engineer	Description of the second of t	
Reviewed by:	Lin	Нао	SAR Test Engineer	# 26	
Approved by:	Qi [Dianyuan	SAR Project Leader	200	

Issued: September 26, 2022

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Glossary:

TSL tissue simulating liquid sensitivity in free space

ConvF sensitivity in TSL / NORMx,y,z

DCP diode compression point

CF crest factor (1/duty_cycle) of the RF signal A,B,C,D modulation dependent linearization parameters

Polarization Φ rotation around probe axis

Polarization θ θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i

θ=0 is normal to probe axis

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)",

July 2016

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

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

NORMx,y,z: Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide).
 NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E²-field uncertainty inside TSL (see below ConvF).

 $NORM(f)x,y,z = NORMx,y,z^*$ 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 (no uncertainty required). DCP does not depend on frequency nor media.

 PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.

 Ax, y, z; Bx, y, z; Cx, y, z; VRx, y, z: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor

media. VR is the maximum calibration range expressed in RMS voltage across the diode.

• ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.

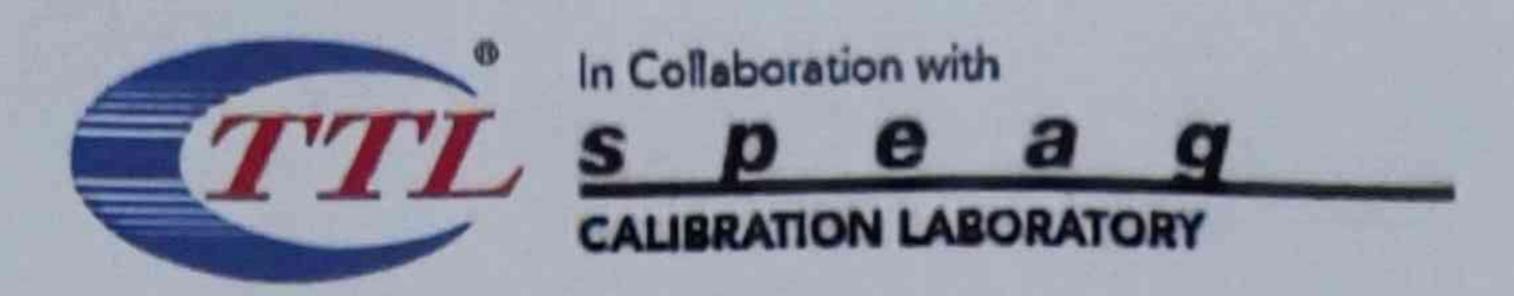
Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat

phantom exposed by a patch antenna.

 Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Connector Angle: The angle is assessed using the information gained by determining the NORMX

(no uncertainty required).





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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3127

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
$Norm(\mu V/(V/m)^2)^A$	1.27	1.26	1.22	±10.0%
DCP(mV)B	102.6	103.2	103.7	

Modulation Calibration Parameters

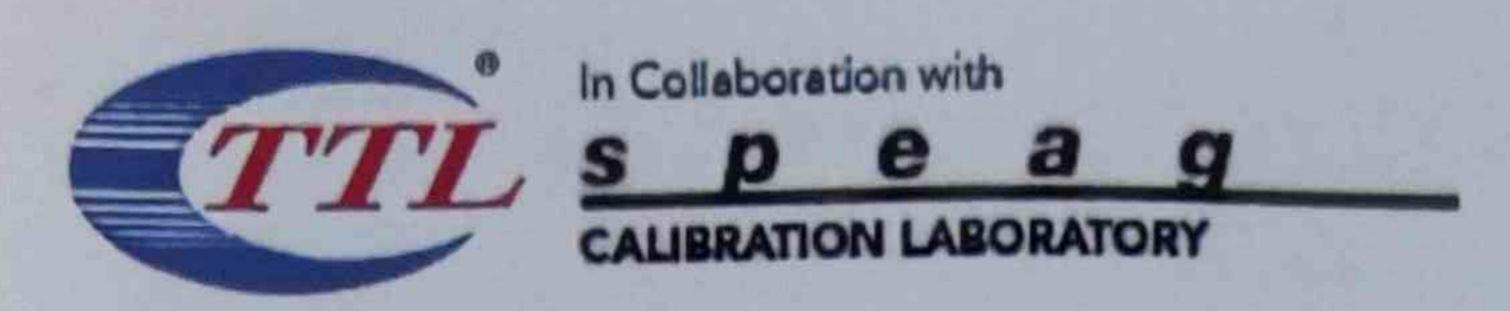
UID	Communication System Name		A	B dBõV	C	D	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	258.4	±2.1%
		Y	0.0	0.0	1.0		259.4	
		Z	0.0	0.0	1.0		256.5	

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

A The uncertainties of Norm X, Y, Z do not affect the E2-field uncertainty inside TSL (see Page 4).

^B Numerical linearization parameter: uncertainty not required.

EUncertainly 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: ES3DV3 - SN:3127

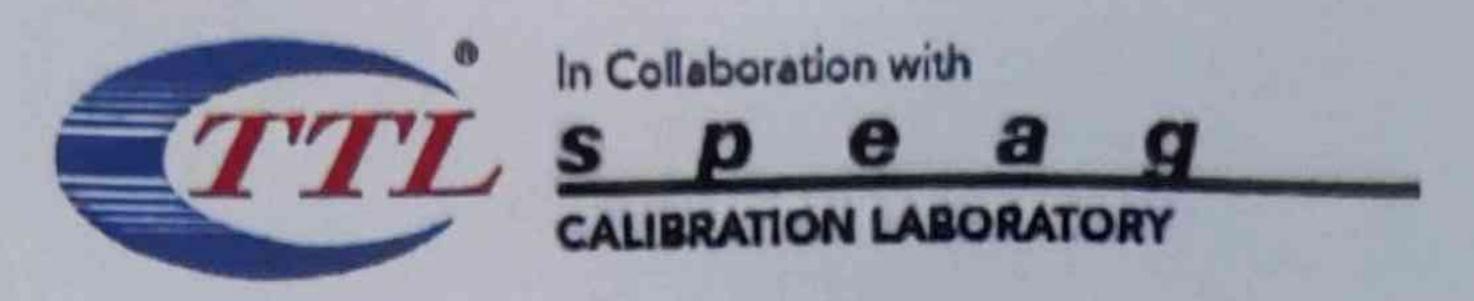
Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]C	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	6.40	6.40	6.40	0.33	1.57	±12.1%
835	41.5	0.90	6.20	6.20	6.20	0.34	1.56	±12.1%
1810	40.0	1.40	5.07	5.07	5.07	0.73	1.19	±12.1%
2000	40.0	1.40	4.99	4.99	4.99	0.55	1.34	±12.1%
2300	39.5	1.67	4.78	4.78	4.78	0.90	1.08	±12.1%
2450	39.2	1.80	4.58	4.58	4.58	0.90	1.08	±12.1%
2600	39.0	1.96	4.41	4.41	4.41	0.90	1.12	±12.1%

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

FAt frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to $\pm 10\%$ if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to $\pm 5\%$. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

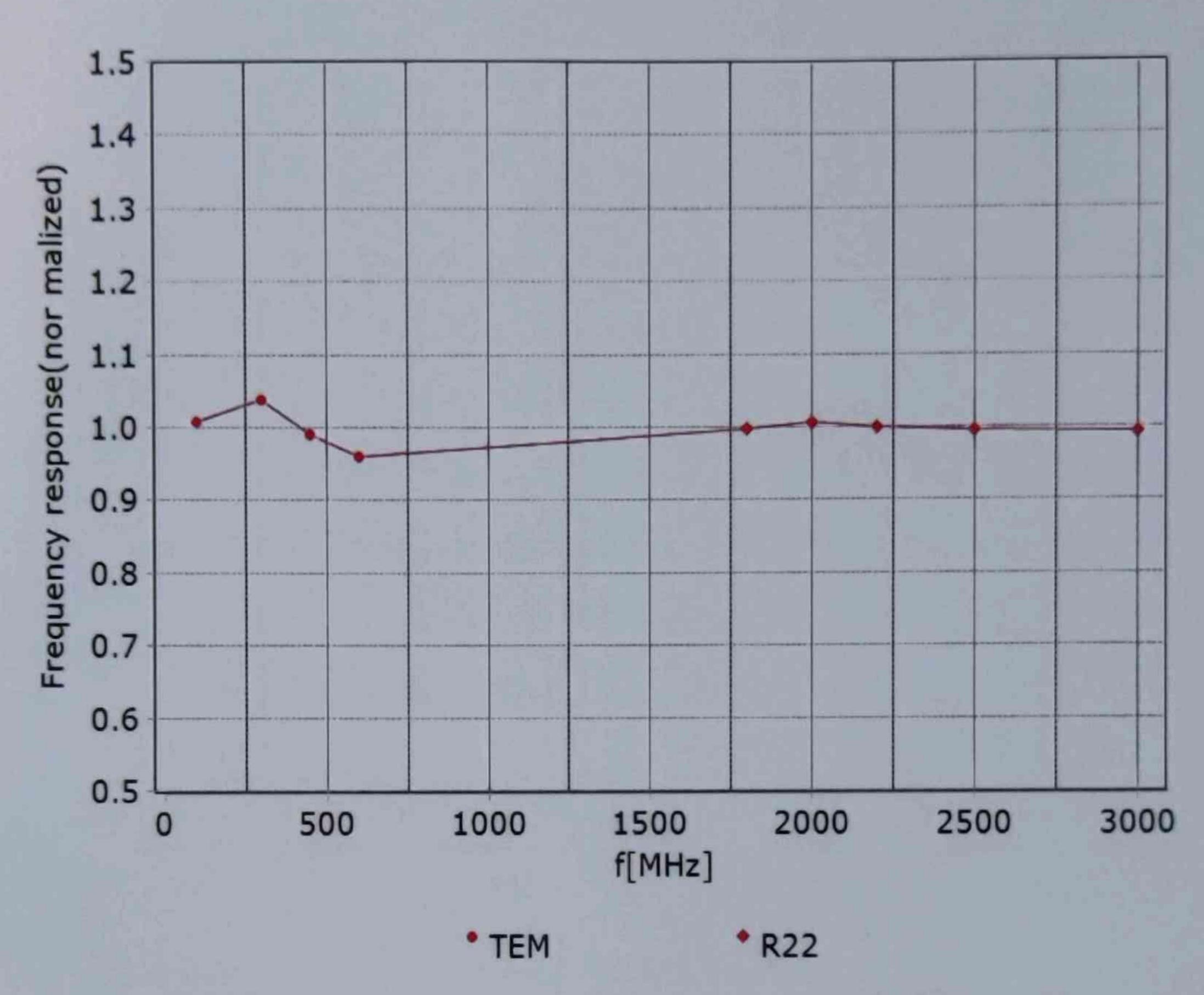




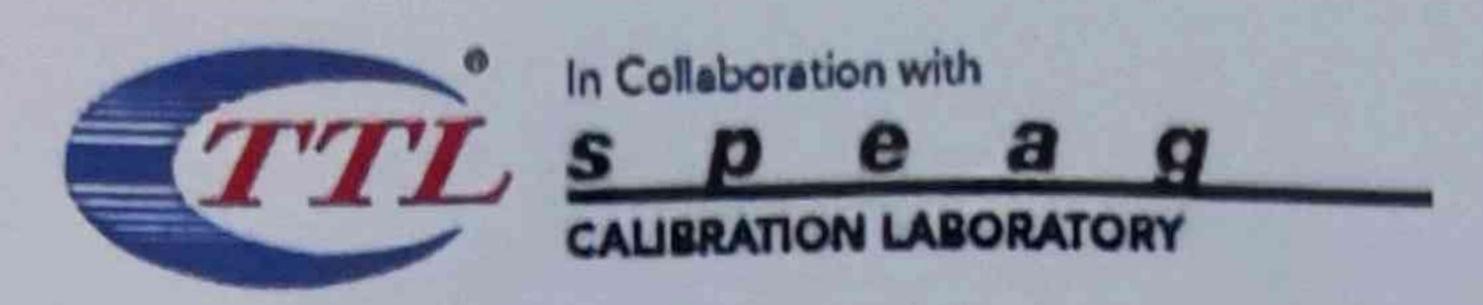
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Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.4% (k=2)





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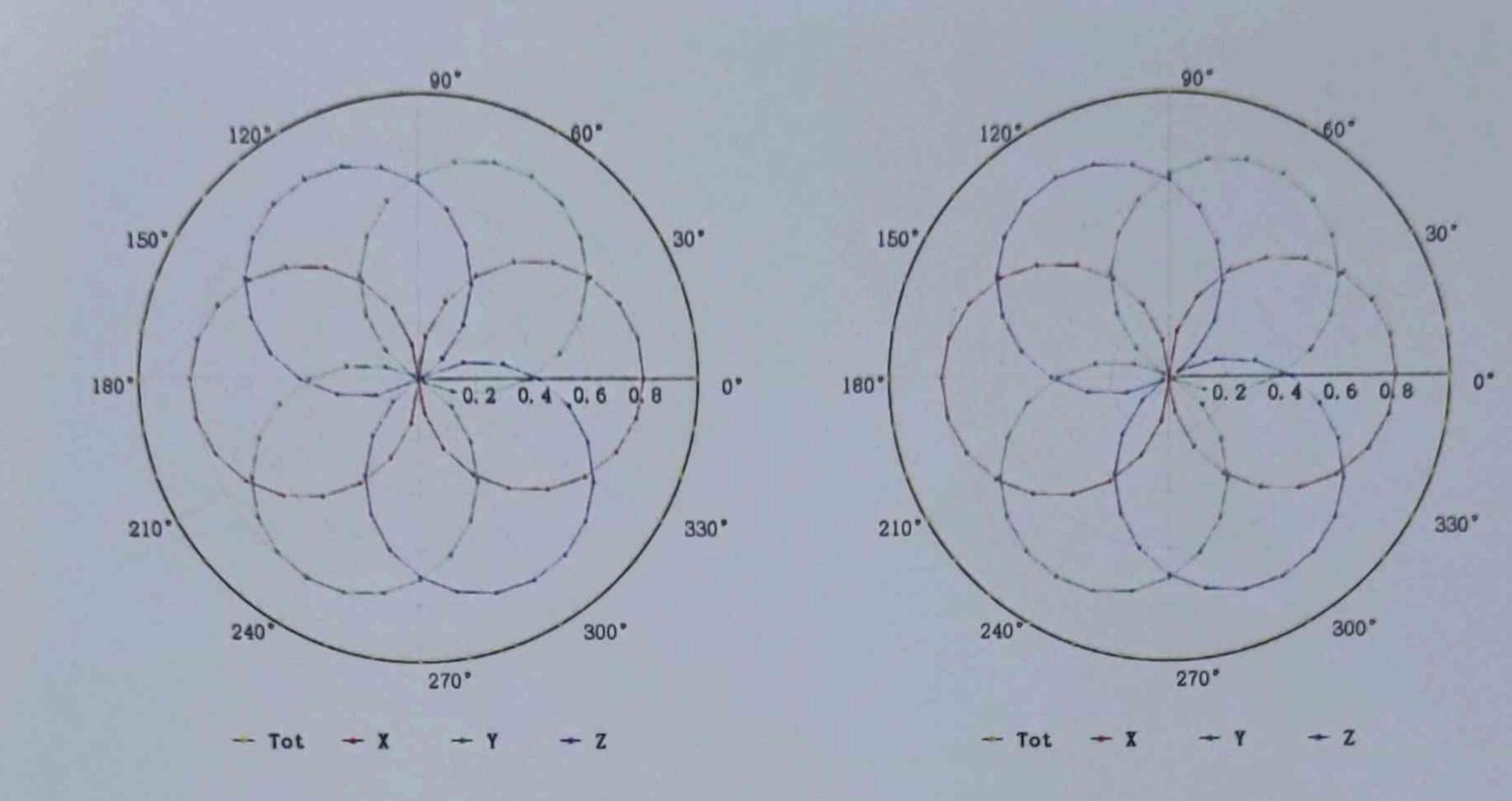
E-mail: emf@caict.ac.cn htt

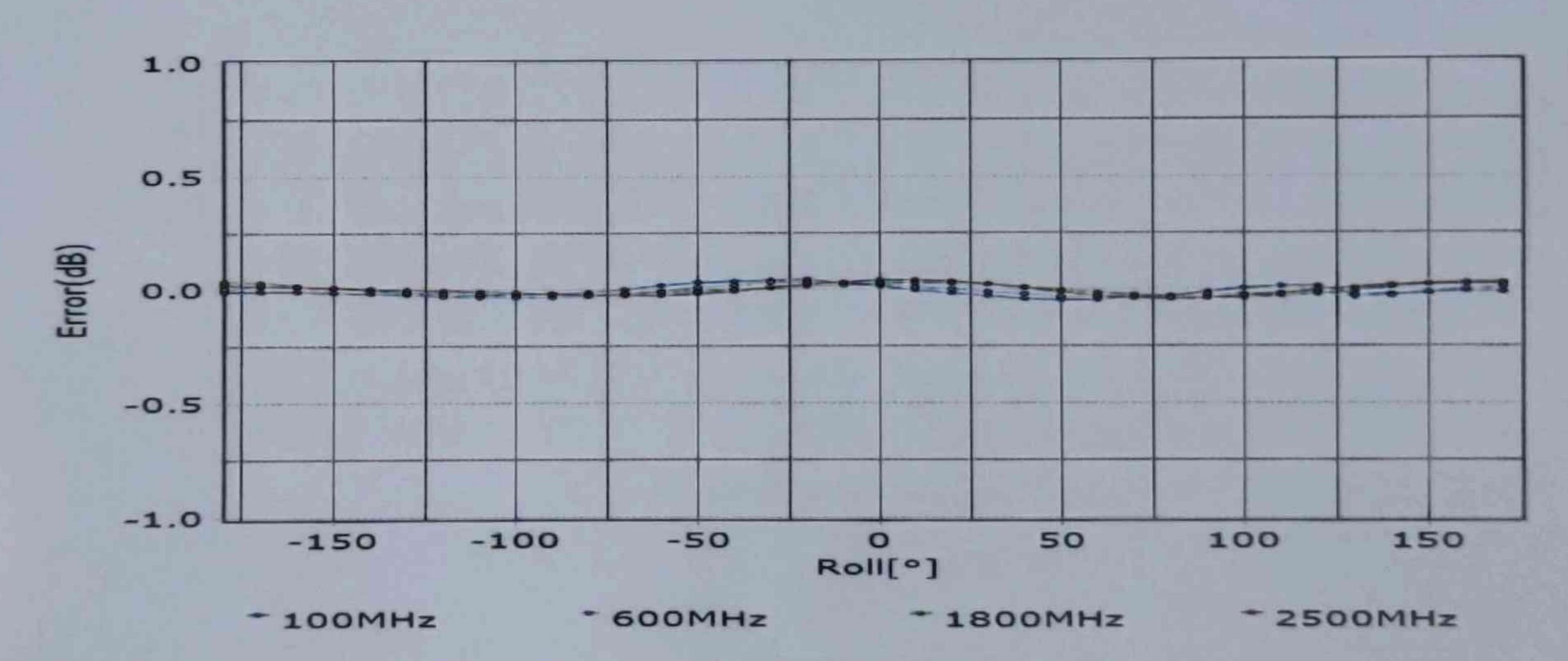
http://www.caict.ac.cn

Receiving Pattern (Φ), θ=0°

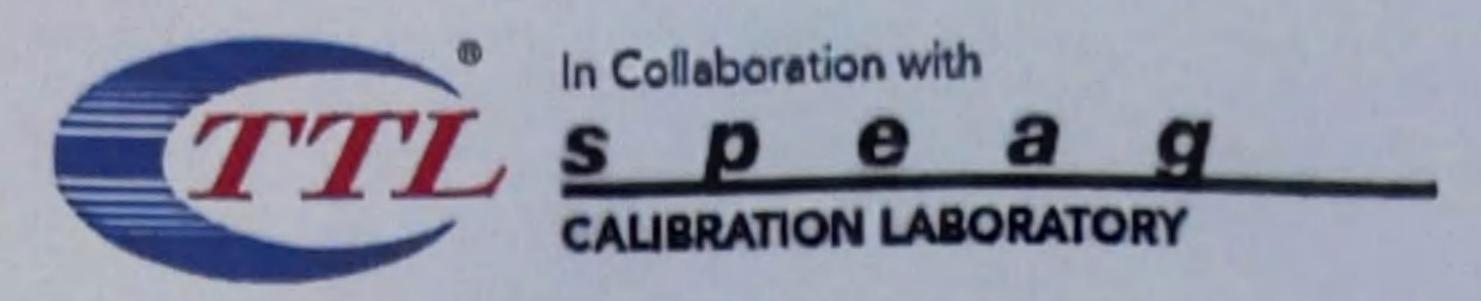
f=600 MHz, TEM

f=1800 MHz, R22





Uncertainty of Axial Isotropy Assessment: ±1.2% (k=2)

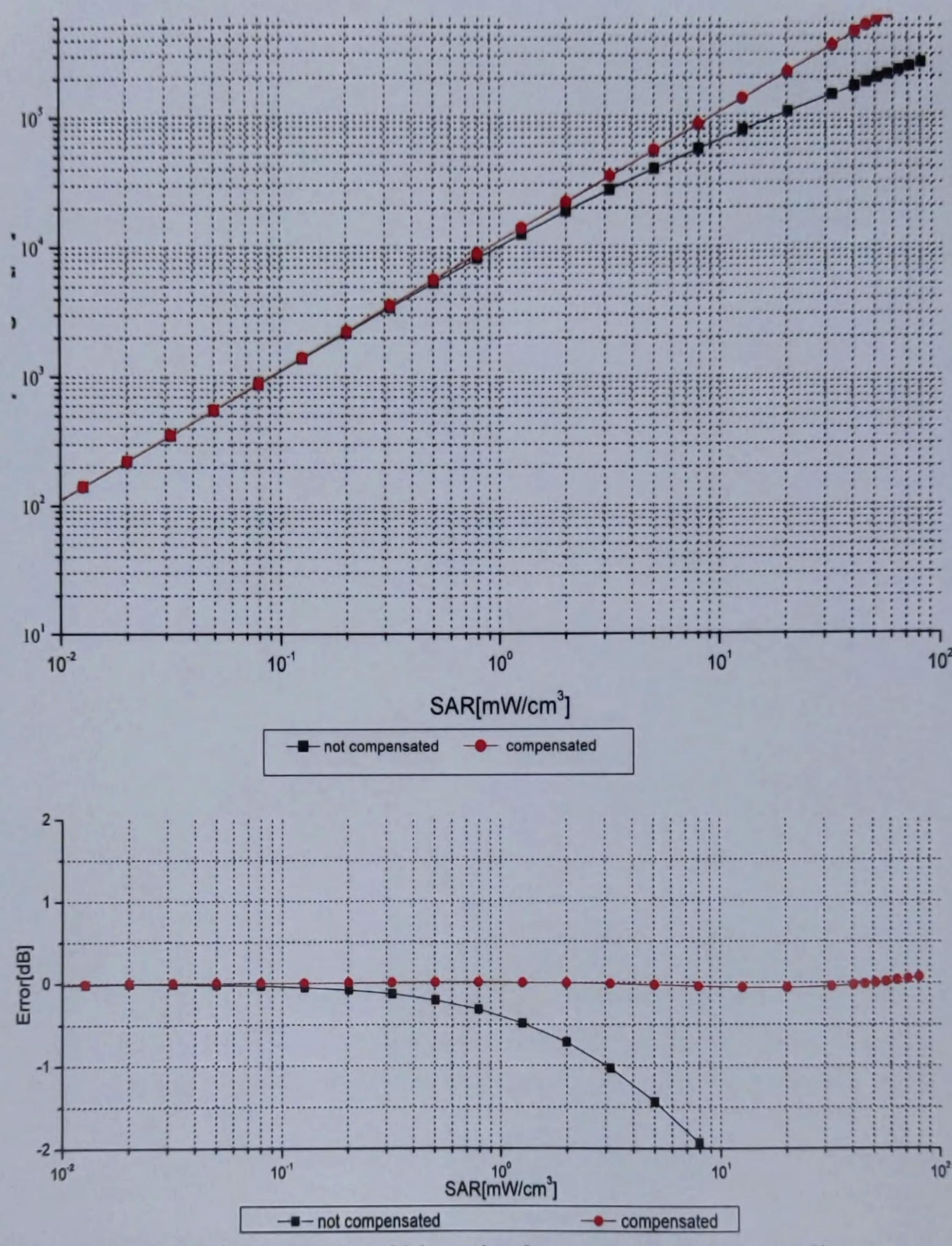




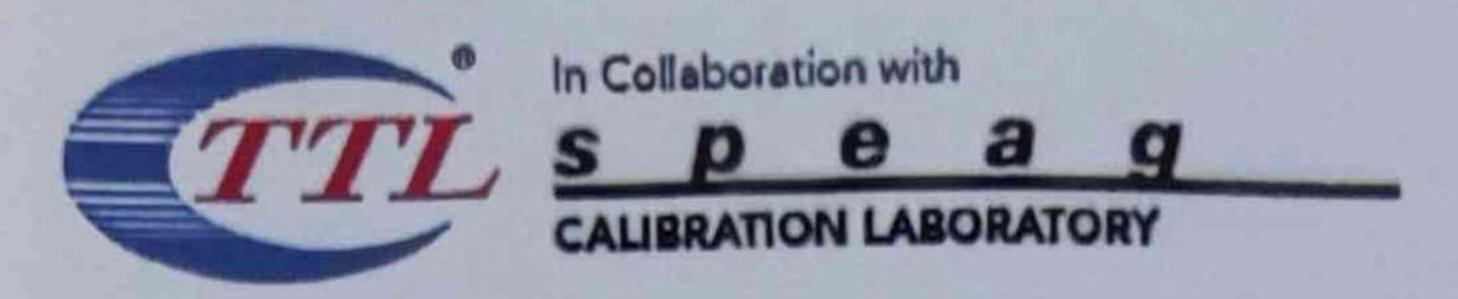
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Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: ±0.9% (k=2)



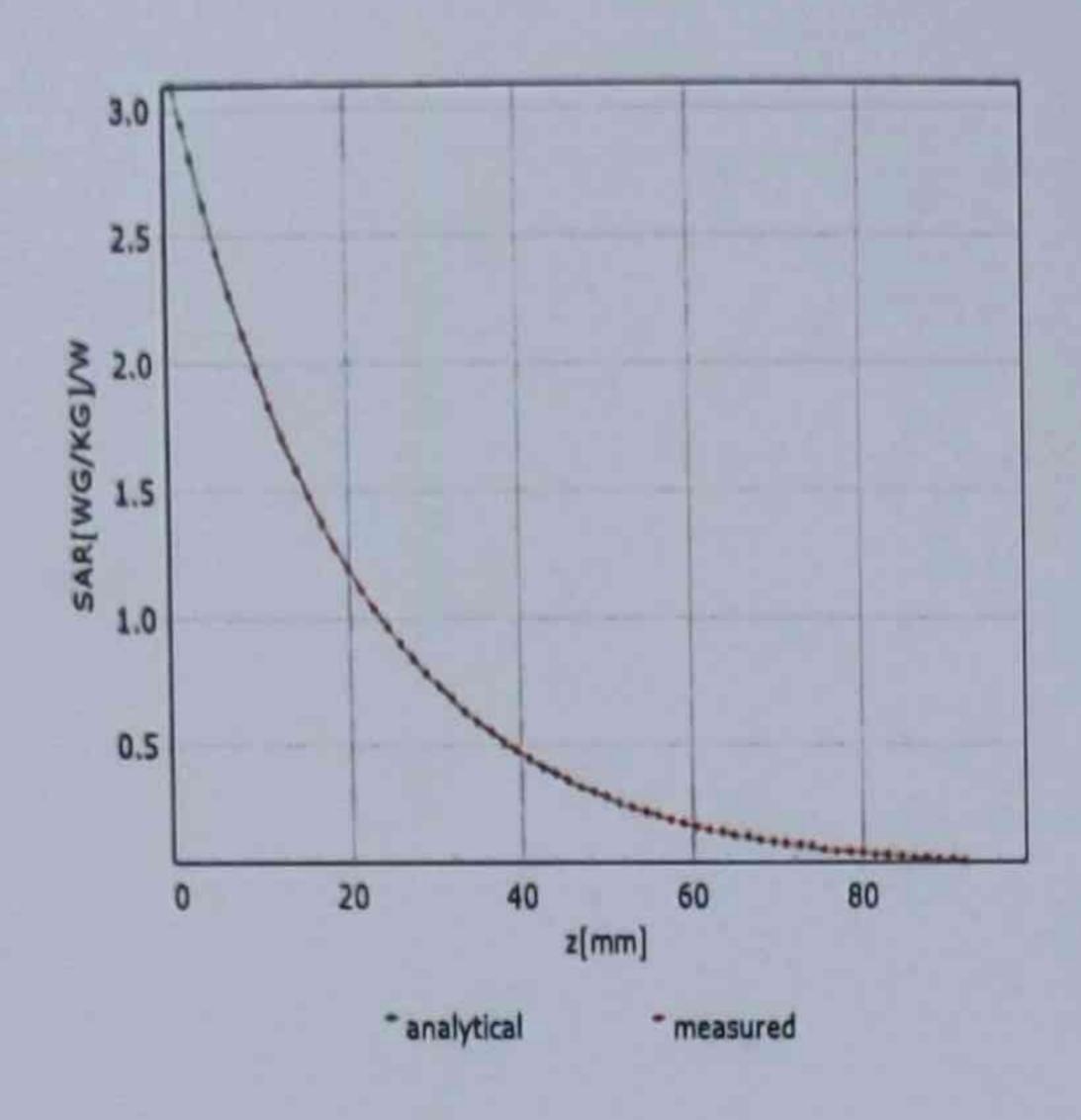


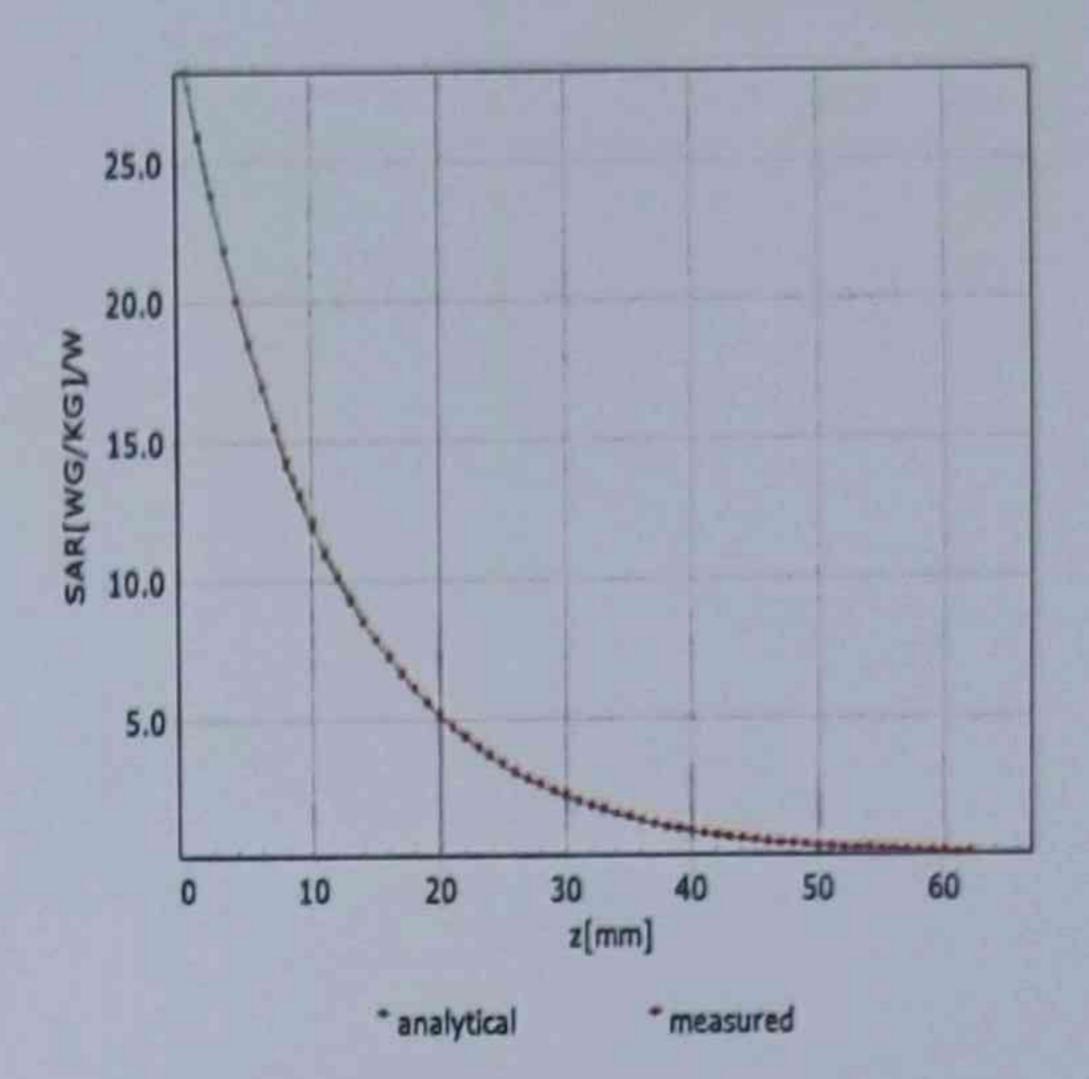
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Conversion Factor Assessment

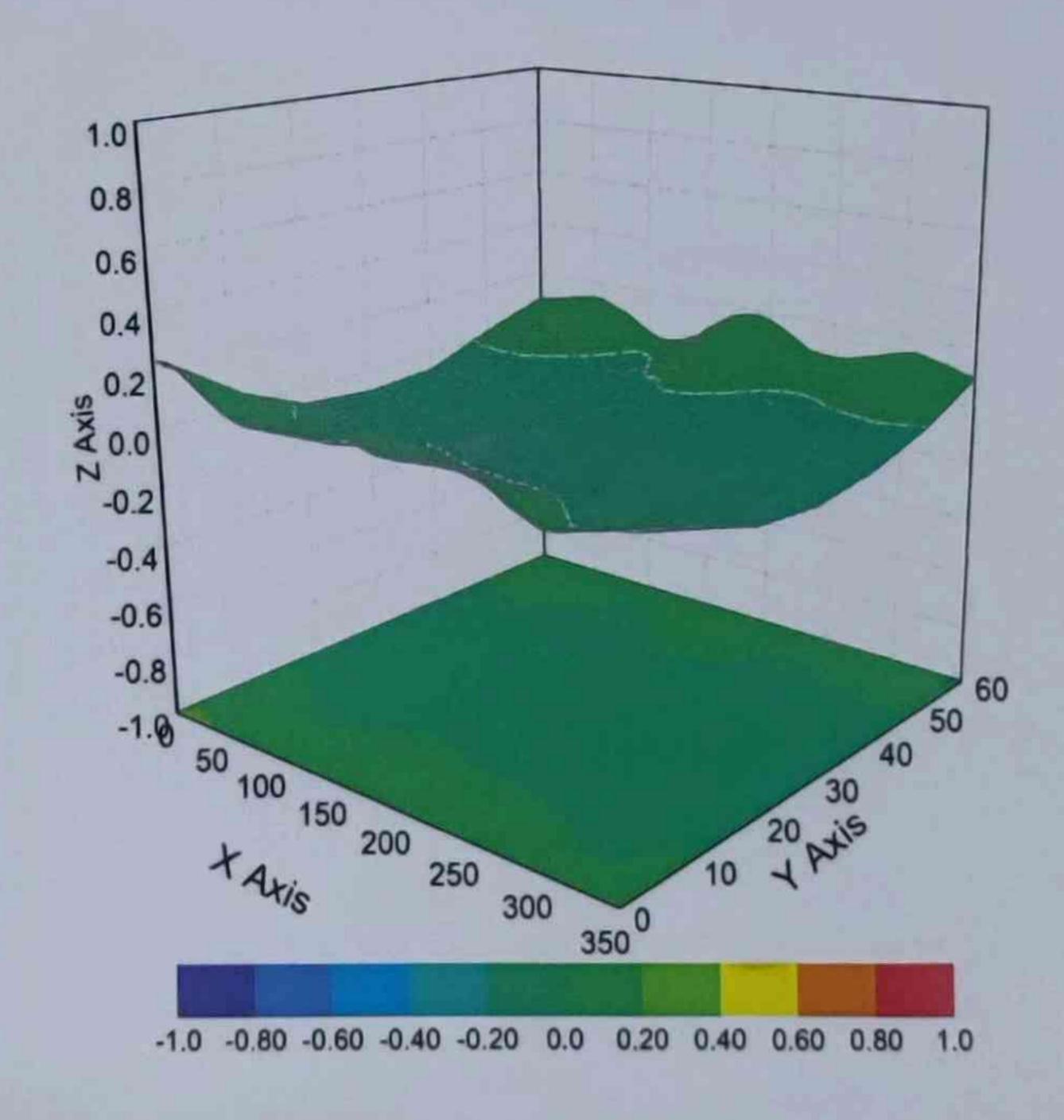
f=750 MHz, WGLS R9(H_convF)

f=1810 MHz,WGLS R22(H_convF)

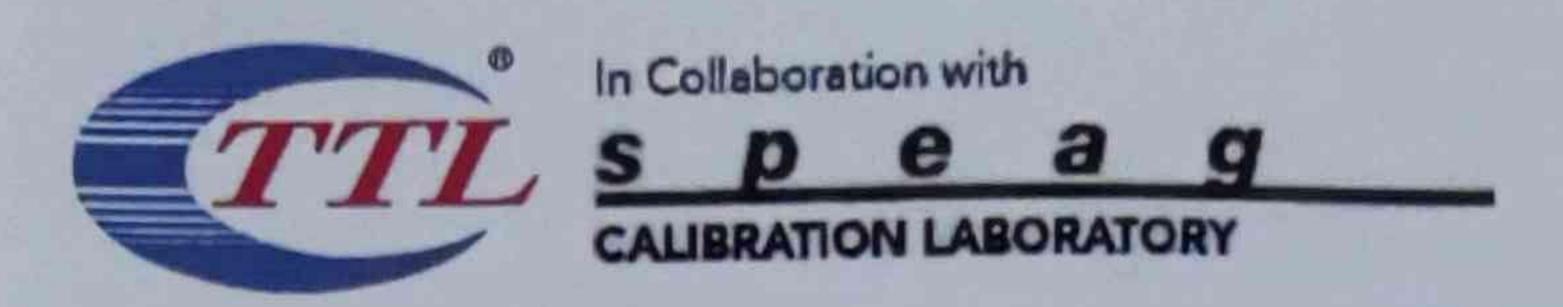




Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (k=2)





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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3127

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	161.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	4mm
Probe Tip to Sensor X Calibration Point	2mm
Probe Tip to Sensor Y Calibration Point	2mm
Probe Tip to Sensor Z Calibration Point	2mm
Recommended Measurement Distance from Surface	3mm

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Accreditation No.: SCS 0108

Certificate No: D450V2-1024 Oct20

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Client

SRTC (Auden)

CALIBRATION CERTIFICATE

Object D450V2 - SN: 1024

Calibration procedure(s) QA CAL-15.v9

Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date October 26, 2020

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).

The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3) °C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN. 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: CC2552 (20x)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 3877	31-Dec-19 (No. EX3-3877_Dec19)	Dec-20
DAE4	SN: 654	26-Jun-20 (No. DAE4-654, Jun20)	Jun-21
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	in house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check, Jun-22
Power sensor E4412A	SN 000110210	06-Apr-16 (in house check Jun-20)	In house check, Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check. Oct-21
	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	-12
Approved by:	Katja Pokovic	Technical Manager	all ra

Issued: October 28, 2020

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Calibration Laboratory of

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S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (8AS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL

tissue simulating liquid

ConvF N/A sensitivity in TSL / NORM x.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 the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of

300 MHz to 6 GHz)", July 2016

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

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom V4.4	Shell thickness: 6 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy , $dz = 5 mm$	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.4 ± 6 %	0.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	****

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.88 W/kg ± 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	0.809 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	3.23 W/kg ± 17.6 % (k=2)

Certificate No: D450V2-1024_Oct20

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.5 Ω - 6.4 jΩ	
Return Loss	- 21.9 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.349 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
manadares ey	

Certificate No: D450V2-1024 Oct20 Page 4 of 6

DASY5 Validation Report for Head TSL

Date: 26.10,2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN: 1024

Communication System: UID 0 - CW; Frequency: 450 MHz

Medium parameters used: f = 450 MHz; $\sigma = 0.87 \text{ S/m}$; $\varepsilon_r = 43.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN3877; ConvF(10.58, 10.58, 10.58) @ 450 MHz; Calibrated: 31.12.2019

· Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn654; Calibrated: 26.06.2020

Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; Serial: 1002

DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 44.73 V/m; Power Drift = -0.02 dB

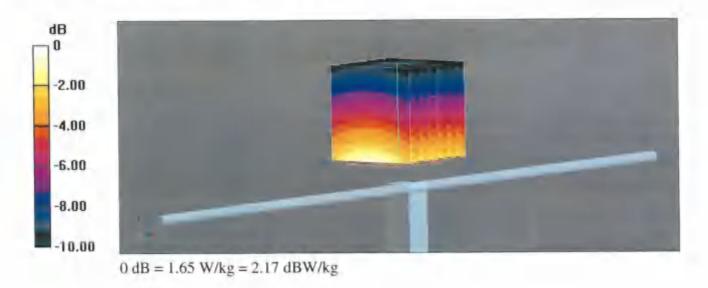
Peak SAR (extrapolated) = 1.90 W/kg

SAR(1 g) = 1.22 W/kg; SAR(10 g) = 0.809 W/kg

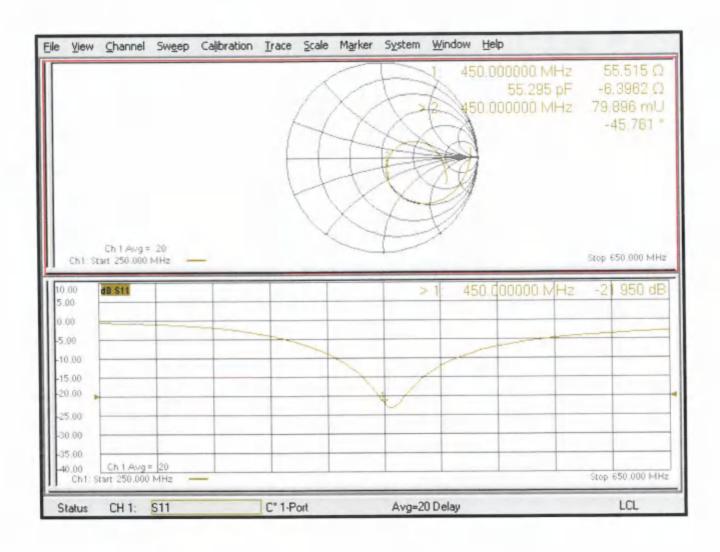
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30mm)

Ratio of SAR at M2 to SAR at M1 = 64.1%

Maximum value of SAR (measured) = 1.65 W/kg



Impedance Measurement Plot for Head TSL





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CALIBRATION LABORATORY

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Client

SRTC

Certificate No:

Z20-60393

CALIBRATION CERTIFICATE

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

Object

D750V3 - SN: 1101

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 16, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
ReferenceProbe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

Function Name Calibrated by: Zhao Jing SAR Test Engineer Reviewed by: Lin Hao SAR Test Engineer Approved by: SAR Project Leader Qi Dianyuan

Issued: October 22, 2020

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Certificate No: Z20-60393

Page I of 6

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Glossary:

TSL

tissue simulating liquid

ConvF

sensitivity in TSL / NORMx,y,z

N/A

not applicable or not measured

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z20-60393 Page 2 of 6



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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	<u> </u>
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	760 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

THE ISLANDING PARAMETERS AND CALCULATION WATER	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.7±6%	0.91 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	_	

SAR result with Head TSL

K Leanit Migh Lead 12F		
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.40 W/kg ± 18.8 % (4=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.70 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 fined point	53,7Ω- 1.63jΩ	
Return Loss	- 28.2dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	0.901 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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Manufactured by	SPEAG

Certificate No: Z20-60393 Page 4 of 6



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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1101

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 750 MHz; $\sigma = 0.905$ S/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 2020-01-30

Date: 10.16.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn771; Calibrated: 2020-02-10

Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062

 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

dy=5mm, dz=5mm

Reference Value = 54.36 V/m; Power Drift = -0.03 dB

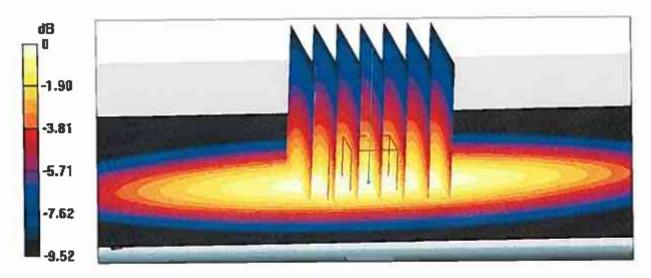
Peak SAR (extrapolated) = 3.04 W/kg

SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.44 W/kg

Smallest distance from peaks to all points 3 dB below = 18.4 mm

Ratio of SAR at M2 to SAR at M1 = 69.9%

Maximum value of SAR (measured) = 2.75 W/kg

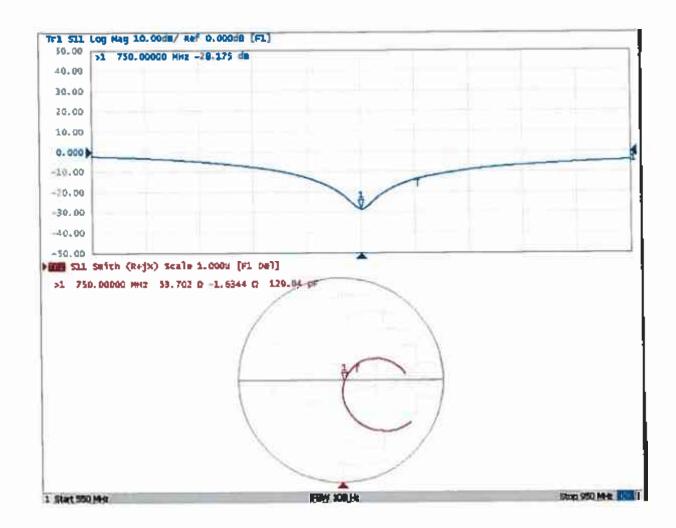


0 dB = 2.75 W/kg = 4.39 dBW/kg



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Impedance Measurement Plot for Head TSL





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Client

SRTC

Certificate No:

Z20-60394

CALIBRATION CERTIFICATE

Object

D835V2 - SN: 4d023

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 16, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)*C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Call Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	108276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
ReferenceProbe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21
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Collhanted has

Name Function

Signature

Calibrated by:

Zhao Jing SAR Test Engineer

22

Reviewed by:

Lin Hao SAR Test Engineer

11/10

Approved by:

Qi Dlanyuan SAR Project Leader

da

Issued: October 22, 2020

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Glossary:

TSL

tissue simulating liquid

ConvF

sensitivity in TSL / NORMx,y,z

N/A not 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 Impedence and Return Loss: These parameters are measured with the dipole
 positioned under the Ilquid 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.7 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	_	

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.38 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (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	6.25 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	52.6Ω - 2.37jΩ	
Return Loss	- 29.3dB	

General Antenna Parameters and Design

	
Electrical Delay (one direction)	1.254 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

Certificate No: Z20-60394



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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d023

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; $\sigma = 0.909$ S/m; $\varepsilon_r = 41.68$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; Convf(9.66, 9.66, 9.66) @ 835 MHz; Calibrated: 2020-01-30

Date: 10.16.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

dy=5mm, dz=5mm

Reference Value = 58.02 V/m; Power Drift = -0.03 dB

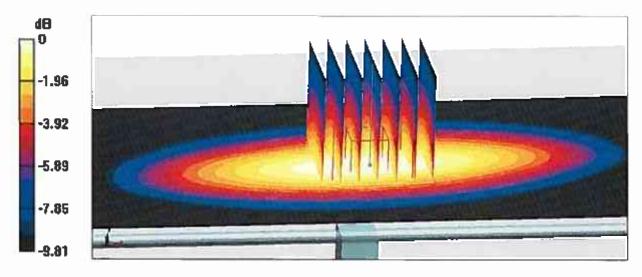
Peak SAR (extrapolated) = 3.40 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.57 W/kg

Smallest distance from peaks to all points 3 dB below = 17 mm

Ratio of SAR at M2 to SAR at M1 = 69.4%

Maximum value of SAR (measured) = 3.08 W/kg



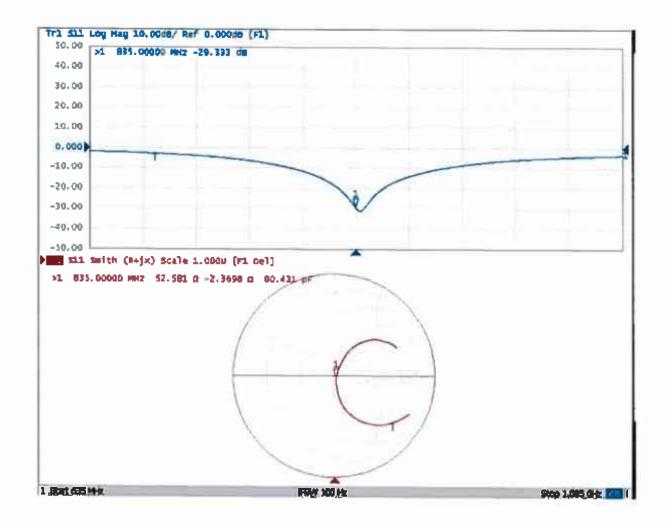
0 dB = 3.08 W/kg = 4.89 dBW/kg

Certificate No: Z20-60394



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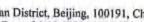
Impedance Measurement Plot for Head TSL





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Client

SRTC

Certificate No:

Z20-60357

CALIBRATION CERTIFICATE

Object

D900V2 - SN:171

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

September 17, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

Name Function Calibrated by: Zhao Jing SAR Test Engineer Reviewed by: Lin Hao SAR Test Engineer Approved by: Qi Dianyuan SAR Project Leader

Issued: September 22, 2020

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Glossary:

TSL tissue simulating liquid

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

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

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z20-60357 Page 2 of 6

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Measurement Conditions

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0,97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.8 ± 6 %	0.97 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		LEC

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.72 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	10.9 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	7.00 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	49.1Ω- 6.69jΩ	
Return Loss	- 23.4dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.271 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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Certificate No: Z20-60357 Page 4 of 6

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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 171

Communication System: UID 0, CW; Frequency: 900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 900 MHz; $\sigma = 0.973$ S/m; $\epsilon_r = 41.82$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(9.56, 9.56, 9.56) @ 900 MHz; Calibrated: 2020-01-30

Date: 09.17.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

dy=5mm, dz=5mm

Reference Value = 59.63 V/m; Power Drift = -0.04 dB

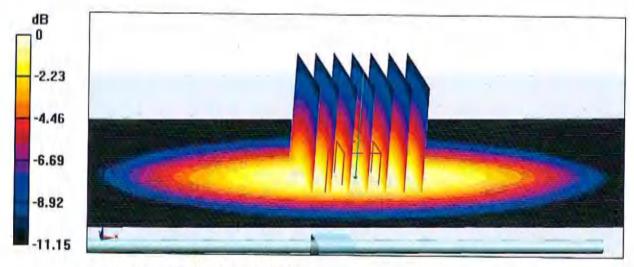
Peak SAR (extrapolated) = 4.13 W/kg

SAR(1 g) = 2.72 W/kg; SAR(10 g) = 1.75 W/kg

Smallest distance from peaks to all points 3 dB below = 16.3 mm

Ratio of SAR at M2 to SAR at M1 = 65.6%

Maximum value of SAR (measured) = 3.67 W/kg



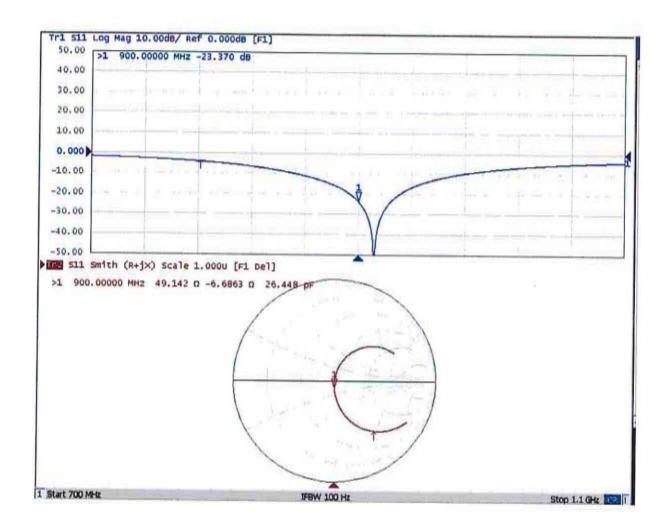
0 dB = 3.67 W/kg = 5.65 dBW/kg

Certificate No: Z20-60357 Page 5 of 6



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Impedance Measurement Plot for Head TSL





In Collaboration with

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CALIBRATION CNAS L0570

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> **Certificate No:** Z20-60395

CALIBRATION CERTIFICATE

SRTC

Object D1450V2 - SN: 1065

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

Client

October 16, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	# CI	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02985)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
ReferenceProbe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zheo Jing	SAR Test Engineer	起礼
Reviewed by:	Lin Hao	SAR Test Engineer	州松
Approved by:	Qi Dlanyuan	SAR Project Leader	30

Issued: October 22, 2020

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Certificate No: Z20-60395



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Glossary:

TSL tissue simulating liquid

ConvF sensitivity in TSL / NORMx,y,2 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 erms 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 antennal connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

Certificate No: Z20-60395 Page 2 of 6



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Measurement Conditions

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

AST SYSTEM COMINGUISMON, as lar as	Tot given on page 1.	
DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phentom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1450 MH2 ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

The totaling parameters and carometers and	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.5	1.20 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.19 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	_	***

SAR result with Head TSL

111000000 11111111111111111111111111111		
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	7.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	28.4 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	3.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	16.0 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	52.4Ω - 1.35 jΩ	
Return Loss	- 31.5 dB	

General Antenna Parameters and Design

·	
Electrical Delay (one direction)	1.122 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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Certificate No: 220-60395 Page 4 of 6



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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1450 MHz; Type: D1450V2; Serial: D1450V2 - SN: 1065

Communication System: UID 0, CW; Frequency: 1450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1450 MHz; $\sigma = 1.186 \text{ S/m}$; $\epsilon_r = 39.87$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(8.72, 8.72, 8.72) @ 1450 MHz; Calibrated: 2020-01-30

Date: 10.16.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn771; Calibrated: 2020-02-10

Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062

 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.90 V/m; Power Drift = -0.01 dB

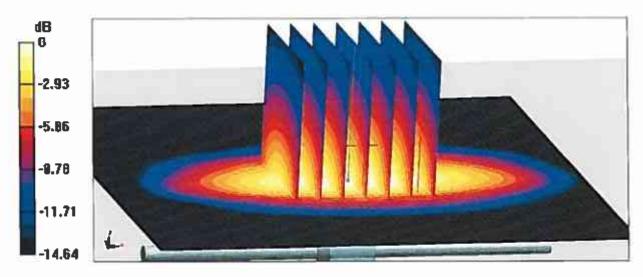
Peak SAR (extrapolated) = 12.3 W/kg

SAR(1 g) = 7.07 W/kg; SAR(10 g) = 3.98 W/kg

Smallest distance from peaks to all points 3 dB below = 11 mm

Ratio of SAR at M2 to SAR at M1 = 58.1%

Maximum value of SAR (measured) = 10.4 W/kg



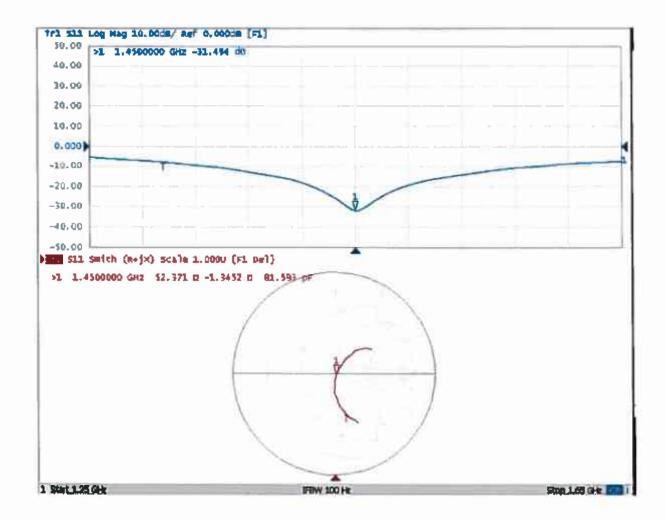
0 dB = 10.4 W/kg = 10.17 dBW/kg

Certificate No: Z20-60395 Page 5 of 6



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Impedance Measurement Plot for Head TSL





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Client

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Tel: +86-10-62304633-2079

Certificate No:

Z20-60358

CALIBRATION CERTIFICATE

Object

D1800V2 - SN: 2d084

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

September 18, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

Calibrated by:

Name Function

Signature

Zhao Jing SAR Test Engineer

Reviewed by:

Lin Hao SAR Test Engineer

Approved by:

Qi Dianyuan SAR Project Leader

Issued: September 22, 2020

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Certificate No: Z20-60358

Page 1 of 6

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Glossary:

TSL tissue simulating liquid

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

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

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

Measurement Conditions: Further details are available from the Validation Report at the end
of the certificate. All figures stated in the certificate are valid at the frequency indicated.

Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
point exactly below the center marking of the flat phantom section, with the arms oriented
parallel to the body axis.

Feed Point Impedance and Return Loss: These parameters are measured with the dipole
positioned under the liquid filled phantom. The impedance stated is transformed from the
measurement at the SMA connector to the feed point. The Return Loss ensures low
reflected power. No uncertainty required.

Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 No uncertainty required.

SAR measured: SAR measured at the stated antenna input power.

- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

Certificate No: Z20-60358 Page 2 of 6

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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
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	1800 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 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 ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.9 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.3 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	48.9Ω- 2.71 jΩ	
Return Loss	- 30.6 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.075 ns	
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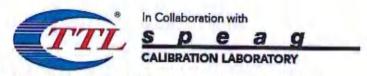
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of 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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Certificate No: Z20-60358 Page 4 of 6



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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d084

Communication System: UID 0, CW; Frequency: 1800 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1800 MHz; $\sigma = 1.39$ S/m; $\epsilon_r = 40.2$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(8.2, 8.2, 8.2) @ 1800 MHz; Calibrated: 2020-01-30

Date: 09.18.2020

- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.62 V/m; Power Drift = -0.03 dB

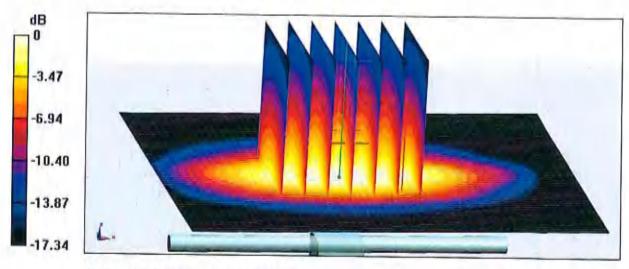
Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 9.67 W/kg; SAR(10 g) = 5.05 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 53.1%

Maximum value of SAR (measured) = 15.2 W/kg



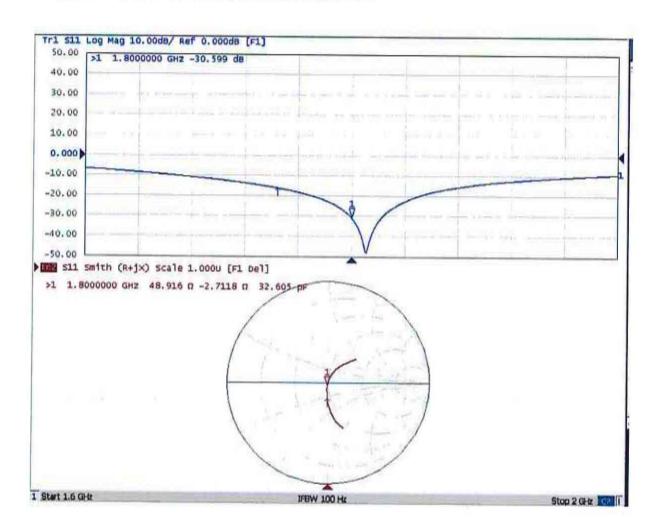
0 dB = 15.2 W/kg = 11.82 dBW/kg

Certificate No: Z20-60358 Page 5 of 6



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Impedance Measurement Plot for Head TSL





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Client

SRTC

Certificate No:

Z20-60396

CALIBRATION CERTIFICATE

Object D2000V2 - SN: 1009

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 14, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
ReferenceProbe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	81
Reviewed by:	Lin Hao	SAR Test Engineer	林%
Approved by:	Ql Dianyuan	SAR Project Leader	200

Issued: October 22, 2020

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lossary:

TSL tissue simulating liquid

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z20-60396 Page 2 of 6

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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
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	2000 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperatura	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.2±6%	1.41 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	_	_

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	41.0 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.12 W/kg
SAR for nominal Head TSL parameters	normalized to 14V	20.5 W/kg ± 18.7 % (k=2)

Certificate No: Z20-60396 Page 3 of 6

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedence, transformed to feed point	49.4Ω- 2.45jΩ
Return Loss	- 31.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.048 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

Certificate No: Z20-60396 Page 4 of 6



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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1009

Communication System: UID 0, CW; Frequency: 2000 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2000 MHz; $\sigma = 1.406$ S/m; $\epsilon_r = 41.15$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(8.25, 8.25, 8.25) @ 2000 MHz; Calibrated: 2020-01-30

Date: 10.14.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.4 V/m; Power Drift = -0.04 dB

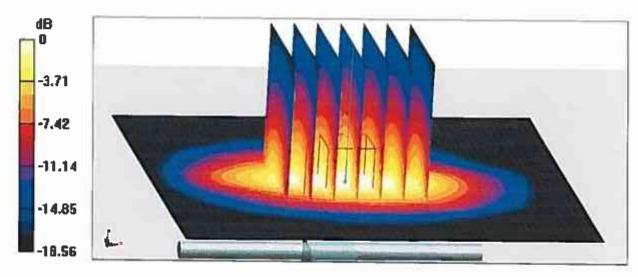
Peak SAR (extrapolated) = 19.5 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.12 W/kg

Smallest distance from peaks to all points 3 dB below = 9.5 mm

Ratio of SAR at M2 to SAR at M1 = 52.5%

Maximum value of SAR (measured) = 16.2 W/kg



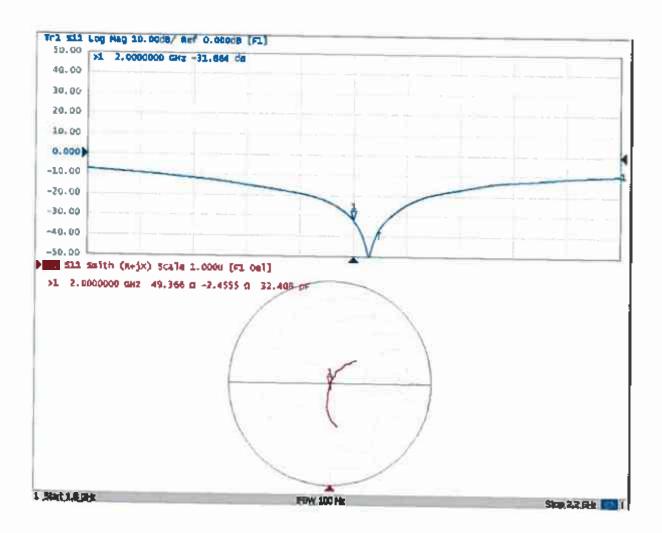
0 dB = 16.2 W/kg = 12.10 dBW/kg

Certificate No: Z20-60396 Page 5 of 6



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Impedance Measurement Plot for Head TSL





In Collaboration with

CALIBRATION LABORATORY

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Client

SRTC

Tel: +86-10-62304633-2079

E-mail: cttl@chinettl.com

Certificate No:

Z20-60397

CALIBRATION CERTIFICATE

Object

D2450V2 - SN: 738

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 13, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
106276	12-May-20 (CTTL, No.J20X02965)	May-21
101369	12-May-20 (CTTL, No.J20X02965)	May-21
SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
MY49071430	25-Feb-20 (CTTL, No.J20X00616)	Feb-21
MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21
M140110013	10-F60-20 (CTTC, NO.320X00818)	F 8 0-21
	106276 101369 SN 3617 SN 771 ID# MY49071430	106276 12-May-20 (CTTL, No.J20X02965) 101369 12-May-20 (CTTL, No.J20X02965) SN 3817 30-Jan-20(SPEAG,No.EX3-3617_Jan20) SN 771 10-Feb-20(CTTL-SPEAG,No.Z20-60017) ID# Cal Date(Calibrated by, Certificate No.) MY49071430 25-Feb-20 (CTTL, No.J20X00616)

Name Function Calibrated by: Zhao Jing SAR Test Engineer Reviewed by: Lin Hao SAR Test Engineer

Approved by: Qi Dianyuan

Issued: October 22, 2020

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Certificate No: 220-60397

Page t of 6

SAR Project Leader



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Glossary:

TSL

tissue simulating liquid

ConvF

sensitivity in TSL / NORMx,y,z

N/A

not applicable or not measured

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z20-60397 Page 2 of 6



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p e a CALIBRATION LABORATORY

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Measurement Conditions

DASY Version	DA\$Y52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phanton	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		****

SAR result with Head TSL

SAR averaged over 1 Cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.0 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 18.7 % (<i>k</i> =2)

Certificate No: Z20-60397 Page 3 of 6 Add: No.51 Xueyuun Road, Haddim District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: ettl@chinattl.com http://www.chinattl.ca

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3Ω+ 8.38 JΩ
Return Loss	- 23.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.021 ns

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

The dipote is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipote. The antenna is therefore short-circuited for DC-signals. On some of the dipotes, small end caps are added to the dipote 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 dipote length is still according to the Standard.

No excessive force must be applied to the dipote arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

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	Manufactured by	SPEAG
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Certificate No: Z20-60397 Page 4 of 6



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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 738

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; $\sigma = 1.809$ S/m; $\varepsilon_c = 39.02$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(7.65, 7.65, 7.65) @ 2450 MHz; Calibrated: 2020-01-30

Date: 10.13.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn771; Calibrated: 2020-02-10

Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062

 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 107.2 V/m; Power Drift = -0.05 dB

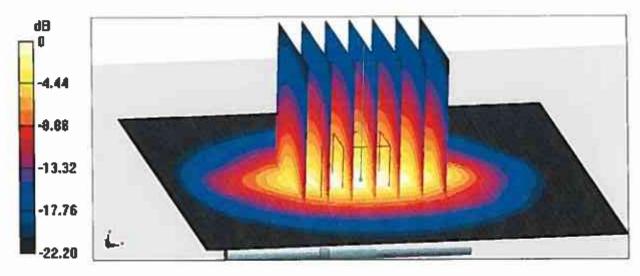
Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.13 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 47.7%

Maximum value of SAR (measured) = 22.7 W/kg



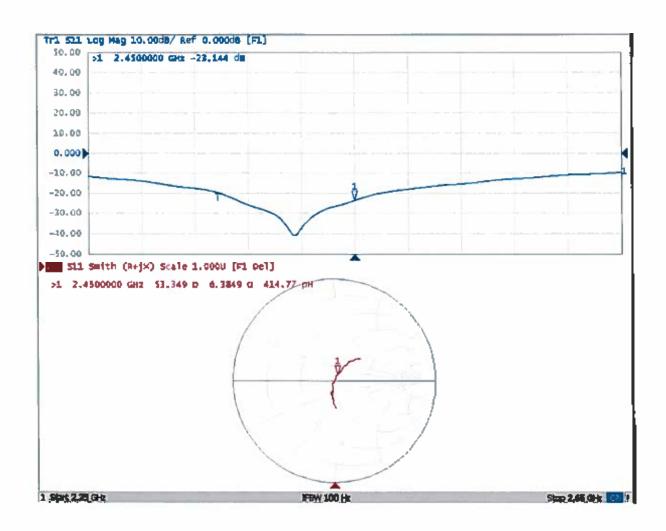
0 dB = 22.7 W/kg = 13.56 dBW/kg

Certificate No: Z20-60397



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Impedance Measurement Plot for Head TSL



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Schweizerischer Kallbrierdienst Service sulsse d'étalonnage Servizio svizzero di taratura Swiss Callbration 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

Client

SRTC-BJ (Auden)

Certificate No: D2600V2-1166_Nov19

CALIBRATION CERTIFICATE

Object D2600V2 - SN:1166

Calibration procedure(s) QA CAL-05.v11

Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: November 08, 2019

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20
	Name	Function	Signatule
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	ana

Issued: November 12, 2019

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Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura 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:

TSL

tissue simulating liquid

ConvF

N/A

sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

 IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)". July 2016

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

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	37.7 ± 6 %	2.01 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	****	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.4 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.9 Ω - 7.8 jΩ	
Return Loss	- 21.7 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 ns
STATE OF THE PROPERTY OF THE P	11.40118

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

Manufacturad bu	55515	
Manufactured by	SPEAG	

Certificate No: D2600V2-1166_Nov19 Page 4 of 6

DASY5 Validation Report for Head TSL

Date: 08.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1166

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: f = 2600 MHz; $\sigma = 2.01 \text{ S/m}$; $\varepsilon_r = 37.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(7.69, 7.69, 7.69) @ 2600 MHz; Calibrated: 29.05.2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 30.04.2019

Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 118.5 V/m; Power Drift = 0.06 dB

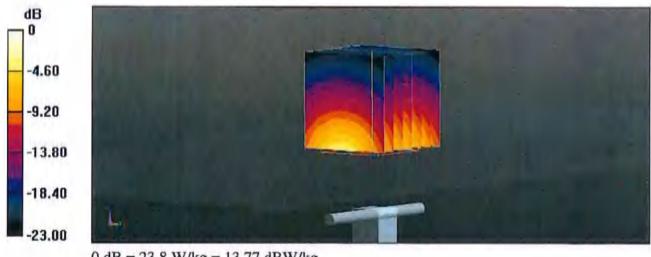
Peak SAR (extrapolated) = 28.7 W/kg

SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.43 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

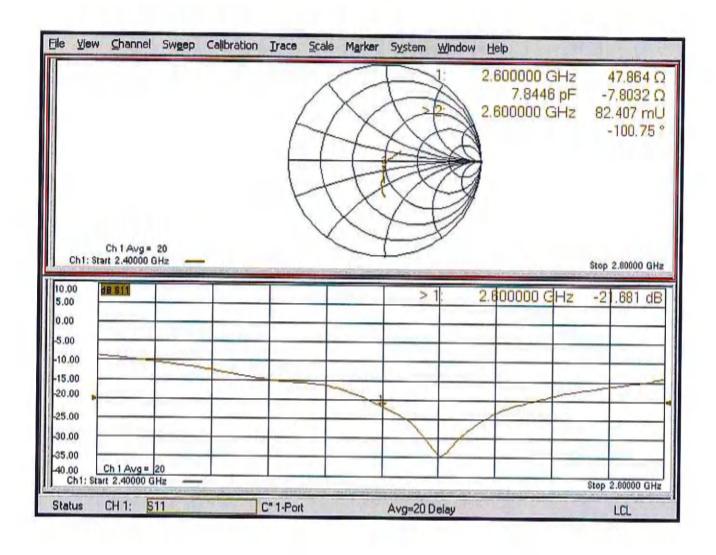
Ratio of SAR at M2 to SAR at M1 = 50.2%

Maximum value of SAR (measured) = 23.8 W/kg



0 dB = 23.8 W/kg = 13.77 dBW/kg

Impedance Measurement Plot for Head TSL



Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 45, 5004 Zurich, Switzerland





Schwegerischer Kallbriernung Service seisse d'étalonnage

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Accreditation No.: SCS 0108

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Multiplieral Agreement for the recognition of on bration certificates

Client SRTC-BJ (Auden)

Certificate No. D3500V2-1090_Nov19

CALIBRATION CERTIFICATE Object D3500V2 - SN:1090 Chilbration procedure(s) QA CAL-22.W Calibration Procedure for SAR Validation Sources between 3-6 GHz Calibration date: November 11, 2019 This colloration certificate decuments the traceability to national standards, which reside the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 31°C and hamidity = 70%. Calibration Equipment yanni (MATE entical for calibration) Frimary Standards 112.0 Gal Date (Carrillaste No.) Scheduled Calibration Power mains NTIP 9N: 104776 00-Apr-19 (No. 217-0-100/02569) Apr-20 Power sensor NRP-Z01 **GN: 103244** 03-Apr 19 (No. 917-08091) Apr-26 Power number NRP-291 SN: 10XP45 (VI-Acr-19 (No. 217-02883) Apr-20 Reférence 20 dli Atimunio BIV: 5008 (20K) OH-Apr 10 ING R1 P-020043 Apr-20 Type-N misminen combination SN 5047.9 / 06927 04-Apr-19 (No. 217-comps) April 20 Perference Picton EXabVii DN: 0508 25-Min-19 (No. EX3-3503 Mart9) MA:-20 DAE's SN 501 30-Apr-10 (Nn DIEN-001 Apr 15) Aprileo Secondary Mandards 100 Chech Daw (in house) Street and Creds Power meter E44190. BN 08:39519475 30-Oct-14 (In house-oneox Feb-18) in house phase Duran Power sensor HP 8481A. SN: URWZWITES 07-Out-15 On house check Con-16) In house them. Gov-Oil POWER BERBOY HIP BABIA. 07-Ga- 16 (in house check Osi-18) SN: MY41032317 in house arride Dal 30 RF generalize PAS SMT-06 3N 100079 15-Jun-15 (in home check Oct-16). In Francis Sheet: Scr-QU Network Analyzer Agilinti Elicistica. SN: US41090477 31-Mar-14 (in house check Oct-19) In Nouse Crack, Col-30 Function Calibridge by: Jeton Kasimil Laboratory Technician Approved by: Katja Pokove Technical Menager brown November 12, 2019. This castisation comitcalls afull not be reproduced except in full without writen approval of the laboratory.

Calibration Laboratory of Schmid & Partner Engineering AG Zeughanternasse M. 1004 Zerich, Switzerland





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Glossary:

TEL

tinsue timulating liquid

ConvF

--- TSL / NORM R.y.z.

N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

 a) IEEE Stil 1528-2013, "IEEE Recommended Practice for Determining the Petik Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 8:209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used text to the ear (frequency range of 300 MHz to 6 GHz)", July 2016.

 EC 60209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in atom proximity to the fruman body (frequency range of 30 MHz to 6 (SHz)", March 2010.

d) KDB B65664, "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 und
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antonia Perameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the conter making of the flat phantom sention, with the arms oriented parellel to the body axis.
- Fixed Point Impedance and Return Lous. These parameters are measured with the dipole positioned rinder 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 fixed point.
 No uncartainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power at 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate time 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%.

Measurement Conditions DASY system configuration, as

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phentom	
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	3500 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.4 ± 6 %	2.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	

SAR result with Head TSL

SAR averaged over 1 cm2 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2,54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108) Antenna Parameters with Head TSL

Impedance, transformed to feed point Return Loss	52.6 Ω + 3.5 ΙΩ	
	- 27.4 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.142 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

About the second to		
Manufactured by	PREAD	
	SPEAG	

DASY5 Validation Report for Head TSL

Date: 11.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1090

Communication System: UID 0 - CW; Frequency: 3500 MHz.

Medium parameters used: I = 3500 MHz; $\sigma = 2.9 \text{ S/m}$; $\varepsilon_r = 37.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63,19-2011)

DA5Y52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.75, 7.75, 7.75) @ 3500 MHz; Calibrated: 25,03,2019
- Sensor-Surface 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04,2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm 3500/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.47 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 6.75 W/kg; SAR(10 g) = 2.54 W/kg

Smallest distunce from peaks to all points 3 dB below = 8.4 mm

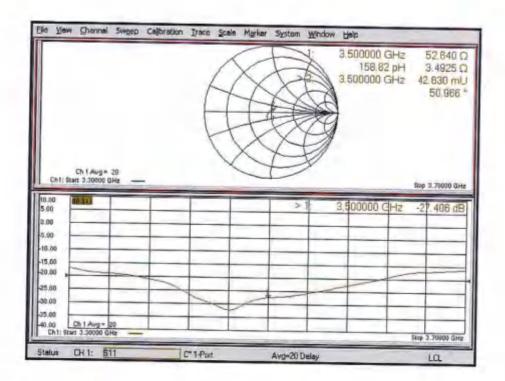
Ratio of SAR at M2 to SAR at M1 = 74.2%

Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Head TSL



Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerla





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Accredited by the Swee Accreditation Service (RAS)

The Swies Accreditation Service is one of the signatories to the EA

Munifolioted Agreement for the recognition of calibration certificates.

Acceptilation No. SCS 0108

Cilimi SRTC-BJ (Auden)

Certificate No. D3700V2-1058 Nov19

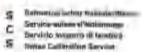
Object	D3700V2 - SN:1058		
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The measurements and the unce	dambes with confidence ;	probability are given on the following pages at	of one part of the certification.
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Calibration Laboratory of

Schmid & Parmer Engineering AG Zeigneuntrasse 45, 6004 Zurich, Switzerland







Accreditation No.1 SCS 0108

Appreciated by the threes Assemble in Herman (EAZ)
The Series Accordington introduce is one of the eigenfunes in the EA
Multiplical Agreement for the recognition of collections continuous

Glossary:

TSL

tissue simulating liquid

ConvF N/A

sensitivity in TSL / NORM x,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 Pauli Spatial-Averaged Specific Abstration Flate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 EC 62209-1, "Measurement procedure for the assersment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 (SHz)", July 2016

EC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for Wireless communication devices used in close proximity to the human body (frequency range of 30, MHz to 8 (GHz)", March 2010.

d) KDB 865664, SAR Measurement Requirements for 100 MHz to 6 GHz*

Additional Documentation:

a) 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 phentom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These paremeters 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 ansums law
 reflected power. No uncertainty required.
- Fleathcal Delay: One-way delay between the SMA connector and the antinna feed point.
 No uncertainty required:
- SAR manufed: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of it W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate menominal 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%.

Measurement Conditions

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	3700 MHz ± 1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mhq/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.8 ± 6 %	3,05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	****	

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.9 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.3 Ω + 1.1 jΩ
Return Loss	- 33.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.134 ris

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

DASY5 Validation Report for Head TSL

Date: 11.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1058

Communication System: UID 0 - CW; Frequency: 3700 MHz

Medium parameters used: f = 3700 MHz; $\sigma = 3.05 \text{ S/m}$; $\varepsilon_r = 36.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63,19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.5, 7.5, 7.5) @ 3700 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DA5Y52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.79 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 19.7 W/kg

SAR(1 g) = 6.88 W/kg; SAR(10 g) = 2.5 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm

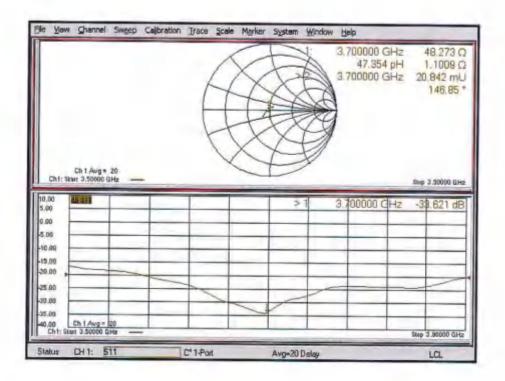
Ratio of SAR at M2 to SAR at M1 = 72.8%

Maximum value of SAR (measured) = 13.3 W/kg



0 dB = 13.3 W/kg = 11.24 dBW/kg

Impedance Measurement Plot for Head TSL



Calibration Laboratory of Schmid & Partner Engineering AG Zeughasseltasus 43, 8004 Zurich, Switzerland





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Accreditation No.: SCS 0108

According by the Swiss Accordinator Service (SAS)

The Swiss Accordinator Service is one of the Algoritorics to the EA

Multilateral Agreement for the recognition of calibration carrilloates

Client

SRTC-BJ (Auden)

Certificate No: D3900V2-1033_Nov19

Object	D3900VZ - SN:1033		
Calibration procedure(n)	QA CAL-22.v4 Calibration Procedure for SAR Validation Sources between 3-6 GHz		
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All calibrations have been conduc	sied in the closed laborals	manual attended as, which reason the physical or probability are given in the following pages a cry facility: environment temperature (22 ± 3)	and my pain of the contilicate.
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Calibration Laboratory of

Schmid & Partner Engineering &G Address St. Miles Survey.





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Accomplisation for SC\$ 0100

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Glossary;

TSL

blupil pritaluine susail

ConvE N/A

surputivity in TSL / NORM x,y,= not applicable or not maunured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1525-2017, TEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques*, June 2013

 EC 62209-1, "Measurement procedure for the assessment of Specific Absorption Flate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2018

 EC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless. communication devices used in close proximity to the human body (frequency range of 3d MHz to 6 GHz)", March 2010

t) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are symbolic from the Validation Report at the and of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Anleona Parameters with TSL: The dipole is mounted with the spacer to position its read point exactly below the center marking of the flat phantam 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 entenns input power.
- SAH normalized SAH as measured, normalized to an input power of 1 W at the antenna zionnector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate in a 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%.

Measurement Conditions

DASY Version	DASY5	V62 10.3
Extrapolation	Advanced Extrepolation	1451515
Phantom	Modular Flat Phantem	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scen Resolution	dx. dy = 4 mm, dz = 1.4 mm	Graded Plate = 1.4 (2 direction)
Prequency	3900 MHz ± 1 MHz 4100 MHz ± 1 MHz	The state of the s

Head TSL parameters at 3900 MHz The following parameters and calculations

	Temperature	Permittivity	Conductivity
Nominal Hand TSL parameters	22.0 °C	37.5	3.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.6 = 8 %	3.21 mho/m = 5.56
Head TSL temperature change during test	×05°C		1

SAR result with Head TSL at 3900 MHz

SAR averaged over 1 cm² (1 g) of Head ISL	Condition	
SAR measured	100 mW input power	6.92 WAD
BAR for nominal Head TSL parameters	Wt citbesiamon	69.2 W/kg a 19.9 % (had)

SAR overaged over 10 cm2 (10 g) of Head TSL	pondition	
SAF) measured	100 mW input power	2.42 W/hg
SAR for nominal Head ToL parameters	numnalized to 1W	24.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 4100 MHz

	Temperature	Permillivity	Conductivity
Nominal Head TSL parameters	22.0°C	37.2	3.53 mhom
Measured Hand TSL parameters	(22.0 = 0.2) °C	36.1 + 0 %	3.35 mhg/m ± 5.5s
Head TSL temperature change during test	<0.5°C	-	-

SAR result with Head TSL at 4100 MHz

SAR averaged over 1 cm² (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.79 W/kg
SAR for normal Head TSL parameters	hompalized to 1W	67.9 W/kg ± 19.5 % (k=2)

SAR avivogad over 10 cm² (10 g) of Head TSL	pondition	
Enjourgem RAS	100 mW Input power	2.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.5 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 3900 MHz

Impedance, transformed to feed point	48.3 D - 4.9 K2
Return Loss	-25.6 dB

Antenna Parameters with Head TSL at 4100 MHz

Impedance, transformed to feed point	59.0 Ω - 0.8 μΩ
Return Loss	-21.6 dB

General Antenna Parameters and Design

Electrical Delevitors at 15 at 1	
Electrical Delay (one direction)	1.107 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 excussive 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	٦

DASY5 Validation Report for Head TSL

Date: 11.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type; D3900V2; Serial: D3900V2 - SN:1033

Communication System: UfD 0 - CW; Frequency: 3900 MHz, Frequency: 4100 MHz Medium parameters used: f = 3900 MHz; $\sigma = 3.21$ S/m; u = 36.6; $\rho = 1000$ kg/m³, Medium parameters used: f = 4100 MHz; $\sigma = 3.39$ S/m; u = 36.3; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY3 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.25, 7.25, 7.25) @ 3900 MHz, ConvF(7.05, 7.05, 7.05) @ 4100 MHz, Calibrated; 25,03,2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Califrated: 30,04,2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3900MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.87 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 19.1 W/kg

SAR(1 g) = 6.92 W/kg; SAR(10 g) = 2.42 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 74.8%

Maximum value of SAR (measured) = 13.4 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4100MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1,4mm

Reference Value = 70.24 V/m; Power Drift = 0.01 dB

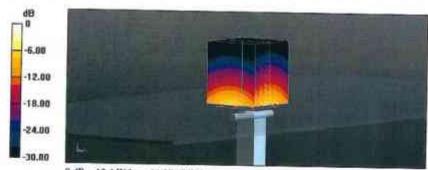
Peak SAR (extrapolated) = 19.4 W/kg

SAR(1 g) = 6.79 W/kg; SAR(10 g) = 2.36 W/kg

Smullest distance from peaks to all points 3 dB below = 8 mm

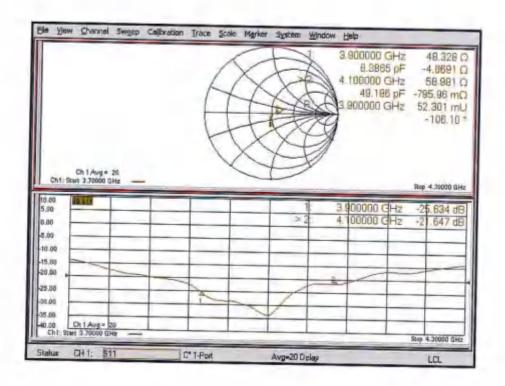
Ratio of SAR at M2 to SAR at M1 = 73.6%

Maximum value of SAR (measured) = 13.4 W/kg



0 dB = 13.4 W/kg = 11.27 dBW/kg

Impedance Measurement Plot for Head TSL



Calibration Laboratory of Schmid & Partner Engineering AG Zaughausstrasse 43, 4004 Zurich, Switzerand





Behweiserischer Kalibrierdional Service susse didatonnage Barvisio svicame di faratura Swisa Calibration Service

Accredited by the Serial Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatures to the EA Mullifained Agreement for the recognition of calibration certificates Accreditation No.: SCS 0108

Client SRTC-BJ (Auden)

Certificets No: D4200V2-1013_Nov19

Object	D4200V2 - SN:1	013	
Californion proposure(s)	QA CAL-22.v4 Calibration Proce	adure for SAR Validation Sources	s between 3-6 GHz
Dalibration date:	November 12, 20	118	
		ional standards, which realize the physical un violability are given on the following pages or	
All callimilians have been conduct	ed in the closed laborato	ey facility, environment temperature (23 ± 3/1	C and humany - ro-
Calibratory Equipment Land (M&T)	E ornical for calibration)		
Primary Standards	ID#	Cali Date (Certificate No.)	Scheduled California
	ID # SN. 104778	Californ (Certificate No.) Ob-Aprills No. 217-02-05/02-003	Scheduled Cartestion Apr-90
Power matter NEW			
Power restar NRP-Z01	SN. 104778	CONSONTE PAU 217-02 INSUZINAL	Apr-90
Power mater NRP-Z91 Power sensor NRP-Z91	SN: 104778- SN: 103244	03-April (No. 217-03-05/02-03) 03-April (No. 217-03-05/2)	Apr-20 Apr-20
Power matter NFP Power sensor NRP-Z91 Power sensor NRP-Z91 Pederunce 20 dtl Allenuator	SN. 104778 SN. 103244 SN 103245	03-Apr-18 (No. 217-02805) 03-Apr-18 (No. 217-02805)	Apr-20 Apr-20
Power matter NRP- Power sensor NRP-291 Power sensor NRP-291 Pollemence 20 del Allemator Type-frammetch combination	SN. 104778 SN. 103244 SN 103245 SN. 1032(20k)	03-April (No. 217-02005/02003) 03-April (No. 217-02003) 03-April (No. 217-02003) 04-April (No. 217-02004)	Apr-20 Apr-20 Apr-20 Apr-20
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Glossery:

TSL

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ConvF

tennettivity in TSL / NORM x.y.z.

N/A not applicable or not measured.

Calibration is Performed According to the Following Standards:

B) IEEE Std 1598-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Flate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013.

 b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-hold and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

 EC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 33 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Mausurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

a) DABY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the me 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 exercity 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 clipale
 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%.

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

DA5Y Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	4300 MHz ± 1 MHz	

Head TSL parameters at 4300 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.0	3.73 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	3.57 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		344

SAR result with Head TSL at 4300 MHz

SAR averaged over 1 cm2 (1 g) of Head TSL	Condition	
SAH measured	100 mW input power	6.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 4300 MHz

Impedance, transformed to feed point	52.1 Ω - 1.6 jΩ	
Return Loss	- 31.7 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.112 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

Date: 12.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 4200 MHz; Type: D4200V2; Serial: D4200V2 - SN:1013

Communication System: UID 0 - CW; Frequency; 4200 MHz, Frequency: 4300 MHz Medium parameters used: f = 4300 MHz; $\sigma = 3.57$ S/m; $\epsilon_r = 36.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Stundard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(6.75, 6.75, 6.75) @ 4300 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601: Calibrated: 30.04.2019
- · Phantom: Flat Phantom 5.0 (front); Type; QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4300MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.49 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 19.8 W/kg

SAR(1 g) = 6.8 W/kg; SAR(10 g) = 2.32 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm.

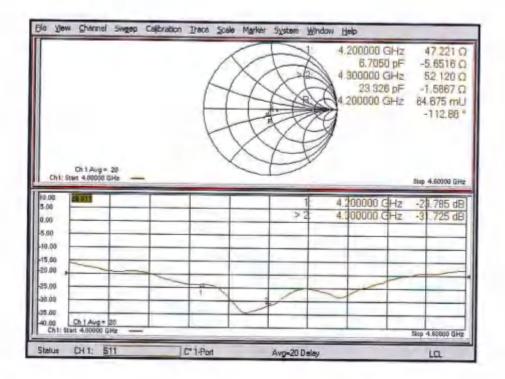
Ratio of SAR at M2 to SAR at M1 = 73.8%

Maximum value of SAR (measured) = 13.6 W/kg



0 dB = 13.6 W/kg = 11.34 dBW/kg

Impedance Measurement Plot for Head TSL



Calibration Laboratory of Schmid & Partner Engineering AG Zeughausdrasse 43, 8004 Zurich, Switterland





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Accredited by the SW65 Accredance Service (SAS). The Swiss Accreditation Service is one of the eignatories to the EA Multiliatural Agreement for the recognition of calibration certificates

Client SRTC-BJ (Auden)

Accreditation No.: SCS 0106

Certificate No: D4600V2-1033_NoV19

CALIBRATION CERTIFICATE

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D4600V2 - SNH033

Calibration procedureds)

QA CAL-22.v4

Calibration Procedure for SAR Validation Sources between 3-6 GHz

Carbratton dete:

November 12, 2019

This cultivation conflicate documents the transactity to national standards, which realize the physical units of measurements (SI). The measurements and the unconstitute with confidence probability are given on the tollowing pages and are part of the conflicate.

All traffirstions have been conducted in the closed taloxalory facility environment temperature (58 x 3)°C and humidity x 70%

Controller Equipment and (MATE crics to carprice)

Primary Standardy	ID: 0	Cai Date (Cortificate No.)	Scheduled Calibration
Power maker NRP	SN: 10477%	(NI-April 19 (No. 917-02892/03893)	Apr-20
Power sensor NRP-Z91	SN 103284	03-Au-+0 (No 21.7 ((2802))	Aur-20
Flower sensor hiter-201	5N: 103845	(O-Apr-19 (No. 217-02501)	Apr-20
Reference 20 dB Aumnumber	5N 5066 (20k)	Of Apr-18 (No. 217 D2GA)	Apri-20
Type-N mammach combination	SN: 5047.2 / 06507	D4-Apr-18 (No. 317-00806)	Apr-20
Reference Probe EXSDV4	STC 3973	25-Mar-19 (No. EXS-0501_Marts)	Mar-20
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Secondary Standards	liD 8	Check, Dalo (in trause)	Scheduled Check
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Himmal Himmoter 12, 2019 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Dentificate No: D4600V2-1031_Nov19

Calibration Laboratory of

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Glossary:

TSL

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N/A

nermitivity in TSL / NORM k.y.z.

Calibration is Performed According to the Following Standards:

 a) IEEE 8td 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Almorption Plate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques," June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Hate (SAR) from hand-hald and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2018

 EC 69209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless, communication devices used in class proximity to the human body (frequency range of 35 MHz to (LGHz)", March 2010

d) KDB 966664, "SAR Measurement Requirements for 100 MHz to 8 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 unit
 of the curtificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipols 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 feast point.
 No encurrainty required.
- 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 R=2, which for a normal distribution corresponds to a opverage protection of approximately 95%.

Measurement Conditions

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

DASY Version	DASYS	V52.10.3
Extrapolation	Adversayd Entrapolation	
Phantom	Madular Fini Phantom	
Distance Dipole Center - TSL	10 mm	with Spraces
Zuum Sonn Resolution	GK, dy = 4 mm. GZ = 1.4 mm	Graded Railo = 1,4 (Z direction)
Frequency	4500 MHz = 1 MHz 4700 MHz = 1 MHz	

Head TSL parameters at 4500 MHz
The following parameters and calculations were applied.

	Temperatura	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	26.7	4.04 m/m/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	376 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	_	-

SAR result with Head TSL at 4500 MHz

SAR averaged over 1 cm2 (1 g) of Head 7SL	Candition	
SAR measured	100 mW (reput power	6.93 WAQ
SAR for nominal Head TSL parameters	normalized to 1W	69.1 W/kg ± 19.3 % (k=2)

SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 W/kg ± 19.5 % (k=2)

Head TSL parameters at 4700 MHz
The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	36.6	4 14 mhs/m
Mnonured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 5 %	395 mho/m ± 6 %
Head TSL temperature change during lest	< 0.5 °C	-	

SAR result with Head TSL at 4700 MHz

BAR averaged over 1 cm2 (1 g) of Head TSL	Condition	
BAR mwasured	100 mW input pawel	6.83 W/kg
SAR for nominal Head TSL parameters	tromalased to 199	68.0 W/kg ± 13.9 % (kx2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input pawer	2.22 W/vg
SAR for nominal Head TSL parameters	normalized to 1W	22.0 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 4500 MHz

Impedance, transformed to feed point	46.4 Ω · 4.5 Ω	
Return Loss	- 24.5 dB	

Antenna Parameters with Head TSL at 4700 MHz

Impedance, transformed to feed point	55.9 \O - 3.2 \O	
Return Loss	- 24.0 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.106 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of 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 and 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
The transfer of	SPEAG

DASY5 Validation Report for Head TSL

Date: 12.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 4600 MHz; Type: D4600V2; Serial: D4600V2 - SN:1033

Communication System: UID 0 - CW; Frequency: 4500 MHz, Frequency: 4700 MHz. Medium parameters used: f = 4500 MHz; $\sigma = 3.76$ S/m; $\epsilon_r = 35.8$; $\rho = 1000$ kg/m 4 . Medium parameters used: f = 4700 MHz; $\sigma = 3.95$ S/m; $\epsilon_r = 35.6$; $\rho = 1000$ kg/m 4 Phantom section: Flat Section Measurement Standard; DA5Y5 (IEEE/IEC/ANSI C63.19-20) [1]

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(6.55, 6.55, 6.55) @ 4500 MHz, ConvF(6.25, 6.25) @ 4700 MHz.
 Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (from); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474).

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm 4500/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 71.61 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 20.0 W/kg

SAR(1 g) = 6.93 W/kg; SAR(10 g) = 2.28 W/kg Smallest distance from peaks to all points 3 dB below = 7.9 mm Ratio of SAR at M2 to SAR at M1 = 73.9% Maximum value of SAR (measured) = 14.0 W/kg

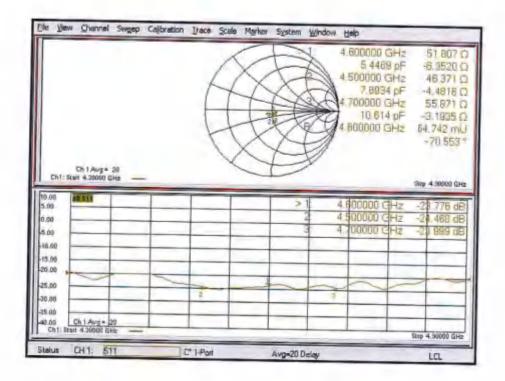
Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm 4700/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 70.53 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 20.7 W/kg SAR(1 g) = 6.83 W/kg; SAR(10 g) = 2.22 W/kg 5mallest distance from peaks to all points 3 dB below = 7.9 mm Ratio of SAR at M2 to SAR at M1 = 72.5% Maximum value of SAR (measured) = 14.2 W/kg



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

Impedance Measurement Plot for Head TSL



Calibration Laboratory of Schmid & Partner Engineering AG Zeughmusersase 45, 8004 Zurich, Switzerland





Schweizerischer Keilbrierdienst Service seinem d'étalonnique Servizie sviezen di teratura Swies Calibration Service

Accreditation No.: SCS 0108

Accorded by the Gene Accordination Service (SAS)
The Swits Accordination Service is one of the signatories to the EA
Multilateral Agreement for the recognition of salibration certificates

Client SRTC-BJ (Auden)

Certificate No: D4900V2-1025_Nov19

CALIBRATION CERTIFICATE

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D4900V2 - SN:1025

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QA CAL-22.W

Galibration Procedure for SAR Validation Sources between 3-6 GHz

Californium date:

November 12, 2019

This calibration smillions discurrents the successive to optional standards, which resize the physical units of measurements (SI).

The measurements and the uncertainties with confidence probability are given an the following pages and are part of the certifique.

All calibrations have been conducind in the closed laboratory facing environment temperature (22 ± 3) °C and number < 70%

Calibration Equipment used (M&TE crecal for calibration)

Primary Standards	ID #	Cat Date (Dertilicate No.)	Schooling Calibration
Fower main HRP	SN-104778	(Th-Apr-19 (No. 217-02042/02093)	Age-QO
Power sensor MRP-ZSN	514: 103244	03-Apr-16 (No. 217-02893)	Apr 20
Fower Money NFIP-Z91	SN: 103245	03-Apr-18 (No. 217-02093)	Apr 20
Reference 20 dll Attenuator	5N: 5058 (20k)	04-Apr-19 (No. 217-02004)	Apr. 00
Type-N internately combination	SN: 5047 2 / 06027	04-Apr-19 (No. 217-02995)	Apr-20
Reference Probe EXSDVI	5N 3503	#8-Mar-10 (No. EX3-3503_Mar-0)	Mar 4/6
DAEA	5N: 601	50-Apr-10 (No. DAE4 601_Apr19)	Aur-20
Secondary Stancerra	in e	Chief Date (in house)	Simulatini Checil
Power restor (044198)	SN: GB39519475	30-Oct-14 (in house check Feb-18)	in house sheck: Oct-PO
Power section HP IMB1A	SN: US37799788	07-Cor-15 (in house check Oct-16)	in house check: Oct-20
Four sensor HP 6481A	SN: MYA1090017	07-Oct-15 (in house chack Oct-18)	In house cleack - Oct-20
RF generator R&S SMT-08	SN: 100075	16-Jun-18 (in house check Cld-18)	In house check: Oct-20
Norway Analyzor Agillant E6259A	SN: US41080477	31-Mar-14 In Fourier shack Col-19)	In howen chuck Oct-20.
	Name	Function	Signature
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Approved by	Kalja Pokevic	Technical Manager	anc

Issued: November 12, 2019

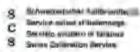
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Calibration Laboratory of Schmid & Partrust Engineering AG

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representative for the second property control control The Swine Assemblation Service is one of the signerories to true of Multitateral Agreement for the recognition of palibration perfillication Assemblation for SCS 0108

Glossary:

TSL ConvF

N/A

Tasus Almulating liquid

sensitivity in TSL / NORM x,y,z not applicable or not measured

Catibration 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 Wireland Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rule-(SAR) from hand-held and body-mounted devices used next to the eur (frequency range of 300 MHz to 6 GHz)", July 2018
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- al) KDB 865664, "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 equilible from the Validation Report at the unit of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Paramoters 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 budy 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 enterna lead 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
- 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 R=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	4900 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.3	4.35 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	4.15 mho/m ± 8 %
Head TSL temperature change during test	< 0.5 °C	_	-

SAR result with Head TSL

SAR averaged over 1 cm2 (1 g) of Head TSL	Condition	
SAR measured	100 mW Input power	7.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	70.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.1 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6 Ω - 5.2 jΩ	
Return Loss	- 25.7 dB	

General Antenna Parameters and Design

1.091 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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DASY5 Validation Report for Head TSL

Date: 12.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 4900 MHz; Type: D4900V2; Serial: D4900V2 - SN:1025

Communication System: UID 0 - CW; Frequency: 4900 MHz

Medium parameters used: f = 4900 MHz; $\sigma = 4.15 \text{ S/m}$; $c_r = 35.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(6.05, 6.05, 6.05) @ 4900 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm 4900/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.76 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 21.6 W/kg

SAR(1 g) = 7.07 W/kg; SAR(10 g) = 2.23 W/kg

Smallest distance from peaks to all points 3 dB below = 7.6 mm.

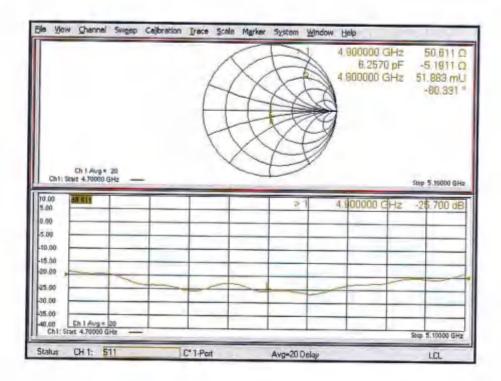
Ratio of SAR at M2 to SAR at M1 = 72.5%

Maximum value of SAR (measured) = 14.9 W/kg



0 dB = 14.9 W/kg = 11.73 dBW/kg

Impedance Measurement Plot for Head TSL





In Collaboration with

CALIBRATION LABORATORY

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CALIBRATION CERTIFICATE

E-mail: cttl@chinattl.com

Object

D6GH2V2 - SN: 1079

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 10, 2020

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

All calibrations have been conducted in the closed laboratory facility; environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	•
ReferenceProbe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	May-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Jan-21
	011771	10-1 B0-20(C11L-3FEAG,140.220-60017)	Feb-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzerE5071C	MY46107873	10-Feb-20 (CTTL, No.J20X00515)	Feb-21
		•	

_	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	-
Reviewed by:	Lin Hao	SAR Test Engineer	林杨
Approved by:	Qi Dlanyuan	SAR Project Leader	20

Issued: October 22, 2020

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

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Glossary:

TSL

tissue simulating liquid

ConvF

sensitivity in TSL / NORMx,y,z

N/A

not applicable or not measured

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipote 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.10	
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 5800 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	38.0 ± 6 %	4.65 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

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	7.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	75.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.4 W/kg ± 24.2 % (k=2)

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Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

THE TOTAL PROPERTY OF THE PROP	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	35.8 ± 8 %	4.76 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	****	_

SAR result with Head TSL at 5300 MHz

	· · · · · · · · · · · · · · · · · · ·	<u> </u>
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7,81 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.0 W/kg ± 24.4 % (<i>k</i> =2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.0 W/kg ± 24.2 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

The locowing parameters and carodiations were	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mino/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		<u> </u>

SAR result with Head TSL at 5500 MHz

V (ABRILL MIRI LIGAR LOF BY 2200 INCIT		
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.3 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 24.2 % (k=2)



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Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	5.08 mhe/m ± 6 %
Head TSL temperature change during test	<1.0 °C	<u></u>	

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 naminal Head TSL parameters	normalized to 1W	80.0 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg ± 24.2 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

Temperature Permittivity Conduc			
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.0 ± 6 %	5.28 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	-100	

SAR result with Head TSL at 5800 MHz

The state of the s		
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	_
SAR measured	100 mW input power	7.86 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.8 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	50.2Ω - 10.0]Ω
Return Loss	- 20.0dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	47.2Ω - 7.33jΩ
Return Loss	- 21.9dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	52.0Ω - 7.98jΩ
Return Loss	- 21.9dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	55.7Ω - 3.78]Ω
Return Loss	- 23.8dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	53.7Ω - 5.87jΩ
Return Loss	- 23.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.069 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 "Messurement 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.

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Additional EUT Data

Manufactured by	SPEAG



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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China
DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1079

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz,

Date: 10.10.2020

Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz,

Medium parameters used: f = 5200 MHz; σ = 4.65 S/m; ϵ_r = 35.95; ρ = 1000 kg/m³, Medium parameters used: f = 5300 MHz; σ = 4.759 S/m; ϵ_r = 35.75; ρ = 1000 kg/m³, Medium parameters used: f = 5500 MHz; σ = 4.969 S/m; ϵ_r = 35.39; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 5.081 S/m; ϵ_r = 35.24; ρ = 1000 kg/m³, Medium parameters used: f = 5800 MHz; σ = 5.279 S/m; ϵ_r = 34.97; ρ = 1000 kg/m³,

Phantom section: Center Section

DASY5 Configuration:

Probe: EX3DV4 - SN3617; ConvF(5.49, 5.49, 5.49) @ 5200 MHz;
 ConvF(5.29, 5.29, 5.29) @ 5300 MHz; ConvF(5.14, 5.14, 5.14) @ 5500 MHz; ConvF(4.99, 4.99, 4.99) @ 5600 MHz; ConvF(5, 5, 5) @ 5800 MHz;
 Calibrated: 2020-01-30

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Dipole Calibration /Pin=100mW, d=10mm, f=6200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.85 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 30.9 W/kg
SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.14 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 64.9%

Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=8300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.07 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 32.5 W/kg

SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.2 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 64.2%

Maximum value of SAR (measured) = 18.8 W/kg

Certificate No: Z20-60398 Page 8 of 10



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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 = 69.06 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 36.1 W/kg

SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.31 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 62.5%

Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan.

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67.87 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 36.0 W/kg

SAR(1 g) = 8.01 W/kg; SAR(10 g) = 2.26 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) = 19.9 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 = 68.36 V/m; Power Drift = -0.08 dB

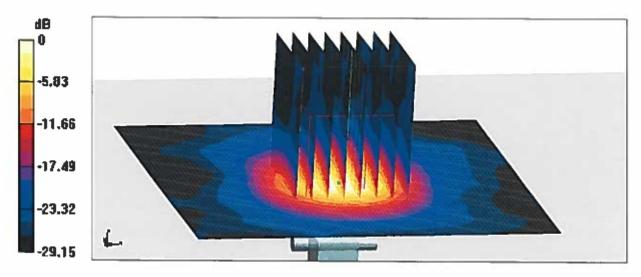
Peak SAR (extrapolated) = 37.0 W/kg

SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.2 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 60.2%

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



0 dB = 19.3 W/kg = 12.86 dBW/kg

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Impedance Measurement Plot for Head TSL

