

Appendix C for KSCR220500066801

Calibration Certificate

Object	Apply	No	Model	SN	Calibration Date
Dipole	☐	1	CLA150	4025	2021/04/26
	☐	2	D450V3	1103	2021/04/21
	☒	3	D750V3	1188	2022/03/29
	☒	4	D835V2	4d114	2022/03/31
	☐	5	D900V2	1d079	2022/06/07
	☒	6	D1800V2	2d170	2022/03/31
	☒	7	D1900V2	5d1136	2022/06/07
	☐	8	D2000V2	1041	2022/06/06
	☒	9	D2300V2	1096	2022/03/31
	☒	10	D2450V2	817	2022/04/01
	☒	11	D2600V2	1158	2022/03/31
	☒	12	D5GHzV2	1095	2022/06/01
DAE	☒	13	DAE4	1245	2022/05/30
Probe	☒	14	EX3DV4	7346	2022/03/30



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No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300
中国·江苏·昆山市留学院创业园伟业路10号 邮编 215300

t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn
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1 Dipole

1.1 CLA150 - SN 4025

Calibration Laboratory of Schmid & Partner Engineering AG Zugstrasse 43, 8004 Zurich, Switzerland		S Schweizerischer Kalibrierdienst C Service suisse de l'etonnage S Swiss Calibration Service		Accreditation No.: SCS 0108	
Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates		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		Accreditation No.: SCS 0108	
Client: SGS-CN (Audeon)		Certificate No: CLA150-4025_Apr21			
CALIBRATION CERTIFICATE					
Object: CLA150 - SN: 4025					
Calibration procedure(s): QA CAL-15.v9 Calibration Procedure for SAR Validation Sources below 700 MHz					
Calibration date: April 26, 2021					
The calibration certificate documents the traceability to national standards, which require the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and on 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&E critical for calibration)					
Primary Standards		ID #	Cal Date (Certificate No.)	Scheduled Calibration	
Power meter NRP		SN: 10476	09-Apr-21 (No. 217-03001/03002)	Apr-22	
Power sensor NRP 20i		SN: 10384	09-Apr-21 (No. 217-03001)	Apr-22	
Power sensor NRP 20i		SN: 10385	09-Apr-21 (No. 217-03002)	Apr-22	
Reference 20 dB Attenuator		SN: C23602 (20dB)	09-Apr-21 (No. 217-03003)	Apr-22	
Type-N mismatch combination		SN: 310907 / 0007	09-Apr-21 (No. 217-03004)	Apr-22	
Reference Probe EX3004		SN: 3877	30-Dec-20 (No. 13X3077_Dec20)	Dec-21	
E1E4		SN: 661	15-Jan-20 (No. 13458-658_Jan20)	Jan-21	
Secondary Standards		ID #	Check Date (in house)	Scheduled Check	
Power meter S4419E		SN: G341303024	09-Apr-15 (in house check Jun-20)	In house check Jun-20	
Power sensor E413A		SN: MY4169007	09-Apr-15 (in house check Jun-20)	In house check Jun-20	
Power sensor E413A		SN: 00010010	09-Apr-15 (in house check Jun-20)	In house check Jun-20	
RF generator HP 8594C		SN: U5400401709	04-Aug-19 (in house check Jun-20)	In house check Jun-20	
Network Analyzer Agilent T8368A		SN: U541000477	31-Mar-14 (in house check Oct-19)	In house check Oct-21	
Calibrated by:		Name: Jurek Katsch	Function: Laboratory Technician	Signature:	
Approved by:		Name: Kaja Polovic	Function: Technical Manager	Signature:	
This calibration certificate shall not be reproduced except in full without written approval of the laboratory. Issued: April 26, 2021					
Certificate No: CLA150-4025_Apr21 Page 1 of 5					

Measurement Conditions	
DASY system configuration, as far as not given on page 1.	
DASY Version	DASY5 V52.10.4
Extrapolation	Advanced Extrapolation
Phantom	ELIA Flat Phantom
EUT Positioning	Touch Position
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm
Frequency	150 MHz ± 1 MHz
Graded Ratio	1.4 (Z direction)

Head TSL parameters	
The following parameters and calculations were applied.	
Temperature	22.0 °C
Permittivity	52.3
Conductivity	0.75 mho/m
Nominal Head TSL parameters	(22.0 ± 0.2) °C
Measured Head TSL parameters	51.1 ± 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	1 W input power
SAR for nominal Head TSL parameters	normalized to 1W
	3.88 W/kg ± 19.4 % (kw2)
SAR averaged over 10 cm³ (10 g) of Head TSL	condition
SAR measured	1 W input power
SAR for nominal Head TSL parameters	normalized to 1W
	2.59 W/kg ± 18.0 % (kw2)

Appendix (Additional assessments outside the scope of SCS 0108)	
Antenna Parameters with Head TSL	
Impedance, transformed to feed point	47.9 Ω ± 1.5 Ω
Return Loss	-31.4 dB
Additional EUT Data	
Manufactured by	SPLEAG

Certificate No: CLA150-4025_Apr21	
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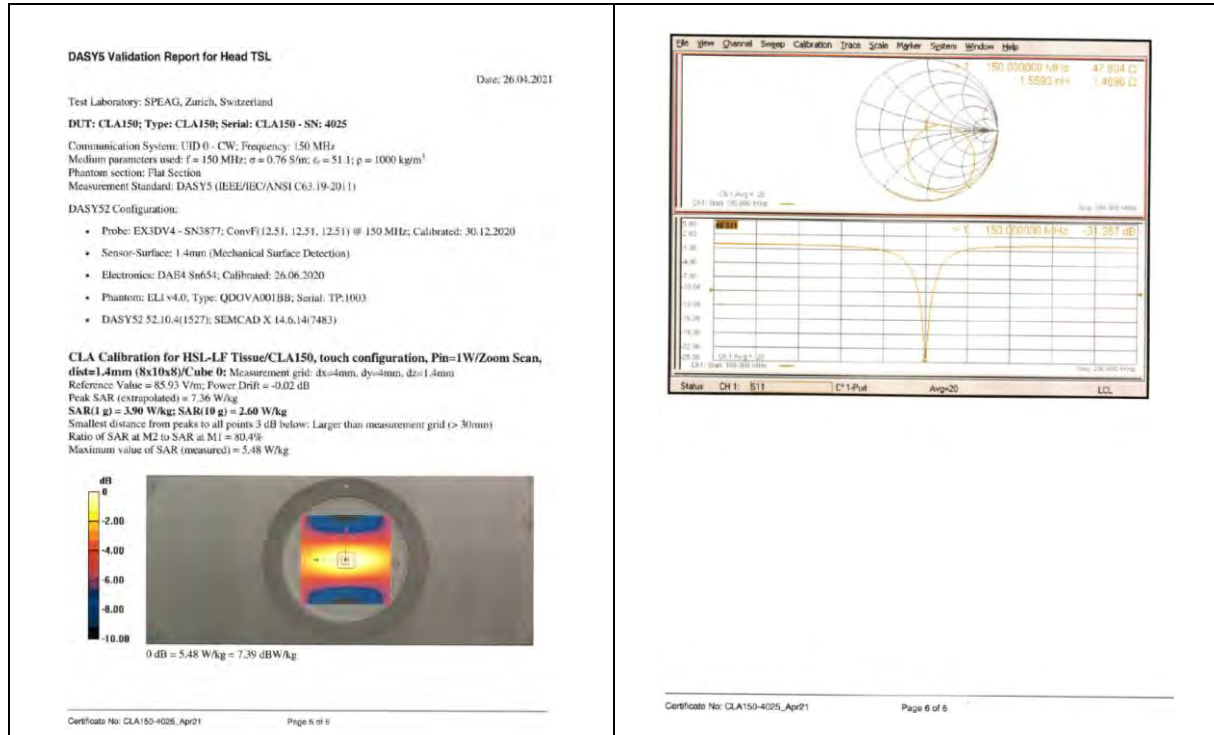
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1.2 D450V3 - SN 1103

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

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Client: **SGS-CN (Aiden)** Certificate No: **D450V3-1103_Apr21**

Accreditation No: **SCS 0108**

CALIBRATION CERTIFICATE

Object: **D450V3 - SN: 1103**

Calibration procedure(s): **QA CAL-15-V9**
Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date: **April 21, 2021**

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 (20 ± 2) °C and humidity < 75%.

Calibration Equipment used (MPE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN 104779	09-Apr-21 (No. 217-0301103020)	Apr-22
Power sensor MHP-291	SN 103244	09-Apr-21 (No. 217-030211)	Apr-22
Power sensor MHP-291	SN 103245	09-Apr-21 (No. 217-030205)	Apr-22
Reference 20 dB Attenuator	SN C2552 (200)	09-Apr-21 (No. 217-030439)	Apr-22
Type-A impedance calibration	SN 310852 / 06327	09-Apr-21 (No. 217-030444)	Apr-22
Reference Probe EX3DV4	SN 3877	30-Dec-20 (No. EX3-2077 Dec20)	Dec-21
DA54	SN 454	06-Jun-20 (No. DA54-664-Jun20)	Jun-21

Secondary Standards

ID #	Cal Date (In House)	Scheduled Check
Power meter E41488	06-Apr-10 (In house check Jun-20)	In house check Jun-20
Power sensor E41412A	06-Apr-10 (In house check Jun-20)	In house check Jun-20
Power sensor E41412A	06-Apr-10 (In house check Jun-20)	In house check Jun-20
RF generator HP 8448C	06-Aug-09 (In house check Jun-20)	In house check Jun-20
Network Analyzer Agilent E8358A	31-Mar-14 (In house check Oct-20)	In house check Oct-21

Calibrated by: **Christoph Linder** Function: **Laboratory Technician**

Approved by: **Klaus Frensch** Function: **Technical Manager**

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Accreditation No: **SCS 0108**

Glossary:

TSL: Issue simulating liquid sensitivity in TSL / NORM x,y,z

ConvF: not applicable or not measured

N/A: 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
- 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
- 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
- KDB 665664, "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 available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions		
DASY system configuration, as far as not given on page 1.		
DASY Version	DASY5	V82.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELJ Flat Phantom	Shell thickness: 2 ± 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	0.57 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.1 ± 6 %	0.57 mho/m ± 8 %
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	1.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.55 W/kg ± 18.1 % (k=2)

SAR result with Head TSL		
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	0.757 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	3.06 W/kg ± 17.6 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0106)	
Antenna Parameters with Head TSL	
Impedance, transformed to feed point	57.1 Ω - j2.6 Ω
Return Loss	-23.0 dB

General Antenna Parameters and Design	
Electrical Delay (one direction)	1.346 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 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.

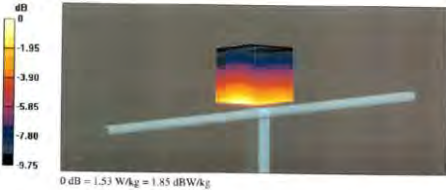
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data	
Manufactured by	SPEAG

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Certificate No: D450V3-1103_Apr21 Page 4 of 6

DASY5 Validation Report for Head TSL	
Test Laboratory: SPEAG, Zurich, Switzerland	
Date: 21.04.2021	
DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1103	
Communication System: UTD 0 - CW; Frequency: 450 MHz	
Medium parameters used: f = 450 MHz; α = 0.87 S/m; ε _r = 43.1; ρ = 1000 kg/m ³	
Phantom section: Flat Section	
Measurement Standard: DASY5 (IEC/ANSI C63.19-2011)	
DASY52 Configuration:	
- Probe: EX3DV4 - SN3877; ConvF [10.64, 10.64] @ 450 MHz; Calibrated: 30.12.2020 - Sensor-Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DAE4 Sn654; Calibrated: 26.06.2020 - Phantom: ELJ v4.0; Type: QDOVA001BB; Serial: TP:1003 - DASY52 52.10.4 (1527); SEMCAD X (4.6.14/7483)	
Dipole Calibration for Head Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:	
Measurement grid: dx=5mm, dy=5mm, dz=5mm	
Reference Value = 39.18 V/m; Power Df/dt = -0.08 dB	
Peak SAR (extrapolated) = 1.76 W/kg	
SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.767 W/kg	
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid	
Ratio of SAR at M2 to SAR at M1 = 64.9%	
Maximum value of SAR (measured) = 1.53 W/kg	



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1.3 D750V3 - SN 1188

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Client: SGS-CN		Certificate No.: Z22-60103																					
CALIBRATION CERTIFICATE																							
Object: D750V3 - SN: 1188																							
Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits																							
Calibration date: March 28, 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)																							
<table border="1"><thead><tr><th>Primary Standards</th><th>ID #</th><th>Cal Date (Calibrated by Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Power Meter NRP2</td><td>104277</td><td>24-Sep-21 (CTTL No. J21X08328)</td><td>Sep-22</td></tr><tr><td>Power sensor NRP88</td><td>104291</td><td>24-Sep-21 (CTTL No. J21X08328)</td><td>Sep-22</td></tr><tr><td>Reference Probe EX30V4</td><td>SN 7307</td><td>26-May-21 (SPEAG No. EX3-7307_May21)</td><td>May-22</td></tr><tr><td>DAE4</td><td>SN 1556</td><td>12-Jan-22 (CTTL-SPEAG No. Z22-60007)</td><td>Jan-23</td></tr></tbody></table>				Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	104277	24-Sep-21 (CTTL No. J21X08328)	Sep-22	Power sensor NRP88	104291	24-Sep-21 (CTTL No. J21X08328)	Sep-22	Reference Probe EX30V4	SN 7307	26-May-21 (SPEAG No. EX3-7307_May21)	May-22	DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23
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<table border="1"><thead><tr><th>Secondary Standards</th><th>ID #</th><th>Cal Date (Calibrated by Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Signal Generator S4436C</td><td>MY46071430</td><td>13-Jan-22 (CTTL No. J22X00406)</td><td>Jan-23</td></tr><tr><td>Network Analyzer E5071C</td><td>MY46110673</td><td>14-Jan-22 (CTTL No. J22X00406)</td><td>Jan-23</td></tr></tbody></table>				Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Signal Generator S4436C	MY46071430	13-Jan-22 (CTTL No. J22X00406)	Jan-23	Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No. J22X00406)	Jan-23								
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Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No. J22X00406)	Jan-23																				
Calibrated by: Zhao Jing		Function: SAR Test Engineer																					
Reviewed by: Lin Hao		Function: SAR Test Engineer																					
Approved by: Qi Dianyun		Function: SAR Project Leader																					
Issued: April 3, 2022																							
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Measurement Conditions DASY system configuration, as far as not given on page 1:			
DASY Version		DASY52	
Extrapolation		Advanced Extrapolation	
Phantom		Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL		15 mm	
Zoom Scan Resolution		dx, dy, dz = 5 mm	
Frequency		750 MHz ± 1 MHz	
Head TSL parameters The following parameters and calculations were applied:			
Temperature		22.0 °C	
Permittivity		42.0	
Conductivity		0.90 mho/m	
Nominal Head TSL parameters		(22.0 ± 0.2) °C	
Measured Head TSL parameters		(22.0 ± 0.2) °C	
Head TSL temperature change during test		<1.0 °C	
SAR result with Head TSL			
SAR averaged over 1 cm ² (1 g) of Head TSL		Condition	
SAR measured		250 mW input power	
SAR for nominal Head TSL parameters		normalized to 1W	
SAR averaged over 10 cm ² (10 g) of Head TSL		Condition	
SAR measured		250 mW input power	
SAR for nominal Head TSL parameters		normalized to 1W	

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Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL			
Impedance, transformed to head point		53.60 - 1.13jΩ	
Return Loss		>28.7dB	
General Antenna Parameters and Design			
Electrical Delay (one direction)		0.947 ns	
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 placed 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 feed-point may be damaged.			
Additional EUT Data			
Manufactured by		SPEAG	
Certificate No: Z22-60103		Page 1 of 6	



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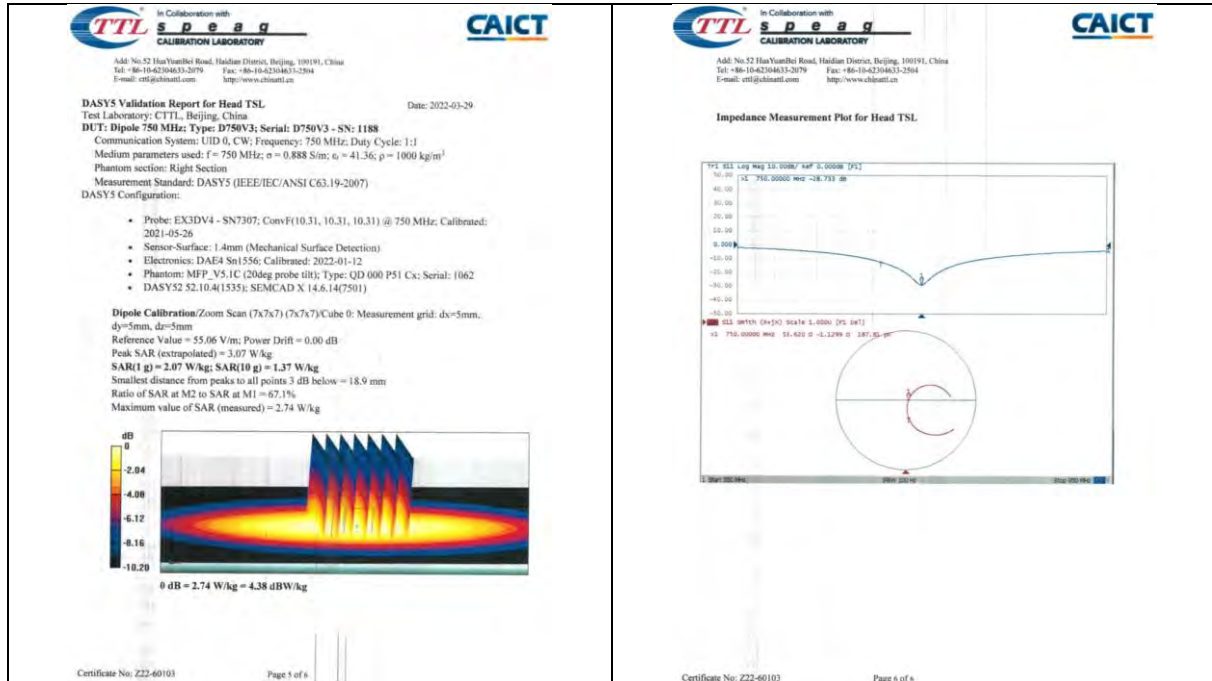
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1.4 D835V2 - SN 4d114

TTL Speaq Calibration Laboratory
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E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.cn

CAICT

Client: SGS-CN Certificate No: Z22-60104

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 4d114

Calibration Procedure(s): FF-211-003-01
Calibration Procedures for dipole validation kits

Calibration date: March 31, 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&E critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL No J21X08326)	Sep-22
Power sensor NRPBS	104281	24-Sep-21 (CTTL No J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21 (SPEAG No EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No J22X00409)	Jan-23
Network Analyzer E5071C	MY46110873	14-Jan-22 (CTTL No J22X00409)	Jan-23

Calibrated by: Zhao Jing, SAR Test Engineer, Signature: [Signature]

Reviewed by: Lin Hao, SAR Test Engineer, Signature: [Signature]

Approved by: Qi Dianyuan, SAR Project Leader, Signature: [Signature]

Issued: April 6, 2022

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Certificate No: Z22-60104 Page 1 of 6

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) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
b) KDB 669664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:
c) 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 space 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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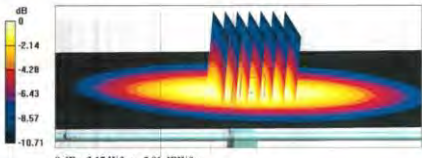
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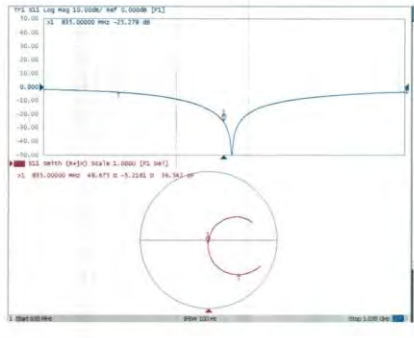
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Measurement Conditions DASY system configuration, as far as not given on page 1			
DASY Version	DASY52	VS2 10.4	
Extrapolation	Advanced Extrapolation		
Phantom	Triple Flat Phantom 5.1C		
Distance Dipole Center - TSL	15 mm	with Spacer	
Zoom Scan Resolution	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	41.0 ± 0.5	0.91 mho/m ± 0.5 %
Head TSL temperature change during last	< 1.0 °C	—	—
SAR result with Head TSL			
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	2.37 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	9.40 W/kg ± 18.8 % (k=2)	
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	1.54 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	6.12 W/kg ± 18.7 % (k=2)	
Certificate No: Z22-60104 Page 1 of 6			

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Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL			
Impedance, transformed to feed point	48.70-5.22jΩ		
Return Loss	-25.3dB		
General Antenna Parameters and Design			
Electrical Delay (one direction)	1.307 ns		
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.			
Additional EUT Data			
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Certificate No: Z22-60104 Page 1 of 6			

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 2022-03-31			
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 40114 Communication System: UTD 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; σ = 0.907 S/m; ε _r = 40.98; ρ = 1000 kg/m ³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:			
- Probe: EX3DV4 - SN7307; ConvF(10.13, 10.13, 10.13) @ 835 MHz; Calibrated: 2021-05-26 - Sensor Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DA64 Sn1556; Calibrated: 2022-01-12 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 - DASY52 52.10.4(153); SEMCAD X 14.6.14(7501)			
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.88 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 3.56 W/kg SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg Smallest distance from peaks to all points 3 dB below = 15.8 mm Ratio of SAR at M2 to SAR at M1 = 66.2% Maximum value of SAR (measured) = 3.17 W/kg			
			
0 dB = 3.17 W/kg = 5.01 dBW/kg			
Certificate No: Z22-60104 Page 1 of 6			

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Impedance Measurement Plot for Head TSL			
			
Certificate No: Z22-60104 Page 6 of 6			



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1.5 D900V2 - SN 1d079

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Client: SGS-CN		Certificate No: Z22-60184																					
CALIBRATION CERTIFICATE																							
Object: D900V2 - SN 1d079																							
Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits																							
Calibration date: June 7, 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 (23±1)°C and humidity 70%.																							
Calibration Equipment used (M&TE critical for calibration)																							
<table border="1"><thead><tr><th>Primary Standards</th><th>ID #</th><th>Cal Date (Calibrated by Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Power Meter NRP2</td><td>106277</td><td>24-Sep-21 (CTTL No. J21X08326)</td><td>Sep-22</td></tr><tr><td>Power sensor NRP85</td><td>104291</td><td>24-Sep-21 (CTTL No. J21X08326)</td><td>Sep-22</td></tr><tr><td>Reference Probe EX32V4</td><td>SN 7464</td><td>26-Jan-22 (SPEAG No. EX3-7464_Jan22)</td><td>Jan-23</td></tr><tr><td>DAE4</td><td>SN 1586</td><td>12-Jan-22 (CTTL-SPEAG No. Z22-60007)</td><td>Jan-23</td></tr></tbody></table>				Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	106277	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Power sensor NRP85	104291	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Reference Probe EX32V4	SN 7464	26-Jan-22 (SPEAG No. EX3-7464_Jan22)	Jan-23	DAE4	SN 1586	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23
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Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]																							
Reviewed by: Lin Hao, SAR Test Engineer, Signature: [Signature]																							
Approved by: Qi Dianyan, SAR Project Leader, Signature: [Signature]																							
Issued: June 13, 2022																							
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Glossary:			
TSL: tissue simulating liquid			
ConvF: sensitivity in TSL / NORM.y,z			
N/A: not applicable or not measured			
Calibration is Performed According to the Following Standards:			
a) IEC/IEEE 62209-1529, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices-Part 1529: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020			
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"			
Additional Documentation:			
c) DASYS45 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: Z22-60184		Page 1 of 6	

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Measurement Conditions																			
DASYS Version: DASYS2																			
Extrapolation: Advanced Extrapolation																			
Phantom: Triple Flat Phantom 5.1C																			
Distance Dipole Center - TSL: 15 mm																			
Zoom Scan Resolution: 0x, dy, dz = 5 mm																			
Frequency: 900 MHz ± 1 MHz																			
Head TSL parameters																			
The following parameters and calculations were applied:																			
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	Temperature	Permittivity	Conductivity																
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Measured Head TSL parameters	(22.0 ± 0.2) °C	42.1 ± 6 %	0.98 mho/m ± 6 %																
Head TSL temperature change during test	<+1.0 °C	---	---																
SAR result with Head TSL																			
<table border="1"><thead><tr><th>SAR averaged over 1 cm³ (1 g) of Head TSL</th><th>Condition</th></tr></thead><tbody><tr><td>SAR measured</td><td>250 mW input power</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td></tr><tr><td>SAR averaged over 10 cm³ (10 g) of Head TSL</td><td>Condition</td></tr><tr><td>SAR measured</td><td>250 mW input power</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td></tr></tbody></table>				SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	SAR measured	250 mW input power	SAR for nominal Head TSL parameters	normalized to 1W	SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	SAR measured	250 mW input power	SAR for nominal Head TSL parameters	normalized to 1W				
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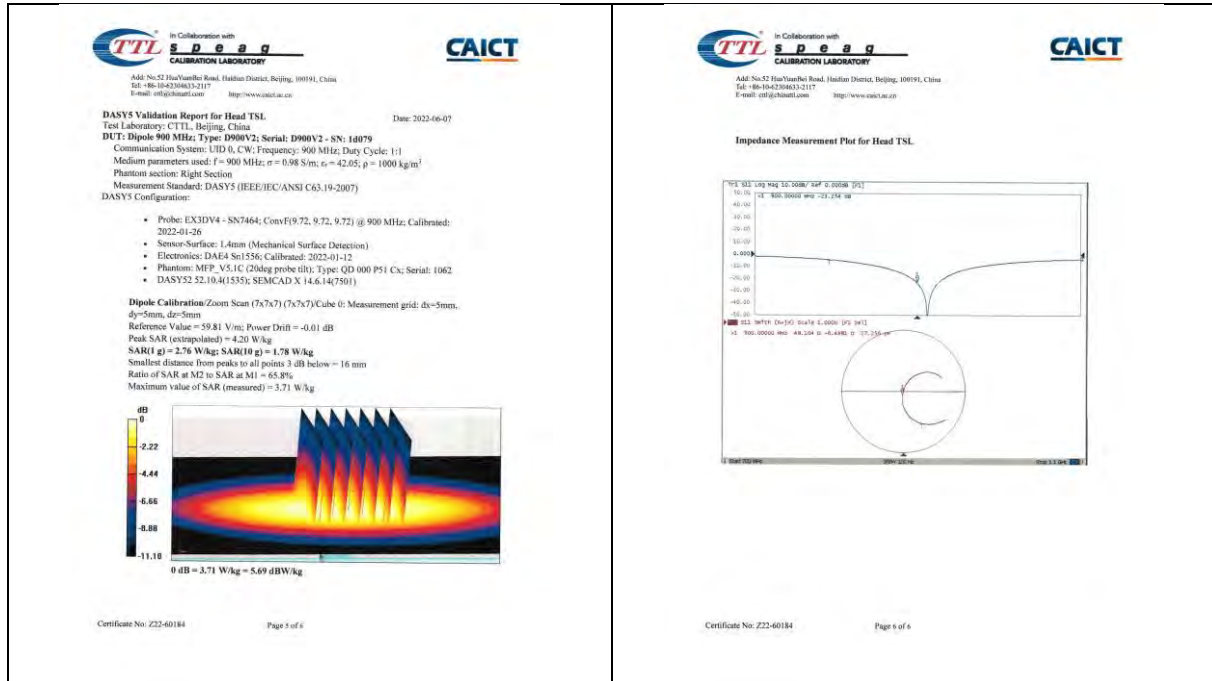
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Appendix (Additional assessments outside the scope of CNAS L0670)									
Antenna Parameters with Head TSL									
<table border="1"><thead><tr><th></th><th></th></tr></thead><tbody><tr><td>Impedance, transformed to feed point</td><td>48 (1.0-9.45G)</td></tr><tr><td>Return Loss</td><td>-23.3 dB</td></tr></tbody></table>						Impedance, transformed to feed point	48 (1.0-9.45G)	Return Loss	-23.3 dB
Impedance, transformed to feed point	48 (1.0-9.45G)								
Return Loss	-23.3 dB								
General Antenna Parameters and Design									
<table border="1"><thead><tr><th></th><th></th></tr></thead><tbody><tr><td>Electrical Delay (one direction)</td><td>1.312 ns</td></tr></tbody></table>						Electrical Delay (one direction)	1.312 ns		
Electrical Delay (one direction)	1.312 ns								
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.									
The dipole is made of standard serringid 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 feed-point may be damaged.									
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Manufactured by	SPEAG								
Certificate No: Z22-60184		Page 1 of 6							



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(86-512) 57355888 (86-512) 57370818 www.sgs.com.cn
(86-512) 57355888 (86-512) 57370818 sgs.china@sgs.com



1.6 D1800V2 - SN 2d170

TTL Calibration Laboratory
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-4230633-2117
E-mail: cti@china.ttl.com

CAICT

Client: **SGS-CN** Certificate No: **Z22-60105**

CALIBRATION CERTIFICATE

Object: **D1800V2 - SN: 2d170**

Calibration Procedure(s): **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

Calibration date: **March 31, 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
Power Meter NRP2	106277	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21 (SPEAG No.EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No.J22X00409)	Jan-23
Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No.J22X00409)	Jan-23

Calibrated by: **Zhao Jing** SAR Test Engineer
Reviewed by: **Lin Hao** SAR Test Engineer
Approved by: **Qi Dianyan** SAR Project Leader

Issued: April 6, 2022
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Certificate No: Z22-60105 Page 1 of 6

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Tel: +86-10-4230633-2117
E-mail: cti@china.ttl.com

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Glossary:
TSL: tissue simulating liquid
ConvF: sensitivity in TSL / NORM_{x,y,z}
N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 855664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:
c) 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: Z22-60105 Page 2 of 6

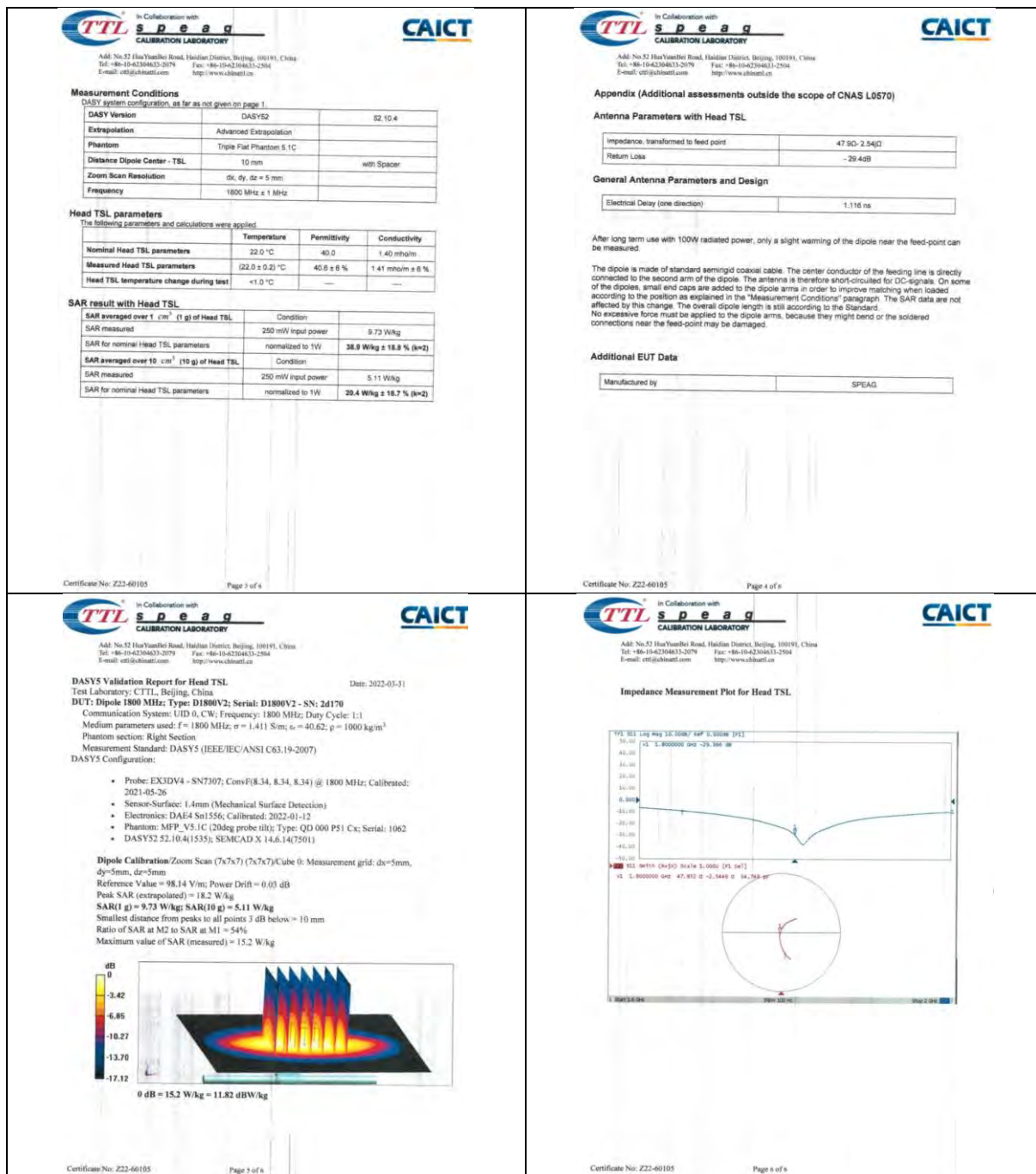


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1.7 D1900V2 - SN 5d136

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Add: No. 52 Huayuan Road, Haidian District, Beijing, 101901 Tel: +86-10-4236403-2117 E-mail: csl@sgs.com.cn		Add: No. 52 Huayuan Road, Haidian District, Beijing, 101901 Tel: +86-10-4236403-2117 E-mail: csl@sgs.com.cn																					
Client: SGS-CN		Certificate No: Z22-60185																					
CALIBRATION CERTIFICATE																							
Object: D1900V2 - SN 5d136																							
Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits																							
Calibration date: June 7, 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 (23±1)°C and humidity <70%.																							
Calibration Equipment used (M&E critical for calibration)																							
<table border="1"><thead><tr><th>Primary Standards</th><th>ID #</th><th>Cal Date (Calibrated by Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Power Meter NRP2</td><td>106277</td><td>24-Sep-21 (CTTL No. J21X08326)</td><td>Sep-22</td></tr><tr><td>Power sensor NRP65</td><td>104291</td><td>24-Sep-21 (CTTL No. J21X08326)</td><td>Sep-22</td></tr><tr><td>Reference Probe EXSDIV4</td><td>SN 7404</td><td>28-Jan-22 (SPEAG No. EX3-7404_Jan22)</td><td>Jan-23</td></tr><tr><td>DSEA</td><td>SN 1558</td><td>12-Jan-22 (CTTL No. J22-60007)</td><td>Jan-23</td></tr></tbody></table>				Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	106277	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Power sensor NRP65	104291	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Reference Probe EXSDIV4	SN 7404	28-Jan-22 (SPEAG No. EX3-7404_Jan22)	Jan-23	DSEA	SN 1558	12-Jan-22 (CTTL No. J22-60007)	Jan-23
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Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]																							
Reviewed by: Name: Lin Hao, Function: SAR Test Engineer, Signature: [Signature]																							
Approved by: Name: Qi Diqian, Function: SAR Project Leader, Signature: [Signature]																							
Issued: June 13, 2022																							
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Certificate No: Z22-60185		Page 1 of 8																					

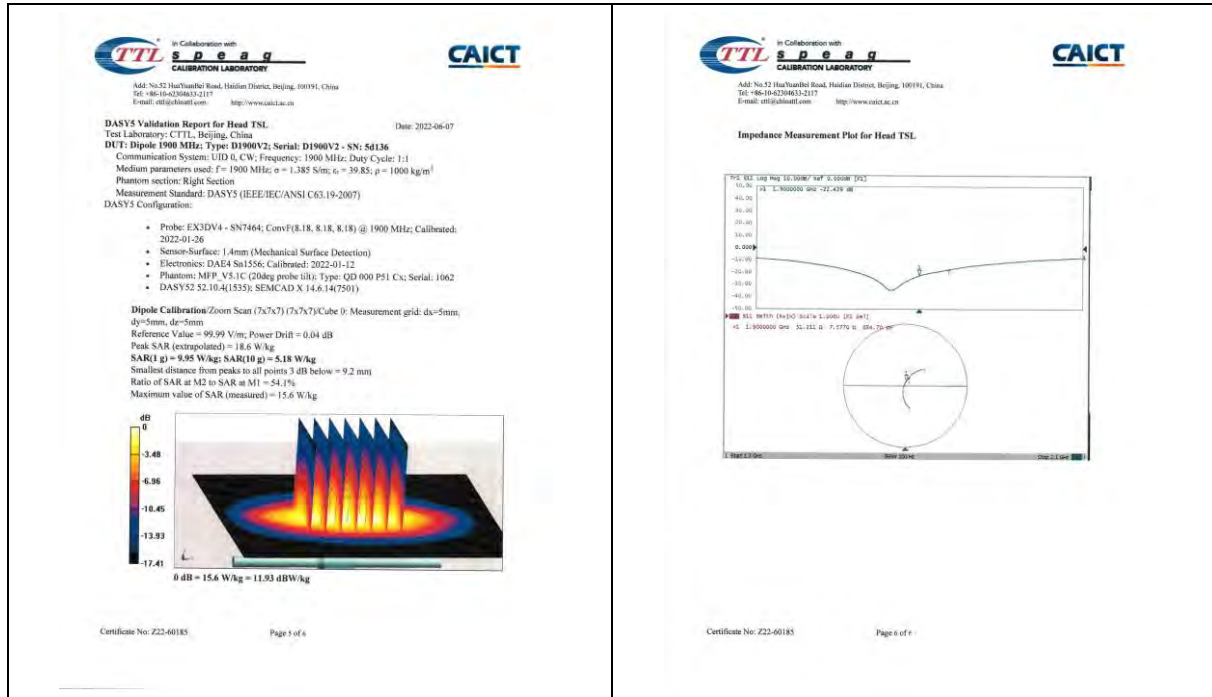
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Measurement Conditions		Appendix (Additional assessments outside the scope of CNAS L0570)	
DASY Version: DASY12		52.10.4	
Extrapolation: Advanced Extrapolation		51.5D ± 1.5dB	
Phantom: Triple Flat Phantom 5.1C		22.4dB	
Distance Dipole Center - TSL: 10 mm		with Spacer	
Zoom Scan Resolution: dx, dy, dz = 5 mm			
Frequency: 1900 MHz ± 1 MHz			
Head TSL parameters		General Antenna Parameters and Design	
The following parameters and calculations were applied:		Electrical Delay (one direction): 1.108 ns	
Nominal Head TSL parameters: Temperature: 22.0 °C, Permittivity: 45.0, Conductivity: 1.40 return			
Measured Head TSL parameters: (22.0 ± 0.5) °C, 39.9 ± 0.5 %, 1.39 return ± 0.5 %			
Head TSL temperature change during test: +1.0 °C			
SAR result with Head TSL		Additional EUT Data	
SAR averaged over 1 cm² (1 g) of Head TSL: Condition: 250 mW input power, 9.65 W/kg		Manufactured by: SPEAG	
SAR for nominal Head TSL parameters: normalized to 1W, 40.0 W/kg ± 16.8 % (k=2)			
SAR averaged over 10 cm² (10 g) of Head TSL: Condition: 250 mW input power, 5.18 W/kg			
SAR for nominal Head TSL parameters: normalized to 1W, 20.0 W/kg ± 16.7 % (k=2)			
Certificate No: Z22-60185		Page 2 of 8	



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(86-512) 57355888 (86-512) 57370818 sgs.china@sgs.com



1.8 D2000V2 - SN 1041

TTL Speaq Calibration Laboratory
 Add: No.52 Huaiyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-420683-1117
 E-mail: ttl@ttspeaq.com http://www.ttspeaq.com

CAICT

Client: SGS-CN Certificate No: Z22-60186

CALIBRATION CERTIFICATE

Object: D2000V2 - SN: 1041

Calibration Procedure(s): FF-Z11-003-01
 Calibration Procedure for dipole validation kits

Calibration date: June 6, 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 (MATE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CITL No. J21K08328)	Sep-22
Power sensor NRP5	104291	24-Sep-21 (CITL No. J21K08328)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22 (SPEAG No. EX3-7464, Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22 (CITL - SPEAG No. Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CITL No. Z22K00408)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CITL No. Z22K00408)	Jan-23

Calibrated by: Zhao Jing SAR Test Engineer

Reviewed by: Lin Hao SAR Test Engineer

Approved by: Qi Danyuan SAR Project Leader

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Certificate No: Z22-60186 Page 1 of 6

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 Add: No.52 Huaiyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-420683-1117
 E-mail: ttl@ttspeaq.com http://www.ttspeaq.com

CAICT

Glossary:

TSL: Issue simulating liquid

ConvF: sensitivity in TSL / NORMx.y.z

N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-Head and Body-Mounted Wireless Communication Devices: Part 1528 Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz), October 2020
- KDB 865564, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/S 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 Parameter 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.
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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: Z22-60186 Page 2 of 6

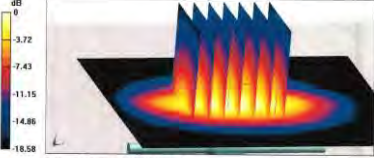
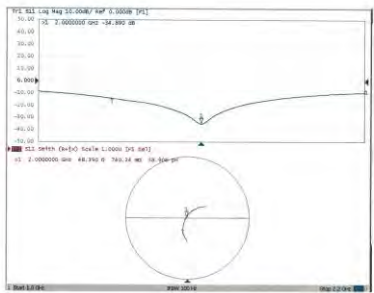


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In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: emil@chinaict.com.cn http://www.chinaict.com.cn Measurement Conditions DASY system configuration, as far as not given on page 1: <table border="1"><tr><td>DASY Version</td><td>DASY52</td><td>52.10.4</td></tr><tr><td>Extrapolation</td><td>Advanced Extrapolation</td><td></td></tr><tr><td>Phantom</td><td>Triple Flat Phantom S.1C</td><td></td></tr><tr><td>Distance Dipole Center - TSL</td><td>10 mm</td><td>with Spacer</td></tr><tr><td>Zoom Scan Resolution</td><td>dx, dy, dz = 5 mm</td><td></td></tr><tr><td>Frequency</td><td>2000 MHz ± 1 MHz</td><td></td></tr></table> Head TSL parameters The following parameters and calculations were applied: <table border="1"><tr><th></th><th>Temperature</th><th>Permittivity</th><th>Conductivity</th></tr><tr><td>Nominal Head TSL parameters</td><td>22.9 °C</td><td>40.0</td><td>1.40 mho/cm</td></tr><tr><td>Measured Head TSL parameters</td><td>(22.0 ± 0.2) °C</td><td>40.2 ± 0.6 %</td><td>1.36 mho/cm ± 0.6 %</td></tr><tr><td>Head TSL temperature change during test</td><td><1.0 °C</td><td></td><td></td></tr></table> SAR result with Head TSL <table border="1"><tr><th></th><th>Condition</th><th></th></tr><tr><td>SAR averaged over 1 cm² (1 g) of Head TSL</td><td></td><td></td></tr><tr><td>SAR measured</td><td>250 mW input power</td><td>10.4 W/kg</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>41.8 W/kg ± 15.8 % (n=2)</td></tr><tr><td>SAR averaged over 10 cm² (10 g) of Head TSL</td><td></td><td></td></tr><tr><td>SAR measured</td><td>250 mW input power</td><td>5.30 W/kg</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>21.3 W/kg ± 18.7 % (n=2)</td></tr></table> Certificate No: Z22-60186 Page 3 of 6	DASY Version	DASY52	52.10.4	Extrapolation	Advanced Extrapolation		Phantom	Triple Flat Phantom S.1C		Distance Dipole Center - TSL	10 mm	with Spacer	Zoom Scan Resolution	dx, dy, dz = 5 mm		Frequency	2000 MHz ± 1 MHz			Temperature	Permittivity	Conductivity	Nominal Head TSL parameters	22.9 °C	40.0	1.40 mho/cm	Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 0.6 %	1.36 mho/cm ± 0.6 %	Head TSL temperature change during test	<1.0 °C				Condition		SAR averaged over 1 cm ² (1 g) of Head TSL			SAR measured	250 mW input power	10.4 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	41.8 W/kg ± 15.8 % (n=2)	SAR averaged over 10 cm ² (10 g) of Head TSL			SAR measured	250 mW input power	5.30 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	21.3 W/kg ± 18.7 % (n=2)	In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: emil@chinaict.com.cn http://www.chinaict.com.cn Appendix (Additional assessments outside the scope of CNAS L0570) Antenna Parameters with Head TSL <table border="1"><tr><td>Impedance, transformed to feed point</td><td>48.4Ω ± 0.74Ω</td></tr><tr><td>Return Loss</td><td>-34.8dB</td></tr></table> General Antenna Parameters and Design <table border="1"><tr><td>Electrical Delay (one direction)</td><td>1.08 ns</td></tr></table> After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. The dipole is made of standard semi-rigid 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 large 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 feed-point may be damaged. Additional EUT Data <table border="1"><tr><td>Manufactured by</td><td>SPEAQ</td></tr></table> Certificate No: Z22-60186 Page 8 of 8	Impedance, transformed to feed point	48.4Ω ± 0.74Ω	Return Loss	-34.8dB	Electrical Delay (one direction)	1.08 ns	Manufactured by	SPEAQ
DASY Version	DASY52	52.10.4																																																														
Extrapolation	Advanced Extrapolation																																																															
Phantom	Triple Flat Phantom S.1C																																																															
Distance Dipole Center - TSL	10 mm	with Spacer																																																														
Zoom Scan Resolution	dx, dy, dz = 5 mm																																																															
Frequency	2000 MHz ± 1 MHz																																																															
	Temperature	Permittivity	Conductivity																																																													
Nominal Head TSL parameters	22.9 °C	40.0	1.40 mho/cm																																																													
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 0.6 %	1.36 mho/cm ± 0.6 %																																																													
Head TSL temperature change during test	<1.0 °C																																																															
	Condition																																																															
SAR averaged over 1 cm ² (1 g) of Head TSL																																																																
SAR measured	250 mW input power	10.4 W/kg																																																														
SAR for nominal Head TSL parameters	normalized to 1W	41.8 W/kg ± 15.8 % (n=2)																																																														
SAR averaged over 10 cm ² (10 g) of Head TSL																																																																
SAR measured	250 mW input power	5.30 W/kg																																																														
SAR for nominal Head TSL parameters	normalized to 1W	21.3 W/kg ± 18.7 % (n=2)																																																														
Impedance, transformed to feed point	48.4Ω ± 0.74Ω																																																															
Return Loss	-34.8dB																																																															
Electrical Delay (one direction)	1.08 ns																																																															
Manufactured by	SPEAQ																																																															
In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: emil@chinaict.com.cn http://www.chinaict.com.cn DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1041 Communication System: UTD 0; CW; Frequency: 2000 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2000 MHz; σ = 1.392 S/m; ε = 40.21; ρ = 1000 kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration: - Probe: EX3DV4 - SN7464; ConvF(R2, R2, R2) @ 2000 MHz; Calibrated: 2022-01-26 - Sensor Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DA64 Sn1556; Calibrated: 2022-01-12 - Phantom: MPP_V5.1C (20kg probe kit); Type: QD 000 P51 Cx; Serial: 1062 - DASY52: S2.10.4(1555); SEMCAD X 14.6.14(7501) Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 103.4 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 19.6 W/kg SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.3 W/kg Smallest distance from peaks to all points 3 dB below = 9.1 mm Ratio of SAR at M2 to SAR at M1 = 51.0% Maximum value of SAR (measured) = 16.3 W/kg  0 dB = 16.3 W/kg = 12.12 dBW/kg Certificate No: Z22-60186 Page 5 of 6	In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: emil@chinaict.com.cn http://www.chinaict.com.cn Impedance Measurement Plot for Head TSL  Certificate No: Z22-60186 Page 6 of 6																																																															

1.9 D2300V2 - SN 1096

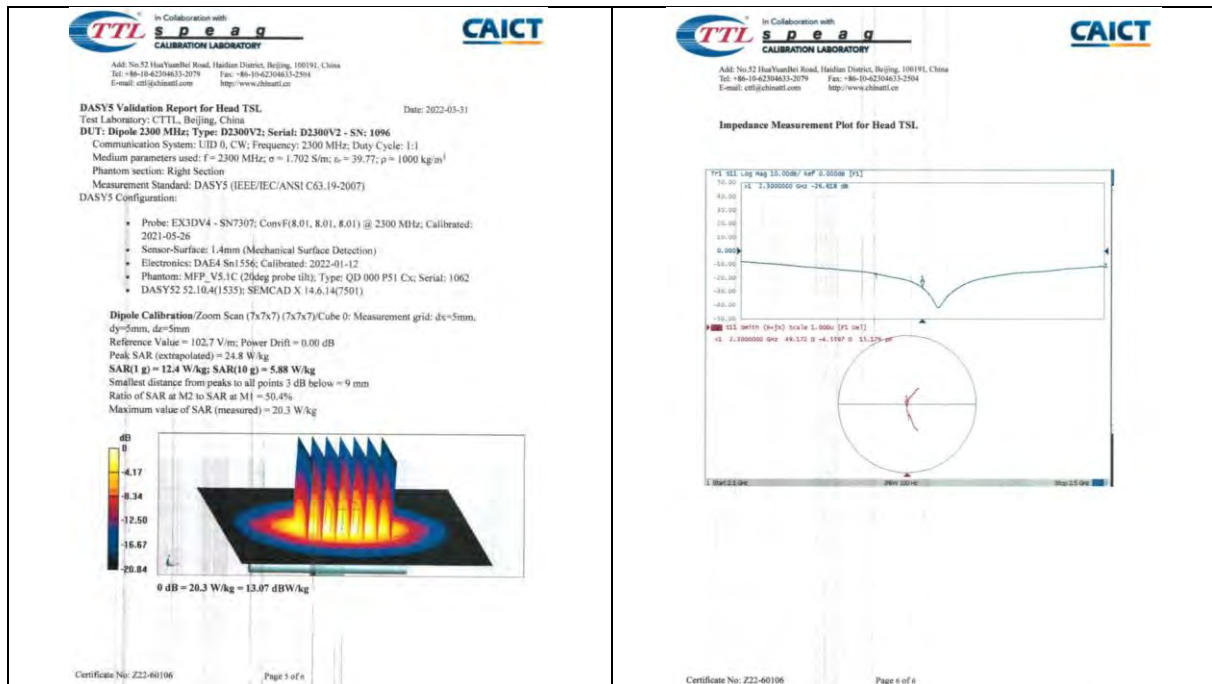
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Client: SGS-CN		Certificate No: Z22-60106	
CALIBRATION CERTIFICATE			
Object	D2300V2 - SN 1096		
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:	March 31, 2022		
This calibration Certificate 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
Power Meter NRP2	106277	24-Sep-21 (CTTL No.J21X08328)	Sep-22
Power sensor NRP8	104291	24-Sep-21 (CTTL No.J21X08328)	Sep-22
Reference Probe EX30V4	SN 7307	26-May-21 (SPEAG No.EK3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No.Z22-60007)	Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4439C	MY49071430	13-Jan-22 (CTTL No.J22X00406)	Jan-23
Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No.J22X00406)	Jan-23
Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Diqian	SAR Project Leader	
Issued: April 6, 2022			
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Certificate No: Z22-60106		Page 1 of 6	
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Measurement Conditions DASY system configuration, as far as not given on page 1:			
DASY Version	DASY2	52.10.4	
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	2300 MHz ± 1 MHz		
Head TSL parameters The following parameters and calculations were applied:			
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 9 %	1.70 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	
SAR result with Head TSL			
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	12.4 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	49.2 W/kg ± 18.8 % (k=2)	
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	5.88 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	23.4 W/kg ± 18.7 % (k=2)	
Certificate No: Z22-60106		Page 3 of 6	
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Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL			
Impedance, transformed to feed point	45.20 - 4.50j		
Return Loss	-26.6dB		
General Antenna Parameters and Design			
Electrical Delay (one direction)	1.083 ns		
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 backed 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 feed-point may be damaged.			
Additional EUT Data			
Manufactured by	SPEAG		
Certificate No: Z22-60106		Page 4 of 6	



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1.10 D2450V2 - SN 817

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Client: **SGS-CN** Certificate No: **Z22-60107**

CALIBRATION CERTIFICATE

Object: **D2450V2 - SN: 817**

Calibration Procedure(s): **FF-Z1(1-003-3)**
Calibration Procedures for dipole validation kits

Calibration date: **April 1, 2022**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements [B]. 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&E critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Power Meter: NRP2	106277	24-Sep-21 (CTTL No.J21X08320)	Sep-22
Power sensor: NRP8S	104291	24-Sep-21 (CTTL No.J21X08320)	Sep-22
Reference Probe EX3DV4	SN 7307	25-May-21(SPEAG No EX3-7307_May21)	May-22
DAE4	SN 1555	12-Jan-22(CTTL-SPEAG No Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No. J22X00406)	Jan-23
Network Analyzer E5071C	MY48110873	14-Jan-22 (CTTL No. J22X00406)	Jan-23

Calibrated by: **Zhao Jing** SAR Test Engineer
Reviewed by: **Liu Hao** SAR Test Engineer
Approved by: **Qi Dianyan** SAR Project Leader

Issued: April 6, 2022

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Glossary:

TSL: tissue simulating liquid
ConvF: sensitivity in TSL / NORMix.y.z
N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
b) KDB 865684, "SAR Measurement Requirements for 100 MHz to 5 GHz"

Additional Documentation:

c) 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: Z22-60107 Page 2 of 5

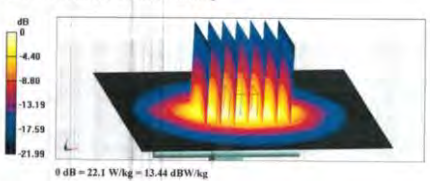
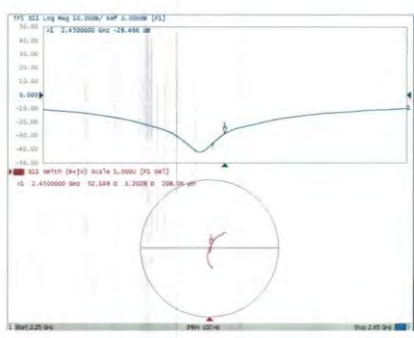


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Measurement Conditions DASY system configuration, as far as not given on page 1:			
DASY Version	DASY52	52.10.4	
Extrapolation	Advanced Extrapolation		
Phantom	Triple Flat Phantom 5.1C		
Distance Dipole Center - TSL	10 mm	with Spacer	
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	2450 MHz ± 1 MHz		
Head TSL parameters The following parameters and calculations were applied:			
Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 6 %	1.79 mho/m ± 8 %
Head TSL temperature change during test	+1.0 °C	—	—
SAR result with Head TSL			
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	13.2 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	6.15 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 18.7 % (k=2)	
Certificate No: Z22-40107 Page 3 of 6			
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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 2022-04-01 DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 817 Communication System: UTD 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; σ = 1.79 S/m; ε = 39.52; ρ = 1000 kg/m ³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration: - Probe: EX3DV4 - SN7307; ConvF(7.75, 7.75) @ 2450 MHz; Calibrated: 2021-05-26 - Sensor-Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DA14 Snt1556; Calibrated: 2022-01-12 - Phantom: MFP-V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 - DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501) Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 104.6 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 27.0 W/kg SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.15 W/kg Smallest distance from peaks to all points 3 dB below = 8.9 mm Ratio of SAR at M2 to SAR at M1 = -49.2% Maximum value of SAR (measured) = 22.1 W/kg			
			
Certificate No: Z22-40107 Page 4 of 6			
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Impedance Measurement Plot for Head TSL			
			
Certificate No: Z22-40107 Page 5 of 6			



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1.11 D2600V2 - SN 1158

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Client: SGS-CN	Certificate No: Z22-60108		
CALIBRATION CERTIFICATE			
Object:	D2600V2 - SN: 1158		
Calibration Procedure(s):	FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:	March 31, 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 (23±3)°C and humidity<70%.			
Calibration Equipment used (MSTE critical for calibration)			
Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	102377	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Reference Probe EX3/DVA	SN 7307	26-May-21 (SPEAG No EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No Z22-60007)	Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E5438C	MY49071430	13-Jan-22 (CTTL No.Z22X00406)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No.Z22X00406)	Jan-23
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: April 6, 2022			
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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 S.1C		
Distance Dipole Center - TSL	10 mm	with Spacer	
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	2600 MHz ± 1 MHz		
Head TSL parameters			
The following parameters and calculations were applied:			
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	38.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.96 mho/m ± 6 %
Head TSL temperature change during test	< ± 0.2 °C	---	
SAR result with Head TSL			
SAR averaged over 1 cm ² (1 g) of Head TSL		Condition	
SAR measured		250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	54.8 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ² (10 g) of Head TSL		Condition	
SAR measured		250 mW input power	6.12 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	24.5 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	49.90 - j6.49Ω		
Return Loss	-23.9dB		
General Antenna Parameters and Design			
Electrical Delay (one direction)	1.053 ns		
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.			
Additional EUT Data			
Manufactured by	SPEAG		

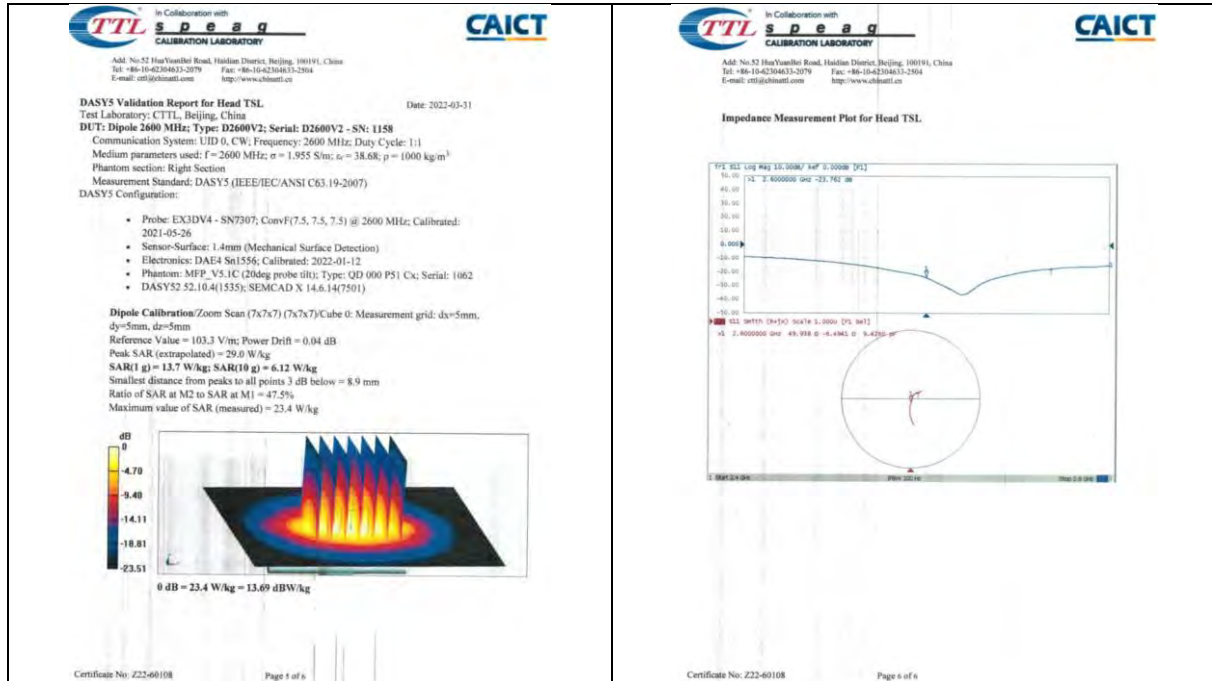


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1.12 D5GHZV2 - SN 1095

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Client: **SGS-CN** Certificate No: **Z22-60187**

CALIBRATION CERTIFICATE

Object: **D5GHZV2 - SN 1095**

Calibration Procedure(s): **FF-Z11-003-01**
Calibration Procedures for dipole validation kit

Calibration date: **June 1, 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 (23±3)°C and humidity <70%.

Calibration Equipment used (MSTE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CCTL No. J2100328)	Sep-22
Power sensor NRP8	104201	24-Sep-21 (CCTL No. J2100328)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22 (SPEAG No. EX3-7464, Jan22)	Jan-23
DA64	SN 1556	12-Jan-22 (CCTL-SPEAG No. Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY48071430	13-Jan-22 (CCTL No. J22000408)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CCTL No. J22000406)	Jan-23

Calibrated by: **Zhao Jing** SAR Test Engineer

Reviewed by: **Liu Hao** SAR Test Engineer

Approved by: **Qi Dianyan** SAR Project Leader

Issued: June 6, 2022

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Glossary:

TSL: Issue simulating liquid

CompF: sensitivity in TSL + NORMk_{y,z}

N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure for the Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices-Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020

b) KDB 665664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY45 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 station 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 SAR system configuration, as for as not given on page 1.			
DASY Version		DASY2	
Extrapolation		Advanced Extrapolation	
Phantom		Triple Flat Phantom S1C	
Distance Dipole Center - TSL		10 mm	
Zoom Scan Resolution		dx, dy = 4 mm, dz = 1.4 mm	
Frequency		3000 MHz ± 1 MHz 3500 MHz ± 1 MHz 3800 MHz ± 1 MHz 5800 MHz ± 1 MHz	
Head TSL parameters at 5200MHz The following parameters and calculations were applied.			
Nominal Head TSL parameters		Temperature	22.0 °C
Measured Head TSL parameters		Permittivity	35.9
Head TSL temperature change during test		Conductivity	4.68 mho/m
			4.73 mho/m ± 5 %
SAR result with Head TSL at 5200MHz The following parameters and calculations were applied.			
SAR averaged over 1 cm ³ (1 g) of Head TSL		Condition	
SAR measured		100 mW input power	7.54 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	75.4 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL		Condition	
SAR measured		100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	22.7 W/kg ± 24.2 % (k=2)
Head TSL parameters at 5500MHz The following parameters and calculations were applied.			
Nominal Head TSL parameters		Temperature	22.0 °C
Measured Head TSL parameters		Permittivity	35.8
Head TSL temperature change during test		Conductivity	4.68 mho/m
			4.64 mho/m ± 5 %
SAR result with Head TSL at 5500MHz The following parameters and calculations were applied.			
SAR averaged over 1 cm ³ (1 g) of Head TSL		Condition	
SAR measured		100 mW input power	8.26 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	82.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL		Condition	
SAR measured		100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	23.4 W/kg ± 24.2 % (k=2)
Certificate No: Z22-60187 Page 4 of 10			

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Head TSL parameters at 5600MHz The following parameters and calculations were applied.			
Nominal Head TSL parameters		Temperature	22.0 °C
Measured Head TSL parameters		Permittivity	35.5
Head TSL temperature change during test		Conductivity	5.07 mho/m
			5.05 mho/m ± 5 %
SAR result with Head TSL at 5600MHz The following parameters and calculations were applied.			
SAR averaged over 1 cm ³ (1 g) of Head TSL		Condition	
SAR measured		100 mW input power	8.12 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	81.2 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL		Condition	
SAR measured		100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	23.8 W/kg ± 24.2 % (k=2)
Head TSL parameters at 5800MHz The following parameters and calculations were applied.			
Nominal Head TSL parameters		Temperature	22.0 °C
Measured Head TSL parameters		Permittivity	35.3
Head TSL temperature change during test		Conductivity	5.27 mho/m
			5.25 mho/m ± 5 %
SAR result with Head TSL at 5800MHz The following parameters and calculations were applied.			
SAR averaged over 1 cm ³ (1 g) of Head TSL		Condition	
SAR measured		100 mW input power	7.71 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	77.1 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL		Condition	
SAR measured		100 mW input power	2.16 W/kg
SAR for nominal Head TSL parameters		normalized to 1W	21.6 W/kg ± 24.2 % (k=2)
Certificate No: Z22-60187 Page 5 of 10			

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Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL at 5200MHz			
Impedance, transformed to feed point		48.10 - j0.03j	
Return Loss		-23.8dB	
Antenna Parameters with Head TSL at 5300MHz			
Impedance, transformed to feed point		47.80 - 2.42j	
Return Loss		-23.5dB	
Antenna Parameters with Head TSL at 5500MHz			
Impedance, transformed to feed point		50.30 - 4.36j	
Return Loss		-27.4dB	
Antenna Parameters with Head TSL at 5600MHz			
Impedance, transformed to feed point		54.80 - 4.86j	
Return Loss		-24.6dB	
Antenna Parameters with Head TSL at 5800MHz			
Impedance, transformed to feed point		51.50 - 5.61j	
Return Loss		-24.9dB	
Certificate No: Z22-60187 Page 6 of 10			

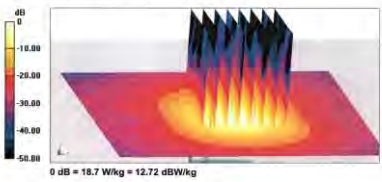
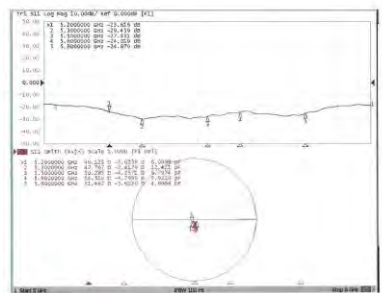


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In Collaboration with TTL CAICT Address: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@caict.ac.cn http://www.caict.ac.cn General Antenna Parameters and Design Electrical Delay (one direction): 1.101 ns After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. The dipole is made of standard semirigid coaxial cable. The carrier conductor of the feeding line is directly connected to the second arm of the dipole. This 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 feed-point may be damaged. Additional EUT Data Manufactured by: SPEAG Certificate No: Z22-60187 Page 1 of 6	In Collaboration with TTL CAICT Address: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@caict.ac.cn http://www.caict.ac.cn DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 2022-09-01 DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1095 Communication System: CW; Frequency: 5200 MHz; Frequency: 5300 MHz; Frequency: 5500 MHz; Frequency: 5600 MHz; Frequency: 5800 MHz; Duty Cycle: 1:1 Medium parameters used: $f = 5200 \text{ MHz}$; $\sigma = 4.82 \text{ S/m}$; $\epsilon = 35.39$; $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: $f = 5300 \text{ MHz}$; $\sigma = 4.73 \text{ S/m}$; $\epsilon = 35.19$; $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: $f = 5500 \text{ MHz}$; $\sigma = 4.939 \text{ S/m}$; $\epsilon = 34.83$; $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: $f = 5600 \text{ MHz}$; $\sigma = 5.051 \text{ S/m}$; $\epsilon = 34.89$; $\rho = 1000 \text{ kg/m}^3$ Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 5.247 \text{ S/m}$; $\epsilon = 34.42$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C38.19-2007) DASY5 Configuration: - Probe: EX3DV4 - SN7484; ConvF(5.6, 5.6, 5.6) @ 5200 MHz; ConvF(5.32, 5.32, 5.32) @ 5300 MHz; ConvF(5.11, 5.11, 5.11) @ 5500 MHz; ConvF(4.91, 4.91, 4.91) @ 5600 MHz; ConvF(5.5, 5.5, 5.5) @ 5800 MHz; Calibrated: 2022-01-26 - Sensor-Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DA84 Sn1556; Calibrated: 2022-01-12 - Phantom: MPF_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 - DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501) Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 60.80 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 29.8 W/kg SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.22 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 66.8% Maximum value of SAR (measured) = 19.3 W/kg Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 61.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 65.5% Maximum value of SAR (measured) = 19.0 W/kg Certificate No: Z22-60187 Page 2 of 6
In Collaboration with TTL CAICT Address: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@caict.ac.cn http://www.caict.ac.cn 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 = 61.92 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 34.7 W/kg SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.34 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 63.9% Maximum value of SAR (measured) = 20.2 W/kg Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 65.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 35.3 W/kg SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 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) = 19.1 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 = 62.13 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 34.8 W/kg SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.16 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 61.6% Maximum value of SAR (measured) = 18.7 W/kg  Certificate No: Z22-60187 Page 3 of 6	In Collaboration with TTL CAICT Address: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@caict.ac.cn http://www.caict.ac.cn Impedance Measurement Plot for Head TSL  Certificate No: Z22-60187 Page 4 of 6



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2 DAE4 - SN 1245

Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland Phone +41 (0) 43 970, Fax +41 (0) 43 971 www.speag.ch, info@speag.ch s p e a g IMPORTANT NOTICE USAGE OF THE DAE4 The DAE4 unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE4. Special attention shall be given to the following points: Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE4 to wear out. Shipping of the DAE4: Before shipping the DAE4 to SPEAG for calibration, remove the batteries and pack the DAE4 in an anti-static bag. This anti-static bag shall then be packed into a larger box or container which protects the DAE4 from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside. E-stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE4 carefully and keep the DAE4 unit in a non-dusty environment if not used for measurements. Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough nonprofessional handling caused the defect. DASY Configuration Files: Since the exact values of the DAE4 input resistances, as measured during the calibration procedure of a DAE4 unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file. Important Note: Warning and calibration is void if the DAE4 unit is disassembled partly or fully by the Customer. Important Note: Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure. Important Note: To prevent damage of the DAE4 probe connector pins, use great care when installing the probe to the DAE4. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE4 while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE4. TN_EH190326AE_DAE4.docx 07.03.2019	Calibration Laboratory of Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland 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: SGS-CN (Auden) Certificate No.: DAE4-1245_May22 Accreditation No.: SCS 0108 CALIBRATION CERTIFICATE Object: DAE4 - SD 000 D04 BM - SN: 1245 Calibration procedure(s): QA CAL-06 v30 Calibration procedure for the data acquisition electronics (DAE) Calibration date: May 30, 2022 This calibration certificate documents the traceability to national standards, which include the physical units of measurement (SI). The measurement 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 ± 1 °C and humidity < 70%). Calibration Equipment used (MATE critical for calibration) <table border="1"><thead><tr><th>Primary Standards</th><th>ID #</th><th>Due Date (Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Kathrein Multimeter Type 2001</td><td>SN: 0810278</td><td>31-Aug-21 (No: 31368)</td><td>Aug-22</td></tr></tbody></table> <table border="1"><thead><tr><th>Secondary Standards</th><th>ID #</th><th>Check Date (in hours)</th><th>Scheduled Check</th></tr></thead><tbody><tr><td>Auto DAE Calibration Unit</td><td>SE LWS 05A AA 1001</td><td>24-Jan-22 (in hours check)</td><td>In house check: Jan-22</td></tr><tr><td>Calibration Box V2.1</td><td>SE LWS 00B AA 1002</td><td>24-Jan-22 (in hours check)</td><td>In house check: Jan-22</td></tr></tbody></table> Calibrated by: Dominique Stiller Function: Laboratory Technician Signature: <i>[Signature]</i> Approved by: (Ben Kuhn) Technical Manager Signature: <i>[Signature]</i> This calibration certificate shall not be reproduced except in full without written approval of the laboratory. Certificate No: DAE4-1245_May22 Page 1 of 5	Primary Standards	ID #	Due Date (Certificate No.)	Scheduled Calibration	Kathrein Multimeter Type 2001	SN: 0810278	31-Aug-21 (No: 31368)	Aug-22	Secondary Standards	ID #	Check Date (in hours)	Scheduled Check	Auto DAE Calibration Unit	SE LWS 05A AA 1001	24-Jan-22 (in hours check)	In house check: Jan-22	Calibration Box V2.1	SE LWS 00B AA 1002	24-Jan-22 (in hours check)	In house check: Jan-22
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Calibration Laboratory of Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland 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 Accreditation No.: SCS 0108 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 following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty. • DC Voltage Measurement Linearity: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement. • Common mode sensitivity: Influence of a positive or negative common mode voltage on the differential measurement. • Channel separation: Influence of a voltage on the neighbor channels not subject to an input voltage. • AD Converter Values with inputs shorted: Values on the internal AD converter corresponding to zero input voltage. • Input Offset Measurement: Output voltage and statistical results over a large number of zero voltage measurements. • Input Offset Current: Typical value for information; Maximum channel input offset current, not considering the input resistance. • Input resistance: Typical value for information; DAE input resistance at the connector, during internal auto-zeroing and during measurement. • Low Battery Alarm Voltage: Typical value for information. Below this voltage, a battery alarm signal is generated. • Power consumption: Typical value for information. Supply currents in various operating modes. Certificate No: DAE4-1245_May22 Page 2 of 5	DC Voltage Measurement AD - Converter Resolution nominal High Range: 1LSB = 6.1 μV, full range = -190...+320 mV Low Range: 1LSB = 61 μV, full range = -1...+32 mV DASY measurement parameters: Auto Zero-Time: 3 sec; Measuring time: 3 sec <table border="1"><thead><tr><th>Calibration Factors</th><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>High Range</td><td>405.265 ± 0.02% (k=2)</td><td>403.974 ± 0.02% (k=2)</td><td>406.092 ± 0.02% (k=2)</td></tr><tr><td>Low Range</td><td>3.99534 ± 1.50% (k=2)</td><td>3.99508 ± 1.50% (k=2)</td><td>4.01015 ± 1.50% (k=2)</td></tr></tbody></table> Connector Angle <table border="1"><thead><tr><th>Connector Angle to be used in DASY system</th><th>30.0° ± 1°</th></tr></thead></table> Certificate No: DAE4-1245_May22 Page 3 of 5	Calibration Factors	X	Y	Z	High Range	405.265 ± 0.02% (k=2)	403.974 ± 0.02% (k=2)	406.092 ± 0.02% (k=2)	Low Range	3.99534 ± 1.50% (k=2)	3.99508 ± 1.50% (k=2)	4.01015 ± 1.50% (k=2)	Connector Angle to be used in DASY system	30.0° ± 1°						
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No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300
中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300

t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn
t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	19994.45	1.52	0.00
Channel X - Input	20004.58	2.22	0.01
Channel X + Input	-20000.14	1.12	-0.01
Channel Y + Input	19994.72	1.58	0.00
Channel Y - Input	20001.22	-1.00	-0.00
Channel Y + Input	-20003.05	-1.57	0.01
Channel Z + Input	19992.44	0.19	0.00
Channel Z - Input	20003.09	0.58	0.00
Channel Z + Input	-20001.73	-0.27	0.00

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2001.91	0.41	0.02
Channel X - Input	202.54	0.65	0.32
Channel X + Input	-197.86	0.07	-0.04
Channel Y + Input	2002.05	0.58	0.03
Channel Y - Input	201.27	-0.67	-0.28
Channel Y + Input	-196.23	-0.06	0.03
Channel Z + Input	2001.96	0.08	0.00
Channel Z - Input	200.09	-1.03	-0.76
Channel Z + Input	-199.85	-1.57	0.79

2. Common mode sensitivity

Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	-5.87	-7.69
-200	9.12	7.79
Channel Y	-8.68	-9.28
-200	8.52	6.36
Channel Z	-5.36	-5.60
-200	3.58	3.08

3. Channel separation

Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	4.07
Channel Y	200	9.36	-
Channel Z	200	10.11	7.14

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4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15984	17040
Channel Y	16562	16768
Channel Z	16035	15968

5. Input Offset Measurement

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

Input (mV)	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	1.00	-0.15	1.93	0.45
Channel Y	-0.18	-1.28	0.94	0.45
Channel Z	-0.58	-2.81	0.58	0.60

6. Input Offset Current

Nominal input circuitry offset current on all channels: <25nA

7. Input Resistance (Typical values for information)

	Zeroing (Ohm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	-8	+14
Supply (- Vcc)	-0.01	-8	-8

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3 EX3DV4 - SN 7346

Calibration Laboratory of Schmid & Partner Engineering AG Zugstrasse 6, 8400 Zug, Switzerland 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: Auden Certificate No: EX3-7346_May22 Accreditation No.: SCS 0108 Calibration Certificate Object: EX3DV4 - SN 7346 Calibration procedure: QA CAL-01 vs. QA CAL-14 vs. QA CAL-23 vs. QA CAL-25-V Calibration procedure for domestic E-field probes Calibration date: March 30, 2022 This calibration certificate documents the traceability to national standards, which require the physical units of measurement (SI). The measurement 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, environmental temperature (22 ± 0.1 °C and humidity < 70%). Calibration Equipment used (MKE): (not for calibration): Primary Standards: <table><tr><th>SI</th><th>Cal Date (Certificate No.)</th><th>Scheduled Calibration</th></tr><tr><td>Power meter MPE</td><td>08-Apr-21 No. 217-0501-0303</td><td>Apr-22</td></tr><tr><td>Power sensor MPE-291</td><td>08-Apr-21 No. 217-0501-0301</td><td>Apr-22</td></tr><tr><td>Power sensor MPE-291</td><td>08-Apr-21 No. 217-0502</td><td>Apr-22</td></tr><tr><td>Reference 20 dB attenuator</td><td>08-Apr-21 No. 217-0503</td><td>Apr-22</td></tr><tr><td>DAK4</td><td>13-Dec-21 No. DAE4-063-04011</td><td>Dec-22</td></tr><tr><td>Reference Probe E3202</td><td>07-Dec-21 No. E33-0013-00011</td><td>Dec-22</td></tr></table> Secondary Standards: <table><tr><th>SI</th><th>Check Date (in house)</th><th>Scheduled Date</th></tr><tr><td>Power meter E4130</td><td>08-Apr-21 in house check (Jan-22)</td><td>In house check (Jan-22)</td></tr><tr><td>Power sensor E4130A</td><td>08-Apr-21 in house check (Jan-22)</td><td>In house check (Jan-22)</td></tr><tr><td>Power sensor E4130A</td><td>08-Apr-21 in house check (Jan-22)</td><td>In house check (Jan-22)</td></tr><tr><td>Power sensor E4130A</td><td>08-Apr-21 in house check (Jan-22)</td><td>In house check (Jan-22)</td></tr><tr><td>RF generator HP 8360A</td><td>08-Apr-21 in house check (Jan-22)</td><td>In house check (Jan-22)</td></tr><tr><td>Network Analyzer B 8300A</td><td>07-Apr-21 in house check (Jan-22)</td><td>In house check (Jan-22)</td></tr></table> Calibrated by: Hans-Joachim Fritzsche Approved by: Hans-Joachim Fritzsche Issued: March 31, 2022 This calibration certificate and not be reproduced (except in full) without written approval of the laboratory. 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The frequency response is implemented in DASY software version 4.2. The uncertainty of the frequency response is included in the stated uncertainty of Comp - OCF(x,y,z): OCF are numerical evaluation parameters assessed based on the data of power sweep with CW signal (no uncertainty required). OCF does not depend on frequency nor media - PAC: PAC is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics - A(x,y,z), B(x,y,z), C(x,y,z), D(x,y,z), V(x,y,z), A, B, C, D are numerical evaluation parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. V(x,y,z) is the maximum calibration range expressed in RMS voltage across the probe <tr><td>Comp: and Boundary Effect Parameters: Assessed in the probe using E-field (or Temperature Transfer Standard for f < 400 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 400 MHz. The same values are used for assessment of the parameters applied by boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are NORM(x,y,z) = NORM(x,y,z) * Comp; the uncertainty corresponds to that given for Comp. A frequency dependent Comp is used in DASY version 4.4 and higher which always exceeding this validity from > 50 MHz to > 100 MHz</td><td>Subtotal accuracy (SD-revision from revision) in a field of low gradients measured using a flat phantom exposed by a patch antenna</td><td>Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (see probe axis). No tolerance required</td><td>Connector Angle: The angle is assessed using the information given by determining the NORM(x,y,z) uncertainty required</td></tr> Certificate No: EX3-7346_May22 Page 2 of 24	Comp: and Boundary Effect Parameters: Assessed in the probe using E-field (or Temperature Transfer Standard for f < 400 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 400 MHz. The same values are used for assessment of the parameters applied by boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are NORM(x,y,z) = NORM(x,y,z) * Comp; the uncertainty corresponds to that given for Comp. 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No.10, Weyue Road, Innovation Park, Kunshan, Jiangsu, China 215300
中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300

(86-512) 57355888 (86-512) 57370818 www.sgsgroup.com.cn
(86-512) 57355888 (86-512) 57370818 sgs.china@sgs.com

EX3DV4 - SN:7346

March 30, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

Sensor Model Parameters

	C1	C2	α	T1	T2	T3	T4	T5	T6
	°F	°F	V ⁻¹	ms V ⁻¹	ms V ⁻¹	ms V ⁻¹	V ⁻¹	V ⁻¹	V ⁻¹
X	39.3	291.80	35.10	5.83	0.03	5.02	1.42	0.12	1.01
Y	37.1	270.84	34.12	8.29	0.00	5.01	1.82	0.05	1.61
Z	39.2	291.74	33.17	8.29	0.00	5.04	1.43	0.10	1.01

Other Probe Parameters	
Sensor Arrangement	Triangular
Connector Angle (°)	-166.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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

[†] The uncertainties of $\Delta \text{H}_{\text{H}2\text{O}}$ in 8, 9, 2 do not affect the H^+ -acid uncertainty in $\Delta \text{H}_{\text{H}2\text{O}}$ (see Pages 2 and 6).

Coefficient Mo: EX17346 Mar22

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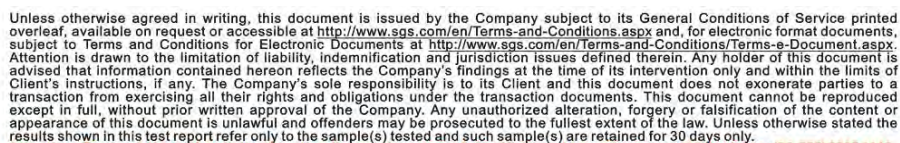
DASY/EASY - Parameters of Probe: FX3DV4 - SN:7346

f (MHz)	Relative Permittivity ^a	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha ^b	Depth ^c (mm)	Unc. (mm)
6500	34.5	6.07	5.30	5.30	5.30	0.20	2.50	± 18.6

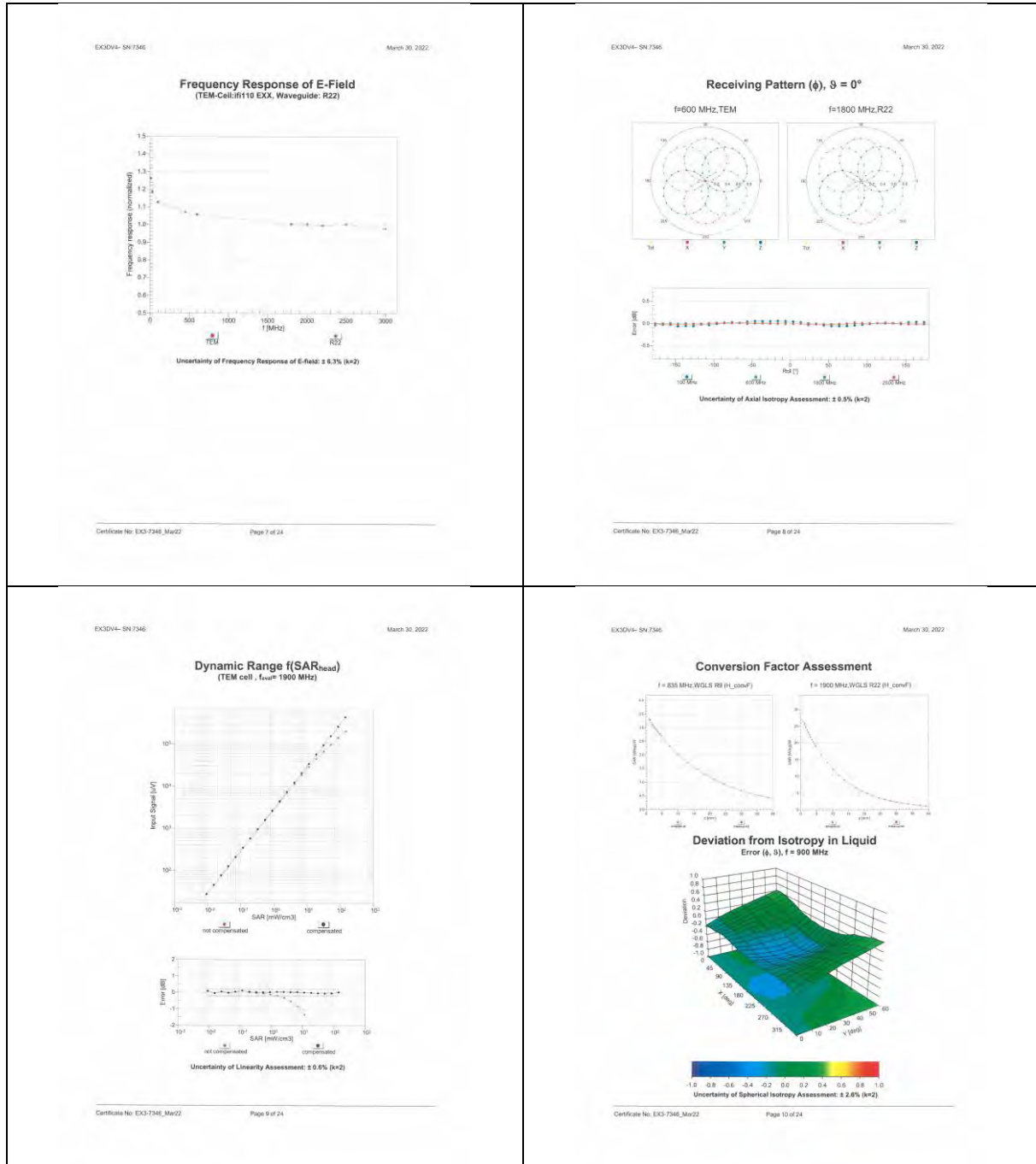
^a Frequency always above 300 MHz or a 100 MHz only applies for GAST v4 and higher; see page 2). Explicitly, it is restricted to 50 MHz. The uncertainty in the RSS of the Conf' associated to calibration frequency and the uncertainty for the indicated frequency value. Frequency values: 6 MHz at 10, 25, 40, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300, 325, 350, 375, 400, 425, 450, 475, 500, 525, 550, 575, 600, 625, 650, 675, 700, 725, 750, 775, 800, 825, 850, 875, 900, 925, 950, 975, 1000, 1025, 1050, 1075, 1100, 1125, 1150, 1175, 1200, 1225, 1250, 1275, 1300, 1325, 1350, 1375, 1400, 1425, 1450, 1475, 1500, 1525, 1550, 1575, 1600, 1625, 1650, 1675, 1700, 1725, 1750, 1775, 1800, 1825, 1850, 1875, 1900, 1925, 1950, 1975, 2000, 2025, 2050, 2075, 2100, 2125, 2150, 2175, 2200, 2225, 2250, 2275, 2300, 2325, 2350, 2375, 2400, 2425, 2450, 2475, 2500, 2525, 2550, 2575, 2600, 2625, 2650, 2675, 2700, 2725, 2750, 2775, 2800, 2825, 2850, 2875, 2900, 2925, 2950, 2975, 3000, 3025, 3050, 3075, 3100, 3125, 3150, 3175, 3200, 3225, 3250, 3275, 3300, 3325, 3350, 3375, 3400, 3425, 3450, 3475, 3500, 3525, 3550, 3575, 3600, 3625, 3650, 3675, 3700, 3725, 3750, 3775, 3800, 3825, 3850, 3875, 3900, 3925, 3950, 3975, 4000, 4025, 4050, 4075, 4100, 4125, 4150, 4175, 4200, 4225, 4250, 4275, 4300, 4325, 4350, 4375, 4400, 4425, 4450, 4475, 4500, 4525, 4550, 4575, 4600, 4625, 4650, 4675, 4700, 4725, 4750, 4775, 4800, 4825, 4850, 4875, 4900, 4925, 4950, 4975, 5000, 5025, 5050, 5075, 5100, 5125, 5150, 5175, 5200, 5225, 5250, 5275, 5300, 5325, 5350, 5375, 5400, 5425, 5450, 5475, 5500, 5525, 5550, 5575, 5600, 5625, 5650, 5675, 5700, 5725, 5750, 5775, 5800, 5825, 5850, 5875, 5900, 5925, 5950, 5975, 6000, 6025, 6050, 6075, 6100, 6125, 6150, 6175, 6200, 6225, 6250, 6275, 6300, 6325, 6350, 6375, 6400, 6425, 6450, 6475, 6500, 6525, 6550, 6575, 6600, 6625, 6650, 6675, 6700, 6725, 6750, 6775, 6800, 6825, 6850, 6875, 6900, 6925, 6950, 6975, 7000, 7025, 7050, 7075, 7100, 7125, 7150, 7175, 7200, 7225, 7250, 7275, 7300, 7325, 7350, 7375, 7400, 7425, 7450, 7475, 7500, 7525, 7550, 7575, 7600, 7625, 7650, 7675, 7700, 7725, 7750, 7775, 7800, 7825, 7850, 7875, 7900, 7925, 7950, 7975, 8000, 8025, 8050, 8075, 8100, 8125, 8150, 8175, 8200, 8225, 8250, 8275, 8300, 8325, 8350, 8375, 8400, 8425, 8450, 8475, 8500, 8525, 8550, 8575, 8600, 8625, 8650, 8675, 8700, 8725, 8750, 8775, 8800, 8825, 8850, 8875, 8900, 8925, 8950, 8975, 9000, 9025, 9050, 9075, 9100, 9125, 9150, 9175, 9200, 9225, 9250, 9275, 9300, 9325, 9350, 9375, 9400, 9425, 9450, 9475, 9500, 9525, 9550, 9575, 9600, 9625, 9650, 9675, 9700, 9725, 9750, 9775, 9800, 9825, 9850, 9875, 9900, 9925, 9950, 9975, 10000, 10025, 10050, 10075, 10100, 10125, 10150, 10175, 10200, 10225, 10250, 10275, 10300, 10325, 10350, 10375, 10400, 10425, 10450, 10475, 10500, 10525, 10550, 10575, 10600, 10625, 10650, 10675, 10700, 10725, 10750, 10775, 10800, 10825, 10850, 10875, 10900, 10925, 10950, 10975, 11000, 11025, 11050, 11075, 11100, 11125, 11150, 11175, 11200, 11225, 11250, 11275, 11300, 11325, 11350, 11375, 11400, 11425, 11450, 11475, 11500, 11525, 11550, 11575, 11600, 11625, 11650, 11675, 11700, 11725, 11750, 11775, 11800, 11825, 11850, 11875, 11900, 11925, 11950, 11975, 12000, 12025, 12050, 12075, 12100, 12125, 12150, 12175, 12200, 12225, 12250, 12275, 12300, 12325, 12350, 12375, 12400, 12425, 12450, 12475, 12500, 12525, 12550, 12575, 12600, 12625, 12650, 12675, 12700, 12725, 12750, 12775, 12800, 12825, 12850, 12875, 12900, 12925, 12950, 12975, 13000, 13025, 13050, 13075, 13100, 13125, 13150, 13175, 13200, 13225, 13250, 13275, 13300, 13325, 13350, 13375, 13400, 13425, 13450, 13475, 13500, 13525, 13550, 13575, 13600, 13625, 13650, 13675, 13700, 13725, 13750, 13775, 13800, 13825, 13850, 13875, 13900, 13925, 13950, 13975, 14000, 14025, 14050, 14075, 14100, 14125, 14150, 14175, 14200, 14225, 14250, 14275, 14300, 14325, 14350, 14375, 14400, 14425, 14450, 14475, 14500, 14525, 14550, 14575, 14600, 14625, 14650, 14675, 14700, 14725, 14750, 14775, 14800, 14825, 14850, 14875, 14900, 14925, 14950, 14975, 15000, 15025, 15050, 15075, 15100, 15125, 15150, 15175, 15200, 15225, 15250, 15275, 15300, 15325, 15350, 15375, 15400, 15425, 15450, 15475, 15500, 15525, 15550, 15575, 15600, 15625, 15650, 15675, 15700, 15725, 15750, 15775, 15800, 15825, 15850, 15875, 15900

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t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn
t(86-512)57355888 f(86-512)57370818 sqs.china@sqs.com



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No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300
中国·江苏·昆山市留学院创业园伟业路10号 邮编 215300

t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn
t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com

EX0004-EN-1741

March 31, 2020

Appendix: Modulation Calibration Parameters

Line	Ref	Communication System Name	Group	PAR (dB)	Unc ¹ (dB)
		CS		WPR	
18012	CAR	ARF-WACOM (Type: 10Mbps, 1Mbps)	WACOM	10.00	± 0.4 %
18013	CAR	ARF-100M (100M)	100M	8.89	± 0.4 %
18013-2	CAR	IEEE 802.11b WPR 2.4 GHz (CDSSS, 1 Mbps)	WLAN	9.89	± 0.6 %
18013-3	CAR	IEEE 802.11b WPR 2.4 GHz (CDSSS, 1 Mbps)	WLAN	9.89	± 0.6 %
18061	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18061-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18061-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18062	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18062-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18062-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18063	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18063-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18063-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18064	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18064-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18064-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18065	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18065-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18065-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18066	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18066-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18066-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18067	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18067-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18067-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18068	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18068-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18068-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18069	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18069-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18069-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18070	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18070-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18070-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18071	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18071-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18071-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18072	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18072-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18072-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18073	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18073-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18073-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18074	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18074-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18074-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18075	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18075-2	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18075-3	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18076	CAD	DSB-SS-400M (100M, 400M)	SSM	14.89	± 0.4 %
18076-2	CAD	DSB-SS-4			

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10182	CAB LTE-FDD (SC-FDMA 1 RB, 10 MHz, 15-G4QAM)	LTE-FDD	6.52 9.8% E
10183	AED LTE-FDD (SC-FDMA 1 RB, 10 MHz, 4-G4QAM)	LTE-FDD	6.50 9.8% E
10184	CAB LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	6.53 9.8% E
10185	CAB LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	6.51 9.8% E
10186	AMT LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	6.50 9.8% E
10187	CAB LTE-FDD (SC-FDMA 1 RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	6.53 9.8% E
10188	CAF LTE-FDD (SC-FDMA 1 RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	6.52 9.8% E
10189	AMT LTE-FDD (SC-FDMA 1 RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	6.50 9.8% E
10190	CAD IEEE 802.11n HT Greenflex, 5.5 Mbps, BPSK	WLAN	8.09 1.0% E
10194	CAD IEEE 802.11n HT Greenflex, 5.5 Mbps, 15-G4QAM	WLAN	8.12 0.1% E
10196	CAD IEEE 802.11n HT Muxed, 6.3 Mbps, 15-G4QAM	WLAN	8.21 0.1% E
10199	CAD IEEE 802.11n HT Muxed, 6.3 Mbps, BPSK	WLAN	8.13 0.1% E
10197	CAD IEEE 802.11n HT Muxed, 6.3 Mbps, 15-G4QAM	WLAN	8.13 0.1% E
10198	CAD IEEE 802.11n HT Muxed, 6.3 Mbps, 15-G4QAM	WLAN	8.27 1.0% E
10219	CAD IEEE 802.11n HT Muxed, 7.2 Mbps, BPSK	WLAN	8.03 0.1% E
10220	CAD IEEE 802.11n HT Muxed, 4.3 Mbps, 15-G4QAM	WLAN	8.13 0.1% E
10221	CAD IEEE 802.11n HT Muxed, 7.2 Mbps, 15-G4QAM	WLAN	8.27 1.0% E
10222	CAD IEEE 802.11n HT Muxed, 4.3 Mbps, 15-G4QAM	WLAN	8.06 0.1% E
10223	CAD IEEE 802.11n HT Muxed, 6.0 Mbps, 15-G4QAM	WLAN	8.48 0.3% E
10224	CAD IEEE 802.11n HT Muxed, 6.0 Mbps, 15-G4QAM	WLAN	8.06 0.0% E
10230	CAB LAMTS FDD p50A1	WCDMA	9.87 0.0% E
10238	CAB LTE-FDD (SC-FDMA 1 RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.48 0.8% E
10237	CAB LTE-FDD (SC-FDMA 1 RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	10.26 0.8% E
10238	CAB LTE-FDD (SC-FDMA 1 RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.22 0.8% E
10239	CAD LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	9.48 0.8% E
10240	CAD LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	10.26 0.8% E
10241	CAD LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	9.19 0.8% E
10232	CAD LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	9.48 0.8% E
10233	CAB LTE-FDD (SC-FDMA 1 RB, 3 MHz, 6-G4QAM)	LTE-FDD	10.35 0.8% E
10234	CAD LTE-FDD (SC-FDMA 1 RB, 3 MHz, 15-G4QAM)	LTE-FDD	9.21 0.8% E
10235	CAD LTE-FDD (SC-FDMA 1 RB, 10 MHz, 15-G4QAM)	LTE-FDD	9.48 0.8% E
10238	CAB LTE-FDD (SC-FDMA 1 RB, 10 MHz, 6-G4QAM)	LTE-FDD	10.25 0.8% E
10237	CAD LTE-FDD (SC-FDMA 1 RB, 10 MHz, 15-G4QAM)	LTE-FDD	9.21 0.8% E
10238	CAF LTE-FDD (SC-FDMA 1 RB, 15 MHz, 15-G4QAM)	LTE-FDD	9.48 0.8% E
10239	CAF LTE-FDD (SC-FDMA 1 RB, 15 MHz, 15-G4QAM)	LTE-FDD	10.25 0.8% E
10240	CAF LTE-FDD (SC-FDMA 1 RB, 15 MHz, 15-G4QAM)	LTE-FDD	9.21 0.8% E
10241	CAB LTE-FDD (SC-FDMA 50% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.82 0.8% E
10242	CAB LTE-FDD (SC-FDMA 50% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.86 0.8% E
10243	CAB LTE-FDD (SC-FDMA 50% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.48 0.8% E
10244	CAB LTE-FDD (SC-FDMA 50% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	10.18 0.8% E
10245	CAD LTE-FDD (SC-FDMA 50% RB, 3 MHz, 6-G4QAM)	LTE-FDD	10.09 0.8% E
10248	CAD LTE-FDD (SC-FDMA 50% RB, 3 MHz, 15-G4QAM)	LTE-FDD	9.30 0.8% E
10247	CAB LTE-FDD (SC-FDMA 50% RB, 3 MHz, 15-G4QAM)	LTE-FDD	9.81 0.8% E
10248	CAB LTE-FDD (SC-FDMA 50% RB, 3 MHz, 6-G4QAM)	LTE-FDD	10.09 0.8% E
10249	CAD LTE-FDD (SC-FDMA 50% RB, 3 MHz, 15-G4QAM)	LTE-FDD	9.29 0.8% E
10250	CAD LTE-FDD (SC-FDMA 50% RB, 15 MHz, 15-G4QAM)	LTE-FDD	9.81 0.8% E
10251	CAD LTE-FDD (SC-FDMA 50% RB, 3 MHz, 6-G4QAM)	LTE-FDD	10.17 0.8% E
10252	CAD LTE-FDD (SC-FDMA 50% RB, 15 MHz, 15-G4QAM)	LTE-FDD	9.14 0.8% E
10253	CAF LTE-FDD (SC-FDMA 50% RB, 15 MHz, 15-G4QAM)	LTE-FDD	9.86 0.8% E
10254	CAF LTE-FDD (SC-FDMA 50% RB, 15 MHz, 15-G4QAM)	LTE-FDD	9.81 0.8% E
10250	CAF LTE-FDD (SC-FDMA 50% RB, 15 MHz, 15-G4QAM)	LTE-FDD	9.30 0.8% E
10256	CAB LTE-FDD (SC-FDMA 100% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.90 0.8% E
10257	CAB LTE-FDD (SC-FDMA 100% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	10.08 0.8% E
10258	CAB LTE-FDD (SC-FDMA 100% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.34 0.8% E
10259	CAD LTE-FDD (SC-FDMA 100% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.96 0.8% E
10260	CAD LTE-FDD (SC-FDMA 100% RB, 1.4 MHz, 15-G4QAM)	LTE-FDD	9.97 0.8% E

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10414	AAA	WLAN CDF4 64-QAMx	Generic	8.54	± 0.6 %		
10415	AAA	IEEE 802.11b WFI 2.4 GHz (DSSS, 1 Mbps, R90c-d)	WLAN	1.54	± 0.6 %		
10416	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 5.5 Mbps, R90c-d)	WLAN	8.23	± 0.6 %		
10417	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 6 Mbps, R90c-d)	WLAN	8.23	± 0.6 %		
10418	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 5.5 Mbps, R90c-d)	WLAN	8.14	± 0.6 %		
10419	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 5.5 Mbps, R90c-d)	WLAN	8.19	± 0.6 %		
10420	AAC	IEEE 802.11n HT Overhead, 7.2 Mbps, R90c-d	WLAN	8.32	± 0.6 %		
10421	AAC	IEEE 802.11n HT Overhead, 6.3 Mbps, 16-QAM	WLAN	8.47	± 0.6 %		
10424	AAC	IEEE 802.11n HT Overhead, 7.2 Mbps, 64-QAM	WLAN	8.40	± 0.6 %		
10425	AAC	IEEE 802.11n HT Overhead, 14 Mbps, R90c-d	WLAN	8.41	± 0.6 %		
10426	AAC	IEEE 802.11n HT Overhead, 30 Mbps, 16-QAM	WLAN	8.45	± 0.6 %		
10427	AAC	IEEE 802.11n HT Overhead, 130 Mbps, 64-QAM	WLAN	8.41	± 0.6 %		
10430	AAD	LTE-FDD (OFDMA, 5 MHz, E-TRP 3.1)	LTE-FDD	8.28	± 0.6 %		
10431	AAD	LTE-FDD (OFDMA, 10 MHz, E-TRP 3.1)	LTE-FDD	8.38	± 0.6 %		
10432	AAC	LTE-FDD (OFDMA, 15 MHz, E-TRP 3.1)	LTE-FDD	8.34	± 0.6 %		
10433	AAC	LTE-FDD (OFDMA, 20 MHz, E-TRP 3.1)	LTE-FDD	8.34	± 0.6 %		
10434	AAA	WCDMA (BS Test Model 1, 64 DPM)	WCDMA	8.60	± 0.6 %		
10435	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10447	AAD	LTE-FDD (OFDMA, 5 MHz, E-TRP 3.1, Clipping 44%)	LTE-FDD	7.96	± 0.6 %		
10448	AAD	LTE-FDD (OFDMA, 10 MHz, E-TRP 3.1, Clipping 44%)	LTE-FDD	7.93	± 0.6 %		
10449	AAC	LTE-FDD (OFDMA, 15 MHz, E-TRP 3.1, Clipping 44%)	LTE-FDD	7.91	± 0.6 %		
10450	AAC	LTE-FDD (OFDMA, 20 MHz, E-TRP 3.1, Clipping 44%)	LTE-FDD	7.88	± 0.6 %		
10451	AAA	WCDMA (BS Test Model 1, 64 DPM, Clipping 44%)	WCDMA	7.89	± 0.6 %		
10452	AAD	Validation (Spurs, 10ms, 1ms)	Test	10.00	± 0.6 %		
10456	AAC	IEEE 802.11ac WFI (160MHz, 64-QAM, R90c-d)	WLAN	8.63	± 0.6 %		
10457	AAA	UMTS FDD (SC-HSPA)	WCDMA	6.62	± 0.6 %		
10458	AAA	CDMA2000 (1xEV-DO, Rev. B, 3.1 centers)	CDMA2000	8.58	± 0.6 %		
10459	AAA	CDMA2000 (1xEV-DO, Rev. B, 3.1 centers)	CDMA2000	8.25	± 0.6 %		
10460	AAA	UMTS FDD (HSPA, R90c-d)	WCDMA	2.39	± 0.6 %		
10461	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10462	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.30	± 0.6 %		
10463	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.30	± 0.6 %		
10464	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10465	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10466	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10467	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10468	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10469	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10470	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10471	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10472	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10473	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10474	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10475	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10476	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10479	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10480	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10481	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10482	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10483	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10484	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.47	± 0.6 %		
10485	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10486	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10487	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10488	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		

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10489	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10490	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10491	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10492	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10493	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10494	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10495	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10496	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10497	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10498	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10499	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10500	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10501	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10502	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10503	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10504	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10505	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10506	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10507	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10508	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10509	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10510	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10511	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10512	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10513	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10514	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 Mbps, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10515	AAA	IEEE 802.11ac WFI 2.4 GHz (DSSS, 2 Mbps, R90c-d)	WLAN	1.58	± 0.6 %		
10516	AAA	IEEE 802.11ac WFI 2.4 GHz (DSSS, 5.5 Mbps, R90c-d)	WLAN	1.57	± 0.6 %		
10517	AAA	IEEE 802.11ac WFI 2.4 GHz (DSSS, 11 Mbps, R90c-d)	WLAN	1.58	± 0.6 %		
10518	AAC	IEEE 802.11ac WFI 5 GHz (OFDM, 5 Mbps, R90c-d)	WLAN	8.23	± 0.6 %		
10519	AAC	IEEE 802.11ac WFI 5 GHz (OFDM, 12 Mbps, R90c-d)	WLAN	8.39	± 0.6 %		
10520	AAC	IEEE 802.11ac WFI 5 GHz (OFDM, 18 Mbps, R90c-d)	WLAN	8.12	± 0.6 %		
10521	AAC	IEEE 802.11ac WFI 5 GHz (OFDM, 24 Mbps, R90c-d)	WLAN	7.97	± 0.6 %		
10522	AAC	IEEE 802.11ac WFI 5 GHz (OFDM, 36 Mbps, R90c-d)	WLAN	8.45	± 0.6 %		
10523	AAC	IEEE 802.11ac WFI 5 GHz (OFDM, 48 Mbps, R90c-d)	WLAN	8.48	± 0.6 %		
10524	AAC	IEEE 802.11ac WFI 5 GHz (OFDM, 54 Mbps, R90c-d)	WLAN	8.27	± 0.6 %		
10525	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	2.36	± 0.6 %		
10526	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.42	± 0.6 %		
10527	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.21	± 0.6 %		
10528	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10529	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.36	± 0.6 %		
10530	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10531	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.43	± 0.6 %		
10532	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.29	± 0.6 %		
10533	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.38	± 0.6 %		
10534	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.45	± 0.6 %		
10535	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.45	± 0.6 %		
10536	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.32	± 0.6 %		
10537	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.44	± 0.6 %		
10538	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.34	± 0.6 %		
10539	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10540	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10541	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.46	± 0.6 %		
10542	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.45	± 0.6 %		
10543	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.45	± 0.6 %		
10544	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.47	± 0.6 %		
10545	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.55	± 0.6 %		
10546	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.35	± 0.6 %		

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10547	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.49	± 0.6 %		
10548	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.37	± 0.6 %		
10549	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10550	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10551	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10552	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.42	± 0.6 %		
10553	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.42	± 0.6 %		
10554	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.48	± 0.6 %		
10555	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.47	± 0.6 %		
10556	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)					



昆智电子科技有限公司
检验检测专用章
Inspection & Testing Services
Compliance, Calibration Services (Kunshan)
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No.10, Weiyue Road, Innovation Park, Kunshan, Jiangsu, China 215300
中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300

(86-512)57355888 (86-512)57370818 www.sgsgroup.com.cn
(86-512)57355888 (86-512)57370818 sgs.china@sgs.com

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EXCIV4-SN 7346 March 30, 2022 15985 AAA 50 NR DL (CP-CFOM, TM 3.1, 40 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.54 ± 9.8 % 15986 AAA 50 NR DL (CP-CFOM, TM 3.1, 50 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.50 ± 9.8 % 15987 AAA 50 NR DL (CP-CFOM, TM 3.1, 60 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.50 ± 9.8 % 15988 AAA 50 NR DL (CP-CFOM, TM 3.1, 70 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.38 ± 9.8 % 15989 AAA 50 NR DL (CP-CFOM, TM 3.1, 80 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.33 ± 9.8 % 15990 AAA 50 NR DL (CP-CFOM, TM 3.1, 90 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.52 ± 9.8 % ¹ Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value. Certificate No. EXC-7346_Mar22 Page 24 of 24	EXCIV4-SN 7346 March 30, 2022 15985 AAA 50 NR DL (CP-CFOM, TM 3.1, 40 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.54 ± 9.8 % 15986 AAA 50 NR DL (CP-CFOM, TM 3.1, 50 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.50 ± 9.8 % 15987 AAA 50 NR DL (CP-CFOM, TM 3.1, 60 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.50 ± 9.8 % 15988 AAA 50 NR DL (CP-CFOM, TM 3.1, 70 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.38 ± 9.8 % 15989 AAA 50 NR DL (CP-CFOM, TM 3.1, 80 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.33 ± 9.8 % 15990 AAA 50 NR DL (CP-CFOM, TM 3.1, 90 MHz, 64-QAM, 30 kHz) SG NR PR1 TDD 9.52 ± 9.8 % ¹ Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value. Certificate No. EXC-7346_Mar22 Page 24 of 24
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4 Impedance and return loss

Dipole CLA150 SN 4025				
Head Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2021/4/26	-31.4	/	47.8	/
Dipole D450V3 SN 1103				
Head Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2021/4/21	-23	/	57.1	/



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No. 10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300
中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300

t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn
t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com