



## ***Appendix C - Calibration***

All of the instruments Calibration information are listed below.

- Dipole \_ D750V3 SN:1004
- Dipole \_ D835V2 SN:4d082
- Dipole \_ D1750V2 SN:1023
- Dipole \_ D1900V2 SN:5d111
- Dipole \_ D2600V2 SN:1007
- Probe \_ EX3DV4 SN:3847
- DAE \_ DAE4 SN:917



57-044\_18-245



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client **ATL**

Certificate No: **Z18-60307**

### CALIBRATION CERTIFICATE

Object: **D750V3 - SN: 1004**

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

Calibration date: **September 5, 2018**

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 NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Sep-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

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

Issued: September 8, 2018

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

#### Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, 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%.



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

### Measurement Conditions

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

<b>DASY Version</b>	DASY52	52.10.1.1476
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	750 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	41.9	0.89 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	43.1 ± 6 %	0.87 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	----	----

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	2.06 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>8.47 mW /g ± 18.8 % (k=2)</b>
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	1.39 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>5.68 mW /g ± 18.7 % (k=2)</b>

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	55.5	0.96 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	56.8 ± 6 %	0.93 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	<1.0 °C	----	----

### SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	2.14 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>8.80 mW /g ± 18.8 % (k=2)</b>
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	1.46 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>5.97 mW /g ± 18.7 % (k=2)</b>



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

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	54.4Ω+ 0.96jΩ
Return Loss	- 27.3dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	48.2Ω- 1.43jΩ
Return Loss	- 32.5dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	0.906 ns
----------------------------------	----------

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

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

**Additional EUT Data**

Manufactured by	SPEAG
-----------------	-------

**DASY5 Validation Report for Head TSL**

Date: 09.05.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1004**

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.866 \text{ S/m}$ ;  $\epsilon_r = 43.13$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(10.57, 10.57, 10.57) @ 750 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

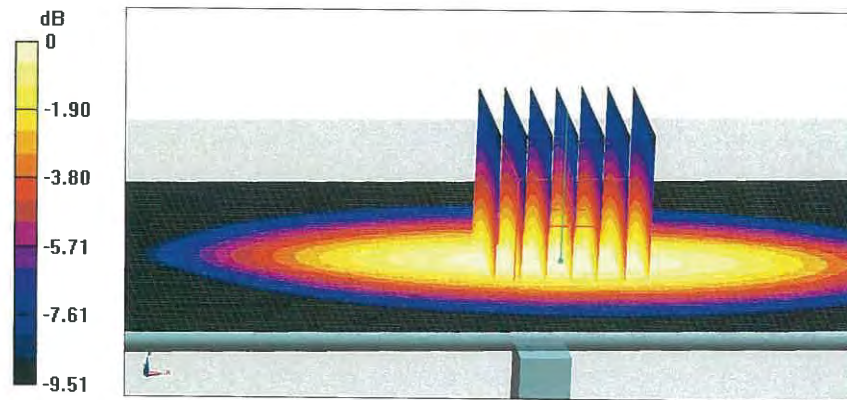
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 55.10 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 3.01 W/kg

**SAR(1 g) = 2.06 W/kg; SAR(10 g) = 1.39 W/kg**

Maximum value of SAR (measured) = 2.69 W/kg



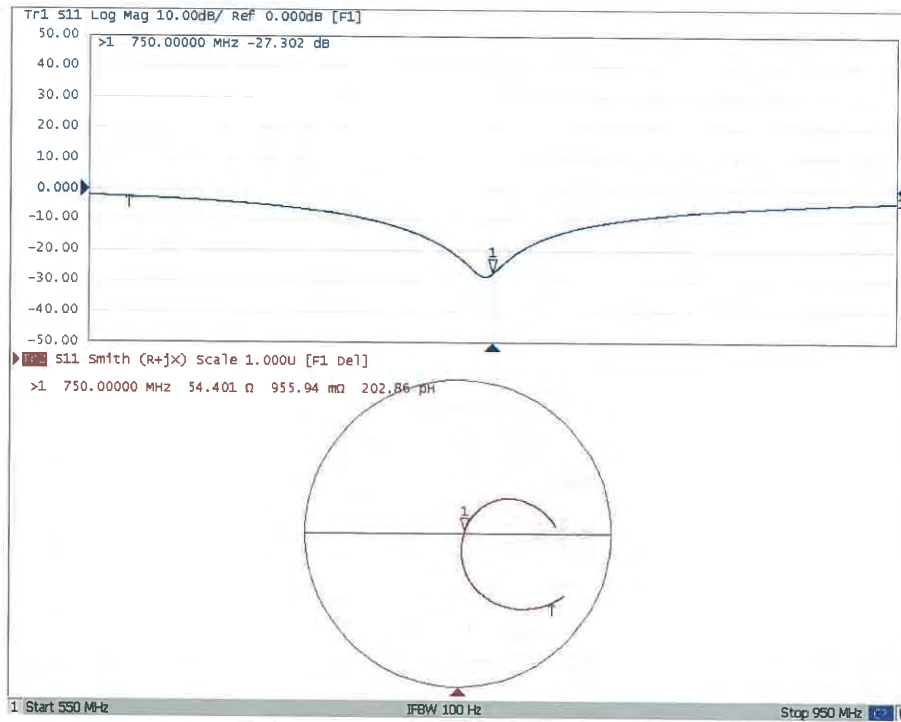




In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

### Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 09.05.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1004**

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.932$  S/m;  $\epsilon_r = 56.82$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(10.63, 10.63, 10.63) @ 750 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

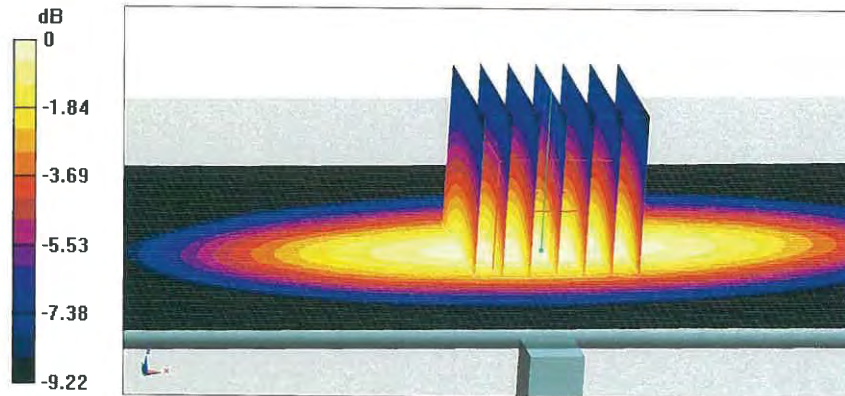
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.38 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.08 W/kg

**SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.46 W/kg**

Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 4.42 dBW/kg

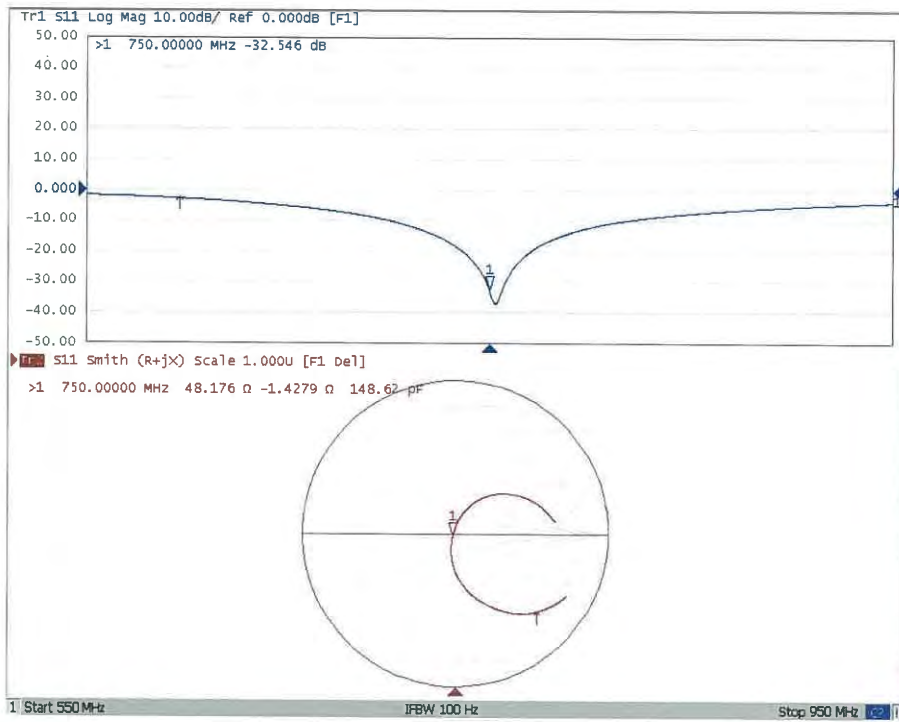




In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

### Impedance Measurement Plot for Body TSL





57-039-18-246



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client **ATL**

Certificate No: **Z18-60308**

## CALIBRATION CERTIFICATE

Object: **D835V2 - SN: 4d082**

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

Calibration date: **September 6, 2018**

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 NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Sep-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

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

Issued: September 9, 2018

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

Certificate No: Z18-60308

Page 1 of 8

**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, 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%.

### Measurement Conditions

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

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 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 $\pm$ 0.2) °C	42.7 $\pm$ 6 %	0.90 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.31 mW / g <math>\pm</math> 18.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>6.09 mW / g <math>\pm</math> 18.7 % (k=2)</b>

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.0 $\pm$ 6 %	1.00 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.46 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.66 mW / g <math>\pm</math> 18.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.65 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.50 mW / g <math>\pm</math> 18.7 % (k=2)</b>



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

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	50.7Ω- 4.27jΩ
Return Loss	- 27.4dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	47.5Ω- 6.62jΩ
Return Loss	- 22.8dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.252 ns
----------------------------------	----------

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

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

**Additional EUT Data**

Manufactured by	SPEAG
-----------------	-------



**DASY5 Validation Report for Head TSL**

Date: 09.04.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d082**

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

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.904 \text{ S/m}$ ;  $\epsilon_r = 42.71$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(10.28, 10.28, 10.28) @ 835 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

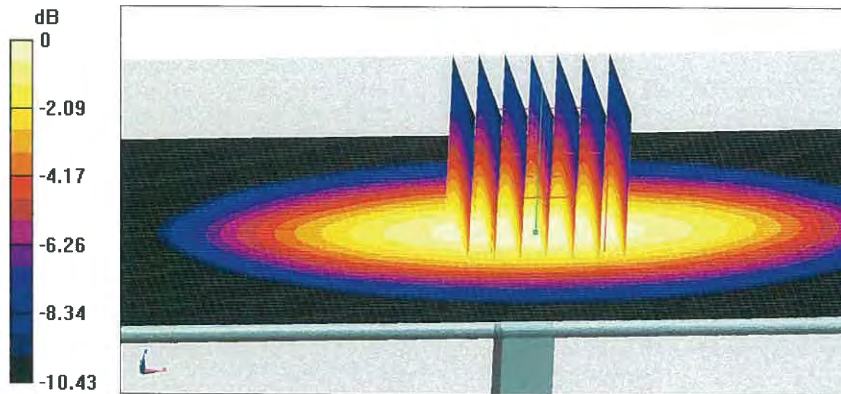
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 57.68 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 3.52 W/kg

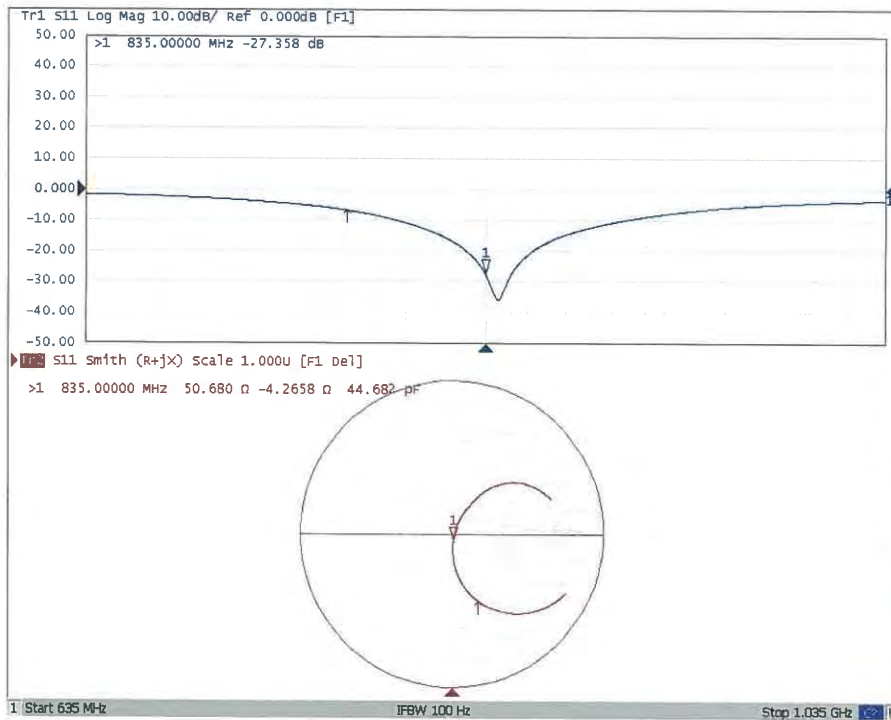
**SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.52 W/kg**

Maximum value of SAR (measured) = 3.11 W/kg





### Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 09.06.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d082**

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

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.998 \text{ S/m}$ ;  $\epsilon_r = 56.04$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(10.21, 10.21, 10.21) @ 835 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

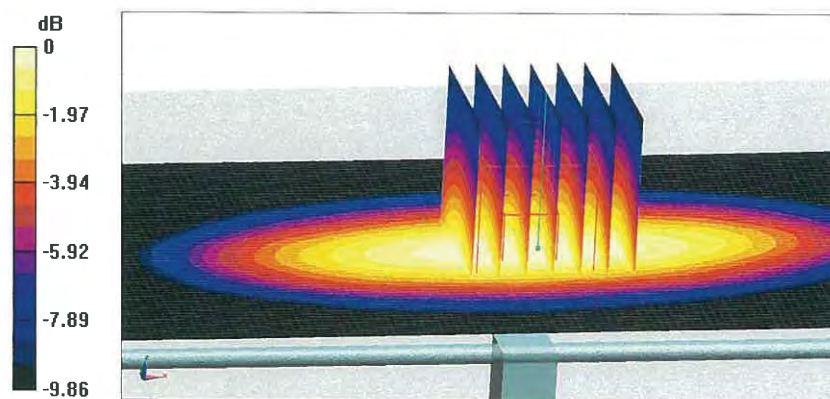
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 56.02 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.69 W/kg

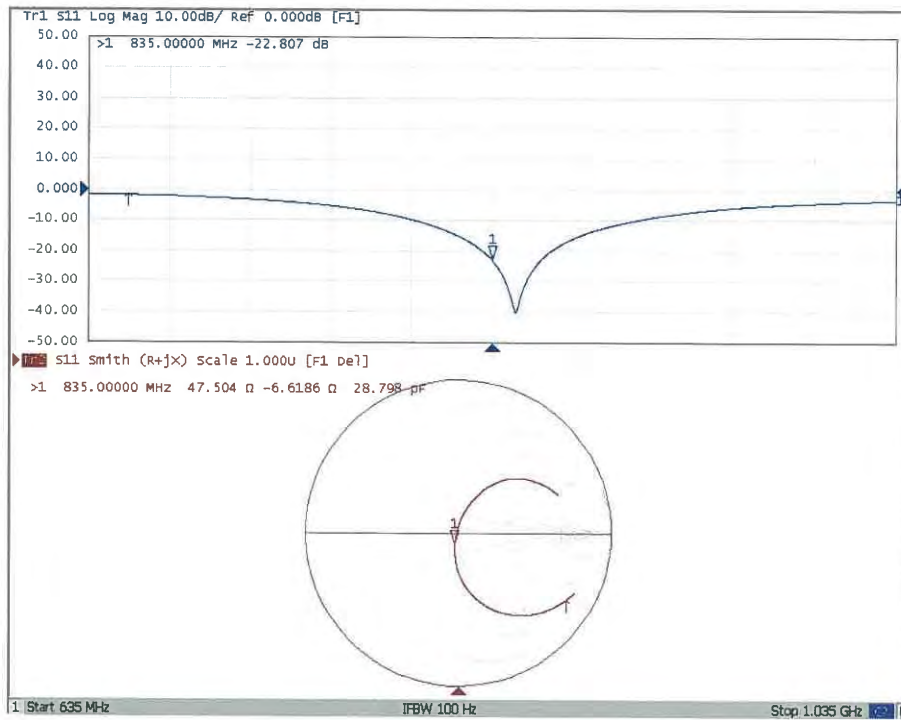
**SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.65 W/kg**

Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

**Impedance Measurement Plot for Body TSL**



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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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 **Auden**

Certificate No: **D1750V2-1023\_Jun18**

## CALIBRATION CERTIFICATE

Object **D1750V2 - SN:1023**

Calibration procedure(s) **QA CAL-05.v10  
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **June 11, 2018**



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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

Calibrated by:	Name <b>Jeton Kastrati</b>	Function <b>Laboratory Technician</b>	Signature 
Approved by:	Name <b>Katja Pokovic</b>	Function <b>Technical Manager</b>	Signature 

Issued: June 11, 2018

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



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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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:**

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:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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



### Measurement Conditions

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

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.0 $\pm$ 6 %	1.36 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>36.3 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>19.3 W/kg <math>\pm</math> 16.5 % (k=2)</b>

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.6 $\pm$ 6 %	1.47 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>36.8 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>19.7 W/kg <math>\pm</math> 16.5 % (k=2)</b>





## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0 $\Omega$ - 0.5 $j\Omega$
Return Loss	- 39.1 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.0 $\Omega$ + 0.3 $j\Omega$
Return Loss	- 27.5 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.217 ns
----------------------------------	----------

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

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

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

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 20, 2009

**DASY5 Validation Report for Head TSL**

Date: 11.06.2018

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1023**

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.36$  S/m;  $\epsilon_r = 39$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

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

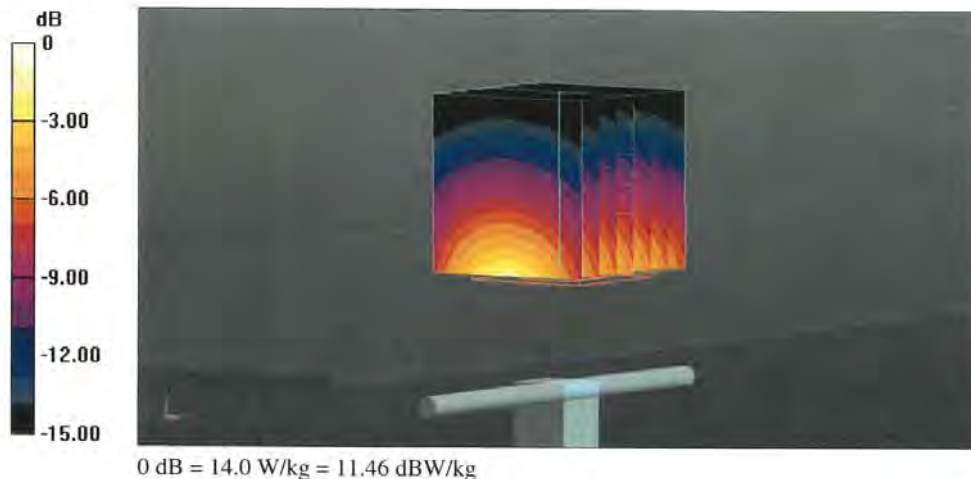
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 106.5 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 16.5 W/kg

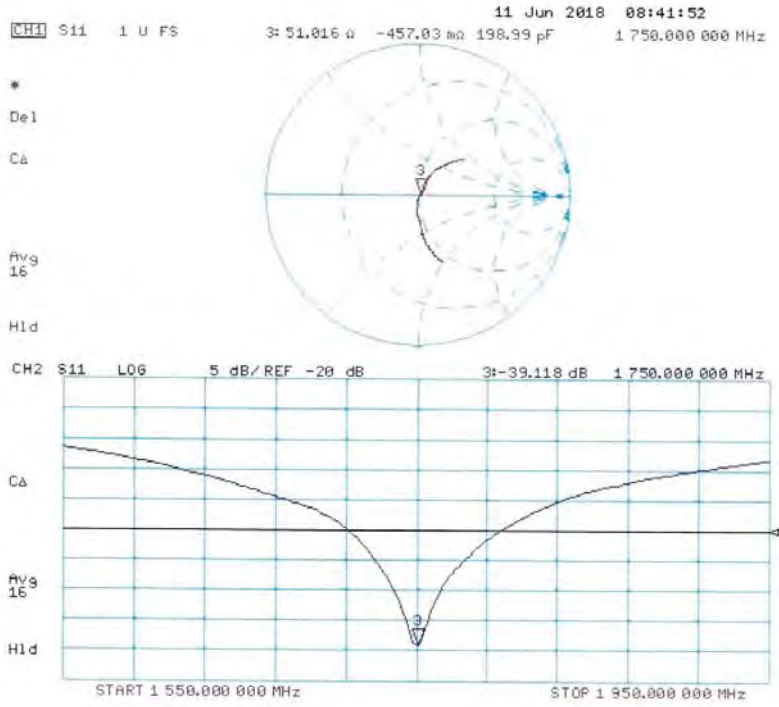
**SAR(1 g) = 9.1 W/kg; SAR(10 g) = 4.82 W/kg**

Maximum value of SAR (measured) = 14.0 W/kg





### Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 11.06.2018

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1023**

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.47$  S/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

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

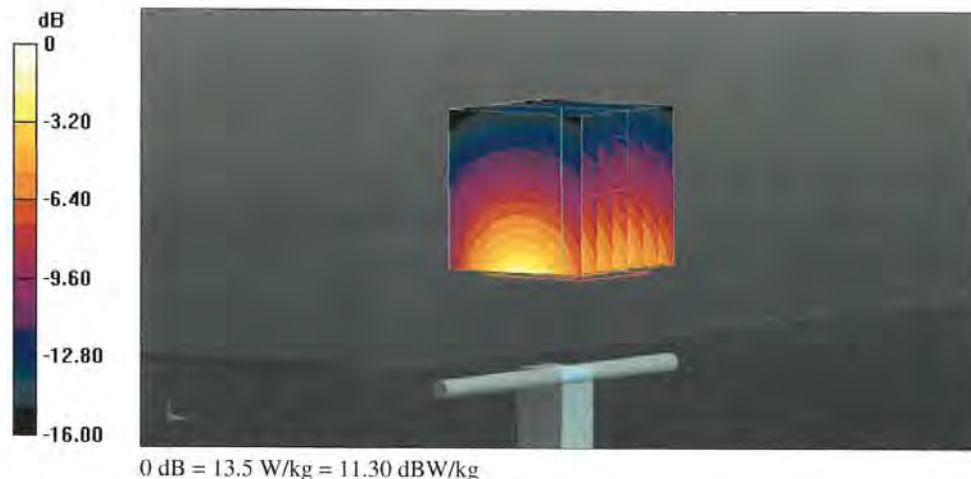
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.3 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 15.8 W/kg

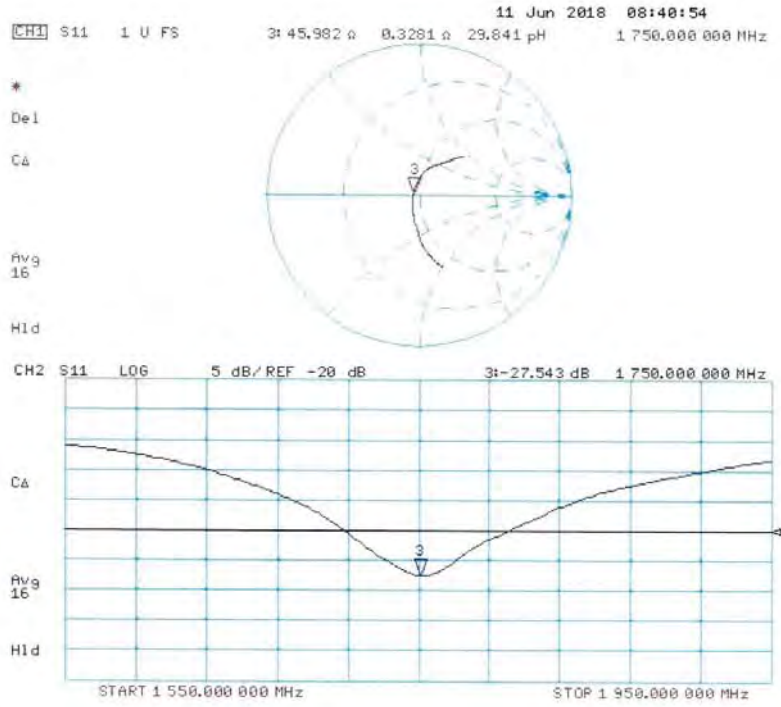
**SAR(1 g) = 9.12 W/kg; SAR(10 g) = 4.9 W/kg**

Maximum value of SAR (measured) = 13.5 W/kg





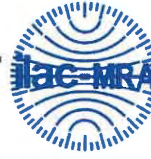
### Impedance Measurement Plot for Body TSL







In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

ST-038-18-247

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

Client

ATL

Certificate No: Z18-60309

## CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d111

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

Calibration date: September 11, 2018

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 NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Sep-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

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

Issued: September 15, 2018

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



**lossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, 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%.

### Measurement Conditions

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

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.4 $\pm$ 6 %	1.44 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>39.8 mW / g <math>\pm</math> 18.8 % (k=2)</b>
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.1 mW / g <math>\pm</math> 18.7 % (k=2)</b>

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.3 $\pm$ 6 %	1.49 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.99 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>40.4 mW / g <math>\pm</math> 18.8 % (k=2)</b>
SAR averaged over 10 $cm^3$ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.41 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.8 mW / g <math>\pm</math> 18.7 % (k=2)</b>

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

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.6Ω+ 6.78jΩ
Return Loss	- 23.3dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.3Ω+ 6.22jΩ
Return Loss	- 22.5dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.066 ns
----------------------------------	----------

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

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

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

### Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

**DASY5 Validation Report for Head TSL**

Date: 09.10.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d111**

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.438$  S/m;  $\epsilon_r = 40.37$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.39, 8.39, 8.39) @ 1900 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

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

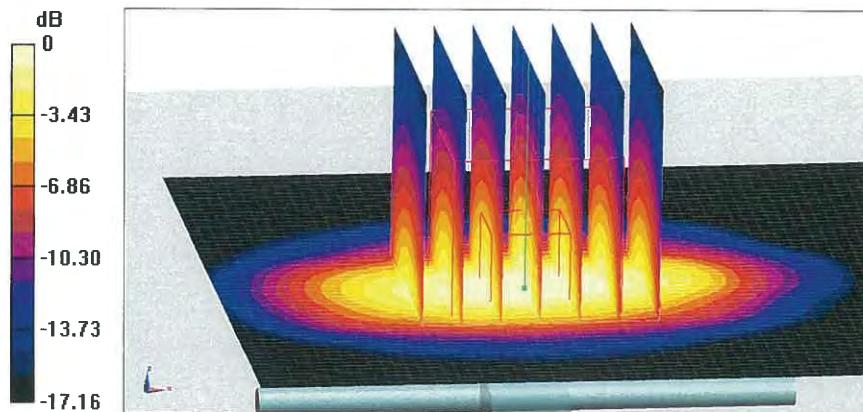
$dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 95.90 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 19.0 W/kg

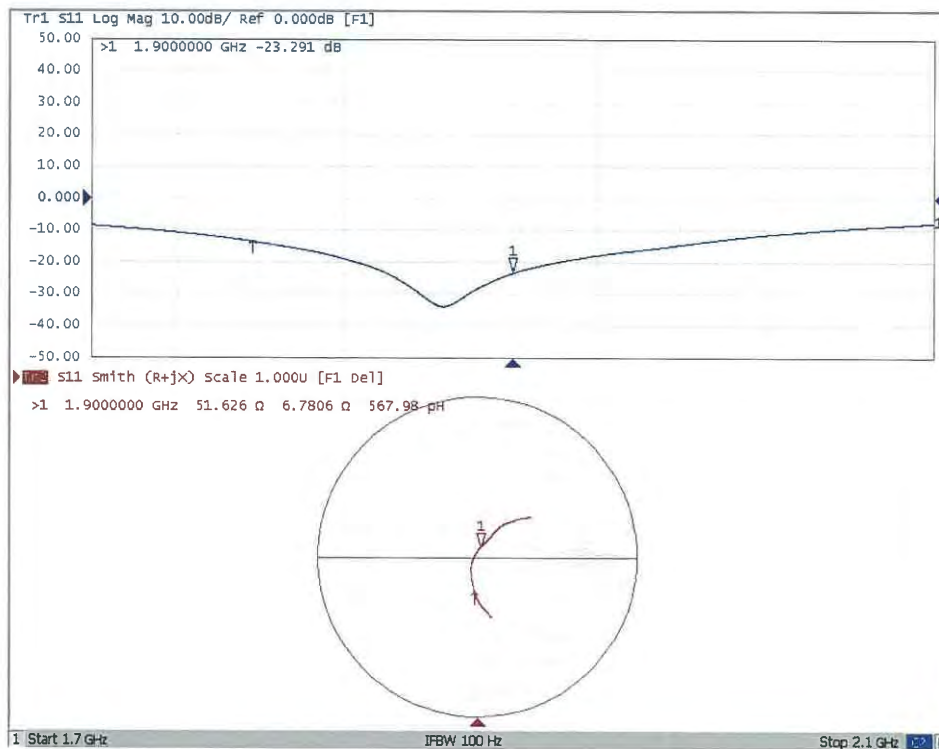
**SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg**

Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

### Impedance Measurement Plot for Head TSL





**DASY5 Validation Report for Body TSL**

Date: 09.10.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d111**

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.493$  S/m;  $\epsilon_r = 53.34$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.32, 8.32, 8.32) @ 1900 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

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

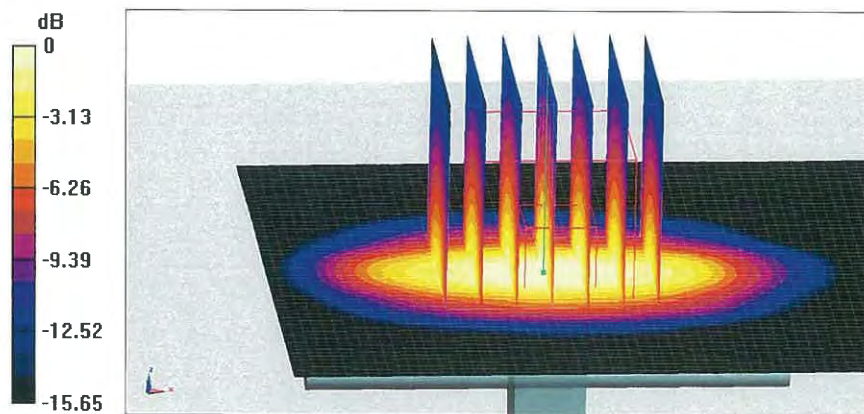
$dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 96.64 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 17.6 W/kg

**SAR(1 g) = 9.99 W/kg; SAR(10 g) = 5.41 W/kg**

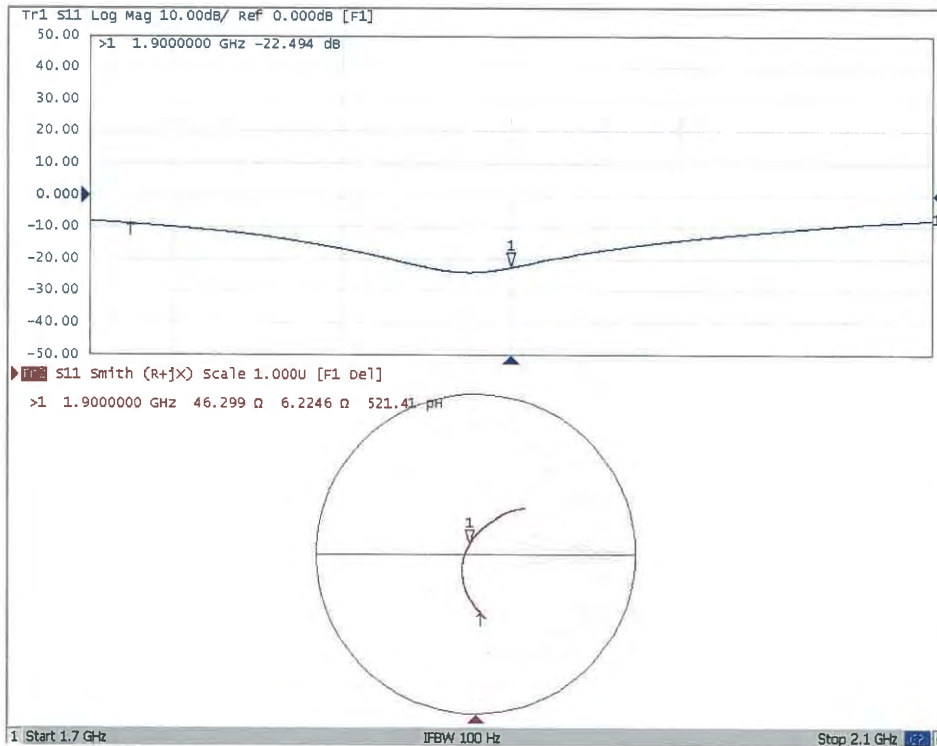
Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg



**Impedance Measurement Plot for Body TSL**

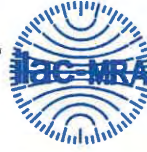




57-021\_18-261



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client **ATL**

Certificate No: **Z18-60414**

### CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1007**

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

Calibration date: **November 1, 2018**

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 NRVD	102196	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Power sensor NRV-Z5	100596	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1555	20-Aug-18(SPEAG,No.DAE4-1555_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
Network Analyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

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

Issued: November 5, 2018

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

Certificate No: Z18-60414

Page 1 of 8



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

#### Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, 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%.



### Measurement Conditions

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

DASY Version	DASY52	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.1 $\pm$ 6 %	1.94 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>56.8 mW / g <math>\pm</math> 18.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>25.4 mW / g <math>\pm</math> 18.7 % (k=2)</b>

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.7 $\pm$ 6 %	2.21 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>54.3 mW / g <math>\pm</math> 18.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.04 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>24.1 mW / g <math>\pm</math> 18.7 % (k=2)</b>



In Collaboration with  
**s p e a g**  
 CALIBRATION LABORATORY

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

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.6Ω- 4.10jΩ
Return Loss	- 27.1dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	46.1Ω- 2.46jΩ
Return Loss	- 26.3dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.020 ns
----------------------------------	----------

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

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

**Additional EUT Data**

Manufactured by	SPEAG
-----------------	-------





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

**DASY5 Validation Report for Head TSL**

Date: 11.01.2018

Test Laboratory: CCTL, Beijing, China

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1007**

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 1.935$  S/m;  $\epsilon_r = 39.07$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

DASY5 Configuration:

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

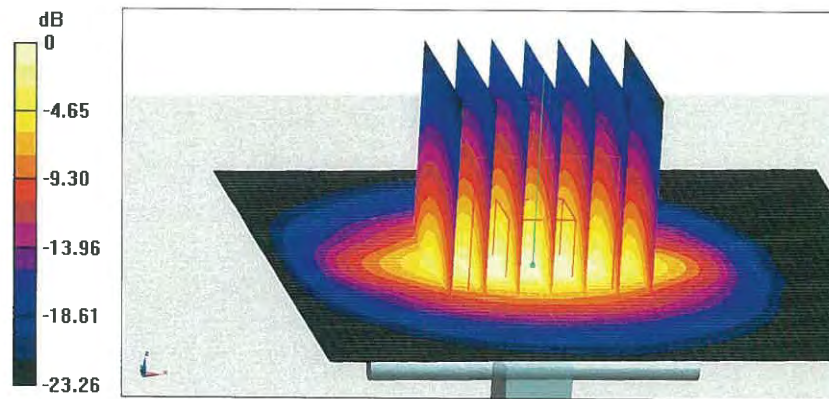
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.2 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 30.8 W/kg

**SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.32 W/kg**

Maximum value of SAR (measured) = 24.4 W/kg



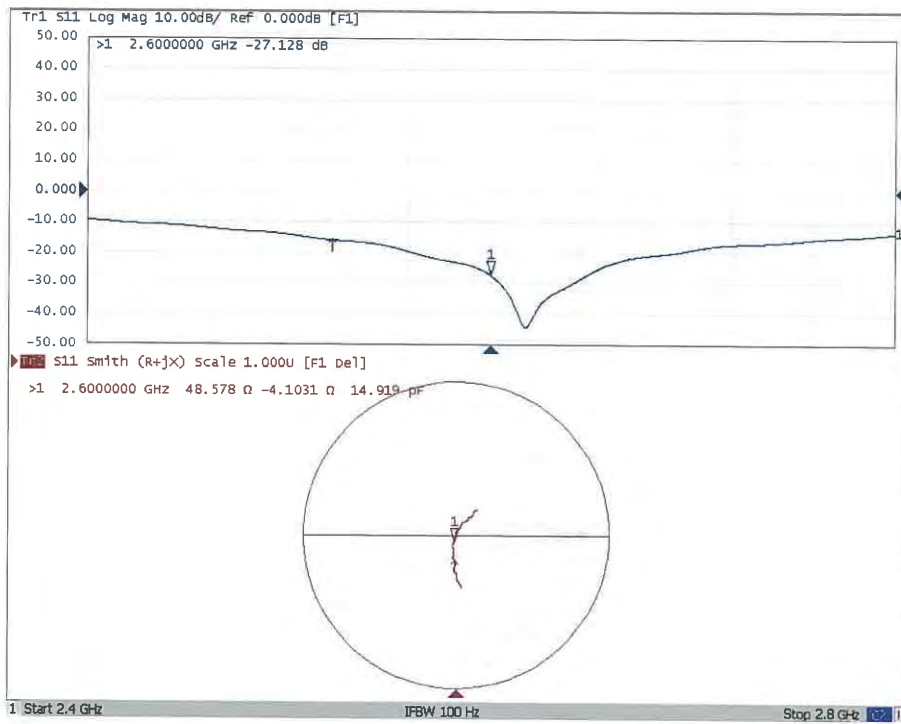
0 dB = 24.4 W/kg = 13.87 dBW/kg



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

### Impedance Measurement Plot for Head TSL





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

**DASY5 Validation Report for Body TSL**

Date: 11.01.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1007**

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.206$  S/m;  $\epsilon_r = 52.65$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.06, 7.06, 7.06) @ 2600 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

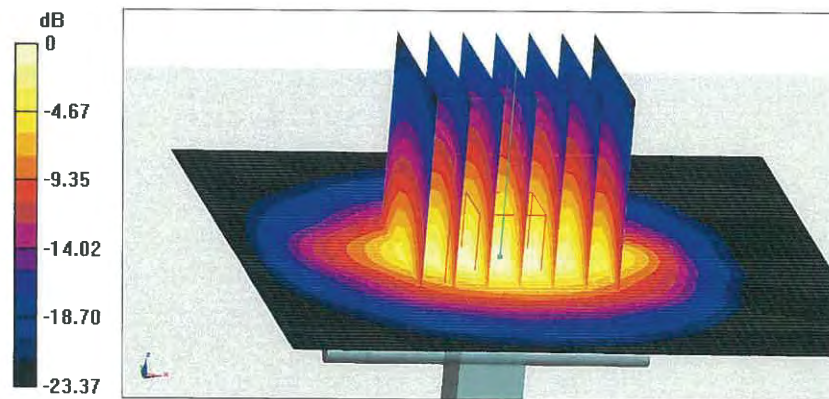
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.12 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 29.9 W/kg

**SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.04 W/kg**

Maximum value of SAR (measured) = 23.5 W/kg



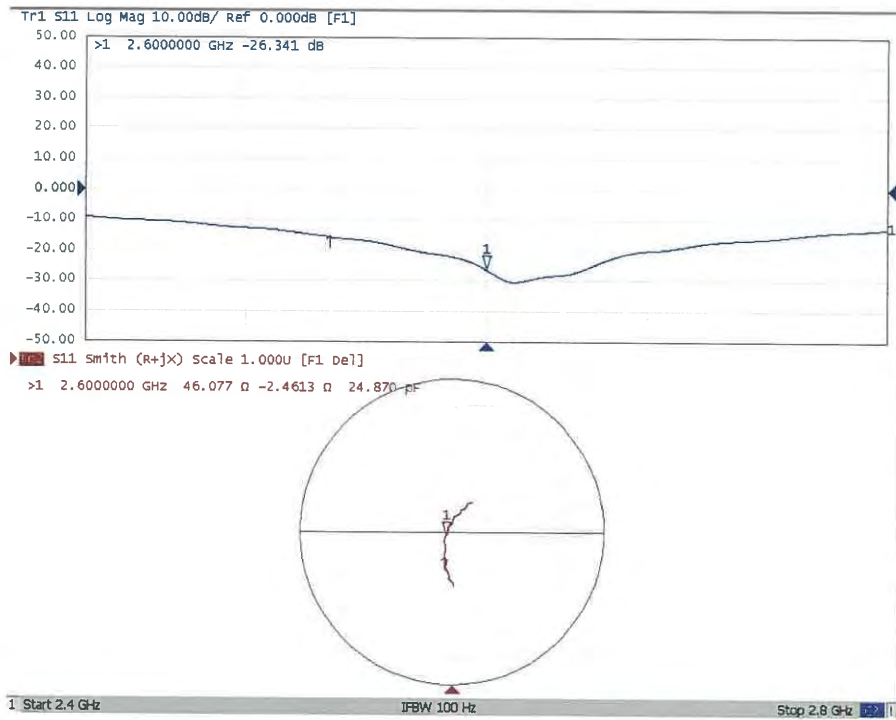
0 dB = 23.5 W/kg = 13.71 dBW/kg



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

### Impedance Measurement Plot for Body TSL



EX-042-18-117

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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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 **ATL (Auden)**

Certificate No: **EX3-3847\_Apr18**

## CALIBRATION CERTIFICATE

Object: **EX3DV4 - SN:3847**

Calibration procedure(s): **QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5,  
QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

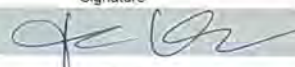

Calibration date: **April 26, 2018**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 28, 2018

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



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



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

#### 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 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).



EX3DV4 – SN:3847

April 26, 2018

# Probe EX3DV4

## SN:3847

Manufactured: October 25, 2011  
Calibrated: April 26, 2018

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



EX3DV4- SN:3847

April 26, 2018

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3847

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.56	0.49	0.41	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	96.4	98.7	97.4	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	144.9	$\pm 3.0\%$
		Y	0.0	0.0	1.0		138.9	
		Z	0.0	0.0	1.0		148.8	

Note: For details on UID parameters see Appendix.

### Sensor Model Parameters

	C1 fF	C2 fF	$\alpha$ V <sup>-1</sup>	T1 ms.V <sup>-2</sup>	T2 ms.V <sup>-1</sup>	T3 ms	T4 V <sup>-2</sup>	T5 V <sup>-1</sup>	T6
X	44.20	340.6	37.46	10.93	0.386	5.086	0.074	0.571	1.009
Y	49.57	371.5	35.85	13.85	0.234	5.100	0.564	0.423	1.006
Z	36.62	278.7	36.64	6.046	0.415	5.038	0.000	0.401	1.009

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

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



EX3DV4– SN:3847

April 26, 2018

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3847

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth (mm) <sup>G</sup>	Unc (k=2)
450	43.5	0.87	10.49	10.49	10.49	0.14	1.20	± 13.3 %
750	41.9	0.89	9.82	9.82	9.82	0.60	0.80	± 12.0 %
835	41.5	0.90	9.61	9.61	9.61	0.50	0.80	± 12.0 %
900	41.5	0.97	9.42	9.42	9.42	0.42	0.93	± 12.0 %
1750	40.1	1.37	8.71	8.71	8.71	0.42	0.80	± 12.0 %
1900	40.0	1.40	8.30	8.30	8.30	0.27	0.80	± 12.0 %
2000	40.0	1.40	8.41	8.41	8.41	0.46	0.82	± 12.0 %
2300	39.5	1.67	7.79	7.79	7.79	0.38	0.84	± 12.0 %
2450	39.2	1.80	7.38	7.38	7.38	0.33	0.84	± 12.0 %
2600	39.0	1.96	7.18	7.18	7.18	0.43	0.80	± 12.0 %
5200	36.0	4.66	5.44	5.44	5.44	0.40	1.80	± 13.1 %
5300	35.9	4.76	5.22	5.22	5.22	0.40	1.80	± 13.1 %
5500	35.6	4.96	5.02	5.02	5.02	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.80	4.80	4.80	0.40	1.80	± 13.1 %
5800	35.3	5.27	5.00	5.00	5.00	0.40	1.80	± 13.1 %

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

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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





## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3847

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth (mm) <sup>D</sup>	Unc (k=2)
450	56.7	0.94	10.62	10.62	10.62	0.08	1.20	± 13.3 %
750	55.5	0.96	9.71	9.71	9.71	0.41	0.96	± 12.0 %
835	55.2	0.97	9.48	9.48	9.48	0.51	0.80	± 12.0 %
900	55.0	1.05	9.37	9.37	9.37	0.48	0.80	± 12.0 %
1750	53.4	1.49	7.91	7.91	7.91	0.34	0.94	± 12.0 %
1900	53.3	1.52	7.70	7.70	7.70	0.40	0.80	± 12.0 %
2000	53.3	1.52	7.76	7.76	7.76	0.37	0.84	± 12.0 %
2300	52.9	1.81	7.39	7.39	7.39	0.42	0.86	± 12.0 %
2450	52.7	1.95	7.30	7.30	7.30	0.32	0.87	± 12.0 %
2600	52.5	2.16	7.18	7.18	7.18	0.38	0.85	± 12.0 %
5200	49.0	5.30	4.84	4.84	4.84	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.64	4.64	4.64	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.28	4.28	4.28	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.11	4.11	4.11	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.29	4.29	4.29	0.50	1.90	± 13.1 %

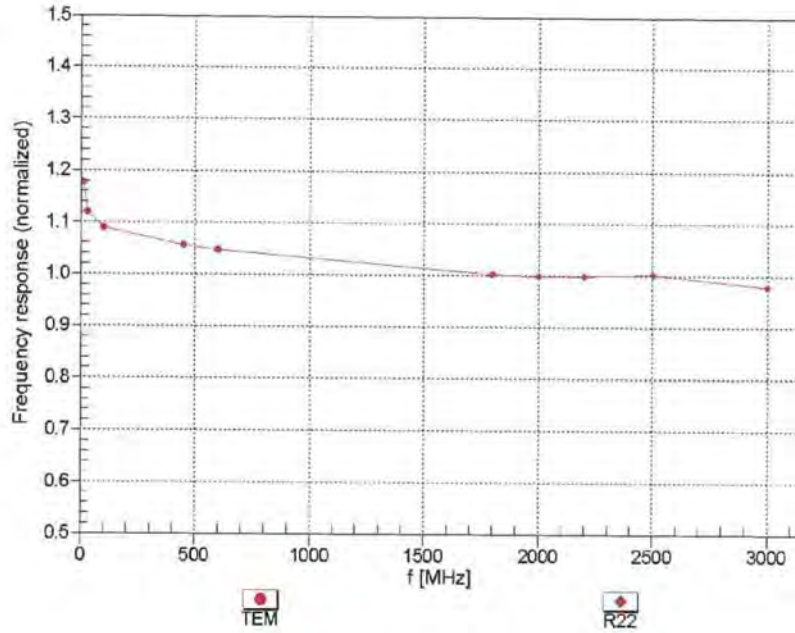
<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below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

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

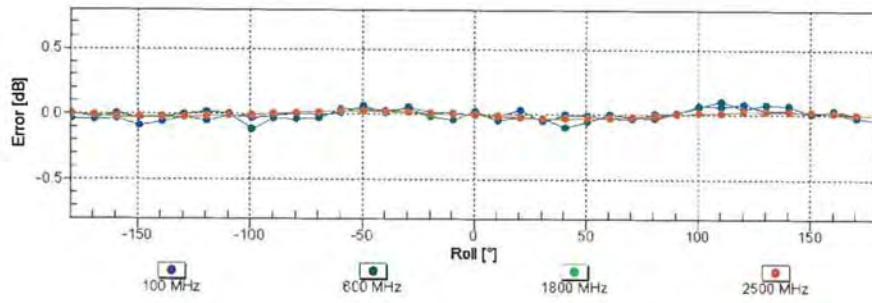
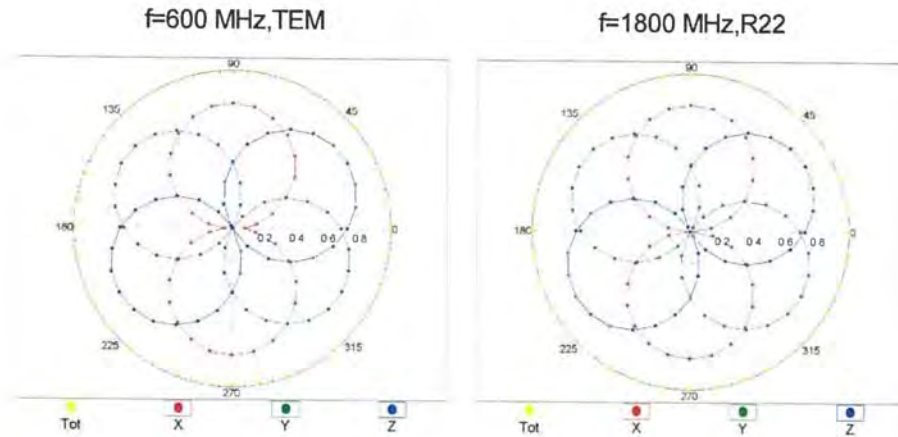


### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



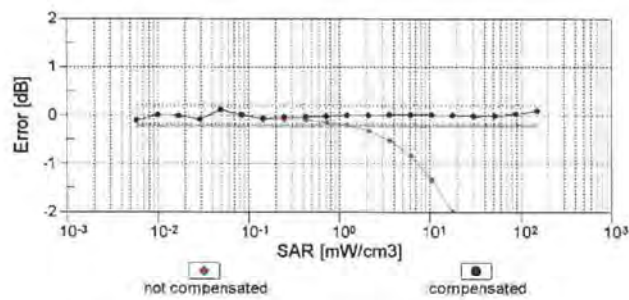
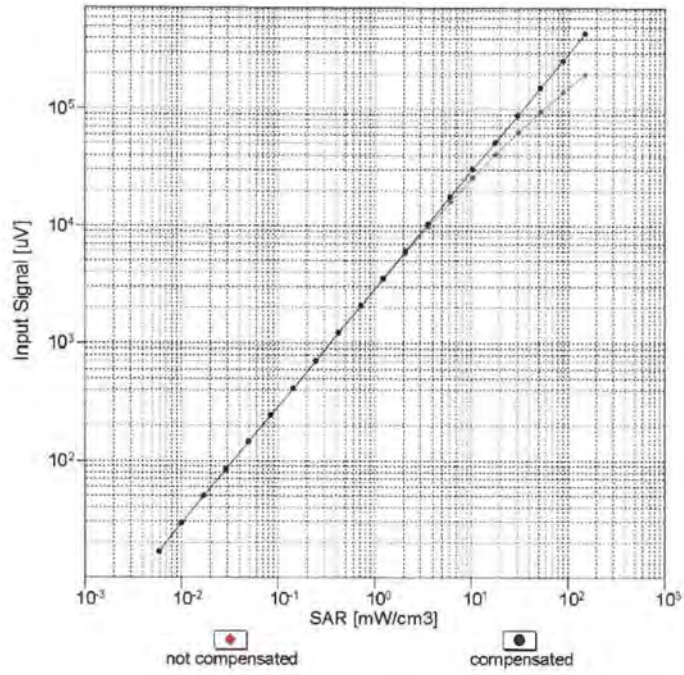
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



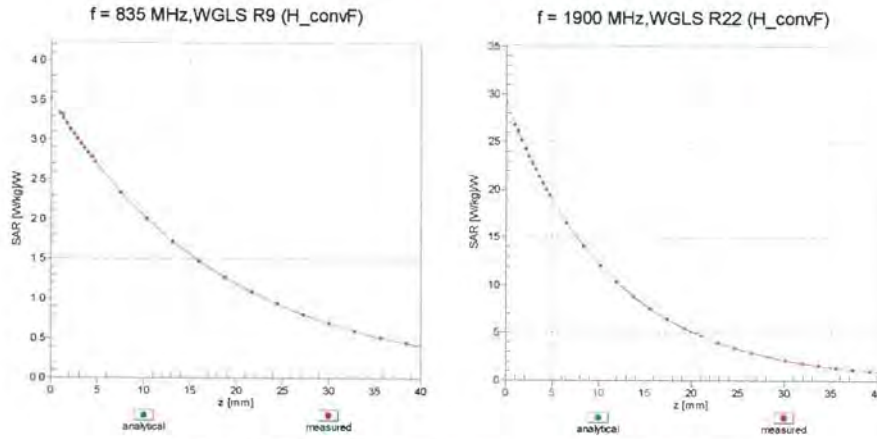
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

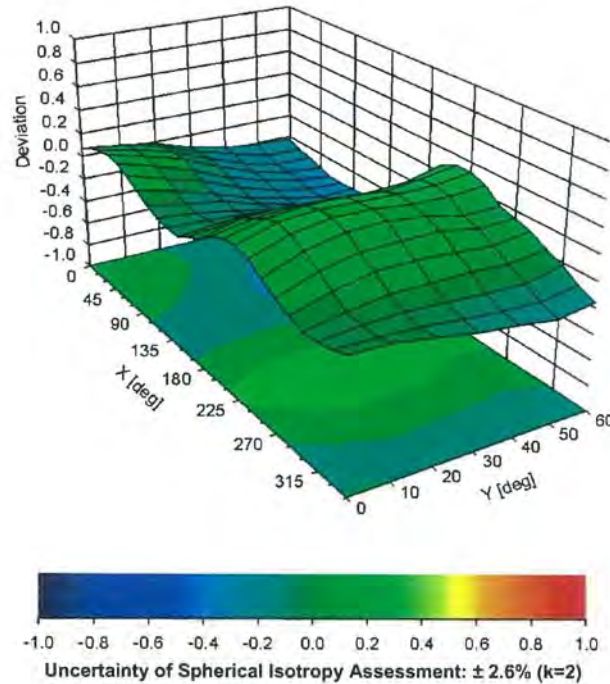


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), $f = 900$ MHz





EX3DV4- SN:3847

April 26, 2018

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3847

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	100.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm





EX3DV4- SN:3847

April 26, 2018

**Appendix: Modulation Calibration Parameters**

UID	Communication System Name		A dB	B dB-μV	C	D dB	VR mV	Max Unc <sup>E</sup> (k=2)
0	CW	X	0.00	0.00	1.00	0.00	144.9	± 3.0 %
		Y	0.00	0.00	1.00		138.9	
		Z	0.00	0.00	1.00		148.8	
10010- CAA	SAR Validation-(Square, 100ms, 10ms)	X	2.07	65.34	9.84	10.00	20.0	± 9.6 %
		Y	4.30	73.24	13.31		20.0	
		Z	1.71	62.89	8.19		20.0	
10011- CAB	UMTS-FDD (WCDMA)	X	0.83	64.13	12.78	0.00	150.0	± 9.6 %
		Y	1.01	67.17	15.08		150.0	
		Z	0.79	64.10	12.59		150.0	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	1.06	62.44	14.01	0.41	150.0	± 9.6 %
		Y	1.16	63.86	15.30		150.0	
		Z	1.02	62.22	13.74		150.0	
10013- CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	4.77	66.37	16.89	1.46	150.0	± 9.6 %
		Y	4.89	66.70	17.17		150.0	
		Z	4.60	66.32	16.67		150.0	
10021- DAC	GSM-FDD (TDMA, GMSK)	X	100.00	113.17	26.65	9.39	50.0	± 9.6 %
		Y	100.00	116.34	28.13		50.0	
		Z	100.00	107.45	23.86		50.0	
10023- DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	100.00	112.66	26.47	9.57	50.0	± 9.6 %
		Y	100.00	115.76	27.91		50.0	
		Z	22.94	91.16	19.83		50.0	
10024- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	100.00	112.56	25.29	6.56	60.0	± 9.6 %
		Y	100.00	117.63	27.75		60.0	
		Z	100.00	105.44	21.74		60.0	
10025- DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	4.03	70.07	26.46	12.57	50.0	± 9.6 %
		Y	5.97	83.97	34.33		50.0	
		Z	3.42	65.00	22.86		50.0	
10026- DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	7.66	89.12	32.08	9.56	60.0	± 9.6 %
		Y	11.45	100.08	36.56		60.0	
		Z	5.68	81.84	28.68		60.0	
10027- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	100.00	112.62	24.53	4.80	80.0	± 9.6 %
		Y	100.00	120.26	28.15		80.0	
		Z	100.00	104.13	20.37		80.0	
10028- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	100.00	112.46	23.76	3.55	100.0	± 9.6 %
		Y	100.00	123.92	28.99		100.0	
		Z	100.00	102.29	18.93		100.0	
10029- DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	4.96	78.87	26.64	7.80	80.0	± 9.6 %
		Y	6.39	85.09	29.52		80.0	
		Z	3.91	73.88	24.12		80.0	
10030- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	X	100.00	110.42	23.88	5.30	70.0	± 9.6 %
		Y	100.00	116.76	26.93		70.0	
		Z	100.00	102.53	19.97		70.0	
10031- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	X	100.00	100.57	17.59	1.88	100.0	± 9.6 %
		Y	100.00	123.52	27.31		100.0	
		Z	0.22	60.00	4.40		100.0	



EX3DV4- SN:3847

April 26, 2018

10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	0.93	68.53	8.07	1.17	100.0	± 9.6 %
		Y	100.00	130.89	29.13		100.0	
		Z	0.18	60.00	2.97		100.0	
10033-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	X	14.79	99.39	26.84	5.30	70.0	± 9.6 %
		Y	100.00	133.58	36.70		70.0	
		Z	4.18	78.83	18.83		70.0	
10034-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	X	2.15	72.78	15.94	1.88	100.0	± 9.6 %
		Y	6.14	88.93	22.90		100.0	
		Z	1.31	66.82	12.20		100.0	
10035-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	X	1.42	68.36	13.66	1.17	100.0	± 9.6 %
		Y	2.81	78.39	18.92		100.0	
		Z	1.01	64.84	10.92		100.0	
10036-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	X	25.55	108.22	29.36	5.30	70.0	± 9.6 %
		Y	100.00	134.11	36.94		70.0	
		Z	5.13	81.95	20.01		70.0	
10037-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	X	2.01	72.03	15.62	1.88	100.0	± 9.6 %
		Y	5.46	87.35	22.37		100.0	
		Z	1.24	66.30	11.95		100.0	
10038-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	X	1.43	68.60	13.88	1.17	100.0	± 9.6 %
		Y	2.85	78.92	19.24		100.0	
		Z	1.01	64.99	11.11		100.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	1.11	65.51	11.66	0.00	150.0	± 9.6 %
		Y	1.79	71.64	15.54		150.0	
		Z	0.86	63.71	9.85		150.0	
10042-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	X	100.00	108.58	23.79	7.78	50.0	± 9.6 %
		Y	100.00	112.54	25.69		50.0	
		Z	5.07	75.45	13.78		50.0	
10044-CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	X	0.04	118.81	12.58	0.00	150.0	± 9.6 %
		Y	0.00	106.69	7.66		150.0	
		Z	0.02	126.45	15.95		150.0	
10048-CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	X	100.00	109.92	26.77	13.80	25.0	± 9.6 %
		Y	100.00	113.54	28.22		25.0	
		Z	6.55	73.12	15.37		25.0	
10049-CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	X	100.00	111.23	26.17	10.79	40.0	± 9.6 %
		Y	100.00	113.76	27.29		40.0	
		Z	6.76	76.32	15.44		40.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	70.38	118.63	32.01	9.03	50.0	± 9.6 %
		Y	100.00	127.71	35.17		50.0	
		Z	12.47	88.74	22.30		50.0	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	3.93	74.26	23.77	6.55	100.0	± 9.6 %
		Y	4.77	78.63	25.95		100.0	
		Z	3.22	70.50	21.79		100.0	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	1.08	63.31	14.55	0.61	110.0	± 9.6 %
		Y	1.20	65.14	16.07		110.0	
		Z	1.02	62.81	14.09		110.0	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	3.16	86.24	21.83	1.30	110.0	± 9.6 %
		Y	100.00	141.96	37.36		110.0	
		Z	1.42	75.84	17.84		110.0	

Certificate No: EX3-3847 Apr18

Page 13 of 39



EX3DV4- SN:3847

April 26, 2018

10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	2.13	75.97	20.39	2.04	110.0	± 9.6 %
		Y	3.98	87.63	25.49		110.0	
		Z	1.48	70.69	17.76		110.0	
10062-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	4.55	66.28	16.23	0.49	100.0	± 9.6 %
		Y	4.69	66.66	16.54		100.0	
		Z	4.40	66.27	16.08		100.0	
10063-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	X	4.57	66.38	16.34	0.72	100.0	± 9.6 %
		Y	4.70	66.77	16.66		100.0	
		Z	4.41	66.35	16.17		100.0	
10064-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	X	4.85	66.66	16.59	0.86	100.0	± 9.6 %
		Y	5.00	67.05	16.90		100.0	
		Z	4.66	66.58	16.39		100.0	
10065-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	X	4.72	66.56	16.71	1.21	100.0	± 9.6 %
		Y	4.87	66.97	17.03		100.0	
		Z	4.53	66.42	16.46		100.0	
10066-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	X	4.74	66.59	16.88	1.46	100.0	± 9.6 %
		Y	4.89	67.00	17.21		100.0	
		Z	4.54	66.42	16.61		100.0	
10067-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	X	5.04	66.83	17.38	2.04	100.0	± 9.6 %
		Y	5.18	67.15	17.66		100.0	
		Z	4.83	66.70	17.10		100.0	
10068-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	X	5.08	66.86	17.61	2.55	100.0	± 9.6 %
		Y	5.23	67.25	17.93		100.0	
		Z	4.86	66.62	17.27		100.0	
10069-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	X	5.16	66.88	17.81	2.67	100.0	± 9.6 %
		Y	5.31	67.21	18.10		100.0	
		Z	4.93	66.66	17.47		100.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	4.86	66.48	17.21	1.99	100.0	± 9.6 %
		Y	4.98	66.80	17.50		100.0	
		Z	4.70	66.39	16.97		100.0	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	4.83	66.77	17.43	2.30	100.0	± 9.6 %
		Y	4.97	67.15	17.74		100.0	
		Z	4.64	66.60	17.13		100.0	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	4.89	66.94	17.78	2.83	100.0	± 9.6 %
		Y	5.02	67.31	18.09		100.0	
		Z	4.70	66.75	17.45		100.0	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	4.88	66.84	17.93	3.30	100.0	± 9.6 %
		Y	4.99	67.18	18.25		100.0	
		Z	4.70	66.67	17.60		100.0	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	4.91	66.93	18.25	3.82	90.0	± 9.6 %
		Y	5.03	67.32	18.59		90.0	
		Z	4.71	66.68	17.85		90.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	4.93	66.73	18.38	4.15	90.0	± 9.6 %
		Y	5.03	67.05	18.69		90.0	
		Z	4.75	66.56	18.02		90.0	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	4.95	66.81	18.48	4.30	90.0	± 9.6 %
		Y	5.05	67.11	18.78		90.0	
		Z	4.78	66.64	18.13		90.0	

Certificate No: EX3-3847\_Apr18

Page 14 of 39





EX3DV4- SN:3847

April 26, 2018

10081-CAB	CDMA2000 (1xRTT, RC3)	X	0.59	62.02	9.23	0.00	150.0	± 9.6 %
		Y	0.82	65.64	12.36		150.0	
		Z	0.47	60.88	7.65		150.0	
10082-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-QPSK, Fullrate)	X	1.95	64.53	5.78	4.77	80.0	± 9.6 %
		Y	0.70	60.00	4.46		80.0	
		Z	0.60	60.00	3.26		80.0	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	100.00	112.66	25.35	6.56	60.0	± 9.6 %
		Y	100.00	117.69	27.79		60.0	
		Z	100.00	105.52	21.80		60.0	
10097-CAB	UMTS-FDD (HSDPA)	X	1.60	65.59	14.08	0.00	150.0	± 9.6 %
		Y	1.81	67.49	15.56		150.0	
		Z	1.55	65.80	13.89		150.0	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	1.57	65.52	14.03	0.00	150.0	± 9.6 %
		Y	1.77	67.44	15.53		150.0	
		Z	1.51	65.73	13.84		150.0	
10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	7.72	89.29	32.14	9.56	60.0	± 9.6 %
		Y	11.58	100.34	36.65		60.0	
		Z	5.71	81.96	28.73		60.0	
10100-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	2.78	68.28	15.47	0.00	150.0	± 9.6 %
		Y	3.12	70.25	16.61		150.0	
		Z	2.67	68.17	15.43		150.0	
10101-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	3.05	66.43	15.19	0.00	150.0	± 9.6 %
		Y	3.23	67.46	15.88		150.0	
		Z	2.94	66.36	15.10		150.0	
10102-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	3.16	66.47	15.32	0.00	150.0	± 9.6 %
		Y	3.34	67.42	15.97		150.0	
		Z	3.05	66.43	15.25		150.0	
10103-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	5.54	74.19	20.01	3.98	65.0	± 9.6 %
		Y	6.87	77.90	21.66		65.0	
		Z	4.95	72.89	19.25		65.0	
10104-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	5.70	72.56	20.06	3.98	65.0	± 9.6 %
		Y	6.39	74.60	21.09		65.0	
		Z	4.99	70.72	19.00		65.0	
10105-CAD	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	5.63	72.17	20.20	3.98	65.0	± 9.6 %
		Y	6.11	73.58	20.95		65.0	
		Z	4.89	70.10	19.03		65.0	
10108-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	2.42	67.56	15.26	0.00	150.0	± 9.6 %
		Y	2.73	69.47	16.43		150.0	
		Z	2.30	67.47	15.19		150.0	
10109-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	2.69	66.17	14.97	0.00	150.0	± 9.6 %
		Y	2.89	67.29	15.77		150.0	
		Z	2.57	66.14	14.84		150.0	
10110-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	1.93	66.56	14.88	0.00	150.0	± 9.6 %
		Y	2.21	68.55	16.04		150.0	
		Z	1.81	66.45	14.48		150.0	
10111-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	2.36	66.62	14.95	0.00	150.0	± 9.6 %
		Y	2.60	68.05	16.04		150.0	
		Z	2.25	66.73	14.74		150.0	



EX3DV4- SN:3847

April 26, 2018

10112-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	2.82	66.25	15.08	0.00	150.0	± 9.6 %
		Y	3.02	67.28	15.83		150.0	
		Z	2.70	66.26	14.96		150.0	
10113-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	2.51	66.86	15.14	0.00	150.0	± 9.6 %
		Y	2.76	68.19	16.18		150.0	
		Z	2.39	67.00	14.94		150.0	
10114-CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	5.01	66.79	16.16	0.00	150.0	± 9.6 %
		Y	5.12	67.14	16.40		150.0	
		Z	4.87	66.71	16.08		150.0	
10115-CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	5.28	66.89	16.23	0.00	150.0	± 9.6 %
		Y	5.42	67.30	16.49		150.0	
		Z	5.12	66.82	16.14		150.0	
10116-CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	5.10	66.95	16.17	0.00	150.0	± 9.6 %
		Y	5.22	67.34	16.43		150.0	
		Z	4.95	66.90	16.10		150.0	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	4.97	66.63	16.10	0.00	150.0	± 9.6 %
		Y	5.09	67.02	16.35		150.0	
		Z	4.86	66.67	16.07		150.0	
10118-CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	5.36	67.10	16.34	0.00	150.0	± 9.6 %
		Y	5.50	67.51	16.60		150.0	
		Z	5.20	67.01	16.25		150.0	
10119-CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	5.08	66.93	16.17	0.00	150.0	± 9.6 %
		Y	5.20	67.28	16.41		150.0	
		Z	4.95	66.90	16.11		150.0	
10140-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	3.19	66.48	15.24	0.00	150.0	± 9.6 %
		Y	3.38	67.43	15.89		150.0	
		Z	3.07	66.44	15.16		150.0	
10141-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	3.31	66.63	15.45	0.00	150.0	± 9.6 %
		Y	3.50	67.52	16.06		150.0	
		Z	3.20	66.63	15.38		150.0	
10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	1.68	66.15	14.00	0.00	150.0	± 9.6 %
		Y	1.98	68.50	15.70		150.0	
		Z	1.53	65.91	13.53		150.0	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	2.12	66.68	14.17	0.00	150.0	± 9.6 %
		Y	2.46	68.76	15.76		150.0	
		Z	1.96	66.44	13.54		150.0	
10144-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	1.97	64.86	12.76	0.00	150.0	± 9.6 %
		Y	2.24	66.53	14.19		150.0	
		Z	1.77	64.38	11.96		150.0	
10145-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	0.91	61.85	9.05	0.00	150.0	± 9.6 %
		Y	1.23	65.13	11.88		150.0	
		Z	0.69	60.25	7.05		150.0	
10146-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	1.50	63.32	9.63	0.00	150.0	± 9.6 %
		Y	1.90	65.91	11.56		150.0	
		Z	1.01	60.65	7.03		150.0	
10147-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	1.63	64.25	10.24	0.00	150.0	± 9.6 %
		Y	2.20	67.75	12.58		150.0	
		Z	1.06	61.03	7.34		150.0	

Certificate No: EX3-3847\_Apr18

Page 16 of 39





EX3DV4- SN:3847

April 26, 2018

10149-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	2.70	66.23	15.02	0.00	150.0	± 9.6 %
		Y	2.90	67.35	15.82		150.0	
		Z	2.58	66.20	14.89		150.0	
10150-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	2.83	66.30	15.12	0.00	150.0	± 9.6 %
		Y	3.02	67.33	15.87		150.0	
		Z	2.71	66.32	15.01		150.0	
10151-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	5.97	77.23	21.34	3.98	65.0	± 9.6 %
		Y	7.34	80.80	22.94		65.0	
		Z	4.90	74.53	19.96		65.0	
10152-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	5.22	72.48	19.71	3.98	65.0	± 9.6 %
		Y	5.95	74.75	20.92		65.0	
		Z	4.50	70.46	18.46		65.0	
10153-CAD	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	5.58	73.49	20.53	3.98	65.0	± 9.6 %
		Y	6.32	75.66	21.67		65.0	
		Z	4.84	71.57	19.35		65.0	
10154-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	1.96	66.86	14.89	0.00	150.0	± 9.6 %
		Y	2.26	68.96	16.30		150.0	
		Z	1.84	66.75	14.68		150.0	
10155-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	2.36	66.64	14.97	0.00	150.0	± 9.6 %
		Y	2.60	68.06	16.06		150.0	
		Z	2.25	66.77	14.76		150.0	
10156-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	1.50	65.80	13.47	0.00	150.0	± 9.6 %
		Y	1.83	68.59	15.50		150.0	
		Z	1.34	65.32	12.76		150.0	
10157-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	1.75	64.90	12.44	0.00	150.0	± 9.6 %
		Y	2.08	67.08	14.22		150.0	
		Z	1.54	64.16	11.40		150.0	
10158-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	2.51	66.91	15.19	0.00	150.0	± 9.6 %
		Y	2.76	68.25	16.22		150.0	
		Z	2.40	67.07	14.99		150.0	
10159-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	1.83	65.22	12.66	0.00	150.0	± 9.6 %
		Y	2.19	67.55	14.51		150.0	
		Z	1.60	64.40	11.57		150.0	
10160-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	2.50	67.15	15.27	0.00	150.0	± 9.6 %
		Y	2.73	68.52	16.21		150.0	
		Z	2.38	67.14	15.17		150.0	
10161-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	2.72	66.21	15.00	0.00	150.0	± 9.6 %
		Y	2.92	67.27	15.80		150.0	
		Z	2.60	66.22	14.84		150.0	
10162-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	2.83	66.40	15.14	0.00	150.0	± 9.6 %
		Y	3.03	67.41	15.91		150.0	
		Z	2.70	66.46	15.00		150.0	
10166-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	3.42	68.83	18.71	3.01	150.0	± 9.6 %
		Y	3.54	69.27	18.90		150.0	
		Z	3.10	68.24	18.48		150.0	
10167-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	4.10	71.30	18.97	3.01	150.0	± 9.6 %
		Y	4.35	72.13	19.35		150.0	
		Z	3.54	70.41	18.64		150.0	



EX3DV4- SN:3847

April 26, 2018

10168-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	4.56	73.60	20.36	3.01	150.0	± 9.6 %
		Y	4.82	74.35	20.66		150.0	
		Z	3.99	73.05	20.25		150.0	
10169-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	2.83	67.78	18.21	3.01	150.0	± 9.6 %
		Y	2.94	68.87	18.74		150.0	
		Z	2.47	66.42	17.63		150.0	
10170-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	3.69	72.71	20.18	3.01	150.0	± 9.6 %
		Y	4.05	74.82	21.07		150.0	
		Z	3.02	70.89	19.59		150.0	
10171-AAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	3.09	69.04	17.57	3.01	150.0	± 9.6 %
		Y	3.32	70.68	18.31		150.0	
		Z	2.54	67.28	16.84		150.0	
10172-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.32	83.38	26.21	6.02	65.0	± 9.6 %
		Y	11.00	98.30	31.47		65.0	
		Z	3.71	77.97	23.91		65.0	
10173-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	11.57	94.78	28.24	6.02	65.0	± 9.6 %
		Y	30.00	112.19	33.34		65.0	
		Z	5.47	83.37	24.17		65.0	
10174-CAD	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	10.34	91.58	26.62	6.02	65.0	± 9.6 %
		Y	20.61	103.66	30.29		65.0	
		Z	3.98	77.30	21.37		65.0	
10175-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	2.80	67.51	17.97	3.01	150.0	± 9.6 %
		Y	2.91	68.57	18.50		150.0	
		Z	2.45	66.15	17.39		150.0	
10176-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	3.70	72.73	20.19	3.01	150.0	± 9.6 %
		Y	4.06	74.85	21.08		150.0	
		Z	3.03	70.91	19.61		150.0	
10177-CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	2.82	67.64	18.06	3.01	150.0	± 9.6 %
		Y	2.93	68.72	18.59		150.0	
		Z	2.46	66.27	17.47		150.0	
10178-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	3.67	72.56	20.09	3.01	150.0	± 9.6 %
		Y	4.01	74.62	20.96		150.0	
		Z	3.01	70.76	19.51		150.0	
10179-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	3.36	70.75	18.74	3.01	150.0	± 9.6 %
		Y	3.65	72.62	19.55		150.0	
		Z	2.75	68.95	18.07		150.0	
10180-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	3.09	68.99	17.53	3.01	150.0	± 9.6 %
		Y	3.31	70.61	18.26		150.0	
		Z	2.53	67.24	16.81		150.0	
10181-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	2.81	67.62	18.05	3.01	150.0	± 9.6 %
		Y	2.93	68.70	18.58		150.0	
		Z	2.46	66.26	17.47		150.0	
10182-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	3.66	72.54	20.08	3.01	150.0	± 9.6 %
		Y	4.01	74.60	20.95		150.0	
		Z	3.00	70.74	19.50		150.0	
10183-AAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	3.08	68.97	17.52	3.01	150.0	± 9.6 %
		Y	3.30	70.59	18.25		150.0	
		Z	2.53	67.23	16.80		150.0	

Certificate No: EX3-3847\_Apr18

Page 18 of 39





EX3DV4- SN:3847

April 26, 2018

10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	2.82	67.66	18.07	3.01	150.0	± 9.6 %
		Y	2.94	68.74	18.61		150.0	
		Z	2.47	66.29	17.49		150.0	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	3.68	72.60	20.12	3.01	150.0	± 9.6 %
		Y	4.03	74.67	20.99		150.0	
		Z	3.02	70.81	19.54		150.0	
10186-AAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	3.10	69.03	17.55	3.01	150.0	± 9.6 %
		Y	3.32	70.66	18.28		150.0	
		Z	2.54	67.28	16.83		150.0	
10187-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	2.83	67.72	18.14	3.01	150.0	± 9.6 %
		Y	2.95	68.79	18.67		150.0	
		Z	2.48	66.36	17.57		150.0	
10188-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	3.78	73.17	20.46	3.01	150.0	± 9.6 %
		Y	4.16	75.34	21.37		150.0	
		Z	3.10	71.36	19.90		150.0	
10189-AAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	3.15	69.39	17.80	3.01	150.0	± 9.6 %
		Y	3.39	71.08	18.56		150.0	
		Z	2.59	67.61	17.09		150.0	
10193-CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	4.39	66.15	15.78	0.00	150.0	± 9.6 %
		Y	4.52	66.55	16.11		150.0	
		Z	4.27	66.26	15.71		150.0	
10194-CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	4.55	66.45	15.91	0.00	150.0	± 9.6 %
		Y	4.69	66.87	16.23		150.0	
		Z	4.41	66.51	15.85		150.0	
10195-CAC	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	4.59	66.48	15.94	0.00	150.0	± 9.6 %
		Y	4.74	66.90	16.25		150.0	
		Z	4.44	66.54	15.87		150.0	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	4.39	66.19	15.79	0.00	150.0	± 9.6 %
		Y	4.52	66.61	16.13		150.0	
		Z	4.25	66.27	15.70		150.0	
10197-CAC	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	4.56	66.47	15.93	0.00	150.0	± 9.6 %
		Y	4.71	66.89	16.24		150.0	
		Z	4.42	66.52	15.86		150.0	
10198-CAC	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	4.59	66.50	15.95	0.00	150.0	± 9.6 %
		Y	4.74	66.92	16.26		150.0	
		Z	4.44	66.54	15.88		150.0	
10219-CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	4.33	66.20	15.74	0.00	150.0	± 9.6 %
		Y	4.47	66.63	16.09		150.0	
		Z	4.20	66.29	15.66		150.0	
10220-CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	4.55	66.43	15.92	0.00	150.0	± 9.6 %
		Y	4.70	66.86	16.23		150.0	
		Z	4.41	66.48	15.85		150.0	
10221-CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	4.60	66.44	15.94	0.00	150.0	± 9.6 %
		Y	4.75	66.84	16.24		150.0	
		Z	4.45	66.49	15.87		150.0	
10222-CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	4.95	66.63	16.09	0.00	150.0	± 9.6 %
		Y	5.07	67.03	16.35		150.0	
		Z	4.83	66.64	16.05		150.0	



EX3DV4- SN:3847

April 26, 2018

10223-CAC	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	X	5.26	66.93	16.27	0.00	150.0	± 9.6 %
		Y	5.37	67.22	16.47		150.0	
		Z	5.11	66.88	16.19		150.0	
10224-CAC	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	X	4.99	66.73	16.07	0.00	150.0	± 9.6 %
		Y	5.11	67.14	16.33		150.0	
		Z	4.87	66.74	16.03		150.0	
10225-CAB	UMTS-FDD (HSPA+)	X	2.62	65.18	14.48	0.00	150.0	± 9.6 %
		Y	2.79	66.03	15.28		150.0	
		Z	2.49	65.19	14.14		150.0	
10226-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	12.41	96.19	28.79	6.02	65.0	± 9.6 %
		Y	33.69	114.53	34.08		65.0	
		Z	5.79	84.47	24.66		65.0	
10227-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	12.38	94.72	27.67	6.02	65.0	± 9.6 %
		Y	30.02	110.23	32.17		65.0	
		Z	5.87	83.75	23.75		65.0	
10228-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	7.23	90.02	28.71	6.02	65.0	± 9.6 %
		Y	13.03	102.13	32.77		65.0	
		Z	4.00	79.75	24.71		65.0	
10229-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	11.66	94.88	28.28	6.02	65.0	± 9.6 %
		Y	30.27	112.32	33.39		65.0	
		Z	5.51	83.47	24.21		65.0	
10230-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	11.55	93.41	27.18	6.02	65.0	± 9.6 %
		Y	27.02	108.22	31.54		65.0	
		Z	5.53	82.68	23.29		65.0	
10231-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	6.92	89.07	28.29	6.02	65.0	± 9.6 %
		Y	12.27	100.80	32.26		65.0	
		Z	3.87	79.05	24.34		65.0	
10232-CAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	11.64	94.87	28.28	6.02	65.0	± 9.6 %
		Y	30.23	112.32	33.38		65.0	
		Z	5.50	83.45	24.20		65.0	
10233-CAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	11.51	93.37	27.17	6.02	65.0	± 9.6 %
		Y	26.94	108.19	31.53		65.0	
		Z	5.52	82.64	23.28		65.0	
10234-CAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	6.69	88.26	27.89	6.02	65.0	± 9.6 %
		Y	11.68	99.60	31.76		65.0	
		Z	3.77	78.47	23.99		65.0	
10235-CAD	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	11.65	94.90	28.29	6.02	65.0	± 9.6 %
		Y	30.32	112.40	33.41		65.0	
		Z	5.50	83.47	24.21		65.0	
10236-CAD	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	11.66	93.56	27.23	6.02	65.0	± 9.6 %
		Y	27.49	108.50	31.61		65.0	
		Z	5.57	82.78	23.32		65.0	
10237-CAD	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	6.93	89.12	28.32	6.02	65.0	± 9.6 %
		Y	12.32	100.92	32.31		65.0	
		Z	3.86	79.06	24.35		65.0	
10238-CAD	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	11.61	94.84	28.27	6.02	65.0	± 9.6 %
		Y	30.17	112.30	33.38		65.0	
		Z	5.49	83.42	24.19		65.0	

Certificate No: EX3-3847\_Apr18

Page 20 of 39





EX3DV4- SN:3847

April 26, 2018

10239-CAD	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	11.47	93.33	27.16	6.02	65.0	± 9.6 %
		Y	26.85	108.15	31.52		65.0	
		Z	5.50	82.60	23.27		65.0	
10240-CAD	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	6.91	89.08	28.30	6.02	65.0	± 9.6 %
		Y	12.27	100.85	32.29		65.0	
		Z	3.86	79.03	24.34		65.0	
10241-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	7.44	80.10	25.19	6.98	65.0	± 9.6 %
		Y	8.19	81.97	26.06		65.0	
		Z	6.09	77.56	23.93		65.0	
10242-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	7.23	79.51	24.87	6.98	65.0	± 9.6 %
		Y	7.66	80.54	25.40		65.0	
		Z	5.78	76.55	23.42		65.0	
10243-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.33	73.92	23.32	6.98	65.0	± 9.6 %
		Y	6.09	76.75	24.72		65.0	
		Z	4.88	73.49	22.94		65.0	
10244-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	5.26	74.70	17.95	3.98	65.0	± 9.6 %
		Y	6.85	78.90	20.11		65.0	
		Z	3.39	68.77	14.26		65.0	
10245-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	5.09	73.91	17.56	3.98	65.0	± 9.6 %
		Y	6.59	78.01	19.70		65.0	
		Z	3.32	68.22	13.93		65.0	
10246-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	4.63	76.49	18.84	3.98	65.0	± 9.6 %
		Y	8.01	85.54	22.95		65.0	
		Z	2.86	69.76	14.97		65.0	
10247-CAD	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	4.37	72.37	17.80	3.98	65.0	± 9.6 %
		Y	5.53	76.31	20.08		65.0	
		Z	3.35	68.75	15.27		65.0	
10248-CAD	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	4.35	71.77	17.51	3.98	65.0	± 9.6 %
		Y	5.45	75.47	19.69		65.0	
		Z	3.35	68.30	15.04		65.0	
10249-CAD	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.84	80.40	21.44	3.98	65.0	± 9.6 %
		Y	9.16	88.22	24.82		65.0	
		Z	3.94	74.55	18.36		65.0	
10250-CAD	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	5.24	74.90	20.72	3.98	65.0	± 9.6 %
		Y	6.18	77.83	22.27		65.0	
		Z	4.37	72.40	19.13		65.0	
10251-CAD	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	5.01	72.81	19.41	3.98	65.0	± 9.6 %
		Y	5.83	75.38	20.86		65.0	
		Z	4.19	70.42	17.81		65.0	
10252-CAD	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.05	79.98	22.38	3.98	65.0	± 9.6 %
		Y	8.11	85.15	24.64		65.0	
		Z	4.65	76.16	20.44		65.0	
10253-CAD	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	5.13	72.01	19.46	3.98	65.0	± 9.6 %
		Y	5.79	74.09	20.63		65.0	
		Z	4.45	70.14	18.22		65.0	
10254-CAD	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	5.46	72.93	20.18	3.98	65.0	± 9.6 %
		Y	6.14	74.96	21.31		65.0	
		Z	4.75	71.10	18.98		65.0	





EX3DV4- SN:3847

April 26, 2018

10255-CAD	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	5.67	76.47	21.24	3.98	65.0	± 9.6 %
		Y	6.83	79.72	22.76		65.0	
		Z	4.70	73.94	19.86		65.0	
10256-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	3.85	69.91	14.71	3.98	65.0	± 9.6 %
		Y	5.28	74.58	17.30		65.0	
		Z	2.42	64.50	10.86		65.0	
10257-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	3.71	69.05	14.20	3.98	65.0	± 9.6 %
		Y	5.01	73.44	16.72		65.0	
		Z	2.38	64.04	10.51		65.0	
10258-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	3.27	70.95	15.52	3.98	65.0	± 9.6 %
		Y	5.77	79.71	19.94		65.0	
		Z	2.03	65.05	11.54		65.0	
10259-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	4.73	73.41	18.90	3.98	65.0	± 9.6 %
		Y	5.80	76.88	20.87		65.0	
		Z	3.76	70.25	16.74		65.0	
10260-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	4.75	73.12	18.77	3.98	65.0	± 9.6 %
		Y	5.79	76.46	20.69		65.0	
		Z	3.80	70.04	16.63		65.0	
10261-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.60	79.27	21.48	3.98	65.0	± 9.6 %
		Y	7.94	85.39	24.24		65.0	
		Z	4.08	74.65	18.96		65.0	
10262-CAD	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	5.23	74.84	20.67	3.98	65.0	± 9.6 %
		Y	6.17	77.78	22.23		65.0	
		Z	4.36	72.33	19.08		65.0	
10263-CAD	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	5.00	72.78	19.40	3.98	65.0	± 9.6 %
		Y	5.82	75.36	20.86		65.0	
		Z	4.18	70.40	17.80		65.0	
10264-CAD	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.99	79.77	22.28	3.98	65.0	± 9.6 %
		Y	8.01	84.91	24.53		65.0	
		Z	4.60	75.96	20.33		65.0	
10265-CAD	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	5.22	72.48	19.71	3.98	65.0	± 9.6 %
		Y	5.95	74.75	20.92		65.0	
		Z	4.50	70.47	18.46		65.0	
10266-CAD	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	5.58	73.47	20.51	3.98	65.0	± 9.6 %
		Y	6.31	75.64	21.86		65.0	
		Z	4.84	71.56	19.34		65.0	
10267-CAD	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	5.96	77.19	21.32	3.98	65.0	± 9.6 %
		Y	7.32	80.74	22.92		65.0	
		Z	4.89	74.49	19.94		65.0	
10268-CAD	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	5.86	72.46	20.12	3.98	65.0	± 9.6 %
		Y	6.50	74.30	21.07		65.0	
		Z	5.17	70.78	19.12		65.0	
10269-CAD	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	5.85	72.07	19.99	3.98	65.0	± 9.6 %
		Y	6.45	73.79	20.90		65.0	
		Z	5.20	70.49	19.02		65.0	
10270-CAD	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	5.90	74.56	20.37	3.98	65.0	± 9.6 %
		Y	6.79	76.97	21.51		65.0	
		Z	5.10	72.64	19.34		65.0	

Certificate No: EX3-3847\_Apr18

Page 22 of 39



EX3DV4- SN:3847

April 26, 2018

10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	2.40	65.40	14.29	0.00	150.0	± 9.6 %
		Y	2.57	66.37	15.17		150.0	
		Z	2.31	65.52	14.03		150.0	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	1.36	65.36	13.69	0.00	150.0	± 9.6 %
		Y	1.59	67.74	15.42		150.0	
		Z	1.29	65.34	13.47		150.0	
10277-CAA	PHS (QPSK)	X	1.85	60.83	6.42	9.03	50.0	± 9.6 %
		Y	2.01	61.72	7.25		50.0	
		Z	1.60	59.63	5.11		50.0	
10278-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.5)	X	4.34	71.93	15.03	9.03	50.0	± 9.6 %
		Y	11.08	86.38	21.21		50.0	
		Z	2.79	65.32	10.81		50.0	
10279-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.38)	X	4.48	72.29	15.25	9.03	50.0	± 9.6 %
		Y	11.33	86.65	21.37		50.0	
		Z	2.86	65.56	10.99		50.0	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	0.98	63.94	10.60	0.00	150.0	± 9.6 %
		Y	1.42	68.39	13.82		150.0	
		Z	0.76	62.34	8.84		150.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	0.58	61.91	9.15	0.00	150.0	± 9.6 %
		Y	0.80	65.42	12.22		150.0	
		Z	0.47	60.79	7.58		150.0	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	0.64	63.49	10.34	0.00	150.0	± 9.6 %
		Y	1.03	69.64	14.66		150.0	
		Z	0.51	62.18	8.67		150.0	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	0.79	65.91	12.03	0.00	150.0	± 9.6 %
		Y	1.64	76.28	17.94		150.0	
		Z	0.64	64.53	10.36		150.0	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	12.08	90.23	25.40	9.03	50.0	± 9.6 %
		Y	12.75	93.47	27.54		50.0	
		Z	11.32	86.31	22.48		50.0	
10297-AAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	2.43	67.64	15.32	0.00	150.0	± 9.6 %
		Y	2.74	69.57	16.50		150.0	
		Z	2.31	67.56	15.25		150.0	
10298-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	1.18	64.09	11.41	0.00	150.0	± 9.6 %
		Y	1.55	67.50	14.03		150.0	
		Z	0.97	62.82	9.94		150.0	
10299-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	2.07	66.50	12.33	0.00	150.0	± 9.6 %
		Y	2.53	69.04	14.02		150.0	
		Z	1.48	63.79	10.06		150.0	
10300-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	1.66	63.31	10.01	0.00	150.0	± 9.6 %
		Y	1.93	64.84	11.28		150.0	
		Z	1.23	61.38	8.04		150.0	
10301-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	X	4.64	65.27	17.18	4.17	50.0	± 9.6 %
		Y	4.80	65.55	17.49		50.0	
		Z	4.29	64.63	16.64		50.0	
10302-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols)	X	5.09	65.68	17.78	4.96	50.0	± 9.6 %
		Y	5.28	66.19	18.23		50.0	
		Z	4.79	65.34	17.40		50.0	

Certificate No: EX3-3847\_Apr18

Page 23 of 39





EX3DV4- SN:3847

April 26, 2018

10303-AAA	IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	X	4.83	65.30	17.59	4.96	50.0	± 9.6 %
		Y	5.03	65.83	18.07		50.0	
		Z	4.55	64.95	17.17		50.0	
10304-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	X	4.64	65.15	17.06	4.17	50.0	± 9.6 %
		Y	4.83	65.68	17.54		50.0	
		Z	4.37	64.87	16.70		50.0	
10305-AAA	IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC, 15 symbols)	X	4.28	67.14	19.04	6.02	35.0	± 9.6 %
		Y	4.42	67.52	19.68		35.0	
		Z	3.97	66.44	18.16		35.0	
10306-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC, 18 symbols)	X	4.60	66.26	18.77	6.02	35.0	± 9.6 %
		Y	4.75	66.58	19.26		35.0	
		Z	4.32	65.78	18.11		35.0	
10307-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC, 18 symbols)	X	4.49	66.36	18.69	6.02	35.0	± 9.6 %
		Y	4.65	66.76	19.23		35.0	
		Z	4.20	65.78	17.99		35.0	
10308-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	X	4.47	66.56	18.83	6.02	35.0	± 9.6 %
		Y	4.62	66.94	19.37		35.0	
		Z	4.17	65.96	18.12		35.0	
10309-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3, 18 symbols)	X	4.65	66.45	18.90	6.02	35.0	± 9.6 %
		Y	4.81	66.83	19.42		35.0	
		Z	4.34	65.87	18.21		35.0	
10310-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3, 18 symbols)	X	4.55	66.31	18.74	6.02	35.0	± 9.6 %
		Y	4.69	66.64	19.23		35.0	
		Z	4.27	65.82	18.09		35.0	
10311-AAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	2.77	67.02	15.08	0.00	150.0	± 9.6 %
		Y	3.10	68.87	16.16		150.0	
		Z	2.65	66.93	15.04		150.0	
10313-AAA	iDEN 1:3	X	3.09	72.60	16.00	6.99	70.0	± 9.6 %
		Y	6.49	82.69	20.03		70.0	
		Z	2.00	67.75	13.58		70.0	
10314-AAA	iDEN 1:6	X	4.75	81.28	22.32	10.00	30.0	± 9.6 %
		Y	11.83	97.36	28.06		30.0	
		Z	3.21	74.69	19.28		30.0	
10315-AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	0.98	62.24	13.79	0.17	150.0	± 9.6 %
		Y	1.06	63.68	15.14		150.0	
		Z	0.95	62.14	13.61		150.0	
10316-AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	4.45	66.23	15.96	0.17	150.0	± 9.6 %
		Y	4.58	66.64	16.29		150.0	
		Z	4.30	66.23	15.82		150.0	
10317-AAC	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	4.45	66.23	15.96	0.17	150.0	± 9.6 %
		Y	4.58	66.64	16.29		150.0	
		Z	4.30	66.23	15.82		150.0	
10400-AAD	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	4.53	66.49	15.91	0.00	150.0	± 9.6 %
		Y	4.69	66.93	16.23		150.0	
		Z	4.37	66.51	15.82		150.0	
10401-AAD	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	5.30	66.87	16.22	0.00	150.0	± 9.6 %
		Y	5.38	67.11	16.39		150.0	
		Z	5.06	66.49	15.95		150.0	

Certificate No: EX3-3847\_Apr18

Page 24 of 39



EX3DV4- SN:3847

April 26, 2018

10402-AAD	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	5.51	67.03	16.16	0.00	150.0	± 9.6 %
		Y	5.63	67.43	16.40		150.0	
		Z	5.39	67.01	16.11		150.0	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	0.98	63.94	10.60	0.00	115.0	± 9.6 %
		Y	1.42	68.39	13.82		115.0	
		Z	0.76	62.34	8.84		115.0	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	0.98	63.94	10.60	0.00	115.0	± 9.6 %
		Y	1.42	68.39	13.82		115.0	
		Z	0.76	62.34	8.84		115.0	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	10.48	91.04	22.47	0.00	100.0	± 9.6 %
		Y	46.29	111.17	27.84		100.0	
		Z	25.97	104.14	25.39		100.0	
10410-AAD	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9, Subframe Conf=4)	X	100.00	126.02	31.95	3.23	80.0	± 9.6 %
		Y	100.00	125.13	31.67		80.0	
		Z	6.89	90.42	22.44		80.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	0.92	61.60	13.26	0.00	150.0	± 9.6 %
		Y	0.99	62.83	14.50		150.0	
		Z	0.90	61.69	13.21		150.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	4.39	66.19	15.86	0.00	150.0	± 9.6 %
		Y	4.52	66.59	16.17		150.0	
		Z	4.26	66.26	15.79		150.0	
10417-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	4.39	66.19	15.86	0.00	150.0	± 9.6 %
		Y	4.52	66.59	16.17		150.0	
		Z	4.26	66.26	15.79		150.0	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	X	4.38	66.34	15.87	0.00	150.0	± 9.6 %
		Y	4.51	66.74	16.19		150.0	
		Z	4.25	66.44	15.83		150.0	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	X	4.40	66.29	15.88	0.00	150.0	± 9.6 %
		Y	4.53	66.69	16.19		150.0	
		Z	4.27	66.39	15.82		150.0	
10422-AAB	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	X	4.52	66.31	15.91	0.00	150.0	± 9.6 %
		Y	4.65	66.70	16.21		150.0	
		Z	4.38	66.38	15.85		150.0	
10423-AAB	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	X	4.66	66.60	16.01	0.00	150.0	± 9.6 %
		Y	4.82	67.02	16.32		150.0	
		Z	4.51	66.64	15.94		150.0	
10424-AAB	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	X	4.59	66.54	15.98	0.00	150.0	± 9.6 %
		Y	4.74	66.97	16.30		150.0	
		Z	4.44	66.59	15.91		150.0	
10425-AAB	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	X	5.21	66.90	16.23	0.00	150.0	± 9.6 %
		Y	5.34	67.27	16.47		150.0	
		Z	5.08	66.89	16.17		150.0	
10426-AAB	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	X	5.24	67.00	16.28	0.00	150.0	± 9.6 %
		Y	5.34	67.29	16.48		150.0	
		Z	5.10	66.98	16.22		150.0	





EX3DV4- SN:3847

April 26, 2018

10427-AAB	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	X	5.24	66.92	16.24	0.00	150.0	± 9.6 %
		Y	5.35	67.28	16.47		150.0	
		Z	5.06	66.77	16.11		150.0	
10430-AAB	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	3.99	69.96	17.43	0.00	150.0	± 9.6 %
		Y	4.23	70.63	18.08		150.0	
		Z	3.95	70.81	17.49		150.0	
10431-AAB	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	4.02	66.60	15.71	0.00	150.0	± 9.6 %
		Y	4.21	67.13	16.17		150.0	
		Z	3.85	66.67	15.55		150.0	
10432-AAB	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	4.34	66.55	15.88	0.00	150.0	± 9.6 %
		Y	4.51	67.01	16.24		150.0	
		Z	4.19	66.62	15.79		150.0	
10433-AAB	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	4.60	66.57	16.00	0.00	150.0	± 9.6 %
		Y	4.75	67.00	16.32		150.0	
		Z	4.45	66.62	15.93		150.0	
10434-AAA	W-CDMA (BS Test Model 1, 64 DPCH)	X	4.02	70.53	17.20	0.00	150.0	± 9.6 %
		Y	4.33	71.48	18.05		150.0	
		Z	3.94	71.25	17.09		150.0	
10435-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	125.79	31.84	3.23	80.0	± 9.6 %
		Y	100.00	124.91	31.56		80.0	
		Z	6.42	89.33	22.05		80.0	
10447-AAB	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	X	3.26	66.26	14.68	0.00	150.0	± 9.6 %
		Y	3.50	67.12	15.48		150.0	
		Z	3.05	66.14	14.21		150.0	
10448-AAB	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	X	3.87	66.37	15.56	0.00	150.0	± 9.6 %
		Y	4.04	66.91	16.02		150.0	
		Z	3.72	66.46	15.41		150.0	
10449-AAB	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	X	4.17	66.36	15.76	0.00	150.0	± 9.6 %
		Y	4.32	66.84	16.14		150.0	
		Z	4.03	66.43	15.68		150.0	
10450-AAB	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	X	4.38	66.32	15.83	0.00	150.0	± 9.6 %
		Y	4.51	66.77	16.17		150.0	
		Z	4.25	66.38	15.77		150.0	
10451-AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	X	3.10	66.18	14.10	0.00	150.0	± 9.6 %
		Y	3.39	67.28	15.10		150.0	
		Z	2.83	65.80	13.41		150.0	
10456-AAB	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc duty cycle)	X	6.12	67.56	16.47	0.00	150.0	± 9.6 %
		Y	6.20	67.82	16.62		150.0	
		Z	6.01	67.50	16.40		150.0	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	3.69	64.86	15.55	0.00	150.0	± 9.6 %
		Y	3.77	65.23	15.88		150.0	
		Z	3.62	65.01	15.50		150.0	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	3.62	69.52	16.34	0.00	150.0	± 9.6 %
		Y	3.97	70.72	17.44		150.0	
		Z	3.37	69.33	15.62		150.0	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	4.90	68.11	17.73	0.00	150.0	± 9.6 %
		Y	5.06	68.23	18.06		150.0	
		Z	4.75	68.62	17.57		150.0	

Certificate No: EX3-3847\_Apr18

Page 26 of 39





EX3DV4- SN:3847

April 26, 2018

10460-AAA	UMTS-FDD (WCDMA, AMR)	X	0.69	64.19	13.09	0.00	150.0	± 9.6 %
		Y	0.87	67.85	15.85		150.0	
		Z	0.67	64.28	12.96		150.0	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	84.02	126.89	33.08	3.29	80.0	± 9.6 %
		Y	100.00	130.31	34.10		80.0	
		Z	4.28	85.78	21.95		80.0	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.52	70.62	13.63	3.23	80.0	± 9.6 %
		Y	26.21	94.19	20.52		80.0	
		Z	0.72	60.00	7.99		80.0	
10463-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.32	63.49	10.12	3.23	80.0	± 9.6 %
		Y	2.56	69.70	12.62		80.0	
		Z	0.73	60.00	7.34		80.0	
10464-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	71.17	121.90	31.12	3.23	80.0	± 9.6 %
		Y	100.00	127.56	32.65		80.0	
		Z	3.03	80.40	19.49		80.0	
10465-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.99	68.14	12.60	3.23	80.0	± 9.6 %
		Y	8.79	82.97	17.46		80.0	
		Z	0.72	60.00	7.91		80.0	
10466-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.21	62.65	9.67	3.23	80.0	± 9.6 %
		Y	1.99	67.25	11.63		80.0	
		Z	0.73	60.00	7.29		80.0	
10467-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	99.99	126.82	32.25	3.23	80.0	± 9.6 %
		Y	100.00	127.88	32.79		80.0	
		Z	3.35	81.84	20.01		80.0	
10468-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.11	68.77	12.88	3.23	80.0	± 9.6 %
		Y	11.17	85.45	18.18		80.0	
		Z	0.72	60.00	7.94		80.0	
10469-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.21	62.67	9.69	3.23	80.0	± 9.6 %
		Y	2.00	67.30	11.64		80.0	
		Z	0.73	60.00	7.29		80.0	
10470-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	126.85	32.25	3.23	80.0	± 9.6 %
		Y	100.00	127.92	32.80		80.0	
		Z	3.35	81.89	20.02		80.0	
10471-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.09	68.68	12.83	3.23	80.0	± 9.6 %
		Y	10.92	85.18	18.09		80.0	
		Z	0.72	60.00	7.93		80.0	
10472-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.21	62.62	9.65	3.23	80.0	± 9.6 %
		Y	1.98	67.19	11.59		80.0	
		Z	0.73	60.00	7.27		80.0	
10473-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	126.81	32.23	3.23	80.0	± 9.6 %
		Y	100.00	127.88	32.78		80.0	
		Z	3.34	81.80	19.99		80.0	
10474-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.08	68.62	12.80	3.23	80.0	± 9.6 %
		Y	10.68	84.97	18.03		80.0	
		Z	0.72	60.00	7.92		80.0	
10475-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.20	62.60	9.64	3.23	80.0	± 9.6 %
		Y	1.97	67.14	11.57		80.0	
		Z	0.73	60.00	7.27		80.0	



EX3DV4- SN:3847

April 26, 2018

10477-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.98	68.11	12.58	3.23	80.0	± 9.6 %
		Y	8.87	83.03	17.46		80.0	
		Z	0.72	60.00	7.90		80.0	
10478-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.20	62.55	9.61	3.23	80.0	± 9.6 %
		Y	1.95	67.03	11.51		80.0	
		Z	0.73	60.00	7.26		80.0	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.77	87.55	23.54	3.23	80.0	± 9.6 %
		Y	9.58	90.88	24.95		80.0	
		Z	5.34	83.01	21.38		80.0	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.80	80.27	19.12	3.23	80.0	± 9.6 %
		Y	11.20	87.21	21.75		80.0	
		Z	3.11	71.34	14.97		80.0	
10481-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.10	75.89	17.20	3.23	80.0	± 9.6 %
		Y	8.44	82.58	19.88		80.0	
		Z	2.28	67.29	12.89		80.0	
10482-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	2.06	67.56	14.47	2.23	80.0	± 9.6 %
		Y	3.95	76.80	19.08		80.0	
		Z	1.30	62.65	11.14		80.0	
10483-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.51	70.88	15.53	2.23	80.0	± 9.6 %
		Y	5.27	76.52	18.28		80.0	
		Z	1.80	63.41	11.09		80.0	
10484-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.27	69.73	15.05	2.23	80.0	± 9.6 %
		Y	4.79	74.98	17.71		80.0	
		Z	1.76	62.89	10.82		80.0	
10485-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	2.53	70.00	16.66	2.23	80.0	± 9.6 %
		Y	3.96	76.89	20.10		80.0	
		Z	1.81	66.19	14.25		80.0	
10486-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.57	66.81	14.63	2.23	80.0	± 9.6 %
		Y	3.53	71.42	17.33		80.0	
		Z	1.91	63.66	12.29		80.0	
10487-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	2.58	66.50	14.48	2.23	80.0	± 9.6 %
		Y	3.50	70.87	17.08		80.0	
		Z	1.93	63.45	12.16		80.0	
10488-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	2.94	70.04	17.55	2.23	80.0	± 9.6 %
		Y	3.91	74.55	19.82		80.0	
		Z	2.36	67.53	16.08		80.0	
10489-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.04	67.41	16.37	2.23	80.0	± 9.6 %
		Y	3.59	69.95	17.90		80.0	
		Z	2.60	65.85	15.19		80.0	
10490-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.13	67.33	16.35	2.23	80.0	± 9.6 %
		Y	3.67	69.71	17.80		80.0	
		Z	2.69	65.82	15.19		80.0	
10491-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.27	69.10	17.32	2.23	80.0	± 9.6 %
		Y	4.01	72.33	19.00		80.0	
		Z	2.76	67.20	16.22		80.0	
10492-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.43	66.99	16.56	2.23	80.0	± 9.6 %
		Y	3.87	68.87	17.69		80.0	
		Z	3.04	65.80	15.69		80.0	

Certificate No: EX3-3847\_Apr18

Page 28 of 39





EX3DV4- SN:3847

April 26, 2018

10493-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.50	65.91	16.53	2.23	80.0	± 9.6 %
		Y	3.93	68.70	17.63		80.0	
		Z	3.11	65.75	15.67		80.0	
10494-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.48	70.31	17.70	2.23	80.0	± 9.6 %
		Y	4.45	74.27	19.62		80.0	
		Z	2.88	68.11	16.53		80.0	
10495-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.45	67.28	16.74	2.23	80.0	± 9.6 %
		Y	3.91	69.30	17.91		80.0	
		Z	3.05	66.01	15.88		80.0	
10496-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.54	67.10	16.70	2.23	80.0	± 9.6 %
		Y	3.98	68.96	17.79		80.0	
		Z	3.15	65.93	15.88		80.0	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	1.40	62.99	11.15	2.23	80.0	± 9.6 %
		Y	2.90	72.22	16.27		80.0	
		Z	0.97	60.00	8.34		80.0	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	1.29	60.00	8.48	2.23	80.0	± 9.6 %
		Y	1.88	63.90	11.46		80.0	
		Z	1.15	60.00	7.19		80.0	
10499-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	1.30	60.00	8.33	2.23	80.0	± 9.6 %
		Y	1.80	63.11	10.92		80.0	
		Z	1.16	60.00	7.04		80.0	
10500-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	2.68	69.88	16.98	2.23	80.0	± 9.6 %
		Y	3.82	75.38	19.79		80.0	
		Z	2.04	66.78	15.02		80.0	
10501-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.79	67.24	15.39	2.23	80.0	± 9.6 %
		Y	3.56	70.81	17.54		80.0	
		Z	2.22	64.82	13.55		80.0	
10502-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	2.85	67.13	15.27	2.23	80.0	± 9.6 %
		Y	3.61	70.61	17.39		80.0	
		Z	2.26	64.72	13.43		80.0	
10503-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	2.91	69.86	17.46	2.23	80.0	± 9.6 %
		Y	3.86	74.33	19.71		80.0	
		Z	2.34	67.37	15.99		80.0	
10504-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.02	67.33	16.31	2.23	80.0	± 9.6 %
		Y	3.57	69.86	17.85		80.0	
		Z	2.59	65.76	15.13		80.0	
10505-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.12	67.25	16.29	2.23	80.0	± 9.6 %
		Y	3.65	69.61	17.75		80.0	
		Z	2.68	65.74	15.13		80.0	
10506-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.45	70.18	17.63	2.23	80.0	± 9.6 %
		Y	4.41	74.11	19.54		80.0	
		Z	2.87	68.00	16.46		80.0	
10507-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.44	67.22	16.70	2.23	80.0	± 9.6 %
		Y	3.90	69.24	17.87		80.0	
		Z	3.04	65.96	15.84		80.0	

Certificate No: EX3-3847\_Apr18

Page 29 of 39



EX3DV4- SN:3847

April 26, 2018

10508-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.53	67.04	16.65	2.23	80.0	± 9.6 %
		Y	3.97	68.89	17.74		80.0	
		Z	3.14	65.87	15.84		80.0	
10509-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.87	69.40	17.33	2.23	80.0	± 9.6 %
		Y	4.64	72.32	18.78		80.0	
		Z	3.35	67.73	16.42		80.0	
10510-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.94	67.14	16.80	2.23	80.0	± 9.6 %
		Y	4.36	68.82	17.75		80.0	
		Z	3.55	66.05	16.10		80.0	
10511-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.00	66.96	16.76	2.23	80.0	± 9.6 %
		Y	4.40	68.51	17.65		80.0	
		Z	3.63	65.95	16.09		80.0	
10512-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.95	70.58	17.67	2.23	80.0	± 9.6 %
		Y	4.99	74.37	19.46		80.0	
		Z	3.34	68.50	16.61		80.0	
10513-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	3.81	67.30	16.87	2.23	80.0	± 9.6 %
		Y	4.26	69.16	17.90		80.0	
		Z	3.43	66.10	16.12		80.0	
10514-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	3.86	66.98	16.78	2.23	80.0	± 9.6 %
		Y	4.26	68.66	17.73		80.0	
		Z	3.49	65.88	16.08		80.0	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	0.88	61.68	13.23	0.00	150.0	± 9.6 %
		Y	0.95	63.01	14.55		150.0	
		Z	0.86	61.76	13.18		150.0	
10516-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc duty cycle)	X	0.40	64.17	12.55	0.00	150.0	± 9.6 %
		Y	0.57	69.89	16.83		150.0	
		Z	0.39	64.39	12.59		150.0	
10517-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc duty cycle)	X	0.70	62.60	13.12	0.00	150.0	± 9.6 %
		Y	0.80	64.84	15.10		150.0	
		Z	0.68	62.64	13.06		150.0	
10518-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	4.38	66.26	15.83	0.00	150.0	± 9.6 %
		Y	4.52	66.66	16.15		150.0	
		Z	4.25	66.35	15.77		150.0	
10519-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc duty cycle)	X	4.55	66.48	15.95	0.00	150.0	± 9.6 %
		Y	4.70	66.90	16.27		150.0	
		Z	4.40	66.53	15.87		150.0	
10520-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc duty cycle)	X	4.40	66.40	15.85	0.00	150.0	± 9.6 %
		Y	4.55	66.86	16.19		150.0	
		Z	4.25	66.44	15.77		150.0	
10521-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc duty cycle)	X	4.33	66.38	15.82	0.00	150.0	± 9.6 %
		Y	4.49	66.85	16.17		150.0	
		Z	4.18	66.40	15.74		150.0	
10522-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc duty cycle)	X	4.39	66.51	15.93	0.00	150.0	± 9.6 %
		Y	4.55	66.94	16.26		150.0	
		Z	4.24	66.53	15.84		150.0	

Certificate No: EX3-3847\_Apr18

Page 30 of 39





EX3DV4- SN:3847

April 26, 2018

10523-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc duty cycle)	X	4.28	66.38	15.77	0.00	150.0	± 9.6 %
		Y	4.43	66.81	16.11		150.0	
		Z	4.16	66.50	15.74		150.0	
10524-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc duty cycle)	X	4.34	66.42	15.89	0.00	150.0	± 9.6 %
		Y	4.49	66.86	16.23		150.0	
		Z	4.19	66.48	15.82		150.0	
10525-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	4.34	65.48	15.49	0.00	150.0	± 9.6 %
		Y	4.48	65.91	15.82		150.0	
		Z	4.21	65.58	15.45		150.0	
10526-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	4.48	65.81	15.63	0.00	150.0	± 9.6 %
		Y	4.64	66.28	15.96		150.0	
		Z	4.33	65.85	15.56		150.0	
10527-AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc duty cycle)	X	4.41	65.75	15.56	0.00	150.0	± 9.6 %
		Y	4.56	66.24	15.91		150.0	
		Z	4.26	65.81	15.49		150.0	
10528-AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc duty cycle)	X	4.42	65.77	15.59	0.00	150.0	± 9.6 %
		Y	4.58	66.25	15.94		150.0	
		Z	4.28	65.82	15.53		150.0	
10529-AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc duty cycle)	X	4.42	65.77	15.59	0.00	150.0	± 9.6 %
		Y	4.58	66.25	15.94		150.0	
		Z	4.28	65.82	15.53		150.0	
10531-AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc duty cycle)	X	4.40	65.83	15.58	0.00	150.0	± 9.6 %
		Y	4.57	66.36	15.95		150.0	
		Z	4.24	65.84	15.50		150.0	
10532-AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc duty cycle)	X	4.27	65.68	15.50	0.00	150.0	± 9.6 %
		Y	4.43	66.21	15.88		150.0	
		Z	4.12	65.69	15.42		150.0	
10533-AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc duty cycle)	X	4.43	65.83	15.58	0.00	150.0	± 9.6 %
		Y	4.59	66.30	15.93		150.0	
		Z	4.28	65.89	15.53		150.0	
10534-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	4.98	65.93	15.72	0.00	150.0	± 9.6 %
		Y	5.11	66.36	16.00		150.0	
		Z	4.85	65.93	15.67		150.0	
10535-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	5.05	66.13	15.81	0.00	150.0	± 9.6 %
		Y	5.18	66.53	16.07		150.0	
		Z	4.89	66.06	15.74		150.0	
10536-AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc duty cycle)	X	4.92	66.06	15.75	0.00	150.0	± 9.6 %
		Y	5.05	66.49	16.03		150.0	
		Z	4.78	66.04	15.70		150.0	
10537-AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc duty cycle)	X	4.97	66.03	15.75	0.00	150.0	± 9.6 %
		Y	5.11	66.45	16.02		150.0	
		Z	4.85	66.05	15.71		150.0	
10538-AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc duty cycle)	X	5.06	66.05	15.80	0.00	150.0	± 9.6 %
		Y	5.20	66.48	16.07		150.0	
		Z	4.92	66.03	15.74		150.0	
10540-AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc duty cycle)	X	4.99	66.04	15.81	0.00	150.0	± 9.6 %
		Y	5.13	66.49	16.09		150.0	
		Z	4.84	65.97	15.73		150.0	

Certificate No: EX3-3847\_Apr18

Page 31 of 39





EX3DV4- SN:3847

April 26, 2018

10541-AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc duty cycle)	X	4.97	65.92	15.74	0.00	150.0	± 9.6 %
		Y	5.10	66.36	16.02		150.0	
		Z	4.83	65.89	15.67		150.0	
10542-AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc duty cycle)	X	5.13	66.03	15.81	0.00	150.0	± 9.6 %
		Y	5.26	66.43	16.07		150.0	
		Z	4.99	66.01	15.75		150.0	
10543-AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc duty cycle)	X	5.19	66.05	15.85	0.00	150.0	± 9.6 %
		Y	5.33	66.46	16.11		150.0	
		Z	5.06	66.10	15.83		150.0	
10544-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	5.31	66.07	15.75	0.00	150.0	± 9.6 %
		Y	5.42	66.48	16.00		150.0	
		Z	5.20	66.05	15.70		150.0	
10545-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	5.50	66.52	15.93	0.00	150.0	± 9.6 %
		Y	5.61	66.88	16.14		150.0	
		Z	5.38	66.50	15.88		150.0	
10546-AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc duty cycle)	X	5.36	66.24	15.80	0.00	150.0	± 9.6 %
		Y	5.49	66.69	16.06		150.0	
		Z	5.23	66.17	15.72		150.0	
10547-AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc duty cycle)	X	5.44	66.31	15.83	0.00	150.0	± 9.6 %
		Y	5.56	66.72	16.07		150.0	
		Z	5.32	66.29	15.78		150.0	
10548-AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc duty cycle)	X	5.66	67.18	16.24	0.00	150.0	± 9.6 %
		Y	5.79	67.60	16.49		150.0	
		Z	5.46	66.91	16.07		150.0	
10550-AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc duty cycle)	X	5.41	66.34	15.86	0.00	150.0	± 9.6 %
		Y	5.51	66.70	16.08		150.0	
		Z	5.30	66.37	15.84		150.0	
10551-AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc duty cycle)	X	5.39	66.30	15.80	0.00	150.0	± 9.6 %
		Y	5.52	66.75	16.06		150.0	
		Z	5.23	66.13	15.69		150.0	
10552-AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc duty cycle)	X	5.32	66.13	15.72	0.00	150.0	± 9.6 %
		Y	5.44	66.55	15.98		150.0	
		Z	5.21	66.15	15.69		150.0	
10553-AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc duty cycle)	X	5.39	66.15	15.77	0.00	150.0	± 9.6 %
		Y	5.52	66.59	16.02		150.0	
		Z	5.26	66.11	15.71		150.0	
10554-AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 99pc duty cycle)	X	5.73	66.46	15.86	0.00	150.0	± 9.6 %
		Y	5.83	66.84	16.08		150.0	
		Z	5.63	66.41	15.80		150.0	
10555-AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 99pc duty cycle)	X	5.85	66.75	15.99	0.00	150.0	± 9.6 %
		Y	5.95	67.13	16.21		150.0	
		Z	5.72	66.64	15.90		150.0	
10556-AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 99pc duty cycle)	X	5.88	66.80	16.01	0.00	150.0	± 9.6 %
		Y	5.97	67.18	16.22		150.0	
		Z	5.76	66.75	15.95		150.0	
10557-AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 99pc duty cycle)	X	5.83	66.68	15.96	0.00	150.0	± 9.6 %
		Y	5.94	67.09	16.20		150.0	
		Z	5.71	66.61	15.89		150.0	

Certificate No: EX3-3847\_Apr18

Page 32 of 39



EX3DV4- SN:3847

April 26, 2018

10558-AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 99pc duty cycle)	X	5.87	66.83	16.05	0.00	150.0	± 9.6 %
		Y	5.99	67.25	16.29		150.0	
		Z	5.72	66.67	15.94		150.0	
10560-AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 99pc duty cycle)	X	5.87	66.69	16.02	0.00	150.0	± 9.6 %
		Y	5.99	67.11	16.26		150.0	
		Z	5.74	66.60	15.95		150.0	
10561-AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 99pc duty cycle)	X	5.80	66.68	16.05	0.00	150.0	± 9.6 %
		Y	5.91	67.07	16.28		150.0	
		Z	5.68	66.59	15.97		150.0	
10562-AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 99pc duty cycle)	X	5.89	66.97	16.19	0.00	150.0	± 9.6 %
		Y	6.03	67.44	16.47		150.0	
		Z	5.73	66.75	16.05		150.0	
10563-AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 99pc duty cycle)	X	6.00	66.93	16.14	0.00	150.0	± 9.6 %
		Y	6.25	67.71	16.56		150.0	
		Z	5.83	66.74	16.01		150.0	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	4.71	66.38	16.03	0.46	150.0	± 9.6 %
		Y	4.84	66.75	16.32		150.0	
		Z	4.57	66.42	15.94		150.0	
10565-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc duty cycle)	X	4.92	66.81	16.35	0.46	150.0	± 9.6 %
		Y	5.07	67.20	16.64		150.0	
		Z	4.77	66.84	16.26		150.0	
10566-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc duty cycle)	X	4.76	66.63	16.15	0.46	150.0	± 9.6 %
		Y	4.91	67.05	16.46		150.0	
		Z	4.60	66.62	16.04		150.0	
10567-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc duty cycle)	X	4.78	67.00	16.50	0.46	150.0	± 9.6 %
		Y	4.93	67.43	16.81		150.0	
		Z	4.63	67.04	16.43		150.0	
10568-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc duty cycle)	X	4.67	66.41	15.92	0.46	150.0	± 9.6 %
		Y	4.82	66.83	16.24		150.0	
		Z	4.50	66.35	15.77		150.0	
10569-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc duty cycle)	X	4.75	67.13	16.58	0.46	150.0	± 9.6 %
		Y	4.89	67.52	16.87		150.0	
		Z	4.62	67.25	16.56		150.0	
10570-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc duty cycle)	X	4.78	66.97	16.51	0.46	150.0	± 9.6 %
		Y	4.92	67.36	16.80		150.0	
		Z	4.62	67.04	16.45		150.0	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	1.04	62.72	14.15	0.46	130.0	± 9.6 %
		Y	1.14	64.34	15.57		130.0	
		Z	0.99	62.38	13.79		130.0	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	1.04	63.14	14.42	0.46	130.0	± 9.6 %
		Y	1.15	64.90	15.93		130.0	
		Z	0.99	62.76	14.05		130.0	
10573-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc duty cycle)	X	0.81	70.70	16.26	0.46	130.0	± 9.6 %
		Y	2.14	87.31	23.95		130.0	
		Z	0.66	68.79	15.25		130.0	
10574-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc duty cycle)	X	1.02	66.72	16.25	0.46	130.0	± 9.6 %
		Y	1.26	70.66	18.88		130.0	
		Z	0.94	66.05	15.78		130.0	

Certificate No: EX3-3847\_Apr18

Page 33 of 39





EX3DV4- SN:3847

April 26, 2018

10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	4.50	66.17	16.08	0.46	130.0	± 9.6 %
		Y	4.63	66.56	16.40		130.0	
		Z	4.35	66.16	15.93		130.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	4.52	66.33	16.14	0.46	130.0	± 9.6 %
		Y	4.66	66.72	16.46		130.0	
		Z	4.37	66.35	16.02		130.0	
10577-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc duty cycle)	X	4.71	66.61	16.32	0.46	130.0	± 9.6 %
		Y	4.86	67.01	16.63		130.0	
		Z	4.54	66.60	16.17		130.0	
10578-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc duty cycle)	X	4.60	66.74	16.40	0.46	130.0	± 9.6 %
		Y	4.76	67.17	16.73		130.0	
		Z	4.44	66.73	16.27		130.0	
10579-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc duty cycle)	X	4.37	65.99	15.69	0.46	130.0	± 9.6 %
		Y	4.52	66.47	16.05		130.0	
		Z	4.19	65.88	15.49		130.0	
10580-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc duty cycle)	X	4.42	66.07	15.73	0.46	130.0	± 9.6 %
		Y	4.57	66.51	16.08		130.0	
		Z	4.23	65.94	15.51		130.0	
10581-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc duty cycle)	X	4.50	66.76	16.33	0.46	130.0	± 9.6 %
		Y	4.65	67.21	16.67		130.0	
		Z	4.34	66.76	16.22		130.0	
10582-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc duty cycle)	X	4.31	65.77	15.48	0.46	130.0	± 9.6 %
		Y	4.47	66.23	15.84		130.0	
		Z	4.12	65.65	15.26		130.0	
10583-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	4.50	66.17	16.08	0.46	130.0	± 9.6 %
		Y	4.63	66.56	16.40		130.0	
		Z	4.35	66.16	15.93		130.0	
10584-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	4.52	66.33	16.14	0.46	130.0	± 9.6 %
		Y	4.66	66.72	16.46		130.0	
		Z	4.37	66.35	16.02		130.0	
10585-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc duty cycle)	X	4.71	66.61	16.32	0.46	130.0	± 9.6 %
		Y	4.86	67.01	16.63		130.0	
		Z	4.54	66.60	16.17		130.0	
10586-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc duty cycle)	X	4.60	66.74	16.40	0.46	130.0	± 9.6 %
		Y	4.76	67.17	16.73		130.0	
		Z	4.44	66.73	16.27		130.0	
10587-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc duty cycle)	X	4.37	65.99	15.69	0.46	130.0	± 9.6 %
		Y	4.52	66.47	16.05		130.0	
		Z	4.19	65.88	15.49		130.0	
10588-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc duty cycle)	X	4.42	66.07	15.73	0.46	130.0	± 9.6 %
		Y	4.57	66.51	16.08		130.0	
		Z	4.23	65.94	15.51		130.0	
10589-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc duty cycle)	X	4.50	66.76	16.33	0.46	130.0	± 9.6 %
		Y	4.65	67.21	16.67		130.0	
		Z	4.34	66.76	16.22		130.0	
10590-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc duty cycle)	X	4.31	65.77	15.48	0.46	130.0	± 9.6 %
		Y	4.47	66.23	15.84		130.0	
		Z	4.12	65.65	15.26		130.0	

Certificate No: EX3-3847\_Apr18

Page 34 of 39



EX3DV4- SN:3847

April 26, 2018

10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	4.65	66.26	16.20	0.46	130.0	± 9.6 %
		Y	4.78	66.62	16.49		130.0	
		Z	4.51	66.28	16.08		130.0	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	4.79	66.57	16.33	0.46	130.0	± 9.6 %
		Y	4.94	66.96	16.63		130.0	
		Z	4.63	66.56	16.20		130.0	
10593-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc duty cycle)	X	4.71	66.46	16.20	0.46	130.0	± 9.6 %
		Y	4.86	66.87	16.51		130.0	
		Z	4.54	66.42	16.05		130.0	
10594-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc duty cycle)	X	4.76	66.63	16.36	0.46	130.0	± 9.6 %
		Y	4.91	67.03	16.66		130.0	
		Z	4.60	66.61	16.22		130.0	
10595-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc duty cycle)	X	4.73	66.58	16.25	0.46	130.0	± 9.6 %
		Y	4.88	66.98	16.56		130.0	
		Z	4.56	66.57	16.12		130.0	
10596-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc duty cycle)	X	4.66	66.56	16.25	0.46	130.0	± 9.6 %
		Y	4.82	66.98	16.56		130.0	
		Z	4.49	66.52	16.10		130.0	
10597-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc duty cycle)	X	4.61	66.45	16.11	0.46	130.0	± 9.6 %
		Y	4.77	66.89	16.45		130.0	
		Z	4.44	66.39	15.95		130.0	
10598-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc duty cycle)	X	4.59	66.66	16.37	0.46	130.0	± 9.6 %
		Y	4.75	67.11	16.70		130.0	
		Z	4.43	66.62	16.23		130.0	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	5.34	66.83	16.48	0.46	130.0	± 9.6 %
		Y	5.45	67.17	16.70		130.0	
		Z	5.20	66.82	16.39		130.0	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	5.48	67.28	16.68	0.46	130.0	± 9.6 %
		Y	5.58	67.55	16.86		130.0	
		Z	5.31	67.19	16.55		130.0	
10601-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc duty cycle)	X	5.36	67.01	16.55	0.46	130.0	± 9.6 %
		Y	5.47	67.32	16.77		130.0	
		Z	5.21	66.95	16.45		130.0	
10602-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc duty cycle)	X	5.48	67.14	16.54	0.46	130.0	± 9.6 %
		Y	5.56	67.34	16.70		130.0	
		Z	5.32	67.06	16.42		130.0	
10603-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc duty cycle)	X	5.54	67.39	16.80	0.46	130.0	± 9.6 %
		Y	5.65	67.65	16.98		130.0	
		Z	5.37	67.31	16.69		130.0	
10604-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc duty cycle)	X	5.41	67.02	16.60	0.46	130.0	± 9.6 %
		Y	5.46	67.14	16.71		130.0	
		Z	5.27	66.97	16.49		130.0	
10605-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc duty cycle)	X	5.47	67.20	16.69	0.46	130.0	± 9.6 %
		Y	5.56	67.45	16.87		130.0	
		Z	5.29	67.05	16.52		130.0	
10606-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc duty cycle)	X	5.19	66.44	16.16	0.46	130.0	± 9.6 %
		Y	5.32	66.83	16.42		130.0	
		Z	5.08	66.47	16.09		130.0	

Certificate No: EX3-3847\_Apr18

Page 35 of 39





EX3DV4- SN:3847

April 26, 2018

10607-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	4.49	65.54	15.80	0.46	130.0	± 9.6 %
		Y	4.62	65.94	16.12		130.0	
		Z	4.35	65.57	15.69		130.0	
10608-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	4.65	65.91	15.96	0.46	130.0	± 9.6 %
		Y	4.81	66.35	16.29		130.0	
		Z	4.48	65.89	15.84		130.0	
10609-AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle)	X	4.54	65.74	15.79	0.46	130.0	± 9.6 %
		Y	4.70	66.20	16.13		130.0	
		Z	4.38	65.70	15.64		130.0	
10610-AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle)	X	4.59	65.90	15.95	0.46	130.0	± 9.6 %
		Y	4.75	66.36	16.29		130.0	
		Z	4.43	65.88	15.82		130.0	
10611-AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle)	X	4.51	65.70	15.80	0.46	130.0	± 9.6 %
		Y	4.66	66.16	16.14		130.0	
		Z	4.34	65.67	15.66		130.0	
10612-AAB	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle)	X	4.51	65.84	15.83	0.46	130.0	± 9.6 %
		Y	4.67	66.32	16.18		130.0	
		Z	4.33	65.77	15.68		130.0	
10613-AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle)	X	4.51	65.70	15.71	0.46	130.0	± 9.6 %
		Y	4.68	66.20	16.07		130.0	
		Z	4.32	65.60	15.53		130.0	
10614-AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle)	X	4.46	65.88	15.93	0.46	130.0	± 9.6 %
		Y	4.62	66.38	16.29		130.0	
		Z	4.29	65.83	15.79		130.0	
10615-AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle)	X	4.51	65.55	15.58	0.46	130.0	± 9.6 %
		Y	4.67	66.00	15.92		130.0	
		Z	4.33	65.49	15.41		130.0	
10616-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	5.15	66.03	16.05	0.46	130.0	± 9.6 %
		Y	5.27	66.43	16.32		130.0	
		Z	5.00	65.97	15.95		130.0	
10617-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	5.22	66.24	16.14	0.46	130.0	± 9.6 %
		Y	5.34	66.59	16.37		130.0	
		Z	5.04	66.10	15.99		130.0	
10618-AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle)	X	5.10	66.23	16.14	0.46	130.0	± 9.6 %
		Y	5.22	66.60	16.39		130.0	
		Z	4.95	66.15	16.02		130.0	
10619-AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle)	X	5.11	66.02	15.97	0.46	130.0	± 9.6 %
		Y	5.24	66.42	16.23		130.0	
		Z	4.97	65.97	15.87		130.0	
10620-AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle)	X	5.20	66.06	16.05	0.46	130.0	± 9.6 %
		Y	5.33	66.46	16.31		130.0	
		Z	5.04	65.98	15.93		130.0	
10621-AAB	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle)	X	5.21	66.21	16.24	0.46	130.0	± 9.6 %
		Y	5.33	66.58	16.48		130.0	
		Z	5.05	66.10	16.11		130.0	
10622-AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle)	X	5.22	66.37	16.31	0.46	130.0	± 9.6 %
		Y	5.34	66.74	16.55		130.0	
		Z	5.04	66.18	16.15		130.0	

Certificate No: EX3-3847\_Apr18

Page 36 of 39



EX3DV4- SN:3847

April 26, 2018

10623-AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle)	X	5.10	65.88	15.93	0.46	130.0	± 9.6 %
		Y	5.22	66.28	16.20		130.0	
		Z	4.93	65.72	15.77		130.0	
10624-AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle)	X	5.29	66.10	16.11	0.46	130.0	± 9.6 %
		Y	5.41	66.47	16.36		130.0	
		Z	5.13	66.01	15.99		130.0	
10625-AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle)	X	5.57	66.83	16.54	0.46	130.0	± 9.6 %
		Y	5.77	67.42	16.88		130.0	
		Z	5.22	66.17	16.14		130.0	
10626-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	5.46	66.12	16.04	0.46	130.0	± 9.6 %
		Y	5.57	66.49	16.27		130.0	
		Z	5.33	66.02	15.93		130.0	
10627-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	5.71	66.74	16.32	0.46	130.0	± 9.6 %
		Y	5.80	67.03	16.50		130.0	
		Z	5.57	66.65	16.21		130.0	
10628-AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle)	X	5.48	66.16	15.96	0.46	130.0	± 9.6 %
		Y	5.60	66.59	16.22		130.0	
		Z	5.33	66.00	15.81		130.0	
10629-AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle)	X	5.56	66.26	16.00	0.46	130.0	± 9.6 %
		Y	5.68	66.64	16.24		130.0	
		Z	5.43	66.19	15.91		130.0	
10630-AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle)	X	5.96	67.65	16.70	0.46	130.0	± 9.6 %
		Y	6.09	68.07	16.95		130.0	
		Z	5.68	67.14	16.38		130.0	
10631-AAB	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle)	X	5.85	67.41	16.77	0.46	130.0	± 9.6 %
		Y	6.00	67.90	17.05		130.0	
		Z	5.64	67.15	16.59		130.0	
10632-AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle)	X	5.68	66.81	16.49	0.46	130.0	± 9.6 %
		Y	5.77	67.09	16.67		130.0	
		Z	5.57	66.83	16.45		130.0	
10633-AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle)	X	5.54	66.34	16.08	0.46	130.0	± 9.6 %
		Y	5.66	66.75	16.33		130.0	
		Z	5.36	66.11	15.91		130.0	
10634-AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle)	X	5.52	66.35	16.14	0.46	130.0	± 9.6 %
		Y	5.65	66.78	16.40		130.0	
		Z	5.38	66.27	16.04		130.0	
10635-AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle)	X	5.40	65.89	15.55	0.46	130.0	± 9.6 %
		Y	5.53	66.13	15.82		130.0	
		Z	5.24	65.52	15.38		130.0	
10636-AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	X	5.89	66.51	16.15	0.46	130.0	± 9.6 %
		Y	5.98	66.86	16.36		130.0	
		Z	5.77	66.40	16.04		130.0	
10637-AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc duty cycle)	X	6.05	66.90	16.33	0.46	130.0	± 9.6 %
		Y	6.13	67.23	16.53		130.0	
		Z	5.89	66.72	16.18		130.0	
10638-AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc duty cycle)	X	6.04	66.86	16.29	0.46	130.0	± 9.6 %
		Y	6.13	67.21	16.49		130.0	
		Z	5.91	66.76	16.18		130.0	

Certificate No: EX3-3847\_Apr18

Page 37 of 39





EX3DV4- SN:3847

April 26, 2018

10639-AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc duty cycle)	X	6.01	66.78	16.29	0.46	130.0	± 9.6 %
		Y	6.11	67.16	16.52		130.0	
		Z	5.87	66.64	16.16		130.0	
10640-AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc duty cycle)	X	6.01	66.78	16.23	0.46	130.0	± 9.6 %
		Y	6.12	67.18	16.47		130.0	
		Z	5.83	66.54	16.05		130.0	
10641-AAC	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc duty cycle)	X	6.08	66.77	16.25	0.46	130.0	± 9.6 %
		Y	6.16	67.08	16.43		130.0	
		Z	5.93	66.63	16.12		130.0	
10642-AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc duty cycle)	X	6.10	66.96	16.51	0.46	130.0	± 9.6 %
		Y	6.20	67.33	16.72		130.0	
		Z	5.95	66.83	16.39		130.0	
10643-AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc duty cycle)	X	5.95	66.67	16.26	0.46	130.0	± 9.6 %
		Y	6.04	67.02	16.47		130.0	
		Z	5.80	66.51	16.11		130.0	
10644-AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc duty cycle)	X	6.08	67.02	16.46	0.46	130.0	± 9.6 %
		Y	6.20	67.51	16.74		130.0	
		Z	5.86	66.89	16.23		130.0	
10645-AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc duty cycle)	X	6.22	67.15	16.49	0.46	130.0	± 9.6 %
		Y	6.53	68.09	16.99		130.0	
		Z	6.01	66.82	16.26		130.0	
10646-AAD	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7)	X	12.46	102.82	35.86	9.30	60.0	± 9.6 %
		Y	25.38	119.99	41.31		60.0	
		Z	6.60	88.90	30.62		60.0	
10647-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7)	X	10.85	100.16	35.12	9.30	60.0	± 9.6 %
		Y	20.81	115.94	40.28		60.0	
		Z	5.89	86.80	29.96		60.0	
10648-AAA	CDMA2000 (1x Advanced)	X	0.51	60.75	7.97	0.00	150.0	± 9.6 %
		Y	0.66	63.18	10.50		150.0	
		Z	0.41	60.00	6.58		150.0	
10652-AAB	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	X	3.30	65.73	15.83	2.23	80.0	± 9.6 %
		Y	3.62	67.09	16.80		80.0	
		Z	3.01	65.04	15.12		80.0	
10653-AAB	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	X	3.88	65.34	16.17	2.23	80.0	± 9.6 %
		Y	4.12	66.32	16.85		80.0	
		Z	3.63	64.83	15.69		80.0	
10654-AAB	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	X	3.88	65.02	16.21	2.23	80.0	± 9.6 %
		Y	4.09	65.94	16.83		80.0	
		Z	3.66	64.54	15.77		80.0	
10655-AAB	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	X	3.95	65.00	16.26	2.23	80.0	± 9.6 %
		Y	4.15	65.93	16.86		80.0	
		Z	3.74	64.49	15.83		80.0	
10658-AAA	Pulse Waveform (200Hz, 10%)	X	100.00	110.04	25.52	10.00	50.0	± 9.6 %
		Y	100.00	112.50	26.65		50.0	
		Z	4.52	71.85	13.49		50.0	
10659-AAA	Pulse Waveform (200Hz, 20%)	X	100.00	108.16	23.56	6.99	60.0	± 9.6 %
		Y	100.00	112.26	25.56		60.0	
		Z	3.99	73.17	12.80		60.0	



EX3DV4- SN:3847

April 26, 2018

10660-AAA	Pulse Waveform (200Hz, 40%)	X	100.00	105.70	21.19	3.98	80.0	± 9.6 %
		Y	100.00	114.35	25.21		80.0	
		Z	1.97	89.76	10.09		80.0	
10661-AAA	Pulse Waveform (200Hz, 60%)	X	100.00	100.43	17.89	2.22	100.0	± 9.6 %
		Y	100.00	117.83	25.42		100.0	
		Z	0.29	80.00	4.69		100.0	
10662-AAA	Pulse Waveform (200Hz, 80%)	X	0.17	80.00	3.90	0.97	120.0	± 9.6 %
		Y	100.00	119.81	24.45		120.0	
		Z	12.34	60.39	1.42		120.0	

<sup>f</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



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



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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 **Auden**

Certificate No: **DAE4-917\_Dec18**

## CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BK - SN: 917**

Calibration procedure(s) **QA CAL-06.v29  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **December 07, 2018**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-18 (No:23488)	Sep-19
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	04-Jan-18 (in house check)	In house check: Jan-19
Calibrator Box V2.1	SE UMS 006 AA 1002	04-Jan-18 (in house check)	In house check: Jan-19

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: December 7, 2018

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

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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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.



### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V, full range = -100...+300 mV

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

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

Calibration Factors	X	Y	Z
High Range	404.233 $\pm$ 0.02% (k=2)	404.237 $\pm$ 0.02% (k=2)	404.247 $\pm$ 0.02% (k=2)
Low Range	3.97030 $\pm$ 1.50% (k=2)	4.00613 $\pm$ 1.50% (k=2)	3.99536 $\pm$ 1.50% (k=2)

### Connector Angle

Connector Angle to be used in DASY system	33,0 $^{\circ}$ $\pm$ 1 $^{\circ}$
---	------------------------------------



## Appendix (Additional assessments outside the scope of SCS0108)

### 1. DC Voltage Linearity

High Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	200037.14	-0.03	-0.00
Channel X + Input	20005.96	0.59	0.00
Channel X - Input	-20003.33	2.74	-0.01
Channel Y + Input	200037.00	-0.24	-0.00
Channel Y + Input	20004.64	-0.71	-0.00
Channel Y - Input	-20007.15	-0.99	0.00
Channel Z + Input	200037.86	0.44	0.00
Channel Z + Input	20003.30	-1.99	-0.01
Channel Z - Input	-20008.56	-2.36	0.01

Low Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2001.09	-0.31	-0.02
Channel X + Input	201.07	-0.16	-0.08
Channel X - Input	-198.38	0.46	-0.23
Channel Y + Input	2001.72	0.58	0.03
Channel Y + Input	200.19	-0.78	-0.39
Channel Y - Input	-200.32	-1.28	0.64
Channel Z + Input	2000.98	-0.04	-0.00
Channel Z + Input	199.54	-1.39	-0.69
Channel Z - Input	-200.69	-1.58	0.79

### 2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	-5.25	-6.70
	-200	7.59	6.09
Channel Y	200	4.75	4.51
	-200	-6.10	-6.66
Channel Z	200	-14.72	-14.53
	-200	12.70	12.31

### 3. Channel separation

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

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	-2.79	-3.96
Channel Y	200	5.41	-	-0.93
Channel Z	200	10.01	2.99	-





**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	16033	16088
Channel Y	16099	13948
Channel Z	15941	15262

**5. Input Offset Measurement**

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec  
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.51	-0.63	1.49	0.45
Channel Y	0.16	-2.22	1.25	0.59
Channel Z	-0.18	-1.94	1.16	0.47

**6. Input Offset Current**

Nominal Input circuitry offset current on all channels: <25fA

**7. Input Resistance** (Typical values for information)

	Zeroing (kOhm)	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	+6	+14
Supply (- Vcc)	-0.01	-8	-9