

	<u>Date(s) of Evaluation</u> Nov 11 – Dec 12	<u>Test Report Serial No.</u> 121514AMW-1313	<u>Test Report Revision No.</u> Rev. 1.1(2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> December 12, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

## APPENDIX E - DIPOLE CALIBRATION

<b>Applicant:</b>	<b>Uniden America Corporation</b>	<b>FCC ID:</b>	<b>AMWUT650</b>	<b>IC:</b>	<b>513C-UT650</b>	
<b>Model(s):</b>	<b>Atlantis 295</b>	<b>DUT Type:</b>	<b>Portable Multi-Band PTT Radio Transceiver</b>	<b>VHF / GMRS</b>		
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 Multilateral Agreement for the recognition of calibration certificates

Client **Celltech**

Certificate No: **CLA150-4007\_Jan14/2**

## **CALIBRATION CERTIFICATE (Replacement of No: CLA150-4007\_Jan14)**

Object **CLA150 - SN: 4007**

Calibration procedure(s) **QA CAL-15.v8**  
**Calibration procedure for system validation sources below 700 MHz**

Calibration date: **January 24, 2014**

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  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe EX3DV4	SN: 3877	06-Jan-14 (No. EX3-3877_Jan14)	Jan-15
DAE4	SN: 654	18-Jul-13 (No. DAE4-654_Jul13)	Jul-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Israe El-Naouq** Laboratory Technician

Approved by: **Katja Pokovic** Technical Manager

Signature

Issued: April 14, 2014

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**Glossary:**

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

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

- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2013
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss:** This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: $2 \pm 0.2$ mm
EUT Positioning	Touch Position	
Zoom Scan Resolution	$dx, dy, dz = 5.0$ mm	
Frequency	$150 \text{ MHz} \pm 1 \text{ MHz}$	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	$22.0 \text{ }^{\circ}\text{C}$	52.3	0.76 mho/m
Measured Head TSL parameters	$(22.0 \pm 0.2) \text{ }^{\circ}\text{C}$	$50.5 \pm 6 \%$	$0.76 \text{ mho/m} \pm 6 \%$
Head TSL temperature change during test	$< 0.5 \text{ }^{\circ}\text{C}$	----	----

## SAR result with Head TSL

SAR averaged over $1 \text{ cm}^3$ (1 g) of Head TSL	Condition	
SAR measured	1 W input power	3.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$3.86 \text{ W/kg} \pm 18.4 \%$ (k=2)

SAR averaged over $10 \text{ cm}^3$ (10 g) of Head TSL	condition	
SAR measured	1 W input power	2.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$2.55 \text{ W/kg} \pm 18.0 \%$ (k=2)

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	$22.0 \text{ }^{\circ}\text{C}$	61.9	0.80 mho/m
Measured Body TSL parameters	$(22.0 \pm 0.2) \text{ }^{\circ}\text{C}$	$62.8 \pm 6 \%$	$0.80 \text{ mho/m} \pm 6 \%$
Body TSL temperature change during test	$< 0.5 \text{ }^{\circ}\text{C}$	----	----

## SAR result with Body TSL

SAR averaged over $1 \text{ cm}^3$ (1 g) of Body TSL	Condition	
SAR measured	1 W input power	3.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	$3.90 \text{ W/kg} \pm 18.4 \%$ (k=2)

SAR averaged over $10 \text{ cm}^3$ (10 g) of Body TSL	condition	
SAR measured	1 W input power	2.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	$2.60 \text{ W/kg} \pm 18.0 \%$ (k=2)

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	43.1 $\Omega$ - 7.3 j $\Omega$
Return Loss	- 19.4 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 $\Omega$ - 9.2 j $\Omega$
Return Loss	- 20.0 dB

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 12, 2013



## DASY5 Validation Report for Head TSL

Date: 24.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: CLA150; Type: CLA150; Serial: CLA150 - SN: 4007**

Communication System: UID 0 - CW; Frequency: 150 MHz

Medium parameters used:  $f = 150 \text{ MHz}$ ;  $\sigma = 0.76 \text{ S/m}$ ;  $\epsilon_r = 50.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(11.76, 11.76, 11.76); Calibrated: 06.01.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.07.2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

### CLA Calibration for HSL-LF Tissue/CLA150, touch configuration, Pin=1W/Area Scan

**(81x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) =  $5.02 \text{ W/kg}$

### CLA Calibration for HSL-LF Tissue/CLA150, touch configuration, Pin=1W/Zoom Scan

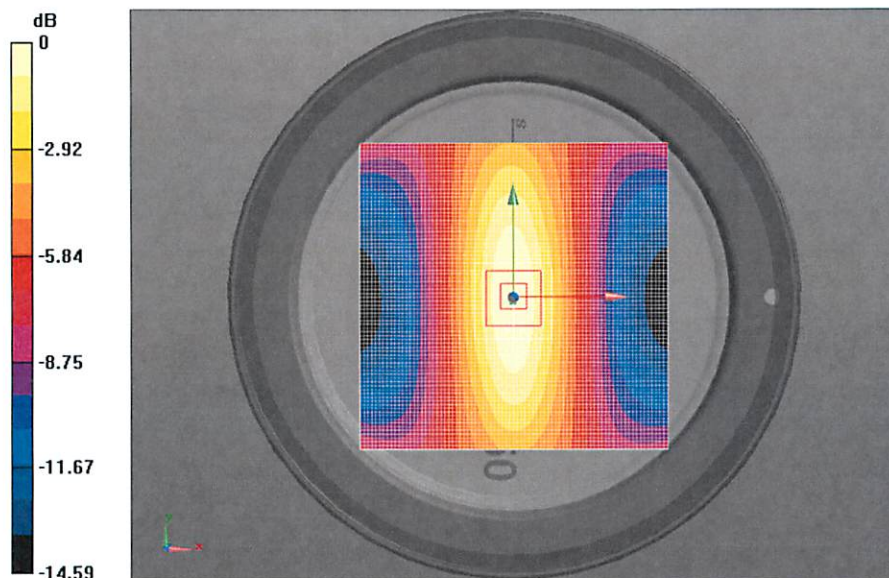
**(7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $81.695 \text{ V/m}$ ; Power Drift =  $-0.04 \text{ dB}$

Peak SAR (extrapolated) =  $6.28 \text{ W/kg}$

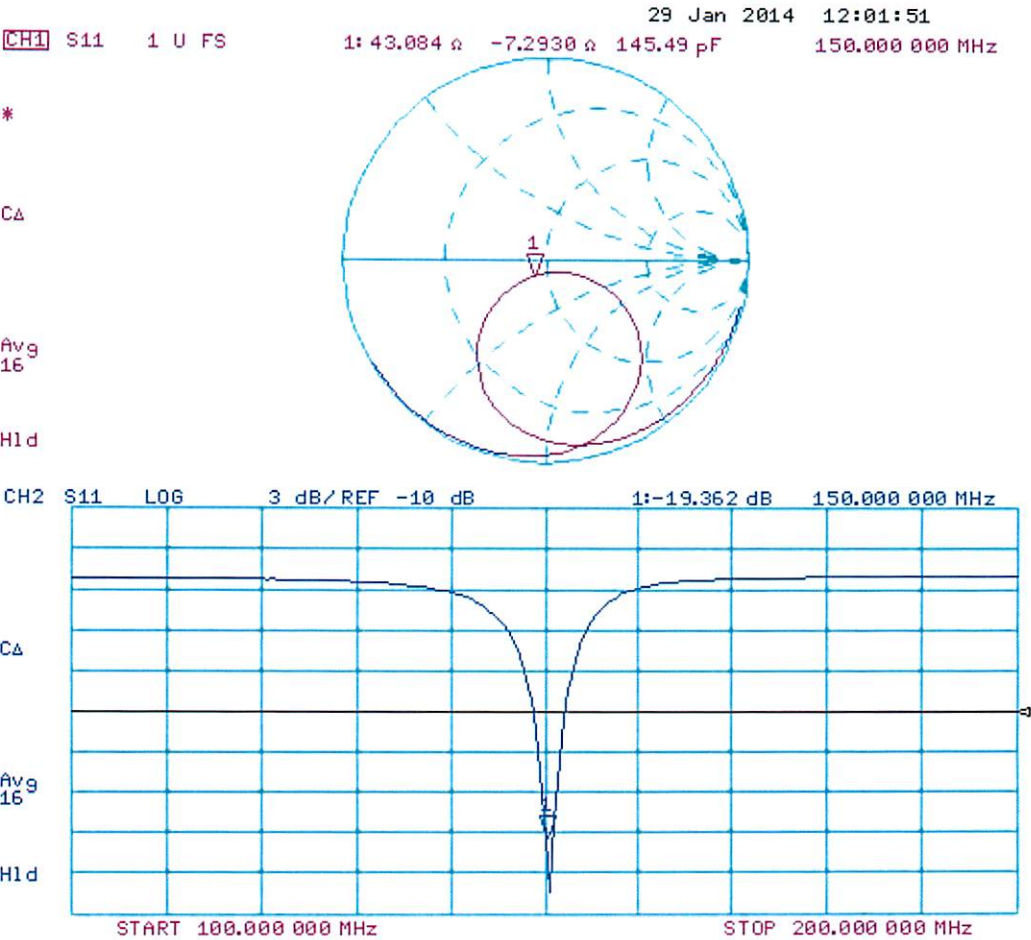
**SAR(1 g) =  $3.89 \text{ W/kg}$ ; SAR(10 g) =  $2.57 \text{ W/kg}$**

Maximum value of SAR (measured) =  $5.03 \text{ W/kg}$



0 dB =  $5.02 \text{ W/kg}$  =  $7.01 \text{ dBW/kg}$

Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 24.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: CLA150; Type: CLA150; Serial: CLA150 - SN: 4007**

Communication System: UID 0 - CW; Frequency: 150 MHz

Medium parameters used:  $f = 150 \text{ MHz}$ ;  $\sigma = 0.799 \text{ S/m}$ ;  $\epsilon_r = 62.757$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(11.45, 11.45, 11.45); Calibrated: 06.01.2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.07.2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

### CLA Calibration for MSL-LF Tissue/CLA150, touch configuration, Pin=1W/Area Scan

**(81x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) =  $5.00 \text{ W/kg}$

### CLA Calibration for MSL-LF Tissue/CLA150, touch configuration, Pin=1W/Zoom Scan

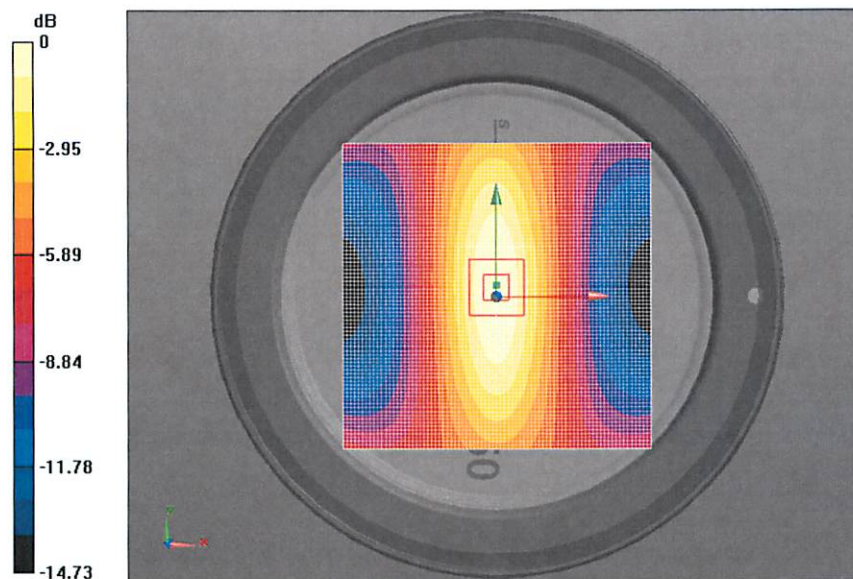
**(7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $79.120 \text{ V/m}$ ; Power Drift =  $0.00 \text{ dB}$

Peak SAR (extrapolated) =  $6.25 \text{ W/kg}$

**SAR(1 g) =  $3.89 \text{ W/kg}$ ; SAR(10 g) =  $2.59 \text{ W/kg}$**

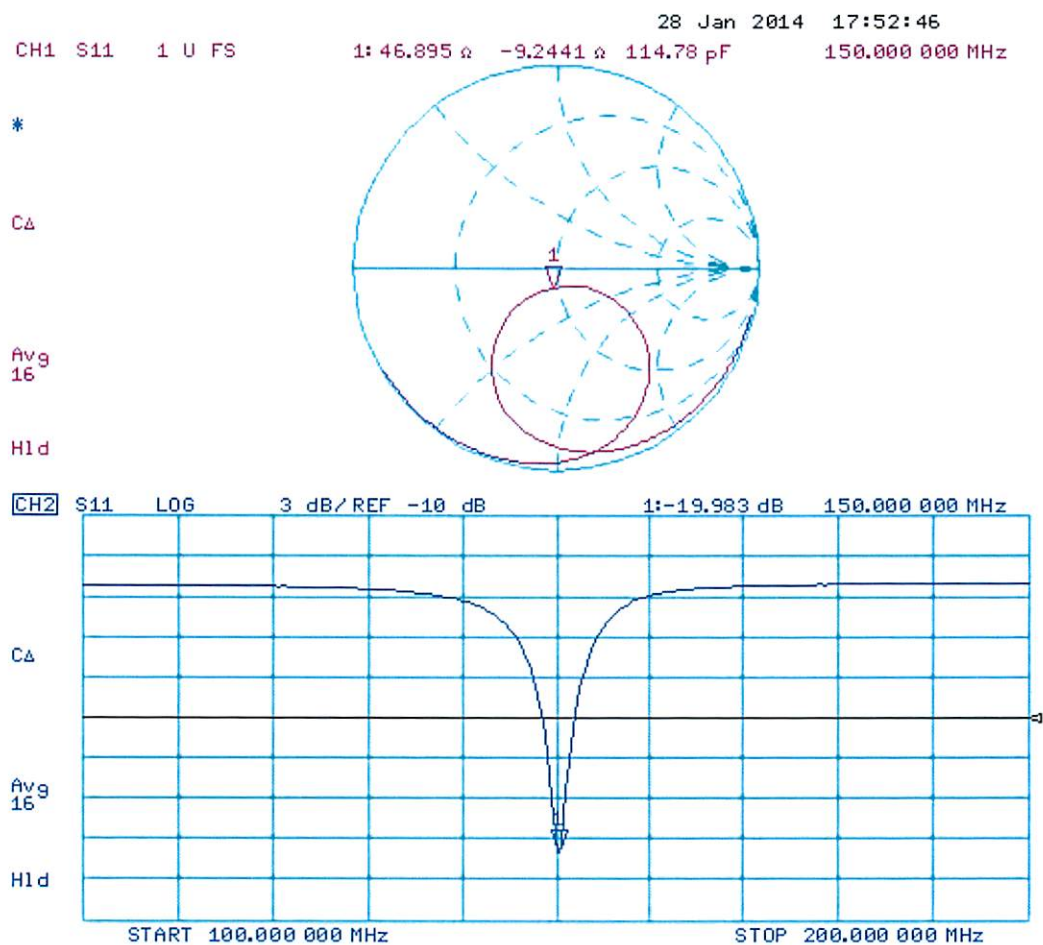
Maximum value of SAR (measured) =  $5.02 \text{ W/kg}$





0 dB =  $5.00 \text{ W/kg}$  =  $6.99 \text{ dBW/kg}$



## Impedance Measurement Plot for Body TSL



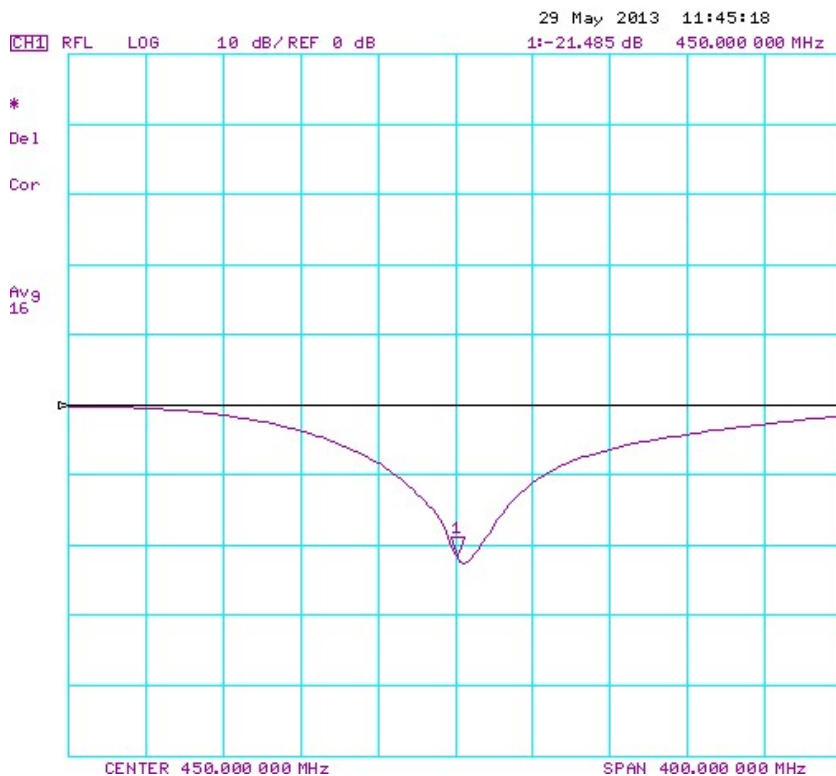
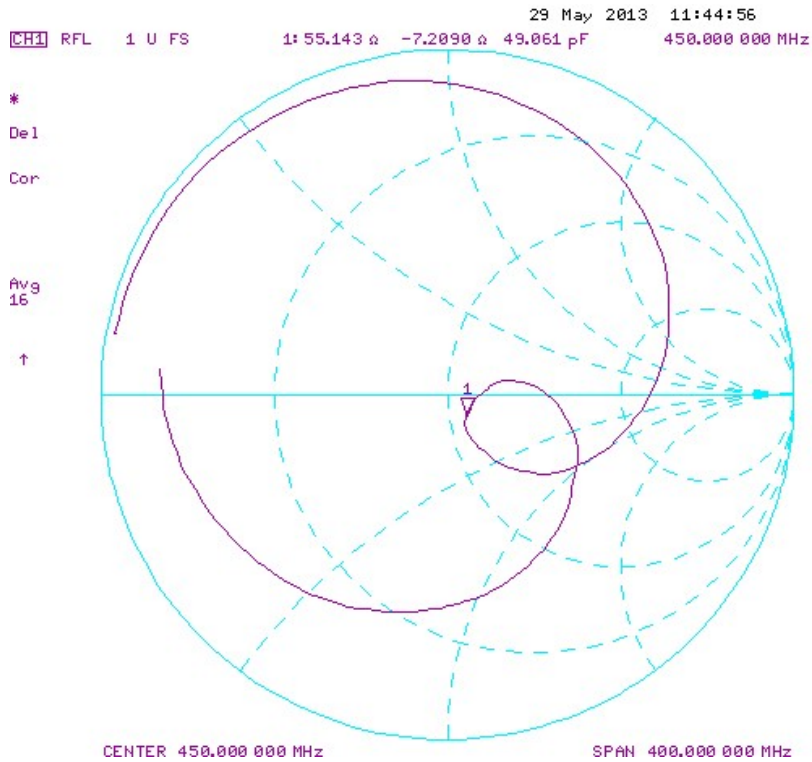
	<u>Date:</u> June 19, 2014	<u>Revision No.</u> Rev. 1.1	 Test Lab Certificate No. 2470.01
	<b>450 MHz Dipole Extended Calibration</b>		

Dipole: D450V3  
Serial Number: 1068  
Last Calibrated: Apr. 27, 2012

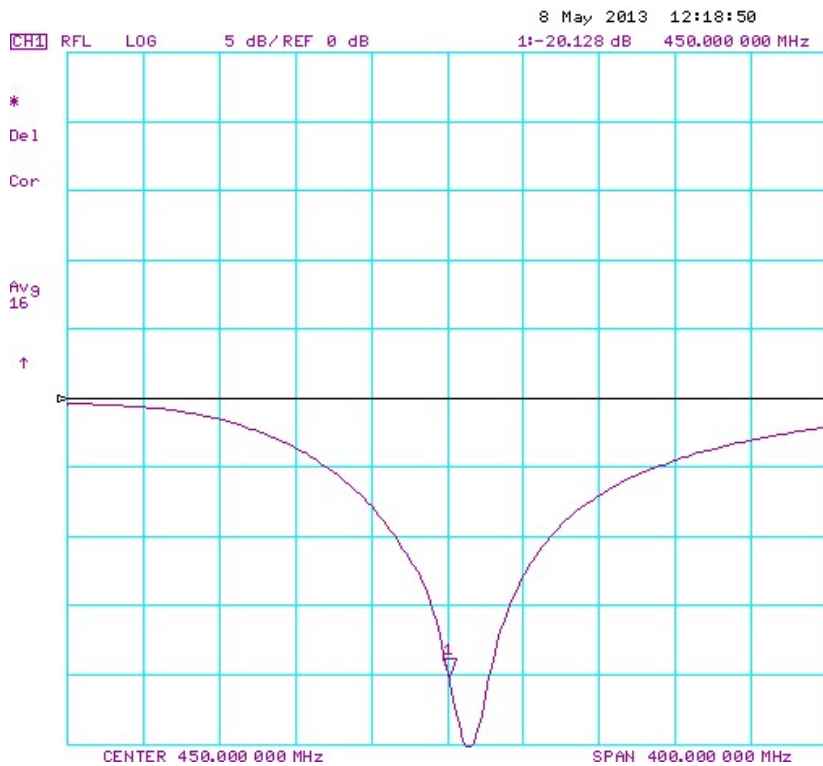
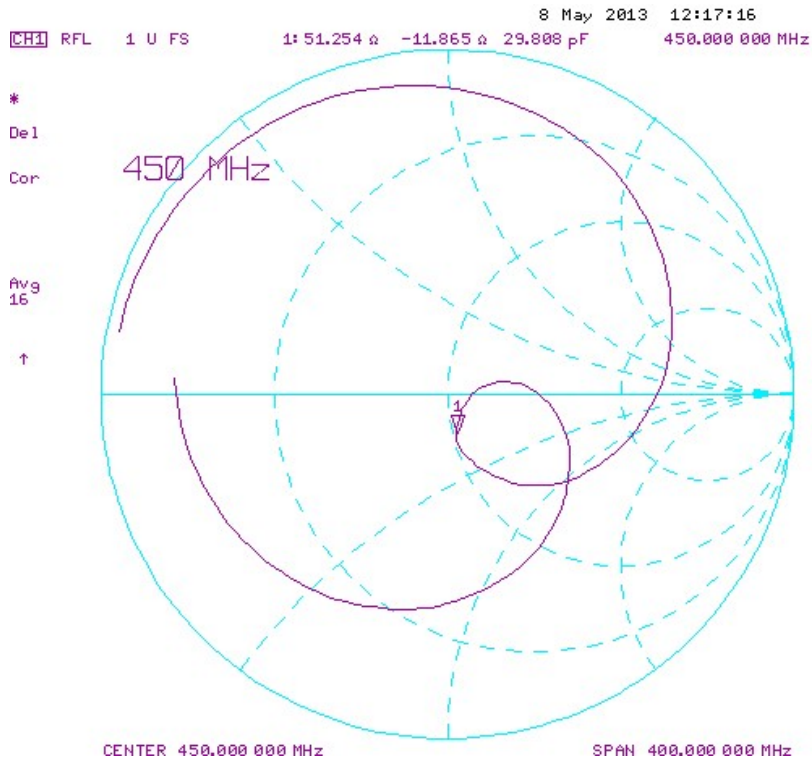
Antenna Parameters with Head TSL						
	Impedance Real (ohms)	Deviation from cal	Impedance Imaginary (ohms)	Deviation from cal	Return Loss (dB)	Deviation from Cal
<b>Last Calibration</b>	57.7	-	-4.7	-	-21.6	-
<b>Extended Cal May 29, 2013</b>	55.1	2.6	-7.2	2.5	-21.5	0.4
<b>Extended Cal May 13, 2014</b>	57.9	0.2	-7.1	2.4	-20.1	-1.5

Antenna Parameters with Body TSL						
	Impedance Real (ohms)	Deviation from cal (ohms)	Impedance Imaginary (ohms)	Deviation from cal (ohms)	Return Loss (dB)	Deviation from Cal (%)
<b>Last Calibration</b>	54.6	-	-8.1	-	-21.0	-
<b>Extended Cal May 8, 2013</b>	51.3	3.3	-11.9	3.8	-20.1	4.3
<b>Extended Cal June 19, 2014</b>	51.2	3.4	-9.4	1.3	-20.2	3.8

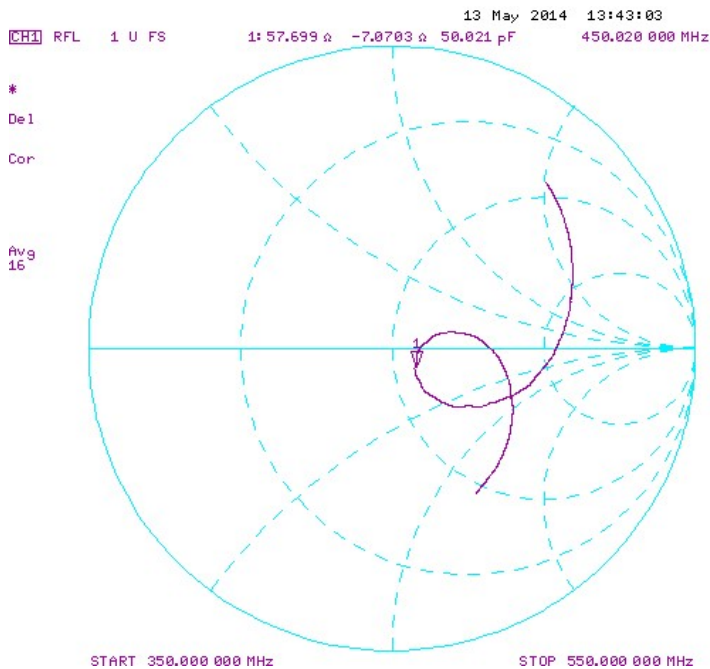
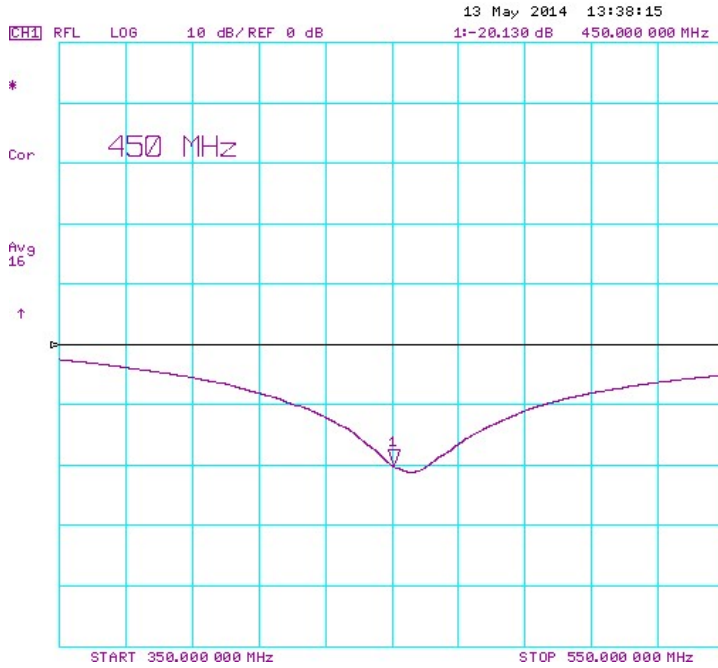
## Antenna VSWR with Head TSL



## Antenna VSWR with Body TSL



## Antenna VSWR with Head TSL

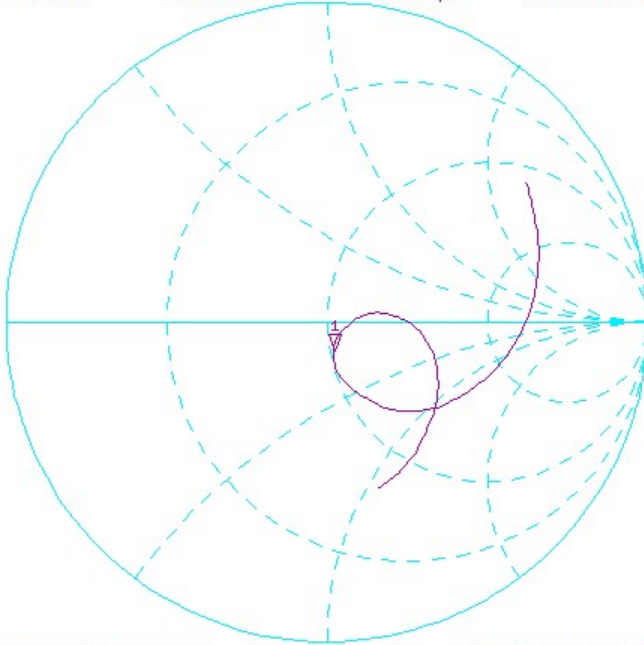




## Antenna VSWR with Body TSL

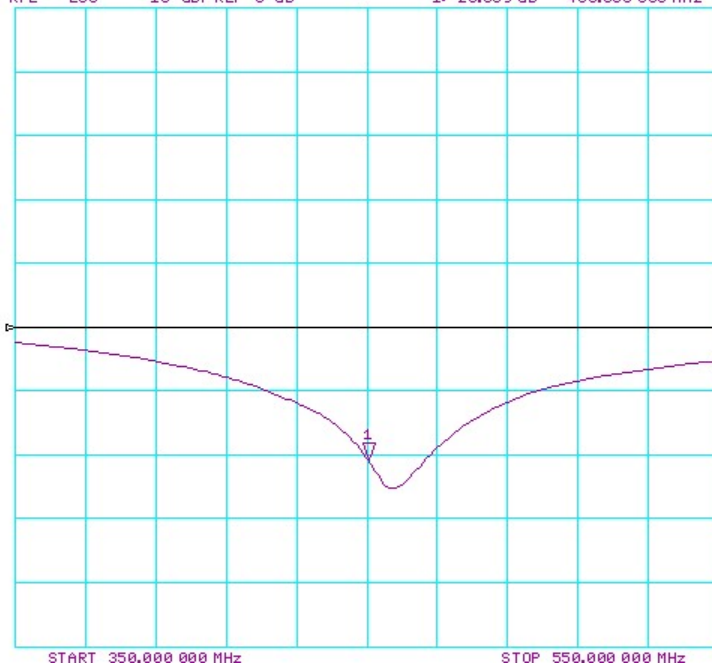
19 Jun 2014 09:26:09  
[CH1] RFL 1 U FS 1: 51.203  $\Omega$  -9.4297  $\Omega$  37.507 pF 450.000 000 MHz

\*  
Del  
Cor  
Avg  
16



START 350.000 000 MHz STOP 550.000 000 MHz  
19 Jun 2014 09:24:11  
[CH1] RFL LOG 10 dB/REF 0 dB 1:-20.639 dB 450.000 000 MHz

\*  
Del  
Cor  
Avg  
16  
↑





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Accreditation No.: **SCS 108**

Client **Celltech**

Certificate No: **D450V3-1068\_Apr12**

## CALIBRATION CERTIFICATE

Object **D450V3 - SN: 1068**

Calibration procedure(s) **QA CAL-15.v6**  
**Calibration procedure for dipole validation kits below 700 MHz**

Calibration date: **April 27, 2012**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ET3DV6	SN: 1507	30-Dec-11 (No. ET3-1507_Dec11)	Dec-12
DAE4	SN: 654	03-May-11 (No. DAE4-654_May11)	May-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	

Approved by:	Katja Pokovic	Technical Manager
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Issued: April 27, 2012

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### Glossary:

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

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### 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	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: $2 \pm 0.2$ mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	44.1 $\pm$ 6 %	0.87 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	398 mW input power	1.87 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	4.71 mW / g $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.25 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	3.15 mW / g $\pm$ 17.6 % (k=2)

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.9 $\pm$ 6 %	0.94 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	398 mW input power	1.81 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	4.52 mW / g $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.21 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	3.02 mW / g $\pm$ 17.6 % (k=2)

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.7 $\Omega$ - 4.7 j $\Omega$
Return Loss	- 21.6 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	54.6 $\Omega$ - 8.1 j $\Omega$
Return Loss	- 21.0 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.755 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 16, 2009



## DASY5 Validation Report for Head TSL

Date: 27.04.2012

Test Laboratory: SPEAG

**DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1068**

Communication System: CW; Frequency: 450 MHz

Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.87$  mho/m;  $\epsilon_r = 44.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.59, 6.59, 6.59); Calibrated: 30.12.2011;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.04.2012
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

### **Dipole Calibration for Head Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:**

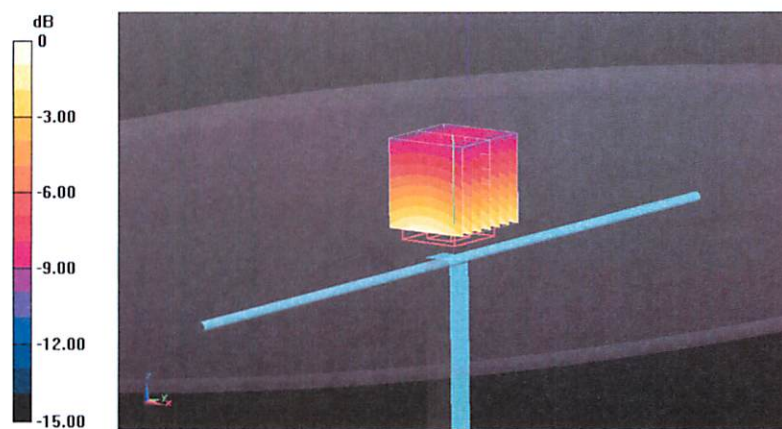
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 49.745 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 2.835 mW/g

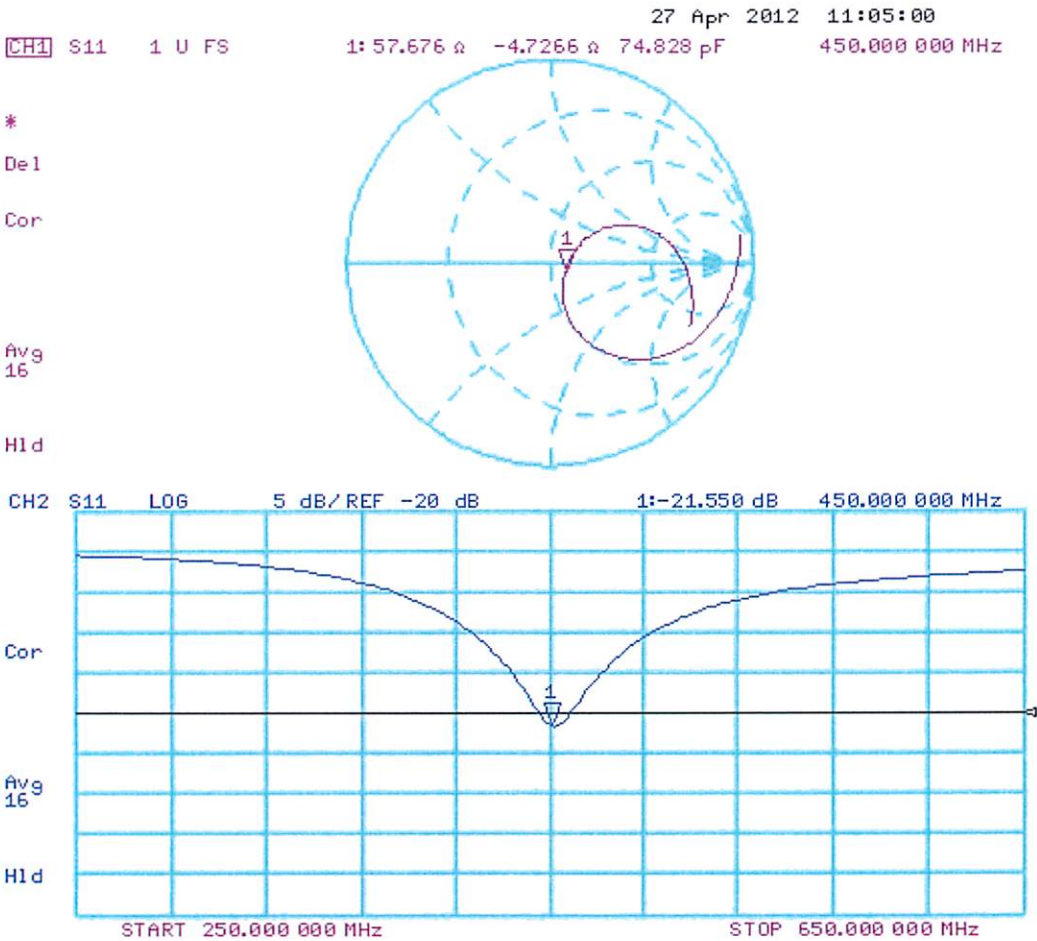
**SAR(1 g) = 1.87 mW/g; SAR(10 g) = 1.25 mW/g**

Maximum value of SAR (measured) = 2.00 mW/g



0 dB = 2.00 mW/g = 6.02 dB mW/g

Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 27.04.2012

Test Laboratory: SPEAG

**DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1068**

Communication System: CW; Frequency: 450 MHz

Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.94$  mho/m;  $\epsilon_r = 54.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.05, 7.05, 7.05); Calibrated: 30.12.2011;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.04.2012
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

### Dipole Calibration for Body Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:

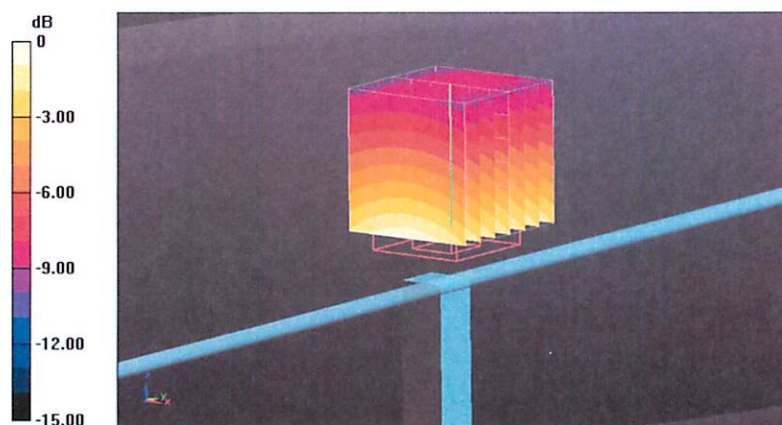
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 46.572 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.834 mW/g

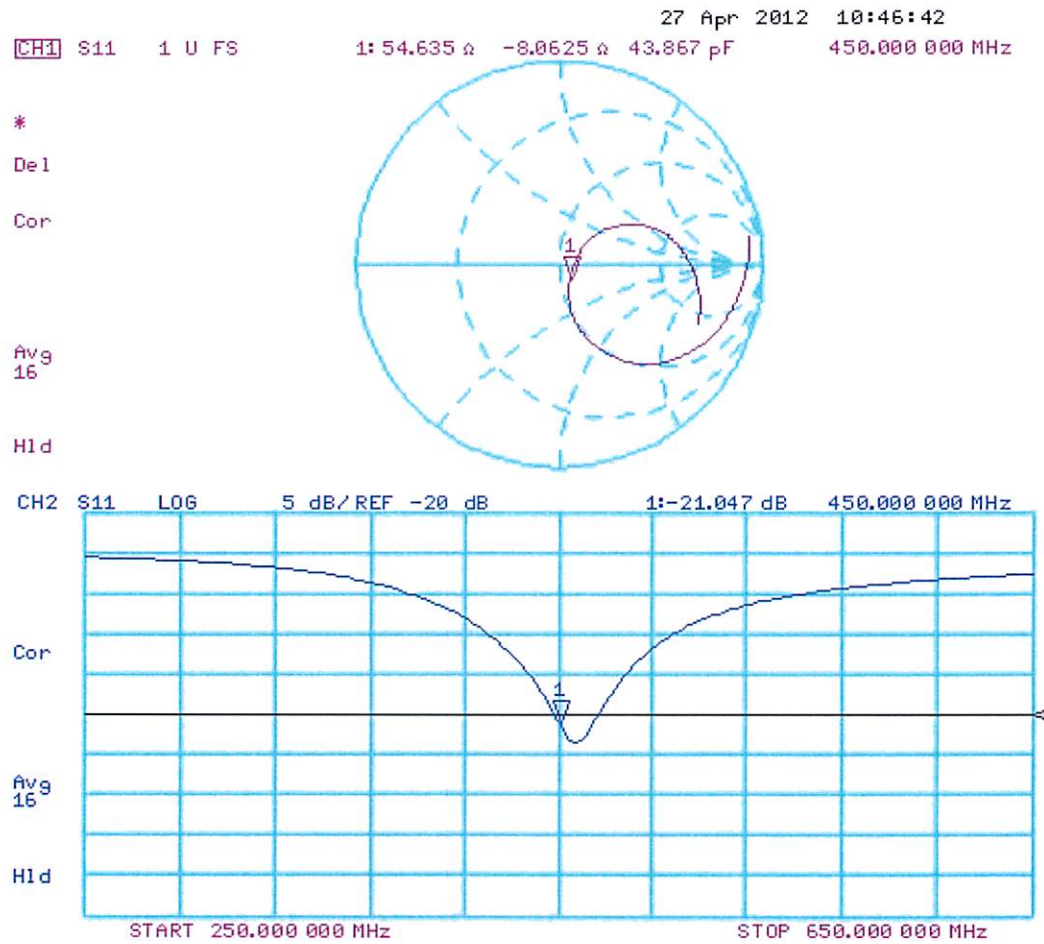
**SAR(1 g) = 1.81 mW/g; SAR(10 g) = 1.21 mW/g**



Maximum value of SAR (measured) = 1.94 mW/g




0 dB = 1.94 mW/g = 5.76 dB mW/g

## Impedance Measurement Plot for Body TSL



	<u>Date(s) of Evaluation</u> Nov 11 – Dec 12	<u>Test Report Serial No.</u> 121514AMW-1313	<u>Test Report Revision No.</u> Rev. 1.1(2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> December 12, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

## APPENDIX F - PROBE CALIBRATION

<b>Applicant:</b>	<b>Uniden America Corporation</b>	<b>FCC ID:</b>	<b>AMWUT650</b>	<b>IC:</b>	<b>513C-UT650</b>	
<b>Model(s):</b>	<b>Atlantis 295</b>	<b>DUT Type:</b>	<b>Portable Multi-Band PTT Radio Transceiver</b>	<b>VHF / GMRS</b>		
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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 108**

Client **Celltech**

Certificate No: **EX3-3600\_Apr14**

## CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3600**

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 15, 2014**

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: April 15, 2014			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

### Glossary:

TSL	tissue simulating liquid
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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### 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).

# Probe EX3DV4

## SN:3600

Manufactured: January 10, 2007  
Calibrated: April 15, 2014

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

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3600

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.50	0.49	0.40	± 10.1 %
DCP (mV) <sup>B</sup>	99.8	92.9	97.6	

### 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	122.9	±3.3 %
		Y	0.0	0.0	1.0		125.6	
		Z	0.0	0.0	1.0		123.5	

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

<sup>A</sup> The uncertainties of NormX,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.

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3600

### 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 <sup>G</sup> (mm)	Unct. (k=2)
150	52.3	0.76	9.80	9.80	9.80	0.00	1.00	± 13.3 %
300	45.3	0.87	9.02	9.02	9.02	0.11	1.10	± 13.3 %
450	43.5	0.87	9.40	9.40	9.40	0.20	1.30	± 13.3 %
750	41.9	0.89	8.55	8.55	8.55	0.28	1.13	± 12.0 %
835	41.5	0.90	8.23	8.23	8.23	0.24	1.30	± 12.0 %
900	41.5	0.97	8.09	8.09	8.09	0.38	0.85	± 12.0 %
1950	40.0	1.40	6.56	6.56	6.56	0.73	0.60	± 12.0 %
2450	39.2	1.80	6.19	6.19	6.19	0.29	0.91	± 12.0 %
5200	36.0	4.66	4.56	4.56	4.56	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.31	4.31	4.31	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.01	4.01	4.01	0.40	1.80	± 13.1 %

<sup>C</sup> Frequency validity 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.

<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:3600

### 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 <sup>G</sup> (mm)	Unct. (k=2)
150	61.9	0.80	8.81	8.81	8.81	0.00	1.00	± 13.3 %
300	58.2	0.92	9.20	9.20	9.20	0.09	1.15	± 13.3 %
450	56.7	0.94	9.05	9.05	9.05	0.12	1.30	± 13.3 %
750	55.5	0.96	8.14	8.14	8.14	0.35	0.97	± 12.0 %
835	55.2	0.97	8.11	8.11	8.11	0.50	0.82	± 12.0 %
900	55.0	1.05	7.92	7.92	7.92	0.41	0.92	± 12.0 %
1950	53.3	1.52	6.79	6.79	6.79	0.56	0.73	± 12.0 %
2450	52.7	1.95	6.26	6.26	6.26	0.77	0.57	± 12.0 %
5200	49.0	5.30	4.06	4.06	4.06	0.40	1.90	± 13.1 %
5500	48.6	5.65	3.65	3.65	3.65	0.40	1.90	± 13.1 %
5800	48.2	6.00	3.65	3.65	3.65	0.50	1.90	± 13.1 %

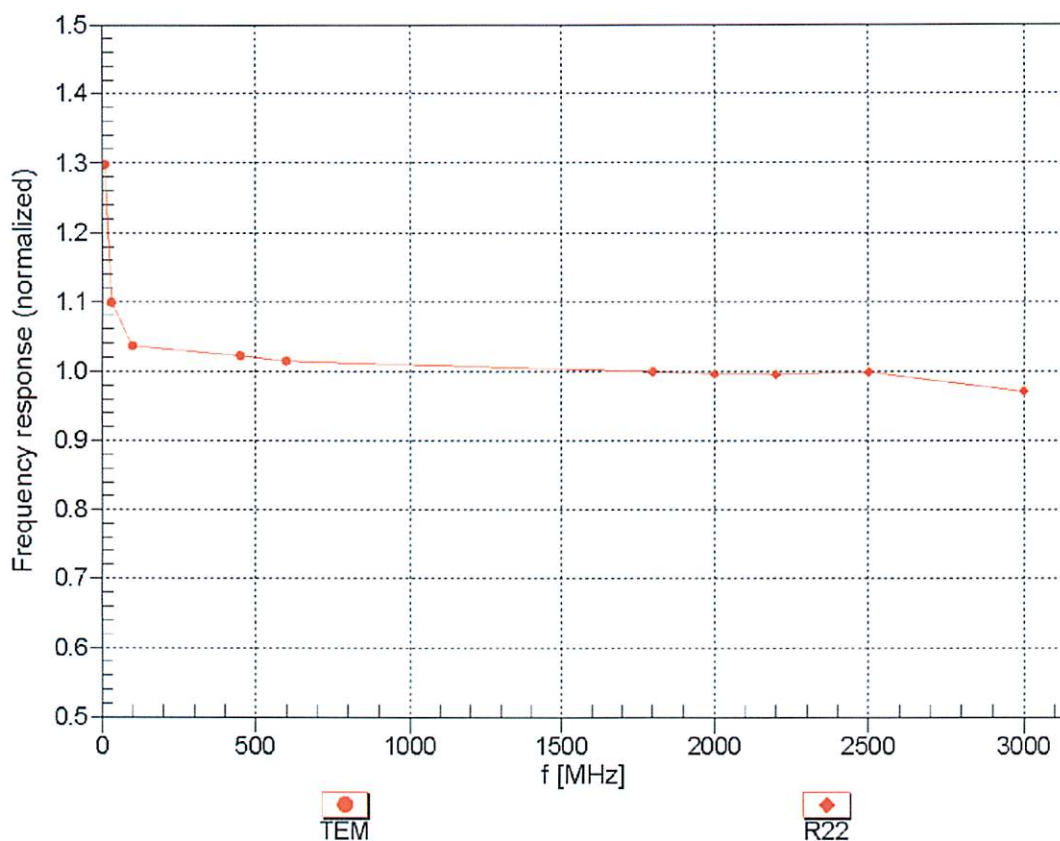
<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<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

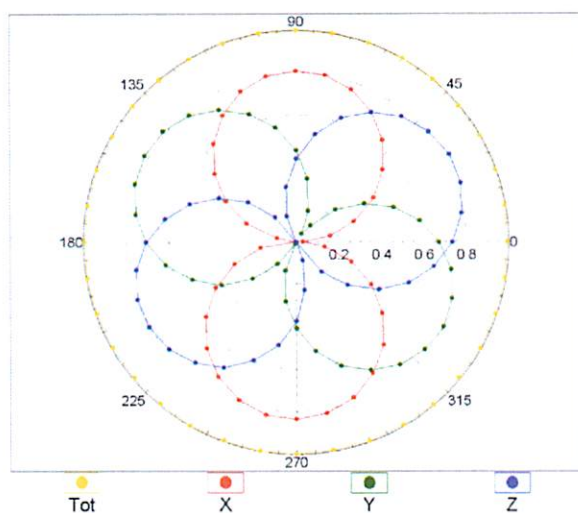
(TEM-Cell:ifi110 EXX, Waveguide: R22)



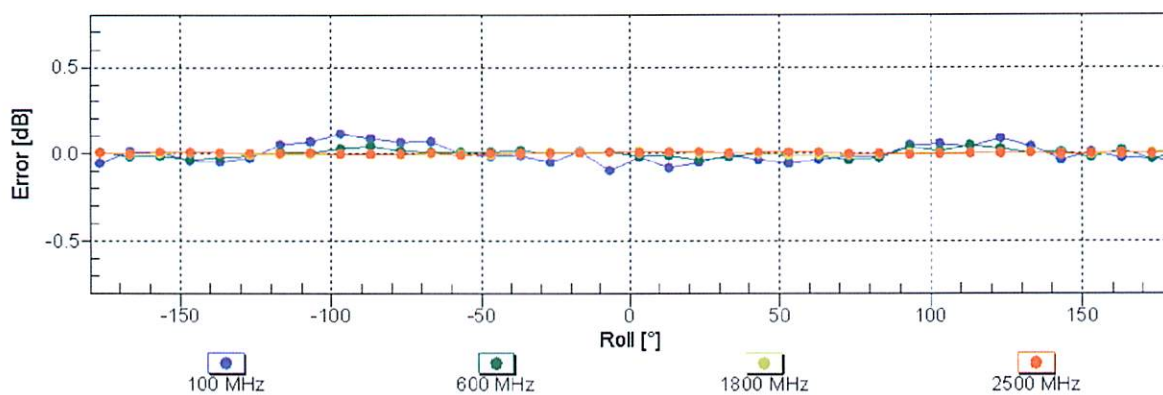
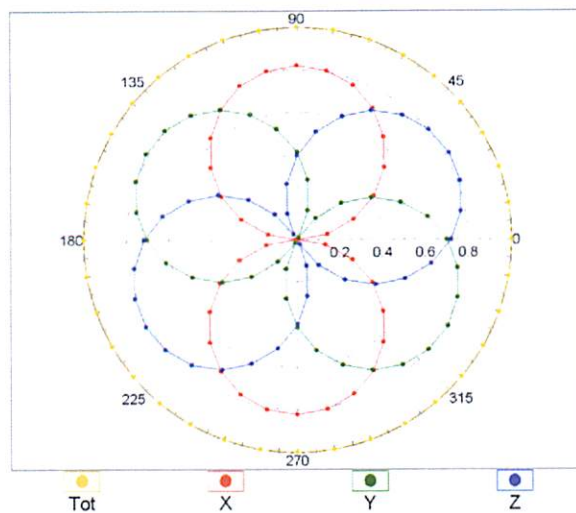
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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

f=600 MHz, TEM



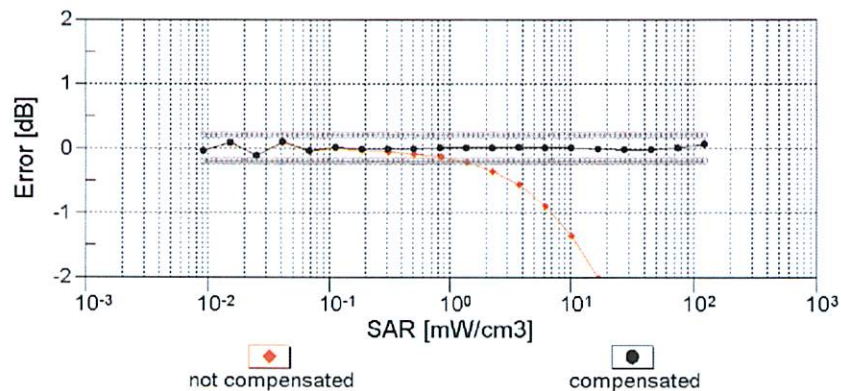
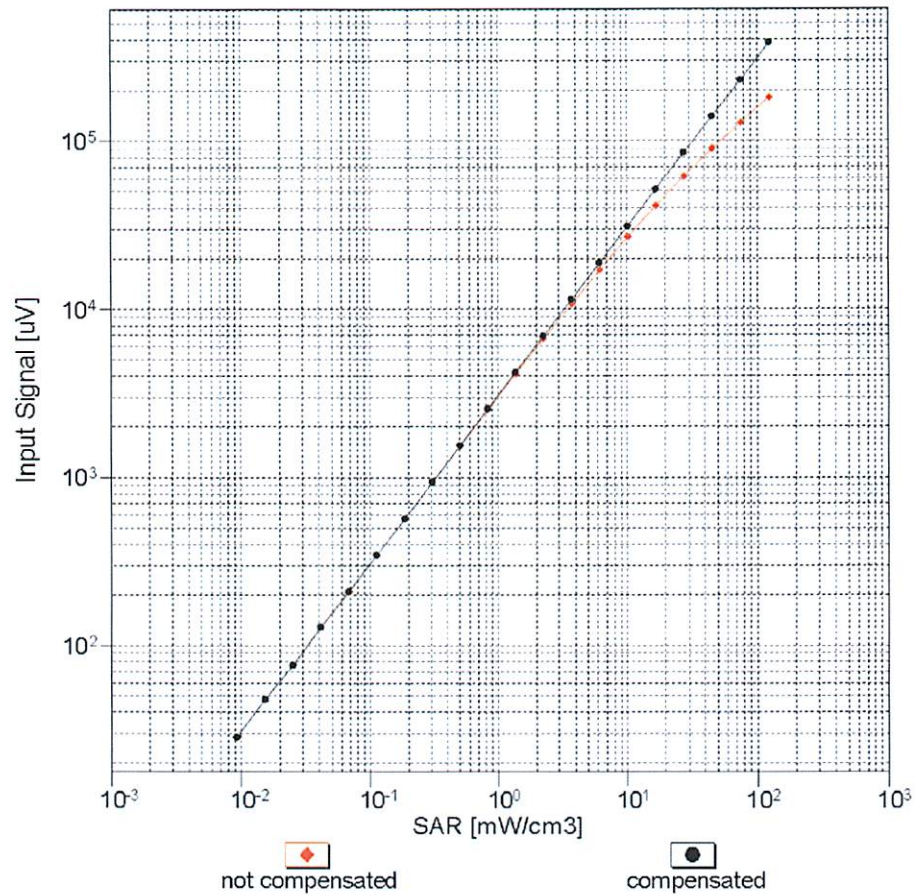
f=1800 MHz, R22



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

## Dynamic Range f(SAR<sub>head</sub>)

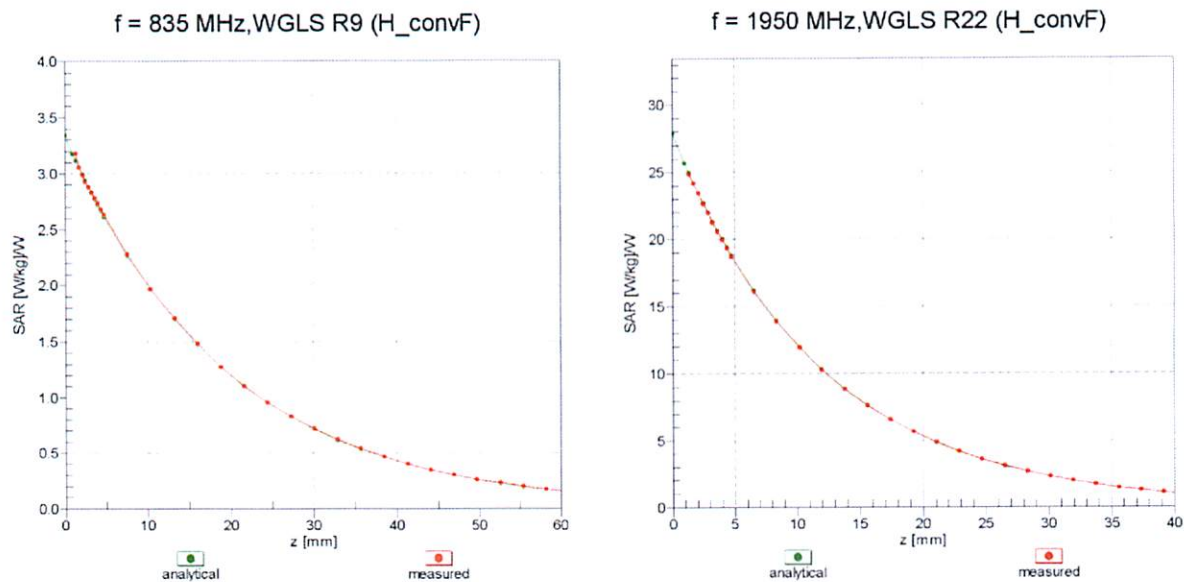
(TEM cell , f<sub>eval</sub>= 1900 MHz)



Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

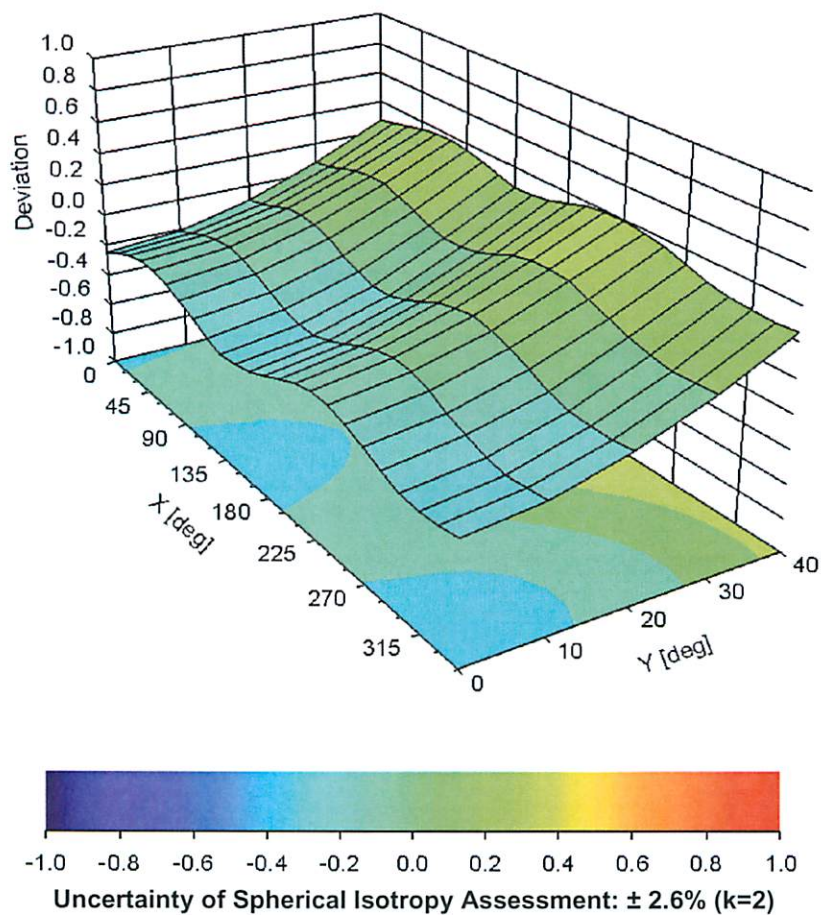


## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$








## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3600

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-146.9
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	2 mm

	<u>Date(s) of Evaluation</u> Nov 11 – Dec 12	<u>Test Report Serial No.</u> 121514AMW-1313	<u>Test Report Revision No.</u> Rev. 1.1(2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> December 12, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

## APPENDIX G - ELI PHANTOM CERTIFICATE OF CONFORMITY

<b>Applicant:</b>	<b>Uniden America Corporation</b>	<b>FCC ID:</b>	<b>AMWUT650</b>	<b>IC:</b>	<b>513C-UT650</b>	
<b>Model(s):</b>	<b>Atlantis 295</b>	<b>DUT Type:</b>	<b>Portable Multi-Band PTT Radio Transceiver</b>	<b>VHF / GMRS</b>		
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Zeughausstrasse 43, 8004 Zurich, Switzerland  
 Phone +41 44 245 9700, Fax +41 44 245 9779  
 info@speag.com, http://www.speag.com

## Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 5.0
Type No	QD OVA 002 A
Series No	1108 and higher
Manufacturer	Untersee Composites Knebelstrasse 8, CH-8268 Mannenbach, Switzerland

### Tests

Complete tests were made on the prototype units QD OVA 001 A, pre-series units QD OVA 001 B as well as on some series units QD OVA 001 B. Some tests are made on all series units QD OVA 002 A.

Test	Requirement	Details	Units tested
Shape	Internal dimensions, depth and sagging are compatible with standards	Bottom elliptical 600 x 400 mm, Depth 190 mm, dimension compliant with [1] for $f > 375$ MHz	Prototypes
Material thickness	Bottom: 2.0mm +/- 0.2mm	dimension compliant with [3] for $f > 800$ MHz	all
Material parameters	rel. permittivity 2 – 5, loss tangent $\leq 0.05$ , at $f \leq 6$ GHz	rel. permittivity 3.5 +/- 0.5 loss tangent $\leq 0.05$	Material samples
Material resistivity	Compatibility with tissue simulating liquids .	Compatible with SPEAG liquids. **	Phantoms, Material sample
Sagging	Sagging of the flat section in tolerance when filled with tissue simulating liquid.	within tolerance for filling height up to 155 mm	Prototypes, samples

\*\* Note: Compatibility restrictions apply certain liquid components mentioned in the standard, containing e.g. DGBE, DGMHE or Triton X-100. Observe technical note on material compatibility.

### Standards

- [1] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
- [2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003
- [3] IEC 62209–1 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", 2005-02-18
- [4] IEC 62209–2 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 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)", 2010-03-30

### Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of **body-worn** SAR measurements and system performance checks as specified in [1 – 4] and further standards.

Date 25.7.2011

Signature / Stamp

**s p e a g**

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 info@speag.com, http://www.speag.com