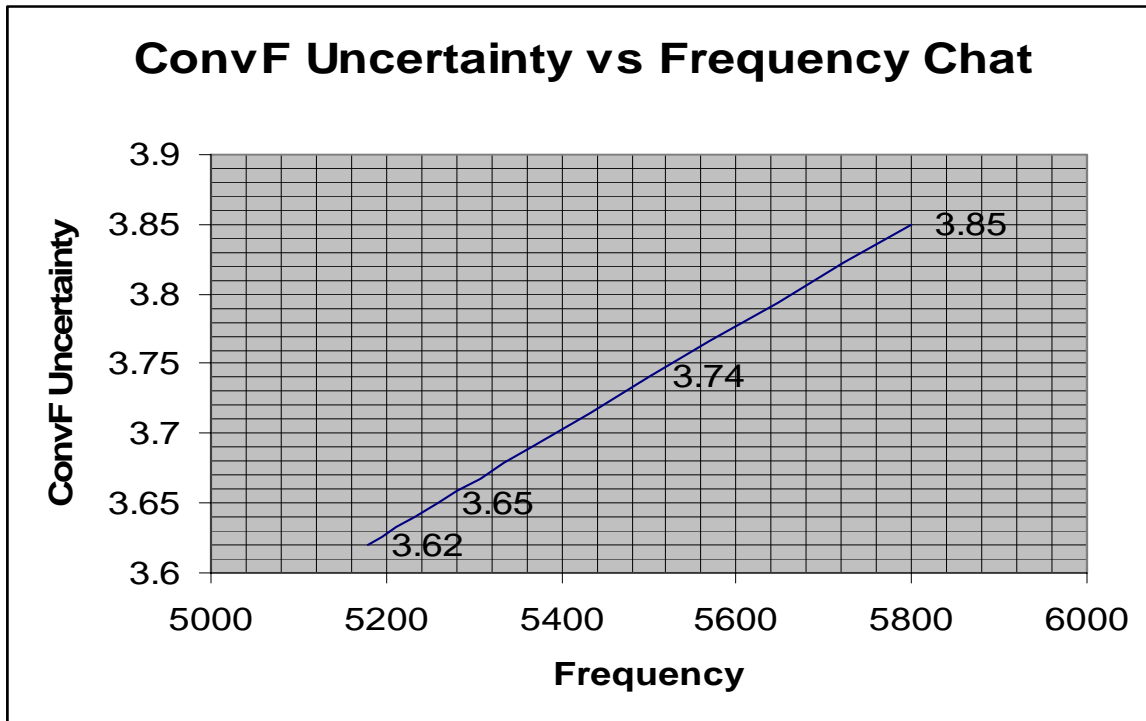


**Conversion Factor Assessment for EX3DV4 SN: 3576 for 5MHz**

TSL: Body

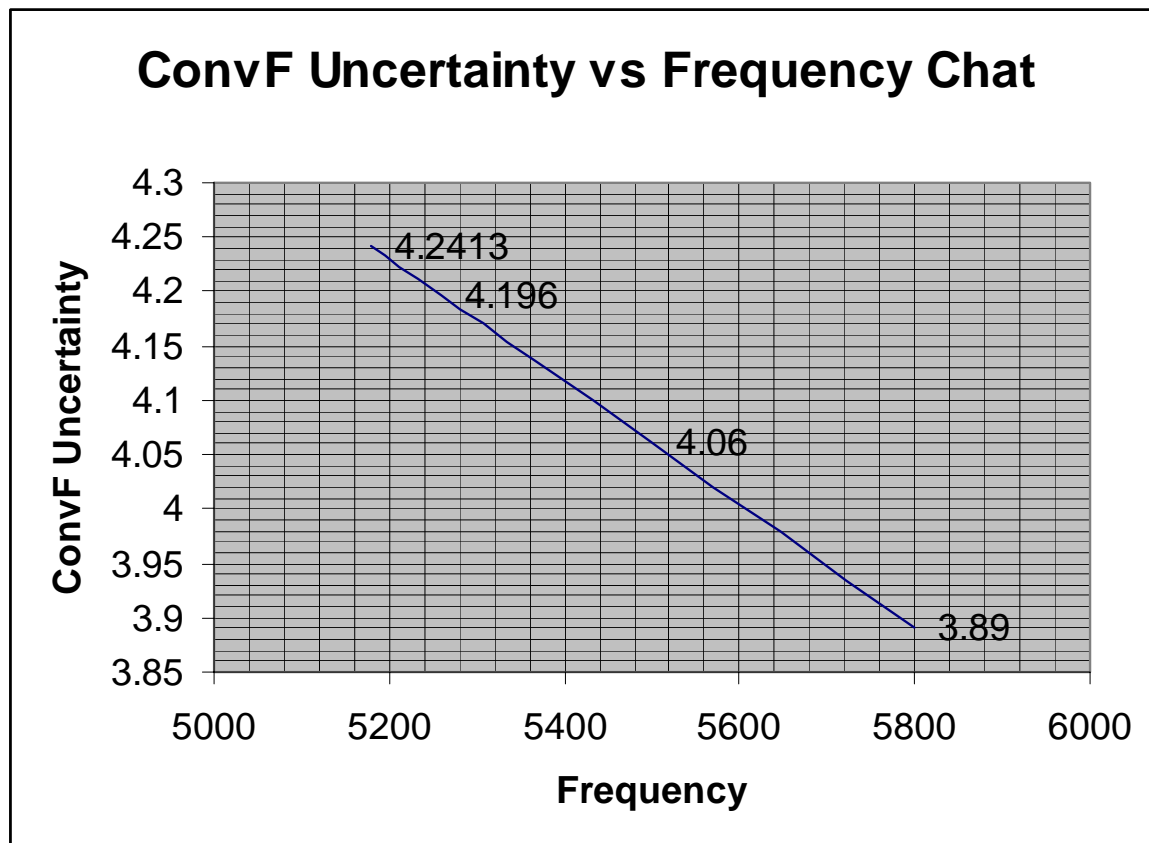
Frequency	ConvF Uncertainty
5180	3.62
5260	3.65
5500	3.74
5800	3.85



**Conversion Factor Assessment for EX3DV4 SN: 3576 for 5MHz**

TSL: Head

Frequency	ConvF Uncertainty
5180	4.24
5260	4.19
5500	4.06
5800	3.89



**APPENDIX C – DIPOLE CALIBRATION CERTIFICATES**

**NCL CALIBRATION LABORATORIES**

Calibration File No: DC-266  
Project Number: BACL-CAL2450-3986

**CERTIFICATE OF CALIBRATION**

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

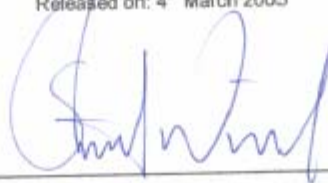
BACL Validation Dipole

Manufacturer: APREL Laboratories  
Part number: D-2450-S-1  
Frequency: 2450 MHz  
Serial No: BCL-141

Customer: Bay Area Compliance Laboratory

Calibrated: 4<sup>th</sup> March 2005  
Released on: 4<sup>th</sup> March 2005

Released By: \_\_\_\_\_



**NCL CALIBRATION LABORATORIES**

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E5

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4182

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Division of APREL Laboratories.

**Conditions**

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C

**Temperature of the Tissue:** 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.



-----  
**Stuart Nicol**  
**Director Product Development**



-----  
**D. Brooks**  
**Member of Engineering Staff**  
**(Calibration Engineer)**

This page has been reviewed for content and attested to by signature within this document.

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**Calibration Results Summary**

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

**Mechanical Dimensions**

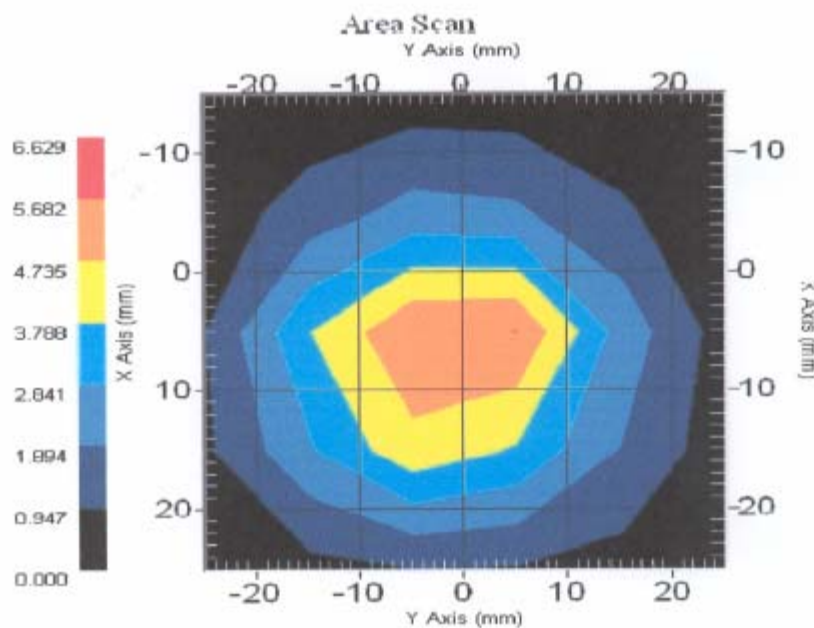
Length: 51.5 mm  
Height: 30.4 mm

**Electrical Specification**

SWR: 1.09 U to 1.38 U  
Return Loss: -27.5 dB to -15.9 dB  
Impedance: 47.9  $\Omega$  to 60.8  $\Omega$

**System Validation Results**

Frequency	1 Gram	10 Gram	Peak
2450 MHz	5.31	2.44	10.18



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**Introduction**

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole BCL-141. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

**References**

SSI-TP-018-ALSAS Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

**Conditions**

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C**Temperature of the Tissue:** 20 °C +/- 0.5°C

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**Dipole Calibration Results****Mechanical Verification**

APREL Length	APREL Height	Measured Length	Measured Height
51.5 mm	30.4 mm	51.6 mm	30.5 mm

**Tissue Validation**

Head Tissue 2450 MHz	Measured
Dielectric constant, $\epsilon_r$	39.2
Conductivity, $\sigma$ [S/m]	1.80

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**Electrical Calibration**

Test	Result
S11 R/L	-27.5 dB to -15.9 dB
SWR	1.09 U to 1.38 U
Impedance	47.9 $\Omega$ to 60.8 $\Omega$

The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

S22 REVERSE REFLECTION



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

MARKER 2  
2.353000 GHz  
-27.537 dB

MARKER TO MAX  
▶ MARKER TO MIN

1 2.449750 GHz  
-15.866 dB

MARKER READOUT  
FUNCTIONS

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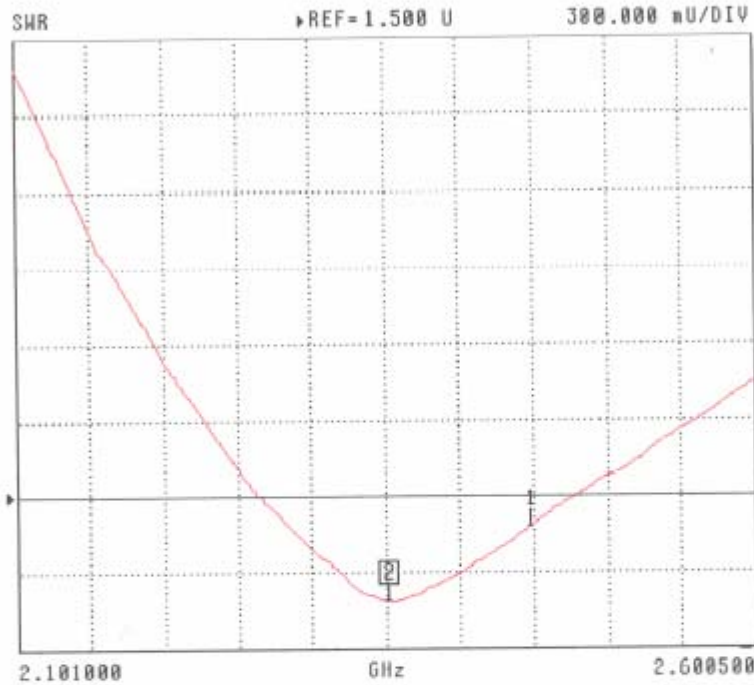
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**SWR**

S22 REVERSE REFLECTION



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

MARKER 2  
2.353000 GHz  
1.090 U

MARKER TO MAX  
MARKER TO MIN

1 2.449750 GHz  
1.380 U

MARKER READOUT  
FUNCTIONS

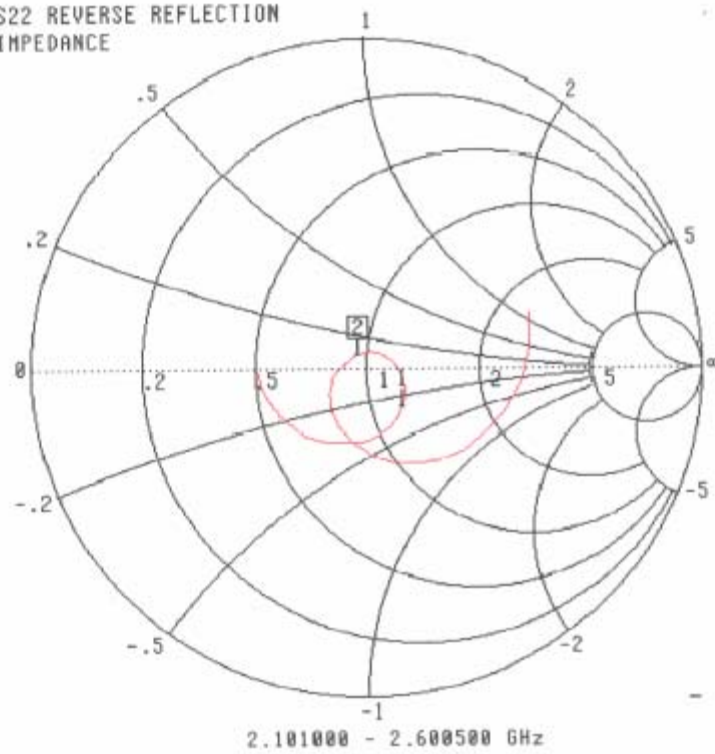
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### Smith Chart Dipole Impedance

S22 REVERSE REFLECTION  
IMPEDANCE



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

MARKER 2  
2.353000 GHz  
47.949  $\Omega$   
3.624 j $\Omega$

MARKER TO MAX  
▶ MARKER TO MIN  
1 2.449750 GHz  
60.783  $\Omega$   
-14.651 j $\Omega$

MARKER READOUT  
FUNCTIONS

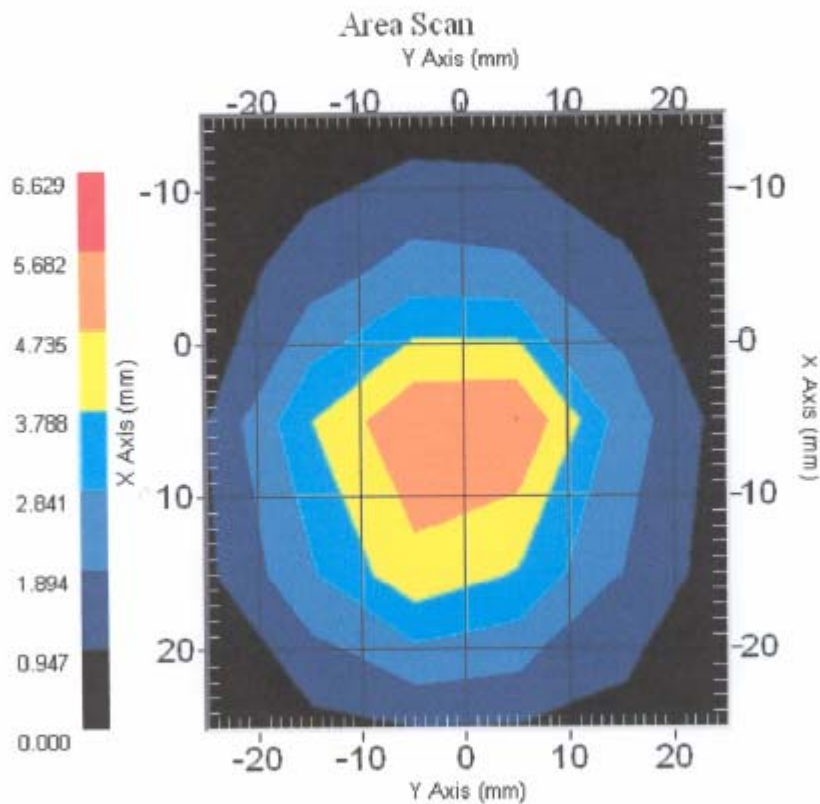
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**System Validation Results Using the Electrically Calibrated Dipole**

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
2450 MHz	5.31	2.44	10.18



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**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2004

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation  
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 **Bay Area**

Certificate No: **D5GHzV2-1001\_May06**

**CALIBRATION CERTIFICATE**

Object **D5100V2 - SN: 1001**

Calibration procedure(s) **QA CAL-22.v1  
Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **May 3, 2006**

Condition of the calibrated item **In Tolerance**

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 E4419B	GB41283874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00556)	Apr-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00488)	Aug-06
Reference Probe EX3DV4	SN: 3503	19-Mar-05 (SPEAG, No. EX3-3503_Mar06)	Mar-07
DAE4	SN: 601	15-Dec-05 (SPEAG, No. DAE4-801_Dec05)	Dec-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

Calibrated by: **Marcel Fehr** (Name), **Laboratory Technician** (Function), *[Signature]* (Signature)

Approved by: **Katja Pokovic** (Name), **Technical Manager** (Function), *[Signature]* (Signature)

Issued: May 4, 2006

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

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



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**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
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Accredited by the Swiss Federal Office of Metrology and Accreditation  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

#### 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) IEC Std 62209 Part 2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", Draft Version 0.9, December 2004
- b) 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:

- c) DASY4 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.

**Measurement Conditions**

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.3 mm, dz = 3 mm	
Frequency	5500 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

**Head TSL parameters at 5500 MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.95 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	35.1 $\pm$ 6 %	4.80 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.7 $\pm$ 0.2) °C	---	---

**SAR result with Head TSL at 5500 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	condition	
SAR measured	250 mW input power	21.3 mW / g
SAR normalized	normalized to 1W	85.2 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	84.7 mW / g $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.00 mW / g
SAR normalized	normalized to 1W	24.0 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	23.8 mW / g $\pm$ 19.5 % (k=2)

<sup>1</sup> Correction to nominal TSL parameters according to c), chapter "SAR Sensitivities"