

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



S Schwizerischer 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 108

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- 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_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 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.

ET3DV6 SN:1531

January 29, 2008

Probe ET3DV6

SN:1531

Manufactured:	July 15, 2000
Last calibrated:	January 22, 2007
Recalibrated:	January 29, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1531

January 29, 2008

DASY - Parameters of Probe: ET3DV6 SN:1531

Sensitivity in Free Space^A

Diode Compression^B

NormX	1.52 ± 10.1%	μV/(V/m) ²	DCP X	95 mV
NormY	1.66 ± 10.1%	μV/(V/m) ²	DCP Y	94 mV
NormZ	1.71 ± 10.1%	μV/(V/m) ²	DCP Z	93 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 900 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	8.3	4.5
SAR _{be} [%]	With Correction Algorithm	0.7	0.0

TSL 1750 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	11.9	8.0
SAR _{be} [%]	With Correction Algorithm	0.5	0.1

Sensor Offset

Probe Tip to Sensor Center **2.7 mm**

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

^A The uncertainties of NormX, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 8).

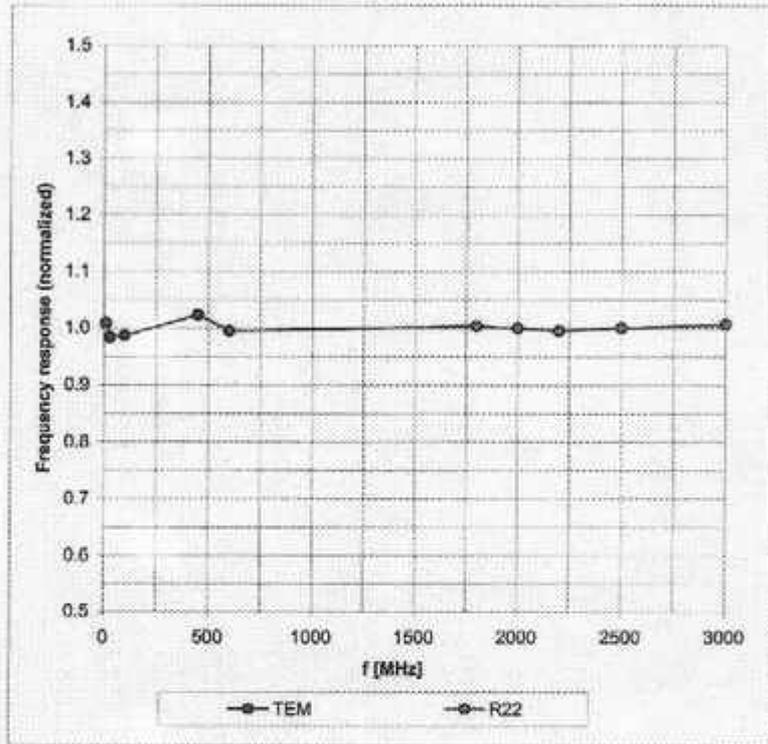
^B Numerical linearization parameter: uncertainty not required.

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Frequency Response of E-Field

(TEM-Cell: if110 EXX, Waveguide: R22)

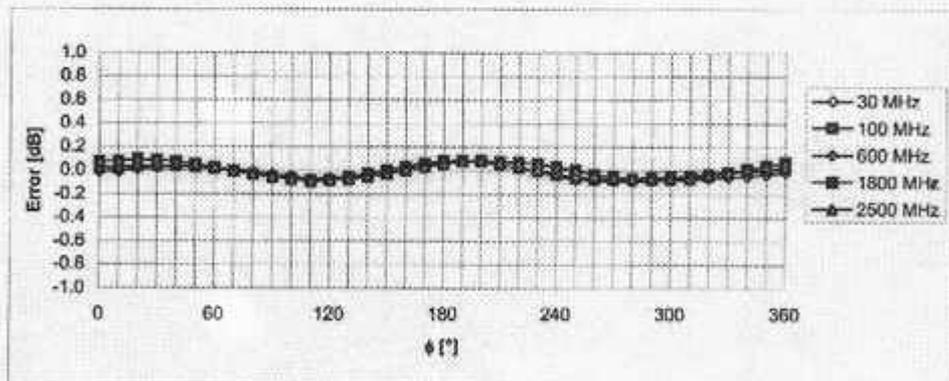
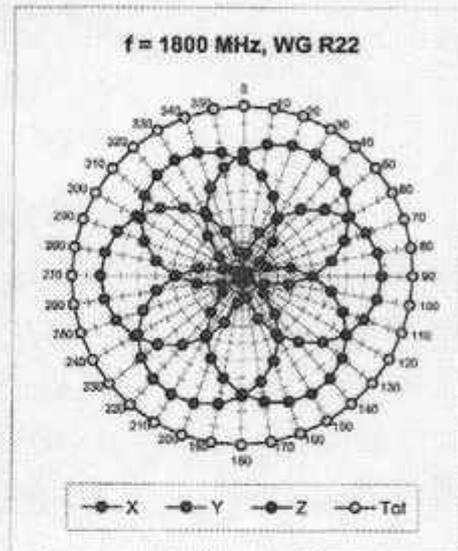
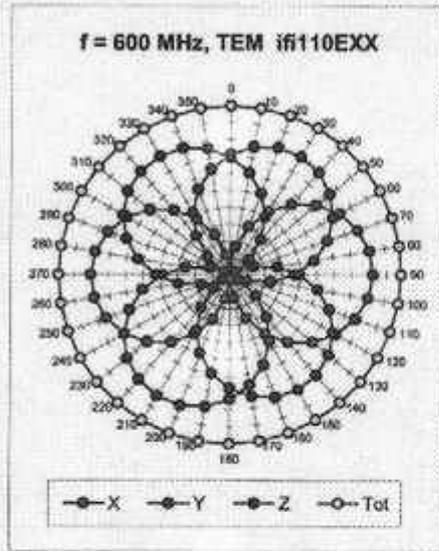


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

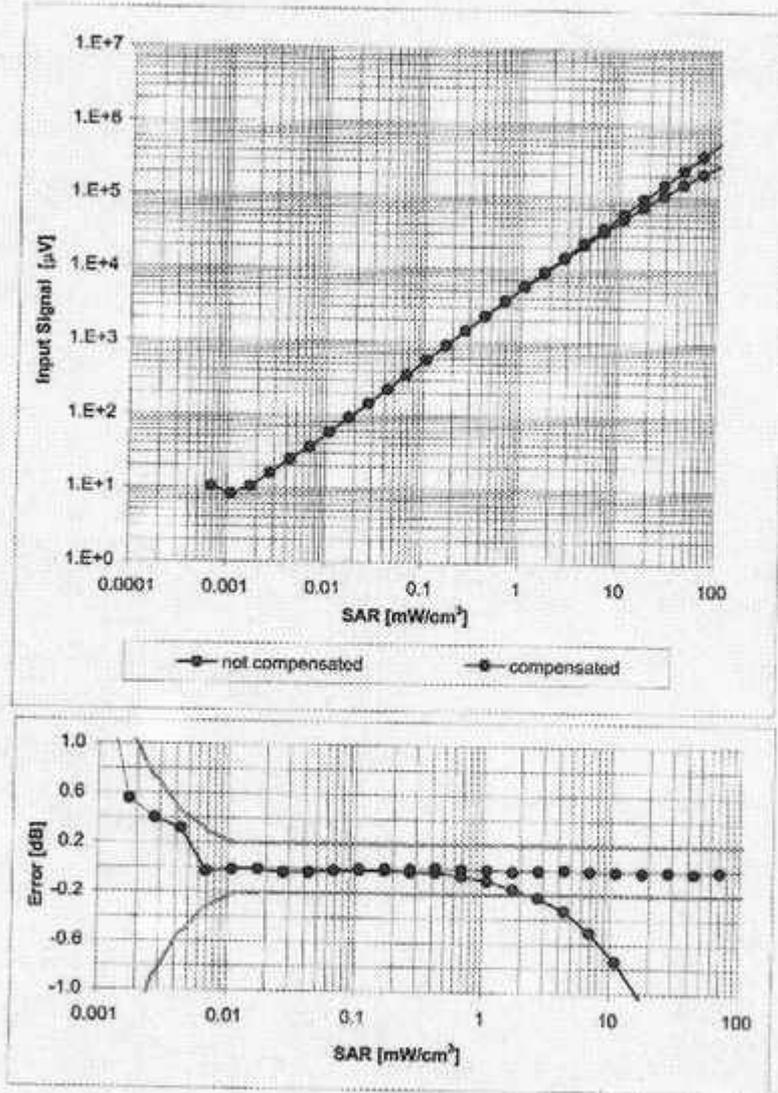


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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Dynamic Range $f(SAR_{head})$
(Waveguide R22, $f = 1800$ MHz)

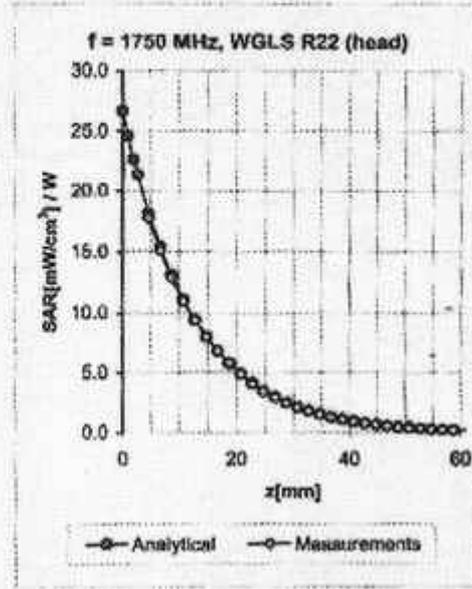
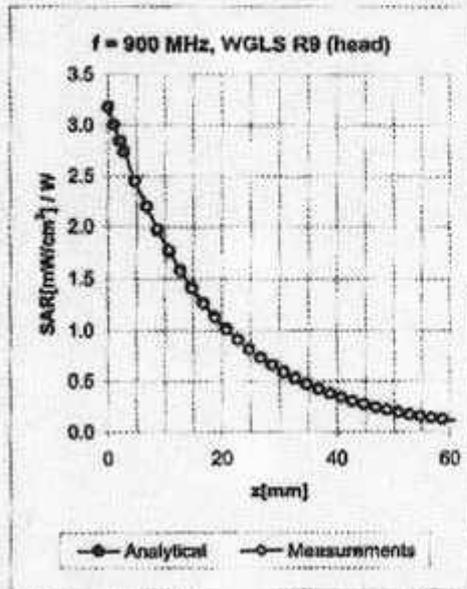


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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Conversion Factor Assessment



f [MHz]	Validity [MHz] ^o	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.27	2.89	6.85 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.52	2.56	5.42 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.49	2.89	5.15 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.35	2.82	6.52 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.56	2.68	4.97 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.88	2.07	4.64 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.68	2.16	4.10 ± 11.8% (k=2)

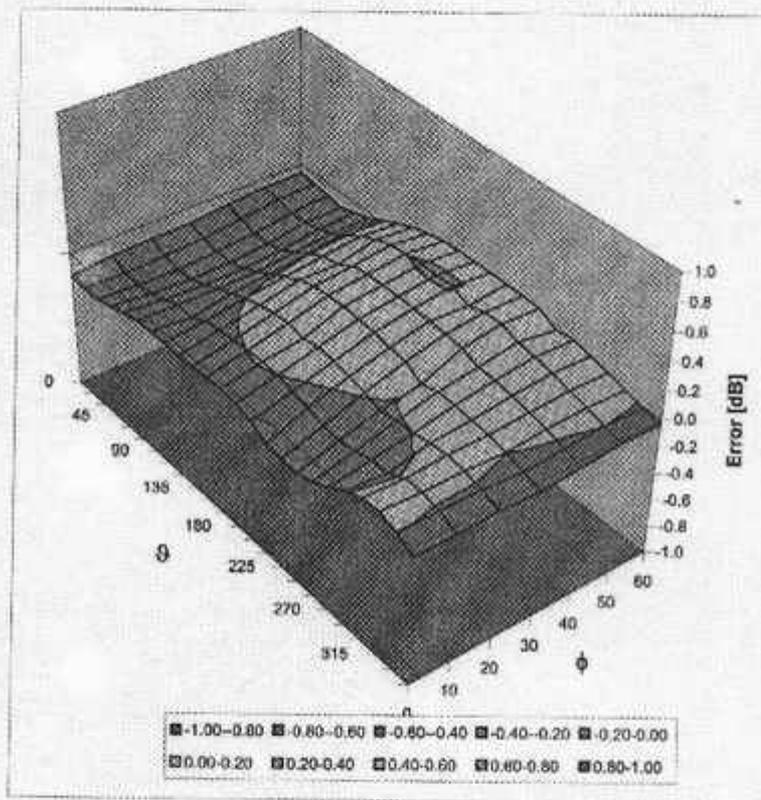
^o The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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January 29, 2008

Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

TA Technology (Shanghai) Co., Ltd. Test Report

No. RZA2008-0255FCC

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ANNEX F: D835V2 DIPOLE CALIBRATION CERTIFICATE

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Accreditation No.: **SCS 108**

Client **TMC China**

Certificate No.: **D835V2-443_Dec07**

CALIBRATION CERTIFICATE																																													
Object	D835V2-SN: 443																																												
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits																																												
Calibration date:	December 9, 2007																																												
Condition of the calibrated item	In Tolerance																																												
<p>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.</p> <p>All calibrations have been conducted at an environment temperature (22±3)°C and humidity<70%</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Primary Standards</th> <th>ID#</th> <th>Cal Data (Calibrated by, Certification NO.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter EPM-442A</td> <td>GB37480704</td> <td>13-Sep-07 (METAS, NO. 217-00608)</td> <td>Sep-08</td> </tr> <tr> <td>Power sensor 8481A</td> <td>US37292783</td> <td>13-Sep-07 (METAS, NO. 217-00608)</td> <td>Sep-08</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN:5086 (20g)</td> <td>12-Jul-07 (METAS, NO. 217-00591)</td> <td>Jul-08</td> </tr> <tr> <td>Reference 10 dB Attenuator</td> <td>SN:5047_2 (10r)</td> <td>12-Jul-07 (METAS, NO. 217-00591)</td> <td>Jul-08</td> </tr> <tr> <td>DAE4</td> <td>SN:801</td> <td>30-Jan-07 (SPEAG, NO.DAE4-801_Jan07)</td> <td>Jan-08</td> </tr> <tr> <td>Reference Probe ET3DV8 (HF)</td> <td>SN: 1507</td> <td>19-Sep-07 (SPEAG, NO. ET3-1507_Sep07)</td> <td>Sep-08</td> </tr> <tr> <th>Secondary Standards</th> <th>ID#</th> <th>Check Data (in house)</th> <th>Scheduled Calibration</th> </tr> <tr> <td>Power sensor HP 8481A</td> <td>MY41092317</td> <td>18-Oct-02(SPEAG, in house check Oct-07)</td> <td>In house check: Oct-09</td> </tr> <tr> <td>RF generator Agilent E4421B</td> <td>MY41000678</td> <td>11-May-05(SPEAG, in house check Nov-07)</td> <td>In house check: Nov-09</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585S4208</td> <td>18-Oct-01(SPEAG, in house check Oct-07)</td> <td>In house check: Oct-08</td> </tr> </tbody> </table>		Primary Standards	ID#	Cal Data (Calibrated by, Certification NO.)	Scheduled Calibration	Power meter EPM-442A	GB37480704	13-Sep-07 (METAS, NO. 217-00608)	Sep-08	Power sensor 8481A	US37292783	13-Sep-07 (METAS, NO. 217-00608)	Sep-08	Reference 20 dB Attenuator	SN:5086 (20g)	12-Jul-07 (METAS, NO. 217-00591)	Jul-08	Reference 10 dB Attenuator	SN:5047_2 (10r)	12-Jul-07 (METAS, NO. 217-00591)	Jul-08	DAE4	SN:801	30-Jan-07 (SPEAG, NO.DAE4-801_Jan07)	Jan-08	Reference Probe ET3DV8 (HF)	SN: 1507	19-Sep-07 (SPEAG, NO. ET3-1507_Sep07)	Sep-08	Secondary Standards	ID#	Check Data (in house)	Scheduled Calibration	Power sensor HP 8481A	MY41092317	18-Oct-02(SPEAG, in house check Oct-07)	In house check: Oct-09	RF generator Agilent E4421B	MY41000678	11-May-05(SPEAG, in house check Nov-07)	In house check: Nov-09	Network Analyzer HP 8753E	US37390585S4208	18-Oct-01(SPEAG, in house check Oct-07)	In house check: Oct-08
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<p>Issued: December 10, 2007</p> <p>This calibration certificate shall not be reported except in full without written approval of the laboratory.</p>																																													

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

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- CENELEC EN 50381, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- 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 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.