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

Client **CCS, USA**

CALIBRATION CERTIFICATE

Object(s)	ES3DV2 - SN:3021
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	July 29, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No.2360)	Sep-03

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Laboratory Director	
Approved by:	Fin Bomholt	R&D Director	

Date issued: July 29, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG

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Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ES3DV2

SN:3021

Manufactured: December 5, 2002
Last calibration: July 29, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV2 SN:3021

Sensitivity in Free Space

Diode Compression

NormX	**1.43** $\mu V/(V/m)^2$	DCP X	**97**	mV
NormY	**1.20** $\mu V/(V/m)^2$	DCP Y	**97**	mV
NormZ	**1.29** $\mu V/(V/m)^2$	DCP Z	**97**	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** ε_r **= 41.5 ± 5%** σ **= 0.97 ± 5% mho/m**

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.5** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.5** ± 9.5% (k=2)	Alpha	**0.93**
ConvF Z	**6.5** ± 9.5% (k=2)	Depth	**0.96**

Head **1800 MHz** ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.1** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.1** ± 9.5% (k=2)	Alpha	**0.21**
ConvF Z	**5.1** ± 9.5% (k=2)	Depth	**2.73**

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	3.8	1.5
SAR_{be} [%]	With Correction Algorithm	0.0	0.2

Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

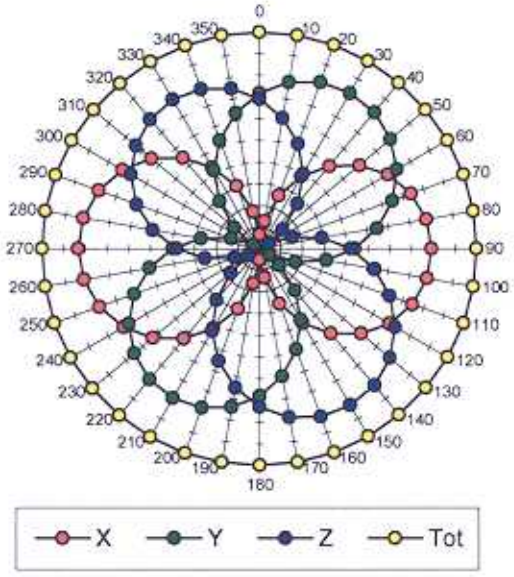
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	7.1	4.6
SAR_{be} [%]	With Correction Algorithm	0.0	0.2

Sensor Offset

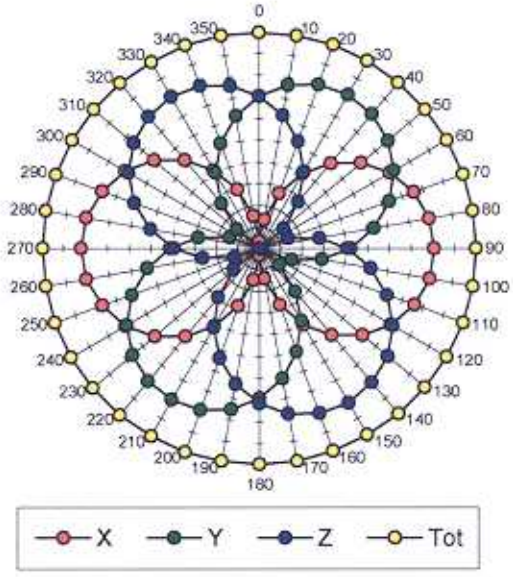
Probe Tip to Sensor Center	**2.1**	mm

Receiving Pattern (ϕ , θ = 0°

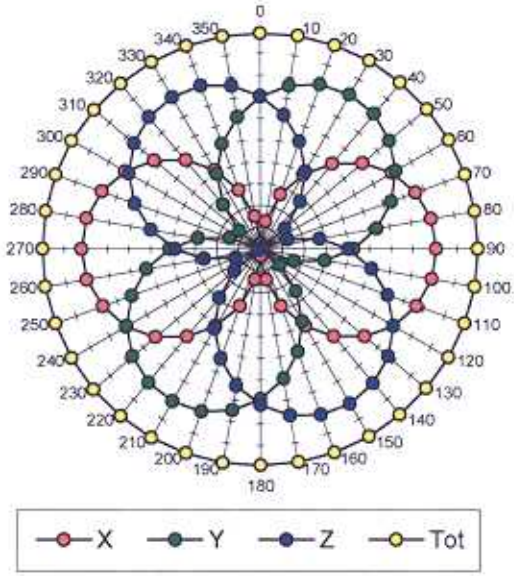
f = 30 MHz, TEM cell ifi110



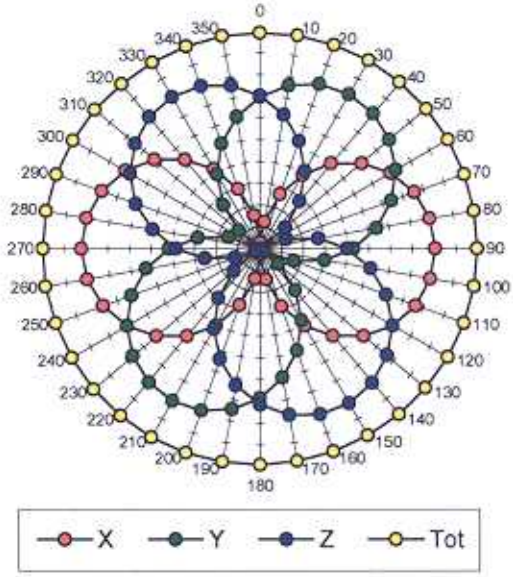
f = 100 MHz, TEM cell ifi110

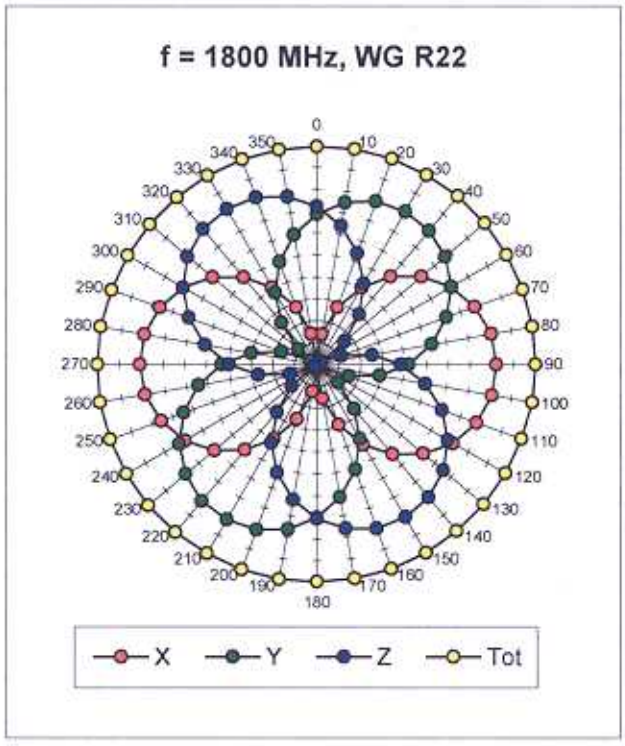


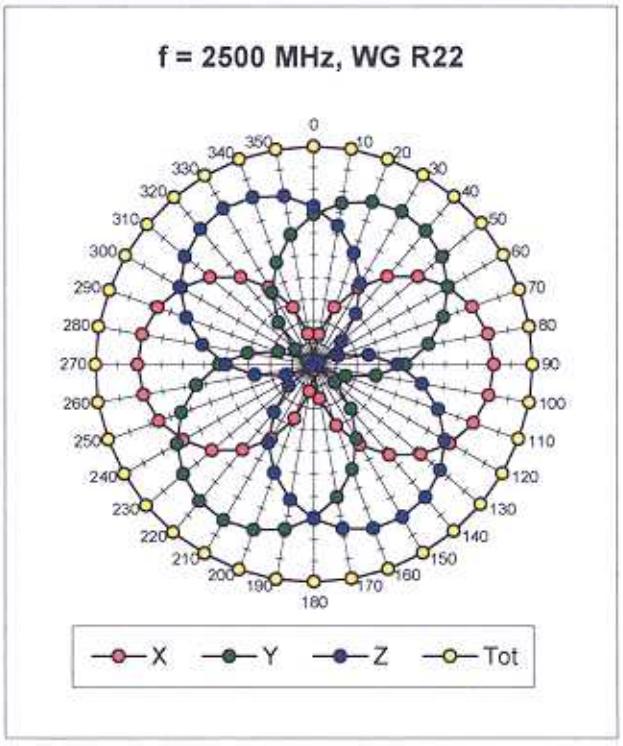
f = 300 MHz, TEM cell ifi110



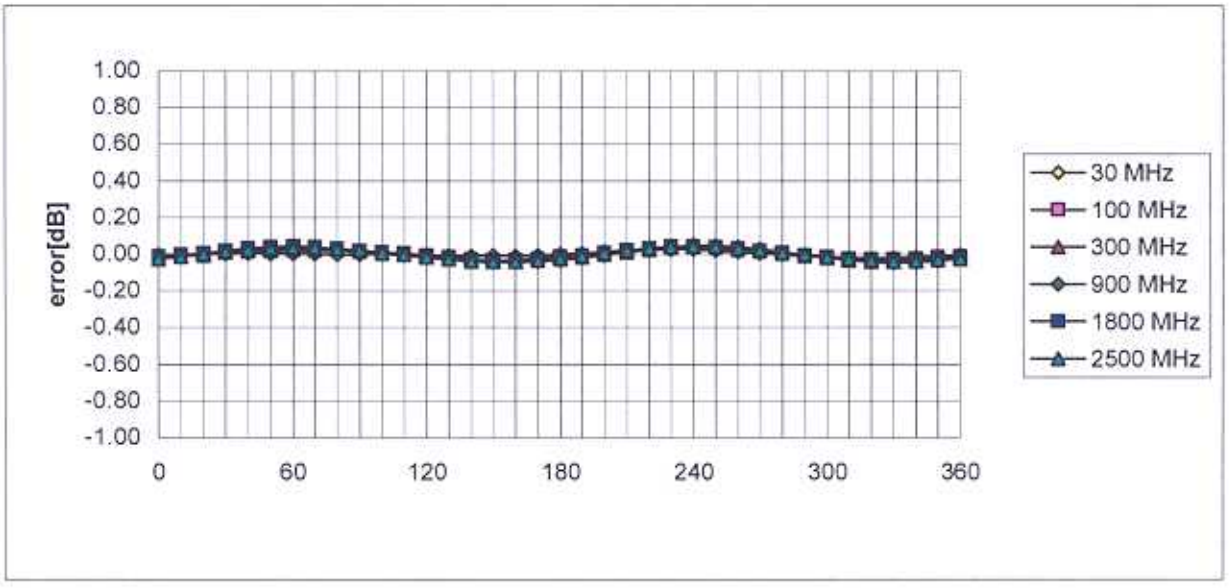
f = 900 MHz, TEM cell ifi110





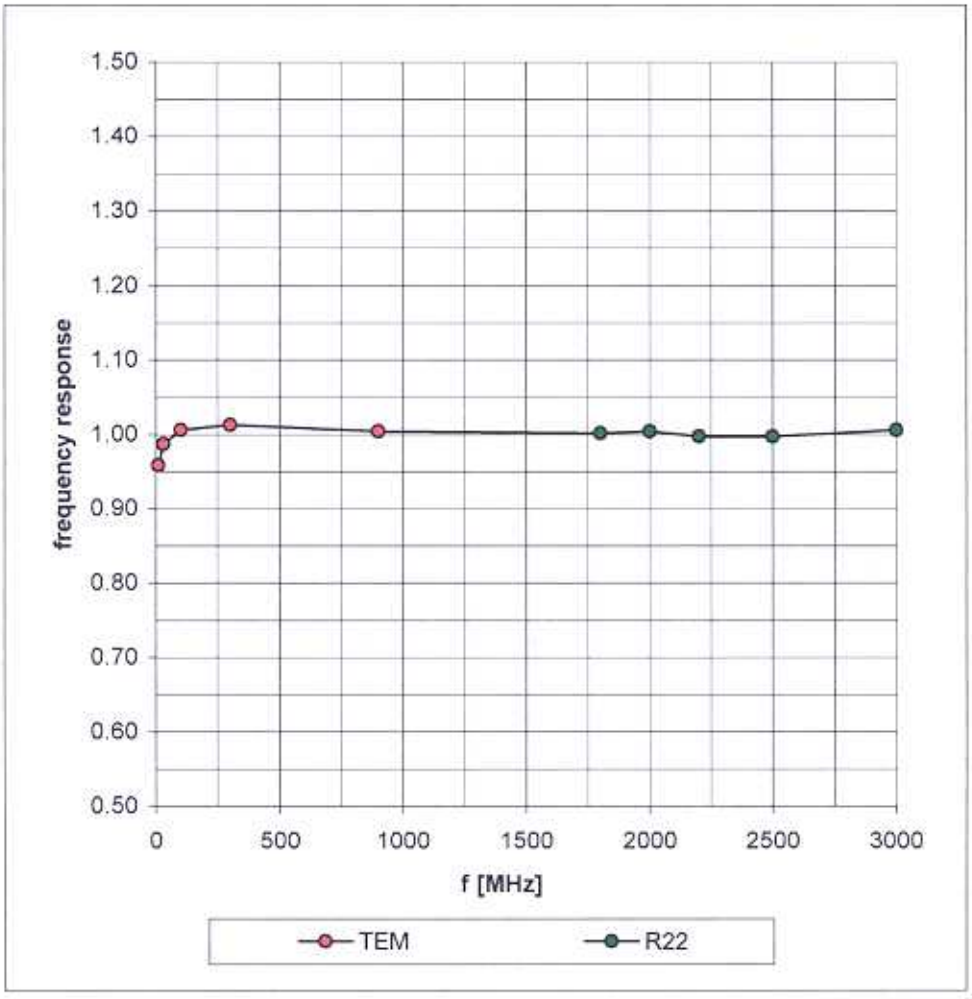


Isotropy Error (ϕ), θ = 0°



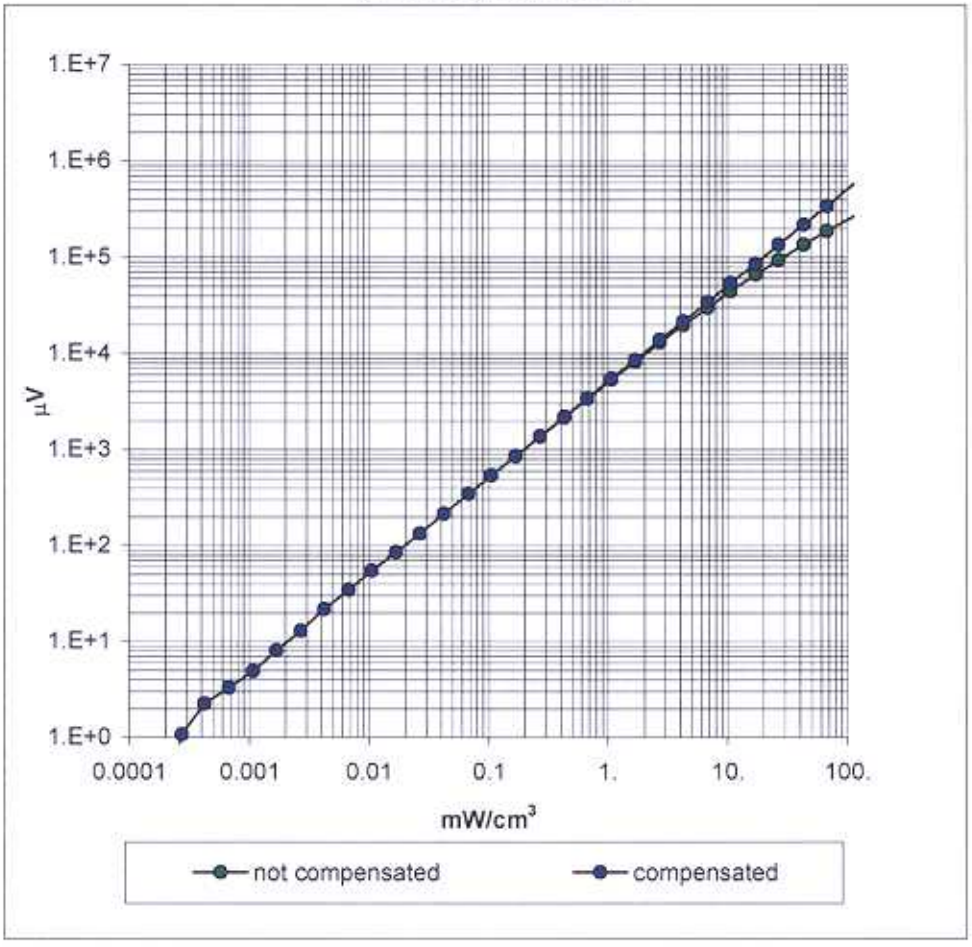
Frequency Response of E-Field

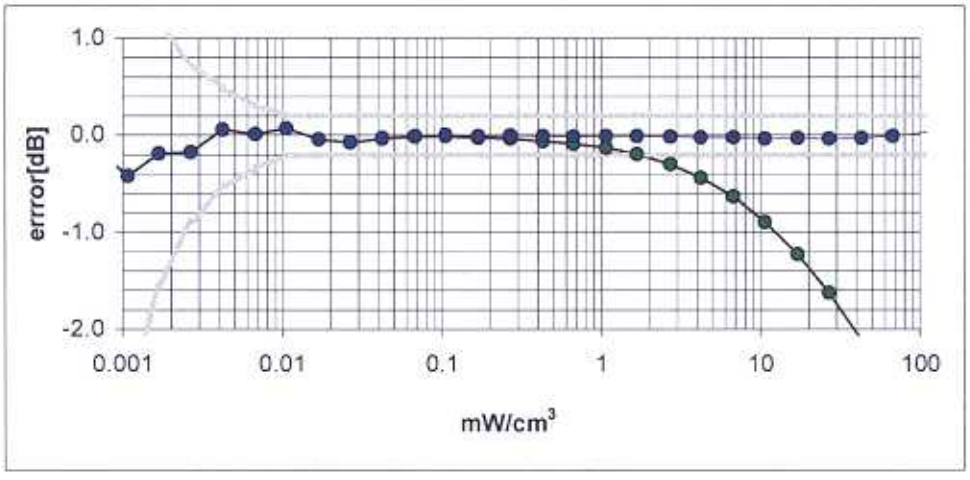
(TEM-Cell:ifi110, Waveguide R22)



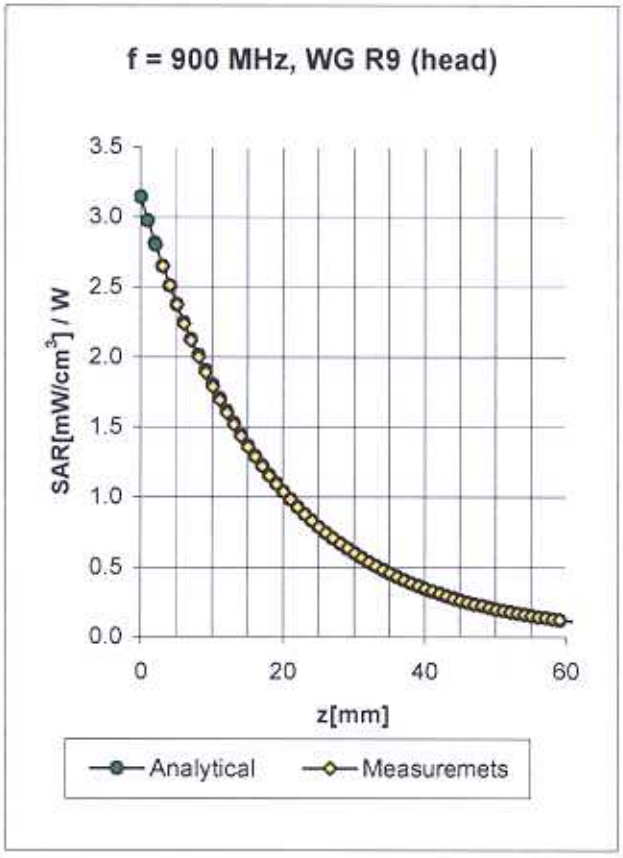
Dynamic Range f(SAR_{brain})

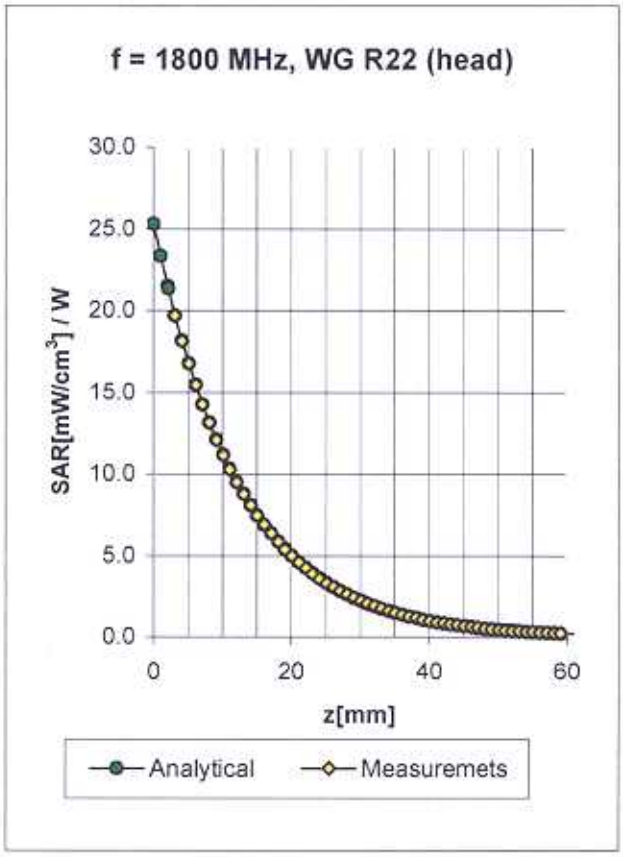
(Waveguide R22)





Conversion Factor Assessment





Head **900 MHz** $\varepsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

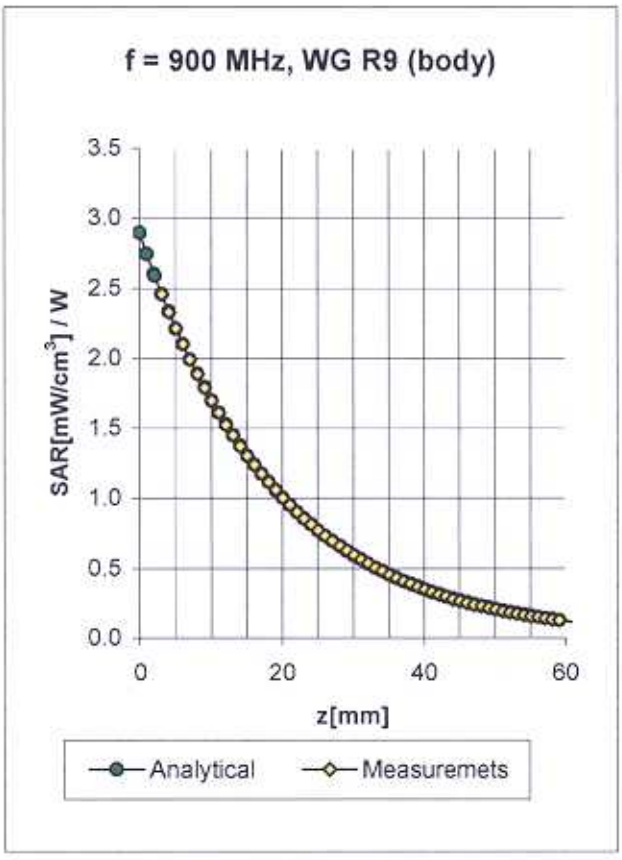
ConvF X	**6.5** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.5** ± 9.5% (k=2)	Alpha	**0.93**
ConvF Z	**6.5** ± 9.5% (k=2)	Depth	**0.96**

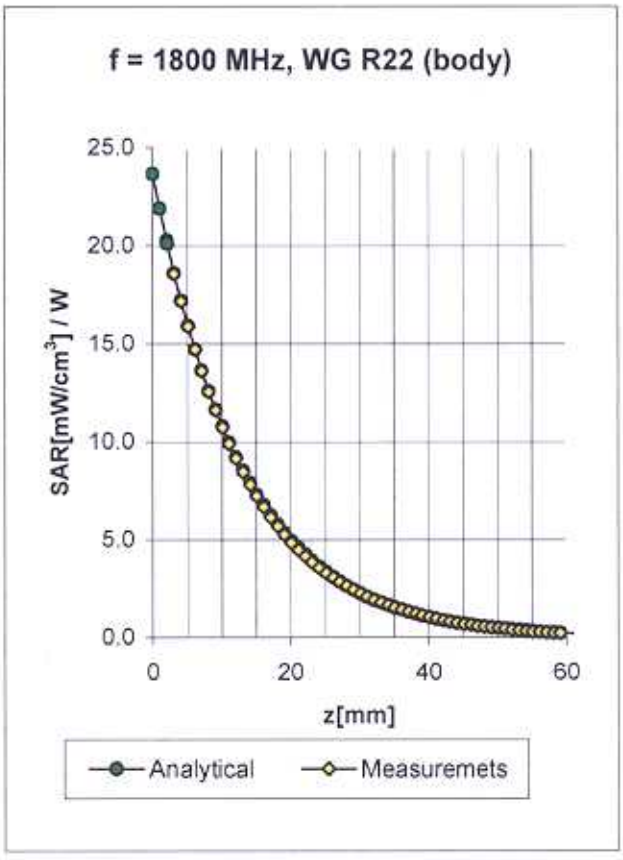
Head **1800 MHz** $\varepsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.1** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.1** ± 9.5% (k=2)	Alpha	**0.21**
ConvF Z	**5.1** ± 9.5% (k=2)	Depth	**2.73**

Conversion Factor Assessment





Body **900 MHz** ε_r = 55.0 ± 5% σ = 1.05 ± 5% mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

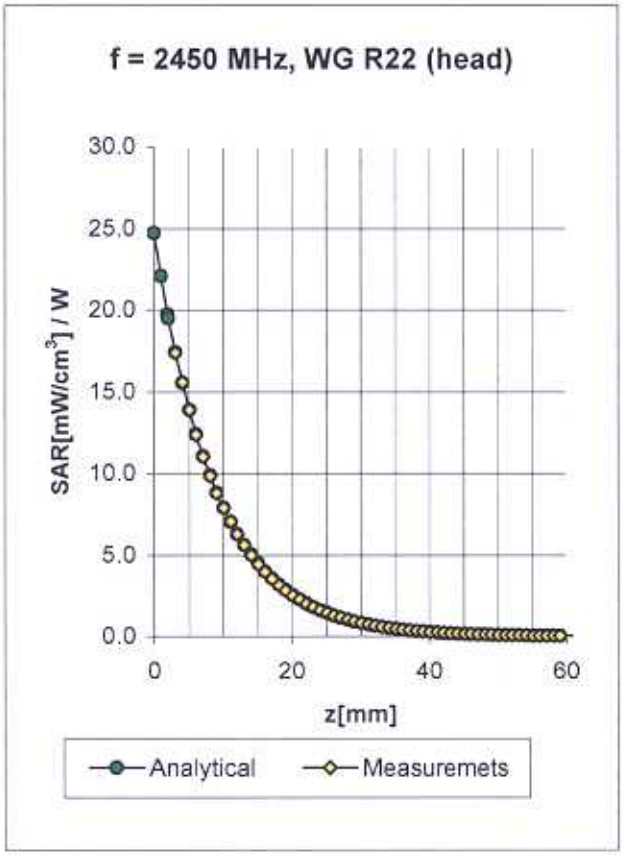
ConvF X	**6.3** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.3** ± 9.5% (k=2)	Alpha	**0.58**
ConvF Z	**6.3** ± 9.5% (k=2)	Depth	**1.22**

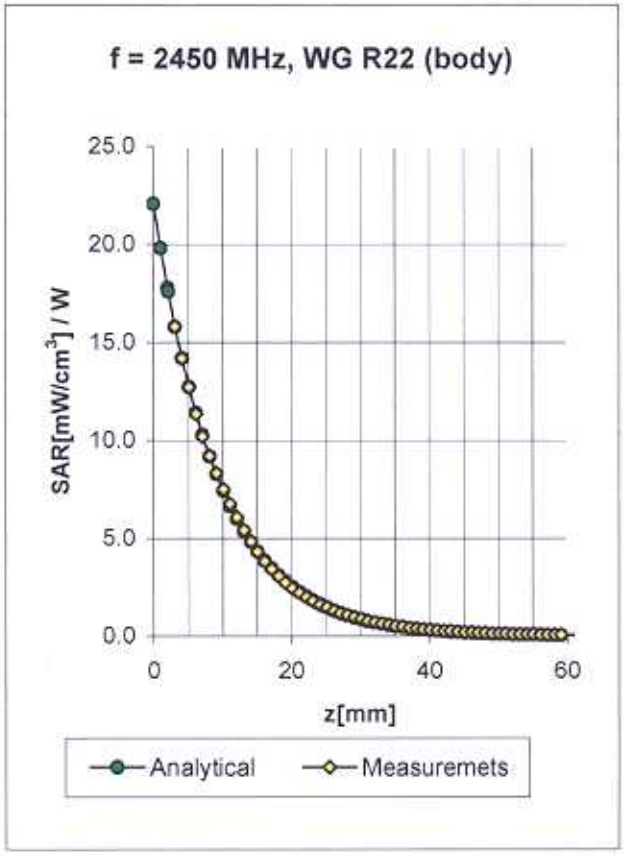
Body **1800 MHz** ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.8** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.8** ± 9.5% (k=2)	Alpha	**0.22**
ConvF Z	**4.8** ± 9.5% (k=2)	Depth	**2.90**

Conversion Factor Assessment





Head **2450 MHz** ε_r = 39.2 ± 5% σ = 1.80 ± 5% mho/m

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

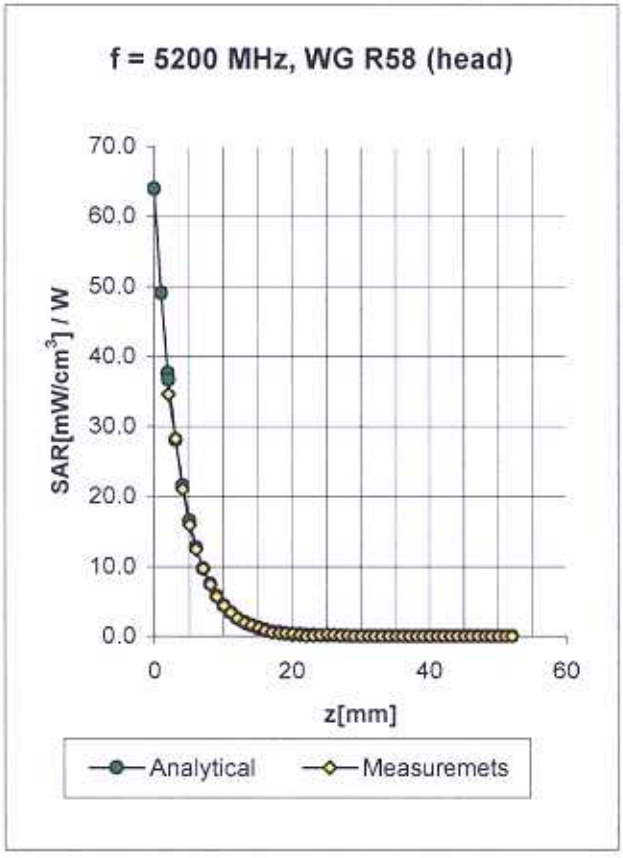
ConvF X	**4.5** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**4.5** ± 8.9% (k=2)	Alpha	**0.37**
ConvF Z	**4.5** ± 8.9% (k=2)	Depth	**1.75**

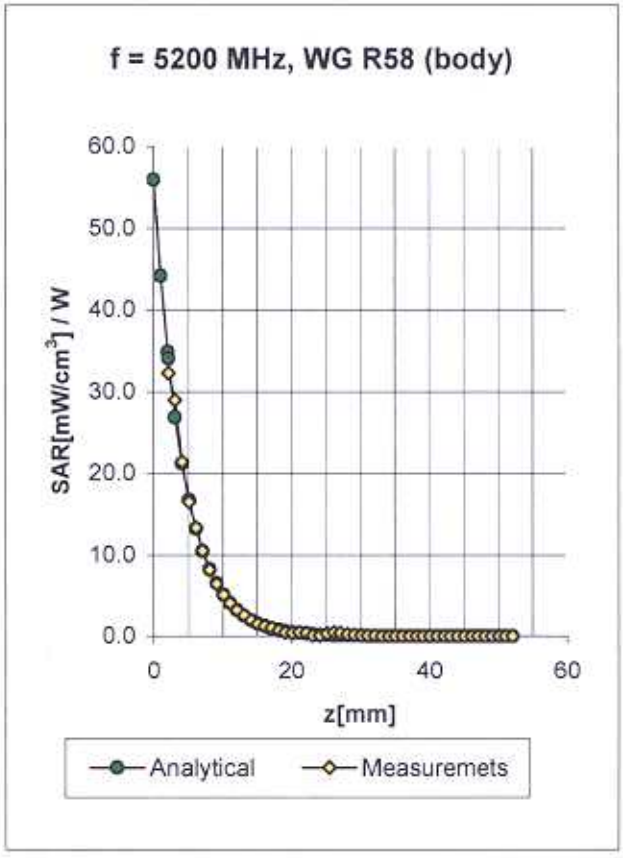
Body **2450 MHz** ε_r = 52.7 ± 5% σ = 1.95 ± 5% mho/m

Valid for f=2400-2500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.1** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**4.1** ± 8.9% (k=2)	Alpha	**0.27**
ConvF Z	**4.1** ± 8.9% (k=2)	Depth	**2.54**

Conversion Factor Assessment





Head **5200 MHz** ε_r = 36.0 ± 5% σ = 4.66 ± 5% mho/m

Valid for f=4940-5460 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

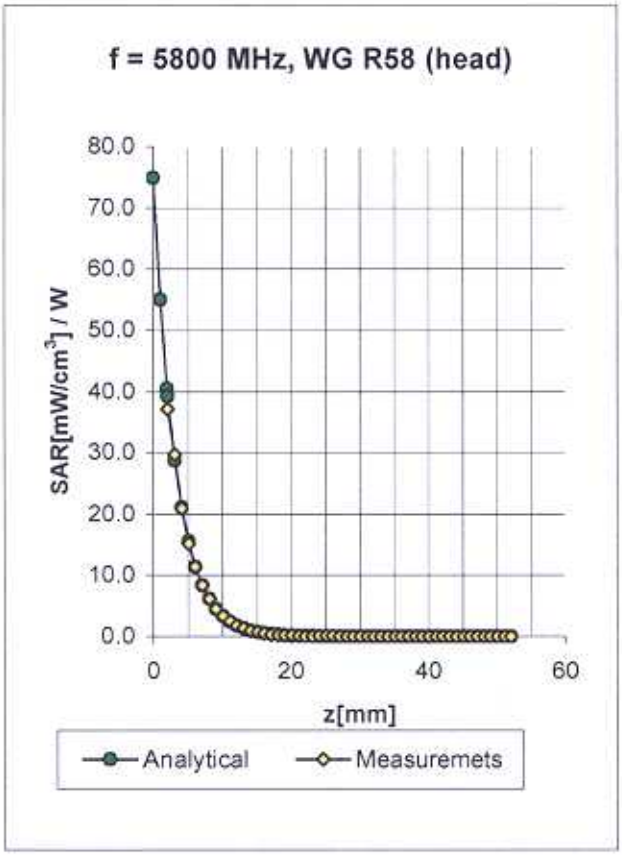
ConvF X	**2.2** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**2.2** ± 14.6% (k=2)	Alpha	**0.99**
ConvF Z	**2.2** ± 14.6% (k=2)	Depth	**1.50**

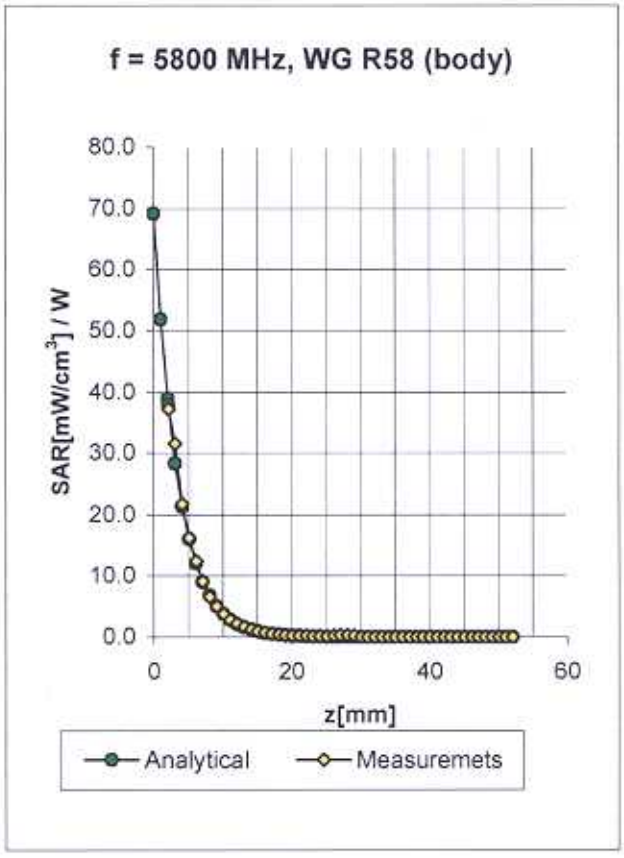
Body **5200 MHz** ε_r = 49.0 ± 5% σ = 5.30 ± 5% mho/m

Valid for f=4940-5460 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.4** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**1.4** ± 14.6% (k=2)	Alpha	**1.12**
ConvF Z	**1.4** ± 14.6% (k=2)	Depth	**1.65**

Conversion Factor Assessment





Head **5800 MHz** ε_r = 35.3 ± 5% σ = 5.27 ± 5% mho/m

Valid for f=5510-6090 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.8** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**1.8** ± 14.6% (k=2)	Alpha	**1.15**
ConvF Z	**1.8** ± 14.6% (k=2)	Depth	**1.50**

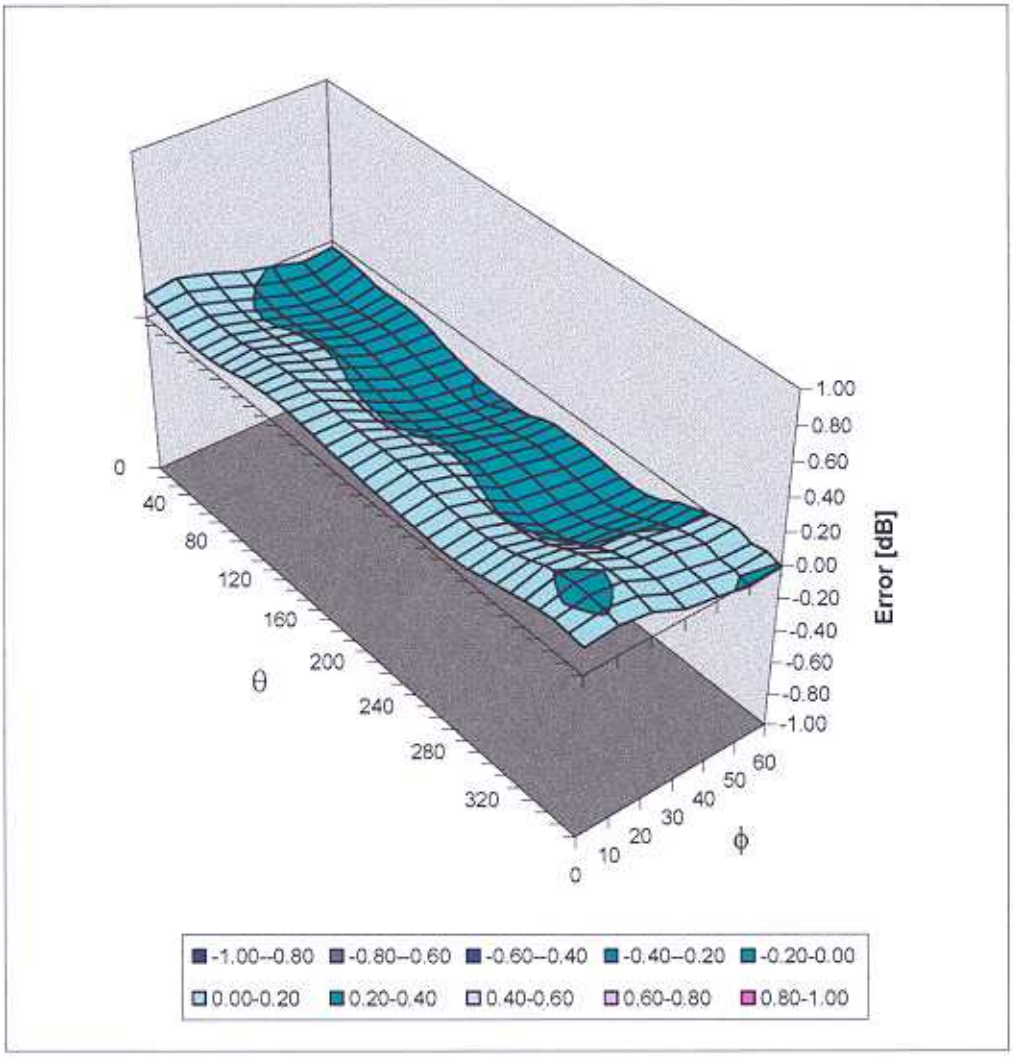
Body **5800 MHz** ε_r = 48.2 ± 5% σ = 6.00 ± 5% mho/m

Valid for f=5510-6090 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.1** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**1.1** ± 14.6% (k=2)	Alpha	**1.10**
ConvF Z	**1.1** ± 14.6% (k=2)	Depth	**1.75**

Deviation from Isotropy in HSL

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



Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
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Dosimetric E-Field Probe ES3DV2 SN:3021

Conversion factor (± standard deviation)

450 MHz	ConvF	**7.6 ± 8%**	ε_r **= 43.5 ± 5%** σ **= 0.87 ± 5% mho/m** (head tissue)
450 MHz	ConvF	**7.4 ± 8%**	ε_r **= 56.7 ± 5%** σ **= 0.94 ± 5% mho/m** (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.