

Applicant:	Kyocera
FCC ID:	V65SCP-3820
Report #:	CT-3820-9C-0610-R0

EXHIBIT 9 APPENDIX C: SAR PROBE CALIBRATION CERTIFICATE

Total pages including cover page = 37



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 Kyocera USA

Certificate No: ES3-3036_Aug09

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3036		
Calibration procedure(s)	QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes		
Calibration date:	August 20, 2009		
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 in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p>			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09
Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	
Issued: August 20, 2009			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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Accreditation No.: **SCS 108**

Glossary:

TS	tissue simulating liquid
NORM x,y,z	sensitivity in free space
ConvF	sensitivity in TS / 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., $\theta = 0$ 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:

- $NORMx,y,z$: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). $NORMx,y,z$ are only intermediate values, i.e., the uncertainties of $NORMx,y,z$ does not effect the E^2 -field uncertainty inside TS (see below *ConvF*).
- $NORM(f)x,y,z = NORMx,y,z * frequency_response$ (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*.
- $DCPx,y,z$: 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 TS corresponds to $NORMx,y,z * ConvF$ 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.

Probe ES3DV3

SN:3036

Manufactured:	August 21, 2003
Last calibrated:	September 18, 2008
Recalibrated:	August 20, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3036

Sensitivity in Free Space^A

NormX	1.24 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.43 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.40 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression^B

DCP X	94 mV
DCP Y	95 mV
DCP Z	98 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **835 MHz** Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	10.0	6.0
SAR _{be} [%]	With Correction Algorithm	0.8	0.6

TSL **1900 MHz** Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	9.9	5.9
SAR _{be} [%]	With Correction Algorithm	0.6	0.4

Sensor Offset

Probe Tip to Sensor Center **2.0 mm**

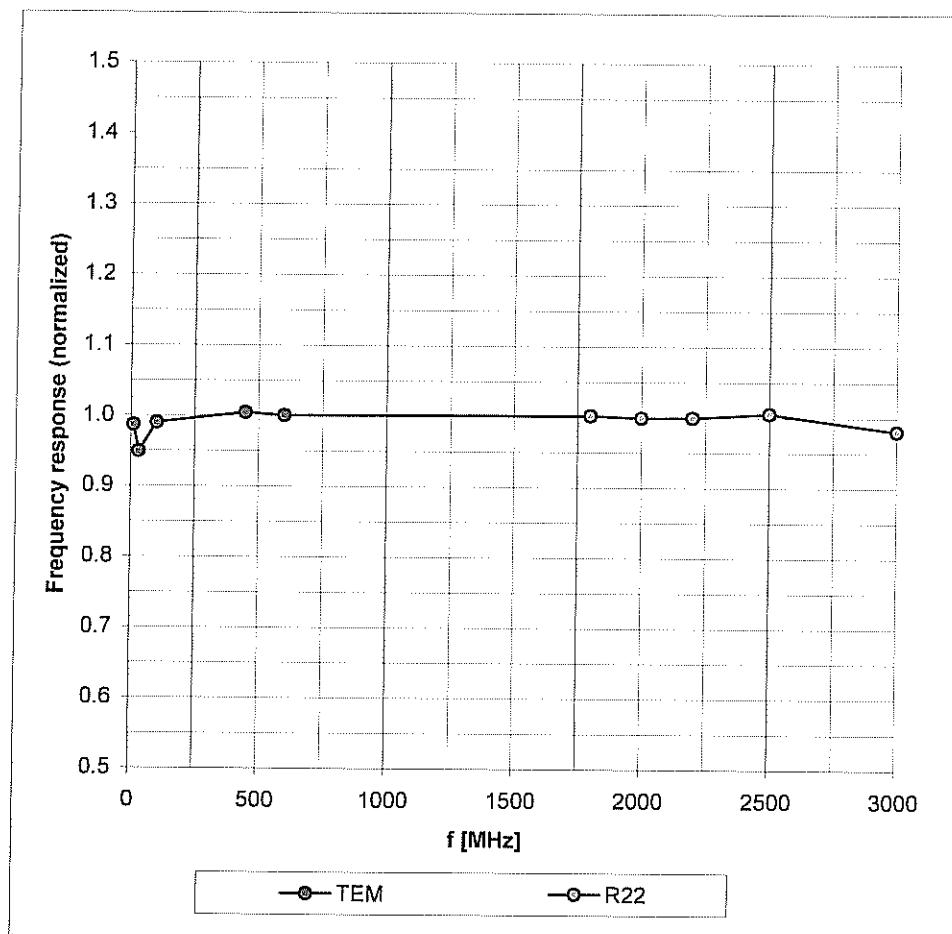
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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

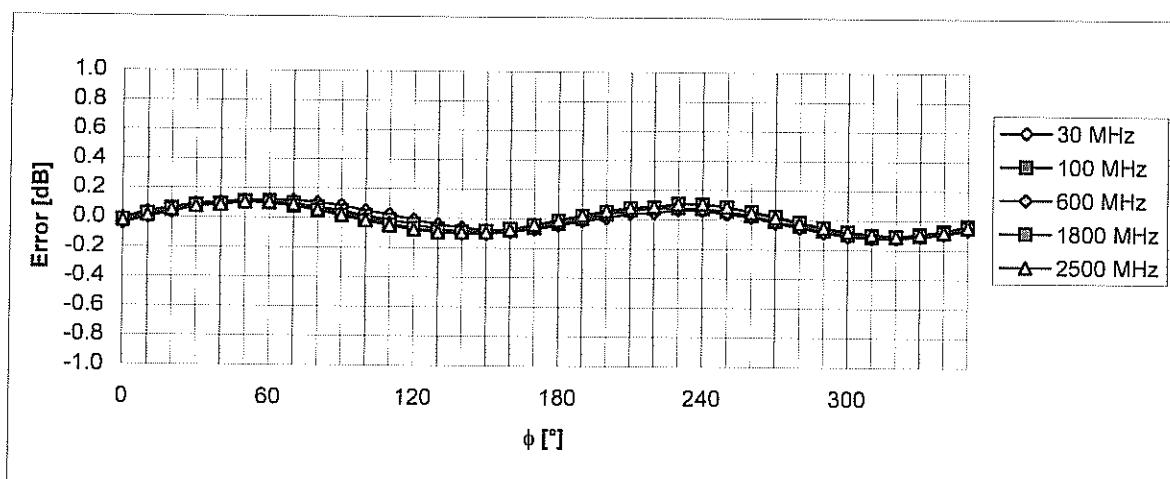
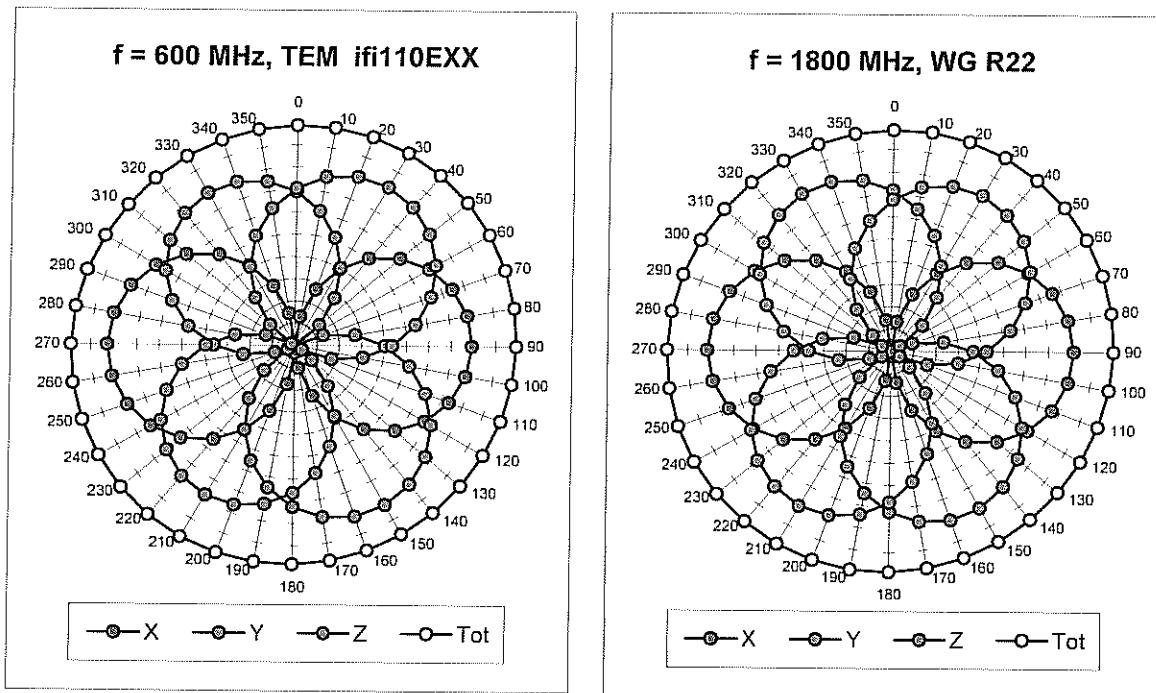
^B Numerical linearization parameter: uncertainty not required.

Frequency Response of E-Field

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

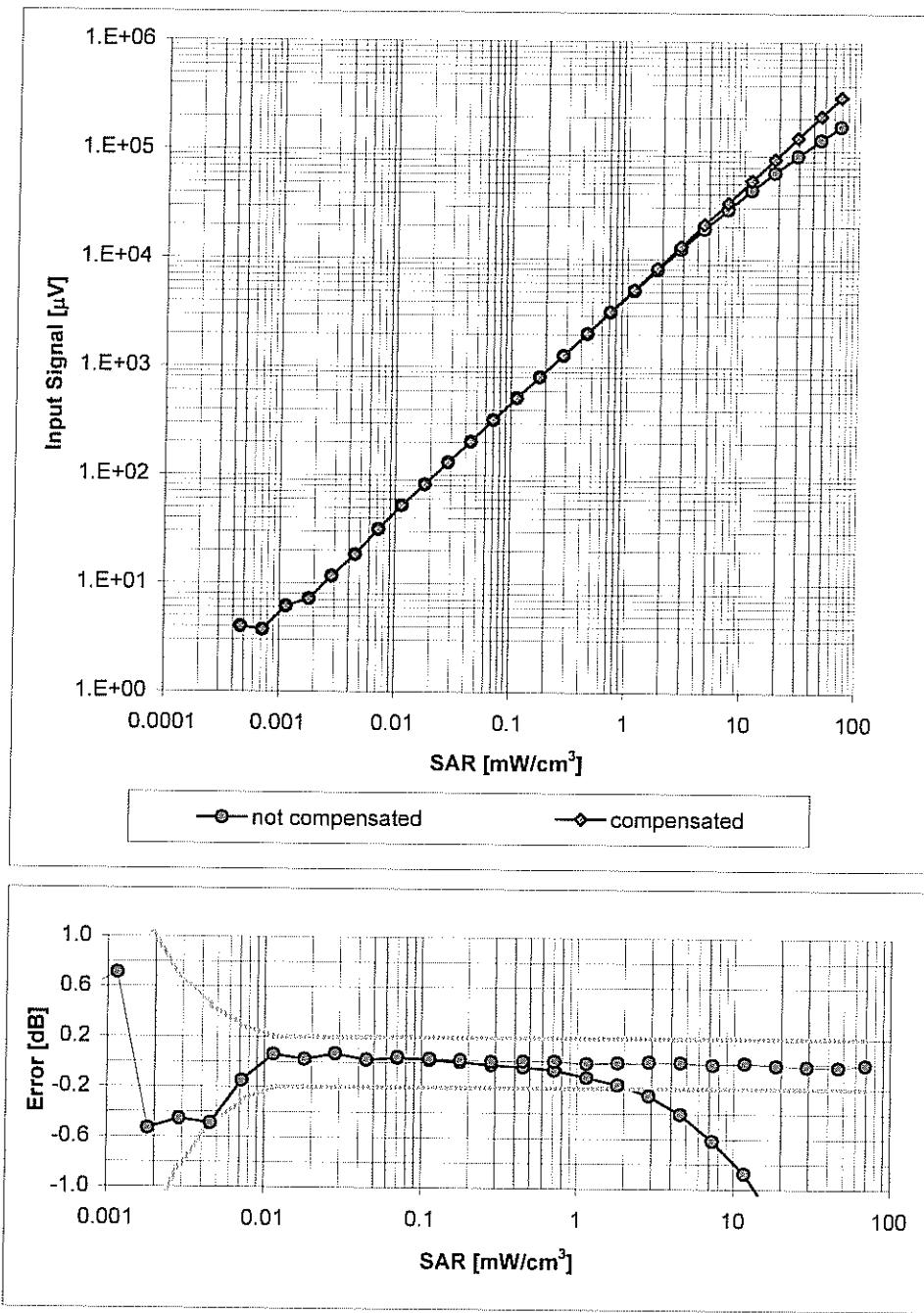


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$ Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

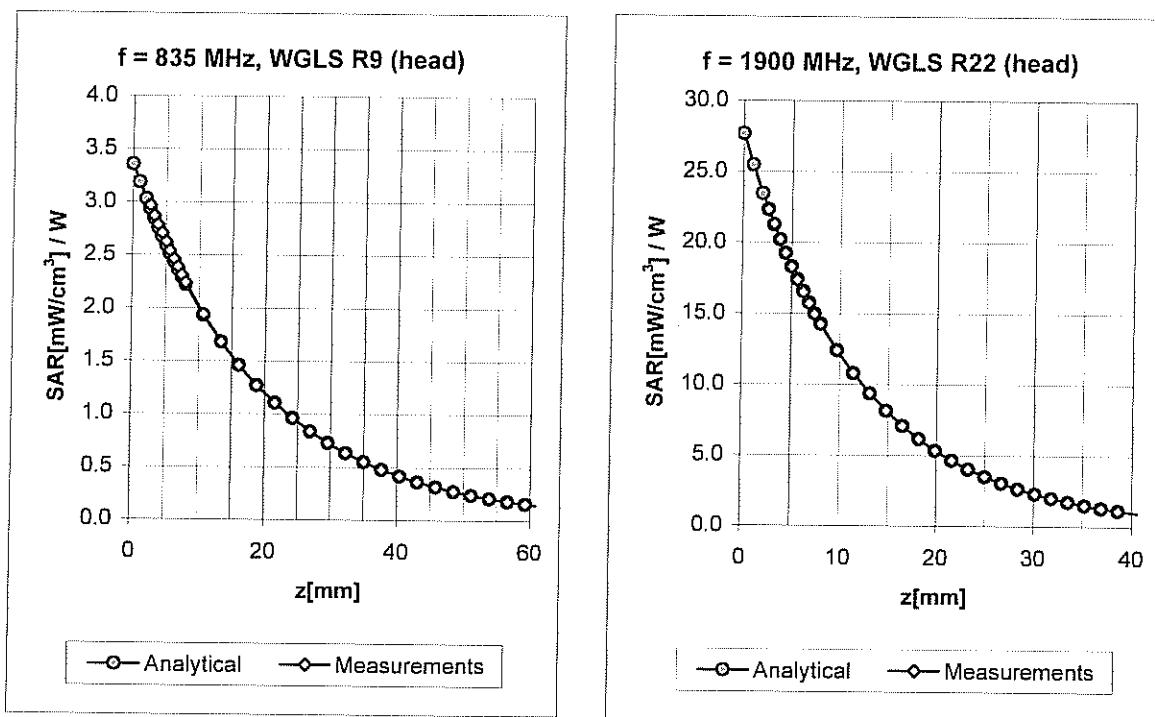
Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)



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

Conversion Factor Assessment



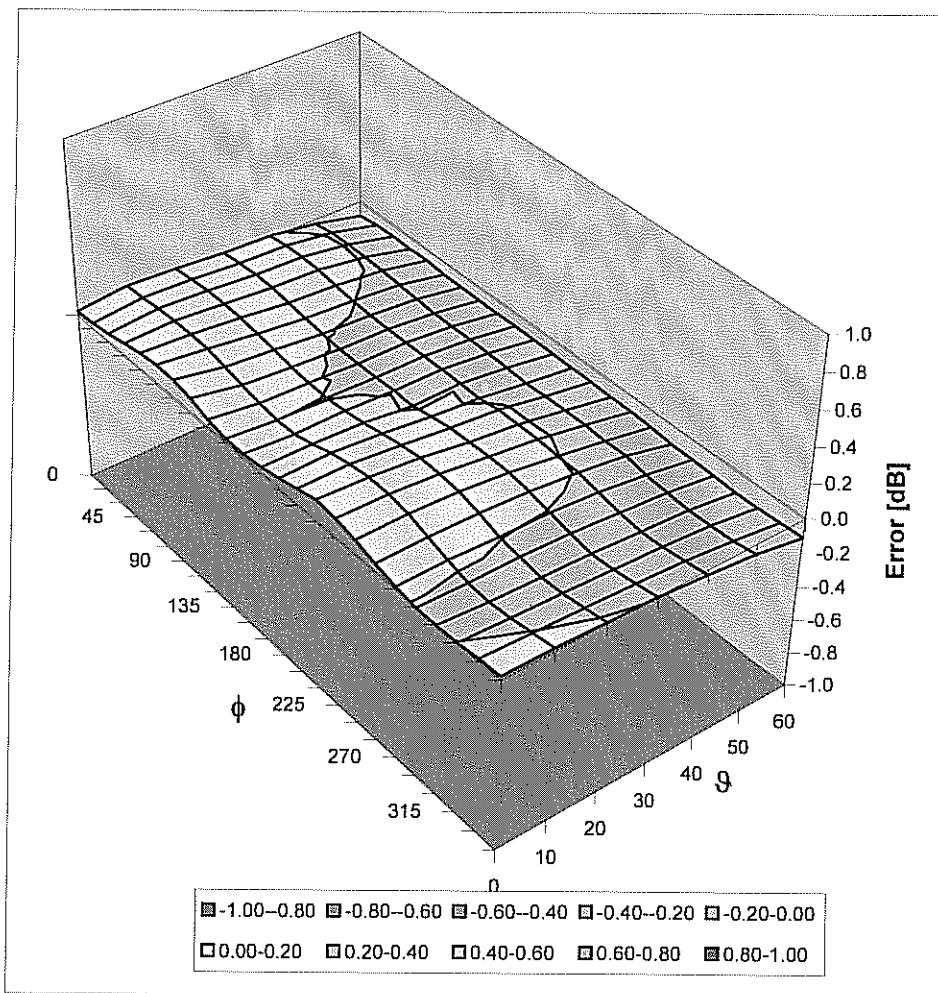
f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.76	1.16	5.96	± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.53	1.48	4.92	± 11.0% (k=2)

835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.69	1.23	5.80	± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.30	2.60	4.50	± 11.0% (k=2)

^c 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.

Deviation from Isotropy in HSL

Error (ϕ, θ), $f = 900$ MHz



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



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Accreditation No.: **SCS 108**

Client **Kyocera USA**

Certificate No: **ES3-3035_Aug09**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3035**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes**

Calibration date: **August 20, 2009**

Condition of the calibrated item **In Tolerance**

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Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: August 20, 2009

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NORM x,y,z	sensitivity in free space
ConvF	sensitivity in TS / NORM x,y,z
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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., $\theta = 0$ is normal to probe axis

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- 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
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Methods Applied and Interpretation of Parameters:

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- 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 TS corresponds to $NORMx,y,z * ConvF$ 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.

Probe ES3DV3

SN:3035

Manufactured:	August 21, 2003
Last calibrated:	August 25, 2008
Recalibrated:	August 20, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3035

Sensitivity in Free Space ^A			Diode Compression ^B		
NormX	1.12 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	97	mV
NormY	0.94 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	99	mV
NormZ	1.17 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	101	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 835 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	8.2	4.8
SAR _{be} [%]	With Correction Algorithm	0.5	0.3

TSL 1900 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	7.0	3.4
SAR _{he} [%]	With Correction Algorithm	0.8	0.5

Sensor Offset

Probe Tip to Sensor Center **2.0 mm**

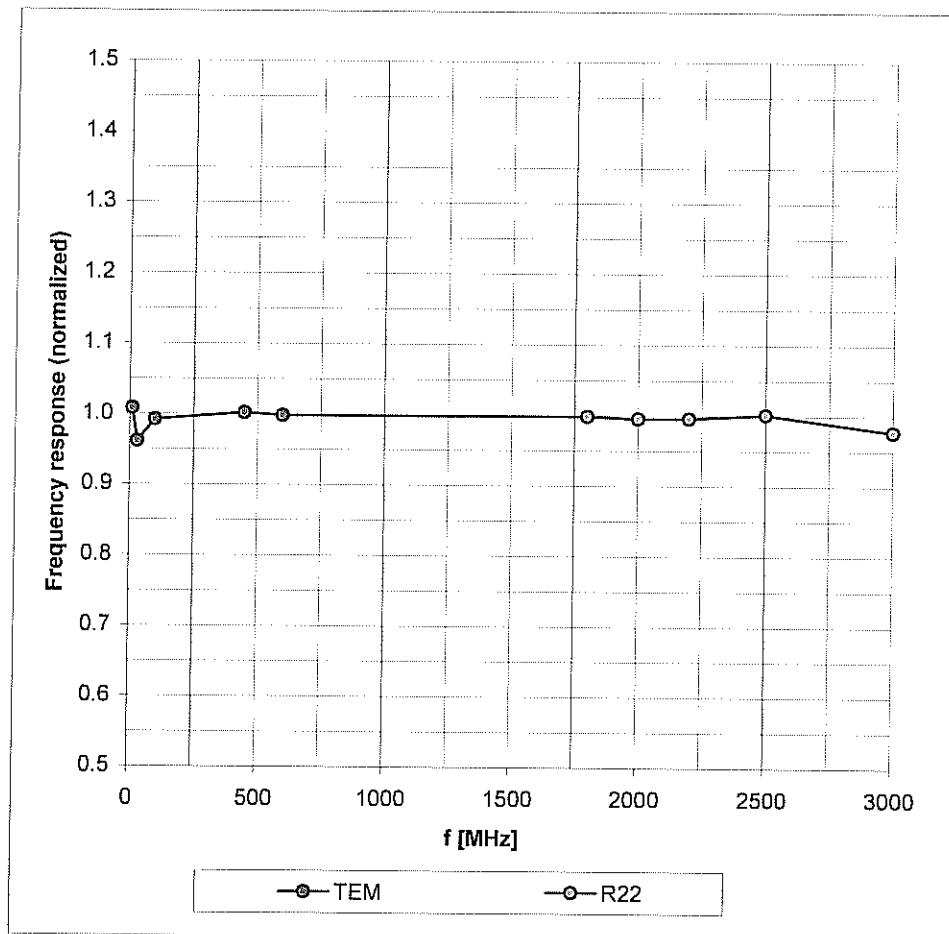
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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

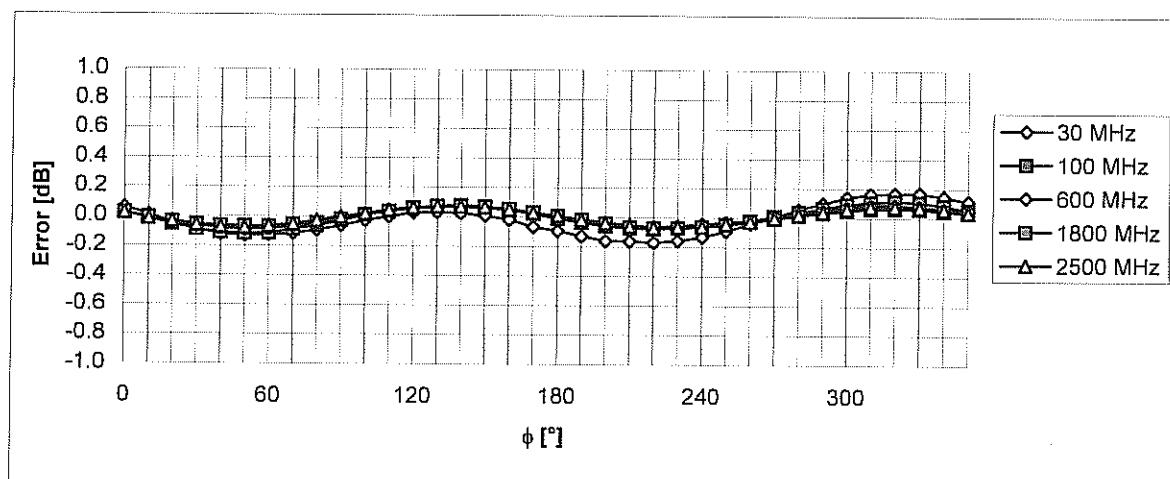
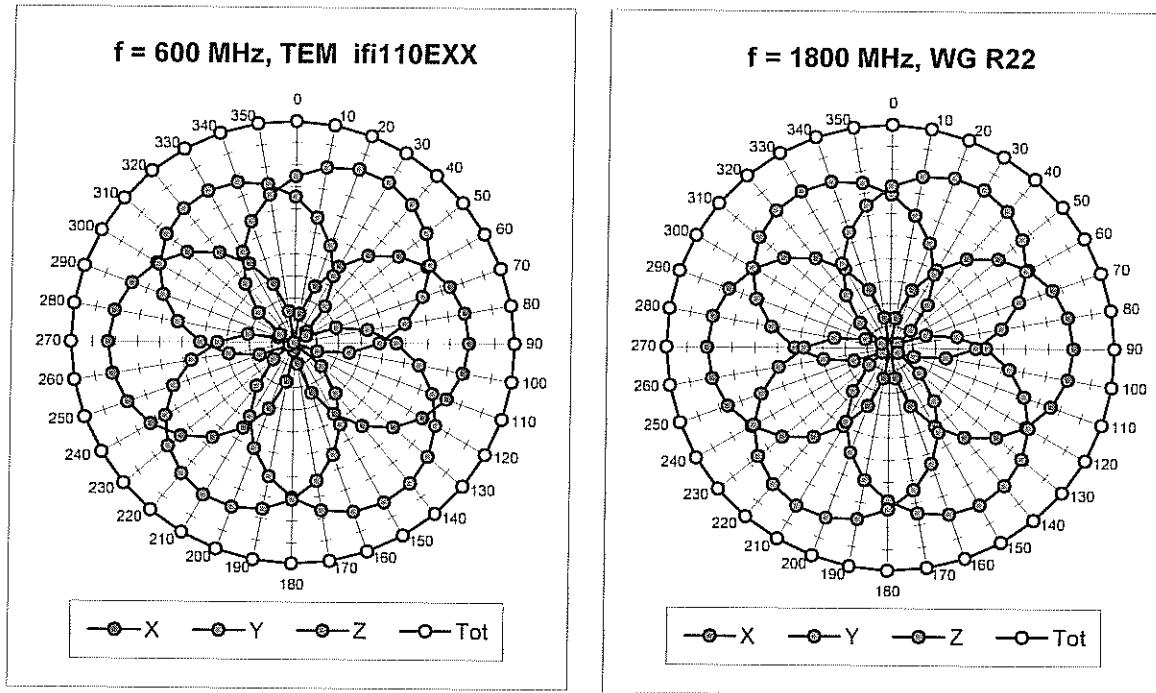
^a Numerical linearization parameter: uncertainty not required

Frequency Response of E-Field

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

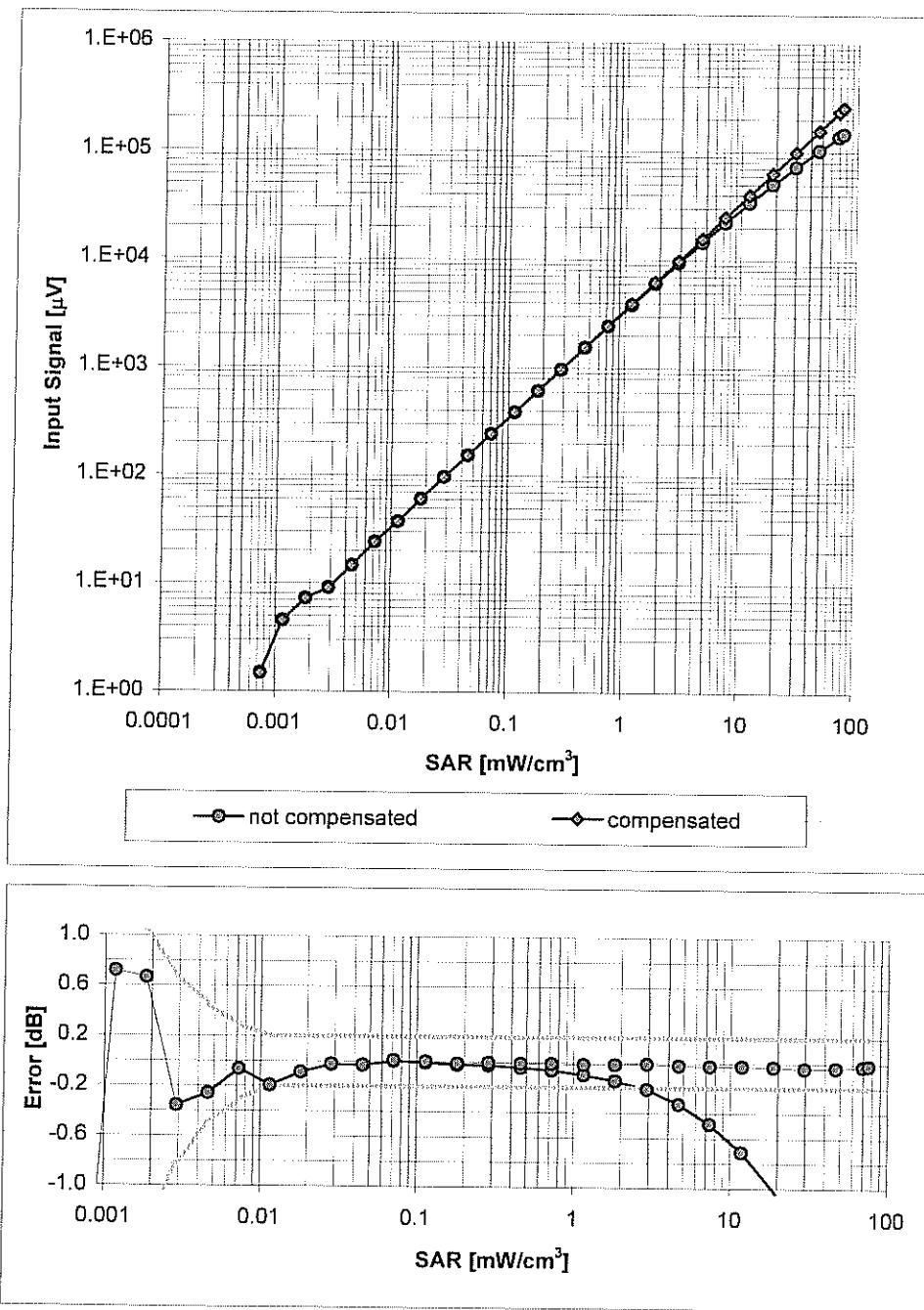


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$ Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

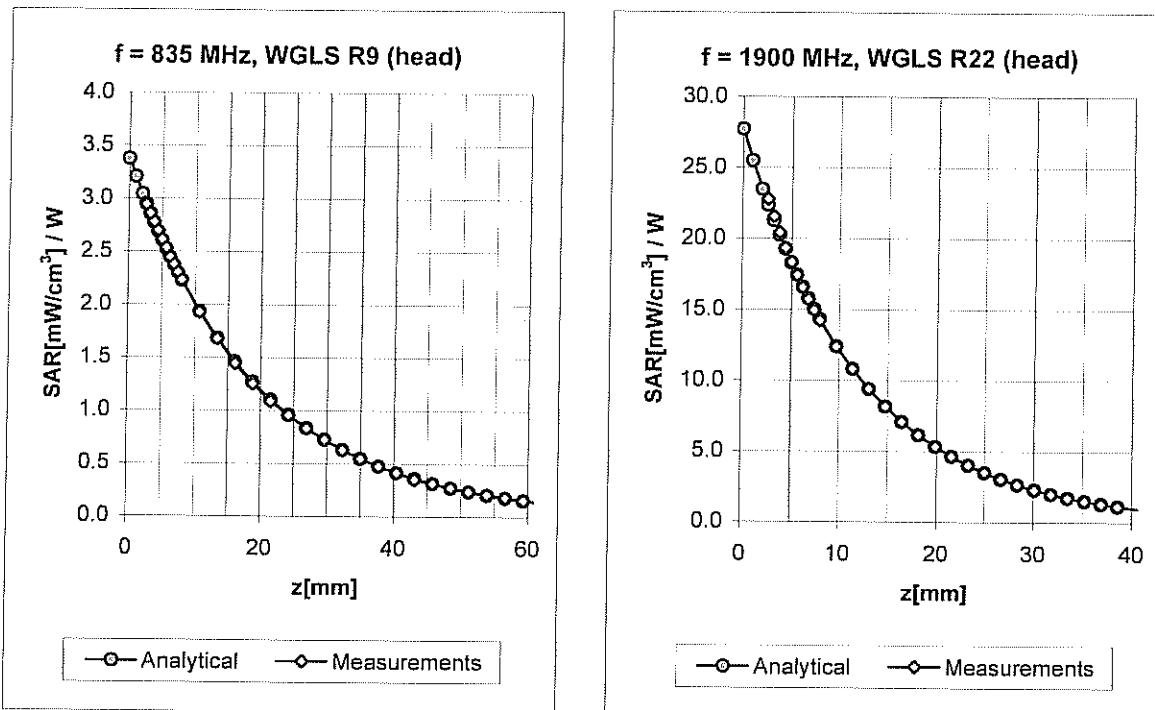
Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)



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

Conversion Factor Assessment



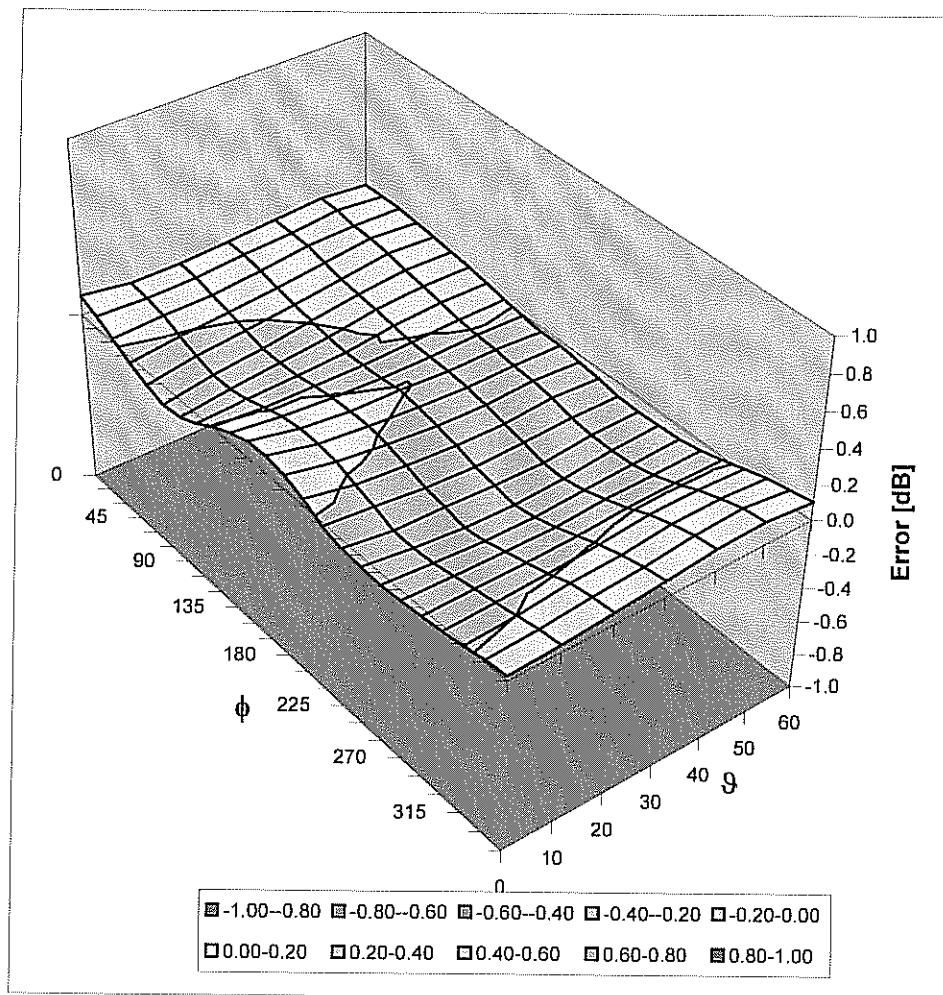
f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	$\pm 50 / \pm 100$	Head	$41.5 \pm 5\%$	$0.90 \pm 5\%$	0.79	1.12	6.12	$\pm 11.0\% \text{ (k=2)}$
1900	$\pm 50 / \pm 100$	Head	$40.0 \pm 5\%$	$1.40 \pm 5\%$	0.39	1.72	4.91	$\pm 11.0\% \text{ (k=2)}$

835	$\pm 50 / \pm 100$	Body	$55.2 \pm 5\%$	$0.97 \pm 5\%$	0.96	1.09	5.94	$\pm 11.0\% \text{ (k=2)}$
1900	$\pm 50 / \pm 100$	Body	$53.3 \pm 5\%$	$1.52 \pm 5\%$	0.29	2.77	4.54	$\pm 11.0\% \text{ (k=2)}$

^c 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.

Deviation from Isotropy in HSL

Error (ϕ, θ), $f = 900$ MHz



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



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Accreditation No.: **SCS 108**

Client **Kyocera USA**

Certificate No: **ET3-1663_Sep09**

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1663
Calibration procedure(s)	QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	September 10, 2009
Condition of the calibrated item	In Tolerance

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Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by:	Name	Function	Signature
	Marcel Fehr	Laboratory Technician	
Approved by:	Kalja Pokovic	Technical Manager	

Issued: September 16, 2009

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ConvF	sensitivity in TSL / NORM _{x,y,z}
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Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis

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- 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*.
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- 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.

Probe ET3DV6

SN:1663

Manufactured: February 8, 2002
Last calibrated: September 22, 2008
Recalibrated: September 10, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1663

Sensitivity in Free Space^A

NormX	2.11 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.77 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	2.23 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression^B

DCP X	92 mV
DCP Y	93 mV
DCP Z	93 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 835 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance	3.7 mm	4.7 mm
SAR _{be} [%] Without Correction Algorithm	11.0	6.5
SAR _{be} [%] With Correction Algorithm	0.9	0.6

TSL 1900 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance	3.7 mm	4.7 mm
SAR _{be} [%] Without Correction Algorithm	12.1	8.2
SAR _{be} [%] With Correction Algorithm	0.8	0.6

Sensor Offset

Probe Tip to Sensor Center	2.7 mm
Optical Surface Detection	not available

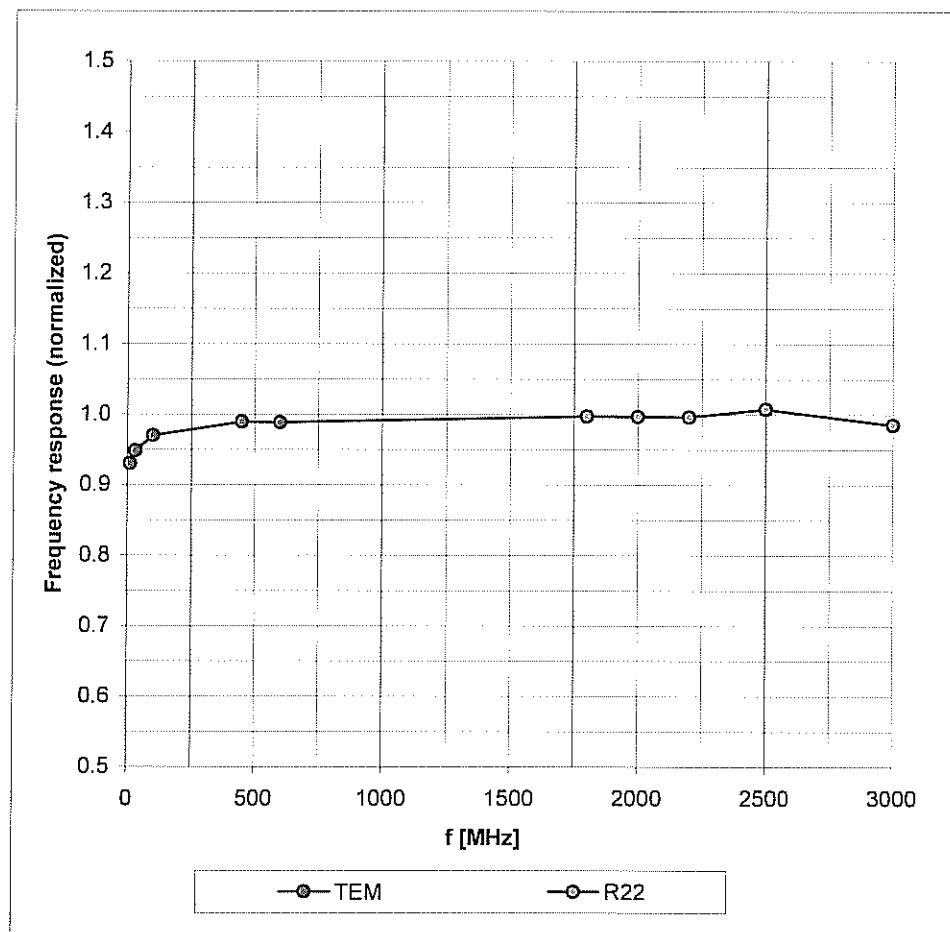
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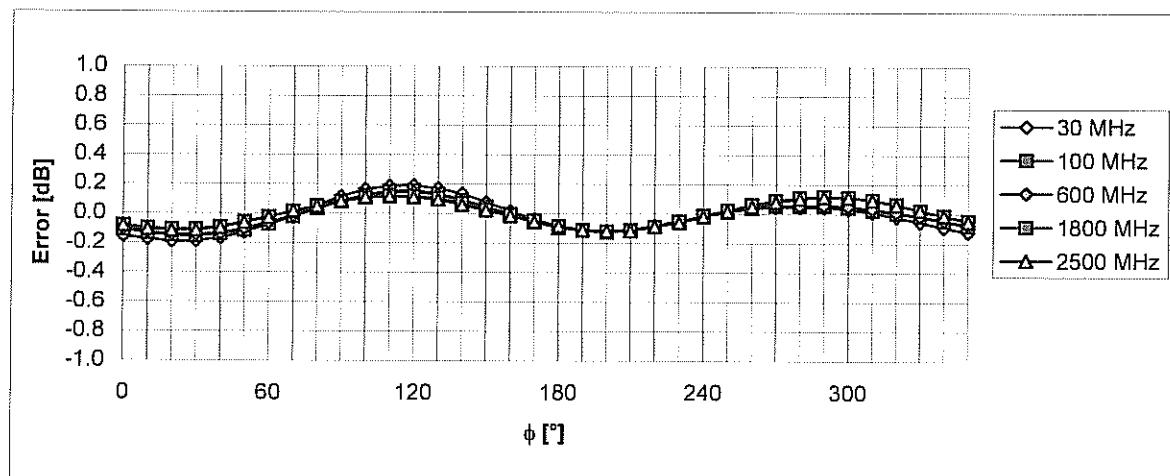
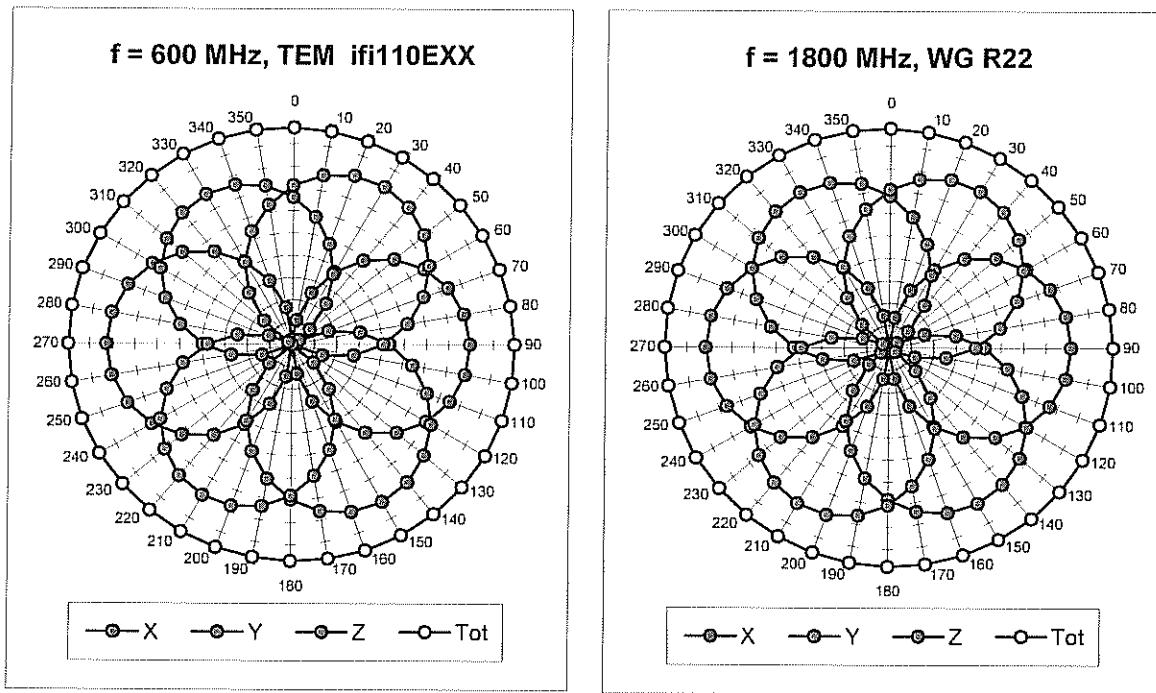
^B Numerical linearization parameter: uncertainty not required.

Frequency Response of E-Field

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

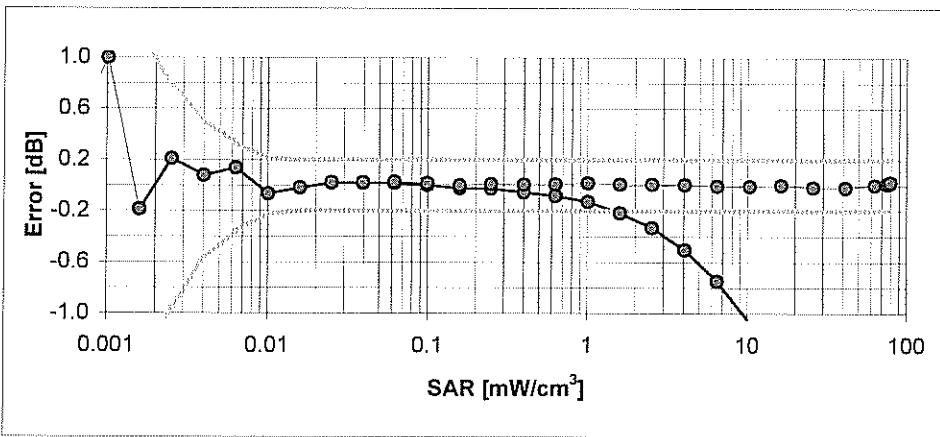
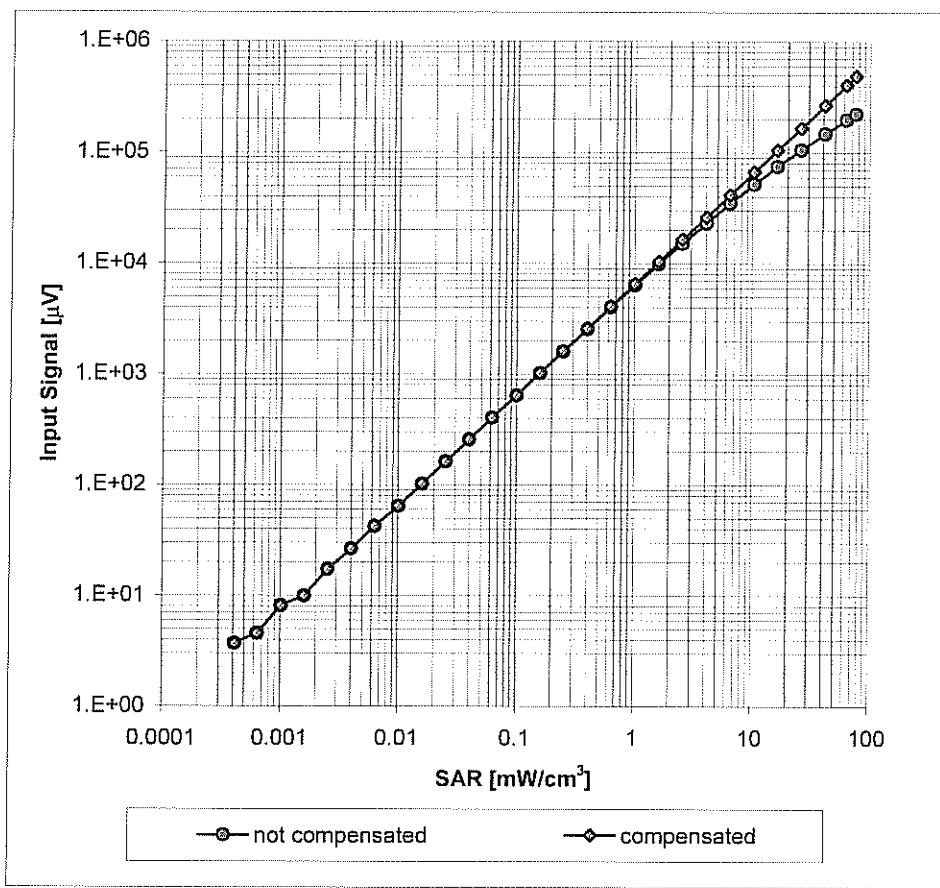


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

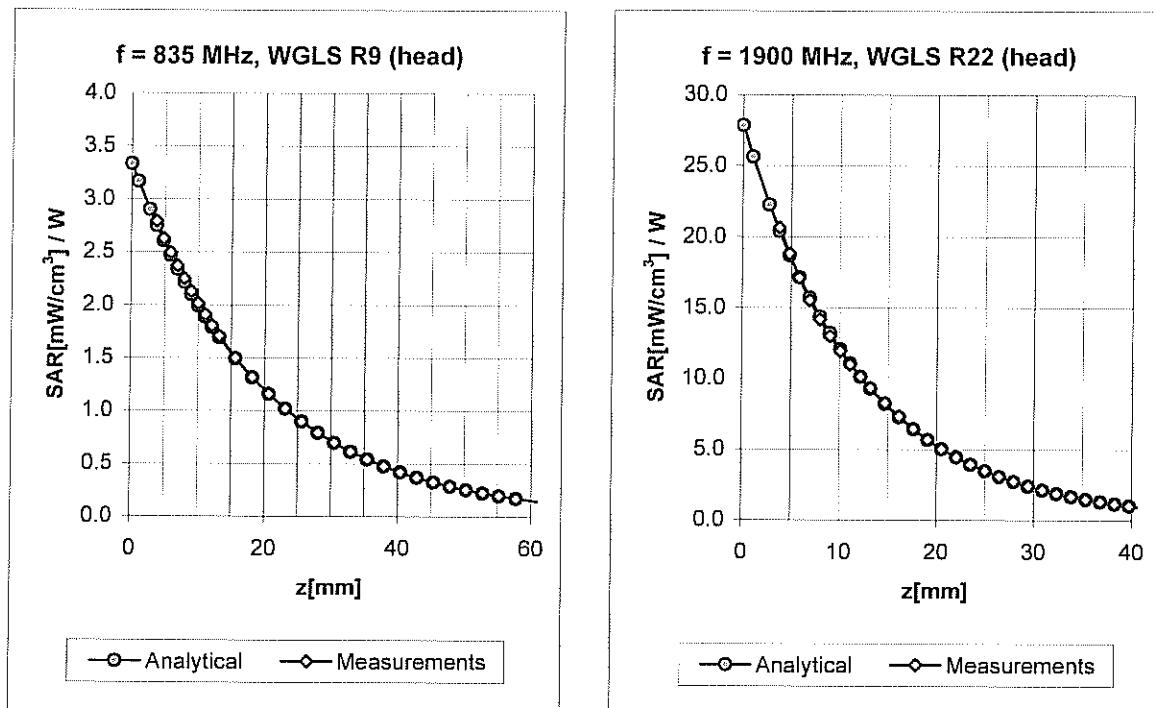
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



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

Conversion Factor Assessment



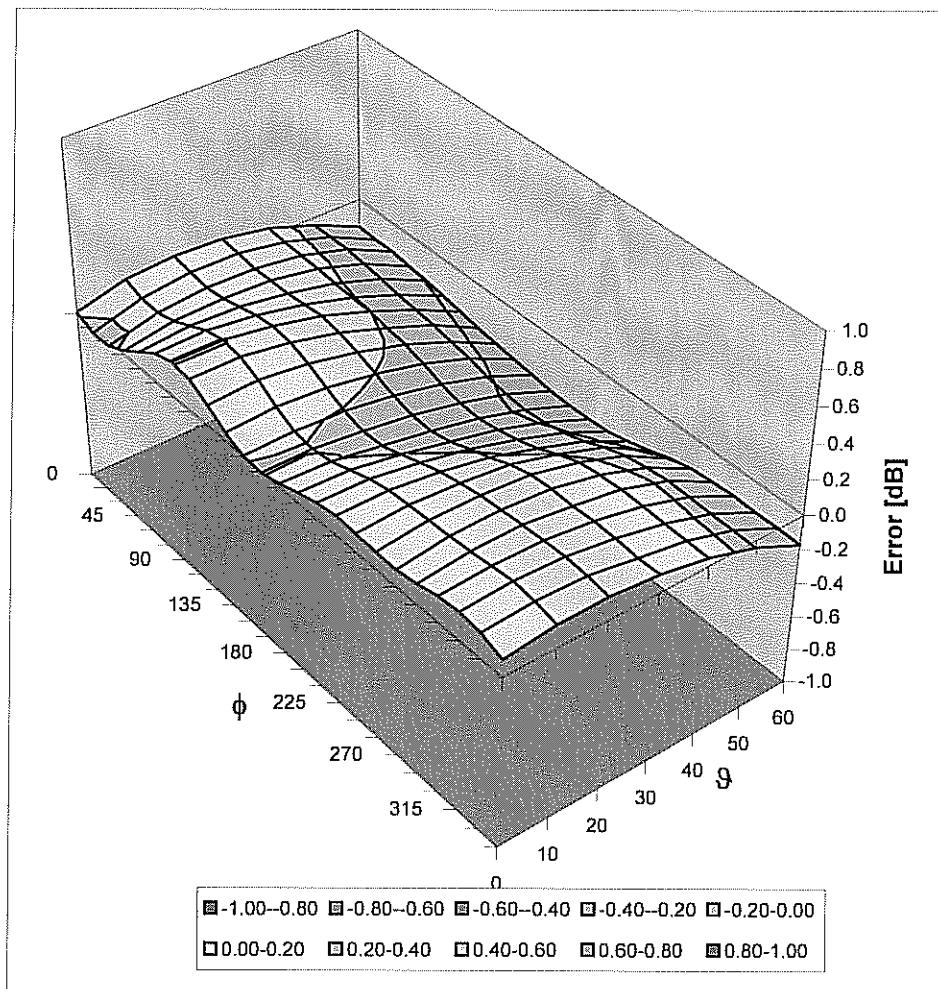
f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	$\pm 50 / \pm 100$	Head	$41.5 \pm 5\%$	$0.90 \pm 5\%$	0.48	2.17	6.44	$\pm 11.0\% \text{ (k=2)}$
1900	$\pm 50 / \pm 100$	Head	$40.0 \pm 5\%$	$1.40 \pm 5\%$	0.72	2.18	5.12	$\pm 11.0\% \text{ (k=2)}$

835	$\pm 50 / \pm 100$	Body	$55.2 \pm 5\%$	$0.97 \pm 5\%$	0.44	2.36	6.13	$\pm 11.0\% \text{ (k=2)}$
1900	$\pm 50 / \pm 100$	Body	$53.3 \pm 5\%$	$1.52 \pm 5\%$	0.80	2.88	4.55	$\pm 11.0\% \text{ (k=2)}$

^c 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.

Deviation from Isotropy in HSL

Error (ϕ, θ), $f = 900$ MHz



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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client Kyocera USA

Certificate No: ET3-1618_Jul09

CALIBRATION CERTIFICATE

Object ET3DV6 - SN:1618

Calibration procedure(s)
QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes

Calibration date: July 15, 2009

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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by: Name Marcel Fehr Function Laboratory Technician

Approved by: Katja Pakovic Technical Manager

Issued: July 15, 2009

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



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Accreditation No.: **SCS 108**

Glossary:

TS	tissue simulating liquid
NORM x,y,z	sensitivity in free space
ConvF	sensitivity in TS / 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:

- $NORMx,y,z$: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). $NORMx,y,z$ are only intermediate values, i.e., the uncertainties of $NORMx,y,z$ does not effect the E^2 -field uncertainty inside TS (see below *ConvF*).
- $NORM(f)x,y,z = NORMx,y,z * frequency_response$ (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*.
- $DCPx,y,z$: 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 TS corresponds to $NORMx,y,z * ConvF$ 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.

Probe ET3DV6

SN:1618

Manufactured: January 25, 2002
Last calibrated: August 25, 2008
Recalibrated: July 15, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1618

Sensitivity in Free Space ^A			Diode Compression ^B		
NormX	2.08 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	91	mV
NormY	2.04 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	93	mV
NormZ	2.21 \pm 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	94	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 835 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	10.6	6.8
SAR _{be} [%]	With Correction Algorithm	0.8	0.5

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	12.0	8.2
SAR _{be} [%]	With Correction Algorithm	0.9	0.6

Sensor Offset

Probe Tip to Sensor Center 2.7 mm

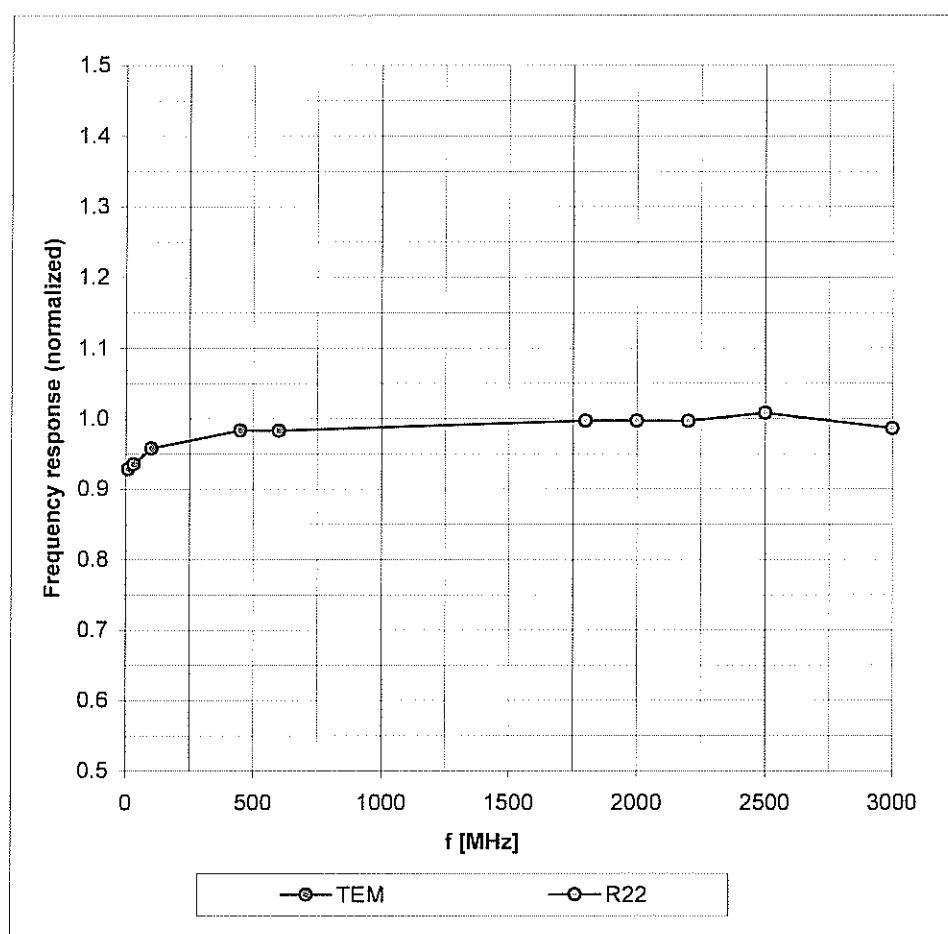
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^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

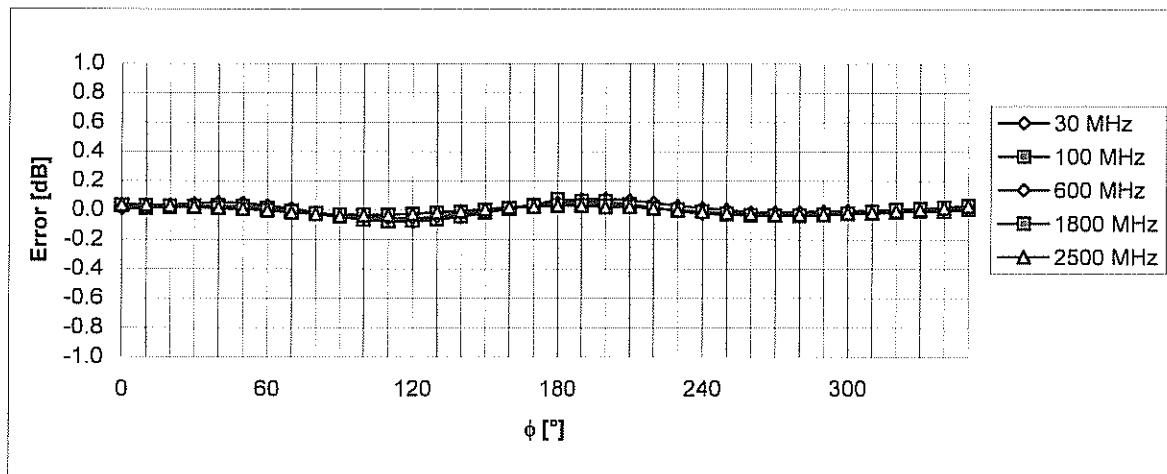
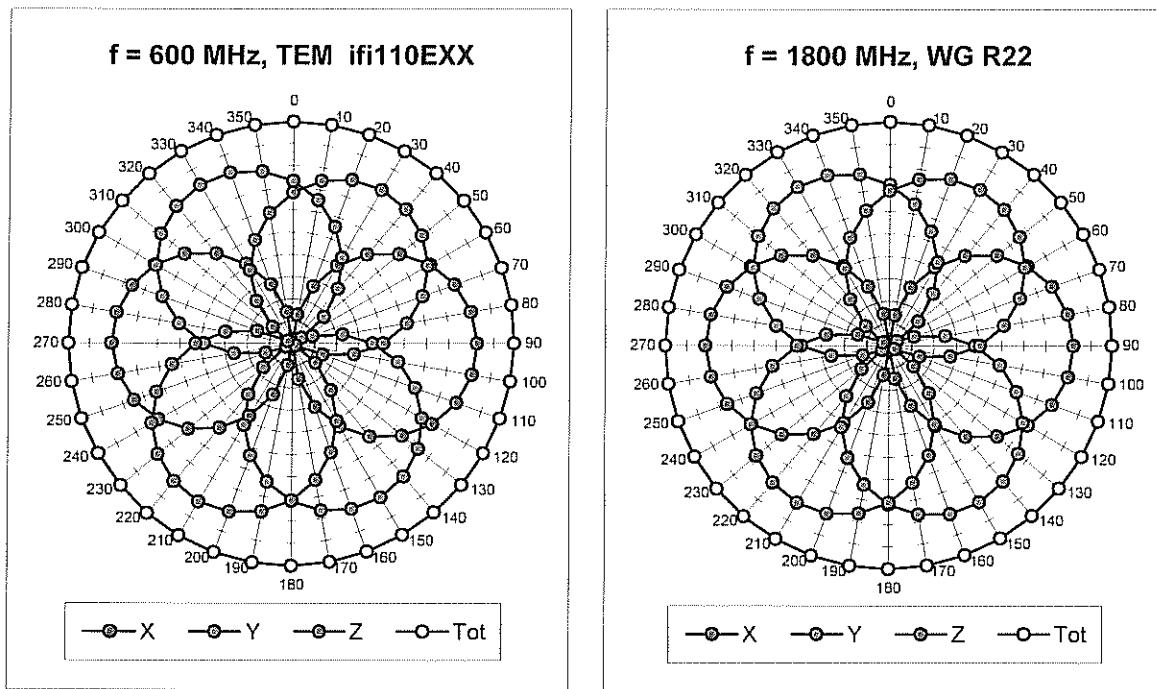
Frequency Response of E-Field

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



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

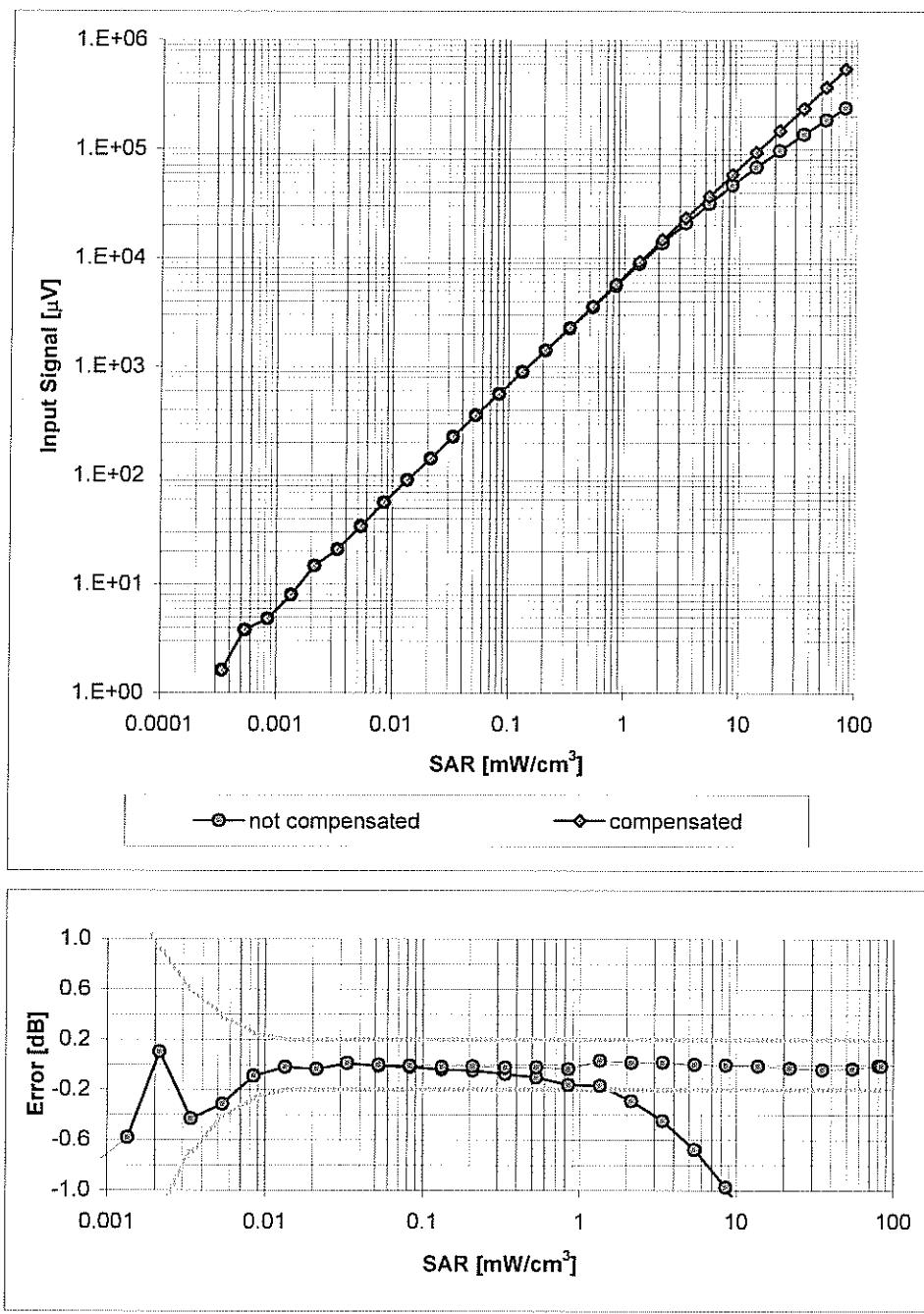
Receiving Pattern (ϕ), $\vartheta = 0^\circ$



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

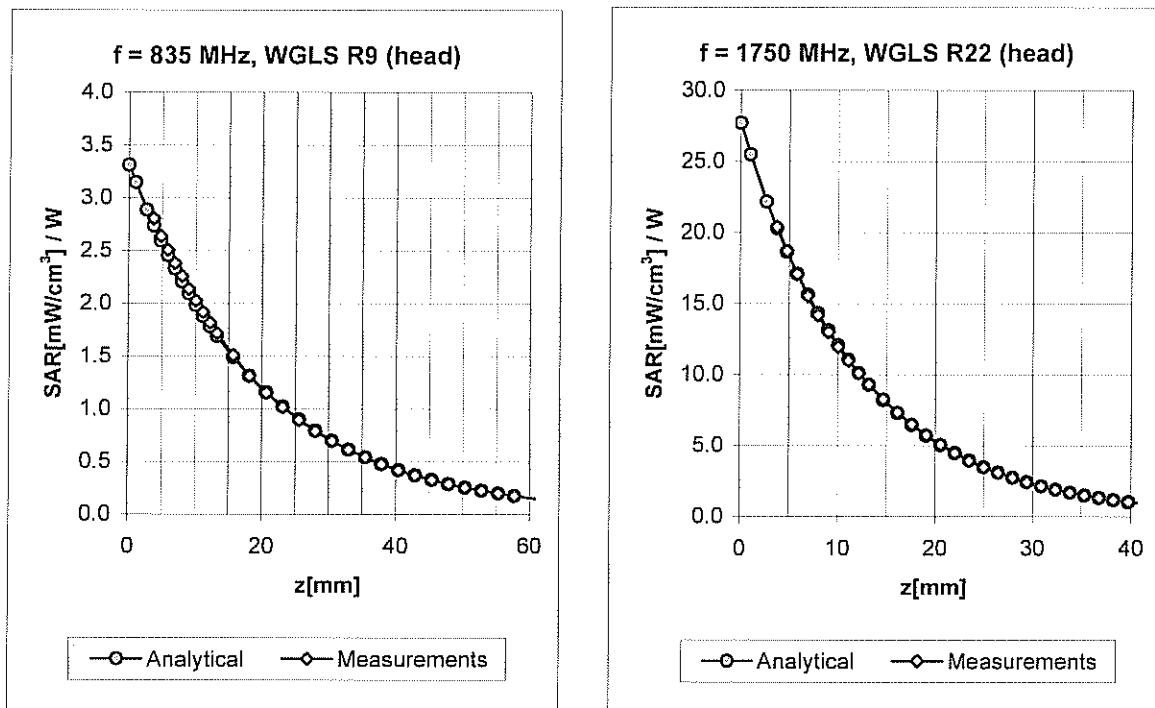
Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)



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

Conversion Factor Assessment



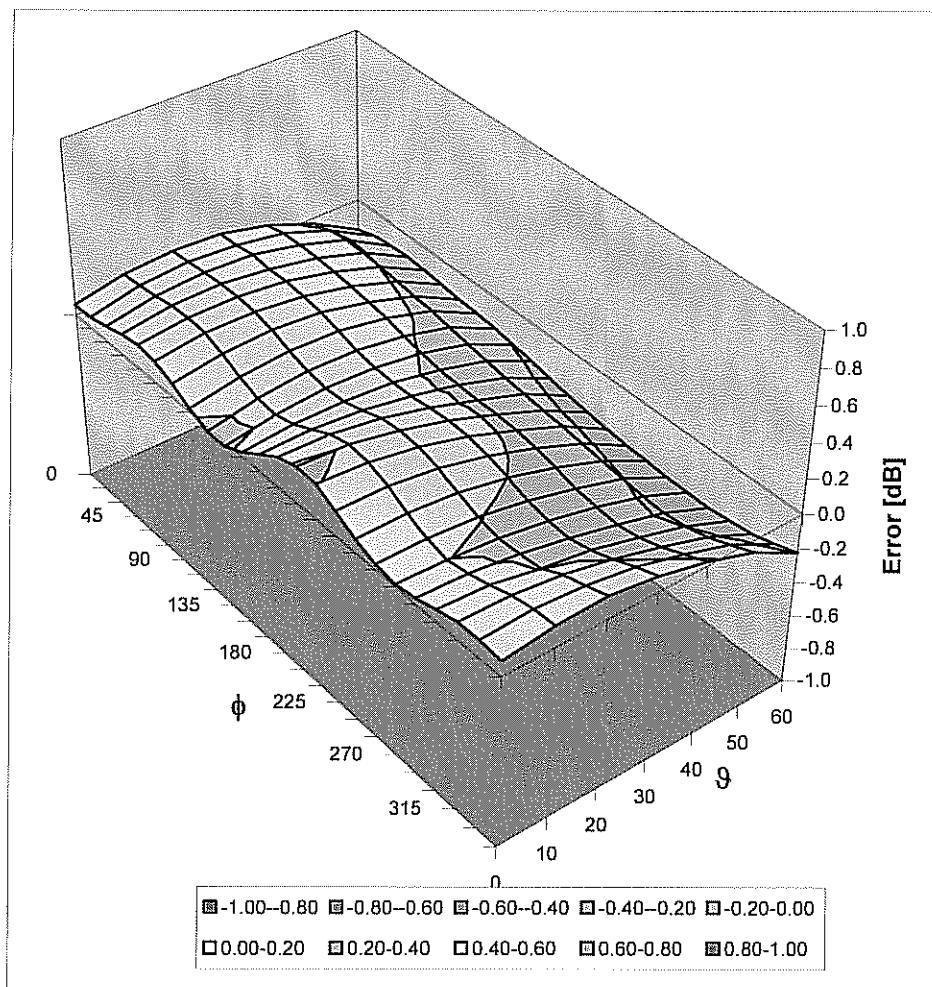
f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	$\pm 50 / \pm 100$	Head	$41.5 \pm 5\%$	$0.90 \pm 5\%$	0.34	2.44	6.49	$\pm 11.0\% (k=2)$
1750	$\pm 50 / \pm 100$	Head	$40.1 \pm 5\%$	$1.37 \pm 5\%$	0.40	3.53	5.52	$\pm 11.0\% (k=2)$
1900	$\pm 50 / \pm 100$	Head	$40.0 \pm 5\%$	$1.40 \pm 5\%$	0.42	3.26	5.28	$\pm 11.0\% (k=2)$

835	$\pm 50 / \pm 100$	Body	$55.2 \pm 5\%$	$0.97 \pm 5\%$	0.33	2.60	6.33	$\pm 11.0\% (k=2)$
1750	$\pm 50 / \pm 100$	Body	$53.4 \pm 5\%$	$1.49 \pm 5\%$	0.67	3.42	4.87	$\pm 11.0\% (k=2)$
1900	$\pm 50 / \pm 100$	Body	$53.3 \pm 5\%$	$1.52 \pm 5\%$	0.89	2.70	4.61	$\pm 11.0\% (k=2)$

^c 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.

Deviation from Isotropy in HSL

Error (ϕ, θ), $f = 900$ MHz



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