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

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Accreditation No.: SCS 0108

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.912 ± 0.02% (k=2)	405.954 ± 0.02% (k=2)	405.400 ± 0.02% (k=2)
Low Range	3.99166 ± 1.50% (k=2)	4.00980 ± 1.50% (k=2)	3.99550 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	53.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200030.95	-2.42	-0.00
Channel X	+ Input	20004.11	-0.05	-0.00
Channel X	- Input	-20003.75	2.02	-0.01
Channel Y	+ Input	200031.20	-2.23	-0.00
Channel Y	+ Input	20001.46	-2.74	-0.01
Channel Y	- Input	-20005.92	-0.05	0.00
Channel Z	+ Input	200032.03	-1.05	-0.00
Channel Z	+ Input	20001.94	-2.11	-0.01
Channel Z	- Input	-20006.15	-0.20	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.66	0.19	0.01
Channel X	+ Input	200.40	-0.18	-0.09
Channel X	- Input	-198.67	0.81	-0.40
Channel Y	+ Input	2000.90	0.48	0.02
Channel Y	+ Input	199.98	-0.58	-0.29
Channel Y	- Input	-200.18	-0.62	0.31
Channel Z	+ Input	2000.68	0.32	0.02
Channel Z	+ Input	199.07	-1.45	-0.72
Channel Z	- Input	-201.14	-1.52	0.76

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	18.32	16.76
	- 200	-15.73	-17.08
Channel Y	200	-20.47	-20.86
	- 200	20.66	20.31
Channel Z	200	13.43	13.46
	- 200	-15.65	-15.97

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	0.08	-3.66
Channel Y	200	7.12	-	1.80
Channel Z	200	10.44	4.52	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15817	15005
Channel Y	16329	14457
Channel Z	15576	15478

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.63	-0.54	2.27	0.51
Channel Y	-2.07	-3.42	-1.02	0.49
Channel Z	-0.89	-2.38	0.83	0.54

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	−0.01	-8	-9

ANNEX J Spot Check

J.1 Dielectric Performance

Table J.1-1: Dielectric Performance of Tissue Simulating Liquid

Measurement Date yyyy/mm/dd	Frequency	Type	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2019-7-8	1900 MHz	Body	53.42	0.23	1.521	0.07
2019-7-9	2450 MHz	Head	39.84	1.63	1.834	1.89
2019-7-10	2600 MHz	Body	53.29	1.50	2.175	0.69

J.2 System Verification

Table J.2-1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2019-7-9	2450 MHz	24.2	51.7	24.2	52.28	0.00%	1.12%

Table J.2-2: System Verification of Body

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2019-7-8	1900 MHz	21.4	40.4	21.64	39.68	1.12%	-1.78%
2019-7-10	2600 MHz	24.5	54.1	24.84	53.6	1.39%	-0.92%

J.3 Conducted power of selected case

Table J.3-1: The conducted Power for WCDMA

Item	band	FDDII result		
	ARFCN	9538/9938	9400/9800	9262/9662
WCDMA	\	(1907.6MHz)	(1880MHz)	(1852.4MHz)
		\	\	23.07

Table J.3-2: The conducted Power for LTE

Test Band	RB offset	Channel	Conducted Power (dBm)
LTE Band2	1RB- Middle	18700	23.12
LTE Band7	1RB- Middle	21350	22.17
LTE Band7	1RB- Middle	21100	22.14
LTE Band7	1RB- Middle	20850	22.13

Table J.3-3: The conducted Power for WiFi

Mode / data rate	Channel	Measured Power (dBm)
802.11b / 5.5Mbps/17dbm	6	16.17

J.4 Measurement results for spot check

Table J.4-1: The spot check results

Test Band	Channel	Frequency	Test Position	Figure	Conducted Power (dBm)	Tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
WCDMA1900	9262	1852.4	Bottom 10mm	Fig J.8-1	23.07	23.5	0.589	**0.65**	1.07	**1.18**	-0.10
LTE Band2	18700	1860	Bottom 10mm	Fig J.8-2	23.12	23.5	0.551	**0.60**	1.02	**1.11**	-0.05
LTE Band7	21350	2560	Bottom 10mm	Fig J.8-3	22.17	22.2	0.613	**0.62**	1.27	**1.28**	-0.02
LTE Band7	21100	2535	Bottom 10mm	\	22.14	22.2	0.61	**0.62**	1.23	**1.25**	0.16
LTE Band7	20850	2510	Bottom 10mm	\	22.13	22.2	0.565	**0.57**	1.12	**1.14**	0.07
Wifi 2.45G	6	2437	Right Cheek	Fig J.8-4	16.17	16.5	0.41	**0.44**	0.796	**0.86**	-0.03

J.5 Reported SAR Comparison

Exposure Configuration	Technology Band	Reported SAR 1g (W/Kg): spot check	Reported SAR 1g (W/Kg): original
Head (Separation Distance 0mm)	GSM850	\	0.39
	PCS1900	\	0.38
	WCDMA1900-BII	\	0.23
	WCDMA1700-BIV	\	0.46
	WCDMA850-BV	\	0.39
	LTE1900-FDD2	\	0.16
	LTE1700-FDD4	\	0.33
	LTE850-FDD5	\	0.36
	LTE2500-FDD7	\	0.20
	LTE700-FDD12	\	0.22
	LTE750-FDD13	\	0.34
	WLAN2450	0.86	0.99
Hotspot (Separation Distance 10mm)	GSM850	\	0.46
	PCS1900	\	1.09
	WCDMA1900-BII	1.18	1.19
	WCDMA1700-BIV	\	1.18
	WCDMA850-BV	\	0.44
	LTE1900-FDD2	1.11	1.19
	LTE1700-FDD4	\	1.16
	LTE850-FDD5	\	0.41
	LTE2500-FDD7	1.28	1.19
	LTE700-FDD12	\	0.30
	LTE750-FDD13	\	0.37
	WLAN2450	\	0.16

Note: All the spot check results marked blue are larger than the original resultd. So it replace the original results and others are shared.

J.6 Evaluation of Simultaneous

Table J.6-1: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Right hand, Touch cheek	0.39	0.99	**1.38**
Highest reported SAR value for Body	Rear	1.18	0.16	**1.34**

Table J.6-2: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Right hand, Touch cheek	0.39	0.21	**0.60**
Maximum reported SAR value for Body	Rear	1.18	0.10	**1.28**

J.7 List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	N5239A	MY46110673	January 24, 2019	One year
02	Power meter	NRVD	102083	Octomber 24, 2018	One year
03	Power sensor	NRV-Z5	100542		
04	Signal Generator	E4438C	MY49070393	January 4, 2019	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	149646	Octomber 22, 2018	One year
07	E-field Probe	SPEAG EX3DV4	7514	August 27, 2018	One year
08	DAE	SPEAG DAE4	1525	September 18, 2018	One year
09	Dipole Validation Kit	SPEAG D1900V2	5d101	July 24,2018	One year
10	Dipole Validation Kit	SPEAG D2450V2	853	July 24,2018	One year
11	Dipole Validation Kit	SPEAG D2600V2	1012	July 26,2018	One year

J.8 Graph Results

WCDMA1900 Body Bottom Low

Date: 2019-7-8

Electronics: DAE4 Sn1525

Medium: body 1900 MHz

Medium parameters used: f = 1852.4 MHz; σ = 1.487 mho/m; εr = 53.68; ρ = 1000 kg/m^3

Ambient Temperature: 22.5ºC, Liquid Temperature: 22.3ºC

Communication System: WCDMA 1900 Frequency: 1852.4 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7514 ConvF(7.53,7.53, 7.53)

Area Scan (121x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.55 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 19.65 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 1.86 W/kg

SAR(1 g) = 1.07 W/kg; SAR(10 g) = 0.589 W/kg

Maximum value of SAR (measured) = 1.58 W/kg

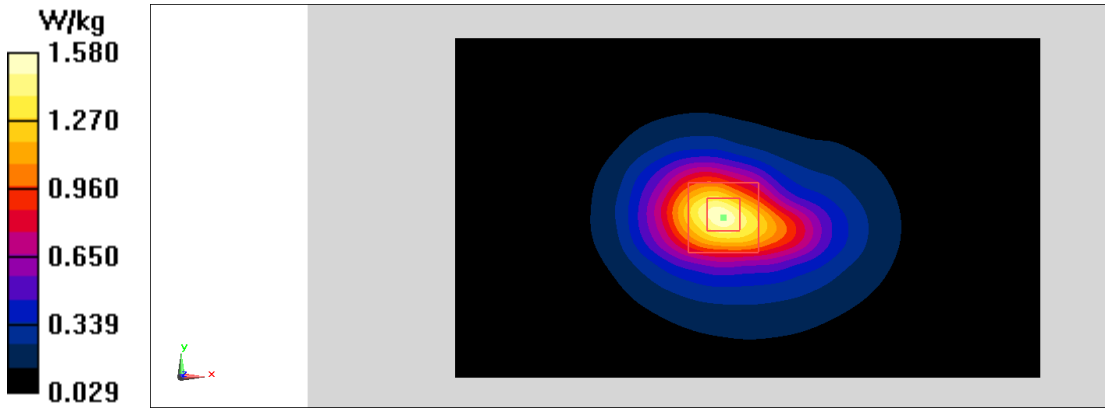


Fig J.8-1 WCDMA1900

LTE Band2 Body Bottom Low with QPSK_20M_1RB_Mid

Date: 2019-7-8

Electronics: DAE4 Sn1525

Medium: body 1900 MHz

Medium parameters used: f = 1860 MHz; σ = 1.492 mho/m; εr = 53.65; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: LTE Band2 Frequency: 1860 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7514 ConvF(7.53, 7.53, 7.53)

Area Scan (141x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.52 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,

dz=5mm

Reference Value = 26.77 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.81 W/kg

SAR(1 g) = 1.02 W/kg; SAR(10 g) = 0.551 W/kg

Maximum value of SAR (measured) = 1.53 W/kg

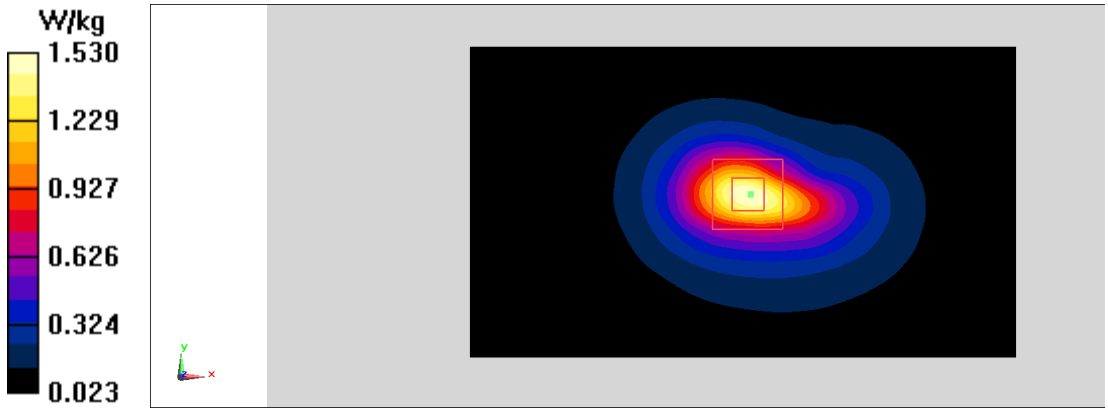


Fig J.8-2 LTE Band2

LTE Band7 Body Bottom High with QPSK_20M_1RB_Mid

Date: 2019-7-10

Electronics: DAE4 Sn1525

Medium: body 2600 MHz

Medium parameters used: f = 2560 MHz; σ = 2.167 mho/m; εr = 53.38; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: LTE Band Frequency:2560 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7514ConvF(7.06, 7.06, 7.06)

Area Scan (141x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 2.17 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,

dz=5mm

Reference Value = 26.25 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.59 W/kg

SAR(1 g) = 1.27 W/kg; SAR(10 g) = 0.613 W/kg

Maximum value of SAR (measured) = 2.08 W/kg

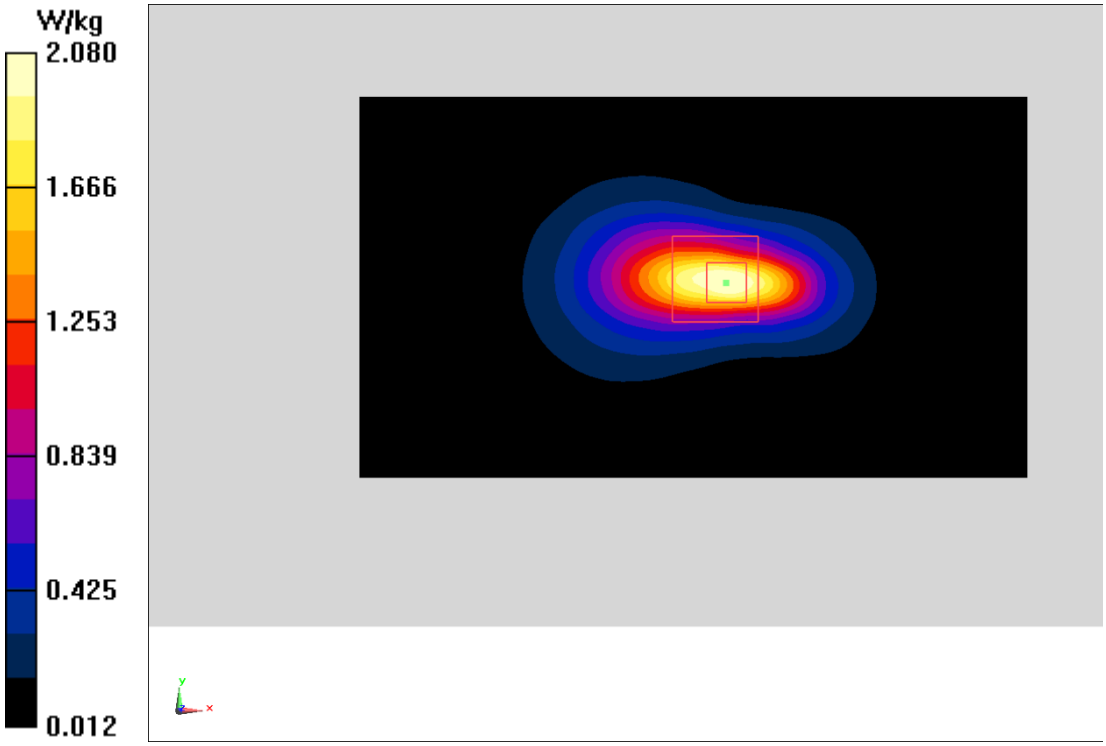


Fig J.8-3 LTE Band7

WLAN2450 Head Right Cheek Channel 6
Date: 2019-7-9
Electronics: DAE4 Sn1525
Medium: Head 2450 MHz
Medium parameters used: f = 2437 MHz; σ = 1.827 mho/m; εr = 39.92; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C
Communication System: WLan 2450 Frequency: 2437 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(6.95,6.95,6.95)

Area Scan (91x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.38 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.81 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.59 W/kg
SAR(1 g) = 0.796 W/kg; SAR(10 g) = 0.410 W/kg
Maximum value of SAR (measured) = 1.18 W/kg

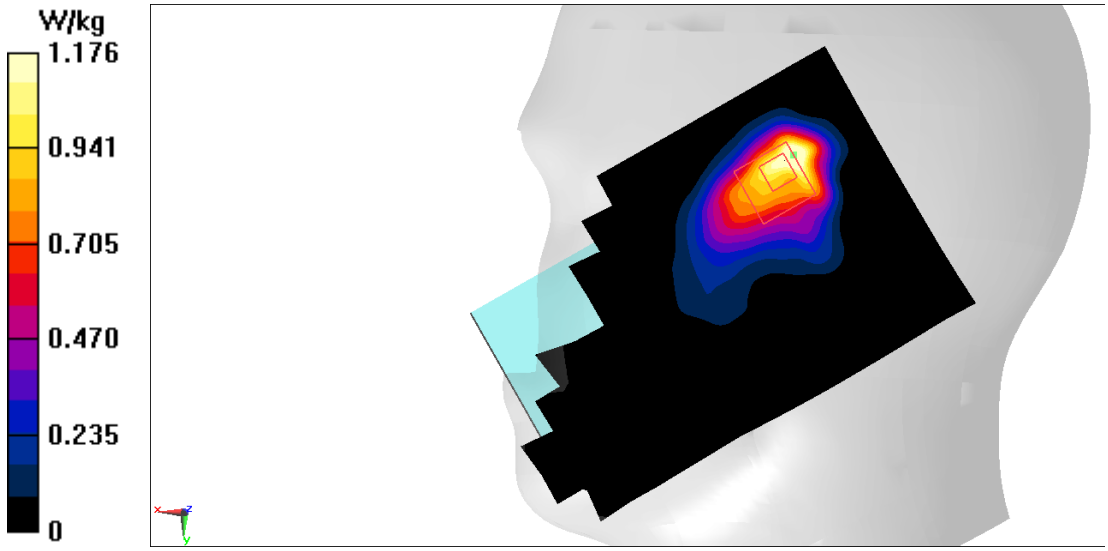


Fig J.8-4 Wifi 2.45G

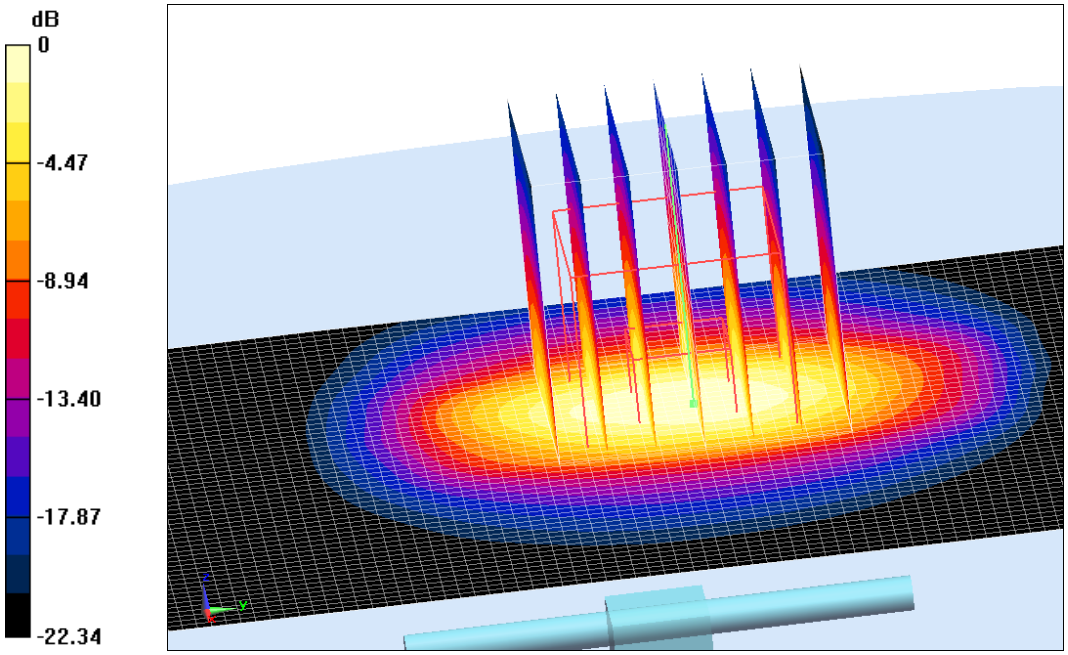
J.9 System Verification Results

2450 MHz

Date: 7/9/2019
Electronics: DAE4 Sn1525
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ =1.521 mho/m; ε_r = 53.42; ρ = 1000 kg/m^3
Ambient Temperature: 22.5ºC Liquid Temperature: 22.3ºC
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(6.95,6.95,6.95)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 116.03 V/m; Power Drift = 0.04
Fast SAR: SAR(1 g) = 12.92 W/kg; SAR(10 g) = 5.98 W/kg
Maximum value of SAR (interpolated) = 21.92 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =116.03 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 26.37 W/kg
SAR(1 g) = 13.07 W/kg; SAR(10 g) = 6.05 W/kg
Maximum value of SAR (measured) = 21.86 W/kg



0 dB = 21.86 W/kg = 13.4 dB W/kg

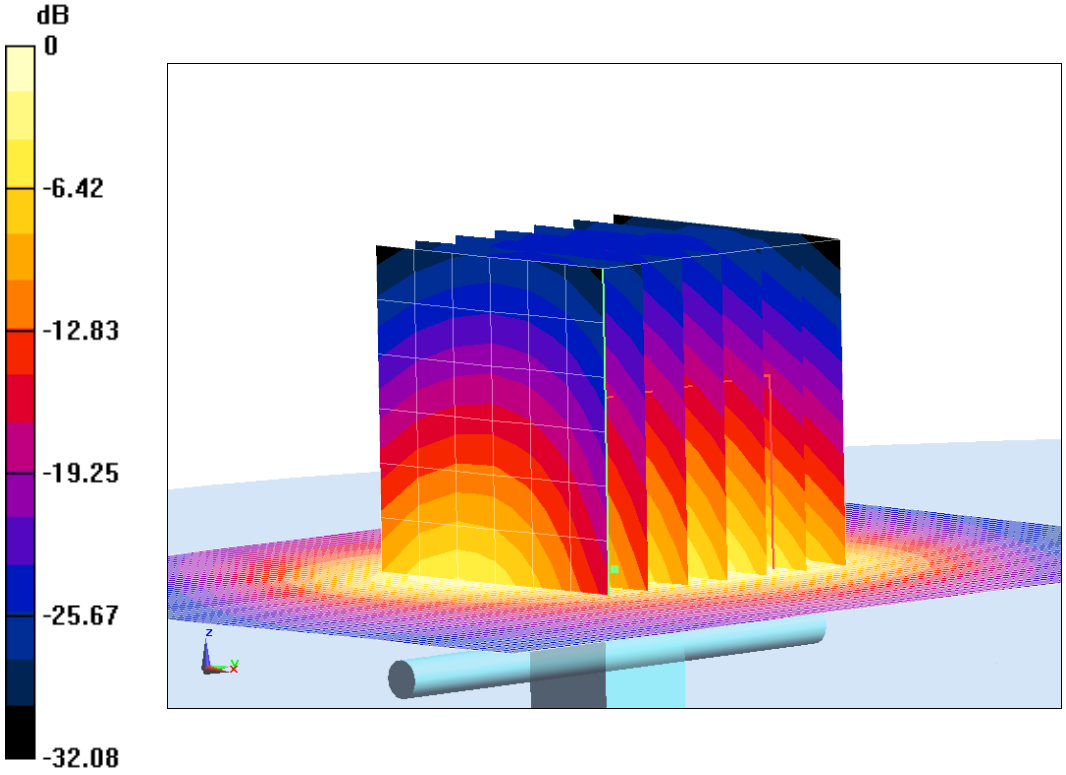
Fig.J.9-1 validation 2450 MHz 250mW

1900 MHz

Date: 7/8/2019
Electronics: DAE4 Sn1525
Medium: Body 1900 MHz
Medium parameters used: f = 1900 MHz; σ =1.834 mho/m; ε_r = 39.84; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(7.53,7.53,7.53)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 105.05 V/m; Power Drift = -0.09
Fast SAR: SAR(1 g) = 9.96 W/kg; SAR(10 g) = 5.31 W/kg
Maximum value of SAR (interpolated) = 14.88 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =105.05 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 17.34 W/kg
SAR(1 g) = 9.92 W/kg; SAR(10 g) = 5.41 W/kg
Maximum value of SAR (measured) = 14.7 W/kg



0 dB = 14.7 W/kg = 11.67 dB W/kg

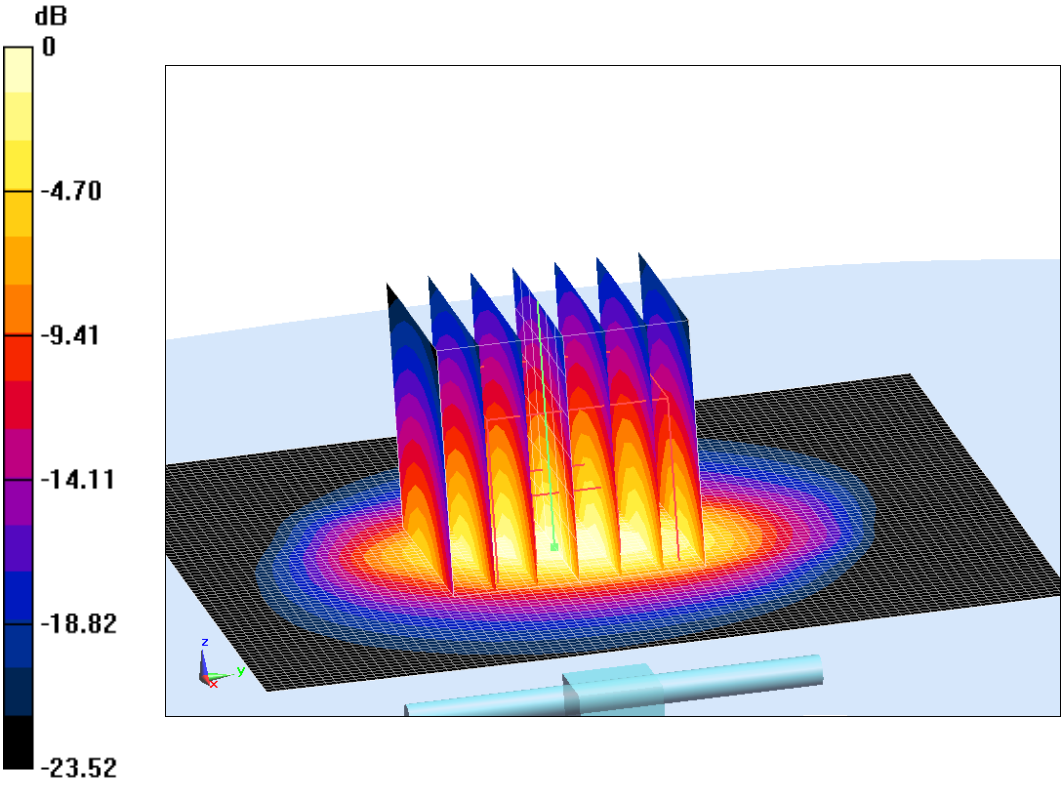
Fig.J.9-2 validation 1900 MHz 250mW

2600 MHz

Date: 7/10/2019
Electronics: DAE4 Sn1525
Medium: Body 2600 MHz
Medium parameters used: f = 2600 MHz; σ =0 mho/m; ε_r = 0; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C
Communication System: CW Frequency: 2600 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(7.06,7.06,7.06)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 109.45 V/m; Power Drift = 0.04
Fast SAR: SAR(1 g) = 13.34 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (interpolated) = 22.29 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =109.45 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 27.16 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.21 W/kg
Maximum value of SAR (measured) = 22.32 W/kg



0 dB = 22.32 W/kg = 13.49 dB W/kg

Fig.J.9-3 validation 2600 MHz 250mW

J.10 Probe Calibration Certificate

Probe 7514 Calibration Certificate

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

S Schweizerischer 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 0108

Client CTTL-BJ (Auden) **Certificate No: EX3-7514_Aug18**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7514

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: August 27, 2018

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 NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

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

Issued: August 27, 2018

Calibration Laboratory of
Schmid & Partner
Engineering AG
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Accreditation No.: SCS 0108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
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., ϑ = 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:

a) 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
b) IEC 62209-1, '', "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "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)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 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 affect the E^2-field uncertainty inside TSL (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 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
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *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 ≤ 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 *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.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:7514

Manufactured: November 13, 2017
Calibrated: August 27, 2018

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7514

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.46	0.44	0.39	± 10.1 %
DCP (mV)[B]	96.5	101.1	97.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	179.1	±3.5 %
		Y	0.0	0.0	1.0		177.3	
		Z	0.0	0.0	1.0		158.1	

Note: For details on UID parameters see Appendix.

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	31.17	241.1	37.77	3.625	0.025	5.031	0.000	0.325	1.005
Y	34.86	259.7	35.41	7.412	0.000	5.026	0.323	0.291	1.002
Z	33.14	259.6	38.65	3.827	0.264	5.046	0.000	0.373	1.008

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 Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] 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:7514

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	12.79	12.79	12.79	0.00	1.00	± 13.3 %
300	45.3	0.87	11.57	11.57	11.57	0.07	1.20	± 13.3 %
450	43.5	0.87	10.68	10.68	10.68	0.14	1.20	± 13.3 %
750	41.9	0.89	9.47	9.47	9.47	0.45	0.89	± 12.0 %
835	41.5	0.90	9.09	9.09	9.09	0.53	0.85	± 12.0 %
900	41.5	0.97	9.03	9.03	9.03	0.49	0.85	± 12.0 %
1450	40.5	1.20	8.24	8.24	8.24	0.35	0.80	± 12.0 %
1640	40.2	1.31	8.22	8.22	8.22	0.38	0.81	± 12.0 %
1750	40.1	1.37	8.10	8.10	8.10	0.36	0.83	± 12.0 %
1810	40.0	1.40	7.82	7.82	7.82	0.35	0.81	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.31	0.80	± 12.0 %
2000	40.0	1.40	7.64	7.64	7.64	0.30	0.84	± 12.0 %
2100	39.8	1.49	7.57	7.57	7.57	0.27	0.85	± 12.0 %
2300	39.5	1.67	7.42	7.42	7.42	0.31	0.80	± 12.0 %
2450	39.2	1.80	6.95	6.95	6.95	0.38	0.98	± 12.0 %
2600	39.0	1.96	6.92	6.92	6.92	0.25	1.05	± 12.0 %
3500	37.9	2.91	6.78	6.78	6.78	0.79	0.64	± 13.1 %
3700	37.7	3.12	6.61	6.61	6.61	0.42	0.93	± 13.1 %
5200	36.0	4.66	5.05	5.05	5.05	0.40	1.80	± 13.1 %
5250	35.9	4.71	5.02	5.02	5.02	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.99	4.99	4.99	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.59	4.59	4.59	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.41	4.41	4.41	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.47	4.47	4.47	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.42	4.42	4.42	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz 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. Frequency validity below at 150 MHz is ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) 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 (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] 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:7514

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	61.9	0.80	12.43	12.43	12.43	0.00	1.00	± 13.3 %
300	58.2	0.92	11.39	11.39	11.39	0.05	1.20	± 13.3 %
450	56.7	0.94	11.34	11.34	11.34	0.08	1.20	± 13.3 %
750	55.5	0.96	9.68	9.68	9.68	0.31	1.04	± 12.0 %
835	55.2	0.97	9.47	9.47	9.47	0.46	0.80	± 12.0 %
900	55.0	1.05	9.34	9.34	9.34	0.46	0.83	± 12.0 %
1450	54.0	1.30	8.02	8.02	8.02	0.31	0.80	± 12.0 %
1640	53.7	1.42	7.85	7.85	7.85	0.42	0.81	± 12.0 %
1750	53.4	1.49	7.82	7.82	7.82	0.39	0.83	± 12.0 %
1810	53.3	1.52	7.69	7.69	7.69	0.32	0.92	± 12.0 %
1900	53.3	1.52	7.53	7.53	7.53	0.35	0.83	± 12.0 %
2000	53.3	1.52	7.45	7.45	7.45	0.39	0.80	± 12.0 %
2100	53.2	1.62	7.39	7.39	7.39	0.32	0.94	± 12.0 %
2300	52.9	1.81	7.25	7.25	7.25	0.37	0.85	± 12.0 %
2450	52.7	1.95	7.13	7.13	7.13	0.32	0.97	± 12.0 %
2600	52.5	2.16	7.06	7.06	7.06	0.24	1.10	± 12.0 %
3500	51.3	3.31	6.85	6.85	6.85	0.00	1.00	± 13.1 %
3700	51.0	3.55	6.75	6.75	6.75	0.00	1.00	± 13.1 %
5200	49.0	5.30	4.59	4.59	4.59	0.50	1.90	± 13.1 %
5250	48.9	5.36	4.54	4.54	4.54	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.49	4.49	4.49	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.17	4.17	4.17	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.00	4.00	4.00	0.50	1.90	± 13.1 %
5750	48.3	5.94	3.98	3.98	3.98	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.94	3.94	3.94	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz 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. Frequency validity below at 150 MHz is ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) 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 (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] 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.

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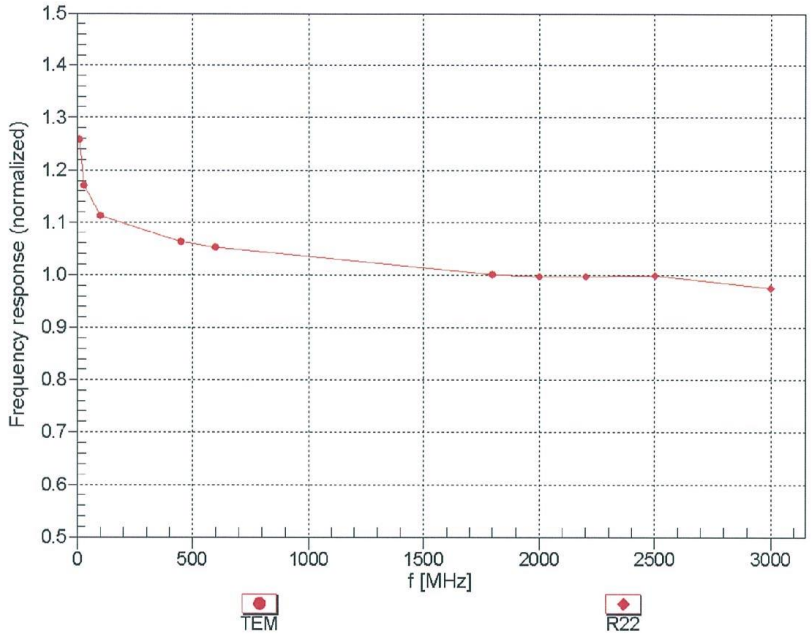
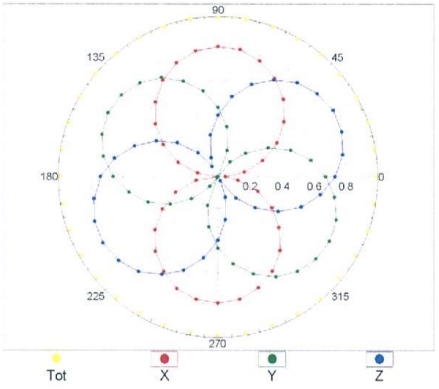
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



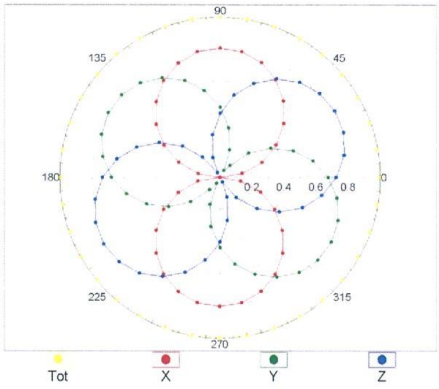
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

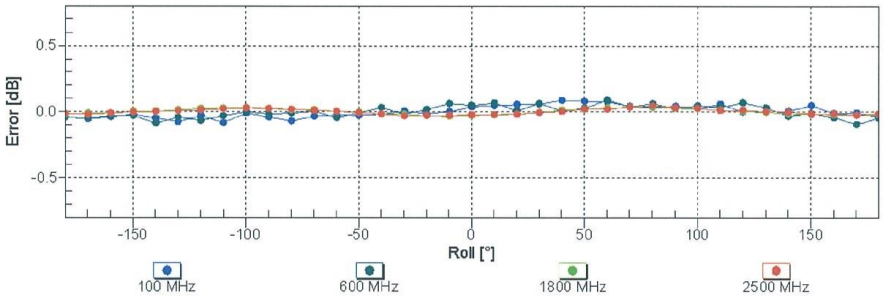
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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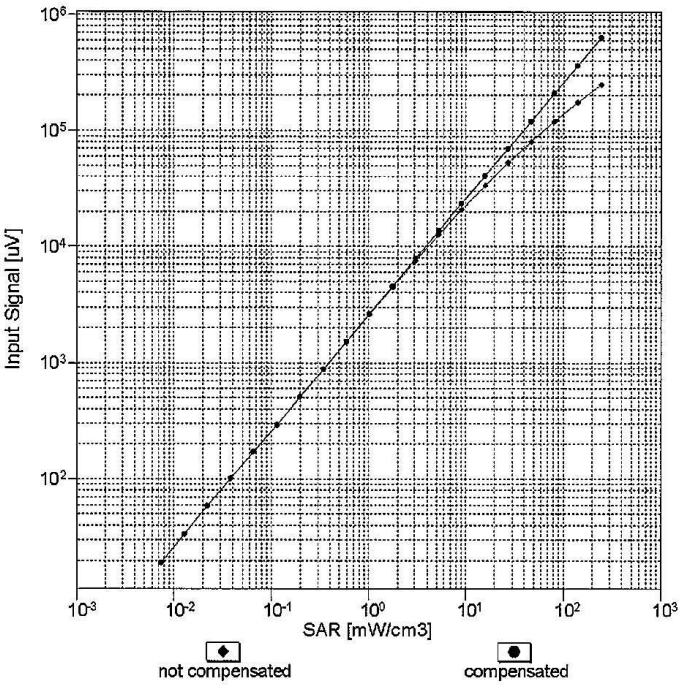
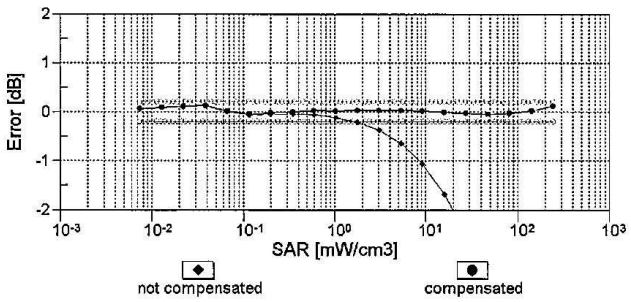
Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)