APPENDIX C: PROBE CALIBRATION

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 **PC Test**

Certificate No: **ES3-3022_Aug15**

CALIBRATION CERTIFICATE

Object ES3DV2 - SN:3022

Calibration procedure(s) QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: August 26, 2015

BN ✓
9/3/2015

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 27, 2015

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) **Accreditation No.: SCS 0108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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, "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
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 ES3DV2

SN:3022

Manufactured: April 15, 2003
Calibrated: August 26, 2015

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.00	1.03	0.95	± 10.1 %
DCP (mV)[B]	99.9	99.7	100.9	

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	179.6	±3.3 %
		Y	0.0	0.0	1.0		183.9	
		Z	0.0	0.0	1.0		179.0	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	3.60	65.9	14.2	10.00	43.5	±2.2 %
		Y	2.84	63.5	13.0		43.3	
		Z	2.76	63.7	12.7		41.7	
10011-CAB	UMTS-FDD (WCDMA)	X	3.32	67.0	18.7	2.91	144.4	±0.7 %
		Y	3.24	66.3	18.0		147.3	
		Z	3.19	66.3	18.0		143.5	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.15	69.9	19.5	1.87	146.1	±0.7 %
		Y	2.88	67.7	18.0		147.9	
		Z	2.78	67.4	17.8		145.6	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.40	71.3	23.8	9.46	144.9	±3.3 %
		Y	11.15	70.5	23.1		146.9	
		Z	10.95	70.5	23.3		140.3	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	20.66	99.8	29.2	9.39	132.6	±2.2 %
		Y	14.36	93.3	26.6		145.3	
		Z	17.17	97.2	27.8		145.4	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	17.22	96.5	28.2	9.57	125.4	±1.9 %
		Y	11.06	88.6	25.0		136.0	
		Z	8.71	84.6	23.4		130.7	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	31.05	99.5	25.9	6.56	135.2	±2.2 %
		Y	25.28	97.4	25.0		132.5	
		Z	21.58	95.7	24.5		144.4	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	42.88	99.9	24.0	4.80	129.5	±1.9 %
		Y	40.80	99.6	23.7		124.9	
		Z	38.42	99.7	23.7		137.8	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	44.48	100.0	23.2	3.55	138.2	±1.9 %
		Y	44.03	99.7	22.8		133.0	
		Z	41.36	99.8	22.8		147.5	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	16.08	99.5	23.3	1.16	127.5	±1.4 %
		Y	79.69	99.6	19.3		146.2	
		Z	45.81	99.9	20.4		138.2	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.43	67.4	19.8	5.67	138.7	±1.4 %
		Y	6.27	66.8	19.2		134.9	
		Z	6.16	66.6	19.2		127.6	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.13	75.0	25.9	9.29	129.4	±3.3 %
		Y	9.46	73.0	24.5		131.8	
		Z	9.52	74.0	25.4		137.0	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.27	66.9	19.7	5.80	137.0	±1.7 %
		Y	6.24	66.7	19.3		140.0	
		Z	6.06	66.3	19.2		127.1	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.16	68.7	21.3	8.07	127.7	±2.2 %
		Y	9.99	68.2	20.9		131.5	
		Z	10.22	69.1	21.4		141.6	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.34	73.4	25.2	9.28	125.0	±3.3 %
		Y	8.92	72.2	24.3		127.2	
		Z	8.95	73.1	25.1		131.9	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.95	66.4	19.4	5.75	134.4	±1.4 %
		Y	5.92	66.2	19.1		137.0	
		Z	5.98	66.7	19.5		146.8	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.39	66.9	19.6	5.82	139.9	±1.7 %
		Y	6.35	66.7	19.3		141.9	
		Z	6.15	66.2	19.2		128.4	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.96	66.6	19.8	5.73	137.3	±1.4 %
		Y	4.85	66.1	19.3		139.8	
		Z	4.85	66.6	19.7		146.7	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.75	78.7	28.3	9.21	138.9	±3.0 %
		Y	7.69	75.1	26.1		140.1	
		Z	7.80	76.6	27.2		144.0	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.88	66.2	19.6	5.72	132.0	±1.4 %
		Y	4.77	65.8	19.1		132.6	
		Z	4.83	66.5	19.6		146.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.91	66.3	19.7	5.72	131.7	±1.4 %
		Y	4.82	66.0	19.2		138.4	
		Z	4.86	66.7	19.7		145.7	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.04	69.1	21.7	8.10	140.9	±2.2 %
		Y	9.62	67.9	20.8		125.2	
		Z	9.74	68.6	21.3		133.3	
10225-CAB	UMTS-FDD (HSPA+)	X	7.01	67.1	19.6	5.97	143.7	±1.4 %
		Y	6.78	66.2	19.0		129.3	
		Z	6.80	66.7	19.3		136.5	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.55	78.0	27.9	9.21	134.6	±3.0 %
		Y	7.79	75.6	26.3		141.6	
		Z	7.89	76.9	27.4		145.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.30	74.8	26.1	9.24	134.8	±3.3 %
		Y	8.65	72.5	24.5		136.4	
		Z	8.33	72.3	24.8		126.6	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	10.20	76.2	26.8	9.30	144.8	±3.3 %
		Y	9.41	73.7	25.1		145.9	
		Z	9.18	73.9	25.6		138.6	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.45	66.7	18.9	3.96	147.0	±0.9 %
		Y	4.21	65.5	17.9		126.5	
		Z	4.36	66.5	18.5		148.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.57	66.3	18.5	3.46	134.3	±0.7 %
		Y	3.48	65.6	17.8		136.8	
		Z	3.51	66.2	18.3		136.4	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.53	66.4	18.6	3.39	135.8	±0.7 %
		Y	3.45	65.8	17.9		140.4	
		Z	3.50	66.5	18.5		137.0	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.18	66.5	19.5	5.81	129.4	±1.4 %
		Y	6.15	66.3	19.1		133.6	
		Z	6.13	66.5	19.3		131.2	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.77	67.2	19.9	6.06	134.8	±1.7 %
		Y	6.81	67.3	19.7		144.8	
		Z	6.68	67.1	19.7		136.7	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.30	69.4	22.0	8.37	142.0	±2.5 %
		Y	9.90	68.2	21.1		126.8	
		Z	10.15	69.3	21.9		142.6	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.72	68.1	18.9	3.76	147.8	±0.7 %
		Y	4.56	67.5	18.2		133.6	
		Z	4.61	68.2	18.7		147.4	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.57	67.8	18.8	3.77	144.3	±0.7 %
		Y	4.43	67.3	18.1		131.3	
		Z	4.57	68.3	18.8		145.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.64	67.9	18.7	1.54	142.1	±0.5 %
		Y	2.36	65.4	16.8		130.3	
		Z	2.50	66.7	17.7		145.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.04	69.0	21.7	8.23	138.8	±2.2 %
		Y	9.71	68.0	20.9		125.6	
		Z	9.94	69.0	21.6		140.4	

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 7 and 8).
[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: ES3DV2 - SN:3022

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)
750	41.9	0.89	6.33	6.33	6.33	0.46	1.43	± 12.0 %
835	41.5	0.90	6.11	6.11	6.11	0.24	2.08	± 12.0 %
1750	40.1	1.37	5.08	5.08	5.08	0.45	1.47	± 12.0 %
1900	40.0	1.40	4.93	4.93	4.93	0.59	1.25	± 12.0 %
2300	39.5	1.67	4.63	4.63	4.63	0.55	1.39	± 12.0 %
2450	39.2	1.80	4.30	4.30	4.30	0.51	1.47	± 12.0 %
2600	39.0	1.96	4.12	4.12	4.12	0.57	1.46	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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: ES3DV2 - SN:3022

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)
750	55.5	0.96	6.16	6.16	6.16	0.50	1.34	± 12.0 %
835	55.2	0.97	6.13	6.13	6.13	0.25	2.16	± 12.0 %
1750	53.4	1.49	4.79	4.79	4.79	0.61	1.33	± 12.0 %
1900	53.3	1.52	4.56	4.56	4.56	0.31	2.02	± 12.0 %
2300	52.9	1.81	4.32	4.32	4.32	0.79	1.19	± 12.0 %
2450	52.7	1.95	4.08	4.08	4.08	0.80	1.12	± 12.0 %
2600	52.5	2.16	3.96	3.96	3.96	0.80	1.10	± 12.0 %

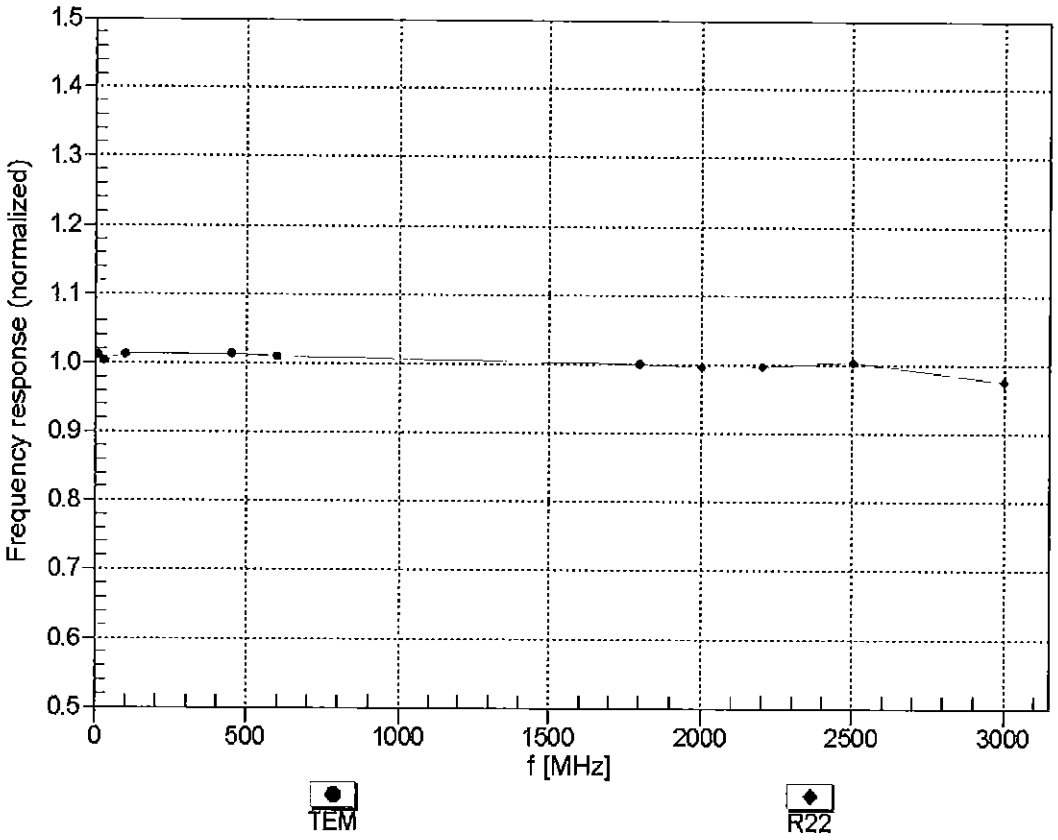
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

Frequency Response of E-Field

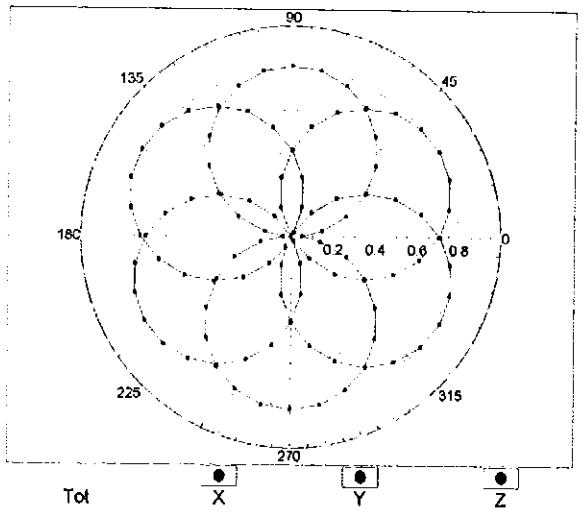
(TEM-Cell:ifi110 EXX, Waveguide: R22)



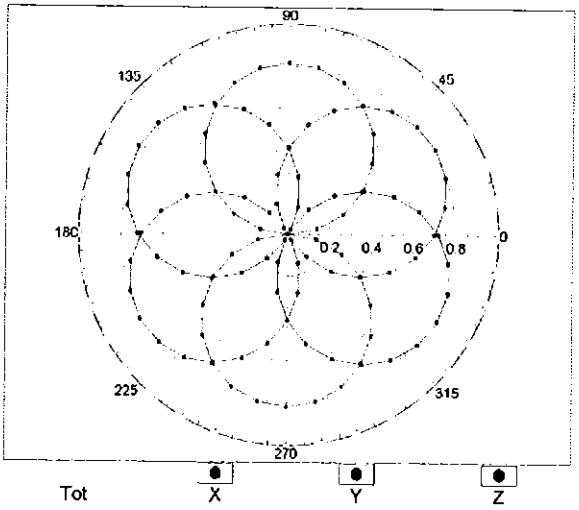
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

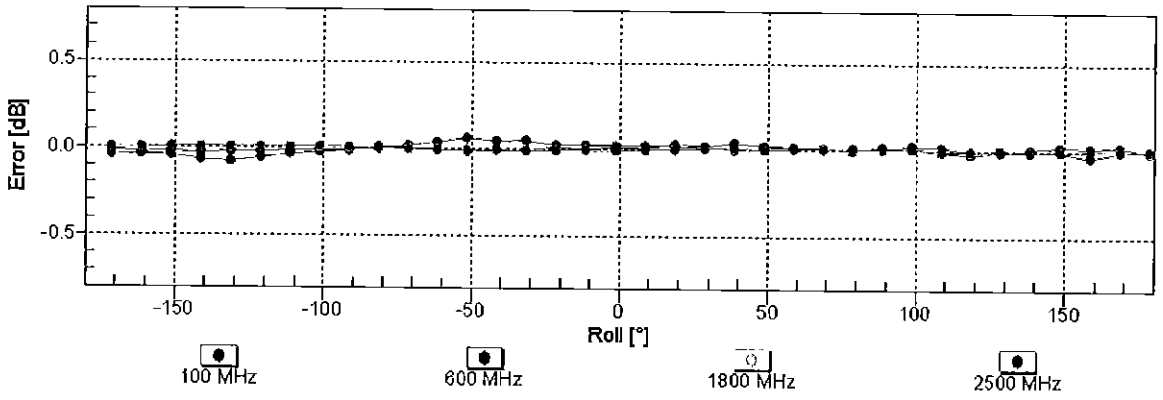
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

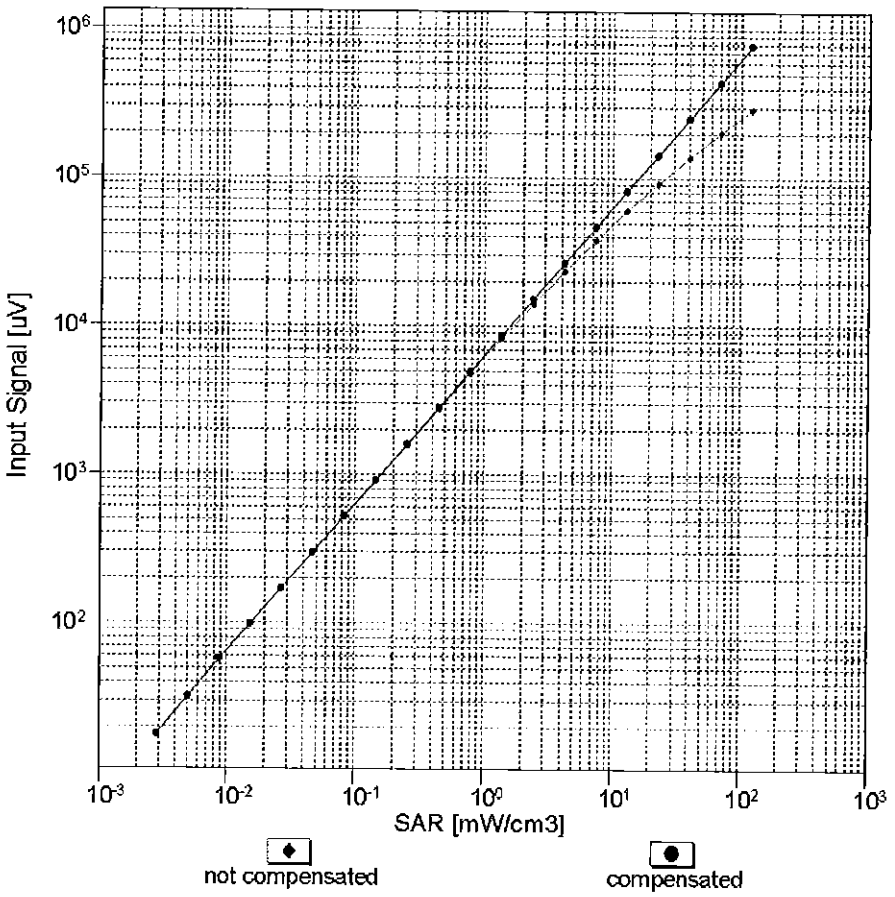


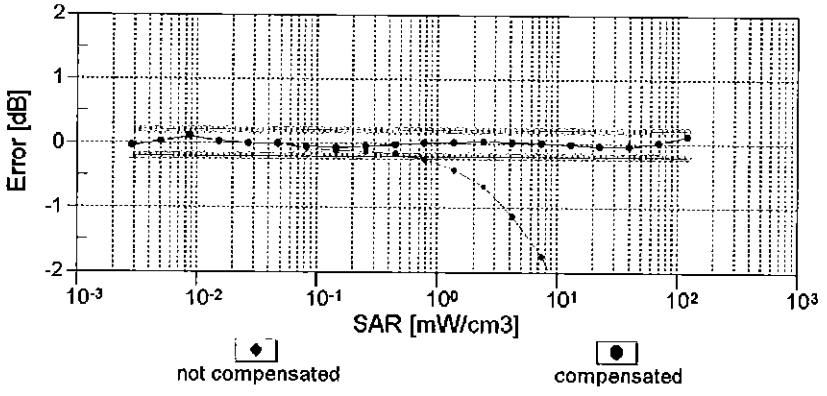


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

(TEM cell , f_{eval}= 1900 MHz)

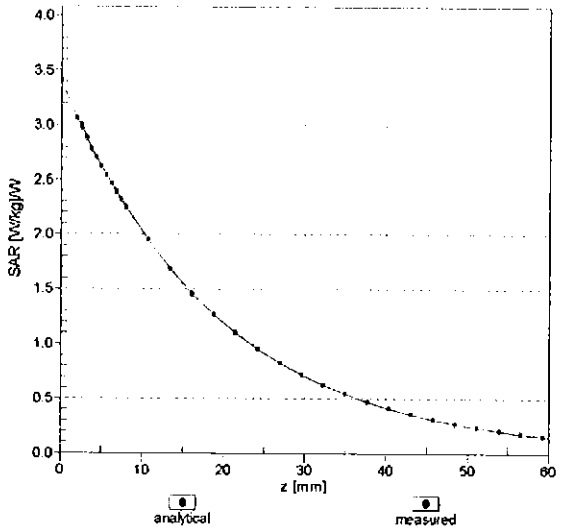




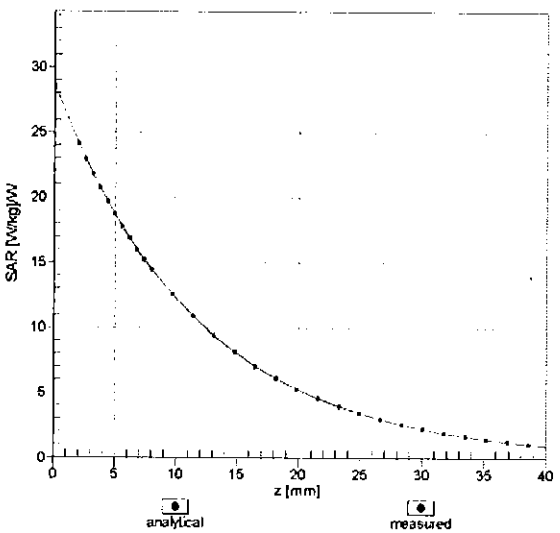
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

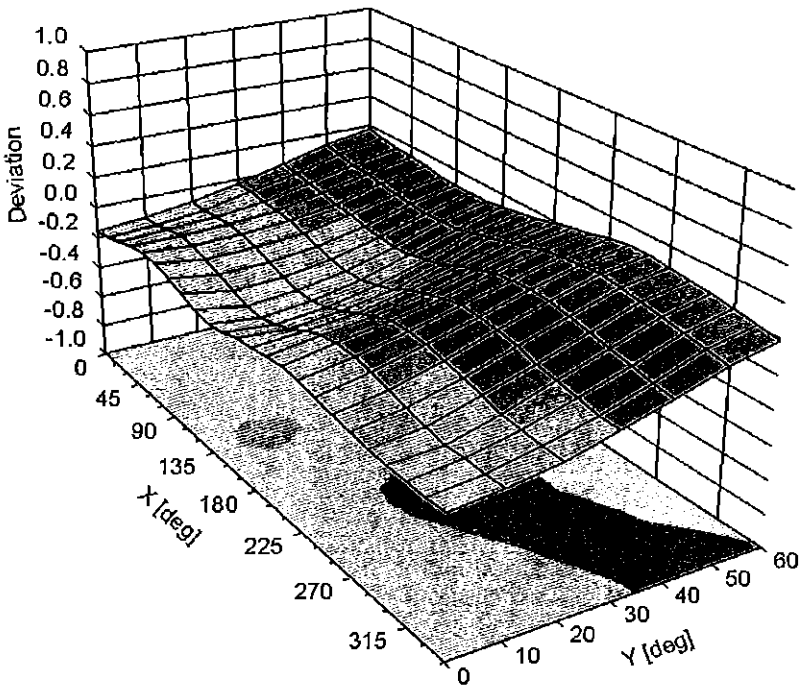


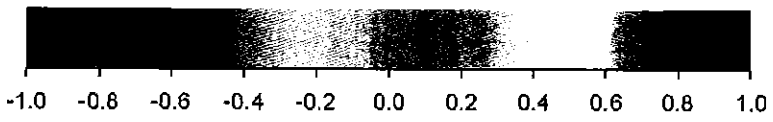
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	98.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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 **PC Test** | **Certificate No: EX3-7406_Apr16**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7406
Calibration procedure(s)	QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	April 19, 2016

BN 04/26/2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (No. 217-02285/02284)	In house check: Jun-16
Power sensor E4412A	SN: MY41498087	06-Apr-16 (No. 217-02285)	In house check: Jun-16
Power sensor E4412A	SN: 000110210	06-Apr-16 (No. 217-02284)	In house check: Jun-16
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Jun-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: April 20, 2016

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
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) **Accreditation No.: SCS 0108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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, "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
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:7406

Manufactured: November 24, 2015
Calibrated: April 19, 2016

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7406

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.48	0.44	0.47	± 10.1 %
DCP (mV)[B]	100.7	97.9	98.6	

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	120.4	±3.3 %
		Y	0.0	0.0	1.0		148.3	
		Z	0.0	0.0	1.0		146.7	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	0.81	54.6	7.4	10.00	50.3	±2.2 %
		Y	0.68	55.1	7.9		47.9	
		Z	1.34	61.0	11.0		46.8	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.83	68.0	18.3	1.87	127.8	±0.5 %
		Y	2.82	68.4	18.4		117.8	
		Z	3.00	69.2	19.0		115.9	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.54	67.4	19.5	5.67	142.1	±1.2 %
		Y	6.19	66.7	19.3		127.6	
		Z	6.37	66.7	19.2		125.7	
10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	7.58	67.9	21.8	9.29	114.4	±1.7 %
		Y	7.34	68.3	22.5		144.3	
		Z	7.53	67.7	21.8		139.5	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.34	66.9	19.4	5.80	137.5	±1.2 %
		Y	5.90	65.9	19.0		123.8	
		Z	6.24	66.4	19.2		123.7	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	7.17	67.2	21.5	9.28	109.5	±1.7 %
		Y	6.83	67.6	22.3		137.0	
		Z	7.23	67.4	21.7		135.1	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.99	66.4	19.2	5.75	132.4	±0.9 %
		Y	5.61	65.8	19.1		119.4	
		Z	5.91	65.9	19.0		120.1	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.47	67.0	19.5	5.82	137.0	±1.2 %
		Y	5.96	66.0	19.1		123.9	
		Z	6.33	66.3	19.1		124.2	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.71	65.5	18.9	5.73	113.2	±1.2 %
		Y	4.60	66.2	19.6		144.2	
		Z	4.93	66.5	19.5		143.2	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.68	68.2	22.4	9.21	117.6	±1.7 %
		Y	5.56	70.1	24.1		146.1	
		Z	5.87	69.4	23.2		143.7	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.75	65.7	19.1	5.72	112.3	±0.9 %
		Y	4.58	66.1	19.5		143.2	
		Z	4.95	66.7	19.6		142.0	

10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.71	65.5	18.9	5.72	110.2	±0.9 %
		Y	4.53	65.8	19.4		141.4	
		Z	4.90	66.5	19.5		138.1	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.69	68.3	22.5	9.21	117.3	±1.7 %
		Y	5.47	69.5	23.8		145.1	
		Z	5.85	69.3	23.1		142.0	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	7.04	68.1	22.2	9.24	141.2	±1.9 %
		Y	6.35	67.2	22.2		125.4	
		Z	6.82	67.1	21.7		127.5	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	7.45	68.3	22.2	9.30	148.0	±1.9 %
		Y	6.84	67.5	22.3		132.0	
		Z	7.24	67.4	21.8		134.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.35	66.9	19.4	5.81	135.3	±1.2 %
		Y	5.92	65.9	19.0		122.9	
		Z	6.26	66.4	19.2		122.1	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.92	67.4	19.7	6.06	139.3	±1.2 %
		Y	6.52	66.6	19.5		127.9	
		Z	6.82	66.9	19.5		126.8	

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 6 and 7).
[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:7406

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)
750	41.9	0.89	10.52	10.52	10.52	0.52	0.89	± 12.0 %
835	41.5	0.90	9.83	9.83	9.83	0.54	0.80	± 12.0 %
1750	40.1	1.37	8.85	8.85	8.85	0.49	0.85	± 12.0 %
1900	40.0	1.40	8.22	8.22	8.22	0.40	0.88	± 12.0 %
2300	39.5	1.67	7.67	7.67	7.67	0.36	0.89	± 12.0 %
2450	39.2	1.80	7.29	7.29	7.29	0.40	0.80	± 12.0 %
2600	39.0	1.96	7.08	7.08	7.08	0.37	0.95	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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:7406

Calibration Parameter Determined in Body Tissue Simulating Media

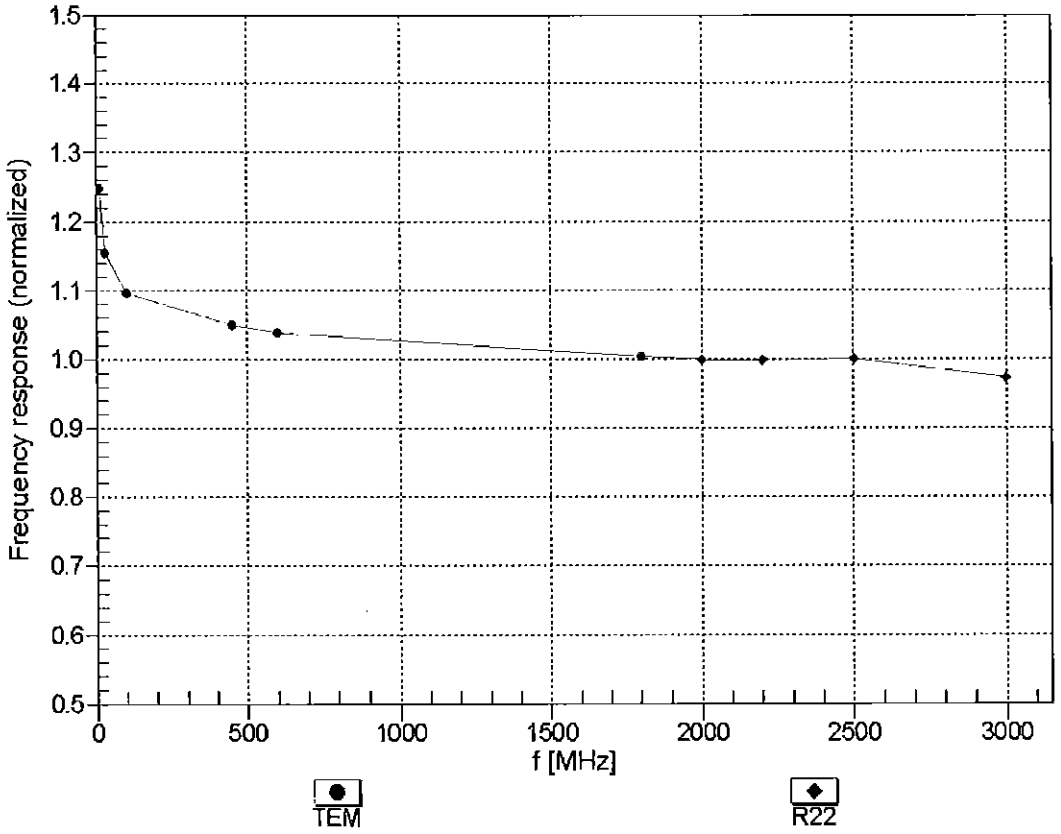
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	9.54	9.54	9.54	0.46	0.80	± 12.0 %
835	55.2	0.97	9.35	9.35	9.35	0.45	0.84	± 12.0 %
1750	53.4	1.49	7.78	7.78	7.78	0.37	0.85	± 12.0 %
1900	53.3	1.52	7.49	7.49	7.49	0.33	0.91	± 12.0 %
2300	52.9	1.81	7.37	7.37	7.37	0.42	0.80	± 12.0 %
2450	52.7	1.95	7.24	7.24	7.24	0.37	0.88	± 12.0 %
2600	52.5	2.16	6.94	6.94	6.94	0.27	0.99	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

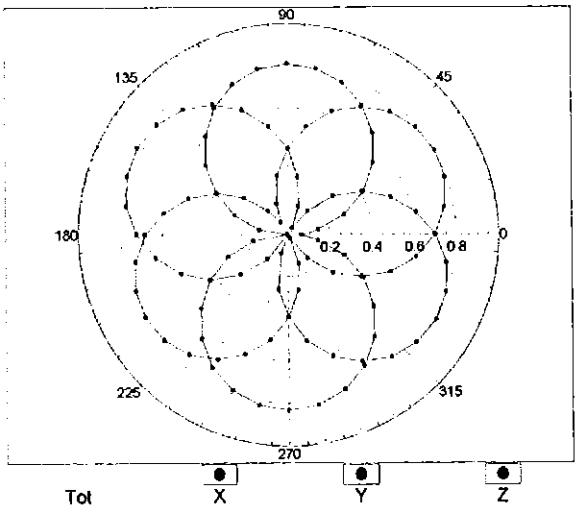
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



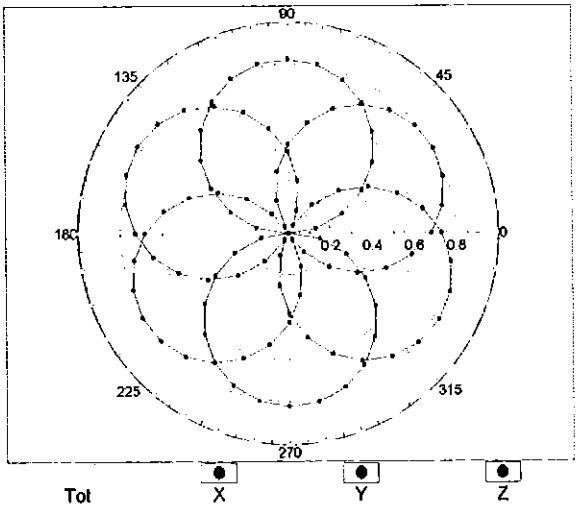
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

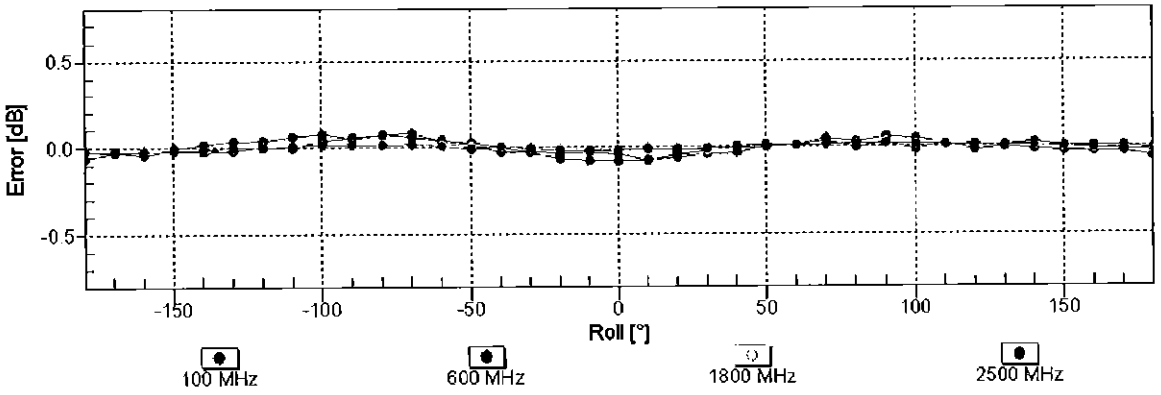
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

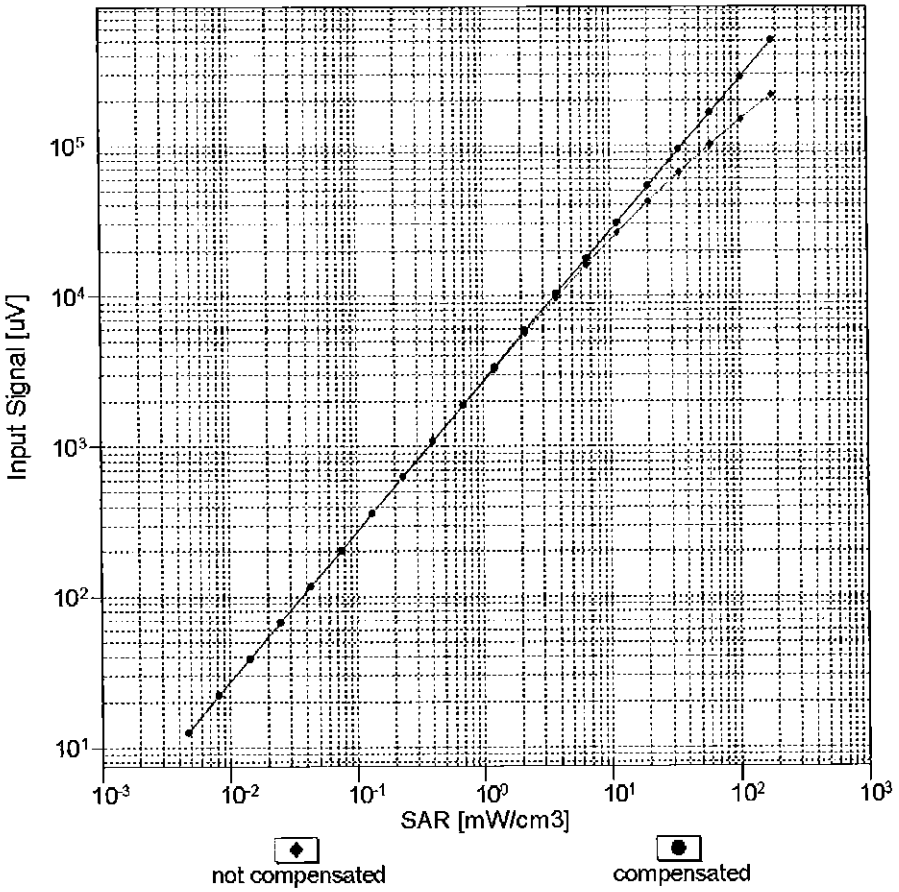


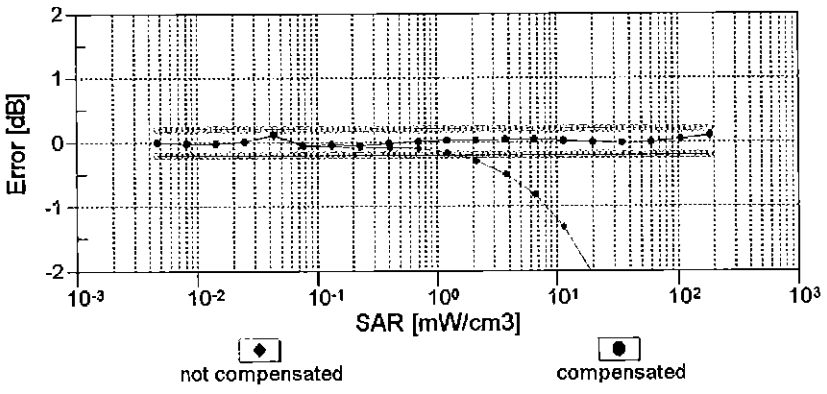


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)

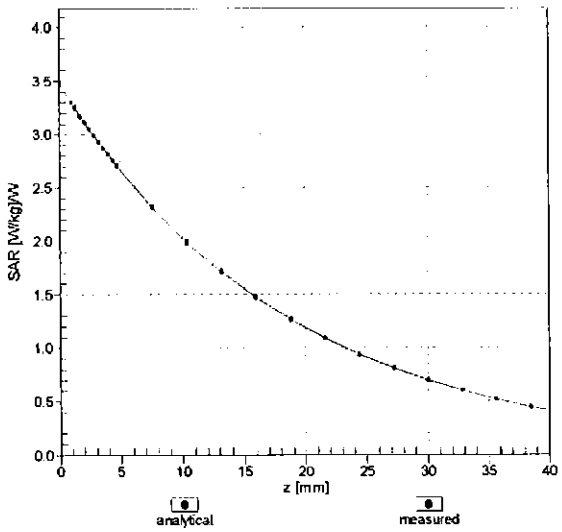




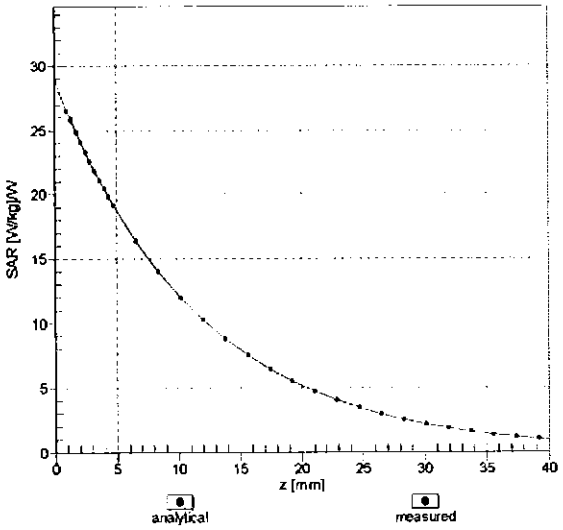
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

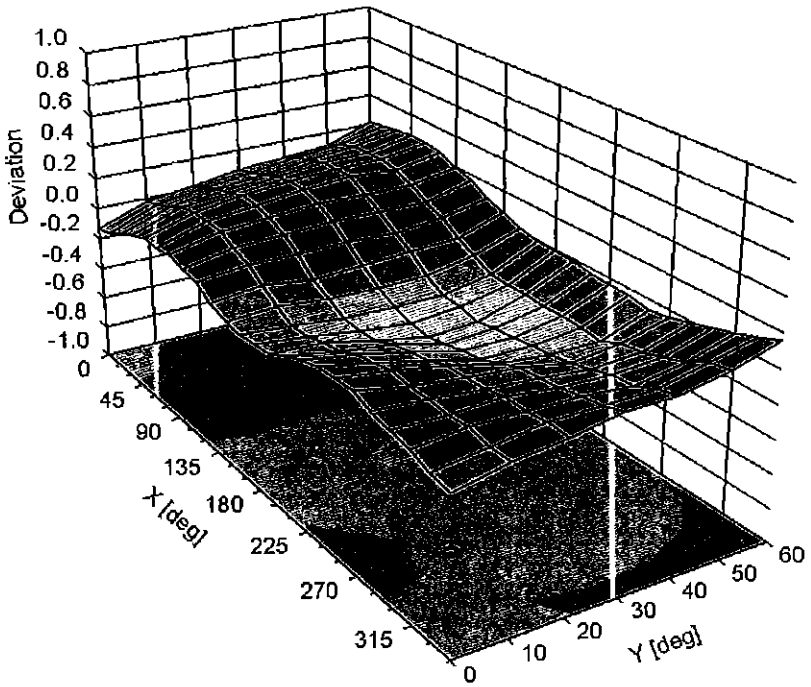


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7406

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	0.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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 **PC Test** | **Certificate No: ES3-3333_Oct15**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3333
Calibration procedure(s)	QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	October 29, 2015

BN ✓ 11/03/15

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (In house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: October 29, 2015

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, "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
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 ES3DV3

SN:3333

Manufactured: January 24, 2012
Calibrated: October 29, 2015

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.07	0.90	0.88	± 10.1 %
DCP (mV)[B]	106.8	108.5	106.8	

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	201.0	±3.5 %
		Y	0.0	0.0	1.0		187.1	
		Z	0.0	0.0	1.0		184.8	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.43	60.7	11.4	10.00	41.6	±2.2 %
		Y	4.35	67.4	13.2		35.6	
		Z	1.46	57.0	8.7		36.2	
10011-CAB	UMTS-FDD (WCDMA)	X	3.35	67.9	19.1	2.91	138.2	±0.5 %
		Y	3.48	68.6	19.2		127.5	
		Z	3.37	67.6	18.6		149.0	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.60	72.8	20.8	1.87	141.0	±0.7 %
		Y	3.68	73.3	20.8		128.0	
		Z	3.01	69.3	18.8		128.2	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.52	71.7	23.9	9.46	139.3	±3.0 %
		Y	10.94	70.4	22.9		147.1	
		Z	10.95	70.8	23.4		144.5	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	21.45	95.2	26.5	9.39	139.9	±2.5 %
		Y	9.12	82.9	21.9		142.0	
		Z	11.47	88.1	23.9		127.6	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	20.81	95.6	27.0	9.57	135.8	±2.2 %
		Y	9.78	84.4	22.7		135.3	
		Z	9.12	83.5	22.1		144.6	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	39.84	99.6	25.2	6.56	140.9	±1.9 %
		Y	35.07	100.0	25.0		128.4	
		Z	35.20	99.8	24.7		131.9	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	47.16	99.8	23.9	4.80	124.9	±2.5 %
		Y	49.75	99.6	22.8		145.4	
		Z	45.37	99.9	23.1		148.5	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	56.24	99.6	22.6	3.55	140.4	±2.7 %
		Y	56.95	99.7	21.9		129.1	
		Z	48.45	99.6	22.1		133.2	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	18.03	99.1	22.8	1.16	127.5	±1.9 %
		Y	35.17	99.6	20.7		141.1	
		Z	21.08	99.9	21.9		127.5	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.36	67.6	19.8	5.67	137.5	±1.2 %
		Y	6.29	67.4	19.6		129.9	
		Z	6.35	67.5	19.7		139.5	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.85	76.6	26.4	9.29	130.6	±2.7 %
		Y	9.58	73.7	24.8		143.0	
		Z	9.94	75.6	26.2		149.3	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.21	67.0	19.7	5.80	128.9	±1.2 %
		Y	6.16	66.9	19.5		129.2	
		Z	6.22	67.2	19.7		138.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.05	68.7	21.2	8.07	126.1	±2.5 %
		Y	10.13	69.0	21.3		146.1	
		Z	9.97	68.7	21.1		126.2	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	10.11	75.5	26.0	9.28	125.8	±3.3 %
		Y	9.06	73.2	24.7		138.2	
		Z	9.32	74.8	26.0		143.1	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.97	66.8	19.6	5.75	133.4	±1.2 %
		Y	5.92	66.7	19.5		127.0	
		Z	5.91	66.7	19.5		134.2	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.40	67.3	19.9	5.82	137.8	±1.2 %
		Y	6.31	67.1	19.6		130.7	
		Z	6.32	67.1	19.6		139.8	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.05	67.3	20.1	5.73	136.8	±1.2 %
		Y	4.89	67.0	19.9		131.1	
		Z	4.93	67.2	20.0		137.4	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	10.74	83.9	30.3	9.21	136.8	±2.7 %
		Y	7.34	74.3	25.5		125.9	
		Z	7.74	76.6	27.1		131.2	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.97	66.9	19.9	5.72	130.8	±1.2 %
		Y	4.86	66.9	19.8		128.5	
		Z	4.97	67.3	20.1		137.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.99	67.0	19.9	5.72	130.1	±1.2 %
		Y	4.88	67.0	19.9		127.6	
		Z	4.95	67.2	20.0		136.2	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.00	69.2	21.7	8.10	137.9	±2.2 %
		Y	9.75	68.7	21.2		137.5	
		Z	9.94	69.4	21.7		145.3	
10225-CAB	UMTS-FDD (HSPA+)	X	7.08	67.5	19.8	5.97	147.1	±1.4 %
		Y	7.06	67.7	19.8		142.3	
		Z	7.04	67.7	19.9		148.8	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	10.66	83.5	30.1	9.21	144.0	±3.0 %
		Y	7.43	74.7	25.7		127.6	
		Z	7.86	77.1	27.4		132.3	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	10.81	78.7	27.9	9.24	139.7	±3.0 %
		Y	8.48	72.4	24.4		130.1	
		Z	8.71	74.1	25.8		135.2	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	11.73	79.9	28.3	9.30	148.6	±3.3 %
		Y	9.11	73.2	24.8		139.0	
		Z	9.38	74.9	26.1		142.7	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.52	67.6	19.3	3.96	144.5	±0.7 %
		Y	4.67	68.3	19.6		146.0	
		Z	4.41	67.0	18.9		130.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.66	67.2	19.0	3.46	134.5	±0.5 %
		Y	3.91	68.9	19.9		133.2	
		Z	3.86	68.5	19.6		146.9	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.63	67.5	19.1	3.39	134.9	±0.5 %
		Y	3.93	69.3	20.0		136.0	
		Z	3.81	68.5	19.6		148.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.20	67.1	19.7	5.81	129.0	±1.2 %
		Y	6.20	67.0	19.6		128.0	
		Z	6.32	67.5	19.9		142.7	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.76	67.6	20.0	6.06	134.7	±1.4 %
		Y	6.75	67.5	19.9		133.5	
		Z	6.90	68.1	20.3		149.2	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.30	69.7	22.1	8.37	140.1	±2.5 %
		Y	10.05	69.0	21.5		141.2	
		Z	9.94	69.0	21.7		126.3	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.80	68.5	19.0	3.76	129.3	±0.5 %
		Y	5.30	71.1	20.2		148.4	
		Z	5.10	70.4	19.9		135.2	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.77	68.8	19.2	3.77	127.3	±0.7 %
		Y	5.35	71.7	20.5		145.4	
		Z	5.03	70.6	20.1		133.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.77	69.7	19.7	1.54	147.0	±0.7 %
		Y	3.73	75.4	22.2		143.7	
		Z	3.25	72.2	20.7		133.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.11	69.4	21.8	8.23	144.7	±2.5 %
		Y	9.86	68.8	21.4		139.3	
		Z	9.72	68.6	21.3		126.0	

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 7 and 8).
[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: ES3DV3 - SN:3333

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)
750	41.9	0.89	6.46	6.46	6.46	0.75	1.22	± 12.0 %
835	41.5	0.90	6.16	6.16	6.16	0.36	1.67	± 12.0 %
1750	40.1	1.37	5.21	5.21	5.21	0.80	1.19	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.73	1.25	± 12.0 %
2300	39.5	1.67	4.73	4.73	4.73	0.60	1.43	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.80	1.28	± 12.0 %
2600	39.0	1.96	4.39	4.39	4.39	0.80	1.29	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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: ES3DV3 - SN:3333

Calibration Parameter Determined in Body Tissue Simulating Media

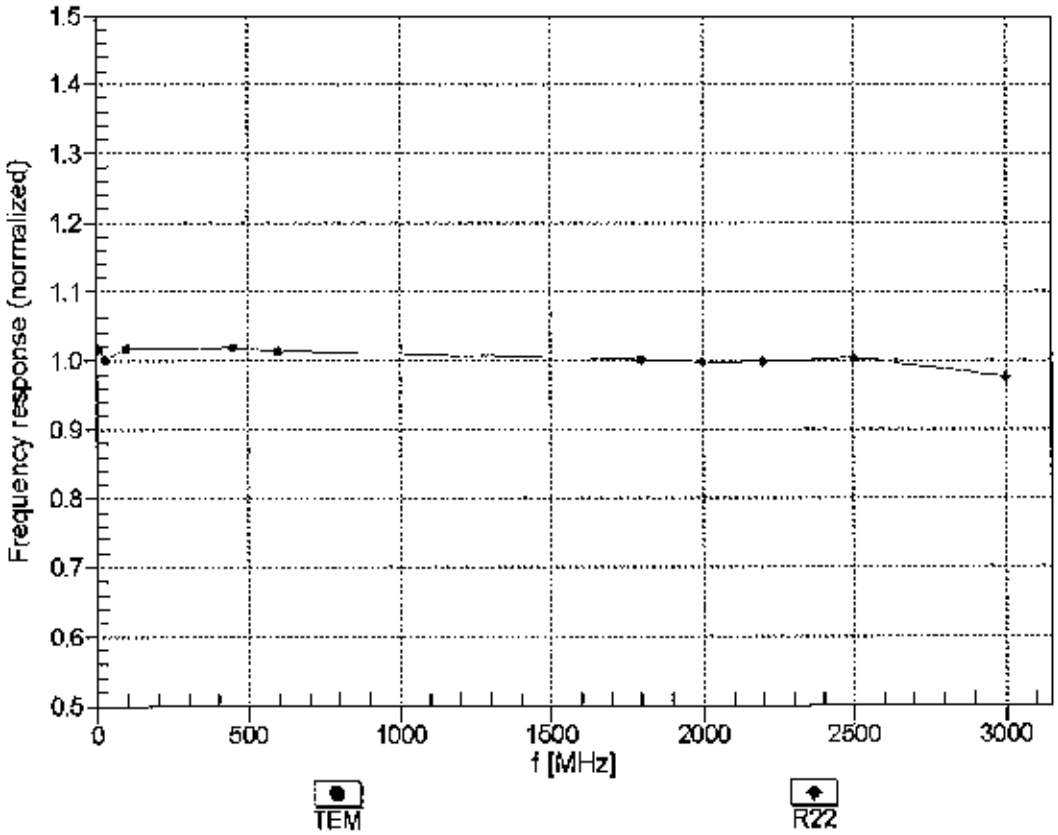
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	6.31	6.31	6.31	0.70	1.26	± 12.0 %
835	55.2	0.97	6.25	6.25	6.25	0.47	1.54	± 12.0 %
1750	53.4	1.49	4.90	4.90	4.90	0.49	1.63	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.54	1.49	± 12.0 %
2300	52.9	1.81	4.51	4.51	4.51	0.80	1.15	± 12.0 %
2450	52.7	1.95	4.34	4.34	4.34	0.80	1.15	± 12.0 %
2600	52.5	2.16	4.23	4.23	4.23	0.80	1.03	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

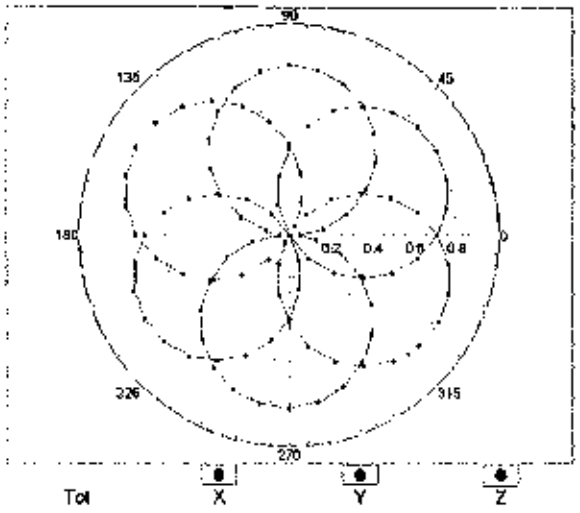
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



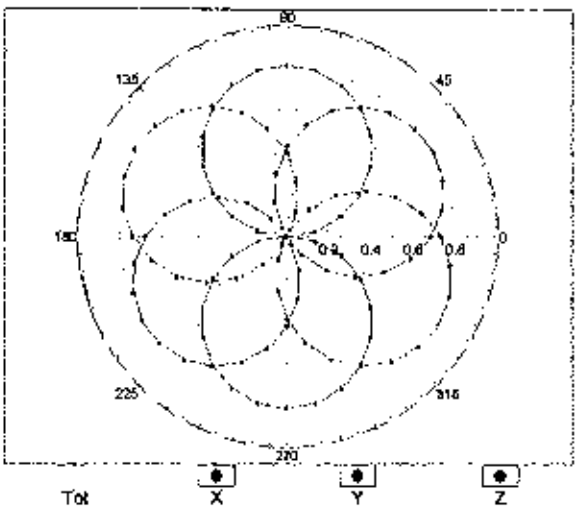
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

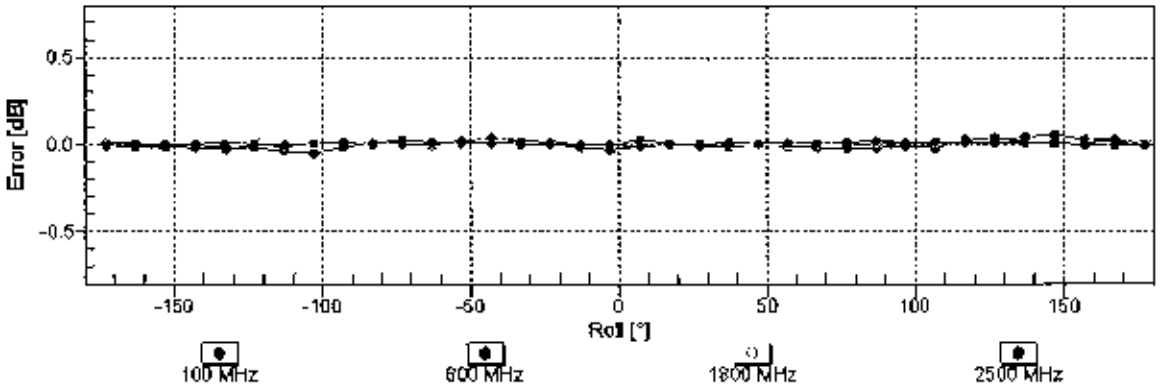
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



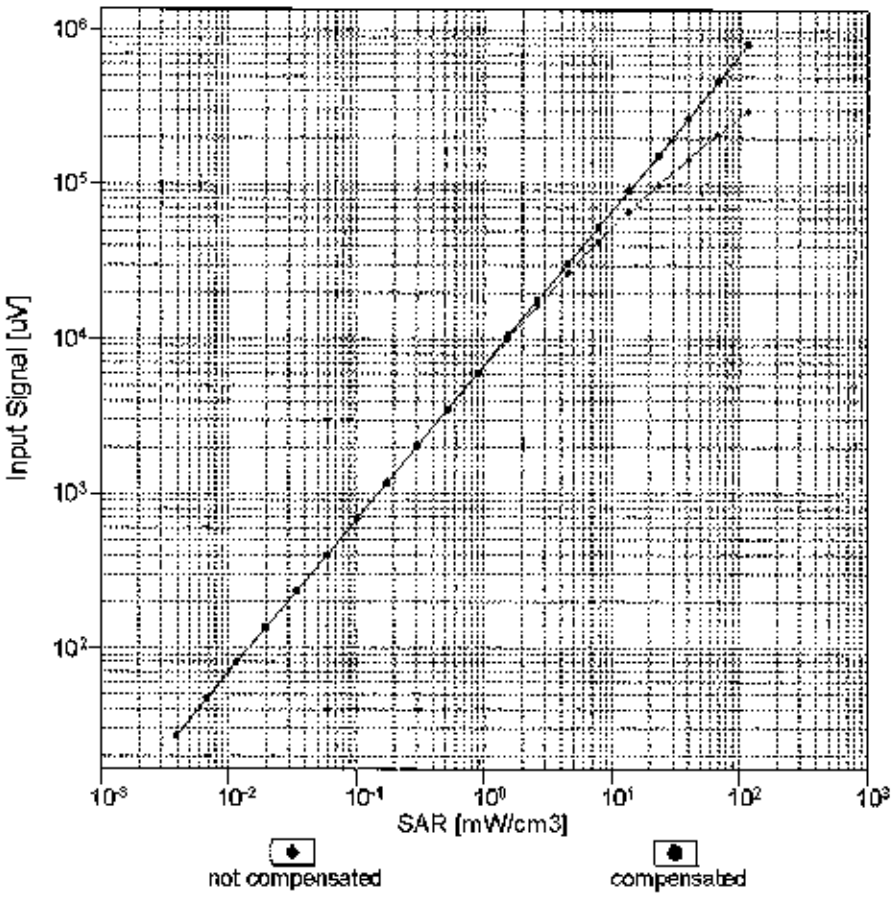
f=1800 MHz,R22

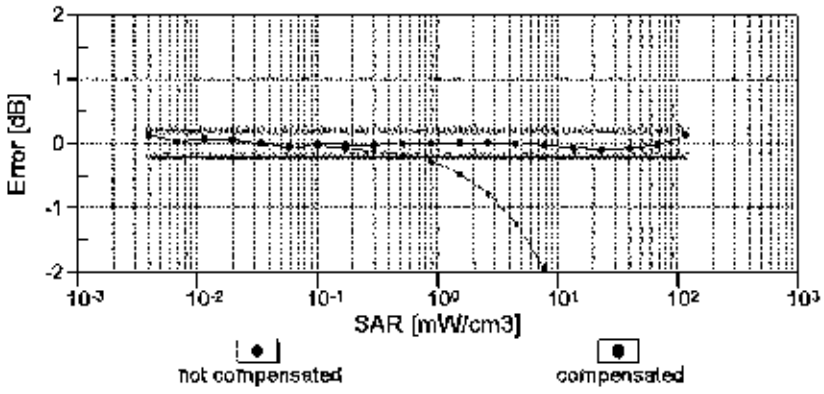




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

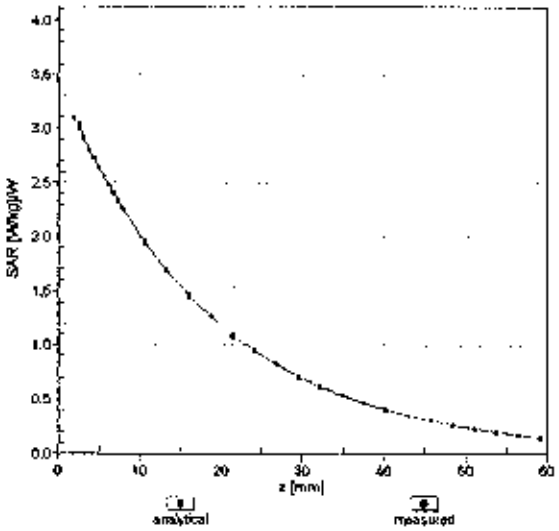




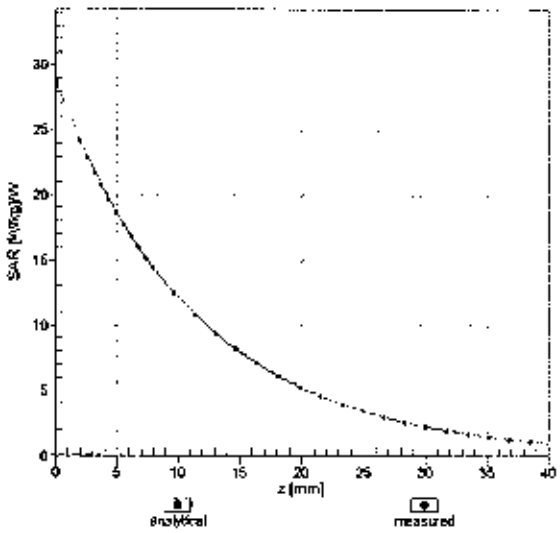
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

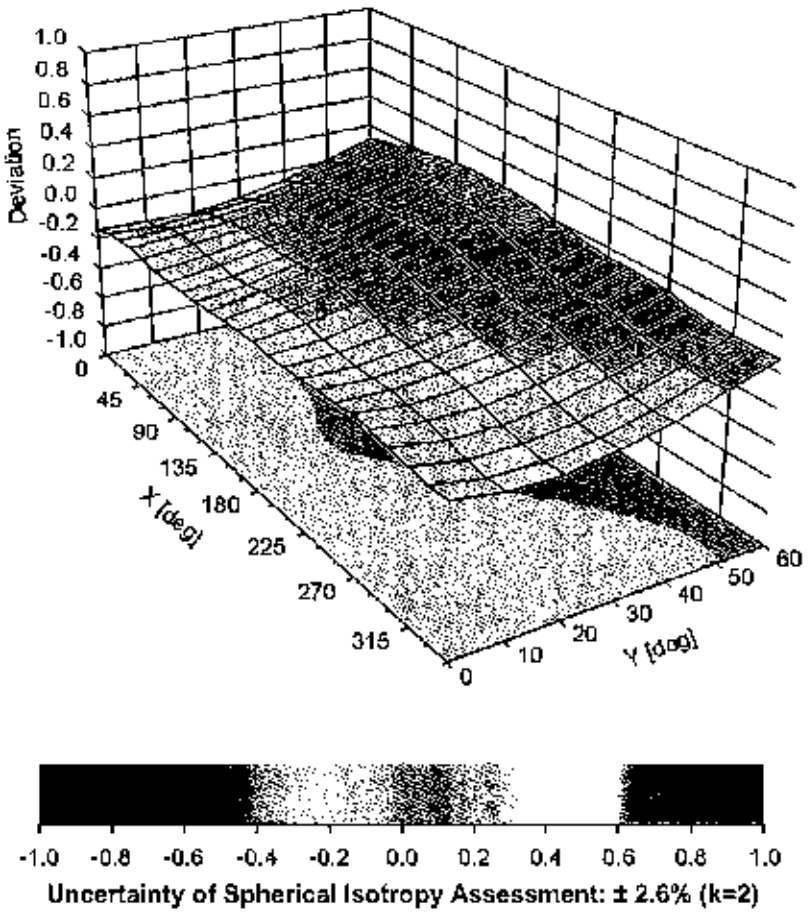


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-32.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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 **PC Test** **Certificate No: EX3-7357_Apr16**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7357
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	April 19, 2016

BN 04/26/16

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (No. 217-02285/02284)	In house check: Jun-16
Power sensor E4412A	SN: MY41498087	06-Apr-16 (No. 217-02285)	In house check: Jun-16
Power sensor E4412A	SN: 000110210	06-Apr-16 (No. 217-02284)	In house check: Jun-16
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Jun-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 21, 2016

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
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

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, "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
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:7357

Manufactured: February 5, 2015
Calibrated: April 19, 2016

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7357

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.41	0.49	0.41	± 10.1 %
DCP (mV)[B]	100.8	97.2	96.9	

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	153.4	±3.5 %
		Y	0.0	0.0	1.0		128.2	
		Z	0.0	0.0	1.0		136.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	0.91	56.3	8.7	10.00	47.8	±0.9 %
		Y	4.06	72.5	15.7		44.9	
		Z	1.42	61.4	10.6		43.6	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.02	67.8	20.9	8.68	112.1	±2.7 %
		Y	10.67	69.9	22.4		141.6	
		Z	10.36	68.8	21.5		139.7	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.12	68.1	20.6	8.07	121.4	±2.2 %
		Y	10.75	69.9	21.9		149.3	
		Z	10.43	68.9	21.1		147.5	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.77	67.9	20.6	8.10	116.1	±2.2 %
		Y	10.28	69.5	21.8		141.5	
		Z	10.05	68.6	21.0		138.3	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.02	68.1	20.9	8.37	116.5	±2.2 %
		Y	10.56	69.7	22.1		142.1	
		Z	10.23	68.6	21.2		137.4	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	10.73	68.6	21.1	8.60	123.1	±2.5 %
		Y	10.37	67.9	21.0		99.7	
		Z	11.03	69.3	21.6		147.8	
10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.70	68.5	20.9	8.53	121.8	±2.2 %
		Y	10.46	68.2	21.0		99.9	
		Z	10.94	69.1	21.3		146.0	

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:7357

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)
5250	35.9	4.71	5.10	5.10	5.10	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.41	4.41	4.41	0.50	1.80	± 13.1 %
5750	35.4	5.22	4.65	4.65	4.65	0.50	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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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:7357

Calibration Parameter Determined in Body Tissue Simulating Media

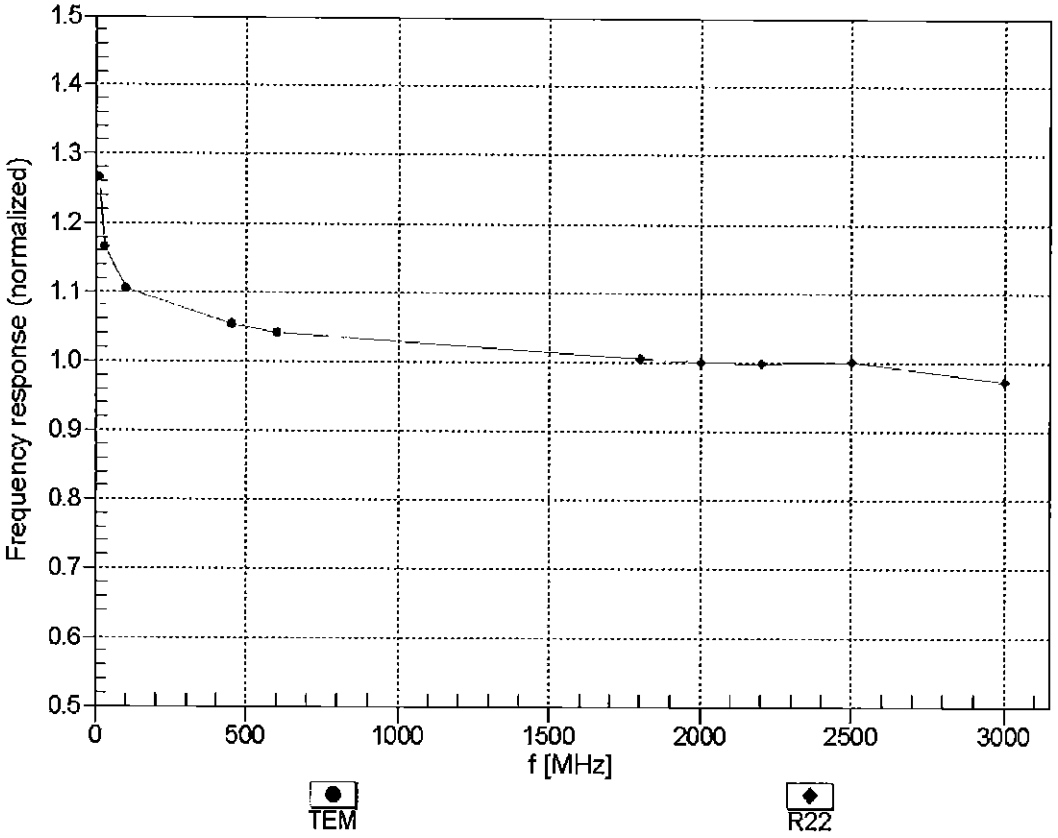
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	9.90	9.90	9.90	0.53	0.80	± 12.0 %
835	55.2	0.97	9.82	9.82	9.82	0.46	0.80	± 12.0 %
1750	53.4	1.49	8.06	8.06	8.06	0.39	0.80	± 12.0 %
1900	53.3	1.52	7.84	7.84	7.84	0.40	0.80	± 12.0 %
2300	52.9	1.81	7.20	7.20	7.20	0.38	0.86	± 12.0 %
2450	52.7	1.95	7.14	7.14	7.14	0.30	0.90	± 12.0 %
2600	52.5	2.16	6.82	6.82	6.82	0.29	0.95	± 12.0 %
5250	48.9	5.36	4.28	4.28	4.28	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.63	3.63	3.63	0.60	1.90	± 13.1 %
5750	48.3	5.94	3.77	3.77	3.77	0.60	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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

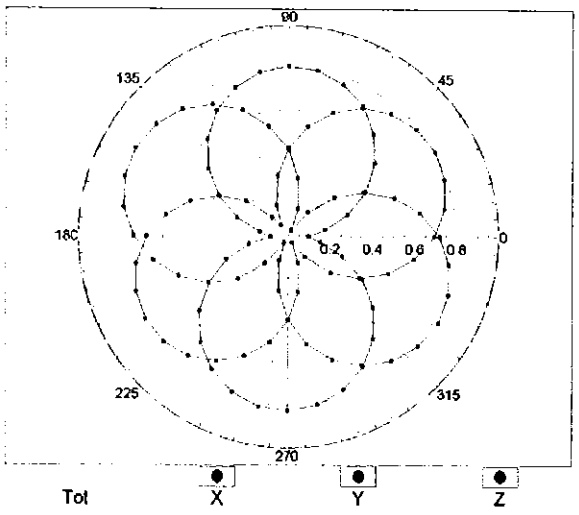
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



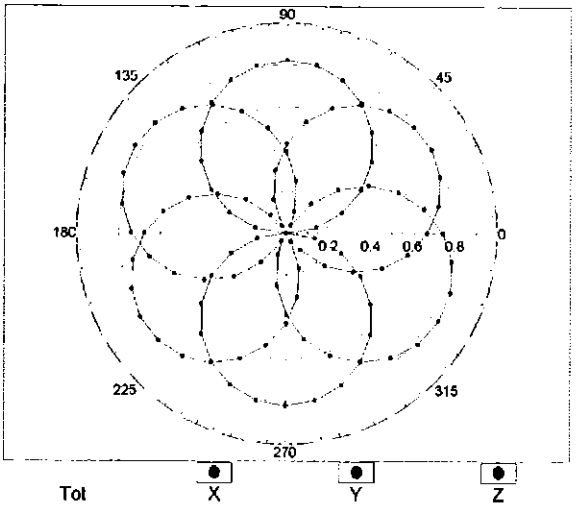
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

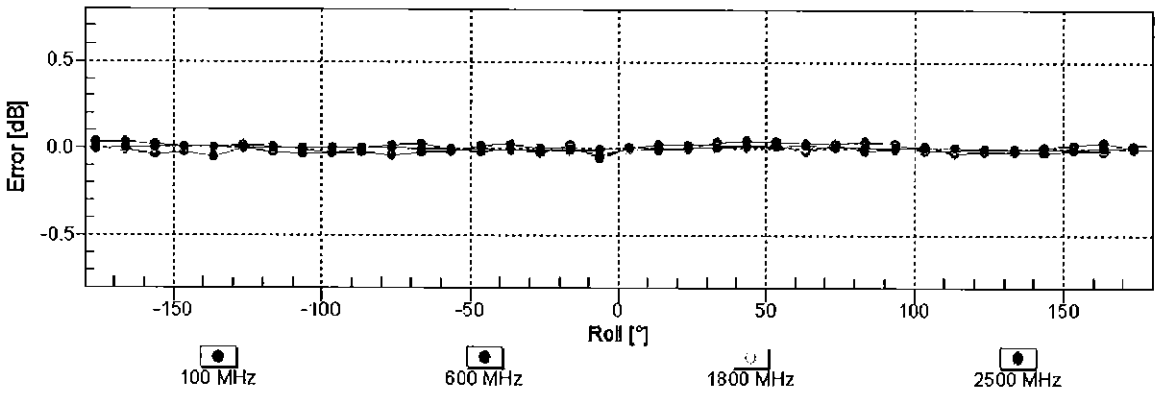
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

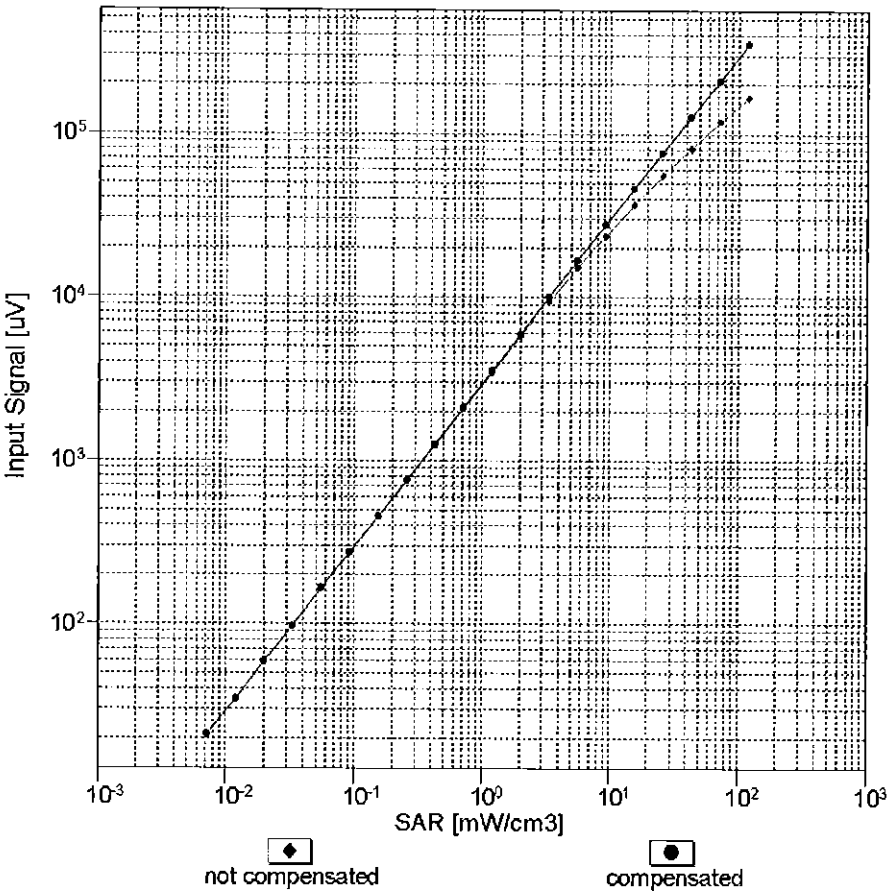


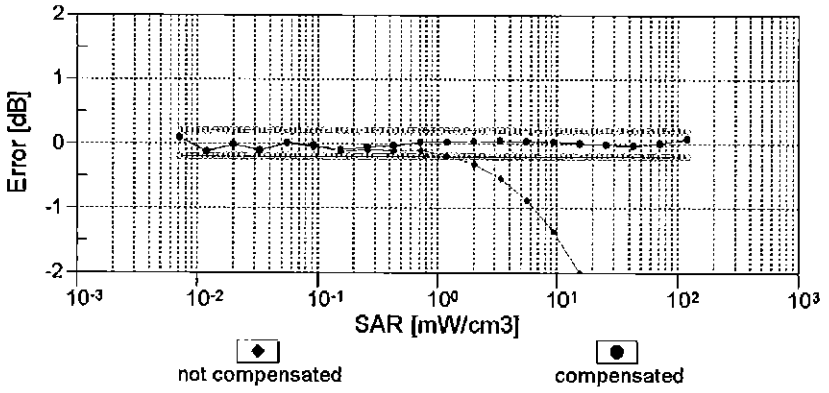


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

(TEM cell , f_{eval}= 1900 MHz)

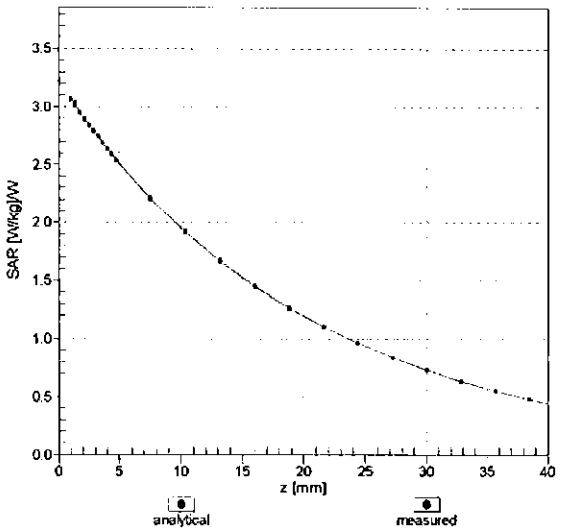




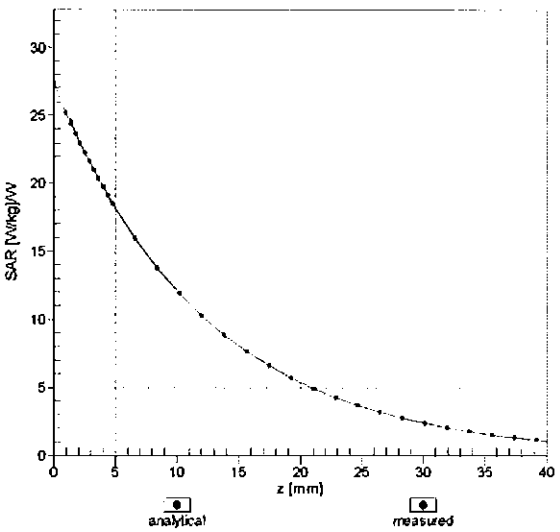
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (M_convF)

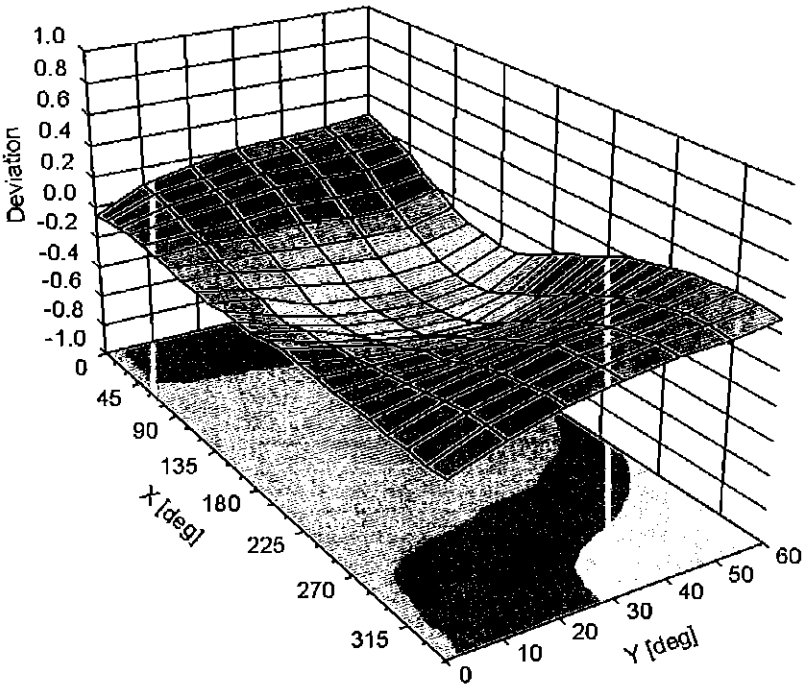


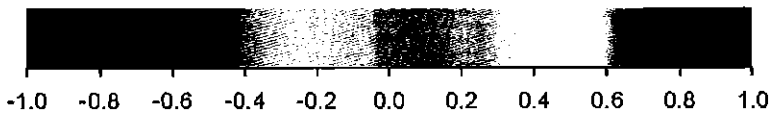
f = 1900 MHz,WGLS R22 (M_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7357

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	13.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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 PC Test

Certificate No: ES3-3334_Nov15

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3334

Calibration procedure(s) QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

BN 11/24/15

Calibration date: November 17, 2015

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: November 17, 2015

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
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**

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, "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
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 ES3DV3

SN:3334

Manufactured: January 24, 2012
Calibrated: November 17, 2015

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.03	1.03	0.99	± 10.1 %
DCP (mV)[B]	107.6	105.3	107.9	

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	192.1	±2.7 %
		Y	0.0	0.0	1.0		183.6	
		Z	0.0	0.0	1.0		183.3	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.27	60.1	10.2	10.00	38.6	±1.4 %
		Y	1.99	59.3	10.2		38.4	
		Z	5.38	67.8	12.9		37.2	
10011-CAB	UMTS-FDD (WCDMA)	X	3.40	68.0	18.9	2.91	131.7	±0.5 %
		Y	3.27	67.0	18.2		130.2	
		Z	3.41	68.3	19.1		148.5	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.93	68.9	18.7	1.87	132.9	±0.7 %
		Y	3.12	69.6	18.8		130.2	
		Z	3.24	71.1	19.7		128.2	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.90	70.3	23.0	9.46	133.5	±3.3 %
		Y	10.53	69.0	22.1		124.6	
		Z	11.14	71.2	23.6		147.1	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	15.05	91.0	24.4	9.39	139.5	±1.9 %
		Y	10.11	85.5	23.3		131.9	
		Z	11.84	87.6	23.4		130.0	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	10.42	84.9	22.6	9.57	131.5	±3.0 %
		Y	13.29	89.7	24.6		141.1	
		Z	14.17	90.2	24.2		148.7	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	11.26	83.1	19.4	6.56	140.7	±1.9 %
		Y	26.29	95.5	23.8		134.7	
		Z	16.82	88.9	21.3		131.6	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	64.74	99.9	22.2	4.80	131.5	±2.2 %
		Y	56.71	99.8	22.7		124.7	
		Z	63.10	99.9	22.2		124.1	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	62.11	99.6	21.6	3.55	146.1	±1.9 %
		Y	77.61	99.8	21.2		132.0	
		Z	72.33	99.7	21.2		133.3	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	96.24	92.7	15.9	1.16	137.2	±1.7 %
		Y	95.69	93.1	16.2		129.5	
		Z	98.67	94.1	16.4		149.7	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.14	66.8	19.2	5.67	126.2	±1.7 %
		Y	6.21	66.8	19.1		139.9	
		Z	6.41	67.9	19.9		145.9	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.07	75.4	25.8	9.29	138.2	±2.5 %
		Y	9.54	73.3	24.5		130.5	
		Z	9.64	75.1	25.8		130.6	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.34	67.6	19.8	5.80	149.5	±1.4 %
		Y	6.13	66.6	19.1		132.1	
		Z	6.19	67.2	19.7		137.8	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.13	68.9	21.2	8.07	138.8	±2.7 %
		Y	10.16	68.9	21.1		149.6	
		Z	9.96	68.7	21.1		127.1	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.42	74.4	25.5	9.28	132.9	±3.0 %
		Y	9.50	74.0	25.0		143.7	
		Z	9.01	73.4	25.0		126.5	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.03	67.1	19.6	5.75	145.5	±1.4 %
		Y	5.81	66.0	18.9		128.9	
		Z	5.91	66.8	19.5		135.1	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.19	66.5	19.2	5.82	126.7	±1.4 %
		Y	6.20	66.4	19.0		132.8	
		Z	6.39	67.5	19.8		141.1	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.05	67.6	20.0	5.73	146.8	±1.4 %
		Y	4.82	66.2	19.2		132.2	
		Z	4.96	67.4	20.0		143.8	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.88	79.7	28.3	9.21	147.9	±3.0 %
		Y	8.00	76.1	26.2		138.9	
		Z	8.39	78.5	27.8		141.5	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.99	67.3	19.9	5.72	140.7	±1.2 %
		Y	4.80	66.2	19.1		131.3	
		Z	4.90	67.1	19.8		136.1	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.99	67.3	19.9	5.72	145.4	±1.4 %
		Y	4.81	66.2	19.2		130.9	
		Z	4.89	67.1	19.8		136.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.78	68.8	21.3	8.10	131.0	±2.5 %
		Y	9.73	68.4	21.0		140.7	
		Z	9.94	69.4	21.6		146.6	
10225-CAB	UMTS-FDD (HSPA+)	X	6.88	66.9	19.3	5.97	133.9	±1.7 %
		Y	6.96	67.1	19.3		144.8	
		Z	6.71	66.6	19.2		125.7	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	9.00	80.2	28.5	9.21	148.2	±3.0 %
		Y	7.73	75.1	25.7		131.6	
		Z	8.27	78.2	27.7		136.1	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.59	76.3	26.7	9.24	144.1	±2.7 %
		Y	8.74	72.9	24.5		133.4	
		Z	9.14	75.2	26.1		136.9	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.25	73.9	25.3	9.30	124.8	±3.0 %
		Y	9.40	73.7	24.9		142.1	
		Z	9.86	76.1	26.5		145.3	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.38	66.9	18.7	3.96	133.3	±0.9 %
		Y	4.44	66.9	18.6		148.2	
		Z	4.30	66.7	18.6		128.9	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.68	67.3	18.7	3.46	145.8	±0.7 %
		Y	3.58	66.6	18.2		136.3	
		Z	3.62	67.3	18.8		139.4	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.73	68.0	19.1	3.39	147.5	±0.7 %
		Y	3.55	66.7	18.3		138.5	
		Z	3.60	67.6	18.9		143.0	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.30	67.4	19.7	5.81	141.4	±1.2 %
		Y	6.11	66.5	19.1		130.3	
		Z	6.17	67.0	19.5		138.8	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.86	68.0	20.1	6.06	147.0	±1.7 %
		Y	6.68	67.1	19.5		136.0	
		Z	6.75	67.7	20.0		141.6	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.97	68.8	21.4	8.37	126.9	±2.7 %
		Y	10.07	68.9	21.4		143.6	
		Z	10.21	69.7	22.0		147.4	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.77	68.5	18.8	3.76	134.9	±0.5 %
		Y	4.69	68.1	18.5		126.7	
		Z	4.74	68.8	18.9		129.4	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.72	68.7	18.8	3.77	132.9	±0.7 %
		Y	4.78	68.9	18.9		147.4	
		Z	4.63	68.7	18.9		127.1	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.72	68.9	18.8	1.54	131.9	±0.5 %
		Y	2.65	68.0	18.1		145.9	
		Z	2.72	69.3	19.0		127.3	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.81	68.6	21.2	8.23	131.6	±2.7 %
		Y	9.90	68.7	21.2		144.1	
		Z	9.97	69.3	21.7		146.0	

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 7 and 8).
[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: ES3DV3 - SN:3334

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)
6	55.5	0.75	6.13	6.13	6.13	0.00	1.00	± 13.3 %
13	55.5	0.75	5.76	5.76	5.76	0.00	1.00	± 13.3 %
750	41.9	0.89	6.56	6.56	6.56	0.24	2.36	± 12.0 %
835	41.5	0.90	6.37	6.37	6.37	0.37	1.70	± 12.0 %
1750	40.1	1.37	5.39	5.39	5.39	0.58	1.32	± 12.0 %
1900	40.0	1.40	5.18	5.18	5.18	0.77	1.20	± 12.0 %
2300	39.5	1.67	4.85	4.85	4.85	0.71	1.28	± 12.0 %
2450	39.2	1.80	4.58	4.58	4.58	0.79	1.17	± 12.0 %
2600	39.0	1.96	4.46	4.46	4.46	0.80	1.26	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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: ES3DV3 - SN:3334

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)
750	55.5	0.96	6.37	6.37	6.37	0.74	1.22	± 12.0 %
835	55.2	0.97	6.24	6.24	6.24	0.31	1.94	± 12.0 %
1750	53.4	1.49	5.03	5.03	5.03	0.50	1.57	± 12.0 %
1900	53.3	1.52	4.84	4.84	4.84	0.50	1.58	± 12.0 %
2300	52.9	1.81	4.61	4.61	4.61	0.74	1.23	± 12.0 %
2450	52.7	1.95	4.45	4.45	4.45	0.74	1.20	± 12.0 %
2600	52.5	2.16	4.29	4.29	4.29	0.80	1.20	± 12.0 %

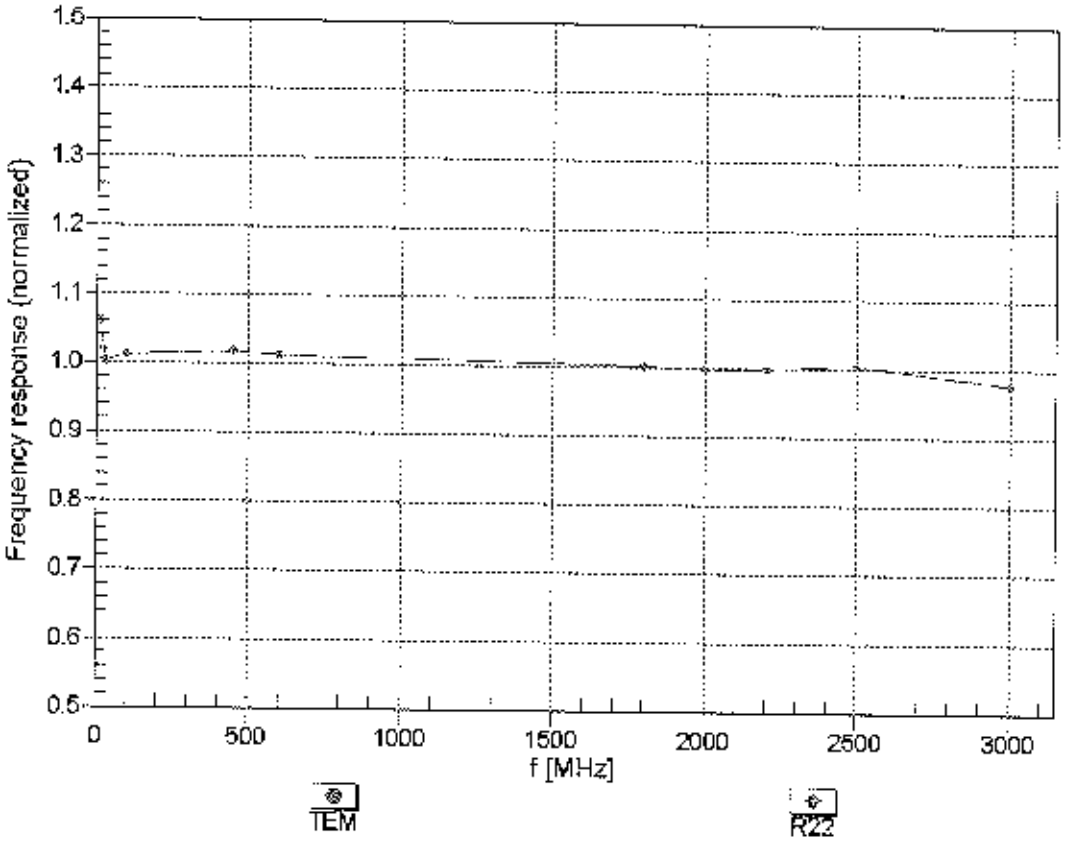
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

Frequency Response of E-Field

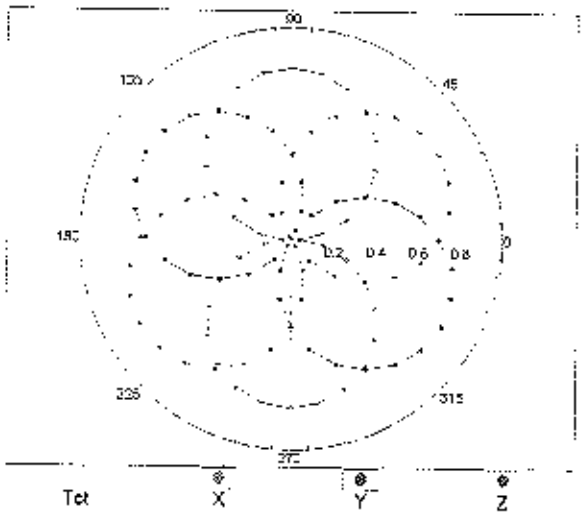
(TEM-Cell:ifi110 EXX, Waveguide: R22)



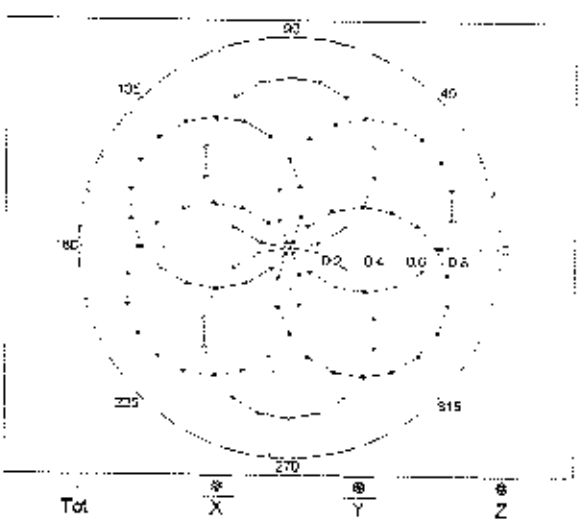
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

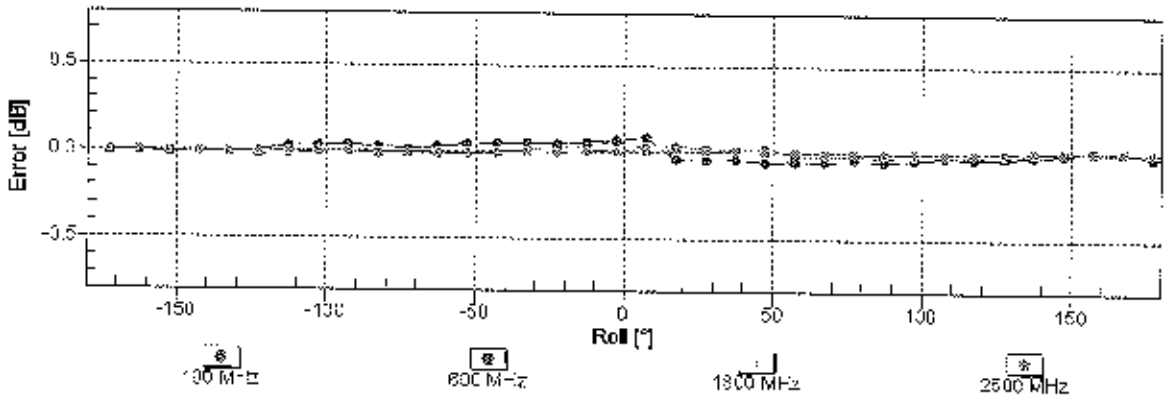
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

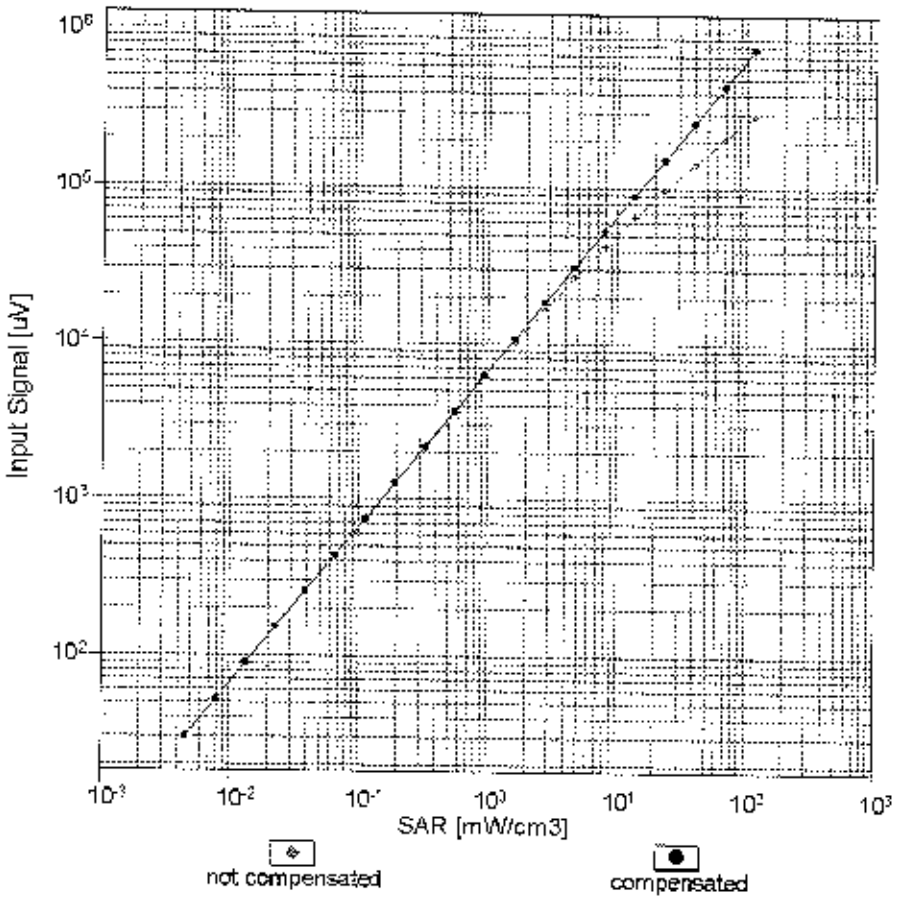


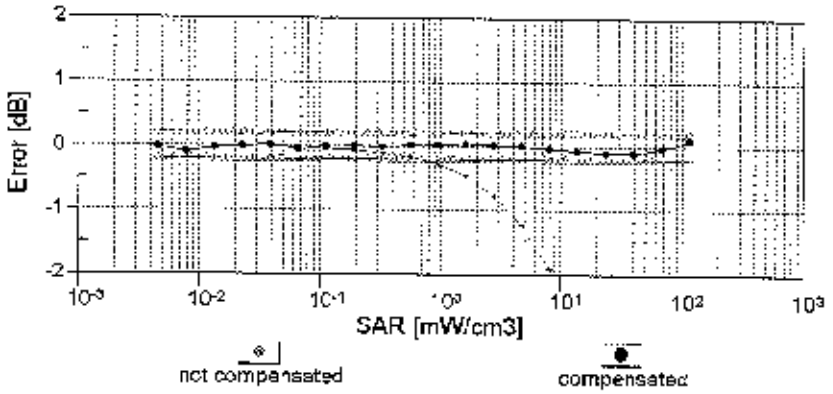


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

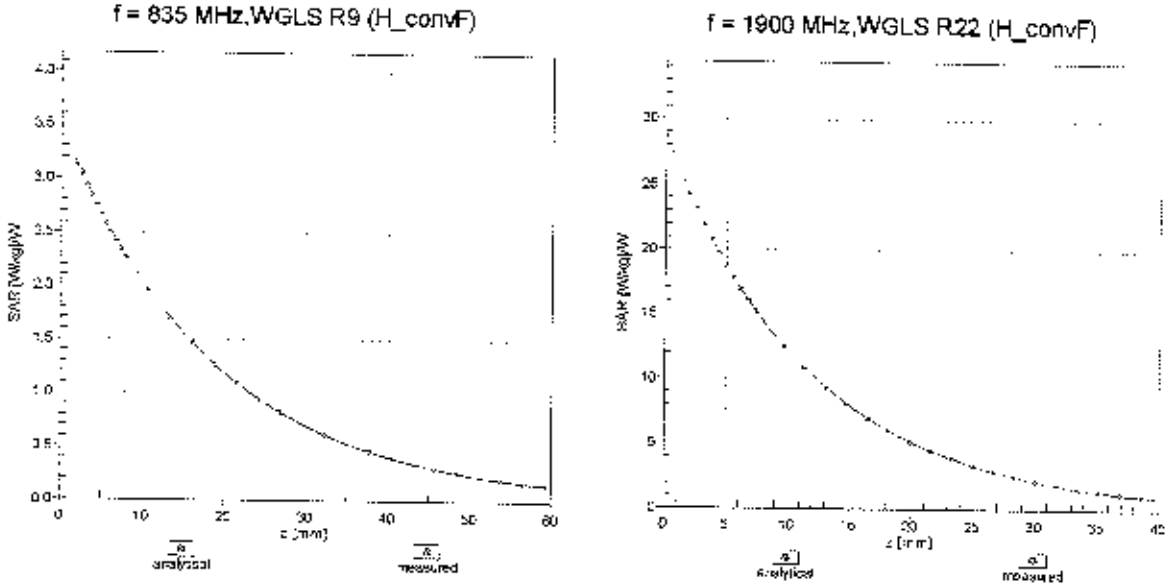
(TEM cell , f_{eval}= 1900 MHz)





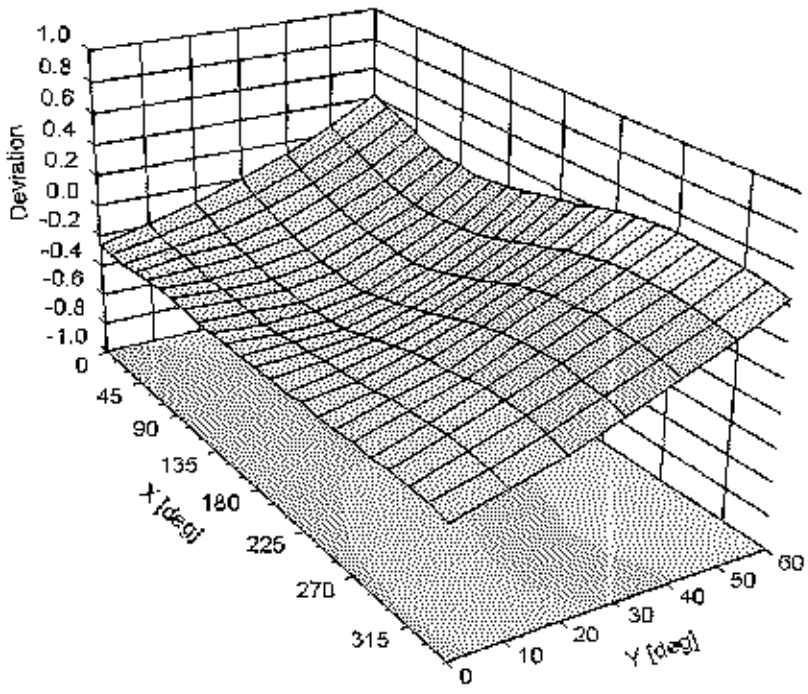
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

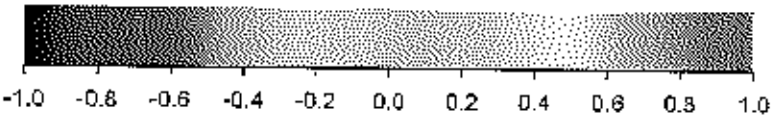
Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	17.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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
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 PC Test

Certificate No: EX3-3914_Feb16

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3914

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

BN
03/01/2016

Calibration date: February 22, 2016

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: February 22, 2016

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., $\vartheta = 0$ 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, "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
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 $\vartheta = 0$ ($f \le 900$ 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 $f \le 800$ 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:3914

Manufactured: December 18, 2012
Calibrated: February 22, 2016

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.48	0.42	0.46	± 10.1 %
DCP (mV)[B]	100.1	102.6	97.6	

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	137.4	±2.7 %
		Y	0.0	0.0	1.0		139.7	
		Z	0.0	0.0	1.0		133.7	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	4.02	69.7	14.2	10.00	41.0	±0.9 %
		Y	2.42	64.8	12.4		41.8	
		Z	2.11	63.9	12.8		44.9	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.26	68.5	21.3	8.68	127.9	±3.3 %
		Y	10.16	68.6	21.4		127.8	
		Z	10.42	68.8	21.4		144.6	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.15	68.2	20.7	8.07	129.4	±3.3 %
		Y	10.18	68.5	20.9		131.7	
		Z	10.42	68.8	20.9		148.3	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.13	68.8	21.1	8.10	146.4	±2.7 %
		Y	9.80	68.3	20.9		126.3	
		Z	9.98	68.3	20.8		139.8	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.33	68.8	21.3	8.37	145.0	±2.7 %
		Y	10.13	68.7	21.3		132.0	
		Z	10.21	68.5	21.0		140.2	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	10.67	68.4	21.1	8.60	125.8	±3.3 %
		Y	10.92	69.3	21.6		140.7	
		Z	10.94	69.0	21.3		148.7	
10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.64	68.4	20.8	8.53	125.5	±3.3 %
		Y	11.11	69.7	21.6		142.1	
		Z	10.93	69.0	21.1		149.2	

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:3914

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)
5250	35.9	4.71	5.07	5.07	5.07	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.66	4.66	4.66	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.74	4.74	4.74	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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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:3914

Calibration Parameter Determined in Body Tissue Simulating Media

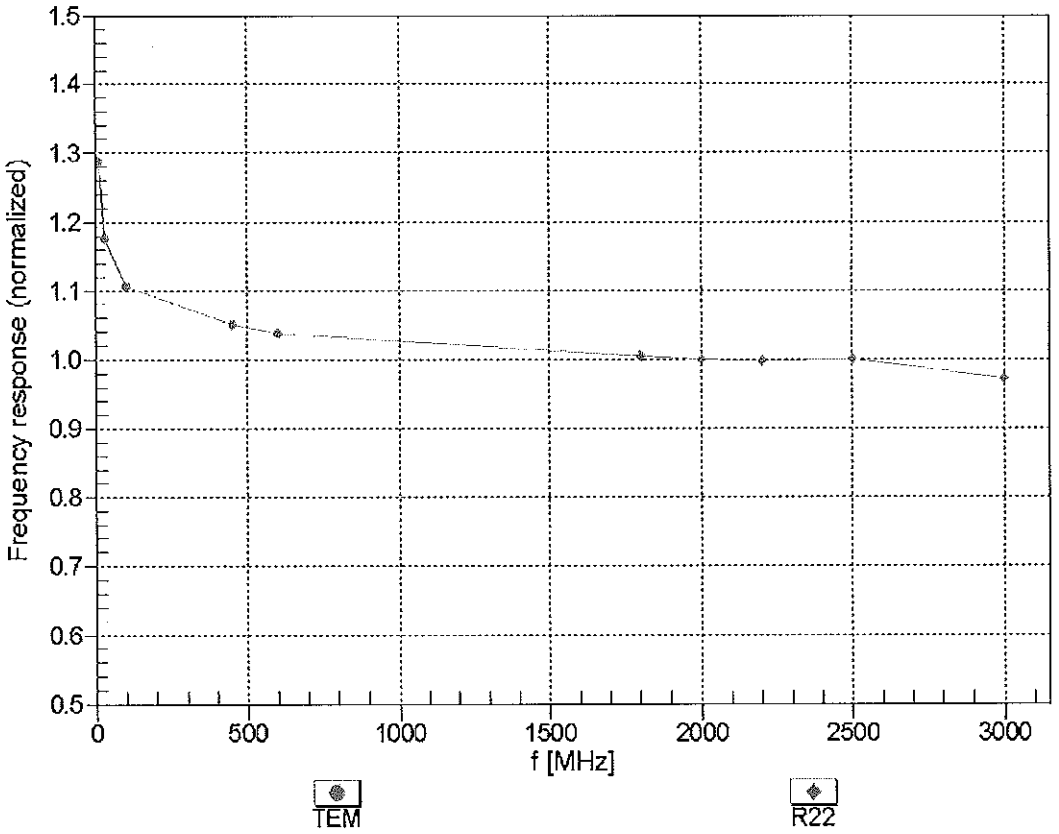
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	9.57	9.57	9.57	0.47	0.85	± 12.0 %
835	55.2	0.97	9.44	9.44	9.44	0.47	0.85	± 12.0 %
1750	53.4	1.49	7.82	7.82	7.82	0.42	0.83	± 12.0 %
1900	53.3	1.52	7.50	7.50	7.50	0.45	0.80	± 12.0 %
2300	52.9	1.81	7.27	7.27	7.27	0.48	0.80	± 12.0 %
2450	52.7	1.95	7.22	7.22	7.22	0.46	0.80	± 12.0 %
2600	52.5	2.16	6.90	6.90	6.90	0.32	0.99	± 12.0 %
5250	48.9	5.36	4.32	4.32	4.32	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.63	3.63	3.63	0.60	1.90	± 13.1 %
5750	48.3	5.94	3.86	3.86	3.86	0.60	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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

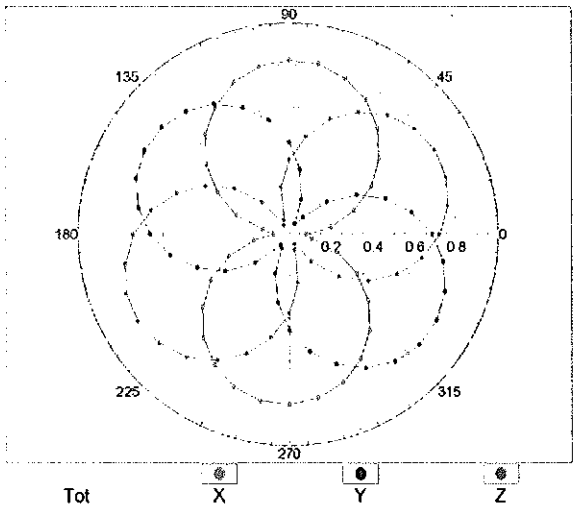
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



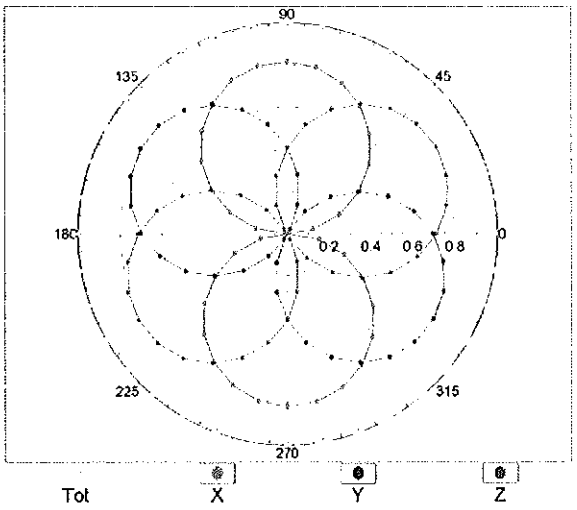
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

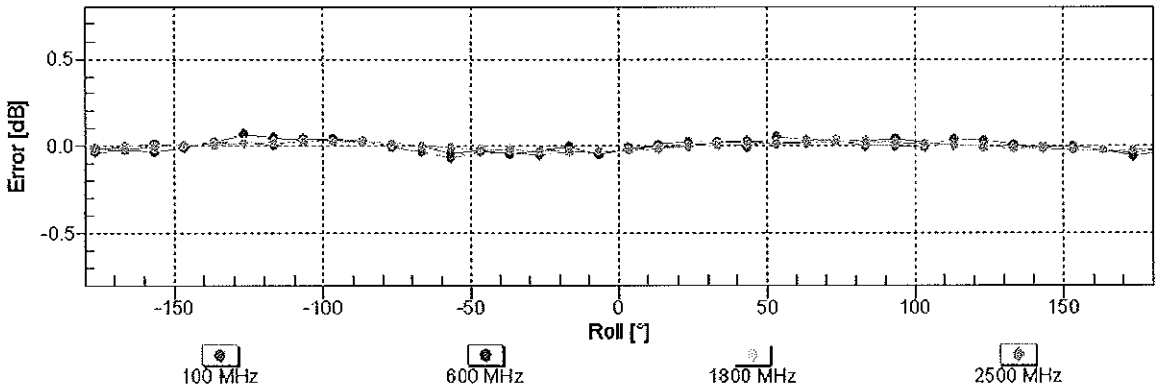
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

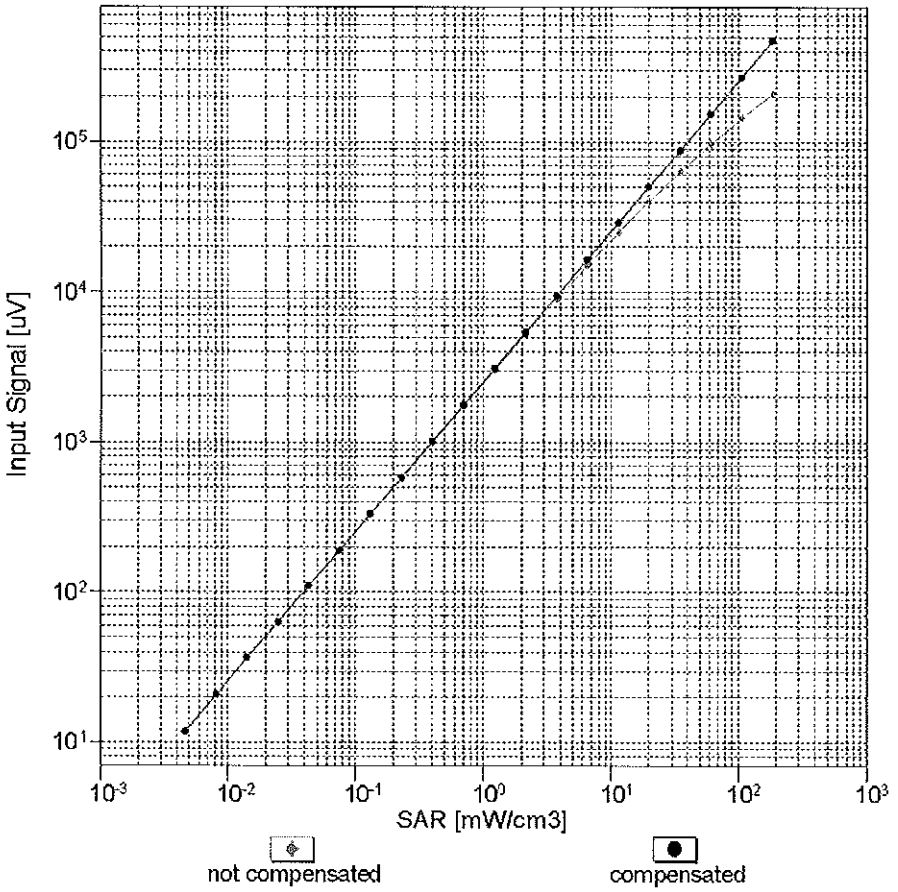


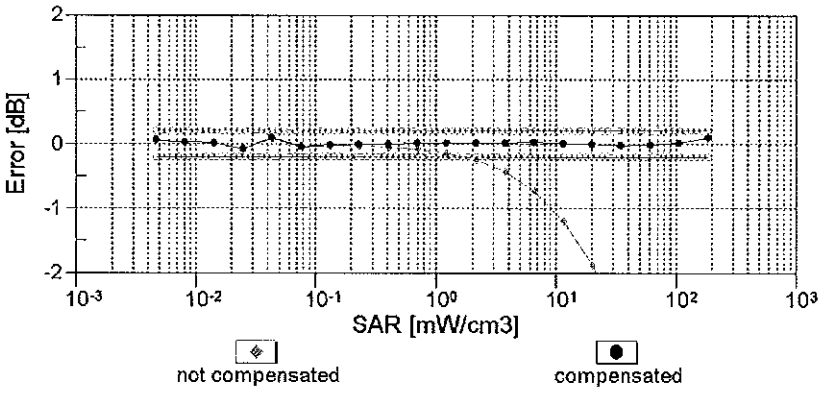


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)

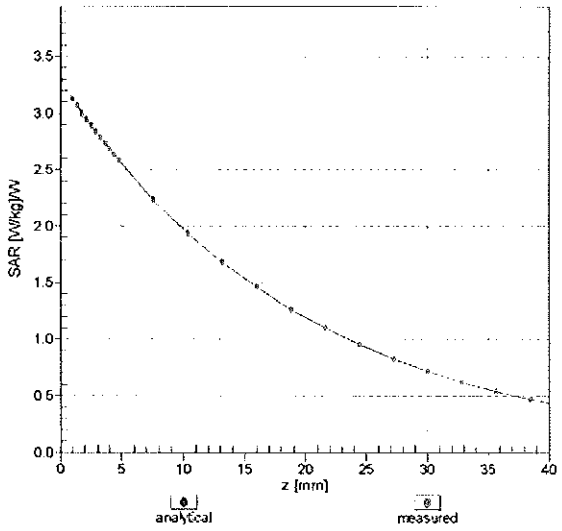




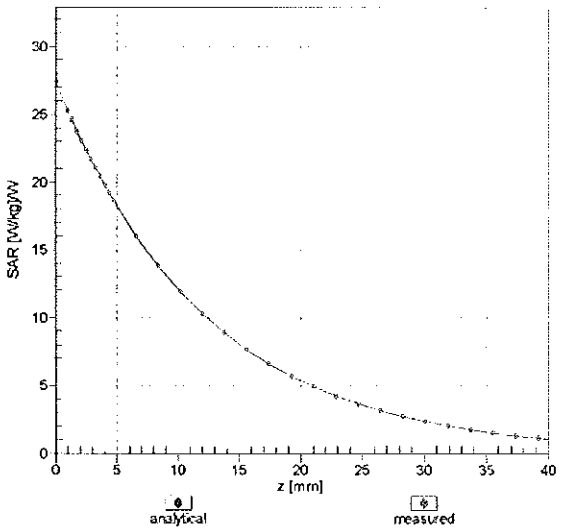
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (M_convF)

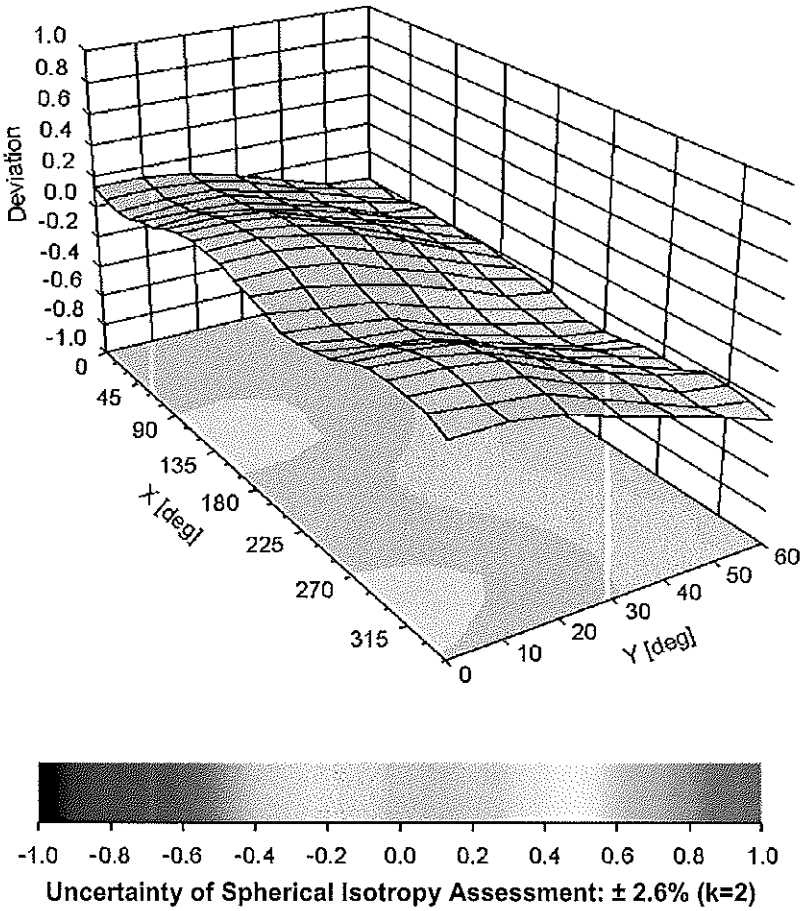


f = 1900 MHz,WGLS R22 (M_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	133.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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 **PC Test**

Certificate No: ES3-3287_Sep16

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3287

Calibration procedure(s) QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

BN ✓
09-28-2016

Calibration date: September 19, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 20, 2016

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

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

Accredited by the Swiss Accreditation Service (SAS) **Accreditation No.: SCS 0108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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, "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
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 ES3DV3

SN:3287

Manufactured: June 7, 2010
Calibrated: September 19, 2016

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.87	0.98	1.00	± 10.1 %
DCP (mV)[B]	101.9	101.4	106.1	

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	198.4	±3.5 %
		Y	0.0	0.0	1.0		189.6	
		Z	0.0	0.0	1.0		184.8	

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	65.67	459.4	34.07	29.08	2.68	5.077	2	0.308	1.009
Y	71.46	511.8	35.31	29.86	3.707	5.1	0.748	0.607	1.009
Z	50.48	357.3	34.55	27.84	2.262	5.1	1.583	0.279	1.01

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: ES3DV3 - SN:3287

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)
750	41.9	0.89	6.96	6.96	6.96	0.44	1.36	± 12.0 %
835	41.5	0.90	6.67	6.67	6.67	0.29	1.69	± 12.0 %
1750	40.1	1.37	5.49	5.49	5.49	0.43	1.42	± 12.0 %
1900	40.0	1.40	5.27	5.27	5.27	0.41	1.45	± 12.0 %
2300	39.5	1.67	4.86	4.86	4.86	0.61	1.28	± 12.0 %
2450	39.2	1.80	4.54	4.54	4.54	0.47	1.51	± 12.0 %
2600	39.0	1.96	4.41	4.41	4.41	0.77	1.18	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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: ES3DV3 - SN:3287

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)
750	55.5	0.96	6.64	6.64	6.64	0.27	1.86	± 12.0 %
835	55.2	0.97	6.55	6.55	6.55	0.50	1.37	± 12.0 %
1750	53.4	1.49	5.11	5.11	5.11	0.33	1.85	± 12.0 %
1900	53.3	1.52	4.94	4.94	4.94	0.42	1.59	± 12.0 %
2300	52.9	1.81	4.55	4.55	4.55	0.55	1.42	± 12.0 %
2450	52.7	1.95	4.35	4.35	4.35	0.80	1.09	± 12.0 %
2600	52.5	2.16	4.12	4.12	4.12	0.80	1.10	± 12.0 %

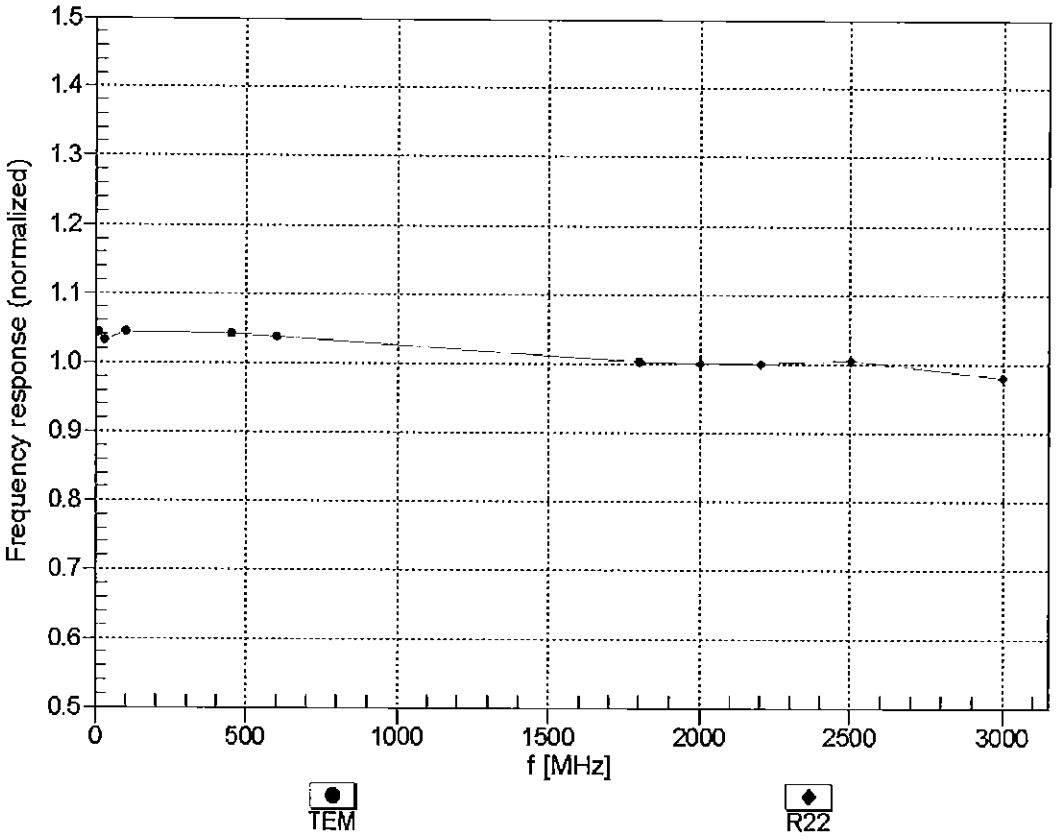
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

Frequency Response of E-Field

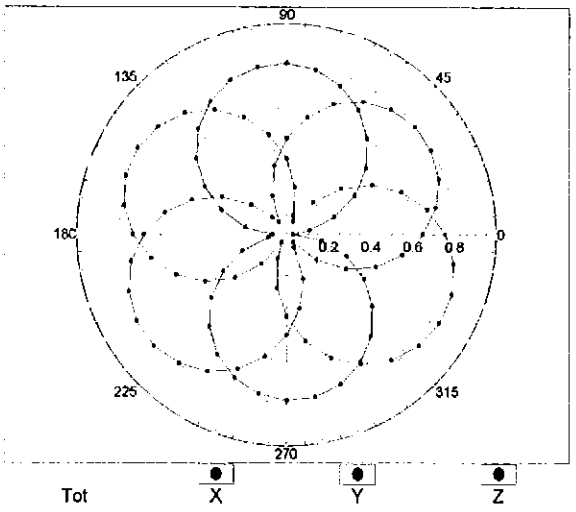
(TEM-Cell:ifi110 EXX, Waveguide: R22)



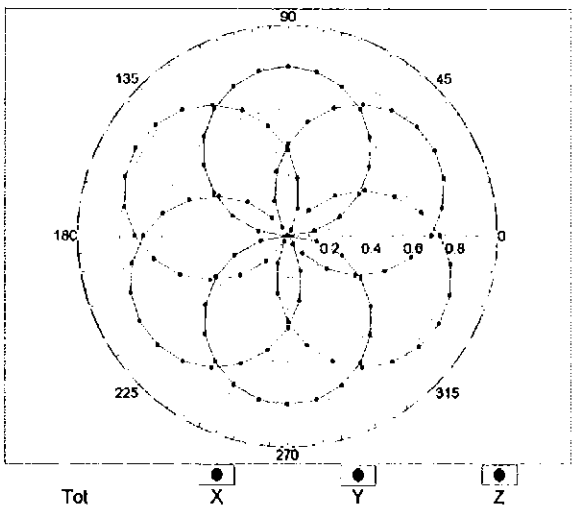
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

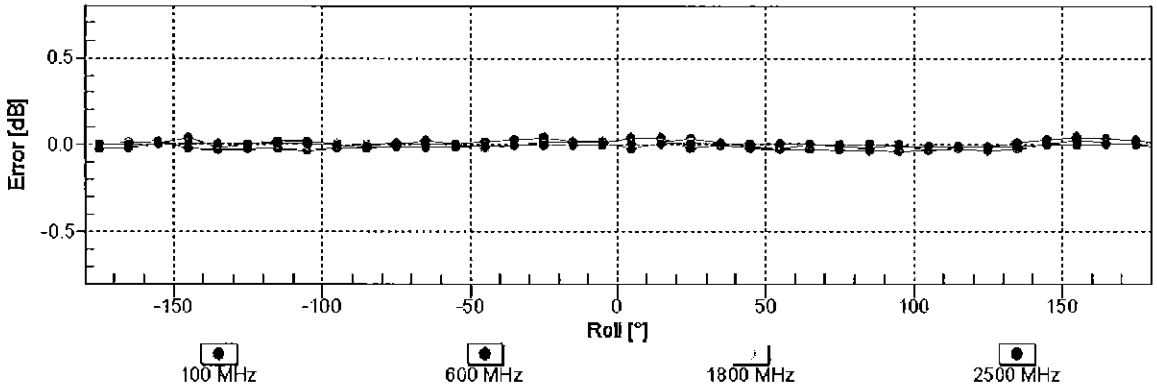
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



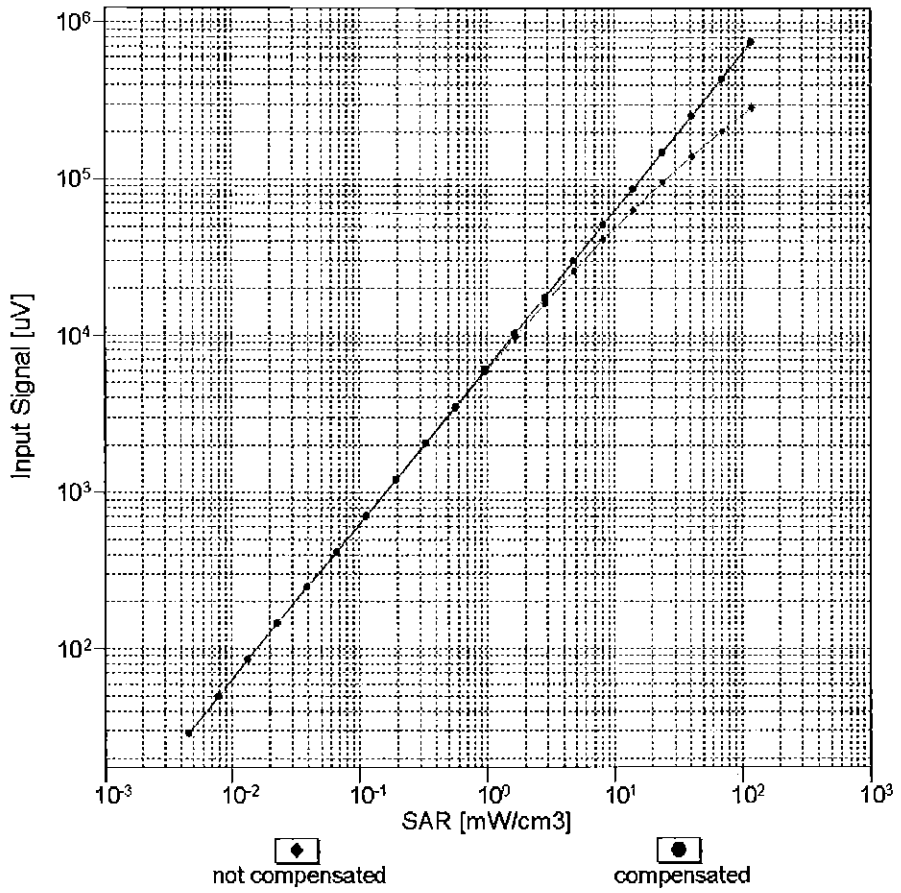
f=1800 MHz,R22

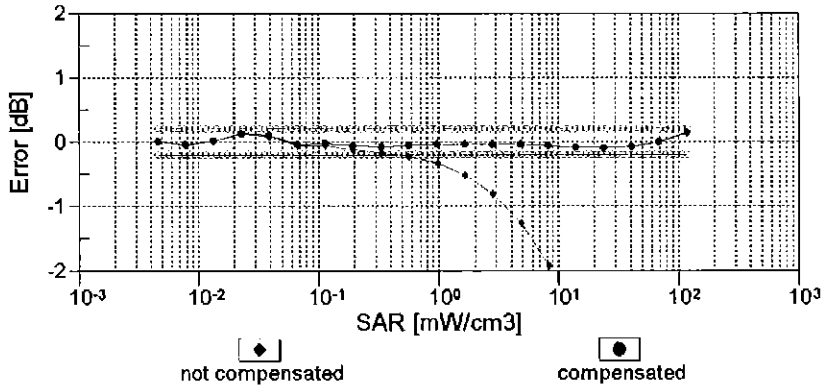




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

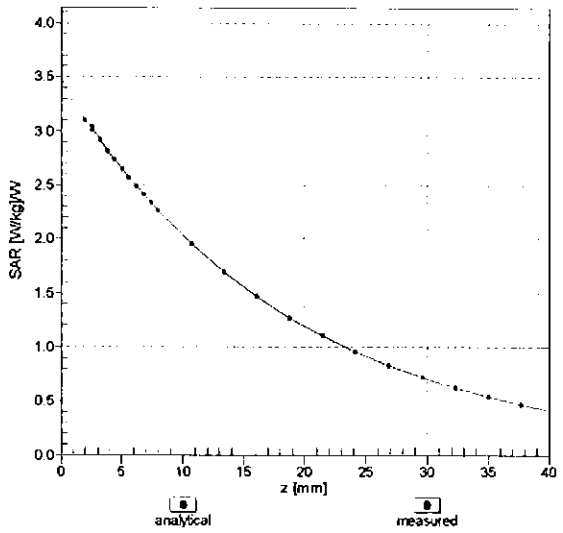




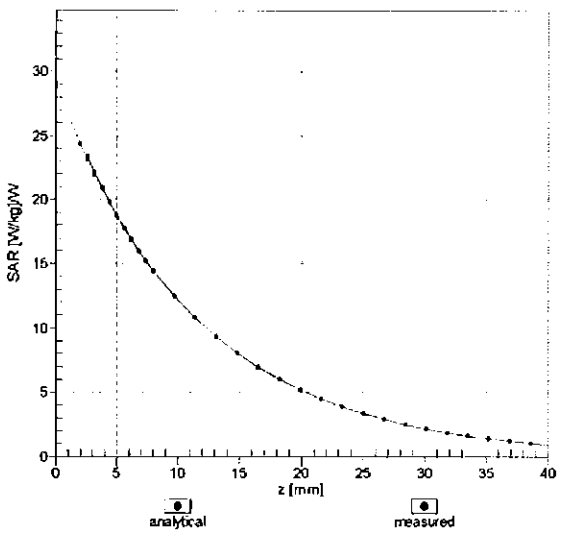
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

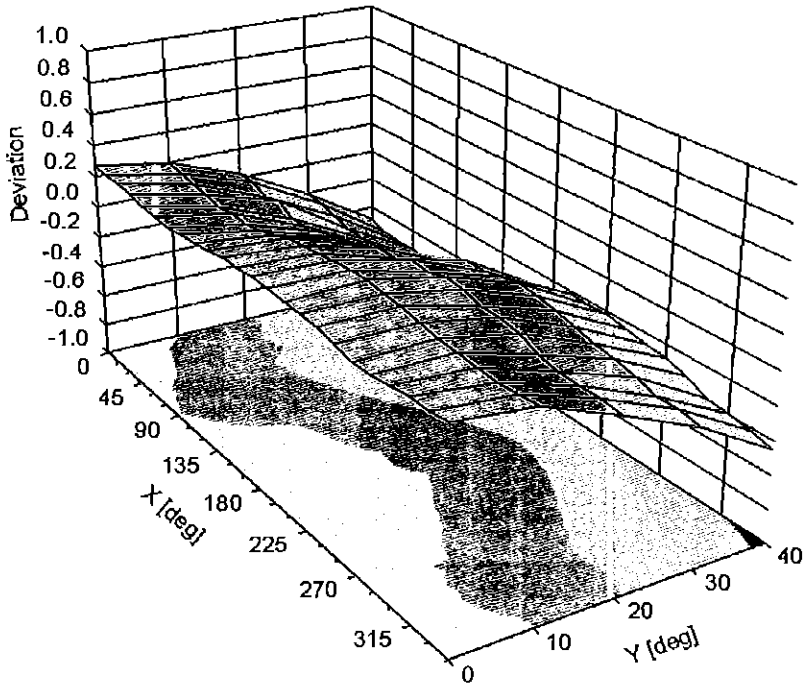


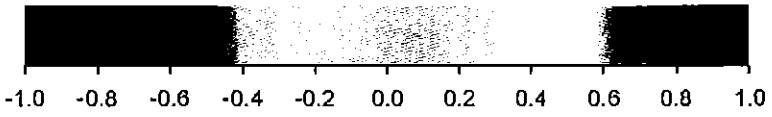
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	84.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max Unc[E] (k=2)
0	CW	X	0.00	0.00	1.00	0.00	198.4	± 3.5 %
		Y	0.00	0.00	1.00		189.6	
		Z	0.00	0.00	1.00		184.8	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	9.57	81.27	19.66	10.00	25.0	± 9.6 %
		Y	9.48	81.17	20.59		25.0	
		Z	11.44	84.72	20.81		25.0	
10011-CAB	UMTS-FDD (WCDMA)	X	1.41	73.12	18.60	0.00	150.0	± 9.6 %
		Y	1.09	67.36	15.29		150.0	
		Z	1.04	67.24	15.12		150.0	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	1.39	66.79	17.15	0.41	150.0	± 9.6 %
		Y	1.33	64.98	15.75		150.0	
		Z	1.31	64.97	15.66		150.0	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	5.20	67.40	17.54	1.46	150.0	± 9.6 %
		Y	5.27	67.18	17.41		150.0	
		Z	5.09	67.33	17.40		150.0	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	25.12	98.64	27.15	9.39	50.0	± 9.6 %
		Y	16.05	91.61	25.96		50.0	
		Z	54.58	112.47	31.02		50.0	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	21.90	96.28	26.48	9.57	50.0	± 9.6 %
		Y	15.04	90.31	25.57		50.0	
		Z	40.95	107.64	29.77		50.0	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	100.00	118.44	30.60	6.56	60.0	± 9.6 %
		Y	56.85	112.42	30.28		60.0	
		Z	100.00	119.26	30.80		60.0	
10025-DAB	EDGE-FDD (TDMA, 8PSK, TN 0)	X	15.98	100.03	37.68	12.57	50.0	± 9.6 %
		Y	12.36	89.89	33.32		50.0	
		Z	14.92	100.13	38.33		50.0	
10026-DAB	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	19.89	102.72	35.15	9.56	60.0	± 9.6 %
		Y	15.11	94.49	32.22		60.0	
		Z	21.16	106.39	36.94		60.0	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	100.00	117.46	29.21	4.80	80.0	± 9.6 %
		Y	100.00	119.97	30.83		80.0	
		Z	100.00	118.35	29.47		80.0	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	100.00	117.97	28.63	3.55	100.0	± 9.6 %
		Y	100.00	119.91	29.91		100.0	
		Z	100.00	118.74	28.84		100.0	
10029-DAB	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	14.03	95.19	31.54	7.80	80.0	± 9.6 %
		Y	11.54	89.32	29.33		80.0	
		Z	13.09	95.17	31.96		80.0	
10030-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	X	100.00	117.04	29.36	5.30	70.0	± 9.6 %
		Y	100.00	119.78	31.12		70.0	
		Z	100.00	117.69	29.49		70.0	
10031-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	X	100.00	120.90	28.34	1.88	100.0	± 9.6 %
		Y	100.00	121.14	28.78		100.0	
		Z	100.00	119.84	27.78		100.0	

10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	100.00	128.75	30.50	1.17	100.0	± 9.6 %
		Y	100.00	125.19	29.33		100.0	
		Z	100.00	124.54	28.68		100.0	
10033-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	X	24.47	102.44	28.62	5.30	70.0	± 9.6 %
		Y	12.93	91.34	25.64		70.0	
		Z	20.22	99.06	27.27		70.0	
10034-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	X	15.75	99.73	26.60	1.88	100.0	± 9.6 %
		Y	6.06	84.29	21.90		100.0	
		Z	7.41	86.87	21.79		100.0	
10035-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	X	8.06	91.60	24.06	1.17	100.0	± 9.6 %
		Y	3.71	78.74	19.66		100.0	
		Z	4.06	80.00	19.16		100.0	
10036-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	X	31.59	106.91	29.95	5.30	70.0	± 9.6 %
		Y	14.71	93.73	26.48		70.0	
		Z	25.49	103.04	28.49		70.0	
10037-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	X	15.02	99.00	26.34	1.88	100.0	± 9.6 %
		Y	5.91	83.93	21.74		100.0	
		Z	6.95	86.01	21.48		100.0	
10038-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	X	8.64	92.97	24.58	1.17	100.0	± 9.6 %
		Y	3.82	79.37	19.97		100.0	
		Z	4.16	80.58	19.47		100.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	3.32	80.83	20.52	0.00	150.0	± 9.6 %
		Y	1.99	71.59	16.56		150.0	
		Z	1.78	71.38	15.53		150.0	
10042-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	X	93.96	116.51	30.17	7.78	50.0	± 9.6 %
		Y	28.36	100.31	27.04		50.0	
		Z	100.00	118.01	30.46		50.0	
10044-CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	X	0.00	110.81	0.68	0.00	150.0	± 9.6 %
		Y	0.00	94.68	0.92		150.0	
		Z	0.01	95.27	0.89		150.0	
10048-CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	X	12.13	84.40	24.33	13.80	25.0	± 9.6 %
		Y	11.03	81.88	24.36		25.0	
		Z	15.47	90.17	26.32		25.0	
10049-CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	X	14.56	88.92	24.53	10.79	40.0	± 9.6 %
		Y	12.34	85.94	24.48		40.0	
		Z	20.46	95.78	26.73		40.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	13.90	88.80	25.15	9.03	50.0	± 9.6 %
		Y	11.60	84.93	24.34		50.0	
		Z	15.96	92.01	26.12		50.0	
10058-DAB	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	10.54	89.79	28.95	6.55	100.0	± 9.6 %
		Y	9.17	85.43	27.21		100.0	
		Z	9.28	88.15	28.66		100.0	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	1.62	69.54	18.42	0.61	110.0	± 9.6 %
		Y	1.52	67.09	16.78		110.0	
		Z	1.47	67.00	16.67		110.0	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	100.00	133.57	34.76	1.30	110.0	± 9.6 %
		Y	47.37	119.92	31.34		110.0	
		Z	100.00	131.70	33.88		110.0	

10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	24.29	111.37	31.49	2.04	110.0	± 9.6 %
		Y	7.57	90.21	25.12		110.0	
		Z	8.96	94.42	26.47		110.0	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	4.94	67.26	16.92	0.49	100.0	± 9.6 %
		Y	4.99	66.94	16.70		100.0	
		Z	4.80	67.06	16.67		100.0	
10063-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	X	4.98	67.42	17.05	0.72	100.0	± 9.6 %
		Y	5.03	67.12	16.85		100.0	
		Z	4.84	67.22	16.80		100.0	
10064-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	X	5.33	67.75	17.30	0.86	100.0	± 9.6 %
		Y	5.40	67.50	17.13		100.0	
		Z	5.14	67.52	17.06		100.0	
10065-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	X	5.22	67.77	17.45	1.21	100.0	± 9.6 %
		Y	5.30	67.55	17.30		100.0	
		Z	5.05	67.55	17.23		100.0	
10066-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	X	5.28	67.89	17.67	1.46	100.0	± 9.6 %
		Y	5.37	67.69	17.54		100.0	
		Z	5.11	67.69	17.47		100.0	
10067-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	X	5.58	67.96	18.07	2.04	100.0	± 9.6 %
		Y	5.70	67.83	17.99		100.0	
		Z	5.44	67.94	17.97		100.0	
10068-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	X	5.73	68.36	18.44	2.55	100.0	± 9.6 %
		Y	5.86	68.26	18.38		100.0	
		Z	5.56	68.20	18.31		100.0	
10069-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	X	5.80	68.22	18.58	2.67	100.0	± 9.6 %
		Y	5.93	68.12	18.53		100.0	
		Z	5.64	68.21	18.51		100.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	5.34	67.61	17.91	1.99	100.0	± 9.6 %
		Y	5.43	67.44	17.80		100.0	
		Z	5.23	67.57	17.79		100.0	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	5.41	68.20	18.23	2.30	100.0	± 9.6 %
		Y	5.52	68.04	18.13		100.0	
		Z	5.28	68.10	18.11		100.0	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	5.54	68.52	18.63	2.83	100.0	± 9.6 %
		Y	5.67	68.41	18.56		100.0	
		Z	5.42	68.46	18.55		100.0	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	5.57	68.60	18.89	3.30	100.0	± 9.6 %
		Y	5.71	68.53	18.84		100.0	
		Z	5.46	68.55	18.80		100.0	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	5.74	69.13	19.40	3.82	90.0	± 9.6 %
		Y	5.91	69.12	19.39		90.0	
		Z	5.60	68.97	19.28		90.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	5.73	68.87	19.48	4.15	90.0	± 9.6 %
		Y	5.91	68.89	19.48		90.0	
		Z	5.64	68.84	19.44		90.0	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	5.76	68.96	19.58	4.30	90.0	± 9.6 %
		Y	5.95	68.98	19.59		90.0	
		Z	5.68	68.95	19.55		90.0	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	1.45	73.74	17.54	0.00	150.0	± 9.6 %
		Y	1.01	66.70	13.93		150.0	
		Z	0.86	65.95	12.65		150.0	
10082-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	X	2.22	64.23	9.03	4.77	80.0	± 9.6 %
		Y	2.60	65.39	10.25		80.0	
		Z	2.07	64.06	8.86		80.0	
10090-DAB	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	100.00	118.52	30.65	6.56	60.0	± 9.6 %
		Y	54.54	111.83	30.17		60.0	
		Z	100.00	119.33	30.85		60.0	
10097-CAB	UMTS-FDD (HSDPA)	X	2.07	69.87	17.29	0.00	150.0	± 9.6 %
		Y	1.87	67.25	15.70		150.0	
		Z	1.83	67.53	15.55		150.0	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	2.03	69.88	17.28	0.00	150.0	± 9.6 %
		Y	1.83	67.20	15.65		150.0	
		Z	1.80	67.49	15.52		150.0	
10099-DAB	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	19.79	102.55	35.10	9.56	60.0	± 9.6 %
		Y	15.06	94.38	32.19		60.0	
		Z	21.07	106.24	36.89		60.0	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	3.71	73.15	18.05	0.00	150.0	± 9.6 %
		Y	3.34	70.68	16.71		150.0	
		Z	3.15	70.31	16.60		150.0	
10101-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	3.53	68.94	16.73	0.00	150.0	± 9.6 %
		Y	3.44	67.88	16.03		150.0	
		Z	3.28	67.66	15.91		150.0	
10102-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	3.62	68.78	16.77	0.00	150.0	± 9.6 %
		Y	3.55	67.81	16.12		150.0	
		Z	3.38	67.61	16.00		150.0	
10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	9.03	78.84	21.45	3.98	65.0	± 9.6 %
		Y	8.52	77.08	20.81		65.0	
		Z	8.79	79.04	21.64		65.0	
10104-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	8.83	77.31	21.70	3.98	65.0	± 9.6 %
		Y	8.68	76.21	21.28		65.0	
		Z	8.45	77.10	21.68		65.0	
10105-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	8.12	75.63	21.27	3.98	65.0	± 9.6 %
		Y	7.58	73.53	20.37		65.0	
		Z	7.68	75.16	21.11		65.0	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	3.26	72.24	17.88	0.00	150.0	± 9.6 %
		Y	2.97	69.86	16.52		150.0	
		Z	2.76	69.54	16.43		150.0	
10109-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	3.21	68.83	16.74	0.00	150.0	± 9.6 %
		Y	3.12	67.65	15.97		150.0	
		Z	2.93	67.47	15.80		150.0	
10110-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	2.68	71.31	17.65	0.00	150.0	± 9.6 %
		Y	2.45	68.82	16.19		150.0	
		Z	2.25	68.65	16.05		150.0	
10111-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	2.94	69.70	17.25	0.00	150.0	± 9.6 %
		Y	2.81	68.04	16.25		150.0	
		Z	2.63	68.09	16.01		150.0	

10112-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	3.32	68.66	16.72	0.00	150.0	± 9.6 %
		Y	3.24	67.56	16.01		150.0	
		Z	3.06	67.45	15.85		150.0	
10113-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	3.09	69.65	17.28	0.00	150.0	± 9.6 %
		Y	2.97	68.11	16.35		150.0	
		Z	2.78	68.22	16.13		150.0	
10114-CAB	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	5.30	67.67	16.69	0.00	150.0	± 9.6 %
		Y	5.32	67.34	16.45		150.0	
		Z	5.18	67.41	16.46		150.0	
10115-CAB	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	5.68	67.95	16.83	0.00	150.0	± 9.6 %
		Y	5.74	67.75	16.66		150.0	
		Z	5.49	67.60	16.57		150.0	
10116-CAB	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	5.43	67.93	16.74	0.00	150.0	± 9.6 %
		Y	5.45	67.58	16.50		150.0	
		Z	5.29	67.63	16.50		150.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	5.31	67.69	16.73	0.00	150.0	± 9.6 %
		Y	5.33	67.35	16.48		150.0	
		Z	5.15	67.28	16.42		150.0	
10118-CAB	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	5.73	68.05	16.89	0.00	150.0	± 9.6 %
		Y	5.76	67.71	16.65		150.0	
		Z	5.58	67.82	16.69		150.0	
10119-CAB	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	5.40	67.88	16.73	0.00	150.0	± 9.6 %
		Y	5.42	67.54	16.49		150.0	
		Z	5.26	67.56	16.48		150.0	
10140-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	3.67	68.77	16.68	0.00	150.0	± 9.6 %
		Y	3.60	67.81	16.05		150.0	
		Z	3.42	67.62	15.92		150.0	
10141-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	3.79	68.75	16.79	0.00	150.0	± 9.6 %
		Y	3.72	67.84	16.19		150.0	
		Z	3.54	67.70	16.08		150.0	
10142-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	2.48	71.58	17.67	0.00	150.0	± 9.6 %
		Y	2.22	68.66	16.03		150.0	
		Z	2.02	68.57	15.71		150.0	
10143-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	2.90	70.86	17.43	0.00	150.0	± 9.6 %
		Y	2.68	68.61	16.20		150.0	
		Z	2.48	68.71	15.71		150.0	
10144-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	2.65	68.53	15.87	0.00	150.0	± 9.6 %
		Y	2.53	66.90	14.94		150.0	
		Z	2.29	66.75	14.27		150.0	
10145-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	2.00	71.65	16.48	0.00	150.0	± 9.6 %
		Y	1.64	67.49	14.42		150.0	
		Z	1.28	65.53	12.17		150.0	
10146-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.65	82.42	19.81	0.00	150.0	± 9.6 %
		Y	3.51	73.00	16.51		150.0	
		Z	2.73	70.16	13.72		150.0	
10147-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	11.62	90.60	22.70	0.00	150.0	± 9.6 %
		Y	4.34	76.22	18.03		150.0	
		Z	3.53	73.44	15.25		150.0	

10149-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	3.22	68.90	16.79	0.00	150.0	± 9.6 %
		Y	3.13	67.70	16.01		150.0	
		Z	2.94	67.52	15.84		150.0	
10150-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	3.33	68.71	16.76	0.00	150.0	± 9.6 %
		Y	3.25	67.61	16.05		150.0	
		Z	3.06	67.50	15.89		150.0	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.59	81.08	22.43	3.98	65.0	± 9.6 %
		Y	8.87	78.87	21.64		65.0	
		Z	9.33	81.38	22.62		65.0	
10152-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	8.50	77.58	21.63	3.98	65.0	± 9.6 %
		Y	8.30	76.31	21.16		65.0	
		Z	8.08	77.33	21.50		65.0	
10153-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	8.85	78.28	22.25	3.98	65.0	± 9.6 %
		Y	8.62	76.95	21.75		65.0	
		Z	8.48	78.15	22.17		65.0	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	2.77	71.95	18.01	0.00	150.0	± 9.6 %
		Y	2.51	69.32	16.50		150.0	
		Z	2.29	69.01	16.28		150.0	
10155-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	2.94	69.69	17.25	0.00	150.0	± 9.6 %
		Y	2.80	68.03	16.25		150.0	
		Z	2.63	68.10	16.02		150.0	
10156-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	2.40	72.31	17.91	0.00	150.0	± 9.6 %
		Y	2.09	68.89	16.05		150.0	
		Z	1.86	68.62	15.51		150.0	
10157-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	2.55	69.65	16.30	0.00	150.0	± 9.6 %
		Y	2.36	67.46	15.11		150.0	
		Z	2.12	67.25	14.30		150.0	
10158-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	3.10	69.70	17.32	0.00	150.0	± 9.6 %
		Y	2.97	68.15	16.39		150.0	
		Z	2.78	68.27	16.17		150.0	
10159-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	2.69	70.18	16.62	0.00	150.0	± 9.6 %
		Y	2.48	67.89	15.40		150.0	
		Z	2.22	67.66	14.56		150.0	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	3.10	70.43	17.35	0.00	150.0	± 9.6 %
		Y	2.94	68.69	16.29		150.0	
		Z	2.78	68.69	16.25		150.0	
10161-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	3.22	68.62	16.74	0.00	150.0	± 9.6 %
		Y	3.14	67.48	16.00		150.0	
		Z	2.96	67.42	15.82		150.0	
10162-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	3.32	68.61	16.76	0.00	150.0	± 9.6 %
		Y	3.24	67.49	16.04		150.0	
		Z	3.07	67.56	15.92		150.0	
10166-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	4.32	72.20	20.50	3.01	150.0	± 9.6 %
		Y	4.09	70.13	19.37		150.0	
		Z	3.89	71.03	19.86		150.0	
10167-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	6.13	77.20	21.71	3.01	150.0	± 9.6 %
		Y	5.31	73.40	20.02		150.0	
		Z	5.17	75.28	20.82		150.0	

10168-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	6.94	79.87	23.11	3.01	150.0	± 9.6 %
		Y	5.79	75.28	21.14		150.0	
		Z	5.82	77.80	22.20		150.0	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.47	76.31	22.20	3.01	150.0	± 9.6 %
		Y	3.93	72.42	20.26		150.0	
		Z	3.45	71.87	20.27		150.0	
10170-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	9.97	90.37	26.89	3.01	150.0	± 9.6 %
		Y	6.08	79.64	22.84		150.0	
		Z	5.69	81.07	23.66		150.0	
10171-AAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	6.58	81.51	22.72	3.01	150.0	± 9.6 %
		Y	4.82	74.69	19.94		150.0	
		Z	4.39	75.54	20.48		150.0	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	73.64	126.23	37.77	6.02	65.0	± 9.6 %
		Y	18.65	98.22	29.94		65.0	
		Z	50.70	122.38	37.42		65.0	
10173-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	94.74	123.96	35.21	6.02	65.0	± 9.6 %
		Y	22.61	98.04	28.47		65.0	
		Z	96.90	127.66	36.64		65.0	
10174-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	56.11	113.11	31.91	6.02	65.0	± 9.6 %
		Y	18.59	93.53	26.66		65.0	
		Z	65.46	118.77	33.84		65.0	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.37	75.74	21.85	3.01	150.0	± 9.6 %
		Y	3.86	71.99	19.97		150.0	
		Z	3.41	71.52	20.02		150.0	
10176-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	9.99	90.41	26.90	3.01	150.0	± 9.6 %
		Y	6.09	79.66	22.85		150.0	
		Z	5.70	81.10	23.67		150.0	
10177-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	4.43	76.02	22.00	3.01	150.0	± 9.6 %
		Y	3.90	72.21	20.10		150.0	
		Z	3.44	71.69	20.11		150.0	
10178-CAC	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	9.65	89.71	26.63	3.01	150.0	± 9.6 %
		Y	5.97	79.26	22.66		150.0	
		Z	5.62	80.80	23.53		150.0	
10179-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	7.97	85.43	24.54	3.01	150.0	± 9.6 %
		Y	5.36	76.88	21.19		150.0	
		Z	4.98	78.13	21.92		150.0	
10180-CAC	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	6.51	81.29	22.61	3.01	150.0	± 9.6 %
		Y	4.79	74.55	19.86		150.0	
		Z	4.38	75.44	20.42		150.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.42	75.99	21.99	3.01	150.0	± 9.6 %
		Y	3.90	72.19	20.09		150.0	
		Z	3.43	71.67	20.11		150.0	
10182-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	9.63	89.67	26.62	3.01	150.0	± 9.6 %
		Y	5.96	79.23	22.65		150.0	
		Z	5.61	80.77	23.51		150.0	
10183-AAA	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	6.50	81.25	22.60	3.01	150.0	± 9.6 %
		Y	4.78	74.53	19.85		150.0	
		Z	4.37	75.41	20.41		150.0	

10184-CAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	4.44	76.05	22.02	3.01	150.0	± 9.6 %
		Y	3.91	72.24	20.12		150.0	
		Z	3.45	71.72	20.13		150.0	
10185-CAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	9.70	89.80	26.67	3.01	150.0	± 9.6 %
		Y	5.99	79.32	22.68		150.0	
		Z	5.64	80.86	23.56		150.0	
10186-AAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	6.54	81.37	22.64	3.01	150.0	± 9.6 %
		Y	4.81	74.60	19.88		150.0	
		Z	4.39	75.50	20.45		150.0	
10187-CAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	4.45	76.10	22.07	3.01	150.0	± 9.6 %
		Y	3.92	72.26	20.15		150.0	
		Z	3.46	71.78	20.19		150.0	
10188-CAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	10.51	91.45	27.34	3.01	150.0	± 9.6 %
		Y	6.26	80.23	23.14		150.0	
		Z	5.89	81.76	24.00		150.0	
10189-AAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	6.85	82.27	23.07	3.01	150.0	± 9.6 %
		Y	4.94	75.14	20.19		150.0	
		Z	4.52	76.06	20.77		150.0	
10193-CAB	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	4.73	67.10	16.51	0.00	150.0	± 9.6 %
		Y	4.75	66.68	16.23		150.0	
		Z	4.57	66.79	16.16		150.0	
10194-CAB	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	4.94	67.48	16.62	0.00	150.0	± 9.6 %
		Y	4.96	67.08	16.34		150.0	
		Z	4.75	67.11	16.28		150.0	
10195-CAB	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	4.98	67.48	16.62	0.00	150.0	± 9.6 %
		Y	5.00	67.07	16.34		150.0	
		Z	4.79	67.14	16.30		150.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	4.76	67.21	16.55	0.00	150.0	± 9.6 %
		Y	4.78	66.80	16.27		150.0	
		Z	4.58	66.86	16.18		150.0	
10197-CAB	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	4.96	67.50	16.63	0.00	150.0	± 9.6 %
		Y	4.98	67.09	16.35		150.0	
		Z	4.76	67.14	16.30		150.0	
10198-CAB	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	4.99	67.50	16.63	0.00	150.0	± 9.6 %
		Y	5.01	67.09	16.35		150.0	
		Z	4.79	67.16	16.31		150.0	
10219-CAB	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	4.71	67.23	16.53	0.00	150.0	± 9.6 %
		Y	4.73	66.82	16.24		150.0	
		Z	4.53	66.87	16.14		150.0	
10220-CAB	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	4.96	67.50	16.63	0.00	150.0	± 9.6 %
		Y	4.98	67.10	16.35		150.0	
		Z	4.76	67.11	16.29		150.0	
10221-CAB	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	4.99	67.43	16.62	0.00	150.0	± 9.6 %
		Y	5.01	67.03	16.34		150.0	
		Z	4.80	67.09	16.30		150.0	
10222-CAB	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	5.29	67.72	16.73	0.00	150.0	± 9.6 %
		Y	5.31	67.38	16.49		150.0	
		Z	5.12	67.29	16.41		150.0	

10223-CAB	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	X	5.67	68.03	16.90	0.00	150.0	± 9.6 %
		Y	5.70	67.71	16.67		150.0	
		Z	5.43	67.50	16.54		150.0	
10224-CAB	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	X	5.35	67.84	16.72	0.00	150.0	± 9.6 %
		Y	5.37	67.51	16.48		150.0	
		Z	5.17	67.40	16.39		150.0	
10225-CAB	UMTS-FDD (HSPA+)	X	3.03	67.01	16.18	0.00	150.0	± 9.6 %
		Y	3.00	66.12	15.59		150.0	
		Z	2.84	66.23	15.31		150.0	
10226-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	100.00	125.13	35.58	6.02	65.0	± 9.6 %
		Y	23.60	98.91	28.82		65.0	
		Z	100.00	128.43	36.91		65.0	
10227-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	61.16	114.83	32.47	6.02	65.0	± 9.6 %
		Y	19.96	94.87	27.16		65.0	
		Z	73.77	120.96	34.46		65.0	
10228-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	72.18	126.53	38.01	6.02	65.0	± 9.6 %
		Y	21.44	101.40	31.05		65.0	
		Z	53.16	123.89	37.96		65.0	
10229-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	94.57	123.93	35.21	6.02	65.0	± 9.6 %
		Y	22.66	98.06	28.49		65.0	
		Z	96.87	127.65	36.65		65.0	
10230-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	56.39	113.28	31.99	6.02	65.0	± 9.6 %
		Y	19.26	94.16	26.88		65.0	
		Z	66.99	119.13	33.93		65.0	
10231-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	66.18	124.67	37.45	6.02	65.0	± 9.6 %
		Y	20.62	100.55	30.72		65.0	
		Z	48.89	122.07	37.41		65.0	
10232-CAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	94.69	123.96	35.21	6.02	65.0	± 9.6 %
		Y	22.64	98.05	28.48		65.0	
		Z	97.00	127.68	36.66		65.0	
10233-CAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	56.52	113.33	32.00	6.02	65.0	± 9.6 %
		Y	19.26	94.17	26.88		65.0	
		Z	67.07	119.16	33.94		65.0	
10234-CAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	60.26	122.59	36.81	6.02	65.0	± 9.6 %
		Y	19.81	99.63	30.34		65.0	
		Z	45.11	120.21	36.81		65.0	
10235-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	95.38	124.09	35.25	6.02	65.0	± 9.6 %
		Y	22.67	98.09	28.50		65.0	
		Z	97.77	127.84	36.70		65.0	
10236-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	57.18	113.50	32.04	6.02	65.0	± 9.6 %
		Y	19.38	94.26	26.90		65.0	
		Z	68.10	119.39	33.99		65.0	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	67.28	125.01	37.54	6.02	65.0	± 9.6 %
		Y	20.74	100.68	30.76		65.0	
		Z	49.59	122.38	37.49		65.0	
10238-CAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	95.00	124.02	35.23	6.02	65.0	± 9.6 %
		Y	22.64	98.06	28.49		65.0	
		Z	97.19	127.73	36.66		65.0	

10239-CAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	56.67	113.39	32.01	6.02	65.0	± 9.6 %
		Y	19.26	94.19	26.88		65.0	
		Z	67.13	119.19	33.94		65.0	
10240-CAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	67.00	124.93	37.52	6.02	65.0	± 9.6 %
		Y	20.68	100.63	30.74		65.0	
		Z	49.37	122.30	37.47		65.0	
10241-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	14.43	89.77	28.56	6.98	65.0	± 9.6 %
		Y	12.31	85.00	26.80		65.0	
		Z	13.89	90.56	28.94		65.0	
10242-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	13.70	88.57	28.03	6.98	65.0	± 9.6 %
		Y	10.82	82.08	25.53		65.0	
		Z	13.16	89.30	28.37		65.0	
10243-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	10.55	84.90	27.56	6.98	65.0	± 9.6 %
		Y	8.88	79.49	25.25		65.0	
		Z	9.99	85.03	27.70		65.0	
10244-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	11.43	83.67	22.47	3.98	65.0	± 9.6 %
		Y	9.78	80.48	21.64		65.0	
		Z	9.76	81.22	20.90		65.0	
10245-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	11.21	83.09	22.22	3.98	65.0	± 9.6 %
		Y	9.71	80.13	21.47		65.0	
		Z	9.48	80.50	20.58		65.0	
10246-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	10.58	85.22	23.00	3.98	65.0	± 9.6 %
		Y	8.86	81.57	21.94		65.0	
		Z	9.16	83.05	21.67		65.0	
10247-CAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	8.25	78.94	21.22	3.98	65.0	± 9.6 %
		Y	7.85	77.32	20.79		65.0	
		Z	7.47	77.61	20.18		65.0	
10248-CAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	8.20	78.37	20.99	3.98	65.0	± 9.6 %
		Y	7.89	76.93	20.61		65.0	
		Z	7.41	77.03	19.93		65.0	
10249-CAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	11.20	86.28	23.89	3.98	65.0	± 9.6 %
		Y	9.29	82.26	22.62		65.0	
		Z	10.48	85.66	23.36		65.0	
10250-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	8.93	80.25	22.81	3.98	65.0	± 9.6 %
		Y	8.46	78.37	22.14		65.0	
		Z	8.46	79.88	22.48		65.0	
10251-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	8.39	77.98	21.64	3.98	65.0	± 9.6 %
		Y	8.12	76.54	21.14		65.0	
		Z	7.98	77.74	21.34		65.0	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	10.53	84.51	23.78	3.98	65.0	± 9.6 %
		Y	9.19	81.18	22.63		65.0	
		Z	10.24	84.82	23.86		65.0	
10253-CAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	8.25	76.95	21.44	3.98	65.0	± 9.6 %
		Y	8.10	75.77	21.00		65.0	
		Z	7.89	76.78	21.28		65.0	
10254-CAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	8.62	77.66	22.02	3.98	65.0	± 9.6 %
		Y	8.44	76.43	21.56		65.0	
		Z	8.28	77.57	21.89		65.0	

10255-CAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	9.25	80.67	22.52	3.98	65.0	± 9.6 %
		Y	8.61	78.53	21.74		65.0	
		Z	9.00	80.97	22.67		65.0	
10256-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	10.45	81.80	21.06	3.98	65.0	± 9.6 %
		Y	9.25	79.43	20.63		65.0	
		Z	8.10	77.76	18.69		65.0	
10257-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	10.14	80.97	20.68	3.98	65.0	± 9.6 %
		Y	9.17	78.95	20.38		65.0	
		Z	7.78	76.81	18.23		65.0	
10258-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	9.51	83.16	21.76	3.98	65.0	± 9.6 %
		Y	8.34	80.46	21.12		65.0	
		Z	7.35	79.00	19.46		65.0	
10259-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	8.50	79.32	21.74	3.98	65.0	± 9.6 %
		Y	8.08	77.61	21.22		65.0	
		Z	7.86	78.44	21.00		65.0	
10260-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	8.50	79.04	21.65	3.98	65.0	± 9.6 %
		Y	8.14	77.44	21.18		65.0	
		Z	7.85	78.11	20.87		65.0	
10261-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	10.46	84.88	23.66	3.98	65.0	± 9.6 %
		Y	8.99	81.35	22.49		65.0	
		Z	9.90	84.54	23.31		65.0	
10262-CAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	8.92	80.22	22.77	3.98	65.0	± 9.6 %
		Y	8.45	78.35	22.11		65.0	
		Z	8.45	79.83	22.45		65.0	
10263-CAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	8.39	77.98	21.64	3.98	65.0	± 9.6 %
		Y	8.12	76.54	21.14		65.0	
		Z	7.97	77.72	21.33		65.0	
10264-CAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	10.46	84.37	23.71	3.98	65.0	± 9.6 %
		Y	9.15	81.08	22.57		65.0	
		Z	10.16	84.65	23.78		65.0	
10265-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	8.50	77.59	21.64	3.98	65.0	± 9.6 %
		Y	8.29	76.32	21.16		65.0	
		Z	8.08	77.33	21.51		65.0	
10266-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	8.85	78.27	22.25	3.98	65.0	± 9.6 %
		Y	8.62	76.95	21.75		65.0	
		Z	8.48	78.14	22.17		65.0	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.58	81.04	22.42	3.98	65.0	± 9.6 %
		Y	8.86	78.85	21.63		65.0	
		Z	9.31	81.34	22.60		65.0	
10268-CAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	8.89	76.95	21.70	3.98	65.0	± 9.6 %
		Y	8.78	75.95	21.31		65.0	
		Z	8.54	76.83	21.69		65.0	
10269-CAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	8.79	76.51	21.59	3.98	65.0	± 9.6 %
		Y	8.71	75.58	21.23		65.0	
		Z	8.47	76.42	21.58		65.0	
10270-CAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	8.98	78.26	21.47	3.98	65.0	± 9.6 %
		Y	8.66	76.86	20.96		65.0	
		Z	8.70	78.39	21.61		65.0	

10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	2.76	67.40	16.12	0.00	150.0	± 9.6 %
		Y	2.68	66.20	15.35		150.0	
		Z	2.61	66.55	15.21		150.0	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	1.97	71.33	17.64	0.00	150.0	± 9.6 %
		Y	1.71	67.84	15.61		150.0	
		Z	1.63	67.82	15.44		150.0	
10277-CAA	PHS (QPSK)	X	5.79	70.12	14.44	9.03	50.0	± 9.6 %
		Y	6.71	72.04	16.24		50.0	
		Z	5.20	69.01	13.39		50.0	
10278-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.5)	X	10.14	81.72	21.64	9.03	50.0	± 9.6 %
		Y	10.00	81.13	22.16		50.0	
		Z	8.80	79.36	20.19		50.0	
10279-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.38)	X	10.33	81.92	21.72	9.03	50.0	± 9.6 %
		Y	10.19	81.33	22.24		50.0	
		Z	8.92	79.53	20.27		50.0	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	2.41	75.76	18.30	0.00	150.0	± 9.6 %
		Y	1.70	69.18	15.23		150.0	
		Z	1.46	68.58	14.00		150.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	1.39	73.22	17.31	0.00	150.0	± 9.6 %
		Y	0.98	66.45	13.79		150.0	
		Z	0.85	65.74	12.53		150.0	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	2.43	83.14	21.70	0.00	150.0	± 9.6 %
		Y	1.15	69.63	15.75		150.0	
		Z	1.04	69.40	14.71		150.0	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	5.22	96.14	26.57	0.00	150.0	± 9.6 %
		Y	1.48	73.58	17.97		150.0	
		Z	1.47	74.43	17.37		150.0	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	10.48	83.75	24.32	9.03	50.0	± 9.6 %
		Y	9.84	81.54	23.85		50.0	
		Z	11.88	86.37	24.91		50.0	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	3.28	72.37	17.95	0.00	150.0	± 9.6 %
		Y	2.98	69.95	16.59		150.0	
		Z	2.77	69.63	16.49		150.0	
10298-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	2.26	72.62	17.48	0.00	150.0	± 9.6 %
		Y	1.88	68.51	15.39		150.0	
		Z	1.59	67.65	14.14		150.0	
10299-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.40	81.89	20.37	0.00	150.0	± 9.6 %
		Y	3.78	73.44	17.26		150.0	
		Z	3.62	73.66	16.18		150.0	
10300-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	3.72	72.73	16.07	0.00	150.0	± 9.6 %
		Y	2.96	68.88	14.55		150.0	
		Z	2.44	67.52	12.75		150.0	
10301-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	X	5.70	68.03	18.84	4.17	80.0	± 9.6 %
		Y	5.77	67.36	18.35		80.0	
		Z	5.64	68.37	18.74		80.0	
10302-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols)	X	6.21	68.72	19.60	4.96	80.0	± 9.6 %
		Y	6.41	68.65	19.47		80.0	
		Z	6.13	69.05	19.54		80.0	

10303-AAA	IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	X	6.07	68.83	19.70	4.96	80.0	± 9.6 %
		Y	6.30	68.82	19.58		80.0	
		Z	5.97	69.08	19.56		80.0	
10304-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	X	5.71	68.13	18.89	4.17	80.0	± 9.6 %
		Y	5.89	68.01	18.73		80.0	
		Z	5.61	68.35	18.73		80.0	
10305-AAA	IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC, 15 symbols)	X	6.90	74.81	23.11	6.02	50.0	± 9.6 %
		Y	9.48	82.28	26.60		50.0	
		Z	9.03	82.45	26.20		50.0	
10306-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC, 18 symbols)	X	6.40	71.34	21.64	6.02	50.0	± 9.6 %
		Y	6.75	71.50	21.57		50.0	
		Z	6.43	72.04	21.56		50.0	
10307-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC, 18 symbols)	X	6.49	72.10	21.82	6.02	50.0	± 9.6 %
		Y	6.85	72.21	21.70		50.0	
		Z	6.50	72.67	21.67		50.0	
10308-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	X	6.53	72.49	22.02	6.02	50.0	± 9.6 %
		Y	6.89	72.58	21.88		50.0	
		Z	6.59	73.18	21.92		50.0	
10309-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3, 18 symbols)	X	6.52	71.66	21.81	6.02	50.0	± 9.6 %
		Y	6.86	71.77	21.70		50.0	
		Z	6.53	72.35	21.74		50.0	
10310-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3, 18 symbols)	X	6.41	71.57	21.66	6.02	50.0	± 9.6 %
		Y	6.75	71.71	21.56		50.0	
		Z	6.45	72.29	21.59		50.0	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	3.66	71.55	17.51	0.00	150.0	± 9.6 %
		Y	3.33	69.32	16.27		150.0	
		Z	3.12	68.94	16.14		150.0	
10313-AAA	iDEN 1:3	X	8.19	79.62	19.16	6.99	70.0	± 9.6 %
		Y	7.35	77.72	18.90		70.0	
		Z	8.21	80.46	19.57		70.0	
10314-AAA	iDEN 1:6	X	11.35	86.83	24.06	10.00	30.0	± 9.6 %
		Y	8.72	81.68	22.69		30.0	
		Z	10.81	87.34	24.49		30.0	
10315-AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	1.24	66.34	16.99	0.17	150.0	± 9.6 %
		Y	1.18	64.44	15.46		150.0	
		Z	1.17	64.45	15.36		150.0	
10316-AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	4.83	67.25	16.68	0.17	150.0	± 9.6 %
		Y	4.86	66.88	16.43		150.0	
		Z	4.68	66.99	16.39		150.0	
10317-AAB	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	4.83	67.25	16.68	0.17	150.0	± 9.6 %
		Y	4.86	66.88	16.43		150.0	
		Z	4.68	66.99	16.39		150.0	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	4.96	67.54	16.61	0.00	150.0	± 9.6 %
		Y	4.98	67.13	16.32		150.0	
		Z	4.75	67.19	16.29		150.0	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	5.54	67.49	16.61	0.00	150.0	± 9.6 %
		Y	5.56	67.14	16.37		150.0	
		Z	5.45	67.43	16.49		150.0	

10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	5.87	68.11	16.75	0.00	150.0	± 9.6 %
		Y	5.89	67.80	16.54		150.0	
		Z	5.70	67.70	16.47		150.0	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	2.41	75.76	18.30	0.00	115.0	± 9.6 %
		Y	1.70	69.18	15.23		115.0	
		Z	1.46	68.58	14.00		115.0	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	2.41	75.76	18.30	0.00	115.0	± 9.6 %
		Y	1.70	69.18	15.23		115.0	
		Z	1.46	68.58	14.00		115.0	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	100.00	120.32	30.30	0.00	100.0	± 9.6 %
		Y	37.67	108.93	28.46		100.0	
		Z	100.00	119.28	29.39		100.0	
10410-AAA	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	118.51	29.90	3.23	80.0	± 9.6 %
		Y	100.00	119.74	30.88		80.0	
		Z	100.00	120.99	30.71		80.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	1.06	64.54	16.02	0.00	150.0	± 9.6 %
		Y	1.03	62.90	14.57		150.0	
		Z	1.03	63.04	14.51		150.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	4.73	67.12	16.55	0.00	150.0	± 9.6 %
		Y	4.75	66.70	16.25		150.0	
		Z	4.58	66.83	16.23		150.0	
10417-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	4.73	67.12	16.55	0.00	150.0	± 9.6 %
		Y	4.75	66.70	16.25		150.0	
		Z	4.58	66.83	16.23		150.0	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	4.72	67.27	16.56	0.00	150.0	± 9.6 %
		Y	4.73	66.83	16.25		150.0	
		Z	4.56	66.98	16.24		150.0	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preambule)	X	4.75	67.23	16.56	0.00	150.0	± 9.6 %
		Y	4.76	66.80	16.26		150.0	
		Z	4.59	66.94	16.24		150.0	
10422-AAA	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	X	4.87	67.22	16.56	0.00	150.0	± 9.6 %
		Y	4.89	66.82	16.28		150.0	
		Z	4.71	66.94	16.26		150.0	
10423-AAA	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	X	5.09	67.62	16.71	0.00	150.0	± 9.6 %
		Y	5.12	67.23	16.44		150.0	
		Z	4.88	67.27	16.38		150.0	
10424-AAA	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	X	5.00	67.56	16.68	0.00	150.0	± 9.6 %
		Y	5.02	67.15	16.39		150.0	
		Z	4.80	67.22	16.35		150.0	
10425-AAA	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	X	5.55	67.83	16.78	0.00	150.0	± 9.6 %
		Y	5.59	67.55	16.57		150.0	
		Z	5.40	67.57	16.55		150.0	
10426-AAA	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	X	5.56	67.88	16.79	0.00	150.0	± 9.6 %
		Y	5.60	67.58	16.58		150.0	
		Z	5.41	67.59	16.56		150.0	

10427-AAA	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	X	5.59	67.91	16.80	0.00	150.0	± 9.6 %
		Y	5.63	67.61	16.59		150.0	
		Z	5.42	67.56	16.54		150.0	
10430-AAA	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	4.54	71.07	18.70	0.00	150.0	± 9.6 %
		Y	4.46	69.99	18.11		150.0	
		Z	4.20	70.41	17.89		150.0	
10431-AAA	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	4.50	67.77	16.69	0.00	150.0	± 9.6 %
		Y	4.51	67.23	16.34		150.0	
		Z	4.26	67.36	16.21		150.0	
10432-AAA	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	4.78	67.63	16.67	0.00	150.0	± 9.6 %
		Y	4.80	67.18	16.37		150.0	
		Z	4.56	67.25	16.29		150.0	
10433-AAA	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	5.01	67.62	16.71	0.00	150.0	± 9.6 %
		Y	5.04	67.21	16.43		150.0	
		Z	4.81	67.25	16.37		150.0	
10434-AAA	W-CDMA (BS Test Model 1, 64 DPCH)	X	4.66	71.93	18.79	0.00	150.0	± 9.6 %
		Y	4.53	70.61	18.11		150.0	
		Z	4.27	71.15	17.82		150.0	
10435-AAA	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	118.35	29.82	3.23	80.0	± 9.6 %
		Y	100.00	119.61	30.82		80.0	
		Z	100.00	120.81	30.62		80.0	
10447-AAA	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	X	3.85	68.02	16.38	0.00	150.0	± 9.6 %
		Y	3.83	67.22	15.92		150.0	
		Z	3.54	67.32	15.53		150.0	
10448-AAA	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clippin 44%)	X	4.31	67.56	16.56	0.00	150.0	± 9.6 %
		Y	4.32	66.99	16.19		150.0	
		Z	4.10	67.13	16.07		150.0	
10449-AAA	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Cliping 44%)	X	4.56	67.47	16.59	0.00	150.0	± 9.6 %
		Y	4.57	66.98	16.26		150.0	
		Z	4.37	67.07	16.19		150.0	
10450-AAA	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	X	4.73	67.38	16.58	0.00	150.0	± 9.6 %
		Y	4.74	66.94	16.27		150.0	
		Z	4.56	67.01	16.22		150.0	
10451-AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	X	3.81	68.42	16.23	0.00	150.0	± 9.6 %
		Y	3.77	67.50	15.73		150.0	
		Z	3.44	67.49	15.16		150.0	
10456-AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc duty cycle)	X	6.40	68.45	16.93	0.00	150.0	± 9.6 %
		Y	6.44	68.23	16.77		150.0	
		Z	6.27	68.12	16.71		150.0	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	3.89	65.77	16.30	0.00	150.0	± 9.6 %
		Y	3.90	65.36	15.99		150.0	
		Z	3.82	65.47	15.93		150.0	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	3.60	67.53	15.71	0.00	150.0	± 9.6 %
		Y	3.56	66.59	15.22		150.0	
		Z	3.27	66.88	14.62		150.0	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	4.70	65.53	16.21	0.00	150.0	± 9.6 %
		Y	4.63	64.60	15.71		150.0	
		Z	4.27	64.85	15.38		150.0	

10460-AAA	UMTS-FDD (WCDMA, AMR)	X	1.28	75.29	20.20	0.00	150.0	± 9.6 %
		Y	0.92	67.71	15.91		150.0	
		Z	0.90	67.71	15.78		150.0	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	122.97	32.01	3.29	80.0	± 9.6 %
		Y	100.00	121.34	31.70		80.0	
		Z	100.00	125.58	32.88		80.0	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	108.03	24.84	3.23	80.0	± 9.6 %
		Y	100.00	109.86	26.18		80.0	
		Z	100.00	108.99	24.93		80.0	
10463-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	105.21	23.49	3.23	80.0	± 9.6 %
		Y	47.92	99.26	23.13		80.0	
		Z	100.00	105.71	23.36		80.0	
10464-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	121.12	31.00	3.23	80.0	± 9.6 %
		Y	100.00	119.76	30.82		80.0	
		Z	100.00	123.61	31.80		80.0	
10465-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	107.54	24.59	3.23	80.0	± 9.6 %
		Y	92.10	108.50	25.75		80.0	
		Z	100.00	108.47	24.68		80.0	
10466-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	104.76	23.28	3.23	80.0	± 9.6 %
		Y	27.79	92.79	21.40		80.0	
		Z	53.71	98.96	21.73		80.0	
10467-AAA	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	121.32	31.10	3.23	80.0	± 9.6 %
		Y	100.00	119.93	30.90		80.0	
		Z	100.00	123.83	31.91		80.0	
10468-AAA	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	107.68	24.66	3.23	80.0	± 9.6 %
		Y	100.00	109.58	26.02		80.0	
		Z	100.00	108.64	24.75		80.0	
10469-AAA	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	104.76	23.27	3.23	80.0	± 9.6 %
		Y	28.45	93.06	21.47		80.0	
		Z	57.15	99.60	21.88		80.0	
10470-AAA	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	121.35	31.10	3.23	80.0	± 9.6 %
		Y	100.00	119.95	30.90		80.0	
		Z	100.00	123.86	31.91		80.0	
10471-AAA	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	107.63	24.63	3.23	80.0	± 9.6 %
		Y	100.00	109.54	26.00		80.0	
		Z	100.00	108.59	24.73		80.0	
10472-AAA	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	104.72	23.24	3.23	80.0	± 9.6 %
		Y	28.52	93.08	21.46		80.0	
		Z	57.07	99.54	21.85		80.0	
10473-AAA	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	121.32	31.09	3.23	80.0	± 9.6 %
		Y	100.00	119.92	30.89		80.0	
		Z	100.00	123.84	31.90		80.0	
10474-AAA	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	107.64	24.63	3.23	80.0	± 9.6 %
		Y	100.00	109.55	26.00		80.0	
		Z	100.00	108.60	24.73		80.0	
10475-AAA	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	104.73	23.25	3.23	80.0	± 9.6 %
		Y	28.13	92.93	21.42		80.0	
		Z	55.36	99.25	21.78		80.0	

10477-AAA	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	107.49	24.56	3.23	80.0	± 9.6 %
		Y	96.57	109.01	25.85		80.0	
		Z	100.00	108.42	24.64		80.0	
10478-AAA	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	104.68	23.23	3.23	80.0	± 9.6 %
		Y	27.68	92.72	21.36		80.0	
		Z	53.23	98.81	21.67		80.0	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	26.63	104.01	29.13	3.23	80.0	± 9.6 %
		Y	9.63	86.48	23.96		80.0	
		Z	24.30	102.59	28.22		80.0	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	38.31	102.90	27.02	3.23	80.0	± 9.6 %
		Y	11.50	85.06	22.20		80.0	
		Z	29.11	98.49	25.10		80.0	
10481-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	30.40	98.59	25.52	3.23	80.0	± 9.6 %
		Y	10.74	83.47	21.41		80.0	
		Z	20.94	92.98	23.18		80.0	
10482-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.51	84.82	22.25	2.23	80.0	± 9.6 %
		Y	5.60	77.58	19.80		80.0	
		Z	5.41	78.09	19.19		80.0	
10483-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	14.01	88.92	23.41	2.23	80.0	± 9.6 %
		Y	8.14	80.18	20.73		80.0	
		Z	9.32	82.50	20.44		80.0	
10484-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	12.47	87.00	22.82	2.23	80.0	± 9.6 %
		Y	7.81	79.33	20.43		80.0	
		Z	8.26	80.64	19.81		80.0	
10485-AAA	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.06	84.25	22.66	2.23	80.0	± 9.6 %
		Y	5.75	77.87	20.37		80.0	
		Z	5.68	79.10	20.42		80.0	
10486-AAA	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.66	75.87	19.43	2.23	80.0	± 9.6 %
		Y	4.94	72.86	18.29		80.0	
		Z	4.62	73.05	17.69		80.0	
10487-AAA	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.56	75.25	19.19	2.23	80.0	± 9.6 %
		Y	4.94	72.51	18.16		80.0	
		Z	4.56	72.51	17.46		80.0	
10488-AAA	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.10	80.82	21.84	2.23	80.0	± 9.6 %
		Y	5.79	76.47	20.13		80.0	
		Z	5.49	77.19	20.36		80.0	
10489-AAA	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.34	73.87	19.44	2.23	80.0	± 9.6 %
		Y	5.00	71.87	18.57		80.0	
		Z	4.68	72.17	18.47		80.0	
10490-AAA	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.35	73.36	19.26	2.23	80.0	± 9.6 %
		Y	5.06	71.53	18.46		80.0	
		Z	4.74	71.87	18.36		80.0	
10491-AAA	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.36	77.12	20.56	2.23	80.0	± 9.6 %
		Y	5.66	74.28	19.36		80.0	
		Z	5.31	74.67	19.54		80.0	
10492-AAA	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.41	72.24	18.98	2.23	80.0	± 9.6 %
		Y	5.23	70.84	18.33		80.0	
		Z	4.89	71.01	18.29		80.0	

10493-AAA	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.44	71.94	18.88	2.23	80.0	± 9.6 %
		Y	5.28	70.63	18.27		80.0	
		Z	4.94	70.81	18.22		80.0	
10494-AAA	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.43	79.70	21.31	2.23	80.0	± 9.6 %
		Y	6.30	76.13	19.88		80.0	
		Z	5.88	76.40	20.05		80.0	
10495-AAA	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.56	72.97	19.25	2.23	80.0	± 9.6 %
		Y	5.33	71.45	18.55		80.0	
		Z	4.97	71.48	18.50		80.0	
10496-AAA	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.54	72.39	19.06	2.23	80.0	± 9.6 %
		Y	5.37	71.03	18.42		80.0	
		Z	5.01	71.08	18.38		80.0	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.31	82.38	20.82	2.23	80.0	± 9.6 %
		Y	4.87	75.75	18.64		80.0	
		Z	4.03	73.68	16.68		80.0	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.73	73.29	16.69	2.23	80.0	± 9.6 %
		Y	4.12	70.77	15.97		80.0	
		Z	2.73	66.24	12.60		80.0	
10499-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.59	72.54	16.27	2.23	80.0	± 9.6 %
		Y	4.10	70.38	15.70		80.0	
		Z	2.62	65.47	12.11		80.0	
10500-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.19	81.83	22.01	2.23	80.0	± 9.6 %
		Y	5.57	76.69	20.07		80.0	
		Z	5.44	77.85	20.24		80.0	
10501-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.46	74.81	19.33	2.23	80.0	± 9.6 %
		Y	4.94	72.30	18.33		80.0	
		Z	4.65	72.67	17.97		80.0	
10502-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.46	74.43	19.15	2.23	80.0	± 9.6 %
		Y	4.98	72.05	18.20		80.0	
		Z	4.68	72.41	17.81		80.0	
10503-AAA	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.99	80.56	21.73	2.23	80.0	± 9.6 %
		Y	5.72	76.28	20.04		80.0	
		Z	5.42	76.98	20.27		80.0	
10504-AAA	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.31	73.78	19.39	2.23	80.0	± 9.6 %
		Y	4.98	71.79	18.52		80.0	
		Z	4.66	72.08	18.42		80.0	
10505-AAA	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.32	73.26	19.21	2.23	80.0	± 9.6 %
		Y	5.03	71.44	18.41		80.0	
		Z	4.72	71.78	18.31		80.0	
10506-AAA	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.35	79.52	21.23	2.23	80.0	± 9.6 %
		Y	6.24	75.99	19.82		80.0	
		Z	5.83	76.25	19.98		80.0	
10507-AAA	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.53	72.90	19.22	2.23	80.0	± 9.6 %
		Y	5.31	71.39	18.51		80.0	
		Z	4.95	71.42	18.47		80.0	

10508-AAA	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.52	72.31	19.02	2.23	80.0	± 9.6 %
		Y	5.35	70.96	18.38		80.0	
		Z	4.99	71.02	18.34		80.0	
10509-AAA	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.86	76.40	20.08	2.23	80.0	± 9.6 %
		Y	6.23	74.05	19.09		80.0	
		Z	5.83	74.13	19.18		80.0	
10510-AAA	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.89	72.04	18.91	2.23	80.0	± 9.6 %
		Y	5.75	70.91	18.36		80.0	
		Z	5.36	70.80	18.32		80.0	
10511-AAA	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.86	71.58	18.77	2.23	80.0	± 9.6 %
		Y	5.75	70.55	18.27		80.0	
		Z	5.39	70.48	18.23		80.0	
10512-AAA	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.85	79.24	20.97	2.23	80.0	± 9.6 %
		Y	6.75	76.04	19.69		80.0	
		Z	6.30	76.05	19.77		80.0	
10513-AAA	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.88	72.72	19.16	2.23	80.0	± 9.6 %
		Y	5.70	71.43	18.55		80.0	
		Z	5.29	71.21	18.47		80.0	
10514-AAA	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.77	72.00	18.94	2.23	80.0	± 9.6 %
		Y	5.64	70.86	18.38		80.0	
		Z	5.26	70.69	18.32		80.0	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	1.03	64.88	16.19	0.00	150.0	± 9.6 %
		Y	0.99	63.07	14.62		150.0	
		Z	0.99	63.20	14.56		150.0	
10516-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc duty cycle)	X	1.64	91.04	26.85	0.00	150.0	± 9.6 %
		Y	0.59	69.22	16.60		150.0	
		Z	0.59	69.23	16.57		150.0	
10517-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc duty cycle)	X	0.96	68.68	17.89	0.00	150.0	± 9.6 %
		Y	0.84	64.94	15.18		150.0	
		Z	0.84	64.94	15.09		150.0	
10518-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	4.73	67.22	16.54	0.00	150.0	± 9.6 %
		Y	4.75	66.79	16.24		150.0	
		Z	4.57	66.91	16.20		150.0	
10519-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc duty cycle)	X	4.96	67.51	16.67	0.00	150.0	± 9.6 %
		Y	4.99	67.12	16.39		150.0	
		Z	4.76	67.15	16.33		150.0	
10520-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc duty cycle)	X	4.82	67.52	16.62	0.00	150.0	± 9.6 %
		Y	4.84	67.09	16.32		150.0	
		Z	4.61	67.11	16.25		150.0	
10521-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc duty cycle)	X	4.75	67.54	16.61	0.00	150.0	± 9.6 %
		Y	4.77	67.10	16.31		150.0	
		Z	4.54	67.10	16.23		150.0	
10522-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc duty cycle)	X	4.79	67.47	16.62	0.00	150.0	± 9.6 %
		Y	4.80	67.00	16.30		150.0	
		Z	4.60	67.19	16.31		150.0	

10523-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc duty cycle)	X	4.66	67.41	16.50	0.00	150.0	± 9.6 %
		Y	4.67	66.95	16.18		150.0	
		Z	4.48	67.04	16.16		150.0	
10524-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc duty cycle)	X	4.74	67.44	16.62	0.00	150.0	± 9.6 %
		Y	4.76	66.99	16.31		150.0	
		Z	4.54	67.10	16.28		150.0	
10525-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	4.69	66.48	16.21	0.00	150.0	± 9.6 %
		Y	4.70	66.02	15.89		150.0	
		Z	4.53	66.15	15.87		150.0	
10526-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	4.91	66.90	16.35	0.00	150.0	± 9.6 %
		Y	4.91	66.43	16.04		150.0	
		Z	4.70	66.52	16.01		150.0	
10527-AAA	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc duty cycle)	X	4.82	66.89	16.32	0.00	150.0	± 9.6 %
		Y	4.83	66.42	16.00		150.0	
		Z	4.62	66.47	15.95		150.0	
10528-AAA	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc duty cycle)	X	4.84	66.91	16.35	0.00	150.0	± 9.6 %
		Y	4.85	66.44	16.03		150.0	
		Z	4.63	66.49	15.99		150.0	
10529-AAA	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc duty cycle)	X	4.84	66.91	16.35	0.00	150.0	± 9.6 %
		Y	4.85	66.44	16.03		150.0	
		Z	4.63	66.49	15.99		150.0	
10531-AAA	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc duty cycle)	X	4.86	67.08	16.39	0.00	150.0	± 9.6 %
		Y	4.87	66.60	16.06		150.0	
		Z	4.63	66.60	16.00		150.0	
10532-AAA	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc duty cycle)	X	4.71	66.97	16.35	0.00	150.0	± 9.6 %
		Y	4.72	66.49	16.02		150.0	
		Z	4.49	66.45	15.93		150.0	
10533-AAA	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc duty cycle)	X	4.86	66.93	16.33	0.00	150.0	± 9.6 %
		Y	4.87	66.45	16.01		150.0	
		Z	4.64	66.54	15.97		150.0	
10534-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	5.34	67.03	16.36	0.00	150.0	± 9.6 %
		Y	5.36	66.66	16.11		150.0	
		Z	5.17	66.62	16.06		150.0	
10535-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	5.42	67.17	16.42	0.00	150.0	± 9.6 %
		Y	5.43	66.80	16.16		150.0	
		Z	5.24	66.80	16.14		150.0	
10536-AAA	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc duty cycle)	X	5.29	67.18	16.41	0.00	150.0	± 9.6 %
		Y	5.30	66.78	16.13		150.0	
		Z	5.11	66.74	16.09		150.0	
10537-AAA	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc duty cycle)	X	5.35	67.14	16.39	0.00	150.0	± 9.6 %
		Y	5.36	66.75	16.12		150.0	
		Z	5.16	66.71	16.08		150.0	
10538-AAA	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc duty cycle)	X	5.47	67.20	16.46	0.00	150.0	± 9.6 %
		Y	5.49	66.85	16.21		150.0	
		Z	5.26	66.74	16.13		150.0	
10540-AAA	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc duty cycle)	X	5.36	67.15	16.45	0.00	150.0	± 9.6 %
		Y	5.38	66.77	16.18		150.0	
		Z	5.19	66.76	16.16		150.0	

10541-AAA	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc duty cycle)	X	5.35	67.08	16.42	0.00	150.0	± 9.6 %
		Y	5.38	66.75	16.17		150.0	
		Z	5.16	66.62	16.08		150.0	
10542-AAA	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc duty cycle)	X	5.49	67.08	16.42	0.00	150.0	± 9.6 %
		Y	5.51	66.73	16.18		150.0	
		Z	5.31	66.69	16.13		150.0	
10543-AAA	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc duty cycle)	X	5.58	67.09	16.44	0.00	150.0	± 9.6 %
		Y	5.61	66.77	16.21		150.0	
		Z	5.39	66.74	16.17		150.0	
10544-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	5.61	67.12	16.33	0.00	150.0	± 9.6 %
		Y	5.62	66.77	16.09		150.0	
		Z	5.48	66.74	16.05		150.0	
10545-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	5.83	67.51	16.46	0.00	150.0	± 9.6 %
		Y	5.84	67.15	16.22		150.0	
		Z	5.68	67.16	16.22		150.0	
10546-AAA	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc duty cycle)	X	5.72	67.42	16.44	0.00	150.0	± 9.6 %
		Y	5.73	67.08	16.20		150.0	
		Z	5.55	66.95	16.13		150.0	
10547-AAA	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc duty cycle)	X	5.81	67.48	16.46	0.00	150.0	± 9.6 %
		Y	5.83	67.17	16.24		150.0	
		Z	5.62	66.99	16.14		150.0	
10548-AAA	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc duty cycle)	X	6.10	68.50	16.94	0.00	150.0	± 9.6 %
		Y	6.15	68.24	16.74		150.0	
		Z	5.89	67.98	16.61		150.0	
10550-AAA	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc duty cycle)	X	5.74	67.36	16.42	0.00	150.0	± 9.6 %
		Y	5.75	67.01	16.18		150.0	
		Z	5.57	66.96	16.14		150.0	
10551-AAA	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc duty cycle)	X	5.76	67.47	16.43	0.00	150.0	± 9.6 %
		Y	5.78	67.14	16.20		150.0	
		Z	5.58	67.00	16.12		150.0	
10552-AAA	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc duty cycle)	X	5.66	67.23	16.33	0.00	150.0	± 9.6 %
		Y	5.67	66.89	16.10		150.0	
		Z	5.49	66.80	16.03		150.0	
10553-AAA	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc duty cycle)	X	5.75	67.26	16.37	0.00	150.0	± 9.6 %
		Y	5.76	66.93	16.14		150.0	
		Z	5.58	66.84	16.08		150.0	
10554-AAA	IEEE 1602.11ac WiFi (160MHz, MCS0, 99pc duty cycle)	X	6.01	67.49	16.42	0.00	150.0	± 9.6 %
		Y	6.02	67.17	16.20		150.0	
		Z	5.89	67.10	16.15		150.0	
10555-AAA	IEEE 1602.11ac WiFi (160MHz, MCS1, 99pc duty cycle)	X	6.17	67.85	16.56	0.00	150.0	± 9.6 %
		Y	6.20	67.56	16.36		150.0	
		Z	6.02	67.41	16.28		150.0	
10556-AAA	IEEE 1602.11ac WiFi (160MHz, MCS2, 99pc duty cycle)	X	6.18	67.83	16.55	0.00	150.0	± 9.6 %
		Y	6.19	67.51	16.33		150.0	
		Z	6.04	67.46	16.30		150.0	
10557-AAA	IEEE 1602.11ac WiFi (160MHz, MCS3, 99pc duty cycle)	X	6.17	67.82	16.57	0.00	150.0	± 9.6 %
		Y	6.19	67.52	16.36		150.0	
		Z	6.00	67.36	16.27		150.0	

10558-AAA	IEEE 1602.11ac WiFi (160MHz, MCS4, 99pc duty cycle)	X	6.23	68.01	16.68	0.00	150.0	± 9.6 %
		Y	6.25	67.72	16.47		150.0	
		Z	6.05	67.53	16.37		150.0	
10560-AAA	IEEE 1602.11ac WiFi (160MHz, MCS6, 99pc duty cycle)	X	6.22	67.85	16.63	0.00	150.0	± 9.6 %
		Y	6.25	67.56	16.43		150.0	
		Z	6.05	67.37	16.33		150.0	
10561-AAA	IEEE 1602.11ac WiFi (160MHz, MCS7, 99pc duty cycle)	X	6.13	67.79	16.64	0.00	150.0	± 9.6 %
		Y	6.15	67.49	16.43		150.0	
		Z	5.97	67.35	16.35		150.0	
10562-AAA	IEEE 1602.11ac WiFi (160MHz, MCS8, 99pc duty cycle)	X	6.29	68.28	16.89	0.00	150.0	± 9.6 %
		Y	6.33	68.01	16.70		150.0	
		Z	6.10	67.74	16.55		150.0	
10563-AAA	IEEE 1602.11ac WiFi (160MHz, MCS9, 99pc duty cycle)	X	6.57	68.63	17.00	0.00	150.0	± 9.6 %
		Y	6.57	68.27	16.77		150.0	
		Z	6.35	68.10	16.68		150.0	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	5.07	67.31	16.69	0.46	150.0	± 9.6 %
		Y	5.10	66.95	16.44		150.0	
		Z	4.91	67.04	16.40		150.0	
10565-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc duty cycle)	X	5.34	67.80	17.01	0.46	150.0	± 9.6 %
		Y	5.38	67.46	16.78		150.0	
		Z	5.14	67.47	16.71		150.0	
10566-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc duty cycle)	X	5.17	67.69	16.85	0.46	150.0	± 9.6 %
		Y	5.21	67.33	16.61		150.0	
		Z	4.97	67.33	16.54		150.0	
10567-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc duty cycle)	X	5.20	68.09	17.20	0.46	150.0	± 9.6 %
		Y	5.23	67.71	16.94		150.0	
		Z	5.00	67.68	16.86		150.0	
10568-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc duty cycle)	X	5.08	67.38	16.59	0.46	150.0	± 9.6 %
		Y	5.11	67.01	16.33		150.0	
		Z	4.90	67.16	16.34		150.0	
10569-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc duty cycle)	X	5.14	68.11	17.22	0.46	150.0	± 9.6 %
		Y	5.16	67.71	16.95		150.0	
		Z	4.96	67.77	16.91		150.0	
10570-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc duty cycle)	X	5.18	67.92	17.15	0.46	150.0	± 9.6 %
		Y	5.21	67.52	16.88		150.0	
		Z	4.99	67.63	16.86		150.0	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	1.45	67.97	17.69	0.46	130.0	± 9.6 %
		Y	1.38	65.84	16.15		130.0	
		Z	1.34	65.80	16.05		130.0	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	1.49	68.86	18.18	0.46	130.0	± 9.6 %
		Y	1.40	66.47	16.51		130.0	
		Z	1.36	66.39	16.40		130.0	
10573-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc duty cycle)	X	100.00	149.30	40.22	0.46	130.0	± 9.6 %
		Y	3.11	88.03	23.54		130.0	
		Z	3.23	89.37	24.00		130.0	
10574-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc duty cycle)	X	2.21	80.01	23.13	0.46	130.0	± 9.6 %
		Y	1.65	72.75	19.44		130.0	
		Z	1.56	72.33	19.21		130.0	

10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	4.88	67.15	16.77	0.46	130.0	± 9.6 %
		Y	4.92	66.81	16.54		130.0	
		Z	4.73	66.93	16.51		130.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	4.91	67.32	16.84	0.46	130.0	± 9.6 %
		Y	4.94	66.97	16.61		130.0	
		Z	4.75	67.08	16.56		130.0	
10577-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc duty cycle)	X	5.15	67.65	17.01	0.46	130.0	± 9.6 %
		Y	5.20	67.33	16.79		130.0	
		Z	4.96	67.36	16.73		130.0	
10578-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc duty cycle)	X	5.05	67.86	17.13	0.46	130.0	± 9.6 %
		Y	5.09	67.50	16.89		130.0	
		Z	4.85	67.51	16.82		130.0	
10579-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc duty cycle)	X	4.82	67.24	16.51	0.46	130.0	± 9.6 %
		Y	4.87	66.90	16.27		130.0	
		Z	4.63	66.89	16.19		130.0	
10580-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc duty cycle)	X	4.86	67.17	16.48	0.46	130.0	± 9.6 %
		Y	4.91	66.83	16.25		130.0	
		Z	4.68	66.92	16.22		130.0	
10581-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc duty cycle)	X	4.96	67.97	17.11	0.46	130.0	± 9.6 %
		Y	5.00	67.61	16.86		130.0	
		Z	4.76	67.57	16.77		130.0	
10582-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc duty cycle)	X	4.78	66.97	16.29	0.46	130.0	± 9.6 %
		Y	4.83	66.64	16.06		130.0	
		Z	4.58	66.67	16.00		130.0	
10583-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	4.88	67.15	16.77	0.46	130.0	± 9.6 %
		Y	4.92	66.81	16.54		130.0	
		Z	4.73	66.93	16.51		130.0	
10584-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	4.91	67.32	16.84	0.46	130.0	± 9.6 %
		Y	4.94	66.97	16.61		130.0	
		Z	4.75	67.08	16.56		130.0	
10585-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc duty cycle)	X	5.15	67.65	17.01	0.46	130.0	± 9.6 %
		Y	5.20	67.33	16.79		130.0	
		Z	4.96	67.36	16.73		130.0	
10586-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc duty cycle)	X	5.05	67.86	17.13	0.46	130.0	± 9.6 %
		Y	5.09	67.50	16.89		130.0	
		Z	4.85	67.51	16.82		130.0	
10587-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc duty cycle)	X	4.82	67.24	16.51	0.46	130.0	± 9.6 %
		Y	4.87	66.90	16.27		130.0	
		Z	4.63	66.89	16.19		130.0	
10588-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc duty cycle)	X	4.86	67.17	16.48	0.46	130.0	± 9.6 %
		Y	4.91	66.83	16.25		130.0	
		Z	4.68	66.92	16.22		130.0	
10589-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc duty cycle)	X	4.96	67.97	17.11	0.46	130.0	± 9.6 %
		Y	5.00	67.61	16.86		130.0	
		Z	4.76	67.57	16.77		130.0	
10590-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc duty cycle)	X	4.78	66.97	16.29	0.46	130.0	± 9.6 %
		Y	4.83	66.64	16.06		130.0	
		Z	4.58	66.67	16.00		130.0	

10591-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	5.03	67.20	16.86	0.46	130.0	± 9.6 %
		Y	5.07	66.88	16.64		130.0	
		Z	4.88	66.97	16.60		130.0	
10592-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	5.21	67.55	16.98	0.46	130.0	± 9.6 %
		Y	5.26	67.23	16.76		130.0	
		Z	5.03	67.30	16.73		130.0	
10593-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc duty cycle)	X	5.14	67.52	16.89	0.46	130.0	± 9.6 %
		Y	5.19	67.20	16.68		130.0	
		Z	4.96	67.23	16.62		130.0	
10594-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc duty cycle)	X	5.19	67.66	17.03	0.46	130.0	± 9.6 %
		Y	5.24	67.33	16.81		130.0	
		Z	5.01	67.38	16.76		130.0	
10595-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc duty cycle)	X	5.17	67.65	16.95	0.46	130.0	± 9.6 %
		Y	5.23	67.33	16.73		130.0	
		Z	4.98	67.35	16.67		130.0	
10596-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc duty cycle)	X	5.11	67.64	16.94	0.46	130.0	± 9.6 %
		Y	5.16	67.30	16.71		130.0	
		Z	4.92	67.35	16.67		130.0	
10597-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc duty cycle)	X	5.06	67.59	16.86	0.46	130.0	± 9.6 %
		Y	5.11	67.26	16.64		130.0	
		Z	4.87	67.26	16.56		130.0	
10598-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc duty cycle)	X	5.05	67.87	17.14	0.46	130.0	± 9.6 %
		Y	5.09	67.53	16.91		130.0	
		Z	4.85	67.47	16.80		130.0	
10599-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	5.68	67.76	17.01	0.46	130.0	± 9.6 %
		Y	5.74	67.54	16.84		130.0	
		Z	5.54	67.51	16.80		130.0	
10600-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	5.91	68.42	17.31	0.46	130.0	± 9.6 %
		Y	6.00	68.29	17.19		130.0	
		Z	5.69	67.96	17.01		130.0	
10601-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc duty cycle)	X	5.75	68.03	17.13	0.46	130.0	± 9.6 %
		Y	5.81	67.81	16.96		130.0	
		Z	5.57	67.70	16.89		130.0	
10602-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc duty cycle)	X	5.85	68.05	17.05	0.46	130.0	± 9.6 %
		Y	5.93	67.91	16.93		130.0	
		Z	5.67	67.73	16.83		130.0	
10603-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc duty cycle)	X	5.97	68.46	17.38	0.46	130.0	± 9.6 %
		Y	6.05	68.29	17.25		130.0	
		Z	5.74	68.01	17.09		130.0	
10604-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc duty cycle)	X	5.70	67.75	17.03	0.46	130.0	± 9.6 %
		Y	5.76	67.53	16.86		130.0	
		Z	5.55	67.48	16.81		130.0	
10605-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc duty cycle)	X	5.80	68.03	17.16	0.46	130.0	± 9.6 %
		Y	5.86	67.81	17.00		130.0	
		Z	5.67	67.84	17.00		130.0	
10606-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc duty cycle)	X	5.58	67.53	16.79	0.46	130.0	± 9.6 %
		Y	5.62	67.26	16.60		130.0	
		Z	5.41	67.19	16.54		130.0	

10607-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	4.86	66.52	16.48	0.46	130.0	± 9.6 %
		Y	4.89	66.14	16.23		130.0	
		Z	4.71	66.27	16.21		130.0	
10608-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	5.09	66.96	16.64	0.46	130.0	± 9.6 %
		Y	5.12	66.58	16.39		130.0	
		Z	4.90	66.67	16.37		130.0	
10609-AAA	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle)	X	4.98	66.85	16.52	0.46	130.0	± 9.6 %
		Y	5.01	66.47	16.26		130.0	
		Z	4.79	66.53	16.22		130.0	
10610-AAA	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle)	X	5.03	67.01	16.67	0.46	130.0	± 9.6 %
		Y	5.06	66.63	16.42		130.0	
		Z	4.84	66.68	16.37		130.0	
10611-AAA	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle)	X	4.96	66.86	16.54	0.46	130.0	± 9.6 %
		Y	4.99	66.50	16.29		130.0	
		Z	4.76	66.50	16.23		130.0	
10612-AAA	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle)	X	4.97	67.00	16.58	0.46	130.0	± 9.6 %
		Y	5.01	66.61	16.31		130.0	
		Z	4.77	66.66	16.28		130.0	
10613-AAA	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle)	X	4.99	66.94	16.49	0.46	130.0	± 9.6 %
		Y	5.03	66.55	16.23		130.0	
		Z	4.77	66.56	16.17		130.0	
10614-AAA	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle)	X	4.92	67.15	16.73	0.46	130.0	± 9.6 %
		Y	4.95	66.76	16.47		130.0	
		Z	4.71	66.71	16.38		130.0	
10615-AAA	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle)	X	4.95	66.65	16.31	0.46	130.0	± 9.6 %
		Y	4.99	66.28	16.06		130.0	
		Z	4.76	66.36	16.03		130.0	
10616-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	5.51	67.07	16.65	0.46	130.0	± 9.6 %
		Y	5.55	66.78	16.45		130.0	
		Z	5.35	66.74	16.40		130.0	
10617-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	5.58	67.18	16.67	0.46	130.0	± 9.6 %
		Y	5.62	66.89	16.46		130.0	
		Z	5.43	66.92	16.46		130.0	
10618-AAA	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle)	X	5.47	67.27	16.74	0.46	130.0	± 9.6 %
		Y	5.50	66.95	16.52		130.0	
		Z	5.31	66.92	16.47		130.0	
10619-AAA	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle)	X	5.49	67.07	16.57	0.46	130.0	± 9.6 %
		Y	5.52	66.76	16.36		130.0	
		Z	5.33	66.76	16.33		130.0	
10620-AAA	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle)	X	5.62	67.19	16.68	0.46	130.0	± 9.6 %
		Y	5.67	66.93	16.49		130.0	
		Z	5.42	66.79	16.40		130.0	
10621-AAA	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle)	X	5.59	67.25	16.82	0.46	130.0	± 9.6 %
		Y	5.63	66.98	16.62		130.0	
		Z	5.41	66.88	16.56		130.0	
10622-AAA	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle)	X	5.58	67.35	16.86	0.46	130.0	± 9.6 %
		Y	5.62	67.06	16.66		130.0	
		Z	5.43	67.06	16.64		130.0	

10623-AAA	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle)	X	5.48	66.99	16.57	0.46	130.0	± 9.6 %
		Y	5.54	66.75	16.40		130.0	
		Z	5.31	66.61	16.29		130.0	
10624-AAA	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle)	X	5.65	67.09	16.68	0.46	130.0	± 9.6 %
		Y	5.69	66.81	16.49		130.0	
		Z	5.50	66.79	16.45		130.0	
10625-AAA	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle)	X	6.03	68.01	17.18	0.46	130.0	± 9.6 %
		Y	6.05	67.65	16.95		130.0	
		Z	5.88	67.81	17.01		130.0	
10626-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	5.76	67.09	16.57	0.46	130.0	± 9.6 %
		Y	5.79	66.81	16.38		130.0	
		Z	5.64	66.79	16.35		130.0	
10627-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	6.01	67.60	16.77	0.46	130.0	± 9.6 %
		Y	6.04	67.32	16.58		130.0	
		Z	5.89	67.37	16.60		130.0	
10628-AAA	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle)	X	5.83	67.28	16.56	0.46	130.0	± 9.6 %
		Y	5.87	67.01	16.37		130.0	
		Z	5.69	66.92	16.32		130.0	
10629-AAA	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle)	X	5.93	67.36	16.58	0.46	130.0	± 9.6 %
		Y	5.99	67.16	16.43		130.0	
		Z	5.77	67.00	16.35		130.0	
10630-AAA	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle)	X	6.47	69.11	17.45	0.46	130.0	± 9.6 %
		Y	6.56	68.99	17.34		130.0	
		Z	6.24	68.58	17.14		130.0	
10631-AAA	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle)	X	6.36	68.89	17.53	0.46	130.0	± 9.6 %
		Y	6.44	68.71	17.39		130.0	
		Z	6.09	68.24	17.15		130.0	
10632-AAA	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle)	X	6.00	67.73	16.97	0.46	130.0	± 9.6 %
		Y	6.05	67.48	16.79		130.0	
		Z	5.85	67.39	16.74		130.0	
10633-AAA	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle)	X	5.95	67.59	16.73	0.46	130.0	± 9.6 %
		Y	6.01	67.38	16.58		130.0	
		Z	5.74	67.05	16.41		130.0	
10634-AAA	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle)	X	5.92	67.56	16.78	0.46	130.0	± 9.6 %
		Y	5.98	67.34	16.62		130.0	
		Z	5.72	67.07	16.47		130.0	
10635-AAA	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle)	X	5.80	66.87	16.18	0.46	130.0	± 9.6 %
		Y	5.85	66.64	16.01		130.0	
		Z	5.62	66.48	15.93		130.0	
10636-AAA	IEEE 1602.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	X	6.16	67.47	16.65	0.46	130.0	± 9.6 %
		Y	6.19	67.22	16.49		130.0	
		Z	6.06	67.16	16.44		130.0	
10637-AAA	IEEE 1602.11ac WiFi (160MHz, MCS1, 90pc duty cycle)	X	6.34	67.89	16.84	0.46	130.0	± 9.6 %
		Y	6.39	67.69	16.69		130.0	
		Z	6.22	67.55	16.62		130.0	
10638-AAA	IEEE 1602.11ac WiFi (160MHz, MCS2, 90pc duty cycle)	X	6.33	67.82	16.78	0.46	130.0	± 9.6 %
		Y	6.36	67.57	16.61		130.0	
		Z	6.21	67.52	16.58		130.0	

10639-AAA	IEEE 1602.11ac WiFi (160MHz, MCS3, 90pc duty cycle)	X	6.34	67.88	16.86	0.46	130.0	± 9.6 %
		Y	6.38	67.64	16.70		130.0	
		Z	6.19	67.47	16.60		130.0	
10640-AAA	IEEE 1602.11ac WiFi (160MHz, MCS4, 90pc duty cycle)	X	6.37	67.96	16.84	0.46	130.0	± 9.6 %
		Y	6.42	67.75	16.69		130.0	
		Z	6.20	67.51	16.57		130.0	
10641-AAA	IEEE 1602.11ac WiFi (160MHz, MCS5, 90pc duty cycle)	X	6.36	67.66	16.71	0.46	130.0	± 9.6 %
		Y	6.40	67.44	16.56		130.0	
		Z	6.24	67.40	16.53		130.0	
10642-AAA	IEEE 1602.11ac WiFi (160MHz, MCS6, 90pc duty cycle)	X	6.44	68.03	17.05	0.46	130.0	± 9.6 %
		Y	6.49	67.81	16.91		130.0	
		Z	6.28	67.62	16.80		130.0	
10643-AAA	IEEE 1602.11ac WiFi (160MHz, MCS7, 90pc duty cycle)	X	6.26	67.70	16.80	0.46	130.0	± 9.6 %
		Y	6.31	67.48	16.64		130.0	
		Z	6.12	67.34	16.57		130.0	
10644-AAA	IEEE 1602.11ac WiFi (160MHz, MCS8, 90pc duty cycle)	X	6.50	68.41	17.18	0.46	130.0	± 9.6 %
		Y	6.57	68.25	17.05		130.0	
		Z	6.29	67.86	16.85		130.0	
10645-AAA	IEEE 1602.11ac WiFi (160MHz, MCS9, 90pc duty cycle)	X	6.78	68.77	17.29	0.46	130.0	± 9.6 %
		Y	6.81	68.48	17.11		130.0	
		Z	6.68	68.60	17.18		130.0	
10646-AAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7)	X	37.14	116.21	38.03	9.30	60.0	± 9.6 %
		Y	19.95	100.33	33.06		60.0	
		Z	62.05	131.91	43.22		60.0	
10647-AAA	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7)	X	38.52	117.84	38.64	9.30	60.0	± 9.6 %
		Y	20.25	101.35	33.50		60.0	
		Z	63.43	133.45	43.81		60.0	
10648-AAA	CDMA2000 (1x Advanced)	X	1.03	68.68	14.68	0.00	150.0	± 9.6 %
		Y	0.85	64.54	12.30		150.0	
		Z	0.71	63.65	10.90		150.0	

[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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
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 **PC Test** **Certificate No: ES3-3213_Feb17**

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3213

Calibration procedure(s) QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

BNV
03-01-2017

Calibration date: February 10, 2017

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-16 (No. ES3-3013_Dec16)	Dec-17
DAE4	SN: 660	7-Dec-16 (No. DAE4-660_Dec16)	Dec-17
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 13, 2017

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
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) Accreditation No.: **SCS 0108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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, "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
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 ES3DV3

SN:3213

Manufactured: October 14, 2008
Calibrated: February 10, 2017

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.44	1.32	1.29	± 10.1 %
DCP (mV)[B]	101.3	102.3	101.6	

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	228.2	±3.5 %
		Y	0.0	0.0	1.0		230.0	
		Z	0.0	0.0	1.0		221.7	

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	56.23	407.2	35.93	28.85	2.251	5.1	1.129	0.439	1.012
Y	55.47	400.7	35.87	28.65	2.277	5.1	1.321	0.386	1.013
Z	51.67	374.7	36	28.45	2.103	5.1	0.358	0.504	1.009

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: ES3DV3 - SN:3213

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)
750	41.9	0.89	6.85	6.85	6.85	0.80	1.18	± 12.0 %
835	41.5	0.90	6.49	6.49	6.49	0.49	1.52	± 12.0 %
1750	40.1	1.37	5.49	5.49	5.49	0.60	1.35	± 12.0 %
1900	40.0	1.40	5.29	5.29	5.29	0.68	1.27	± 12.0 %
2300	39.5	1.67	4.95	4.95	4.95	0.70	1.28	± 12.0 %
2450	39.2	1.80	4.70	4.70	4.70	0.80	1.24	± 12.0 %
2600	39.0	1.96	4.52	4.52	4.52	0.78	1.28	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 end 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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: ES3DV3 - SN:3213

Calibration Parameter Determined in Body Tissue Simulating Media

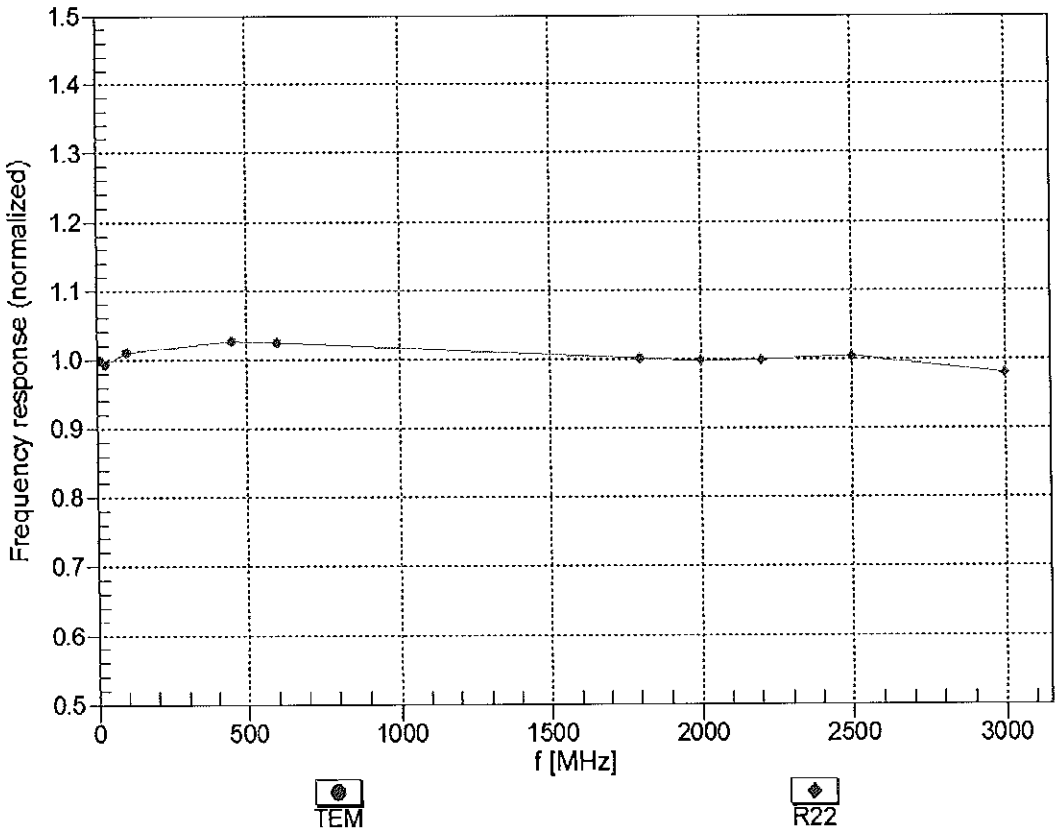
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	6.38	6.38	6.38	0.60	1.31	± 12.0 %
835	55.2	0.97	6.28	6.28	6.28	0.80	1.20	± 12.0 %
1750	53.4	1.49	5.09	5.09	5.09	0.66	1.33	± 12.0 %
1900	53.3	1.52	4.94	4.94	4.94	0.40	1.85	± 12.0 %
2300	52.9	1.81	4.69	4.69	4.69	0.80	1.24	± 12.0 %
2450	52.7	1.95	4.53	4.53	4.53	0.72	1.28	± 12.0 %
2600	52.5	2.16	4.32	4.32	4.32	0.80	1.20	± 12.0 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

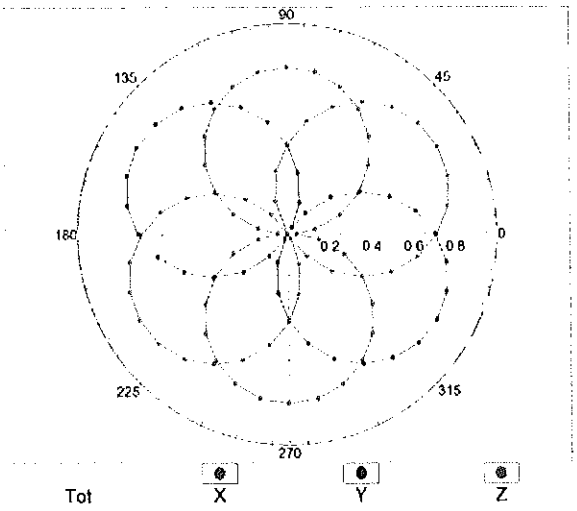
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



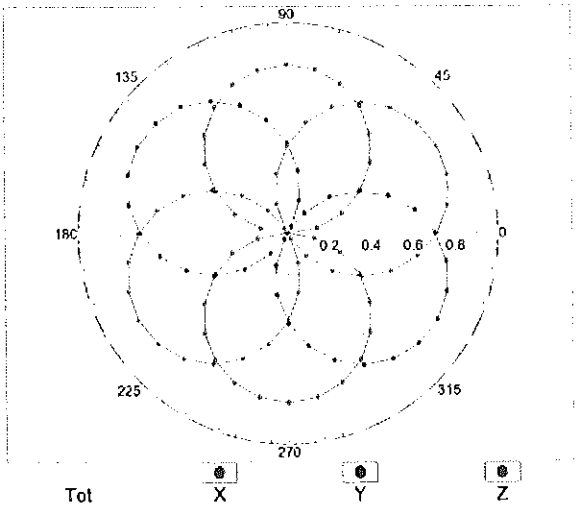
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

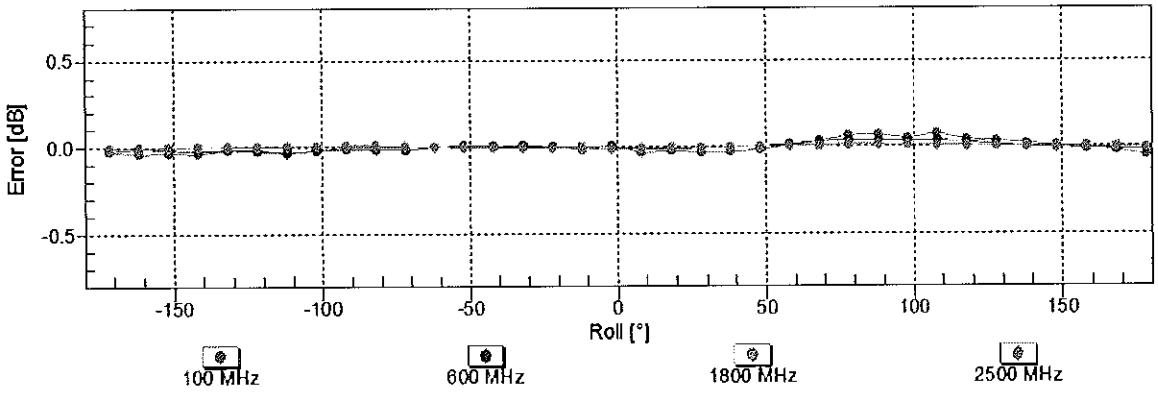
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

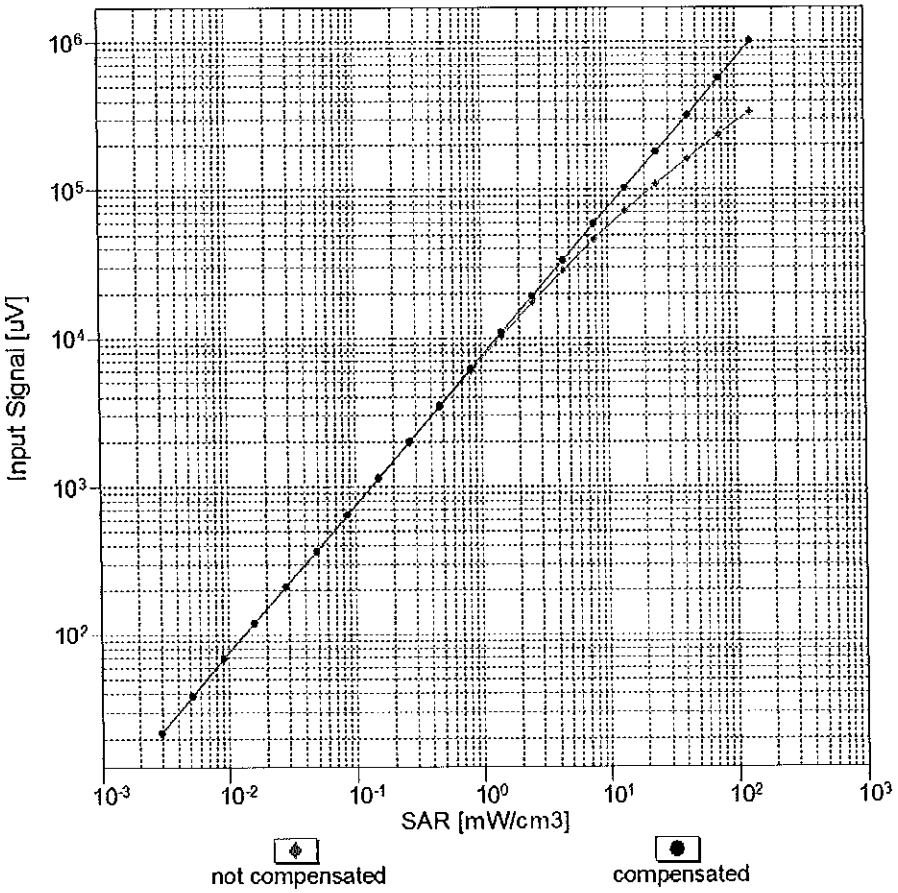


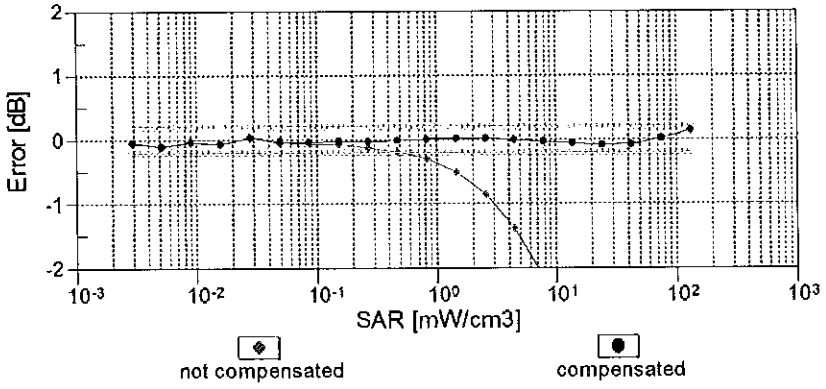


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)

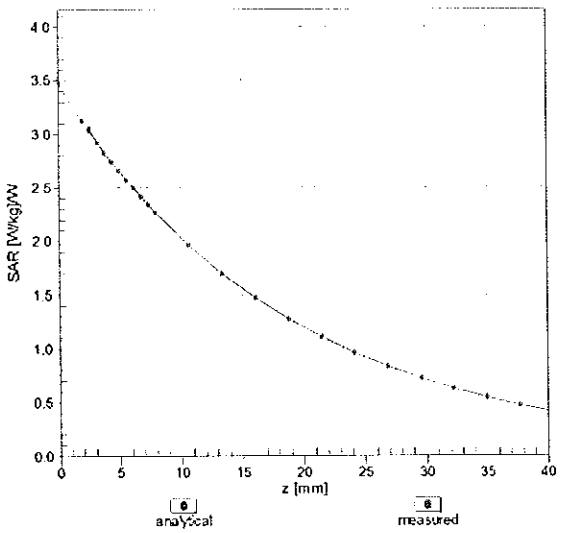




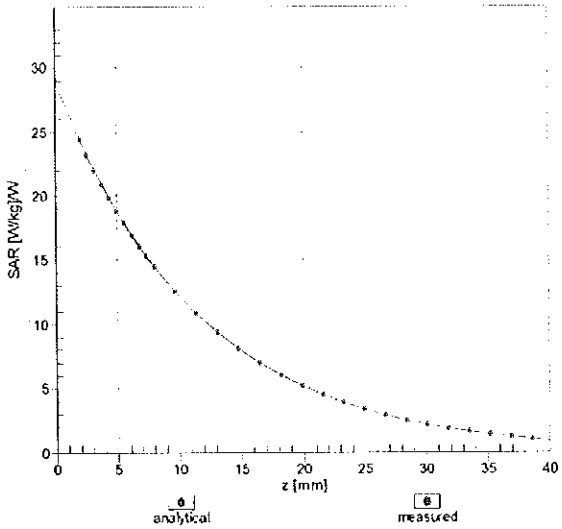
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

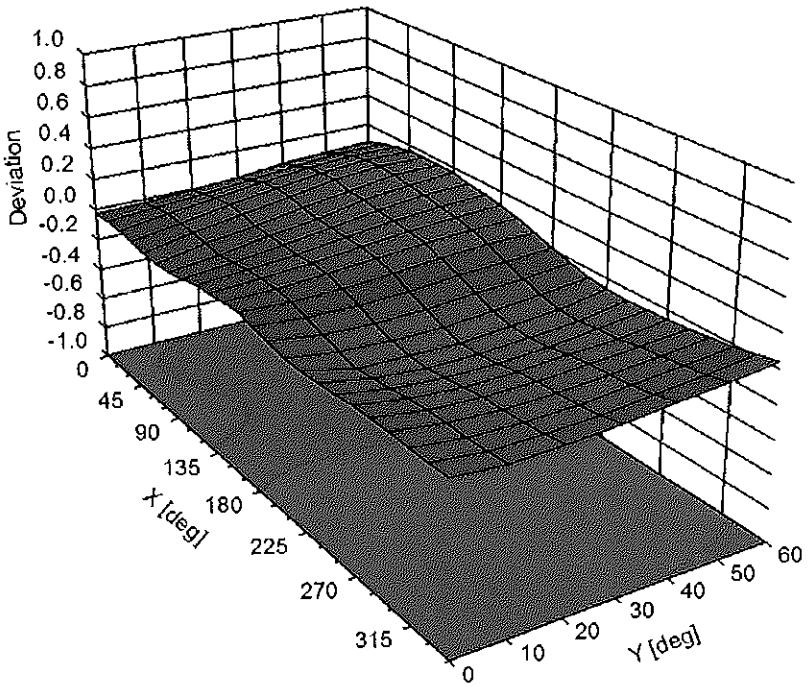


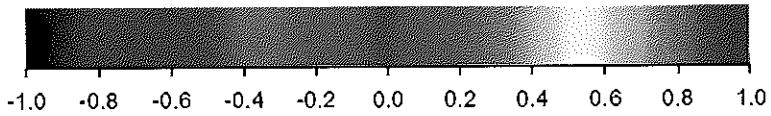
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	98.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max Unc[E] (k=2)
0	CW	X	0.00	0.00	1.00	0.00	228.2	± 3.5 %
		Y	0.00	0.00	1.00		230.0	
		Z	0.00	0.00	1.00		221.7	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	11.07	84.26	20.62	10.00	25.0	± 9.6 %
		Y	10.49	83.36	20.27		25.0	
		Z	11.03	84.22	20.43		25.0	
10011-CAB	UMTS-FDD (WCDMA)	X	1.04	66.65	14.82	0.00	150.0	± 9.6 %
		Y	1.16	69.13	16.33		150.0	
		Z	1.01	66.30	14.54		150.0	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	1.30	64.60	15.49	0.41	150.0	± 9.6 %
		Y	1.33	65.49	16.22		150.0	
		Z	1.28	64.47	15.36		150.0	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	5.14	67.15	17.39	1.46	150.0	± 9.6 %
		Y	5.14	67.35	17.57		150.0	
		Z	5.09	67.17	17.37		150.0	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	62.94	114.81	31.61	9.39	50.0	± 9.6 %
		Y	41.95	107.82	29.66		50.0	
		Z	94.76	121.25	33.03		50.0	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	46.50	109.76	30.33	9.57	50.0	± 9.6 %
		Y	33.70	104.15	28.69		50.0	
		Z	62.69	114.46	31.37		50.0	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	100.00	119.19	30.75	6.56	60.0	± 9.6 %
		Y	100.00	118.97	30.64		60.0	
		Z	100.00	118.83	30.48		60.0	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	18.95	107.68	41.29	12.57	50.0	± 9.6 %
		Y	31.91	124.81	47.58		50.0	
		Z	17.05	104.98	40.36		50.0	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	20.29	105.23	36.57	9.56	60.0	± 9.6 %
		Y	28.92	114.92	39.99		60.0	
		Z	20.11	105.49	36.71		60.0	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	100.00	118.17	29.38	4.80	80.0	± 9.6 %
		Y	100.00	118.12	29.34		80.0	
		Z	100.00	117.81	29.12		80.0	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	100.00	118.40	28.68	3.55	100.0	± 9.6 %
		Y	100.00	118.60	28.76		100.0	
		Z	100.00	118.00	28.41		100.0	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	12.78	94.46	31.72	7.80	80.0	± 9.6 %
		Y	16.27	100.85	34.22		80.0	
		Z	12.37	94.11	31.64		80.0	
10030-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	X	100.00	117.61	29.45	5.30	70.0	± 9.6 %
		Y	100.00	117.52	29.40		70.0	
		Z	100.00	117.17	29.14		70.0	
10031-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	X	100.00	119.11	27.47	1.88	100.0	± 9.6 %
		Y	100.00	120.30	27.96		100.0	
		Z	100.00	118.27	27.02		100.0	

10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	100.00	123.13	28.10	1.17	100.0	± 9.6 %
		Y	100.00	125.86	29.19		100.0	
		Z	100.00	121.81	27.46		100.0	
10033-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	X	19.81	99.27	27.58	5.30	70.0	± 9.6 %
		Y	23.75	102.32	28.48		70.0	
		Z	20.10	99.19	27.31		70.0	
10034-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	X	6.18	84.61	21.36	1.88	100.0	± 9.6 %
		Y	8.74	90.01	23.19		100.0	
		Z	6.07	84.02	20.83		100.0	
10035-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	X	3.50	78.04	18.75	1.17	100.0	± 9.6 %
		Y	4.77	82.88	20.59		100.0	
		Z	3.40	77.42	18.19		100.0	
10036-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	X	25.06	103.36	28.83	5.30	70.0	± 9.6 %
		Y	30.48	106.66	29.76		70.0	
		Z	25.78	103.46	28.61		70.0	
10037-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	X	5.91	84.02	21.13	1.88	100.0	± 9.6 %
		Y	8.37	89.43	22.97		100.0	
		Z	5.74	83.28	20.55		100.0	
10038-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	X	3.58	78.59	19.05	1.17	100.0	± 9.6 %
		Y	4.93	83.62	20.94		100.0	
		Z	3.47	77.94	18.48		100.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	1.75	70.49	15.41	0.00	150.0	± 9.6 %
		Y	2.11	73.63	16.88		150.0	
		Z	1.63	69.80	14.78		150.0	
10042-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	X	100.00	117.99	30.44	7.78	50.0	± 9.6 %
		Y	100.00	117.70	30.30		50.0	
		Z	100.00	117.57	30.13		50.0	
10044-CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	X	0.01	92.86	0.28	0.00	150.0	± 9.6 %
		Y	0.00	128.30	10.22		150.0	
		Z	0.01	91.94	0.27		150.0	
10048-CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	X	16.43	91.36	26.72	13.80	25.0	± 9.6 %
		Y	14.26	88.55	25.69		25.0	
		Z	18.21	93.36	27.20		25.0	
10049-CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	X	21.81	96.95	27.09	10.79	40.0	± 9.6 %
		Y	18.36	93.74	25.99		40.0	
		Z	24.94	99.20	27.59		40.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	16.12	92.43	26.40	9.03	50.0	± 9.6 %
		Y	16.40	92.69	26.46		50.0	
		Z	16.84	93.23	26.48		50.0	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	9.13	87.64	28.49	6.55	100.0	± 9.6 %
		Y	10.85	92.11	30.40		100.0	
		Z	8.80	87.14	28.33		100.0	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	1.45	66.53	16.46	0.61	110.0	± 9.6 %
		Y	1.51	67.75	17.33		110.0	
		Z	1.43	66.36	16.31		110.0	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	71.32	126.43	32.69	1.30	110.0	± 9.6 %
		Y	100.00	133.00	34.47		110.0	
		Z	56.46	122.77	31.74		110.0	

10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	7.70	91.83	25.70	2.04	110.0	± 9.6 %
		Y	12.85	101.15	28.77		110.0	
		Z	7.42	91.30	25.47		110.0	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	4.86	66.91	16.67	0.49	100.0	± 9.6 %
		Y	4.87	67.10	16.85		100.0	
		Z	4.81	66.91	16.64		100.0	
10063-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	X	4.90	67.06	16.81	0.72	100.0	± 9.6 %
		Y	4.91	67.26	16.99		100.0	
		Z	4.85	67.06	16.78		100.0	
10064-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	X	5.22	67.40	17.08	0.86	100.0	± 9.6 %
		Y	5.23	67.59	17.25		100.0	
		Z	5.16	67.38	17.04		100.0	
10065-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	X	5.12	67.42	17.25	1.21	100.0	± 9.6 %
		Y	5.13	67.61	17.43		100.0	
		Z	5.06	67.40	17.21		100.0	
10066-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	X	5.18	67.55	17.48	1.46	100.0	± 9.6 %
		Y	5.19	67.76	17.66		100.0	
		Z	5.11	67.52	17.44		100.0	
10067-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	X	5.50	67.74	17.95	2.04	100.0	± 9.6 %
		Y	5.51	67.96	18.15		100.0	
		Z	5.44	67.76	17.93		100.0	
10068-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	X	5.63	68.06	18.32	2.55	100.0	± 9.6 %
		Y	5.64	68.30	18.53		100.0	
		Z	5.56	68.03	18.28		100.0	
10069-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	X	5.71	68.03	18.50	2.67	100.0	± 9.6 %
		Y	5.72	68.29	18.74		100.0	
		Z	5.64	68.03	18.48		100.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	5.28	67.38	17.78	1.99	100.0	± 9.6 %
		Y	5.29	67.59	17.97		100.0	
		Z	5.23	67.40	17.76		100.0	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	5.33	67.91	18.09	2.30	100.0	± 9.6 %
		Y	5.34	68.14	18.30		100.0	
		Z	5.28	67.91	18.07		100.0	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	5.46	68.24	18.51	2.83	100.0	± 9.6 %
		Y	5.48	68.51	18.74		100.0	
		Z	5.40	68.25	18.50		100.0	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	5.49	68.30	18.76	3.30	100.0	± 9.6 %
		Y	5.51	68.58	19.00		100.0	
		Z	5.44	68.31	18.74		100.0	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	5.63	68.74	19.25	3.82	90.0	± 9.6 %
		Y	5.66	69.06	19.51		90.0	
		Z	5.57	68.71	19.21		90.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	5.64	68.56	19.38	4.15	90.0	± 9.6 %
		Y	5.68	68.89	19.66		90.0	
		Z	5.60	68.57	19.36		90.0	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	5.68	68.64	19.49	4.30	90.0	± 9.6 %
		Y	5.71	68.99	19.77		90.0	
		Z	5.64	68.66	19.47		90.0	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	0.88	65.55	12.70	0.00	150.0	± 9.6 %
		Y	1.01	67.94	14.05		150.0	
		Z	0.82	64.98	12.07		150.0	
10082-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	X	2.05	63.91	8.77	4.77	80.0	± 9.6 %
		Y	2.06	64.02	8.81		80.0	
		Z	1.95	63.58	8.48		80.0	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	100.00	119.26	30.80	6.56	60.0	± 9.6 %
		Y	100.00	119.04	30.70		60.0	
		Z	100.00	118.90	30.53		60.0	
10097-CAB	UMTS-FDD (HSDPA)	X	1.83	67.01	15.38	0.00	150.0	± 9.6 %
		Y	1.91	68.15	16.11		150.0	
		Z	1.80	66.92	15.21		150.0	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	1.79	66.97	15.34	0.00	150.0	± 9.6 %
		Y	1.88	68.14	16.10		150.0	
		Z	1.76	66.87	15.18		150.0	
10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	20.23	105.10	36.53	9.56	60.0	± 9.6 %
		Y	28.70	114.68	39.91		60.0	
		Z	20.06	105.38	36.67		60.0	
10100-CAC	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	3.16	69.99	16.45	0.00	150.0	± 9.6 %
		Y	3.31	71.03	17.06		150.0	
		Z	3.09	69.73	16.33		150.0	
10101-CAC	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	3.32	67.51	15.87	0.00	150.0	± 9.6 %
		Y	3.38	68.00	16.23		150.0	
		Z	3.27	67.36	15.78		150.0	
10102-CAC	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	3.43	67.46	15.96	0.00	150.0	± 9.6 %
		Y	3.47	67.89	16.28		150.0	
		Z	3.37	67.33	15.88		150.0	
10103-CAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	8.65	78.54	21.48	3.98	65.0	± 9.6 %
		Y	8.85	79.12	21.77		65.0	
		Z	8.48	78.45	21.46		65.0	
10104-CAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	8.46	76.91	21.67	3.98	65.0	± 9.6 %
		Y	8.66	77.60	22.06		65.0	
		Z	8.34	76.89	21.66		65.0	
10105-CAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	7.58	74.70	20.99	3.98	65.0	± 9.6 %
		Y	7.79	75.45	21.40		65.0	
		Z	7.31	74.25	20.79		65.0	
10108-CAD	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	2.79	69.24	16.28	0.00	150.0	± 9.6 %
		Y	2.91	70.28	16.91		150.0	
		Z	2.71	69.00	16.16		150.0	
10109-CAD	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	2.98	67.28	15.76	0.00	150.0	± 9.6 %
		Y	3.03	67.83	16.15		150.0	
		Z	2.92	67.15	15.65		150.0	
10110-CAD	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	2.28	68.31	15.91	0.00	150.0	± 9.6 %
		Y	2.39	69.47	16.63		150.0	
		Z	2.21	68.09	15.75		150.0	
10111-CAD	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	2.66	67.75	15.94	0.00	150.0	± 9.6 %
		Y	2.72	68.40	16.37		150.0	
		Z	2.60	67.66	15.80		150.0	

10112-CAD	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	3.11	67.26	15.82	0.00	150.0	± 9.6 %
		Y	3.15	67.75	16.17		150.0	
		Z	3.05	67.15	15.72		150.0	
10113-CAD	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	2.82	67.88	16.07	0.00	150.0	± 9.6 %
		Y	2.87	68.46	16.46		150.0	
		Z	2.76	67.81	15.94		150.0	
10114-CAB	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	5.24	67.28	16.46	0.00	150.0	± 9.6 %
		Y	5.25	67.46	16.63		150.0	
		Z	5.20	67.29	16.46		150.0	
10115-CAB	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	5.61	67.64	16.65	0.00	150.0	± 9.6 %
		Y	5.61	67.79	16.81		150.0	
		Z	5.52	67.52	16.58		150.0	
10116-CAB	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	5.36	67.55	16.52	0.00	150.0	± 9.6 %
		Y	5.37	67.74	16.69		150.0	
		Z	5.32	67.53	16.51		150.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	5.22	67.23	16.45	0.00	150.0	± 9.6 %
		Y	5.23	67.39	16.61		150.0	
		Z	5.17	67.16	16.41		150.0	
10118-CAB	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	5.69	67.85	16.77	0.00	150.0	± 9.6 %
		Y	5.70	68.02	16.93		150.0	
		Z	5.63	67.79	16.73		150.0	
10119-CAB	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	5.34	67.49	16.51	0.00	150.0	± 9.6 %
		Y	5.35	67.67	16.67		150.0	
		Z	5.29	67.47	16.49		150.0	
10140-CAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	3.47	67.47	15.89	0.00	150.0	± 9.6 %
		Y	3.51	67.91	16.21		150.0	
		Z	3.41	67.34	15.80		150.0	
10141-CAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	3.59	67.54	16.05	0.00	150.0	± 9.6 %
		Y	3.63	67.94	16.35		150.0	
		Z	3.53	67.43	15.97		150.0	
10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	2.05	68.16	15.60	0.00	150.0	± 9.6 %
		Y	2.17	69.48	16.39		150.0	
		Z	1.97	67.92	15.36		150.0	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	2.51	68.28	15.68	0.00	150.0	± 9.6 %
		Y	2.59	69.11	16.17		150.0	
		Z	2.43	68.15	15.43		150.0	
10144-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	2.35	66.54	14.37	0.00	150.0	± 9.6 %
		Y	2.42	67.28	14.84		150.0	
		Z	2.27	66.32	14.07		150.0	
10145-CAD	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	1.37	65.72	12.66	0.00	150.0	± 9.6 %
		Y	1.46	66.99	13.37		150.0	
		Z	1.25	64.89	11.82		150.0	
10146-CAD	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	3.11	71.69	15.06	0.00	150.0	± 9.6 %
		Y	3.87	74.93	16.48		150.0	
		Z	2.20	67.57	12.72		150.0	
10147-CAD	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	3.99	75.14	16.65	0.00	150.0	± 9.6 %
		Y	5.26	79.21	18.27		150.0	
		Z	2.59	69.69	13.85		150.0	

10149-CAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	2.99	67.34	15.80	0.00	150.0	± 9.6 %
		Y	3.04	67.88	16.19		150.0	
		Z	2.93	67.20	15.70		150.0	
10150-CAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	3.11	67.30	15.85	0.00	150.0	± 9.6 %
		Y	3.16	67.79	16.21		150.0	
		Z	3.05	67.19	15.76		150.0	
10151-CAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.14	80.78	22.44	3.98	65.0	± 9.6 %
		Y	9.49	81.66	22.85		65.0	
		Z	9.14	81.08	22.55		65.0	
10152-CAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	8.08	77.12	21.52	3.98	65.0	± 9.6 %
		Y	8.33	77.95	21.96		65.0	
		Z	7.95	77.09	21.46		65.0	
10153-CAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	8.46	77.89	22.17	3.98	65.0	± 9.6 %
		Y	8.68	78.63	22.56		65.0	
		Z	8.36	77.94	22.15		65.0	
10154-CAD	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	2.33	68.67	16.15	0.00	150.0	± 9.6 %
		Y	2.44	69.83	16.86		150.0	
		Z	2.25	68.43	15.98		150.0	
10155-CAD	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	2.66	67.76	15.95	0.00	150.0	± 9.6 %
		Y	2.72	68.41	16.38		150.0	
		Z	2.60	67.68	15.82		150.0	
10156-CAD	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	1.90	68.21	15.44	0.00	150.0	± 9.6 %
		Y	2.03	69.70	16.30		150.0	
		Z	1.81	67.89	15.12		150.0	
10157-CAD	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	2.18	67.00	14.41	0.00	150.0	± 9.6 %
		Y	2.26	67.93	14.96		150.0	
		Z	2.09	66.73	14.04		150.0	
10158-CAD	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	2.82	67.92	16.11	0.00	150.0	± 9.6 %
		Y	2.87	68.51	16.50		150.0	
		Z	2.76	67.86	15.98		150.0	
10159-CAD	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	2.28	67.39	14.67	0.00	150.0	± 9.6 %
		Y	2.36	68.28	15.19		150.0	
		Z	2.18	67.11	14.29		150.0	
10160-CAC	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	2.82	68.45	16.16	0.00	150.0	± 9.6 %
		Y	2.91	69.30	16.70		150.0	
		Z	2.76	68.35	16.07		150.0	
10161-CAC	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	3.01	67.20	15.78	0.00	150.0	± 9.6 %
		Y	3.05	67.71	16.14		150.0	
		Z	2.95	67.10	15.68		150.0	
10162-CAC	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	3.11	67.31	15.88	0.00	150.0	± 9.6 %
		Y	3.16	67.80	16.23		150.0	
		Z	3.06	67.24	15.78		150.0	
10166-CAD	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	3.96	70.63	19.76	3.01	150.0	± 9.6 %
		Y	4.08	71.58	20.41		150.0	
		Z	3.69	69.63	19.19		150.0	
10167-CAD	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	5.16	74.36	20.54	3.01	150.0	± 9.6 %
		Y	5.47	75.92	21.41		150.0	
		Z	4.54	72.52	19.67		150.0	

10168-CAD	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	5.71	76.55	21.79	3.01	150.0	± 9.6 %
		Y	6.04	78.08	22.60		150.0	
		Z	4.98	74.53	20.87		150.0	
10169-CAC	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	3.56	71.66	20.23	3.01	150.0	± 9.6 %
		Y	3.72	73.10	21.16		150.0	
		Z	3.12	69.36	19.09		150.0	
10170-CAC	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	5.50	79.49	23.11	3.01	150.0	± 9.6 %
		Y	6.14	82.25	24.43		150.0	
		Z	4.23	74.96	21.26		150.0	
10171-AAC	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	4.39	74.63	20.21	3.01	150.0	± 9.6 %
		Y	4.87	77.16	21.52		150.0	
		Z	3.55	71.26	18.74		150.0	
10172-CAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	36.90	115.61	35.71	6.02	65.0	± 9.6 %
		Y	89.16	134.58	40.97		65.0	
		Z	21.04	105.02	32.65		65.0	
10173-CAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	54.93	117.26	34.23	6.02	65.0	± 9.6 %
		Y	100.00	128.92	37.35		65.0	
		Z	30.85	107.44	31.57		65.0	
10174-CAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	39.60	109.76	31.68	6.02	65.0	± 9.6 %
		Y	70.95	120.74	34.73		65.0	
		Z	23.48	101.22	29.25		65.0	
10175-CAD	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	3.51	71.32	19.98	3.01	150.0	± 9.6 %
		Y	3.68	72.77	20.92		150.0	
		Z	3.08	69.09	18.87		150.0	
10176-CAD	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.51	79.52	23.12	3.01	150.0	± 9.6 %
		Y	6.15	82.28	24.44		150.0	
		Z	4.23	74.98	21.27		150.0	
10177-CAF	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	3.54	71.49	20.08	3.01	150.0	± 9.6 %
		Y	3.71	72.93	21.01		150.0	
		Z	3.11	69.22	18.95		150.0	
10178-CAD	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.43	79.21	22.98	3.01	150.0	± 9.6 %
		Y	6.06	81.97	24.30		150.0	
		Z	4.19	74.78	21.16		150.0	
10179-CAD	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	4.90	76.90	21.51	3.01	150.0	± 9.6 %
		Y	5.47	79.59	22.84		150.0	
		Z	3.86	73.02	19.88		150.0	
10180-CAD	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	4.38	74.54	20.15	3.01	150.0	± 9.6 %
		Y	4.86	77.07	21.46		150.0	
		Z	3.54	71.20	18.69		150.0	
10181-CAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	3.54	71.47	20.07	3.01	150.0	± 9.6 %
		Y	3.70	72.91	21.00		150.0	
		Z	3.10	69.21	18.95		150.0	
10182-CAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.42	79.19	22.97	3.01	150.0	± 9.6 %
		Y	6.05	81.94	24.29		150.0	
		Z	4.19	74.76	21.15		150.0	
10183-AAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	4.37	74.51	20.14	3.01	150.0	± 9.6 %
		Y	4.85	77.04	21.45		150.0	
		Z	3.53	71.17	18.68		150.0	

10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	3.55	71.52	20.09	3.01	150.0	± 9.6 %
		Y	3.72	72.96	21.02		150.0	
		Z	3.11	69.25	18.97		150.0	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.45	79.27	23.00	3.01	150.0	± 9.6 %
		Y	6.09	82.03	24.33		150.0	
		Z	4.20	74.82	21.19		150.0	
10186-AAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	4.39	74.59	20.17	3.01	150.0	± 9.6 %
		Y	4.88	77.13	21.49		150.0	
		Z	3.55	71.24	18.71		150.0	
10187-CAD	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	3.56	71.57	20.15	3.01	150.0	± 9.6 %
		Y	3.73	73.01	21.08		150.0	
		Z	3.12	69.30	19.03		150.0	
10188-CAD	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	5.67	80.08	23.42	3.01	150.0	± 9.6 %
		Y	6.33	82.86	24.73		150.0	
		Z	4.33	75.42	21.53		150.0	
10189-AAD	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	4.51	75.09	20.47	3.01	150.0	± 9.6 %
		Y	5.01	77.67	21.79		150.0	
		Z	3.62	71.63	18.97		150.0	
10193-CAB	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	4.64	66.65	16.17	0.00	150.0	± 9.6 %
		Y	4.65	66.84	16.35		150.0	
		Z	4.59	66.64	16.13		150.0	
10194-CAB	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	4.82	67.00	16.30	0.00	150.0	± 9.6 %
		Y	4.83	67.19	16.48		150.0	
		Z	4.76	66.96	16.26		150.0	
10195-CAB	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	4.87	67.02	16.31	0.00	150.0	± 9.6 %
		Y	4.87	67.22	16.49		150.0	
		Z	4.81	67.00	16.28		150.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	4.65	66.74	16.20	0.00	150.0	± 9.6 %
		Y	4.66	66.93	16.38		150.0	
		Z	4.59	66.71	16.15		150.0	
10197-CAB	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	4.84	67.02	16.31	0.00	150.0	± 9.6 %
		Y	4.85	67.22	16.49		150.0	
		Z	4.78	66.99	16.27		150.0	
10198-CAB	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	4.87	67.04	16.32	0.00	150.0	± 9.6 %
		Y	4.88	67.24	16.50		150.0	
		Z	4.81	67.01	16.29		150.0	
10219-CAB	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	4.60	66.74	16.16	0.00	150.0	± 9.6 %
		Y	4.61	66.94	16.34		150.0	
		Z	4.54	66.71	16.11		150.0	
10220-CAB	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	4.84	67.00	16.31	0.00	150.0	± 9.6 %
		Y	4.84	67.20	16.48		150.0	
		Z	4.77	66.96	16.26		150.0	
10221-CAB	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	4.88	66.97	16.31	0.00	150.0	± 9.6 %
		Y	4.89	67.16	16.49		150.0	
		Z	4.82	66.95	16.28		150.0	
10222-CAB	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	5.20	67.24	16.45	0.00	150.0	± 9.6 %
		Y	5.21	67.41	16.61		150.0	
		Z	5.15	67.17	16.40		150.0	

10223-CAB	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	X	5.54	67.51	16.61	0.00	150.0	± 9.6 %
		Y	5.54	67.65	16.76		150.0	
		Z	5.46	67.41	16.55		150.0	
10224-CAB	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	X	5.24	67.33	16.42	0.00	150.0	± 9.6 %
		Y	5.25	67.50	16.58		150.0	
		Z	5.19	67.27	16.38		150.0	
10225-CAB	UMTS-FDD (HSPA+)	X	2.89	66.01	15.34	0.00	150.0	± 9.6 %
		Y	2.91	66.41	15.64		150.0	
		Z	2.83	65.96	15.20		150.0	
10226-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	60.00	119.05	34.79	6.02	65.0	± 9.6 %
		Y	100.00	129.10	37.47		65.0	
		Z	33.08	108.86	32.05		65.0	
10227-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	44.36	111.89	32.33	6.02	65.0	± 9.6 %
		Y	77.77	122.52	35.25		65.0	
		Z	27.85	104.26	30.19		65.0	
10228-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	40.71	118.07	36.50	6.02	65.0	± 9.6 %
		Y	92.59	135.95	41.44		65.0	
		Z	26.22	109.78	34.13		65.0	
10229-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	54.96	117.26	34.24	6.02	65.0	± 9.6 %
		Y	100.00	128.91	37.35		65.0	
		Z	30.93	107.47	31.58		65.0	
10230-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	41.37	110.53	31.89	6.02	65.0	± 9.6 %
		Y	71.92	120.98	34.79		65.0	
		Z	26.25	103.12	29.80		65.0	
10231-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	37.97	116.54	36.00	6.02	65.0	± 9.6 %
		Y	84.76	133.97	40.88		65.0	
		Z	24.71	108.49	33.69		65.0	
10232-CAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	54.99	117.28	34.24	6.02	65.0	± 9.6 %
		Y	100.00	128.92	37.35		65.0	
		Z	30.92	107.48	31.58		65.0	
10233-CAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	41.40	110.55	31.90	6.02	65.0	± 9.6 %
		Y	72.14	121.04	34.81		65.0	
		Z	26.24	103.13	29.80		65.0	
10234-CAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	35.49	114.97	35.47	6.02	65.0	± 9.6 %
		Y	77.34	131.82	40.23		65.0	
		Z	23.39	107.20	33.21		65.0	
10235-CAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	55.28	117.39	34.27	6.02	65.0	± 9.6 %
		Y	100.00	128.93	37.36		65.0	
		Z	31.03	107.56	31.61		65.0	
10236-CAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	41.91	110.74	31.95	6.02	65.0	± 9.6 %
		Y	73.33	121.30	34.87		65.0	
		Z	26.52	103.28	29.84		65.0	
10237-CAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	38.41	116.80	36.08	6.02	65.0	± 9.6 %
		Y	86.80	134.49	41.01		65.0	
		Z	24.91	108.68	33.74		65.0	
10238-CAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	55.05	117.31	34.25	6.02	65.0	± 9.6 %
		Y	100.00	128.93	37.35		65.0	
		Z	30.91	107.49	31.58		65.0	

10239-CAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	41.42	110.58	31.91	6.02	65.0	± 9.6 %
		Y	72.33	121.11	34.83		65.0	
		Z	26.22	103.13	29.80		65.0	
10240-CAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	38.25	116.72	36.05	6.02	65.0	± 9.6 %
		Y	86.28	134.37	40.98		65.0	
		Z	24.82	108.62	33.73		65.0	
10241-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	12.92	88.42	28.30	6.98	65.0	± 9.6 %
		Y	14.47	91.50	29.64		65.0	
		Z	11.71	86.68	27.54		65.0	
10242-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	12.30	87.28	27.78	6.98	65.0	± 9.6 %
		Y	13.91	90.55	29.21		65.0	
		Z	10.78	84.84	26.74		65.0	
10243-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	9.57	83.58	27.27	6.98	65.0	± 9.6 %
		Y	10.70	86.76	28.80		65.0	
		Z	8.63	81.57	26.33		65.0	
10244-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	9.97	81.73	21.53	3.98	65.0	± 9.6 %
		Y	10.43	82.64	21.91		65.0	
		Z	8.76	79.58	20.36		65.0	
10245-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	9.75	81.12	21.26	3.98	65.0	± 9.6 %
		Y	10.17	81.97	21.61		65.0	
		Z	8.56	78.97	20.07		65.0	
10246-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	9.14	83.08	21.95	3.98	65.0	± 9.6 %
		Y	9.72	84.22	22.38		65.0	
		Z	8.89	82.67	21.56		65.0	
10247-CAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	7.53	77.68	20.47	3.98	65.0	± 9.6 %
		Y	7.73	78.28	20.74		65.0	
		Z	7.33	77.37	20.13		65.0	
10248-CAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	7.50	77.17	20.25	3.98	65.0	± 9.6 %
		Y	7.71	77.80	20.54		65.0	
		Z	7.27	76.81	19.89		65.0	
10249-CAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	10.17	85.08	23.35	3.98	65.0	± 9.6 %
		Y	10.94	86.52	23.90		65.0	
		Z	10.18	85.27	23.26		65.0	
10250-CAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	8.40	79.60	22.53	3.98	65.0	± 9.6 %
		Y	8.67	80.38	22.90		65.0	
		Z	8.32	79.67	22.46		65.0	
10251-CAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	7.96	77.51	21.40	3.98	65.0	± 9.6 %
		Y	8.23	78.35	21.83		65.0	
		Z	7.84	77.49	21.29		65.0	
10252-CAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.91	84.03	23.67	3.98	65.0	± 9.6 %
		Y	10.54	85.36	24.22		65.0	
		Z	9.99	84.47	23.78		65.0	
10253-CAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.87	76.54	21.30	3.98	65.0	± 9.6 %
		Y	8.11	77.33	21.72		65.0	
		Z	7.77	76.53	21.24		65.0	
10254-CAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	8.25	77.30	21.90	3.98	65.0	± 9.6 %
		Y	8.47	78.02	22.29		65.0	
		Z	8.16	77.35	21.86		65.0	

10255-CAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	8.82	80.37	22.51	3.98	65.0	± 9.6 %
		Y	9.18	81.32	22.95		65.0	
		Z	8.82	80.67	22.60		65.0	
10256-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	8.67	79.06	19.69	3.98	65.0	± 9.6 %
		Y	9.00	79.76	19.98		65.0	
		Z	7.35	76.40	18.22		65.0	
10257-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	8.39	78.18	19.27	3.98	65.0	± 9.6 %
		Y	8.67	78.82	19.53		65.0	
		Z	7.11	75.57	17.80		65.0	
10258-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	7.67	79.80	20.11	3.98	65.0	± 9.6 %
		Y	7.97	80.50	20.36		65.0	
		Z	7.13	78.64	19.35		65.0	
10259-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	7.87	78.36	21.19	3.98	65.0	± 9.6 %
		Y	8.11	79.04	21.50		65.0	
		Z	7.72	78.21	20.96		65.0	
10260-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	7.88	78.07	21.09	3.98	65.0	± 9.6 %
		Y	8.10	78.72	21.39		65.0	
		Z	7.71	77.89	20.85		65.0	
10261-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	9.63	83.94	23.25	3.98	65.0	± 9.6 %
		Y	10.30	85.33	23.81		65.0	
		Z	9.64	84.17	23.22		65.0	
10262-CAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	8.39	79.56	22.49	3.98	65.0	± 9.6 %
		Y	8.66	80.34	22.86		65.0	
		Z	8.31	79.62	22.42		65.0	
10263-CAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	7.95	77.50	21.40	3.98	65.0	± 9.6 %
		Y	8.22	78.34	21.82		65.0	
		Z	7.83	77.47	21.29		65.0	
10264-CAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	9.83	83.88	23.59	3.98	65.0	± 9.6 %
		Y	10.46	85.22	24.15		65.0	
		Z	9.91	84.30	23.70		65.0	
10265-CAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	8.08	77.12	21.52	3.98	65.0	± 9.6 %
		Y	8.33	77.96	21.96		65.0	
		Z	7.95	77.09	21.47		65.0	
10266-CAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	8.45	77.88	22.16	3.98	65.0	± 9.6 %
		Y	8.68	78.62	22.55		65.0	
		Z	8.36	77.93	22.14		65.0	
10267-CAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.12	80.75	22.43	3.98	65.0	± 9.6 %
		Y	9.47	81.62	22.84		65.0	
		Z	9.12	81.04	22.54		65.0	
10268-CAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	8.54	76.63	21.68	3.98	65.0	± 9.6 %
		Y	8.73	77.26	22.04		65.0	
		Z	8.44	76.63	21.67		65.0	
10269-CAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	8.47	76.21	21.58	3.98	65.0	± 9.6 %
		Y	8.64	76.83	21.94		65.0	
		Z	8.37	76.22	21.56		65.0	
10270-CAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	8.62	78.00	21.50	3.98	65.0	± 9.6 %
		Y	8.81	78.56	21.80		65.0	
		Z	8.57	78.16	21.57		65.0	

10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	2.63	66.22	15.16	0.00	150.0	± 9.6 %
		Y	2.68	66.76	15.56		150.0	
		Z	2.60	66.20	15.05		150.0	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	1.63	67.34	15.24	0.00	150.0	± 9.6 %
		Y	1.75	68.91	16.21		150.0	
		Z	1.59	67.10	15.04		150.0	
10277-CAA	PHS (QPSK)	X	5.23	69.17	13.58	9.03	50.0	± 9.6 %
		Y	5.23	69.14	13.54		50.0	
		Z	4.94	68.42	12.95		50.0	
10278-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.5)	X	9.44	80.92	21.03	9.03	50.0	± 9.6 %
		Y	9.27	80.52	20.82		50.0	
		Z	8.80	79.60	20.21		50.0	
10279-CAA	PHS (QPSK, BW 884MHz, Rolloff 0.38)	X	9.60	81.11	21.12	9.03	50.0	± 9.6 %
		Y	9.45	80.75	20.93		50.0	
		Z	8.93	79.76	20.30		50.0	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	1.49	68.14	14.07	0.00	150.0	± 9.6 %
		Y	1.71	70.53	15.29		150.0	
		Z	1.38	67.47	13.43		150.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	0.87	65.35	12.59	0.00	150.0	± 9.6 %
		Y	0.98	67.67	13.90		150.0	
		Z	0.81	64.81	11.96		150.0	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	1.01	68.28	14.43	0.00	150.0	± 9.6 %
		Y	1.28	72.37	16.47		150.0	
		Z	0.94	67.61	13.77		150.0	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	1.31	72.09	16.62	0.00	150.0	± 9.6 %
		Y	1.86	78.07	19.28		150.0	
		Z	1.24	71.48	16.00		150.0	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	11.68	86.43	25.21	9.03	50.0	± 9.6 %
		Y	12.34	87.51	25.61		50.0	
		Z	12.30	87.31	25.27		50.0	
10297-AAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	2.80	69.32	16.34	0.00	150.0	± 9.6 %
		Y	2.92	70.37	16.97		150.0	
		Z	2.72	69.08	16.22		150.0	
10298-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	1.65	67.43	14.29	0.00	150.0	± 9.6 %
		Y	1.78	69.00	15.16		150.0	
		Z	1.54	66.87	13.72		150.0	
10299-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	3.71	73.80	16.79	0.00	150.0	± 9.6 %
		Y	4.50	76.98	18.19		150.0	
		Z	2.80	70.24	14.88		150.0	
10300-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	2.66	68.22	13.61	0.00	150.0	± 9.6 %
		Y	2.97	70.07	14.57		150.0	
		Z	2.16	65.95	12.13		150.0	
10301-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	X	5.56	67.67	18.53	4.17	80.0	± 9.6 %
		Y	5.78	68.72	19.18		80.0	
		Z	5.51	67.68	18.44		80.0	
10302-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols)	X	6.08	68.43	19.36	4.96	80.0	± 9.6 %
		Y	6.31	69.64	20.14		80.0	
		Z	6.00	68.40	19.26		80.0	

10303-AAA	IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	X	5.91	68.44	19.38	4.96	80.0	± 9.6 %
		Y	6.17	69.77	20.23		80.0	
		Z	5.83	68.37	19.25		80.0	
10304-AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	X	5.57	67.76	18.57	4.17	80.0	± 9.6 %
		Y	5.77	68.85	19.27		80.0	
		Z	5.49	67.73	18.47		80.0	
10305-AAA	IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC, 15 symbols)	X	7.72	78.82	24.99	6.02	50.0	± 9.6 %
		Y	9.80	85.05	27.90		50.0	
		Z	7.68	78.78	24.73		50.0	
10306-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC, 18 symbols)	X	6.19	70.81	21.17	6.02	50.0	± 9.6 %
		Y	6.78	73.45	22.69		50.0	
		Z	6.09	70.68	20.96		50.0	
10307-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC, 18 symbols)	X	6.23	71.39	21.28	6.02	50.0	± 9.6 %
		Y	6.93	74.34	22.91		50.0	
		Z	6.66	74.17	22.78		50.0	
10308-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	X	6.84	74.87	23.29	6.02	50.0	± 9.6 %
		Y	7.04	74.94	23.20		50.0	
		Z	6.77	74.83	23.10		50.0	
10309-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3, 18 symbols)	X	6.29	71.13	21.36	6.02	50.0	± 9.6 %
		Y	6.92	73.87	22.92		50.0	
		Z	6.18	70.98	21.13		50.0	
10310-AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3, 18 symbols)	X	6.19	71.01	21.18	6.02	50.0	± 9.6 %
		Y	6.82	73.78	22.75		50.0	
		Z	6.55	73.55	22.58		50.0	
10311-AAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	3.15	68.64	16.01	0.00	150.0	± 9.6 %
		Y	3.28	69.57	16.56		150.0	
		Z	3.07	68.40	15.89		150.0	
10313-AAA	iDEN 1:3	X	7.93	80.00	19.43	6.99	70.0	± 9.6 %
		Y	8.50	81.06	19.83		70.0	
		Z	7.91	80.08	19.40		70.0	
10314-AAA	iDEN 1:6	X	10.36	86.77	24.35	10.00	30.0	± 9.6 %
		Y	11.09	87.90	24.72		30.0	
		Z	10.57	87.37	24.52		30.0	
10315-AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	1.16	64.08	15.18	0.17	150.0	± 9.6 %
		Y	1.19	64.95	15.92		150.0	
		Z	1.15	63.96	15.05		150.0	
10316-AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	4.74	66.85	16.40	0.17	150.0	± 9.6 %
		Y	4.75	67.05	16.58		150.0	
		Z	4.69	66.84	16.36		150.0	
10317-AAB	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	4.74	66.85	16.40	0.17	150.0	± 9.6 %
		Y	4.75	67.05	16.58		150.0	
		Z	4.69	66.84	16.36		150.0	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	4.83	67.07	16.30	0.00	150.0	± 9.6 %
		Y	4.84	67.29	16.50		150.0	
		Z	4.76	67.04	16.26		150.0	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	5.51	67.29	16.49	0.00	150.0	± 9.6 %
		Y	5.53	67.49	16.67		150.0	
		Z	5.49	67.36	16.51		150.0	

10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	5.79	67.69	16.53	0.00	150.0	± 9.6 %
		Y	5.79	67.83	16.67		150.0	
		Z	5.72	67.60	16.48		150.0	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	1.49	68.14	14.07	0.00	115.0	± 9.6 %
		Y	1.71	70.53	15.29		115.0	
		Z	1.38	67.47	13.43		115.0	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	1.49	68.14	14.07	0.00	115.0	± 9.6 %
		Y	1.71	70.53	15.29		115.0	
		Z	1.38	67.47	13.43		115.0	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	100.00	122.23	31.08	0.00	100.0	± 9.6 %
		Y	100.00	122.94	31.38		100.0	
		Z	21.98	102.39	26.35		100.0	
10410-AAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	121.68	31.26	3.23	80.0	± 9.6 %
		Y	100.00	122.54	31.65		80.0	
		Z	100.00	121.97	31.19		80.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	1.03	62.73	14.35	0.00	150.0	± 9.6 %
		Y	1.04	63.46	15.05		150.0	
		Z	1.02	62.64	14.23		150.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	4.64	66.69	16.23	0.00	150.0	± 9.6 %
		Y	4.65	66.89	16.41		150.0	
		Z	4.59	66.68	16.20		150.0	
10417-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	4.64	66.69	16.23	0.00	150.0	± 9.6 %
		Y	4.65	66.89	16.41		150.0	
		Z	4.59	66.68	16.20		150.0	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	4.63	66.83	16.23	0.00	150.0	± 9.6 %
		Y	4.64	67.04	16.42		150.0	
		Z	4.58	66.82	16.21		150.0	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preambule)	X	4.65	66.79	16.24	0.00	150.0	± 9.6 %
		Y	4.66	66.99	16.43		150.0	
		Z	4.60	66.78	16.21		150.0	
10422-AAA	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	X	4.78	66.81	16.27	0.00	150.0	± 9.6 %
		Y	4.78	67.00	16.45		150.0	
		Z	4.72	66.79	16.24		150.0	
10423-AAA	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	X	4.96	67.16	16.40	0.00	150.0	± 9.6 %
		Y	4.97	67.35	16.58		150.0	
		Z	4.89	67.12	16.36		150.0	
10424-AAA	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	X	4.88	67.10	16.36	0.00	150.0	± 9.6 %
		Y	4.88	67.30	16.54		150.0	
		Z	4.81	67.07	16.33		150.0	
10425-AAA	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	X	5.49	67.52	16.59	0.00	150.0	± 9.6 %
		Y	5.50	67.70	16.76		150.0	
		Z	5.44	67.51	16.58		150.0	
10426-AAA	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	X	5.49	67.54	16.59	0.00	150.0	± 9.6 %
		Y	5.50	67.71	16.76		150.0	
		Z	5.45	67.53	16.59		150.0	

10427-AAA	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	X	5.50	67.50	16.57	0.00	150.0	± 9.6 %
		Y	5.51	67.67	16.73		150.0	
		Z	5.45	67.48	16.56		150.0	
10430-AAA	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	4.25	70.00	17.85	0.00	150.0	± 9.6 %
		Y	4.23	70.09	17.93		150.0	
		Z	4.19	70.14	17.80		150.0	
10431-AAA	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	4.34	67.20	16.23	0.00	150.0	± 9.6 %
		Y	4.36	67.46	16.45		150.0	
		Z	4.27	67.18	16.16		150.0	
10432-AAA	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	4.64	67.12	16.31	0.00	150.0	± 9.6 %
		Y	4.65	67.34	16.50		150.0	
		Z	4.57	67.09	16.26		150.0	
10433-AAA	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	4.89	67.13	16.38	0.00	150.0	± 9.6 %
		Y	4.90	67.33	16.56		150.0	
		Z	4.82	67.10	16.34		150.0	
10434-AAA	W-CDMA (BS Test Model 1, 64 DPCH)	X	4.31	70.67	17.79	0.00	150.0	± 9.6 %
		Y	4.30	70.79	17.87		150.0	
		Z	4.25	70.82	17.71		150.0	
10435-AAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	121.51	31.18	3.23	80.0	± 9.6 %
		Y	100.00	122.37	31.57		80.0	
		Z	100.00	121.79	31.11		80.0	
10447-AAA	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	X	3.63	67.13	15.60	0.00	150.0	± 9.6 %
		Y	3.66	67.50	15.86		150.0	
		Z	3.54	67.07	15.44		150.0	
10448-AAA	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clippin 44%)	X	4.17	66.96	16.08	0.00	150.0	± 9.6 %
		Y	4.19	67.23	16.30		150.0	
		Z	4.10	66.94	16.02		150.0	
10449-AAA	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Cliping 44%)	X	4.44	66.92	16.19	0.00	150.0	± 9.6 %
		Y	4.45	67.15	16.39		150.0	
		Z	4.38	66.90	16.14		150.0	
10450-AAA	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	X	4.63	66.87	16.23	0.00	150.0	± 9.6 %
		Y	4.64	67.08	16.41		150.0	
		Z	4.58	66.85	16.19		150.0	
10451-AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	X	3.53	67.33	15.28	0.00	150.0	± 9.6 %
		Y	3.57	67.74	15.55		150.0	
		Z	3.43	67.21	15.05		150.0	
10456-AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc duty cycle)	X	6.35	68.11	16.76	0.00	150.0	± 9.6 %
		Y	6.36	68.24	16.90		150.0	
		Z	6.31	68.06	16.74		150.0	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	3.86	65.32	15.94	0.00	150.0	± 9.6 %
		Y	3.86	65.52	16.13		150.0	
		Z	3.83	65.31	15.89		150.0	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	3.37	66.71	14.79	0.00	150.0	± 9.6 %
		Y	3.41	67.16	15.08		150.0	
		Z	3.26	66.61	14.51		150.0	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	4.52	65.23	15.77	0.00	150.0	± 9.6 %
		Y	4.60	65.75	16.11		150.0	
		Z	4.38	65.07	15.54		150.0	

10460-AAA	UMTS-FDD (WCDMA, AMR)	X	0.89	66.92	15.35	0.00	150.0	± 9.6 %
		Y	1.01	69.93	17.18		150.0	
		Z	0.86	66.57	15.06		150.0	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	125.62	33.15	3.29	80.0	± 9.6 %
		Y	100.00	127.39	33.94		80.0	
		Z	100.00	125.16	32.74		80.0	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	110.62	25.96	3.23	80.0	± 9.6 %
		Y	100.00	111.65	26.39		80.0	
		Z	84.76	108.06	25.05		80.0	
10463-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	107.62	24.51	3.23	80.0	± 9.6 %
		Y	100.00	108.53	24.89		80.0	
		Z	14.33	86.37	18.99		80.0	
10464-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	123.78	32.14	3.23	80.0	± 9.6 %
		Y	100.00	125.58	32.94		80.0	
		Z	100.00	123.19	31.67		80.0	
10465-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	110.13	25.71	3.23	80.0	± 9.6 %
		Y	100.00	111.18	26.15		80.0	
		Z	35.58	97.99	22.58		80.0	
10466-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	95.39	106.65	24.18	3.23	80.0	± 9.6 %
		Y	100.00	108.07	24.67		80.0	
		Z	9.21	81.47	17.50		80.0	
10467-AAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	123.99	32.23	3.23	80.0	± 9.6 %
		Y	100.00	125.80	33.04		80.0	
		Z	100.00	123.41	31.77		80.0	
10468-AAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	110.29	25.79	3.23	80.0	± 9.6 %
		Y	100.00	111.34	26.23		80.0	
		Z	43.78	100.42	23.20		80.0	
10469-AAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	99.99	107.17	24.29	3.23	80.0	± 9.6 %
		Y	100.00	108.09	24.67		80.0	
		Z	9.38	81.68	17.56		80.0	
10470-AAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	124.02	32.24	3.23	80.0	± 9.6 %
		Y	100.00	125.83	33.05		80.0	
		Z	100.00	123.44	31.77		80.0	
10471-AAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	110.24	25.76	3.23	80.0	± 9.6 %
		Y	100.00	111.29	26.20		80.0	
		Z	43.76	100.38	23.18		80.0	
10472-AAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	107.12	24.26	3.23	80.0	± 9.6 %
		Y	100.00	108.04	24.64		80.0	
		Z	9.36	81.64	17.53		80.0	
10473-AAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	100.00	123.99	32.23	3.23	80.0	± 9.6 %
		Y	100.00	125.81	33.03		80.0	
		Z	100.00	123.41	31.76		80.0	
10474-AAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	110.25	25.76	3.23	80.0	± 9.6 %
		Y	100.00	111.30	26.20		80.0	
		Z	42.90	100.17	23.13		80.0	
10475-AAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	99.25	107.05	24.25	3.23	80.0	± 9.6 %
		Y	100.00	108.06	24.65		80.0	
		Z	9.24	81.52	17.50		80.0	

10477-AAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	100.00	110.09	25.68	3.23	80.0	± 9.6 %
		Y	100.00	111.14	26.12		80.0	
		Z	37.23	98.47	22.68		80.0	
10478-AAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	95.92	106.64	24.15	3.23	80.0	± 9.6 %
		Y	100.00	108.00	24.62		80.0	
		Z	9.13	81.36	17.44		80.0	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	15.99	96.17	26.79	3.23	80.0	± 9.6 %
		Y	25.94	104.65	29.40		80.0	
		Z	12.83	92.51	25.34		80.0	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	19.48	93.48	24.25	3.23	80.0	± 9.6 %
		Y	30.64	100.38	26.28		80.0	
		Z	12.85	87.46	22.08		80.0	
10481-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	16.00	89.85	22.83	3.23	80.0	± 9.6 %
		Y	23.58	95.63	24.59		80.0	
		Z	10.55	84.00	20.64		80.0	
10482-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.04	76.94	19.04	2.23	80.0	± 9.6 %
		Y	6.02	79.79	20.13		80.0	
		Z	4.78	76.30	18.55		80.0	
10483-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.12	82.48	20.94	2.23	80.0	± 9.6 %
		Y	10.77	85.20	21.94		80.0	
		Z	6.99	78.47	19.09		80.0	
10484-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	8.29	80.89	20.40	2.23	80.0	± 9.6 %
		Y	9.58	83.28	21.31		80.0	
		Z	6.43	77.10	18.60		80.0	
10485-AAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.28	77.72	20.08	2.23	80.0	± 9.6 %
		Y	6.19	80.50	21.18		80.0	
		Z	5.13	77.51	19.85		80.0	
10486-AAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.51	72.42	17.68	2.23	80.0	± 9.6 %
		Y	4.81	73.61	18.21		80.0	
		Z	4.36	72.13	17.34		80.0	
10487-AAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.47	71.97	17.49	2.23	80.0	± 9.6 %
		Y	4.74	73.05	17.98		80.0	
		Z	4.32	71.65	17.14		80.0	
10488-AAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.28	76.23	20.05	2.23	80.0	± 9.6 %
		Y	5.88	78.28	20.95		80.0	
		Z	5.13	76.06	19.94		80.0	
10489-AAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.61	71.60	18.35	2.23	80.0	± 9.6 %
		Y	4.82	72.56	18.83		80.0	
		Z	4.51	71.52	18.23		80.0	
10490-AAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.69	71.33	18.26	2.23	80.0	± 9.6 %
		Y	4.87	72.22	18.72		80.0	
		Z	4.59	71.26	18.14		80.0	
10491-AAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.21	74.00	19.31	2.23	80.0	± 9.6 %
		Y	5.57	75.36	19.96		80.0	
		Z	5.08	73.85	19.24		80.0	
10492-AAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.87	70.59	18.20	2.23	80.0	± 9.6 %
		Y	5.02	71.33	18.60		80.0	
		Z	4.77	70.51	18.12		80.0	

10493-AAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.93	70.41	18.14	2.23	80.0	± 9.6 %
		Y	5.07	71.11	18.53		80.0	
		Z	4.83	70.34	18.06		80.0	
10494-AAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.74	75.68	19.79	2.23	80.0	± 9.6 %
		Y	6.23	77.26	20.51		80.0	
		Z	5.57	75.46	19.70		80.0	
10495-AAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.94	71.08	18.40	2.23	80.0	± 9.6 %
		Y	5.11	71.86	18.83		80.0	
		Z	4.84	70.96	18.32		80.0	
10496-AAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.99	70.71	18.29	2.23	80.0	± 9.6 %
		Y	5.14	71.42	18.69		80.0	
		Z	4.89	70.61	18.21		80.0	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	3.95	73.39	16.94	2.23	80.0	± 9.6 %
		Y	4.59	75.63	17.82		80.0	
		Z	3.56	72.03	16.04		80.0	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	2.99	67.14	13.42	2.23	80.0	± 9.6 %
		Y	3.17	68.04	13.81		80.0	
		Z	2.58	65.48	12.27		80.0	
10499-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	2.90	66.50	13.01	2.23	80.0	± 9.6 %
		Y	3.06	67.30	13.36		80.0	
		Z	2.49	64.82	11.82		80.0	
10500-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.14	76.64	19.91	2.23	80.0	± 9.6 %
		Y	5.86	79.02	20.91		80.0	
		Z	5.00	76.51	19.75		80.0	
10501-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.55	72.03	17.90	2.23	80.0	± 9.6 %
		Y	4.80	73.10	18.41		80.0	
		Z	4.43	71.87	17.67		80.0	
10502-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.59	71.80	17.77	2.23	80.0	± 9.6 %
		Y	4.83	72.81	18.25		80.0	
		Z	4.47	71.64	17.53		80.0	
10503-AAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.22	76.03	19.96	2.23	80.0	± 9.6 %
		Y	5.81	78.08	20.86		80.0	
		Z	5.07	75.86	19.85		80.0	
10504-AAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.59	71.52	18.30	2.23	80.0	± 9.6 %
		Y	4.80	72.48	18.79		80.0	
		Z	4.49	71.43	18.18		80.0	
10505-AAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.66	71.24	18.21	2.23	80.0	± 9.6 %
		Y	4.85	72.13	18.67		80.0	
		Z	4.56	71.17	18.09		80.0	
10506-AAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.69	75.54	19.72	2.23	80.0	± 9.6 %
		Y	6.18	77.12	20.44		80.0	
		Z	5.52	75.31	19.63		80.0	
10507-AAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	4.93	71.03	18.37	2.23	80.0	± 9.6 %
		Y	5.09	71.81	18.80		80.0	
		Z	4.82	70.90	18.29		80.0	

10508-AAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	4.98	70.65	18.25	2.23	80.0	± 9.6 %
		Y	5.12	71.36	18.65		80.0	
		Z	4.87	70.54	18.17		80.0	
10509-AAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.75	73.61	18.99	2.23	80.0	± 9.6 %
		Y	6.04	74.62	19.49		80.0	
		Z	5.61	73.42	18.92		80.0	
10510-AAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.37	70.52	18.25	2.23	80.0	± 9.6 %
		Y	5.50	71.12	18.60		80.0	
		Z	5.26	70.38	18.18		80.0	
10511-AAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.39	70.20	18.16	2.23	80.0	± 9.6 %
		Y	5.51	70.76	18.50		80.0	
		Z	5.29	70.08	18.10		80.0	
10512-AAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.17	75.45	19.55	2.23	80.0	± 9.6 %
		Y	6.61	76.77	20.16		80.0	
		Z	5.99	75.18	19.45		80.0	
10513-AAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	5.29	70.93	18.40	2.23	80.0	± 9.6 %
		Y	5.44	71.61	18.78		80.0	
		Z	5.18	70.76	18.31		80.0	
10514-AAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	X	5.26	70.42	18.25	2.23	80.0	± 9.6 %
		Y	5.39	71.03	18.61		80.0	
		Z	5.16	70.27	18.17		80.0	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	0.99	62.88	14.39	0.00	150.0	± 9.6 %
		Y	1.01	63.69	15.14		150.0	
		Z	0.98	62.78	14.25		150.0	
10516-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc duty cycle)	X	0.57	67.90	15.77	0.00	150.0	± 9.6 %
		Y	0.79	74.76	19.51		150.0	
		Z	0.54	67.33	15.34		150.0	
10517-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc duty cycle)	X	0.83	64.48	14.80	0.00	150.0	± 9.6 %
		Y	0.88	66.11	16.05		150.0	
		Z	0.82	64.26	14.59		150.0	
10518-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	4.64	66.76	16.21	0.00	150.0	± 9.6 %
		Y	4.64	66.97	16.39		150.0	
		Z	4.58	66.75	16.17		150.0	
10519-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc duty cycle)	X	4.84	67.04	16.35	0.00	150.0	± 9.6 %
		Y	4.85	67.24	16.53		150.0	
		Z	4.77	67.00	16.30		150.0	
10520-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc duty cycle)	X	4.69	67.00	16.26	0.00	150.0	± 9.6 %
		Y	4.70	67.20	16.45		150.0	
		Z	4.62	66.95	16.22		150.0	
10521-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc duty cycle)	X	4.62	66.99	16.24	0.00	150.0	± 9.6 %
		Y	4.63	67.20	16.43		150.0	
		Z	4.55	66.94	16.20		150.0	
10522-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc duty cycle)	X	4.67	67.03	16.31	0.00	150.0	± 9.6 %
		Y	4.69	67.25	16.50		150.0	
		Z	4.61	67.03	16.28		150.0	

10523-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc duty cycle)	X	4.55	66.89	16.15	0.00	150.0	± 9.6 %
		Y	4.56	67.11	16.34		150.0	
		Z	4.49	66.88	16.12		150.0	
10524-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc duty cycle)	X	4.62	66.97	16.28	0.00	150.0	± 9.6 %
		Y	4.63	67.19	16.48		150.0	
		Z	4.56	66.95	16.25		150.0	
10525-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	4.59	65.99	15.86	0.00	150.0	± 9.6 %
		Y	4.60	66.20	16.05		150.0	
		Z	4.54	65.98	15.83		150.0	
10526-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	4.77	66.38	16.01	0.00	150.0	± 9.6 %
		Y	4.79	66.60	16.20		150.0	
		Z	4.71	66.35	15.98		150.0	
10527-AAA	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc duty cycle)	X	4.69	66.34	15.95	0.00	150.0	± 9.6 %
		Y	4.71	66.56	16.15		150.0	
		Z	4.63	66.30	15.91		150.0	
10528-AAA	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc duty cycle)	X	4.71	66.36	15.99	0.00	150.0	± 9.6 %
		Y	4.72	66.58	16.18		150.0	
		Z	4.65	66.32	15.95		150.0	
10529-AAA	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc duty cycle)	X	4.71	66.36	15.99	0.00	150.0	± 9.6 %
		Y	4.72	66.58	16.18		150.0	
		Z	4.65	66.32	15.95		150.0	
10531-AAA	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc duty cycle)	X	4.71	66.48	16.01	0.00	150.0	± 9.6 %
		Y	4.73	66.71	16.20		150.0	
		Z	4.64	66.43	15.96		150.0	
10532-AAA	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc duty cycle)	X	4.56	66.33	15.94	0.00	150.0	± 9.6 %
		Y	4.58	66.56	16.14		150.0	
		Z	4.50	66.27	15.89		150.0	
10533-AAA	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc duty cycle)	X	4.72	66.39	15.97	0.00	150.0	± 9.6 %
		Y	4.73	66.61	16.16		150.0	
		Z	4.65	66.36	15.93		150.0	
10534-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	5.24	66.54	16.07	0.00	150.0	± 9.6 %
		Y	5.25	66.71	16.24		150.0	
		Z	5.19	66.49	16.04		150.0	
10535-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	5.31	66.70	16.14	0.00	150.0	± 9.6 %
		Y	5.33	66.88	16.31		150.0	
		Z	5.26	66.68	16.13		150.0	
10536-AAA	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc duty cycle)	X	5.18	66.65	16.10	0.00	150.0	± 9.6 %
		Y	5.19	66.84	16.27		150.0	
		Z	5.12	66.60	16.07		150.0	
10537-AAA	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc duty cycle)	X	5.24	66.63	16.10	0.00	150.0	± 9.6 %
		Y	5.25	66.81	16.26		150.0	
		Z	5.19	66.58	16.06		150.0	
10538-AAA	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc duty cycle)	X	5.35	66.69	16.17	0.00	150.0	± 9.6 %
		Y	5.36	66.87	16.33		150.0	
		Z	5.28	66.62	16.12		150.0	
10540-AAA	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc duty cycle)	X	5.26	66.66	16.17	0.00	150.0	± 9.6 %
		Y	5.27	66.85	16.34		150.0	
		Z	5.21	66.63	16.14		150.0	

10541-AAA	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc duty cycle)	X	5.23	66.53	16.10	0.00	150.0	± 9.6 %
		Y	5.24	66.71	16.26		150.0	
		Z	5.18	66.49	16.06		150.0	
10542-AAA	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc duty cycle)	X	5.39	66.62	16.16	0.00	150.0	± 9.6 %
		Y	5.40	66.79	16.32		150.0	
		Z	5.34	66.57	16.12		150.0	
10543-AAA	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc duty cycle)	X	5.48	66.66	16.19	0.00	150.0	± 9.6 %
		Y	5.49	66.83	16.36		150.0	
		Z	5.42	66.63	16.18		150.0	
10544-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	5.54	66.65	16.07	0.00	150.0	± 9.6 %
		Y	5.55	66.80	16.22		150.0	
		Z	5.50	66.61	16.04		150.0	
10545-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	5.76	67.11	16.24	0.00	150.0	± 9.6 %
		Y	5.77	67.28	16.40		150.0	
		Z	5.71	67.07	16.23		150.0	
10546-AAA	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc duty cycle)	X	5.63	66.91	16.16	0.00	150.0	± 9.6 %
		Y	5.64	67.07	16.32		150.0	
		Z	5.57	66.84	16.12		150.0	
10547-AAA	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc duty cycle)	X	5.72	67.00	16.20	0.00	150.0	± 9.6 %
		Y	5.72	67.16	16.35		150.0	
		Z	5.65	66.88	16.14		150.0	
10548-AAA	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc duty cycle)	X	6.07	68.22	16.78	0.00	150.0	± 9.6 %
		Y	6.08	68.42	16.96		150.0	
		Z	5.98	68.06	16.70		150.0	
10550-AAA	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc duty cycle)	X	5.65	66.89	16.16	0.00	150.0	± 9.6 %
		Y	5.66	67.05	16.31		150.0	
		Z	5.60	66.86	16.14		150.0	
10551-AAA	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc duty cycle)	X	5.65	66.93	16.14	0.00	150.0	± 9.6 %
		Y	5.66	67.09	16.29		150.0	
		Z	5.60	66.87	16.11		150.0	
10552-AAA	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc duty cycle)	X	5.56	66.71	16.04	0.00	150.0	± 9.6 %
		Y	5.57	66.86	16.19		150.0	
		Z	5.51	66.66	16.01		150.0	
10553-AAA	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc duty cycle)	X	5.65	66.77	16.10	0.00	150.0	± 9.6 %
		Y	5.66	66.92	16.25		150.0	
		Z	5.60	66.70	16.07		150.0	
10554-AAA	IEEE 1602.11ac WiFi (160MHz, MCS0, 99pc duty cycle)	X	5.95	67.04	16.18	0.00	150.0	± 9.6 %
		Y	5.96	67.19	16.31		150.0	
		Z	5.91	66.99	16.15		150.0	
10555-AAA	IEEE 1602.11ac WiFi (160MHz, MCS1, 99pc duty cycle)	X	6.09	67.37	16.32	0.00	150.0	± 9.6 %
		Y	6.11	67.53	16.46		150.0	
		Z	6.05	67.32	16.29		150.0	
10556-AAA	IEEE 1602.11ac WiFi (160MHz, MCS2, 99pc duty cycle)	X	6.11	67.40	16.33	0.00	150.0	± 9.6 %
		Y	6.12	67.56	16.47		150.0	
		Z	6.07	67.36	16.30		150.0	
10557-AAA	IEEE 1602.11ac WiFi (160MHz, MCS3, 99pc duty cycle)	X	6.08	67.33	16.31	0.00	150.0	± 9.6 %
		Y	6.09	67.48	16.45		150.0	
		Z	6.03	67.26	16.27		150.0	

10558-AAA	IEEE 1602.11ac WiFi (160MHz, MCS4, 99pc duty cycle)	X	6.14	67.52	16.42	0.00	150.0	± 9.6 %
		Y	6.15	67.67	16.56		150.0	
		Z	6.09	67.43	16.37		150.0	
10560-AAA	IEEE 1602.11ac WiFi (160MHz, MCS6, 99pc duty cycle)	X	6.13	67.34	16.37	0.00	150.0	± 9.6 %
		Y	6.14	67.49	16.51		150.0	
		Z	6.07	67.26	16.33		150.0	
10561-AAA	IEEE 1602.11ac WiFi (160MHz, MCS7, 99pc duty cycle)	X	6.05	67.31	16.39	0.00	150.0	± 9.6 %
		Y	6.06	67.47	16.54		150.0	
		Z	6.00	67.24	16.36		150.0	
10562-AAA	IEEE 1602.11ac WiFi (160MHz, MCS8, 99pc duty cycle)	X	6.21	67.80	16.64	0.00	150.0	± 9.6 %
		Y	6.22	67.97	16.79		150.0	
		Z	6.14	67.67	16.57		150.0	
10563-AAA	IEEE 1602.11ac WiFi (160MHz, MCS9, 99pc duty cycle)	X	6.60	68.52	16.95	0.00	150.0	± 9.6 %
		Y	6.61	68.70	17.11		150.0	
		Z	6.44	68.18	16.78		150.0	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	4.98	66.92	16.42	0.46	150.0	± 9.6 %
		Y	4.99	67.12	16.60		150.0	
		Z	4.93	66.90	16.38		150.0	
10565-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc duty cycle)	X	5.22	67.37	16.73	0.46	150.0	± 9.6 %
		Y	5.23	67.55	16.90		150.0	
		Z	5.16	67.34	16.69		150.0	
10566-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc duty cycle)	X	5.06	67.23	16.56	0.46	150.0	± 9.6 %
		Y	5.06	67.43	16.74		150.0	
		Z	4.99	67.19	16.51		150.0	
10567-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc duty cycle)	X	5.08	67.57	16.87	0.46	150.0	± 9.6 %
		Y	5.08	67.74	17.03		150.0	
		Z	5.01	67.53	16.84		150.0	
10568-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc duty cycle)	X	4.98	67.03	16.35	0.46	150.0	± 9.6 %
		Y	4.99	67.26	16.56		150.0	
		Z	4.91	67.01	16.31		150.0	
10569-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc duty cycle)	X	5.02	67.62	16.91	0.46	150.0	± 9.6 %
		Y	5.03	67.78	17.06		150.0	
		Z	4.97	67.61	16.89		150.0	
10570-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc duty cycle)	X	5.07	67.49	16.86	0.46	150.0	± 9.6 %
		Y	5.07	67.68	17.03		150.0	
		Z	5.00	67.48	16.83		150.0	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	1.33	65.38	15.85	0.46	130.0	± 9.6 %
		Y	1.37	66.42	16.66		130.0	
		Z	1.31	65.23	15.71		130.0	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	1.35	65.94	16.19	0.46	130.0	± 9.6 %
		Y	1.40	67.08	17.03		130.0	
		Z	1.33	65.79	16.04		130.0	
10573-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc duty cycle)	X	2.45	84.59	22.30	0.46	130.0	± 9.6 %
		Y	10.53	109.30	30.18		130.0	
		Z	2.23	83.07	21.66		130.0	
10574-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc duty cycle)	X	1.51	71.42	18.78	0.46	130.0	± 9.6 %
		Y	1.69	74.14	20.31		130.0	
		Z	1.47	71.09	18.56		130.0	

10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	4.80	66.79	16.52	0.46	130.0	± 9.6 %
		Y	4.80	66.99	16.70		130.0	
		Z	4.74	66.78	16.48		130.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	4.82	66.93	16.57	0.46	130.0	± 9.6 %
		Y	4.83	67.13	16.75		130.0	
		Z	4.77	66.93	16.54		130.0	
10577-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc duty cycle)	X	5.04	67.25	16.75	0.46	130.0	± 9.6 %
		Y	5.04	67.43	16.92		130.0	
		Z	4.97	67.22	16.71		130.0	
10578-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc duty cycle)	X	4.93	67.39	16.83	0.46	130.0	± 9.6 %
		Y	4.93	67.57	17.00		130.0	
		Z	4.87	67.36	16.79		130.0	
10579-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc duty cycle)	X	4.71	66.78	16.21	0.46	130.0	± 9.6 %
		Y	4.73	67.02	16.43		130.0	
		Z	4.65	66.73	16.16		130.0	
10580-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc duty cycle)	X	4.76	66.79	16.23	0.46	130.0	± 9.6 %
		Y	4.77	67.05	16.45		130.0	
		Z	4.69	66.76	16.18		130.0	
10581-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc duty cycle)	X	4.83	67.44	16.78	0.46	130.0	± 9.6 %
		Y	4.84	67.63	16.95		130.0	
		Z	4.77	67.41	16.74		130.0	
10582-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc duty cycle)	X	4.66	66.56	16.03	0.46	130.0	± 9.6 %
		Y	4.68	66.83	16.26		130.0	
		Z	4.59	66.51	15.97		130.0	
10583-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	4.80	66.79	16.52	0.46	130.0	± 9.6 %
		Y	4.80	66.99	16.70		130.0	
		Z	4.74	66.78	16.48		130.0	
10584-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	4.82	66.93	16.57	0.46	130.0	± 9.6 %
		Y	4.83	67.13	16.75		130.0	
		Z	4.77	66.93	16.54		130.0	
10585-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc duty cycle)	X	5.04	67.25	16.75	0.46	130.0	± 9.6 %
		Y	5.04	67.43	16.92		130.0	
		Z	4.97	67.22	16.71		130.0	
10586-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc duty cycle)	X	4.93	67.39	16.83	0.46	130.0	± 9.6 %
		Y	4.93	67.57	17.00		130.0	
		Z	4.87	67.36	16.79		130.0	
10587-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc duty cycle)	X	4.71	66.78	16.21	0.46	130.0	± 9.6 %
		Y	4.73	67.02	16.43		130.0	
		Z	4.65	66.73	16.16		130.0	
10588-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc duty cycle)	X	4.76	66.79	16.23	0.46	130.0	± 9.6 %
		Y	4.77	67.05	16.45		130.0	
		Z	4.69	66.76	16.18		130.0	
10589-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc duty cycle)	X	4.83	67.44	16.78	0.46	130.0	± 9.6 %
		Y	4.84	67.63	16.95		130.0	
		Z	4.77	67.41	16.74		130.0	
10590-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc duty cycle)	X	4.66	66.56	16.03	0.46	130.0	± 9.6 %
		Y	4.68	66.83	16.26		130.0	
		Z	4.59	66.51	15.97		130.0	

10591-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	4.94	66.84	16.61	0.46	130.0	± 9.6 %
		Y	4.95	67.02	16.78		130.0	
		Z	4.89	66.83	16.58		130.0	
10592-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	5.11	67.18	16.74	0.46	130.0	± 9.6 %
		Y	5.11	67.36	16.91		130.0	
		Z	5.05	67.16	16.71		130.0	
10593-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc duty cycle)	X	5.04	67.12	16.64	0.46	130.0	± 9.6 %
		Y	5.04	67.31	16.81		130.0	
		Z	4.97	67.08	16.60		130.0	
10594-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc duty cycle)	X	5.09	67.26	16.77	0.46	130.0	± 9.6 %
		Y	5.09	67.44	16.95		130.0	
		Z	5.02	67.24	16.74		130.0	
10595-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc duty cycle)	X	5.06	67.23	16.68	0.46	130.0	± 9.6 %
		Y	5.07	67.42	16.86		130.0	
		Z	4.99	67.20	16.64		130.0	
10596-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc duty cycle)	X	5.00	67.23	16.68	0.46	130.0	± 9.6 %
		Y	5.01	67.44	16.87		130.0	
		Z	4.93	67.20	16.65		130.0	
10597-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc duty cycle)	X	4.95	67.15	16.58	0.46	130.0	± 9.6 %
		Y	4.96	67.36	16.77		130.0	
		Z	4.88	67.11	16.54		130.0	
10598-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc duty cycle)	X	4.92	67.37	16.82	0.46	130.0	± 9.6 %
		Y	4.93	67.55	16.99		130.0	
		Z	4.86	67.32	16.78		130.0	
10599-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	5.62	67.44	16.83	0.46	130.0	± 9.6 %
		Y	5.62	67.59	16.99		130.0	
		Z	5.57	67.41	16.81		130.0	
10600-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	5.83	68.08	17.13	0.46	130.0	± 9.6 %
		Y	5.83	68.26	17.31		130.0	
		Z	5.75	67.98	17.08		130.0	
10601-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc duty cycle)	X	5.67	67.70	16.95	0.46	130.0	± 9.6 %
		Y	5.68	67.87	17.12		130.0	
		Z	5.61	67.65	16.92		130.0	
10602-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc duty cycle)	X	5.76	67.70	16.88	0.46	130.0	± 9.6 %
		Y	5.77	67.88	17.05		130.0	
		Z	5.71	67.69	16.87		130.0	
10603-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc duty cycle)	X	5.83	67.96	17.13	0.46	130.0	± 9.6 %
		Y	5.84	68.14	17.30		130.0	
		Z	5.78	67.93	17.11		130.0	
10604-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc duty cycle)	X	5.62	67.40	16.84	0.46	130.0	± 9.6 %
		Y	5.63	67.56	17.00		130.0	
		Z	5.57	67.37	16.81		130.0	
10605-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc duty cycle)	X	5.75	67.79	17.04	0.46	130.0	± 9.6 %
		Y	5.76	67.98	17.22		130.0	
		Z	5.71	67.80	17.04		130.0	
10606-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc duty cycle)	X	5.50	67.17	16.59	0.46	130.0	± 9.6 %
		Y	5.51	67.36	16.78		130.0	
		Z	5.45	67.15	16.57		130.0	

10607-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	4.77	66.11	16.20	0.46	130.0	± 9.6 %
		Y	4.78	66.31	16.38		130.0	
		Z	4.72	66.10	16.17		130.0	
10608-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	4.97	66.53	16.37	0.46	130.0	± 9.6 %
		Y	4.98	66.73	16.55		130.0	
		Z	4.91	66.51	16.34		130.0	
10609-AAA	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle)	X	4.86	66.39	16.22	0.46	130.0	± 9.6 %
		Y	4.87	66.61	16.41		130.0	
		Z	4.80	66.37	16.19		130.0	
10610-AAA	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle)	X	4.91	66.54	16.37	0.46	130.0	± 9.6 %
		Y	4.92	66.75	16.55		130.0	
		Z	4.85	66.52	16.34		130.0	
10611-AAA	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle)	X	4.83	66.37	16.24	0.46	130.0	± 9.6 %
		Y	4.84	66.58	16.42		130.0	
		Z	4.77	66.34	16.20		130.0	
10612-AAA	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle)	X	4.85	66.53	16.28	0.46	130.0	± 9.6 %
		Y	4.86	66.77	16.48		130.0	
		Z	4.78	66.50	16.25		130.0	
10613-AAA	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle)	X	4.86	66.45	16.19	0.46	130.0	± 9.6 %
		Y	4.87	66.68	16.39		130.0	
		Z	4.79	66.40	16.14		130.0	
10614-AAA	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle)	X	4.79	66.59	16.39	0.46	130.0	± 9.6 %
		Y	4.80	66.80	16.57		130.0	
		Z	4.72	66.55	16.34		130.0	
10615-AAA	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle)	X	4.84	66.22	16.03	0.46	130.0	± 9.6 %
		Y	4.85	66.46	16.24		130.0	
		Z	4.77	66.19	15.99		130.0	
10616-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	5.43	66.66	16.42	0.46	130.0	± 9.6 %
		Y	5.44	66.83	16.58		130.0	
		Z	5.38	66.62	16.39		130.0	
10617-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	5.49	66.80	16.46	0.46	130.0	± 9.6 %
		Y	5.50	66.99	16.63		130.0	
		Z	5.45	66.83	16.47		130.0	
10618-AAA	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle)	X	5.38	66.84	16.49	0.46	130.0	± 9.6 %
		Y	5.39	67.01	16.65		130.0	
		Z	5.33	66.80	16.47		130.0	
10619-AAA	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle)	X	5.41	66.69	16.36	0.46	130.0	± 9.6 %
		Y	5.42	66.88	16.53		130.0	
		Z	5.36	66.66	16.34		130.0	
10620-AAA	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle)	X	5.51	66.76	16.45	0.46	130.0	± 9.6 %
		Y	5.52	66.94	16.61		130.0	
		Z	5.45	66.69	16.40		130.0	
10621-AAA	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle)	X	5.49	66.80	16.57	0.46	130.0	± 9.6 %
		Y	5.49	66.95	16.72		130.0	
		Z	5.43	66.76	16.55		130.0	
10622-AAA	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle)	X	5.50	66.97	16.65	0.46	130.0	± 9.6 %
		Y	5.51	67.14	16.81		130.0	
		Z	5.46	66.96	16.64		130.0	

10623-AAA	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle)	X	5.38	66.52	16.31	0.46	130.0	± 9.6 %
		Y	5.39	66.70	16.48		130.0	
		Z	5.33	66.49	16.29		130.0	
10624-AAA	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle)	X	5.58	66.73	16.48	0.46	130.0	± 9.6 %
		Y	5.59	66.90	16.64		130.0	
		Z	5.52	66.69	16.46		130.0	
10625-AAA	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle)	X	6.03	67.94	17.14	0.46	130.0	± 9.6 %
		Y	6.04	68.15	17.32		130.0	
		Z	5.94	67.84	17.08		130.0	
10626-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	5.70	66.70	16.37	0.46	130.0	± 9.6 %
		Y	5.71	66.85	16.51		130.0	
		Z	5.66	66.67	16.35		130.0	
10627-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	5.98	67.34	16.65	0.46	130.0	± 9.6 %
		Y	5.99	67.51	16.80		130.0	
		Z	5.93	67.32	16.64		130.0	
10628-AAA	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle)	X	5.76	66.88	16.35	0.46	130.0	± 9.6 %
		Y	5.78	67.04	16.51		130.0	
		Z	5.72	66.82	16.32		130.0	
10629-AAA	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle)	X	5.85	66.94	16.38	0.46	130.0	± 9.6 %
		Y	5.86	67.11	16.54		130.0	
		Z	5.81	66.93	16.37		130.0	
10630-AAA	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle)	X	6.47	68.96	17.39	0.46	130.0	± 9.6 %
		Y	6.50	69.20	17.59		130.0	
		Z	6.37	68.78	17.30		130.0	
10631-AAA	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle)	X	6.25	68.39	17.28	0.46	130.0	± 9.6 %
		Y	6.25	68.53	17.42		130.0	
		Z	6.15	68.22	17.20		130.0	
10632-AAA	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle)	X	5.93	67.33	16.77	0.46	130.0	± 9.6 %
		Y	5.93	67.47	16.90		130.0	
		Z	5.89	67.32	16.77		130.0	
10633-AAA	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle)	X	5.83	67.02	16.45	0.46	130.0	± 9.6 %
		Y	5.83	67.17	16.59		130.0	
		Z	5.76	66.93	16.40		130.0	
10634-AAA	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle)	X	5.80	67.01	16.50	0.46	130.0	± 9.6 %
		Y	5.81	67.15	16.64		130.0	
		Z	5.75	66.94	16.47		130.0	
10635-AAA	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle)	X	5.71	66.44	15.97	0.46	130.0	± 9.6 %
		Y	5.72	66.63	16.15		130.0	
		Z	5.64	66.35	15.92		130.0	
10636-AAA	IEEE 1602.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	X	6.12	67.11	16.48	0.46	130.0	± 9.6 %
		Y	6.13	67.25	16.62		130.0	
		Z	6.09	67.07	16.46		130.0	
10637-AAA	IEEE 1602.11ac WiFi (160MHz, MCS1, 90pc duty cycle)	X	6.30	67.52	16.67	0.46	130.0	± 9.6 %
		Y	6.31	67.68	16.81		130.0	
		Z	6.26	67.49	16.65		130.0	
10638-AAA	IEEE 1602.11ac WiFi (160MHz, MCS2, 90pc duty cycle)	X	6.30	67.50	16.63	0.46	130.0	± 9.6 %
		Y	6.31	67.65	16.78		130.0	
		Z	6.26	67.46	16.61		130.0	

10639-AAA	IEEE 1602.11ac WiFi (160MHz, MCS3, 90pc duty cycle)	X	6.28	67.46	16.65	0.46	130.0	± 9.6 %
		Y	6.28	67.59	16.79		130.0	
		Z	6.23	67.38	16.62		130.0	
10640-AAA	IEEE 1602.11ac WiFi (160MHz, MCS4, 90pc duty cycle)	X	6.30	67.54	16.64	0.46	130.0	± 9.6 %
		Y	6.31	67.70	16.79		130.0	
		Z	6.24	67.43	16.59		130.0	
10641-AAA	IEEE 1602.11ac WiFi (160MHz, MCS5, 90pc duty cycle)	X	6.31	67.32	16.55	0.46	130.0	± 9.6 %
		Y	6.32	67.48	16.70		130.0	
		Z	6.28	67.31	16.54		130.0	
10642-AAA	IEEE 1602.11ac WiFi (160MHz, MCS6, 90pc duty cycle)	X	6.36	67.59	16.84	0.46	130.0	± 9.6 %
		Y	6.36	67.71	16.97		130.0	
		Z	6.31	67.52	16.81		130.0	
10643-AAA	IEEE 1602.11ac WiFi (160MHz, MCS7, 90pc duty cycle)	X	6.20	67.31	16.61	0.46	130.0	± 9.6 %
		Y	6.21	67.47	16.77		130.0	
		Z	6.16	67.26	16.58		130.0	
10644-AAA	IEEE 1602.11ac WiFi (160MHz, MCS8, 90pc duty cycle)	X	6.42	67.97	16.97	0.46	130.0	± 9.6 %
		Y	6.43	68.15	17.13		130.0	
		Z	6.34	67.82	16.88		130.0	
10645-AAA	IEEE 1602.11ac WiFi (160MHz, MCS9, 90pc duty cycle)	X	6.93	69.02	17.44	0.46	130.0	± 9.6 %
		Y	6.97	69.27	17.65		130.0	
		Z	6.82	68.81	17.34		130.0	
10646-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7)	X	47.20	124.94	41.34	9.30	60.0	± 9.6 %
		Y	100.00	143.87	46.72		60.0	
		Z	42.87	123.31	40.85		60.0	
10647-AAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7)	X	47.80	126.16	41.84	9.30	60.0	± 9.6 %
		Y	100.00	144.94	47.17		60.0	
		Z	42.80	124.20	41.27		60.0	
10648-AAA	CDMA2000 (1x Advanced)	X	0.75	63.57	11.13	0.00	150.0	± 9.6 %
		Y	0.80	64.99	12.02		150.0	
		Z	0.70	63.11	10.54		150.0	

[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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
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 **PC Test**

Certificate No: EX3-3589_Jan17

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3589

Calibration procedure(s) QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

BN ✓ 01-26-2017

Calibration date: January 13, 2017

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-16 (No. ES3-3013_Dec16)	Dec-17
DAE4	SN: 660	7-Dec-16 (No. DAE4-660_Dec16)	Dec-17
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 16, 2017

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
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

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, "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
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:3589

Manufactured: March 30, 2006
Calibrated: January 13, 2017

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.45	0.39	0.39	± 10.1 %
DCP (mV)[B]	103.1	103.4	99.2	

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	161.2	±3.3 %
		Y	0.0	0.0	1.0		173.7	
		Z	0.0	0.0	1.0		135.7	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	4.33	68.3	14.2	10.00	44.8	±1.9 %
		Y	3.03	64.9	12.6		44.0	
		Z	1.75	59.1	10.5		48.9	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.36	69.2	21.9	8.68	126.5	±2.7 %
		Y	10.35	68.8	21.4		136.4	
		Z	10.74	70.2	22.3		149.4	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.30	69.0	21.3	8.07	131.3	±1.9 %
		Y	10.24	68.6	20.9		140.6	
		Z	9.68	67.3	20.2		105.8	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.88	68.6	21.2	8.10	125.0	±2.2 %
		Y	9.95	68.5	20.9		134.8	
		Z	9.28	67.0	20.1		100.7	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.17	68.9	21.6	8.37	125.5	±2.2 %
		Y	10.21	68.7	21.1		134.8	
		Z	9.53	67.2	20.4		100.7	
10401-AAC	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	10.95	69.6	21.9	8.60	134.0	±2.5 %
		Y	10.86	69.1	21.4		143.2	
		Z	10.34	67.9	20.8		107.9	
10402-AAC	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	11.11	70.0	21.9	8.53	134.7	±2.5 %
		Y	10.77	68.9	21.1		141.7	
		Z	10.46	68.2	20.7		107.7	

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:3589

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)
5250	35.9	4.71	4.78	4.78	4.78	0.30	1.80	± 13.1 %
5600	35.5	5.07	4.24	4.24	4.24	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.44	4.44	4.44	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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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:3589

Calibration Parameter Determined in Body Tissue Simulating Media

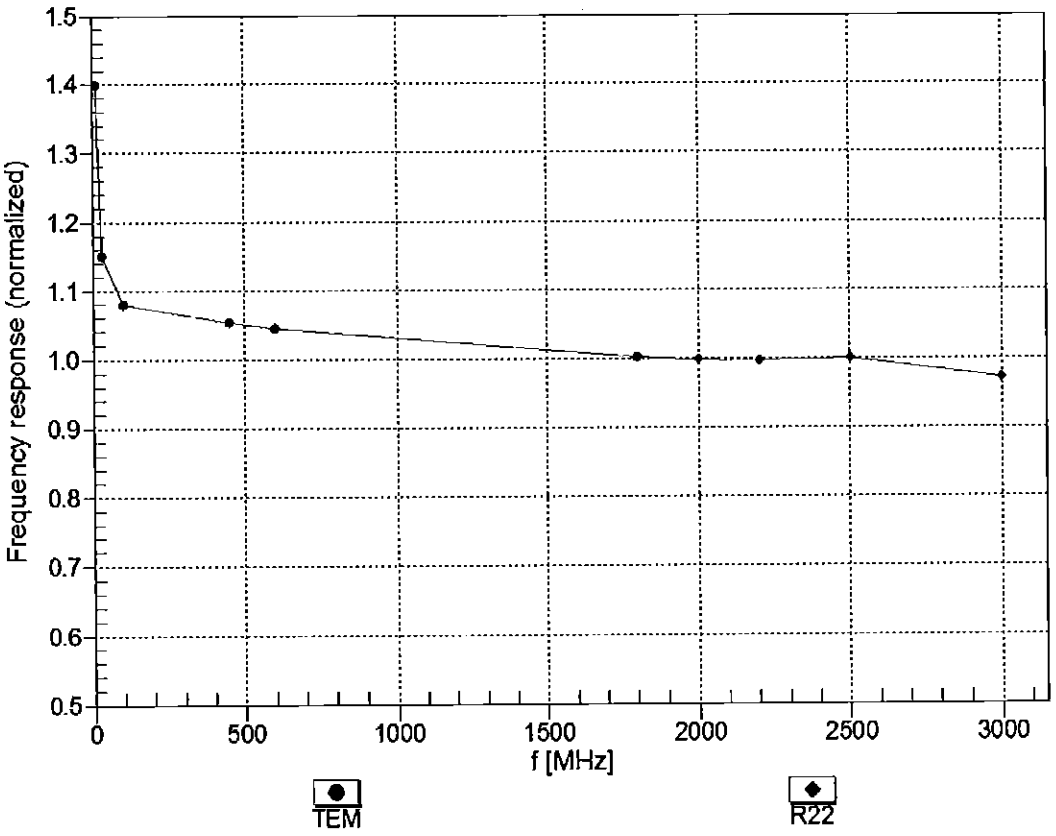
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
5250	48.9	5.36	4.19	4.19	4.19	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.82	3.82	3.82	0.40	1.90	± 13.1 %
5750	48.3	5.94	3.83	3.83	3.83	0.50	1.90	± 13.1 %

[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 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. 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.

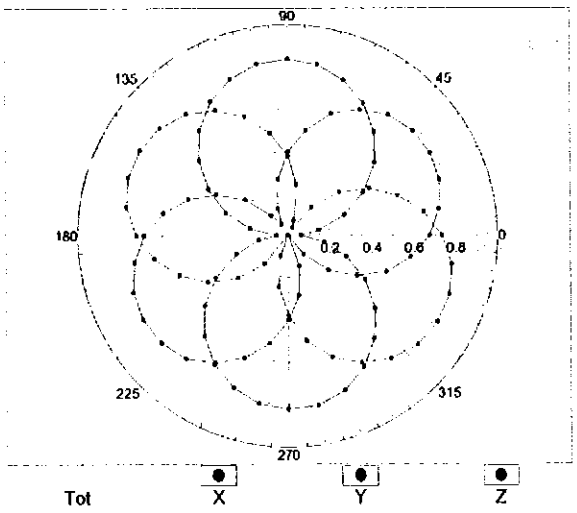
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



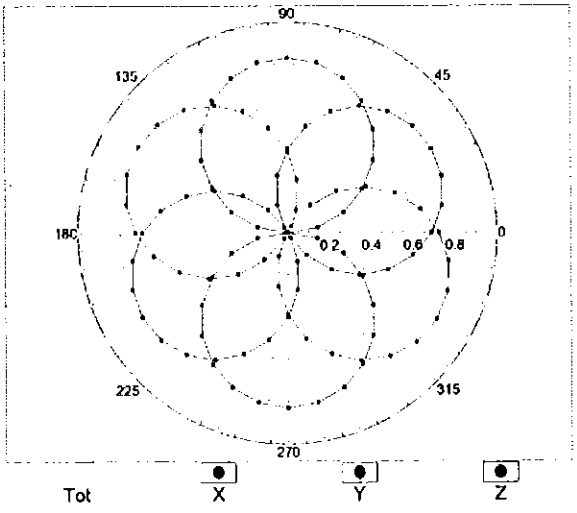
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

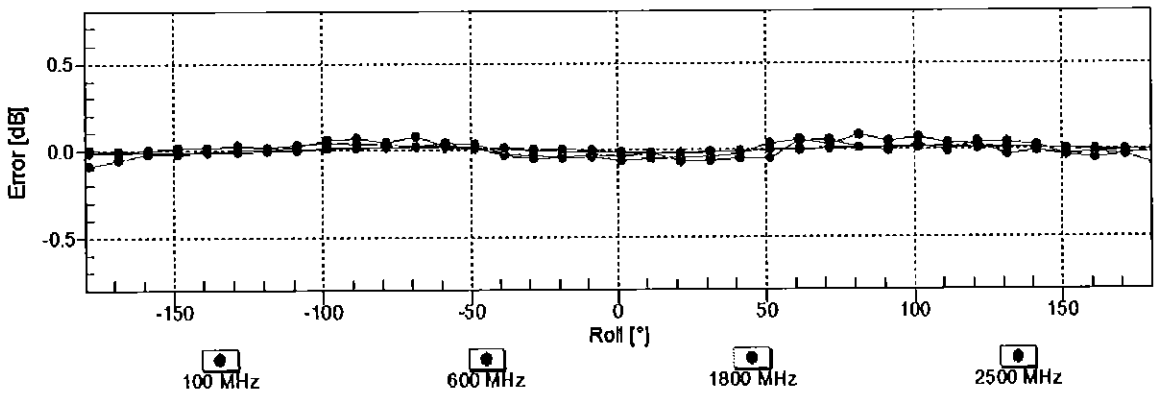
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



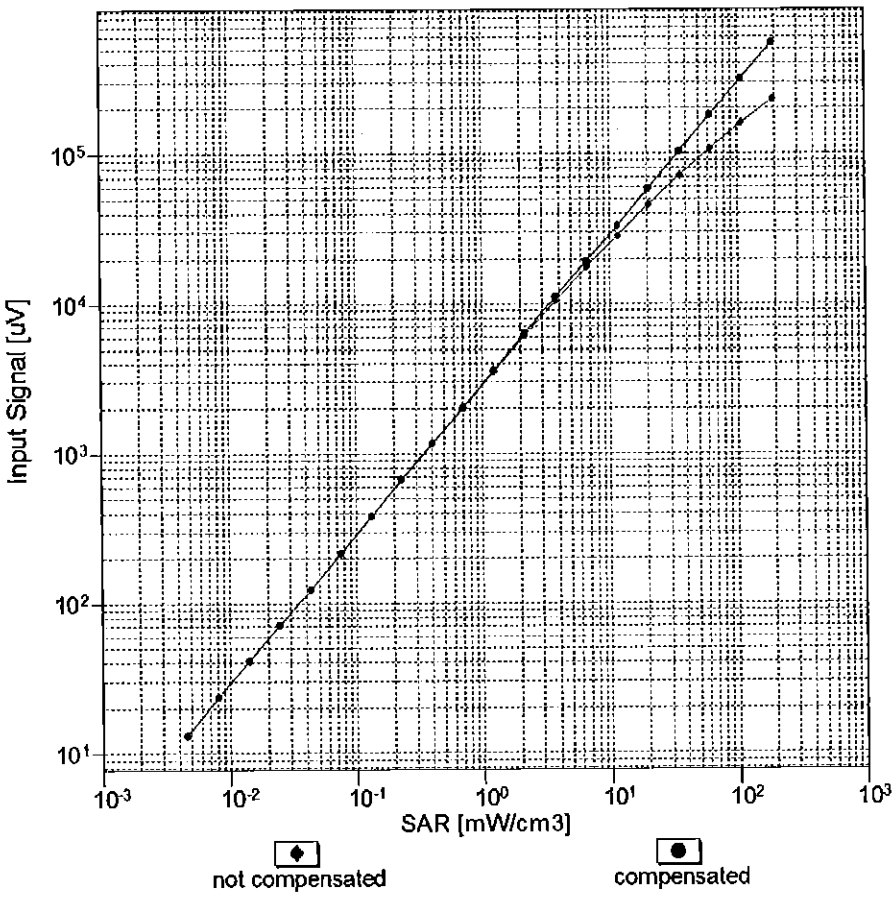
f=1800 MHz,R22

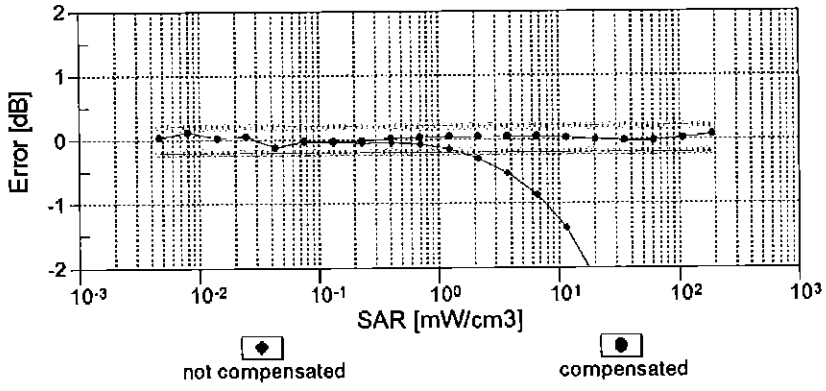




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

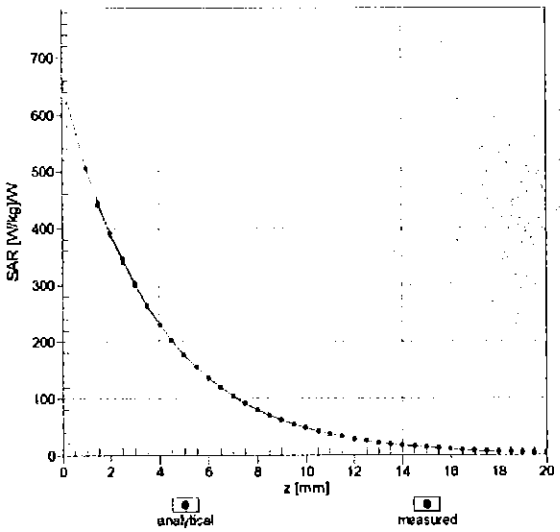




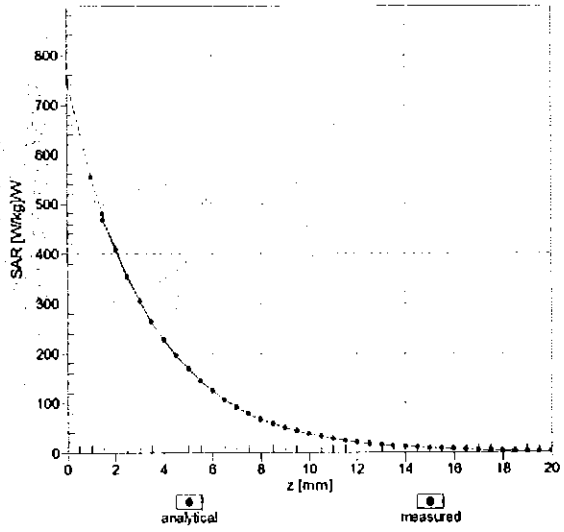
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 5250 MHz,WGLS R58 (H_convF)-SCS

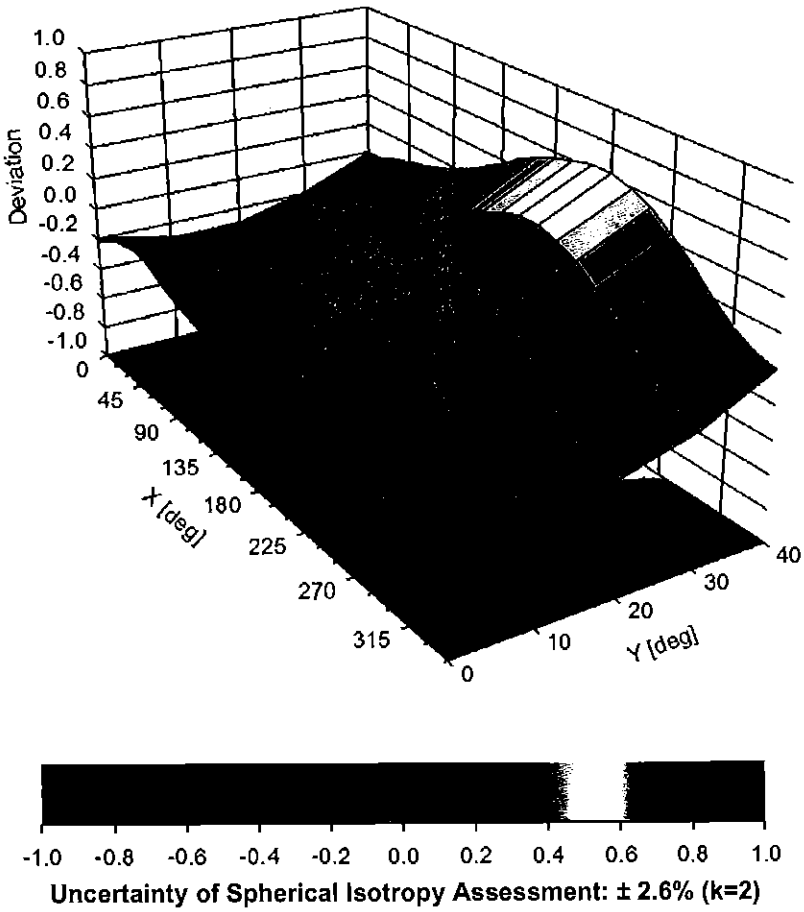


f = 5750 MHz,WGLS R58 (H_convF)-SCS



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	141.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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 **PC Test**

Certificate No: D750V3-1046_Feb16

CALIBRATION CERTIFICATE

Object D750V3 - SN:1046

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: February 16, 2016

BN ✓
3/1/2016

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 EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 17, 2016

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

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.8 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.20 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.36 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ± 6 %	0.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.77 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.80 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.7 Ω + 2.3 jΩ
Return Loss	- 23.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.7 Ω - 0.8 jΩ
Return Loss	- 34.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.037 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 02, 2011

DASY5 Validation Report for Head TSL

Date: 16.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1046

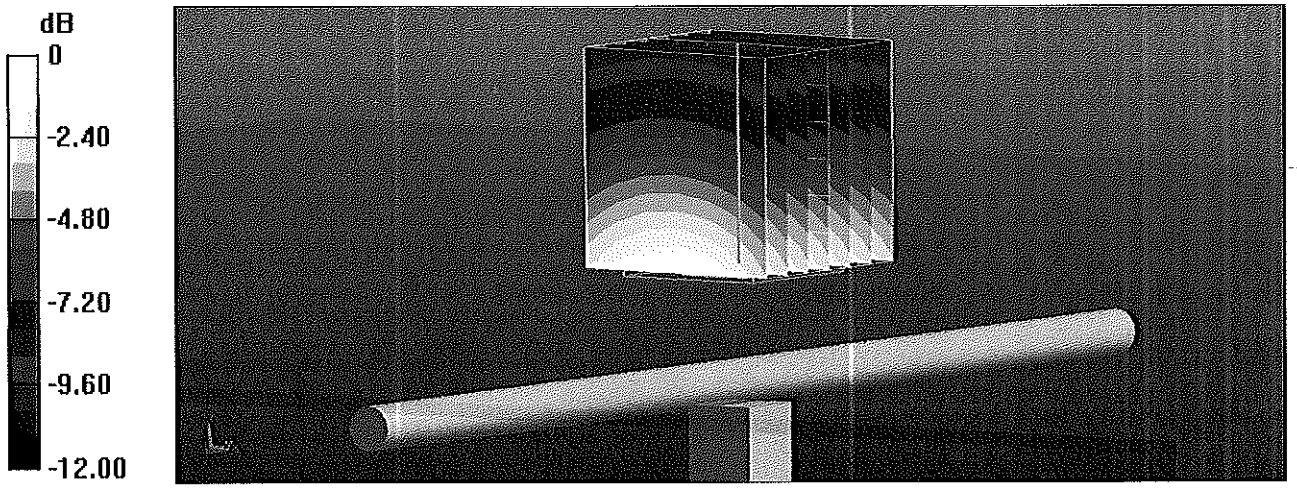
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.9 S/m; ε_r = 41.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.28, 10.28, 10.28); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

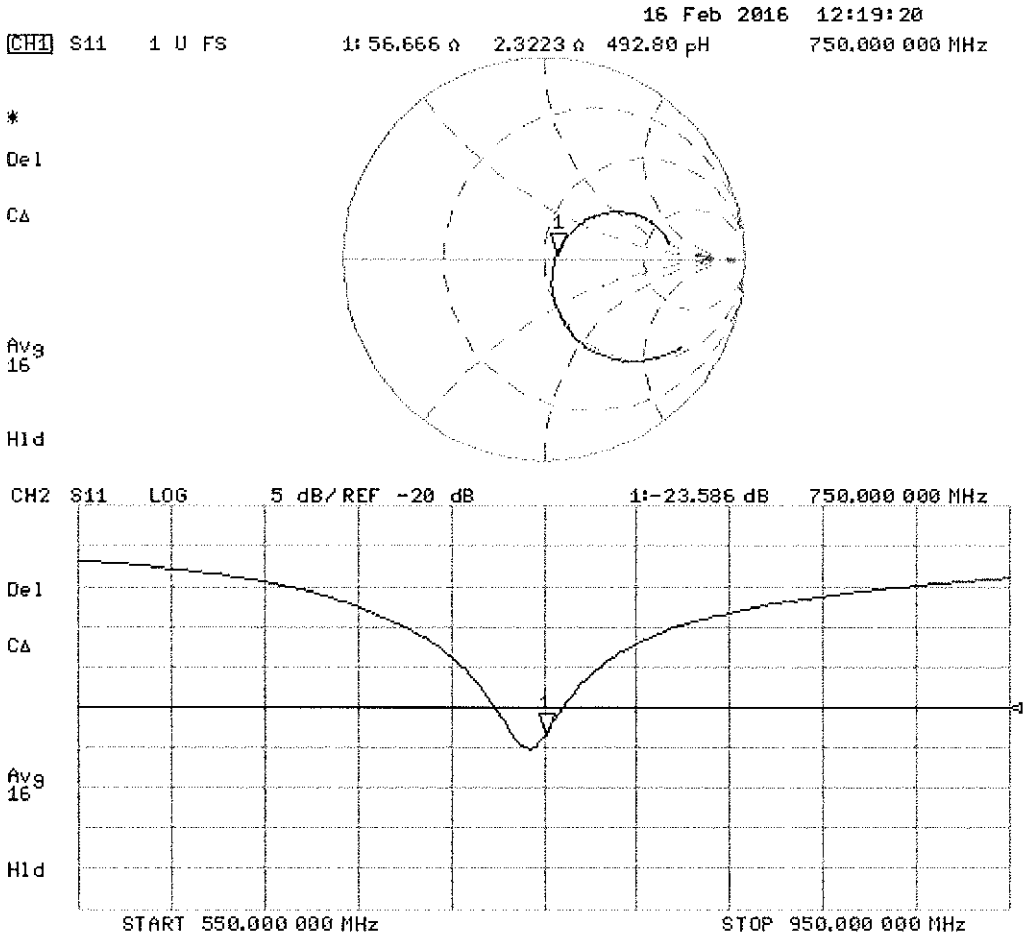
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.40 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.11 W/kg
SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.35 W/kg
Maximum value of SAR (measured) = 2.75 W/kg



0 dB = 2.75 W/kg = 4.39 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046

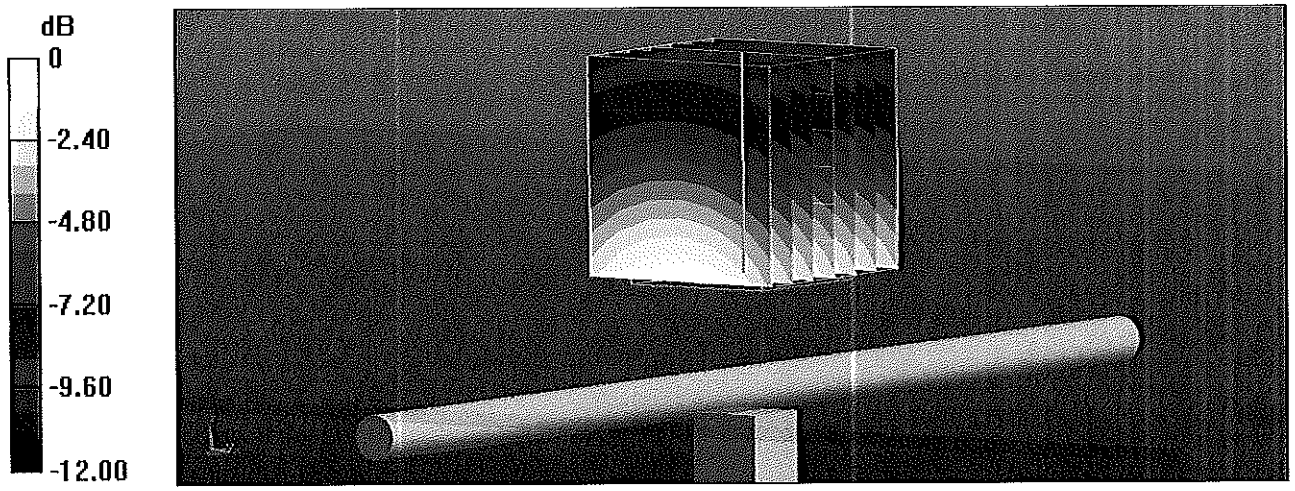
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.98 S/m; ε_r = 55.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

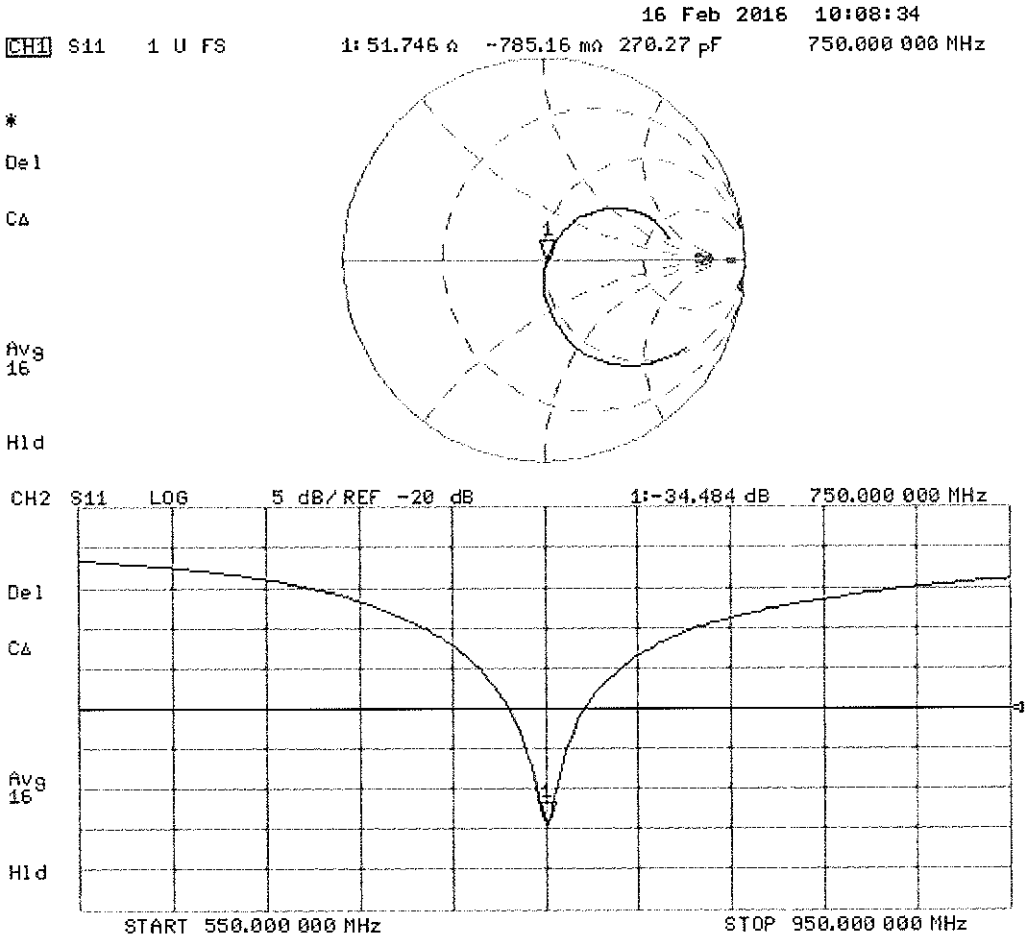
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.48 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.31 W/kg
SAR(1 g) = 2.23 W/kg; SAR(10 g) = 1.47 W/kg
Maximum value of SAR (measured) = 2.94 W/kg



0 dB = 2.94 W/kg = 4.68 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D835V2-4d119_Apr16

CALIBRATION CERTIFICATE

PM ✓ 4/25/16

Object	D835V2 - SN: 4d119
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 14, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M. Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 15, 2016

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

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.7 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.14 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.97 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.4 ± 6 %	1.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.38 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.14 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.04 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω - 4.1 jΩ
Return Loss	- 27.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 Ω - 6.1 jΩ
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.385 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 29, 2010

DASY5 Validation Report for Head TSL

Date: 14.04.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d119

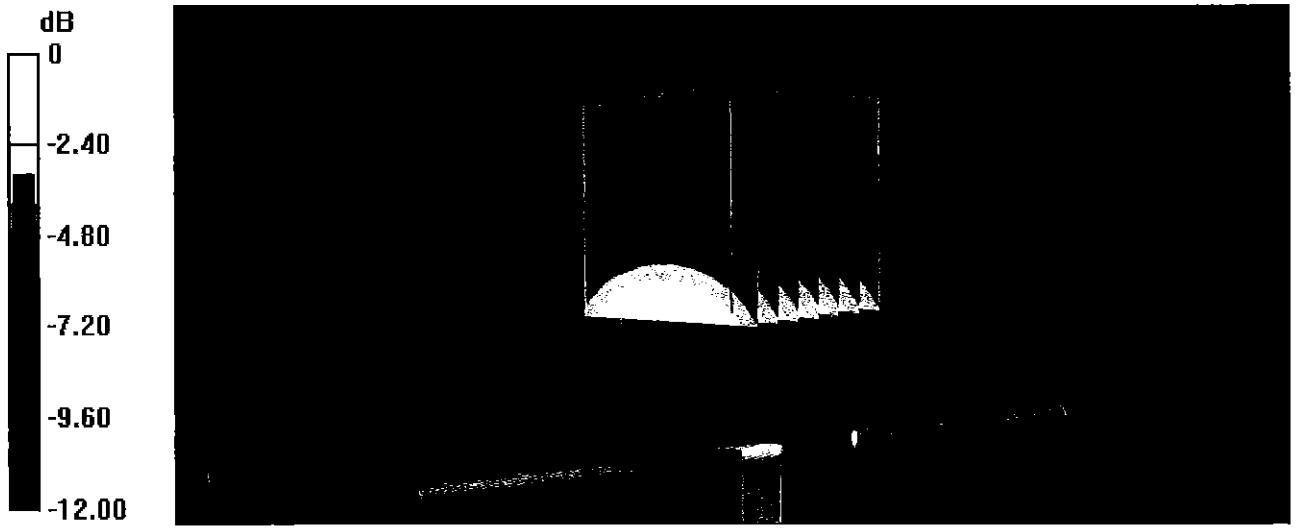
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.93 S/m; ε_r = 41.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.83, 9.83, 9.83); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

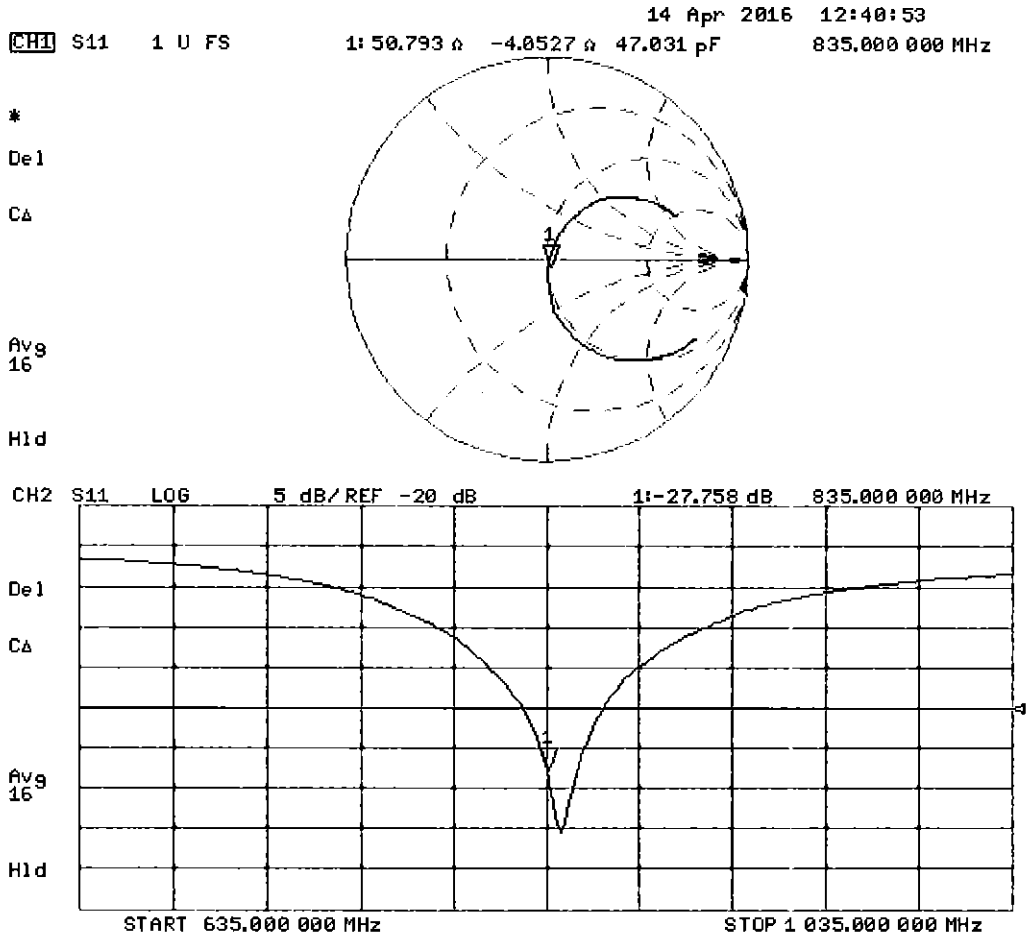
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.95 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.48 W/kg
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.52 W/kg
Maximum value of SAR (measured) = 3.11 W/kg



0 dB = 3.11 W/kg = 4.93 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.04.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d119

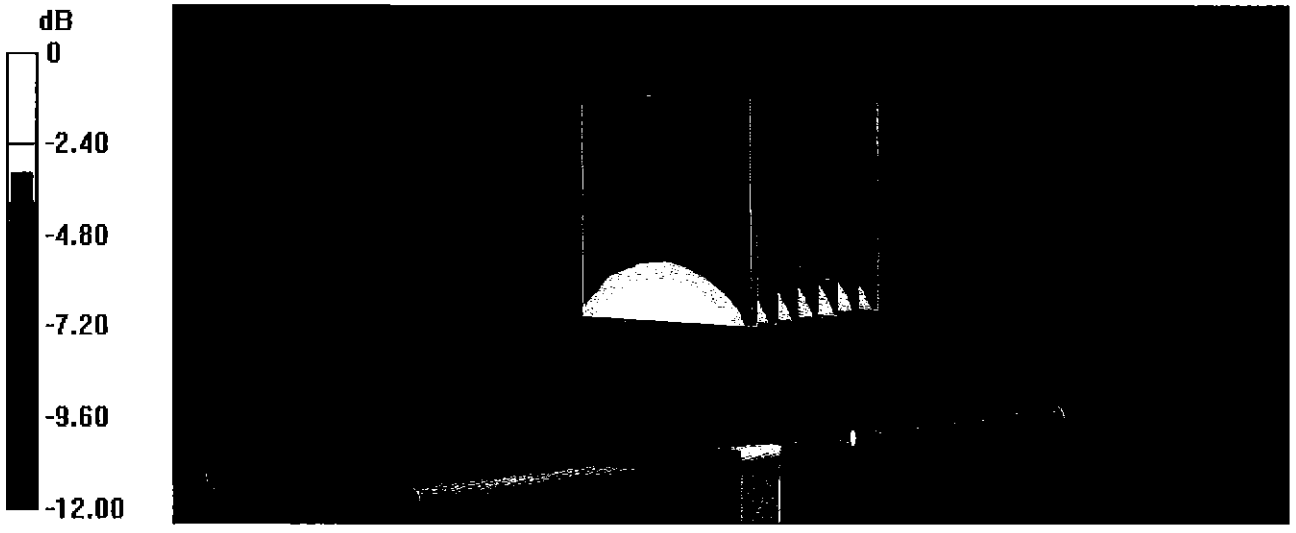
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.02 S/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.73, 9.73, 9.73); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

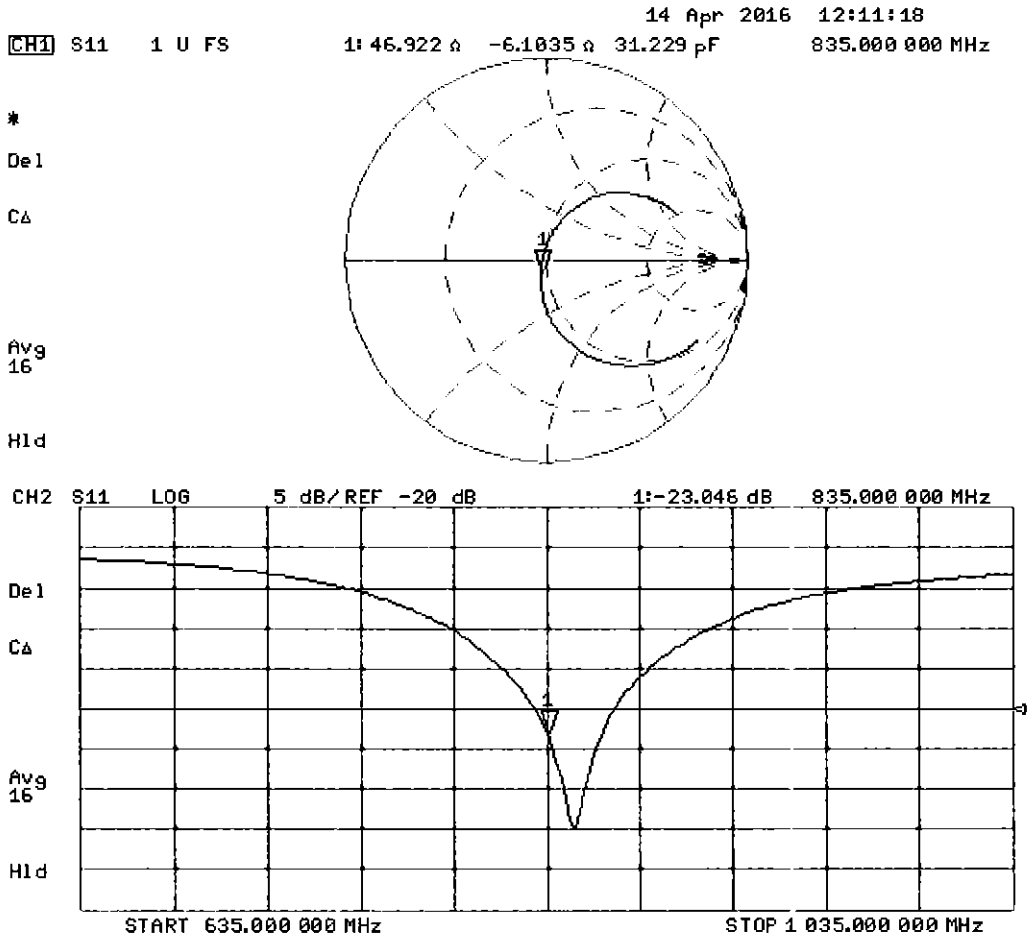
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.35 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.46 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 3.11 W/kg



0 dB = 3.11 W/kg = 4.93 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D1765V2-1008_May16

CALIBRATION CERTIFICATE

Object D1765V2 - SN:1008

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

BNV 05/23/16

Calibration date: May 11, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M. Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 17, 2016

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.36 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.81 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.50 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.8 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.8 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.8 Ω - 6.0 jΩ
Return Loss	- 24.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8 Ω - 6.8 jΩ
Return Loss	- 21.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.211 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2005

DASY5 Validation Report for Head TSL

Date: 11.05.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

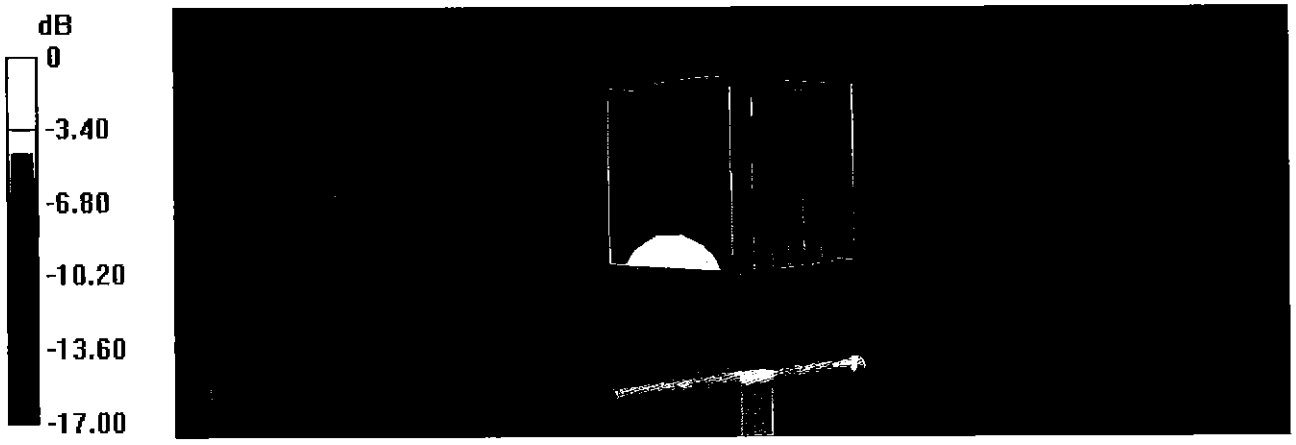
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.36 S/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.54, 8.54, 8.54); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

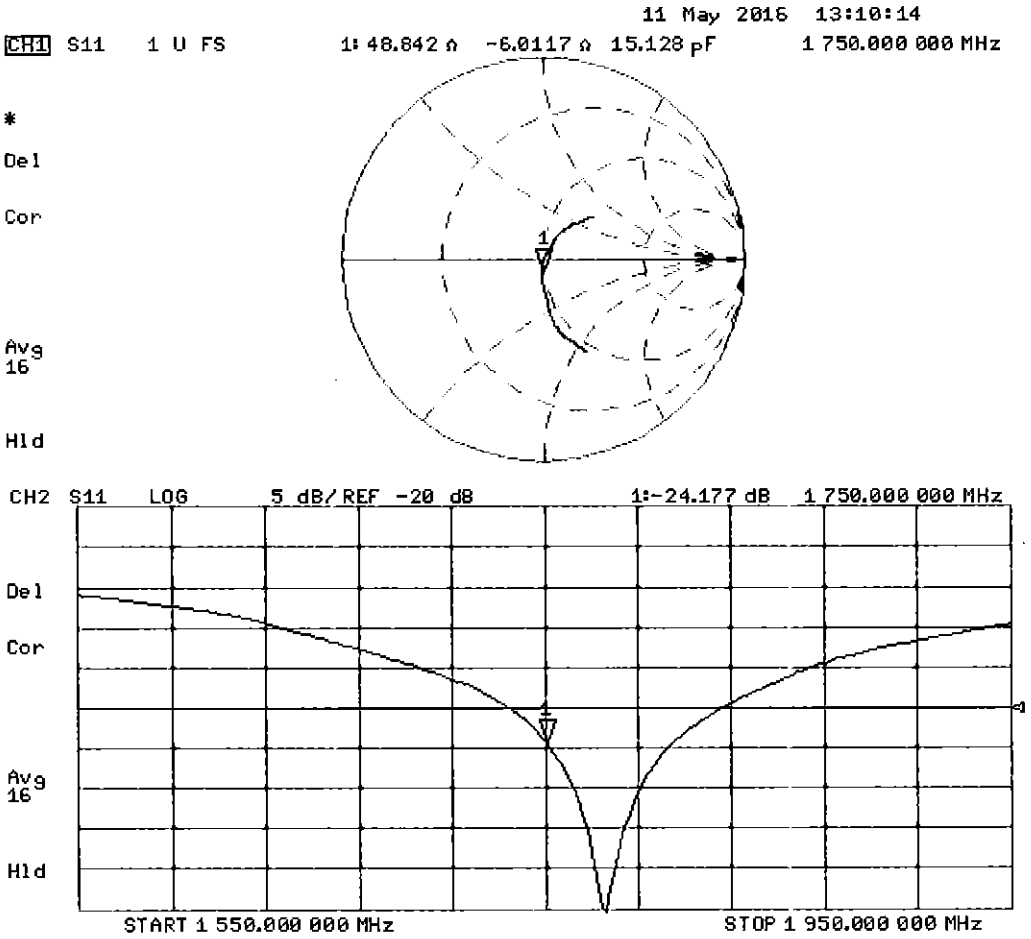
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.4 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.1 W/kg; SAR(10 g) = 4.81 W/kg
Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.37 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.05.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

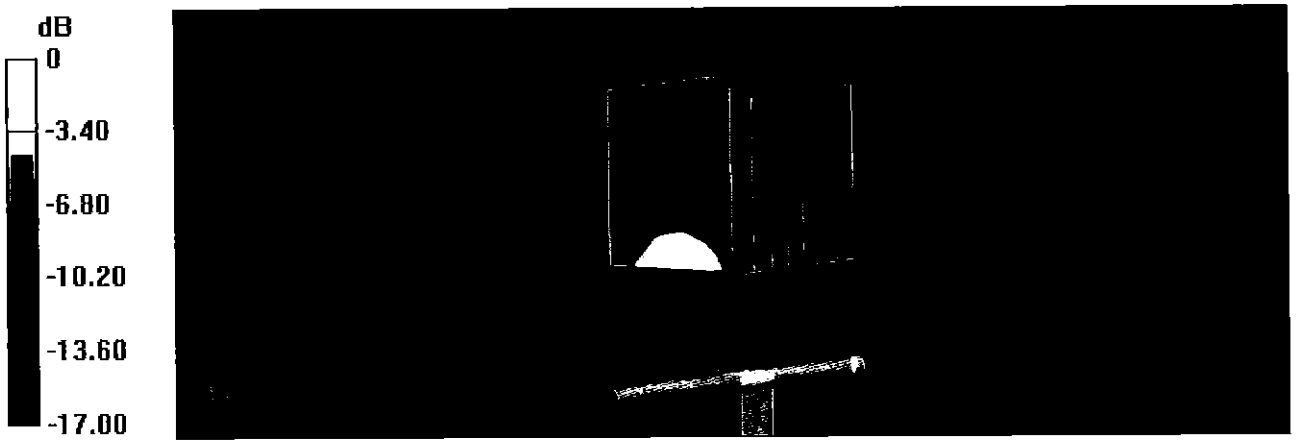
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.5 S/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.25, 8.25, 8.25); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

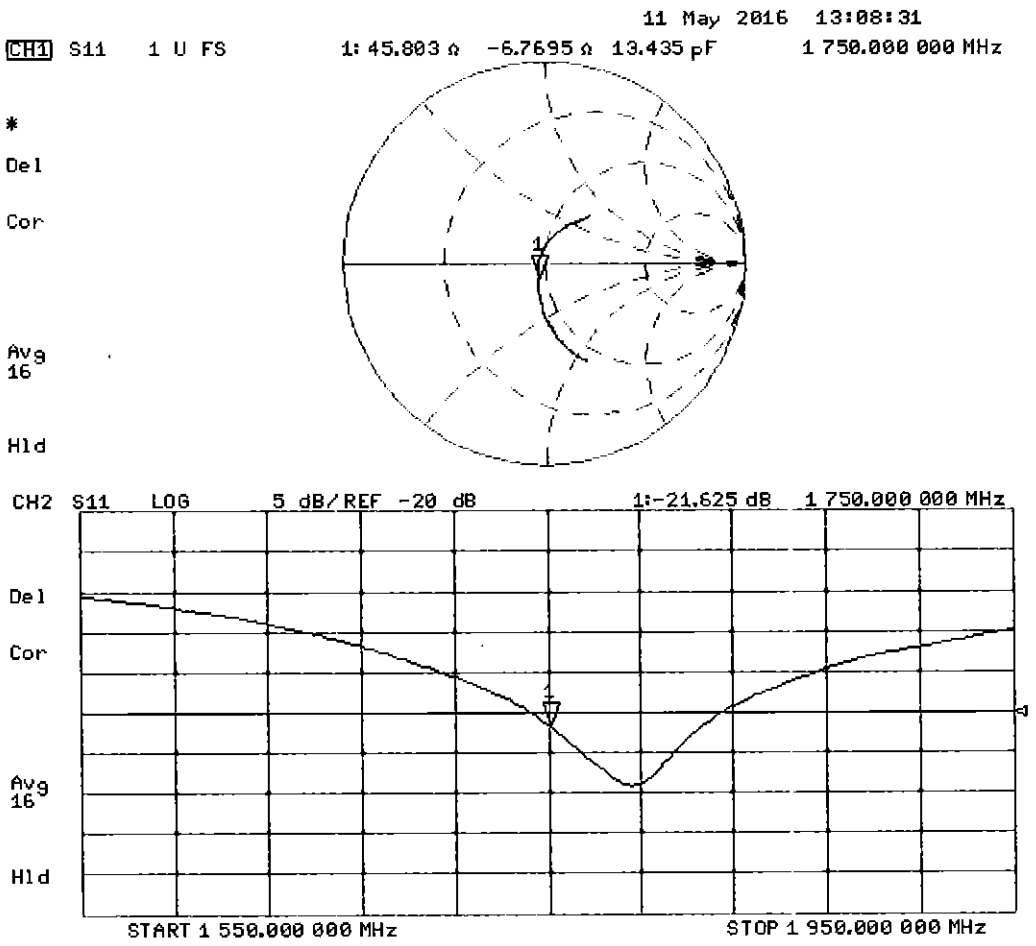
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.9 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.3 W/kg; SAR(10 g) = 4.94 W/kg
Maximum value of SAR (measured) = 14.0 W/kg



0 dB = 14.0 W/kg = 11.46 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D1900V2-5d141_Apr16

CALIBRATION CERTIFICATE

PM ✓ 4/25/16

Object	D1900V2 - SN:5d141
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 12, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 15, 2016

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.0 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**38.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.80 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.0 Ω + 6.3 jΩ
Return Loss	- 23.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.9 Ω + 7.5 jΩ
Return Loss	- 22.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.198 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 12.04.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d141

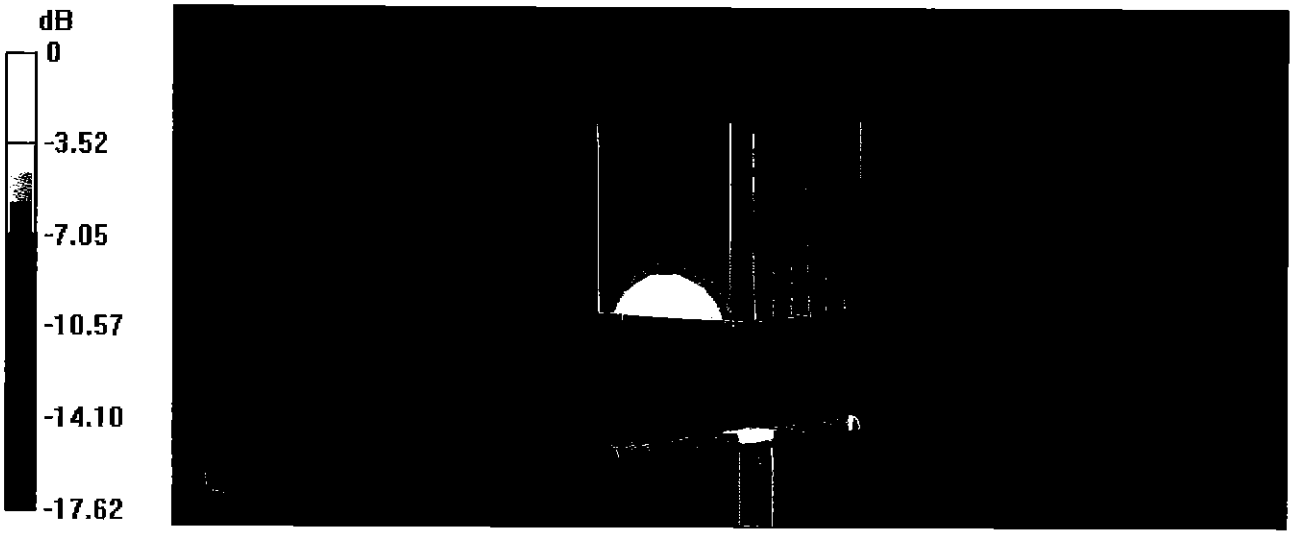
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.37 S/m; ε_r = 40; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.2, 8.2, 8.2); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

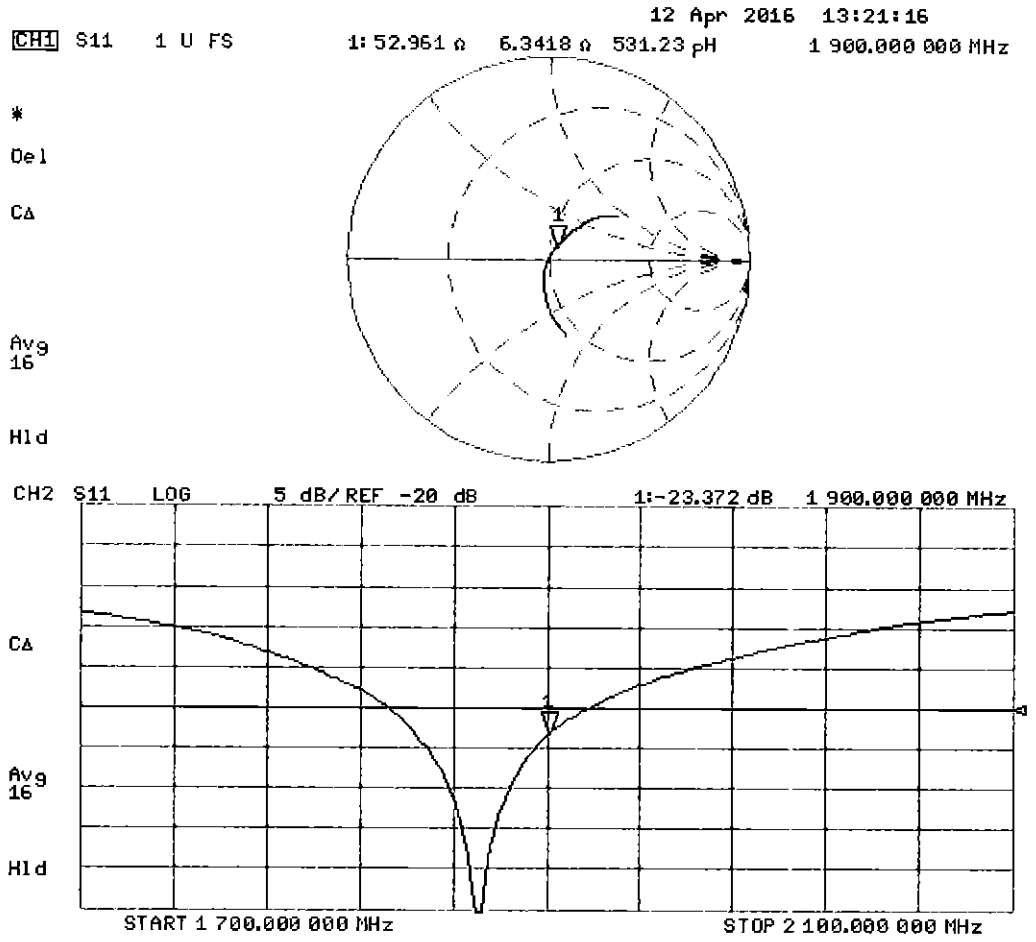
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.9 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.5 W/kg; SAR(10 g) = 4.97 W/kg
Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.04.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d141

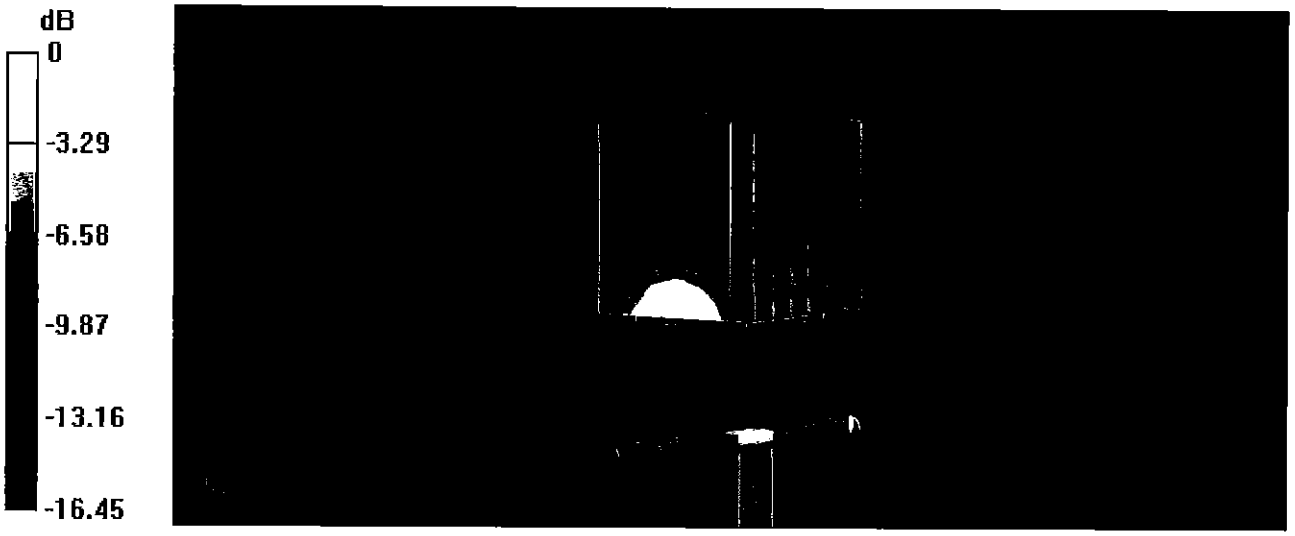
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.49 S/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.03, 8.03, 8.03); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

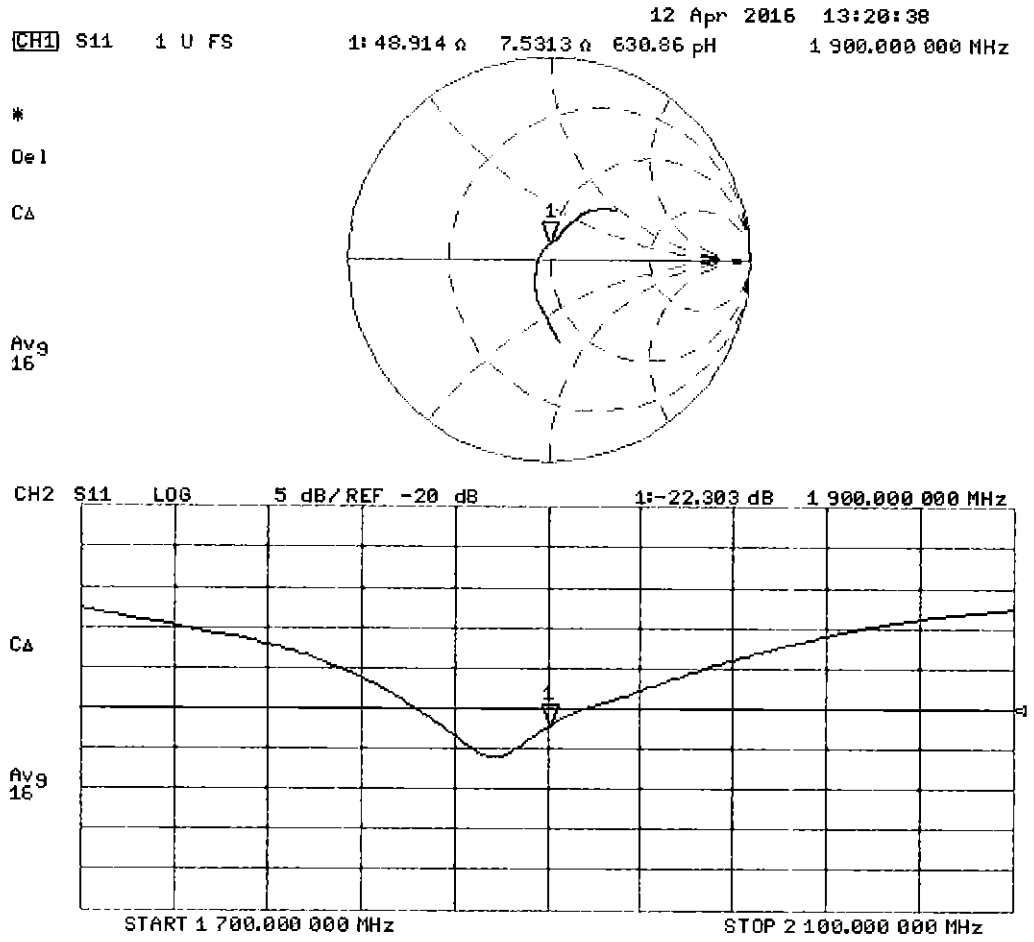
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.2 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 9.8 W/kg; SAR(10 g) = 5.2 W/kg
Maximum value of SAR (measured) = 14.8 W/kg



0 dB = 14.8 W/kg = 11.70 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D2450V2-719_Aug15

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 719
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 20, 2015

BN ✓
9/3/15

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 EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M. Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 21, 2015

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) **Accreditation No.: SCS 0108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.2 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**54.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.7 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.3 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω + 5.3 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.1 Ω + 6.5 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 20.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

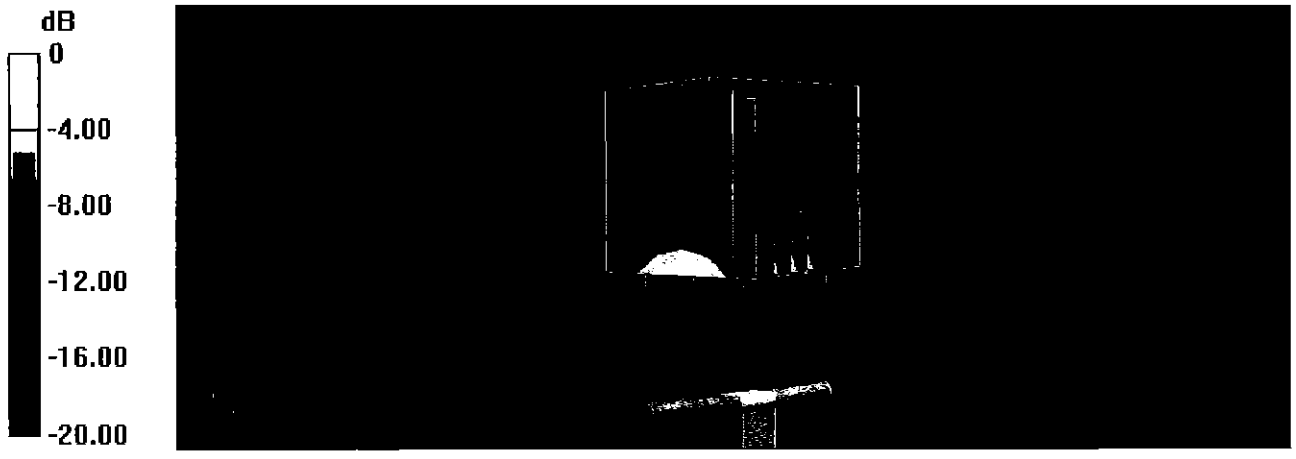
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

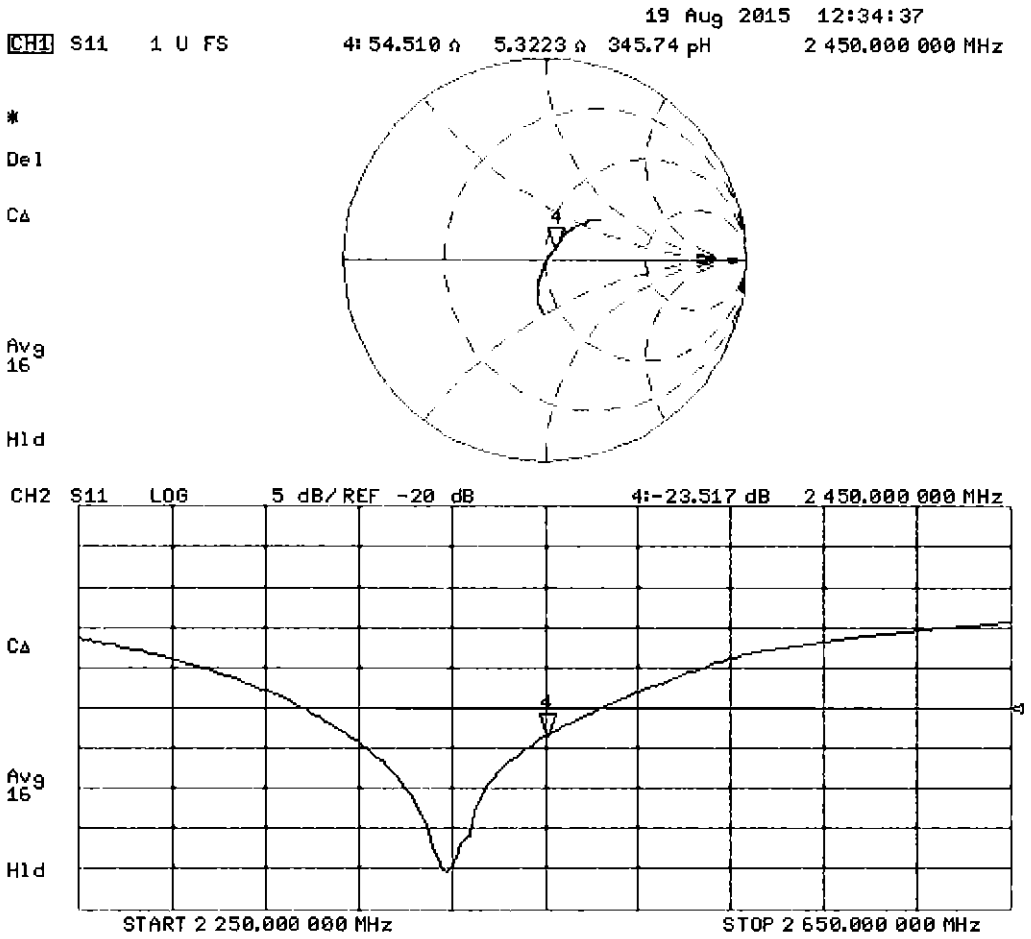
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.2 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.48 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2 S/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

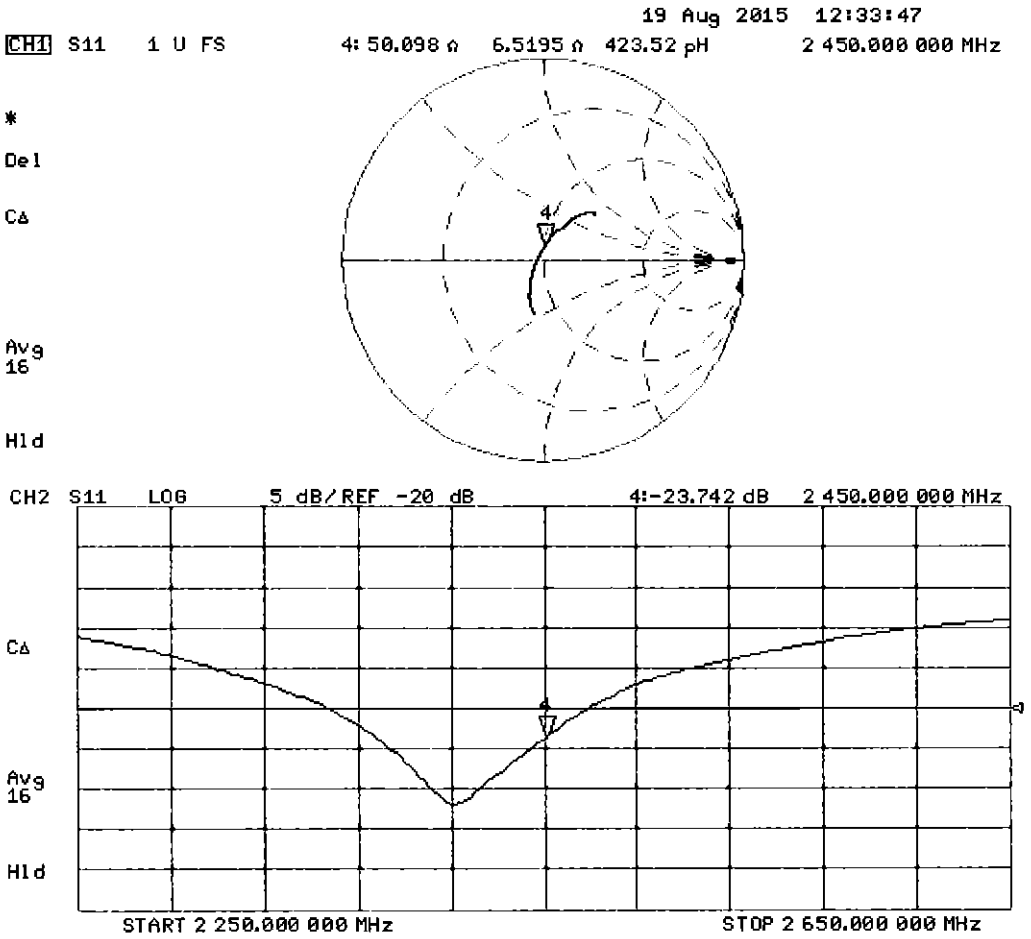
- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.73 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.11 W/kg
Maximum value of SAR (measured) = 17.3 W/kg

0 dB = 17.3 W/kg = 12.38 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D2600V2-1004_Apr16

CALIBRATION CERTIFICATE

PM ✓ 4/25/16

Object	D2600V2 - SN: 1004
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 19, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 20, 2016

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

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 6 %	2.00 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**55.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.7 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	2.16 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**52.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.4 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.7 Ω - 5.0 jΩ
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.9 Ω - 3.7 jΩ
Return Loss	- 24.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 23, 2006

DASY5 Validation Report for Head TSL

Date: 19.04.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

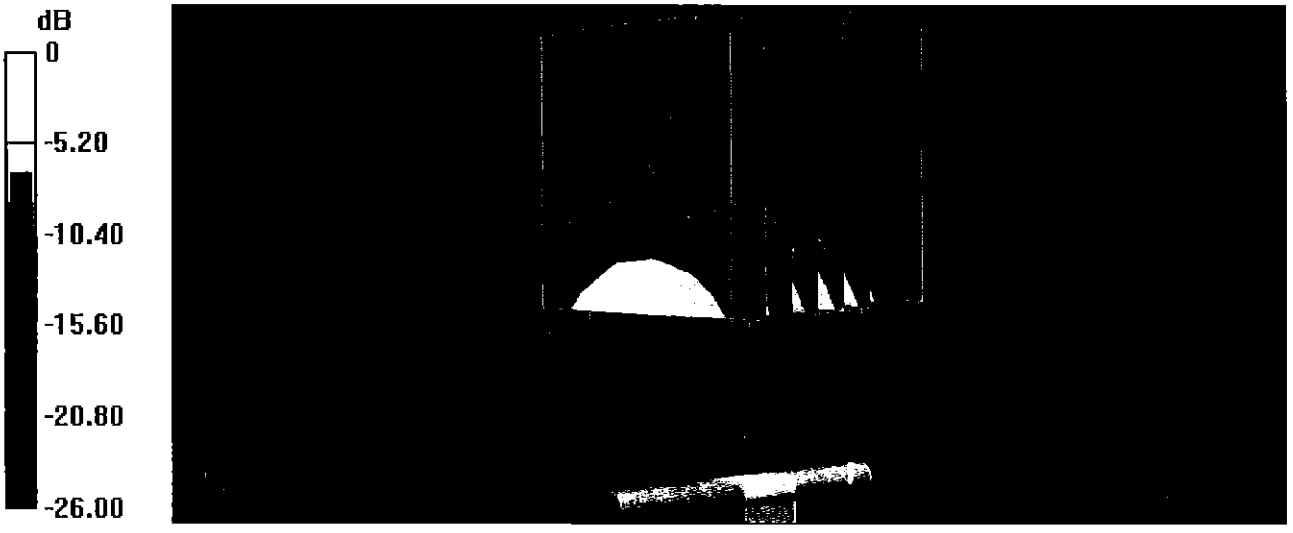
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2 S/m; ε_r = 39.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.49, 7.49, 7.49); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

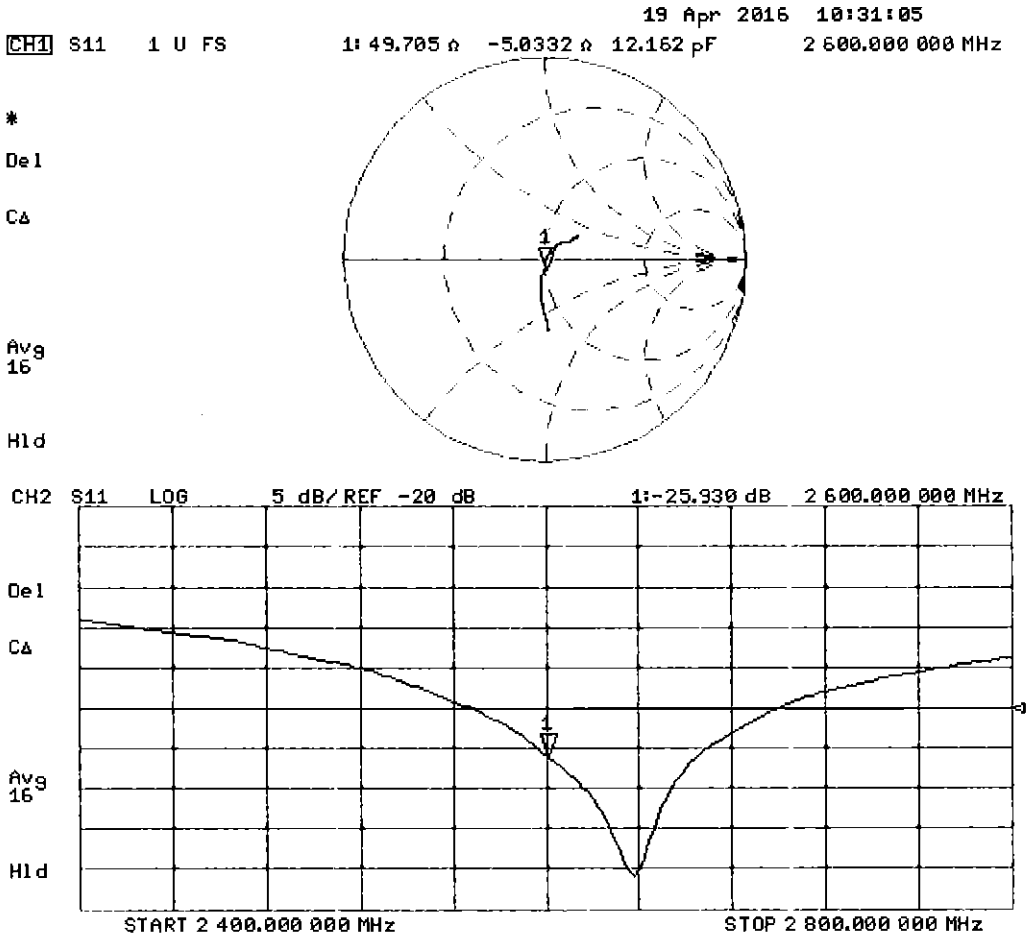
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 115.2 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 14 W/kg; SAR(10 g) = 6.2 W/kg
Maximum value of SAR (measured) = 24.0 W/kg



0 dB = 24.0 W/kg = 13.80 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.04.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

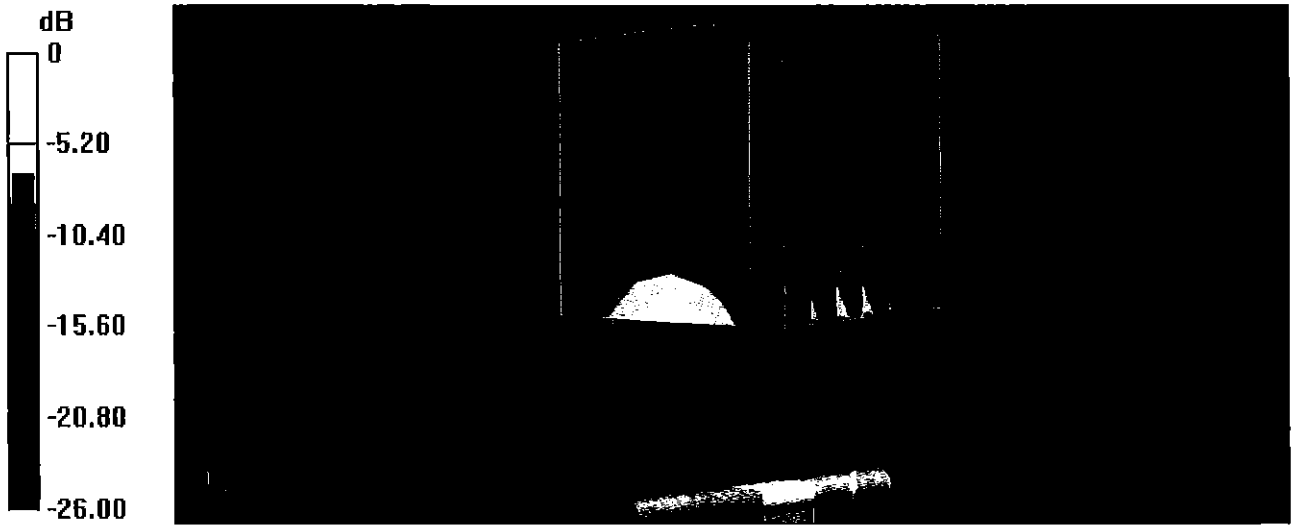
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.16 S/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.6, 7.6, 7.6); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

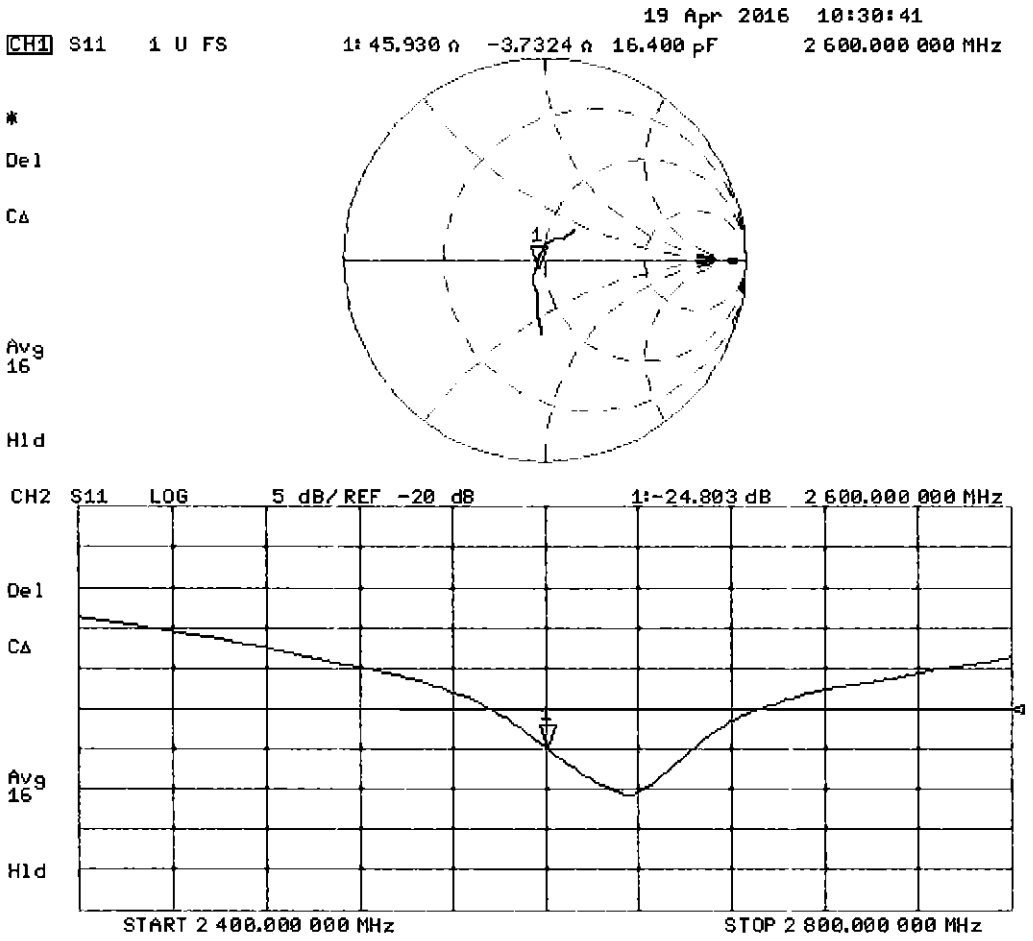
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.5 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.6 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 5.86 W/kg
Maximum value of SAR (measured) = 21.7 W/kg



0 dB = 21.7 W/kg = 13.36 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D5GHzV2-1191_Sep15

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1191**

Calibration procedure(s) **QA CAL-22.v2**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **September 16, 2015**

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 EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 18, 2015

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) 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 62209-2, "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
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.6 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	5.04 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.53 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.5 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.7 ± 6 %	5.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**81.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	6.20 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.76 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.4 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	54.1 Ω - 5.2 jΩ
Return Loss	- 24.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	58.0 Ω - 3.2 jΩ
Return Loss	- 22.0 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	59.2 Ω + 3.7 jΩ
Return Loss	- 20.8 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	54.5 Ω - 3.9 jΩ
Return Loss	- 24.8 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	59.0 Ω - 2.5 jΩ
Return Loss	- 21.3 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	59.9 Ω + 4.8 jΩ
Return Loss	- 20.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 28, 2003

DASY5 Validation Report for Head TSL

Date: 15.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1191

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.54 S/m; ε_r = 34.9; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.88 S/m; ε_r = 34.4; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 5.04 S/m; ε_r = 34.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

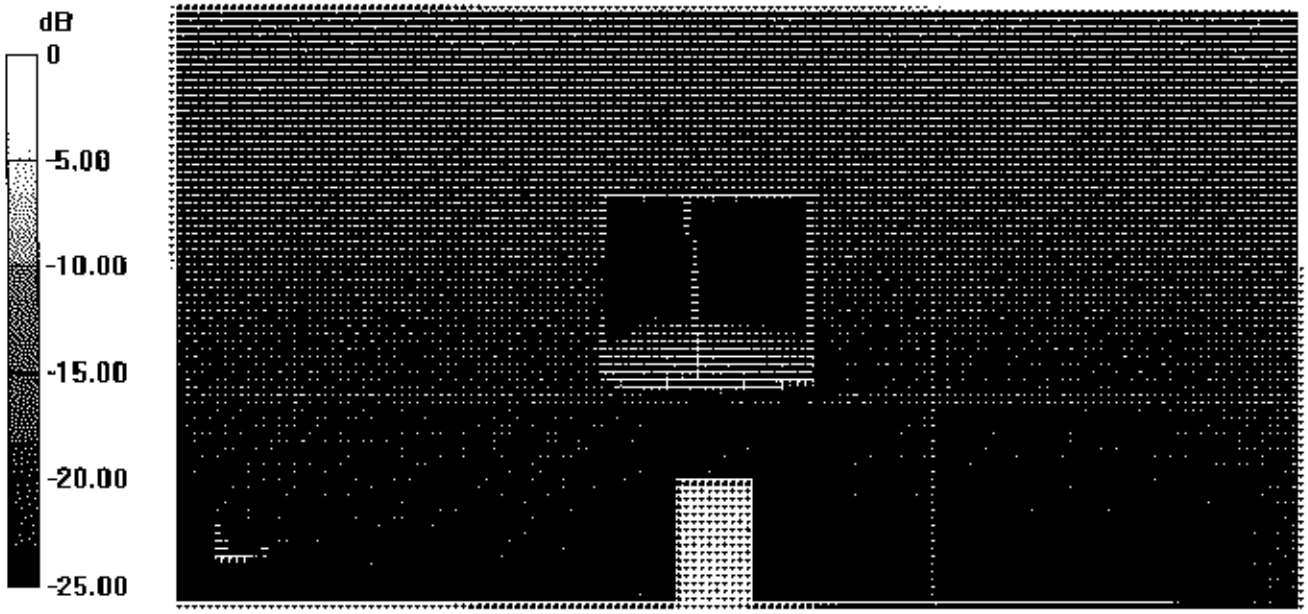
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.45, 5.45, 5.45); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.94 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 19.5 W/kg

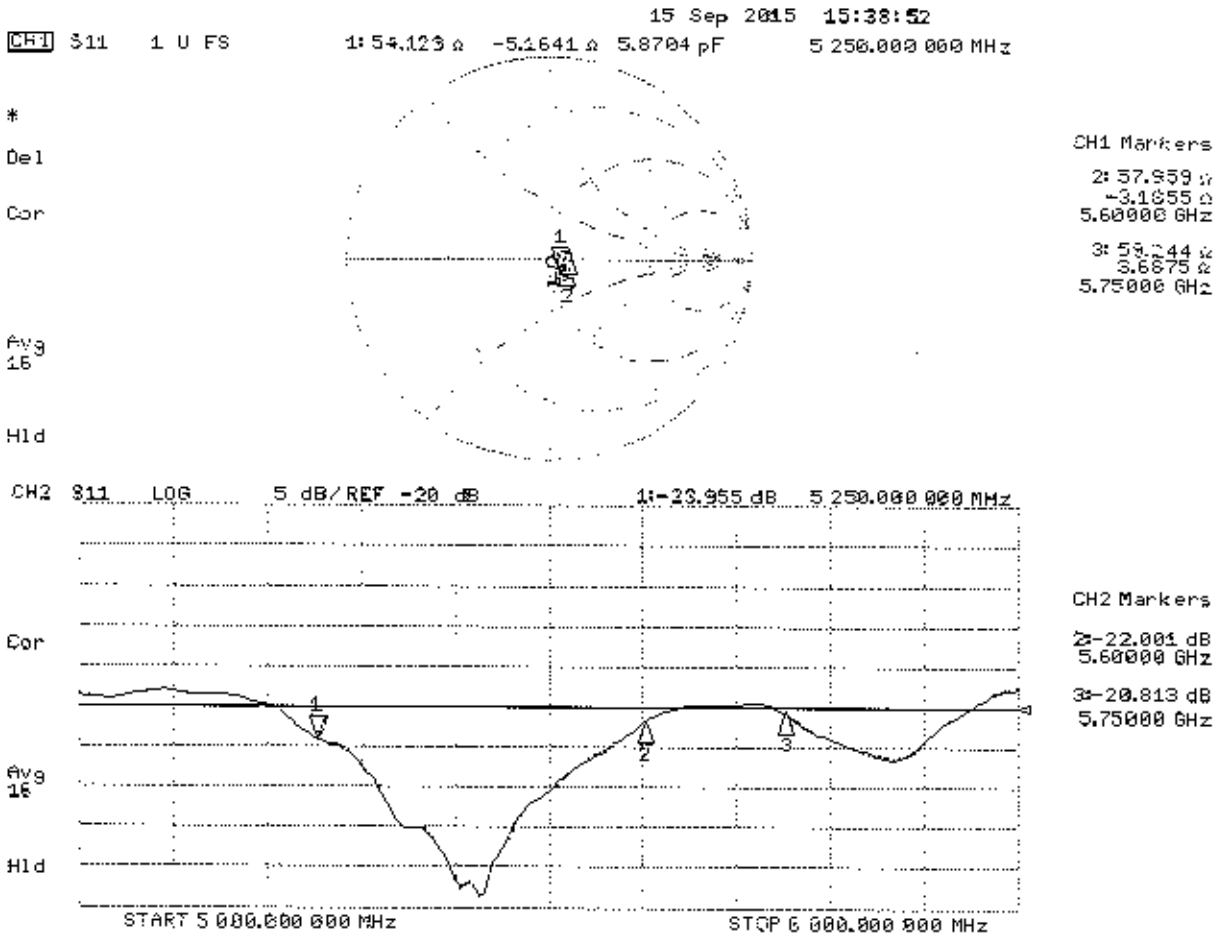
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.94 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 8.52 W/kg; SAR(10 g) = 2.43 W/kg
Maximum value of SAR (measured) = 20.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.52 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 33.4 W/kg
SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 19.9 W/kg



0 dB = 19.9 W/kg = 12.99 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1191

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 5.53 S/m; ε_r = 47.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 5.99 S/m; ε_r = 46.7; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 6.2 S/m; ε_r = 46.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

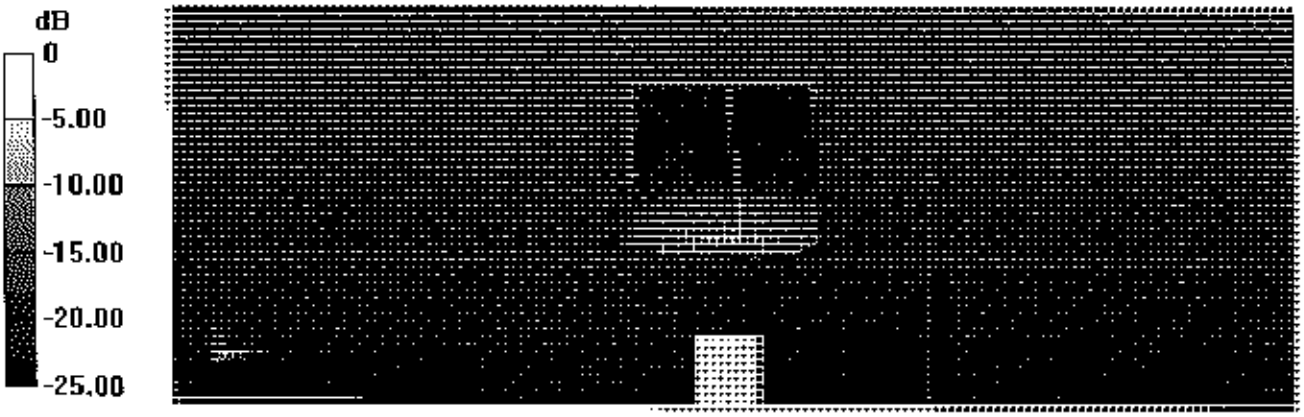
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.40 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 30.8 W/kg
SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 19.0 W/kg

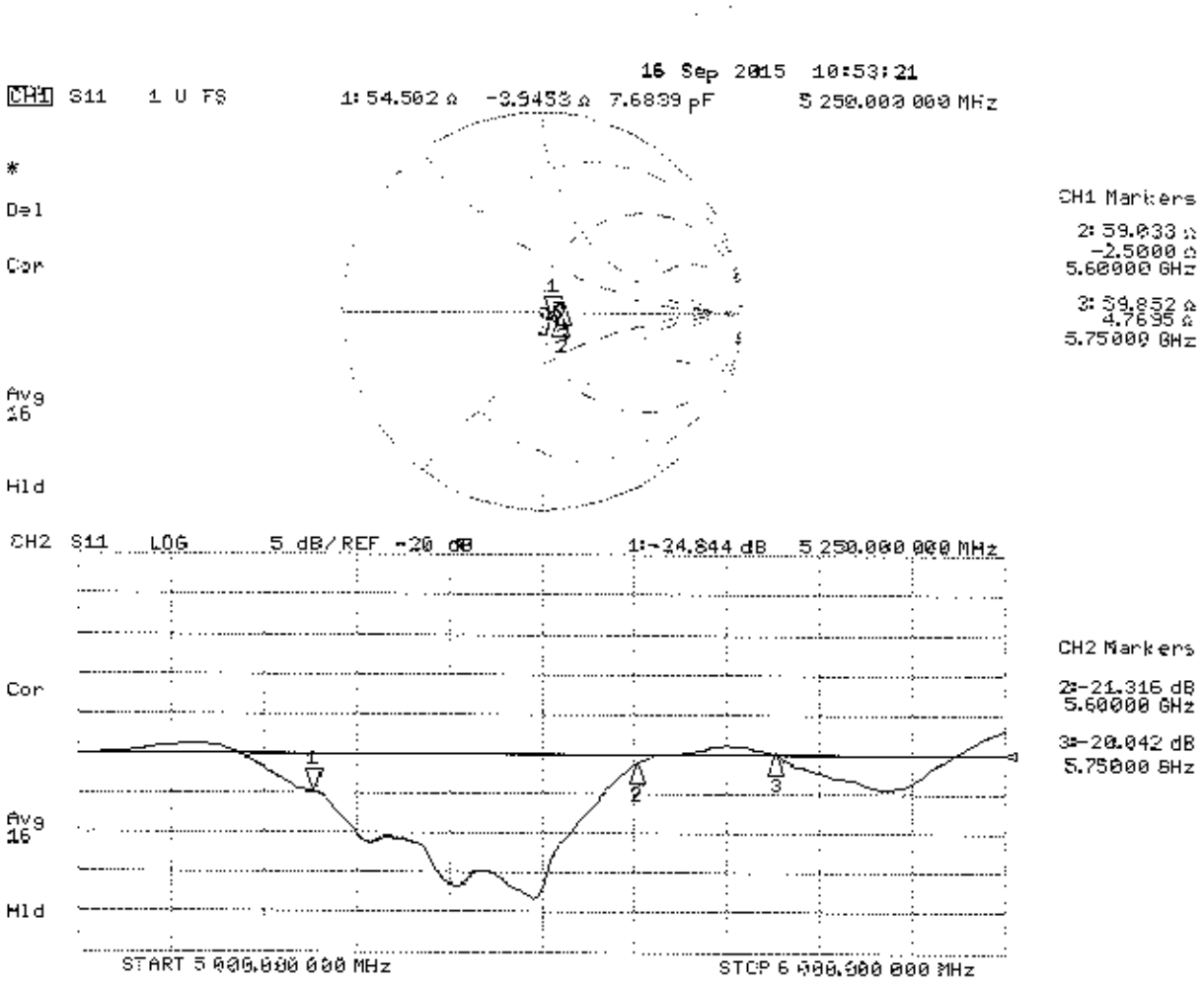
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.20 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 36.1 W/kg
SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 21.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 56.52 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 35.5 W/kg
SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 19.9 W/kg



0 dB = 19.9 W/kg = 12.99 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D2600V2-1071_Oct15

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1071
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	October 21, 2015

BN ✓
4/03/15

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 EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	30-Dec-14 (No. EX3-7349_Dec14)	Dec-15
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (In house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: October 22, 2015

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

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from tha 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 meesured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.4 ± 6 %	2.02 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**55.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.4 ± 6 %	2.18 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**54.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.5 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 5.4 jΩ
Return Loss	- 25.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.7 Ω - 4.6 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 17, 2013

DASY5 Validation Report for Head TSL

Date: 21.10.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1071

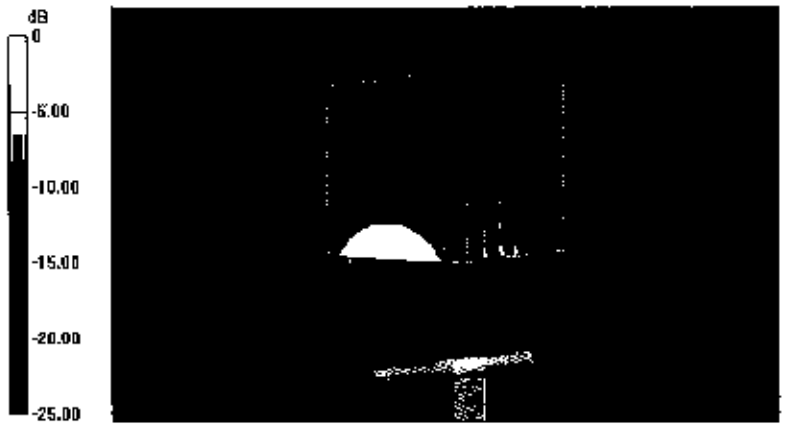
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.02 S/m; ε_r = 37.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.4, 7.4, 7.4); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

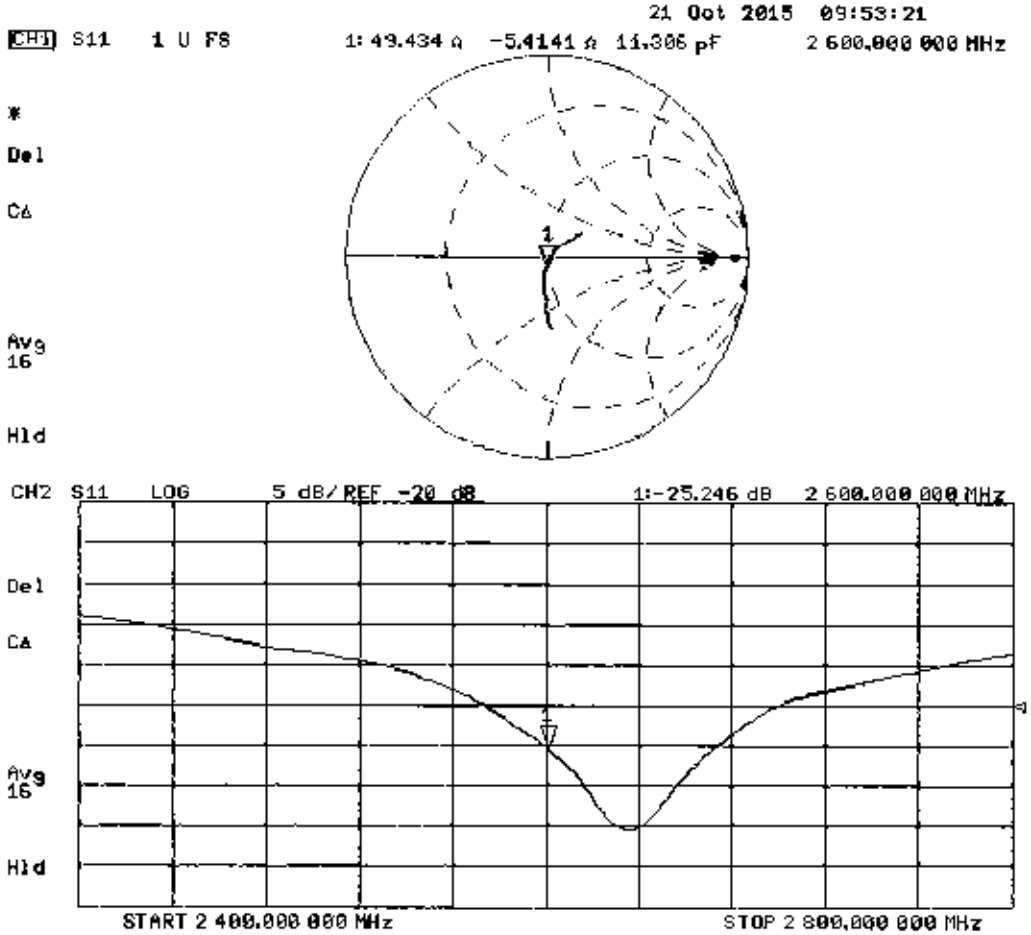
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 115.2 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 30.8 W/kg
SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.33 W/kg
Maximum value of SAR (measured) = 24.2 W/kg



0 dB = 24.2 W/kg = 13.84 dBW/kg

Impedance Measurement Plot for Head TSL



Date: 21.10.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1071

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.18 S/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

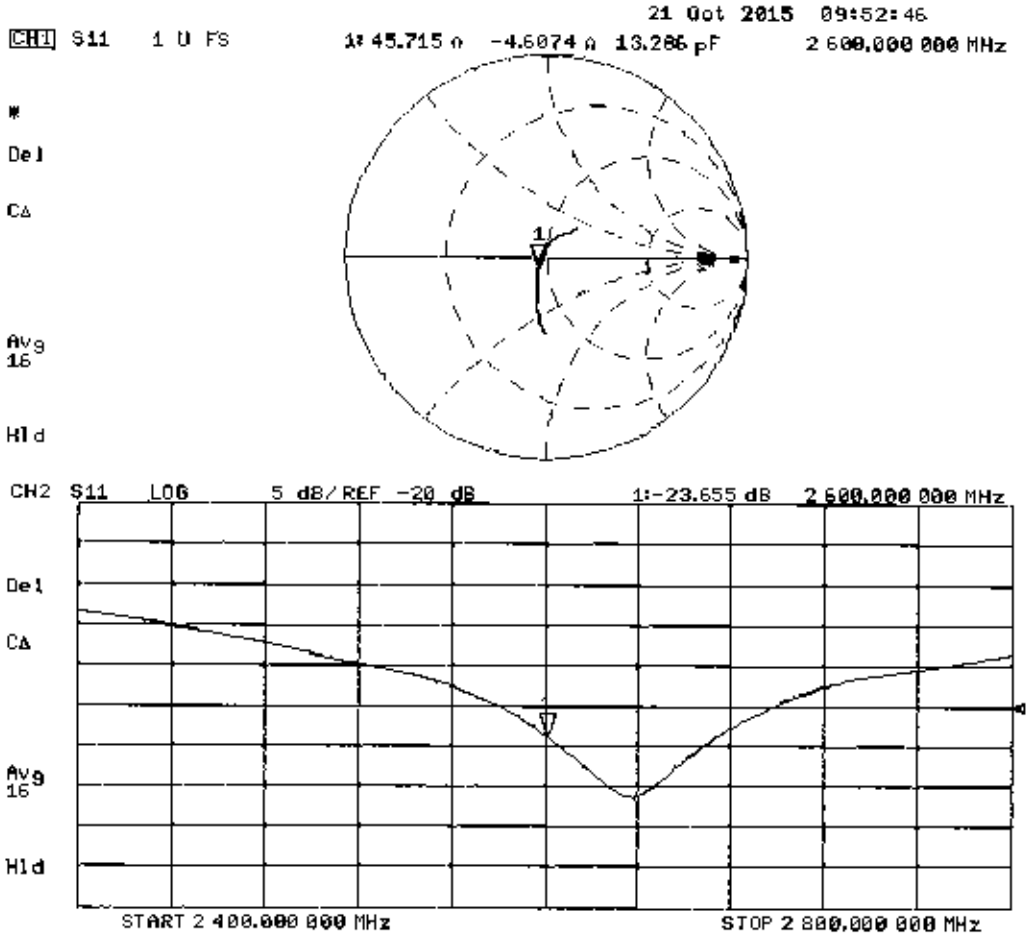
- Probe: EX3DV4 - SN7349; ConvF(7.52, 7.52, 7.52); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 108.6 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 28.8 W/kg
SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.14 W/kg
Maximum value of SAR (measured) = 23.3 W/kg

0 dB = 23.3 W/kg = 13.67 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test** **Certificate No: D5GHzV2-1120_Feb16**

CALIBRATION CERTIFICATE

Object D5GHzV2 - SN: 1120

Calibration procedure(s) QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

BN ✓
03/01/2016

Calibration date: February 25, 2016

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 EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 3503	31-Dec-15 (No. EX3-3503_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: February 25, 2016

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) 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 62209-2, "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
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.56 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	4.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.3 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	5.07 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.98 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.94 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	6.15 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.71 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.3 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	52.8 Ω - 1.3 jΩ
Return Loss	- 30.5 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.8 Ω - 1.0 jΩ
Return Loss	- 23.8 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.5 Ω + 4.2 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	51.7 Ω - 0.6 jΩ
Return Loss	- 34.9 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	58.8 Ω + 2.2 jΩ
Return Loss	- 21.5 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	53.9 Ω + 6.1 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.205 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 08, 2011

DASY5 Validation Report for Head TSL

Date: 25.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1120

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz Medium parameters used: f = 5250 MHz; σ = 4.56 S/m; ε_r = 34.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.91 S/m; ε_r = 34.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 5.07 S/m; ε_r = 34.1; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

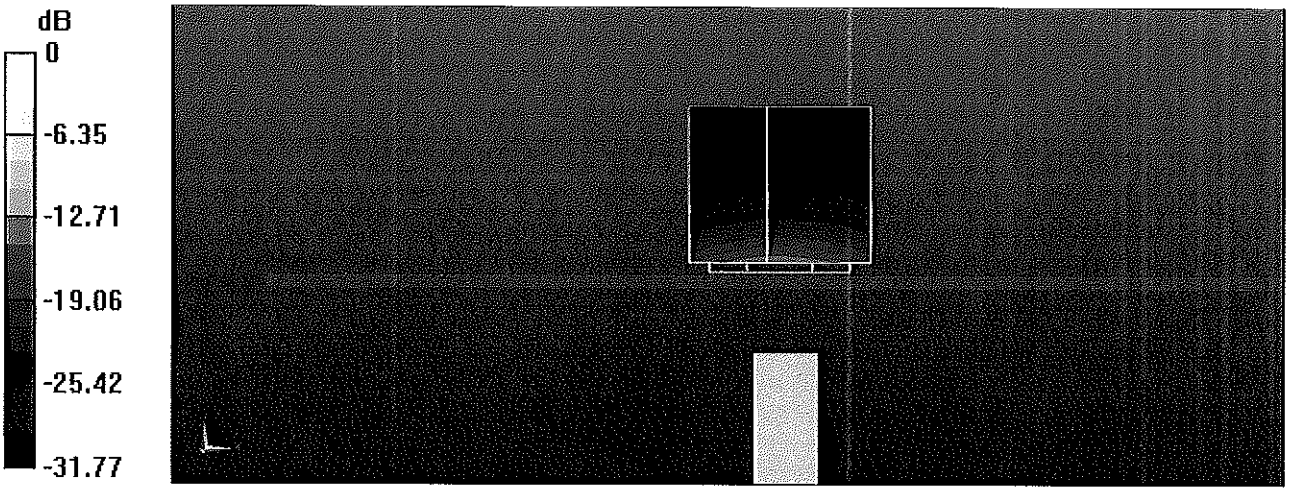
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.53, 5.53, 5.53); Calibrated: 31.12.2015, ConvF(4.99, 4.99, 4.99); Calibrated: 31.12.2015, ConvF(4.95, 4.95, 4.95); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom Type: QD000P50AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.31 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 29.0 W/kg
SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.28 W/kg
Maximum value of SAR (measured) = 18.4 W/kg

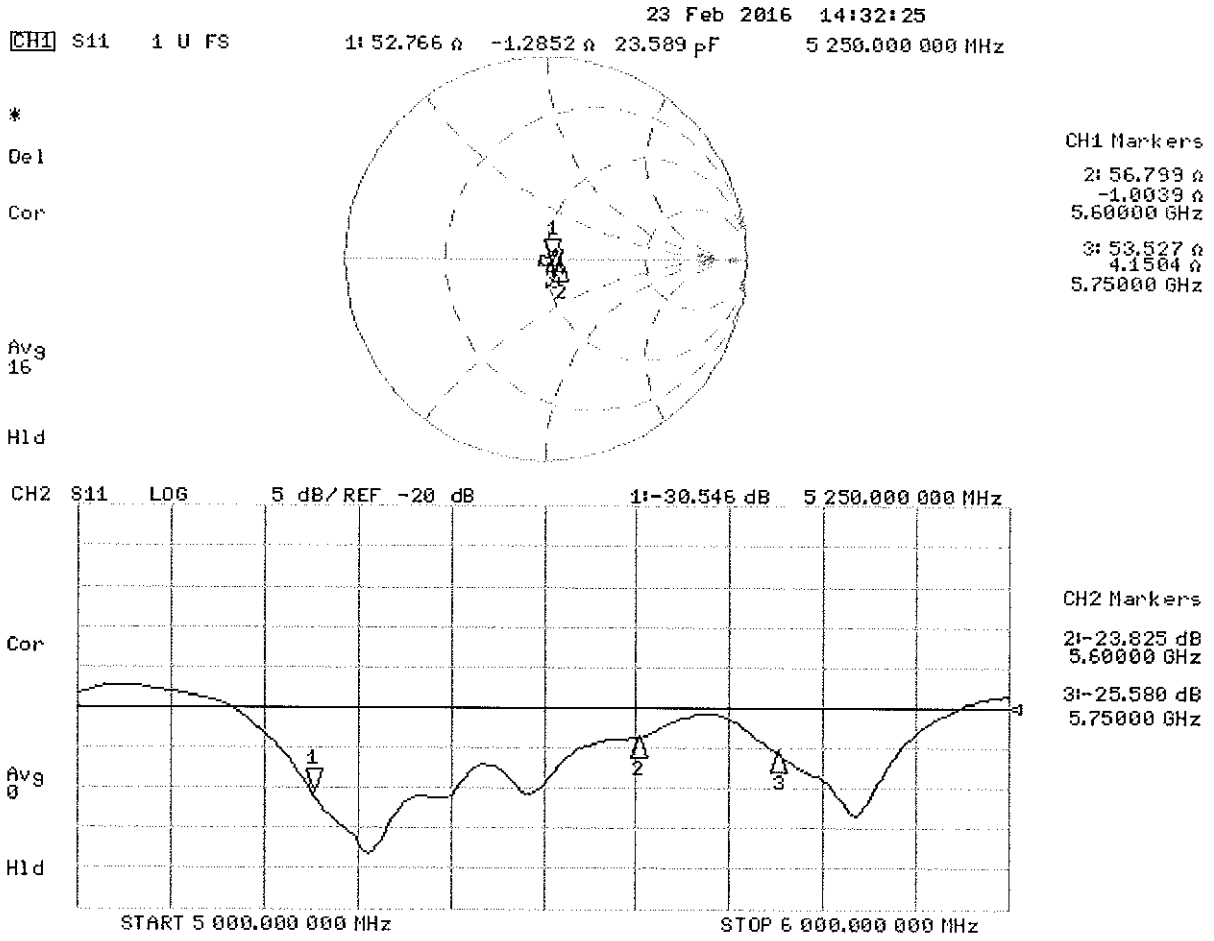
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.36 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.09 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.98 W/kg; SAR(10 g) = 2.28 W/kg
Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 18.4 W/kg = 12.65 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1120

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 5.46 S/m; ε_r = 47.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.94 S/m; ε_r = 46.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 6.15 S/m; ε_r = 46.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

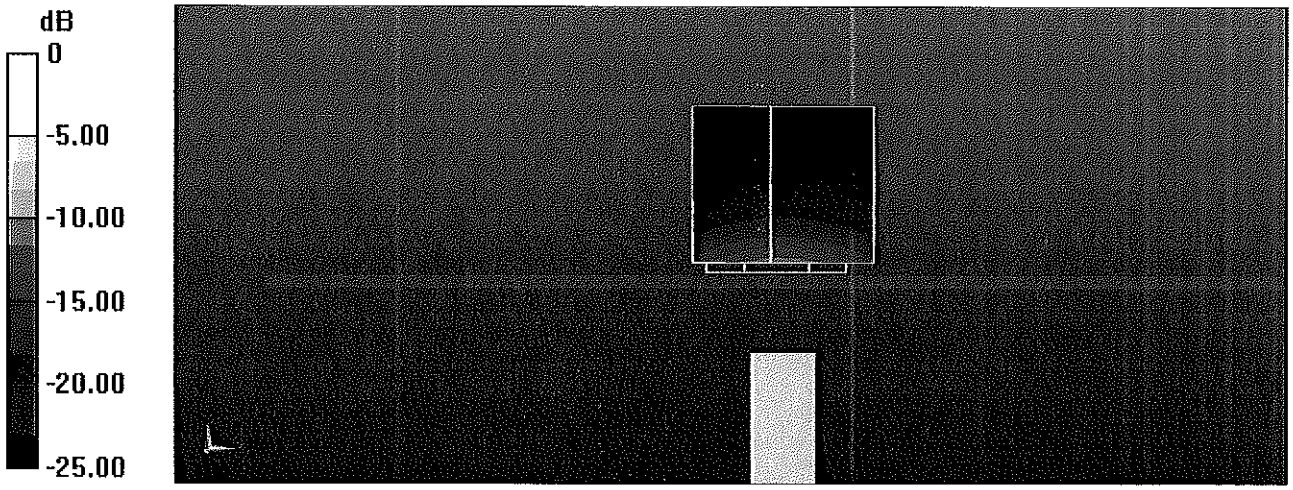
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.85, 4.85, 4.85); Calibrated: 31.12.2015, ConvF(4.35, 4.35, 4.35); Calibrated: 31.12.2015, ConvF(4.3, 4.3, 4.3); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.97 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.14 W/kg
Maximum value of SAR (measured) = 18.3 W/kg

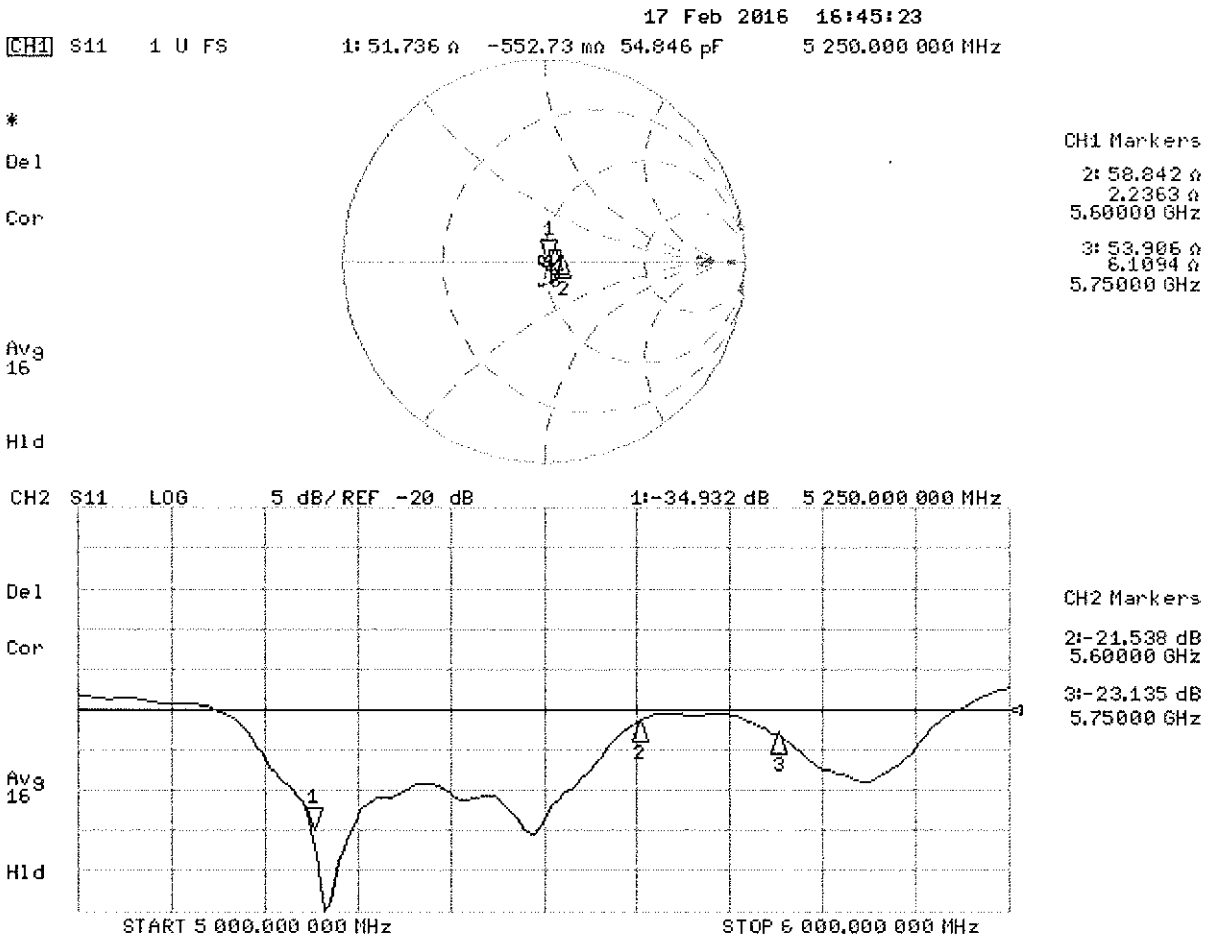
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.65 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.28 W/kg
Maximum value of SAR (measured) = 20.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.41 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 33.1 W/kg
SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.15 W/kg
Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 18.3 W/kg = 12.62 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D750V3-1161_Jul16

CALIBRATION CERTIFICATE

Object D750V3 - SN:1161

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: July 13, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 13, 2016

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.17 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.39 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.43 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.53 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.6 Ω - 0.9 jΩ
Return Loss	- 25.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω - 4.0 jΩ
Return Loss	- 28.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.033 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 19, 2015

DASY5 Validation Report for Head TSL

Date: 13.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

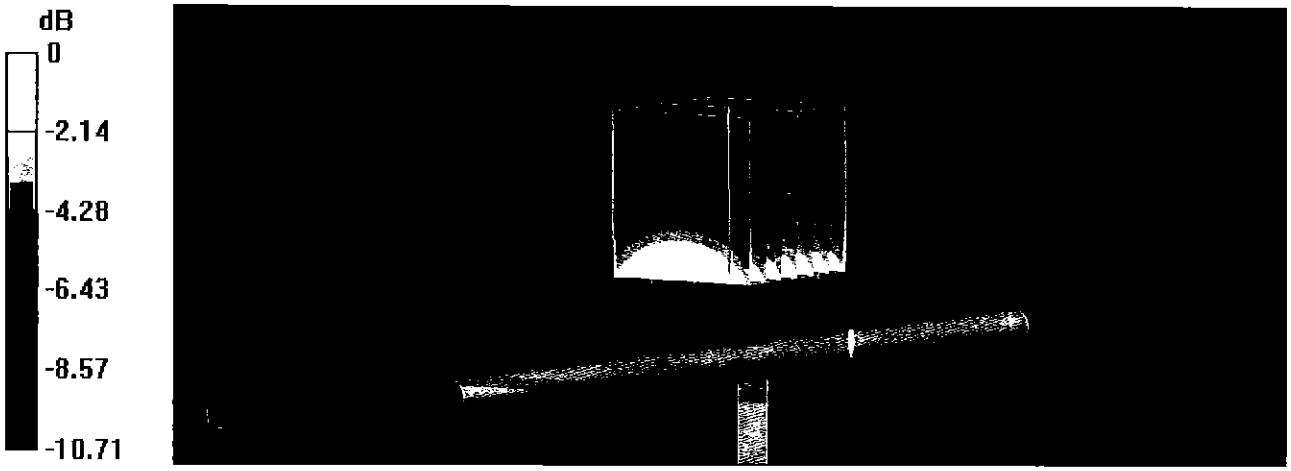
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.91 S/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

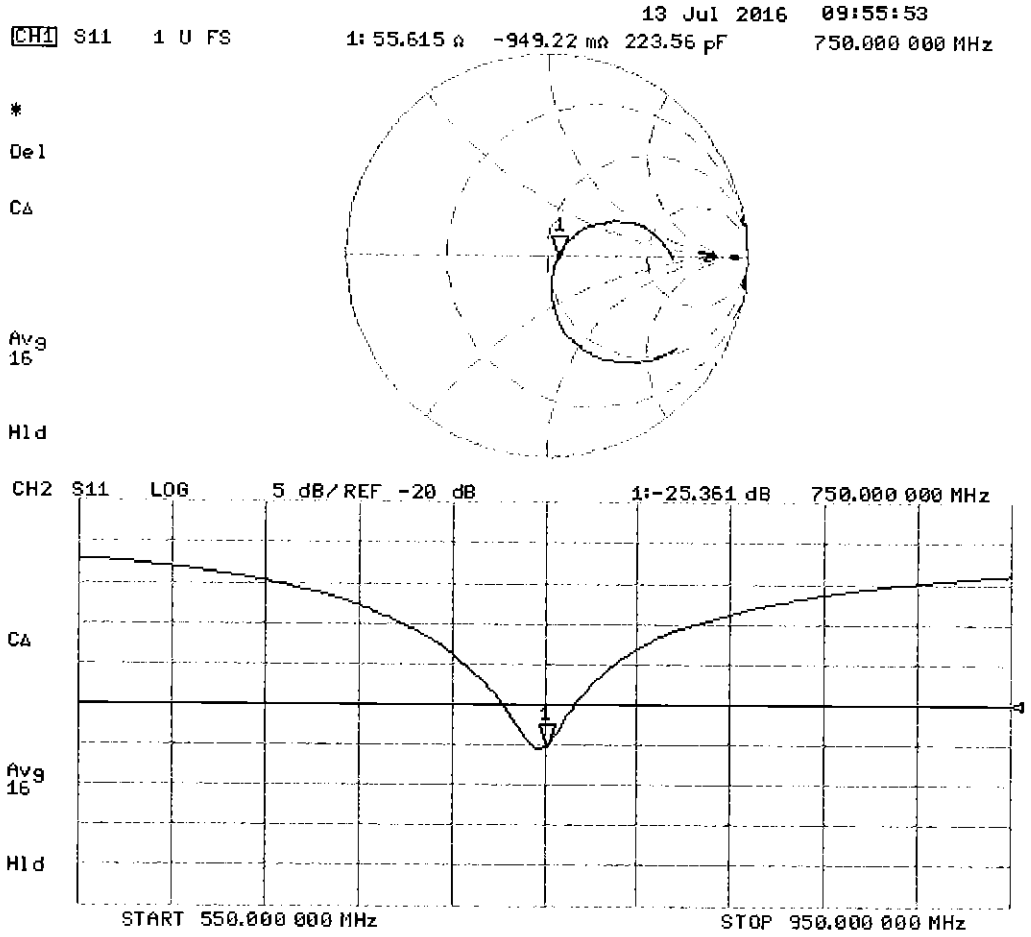
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.07 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.13 W/kg
SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.37 W/kg
Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

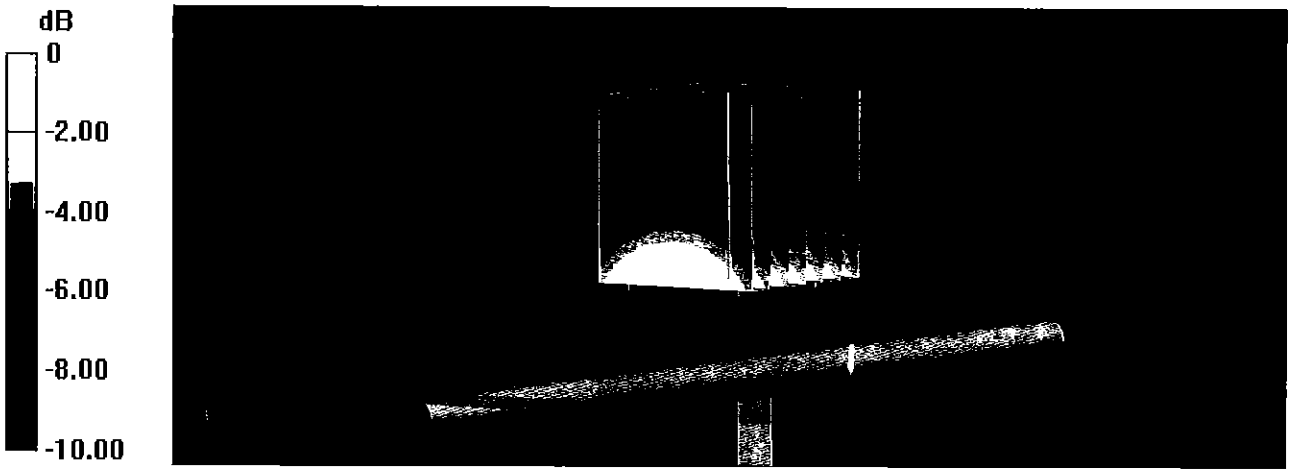
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.99 S/m; ε_r = 55.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

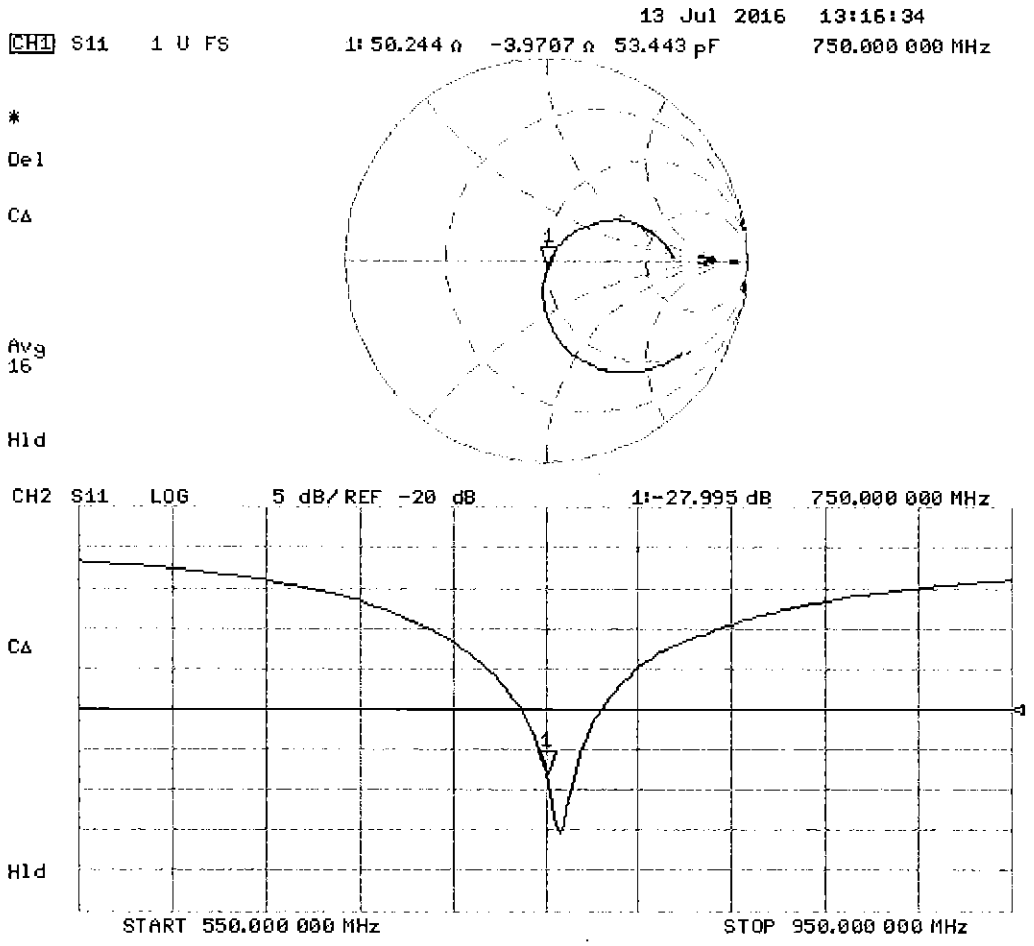
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.33 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.22 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.41 W/kg
Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 4.58 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D1900V2-5d080_Jul16

CALIBRATION CERTIFICATE

Object D1900V2 - SN:5d080

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

BN ✓ 7/16/2016

Calibration date: July 08, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: July 13, 2016

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**39.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.7 ± 6 %	1.51 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.75 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 Ω + 5.3 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω + 6.8 jΩ
Return Loss	- 22.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 28, 2006

DASY5 Validation Report for Head TSL

Date: 08.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

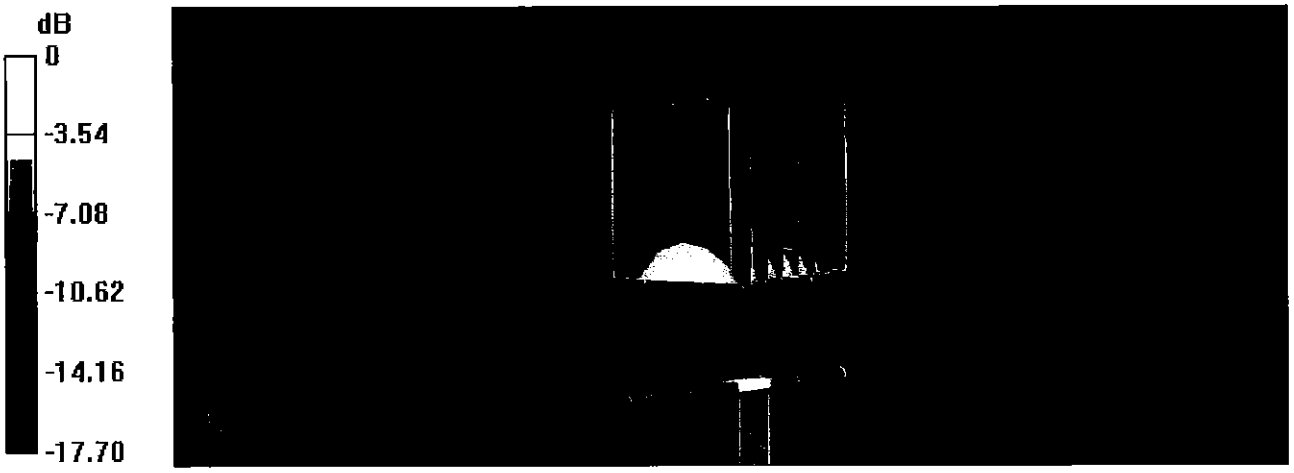
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.99, 7.99, 7.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

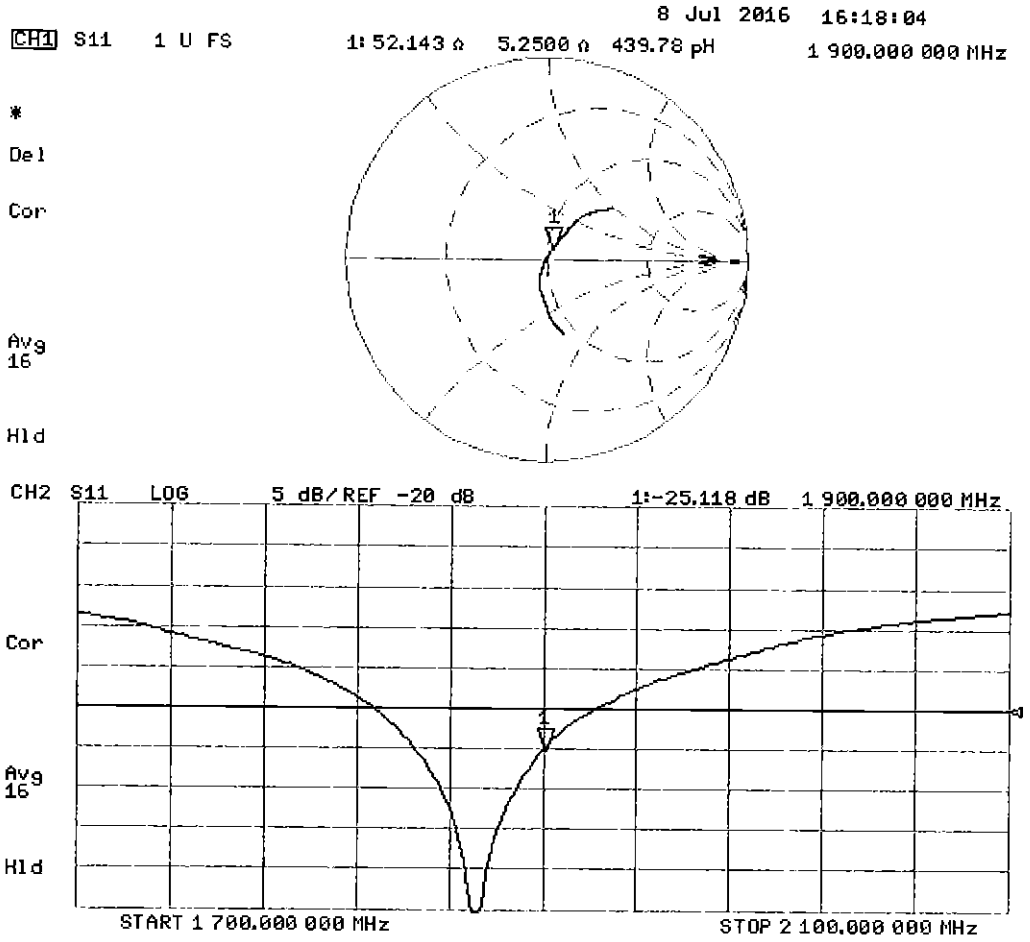
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.6 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 18.4 W/kg
SAR(1 g) = 9.76 W/kg; SAR(10 g) = 5.1 W/kg
Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

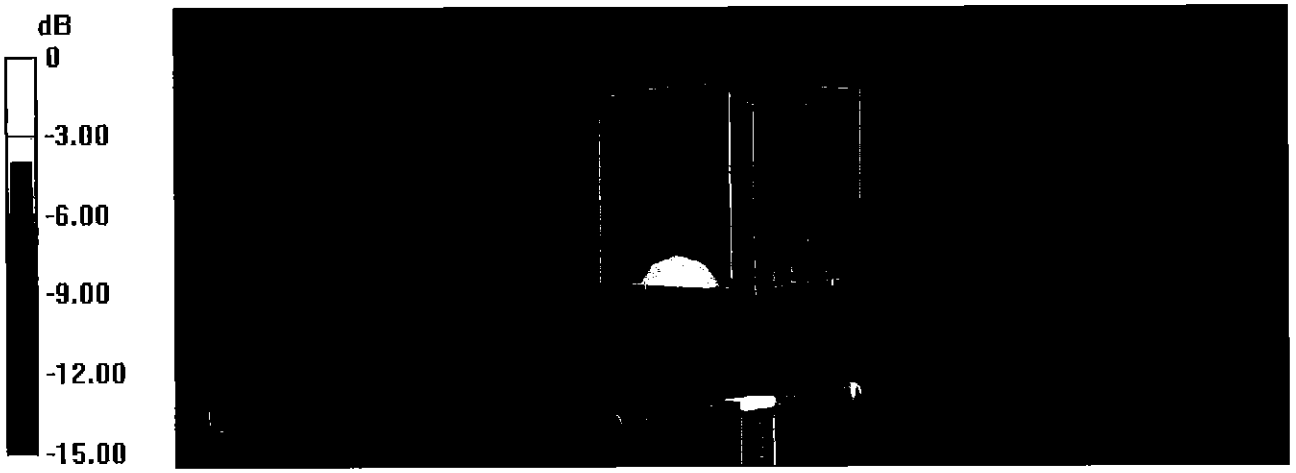
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.51 S/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.03, 8.03, 8.03); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

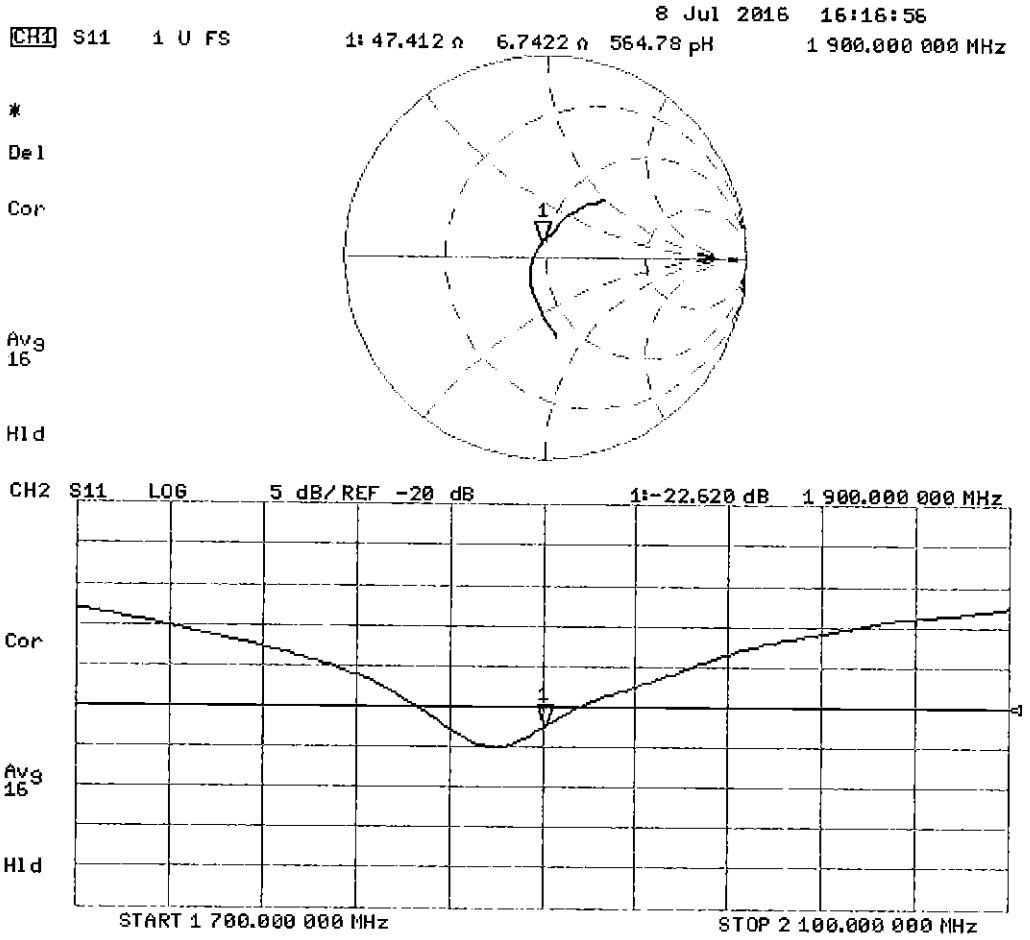
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.1 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 9.75 W/kg; SAR(10 g) = 5.17 W/kg
Maximum value of SAR (measured) = 14.7 W/kg



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

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: D2450V2-981_Jul16

CALIBRATION CERTIFICATE

Object D2450V2 - SN:981

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

VPH
8/9/16

Calibration date: July 25, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 27, 2016

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

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.7 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	2.03 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.8 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.2 Ω + 3.4 jΩ
Return Loss	- 26.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω + 4.5 jΩ
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 30, 2014

DASY5 Validation Report for Head TSL

Date: 13.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:981

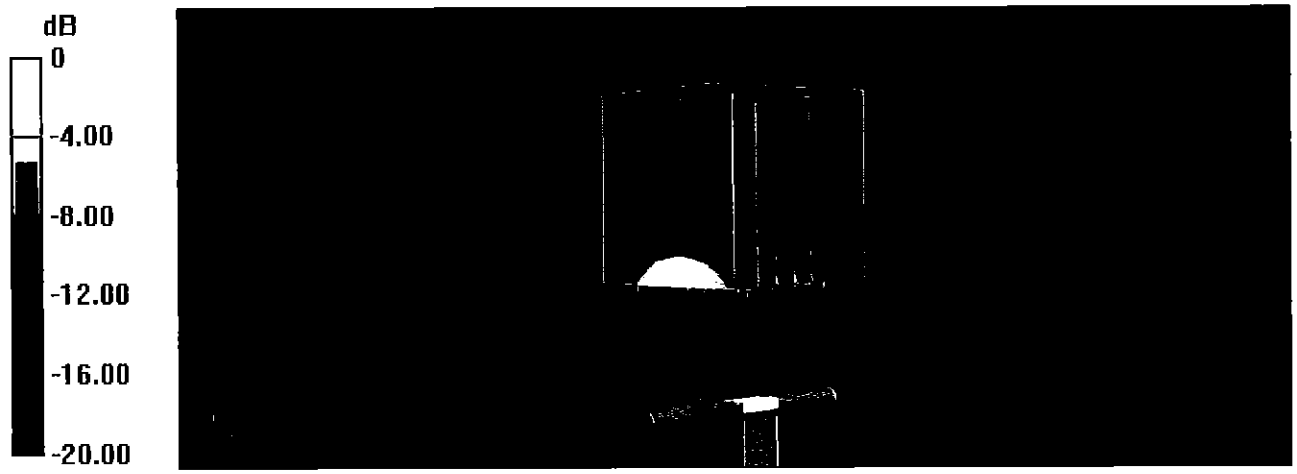
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 38; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.72, 7.72, 7.72); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

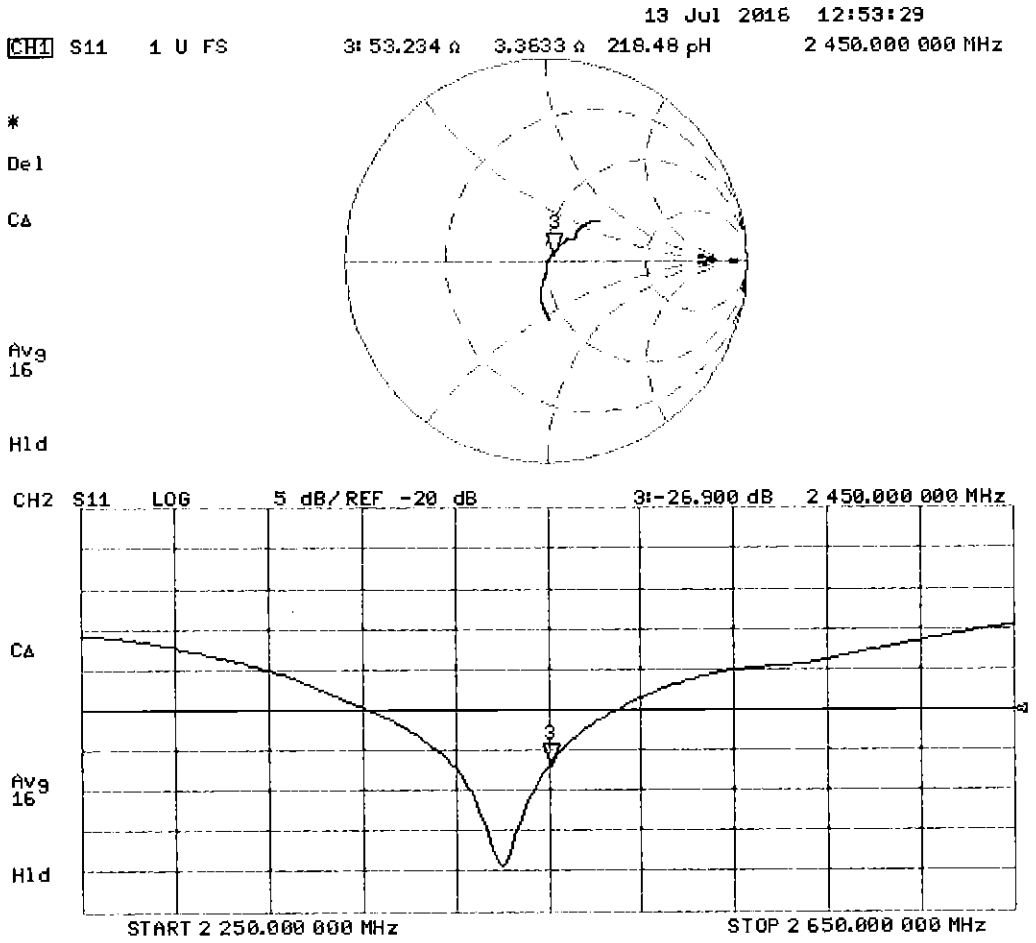
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 115.8 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.26 W/kg
Maximum value of SAR (measured) = 22.5 W/kg



0 dB = 22.5 W/kg = 13.52 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:981

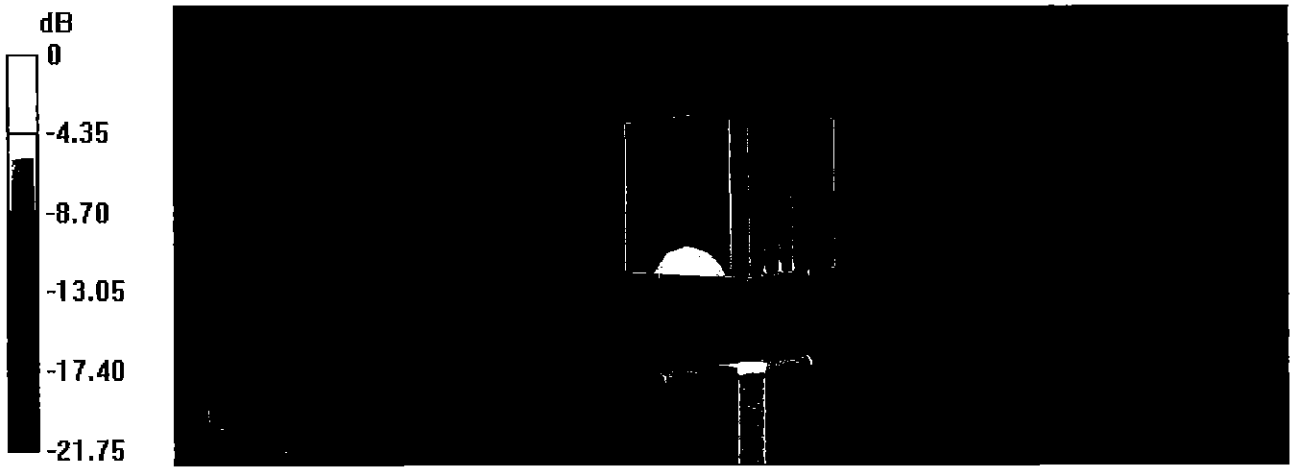
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

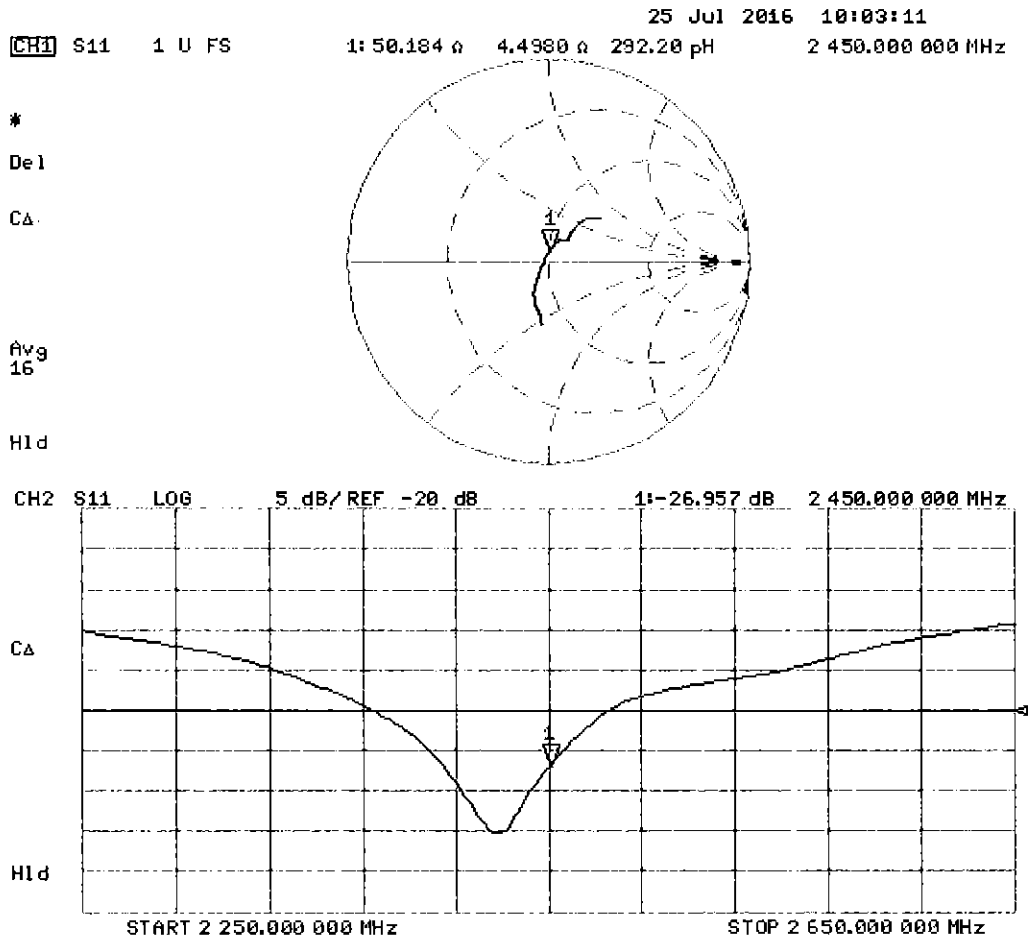
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.1 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 26.0 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.04 W/kg
Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test**

Certificate No: **D5GHzV2-1237_Aug16**

CALIBRATION CERTIFICATE

Object D5GHzV2 - SN:1237

Calibration procedure(s) QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

vPT 8/9/16

Calibration date: August 02, 2016

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	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 3503	30-Jun-16 (No. EX3-3503_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 4, 2016

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) 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 62209-2, "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
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.52 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.00 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.9 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.3 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.9 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.7 ± 6 %	5.02 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.42 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.54 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	5.88 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.76 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.5 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	6.11 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.6 Ω - 2.5 jΩ
Return Loss	- 30.7 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	50.9 Ω + 1.5 jΩ
Return Loss	- 35.3 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.8 Ω + 5.8 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	47.0 Ω - 3.9 jΩ
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	51.5 Ω + 3.9 jΩ
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	53.8 Ω + 0.3 jΩ
Return Loss	- 28.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	May 04, 2015

DASY5 Validation Report for Head TSL

Date: 02.08.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1237

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.52 S/m; ε_r = 34.4; ρ = 1000 kg/m^3
Medium parameters used: f = 5600 MHz; σ = 4.86 S/m; ε_r = 33.9; ρ = 1000 kg/m^3
Medium parameters used: f = 5750 MHz; σ = 5.02 S/m; ε_r = 33.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

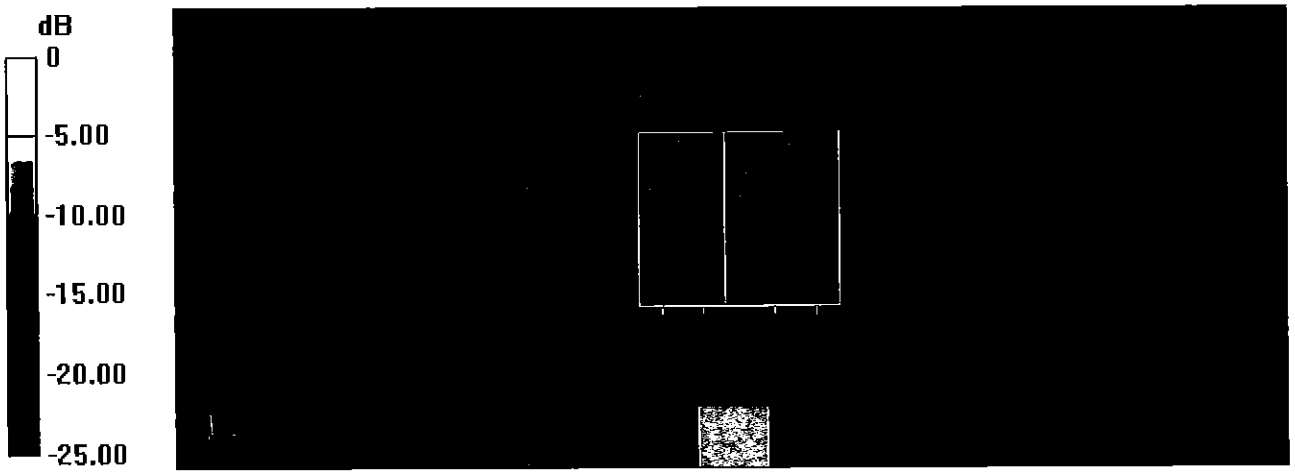
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.42, 5.42, 5.42); Calibrated: 30.06.2016; ConvF(4.89, 4.89, 4.89); Calibrated: 30.06.2016, ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.10 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 8 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 18.3 W/kg

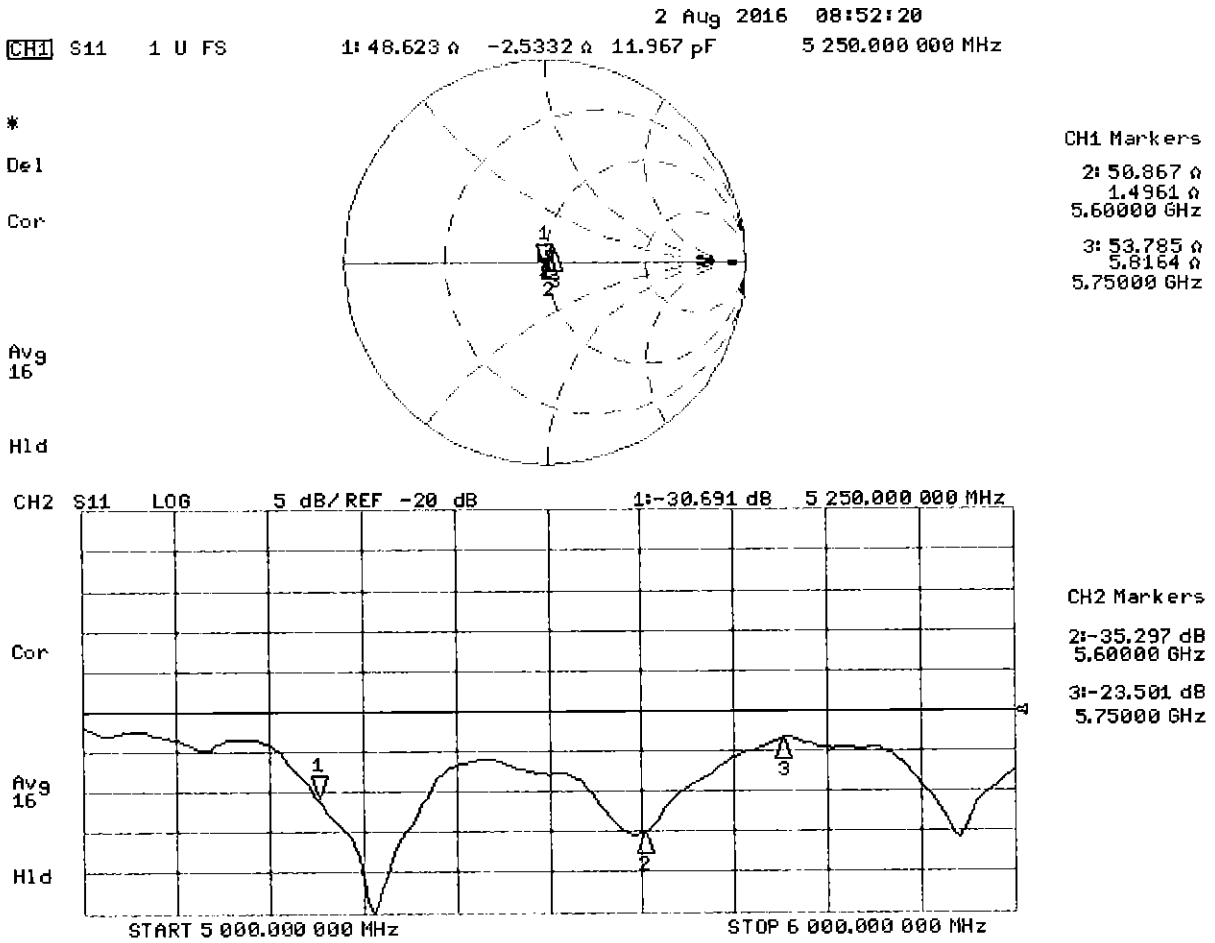
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.55 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 8.43 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.23 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 8.25 W/kg; SAR(10 g) = 2.35 W/kg
Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 18.3 W/kg = 12.62 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 02.08.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1237

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 5.42 S/m; ε_r = 47.1; ρ = 1000 kg/m^3
Medium parameters used: f = 5600 MHz; σ = 5.88 S/m; ε_r = 46.5; ρ = 1000 kg/m^3
Medium parameters used: f = 5750 MHz; σ = 6.11 S/m; ε_r = 46.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

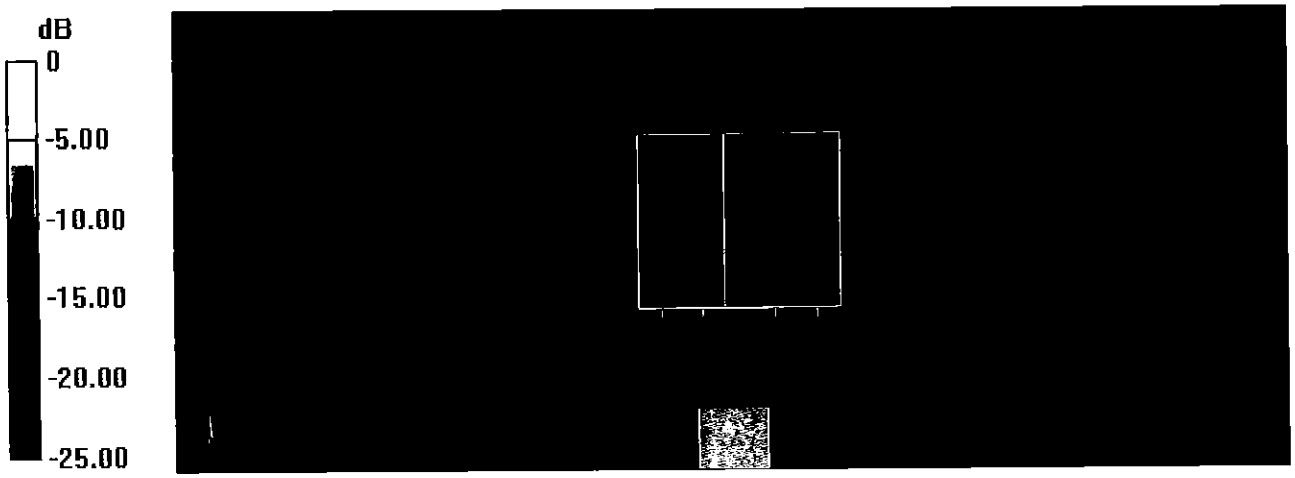
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016, ConvF(4.35, 4.35, 4.35); Calibrated: 30.06.2016, ConvF(4.3, 4.3, 4.3); Calibrated: 30.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.19 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 28.4 W/kg
SAR(1 g) = 7.54 W/kg; SAR(10 g) = 2.12 W/kg
Maximum value of SAR (measured) = 17.3 W/kg

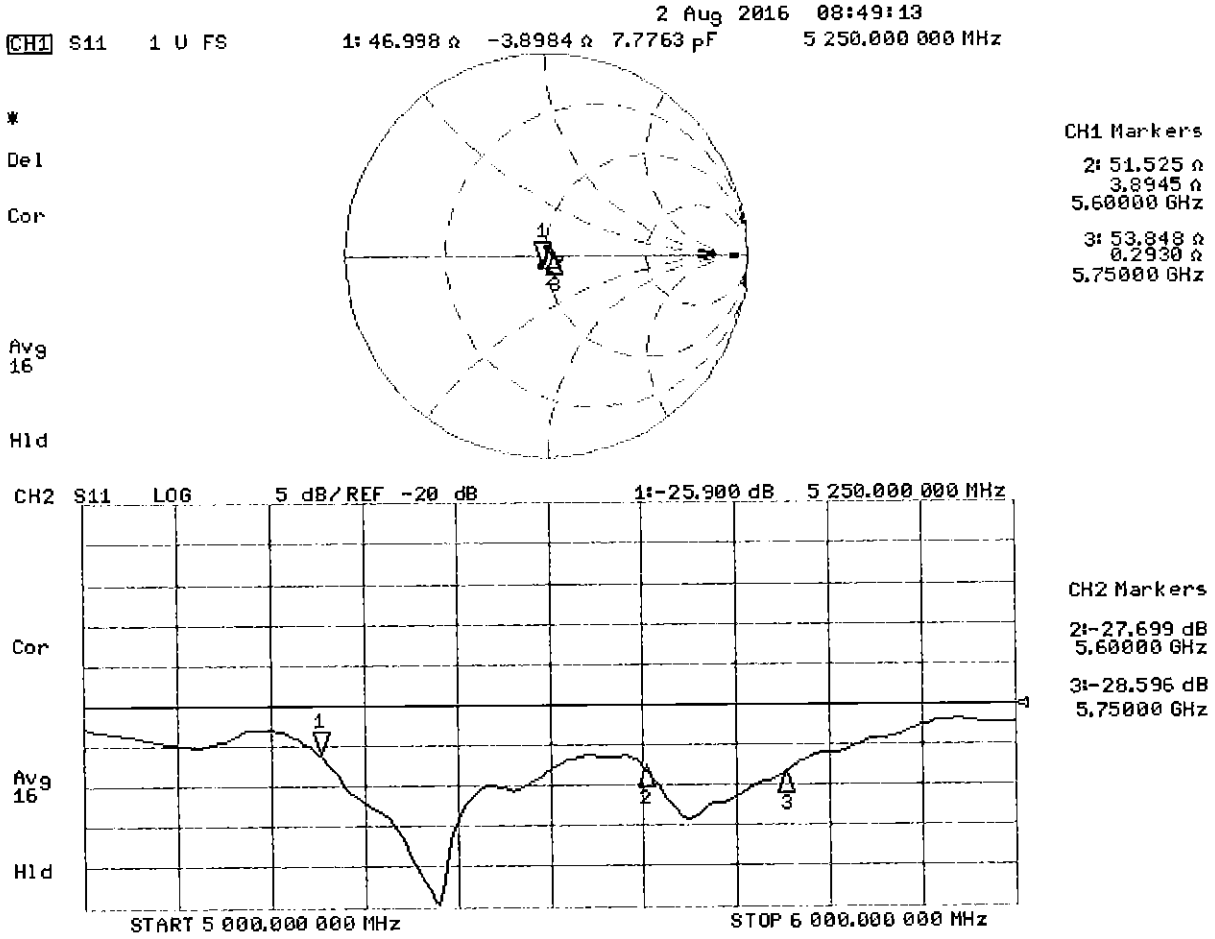
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.80 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 18.3 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.31 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 7.6 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 18.4 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

Impedance Measurement Plot for Body TSL



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 **PC Test** **Certificate No: D2450V2-882_Feb16**

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 882

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

BN ✓
03/01/2016

Calibration date: February 18, 2016

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 EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 19, 2016

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) 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, "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
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"

Additional Documentation:

e) DASY4/5 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**50.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.92 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.5 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.81 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.1 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω + 1.0 jΩ
Return Loss	- 31.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 Ω + 3.5 jΩ
Return Loss	- 28.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.157 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2011

DASY5 Validation Report for Head TSL

Date: 18.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 882

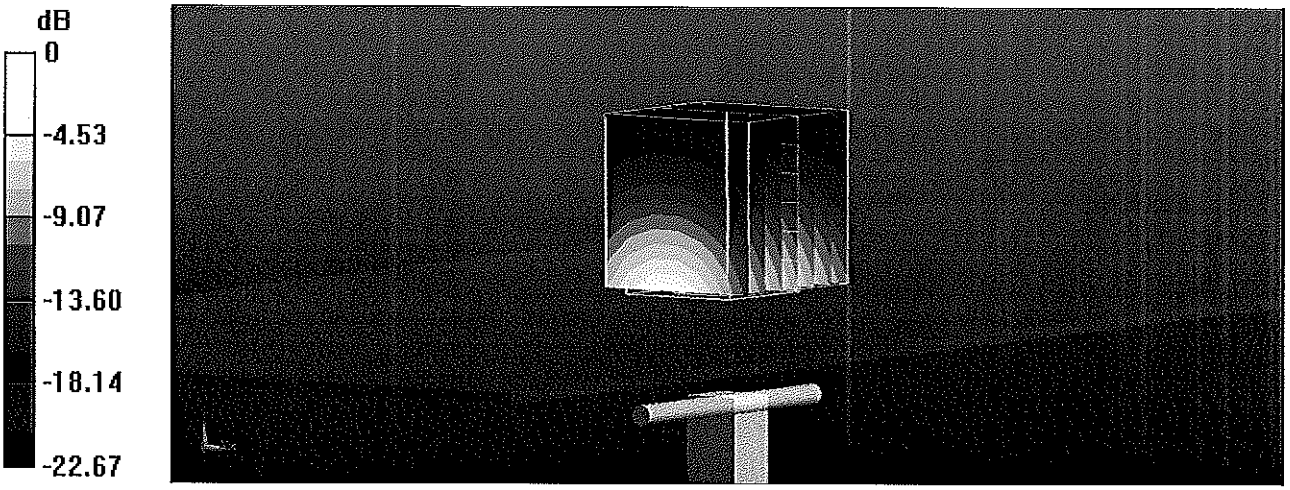
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 38.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.76, 7.76, 7.76); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

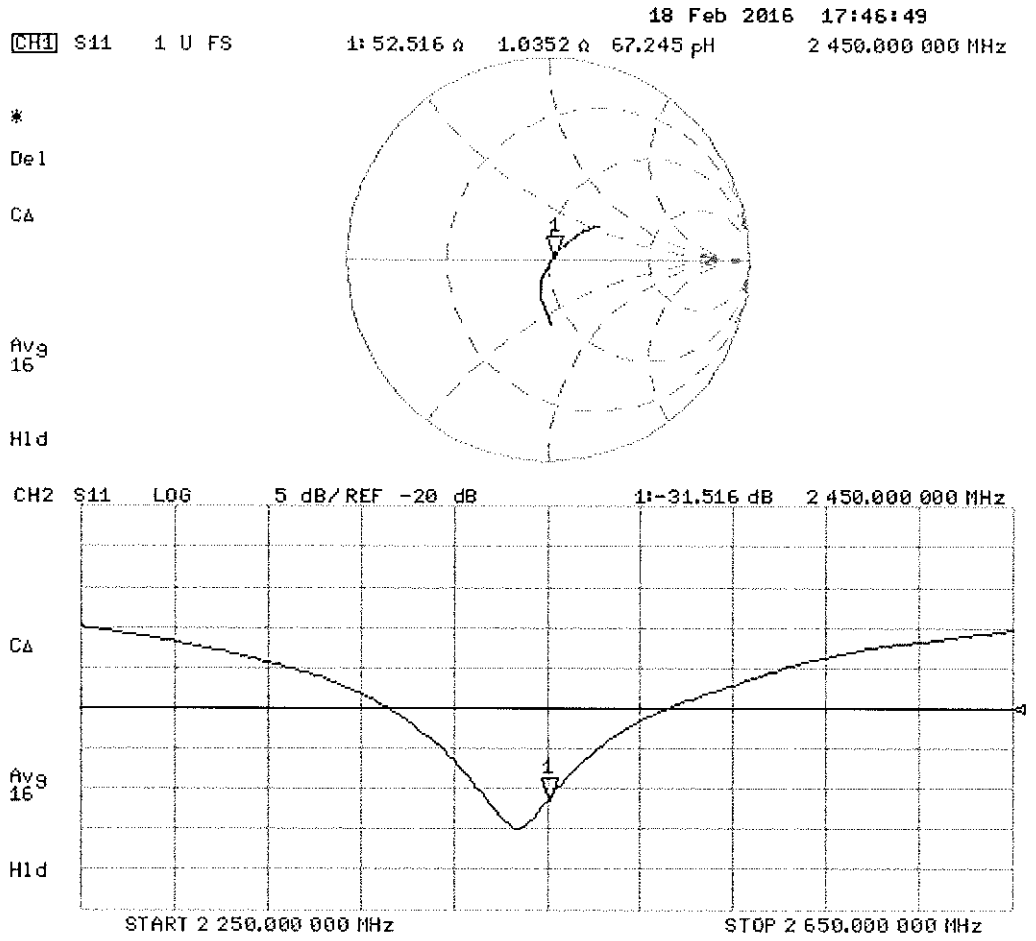
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 109.8 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 25.7 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.92 W/kg
Maximum value of SAR (measured) = 20.1 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 882

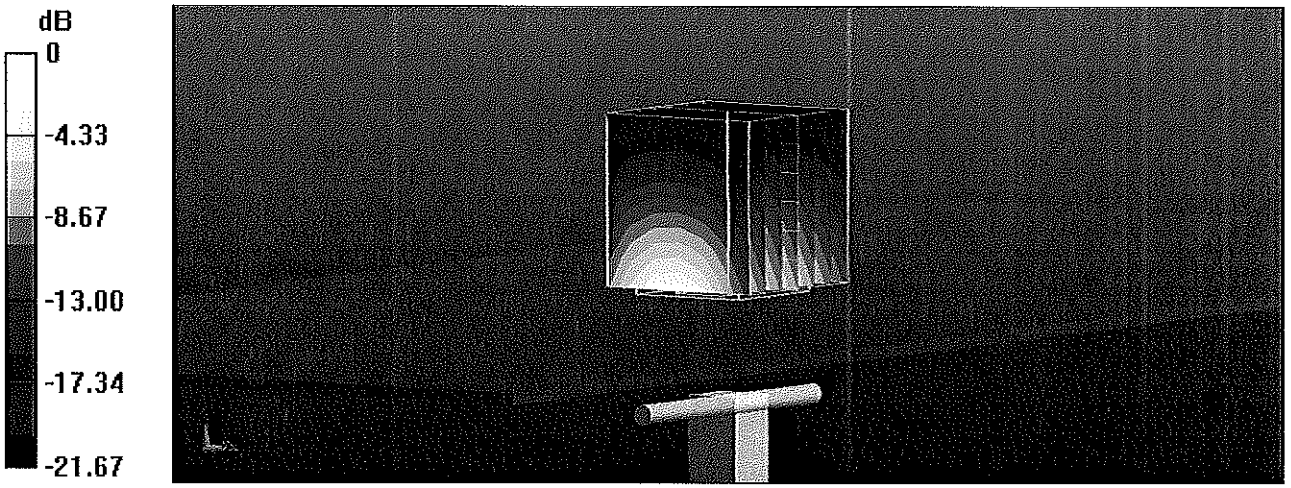
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2 S/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

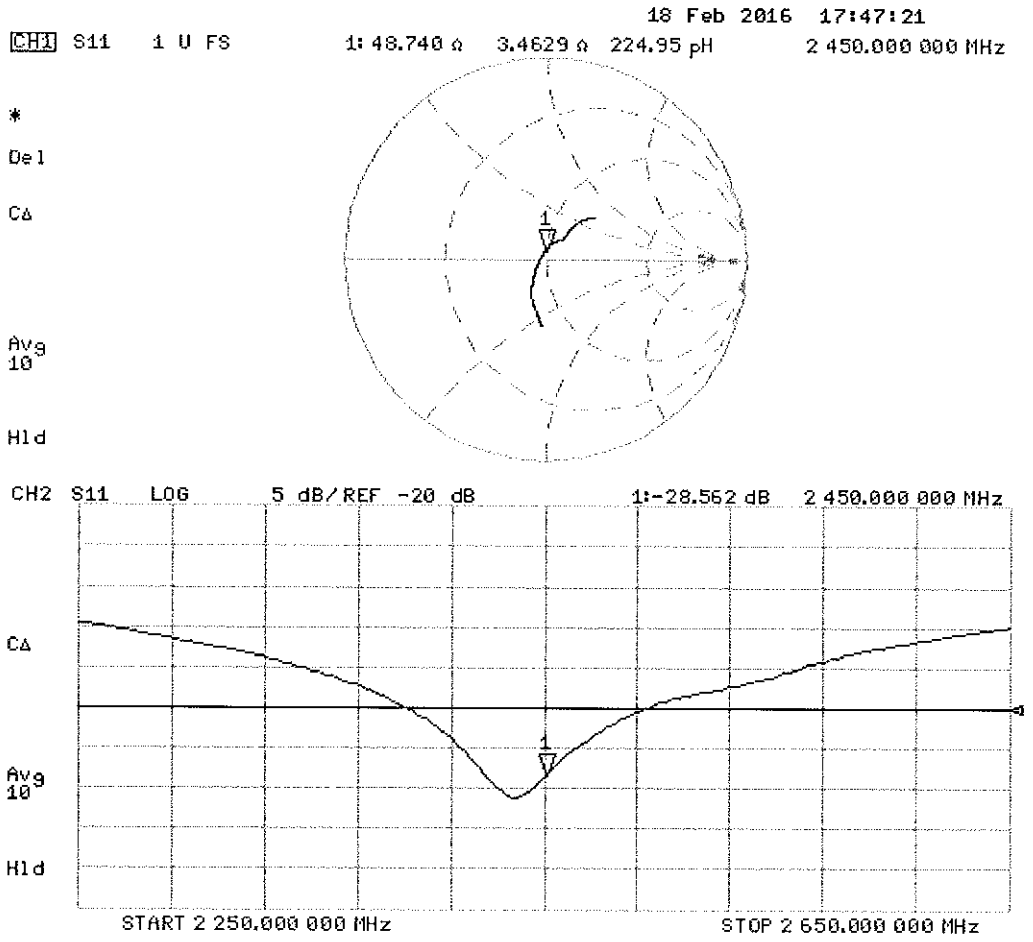
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.8 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 24.8 W/kg
SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.81 W/kg
Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

Impedance Measurement Plot for Body TSL



APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity ε_r' can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{\left[\ln(b/a)\right]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

Table D-I
Composition of the Tissue Equivalent Matter

Frequency (MHz)	750	750	835	835	1750	1750	1900	1900	2450-2600	2450-2600	5200-5800	5200-5800
Tissue	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Ingredients (% by weight)												
Bactericide	See page 2-3	See page 2	0.1	0.1					See page 4		See page 5	
DGBE					47	31	44.92	29.44		26.7		
HEC			1	1								
NaCl			1.45	0.94	0.4	0.2	0.18	0.39		0.1		
Sucrose			57	44.9								
Polysorbate (Tween) 80												20
Water			40.45	53.06	52.6	68.8	54.9	70.17		73.2		80

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

H_2O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40 – 60%
NaCl	Sodium Chloride, 0 – 6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1 – 0.7%
	Relevant for safety; Refer to the respective Safety Data Sheet*.

Figure D-1
Composition of 750 MHz Head and Body Tissue Equivalent Matter

Note: 750MHz liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

Measurement Certificate / Material Test

Item Name	**Body Tissue Simulating Liquid (MSL750V2)**
Product No.	SL AAM 075 AA (Batch: 150518-2)
Manufacturer	SPEAG

Measurement Method
TSL dielectric parameters measured using calibrated DAK probe.

Setup Validation
Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters
Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

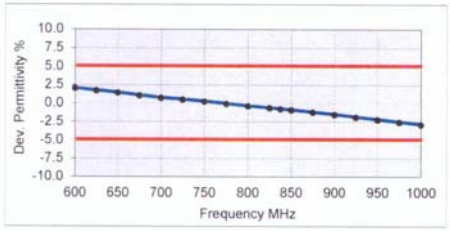
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	20-Apr-16
Operator	WM

Additional Information

TSL Density	1.212 g/cm^3
TSL Heat-capacity	3.006 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e"	sigma	eps	sigma	Δ-eps	Δ-sigma
600	57.2	24.76	0.83	56.1	0.95	2.0	-13.2
625	57.0	24.43	0.85	56.0	0.95	1.7	-11.0
650	56.7	24.11	0.87	55.9	0.96	1.4	-8.8
675	56.4	23.82	0.89	55.8	0.96	1.1	-6.6
700	56.1	23.53	0.92	55.7	0.96	0.7	-4.5
725	55.9	23.32	0.94	55.6	0.96	0.5	-2.2
750	**55.7**	**23.12**	**0.96**	**55.5**	**0.96**	**0.2**	**0.1**
775	55.4	22.93	0.99	55.4	0.97	-0.1	2.4
800	55.1	22.73	1.01	55.3	0.97	-0.4	4.6
825	54.9	22.59	1.04	55.2	0.98	-0.7	6.0
838	54.8	22.52	1.05	55.2	0.98	-0.8	6.7
850	54.6	22.45	1.06	55.2	0.99	-0.9	7.4
875	54.4	22.32	1.09	55.1	1.02	-1.2	6.6
900	54.1	22.19	1.11	55.0	1.05	-1.6	5.8
925	53.9	22.09	1.14	55.0	1.06	-1.9	6.9
950	53.7	21.98	1.16	54.9	1.08	-2.2	8.0
975	53.5	21.91	1.19	54.9	1.09	-2.6	9.3
1000	53.2	21.83	1.21	54.8	1.10	-2.9	10.6



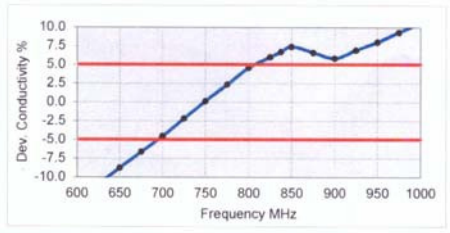


Figure D-2
750MHz Body Tissue Equivalent Matter

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HSL750V2)**
Product No.	SL AAH 075 AB (Batch: 160322-2)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

Setup Validation

Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

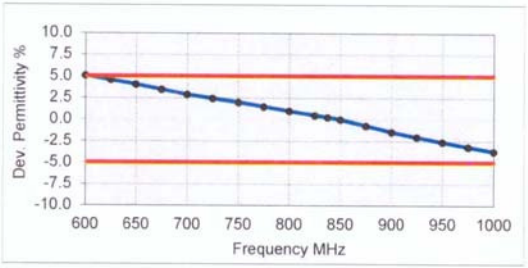
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	23-Mar-16
Operator	WM

Additional Information

TSL Density	1.284 g/cm^3
TSL Heat-capacity	2.701 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
600	44.9	22.60	0.75	42.7	0.88	5.1	-14.4
625	44.5	22.37	0.78	42.6	0.88	4.5	-12.0
650	44.2	22.13	0.80	42.5	0.89	4.0	-9.6
675	43.8	21.90	0.82	42.3	0.89	3.4	-7.4
700	43.4	21.67	0.84	42.2	0.89	2.8	-5.1
725	43.1	21.52	0.87	42.1	0.89	2.4	-2.6
750	**42.8**	**21.37**	**0.89**	**41.9**	**0.89**	**2.0**	**-0.2**
775	42.4	21.21	0.91	41.8	0.90	1.5	2.1
800	42.1	21.04	0.94	41.7	0.90	0.9	4.4
825	41.8	20.92	0.96	41.6	0.91	0.5	5.9
838	41.6	20.86	0.97	41.5	0.91	0.2	6.6
850	41.5	20.79	0.98	41.5	0.92	0.0	7.3
875	41.2	20.68	1.01	41.5	0.94	-0.7	6.7
900	40.9	20.56	1.03	41.5	0.97	-1.5	6.1
925	40.6	20.48	1.05	41.5	0.98	-2.0	7.3
950	40.3	20.39	1.08	41.4	0.99	-2.6	8.3
975	40.1	20.29	1.10	41.4	1.00	-3.2	9.5
1000	39.8	20.20	1.12	41.3	1.01	-3.7	10.7



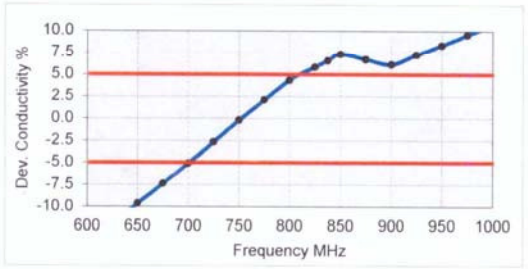


Figure D-3
750MHz Head Tissue Equivalent Matter

3 Composition / Information on ingredients

The Item is composed of the following ingredients:

Water	50 – 73 %	
Non-ionic detergents	25 – 50 %	polyoxyethylenesorbitan monolaurate
NaCl	0 – 2 %	
Preservative	0.05 – 0.1%	Preventol-D7

Safety relevant ingredients:

CAS-No. 55965-84-9	< 0.1 %	aqueous preparation, containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone
CAS-No. 9005-64-5	<50 %	polyoxyethylenesorbitan monolaurate

According to international guidelines, the product is not a dangerous mixture and therefore not required to be marked by symbols.

Figure D-4
Composition of 2.4-2.6 GHz Head Tissue Equivalent Matter

Note: 2.4-2.6 GHz head liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL1900-3800V3)**
Product No.	SL AAH 196 AB (Batch: 160330-1)
Manufacturer	SPEAG

Measurement Method
TSL dielectric parameters measured using calibrated DAK probe.

Setup Validation
Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters
Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

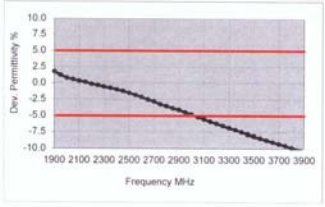
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	30-Mar-16
Operator	WM

Additional Information

TSL Density	1.054 g/cm³
TSL Heat-capacity	3.389 kJ/(kg*K)

	Measured			Target		Diff to Target [%]	
f [MHz]	ε'	ε''	sigma	eps	sigma	Δ-eps	Δ-sigma
1900	40.7	12.3	1.3	40.0	1.4	1.7	-6.9
1950	40.5	12.5	1.4	40.0	1.4	1.2	-3.3
2000	40.3	12.6	1.4	40.0	1.4	0.8	0.1
2050	40.1	12.7	1.5	39.9	1.4	0.6	0.5
2100	39.9	12.9	1.5	39.8	1.5	0.3	0.9
2150	39.8	13.0	1.6	39.7	1.5	0.1	1.2
2200	39.6	13.1	1.6	39.6	1.6	-0.2	1.7
2250	39.4	13.2	1.7	39.6	1.6	-0.3	2.0
2300	39.2	13.3	1.7	39.5	1.7	-0.6	2.4
2350	39.1	13.5	1.8	39.4	1.7	-0.8	2.9
2400	38.9	13.6	1.8	39.3	1.8	-1.0	3.4
2450	38.7	13.7	1.9	39.2	1.8	-1.2	4.0
2500	38.5	13.8	1.9	39.1	1.9	-1.5	3.9
2550	38.3	13.9	2.0	39.1	1.9	-1.9	3.5
2600	38.2	14.1	2.0	39.0	2.0	-2.2	3.9
2650	37.9	14.2	2.1	38.9	2.0	-2.6	3.8
2700	37.8	14.3	2.2	38.9	2.1	-2.8	3.9
2750	37.5	14.4	2.2	38.8	2.1	-3.3	3.6
2800	37.4	14.5	2.3	38.8	2.2	-3.6	3.6
2850	37.2	14.6	2.3	38.7	2.2	-3.9	3.7
2900	37.0	14.7	2.4	38.6	2.3	-4.1	3.8
2950	36.8	14.8	2.4	38.6	2.3	-4.5	3.7
3000	36.6	14.9	2.5	38.5	2.4	-4.8	3.6
3050	36.4	15.0	2.5	38.4	2.5	-5.2	3.8
3100	36.2	15.1	2.6	38.4	2.5	-5.6	3.8
3150	36.1	15.2	2.7	38.3	2.6	-5.9	4.0
3200	35.9	15.2	2.7	38.3	2.6	-6.2	3.9
3250	35.7	15.3	2.8	38.2	2.7	-6.6	4.1
3300	35.5	15.3	2.8	38.2	2.7	-6.9	4.0
3350	35.4	15.4	2.9	38.1	2.8	-7.2	4.2
3400	35.2	15.5	2.9	38.0	2.8	-7.5	4.1
3450	35.0	15.5	3.0	38.0	2.9	-7.8	4.2
3500	34.9	15.6	3.0	37.9	2.9	-8.1	4.2
3550	34.7	15.6	3.1	37.9	3.0	-8.4	4.2
3600	34.5	15.7	3.1	37.8	3.0	-8.7	4.4
3650	34.4	15.8	3.2	37.8	3.1	-9.0	4.3
3700	34.2	15.8	3.3	37.7	3.1	-9.3	4.5
3750	34.1	15.9	3.3	37.6	3.2	-9.5	4.4
3800	33.9	15.9	3.4	37.6	3.2	-9.9	4.7
3850	33.7	16.0	3.4	37.5	3.3	-10.1	4.7



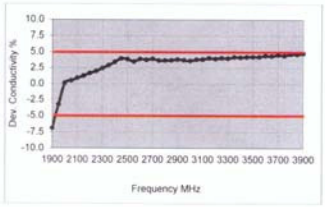


Figure D-5
2.4-2.6 GHz Head Tissue Equivalent Matter

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

Water	50 – 65%
Mineral oil	10 – 30%
Emulsifiers	8 – 25%
Sodium salt	0 – 1.5%

Figure D-6
Composition of 5 GHz Head Tissue Equivalent Matter

Note: 5GHz head liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL3500-5800V5)**
Product No.	SL AAH 502 AG (Batch: 160331-2)
Manufacturer	SPEAG

Measurement Method
TSL dielectric parameters measured using calibrated DAK probe.

Setup Validation
Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters
Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

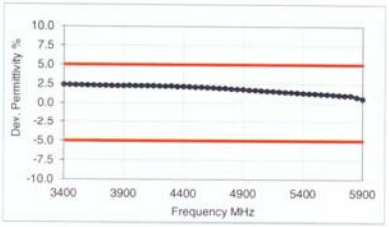
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	4-Apr-16
Operator	WM

Additional Information

TSL Density	0.985 g/cm^3
TSL Heat-capacity	3.383 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
3400	39.0	15.12	2.86	38.0	2.81	2.5	1.8
3500	**38.8**	**15.09**	**2.94**	**37.9**	**2.91**	**2.3**	**0.9**
3600	38.7	15.08	3.02	37.8	3.02	2.3	0.2
3700	**38.6**	**15.08**	**3.10**	**37.7**	**3.12**	**2.4**	**-0.6**
3800	38.4	15.07	3.19	37.6	3.22	2.2	-0.9
3900	38.3	15.09	3.27	37.5	3.32	2.2	-1.6
4000	38.2	15.10	3.36	37.4	3.43	2.3	-1.9
4100	38.1	15.13	3.45	37.2	3.53	2.3	-2.2
4200	38.0	15.18	3.55	37.1	3.63	2.3	-2.2
4300	37.8	15.22	3.64	37.0	3.73	2.1	-2.5
4400	37.7	15.29	3.74	36.9	3.84	2.2	-2.5
4500	37.6	15.34	3.84	36.8	3.94	2.2	-2.5
4600	37.4	15.41	3.94	36.7	4.04	2.0	-2.5
4700	37.3	15.47	4.05	36.6	4.14	2.0	-2.2
4800	37.1	15.53	4.15	36.4	4.25	1.8	-2.2
4850	37.1	15.57	4.20	36.4	4.30	2.0	-2.2
4900	37.0	15.60	4.25	36.3	4.35	1.8	-2.2
4950	36.9	15.62	4.30	36.3	4.40	1.7	-2.2
5000	36.8	15.66	4.35	36.2	4.45	1.6	-2.2
5050	36.8	15.68	4.40	36.2	4.50	1.8	-2.2
5100	36.7	15.73	4.46	36.1	4.55	1.7	-2.0
5150	36.6	15.75	4.51	36.0	4.60	1.5	-2.0
5200	**36.5**	**15.78**	**4.57**	**36.0**	**4.66**	**1.4**	**-1.8**
5250	36.4	15.80	4.62	35.9	4.71	1.3	-1.8
5300	36.4	15.84	4.67	35.9	4.76	1.5	-1.8
5350	36.3	15.85	4.72	35.8	4.81	1.4	-1.8
5400	36.2	15.88	4.77	35.8	4.86	1.2	-1.9
5450	36.2	15.90	4.82	35.7	4.91	1.4	-1.9
5500	**36.1**	**15.91**	**4.87**	**35.6**	**4.96**	**1.3**	**-1.9**
5550	36.0	15.95	4.93	35.6	5.01	1.2	-1.7
5600	35.9	15.99	4.98	35.5	5.07	1.0	-1.7
5650	35.9	16.02	5.04	35.5	5.12	1.2	-1.5
5700	35.8	16.05	5.09	35.4	5.17	1.1	-1.5
5750	35.7	16.09	5.15	35.4	5.22	1.0	-1.3
5800	**35.7**	**16.10**	**5.20**	**35.3**	**5.27**	**1.1**	**-1.3**
5850	35.6	16.14	5.25	35.3	5.34	0.8	-1.6
5900	35.5	16.15	5.30	35.3	5.40	0.6	-1.9



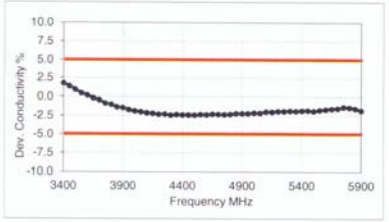


Figure D-7
5GHz Head Tissue Equivalent Matter

APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB Publication 865664 D02v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table E-I
SAR System Validation Summary- 1g

SAR SYSTEM #	FREQ. [MHz]	DATE	PROBE SN	PROBE TYPE	PROBE CAL. POINT		COND.	PERM.	CW VALIDATION			MOD. VALIDATION		
							(σ)	(εr)	SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
K	750	2/16/2016	3022	ES3DV2	750	Head	0.905	42.793	PASS	PASS	PASS	N/A	N/A	N/A
I	835	11/3/2015	3333	ES3DV3	835	Head	0.930	41.384	PASS	PASS	PASS	GMSK	PASS	N/A
E	1750	4/25/2016	7406	EX3DV4	1750	Head	1.390	40.075	PASS	PASS	PASS	N/A	N/A	N/A
I	1900	11/4/2015	3333	ES3DV3	1900	Head	1.440	39.391	PASS	PASS	PASS	GMSK	PASS	N/A
K	2450	2/12/2016	3022	ES3DV2	2450	Head	1.813	38.236	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
K	2600	2/15/2016	3022	ES3DV2	2600	Head	1.934	37.344	PASS	PASS	PASS	TDD	PASS	N/A
J	5250	4/25/2106	7357	EX3DV4	5250	Head	4.508	34.565	PASS	PASS	PASS	OFDM	N/A	PASS
J	5600	4/25/2016	7357	EX3DV4	5600	Head	4.852	34.028	PASS	PASS	PASS	OFDM	N/A	PASS
J	5750	4/25/2016	7357	EX3DV4	5750	Head	5.021	33.850	PASS	PASS	PASS	OFDM	N/A	PASS
I	750	3/7/2017	3213	ES3DV3	750	Body	0.955	56.554	PASS	PASS	PASS	N/A	N/A	N/A
E	835	4/27/2016	7406	EX3DV4	835	Body	0.992	52.834	PASS	PASS	PASS	GMSK	PASS	N/A
E	1750	4/25/2016	7406	EX3DV4	1750	Body	1.490	53.432	PASS	PASS	PASS	N/A	N/A	N/A
G	1900	9/29/2016	3287	ES3DV3	1900	Body	1.547	51.110	PASS	PASS	PASS	GMSK	PASS	N/A
G	2450	12/4/2015	3334	ES3DV3	2450	Body	1.997	51.699	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
E	2450	4/27/2016	7406	ES3DV3	2450	Body	2.016	51.629	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
G	2600	12/4/2015	3334	ES3DV3	2600	Body	2.198	51.174	PASS	PASS	PASS	TDD	PASS	N/A
D	5250	2/2/2017	3589	EX3DV4	5250	Body	5.422	47.823	PASS	PASS	PASS	OFDM	N/A	PASS
D	5600	2/2/2017	3589	EX3DV4	5600	Body	5.882	47.193	PASS	PASS	PASS	OFDM	N/A	PASS
D	5750	2/2/2017	3589	EX3DV4	5750	Body	6.117	46.985	PASS	PASS	PASS	OFDM	N/A	PASS

Table E-II
SAR System Validation Summary- 10g

SAR SYSTEM #	FREQ. [MHz]	DATE	PROBE SN	PROBE TYPE	PROBE CAL. POINT		COND.	PERM.	CW VALIDATION			MOD. VALIDATION		
							(σ)	(εr)	SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
D	5250	3/1/2016	3914	EX3DV4	5250	Body	5.438	47.912	PASS	PASS	PASS	OFDM	N/A	PASS
D	5600	3/1/2016	3914	EX3DV4	5600	Body	5.895	47.321	PASS	PASS	PASS	OFDM	N/A	PASS

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r04 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to FCC KDB Publication 865664 D01v01r04.