Appendix A

Probe Certificate

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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 **Motorola Solutions MY** Certificate No: **EX3-7519_Oct18**

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:7519

Calibration procedure(s) QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: October 19, 2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: October 23, 2018

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, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:7519

Manufactured: February 26, 2018
Calibrated: October 19, 2018

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7519

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.57	0.40	0.47	± 10.1 %
DCP (mV)[B]	99.8	100.3	99.6	

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	150.2	±2.7 %
		Y	0.0	0.0	1.0		159.5	
		Z	0.0	0.0	1.0		137.7	

Note: For details on UID parameters see Appendix.

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:7519

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	13.03	13.03	13.03	0.00	1.00	± 13.3 %
300	45.3	0.87	11.73	11.73	11.73	0.08	1.30	± 13.3 %
450	43.5	0.87	10.99	10.99	10.99	0.13	1.30	± 13.3 %
750	41.9	0.89	9.97	9.97	9.97	0.47	0.84	± 12.0 %
835	41.5	0.90	9.85	9.85	9.85	0.45	0.80	± 12.0 %
900	41.5	0.97	9.71	9.71	9.71	0.26	1.13	± 12.0 %
1450	40.5	1.20	8.68	8.68	8.68	0.39	0.80	± 12.0 %
1810	40.0	1.40	8.34	8.34	8.34	0.36	0.88	± 12.0 %
1900	40.0	1.40	8.24	8.24	8.24	0.36	0.88	± 12.0 %
2100	39.8	1.49	8.17	8.17	8.17	0.28	0.90	± 12.0 %
2300	39.5	1.67	7.81	7.81	7.81	0.28	0.90	± 12.0 %
2450	39.2	1.80	7.46	7.46	7.46	0.33	0.90	± 12.0 %
2600	39.0	1.96	7.33	7.33	7.33	0.36	0.90	± 12.0 %
3500	37.9	2.91	7.18	7.18	7.18	0.28	1.20	± 13.1 %
3700	37.7	3.12	6.89	6.89	6.89	0.30	1.25	± 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:7519

Calibration Parameter Determined in Body Tissue Simulating Media

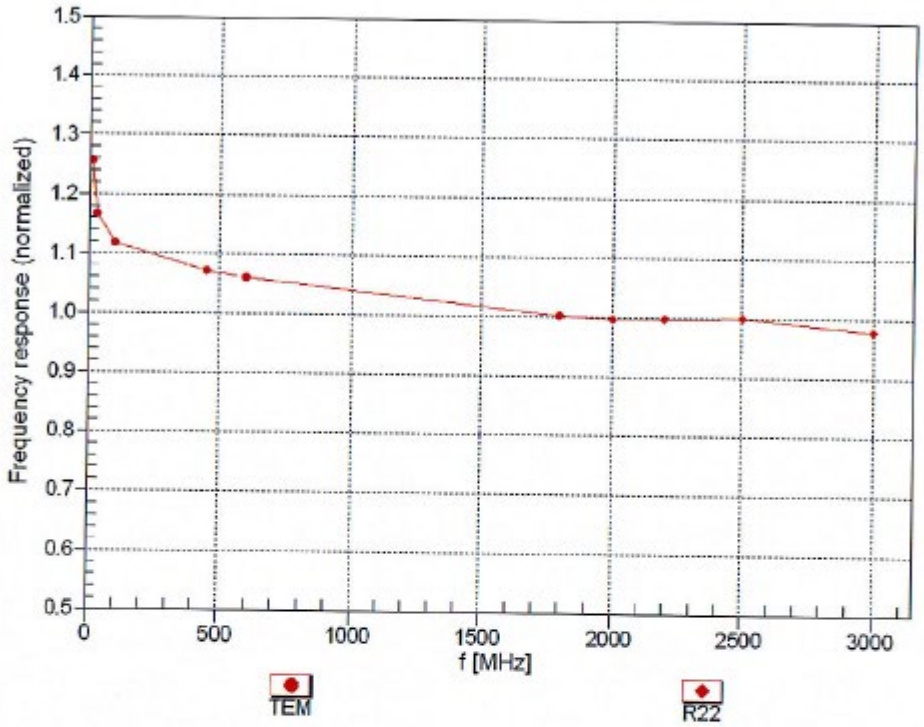
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	61.9	0.80	12.42	12.42	12.42	0.00	1.00	± 13.3 %
300	58.2	0.92	11.52	11.52	11.52	0.05	1.20	± 13.3 %
450	56.7	0.94	11.27	11.27	11.27	0.08	1.20	± 13.3 %
750	55.5	0.96	10.23	10.23	10.23	0.43	0.85	± 12.0 %
835	55.2	0.97	9.90	9.90	9.90	0.46	0.80	± 12.0 %
900	55.0	1.05	9.78	9.78	9.78	0.48	0.80	± 12.0 %
1450	54.0	1.30	8.45	8.45	8.45	0.28	0.80	± 12.0 %
1810	53.3	1.52	8.03	8.03	8.03	0.36	0.85	± 12.0 %
1900	53.3	1.52	7.78	7.78	7.78	0.31	0.96	± 12.0 %
2100	53.2	1.62	7.93	7.93	7.93	0.38	0.90	± 12.0 %
2300	52.9	1.81	7.85	7.85	7.85	0.37	0.90	± 12.0 %
2450	52.7	1.95	7.55	7.55	7.55	0.31	0.90	± 12.0 %
2600	52.5	2.16	7.49	7.49	7.49	0.21	1.20	± 12.0 %
3500	51.3	3.31	7.08	7.08	7.08	0.30	1.20	± 13.1 %
3700	51.0	3.55	6.70	6.70	6.70	0.28	1.25	± 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.

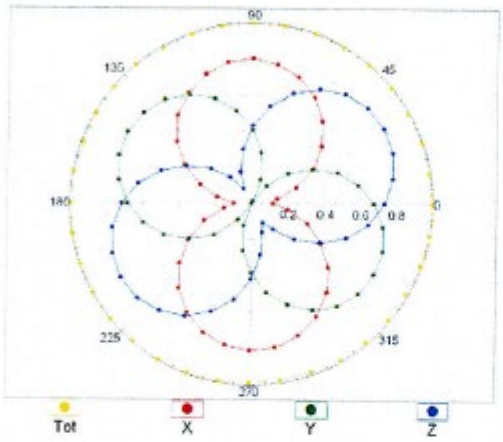
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



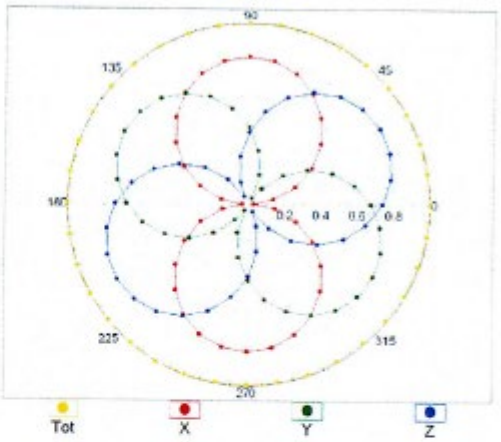
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

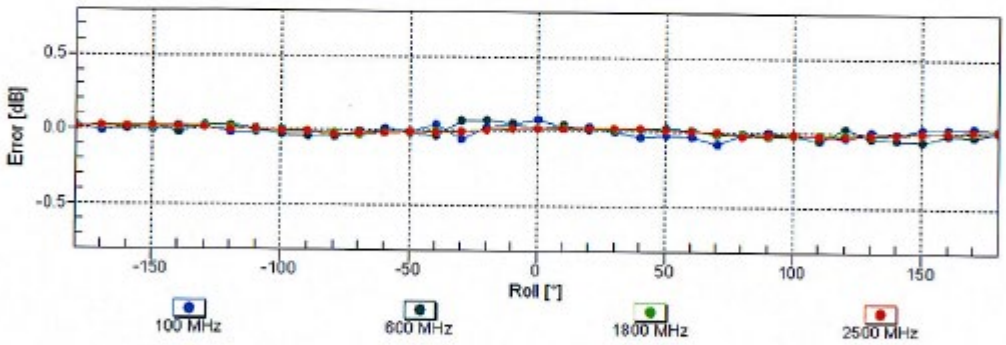
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



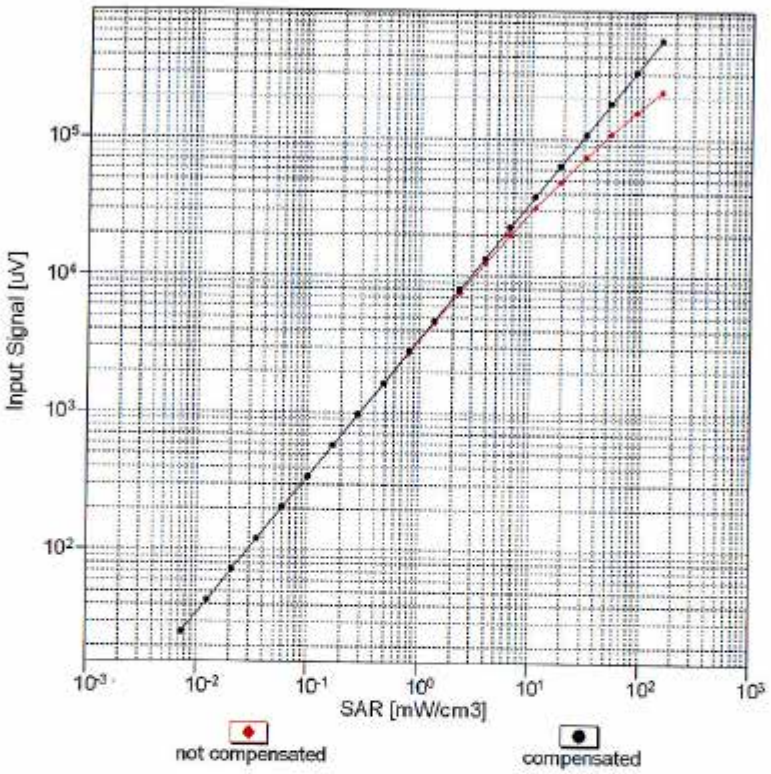
f=1800 MHz,R22

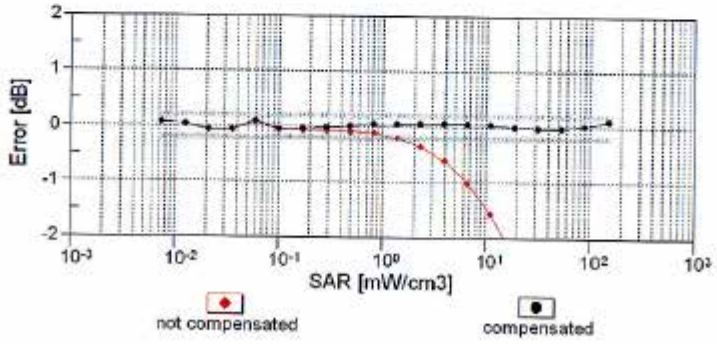




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

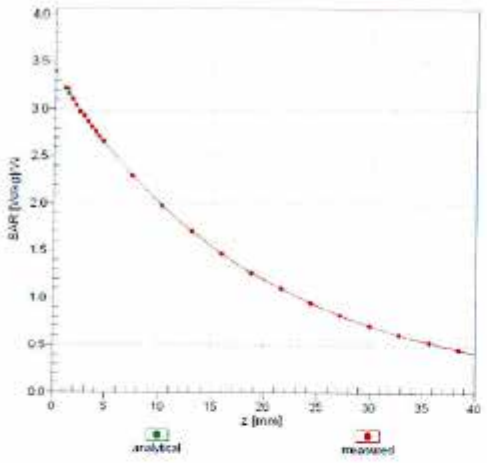




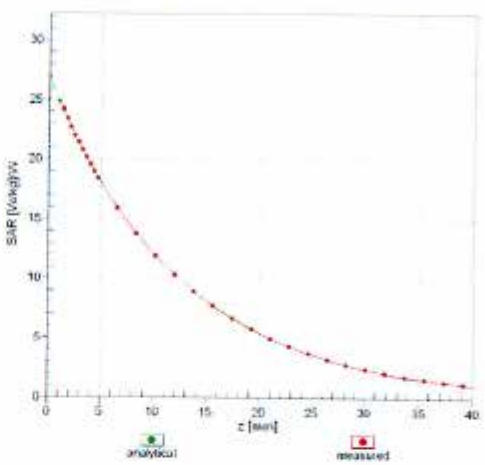
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

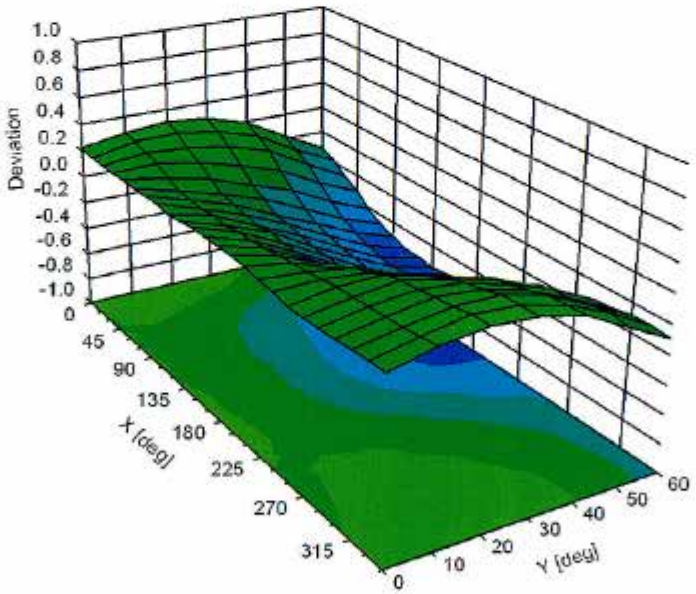


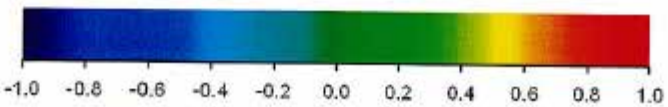
f = 1810 MHz,WGLS R22 (H_convF)



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:7519

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-9.8
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

Appendix: 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	150.2	±2.7 %
		Y	0.0	0.0	1.0		159.5	
		Z	0.0	0.0	1.0		137.7	
10011-CAB	UMTS-FDD (WCDMA)	X	3.40	67.9	19.2	2.91	138.3	±0.5 %
		Y	3.01	65.6	17.8		145.6	
		Z	3.52	68.3	19.2		149.3	
10097-CAB	UMTS-FDD (HSDPA)	X	4.67	67.4	19.1	3.98	147.9	±0.9 %
		Y	4.18	65.3	17.8		130.4	
		Z	4.60	66.9	18.7		134.3	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.65	67.3	19.0	3.98	147.8	±0.7 %
		Y	4.18	65.3	17.8		130.7	
		Z	4.58	66.8	18.7		134.5	
10100-CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.27	67.1	19.7	5.67	131.2	±1.4 %
		Y	5.84	65.5	18.7		135.8	
		Z	6.36	67.3	19.7		141.5	
10101-CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.44	67.9	20.5	6.42	140.5	±1.7 %
		Y	6.90	66.1	19.2		144.5	
		Z	7.19	66.9	19.8		126.7	
10108-CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.20	67.1	19.9	5.80	128.9	±1.4 %
		Y	5.76	65.3	18.7		132.6	
		Z	6.25	67.1	19.8		138.5	
10109-CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.17	67.6	20.4	6.43	136.1	±1.7 %
		Y	6.68	65.9	19.2		139.7	
		Z	7.17	67.5	20.2		146.3	
10110-CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.12	67.7	20.4	5.75	148.4	±1.4 %
		Y	5.50	65.1	18.6		129.2	
		Z	5.92	66.7	19.6		134.2	
10111-CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	6.92	67.7	20.5	6.44	130.7	±1.4 %
		Y	6.45	66.0	19.2		135.3	
		Z	6.90	67.4	20.2		140.4	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.17	69.1	21.7	8.07	143.7	±2.2 %
		Y	9.56	67.6	20.6		144.5	
		Z	9.83	68.1	21.0		128.1	
10140-CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.62	68.1	20.6	6.49	142.4	±1.7 %
		Y	7.09	66.4	19.4		145.7	
		Z	7.33	67.0	19.8		127.7	
10142-CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.90	67.5	20.3	5.73	144.6	±1.4 %
		Y	5.46	65.6	18.9		149.4	
		Z	5.72	66.5	19.5		131.4	
10143-CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	6.62	67.6	20.5	6.35	126.6	±1.4 %
		Y	6.15	65.9	19.1		130.3	
		Z	6.65	67.5	20.2		136.4	

10145-CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.74	68.0	20.6	5.76	139.3	±1.2 %
		Y	5.23	65.7	18.9		143.1	
		Z	5.70	67.6	20.1		149.8	
10146-CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.60	69.0	21.2	6.41	142.9	±1.4 %
		Y	6.06	66.9	19.7		147.0	
		Z	6.38	67.9	20.5		129.6	
10149-CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.12	67.5	20.4	6.42	135.2	±1.7 %
		Y	6.67	66.0	19.2		139.5	
		Z	7.19	67.6	20.2		145.7	
10154-CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.09	67.6	20.3	5.75	147.4	±1.2 %
		Y	5.49	65.1	18.6		128.9	
		Z	5.91	66.6	19.6		134.3	
10155-CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	6.89	67.6	20.5	6.43	130.6	±1.4 %
		Y	6.46	66.0	19.2		135.1	
		Z	6.93	67.6	20.3		140.6	
10156-CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.88	67.6	20.4	5.79	143.0	±1.4 %
		Y	5.43	65.7	19.0		147.5	
		Z	5.72	66.7	19.7		130.1	
10157-CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	6.88	68.7	21.1	6.49	148.3	±1.4 %
		Y	6.19	66.1	19.4		128.4	
		Z	6.68	67.7	20.4		134.2	
10160-CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.38	67.5	20.2	5.82	130.4	±1.4 %
		Y	5.86	65.4	18.7		133.9	
		Z	6.36	67.2	19.8		139.6	
10161-CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.20	67.8	20.5	6.43	135.5	±1.7 %
		Y	6.75	66.3	19.4		140.1	
		Z	7.22	67.7	20.3		146.5	
10166-CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.21	68.1	20.6	5.46	133.8	±0.9 %
		Y	4.68	65.5	18.8		137.5	
		Z	5.15	67.5	20.0		143.5	
10167-CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	6.05	69.1	21.3	6.21	134.8	±1.2 %
		Y	5.48	66.7	19.6		138.6	
		Z	6.02	68.7	20.9		144.5	
10169-CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.05	68.1	20.9	5.73	127.4	±0.9 %
		Y	4.56	65.6	19.0		132.6	
		Z	5.00	67.6	20.3		137.1	
10170-CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	5.93	69.8	22.1	6.52	148.5	±1.4 %
		Y	5.13	66.2	19.7		130.2	
		Z	5.67	68.4	21.1		134.8	
10175-CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.27	69.2	21.5	5.72	149.6	±1.2 %
		Y	4.51	65.3	18.9		132.4	
		Z	5.01	67.6	20.4		136.6	
10176-CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.95	69.9	22.1	6.52	148.2	±1.4 %
		Y	5.13	66.2	19.7		130.4	
		Z	5.68	68.5	21.1		134.6	

10177-CAI	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	5.23	68.9	21.3	5.73	149.5	±0.9 %
		Y	4.53	65.4	19.0		132.6	
		Z	5.03	67.7	20.4		136.6	
10178-CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.94	69.8	22.1	6.52	148.1	±1.4 %
		Y	5.11	66.1	19.6		129.7	
		Z	5.65	68.3	21.1		134.7	
10181-CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.25	69.0	21.4	5.72	149.5	±1.2 %
		Y	4.56	65.6	19.1		132.1	
		Z	5.01	67.6	20.4		137.0	
10182-CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.92	69.7	22.0	6.52	148.1	±1.4 %
		Y	5.11	66.1	19.6		129.8	
		Z	5.67	68.4	21.1		134.6	
10184-CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	5.05	68.1	20.9	5.73	127.4	±0.9 %
		Y	4.57	65.6	19.1		132.9	
		Z	5.03	67.7	20.4		136.9	
10185-CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.94	69.9	22.1	6.51	148.3	±1.4 %
		Y	5.08	65.9	19.4		130.3	
		Z	5.69	68.5	21.2		134.7	
10187-CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	5.22	68.9	21.3	5.73	149.7	±1.2 %
		Y	4.52	65.3	18.9		132.2	
		Z	5.03	67.7	20.4		136.7	
10188-CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	6.00	70.1	22.3	6.52	148.3	±1.7 %
		Y	5.10	66.0	19.6		129.7	
		Z	5.68	68.5	21.1		134.7	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.74	68.9	21.7	8.10	135.1	±2.5 %
		Y	9.19	67.4	20.6		138.0	
		Z	9.81	69.0	21.6		146.4	
10225-CAB	UMTS-FDD (HSPA+)	X	7.00	68.0	20.4	5.97	136.0	±1.2 %
		Y	6.54	66.4	19.1		141.6	
		Z	6.98	67.7	20.0		146.1	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.94	67.5	19.5	4.87	133.4	±0.9 %
		Y	5.47	66.0	18.4		137.2	
		Z	5.93	67.4	19.3		143.2	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.69	68.4	20.0	3.96	143.4	±0.7 %
		Y	4.09	65.6	18.1		148.3	
		Z	4.47	67.2	19.1		129.0	
10297-AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.51	68.6	21.1	5.81	127.5	±0.9 %
		Y	5.79	65.4	18.8		132.3	
		Z	6.37	67.7	20.3		136.6	
10298-AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.90	68.6	21.0	5.72	141.0	±1.2 %
		Y	5.30	65.8	19.0		145.4	
		Z	5.63	67.1	19.9		128.6	
10299-AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.73	69.1	21.3	6.39	144.8	±1.2 %
		Y	6.17	66.9	19.7		148.5	
		Z	6.53	68.1	20.6		131.4	

10311-AAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.81	67.8	20.4	6.06	133.0	±1.4 %
		Y	6.26	65.8	19.0		136.3	
		Z	6.83	67.7	20.2		143.4	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	4.91	81.0	24.8	1.54	142.0	±1.2 %
		Y	2.53	67.7	18.5		149.7	
		Z	4.06	76.1	22.3		129.5	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.85	69.0	21.9	8.23	135.9	±2.7 %
		Y	9.30	67.5	20.7		137.8	
		Z	9.89	69.0	21.7		146.0	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.70	68.8	21.7	8.14	134.7	±2.5 %
		Y	9.18	67.5	20.7		137.4	
		Z	9.75	68.9	21.6		145.1	
10435-AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.93	70.8	23.7	7.82	149.2	±1.9 %
		Y	5.15	67.1	21.2		147.2	
		Z	5.71	69.5	22.7		136.1	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	8.19	67.3	20.2	6.62	131.4	±1.9 %
		Y	7.82	66.3	19.3		136.3	
		Z	8.24	67.4	20.1		142.0	
10460-AAA	UMTS-FDD (WCDMA, AMR)	X	3.97	75.2	22.9	2.39	136.1	±0.9 %
		Y	2.77	67.5	18.7		143.1	
		Z	3.67	73.0	21.5		145.5	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.96	71.0	23.8	7.82	148.9	±2.2 %
		Y	5.13	66.9	21.1		147.1	
		Z	5.70	69.4	22.6		136.2	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.43	71.8	24.3	8.30	146.4	±2.2 %
		Y	5.49	67.6	21.5		143.7	
		Z	6.13	70.2	23.2		133.4	
10464-AAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.90	70.6	23.5	7.82	148.7	±1.9 %
		Y	5.14	67.0	21.1		147.5	
		Z	5.67	69.3	22.6		135.6	
10465-AAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.41	71.6	24.2	8.32	146.4	±2.2 %
		Y	5.56	67.9	21.7		144.2	
		Z	6.14	70.1	23.2		133.2	
10467-AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.91	70.6	23.5	7.82	148.3	±2.2 %
		Y	5.14	67.0	21.0		148.1	
		Z	5.68	69.3	22.6		135.8	
10468-AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.45	71.8	24.3	8.32	146.6	±1.9 %
		Y	5.54	67.8	21.6		144.0	
		Z	6.14	70.1	23.2		133.2	
10470-AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.94	70.8	23.7	7.82	148.2	±2.2 %
		Y	5.15	67.1	21.1		148.0	
		Z	5.67	69.2	22.5		135.7	

10471-AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.43	71.7	24.3	8.32	146.8	±1.9 %
		Y	5.55	67.8	21.7		144.0	
		Z	6.13	70.1	23.1		133.4	
10473-AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.95	70.9	23.7	7.82	148.6	±2.2 %
		Y	5.12	66.9	21.0		147.4	
		Z	5.67	69.2	22.5		135.4	
10474-AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.41	71.6	24.3	8.32	146.3	±1.9 %
		Y	5.51	67.5	21.5		144.1	
		Z	6.12	70.0	23.1		133.3	
10477-AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.46	71.8	24.4	8.32	146.3	±2.2 %
		Y	5.55	67.8	21.6		144.6	
		Z	6.15	70.2	23.3		133.2	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	5.98	69.3	22.7	7.74	132.7	±1.4 %
		Y	5.25	65.9	20.3		134.1	
		Z	5.91	68.8	22.1		141.4	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	6.60	70.3	23.2	8.18	134.7	±1.7 %
		Y	5.78	66.9	20.9		134.1	
		Z	6.56	69.9	22.8		143.3	
10482-AAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.33	69.0	22.5	7.71	140.1	±1.7 %
		Y	5.56	65.7	20.1		140.5	
		Z	6.28	68.5	21.9		149.4	
10483-AAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.30	70.1	23.2	8.39	144.8	±1.7 %
		Y	6.48	67.0	21.0		143.2	
		Z	7.09	69.0	22.3		132.3	
10485-AAE	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.34	69.0	22.4	7.59	142.4	±1.7 %
		Y	5.57	65.6	20.0		142.8	
		Z	6.10	67.6	21.4		129.8	
10486-AAE	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.45	70.0	23.1	8.38	149.3	±1.9 %
		Y	6.63	66.8	20.9		147.0	
		Z	7.22	68.8	22.2		136.1	
10488-AAE	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.69	68.8	22.3	7.70	148.3	±1.9 %
		Y	5.91	65.7	20.1		147.5	
		Z	6.49	67.7	21.5		135.1	
10489-AAE	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.48	68.7	22.4	8.31	133.7	±1.9 %
		Y	6.71	65.9	20.3		134.0	
		Z	7.48	68.6	22.1		143.1	
10491-AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.91	68.4	22.0	7.74	131.7	±1.7 %
		Y	6.11	65.4	19.9		131.9	
		Z	6.91	68.2	21.7		140.9	
10492-AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.94	69.0	22.5	8.41	140.0	±2.2 %
		Y	7.14	66.3	20.6		139.4	
		Z	7.96	68.9	22.3		149.8	
10494-AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.92	68.6	22.1	7.74	132.0	±1.7 %
		Y	6.10	65.5	20.0		132.3	
		Z	6.88	68.2	21.6		140.3	

10495-AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.88	68.9	22.4	8.37	139.9	±2.2 %
		Y	7.06	66.1	20.5		139.1	
		Z	7.88	68.7	22.1		149.6	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.25	69.2	22.5	7.67	139.2	±1.7 %
		Y	5.53	66.1	20.3		139.6	
		Z	6.20	68.6	21.9		148.7	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.26	70.5	23.4	8.40	142.7	±1.9 %
		Y	6.38	67.1	21.0		140.8	
		Z	6.99	69.1	22.4		129.9	
10500-AAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.50	68.9	22.4	7.67	144.6	±1.7 %
		Y	5.71	65.5	20.0		144.4	
		Z	6.29	67.8	21.5		131.8	
10501-AAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.39	69.0	22.6	8.44	128.7	±2.2 %
		Y	6.76	66.7	20.9		149.6	
		Z	7.38	68.7	22.2		138.1	
10503-AAE	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.74	69.0	22.4	7.72	148.5	±1.9 %
		Y	5.93	65.7	20.2		147.8	
		Z	6.51	67.8	21.5		134.8	
10504-AAE	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.44	68.6	22.3	8.31	133.0	±1.9 %
		Y	6.71	65.9	20.3		133.9	
		Z	7.47	68.5	22.0		143.0	
10506-AAE	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	6.89	68.4	22.0	7.74	131.3	±1.7 %
		Y	6.07	65.4	19.9		131.8	
		Z	6.88	68.2	21.6		140.4	
10507-AAE	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.86	68.9	22.4	8.36	139.6	±2.2 %
		Y	7.02	66.0	20.4		138.9	
		Z	7.88	68.7	22.1		149.5	
10509-AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.54	69.0	22.3	7.99	137.8	±1.9 %
		Y	6.60	65.7	20.1		137.0	
		Z	7.52	68.8	22.0		147.2	
10510-AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.41	69.3	22.6	8.49	146.6	±2.5 %
		Y	7.47	66.3	20.6		143.6	
		Z	8.18	68.3	21.9		133.2	
10512-AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.29	69.2	22.3	7.74	136.5	±1.7 %
		Y	6.31	65.6	19.9		135.1	
		Z	7.25	68.8	21.8		145.4	
10513-AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.26	69.1	22.5	8.42	145.0	±2.2 %
		Y	7.33	66.1	20.4		142.5	
		Z	8.07	68.3	21.9		132.2	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	4.23	78.0	23.6	1.58	141.7	±0.9 %
		Y	2.50	67.6	18.4		147.5	
		Z	4.36	77.7	23.0		129.8	

10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.83	68.9	21.8	8.25	134.9	±2.7 %
		Y	9.33	67.7	20.8		138.1	
		Z	9.94	69.1	21.8		146.6	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	4.68	79.4	24.3	1.99	138.8	±0.9 %
		Y	2.52	67.1	18.3		144.4	
		Z	3.77	74.3	21.8		149.2	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	5.40	82.6	25.6	1.99	138.3	±1.2 %
		Y	2.66	68.3	19.0		143.1	
		Z	3.89	75.2	22.2		148.7	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	9.93	68.9	22.1	8.59	132.5	±3.0 %
		Y	9.41	67.6	21.0		134.5	
		Z	10.02	69.1	22.0		143.6	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	9.92	68.9	22.1	8.60	132.3	±3.0 %
		Y	9.37	67.5	20.9		134.5	
		Z	10.02	69.1	22.0		143.2	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	10.05	69.0	22.1	8.63	134.2	±3.0 %
		Y	9.50	67.6	21.0		136.2	
		Z	10.13	69.1	22.0		144.9	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	10.20	69.1	22.2	8.79	134.2	±3.0 %
		Y	9.65	67.7	21.1		136.0	
		Z	10.30	69.3	22.2		145.4	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.67	69.5	22.3	8.79	142.0	±2.5 %
		Y	10.02	67.9	21.2		143.2	
		Z	10.36	68.6	21.7		126.9	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.78	69.7	22.5	8.88	142.2	±2.7 %
		Y	10.09	68.0	21.3		143.2	
		Z	10.44	68.6	21.8		127.4	

[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
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 **Motorola Solutions MY**

Certificate No: **ES3-3122_Apr18**

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3122

Calibration procedure(s) QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: April 18, 2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-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-17)	In house check: Oct-18

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

Issued: April 19, 2018

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
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe ES3DV3

SN:3122

Manufactured: July 11, 2006
Calibrated: April 18, 2018

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3122

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.30	1.19	1.39	± 10.1 %
DCP (mV)[B]	101.7	102.8	102.3	

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	212.2	±3.5 %
		Y	0.0	0.0	1.0		209.0	
		Z	0.0	0.0	1.0		170.3	

Note: For details on UID parameters see Appendix.

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:3122

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	7.20	7.20	7.20	0.08	1.20	± 13.3 %
300	45.3	0.87	7.01	7.01	7.01	0.13	1.20	± 13.3 %
450	43.5	0.87	6.80	6.80	6.80	0.23	1.30	± 13.3 %
750	41.9	0.89	6.61	6.61	6.61	0.80	1.17	± 12.0 %
835	41.5	0.90	6.31	6.31	6.31	0.61	1.31	± 12.0 %
900	41.5	0.97	6.18	6.18	6.18	0.66	1.28	± 12.0 %
1450	40.5	1.20	5.64	5.64	5.64	0.80	1.12	± 12.0 %
1810	40.0	1.40	5.24	5.24	5.24	0.39	1.66	± 12.0 %
1900	40.0	1.40	5.21	5.21	5.21	0.44	1.51	± 12.0 %
2100	39.8	1.49	5.28	5.28	5.28	0.80	1.20	± 12.0 %
2300	39.5	1.67	4.86	4.86	4.86	0.80	1.21	± 12.0 %
2450	39.2	1.80	4.64	4.64	4.64	0.69	1.32	± 12.0 %
2600	39.0	1.96	4.46	4.46	4.46	0.80	1.33	± 12.0 %
3500	37.9	2.91	4.38	4.38	4.38	0.80	1.25	± 13.1 %
3700	37.7	3.12	4.08	4.08	4.08	0.70	1.25	± 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: ES3DV3 - SN:3122

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	61.9	0.80	6.82	6.82	6.82	0.08	1.20	± 13.3 %
300	58.2	0.92	6.79	6.79	6.79	0.10	1.20	± 13.3 %
450	56.7	0.94	6.95	6.95	6.95	0.10	1.30	± 13.3 %
750	55.5	0.96	6.39	6.39	6.39	0.54	1.37	± 12.0 %
835	55.2	0.97	6.28	6.28	6.28	0.80	1.14	± 12.0 %
900	55.0	1.05	6.22	6.22	6.22	0.58	1.33	± 12.0 %
1450	54.0	1.30	5.39	5.39	5.39	0.80	1.12	± 12.0 %
1810	53.3	1.52	5.02	5.02	5.02	0.51	1.53	± 12.0 %
1900	53.3	1.52	4.81	4.81	4.81	0.67	1.36	± 12.0 %
2100	53.2	1.62	5.09	5.09	5.09	0.57	1.53	± 12.0 %
2300	52.9	1.81	4.58	4.58	4.58	0.80	1.24	± 12.0 %
2450	52.7	1.95	4.52	4.52	4.52	0.80	1.18	± 12.0 %
2600	52.5	2.16	4.26	4.26	4.26	0.79	1.20	± 12.0 %
3500	51.3	3.31	3.86	3.86	3.86	0.70	1.30	± 13.1 %
3700	51.0	3.55	3.85	3.85	3.85	0.70	1.30	± 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.

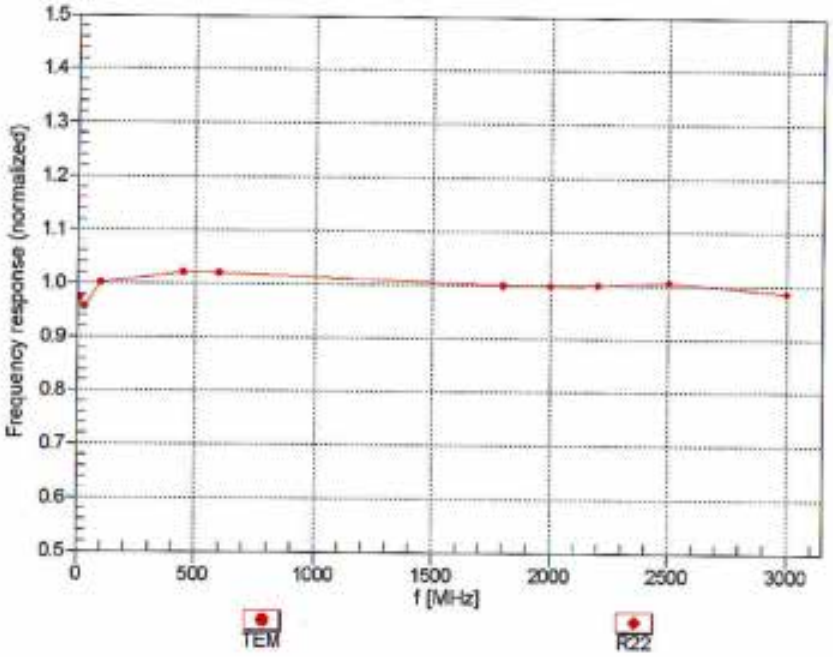
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF 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.

ES3DV3– SN:3122

April 18, 2018

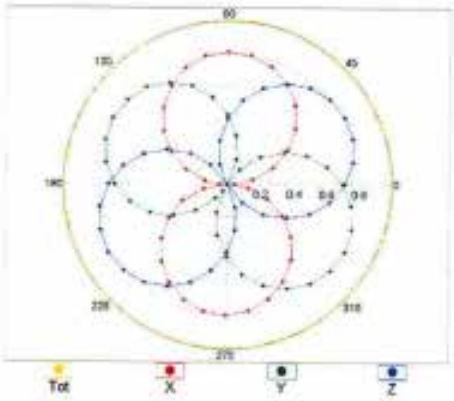
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



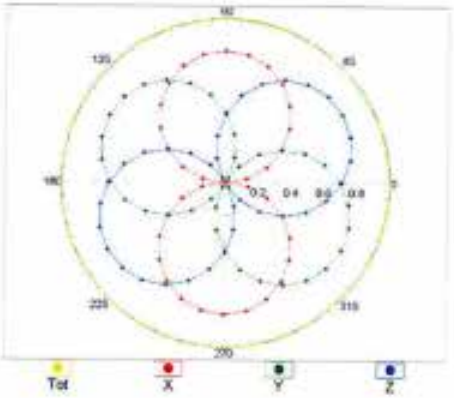
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

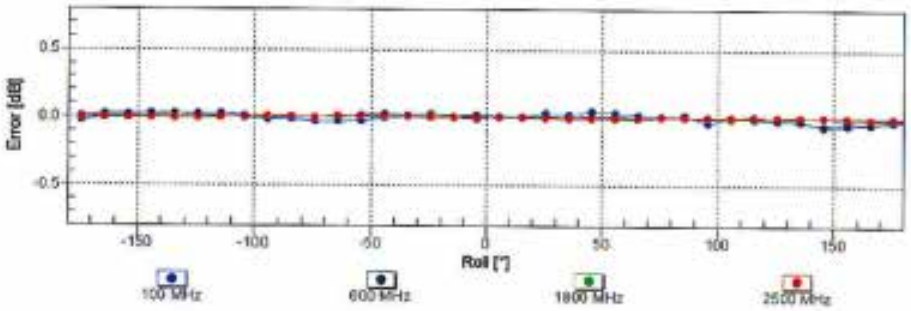
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



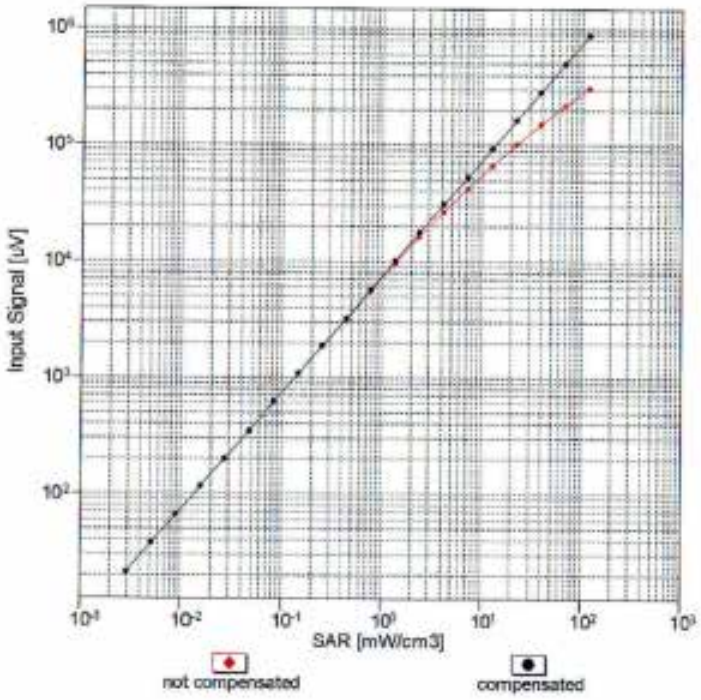
f=1800 MHz,R22

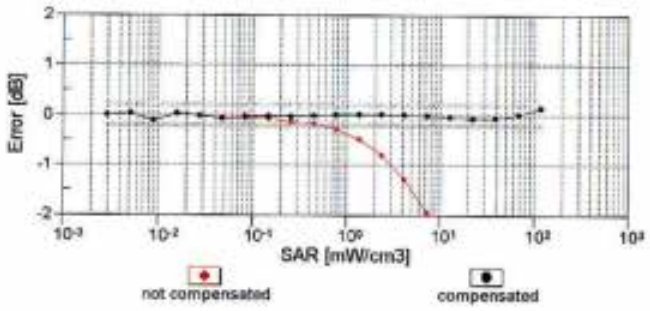




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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





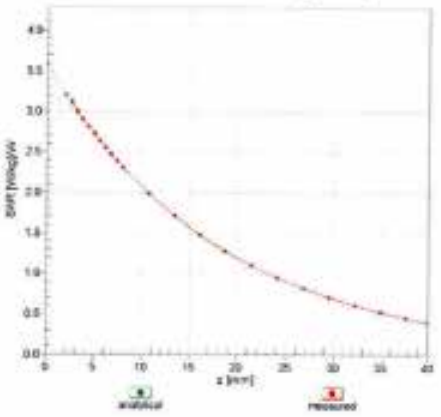
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ES3DV3- SN:3122

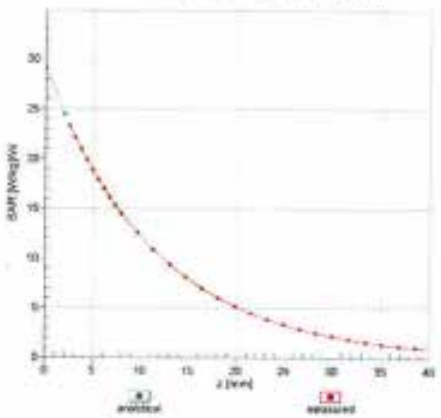
April 18, 2018

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

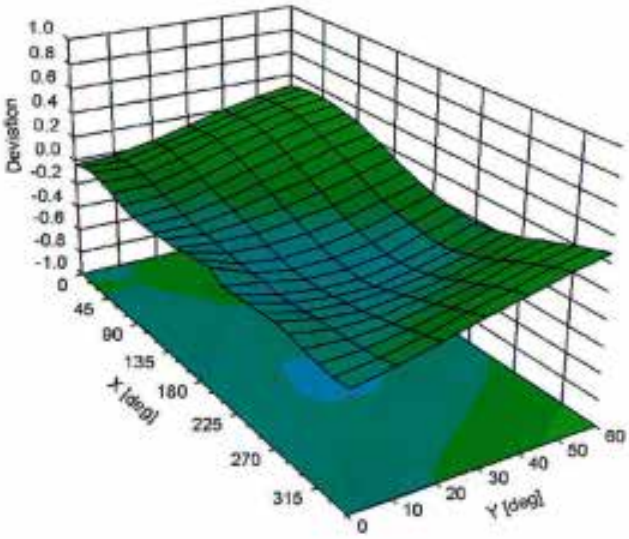


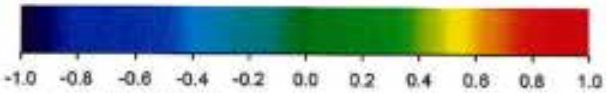
f = 1900 MHz,WGLS R22 (H_convF)



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:3122

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	25.7
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	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	212.2	±3.5 %
		Y	0.0	0.0	1.0		209.0	
		Z	0.0	0.0	1.0		170.3	
10011-CAB	UMTS-FDD (WCDMA)	X	2.98	64.8	17.0	2.91	126.1	±0.7 %
		Y	3.13	65.9	17.9		124.0	
		Z	3.15	66.2	18.0		136.1	
10097-CAB	UMTS-FDD (HSDPA)	X	4.38	65.4	17.7	3.98	134.3	±0.7 %
		Y	4.50	66.1	18.2		132.7	
		Z	4.48	66.2	18.3		145.2	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.34	65.2	17.5	3.98	134.1	±0.7 %
		Y	4.49	66.0	18.2		132.3	
		Z	4.50	66.3	18.3		145.2	
10100-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.27	67.0	19.3	5.67	140.9	±1.2 %
		Y	6.41	67.6	19.8		139.9	
		Z	5.90	65.7	18.8		108.7	
10101-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	6.87	65.7	18.9	6.42	106.2	±1.4 %
		Y	7.57	68.1	20.4		149.7	
		Z	7.03	66.4	19.4		115.6	
10108-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.22	66.8	19.4	5.80	138.9	±1.2 %
		Y	6.37	67.5	19.9		137.7	
		Z	5.89	65.6	18.8		107.6	
10109-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.24	67.4	19.9	6.43	148.0	±1.4 %
		Y	7.38	68.0	20.4		146.2	
		Z	6.83	66.2	19.3		113.4	
10110-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.97	66.4	19.2	5.75	136.1	±1.2 %
		Y	6.07	66.9	19.6		135.0	
		Z	6.07	67.0	19.7		147.6	
10111-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	7.04	67.2	19.8	6.44	145.2	±1.2 %
		Y	7.15	67.8	20.3		143.0	
		Z	6.63	66.0	19.3		110.9	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.95	68.4	21.0	8.07	128.7	±1.9 %
		Y	10.18	69.0	21.5		127.3	
		Z	10.18	69.1	21.5		141.1	
10140-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.06	65.9	19.1	6.49	107.8	±1.2 %
		Y	7.20	66.4	19.5		105.6	
		Z	7.24	66.6	19.5		117.5	
10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.88	66.4	19.2	5.73	134.9	±1.2 %
		Y	5.92	66.7	19.5		132.9	
		Z	5.90	66.8	19.6		145.1	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	6.86	67.2	19.8	6.35	142.8	±1.2 %
		Y	6.92	67.6	20.2		140.2	
		Z	6.39	65.8	19.2		108.6	

10145-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.65	66.0	19.0	5.76	131.7	±0.9 %
		Y	5.68	66.4	19.4		129.3	
		Z	5.69	66.7	19.5		140.8	
10146-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.63	67.1	19.8	6.41	137.8	±1.2 %
		Y	6.68	67.6	20.2		134.4	
		Z	6.66	67.7	20.3		146.5	
10149-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.25	67.4	20.0	6.42	147.7	±1.4 %
		Y	7.35	67.9	20.4		145.9	
		Z	6.83	66.2	19.3		113.4	
10154-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.99	66.5	19.3	5.75	136.2	±1.2 %
		Y	6.07	66.9	19.6		134.5	
		Z	6.07	67.0	19.7		147.4	
10155-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	7.06	67.3	19.9	6.43	145.5	±1.4 %
		Y	7.14	67.7	20.3		142.7	
		Z	6.59	65.9	19.2		110.4	
10156-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.81	66.1	19.1	5.79	133.7	±1.2 %
		Y	5.87	66.5	19.5		131.2	
		Z	5.86	66.7	19.6		143.6	
10157-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	6.87	67.2	19.9	6.49	140.8	±1.2 %
		Y	6.94	67.7	20.4		138.5	
		Z	6.41	65.9	19.3		107.2	
10160-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.37	66.8	19.4	5.82	141.1	±1.2 %
		Y	6.51	67.4	19.9		139.7	
		Z	6.01	65.7	18.9		108.6	
10161-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.33	67.5	20.0	6.43	149.2	±1.4 %
		Y	7.44	68.0	20.4		147.2	
		Z	6.88	66.2	19.3		114.2	
10166-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.07	65.6	18.8	5.46	126.4	±0.9 %
		Y	5.09	66.0	19.1		124.0	
		Z	5.12	66.3	19.3		136.0	
10167-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	6.07	66.9	19.6	6.21	130.6	±1.2 %
		Y	6.12	67.4	20.1		127.4	
		Z	6.13	67.7	20.2		139.8	
10169-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.95	65.8	19.0	5.73	120.9	±0.9 %
		Y	5.02	66.5	19.6		118.9	
		Z	5.03	66.6	19.6		130.3	
10170-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	5.79	67.1	20.0	6.52	121.6	±1.2 %
		Y	5.87	67.7	20.5		118.9	
		Z	5.88	67.9	20.5		130.8	
10175-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.94	65.8	18.9	5.72	121.0	±0.9 %
		Y	5.03	66.5	19.5		118.8	
		Z	5.04	66.7	19.6		130.1	
10176-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.81	67.2	20.0	6.52	121.6	±1.2 %
		Y	5.88	67.8	20.6		118.6	
		Z	5.90	68.0	20.6		130.7	

10177-CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	4.97	65.9	19.0	5.73	121.3	±0.9 %
		Y	5.02	66.4	19.5		118.7	
		Z	5.04	66.7	19.6		130.4	
10178-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.82	67.2	20.0	6.52	121.9	±1.2 %
		Y	5.84	67.6	20.4		118.9	
		Z	5.91	68.0	20.6		131.0	
10181-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.94	65.7	18.9	5.72	121.0	±0.9 %
		Y	5.02	66.4	19.5		118.7	
		Z	5.06	66.8	19.7		130.4	
10182-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.80	67.1	19.9	6.52	121.6	±1.2 %
		Y	5.86	67.7	20.5		118.8	
		Z	5.91	68.0	20.6		130.8	
10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	4.96	65.9	19.0	5.73	121.0	±0.9 %
		Y	5.03	66.5	19.6		118.7	
		Z	5.03	66.6	19.6		130.0	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.80	67.1	20.0	6.51	121.5	±1.2 %
		Y	5.88	67.8	20.5		118.7	
		Z	5.92	68.1	20.7		130.9	
10187-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	4.95	65.8	18.9	5.73	120.9	±0.9 %
		Y	5.03	66.4	19.5		119.0	
		Z	5.02	66.5	19.5		130.1	
10188-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	5.81	67.1	20.0	6.52	121.6	±1.2 %
		Y	5.87	67.7	20.5		118.9	
		Z	5.91	68.0	20.6		131.0	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.69	68.1	20.9	8.10	124.2	±1.9 %
		Y	9.87	68.7	21.5		122.8	
		Z	9.88	68.9	21.5		136.4	
10225-CAB	UMTS-FDD (HSPA+)	X	6.58	65.3	18.5	5.97	107.4	±1.2 %
		Y	6.57	65.5	18.7		104.1	
		Z	6.70	66.1	19.0		116.2	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.90	66.4	18.6	4.67	148.3	±0.9 %
		Y	6.00	66.9	19.0		144.2	
		Z	5.62	65.8	18.3		112.0	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.25	65.6	18.0	3.96	130.0	±0.7 %
		Y	4.34	66.2	18.5		128.8	
		Z	4.37	66.5	18.6		140.4	
10297-AAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.29	67.1	19.6	5.81	138.4	±1.2 %
		Y	6.38	67.4	19.9		137.2	
		Z	5.90	65.7	18.9		106.8	
10298-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.72	66.2	19.1	5.72	132.5	±1.2 %
		Y	5.78	66.7	19.6		130.4	
		Z	5.74	66.7	19.6		142.0	
10299-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.73	67.1	19.8	6.39	139.4	±1.2 %
		Y	6.79	67.7	20.3		136.6	
		Z	6.79	67.9	20.4		149.1	

10311-AAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.77	67.4	19.8	6.06	143.5	±1.2 %
		Y	6.94	68.0	20.3		142.6	
		Z	6.39	66.2	19.2		110.2	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.33	65.6	17.0	1.54	129.1	±0.5 %
		Y	2.47	66.6	17.8		127.4	
		Z	2.44	66.8	17.9		139.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.79	68.3	21.2	8.23	125.1	±1.9 %
		Y	10.02	69.0	21.7		122.7	
		Z	9.95	68.9	21.6		136.4	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.68	68.3	21.1	8.14	124.1	±1.7 %
		Y	9.88	68.9	21.6		121.6	
		Z	9.84	68.9	21.5		135.2	
10430-AAB	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	9.17	67.9	21.0	8.28	114.8	±1.7 %
		Y	9.27	68.5	21.6		111.7	
		Z	9.24	68.6	21.6		123.3	
10431-AAB	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	9.64	68.2	21.2	8.38	120.8	±1.9 %
		Y	9.80	68.8	21.7		118.2	
		Z	9.78	68.9	21.7		131.0	
10432-AAB	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	9.81	68.3	21.2	8.34	123.7	±1.9 %
		Y	10.05	69.1	21.9		121.5	
		Z	9.98	69.0	21.7		135.3	
10433-AAB	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	9.99	68.5	21.3	8.34	126.5	±1.9 %
		Y	10.26	69.3	21.9		124.6	
		Z	10.17	69.2	21.8		137.9	
10435-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.10	71.6	23.1	7.82	112.9	±1.9 %
		Y	7.32	72.6	23.9		111.3	
		Z	7.64	73.9	24.5		123.1	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	7.93	66.1	19.2	6.62	119.3	±1.4 %
		Y	8.08	66.6	19.6		118.1	
		Z	8.09	66.7	19.6		130.5	
10460-AAA	UMTS-FDD (WCDMA, AMR)	X	2.62	65.9	17.6	2.39	123.9	±0.5 %
		Y	2.76	66.9	18.4		122.0	
		Z	2.79	67.5	18.7		134.0	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.13	71.6	23.1	7.82	113.1	±1.9 %
		Y	7.43	73.0	24.1		111.8	
		Z	7.64	73.8	24.4		122.7	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.65	72.3	23.7	8.30	112.2	±2.2 %
		Y	7.95	73.7	24.7		111.2	
		Z	8.26	74.9	25.2		122.1	
10464-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.11	71.6	23.1	7.82	112.9	±1.9 %
		Y	7.35	72.7	23.9		111.4	
		Z	7.58	73.6	24.3		122.6	

10465-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.68	72.4	23.8	8.32	111.9	±1.9 %
		Y	7.92	73.6	24.6		111.2	
		Z	8.26	74.8	25.1		122.0	
10467-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.15	71.7	23.2	7.82	112.9	±1.9 %
		Y	7.43	73.0	24.1		111.0	
		Z	7.66	73.9	24.5		122.9	
10468-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.68	72.4	23.8	8.32	112.4	±1.9 %
		Y	7.93	73.6	24.7		110.9	
		Z	8.22	74.7	25.1		121.8	
10470-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.09	71.5	23.1	7.82	112.7	±1.9 %
		Y	7.34	72.7	23.9		111.2	
		Z	7.62	73.7	24.4		122.5	
10471-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.67	72.4	23.8	8.32	112.3	±2.2 %
		Y	7.88	73.4	24.5		110.9	
		Z	8.24	74.7	25.1		122.2	
10473-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.12	71.6	23.2	7.82	112.9	±1.9 %
		Y	7.37	72.8	24.0		111.2	
		Z	7.60	73.7	24.4		122.6	
10474-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.73	72.6	23.9	8.32	112.4	±1.9 %
		Y	7.87	73.4	24.6		111.0	
		Z	8.21	74.6	25.0		121.8	
10477-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.64	72.3	23.7	8.32	111.8	±2.2 %
		Y	7.90	73.5	24.6		111.1	
		Z	8.18	74.6	25.0		121.9	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.45	71.3	22.9	7.74	120.3	±2.2 %
		Y	7.66	72.3	23.7		118.0	
		Z	7.88	73.2	24.1		129.9	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.25	72.2	23.6	8.18	123.2	±2.2 %
		Y	8.45	73.3	24.4		120.5	
		Z	8.67	74.1	24.7		133.0	
10482-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.03	71.7	23.1	7.71	127.5	±2.2 %
		Y	8.19	72.5	23.7		125.5	
		Z	8.42	73.5	24.2		138.2	
10483-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.13	72.6	23.9	8.39	134.8	±2.7 %
		Y	9.37	73.7	24.7		132.1	
		Z	9.59	74.6	25.1		146.2	
10485-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.00	71.7	22.9	7.59	129.1	±2.2 %
		Y	8.29	72.8	23.8		127.4	
		Z	8.44	73.5	24.1		140.5	
10486-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.23	72.6	23.9	8.38	137.5	±2.7 %
		Y	9.54	73.8	24.8		135.8	
		Z	9.69	74.4	25.0		149.2	
10488-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.43	72.1	23.2	7.70	133.5	±2.5 %
		Y	8.75	73.3	24.1		131.7	
		Z	8.90	73.8	24.3		146.1	

10489-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.50	72.7	23.9	8.31	143.4	±2.7 %
		Y	9.76	73.6	24.6		141.5	
		Z	8.33	69.4	22.2		106.1	
10491-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.89	72.5	23.4	7.74	138.5	±2.5 %
		Y	9.25	73.7	24.2		138.1	
		Z	7.77	69.3	21.8		103.9	
10492-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.48	68.5	21.6	8.41	101.7	±2.2 %
		Y	10.41	74.3	25.0		148.8	
		Z	8.85	69.9	22.5		111.1	
10494-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.83	72.6	23.4	7.74	137.3	±2.5 %
		Y	9.23	73.8	24.3		136.5	
		Z	7.73	69.3	21.8		102.7	
10495-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.90	73.0	24.1	8.37	148.8	±3.0 %
		Y	10.25	74.1	24.9		147.7	
		Z	8.73	69.8	22.4		110.1	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.88	71.5	22.9	7.67	126.6	±2.2 %
		Y	8.14	72.7	23.8		124.7	
		Z	8.32	73.5	24.1		137.7	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.98	72.6	23.9	8.40	132.5	±2.7 %
		Y	9.18	73.5	24.6		129.8	
		Z	9.41	74.4	25.0		143.5	
10500-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.22	71.9	23.1	7.67	131.3	±2.2 %
		Y	8.51	73.0	24.0		129.2	
		Z	8.66	73.7	24.2		142.6	
10501-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.44	72.7	24.0	8.44	140.1	±2.7 %
		Y	9.70	73.7	24.8		137.6	
		Z	8.19	69.2	22.2		103.6	
10503-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.41	72.0	23.2	7.72	133.4	±2.5 %
		Y	8.78	73.3	24.1		132.4	
		Z	8.93	73.9	24.3		146.1	
10504-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.47	72.6	23.8	8.31	143.3	±2.7 %
		Y	9.78	73.7	24.7		141.4	
		Z	8.34	69.4	22.2		106.3	
10506-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.81	72.5	23.4	7.74	137.6	±2.2 %
		Y	9.27	74.0	24.4		136.6	
		Z	7.75	69.4	21.9		102.8	
10507-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.84	72.8	24.0	8.36	148.2	±2.7 %
		Y	10.25	74.1	24.9		147.3	
		Z	8.73	69.7	22.3		110.1	
10509-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	9.51	73.2	23.8	7.99	144.0	±2.5 %
		Y	10.02	74.6	24.8		143.6	
		Z	8.39	69.9	22.2		107.5	

10510-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.90	69.0	21.8	8.49	104.8	±1.9 %
		Y	9.29	70.1	22.6		104.4	
		Z	9.32	70.3	22.7		115.7	
10512-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	9.20	73.1	23.6	7.74	141.4	±2.2 %
		Y	9.71	74.6	24.5		140.9	
		Z	8.12	70.0	22.1		105.9	
10513-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.75	68.9	21.8	8.42	103.2	±1.9 %
		Y	9.18	70.2	22.7		102.7	
		Z	9.18	70.3	22.7		114.3	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.40	66.0	17.2	1.58	129.3	±0.5 %
		Y	2.48	66.6	17.8		128.1	
		Z	2.48	67.0	18.0		140.0	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.86	68.4	21.2	8.25	124.9	±1.9 %
		Y	10.07	69.1	21.7		122.7	
		Z	10.05	69.1	21.7		136.5	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	3.14	68.9	18.5	1.99	129.3	±0.7 %
		Y	3.26	69.5	19.1		127.8	
		Z	3.46	71.1	19.7		140.3	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	3.02	68.2	18.2	1.99	128.8	±0.5 %
		Y	3.29	69.8	19.2		127.7	
		Z	3.48	71.2	19.7		139.7	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	10.24	69.0	21.7	8.59	125.8	±2.2 %
		Y	10.50	69.8	22.3		123.8	
		Z	10.46	69.7	22.3		137.2	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	10.24	69.0	21.7	8.60	125.5	±2.2 %
		Y	10.55	69.9	22.4		123.8	
		Z	10.47	69.8	22.3		136.8	
10581-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	10.36	69.0	21.8	8.63	127.3	±3.0 %
		Y	10.67	69.9	22.5		125.9	
		Z	10.57	69.8	22.3		138.9	
10582-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	10.54	69.3	22.0	8.79	127.5	±3.3 %
		Y	10.87	70.2	22.7		126.3	
		Z	10.80	70.1	22.6		140.1	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.88	69.6	22.1	8.79	132.3	±2.2 %
		Y	11.27	70.6	22.8		131.4	
		Z	11.17	70.4	22.7		145.6	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.96	69.7	22.2	8.88	132.5	±3.5 %
		Y	11.36	70.7	22.9		131.7	
		Z	11.27	70.6	22.8		146.1	

[a] 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
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 Motorola Solutions MY

Certificate No: EX3-3612_Oct18

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3612

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: October 18, 2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: October 23, 2018

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, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3612

Manufactured: March 23, 2007
Calibrated: October 18, 2018

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3612

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.43	0.48	0.39	± 10.1 %
DCP (mV)[B]	97.2	94.9	96.3	

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	147.9	±3.5 %
		Y	0.0	0.0	1.0		139.1	
		Z	0.0	0.0	1.0		141.6	

Note: For details on UID parameters see Appendix.

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:3612

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	9.98	9.98	9.98	0.00	1.00	± 13.3 %
300	45.3	0.87	9.88	9.88	9.88	0.07	1.30	± 13.3 %
450	43.5	0.87	9.09	9.09	9.09	0.13	1.30	± 13.3 %
750	41.9	0.89	8.79	8.79	8.79	0.36	1.00	± 12.0 %
835	41.5	0.90	8.23	8.23	8.23	0.52	0.84	± 12.0 %
900	41.5	0.97	8.08	8.08	8.08	0.49	0.86	± 12.0 %
1810	40.0	1.40	7.20	7.20	7.20	0.35	0.96	± 12.0 %
1900	40.0	1.40	7.16	7.16	7.16	0.40	0.90	± 12.0 %
2100	39.8	1.49	7.27	7.27	7.27	0.40	0.90	± 12.0 %
2450	39.2	1.80	6.51	6.51	6.51	0.40	0.90	± 12.0 %
4950	36.3	4.40	4.95	4.95	4.95	0.40	1.80	± 13.1 %
5250	35.9	4.71	4.63	4.63	4.63	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.55	4.55	4.55	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.31	4.31	4.31	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.70	4.70	4.70	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:3612

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	61.9	0.80	9.73	9.73	9.73	0.00	1.00	± 13.3 %
300	58.2	0.92	9.32	9.32	9.32	0.05	1.20	± 13.3 %
450	56.7	0.94	9.24	9.24	9.24	0.07	1.20	± 13.3 %
750	55.5	0.96	8.55	8.55	8.55	0.47	0.87	± 12.0 %
835	55.2	0.97	8.21	8.21	8.21	0.39	0.91	± 12.0 %
900	55.0	1.05	8.17	8.17	8.17	0.47	0.85	± 12.0 %
1810	53.3	1.52	6.97	6.97	6.97	0.40	0.95	± 12.0 %
1900	53.3	1.52	6.83	6.83	6.83	0.45	0.90	± 12.0 %
2100	53.2	1.62	7.02	7.02	7.02	0.30	1.07	± 12.0 %
2450	52.7	1.95	6.70	6.70	6.70	0.40	0.95	± 12.0 %
4950	49.4	5.01	4.28	4.28	4.28	0.50	1.90	± 13.1 %
5250	48.9	5.36	4.14	4.14	4.14	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.78	3.78	3.78	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.69	3.69	3.69	0.50	1.90	± 13.1 %
5750	48.3	5.94	3.96	3.96	3.96	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.

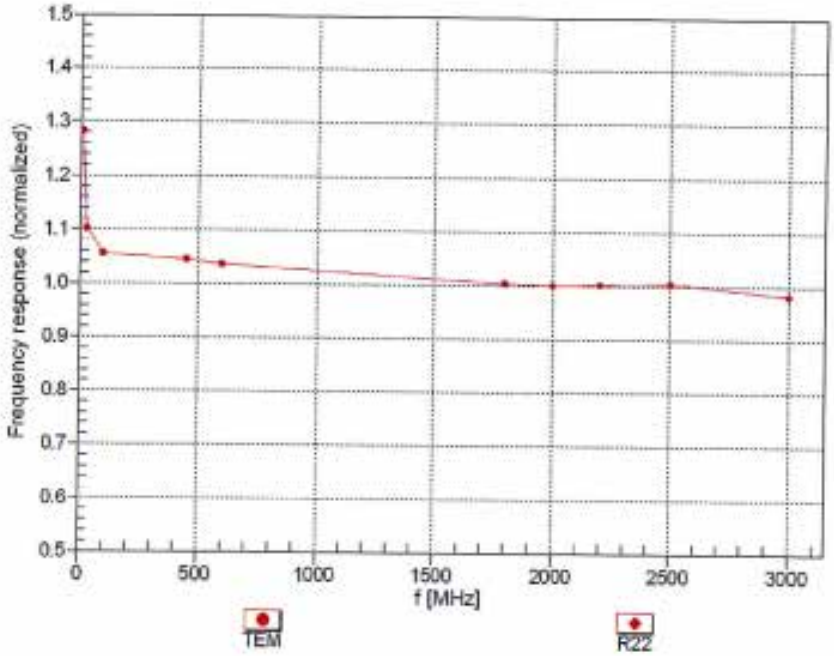
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF 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.

EX3DV4– SN:3612

October 18, 2018

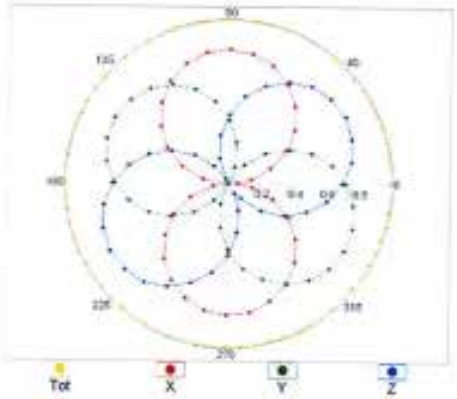
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



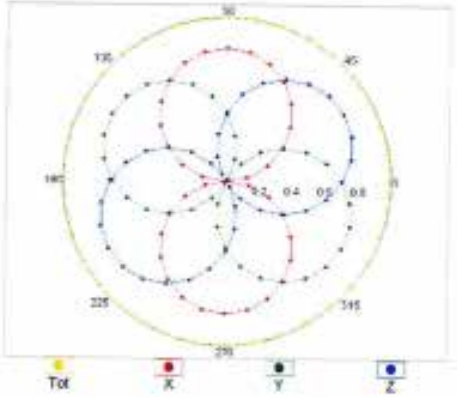
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

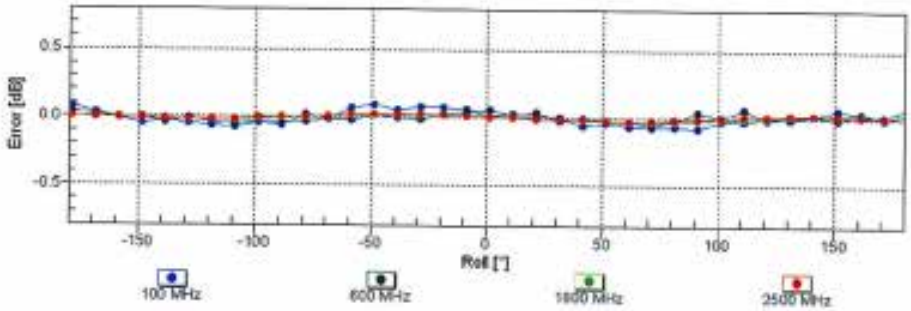
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

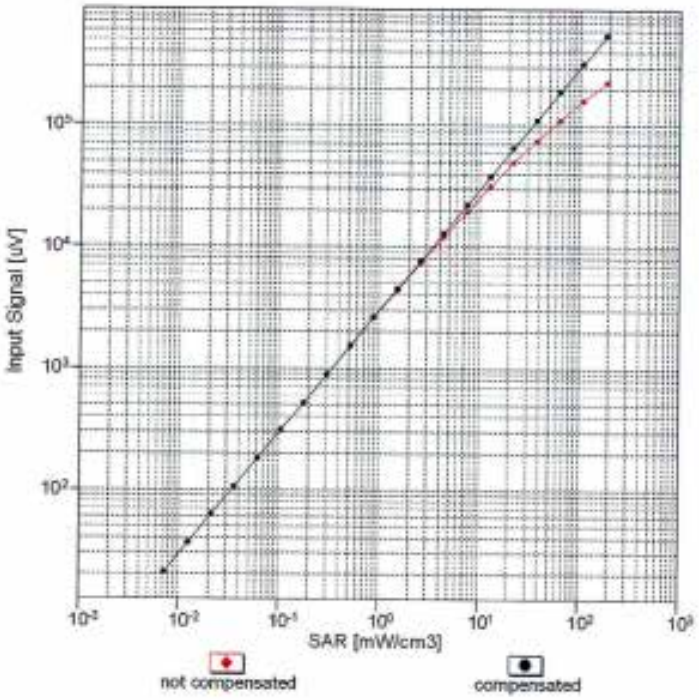


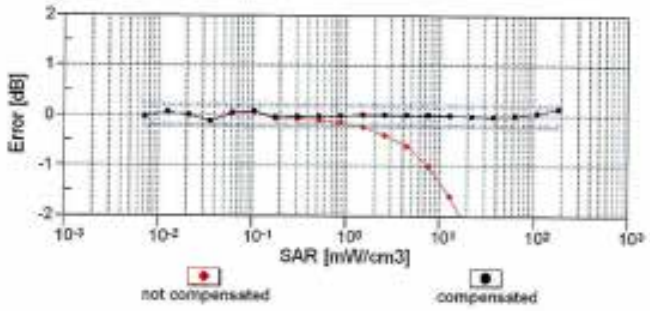


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3812 October 18, 2018

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



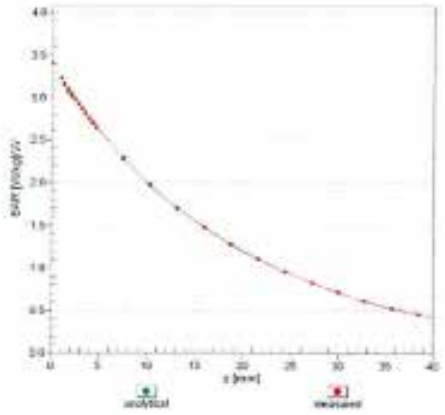


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

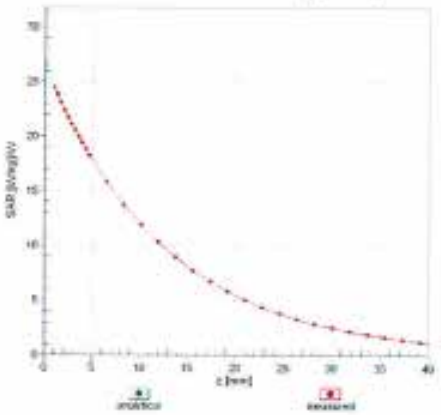
EX3DV4– SN:3612 October 18, 2018

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

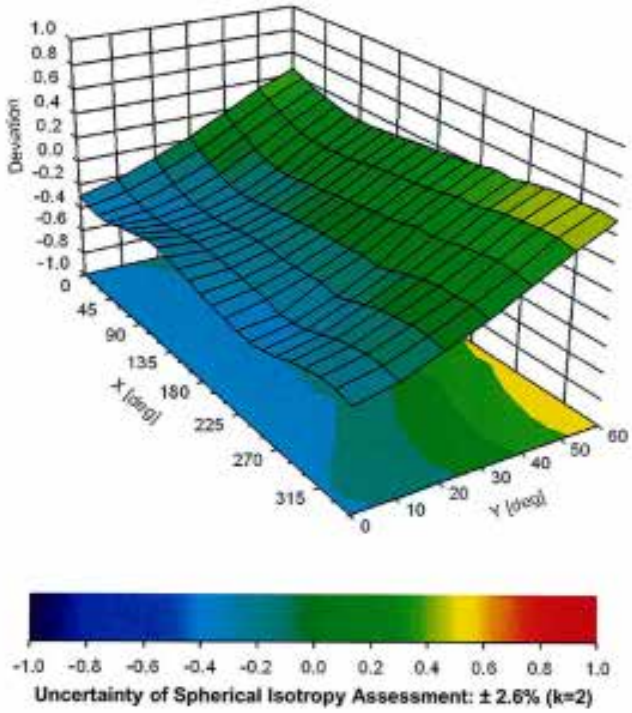


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: EX3-3612_Oct18 Page 10 of 16

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3612

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	81.3
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

Appendix: 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	147.9	±3.5 %
		Y	0.0	0.0	1.0		139.1	
		Z	0.0	0.0	1.0		141.6	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	1.69	63.3	11.9	9.39	89.4	±1.4 %
		Y	1.80	66.0	13.2		62.6	
		Z	1.81	63.3	12.3		87.6	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.68	62.7	11.5	9.57	86.7	±1.4 %
		Y	1.83	66.3	13.4		60.7	
		Z	1.80	62.8	12.0		85.4	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.53	64.1	11.0	6.56	137.8	±1.2 %
		Y	2.39	71.8	14.2		115.7	
		Z	2.22	68.5	13.3		134.8	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	5.30	72.2	25.5	12.62	58.2	±1.2 %
		Y	3.83	63.8	21.1		40.1	
		Z	5.51	72.8	25.8		56.5	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	4.79	72.5	24.1	9.55	131.7	±1.2 %
		Y	3.79	68.5	20.7		91.4	
		Z	5.19	74.1	24.7		129.8	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	1.07	61.6	8.6	4.80	132.4	±1.2 %
		Y	1.21	66.9	11.9		147.8	
		Z	1.41	64.1	10.0		128.7	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	37.91	99.7	21.0	3.55	148.0	±1.2 %
		Y	0.70	62.0	9.0		135.5	
		Z	0.96	61.1	7.5		144.3	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	4.32	71.0	22.1	7.78	130.4	±1.4 %
		Y	4.16	70.9	22.2		143.3	
		Z	4.75	73.1	23.2		126.8	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.53	65.7	18.4	4.57	116.3	±0.9 %
		Y	4.50	65.4	18.2		149.7	
		Z	4.44	65.3	18.1		111.9	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	4.05	68.3	23.1	11.01	84.6	±1.4 %
		Y	3.35	64.7	21.6		58.7	
		Z	4.22	68.9	23.4		82.5	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.59	73.8	23.0	6.52	148.8	±0.9 %
		Y	3.53	68.1	20.3		133.4	
		Z	4.80	73.9	22.5		144.7	
10061-CAB	CDMA2000 (1xRTT, RC3)	X	3.83	65.4	18.1	3.97	113.8	±0.7 %
		Y	3.72	64.6	17.6		146.8	
		Z	3.76	65.0	17.8		109.2	

10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	1.83	67.3	12.6	6.56	136.2	±1.4 %
		Y	3.66	77.8	16.6		113.9	
		Z	1.76	65.0	11.3		134.2	
10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	5.14	74.3	24.9	9.55	131.6	±1.7 %
		Y	4.11	69.2	22.4		90.6	
		Z	5.28	74.4	24.8		128.6	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.79	67.6	20.6	8.07	117.2	±2.2 %
		Y	9.39	66.6	20.0		106.3	
		Z	9.69	67.3	20.4		111.8	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.44	67.4	20.6	8.10	112.5	±2.5 %
		Y	9.68	68.1	20.9		147.7	
		Z	9.32	67.1	20.4		106.9	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	4.21	66.6	18.6	3.91	116.4	±0.7 %
		Y	3.77	64.3	17.2		109.2	
		Z	4.05	65.7	17.9		111.9	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.53	65.9	18.2	3.46	113.6	±0.7 %
		Y	3.36	64.8	17.5		147.1	
		Z	3.55	65.9	18.1		109.1	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.48	65.9	18.2	3.39	113.1	±0.5 %
		Y	3.32	64.9	17.5		146.7	
		Z	3.53	66.2	18.1		109.1	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	3.53	65.7	18.1	3.50	113.4	±0.7 %
		Y	3.37	64.7	17.4		147.0	
		Z	3.66	66.5	18.4		109.1	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	5.19	65.7	23.2	12.49	89.6	±1.2 %
		Y	4.39	61.5	20.8		48.0	
		Z	5.26	65.9	23.3		67.8	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.97	68.6	18.9	3.76	146.2	±0.7 %
		Y	5.26	69.9	19.9		132.8	
		Z	5.62	72.1	20.9		144.9	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.78	68.8	19.1	3.77	117.5	±0.5 %
		Y	4.44	67.2	18.1		110.4	
		Z	4.64	68.2	18.5		113.3	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	6.34	69.5	20.1	5.22	121.0	±0.9 %
		Y	5.63	66.9	18.6		113.0	
		Z	6.31	69.6	20.0		116.6	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.82	68.3	18.7	1.54	119.1	±0.5 %
		Y	2.28	64.6	16.6		111.7	
		Z	2.89	68.5	18.4		115.2	

10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.54	67.5	20.8	8.23	111.7	±2.5 %
		Y	9.74	68.0	21.0		147.4	
		Z	9.44	67.2	20.6		106.6	
10417-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.54	67.5	20.8	8.23	111.9	±2.5 %
		Y	9.75	68.1	21.0		147.2	
		Z	9.44	67.2	20.6		106.7	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.41	67.4	20.7	8.14	110.8	±2.5 %
		Y	9.61	68.0	20.9		146.6	
		Z	9.29	67.1	20.4		105.9	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	8.37	68.9	20.6	6.55	145.1	±1.9 %
		Y	7.89	67.4	19.7		134.8	
		Z	8.31	68.8	20.4		139.5	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	10.43	68.7	21.4	8.25	120.8	±2.2 %
		Y	10.22	68.1	20.9		110.4	
		Z	10.29	68.5	21.2		114.9	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.95	69.4	19.2	1.58	118.9	±0.5 %
		Y	2.34	65.1	16.9		111.6	
		Z	2.88	68.5	18.4		114.9	
10518-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	9.52	67.4	20.8	8.23	110.1	±2.5 %
		Y	9.75	68.1	21.0		147.8	
		Z	9.44	67.2	20.6		106.1	
10525-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	9.73	67.6	20.9	8.36	111.8	±2.5 %
		Y	9.96	68.2	21.2		149.6	
		Z	9.65	67.4	20.7		107.2	
10526-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	9.81	67.7	21.0	8.42	112.9	±1.9 %
		Y	9.47	66.8	20.4		104.2	
		Z	9.70	67.4	20.7		107.7	
10534-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	10.26	68.1	21.1	8.45	118.1	±2.2 %
		Y	9.86	67.2	20.5		108.3	
		Z	10.20	67.9	21.0		112.8	
10535-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	10.28	68.1	21.2	8.45	118.5	±2.2 %
		Y	9.83	67.0	20.4		108.5	
		Z	10.17	67.8	20.9		113.2	
10544-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	10.55	68.4	21.1	8.47	122.3	±2.2 %
		Y	10.03	67.1	20.4		110.6	
		Z	10.46	68.1	20.9		116.7	
10545-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	10.64	68.5	21.2	8.55	121.9	±2.2 %
		Y	10.11	67.2	20.5		110.1	
		Z	10.54	68.2	21.0		116.6	

10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.56	67.5	20.8	8.25	110.7	±2.5 %
		Y	9.80	68.2	21.1		148.1	
		Z	9.47	67.2	20.6		106.2	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	2.94	68.6	19.1	1.99	116.3	±0.5 %
		Y	2.44	65.1	17.1		148.4	
		Z	2.94	68.2	18.4		111.5	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	3.02	69.2	19.3	1.99	115.7	±0.5 %
		Y	2.39	64.9	16.9		148.1	
		Z	3.03	68.9	18.8		111.0	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	9.64	67.4	21.0	8.59	108.5	±2.5 %
		Y	9.85	68.1	21.2		143.2	
		Z	9.57	67.3	20.9		103.8	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	9.67	67.5	21.0	8.60	108.8	±2.5 %
		Y	9.87	68.1	21.3		143.7	
		Z	9.58	67.3	20.9		103.8	
10583-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	9.64	67.4	21.0	8.59	109.3	±2.5 %
		Y	9.85	68.1	21.3		143.6	
		Z	9.58	67.3	20.9		104.1	
10584-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	9.64	67.4	21.0	8.60	108.7	±2.5 %
		Y	9.88	68.2	21.3		143.1	
		Z	9.57	67.3	20.8		103.4	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	9.80	67.6	21.1	8.63	110.8	±2.7 %
		Y	9.95	68.1	21.3		144.8	
		Z	9.69	67.3	20.9		105.1	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	9.96	67.8	21.3	8.79	111.0	±2.7 %
		Y	10.14	68.3	21.5		145.5	
		Z	9.85	67.5	21.0		105.3	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.40	68.2	21.4	8.79	116.5	±2.2 %
		Y	9.94	67.1	20.7		105.3	
		Z	10.30	67.9	21.2		110.9	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.49	68.3	21.5	8.88	116.8	±2.2 %
		Y	10.04	67.2	20.8		106.0	
		Z	10.37	68.0	21.3		111.0	
10607-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	9.82	67.6	21.1	8.64	111.1	±2.5 %
		Y	9.99	68.1	21.3		145.3	
		Z	9.73	67.4	20.9		105.7	
10608-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	9.97	67.8	21.3	8.77	111.5	±2.7 %
		Y	10.13	68.3	21.5		145.1	
		Z	9.89	67.6	21.1		105.8	

10616-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	10.42	68.2	21.4	8.82	116.6	±2.2 %
		Y	9.98	67.1	20.7		106.0	
		Z	10.36	68.0	21.3		111.3	
10617-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	10.41	68.2	21.4	8.81	116.3	±2.2 %
		Y	9.96	67.1	20.7		106.2	
		Z	10.33	67.9	21.2		111.2	
10626-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	10.71	68.4	21.4	8.83	121.0	±2.2 %
		Y	10.16	67.2	20.6		108.5	
		Z	10.63	68.2	21.2		115.3	
10627-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	10.78	68.5	21.5	8.88	120.9	±2.2 %
		Y	10.17	67.1	20.6		108.1	
		Z	10.73	68.4	21.4		115.9	
10648-AAA	CDMA2000 (1x Advanced)	X	3.67	66.8	18.8	3.45	113.4	±0.7 %
		Y	3.43	65.4	17.8		147.2	
		Z	3.58	66.2	18.2		108.9	

[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 C S Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
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 **Motorola Solutions MY**

Certificate No: EX3-7486_Mar18/2

CALIBRATION CERTIFICATE (Replacement of No:EX3-7486_Mar18)

Object EX3DV4 - SN:7486

Calibration procedure(s) QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: March 20, 2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02528)	Apr-18
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-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-17)	In house check: Oct-18

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

Issued: April 13, 2018

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
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:7486

Manufactured: March 20, 2017
Calibrated: March 20, 2018

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7486

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)²)[A]	0.37	0.47	0.49	± 10.1 %
DCP (mV)[B]	101.3	90.8	100.1	

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	134.1	±3.0 %
		Y	0.0	0.0	1.0		129.8	
		Z	0.0	0.0	1.0		135.9	

Note: For details on UID parameters see Appendix.

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:7486

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	13.66	13.66	13.66	0.00	1.00	± 13.3 %
300	45.3	0.87	12.30	12.30	12.30	0.08	1.20	± 13.3 %
450	43.5	0.87	11.43	11.43	11.43	0.14	1.30	± 13.3 %
750	41.9	0.89	10.72	10.72	10.72	0.34	0.99	± 12.0 %
835	41.5	0.90	10.29	10.29	10.29	0.44	0.80	± 12.0 %
900	41.5	0.97	10.11	10.11	10.11	0.24	1.21	± 12.0 %
1450	40.5	1.20	9.06	9.06	9.06	0.36	0.80	± 12.0 %
1810	40.0	1.40	8.66	8.66	8.66	0.40	0.80	± 12.0 %
1900	40.0	1.40	8.32	8.32	8.32	0.28	0.85	± 12.0 %
2100	39.8	1.49	8.67	8.67	8.67	0.33	0.85	± 12.0 %
2300	39.5	1.67	8.06	8.06	8.06	0.30	0.80	± 12.0 %
2450	39.2	1.80	7.72	7.72	7.72	0.36	0.87	± 12.0 %
2600	39.0	1.96	7.42	7.42	7.42	0.36	0.84	± 12.0 %
4950	36.3	4.40	5.98	5.98	5.98	0.35	1.80	± 13.1 %
5250	35.9	4.71	5.61	5.61	5.61	0.40	1.80	± 13.1 %
5500	35.6	4.96	5.15	5.15	5.15	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.93	4.93	4.93	0.40	1.80	± 13.1 %
5750	35.4	5.22	5.13	5.13	5.13	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:7486

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	61.9	0.80	13.10	13.10	13.10	0.00	1.00	± 13.3 %
300	58.2	0.92	12.07	12.07	12.07	0.05	1.20	± 13.3 %
450	56.7	0.94	11.68	11.68	11.68	0.09	1.30	± 13.3 %
750	55.5	0.96	10.35	10.35	10.35	0.55	0.80	± 12.0 %
835	55.2	0.97	9.98	9.98	9.98	0.59	0.80	± 12.0 %
900	55.0	1.05	9.94	9.94	9.94	0.41	0.91	± 12.0 %
1450	54.0	1.30	8.98	8.98	8.98	0.34	0.80	± 12.0 %
1810	53.3	1.52	8.42	8.42	8.42	0.39	0.80	± 12.0 %
1900	53.3	1.52	8.30	8.30	8.30	0.38	0.85	± 12.0 %
2100	53.2	1.62	8.60	8.60	8.60	0.34	0.89	± 12.0 %
2300	52.9	1.81	7.85	7.85	7.85	0.41	0.80	± 12.0 %
2450	52.7	1.95	7.77	7.77	7.77	0.38	0.80	± 12.0 %
2600	52.5	2.16	7.49	7.49	7.49	0.36	0.80	± 12.0 %
4950	49.4	5.01	5.16	5.16	5.16	0.45	1.90	± 13.1 %
5250	48.9	5.36	4.77	4.77	4.77	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.27	4.27	4.27	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.11	4.11	4.11	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.27	4.27	4.27	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.

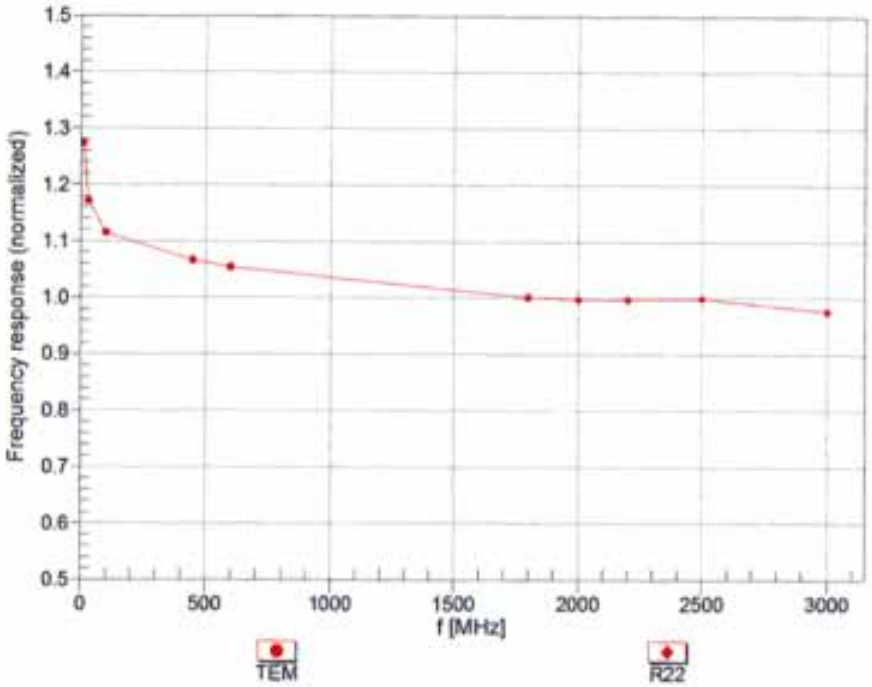
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF 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.

EX3DV4- SN:7486 March 20, 2018

Frequency Response of E-Field

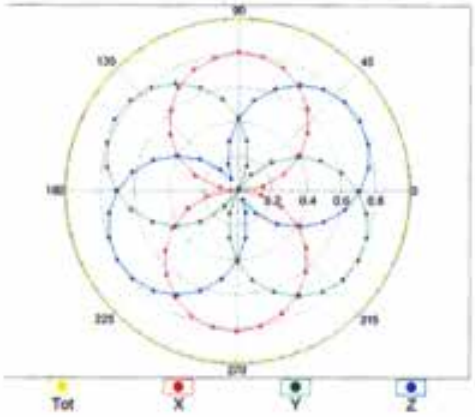
(TEM-Cell:ifi110 EXX, Waveguide: R22)



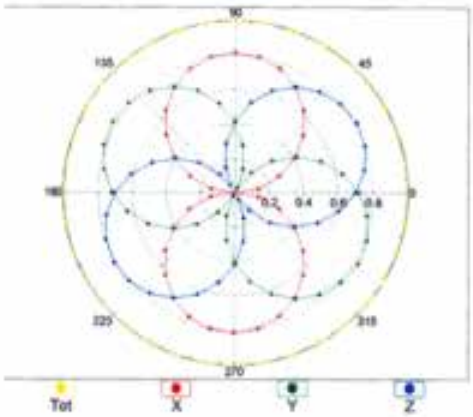
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

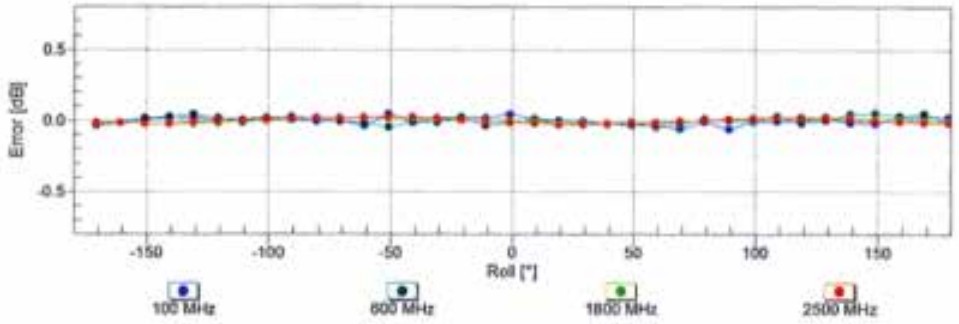
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



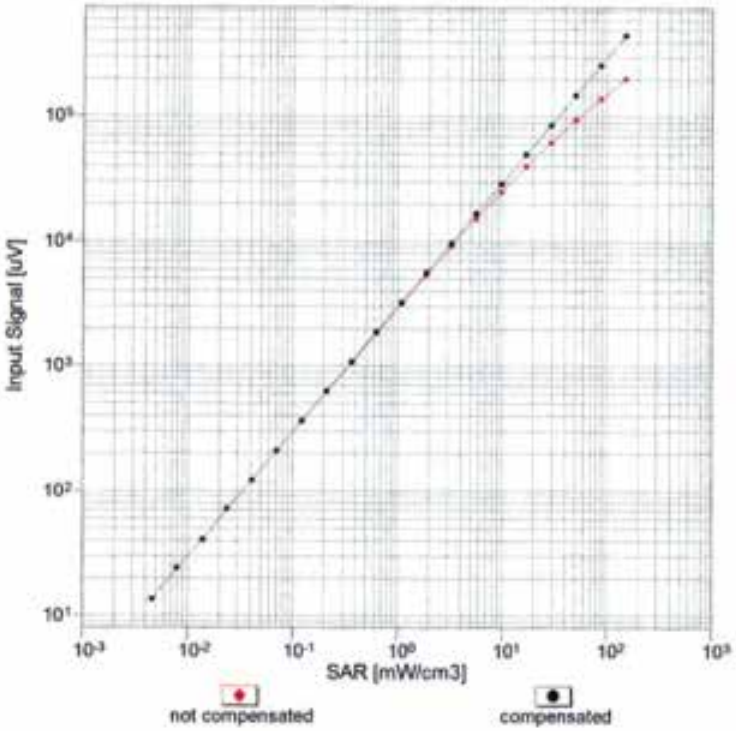
f=1800 MHz,R22

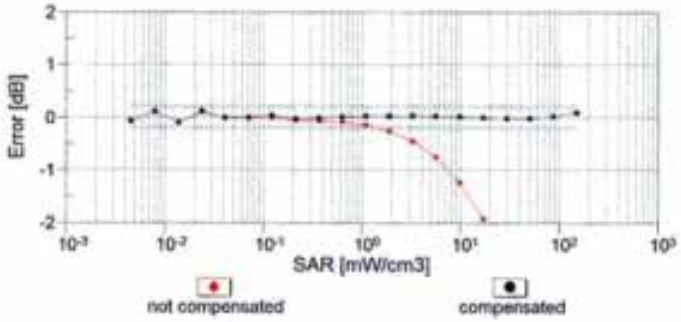




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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



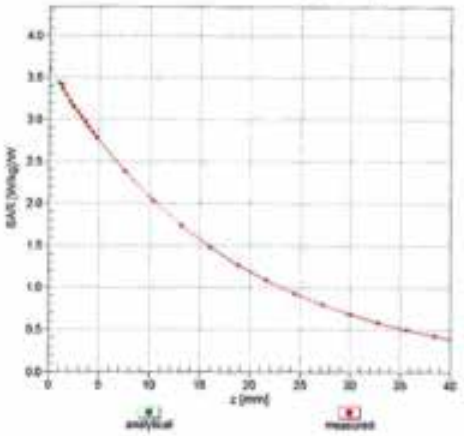


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

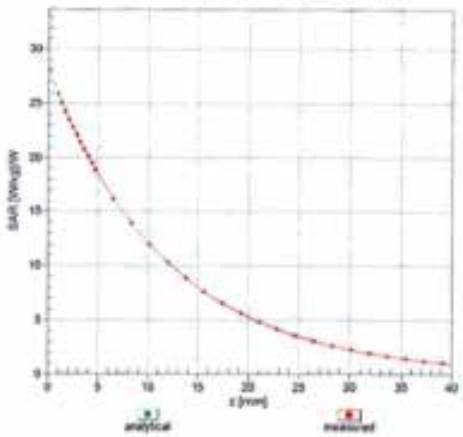
EX3DV4- SN:7486 March 20, 2018

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

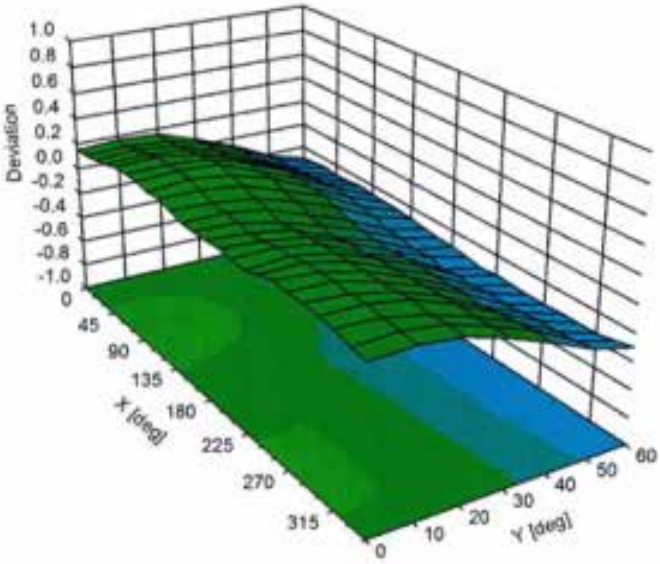


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: EX3-7486_Mar18/2 Page 10 of 16

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7486

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	19.1
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

Appendix: 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	134.1	±3.0 %
		Y	0.0	0.0	1.0		129.8	
		Z	0.0	0.0	1.0		135.9	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	1.23	59.7	9.5	9.39	79.8	±1.9 %
		Y	1.64	64.6	12.9		66.6	
		Z	1.58	63.0	11.5		93.7	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.31	60.4	9.9	9.57	77.2	±1.9 %
		Y	1.71	65.2	13.1		64.2	
		Z	1.56	62.3	11.3		90.7	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.32	63.4	10.1	6.56	147.2	±2.2 %
		Y	3.32	76.5	16.6		132.6	
		Z	1.43	64.4	11.2		144.8	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	4.76	70.7	24.3	12.62	56.7	±1.7 %
		Y	4.37	68.2	23.8		47.2	
		Z	5.41	74.8	27.1		66.8	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	4.29	70.7	22.6	9.55	116.8	±1.7 %
		Y	3.95	68.2	21.8		96.1	
		Z	4.86	73.6	24.5		138.6	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	0.96	62.2	8.9	4.80	135.3	±1.9 %
		Y	1.12	65.3	11.3		141.0	
		Z	1.05	62.3	8.7		139.1	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	0.53	58.4	6.0	3.55	131.7	±1.7 %
		Y	0.86	63.5	9.5		144.8	
		Z	38.86	97.7	19.9		135.9	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	4.31	72.6	22.6	7.78	146.7	±1.7 %
		Y	4.25	72.0	23.1		136.1	
		Z	4.86	75.6	24.5		136.8	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.48	66.3	18.5	4.57	141.8	±0.9 %
		Y	4.50	65.6	18.5		138.4	
		Z	4.67	67.2	19.2		145.8	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	3.77	67.7	22.6	11.01	82.1	±1.4 %
		Y	3.60	66.5	22.7		68.6	
		Z	4.07	69.7	24.1		97.1	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.28	73.6	22.5	6.52	149.5	±1.7 %
		Y	3.98	71.2	21.9		142.7	
		Z	4.54	74.9	23.5		134.9	
10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.87	66.3	18.4	3.97	138.9	±0.7 %
		Y	3.84	65.5	18.4		135.4	
		Z	3.99	67.0	19.0		142.5	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	1.19	61.8	8.9	6.56	145.6	±1.9 %
		Y	1.75	67.1	11.8		131.7	
		Z	1.37	63.4	10.2		143.5	

10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	4.71	73.7	24.3	9.55	114.9	±2.7 %
		Y	4.59	72.7	24.5		96.4	
		Z	5.27	76.6	26.1		136.9	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.85	68.2	20.8	8.07	145.6	±3.0 %
		Y	9.82	67.8	20.9		141.9	
		Z	9.64	67.7	20.7		124.8	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.44	68.1	20.8	8.10	137.7	±3.0 %
		Y	9.52	67.8	21.0		135.6	
		Z	9.63	68.5	21.3		142.3	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	4.09	66.9	18.5	3.91	142.6	±0.7 %
		Y	4.05	66.1	18.5		139.2	
		Z	4.31	68.0	19.3		145.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.58	67.0	18.5	3.46	138.6	±0.7 %
		Y	3.52	66.1	18.5		135.6	
		Z	3.76	68.0	19.3		142.5	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.55	67.1	18.5	3.39	138.8	±0.7 %
		Y	3.45	66.0	18.3		135.3	
		Z	3.72	68.2	19.3		142.1	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	3.59	66.8	18.4	3.50	139.1	±0.7 %
		Y	3.53	65.9	18.3		135.3	
		Z	3.75	67.9	19.2		142.1	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	4.79	64.7	22.2	12.49	67.0	±0.9 %
		Y	4.55	62.7	21.6		55.7	
		Z	5.09	66.2	23.5		79.2	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.94	70.5	19.4	3.76	143.1	±0.5 %
		Y	4.58	67.9	18.5		142.3	
		Z	5.28	71.7	20.3		147.5	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.98	71.0	19.7	3.77	142.4	±0.7 %
		Y	4.65	68.7	19.0		140.8	
		Z	5.22	71.9	20.4		146.7	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	6.06	70.3	20.2	5.22	144.0	±0.9 %
		Y	6.09	69.1	20.0		144.9	
		Z	6.35	71.1	20.9		126.5	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.84	68.7	18.4	1.54	147.1	±0.7 %
		Y	2.69	67.9	18.5		142.7	
		Z	3.42	72.6	20.5		127.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.55	68.1	21.0	8.23	138.3	±3.0 %
		Y	9.63	67.9	21.1		135.2	
		Z	9.74	68.6	21.4		143.3	
10417-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.55	68.1	21.0	8.23	138.6	±3.0 %
		Y	9.57	67.7	21.0		135.1	
		Z	9.75	68.7	21.5		142.9	

10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.42	68.1	20.9	8.14	137.4	±2.7 %
		Y	9.48	67.8	21.1		133.4	
		Z	9.60	68.6	21.4		142.1	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	8.00	69.1	20.4	6.55	146.0	±1.4 %
		Y	8.03	68.3	20.3		145.6	
		Z	7.90	68.7	20.4		126.9	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	10.44	70.1	21.8	8.25	142.9	±3.0 %
		Y	10.66	69.7	21.9		145.3	
		Z	10.16	69.1	21.5		125.4	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.80	68.5	18.3	1.58	146.7	±0.7 %
		Y	2.68	67.7	18.4		142.1	
		Z	3.39	72.6	20.6		127.7	
10518-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	9.54	68.2	21.0	8.23	137.2	±2.7 %
		Y	9.60	67.9	21.1		134.4	
		Z	9.73	68.7	21.4		142.6	
10525-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	9.75	68.3	21.1	8.36	139.0	±3.0 %
		Y	9.84	68.1	21.3		136.8	
		Z	9.97	68.9	21.6		144.9	
10526-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	9.83	68.4	21.2	8.42	139.8	±3.0 %
		Y	9.87	68.1	21.3		136.8	
		Z	10.02	68.9	21.7		145.1	
10534-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	10.28	68.7	21.3	8.45	147.5	±3.3 %
		Y	10.29	68.4	21.4		142.9	
		Z	10.10	68.2	21.2		126.2	
10535-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	10.28	68.7	21.3	8.45	147.1	±3.3 %
		Y	10.31	68.5	21.5		143.9	
		Z	10.06	68.1	21.1		126.4	
10544-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	10.17	67.8	20.6	8.47	126.6	±3.0 %
		Y	10.49	68.4	21.3		147.4	
		Z	10.41	68.4	21.2		131.6	
10545-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	10.26	68.0	20.8	8.55	126.9	±3.0 %
		Y	10.58	68.5	21.4		147.6	
		Z	10.47	68.5	21.2		131.4	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.59	68.3	21.1	8.25	138.4	±3.0 %
		Y	9.65	68.0	21.2		135.3	
		Z	9.77	68.7	21.5		143.3	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	2.92	68.6	18.6	1.99	142.6	±0.9 %
		Y	2.91	68.8	19.2		138.5	
		Z	3.22	71.0	20.0		146.2	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	2.98	69.3	18.9	1.99	142.2	±0.7 %
		Y	2.73	67.6	18.5		137.3	
		Z	3.32	71.8	20.4		146.3	

10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	9.66	68.2	21.3	8.59	135.0	±3.0 %
		Y	9.71	67.9	21.3		131.3	
		Z	9.86	68.7	21.7		140.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	9.65	68.2	21.3	8.60	134.6	±3.0 %
		Y	9.72	68.0	21.4		130.7	
		Z	9.86	68.7	21.7		140.0	
10583-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	9.65	68.2	21.2	8.59	135.2	±3.0 %
		Y	9.73	68.0	21.4		131.7	
		Z	9.86	68.8	21.6		140.4	
10584-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	9.68	68.3	21.3	8.60	134.7	±3.0 %
		Y	9.70	67.9	21.4		131.0	
		Z	9.87	68.8	21.8		139.9	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	9.78	68.2	21.3	8.63	136.5	±3.3 %
		Y	9.77	67.8	21.3		132.6	
		Z	9.98	68.8	21.7		141.9	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	9.93	68.4	21.5	8.79	137.0	±3.3 %
		Y	9.95	68.0	21.5		132.6	
		Z	10.14	68.9	21.9		142.4	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.39	68.7	21.6	8.79	144.8	±3.3 %
		Y	10.30	68.2	21.6		138.5	
		Z	10.20	68.2	21.4		124.8	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.45	68.8	21.6	8.88	144.7	±3.5 %
		Y	10.43	68.4	21.7		139.6	
		Z	10.26	68.3	21.5		124.7	
10607-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	9.79	68.2	21.3	8.64	136.8	±3.0 %
		Y	9.85	67.9	21.4		133.4	
		Z	10.02	68.9	21.8		142.3	
10608-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	9.93	68.4	21.5	8.77	136.9	±3.3 %
		Y	9.99	68.1	21.6		132.2	
		Z	10.15	69.0	22.0		142.6	
10616-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	10.42	68.8	21.6	8.82	144.9	±3.3 %
		Y	10.38	68.3	21.6		139.5	
		Z	10.24	68.3	21.5		124.8	
10617-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	10.39	68.7	21.5	8.81	144.8	±3.5 %
		Y	10.40	68.4	21.7		139.7	
		Z	10.20	68.2	21.4		124.6	
10626-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	10.30	67.8	20.9	8.83	124.0	±3.0 %
		Y	10.61	68.4	21.5		143.7	
		Z	10.54	68.5	21.4		129.7	
10627-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	10.35	67.9	21.0	8.88	124.1	±3.0 %
		Y	10.68	68.6	21.7		144.0	
		Z	10.58	68.5	21.5		129.5	

10648-AAA	CDMA2000 (1x Advanced)	X	3.62	67.2	18.6	3.45	139.5	±0.7 %
		Y	3.49	66.1	18.5		135.6	
		Z	3.75	68.1	19.4		143.0	

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