



In Collaboration with

s p e a g
CALIBRATION LABORATORY

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7838

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.70	0.70	0.78	±10.0%
DCP(mV) ^B	114.5	112.9	114.6	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max Dev.	Max Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	222.3	±2.3%	±4.7%
		Y	0.0	0.0	1.0		219.9		
		Z	0.0	0.0	1.0		237.9		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	1.41	60.04	6.02	10.00	60	±3.0%	±9.6%
		Y	1.41	60.00	5.81		60		
		Z	1.51	60.38	5.84		60		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	0.86	60.00	4.85	6.99	80	±2.5%	±9.6%
		Y	0.90	60.00	4.45		80		
		Z	0.85	60.00	4.45		80		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	24.00	72.00	7.00	3.98	95	±2.2%	±9.6%
		Y	0.43	150.95	0.40		95		
		Z	0.25	151.92	1.33		95		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	15.40	129.87	3.35	2.22	120	±1.6%	±9.6%
		Y	10.43	159.92	8.47		120		
		Z	4.91	159.88	13.92		120		
10387-AAA	QPSK Waveform, 1 MHz	X	0.42	60.00	8.52	1.00	150	±3.5%	±9.6%
		Y	0.40	60.16	9.02		150		
		Z	0.41	61.66	10.52		150		
10388-AAA	QPSK Waveform, 10 MHz	X	0.98	61.40	10.04	0.00	150	±1.2%	±9.6%
		Y	1.09	63.16	11.61		150		
		Z	1.17	64.77	12.92		150		
10396-AAA	64-QAM Waveform, 100 kHz	X	1.71	63.67	14.90	3.01	150	±0.9%	±9.6%
		Y	1.74	64.91	16.07		150		
		Z	1.78	65.99	17.03		150		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	3.53	65.04	14.06	0.00	150	±3.8%	±9.6%
		Y	3.70	65.79	14.78		150		
		Z	3.82	66.54	15.36		150		

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 Page 5 and Page 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.



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Sensor Model Parameters

	C1 fF	C2 fF	α V ⁻¹	T1 ms.V ⁻²	T2 ms.V ⁻¹	T3 ms	T4 V ⁻²	T5 V ⁻¹	T6
X	8.17	58.24	32.02	3.91	0.00	4.90	0.51	0.00	1.01
Y	9.03	64.43	32.40	3.22	0.00	4.90	0.47	0.00	1.01
Z	9.14	65.00	32.42	3.78	0.00	4.90	0.49	0.00	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	64.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm



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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7838

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)	Unct. (k=2)
750	41.9	0.89	10.20	10.20	10.20	0.12	1.36	± 13%
835	41.5	0.90	9.77	9.77	9.77	0.13	1.29	± 13%
1750	40.1	1.37	8.40	8.40	8.40	0.25	0.96	± 13%
1900	40.0	1.40	8.03	8.03	8.03	0.21	1.14	± 13%
2100	39.8	1.49	8.04	8.04	8.04	0.19	1.20	± 13%
2300	39.5	1.67	7.80	7.80	7.80	0.57	0.67	± 13%
2450	39.2	1.80	7.55	7.55	7.55	0.58	0.69	± 13%
2600	39.0	1.96	7.37	7.37	7.37	0.57	0.69	± 13%
5250	35.9	4.71	5.35	5.35	5.35	0.50	1.30	± 14%
5600	35.5	5.07	4.75	4.75	4.75	0.50	1.30	± 14%
5750	35.4	5.22	4.86	4.86	4.86	0.45	1.40	± 14%

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is $\pm 10, 25, 40, 50$ 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 frequency up to 6 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to $\pm 10\%$ if liquid compensation formula is applied to measured SAR values. 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 $\pm 1\%$ for frequencies below 3 GHz and below $\pm 2\%$ for the frequencies between $3-6$ GHz at any distance larger than half the probe tip diameter from the boundary.



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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)	Unct. (k=2)
6500	34.5	6.07	5.46	5.46	5.46	0.15	1.40	±19%

^C Frequency validity at 6.5 GHz is -600/+700 MHz, and ±700 MHz at or above 7 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

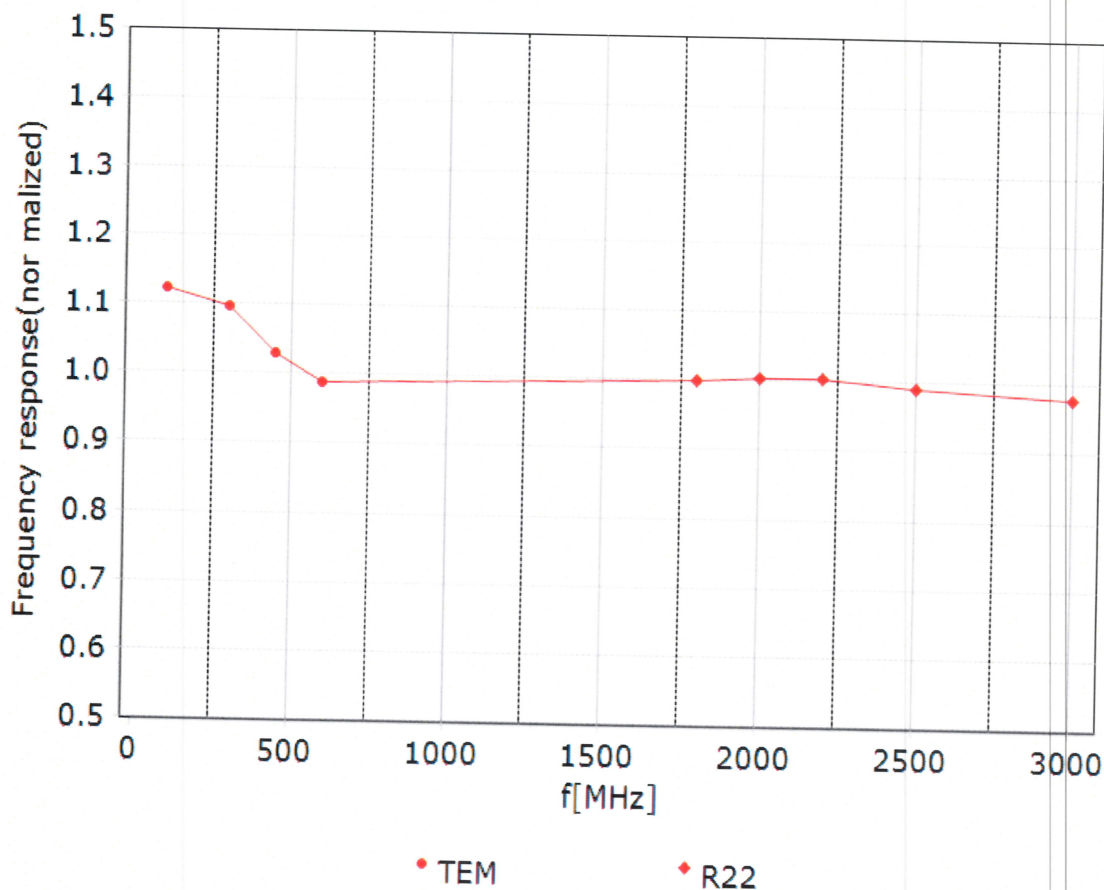
^F The probes are calibrated using tissue simulating liquids (TSL) that deviate for ϵ and σ by less than ±10% from the target values (typically better than ±6%) and are valid for TSL with deviations of up to ±10%.

^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; below ±2% for frequencies between 3-6 GHz; and below ±4% for frequencies between 6-10 GHz at any distance larger than half the probe tip diameter from the boundary.



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

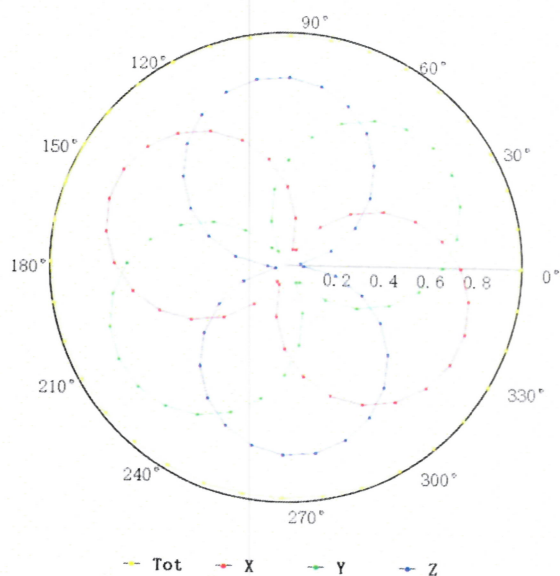


Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ ($k=2$)

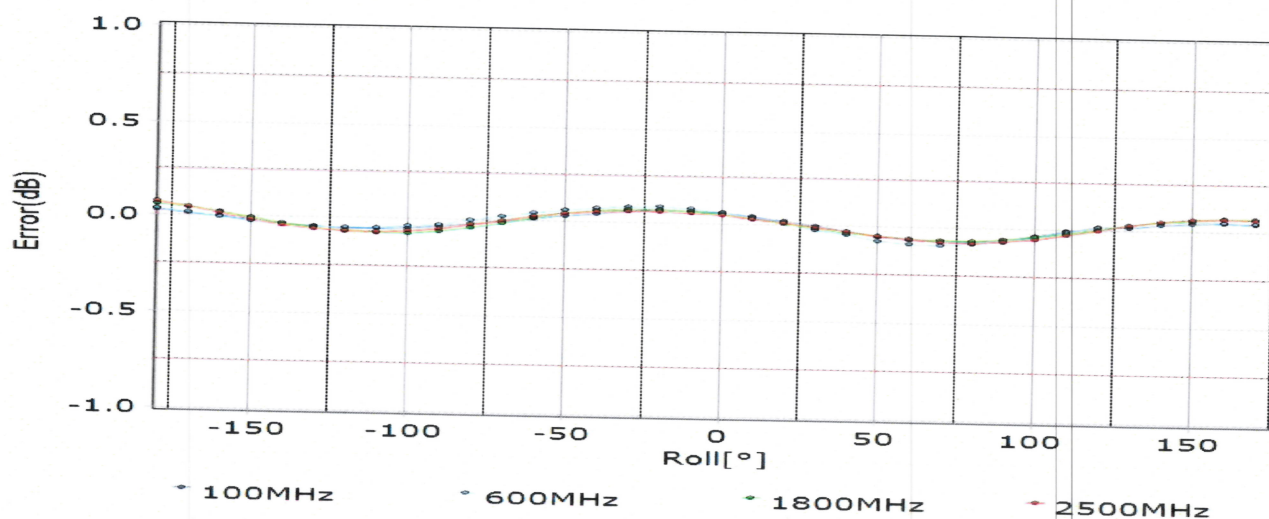
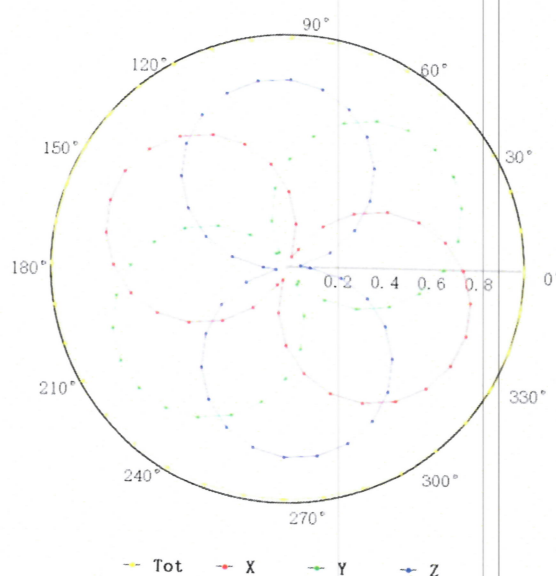
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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM



f=1800 MHz, R22



Uncertainty of Axial Isotropy Assessment: $\pm 1.2\%$ ($k=2$)