

## APPENDIX D: UNCERTAINTY BUDGET

Source of Uncertainty	Description (Anex)	Tolerance Value	Probability Distribution	Divisor	$c_i^{-1} (1-g)$	$c_i^{-1} (10-g)$	Standard Uncertainty (1-g)	Standard Uncertainty (10-g)	$v_i^2$ or $v_{eff}$
<b>Measurement System</b>									
Probe Calibration	E1.1	3.5	normal	1	1	1	3.5	3.5	
Axial Isotropy	E1.2	3.7	rectangular	3	$(1-cp)^{1/2}$	$(1-cp)1/2$	1.5	1.5	
Hemispherical Isotropy	E1.2	10.9	rectangular	3	cp	cp	4.4	4.4	
Boundary Effect	E1.3	1.0	rectangular	3	1	1	0.6	0.6	
Linearity	E1.4	4.7	rectangular	3	1	1	2.7	2.7	
Detection Limit	E1.5	1.0	rectangular	3	1	1	0.6	0.6	
Readout Electronics	E1.6	1.0	normal	1	1	1	1.0	1.0	
Response Time	E1.7	0.8	rectangular	3	1	1	0.5	0.5	
Integration Time	E1.8	1.7	rectangular	3	1	1	1.0	1.0	
RF Ambient Condition	E5.1	3.0	rectangular	3	1	1	1.7	1.7	
Probe Positioner Mech. Restrictions	E5.2	0.4	rectangular	3	1	1	0.2	0.2	
Probe Positioning with respect to Phantom Shell	E5.3	2.9	rectangular	3	1	1	1.7	1.7	
Extrapolation and Integration	E4.2	3.7	rectangular	3	1	1	2.1	2.1	
<b>Test Sample</b>									
Test Sample Positioning	E3.1.3	4.0	normal	1	1	1	4.0	4.0	11
Device Holder Uncertainty	E3.1.2	2.0	normal	1	1	1	2.0	2.0	8
Drift of Output Power	Section 5.6.2	3.5	rectangular	3	1	1	2.0	2.0	
<b>Phantom and Setup</b>									
Phantom Uncertainty (shape and thickness tolerance)	E2.1	3.4	rectangular	3	1	1	2.0	2.0	
Liquid Conductivity (target)	E2.2	3.8	rectangular	3	0.7	0.5	1.5	1.1	
Liquid Conductivity (meas.)	E2.2	2.0	rectangular	3	0.7	0.5	0.8	0.6	
Liquid Permittivity (target)	E2.2	4.7	rectangular	3	0.6	0.5	1.6	1.4	
Liquid Permittivity (meas.)	E2.2	2.0	rectangular	3	0.6	0.5	0.7	0.6	
<b>Combined Uncertainty</b>			RSS				9.3	9.2	
<b>Combined Uncertainty (coverage factor = 2)</b>			Normal (k=2)				18.6	18.4	

