5.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2003 for both Handset SAR tests and Validation uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

Table 11: Uncertainty Budget for DASY4 Version V4.4 Build 3 – EUT SAR test

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i (%)	10g u_i (%)	v_i
Measurement System									
Probe Calibration (k=1) (standard calibration)	E.2.1	10	N	1	1	1	10.0	10.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	10	R	1.73	1	1	5.8	5.8	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty	E.4.1	3.34	N	1	1	1	3.3	3.3	7
Output Power Variation – SAR Drift Measurement	6.6.2	7.15	R	1.73	1	1	4.1	4.1	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	2.5	N	1	0.64	0.43	1.6	1.1	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	2.5	N	1	0.6	0.49	1.5	1.2	5
Combined standard Uncertainty			RSS				14.6	14.5	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				29.3	28.92	

Estimated total measurement uncertainty for the DASY4 measurement system was ± 14.6%. The extended uncertainty (K = 2) was assessed to be ± 29.3% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table 12: Uncertainty Budget for DASY4 Version V4.4 Build 3 - Validation

a	b	c	d	e= f(d,k)	f	g	h=cxf/e	i=cxg/e	k
Uncertainty Component	Sec.	Tol. (%)	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i (%)	10g u_i (%)	v_i
Measurement System									
Probe Calibration (k=1) (standard calibration)	E.2.1	4.8	N	1	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Hemispherical Isotropy	E.2.2	0	R	1.73	1	1	0.0	0.0	∞
Boundary Effect	E.2.3	1	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1	N	1	1	1	1.0	1.0	∞
Response Time	E.2.7	0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	0.05	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	2.9	R	1.73	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning		2	R	1.73	1	1	1.2	1.2	∞
Device Holder Uncertainty		4.7	R	1.73	1	1	2.7	2.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.43	1.7	1.2	∞
Liquid Conductivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.43	0.9	0.6	5
Liquid Permittivity – Deviation from target values	E.3.2	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	E.3.3	2.5	N	1.73	0.6	0.49	0.9	0.7	5
Combined standard Uncertainty			RSS				8.0	7.8	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				16.0	15.63	

Estimated total measurement uncertainty for the DASY4 measurement system was ±8.0%. The extended uncertainty (K = 2) was assessed to be ±16% based on 95% confidence level. The uncertainty is not added to the Validation measurement result.

6.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table 13: SPEAG DASY4 Version V4.4 Build 3

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	Yes
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	Yes
SAM Phantom	SPEAG	N/A	1260	Not applicable	Yes
SAM Phantom	SPEAG	N/A	1060	Not applicable	No
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	Yes
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	No
Flat Phantom	SPEAG	PO1A 6mm	1003	Not Applicable	No
Data Acquisition Electronics	SPEAG	DAE3 V1	359	09-July-2005	No
Data Acquisition Electronics	SPEAG	DAE3 V1	442	06-Dec-2005	Yes
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	No
Probe E-Field	SPEAG	ET3DV6	1380	14-July-2005	No
Probe E-Field	SPEAG	ET3DV6	1377	29-Sept -2005	Yes
Probe E-Field	SPEAG	ES3DV6	3029	1-Nov-2005	No
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	27- Nov-2005	No
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	15-Dec-2006	No
Antenna Dipole 900 MHz	SPEAG	D900V2	047	12-July-2006	Yes
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	25-May-2006	No
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	13-July-2006	Yes
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	2-Nov-2006	No
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	05-Oct-2005	No
RF Amplifier	EIN	603L	N/A	In test	No
RF Amplifier	Mini-Circuits	ZHL-42	N/A	In test	Yes
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	In test	No
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*Not Required	Yes
RF Power Meter Dual	Hewlett Packard	437B	3125012786	26-May-2005	Yes
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	27-May-2005	Yes
RF Power Meter Dual	Gigatronics	8542B	1830125	13-April-2006	Yes
RF Power Sensor	Gigatronics	80301A	1828805	13-April-2006	Yes
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*Not Required	Yes
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*Not Required	Yes
Network Analyser	Hewlett Packard	8714B	GB3510035	10-Sept-2005	Yes
Network Analyser	Hewlett Packard	8753ES	JP39240130	06-Aug-2006	No
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	In test	No
Dual Directional Coupler	NARDA	3022	75453	In test	Yes

*Reference meter only

7.0 SAR TEST METHOD

7.1 Description of the Test Positions (Body Sections)

The SAR measurements were performed in the test positions listed below, using the centre frequency of the transmitter. The test positions were derived to account for all possible scenarios of device usage. The configuration giving the maximum mass-averaged SAR is used to test the low-end and high-end frequencies of the transmitting band. All SAR measurements were performed in the flat phantom. The SAR validation was performed in the SAM phantom.
See Appendix A for photos of test positions.

7.1.1 *"Belt-Clip Position"*

The device was positioned with the vertical centre line of the device edge parallel to the longest dimension of the FLAT PHANTOM 10.1 phantom. While maintaining the device in this plane, the vertical centre line was rotated until belt-clip (left side of the device was facing the flat phantom). Once in this position the device is moved towards the phantom until the device is touching the phantom in two sections. This was performed with the holster. See Appendix A for photos.

7.1.2 *"Front Side (Keypad Position)"*

The device was positioned with the vertical centre line of the device parallel to the longest dimension of the FLAT PHANTOM 10.1 phantom. While maintaining the device in this plane, the vertical centre line was rotated until the keypad side of the device was facing the flat phantom. Once in this position the device is moved towards the phantom until the device is touching the phantom. This position was performed without the non-metallic holster. See Appendix A for photos.

7.1.3 *"Back Side (Hand Held Position)"*

The device was positioned with the vertical centre line of the device parallel to the longest dimension of the FLAT PHANTOM 10.1 phantom. While maintaining the device in this plane, the vertical centre line was rotated until the keypad was facing away from the flat phantom. Once in this position the device is moved towards the phantom until the device is touching the phantom in two sections. This position was performed without the non-metallic holster. See Appendix A for photos.

7.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes etc)

The SAR was measured at three test channels for each band of operation with the test sample operating as maximum power, as specified in section 2.2.

7.3 FCC RF Exposure Limits for Occupational/ Controlled Exposure

Spatial Peak SAR Limits For:	
Partial-Body:	8.0 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	20.0 mW/g (averaged over 10g cube of tissue)

7.4 FCC RF Exposure Limits for Un-controlled/Non–occupational

Spatial Peak SAR Limits For:	
Partial-Body:	1.6 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	4.0 mW/g (averaged over 10g cube of tissue)

8.0 SAR EVALUATION RESULTS

The SAR values averaged over 1g and 10g tissue masses were determined for the sample device for the belt-clip and hand-held configurations of the phantom. The results are given in Table 14 (850 MHz) and Table 15 (1900 MHz).

The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the devices, are contained in Appendix B of this report.

8.1 SAR Measurement Results for 850 MHz

Table 14: SAR Measurement Results – 850 MHz

Test Position	Plot Number	Test Channel	Test Freq. (MHz)	SAR Level for (1g) mW/g	DASY4 Measured Drift (dB)
Hand Held Back Side Position	1	128	824	0.471	0.00
	2	190	836	0.453	-0.10
	3	251	849	0.416	0.00
Hand Held Front Side Position	4	190	836	0.062	-0.10
Belt-Clip – with holster	5	190	836	0.187	-0.10

Note: The uncertainty of the system (±29.3%) has not been added to the result.

The maximum measured SAR level in the 850MHz band was 0.471 mW/g for a 1-gram cube this value was measured in the Hand Held Back Side Position at a frequency of 824 MHz (Channel 128).

The FCC SAR limit is 1.6 mW/g measured in a 1g cube of tissue for un-controlled partial body exposure.

8.2 SAR Measurement Results for 1900 MHz

Table 15: SAR Measurement Results – 1900 MHz

Test Position	Plot Number	Test Channel	Test Freq. (MHz)	SAR Level for (1g) mW/g	DASY4 Measured Drift (dB)
Hand Held Back Side Position	6	512	1850	0.518	-0.10
	7	661	1880	0.650	0.00
	8	810	1910	0.761	-0.01
Hand Held Front Side Position	9	661	1880	0.068	0.01
Belt-Clip – with holster	10	661	1880	0.239	-0.30

Note: The uncertainty of the system (±29.3%) has not been added to the result.

The maximum measured SAR level in the 1900MHz band was 0.761 mW/g for a 1-gram cube this value was measured in the Hand Held Back Side Position at a frequency of 1910 MHz (Channel 810).

The FCC SAR limit for RF devices used at the body or head is 1.6 mW/g measured in a 1g cube of tissue. The SAR limit for the hands is 4.0mW/g measured in a 10g cube of tissue.

9.0 COMPLIANCE STATEMENT

The Keycorp Ltd, Dual Band GSM Cellular EFTPOS Terminal was tested on behalf of Keycorp Ltd It complied with the FCC and RSS-102 SAR requirements.

The highest SAR level recorded for the 850 MHz GSM band was 0.471 mW/g, which is below the limit of 1.6 mW/g into a 1g cube averaging mass, even taking into account the measurement uncertainty of 29.3%.

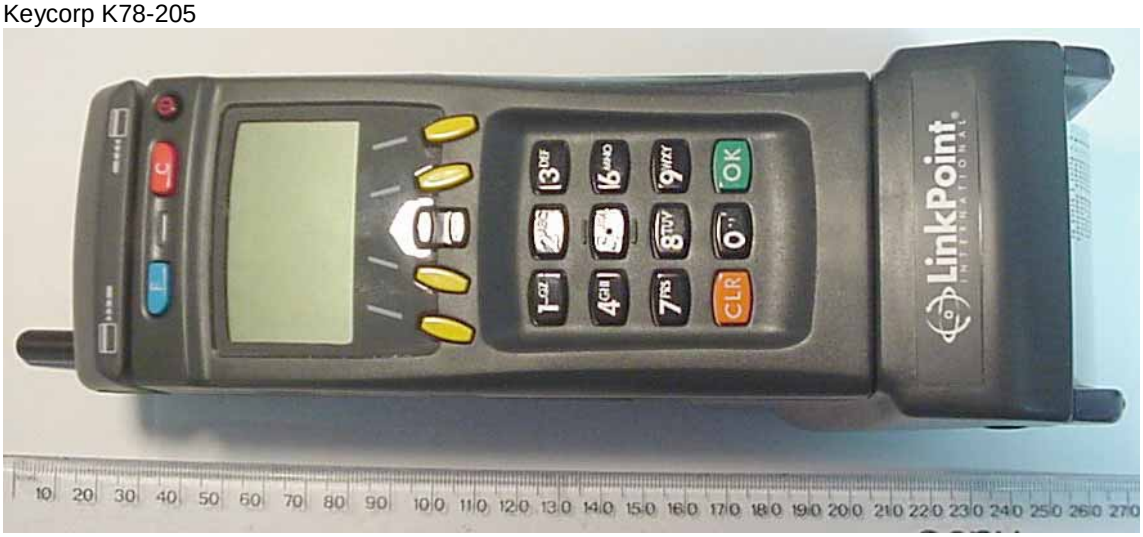
The highest SAR level recorded for the 1900 MHz GSM band was 0.761 mW/g, which is below the limit of 1.6 mW/g into a 1g cube averaging mass, even taking into account the measurement uncertainty of 29.3%.

APPENDIX A1
TEST SAMPLE PHOTOGRAPHS

Battery #1

Battery #2

Keycorp K78-205



Keycorp K78-205

APPENDIX A2
TEST SAMPLE PHOTOGRAPHS

Keycorp K78-205

APPENDIX A3
TEST SETUP PHOTOGRAPHS

Hand Held Back Side Position

Hand Held Back Side Position

APPENDIX A4
TEST SETUP PHOTOGRAPHS

Hand Held Front Side Position

Hand Held Front Side Position

APPENDIX A5
TEST SETUP PHOTOGRAPHS

Belt Clip Position

Belt Clip Position