SAR Compliance Test Report

Test report no.:	02-RF-0159.001	**Date of report:**	9 December, 2002
Number of pages:	22	**Contact person:**	Nerina Walton
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Tested devices: **GMLNPD-4AW, Model 3585i**
BLC-2, HDB-4, HDC-5, Regular Cover, Erica Cover

Supplement reports: -

Testing has been carried out in accordance with:
IEEE Std 1528-200X, Draft CBD 1.0 – April 4, 2002
Draft Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques
FCC Supplement C Edition, 01-01
Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

Documentation: The documentation of the testing performed on the tested devices is archived for 15 years at Test & Certification Center (TCC) Dallas

Test results: **The tested device complies with the requirements in respect of all parameters subject to the test.**

The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.

Date and signatures: 9 December, 2002

For the contents:

On behalf of
Rudy Lerma
Alan C. Ewing
TCC Line Manager

Nerina Walton
Test Engineer

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1. QUALITY SYSTEM

The quality system in place for TCC-Dallas conforms to ISO/IEC 17025 and has been audited to the standard by A2LA (American Association of Laboratory Accreditation). Appendix D of this report contains the scope of accreditation for A2LA. TCC – Dallas has also been audited using the ISO 9000 Quality System, as part of Nokia Mobile Phones, Inc., by ABS (American Bureau of Shipping) Quality Evaluations Inc.

TCC-Dallas is a recognized laboratory with the Federal Communications Commission in filing applications for Certification under Parts 15 and 18, Registration Number 100060, and Industry Canada, Registration Number IC 661.

2. SUMMARY FOR SAR TEST REPORT

Date of test	2002.09.16 – 2002.10.11
Contact person	Nerina Walton
Test plan referred to	-
FCC ID	GMLNPD-4AW
SN, HW, SW and DUT numbers of tested device	ESN: 235/14068911, HW: Proto B4.0, SW: B130b01.nep, Type: NPD-4AW, DUT: 02-RF-0159, 01 of 06
Accessories used in testing	BLC-2 Battery, HDB-4 Headset, HDC-5 Headset, Erica Cover (B4.1)
Notes	-
Document code	02-RF-0159.001
Responsible test engineer	Nerina Walton
Measurement performed by	Mark Severson / Bob Alexander

2.1 Maximum Results Found during SAR Evaluation

The equipment is deemed to fulfill the requirements if the measured values are less than or equal to the limit.

2.1.1 Head Configuration

Mode	Ch / *f* (MHz)	Power (dBm)	Position	Limit (mW/g)	Measured (mW/g)	Result
AMPS	799 / 848.97	26.35	Left Touch, Regular Cover, Antenna Extended	1.6	1.13	**PASSED**
CDMA 800	1013 / 824.70	25.80	Left Touch, Regular Cover, Antenna Extended	1.6	1.04	**PASSED**
CDMA 1900	600 / 1880.00	23.22	Left Touch, Regular Cover, Antenna Retracted	1.6	1.13	**PASSED**

2.1.2 Body Worn Configuration

Mode	Ch / *f* (MHz)	Power (dBm)	Position	Limit (mW/g)	Measured (mW/g)	Result
AMPS	384 / 836.52	26.32	Flat, Regular Cover, Antenna Retracted, HDC-5 Headset	1.6	1.03	**PASSED**
CDMA 800	384 / 836.52	25.74	Flat, Regular Cover, Antenna Retracted, HDB-4 Headset	1.6	0.82	**PASSED**
CDMA 1900	1175 / 1908.75	23.45	Flat, Regular Cover, Antenna Extended, HDC-5 Headset	1.6	0.54	**PASSED**

2.1.3 Measurement Uncertainty

Combined Standard Uncertainty	**± 13.6%**
Expanded Standard Uncertainty (k=2)	**± 27.1%**

3. DESCRIPTION OF TESTED DEVICE

Device category	Portable device		
Exposure environment	Uncontrolled exposure		
Unit type	Prototype unit		
Case type	Fixed case		
Mode of Operation	AMPS	CDMA 800	CDMA 1900
Maximum Device Rating	Power Class III	Power Class III	Power Class III
Modulation Mode	Frequency Modulation (FM)	Quadrature Phase Shift Keying	Quadrature Phase Shift Keying
Duty Cycle	1	1	1
Transmitter Frequency Range (MHz)	824.04 - 848.97	824.70 - 848.31	1851.25 – 1908.75

3.1 Picture of Phone

The tested device, GMLNPD-4AW is shown below with the antenna retracted, displayed with each of the tested covers: -

Regular Cover

Erica Cover

The tested device, GMLNPD-4AW, is shown below with the antenna extended, displayed with the Regular Cover: -

3.2 Description of the Antenna

Type	Retractable whip with internal PIFA
Location	Back of phone, right hand side

3.3 Battery Options

There is only one battery available for the tested device, a rechargeable Li-ion battery, BLC-2.

3.4 Body Worn Accessories

No body worn accessories are available for the GMLNPD-4AW.

4. TEST CONDITIONS

4.1 Ambient Conditions

Ambient temperature (°C)	22±2
Tissue simulating liquid temperature (°C)	21±2
Humidity (%)	49

4.2 RF characteristics of the test site

Tests were performed in a fully enclosed RF shielded environment.

4.3 Test Signal, Frequencies, and Output Power

The device was controlled by using a radio tester. Communication between the device and the tester was established by air link.

Measurements were performed on the lowest, middle and highest channels of the operating band.

The phone was set to maximum power level during all tests and at the beginning of each test the battery was fully charged.

The DASY3 system measures power drift during SAR testing by comparing e-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

5. DESCRIPTION OF THE TEST EQUIPMENT

The measurements were performed with an automated near-field scanning system, DASY3, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.

Test Equipment	Model	NMP #	Serial Number	Due Date
DASY3, Data Acquisition	DAE V1	2292	389	07/03
E-field Probe	ET3DV6	2954	1504	07/03
Dipole Validation Kit	D835V2	2951	415	05/03
Dipole Validation Kit	D1900V2	2952	504	05/03

E-field probe and dipole validation kit calibration records are presented in Appendix D.

Additional equipment (required for validation).

Test Equipment	Model	NMP #	Serial Number	Due Date
Signal Generator	HP 8648C	0409	3836A04346	06/03
Amplifier	AR 5S1G4	0188	25583	-
Coupler	AR DC7144	2057	25304	-
Power Meter	Boonton 4232A	2996	64701	05/03
Power Sensor	Boonton 51015	2997	32187	05/03
Power Sensor	Boonton 51015	2998	32188	05/03
Thermometer	Omega CL27	3391	T-228450	03/03
Network Analyzer	HP 8720D	0455	US38431353	06/03
Dielectric Probe Kit	Agilent 85070C	3089	US99360172	-

The calibration interval on all items listed above can be obtained from the Engineering Services Group within NMP, Product Creation - Dallas. Where relevant, measuring equipment is subjected to in-service checks between testing. TCC - Dallas shall notify clients promptly, in writing, of identification of defective measuring equipment that casts doubt on the validity of results given in this report.

5.1 System Accuracy Verification

The manufacturer calibrates the probes annually. Dielectric parameters of the simulating liquids are measured using an Agilent 85070C dielectric probe kit and an HP 8720D network analyzer.

SAR measurements of the tested device were performed within 24 hours of system accuracy verification, which was done using the dipole validation kit.

The dipole antenna's, which are manufactured by Schmid & Partner Engineering AG, are matched to be used near a flat phantom filled with tissue simulating solution. Length of the 835MHz dipole is 161mm with an overall height of 330mm; length of the 1900MHz dipole is 68mm with an overall height of 300mm. A specific distance holder is used in the positioning to ensure correct spacing between the phantom and the dipole.

A power level of 250 mW was supplied to the dipole antenna placed under the flat section of the SAM phantom. Validation results are in the table below and a print out of the validation tests are presented in Appendix B. All the measured parameters were within specification.

5.1.1 Head Tissue

Tissue	*f* (MHz)	Description	SAR (W/kg), 1g	Dielectric Parameters		Temp (°C)
				ε_r	σ (S/m)	
Head	835	Measured, 16-Sep-02	10.8	40.7	0.89	20.8
		Measured, 18-Sep-02	11.0	40.3	0.91	21.2
		Measured, 19-Sep-02	11.0	40.5	0.91	20.7
		Measured, 24-Sep-02	11.0	39.9	0.91	21.4
		Measured, 25-Sep-02	11.0	40.3	0.91	20.8
		Measured, 26-Sep-02	11.0	40.2	0.91	21.2
		Measured, 2-Oct-02	11.1	40.9	0.92	21.2
		Measured, 8-Oct-02	11.1	40.9	0.92	21.4
		Measured, 9-Oct-02	11.1	40.6	0.92	21.3
		Measured, 5-Dec-02	10.7	42.0	0.90	21.0
		Reference Result	10.1	41.7	0.89	N/A
Head	1900	Measured, 17-Sept-02	42.8	39.1	1.43	21.0
		Measured, 30-Sept-02	42.0	40.3	1.42	20.8
		Measured, 1-Oct-02	42.4	40.4	1.46	21.3
		Measured, 10-Oct-02	43.2	40.4	1.44	21.3
		Reference Result	42.8	38.5	1.44	N/A

5.1.2 Muscle Tissue

Tissue	*f* (MHz)	Description	SAR (W/kg), 1g	Dielectric Parameters		Temp (°C)
				ε_r	σ (S/m)	
Muscle	835	Measured, 27-Sep-02	10.6	56.0	0.95	21.7
		Measured, 3-Oct-02	10.6	56.3	0.95	21.7
		Measured, 4-Oct-02	10.6	55.5	0.94	21.1
		Measured, 5-Oct-02	10.7	55.5	0.94	21.6
		Measured, 7-Oct-02	10.4	56.4	0.93	20.4
		Measured, 8-Oct-02	10.4	56.2	0.93	21.4
		Reference Result	10.4	55.4	0.97	N/A
Muscle	1900	Measured, 10-Oct-02	42.8	54.3	1.56	19.7
		Measured, 11-Oct-02	42.0	53.8	1.54	21.2
		Reference Result	43.6	51.9	1.58	N/A

5.2 Tissue Simulants

All dielectric parameters of tissue simulants were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the ear reference point of the phantom was 15cm ± 5mm during all tests. Volume for each tissue simulant was 26 litres.

5.2.1 Head Tissue Simulant

The composition of the brain tissue simulating liquid for 835 MHz is: -

51.07%	De-Ionized Water
47.31%	Sugar
1.15%	Salt
0.23%	HEC
0.24%	Bactericide

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
836.52	Measured, 16-Sep-02	40.7	0.89	20.8
	Measured, 18-Sep-02	40.2	0.91	21.2
	Measured, 19-Sep-02	40.5	0.91	20.7
	Measured, 24-Sep-02	39.9	0.91	21.4
	Measured, 25-Sep-02	40.3	0.91	20.8
	Measured, 26-Sep-02	40.2	0.91	21.2
	Measured, 2-Oct-02	40.9	0.92	21.2
	Measured, 8-Oct-02	40.8	0.92	21.4
	Measured, 9-Oct-02	40.6	0.92	21.3
	Measured, 5-Dec-02	42.0	0.90	21.0
	Recommended Values	41.5	0.90	N/A

The composition of the brain tissue simulating liquid for 1900 MHz is: -

44.91%	2-(2-butoxyethoxy) Ethanol
54.88%	De-Ionized Water
0.21%	Salt

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
1880	Measured, 17-Sept-02	39.1	1.41	21.0
	Measured, 30-Sept-02	40.4	1.40	20.8
	Measured, 1-Oct-02	40.5	1.44	21.3
	Measured, 10-Oct-02	40.5	1.44	21.3
	Recommended Values	40.0	1.40	N/A

Recommended values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

5.2.2 Muscle Tissue Simulant

The composition of the muscle tissue simulating liquid for 835 MHz is: -

65.45% De-Ionized Water
34.31% Sugar
0.62% Salt
0.10% Bactericide

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
836.52	Measured, 27-Sep-02	56.0	0.95	21.7
	Measured, 3-Oct-02	56.3	0.95	21.7
	Measured, 4-Oct-02	55.6	0.94	21.1
	Measured, 5-Oct-02	55.5	0.94	21.6
	Measured, 7-Oct-02	56.4	0.93	20.4
	Measured, 8-Oct-02	56.2	0.93	21.4
	Recommended Values	55.2	0.97	N/A

The composition of the muscle tissue simulating liquid for 1900 MHz is: -

69.02% De-Ionized Water
30.76% Diethylene Glycol Monobutyl Ether
0.22% Salt

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
1880	Measured, 10-Oct-02	54.4	1.53	19.7
	Measured, 11-Oct-02	54.0	1.52	21.2
	Recommended Values	53.3	1.52	N/A

Recommended values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

5.3 Phantoms

"SAM v4.0" phantom", manufactured by SPEAG, was used during the measurement. It has a fiberglass shell integrated into a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference markings on the phantom allow the complete set-up of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

The thickness of phantom shell is 2 mm except for the ear, where an integrated ear spacer provides a 6 mm spacing from the tissue boundary. Manufacturer reports tolerance in shell thickness to be ±0.1mm.

5.4 Isotropic E-Field Probe ET3DV6

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)
Calibration	Calibration certificate in Appendix D
Frequency	10 MHz to 3 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

6. DESCRIPTION OF THE TEST PROCEDURE

6.1 Test Positions

The device was placed into a holder using a special positioning tool, which aligns the bottom of the device with the holder and ensures that holder contacts only to the sides of the device. After positioning is done, the tool is removed. This method provides standard positioning and separation, and also ensures free space for antenna.

Device holder was provided by SPEAG together with the DASY3.

6.1.1 Against Phantom Head

Measurements were made on both the "left hand" and "right hand" side of the phantom.

The device was positioned against phantom according to OET Bulletin 65 (97-01) Supplement C (01-01). Definitions of terms used in aligning the device to a head phantom are available in IEEE Std 1528-200X “Draft Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”

6.1.1.1 Initial Ear Position

The device was initially positioned with the earpiece region pressed against the ear spacer of a head phantom parallel to the “Neck-Front” line defined along the base of the ear spacer that contains the “ear reference point”. The “test device reference point” is aligned to the “ear reference point” on the head phantom and the “vertical centerline” is aligned to the “phantom reference plane”.

6.1.1.2 Touch Position

“Initial ear position” alignments are maintained and the device is brought toward the mouth of the head phantom by pivoting along the “Neck-Front” line until any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom or when any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

The following picture shows the tested device in the left touch position:

6.1.1.3 Tilt Position

In the "Touch Position", if the earpiece of the device is not in full contact with the phantom's ear spacer and the peak SAR location for the "touch position" is located at the ear spacer region or corresponds to the earpiece region of the handset, the device is returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer. Otherwise, the device is moved away from the cheek perpendicular to the line passes through both "ear reference points" for approximate 2-3 cm. While it is in this position, the device is tilted away from the mouth with respect to the "test device reference point" by 15°. After the tilt, it is then moved back toward the head perpendicular to the line passes through both "ear reference points" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process is repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously.

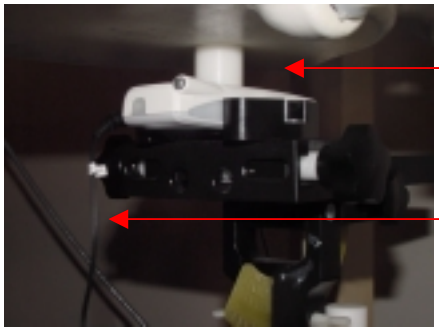
The following picture shows the tested device in the left tilt position:

6.1.2 Body Worn Configuration

Since there are no body worn accessories available for the GMLNPD-4AW, body SAR measurements were performed with the antenna facing towards the flat part of the phantom with a separation distance of 22mm.

Body SAR measurements were performed with the HDC-5 headset connected and were then repeated with the HDB-4 headset connected.

The following picture shows the tested device in the body test position: -



Note: the 22mm spacer was removed during the SAR measurement.

6.2 Scan Procedures

First coarse scans are used for quick determination of the field distribution. Next a cube scan, 5x5x7 points; spacing between each point 8x8x5 mm, is performed around the highest E-field value to determine the averaged SAR-distribution over 1g.

6.3 SAR Averaging Methods

The maximum SAR value is averaged over its volume using interpolation and extrapolation.

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot" -condition [W. Gander, Computermathematik, p. 141-150] (x, y and z -directions) [Numerical Recipes in C, Second Edition, p 123].

The extrapolation is based on least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 30 mm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1mm from one another.

7. MEASUREMENT UNCERTAINTY

7.1 Description of Individual Measurement Uncertainty

7.1.1 Assessment Uncertainty

Uncertainty description	Uncert. value %	Probability distribution	Div.	c_i	Stand. uncert (1g) %	v_i or v_{eff}
Measurement System						
Probe calibration	± 4.4	normal	1	1	± 4.4	∞
Axial isotropy of the probe	± 4.7	rectangular	√3	$(1-c_p)^{1/2}$	± 1.9	∞
Sph. Isotropy of the probe	± 9.6	rectangular	√3	$(c_p)1^{1/2}$	± 3.9	∞
Spatial resolution	± 0.0	rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	normal	1	1	± 1.0	∞
Response time	± 0.8	rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	rectangular	√3	1	± 1.7	∞
Mech. constrains of robot	± 0.4	rectangular	√3	**1**	± 0.2	∞
Probe positioning	± 2.9	rectangular	√3	1	± 1.7	∞
Extrap. and integration	± 3.9	rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 6.0	normal	0.89	1	± 6.7	12
Device holder uncertainty	± 5.0	normal	0.84	1	± 5.9	8
Power drift	± 5.0	rectangular	√3	1	± 2.9	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	rectangular	√3	**1**	± 2.3	∞
Liquid conductivity (target)	± 5.0	rectangular	√3	**0.6**	± 1.7	∞
Liquid conductivity (meas.)	± 10.0	rectangular	√3	**0.6**	± 3.5	∞
Liquid permittivity (target)	± 5.0	rectangular	√3	**0.6**	± 1.7	∞
Liquid permittivity (meas.)	± 5.0	rectangular	√3	**0.6**	± 1.7	∞
Combined Standard Uncertainty					± 13.6	
Expanded Standard Uncertainty (k=2)					± 27.1	

8. RESULTS

Corresponding SAR distribution print outs of maximum results in every operating mode and position (indicated in bold), are shown in Appendix C1 and Appendix C2; they also includes Z-plots of maximum measurement results in head and body worn configurations. The SAR distributions are substantially similar or equivalent to the plots submitted, regardless of used channel in each mode and position unless otherwise presented.

8.1 Head Configuration

8.1.1 Regular Cover

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)			
				Left-hand		Right-hand	
				Touch	Tilt	Touch	Tilt
AMPS	991 / 824.04	26.30	Extended	1.09	0.63	**1.11**	0.56
			Retracted	0.84	0.57	0.83	0.50
	384 / 836.52	26.32	Extended	1.07	0.73	1.04	0.63
			Retracted	0.97	0.66	0.96	0.59
	799 / 848.97	26.35	Extended	**1.13**	**0.83**	0.97	**0.64**
			Retracted	**1.09**	**0.78**	**1.07**	**0.73**

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)			
				Left-hand		Right-hand	
				Touch	Tilt	Touch	Tilt
CDMA 800	1013 / 824.70	25.80	Extended	**1.04**	0.62	**1.01**	**0.61**
			Retracted	0.83	0.52	0.79	0.46
	384 / 836.52	25.74	Extended	1.00	0.68	0.98	0.57
			Retracted	0.86	0.57	0.90	0.58
	777 / 848.31	25.70	Extended	1.03	**0.74**	0.93	0.54
			Retracted	**1.03**	**0.73**	**1.00**	**0.66**

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)			
				Left-hand		Right-hand	
				Touch	Tilt	Touch	Tilt
CDMA 1900	25 / 1851.25	23.10	Extended	**0.92**	**0.79**	**0.91**	**0.69**
			Retracted	1.08	0.84	0.95	0.83
	600 / 1880.00	23.22	Extended	0.87	0.67	0.73	**0.69**
			Retracted	**1.13**	**0.97**	0.94	0.85
	1175 / 1908.75	23.45	Extended	0.87	0.64	0.71	0.58
			Retracted	**1.13**	0.96	**1.05**	**0.88**

8.1.2 Erica Cover

Since the Erica Cover provides a greater distance to the head phantom than the Regular Cover, it is expected to give lower head SAR results. On this basis, SAR measurements were performed on the tested device in those modes / frequencies and head positions that had a SAR value of 0.80mW/g or higher when measured with the Regular Cover.

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)			
				Left-hand		Right-hand	
				Touch	Tilt	Touch	Tilt
AMPS	991 / 824.04	26.30	Extended	0.69	-	0.74	-
			Retracted	0.51	-	0.53	-
	384 / 836.52	26.32	Extended	0.69	-	**0.77**	-
			Retracted	0.58	-	0.68	-
	799 / 848.97	26.35	Extended	**0.75**	**1.01**	**0.77**	**0.81**
			Retracted	**0.73**	**0.83**	**0.77**	**0.69**

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)			
				Left-hand		Right-hand	
				Touch	Tilt	Touch	Tilt
CDMA 800	1013 / 824.70	25.80	Extended	0.62	-	0.67	**0.60**
			Retracted	0.60	-	0.48	-
	384 / 836.52	25.74	Extended	**0.65**	-	**0.70**	-
			Retracted	0.70	-	0.60	-
	777 / 848.31	25.70	Extended	0.64	**0.90**	0.60	-
			Retracted	**0.83**	**0.77**	**0.72**	**0.64**

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)			
				Left-hand		Right-hand	
				Touch	Tilt	Touch	Tilt
CDMA 1900	25 / 1851.25	23.10	Extended	**0.63**	**0.70**	**0.57**	**0.65**
			Retracted	0.66	0.67	0.59	0.56
	600 / 1880.00	23.22	Extended	**0.63**	-	-	-
			Retracted	0.74	**0.73**	0.60	0.60
	1175 / 1908.75	23.45	Extended	0.56	-	-	-
			Retracted	**0.76**	**0.73**	**0.72**	**0.61**

8.2 Body Worn Configuration

Body SAR measurements were performed on the tested device in all three modes for all frequencies and body positions, i.e. with the HDB-4 headset and then the HDC-5 headset connected.

8.2.1 Regular Cover

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)	
				HDB-4	HDC-5
AMPS	991 / 824.04	26.30	Extended	0.53	0.48
			Retracted	0.61	0.66
	384 / 836.52	26.32	Extended	0.52	**0.74**
			Retracted	0.63	**1.03**
	799 / 848.97	26.35	Extended	**0.56**	0.58
			Retracted	**0.65**	0.72

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)	
				HDB-4	HDC-5
CDMA 800	1013 / 824.70	25.80	Extended	0.43	0.50
			Retracted	0.61	0.75
	384 / 836.52	25.74	Extended	0.60	**0.69**
			Retracted	**0.82**	**0.79**
	777 / 848.31	25.70	Extended	**0.61**	0.51
			Retracted	0.53	0.71

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)	
				HDB-4	HDC-5
CDMA 1900	25 / 1851.25	23.10	Extended	0.34	0.34
			Retracted	0.31	0.30
	600 / 1880.00	23.22	Extended	0.34	0.44
			Retracted	0.39	0.39
	1175 / 1908.75	23.45	Extended	**0.49**	**0.54**
			Retracted	**0.47**	**0.44**

8.2.2 Erica Cover

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)	
				HDB-4	HDC-5
AMPS	991 / 824.04	26.30	Extended	0.44	0.59
			Retracted	0.48	0.85
	384 / 836.52	26.32	Extended	**0.53**	**0.76**
			Retracted	0.51	**0.93**
	799 / 848.97	26.35	Extended	0.47	0.67
			Retracted	**0.55**	0.65

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)	
				HDB-4	HDC-5
CDMA 800	1013 / 824.70	25.80	Extended	0.42	0.45
			Retracted	0.55	0.69
	384 / 836.52	25.74	Extended	**0.60**	**0.51**
			Retracted	**0.58**	**0.69**
	777 / 848.31	25.70	Extended	0.52	0.42
			Retracted	0.50	0.62

Mode	Channel/ *f* (MHz)	Power (dBm)	Antenna	SAR, averaged over 1g (mW/g)	
				HDB-4	HDC-5
CDMA 1900	25 / 1851.25	23.10	Extended	0.28	0.30
			Retracted	0.25	0.26
	600 / 1880.00	23.22	Extended	0.32	0.31
			Retracted	0.29	0.31
	1175 / 1908.75	23.45	Extended	**0.39**	**0.41**
			Retracted	**0.34**	**0.35**

APPENDIX A: SCOPE OF ACCREDITATION FOR A2LA

TCC-Dallas is accredited by the American Association for Laboratory Accreditation (A2LA) as shown in the scope below:

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

NOKIA MOBILE PHONES
Test & Certification Center - Dallas
Irving, TX

for technical competence in the field of

Electrical Testing

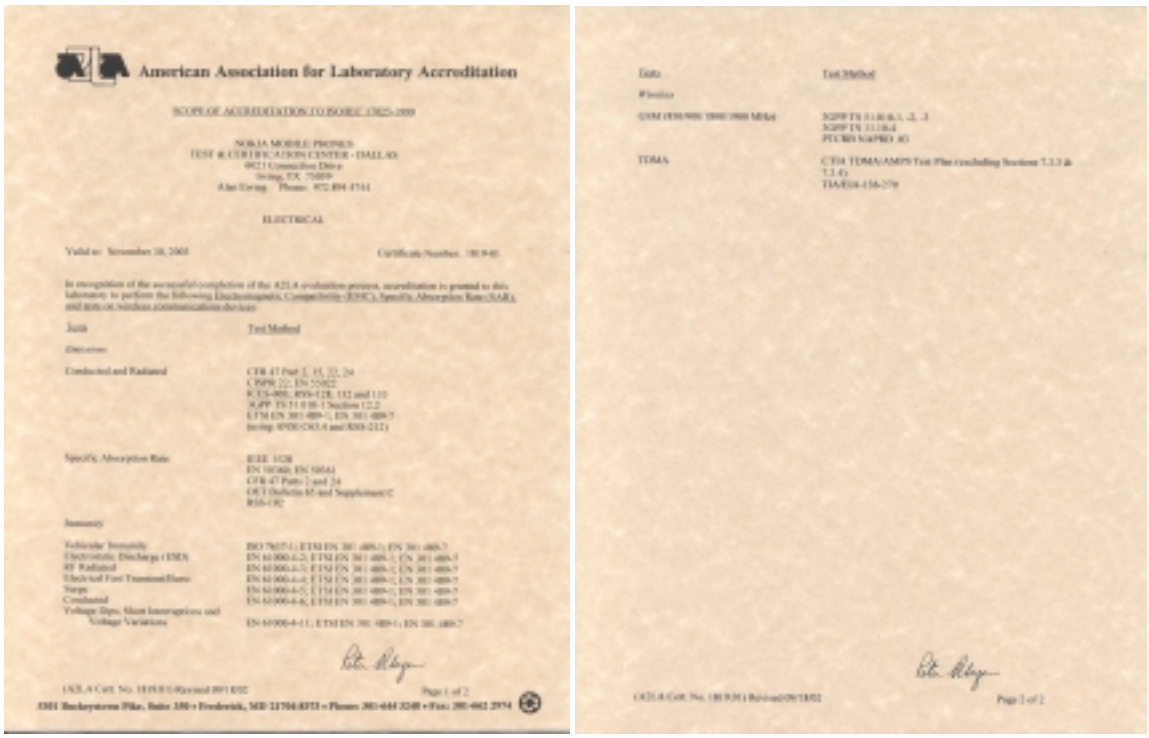
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002.

Presented this 1st day of October, 2001

SEAL

President
For the Accreditation Council
Certificate Number 1819.01
Valid to November 30, 2003

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation



American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999

NOKIA MOBILE PHONES
TEST & CERTIFICATION CENTER - DALLAS
9021 Connection Drive
Irving, TX 75039
Alan Ewing Phone: 972.894.4744

ELECTRICAL

Valid to: November 30, 2003 Certificate Number: 1819-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following Electromagnetic Compatibility (EMC), Specific Absorption Rate (SAR), and tests on wireless communications devices:

Item	Test Method
Conducted and Radiated	CFR 47 Part 2, 15, 22, 24 UNPR 22, EN 55022 ICES-003, RSS-128, 132 and 133 3GPP TS 51.010-1 Section 12.2 ETSI EN 301 489-1, EN 301 489-7 Irving: 89500/C813.4 and 89089-2121
Specific Absorption Rate	IEEE 1528 EN 50360, EN 50361 CFR 47 Parts 2 and 24 OET Bulletin 65 and Supplement C RSS-102
Immunity	
Vehicular Immunity	ISO 7637-1; ETSI EN 301 489-1; EN 301 489-7
Electrostatic Discharge (ESD)	EN 61000-4-2; ETSI EN 301 489-1; EN 301 489-7
RF Radiated	EN 61000-4-3; ETSI EN 301 489-1; EN 301 489-7
Electrical Fast Transient/Burst	EN 61000-4-4; ETSI EN 301 489-1; EN 301 489-7
Surge	EN 61000-4-5; ETSI EN 301 489-1; EN 301 489-7
Conducted	EN 61000-4-6; ETSI EN 301 489-1; EN 301 489-7
Voltage Dips, Short Interruptions and Voltage Variations	EN 61000-4-11; ETSI EN 301 489-1; EN 301 489-7

A2LA Cert. No. 1819.01 Revised 09/18/02 Page 1 of 2

8501 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644-3240 • Fax: 301-662-2974

Item Test Method

Wireless

GSM (850/900/1800/1900 MHz) 3GPP TS 11.10-0.3, -2, -3
3GPP TS 11.10-4
PTCRB VarPRO 4.0

TDMA CTIA TDMA/AMPS Test Plan (excluding Sections 7.3.3 & 7.3.4)
TIA/EIA-136-270

A2LA Cert. No. 1819.01 Revised 09/18/02 Page 2 of 2

"This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this report have been determined to be in accordance with the laboratory's terms of accreditation unless stated otherwise in the report."

Should this report contain any data for tests for which we are not accredited, such data would not be covered by this laboratory's A2LA accreditation.

