TCC
Copenhagen

DANAK
Reg. Nr. 416

SAR Compliance Test Report

Test Report no.:	DTX04948-EN	**Date of Report:**	11th of July 2002
Number of pages:	27	**Contact person:**	Darin Yeoman
		Responsible Test engineer:	Ruben Chr. Hansen

Testing laboratory:	TCC Copenhagen Nokia Danmark A/S Frederikskaj DK-1790 Copenhagen V Denmark Tel. +45 33 29 29 29 Fax. +45 33 29 20 01	**Client:**	Nokia USA 12278 Scripps Summit Dr. San Diego CA 92131, USA Tel. +1.858.831.5000 Fax.+1.858.831.6500

Tested device: FCC ID: GMLNPD-1AW, Model 3585, ESN: 078/02621851, HW: 4.0, SW: eg133B04, DUT#: 231675

Supplement reports:

Testing has been Carried out in Accordance with: IEEE Std 1528-200X Draft 6.4
Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques.

Documentation: The documentation of the testing performed on the tested devices is archived for 15 years at Test & Certification Center, Copenhagen

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: 07/11/2002

For the contents:

Claus A. Madsen
Deputy for TCC Manager

Ruben Chr. Hansen
SAR Test Engineer

CONTENTS

1. SUMMARY FOR SAR TEST REPORT

The tests described in this report have been performed in order to demonstrate that the equipment under test complies with the requirements in IEEE Std 1528-200X Draft 6.4 Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques and FCC OET Bulletin 65, Supplement C, Edition 01-01.

Date of receipt	2002.03.09
Date of test	2002.03.09- 2002.05.02
Contact person	Robert Taylor, TCC San Diego, Nokia Mobile Phones, CA, USA
FCC ID, ESN, HW, SW and DUT numbers	GMLNPD-1AW, ESN: 078/02621851, HW: 4.0, SW: eg133B04 DUT #: 231675
Accessories	Battery, Type: BLC-2, DUT #: 231676 & # 231677, Headset, Type: HDB-4 DUT #: 231682, Headset, Type: HDC-5 DUT #231680.
Document code	DTX04948-EN.doc
Responsible SAR Test Engineer	Ruben Chr. Hansen
Measurements performed by	Bo Christensen & Leif Funch Klysner

1.1 Maximum Results Found during SAR Evaluation

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

1.1.1 Head Configuration

Mode of operation	Channel	Power [dBm]	Position	Limit [mW/g]	Measured [mW/g]	Result
AMPS	799	25.60	Touch, Left Hand, Antenna Retracted	1.6	1.28	**PASSED**
PCS	25	22.5	Tilted, Left Hand, Antenna Retracted	1.6	1.14	**PASSED**

1.1.2 Body Worn Configuration

Mode of Operation	Channel	Power [dBm]	Position	Limit [mW/g]	Measured [mW/g]	Result
AMPS	384	26.15	Flat Section, Headset HDC-5, 15 mm space	1.6	1.28	**PASSED**
PCS	1175	23.5	Flat Section, Headset HDB-4, 15 mm space	1.6	0.983	**PASSED**

1.1.3 Measurement Uncertainty

Combined Uncertainty	± **12.11%**
Expanded Uncertainty (k=2) 95.5%	± **24.23%**

2. DESCRIPTION OF THE DEVICE(S) UNDER TEST

2.1 Device description

FCC ID Number:	GMLNPD-1AW		
ESN:	078/02621851		
Mode(s) of operation	AMPS	CDMA	PCS
Modulation Mode(s)	FM	Quadrature PSK	Quadrature PSK
Duty Cycle	1	1	1
Transmitting Frequency Range [MHz]	824.040 – 848.970	824.730 – 848.310	1851.250 – 1908.750
Production Unit or Identical Prototype (47 CFR. § 2.908)	Identical Prototype		
Device Category	Portable		
RF Exposure Limits	General Population / Uncontrolled		

2.2 Picture of GMLNPD-1AW (NOKIA 3585)

Figure 1 GMLNPD-1AW (NOKIA 3585)

2.3 Description of the antenna

The GMLNPD-1AW (NOKIA 3585) cellular phone has an integral patch antenna and a retractable antenna.

Figure 2 GMLNPD-1AW with antenna extended

2.4 Battery

A Li-Ion battery, type BLC-2 was used during the measurement.

2.5 Body Worn Accessory

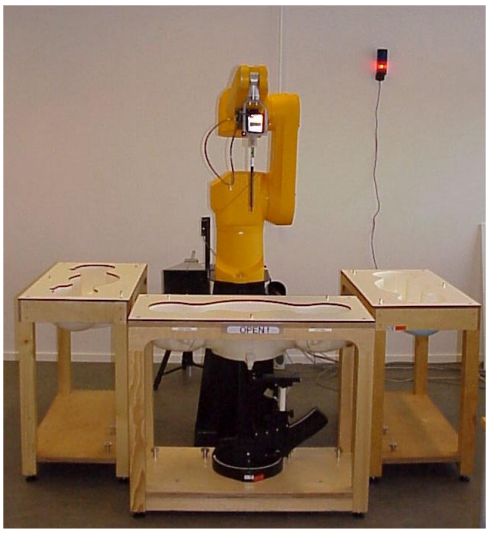
Body worn accessories are not currently available for the product.

3. DESCRIPTION OF THE TEST EQUIPMENT

The measurements were performed with an automated near-field scanning system, **DASY3**.

3.1 Manufacturer of DASY3

Schmid & Partner Engineering AG (SPEAG).
Zeughausstrasse 43
8004 Zurich, Switzerland
Phone 41 1 245 97 00, Fax 41 1 245 97 79
www.speag.com



3.2 Robot

The robot is a RX90L manufactured by Stäubli France, www.staubli.com

Number of axis:	6
Payload:	3.5 kg
Reach:	1185 mm
Repeatability:	± 0.025 mm
Control unit:	CS7/cs7M

3.3 Isotropic E-field probe ET3DV6R

Frequency:	10 MHz to 3 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)
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 > 100mW/g; Linearity: ± 0.2 dB
Dimension:	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
Calibration:	See List of Instruments

3.4 Device holder

The holder was provided by SPEAG as a part of the DASY3 system.

3.5 Dipole antennas for validation

The dipole antennas are matched for use near flat phantoms filled with head/body simulation solutions. The dipoles are equipped with 10 or 15 mm distance holders.

Calibration: See List of Instruments

3.6 Phantom

The phantoms enables dosimetric evaluation of left and right hand phone usage, as well as body mounted usage at the flat phantom region.

Shell thickness: 2 ± 0.2 mm, except at Ear Reference Point, where an integrated spacer provides a 6 mm spacing from tissue simulating liquid.

3.7 Liquid depth

The liquid level was during measurement 15 cm ±0.5 cm.

4. TEST CONDITIONS

4.1 Temperature and Humidity

Ambient temperature: 23° ± 1° C

Tissue simulating liquid temperature: 23° ± 1° C

Ambient humidity: 45 ± 10 % r.h.

4.2 SAR measurement system verification

The SAR measurements were verified using a dipole antenna placed under the flat section of the generic twin phantom. A power level of 250 mW supplied to the dipole antenna was used for the verification. The results are normalised to 1 W input power. The power level was controlled during verification, using a directional coupler and a power meter. A SAR measurement was performed to verify that the measured SAR was within ± 10% from the target value indicated in the dipole(s) calibration certificate. These tests were done at 900 MHz and 1800 MHz, which is within 100 MHz of the mid-band frequency of the D.U.T. The tests were performed every morning before measurements of the D.U.T. The liquid depth was 15.0 cm ±0.5 cm.

Liquid	Date	Frequency [MHz]	Description	SAR averaged over 1g [mW/g]	Dielectric Parameters	
					ε_r	σ [S/m]
Head	04/09/02	900	Measured	11.04	39.94	0.95
			Reference	11.44	41.5	0.97
	04/10/02	900	Measured	11.40	39.92	0.95
			Reference	11.44	41.5	0.97
	04/11/02	900	Measured	11.6	38.94	0.98
			Reference	11.44	41.5	0.97
	04/16/02	900	Measured	11.68	40.04	0.97
			Reference	11.44	41.5	0.97
	04/17/02	900	Measured	11.52	40.04	0.97
			Reference	11.44	41.5	0.97
	04/18/02	900	Measured	11.44	39.14	0.95
			Reference	11.44	41.5	0.97
	04/19/02	900	Measured	11.68	41.0	0.97
			Reference	11.44	41.5	0.97
	04/22/02	900	Measured	11.32	39.46	0.95
			Reference	11.44	41.5	0.97
	04/23/02	900	Measured	11.44	40.66	0.97
			Reference	11.44	41.5	0.97
	04/24/02	900	Measured	11.2	39.30	0.94
			Reference	11.44	41.5	0.97

Liquid	Date	Frequency [MHz]	Description	SAR averaged over 1g [mW/g]	Dielectric Parameters	
					ε_r	σ [S/m]
		900	Measured	11.04	39.94	0.95
	04/25/02		Measured	11.56	40.91	0.97
			Reference	11.44	41.5	0.97
	04/12/02		Measured	41.2	38.13	1.37
			Reference	37.4	40.7	1.35
	04/15/02		Measured	39.52	38.74	1.36
			Reference	37.4	40.7	1.35
	04/16/02	1800	Measured	41.2	38.2	1,43
			Reference	37.4	40.7	1.35

Liquid	Date	Frequency [MHz]	Description	SAR averaged over 1g [mW/g]	Dielectric Parameters	
					ε_r	σ [S/m]
Body	04/30/02	900	Measured	11.36	56.2	1.01
			Reference	11.84	55.4	1.04
	05/01/02	900	Measured	11.32	56.2	1.01
			Reference	11.84	55.4	1.04
	04/29/02	1800	Measured	40.4	52.5	1.46
			Reference	40.8	53.5	1.45
	04/30/02	1800	Measured	40.8	52.5	1.46
			Reference	40.8	53.5	1.45
	05/01/02	1800	Measured	40.8	52.5	1.46
			Reference	40.8	53.5	1.45
	05/02/02	1800	Measured	39.68	52.5	1.46
			Reference	40.8	53.5	1.45

4.3 Synthetic head tissue simulating liquid parameters, measured values:

The tissue simulating liquids are measured using a HP 85070A dielectric probe kit.

Date	Frequency [MHz]	Description	ε_r Relative permittivity	σ [S/m] Conductivity
04/09/02	835	Measured	40.77	0.89
		Recommended	41.5	0.90
04/10/02	835	Measured	40.75	0.89
		Recommended	41.5	0.90
04/11/02	835	Measured	39.74	0.92
		Recommended	41.5	0.90
04/16/02	835	Measured	40.84	0.90
		Recommended	41.5	0.90
04/17/02	835	Measured	40.84	0.90
		Recommended	41.5	0.90
04/18/02	835	Measured	39.93	0.89
		Recommended	41.5	0.90
04/19/02	835	Measured	41.78	0.91
		Recommended	41.5	0.90
04/22/02	835	Measured	40.22	0.89
		Recommended	41.5	0.90
04/23/02	835	Measured	41.45	0.91
		Recommended	41.5	0.90
04/24/02	835	Measured	40.07	0.88
		Recommended	41.5	0.90
04/25/02	835	Measured	41.67	0.91
		Recommended	41.5	0.90
04/12/02	1880	Measured	37.77	1.46
		Recommended	40.0	1.40
04/15/02	1880	Measured	38.41	1.44
		Recommended	40.0	1.40
04/16/02	1880	Measured	37.89	1.43
		Recommended	40.0	1.40

4.4 Synthetic muscle tissue simulating liquid parameters, measured values:

Frequency band [MHz]		Description	ε_r Relative permittivity	σ [S/m] Conductivity
04/30/02	835	Measured	56.77	0.94
		Recommended	55.2	0.97
04/29/02	1880	Measured	52.47	1.46
		Recommended	53.5	1.52

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

4.5 Synthetic tissue simulating liquid recipes

4.5.1 835 MHz

Ingredients	Head (% by weight)	Body (% by weight)
De-ionized Water	39.74	55.97
Hydroxyethyl Cellulose	0.25	1.21
Sugar	58.31	41.76
Preservative	0.15	0.27
Salt	1.55	0.79

4.5.2 1880 MHz

Ingredients	Head (% by weight)	Body (% by weight)
De-ionized Water	54.88	69.02
Di(ethylene glycol) butyl ether	44.91	30.76
Salt	0.21	0.22

5. DEVICE POSITIONING

5.1 Positioning procedures

The cellular phone was measured in 2 positions on both the "left hand" and "right hand" side of the phantom with the antenna in both extended and retracted positions. Furthermore the cellular phone was measured in the carrying case under the flat section of the phantom.

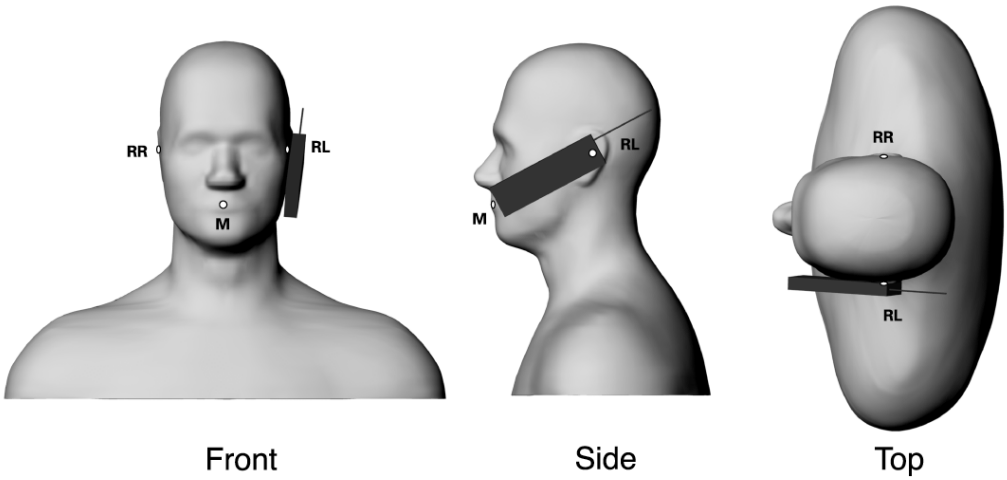


Figure 3. "Cheek/Touch" Position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the plane for phone positioning, are indicated.

5.1.1 Cheek/Touch Position

1) The phone was positioned with the vertical center line of the body of the phone and the horizontal line crossing the center of the ear piece in a plane parallel to the sagittal plane of the phantom ("initial position"). While maintaining the phone in this plane, the vertical center line was aligned with the reference plane containing the three ear and mouth reference points (RE, LE and M) and the center of the ear piece was aligned with the line RE-LE
2) The mobile phone was moved towards the phantom with the earpiece aligned with the line LE-RE until the phone touched the ear. While maintaining the phone contact with the ear, the bottom of the phone was moved until a point on the front side was in contact with the cheek of the phantom or until contact with the ear was lost.

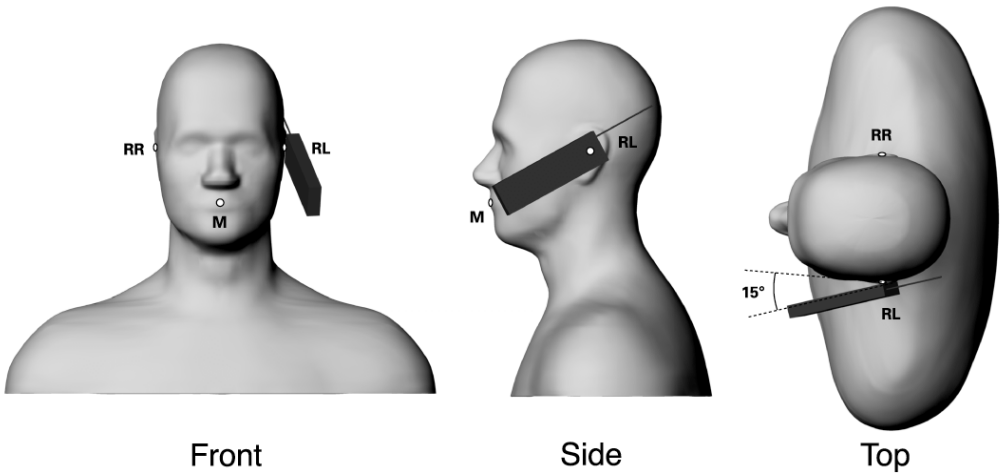


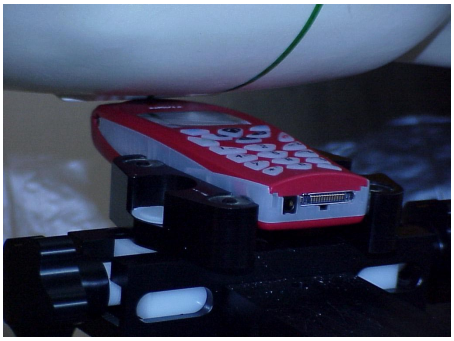
Figure 4. "Ear/Tilted Position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the plane for phone positioning, are indicated.

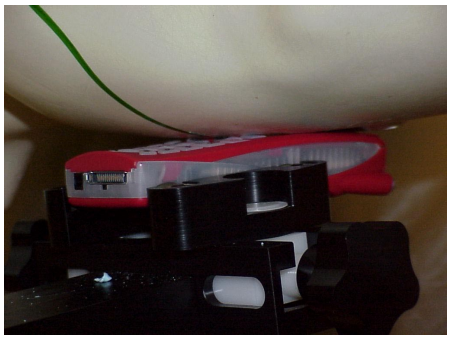
5.1.2 Ear/Tilted Position

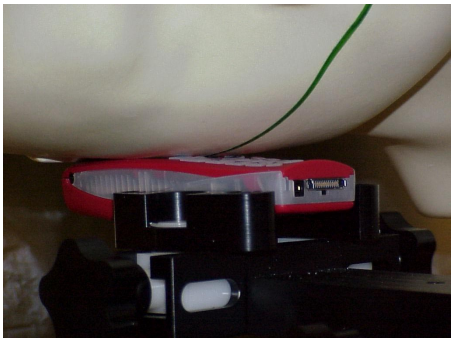
1) The phone was positioned in the "cheek/touch" position as described above;
2) While the phone was maintained in the reference plane described above and pivoting against the ear, the phone was moved outward away from the mouth by an angle of 15 degrees or until contact with the ear was lost.

5.1.3 Photos of setup


Tilted, left hand


Tilted, right hand


Touch, left hand


Touch, right hand

5.1.4 Body Worn Configuration

The phone was positioned into the holder and placed below the flat section of the phantom.
The distance between the phone and the phantom was kept at 15 mm during all measurements.
This position was kept with antenna extended and retracted.
Measurements in the PCS band were performed with the display side towards the phantom and with the antenna side towards the phantom. The maximum level was found to come from the antenna side of the phone, therefore the measurements in both AMPS and CDMA 800 bands were performed on this side only. Measurements were performed with headsets HDB-4 and HDC-5, and with the antenna in both extended and retracted positions.

Figure 5 GMLNPD-1AW under flat section of phantom.

5.2 Scan Procedure

First coarse scans are used for quick determination of the field distribution. The distance of the probe tip to the inner surface of the phantom was 2 mm during the coarse scan measurements. At the peak SAR location determined by the extrapolated data from the coarse scan, a cube scan, 7x7x7 with a spacing of 5 mm between each scan point, is performed to determine the averaged SAR-distribution for 1g and 10g.

5.3 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 123ff].

The extrapolation is based on least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3cm 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 (resolution) of 1mm from one another.

6. MEASUREMENT UNCERTAINTY

6.1 Description of individual measurement uncertainty

Uncertainty description	Error	Distrib.	Weight	Std. Dev.
- axial isotropy	± 0.2 dB	U-shape	0.5	± 2.4%
- spherical isotropy	± 0.4 dB	U-shape	0.5	± 4.8%
- Spatial resolution	± 0.5 dB	Normal	1	± 0.5%
- Linearity error	± 0.2 dB	Rectang.	1	± 2.7%
- Calibration error	± 3.3%	Normal	1	± 3.3%
Total Probe Uncertainty				**± 6.87%**
- Data acquisition error	± 1%	Rectang.	1	± 0.6%
- ELF and RF disturbances	± 0.25%	Normal	1	± 0.25%
- Conductivity assessment	± 10%	Rectang.	1	± 5.8%
Total SAR Evaluation Uncertainty				**± 5.84%**
- Extrapol + boundary effect	± 3%	Normal	1	± 3%
- Probe positioning error	± 0.1mm	Normal	1	± 1%
- Integrat and cube orient	± 3%	Normal	1	± 3%
- Cube shape inaccuracies	± 2%	Rectang.	1	± 1.2%
Total Spatial Peak SAR Evaluation Uncertainty				**± 4.52%**
Total Measurement Uncertainty				**± 10.09%**

6.2 Source Uncertainty

Uncertainty description	Error	Distrib.	Weight	Std. Dev.
- Device positioning	± 6%	Normal	1	± 6%
- Laboratory set up	± 3%	Normal	1	± 3%
Total Source Uncertainty				**± 6.71%**

6.3 Estimation of the total measurement uncertainty

Uncertainty description	Uncertainty
- Total Measurement Uncertainty	± 10.09%
- Total Source Uncertainty	± 6.71%
Combined Uncertainty	**± 12.11%**
Expanded Uncertainty (k=2) 95.5%	**± 24.23%**

7. RESULTS

The SAR results shown in the tables are maximum SAR values averaged over 1 gram of tissue. Also shown are the conducted output power, the connection between low, mid and high channels, channel numbers and frequency. The results indicated as bold numbers in the tables are included in the appendix. All other results are lower SAR values.

7.1 AMPS

Position	AMPS			
	Channel	Low	Mid	High
	Channel #	991	384	799
	Frequency [MHz]	824.040	836.520	848.970
	Power [dBm]	26.15	26.15	25.60
Touch, left hand	Antenna in	1.04	1.10	**1.28**
Touch, left hand	Antenna out	**1.21**	**1.22**	1.15
Tilted, left hand	Antenna in	0.604	0.662	0.785
Tilted, left hand	Antenna out	0.783	0.824	0.863
Touch, right hand	Antenna in	1.07	1.06	1.24
Touch, right hand	Antenna out	1.06	1.01	0.990
Tilted, right hand	Antenna in	0.664	0.662	0.773
Tilted, right hand	Antenna out	0.718	0.693	0.707
Body, Antenna towards phantom				
Body, HDC-5	Antenna in	**1.21**	**1.28**	**0.935**
Body, HDC-5	Antenna out	0.866	1.16	0.794
Body, HDB-4	Antenna in		0.829	
Body, HDB-4	Antenna out		0.800	

7.2 CDMA 800 MHz

Position	CDMA			
	Channel	Low	Mid	High
	Channel #	1013	384	777
	Frequency [MHz]	824.700	836.520	848.310
	Power [dBm]	25.0	25.0	25.0
Touch, left hand	Antenna in	0.957	0.906	1.21
Touch. left hand	Antenna out	**1.01**	0.940	1.10
Tilted. left hand	Antenna in	0.563	0.558	0.747
Tilted. left hand	Antenna out	0.673	0.686	0.808
Touch. right hand	Antenna in	0.976	**0.949**	**1.25**
Touch. right hand	Antenna out	0.912	0.862	0.894
Tilted. right hand	Antenna in	0.533	0.534	0.703
Tilted. right hand	Antenna out	0.577	0.621	0.669
Body, Antenna towards phantom				
Body, HDC-5	Antenna in	**1.07**	**0.955**	**0.955**
Body, HDC-5	Antenna out	0.725	0.794	0.791
Body, HDB-4	Antenna in		0.719	
Body, HDB-4	Antenna out		0.695	

7.3 CDMA PCS

Position	CDMA PCS			
	Channel	Low	Mid	High
	Channel #	25	600	1175
	Frequency [MHz]	1851.250	1880.000	1908.750
	Power [dBm]	22.5	22.9	23.5
Touch. left hand	Antenna in	1.05	**1.11**	**1.06**
Touch. left hand	Antenna out	0.897	0.852	0.762
Tilted. left hand	Antenna in	**1.14**	1.08	1.03
Tilted. left hand	Antenna out	0.958	0.820	0.725
Touch. right hand	Antenna in	0.850	0.949	0.944
Touch. right hand	Antenna out	0.804	0.760	0.684
Tilted. right hand	Antenna in	1.04	1.06	1.04
Tilted. right hand	Antenna out	0.897	0.942	0.830

Display towards phantom

Body, HDC-5	Antenna in	0.390	0.400	0.376
Body, HDC-5	Antenna out	0.354	0.311	0.288
Body, HDB-4	Antenna in	0.318	0.351	0.349
Body, HDB-4	Antenna out	0.300	0.297	0.240

Antenna towards phantom

Body, HDC-5	Antenna in	0.699	0.782	0.883
Body, HDC-5	Antenna out	0.653	0.783	0.935
Body, HDB-4	Antenna in	**0.739**	**0.843**	**0.983**
Body, HDB-4	Antenna out	0.696	0.819	0.963

8. LIST OF INSTRUMENTS

Equipment no	Equipment	Type	Serial no	Manufacturer	Last week	Last year	Next week	Next year	Calibration lab
13172	Power Supply 15V DC 4 A	PL154	043068	Thurlby&Thandar					
13393	RF Amplifier 10-2.4GHz	ZHL-42W	D091395-1	Mini-Circuits					
14509	Double Ridged Horn Antenna	BBHA9120-LF	BBHA 9120 LF-A/105	Schwarzbech Mess El.	27	98			Schwarzbech
14824	Vector Signal Generator	SMIQ03B	826046/034	Rohde&Schwarz	33	2000	33	2003	R&S
14867	Digital Weight 0-3100g 0.01g	BP3100S	81006038	Sartorius					
15001	Digital Radio Comm. Tester	CTS55	828273/014	Rohde&Schwarz					
15199	Industrial Robot f SAR	RX90L	598299-01	Stäubli					
15200	Robot Controller Unit	Dasy3	---------- -	Stäubli					
15201	Phantom	Generic Twin Phantom V3.0	---------- -	Schmid&Partner					
15202	Phantom	Generic Twin Phantom V3.0	---------- -	Schmid&Partner					
17737	SCC-34/SC-2 Phantom	Generic Twin Phantom V4.1	---------- -	Schmid&Partner					
15203	Phone Test Fixture f Test	---------- -	---------- -	Stäubli					
15204	Dipole Antenna 900MHz SMA	D900V2	033	Schmid&Partner	29	2000	29	2002	Schmid&Partner
15205	Dipole Antenna 1800MHz SMA	D1800V2	230	Schmid&Partner	29	2000	29	2002	Schmid&Partner
15206	Dummy Probe f SAR	---------- -	---------- -	Schmid&Partner					
15207	Probe f SAR Measurements	ET3DV5	1345	Schmid&Partner	34	2001	34	2002	Schmid&Partner
15208	Probe f SAR Measurements	ET3DV5	1344	Schmid&Partner	34	2001	34	2002	Schmid&Partner
15209	Dielectric Probe Kit	HP85070B	US33020403	Hewlett Packard					
15319	Closed Torso Manneguin V2.0	V2.0	---------- -	Schmid&Partner					
15859	Digital Radio Communication	4201S	0113217	Wavetek					
15883	RF Shielded Box	248390	LX658054	Wavetek					
16744	Dosimetric Assessment	DAE3V1	339	Schmid&Partner	34	2001	34	2002	Schmid&Partner
17266	RF S-Parameter Network	AT8753ES	MY40001091	Agilent Technologies	7	2001	7	2002	AT Factory
17555	Dosimetric Assessment	DAE3V1	435	Schmid&Partner	46	2001	46	2002	Scmid & Partner
17556	Dosimetric E-Field Probe f	ET3DV6R	1429	Schmid&Partner	17	2002	17	2003	Schmid&Partner
17752	Dosimetric E-Field Probe f	ET3DV6R	1431	Schmid&Partner	51	2001	51	2002	Schmid&Partner
	CDMA Mobile Station Test Set	E8285A	US40252509	Agilent	45	2000	45	2002	Agilent