ITS Intertek Testing Services
ETL SEMKO

Specific Absorption Rate (SAR) Test Report
for
Wireless Link Corporation
On the
TDMA/AMPS Cellular Phone
Model: TDM-3100

Test Report: J20028710
Date of Report: October 30, 2000

NVLAP®
NVLAP Laboratory Code 200201-0
Accredited for testing to FCC Parts 15

Tested by: Suresh Kondapalli	Senior Project Engineer	
Reviewed by: David Chernomordik	EMC Manager	David Chernomordik

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1 JOB DESCRIPTION

1.1 Client Information

The EUT has been tested at the request of

Company: Wireless Link Corporation
1909, Milmont Drive
Milpitas, California 95035

Name of contact: Mr. Erick Maxon
US Telephone: (408) 719- 1100
US Fax: (408) 719-9646

1.2 Equipment under test (EUT)

Product Descriptions:

Equipment	AMPS/TDMA Cellular Radio Telephone		
Trade Name	AudioVox	Model No.	TDM-3100
FCC ID	NPQTDM-3100	S/N No.	089
Category	Portable	RF Exposure	Uncontrolled Environment
Frequency Band	AMPS: 824-849 MHz TDMA: 824-849MHz PCS : 1850-1909.9 MHz	System	AMPS TDMA TDMA

EUT Antenna Description			
Type	Monopole	Configuration	Fixed
Dimensions	104 mm (L)	Gain	0
Location	Left, Top		

Use of Product : Voice communications

Manufacturer: SAME as above.

Production is planned: [X] Yes, [ ] No

EUT receive date: 10/18/00

EUT received condition: Good condition prototype

Test start date: 10/18/00

Test end date: 10/28/00

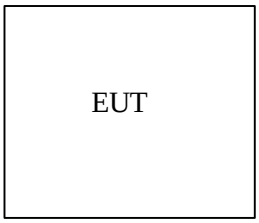
1.3 Test plan reference

FCC rule part 2.1093, FCC Docket 96-326 & Supplement C to OET Bulletin 65

1.4 System test configuration

1.4.1 System block diagram & Support equipment

The diagram shown below details test configuration of the equipment under test .



S:	Shielded	**U:**	Unshielded	**F:**	With Ferrite Core

Support equipment					
Equp. #	**Equipment**	**Manufacturer**	**Model #**	**S/N #**	**FCC ID**
None					

1.4.2 Test Position

The EUT was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C95.1 (1992) and Supplement C of OET 65 (1998). The EUT was placed in the intended use position, i.e. CENELEC 80^o position. This position is defined by a reference plane and a line. The reference plane of the head is given by three points, the auditory canal opening of both ears and center of the closed mouth. The reference line of the EUT is defined by the line which connects the center of the ear piece with the center of the bottom of the case and lies on the surface of the case facing the phantom. The reference line of the EUT lies in the reference plane of the head. The center of the ear piece of the EUT is place at the entry of the auditory canal. The angle between the reference line of the phone and the line connecting both auditory canal openings is 80^o. Please refer to figure 1 below for the position details:

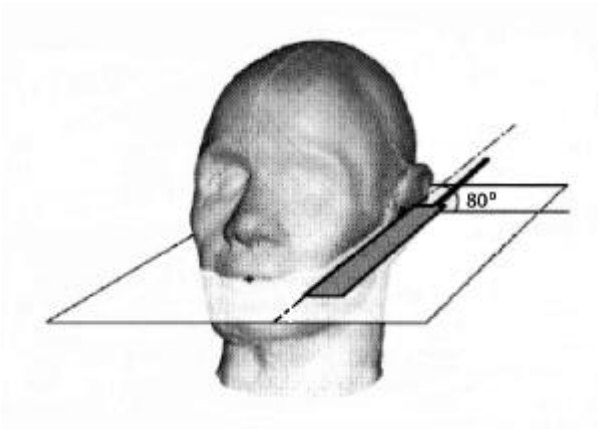


Figure 1: Intended use position

1.4.3 Test Condition

During tests, the worst case data (max. RF coupling) was determined with following conditions:

EUT Antenna	Extended	Orientation	N/A
Usage	Left-Hand and Right –Hand	Distance between antenna axis at the joint and the liquid surface:	18.4 mm
Simulating human hand	Not Used	EUT Battery	Fully Charged
Power output	23.8-23.9 dBm antenna port at AMPS mode (Maximum)		

The spatial peak SAR values were accessed for lowest, middle and highest operating channels defined by the manufacturer. Tests were performed at AMPS mode and TDMA mode.

Antenna port power measurement was performed, with the HP 435A power meter, before and after the SAR tests to ensure that the EUT operated at the highest power level.

1.5 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

1.6 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from standard.

2 SAR EVALUATION

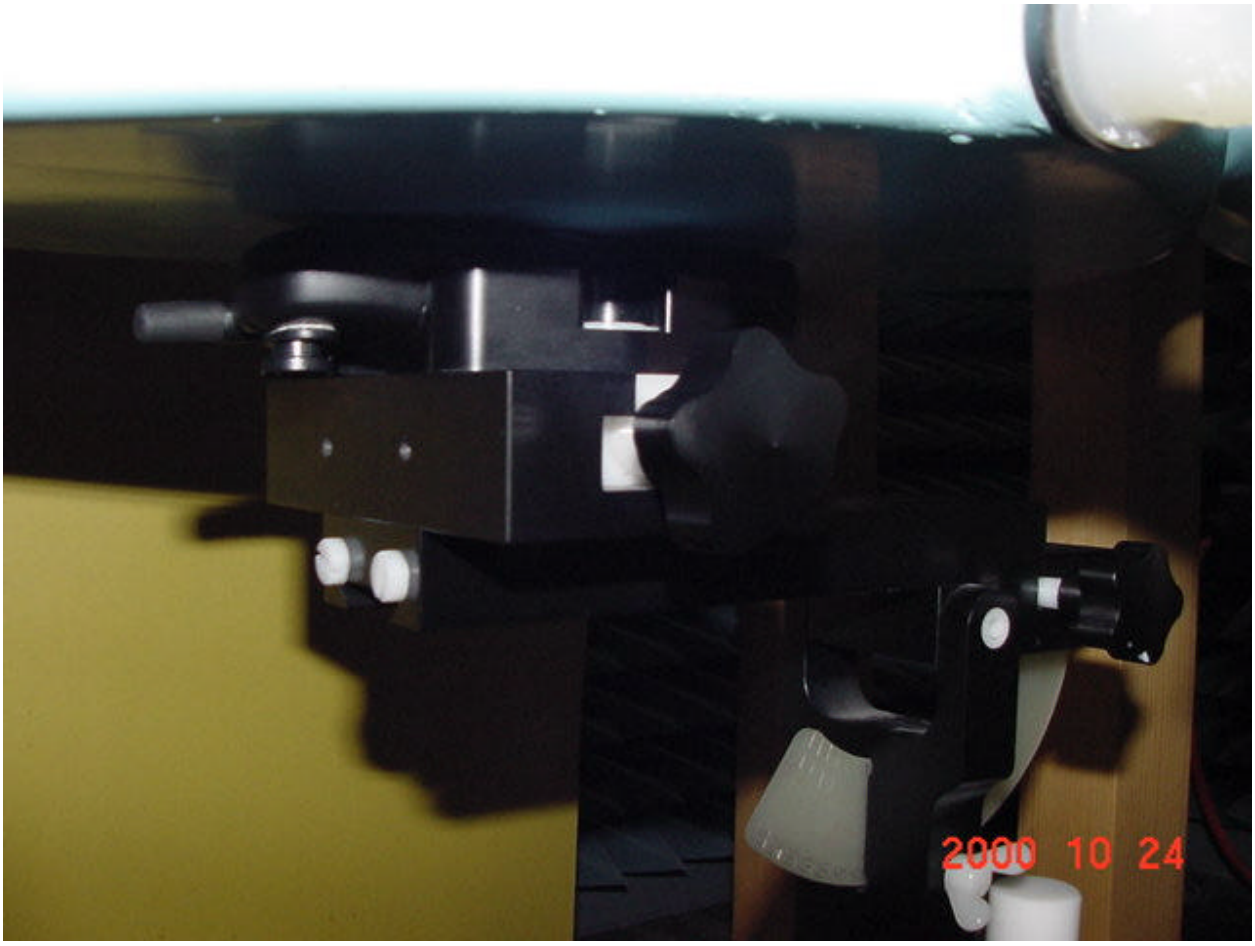
2.1 SAR Limits

The following FCC limits for SAR apply to devices operate in General Population/Uncontrolled Exposure environment:

EXPOSURE (General Population/Uncontrolled Exposure environment)	**SAR (W/kg)**
Average over the whole body	0.08
Spatial Peak (1g)	1.60
Spatial Peak for hands, wrists, feet and ankles (10g)	4.00

2.2 Configuration Photographs

Worst-Case SAR measurement

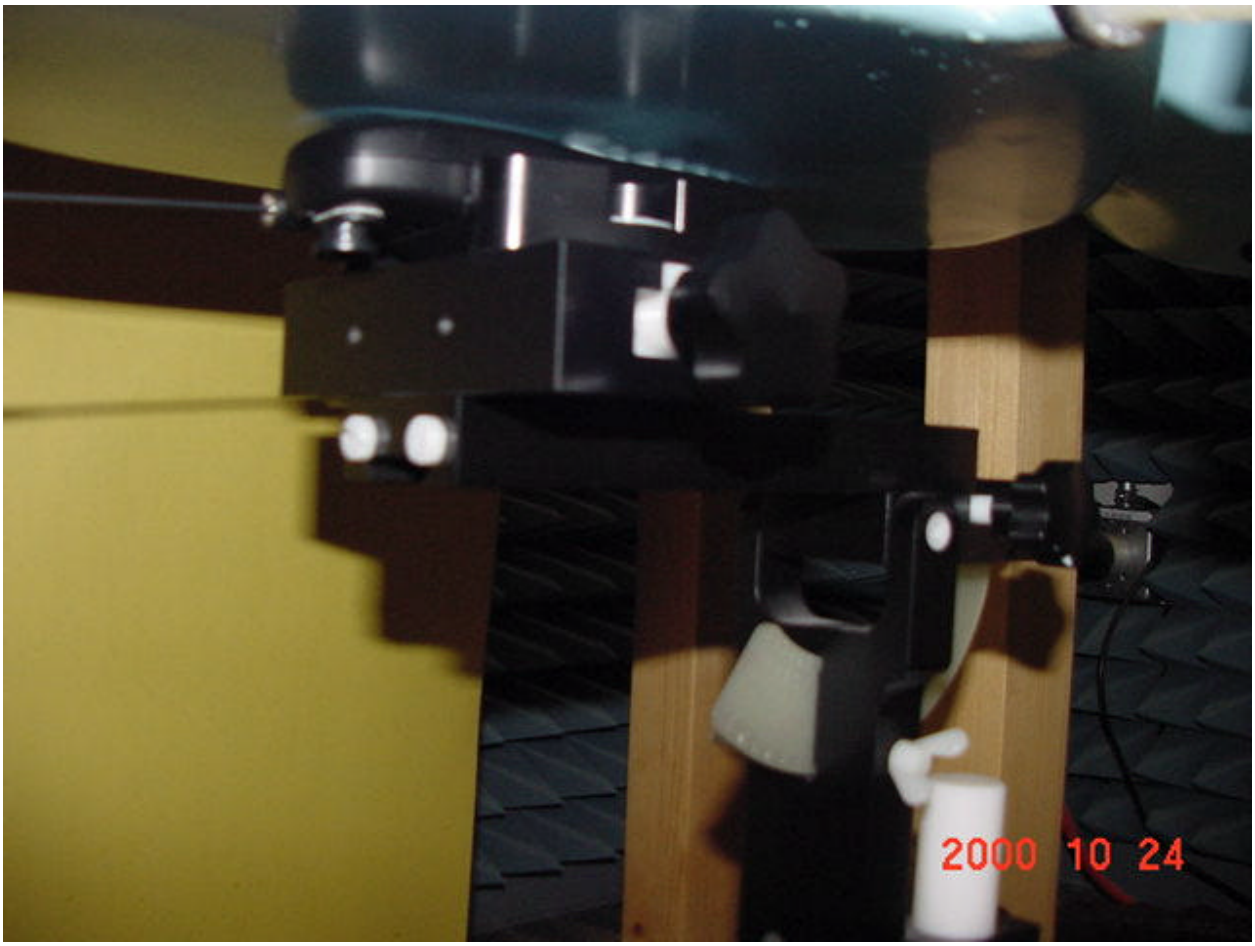


2.3 Configuration Photographs - Continued

Worst-Case SAR measurement

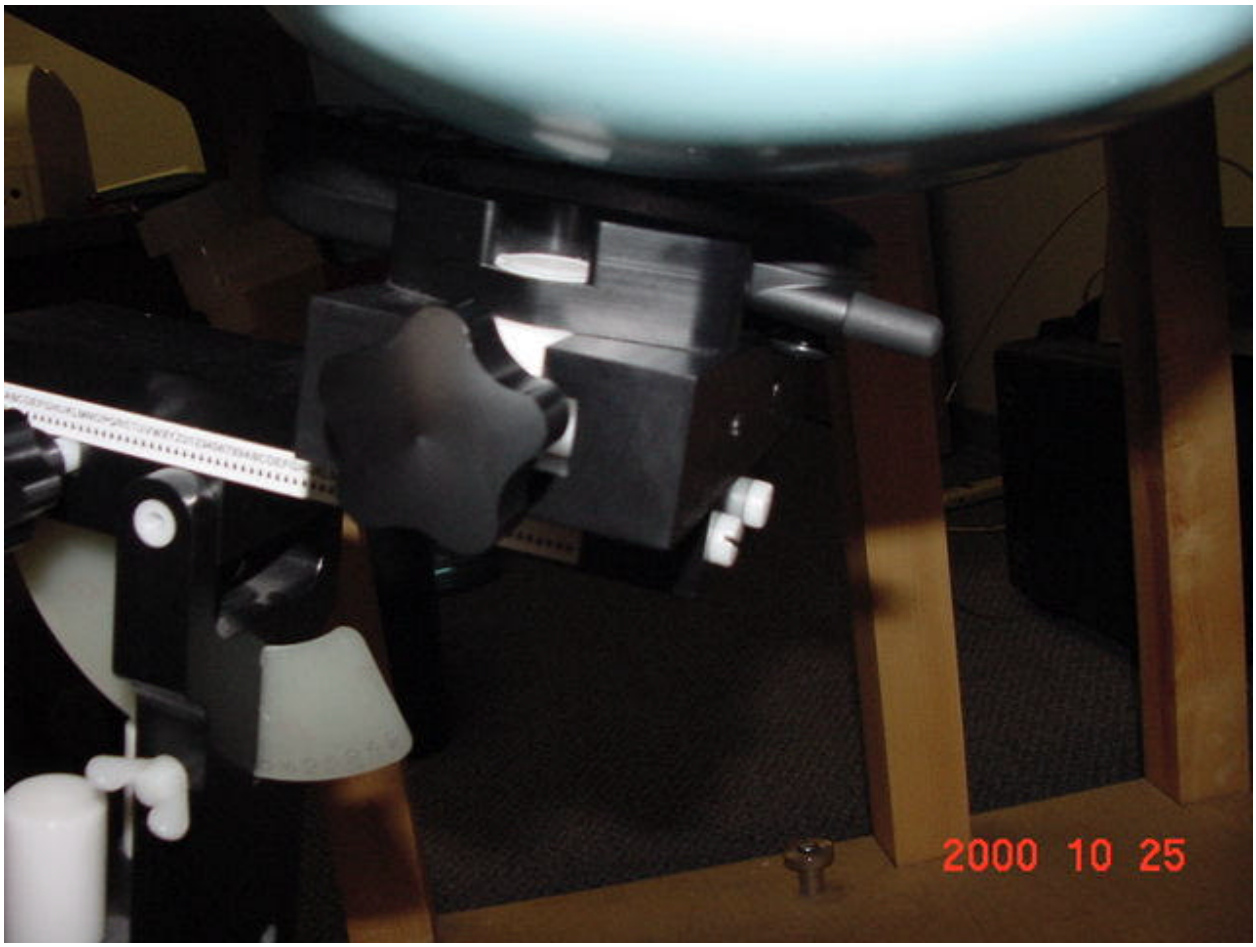
2.4 Configuration Photographs

Worst-Case SAR measurement



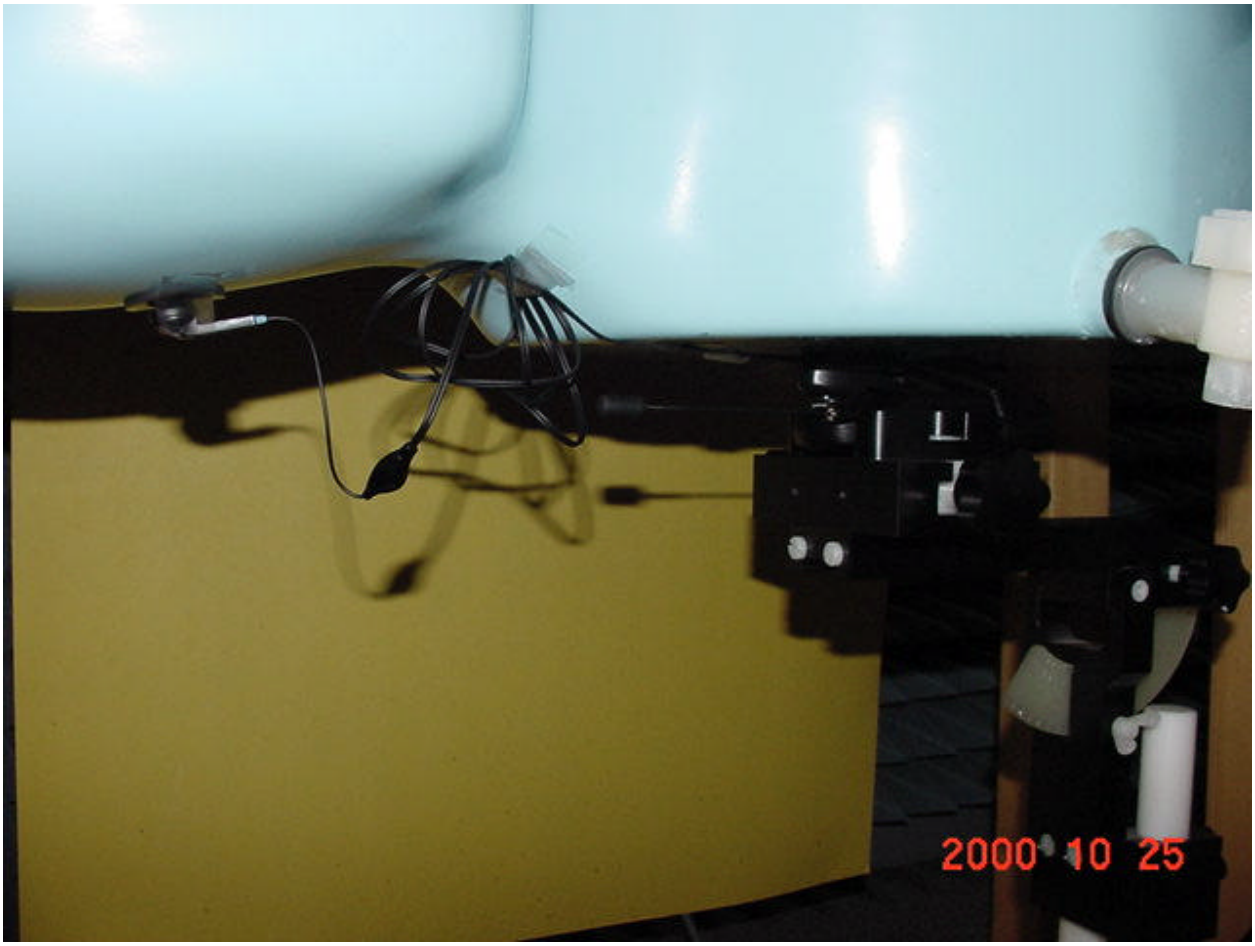
2.5 Configuration Photographs

Worst-Case SAR measurement



2.6 Configuration Photographs

Worst-Case SAR measurement



2.7 System Verification

Prior to the assessment, the system was verified to the ±5% of the specifications by using the system validation kit. The validation was performed at 900 MHz.

Validation kit	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)
D900V2, S/N #: 013	3.92	3.86

2.8 Evaluation Procedures

The SAR evaluation was performed with the following procedures:

a. SAR was measured at a fixed location above the ear point and used as a reference value for the assessing the power drop.

b. The SAR distribution at the exposed side of the head was measured at a distance of 4.0 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20 mm x 20 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.

c. Around this point, a volume of 32 mm x 32 mm x 34 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

   I) The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measurement point is 1.6 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in Z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

   ii) The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3-D spline interpolation algorithm. The 3-D spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y and z directions). The volume was integrated with the trapezoidal algorithm. 1000 points (10 x 10 x 10) were interpolated to calculate the average.

   iii) All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

d. Re-measurement of the SAR value at the same location as in step a. above. If the value changed by more than 5 %, the evaluation was repeated.

2.9 Test Results

The results on the following page(s) were obtained when the device was tested in the condition described in this report. Detail measurement data and plots which reveal information about the location of the maximum SAR with respect to the device, are reported in Appendix A.

Trade Name:	Wireless Link	**Model No.:**	TDM-3100
Serial No.:	089	**Test Engineer:**	Suresh Kondapalli

TEST CONDITIONS			
Ambient Temperature	23 °C	Relative Humidity	55 %
Test Signal Source	Test Mode	Signal Modulation	CW
Output Power Before SAR Test Cellular Band PCS Band	23.8 to23.9 dBm(AMPS) 27.77 to 27.89 dBm (TDMA) 27.77 to 27.88 dBm	Output Power After SAR Test Cellular Band PCS Band	23.8 to 23.9dBm (AMPS) 27.77 to 27.89 dBm (TDMA) 27.77 to 27.88 dBm
Test Duration	23 Min.	Number of Battery Change	1

EUT Position: Left Hand, 80°					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
824	AMPS	1	Extended	1.06	1
836.5	AMPS	1	Extended	1.35	2
849	AMPS	1	Extended	1.10	3

EUT Position: Left Hand, 2 Points Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
824	AMPS	1	Extended	1.23	4
824	AMPS	1	Retracted	1.02	5
836.5	AMPS	1	Extended	1.31	6
836.5	AMPS	1	Retracted	1.42	7
849	AMPS	1	Extended	1.43	8
849	AMPS	1	Retracted	1.30	9

EUT Position: Right Hand, 2 Points Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
824	AMPS	1	Extended	1.21	10
824	AMPS	1	Retracted	0.97	11
836.5	AMPS	1	Extended	1.37	12
836.5	AMPS	1	Retracted	1.35	13

EUT Position: Right Hand, 2 Points Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
849	AMPS	1	Extended	1.52	14
849	AMPS	1	Retracted	1.27	15

EUT Position: Left Hand, 2 Points Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
824.04	TDMA	3	Extended	0.661	16
836.55	TDMA	3	Extended	1.05	17
849	TDMA	3	Extended	0.818	18

EUT Position: Right Hand, 2 Points Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
836.55	TDMA	3	Extended	0.165	19
836.55	TDMA	3	Retracted	0.175	20

EUT Position: Left Hand, 2 Points Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
1880	TDMA	3	Extended	0.108	21
1880	TDMA	3	Retracted	0.293	22

EUT Position: Right Hand, 2 Points Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
1880	TDMA	3	Extended	0.127	23
1880	TDMA	3	Retracted	0.347	24

EUT Position: Right Hand, 80					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
1880	TDMA	3	Extended	0.140	23
1880	TDMA	3	Retracted	0.361	24

EUT Position: Middle, Front Side Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)	Plot Number
824	AMPS	1	Extended	0.929	25
836.5	AMPS	1	Extended	0.814	26
849	AMPS	1	Extended	0.877	27

EUT Position: Middle, Back Side Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
824	AMPS	1	Extended	0.432	28

EUT Position: Middle, Back Side, Touching Phantom with Headset and Micro Phone NiMH Battery					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
824	AMPS	1	Extended	0.528	29

EUT Position: Middle, Back Side, Touching Phantom with Thick Li Battery with belt Clip					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
824	AMPS	1	Extended	0.432	30

EUT Position: Middle, Back Side, Touching Phantom with Thin Li Battery with belt Clip					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
824	AMPS	1	Extended	0.425	31

EUT Position: Middle, Back Side, Touching Phantom with Headset, Micro Phone and belt Clip					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
1880	PCS TDMA	3	Retracted	0.139	32

EUT Position: Middle, Back Side, Touching Phantom with Thick Li Battery with belt Clip					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
1880	PCS TDMA	3	Retracted	0.123	33

EUT Position: Middle, Back Side, Touching Phantom with Thin Li Battery with belt Clip					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
1880	PCS TDMA	3	Retracted	0.110	34

EUT Position: Middle, Back Side, Touching Phantom with NiMH Battery with belt Clip					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
1880	PCS TDMA	3	Retracted	0.105	35

EUT Position: Middle, Front Side Touching Phantom					
Channel MHz	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{10g} (mW/g)	Plot Number
1850	PCS TDMA	3	Extended	0.09	36
1850	PCS TDMA	3	Retracted	0.199	37
1880	PCS TDMA	3	Extended	0.142	38
1880	PCS TDMA	3	Retracted	0.305	39
1909	PCS TDMA	3	Extended	0.153	40
1909	PCS TDMA	3	Retracted	0.234	41

Note: a) Worst case data were reported
b) Duty cycle factor included in the measured SAR data
c) Uncertainty of the system is not included
d) Test was repeated at worst case frequency found in Right hand usage configuration.

3.0 EQUIPMENT

3.1 Equipment List

The Specific Absorption Rate (SAR) tests were performed with the SPEAG model DASY 3 automated near-field scanning system which is package optimized for dosimetric evaluation of mobile radios [3].

The following major equipment/components were used for the SAR evaluations:

SAR Measurement System			
EQUIPMENT	SPECIFICATIONS	S/N #	CAL. DATE
Robot	**Stäubi RX60L**	597412-01	N/A
	Repeatability: ± 0.025mm Accuracy: $0.806x10^{-3}$ degree Number of Axes: 6		
E-Field Probe	**ET3DV5**	1333	04/10/00
	Frequency Range: 10 MHZ to 6 GHz Linearity: ± 0.2 dB Directivity: ± 0.1 dB in brain tissue		
Data Acquisition	**DAE3**	317	N/A
	Measurement Range: 1µV to >200mV Input offset Voltage: < 1µV (with auto zero) Input Resistance: 200 M		
Phantom	**Generic Twin V3.0**	N/A	N/A
	Type: Generic Twin, Homogenous Shell Material: Fiberglass Thickness: 2 ± 0.1 mm Capacity: 20 liter Ear spacer: 4 mm (between EUT ear piece and tissue simulating liquid)		
Simulated Tissue	**Mixture**	N/A	10/20/00
	Please see section 6.2 for details		
Peak Power Meter	**HP 8900D** w/ 84811A sensor	3607U00673	07/31/00
	Frequency Range: 100kHz to 18 GHz Power Range: 300µW to 3W		

3.2 Brain Tissue Simulating Liquid

Ingredient	**Frequency** (800 – 900 MHz)
Water	40.3 %
Sugar	56.0 %
Salt	2.5 %
HEC	1.0 %
Bactericide	0.2 %

The dielectric parameters were verified prior to assessment using the HP 85070A dielectric probe kit and the HP 8753C network Analyzer. The dielectric parameters were:

Frequency (MHZ)	$_r$ *	*(mho/m)	**(kg/m$^{3)}$
900	41.9± 5%	0.835 ± 10%	1000

* *worst case uncertainty of the HP 85070A dielectric probe kit*
** *worst case assumption*

3.3 E-Field Probe Calibration

Probes were calibrated by the manufacturer in the TEM cell ifi 110. To ensure consistency, a strict protocol was followed. The conversion factor (ConF) between this calibration and the measurement in the tissue simulation solution was performed by comparison with temperature measurement and computer simulations. Probe calibration factors are included in Appendix C.

3.4 Measurement Uncertainty

The uncertainty budget has been determined for the DASY3 measurement system according to the NIS81 [5] and the NIST 1297 [6] documents and is given in the following table. The extended uncertainty (K=2) was assessed to be 23.5 %

UNCERTAINTY BUDGET				
Uncertainty Description	**Error**	**Distrib.**	**Weight**	**Std.Dev.**
Probe Uncertainty				
Axial isotropy	±0.2 dB	U-shape	0.5	±2.4 %
Spherical isotropy	±0.4 dB	U-shape	0.5	±4.8 %
Isotropy from gradient	±0.5 dB	U-shape	0	
Spatial resolution	±0.5 %	Normal	1	±0.5 %
Linearity error	±0.2 dB	Rectang.	1	±2.7 %
Calibration error	±3.3 %	Normal	1	±3.3 %
SAR Evaluation Uncertainty				
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 %
Spatial Peak SAR Evaluation Uncertainty				
Extrapol boundary effect	±3 %	Normal	1	±3 %
Probe positioning error	±0.1 mm	Normal	1	±1 %
Integrat. And cube orient	±3 %	Normal	1	±3 %
Cube shape inaccuracies	±2 %	Rectang.	1	±1.2 %
Device positioning	±6 %	Normal	1	±6 %
Combined Uncertanties				**±11.7 %**

3.5 Measurement Traceability

All measurements described in this report are traceable to National Institute of Standards and Technology (NIST) standards or appropriate national standards.

4.0 WARNING LABEL INFORMATION - USA

See attached users manual.

5.0 REFERENCES

[1] ANSI, *ANSI/IEEE C95.1-1991: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 Ghz*, The Institute of electrical and Electronics Engineers, Inc., New York, NY 10017, 1992

[2] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", OET Bulletin 65, FCC, Washington, D.C. 20554, 1997

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", *IEEE Transaction on Microwave Theory and Techniques*, vol. 44, pp. 105-113, Jan. 1996.

[4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetic evaluation of mobile communications equipment with know precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp.645-652, May 1997.

[5] NIS81, NAMAS, "The treatment of uncertainty in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddinton, Middlesex, England, 1994.

[6] Barry N. Tayor and Chris E. Kuyatt, "Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institude of Standards and Technology, 1994.