SAR TEST REPORT

REPORT NO.: SA920130R01
MODEL NO.: WLL220
RECEIVED: March. 07, 2003
TESTED: March. 07, 2003

APPLICANT: ASKEY COMPUTER CORP.

ADDRESS: 10F, No.119, CHIENKANG RD, CHUNG-HO, TAIPEI, TAIWAN R.O.C.

ISSUED BY: Advance Data Technology Corporation

LAB LOCATION: 47 14th Lin, Chiapau Tsun, Linko, Taipei, Taiwan, R.O.C.

Table of Contents

1. CERTIFICATION

PRODUCT :	2.4GHz/5GHz Mini – PCI Card
MODEL NO. :	WLL220
BRAND NAME :	ASKEY
APPLICANT :	ASKEY COUMPTER CORP.
STANDARDS :	47 CFR Part 2 (Section 2.1093), FCC OET Bulletin 65, Supplement C (01-01), RSS-102

We, **Advance Data Technology Corporation**, hereby certify that one sample of the designation has been tested in our facility on 07th March. 2003. The test record, data evaluation and Equipment Under Test (EUT) configurations represented herein are true and accurate, and it was tested according to the standards listed above. This device was found to be in compliance with the Specific Absorption Rate (SAR) requirement specified in FCC part 2.1093 under General Population / Uncontrolled Exposure condition.

CHECKED BY : Bunny Yao , **DATE** : March. 10, 2003
Bunny Yao

APPROVED BY : , **DATE** : March. 10, 2003
Dr. Alan Lane, Manager

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	2.4GHz/5GHz Mini – PCI Card
MODEL NO.	WLL220
POWER SUPPLY	3.3VDC powered by host equipment
CLASSIFICATION	Portable device, production unit
RADIO TECHNOLOGY	DSSS , OFDM
TRANSFER RATE	1/2/5.5/11/48/54/Mbps
FREQUENCY RANGE	2412MHz ~ 2462MHz
NUMBER OF CHANNEL	11
CONDUCTED OUTPUT POWER	49.65mW
ANTENNA TYPE	Internal Diversity
PEAK SAR	1.21W/kg
DATA CABLE	NA
I/O PORTS	Mini PCI
ASSOCIATED DEVICES	NA

2.2 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturer, this product must comply with the requirements of the following standards:

FCC 47 CFR Part 2 (2.1093)
FCC OET Bulletin 65, Supplement C (01- 01)
RSS-102

All tests have been performed and recorded as per the above standards.

2.3 GENERAL INOFRMATION OF THE SAR SYSTEM

DASY3 (software 3.1d) consists of high precision robtics system, probe alignment sensor, phantom, robot controller, controlled PC and near-field probe. The robot includes six axis that can move to the precision position of the DASY3 software defined. The DASY3 software can define the area which is detected by the probe. The robot is connected to controlled box. Controlled PC is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement, surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

ET3DV6 ISOTROPIC E-FIELD PROBE

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., glycolether).
Calibration	Basic Broad Band Calibration in air: 10-2500 MHz Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon request
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 > 100 mW/g; Linearity: ± 0.2 dB
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions	Overall length: 330 mm (Tip Length: 16 mm) Tip diameter: 6.8 mm (Body diameter: 12 mm) Distance from probe tip to dipole centers: 2.7 mm
Application	General dosimetric measurements up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms (ET3DV6)

TWIN SAM V4.0

Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Height: 810 mm; Length: 1000 mm; Width: 500 mm

SYSTEM VALIDATION KITS: D900V2 – D2450V2

Construction	Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor
Calibration	Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions
Frequency	900, 1800, 1900, 2450 MHz
Return Loss	> 20 dB at specified validation position
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
Options	Dipoles for other frequencies or solutions and other calibration conditions upon request
Dimensions	D900V2: dipole length: 149 mm; overall height: 83.3mm D1800V2: dipole length: 72 mm; overall height: 41.2 mm D1900V2: dipole length: 68 mm; overall height: 39.5 mm D2450V2: dipole length: 51.5 mm; overall height: 30.6 mm

2.4 GENERAL DESCRIPTION OF THE PROBE SCAN RULE

The maximum search is automatically performed after each coarse scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations.

The 1g peak evaluations are only available for the predefined cube 5x5x7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 32x32x30mm contains about 35g of tissue. The first procedure is an extrapolation (incl. boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid (35000 points). In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

3. DESCRIPTION OF TEST MODES AND CONFIGURATIONS

CARRIER MODULATION UNDER TEST	DSSS
CREST FACTOR	1.0
CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER	49.65mW / Ch1: 2412MHz 48.30mW / Ch6: 2437MHz 46.20mW / Ch11: 2462MHz
ANTENNA CONFIGURATION	Internal Diversity Antenna
EUT POWER SOURCE	From Host Notebook
HOST POWER SOURCE	Fully Charged Battery

The following test configurations have been applied in this test report:

Mode 1 EUT of the transmitted antenna 1 in the right side of the notebook, the bottom transmitted antenna of the notebook contact the bottom of the flat phantom with 0 cm separation distance.

Mode 2 EUT of the transmitted antenna 1 in the right side of the notebook, the keyboard face of the notebook is perpendicular to the bottom of the flat phantom and the right side of notebook is facing the phantom. The separation distance is 1.5 cm between the right side of the notebook and the bottom of the flat phantom.

Mode 3 EUT of the transmitted antenna 1 in the right side of the notebook, the keyboard face of the notebook is perpendicular to the bottom of the flat phantom and the right side of notebook is facing the phantom. The separation distance is 0 cm between the right side of notebook and the bottom of the flat phantom.

Mode 4 EUT of the transmitted antenna 2 in the left side of the notebook, the bottom transmitted antenna of the notebook contact the bottom of the flat phantom with 0 cm separation distance.

Mode 5 EUT of the transmitted antenna 2 in the left side of the notebook, the keyboard face of the notebook is perpendicular to the bottom of the flat phantom and the right side of notebook is facing the phantom. The separation distance is 1.5 cm between the right side of the notebook and the bottom of the flat phantom.

Mode 6 EUT of the transmitted antenna 2 in the left side of the notebook, the keyboard face of the notebook is perpendicular to the bottom of the flat phantom and the right side of notebook is facing the phantom. The separation distance is 0 cm between the right side of notebook and the

bottom of the flat phantom.

NOTE 1: Please reference “APPENDIX A” for the photos of test configuration.

NOTE 2: Both DSSS and OFDM can be provided in this product. The conducted power of DSSS is higher and the SAR testing of DSSS is also higher, so the mode DSSS was chosen to be tested and presented in this report.

4. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NB				FCC DoC APPROVED

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

5. TEST RESULTS

5.1 TEST PROCEDURES

The SAR value was calculated via the 3D spline interpolation algorithm which has been implemented in the software of DASY3 SAR measurement system manufactured and calibrated by Schmid & Partner.

A coarse scan with 20mm x 20mm grid was performed for the highest spatial SAR location. A fine scan with 32mm x 32mm x 30mm volume was performed for SAR value averaged over 1g and 10g spatial volumes.

5.2 MEASURED SAR RESULT

VIRONMENTAL ONDICTION	Temperature：22°C, Humidity：60%RH		
TESTED BY	Bunny Yao		
MODE	**CHANNEL**	**FREQUENCY (MHz)**	**MEASURED 1g SAR (W/kg)**
1	1	2412	0.0346
	6	2437	0.0264
	11	2462	0.0158
2	1	2412	0.107
	6	2437	0.0993
	11	2462	0.076
3	1	2412	0.964
	6	2437	1.21
	11	2462	0.971
4	1	2412	0.0325
	6	2437	0.0241
	11	2462	0.0140
5	1	2412	0.0940
	6	2437	0.0921
	11	2462	0.0721
6	1	2412	0.921
	6	2437	1.010

	11	2462	0.935

NOTE:

1.Test configuration of each mode is described in section 3.

2.In this testing, the limit for General Population Spatial Peak averaged over 1g, **1.6 W/kg**, is applied.

3.Please see the Appendix for the photo of the test configuration and also the data.

5.3 SAR LIMITS

HUMAN EXPOSURE	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / controlled Exposure Environment)
Spatial Average (whole body)	0.08	0.4
Spatial Peak (averaged over 1 g)	**1.6**	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

5.4 EUT CONDUCTED POWER VARIATION

The variation of the EUT conducted power measured before and after SAR testing should not over 5%. The test procedures for conducted power level is described in FCC rule part 2.1046.

The maximum variation in this testing is listed in the following table.

Channel	Conducted Power (Before)	Conducted Power (After)	Variation (%)
1	49.65	49.15	-1.0
6	48.30	48.40	0.20
11	46.20	46.43	0.49

5.5 TISSUE

Tissue Components		
Ingredient	**Brain**	**Muscle**
Water	55.20%	69.95%
Glycol Monobutyl	44.80%	30.00%
Salt	-	0.05%

The tissue of 2450MHz for brain and body was well prepared according to the standard procedures. The required and measured dielectric parameters are listed in this table.

	Brain		**Muscle**	
	Required	**Measured**	**Required**	**Measured**
Permitivity (ε_r)	39.2 ± 5%	NA	52.7 ± 5%	52.03
Conductivity (σ)	1.8 ± 5%	NA	1.95 ± 5%	1.95

The measured parameters of the used tissue.

Tissue Prepared and Measured on 07th March. 2003				
	Brain		**Muscle**	
	Value	**Freq. (MHz)**	**Value**	**Freq.(MHz)**
Permitivity	NA	NA	52.4	2412
	NA	NA	52.12	2437
	NA	NA	51.85	2462
Conductivity	NA	NA	1.87	2412
	NA	NA	1.91	2437
	NA	NA	1.97	2462

5.6 TEST EQUIPMENT FOR TISSUE PROPERTY

Item	Name	Provider	Type	Series No.	Calibrated Until
1	Network Analyzer	Agilent	8720ES	NA	May 6, 2003
2	Dielectric Probe	Agilent	85070C	NA	NA

6. SYSTEM VALIDATION

The system validation was performed in the flat phantom with equipment listed in the following table. Since the SAR value is calculated from the measured electric field, dielectric constant and conductivity of the body tissue, and the SAR is proportional to the square of the electric field. So, the SAR value will be also proportional to the RF power input to the system validation dipole under the same test environment. In our system validation test, 50mW RF input power was used instead of 250mW used by Schmid & Partner, then the measured SAR will be linearly extrapolated to that of 250mW RF power.

6.1 TEST EQUIPMENT

Item	Name	Provider	Type	Series No.	Calibrated Until
1	SAM Phantom	S & P	QD000 P40 CA	PT-1150	NA
2	Validation Dipole	S & P	D2450V2	716	Sept. 25, 2004
3	Signal Generator	R & S	SMP04	10001	May 5, 2003
4	E-Field Probe	S & P	ET3DV6	1687	Sept. 27, 2003
5	DAE	S & P	DAE3 V1	510	April 10, 2004
6	Robot Positioner	Staubli Unimation	NA	NA	NA

6.2 VALIDATION RESULT

ENVIRONMENTAL ONDICTION	Temperature：23°C, Humidity：60%RH		
TESTED BY	Bunny Yao		
2450MHz System Validation Test in Body Tissue			
Required	**Measured**	**Deviation (%)**	**Separation Distance**
14.30 (1g)	13.7	-4.37	1.0cm
6.74 (10g)	6.4	-5.31	1.0cm

NOTE: Please see Appendix for the photo of system validation test.

7. MEASUREMENT UNCERTAINTIES

	Uncertainty Value	Probability Distribution	Divisor	C_i	Stantard Uncertainty
Test Sample Related					
Test Sample Positioning	±6%	Normal	1	1	±6%
Drift of Output Power	±5%	Rectangular	$\sqrt{3}$	1	±2.9%
Phantom and Setup					
Phantom Uncertainty	±0%	Rectangular	$\sqrt{3}$	1	±0%
Liquid Conductivity(target)	±5%	Rectangular	$\sqrt{3}$	0.5	±1.4%
Liqiuid Conductivity(meas)	±10%	Rectangular	$\sqrt{3}$	0.5	±2.9%
Liquid Permittivity(target)	±5%	Rectangular	$\sqrt{3}$	0.5	±1.4%
Liquid Permittivity(meas)	±5%	Rectangular	$\sqrt{3}$	0.5	±1.4%
RF Ambient Conditions	±3%	Rectangular	$\sqrt{3}$	1	±1.7%
System Check					
Calibration	± 2.6 %	normal	1	1	± 2.6 %
Axial isotropy	± 2.3 %	rectangular	$\sqrt{3}$	$(1\text{-cp})^{1/2}$	± 0.9 %
Hemispherical isotropy	± 9.6 %	rectangular	$\sqrt{3}$	$\sqrt{cp}$	± 3.9 %
Spatial resolution	± 0.5 %	rectangular	$\sqrt{3}$	1	± 0.3 %
Boundary effect	± 4.0 %	rectangular	$\sqrt{3}$	1	± 6.4 %
Linearity	± 4.7 %	rectangular	$\sqrt{3}$	1	± 2.7 %
Detection Limit	± 2.0 %	rectangular	$\sqrt{3}$	1	± 1.2 %
Readout Electronics	± 1.0 %	normal	1	1	± 1.0 %
Mechanical Constrains of Robot	± 0.4 %	normal	1	1	± 0.4 %
Probe positioning	± 5.0 %	rectangular	$\sqrt{3}$	1	± 2.9 %
Extrapolation/Integration	± 3.9 %	rectangular	$\sqrt{3}$	1	± 2.3 %
Dipole/Liquid Distance	± 1.0 %	rectangular	$\sqrt{3}$	1	± 0.6 %
Dipole Input Power	± 4.7 %		1	1	± 4.7 %
Liquid conductivity (target)	± 5.0 %	rectangular	$\sqrt{3}$	0.6	± 1.7 %
Liquid conductivity (meas.)	± 10 %	rectangular	$\sqrt{3}$	0.6	± 3.5 %
Liquid permittivity (target)	± 5.0 %	rectangular	$\sqrt{3}$	0.6	± 1.7 %
Liquid permittivity (meas.)	± 5.0 %	rectangular	$\sqrt{3}$	0.6	± 1.7 %
RF Ambient condition	± 3.0 %	normal	1	1	± 1.7 %
Combined Standard Uncertainty					±12.4 %
Expanded Uncertainty (K=2)					±24.9 %

8. INFORMATION ON THE TESTING LABORATORIES

We, ADT Corp., were founded in 1988 to provide our best service in EMC and Safety consultation. Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025, Guide 25 or EN 45001:

USA	FCC, NVLAP
Germany	TUV Rheinland
Japan	VCCI
New Zealand	MoC
Norway	NEMKO
R.O.C.	BSMI, DGT, CNLA

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC Lab:
Tel: 886-2-26052180
Fax: 886-2-26052943

Hsin Chu EMC Lab:
Tel: 886-35-935343
Fax: 886-35-935342

Lin Kou Safety Lab:
Tel: 886-2-26093195
Fax: 886-2-26093184

Lin Kou RF&Telecom Lab
Tel: 886-3-3270910
Fax: 886-3-3270892

Email: service@mail.adt.com.tw
Web Site: www.adt.com.tw

The address and road map of all our labs can be found in our web site also.