CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Test Lab:	**Applicant Information:**
CELLTECH RESEARCH INC. Testing and Engineering Lab 1955 Moss Court Kelowna, B.C. Canada V1Y 9L3 Phone: 250 - 860-3130 Fax: 250 - 860-3110 Toll Free: 1-877-545-6287 e-mail: info@celltechlabs.com web site: www.celtechlabs.com	**VTECH MOBILE (ASIA) LIMITED** Block 1, 23/F, Tai Ping Industrial Center 57 Ting Kok Road, Tai Po Hong Kong, China

FCC ID:	**P5680-5196-00**
Model(s):	**A700**
Equipment Type:	**Single-Mode PCS GSM Phone**
Classification:	**Part 24 Licensed Portable Transmitter Held to Ear (PCE)**
Tx Frequency Range:	**1850.2 - 1909.8 MHz**
Rated RF Conducted Pwr:	**29 dBm**
FCC Rule Part(s):	**2.1093; ET Docket 96.326**
IC Rule Part(s):	**RSS-102 Issue 1 (Provisional)**

Celltech Research Inc. declares under its sole responsibility that this device was found to be in compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC OET Bulletin 65, Supplement C, Edition 01-01, and Industry Canada RSS-102 Issue 1 (General Population/Uncontrolled Exposure), and was tested in accordance with the appropriate measurement standards, guidelines, and recommended practices specified in American National Standards Institute C95.1-1992.

I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

This test report shall not be reproduced partially, or in full, without the prior written approval of Celltech Research Inc. The results and statements contained in this report pertain only to the device(s) evaluated.

Shawn McMillen
General Manager
Celltech Research Inc.

© 2002 Celltech Research Inc.

TABLE OF CONTENTS

1.0 **INTRODUCTION**…… 1

2.0 **DESCRIPTION OF EUT**……..……..…… 1

3.0 **SAR MEASUREMENT SYSTEM** …… 2

4.0 **MEASUREMENT SUMMARY**……..……... 3-5

5.0 **DETAILS OF SAR EVALUATION**……. 6-7

6.0 **EVALUATION PROCEDURES**……..…….. 8-9

7.0 **SYSTEM VALIDATION**……..... 10

8.0 **TISSUE PARAMETERS**…… 10

9.0 **SIMULATED EQUIVALENT TISSUES**……..……. 11

10.0 **SAR LIMITS**…… 11

11.0 **SYSTEM SPECIFICATIONS**.……... 12

12.0 **SAM PHANTOM**……..…..……... 13

13.0 **DEVICE HOLDER**……..…… 13

14.0 **PROBE SPECIFICATION**……. 13

15.0 **TEST EQUIPMENT LIST**……..…… 14

16.0 **MEASUREMENT UNCERTAINTIES**……. 15

17.0 **REFERENCES**……. 16

APPENDIX A - SAR MEASUREMENT DATA……...……. 17
APPENDIX B - DIPOLE VALIDATION……..……. 18
APPENDIX C - PROBE CALIBRATION……..…… 19
APPENDIX D - MEASURED LIQUID DIELECTRIC PARAMETERS….…... 20
APPENDIX E - CERTIFICATE OF CONFORMITY: SAM PHANTOM…..... 21
APPENDIX F - SAR TEST SETUP & BODY HOLSTER PHOTOGRAPHS... 22

© 2002 Celltech Research Inc.

1.0 INTRODUCTION

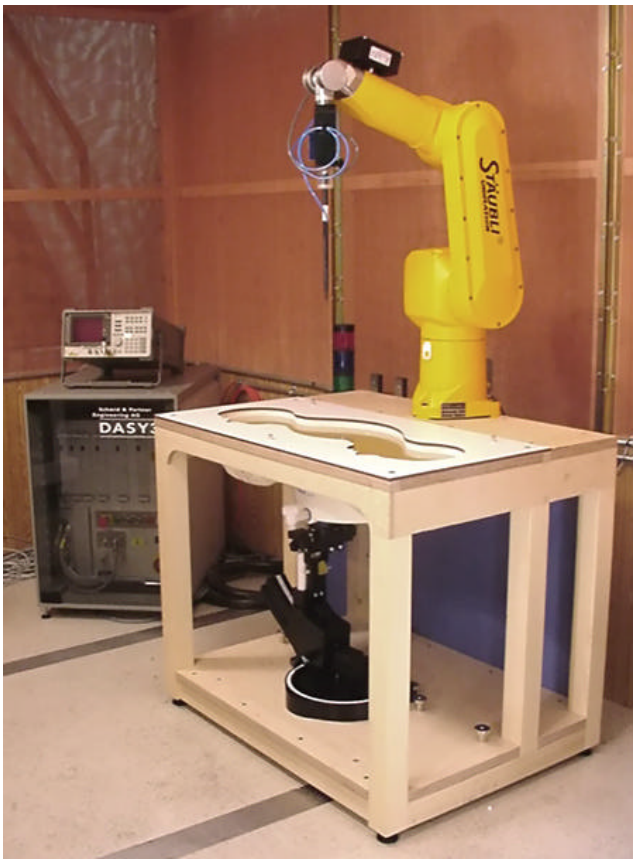
This measurement report shows that the VTECH Model: A700 Single-Mode PCS GSM Phone FCC ID: P5680-5196-00 complies with FCC Part 2.1093, ET Docket 96-326 Rules for mobile and portable devices. The test procedures, as described in American National Standards Institute C95.1-1992 (see reference [1]), FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [2]), and Industry Canada RSS-102 Issue 1 (see reference [3]) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION of Equipment Under Test (EUT)

EUT Type	Single-Mode PCS GSM Phone	**FCC ID**	P5680-5196-00
Equipment Class	Licensed Portable Transmitter Held to Ear (PCE)	**Model No.(s)**	A700
FCC Rule Part(s)	§ 2.1093, Docket 96-326	**Application Type(s)**	FCC Part 24 Certification IC RSS-133 Certification
IC Rule Part(s)	RSS-102 Issue 1 (Provisional)	**Serial No.**	Pre-production Unit
Tx Frequency Range	1850.2 - 1909.8 MHz	**Battery Type(s)**	Lithium-Ion Battery Standard-life: 4.2V 540mAh Extended-life: 4.2V 700mAh
Modulation	PCS GSM	**Antenna Type**	Helical Stubby (1/4λ)
Rated RF Conducted Pwr.	29 dBm	**Antenna Length**	30 mm

3.0 SAR MEASUREMENT SYSTEM

Celltech Research SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.



DASY3 SAR Measurement System with SAM phantom

4.0 MEASUREMENT SUMMARY

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix A.

HEAD SAR MEASUREMENT RESULTS – Left Head Section

Freq. (MHz)	Channel	Modulation	Cond. Power Before (dBm)	Cond. Power After (dBm)	Battery Type	Antenna Position	Phantom Section	Test Position	SAR 1g (w/kg)
1850.2	512	PCS GSM	29.21	29.09	Standard	Fixed	Left Ear	Cheek/Touch	0.778
1880.0	661	PCS GSM	29.28	29.19	Standard	Fixed	Left Ear	Cheek/Touch	0.799
1909.8	810	PCS GSM	29.48	29.39	Standard	Fixed	Left Ear	Cheek/Touch	0.918
1850.2	512	PCS GSM	29.15	29.08	Standard	Fixed	Left Ear	Ear/Tilt	1.02
1880.0	661	PCS GSM	29.24	29.17	Standard	Fixed	Left Ear	Ear/Tilt	1.10
1909.8	810	PCS GSM	29.42	29.36	Standard	Fixed	Left Ear	Ear/Tilt	1.30
1850.2	512	PCS GSM	29.35	29.29	Extended	Fixed	Left Ear	Ear/Tilt	1.07
1880.0	661	PCS GSM	29.42	29.41	Extended	Fixed	Left Ear	Ear/Tilt	1.13
1909.8	810	PCS GSM	29.60	29.57	Extended	Fixed	Left Ear	Ear/Tilt	1.40

Mixture Type: Brain (Measured)		
Date	**Dielectric Constant**	**Conductivity**
1/4/02	**39.5**	**1.40**
1/7/02	**39.4**	**1.40**

ANSI / IEEE C95.1 1992 - SAFETY LIMIT
Spatial Peak - Uncontrolled Exposure/General Population
BRAIN: 1.6 W/kg (averaged over 1 gram)

Notes:

1. Test Date(s): January 4, 2002 (standard-life battery)
   January 7, 2002 (extended-life battery)
2. The SAR values found were below the maximum limit of 1.6 w/kg (averaged over 1 gram).
3. The highest head SAR value found was 1.40 w/kg (extended-life battery, ear/tilt position).
4. The EUT was tested for body SAR with both the standard and extended life battery options.
5. Ambient TEMPERATURE: 22.7 °C
   Relative HUMIDITY: 56.6 %
   Atmospheric PRESSURE: 95.4 kPa
6. Fluid Temperature ≈ 23 °C
7. During the entire test the conducted power was maintained to within 5% of the initial conducted power.

MEASUREMENT SUMMARY (CONT.)

HEAD SAR MEASUREMENT RESULTS – Right Head Section

Freq. (MHz)	Channel	Modulation	Cond. Power Before (dBm)	Cond. Power After (dBm)	Battery Type	Antenna Position	Phantom Section	Test Position	SAR 1g (w/kg)
1850.2	512	PCS GSM	29.17	29.13	Standard	Fixed	Right Ear	Cheek/Touch	0.709
1880.0	661	PCS GSM	29.21	29.19	Standard	Fixed	Right Ear	Cheek/Touch	0.744
1909.87	810	PCS GSM	29.39	29.35	Standard	Fixed	Right Ear	Cheek/Touch	0.847
1850.2	512	PCS GSM	29.27	29.21	Standard	Fixed	Right Ear	Ear/Tilt	1.04
1880.0	661	PCS GSM	29.40	29.38	Standard	Fixed	Right Ear	Ear/Tilt	1.25
1909.8	810	PCS GSM	29.19	29.16	Standard	Fixed	Right Ear	Ear/Tilt	0.967
1850.2	512	PCS GSM	29.44	29.39	Extended	Fixed	Right Ear	Ear/Tilt	0.889
1880.0	661	PCS GSM	29.60	29.55	Extended	Fixed	Right Ear	Ear/Tilt	0.957
1909.8	810	PCS GSM	29.60	29.56	Extended	Fixed	Right Ear	Ear/Tilt	1.18

Mixture Type: Brain (Measured)			
Date	**Dielectric Constant**	**Conductivity**	**ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak - Uncontrolled Exposure/General Population BRAIN: 1.6 W/kg (averaged over 1 gram)**
1/4/02 1/7/02	**39.5 39.4**	**1.40 1.40**	

Notes:

1. Test Date(s): January 4, 2002 (standard-life battery)
   January 7, 2002 (extended-life battery)
2. The SAR values found were below the maximum limit of 1.6 w/kg (averaged over 1 gram).
3. The highest head SAR value found was 1.25 w/kg (standard-life battery, ear/tilt position).
4. The EUT was tested for body SAR with both standard and extended life battery options.
5. Ambient TEMPERATURE: 22.7 °C
   Relative HUMIDITY: 56.6 %
   Atmospheric PRESSURE: 95.4 kPa
6. Fluid Temperature ≈ 23 °C
7. During the entire test the conducted power was maintained to within 5% of the initial conducted power.

BODY SAR MEASUREMENT RESULTS

Freq. (MHz)	Channel	Modulation	Cond. Power Before (dBm)	Cond. Power After (dBm)	Battery Type	Antenna Position	Phantom Section	Body Holster Separation Distance (cm)	SAR 1g (w/kg)
1850.2	512	PCS GSM	29.36	29.31	Standard	Fixed	Planar	1.5	0.295
1880.0	661	PCS GSM	29.48	29.36	Standard	Fixed	Planar	1.5	0.367
1909.8	810	PCS GSM	29.60	29.57	Standard	Fixed	Planar	1.5	0.538
1850.2	512	PCS GSM	29.44	29.39	Extended	Fixed	Planar	1.5	0.298
1880.0	661	PCS GSM	29.48	29.47	Extended	Fixed	Planar	1.5	0.363
1909.8	810	PCS GSM	29.60	29.57	Extended	Fixed	Planar	1.5	0.438
Mixture Type: Body (Measured) Dielectric Constant: 53.4 Conductivity: 1.52				**ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak: Uncontrolled Exposure/General Population BODY: 1.6 W/kg (averaged over 1 gram)**					

Notes:

1. Test Date(s): January 7, 2002.
2. The body SAR values found were below the maximum limit of 1.6 w/kg (averaged over 1 gram).
3. The highest body SAR value found was 0.538 w/kg (standard-life battery).
4. The EUT was tested for body SAR with both the standard and extended life battery options.
5. The EUT was tested for body SAR with ear-microphone and leather body-holster. The body-holster provided a 1.5cm separation distance between the back of the phone and the outer surface of the SAM planar phantom.
6. Ambient TEMPERATURE: 22.6 °C
   Relative HUMIDITY: 56.3 %
   Atmospheric PRESSURE: 95.1 kPa
7. Fluid Temperature ≈ 23.0 °C
8. During the entire test the conducted power was maintained to within 5% of the initial conducted power.

5.0 DETAILS OF SAR EVALUATION

The VTECH Model: A700 Single-Mode PCS GSM Phone FCC ID: P5680-5196-00 was found to be compliant for localized Specific Absorption Rate (SAR) based on the following test provisions and conditions:

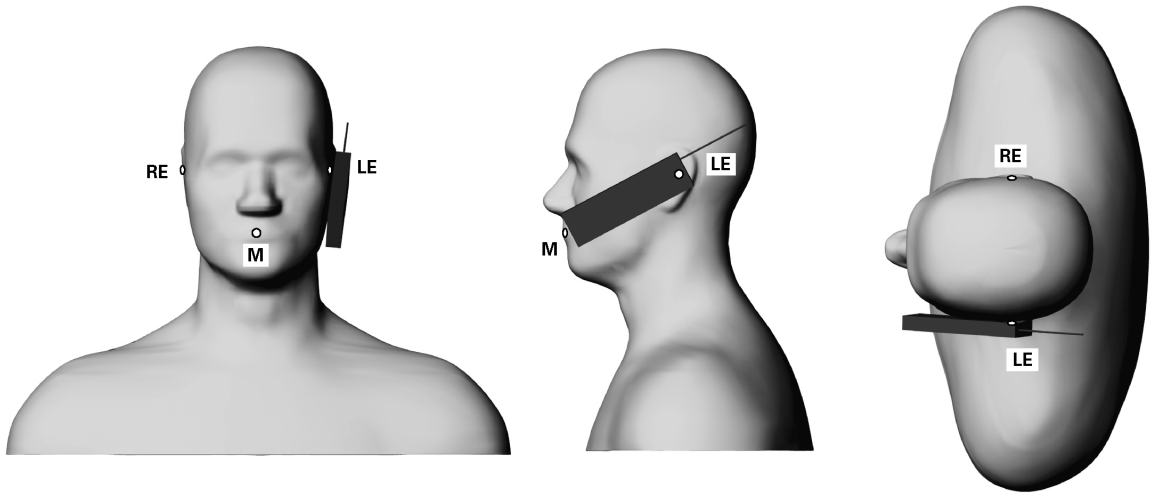
1) The EUT was tested in a ear-held configuration on both the left and right sections of the phantom with the device antenna in both the extended and retracted positions as follows:

a) The handset was placed in the device holder in a normal operating position with the test device reference point located along the vertical centerline on the front of the device aligned to the ear reference point, with the center of the earpiece touching the center of the ear spacer of the SAM phantom.

b) With the handset positioned parallel to the cheek, the test device reference point was aligned to the ear reference point on the head phantom, and the vertical centerline was aligned to the phantom reference plane (initial ear position).

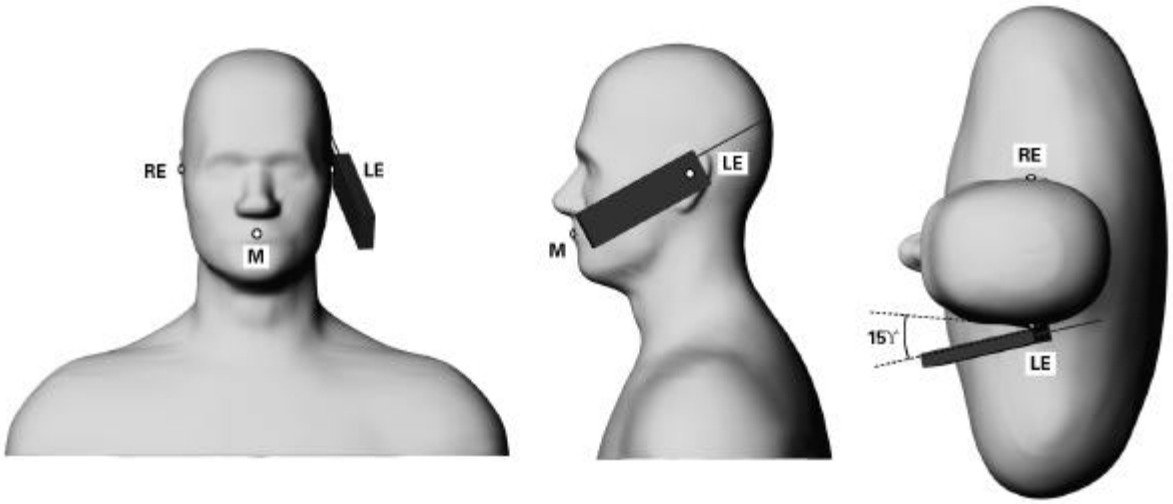
c) While maintaining the three alignments, the body of the handset was gradually adjusted to each of the following test positions:

- Cheek/Touch Position: The handset was brought toward the mouth of the head phantom by pivoting against the ear reference point until any point of the mouthpiece or keypad touched the phantom.



Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated (Shoulders are shown for illustration only).

- Ear/Tilt Position: With the phone aligned in the Cheek/Touch position, the handset was tilted away from the mouth with respect to the test device reference point by 15 degrees.



Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated (Shoulders are shown for illustration only).

2) The EUT was tested in a body-worn configuration with ear-microphone and leather body holster. The back of the EUT was placed parallel to, and touching, the outer surface of the planar phantom. The leather body holster provided a 1.5 cm separation distance between the back of the EUT and the outer surface of the planar phantom. Both antenna extended and retracted antenna modes were tested.
3) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimize drift. The conducted power levels were checked before and after each test. If the conducted power level deviated more than 5% of the initial power level, then the EUT was retested. Any unusual anomalies over the course of the test also warranted a re-evaluation.
4) The conducted power was measured according to the procedures described in FCC Part 2.1046.
5) The EUT was placed into test mode via keypad access at a full data rate in the "always up" power control mode.
6) The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the handset and its antenna.
7) The EUT was tested with a fully charged battery.

6.0 EVALUATION PROCEDURES

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation both the left and right ear positions were evaluated at the low, middle, and high frequencies of the band at maximum power, and with the device antenna in both the extended and extracted positions as applicable. The positioning of the ear-held device relative to the phantom was performed in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) using the SAM phantom.

(ii) For face-held and body-worn devices a planar phantom was used.

b. The SAR was determined by a pre-defined procedure within the DASY3 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface using a uniform grid spacing.

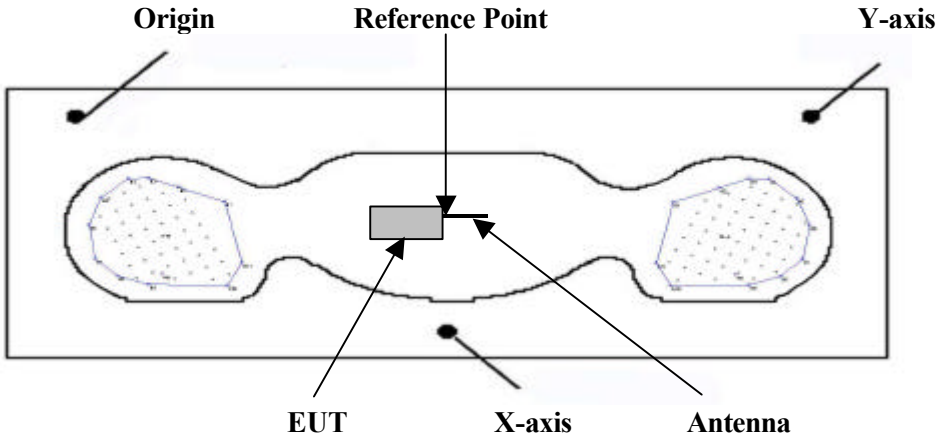
c. A 5x5x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.

d. The depth of the simulating tissue in the phantom used for the SAR evaluation and system validation was no less than 15cm.

e. The E-field probe conversion factors were determined as follows:

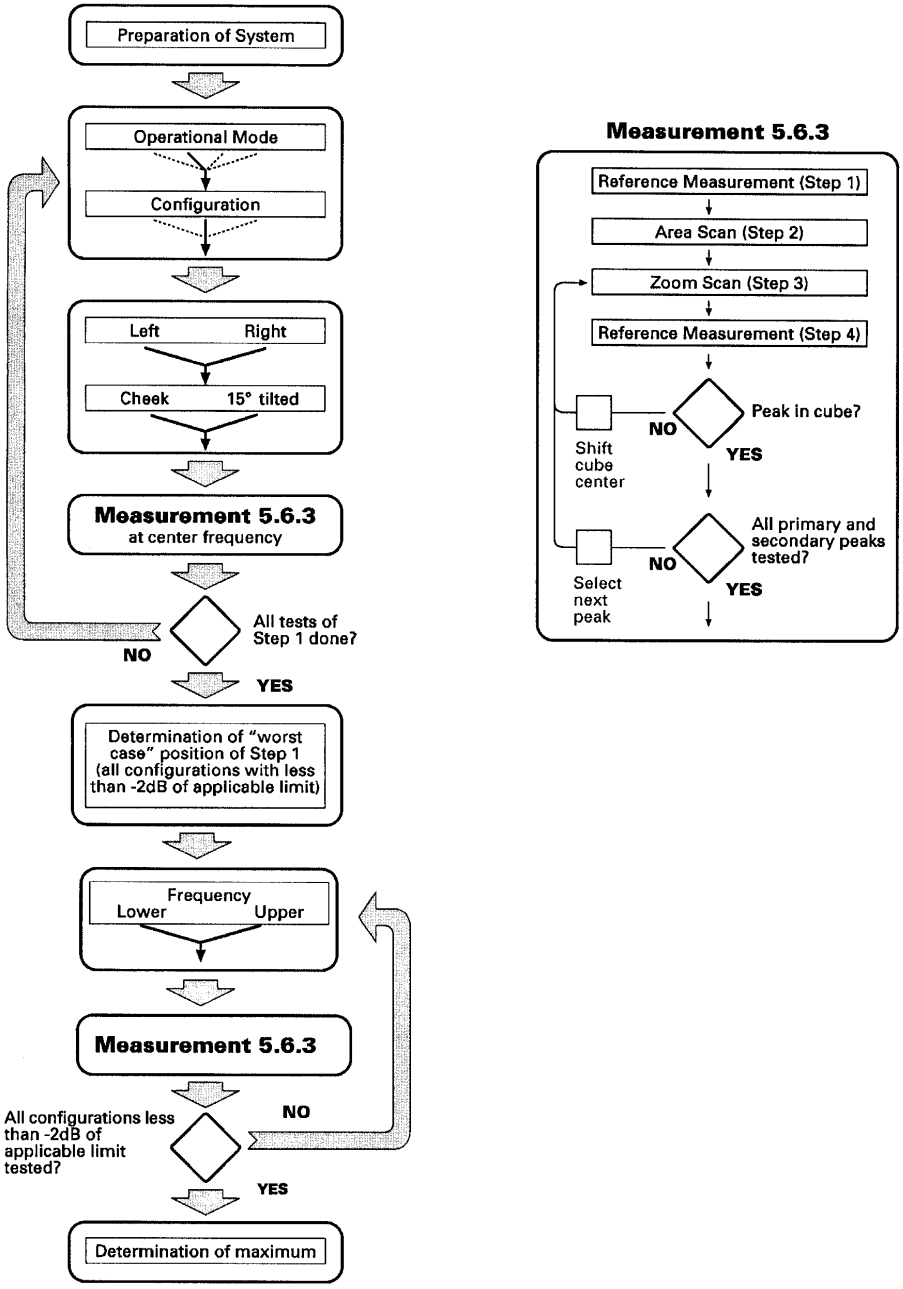
- In brain and muscle tissue between 750MHz and 1GHz, the conversion factor decreases approximately 1.3% per 100MHz frequency increase.
- In brain and muscle tissue between 1.6GHz and 2GHz, the conversion factor decreases approximately 1% per 100MHz frequency increase.

f. The 1800MHz probe conversion factors used for the SAR evaluation were 5.78 for head and 5.36 for body. The manufacturers specified probe conversion factors at 1900MHz are 5.66 and 5.25 for head and body respectively. An evaluation of the highest SAR values for the EUT using 1900MHz probe conversion factors increases the overall SAR for head and body by approximately 2%, which is less than the uncertainty of the probe conversion factors and considerably less then the overall uncertainty of the entire system.



Device Positioning & Reference Point (Body SAR)

EVALUATION PROCEDURES (Cont.)



Flow chart of the recommended practices and procedures (IEEE P1528)

7.0 SYSTEM VALIDATION

Prior to the assessment, the system was verified in the planar section of the SAM phantom using an 1800MHz dipole. A forward power of 250mW was applied to the dipole, and the system was verified to a tolerance of ±10%. The applicable verification is as follows (see Appendix B for validation test plots):

Dipole Validation Kit	Target SAR 1g (w/kg)	Measured SAR 1g (w/kg)	Fluid Temperature	Validation Date
D1800V2	9.66	9.62	≈23.0 °C	01/04/02
		9.69	≈23.0 °C	01/07/02

8.0 TISSUE PARAMETERS

The dielectric parameters of the fluids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer. The dielectric parameters of the fluid are listed below. See also Appendix D - Measured Liquid Dielectric Parameters.

BRAIN TISSUE PARAMETERS - DIPOLE VALIDATION & EUT EVALUATION			
Equivalent Tissue	**Dielectric Constant e_r**	**Conductivity s (mho/m)**	**r (Kg/m^3)**
1800MHz Brain (Target)	40.0 ±5%	1.40 ±5%	1000
1800MHz Brain (Measured: 01/04/02)	39.5	1.40	1000
1800MHz Brain (Measured: 01/07/02)	39.4	1.40	1000

BODY TISSUE PARAMETERS - EUT EVALUATION			
Equivalent Tissue	**Dielectric Constant e_r**	**Conductivity s (mho/m)**	**r (Kg/m^3)**
1800MHz Body (Target)	53.3 ±5%	1.52 ±5%	1000
1800MHz Body (Measured: 01/07/02)	53.4	1.52	1000

9.0 SIMULATED TISSUES

The 1800MHz brain and body mixtures consist of Glycol-monobutyl, water, and salt. The fluid was prepared according to standardized procedures, and measured for dielectric parameters (permitivity and conductivity).

TISSUE MIXTURE - DIPOLE VALIDATION & EUT EVALUATION		
INGREDIENT	**1800MHz Brain Mixture (Validation & EUT Evaluation)**	**1800MHz Body Mixture (EUT Evaluation)**
Water	54.90 %	69.91 %
Glycol Monobutyl	44.92 %	29.96 %
Salt	0.18 %	0.13 %

10.0 SAR SAFETY LIMITS

EXPOSURE LIMITS	**SAR (W/Kg)**	
	(General Population / Uncontrolled Exposure Environment)	**(Occupational / Controlled Exposure Environment)**
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

Notes: 1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.

2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

11.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER:	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability:	0.02 mm
No. of axis:	6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor:	Pentium III
Clock Speed:	450 MHz
Operating System:	Windows NT
Data Card:	DASY3 PC-Board

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY3 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16-bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot

E-Field Probe

Model:	ET3DV6
Serial No.:	1590
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

Phantom

Type:	SAM V4.0C
Configuration:	Left Head, Right Head, Planar Section
Shell Material:	Fiberglass
Thickness:	2.0 ±0.1 mm
Volume:	Approx. 20 liters

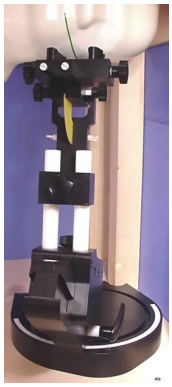
12.0 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0 mm shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections.

SAM Phantom V4.0C

13.0 DEVICE HOLDER

The DASY3 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.



Device Holder

14.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to >6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz)
Directivity:	±0.2 dB in brain tissue (rotation around probe axis) ±0.4 dB in brain tissue (rotation normal to probe axis)
Dynam. Rnge:	5 µW/g to >100 mW/g; Linearity: ±0.2 dB
Srfce. Detect.	±0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
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 phone

ET3DV6 E-Field Probe

15.0 TEST EQUIPMENT LIST

SAR MEASUREMENT SYSTEM		
EQUIPMENT	***SERIAL NO.***	***DATE CALIBRATED***
DASY3 System -Robot -ET3DV6 E-Field Probe -900MHz Validation Dipole -1800MHz Validation Dipole -SAM Phantom V4.0C	 599396-01 1590 054 247 N/A	 N/A Mar 2001 June 2001 June 2001 N/A
85070C Dielectric Probe Kit	N/A	N/A
Gigatronics 8652A Power Meter -Power Sensor 80701A -Power Sensor 80701A	1835272 1833535 1833542	Oct 2001 Jan 2002 Feb 2001
CMD55 GSM Base Station Simulator	832474/043	May 2001
E4408B Spectrum Analyzer	US39240170	Nov 2001
8594E Spectrum Analyzer	3543A02721	Mar 2001
8753E Network Analyzer	US38433013	Nov 2001
8648D Signal Generator	3847A00611	Aug 2001
5S1G4 Amplifier Research Power Amplifier	26235	N/A

16.0 MEASUREMENT UNCERTAINTIES

Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	c_i 1g	Standard Uncertainty ±% (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	$(1-c_p)$	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(c_p)	± 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. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Extrap. & 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		± 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 (measured)	± 10.0	Rectangular	√3	0.6	± 3.5	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					**± 13.6**	
Expanded Uncertainty (k=2)					**± 27.1**	

The divisor for device positioning uncertainty and holder uncertainty are based on the procedure defined in IEEE Std 1528 (draft) (see reference [6]), or based on the degrees of freedom for each error source.

For estimation of Device Positioning Uncertainty (divisor=0.89) 12 different devices were used (see last column - i.e. degrees of freedom). The corresponding k_p factor for v_{eff}=12 is 2.23, therefore the divisor is 2/2.23=0.89.

For estimation of Device Holder Uncertainty (divisor=0.84) 8 different devices were used (see last column - i.e. degrees of freedom). The corresponding k_p factor for v_{eff}=8 is 2.37, therefore the divisor is 2/2.37=0.84.

17.0 REFERENCES

[1] ANSI, ANSI/IEEE C95.1: 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: 1992.

[2] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.

[3] Industry Canada, "Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields", RSS-102 Issue 1 (Provisional): September 1999.

[4] 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: January 1996.

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

[6] IEEE Standards Coordinating Committee 34, Std. P1528, DRAFT Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques: Draft 6.4, December 2001.