JAPAN QUALITY ASSURANCE ORGANIZATION
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EMC SAR - TEST REPORT

JQA APPLICATION No. : KL80040152R

Name of Product : GSM Cellular-Phone

Model/Type No. : GX25

FCC ID : APYHRO00036

Applicant : Sharp Corporation, Communication Systems Group

Address : 2-13-1, Iida, Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan

Manufacturer : Sharp Corporation, Communication Systems Group

Address : 2-13-1, Iida, Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan

Receive date of EUT : July 20, 2004

Final Judgement : **Passed**

TEST RESULTS IN THIS REPORT are obtained in use of equipment that is traceable to National Institute of Advanced Industrial Science and Technology (AIST) under METI Japan, National Institute of Information and Communications Technology (NICT) under MPHPT Japan, and Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zürich, Switzerland.

THE TEST RESULTS only responds to the test sample. This test report shall not be reproduced except in full.

Authorized by:

Takashi Yamanaka, Director
JQA KITA-KANSAI Testing Center

DIRECTORY

TEST REGULATION

FCC Rules and Regulations Parts 2 Subpart J (October 1, 2003)

○ - Mobile Devices (§2.1091)
● - Portable Devices (§2.1093)
○ - Occupational/Controlled Exposure
● - General Population/Uncontrolled Exposure

Test procedure:

The SAR measurement procedures were specified in FCC/OET Bulletin 65 Supplement C (July, 2001) and IEEE Std 1528™-2003
The exposure limits were specified in ANSI/IEEE C95.1-1999.

GENERAL INFORMATION

Description of the Equipment Under Test (EUT):

1)	Name	: GSM Cellular-Phone
2)	Model/Type No.	: GX25
3)	Product Type	: Pre-production (S/N: TA-257)
4)	EUT Authorization	: ○ - Verification ● - Certification ○ - D.o.C.
5)	Transmitting Frequency	: 1850.20 MHz - 1909.80 MHz (PCS1900) 2402.00 MHz - 2480.00 MHz (Bluetooth)
6)	Receiving Frequency	: 1930.20 MHz - 1989.80 MHz (PCS1900) 2402.00 MHz - 2480.00 MHz (Bluetooth)
7)	Max. RF Output Power	: 29.56 dBm
8)	Power Rating	: 3.9VDC

Note : This device contains GSM 900 MHz and DCS 1800 MHz functions not operational in U.S. territories. This report is only appliance for PCS 1900 MHz band.

Definitions for symbols used in this test report:

● - Black box indicates that the listed condition, standard or equipment is applicable for this Report.
○ - Blank box indicates that the listed condition, standard or equipment is not applicable for this Report.

Description of the Antenna:

Type : Inverted F type antenna
Dimensions : Maximum width 36.38 mm
Maximum length 16.37 mm
Location : Inside the back cover

[Bluetooth Antenna]
Type : Inverted L type antenna
Dimensions : Maximum width 8.2 mm
Maximum length 19.05 mm
Location : Inside the back cover

Battery Option:

Lithium-ion Battery Pack XN-1BT30 (780mAh)

Probe Specification:

Construction : Symmetrical design with triangular core
Built-in optical fiber for surface detection system
Built-in shielding against static changes

Calibration : In air form 10 MHz to 2.5 GHz
In head tissue simulating liquid (HSL) and muscle tissue simulating liquid
900 MHz (accuracy ± 11.3%; k=2)
1800 MHz (accuracy ± 11.7%; k=2)
2450 MHz (accuracy ± 9.7%; k=2)

Frequency : 10 MHz to 3 GHz (dosimetry);
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 probe axis)

Dynamic Range : 5 μW/g to >100 mW/g; Linearity: ± 0.2 dB

Surface Detection : ± 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

Twin SAM Phantom:

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 head 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 : Volume Approx. 25 liters
Dimensions : 810 × 1000 × 500 mm (H × L × W)

Mounting Device for Transmitters:

The Mounting Device enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Typical Composition of Ingredients for Liquid Tissue:

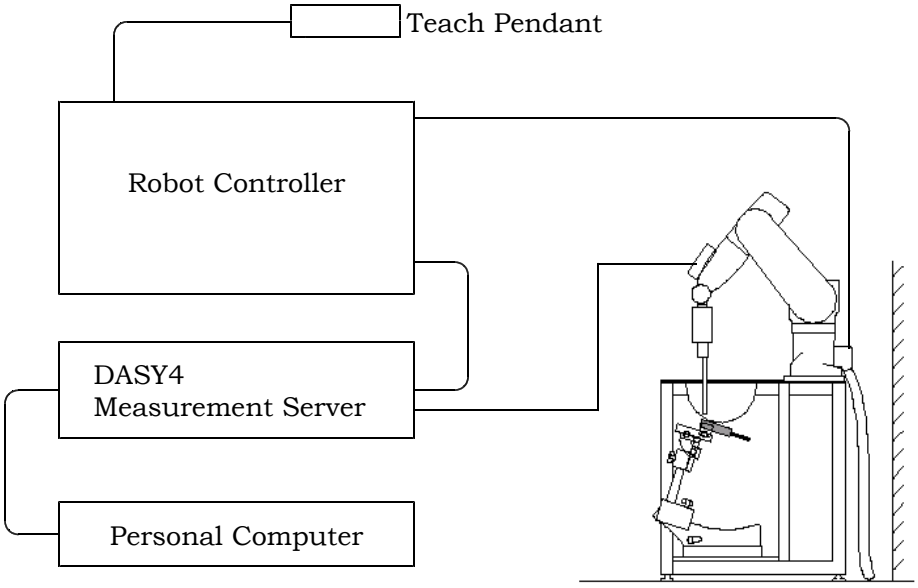
Ingredients (% by weight)	Frequency (MHz)					
	835		1900		2450	
	Head	Body	Head	Body	Head	Body
Water	41.45	52.40	54.90	40.40	62.70	73.20
Salt (NaCl)	1.45	1.40	0.18	0.50	0.50	0.04
Sugar	56.00	45.00	0.00	58.00	0.00	0.00
HEC	1.00	1.00	0.00	1.00	0.00	0.00
Bactericide	0.10	0.10	0.00	0.10	0.00	0.00
Triton X-100	0.00	0.00	0.00	0.00	36.80	0.00
DGBE	0.00	0.00	44.92	0.00	0.00	26.70

Salt : 99^{+}% Pure Sodium Chloride Sugar : 98^{+}% Pure Sucrose
Water : De-ionized, 16 MΩ^{+} resistivity HEC : Hydroxyethyl Cellulose
DGBE : 99^{+}% Di (ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure) : Polyethylene glycol mono [4-(1,1,3,3-tetramethylbuthyl)phenyl]ether

The composition of ingredients is according to FCC/OET Bulletin 65 Supplement C (July, 2001).

SAR MEASUREMENT SET-UP

These measurements are performed using the DASY4 automated dosimetric assessment system (manufactured by Schmid & Partner Engineering AG (SPEAG) in Zürich, Switzerland). It consists of high precision robotics system, cell controller system, DASY4 measurement server, personal computer with DASY4 software, data acquisition electronic (DAE) circuit, the Electro-optical coupler (EOC), near-field probe, and the twin SAM phantom containing the equivalent tissue. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF).
The Robot is connected to the cell controller to allow software manipulation of the robot. The DAE is connected to the EOC. The DAE performs the signal amplification, signal multiplexing, A/D conversion, offset measurements, mechanical surface detection, collision detection, etc. The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server.



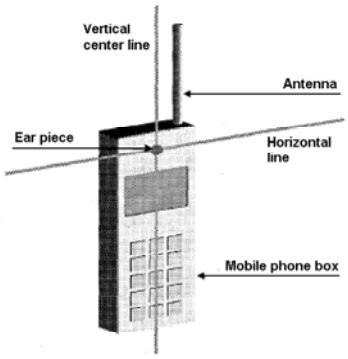
TEST CONFIGURATION POSITIONS

Cheek/Touch Position:

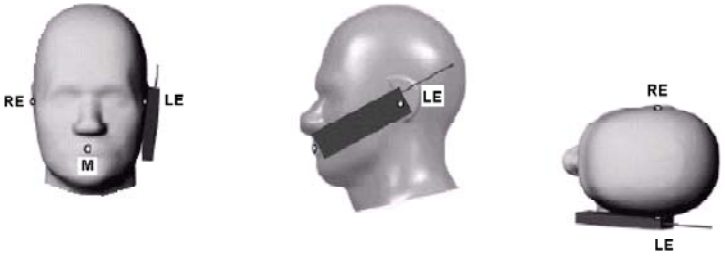
1. Position the device with the vertical center line of the body of the device and the horizontal line crossing the center of the ear piece in a plane parallel to the sagittal plane of the phantom.

2. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference points (M, RE and LE) and align the center of the ear piece with the line RE-LE.

3. Translate the mobile phone box towards the phantom with the ear piece aligned with the line RE-LE until the phone touches the ear.



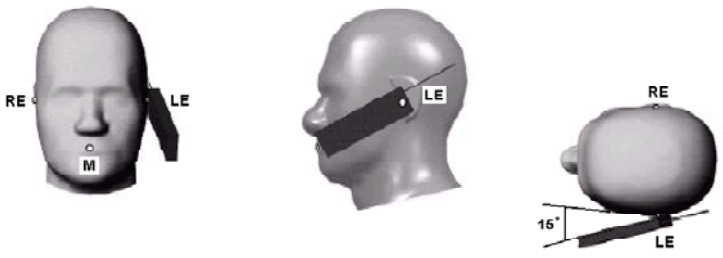
4. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the box until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.



Ear/Tilt Position:

1. Position the device in the “Cheek/Touch Position”.

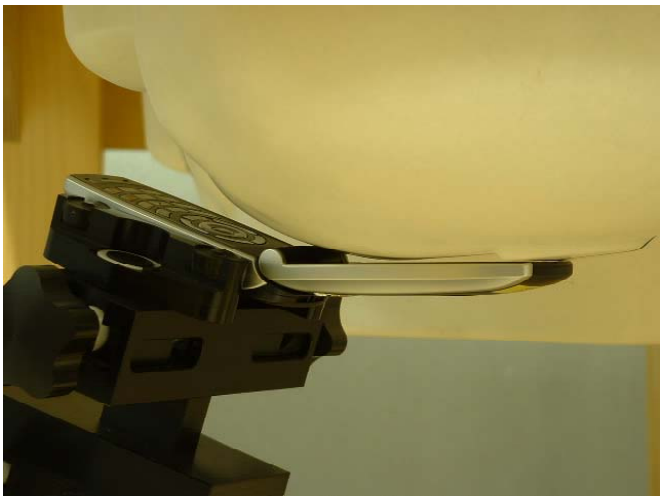
2. While maintaining the device in the reference plane and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost.



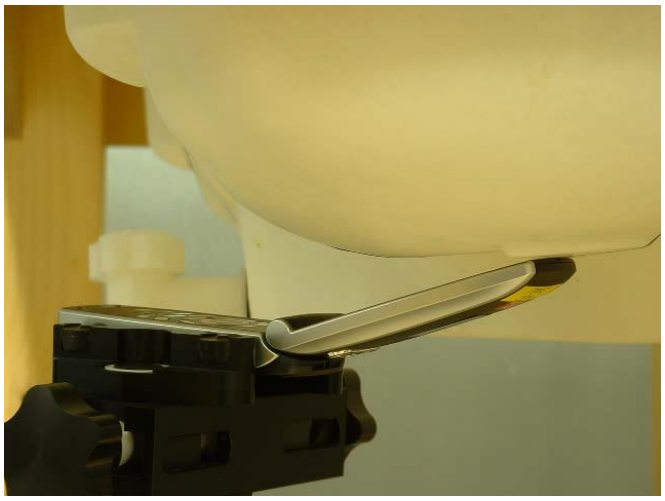
Test Set-up (Photographs):

Left Head

Cheek/Touch Position

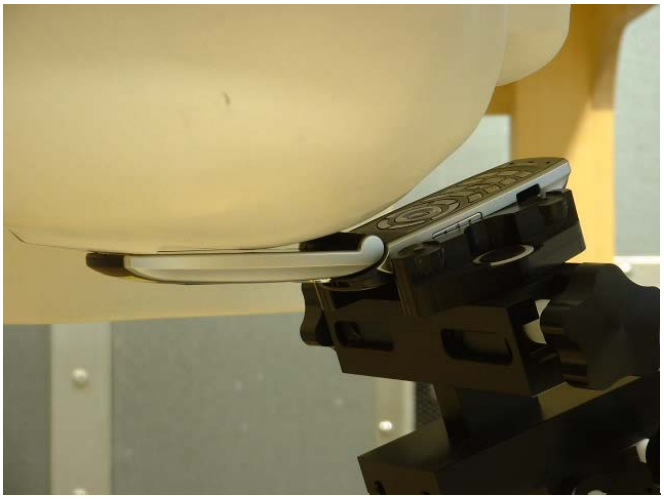


Ear/Tilt Position

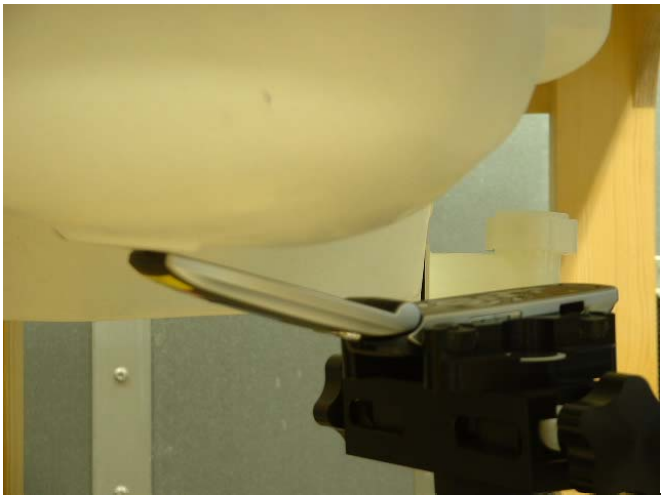


Right Head

Cheek/Touch Position

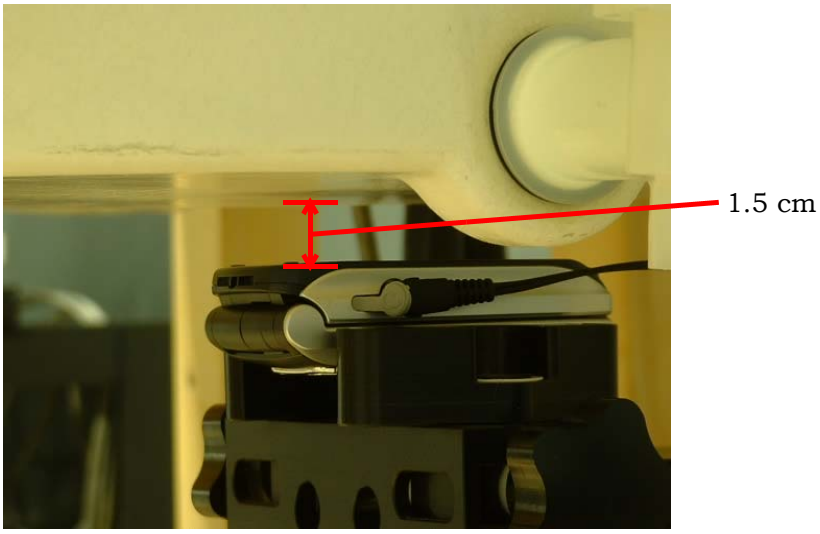


Ear/Tilt Position



Body Worn Configuration:

For body-worn operating configurations, the device is tested against a flat phantom representing the user body. A headset is connected to the device. Belt-clips or holsters are not supplied with the device as an accessory, then the device is 1.5 cm on distance from the flat phantom. It is recommended for testing body-worn SAR compliance.



MEASUREMENT PROCESS

Area Scan for Maximum Search:

The SAR distribution at the exposed side of the head was measured at a distance of 3.9 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 10 mm × 10 mm. The evaluation on the measured area scan gives the interpolated maximum (hot spot) of the measured area.

Cube Scan for Spatial Peak SAR Evaluation:

The 1g and 10g peak evaluations were available for the predefined cube 5×5×7 scans. The grid spacing was 8 mm × 8 mm × 5 mm. The first procedure is an extrapolation 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 moved around until the highest averaged SAR is found. This last procedure is repeated for a 10g cube. 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.

Extrapolation:

The extrapolation is based on a least square algorithm. Through the points in the first 3 cm 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 1 mm from one another.

Interpolation:

The maximum interpolated value is serched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) are computed by the 3D spline algorithm. The 3D spline is composed of three one-dimensional splines with the “Not a knot”-condition (x, y and z -directions). The volume is integrated with the trapezoidal algorithm.

MEASUREMENT UNCERTAINTIES

Uncertainty Component	Uncertainty value (%)	Probability distribution	Divisor	c_i	Standard uncertainty 1g (%)	v_i
Measurement System						
Probe calibration	4.8	Normal	1	1	4.8	∞
Axial isotropy	4.7	Rectangular	√3	0.7	1.9	∞
Hemispherical isotropy	9.6	Rectangular	√3	0.7	3.9	∞
Boundary effect	1.0	Rectangular	√3	1	0.6	∞
Linearity	4.7	Rectangular	√3	1	2.7	∞
Detection limits	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	2.6	Rectangular	√3	1	1.5	∞
RF ambient conditions	3.0	Rectangular	√3	1	1.7	∞
Mechanical tolerance	0.4	Rectangular	√3	1	0.2	∞
Probe positioning	2.9	Rectangular	√3	1	1.7	∞
Extrapolation, interpolation and integration algorithms	1.0	Rectangular	√3	1	0.6	∞
Test Sample Related						
Device positioning	3.4	Normal	1	1	3.4	23
Device holder uncertainty	4.6	Normal	1	1	4.6	5
Output power drift	5.0	Rectangular	√3	1	2.9	∞
Physical parameters						
Phantom uncertainty	4.0	Rectangular	√3	1	2.3	∞
Liquid conductivity - deviation from target values	5.0	Rectangular	√3	0.6	1.7	∞
Liquid Conductivity - measurement uncertainty	10.0	Rectangular	√3	0.6	3.5	∞
Liquid Permittivity - deviation from target values	5.0	Rectangular	√3	0.6	1.7	∞
Liquid Permittivity - measurement uncertainty	5.0	Rectangular	√3	0.6	1.7	∞
Combined Standard Uncertainty					11.3	
Expanded Uncertainty (k=2) (confidence interval of 95%)					22.5	

TEST CONDITIONS

SAR Measurement
was performed in the following test site.

Test location:

KAMEOKA EMC Branch Shielded Room
9-1, Ozaki, Inukanno, Nishibetsuin-Cho, Kameoka-Shi, Kyoto, 621-0126, Japan

Test instruments used in SAR measurement:

Name	Model No.	Device ID	Last Cal. Date	Cal. Interval
● - E-Field Probe	ET3DV6	S - 1	February, 2004	1 Year
○ - E-Field Probe	ET3DV6	S - 2		
● - DASY3 DAE	DAE3 V1	S - 3	February, 2004	1 Year
○ - Validation Dipole	D900V2	S - 4		
● - Validation Dipole	D1800V2	S - 5	February, 2003	2 Years
○ - Validation Dipole	D2450V2	S - 6		

Additional instruments used in test system validation:

Name	Model No.	Device ID	Last Cal. Date	Cal. Interval
○ - Signal Generator	8673D	B - 2		
● - Signal Generator	MG3681A	B - 3	February, 2004	1 Year
● - Power Meter	E4417A	B - 51	August, 2003	1 Year
● - Power Sensor	E9300B	B - 32	May, 2004	1 Year
● - Power Amplifier	A0840-3833-R	A - 34	N/A	N/A
● - Network Analyzer	8719ET	B - 53	September, 2003	1 Year
● - Dielectric Probe Kit	85070D	B - 54	N/A	N/A

Test instruments used to measure conducted power output:

Name	Model No.	Device ID	Last Cal. Date	Cal. Interval
● - Power Meter	E4417A	B - 51	August, 2003	1 Year
● - Power Sensor	E9321A	B - 52	May, 2004	1 Year
● - Fixed Attenuator	54-10	D - 82	November, 2003	1 Year
● - Fixed Attenuator	54-10	D - 83	November, 2003	1 Year

EUT TUNE-UP PROCEDURE

The following procedures had been used to prepare the EUT for the SAR test.

To setup the desire channel frequency and the maximum output power, a Radio Communication Tester "Rohde & Schwarz, CMU-200" was used to program the EUT.

SM Mobile Station : GSM 1900
Network Support : GSM Mode - Circuit Switched
GPRS Mode - Packet Data (GPRS Level 10 / 2 slots)
Power Control Level (PCL) : 0 (30.0 dBm)

Channel	Frequency
0512	1850.20
0661	1880.00
0810	1909.80

For the Bluetooth transmitter, RF test mode prepared by the manufacturer was used to program the EUT.

Communication system : Bluetooth
Modulation type : Frequency Hopping Spread Spectrum (FHSS)

Channel	Frequency
00	2402.00
39	2441.00
78	2480.00

Maximum conducted power was measured by replacing the antenna with an adapter for conductive measurements, before and after the SAR measurements was done.

EUT Modification

● - No modifications were conducted by JQA to achieve compliance to applied levels.

○ - To achieve compliance to applied levels, the following change(s) were made by JQA during the compliance test.

The modification(s) will be implemented in all production models of this equipment.

Applicant : N/A Date : N/A

Typed Name : N/A Position : N/A

Responsible Party

Responsible Party of Test Item(Product)

Responsible party :

Contact Person :

Signatory

Deviation from Standard

● - No deviations from the standard described in page 3.

○ - The following deviations were employed from the standard described in page 3.

TEST RESULTS

Head Configuration

The requirements are	● - **Passed**	○ - **Not Passed**	
The Maximum SAR (1g) is	0.618 mW/g	at 1880.00	MHz
Phantom Position	● - Left Head	○ - Right Head	
Device Position	● - Cheek/Touch	○ - Ear/Tilt	
Antenna Position	○ - In	○ - Out	● - Fixed
Modulation Type		GSM	
Measurement Uncertainty		22.5	%

Remarks: _____

Body-worn Configuration

The requirements are	● - **Passed**	○ - **Not Passed**	
The Maximum SAR (1g) is	0.282 mW/g	at 1880.00	MHz
Modulation Type		GSM+GPRS	
Measurement Uncertainty		22.5	%

Remarks: _____

SUMMARY

GENERAL REMARKS :

The EUT was tested according to the requirements of FCC Rules and Regulations Part 2 Subpart J (October 1, 2003) under the test configuration, as shown in page 7.

The conclusion for the test items of which are required by the applied regulation is indicated under the final judgement.

FINAL JUDGEMENT :

The "as received" sample;

● - fulfill the test requirements of the regulation mentioned on page 3.

○ - fulfill the test requirements of the regulation mentioned on page 3, but with certain qualifications.

○ - doesn't fulfill the test regulation mentioned on page 3.

Begin of testing : July 20, 2004

End of testing : July 27, 2004

- JAPAN QUALITY ASSURANCE ORGANIZATION -

Approved by :

A. Hosoda

Akio Hosoda
Manager
EMC Div.
JQA KITA-KANSAI Testing Center

Issued by :

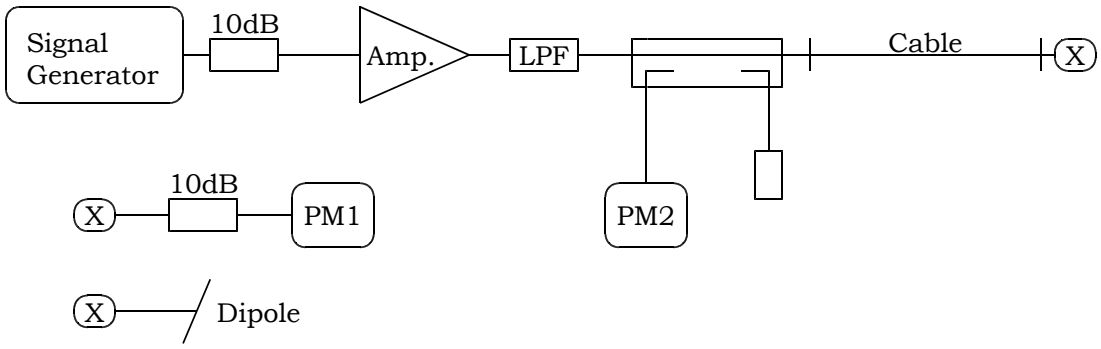
S. Kino

Shigeru Kinoshita
Deputy Manager
EMC Div.
JQA KITA-KANSAI Testing Center

TEST SYSTEM VALIDATION

The power meter PM1 (including 10dB Attenuator) measures the forward power at the location of the validation dipole connector. The signal generator is adjusted for 250 mW at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

The dipole antenna is matched to be used near flat phantom filled with tissue simulating solution. A specific distance holder is used in the positioning of the antenna to ensure correct spacing between the phantom and the dipole.



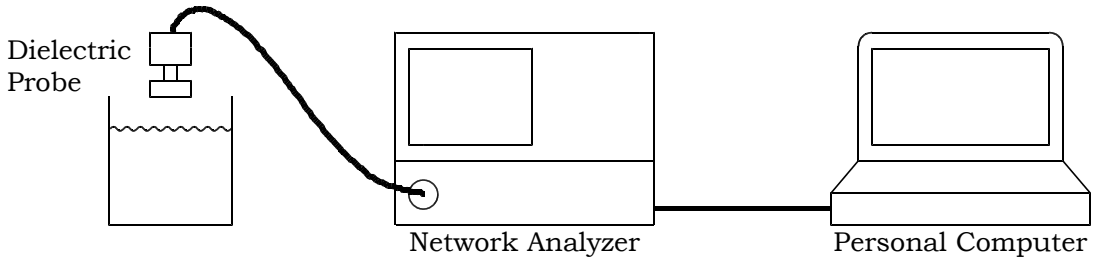
System Validation Results:

System Validation Dipole: D1800V2, S/N: 2d038 **Ambient Conditions: 21°C 58%** **Depth of Liquid: 15.0 cm** **Test Date: July 20, 2004**						
Liquid		**Parameters**	**Target**	**Measured**	**Deviation [%]**	**Limit [%]**
Medium	**Temp. [°C]**					
Head 1800MHz	21.0	ε_r σ ***1g SAR (mW/g)***	40.00 1.40 9.62	38.26 1.386 9.44	-4.35 -1.00 -1.87	± 5 ± 5 ± 10
Ambient Conditions: 22°C 58%		**Depth of Liquid: 15.0 cm**			**Test Date: July 26, 2004**	
Head 1800MHz	22.0	ε_r σ ***1g SAR (mW/g)***	40.00 1.40 9.62	38.53 1.360 9.63	-3.68 -2.86 +0.10	± 5 ± 5 ± 10
Ambient Conditions: 21°C 52%		**Depth of Liquid: 15.0 cm**			**Test Date: July 27, 2004**	
Muscle 1800MHz	21.0	ε_r σ ***1g SAR (mW/g)***	53.30 1.52 9.21	54.09 1.489 9.48	+1.48 -2.04 +2.93	± 5 ± 5 ± 10

Note) Please refer to Appendix for the result presentation in plot format.

TISSUE SIMULANT VERIFICATION

The tissue dielectric parameters of the tissue medium at the middle of a device transmission band should be within ±5% of the parameters specified at that target frequency. It is verified by using the dielectric probe and the network analyzer.



Tissue Verification Results:

Ambient Conditions: 21°C 58%					**Test Date: July 20, 2004**	
Liquid		**Parameters**	**Target**	**Measured**	**Deviation [%]**	**Limit [%]**
Medium	**Temp. [°C]**					
Head 1900MHz	21.0	ε_r	40.00	38.14	-4.65	± 5
		σ	1.40	1.432	+2.29	± 5
Ambient Conditions: 22°C 58%					**Test Date: July 26, 2004**	
Head 1900MHz	22.0	ε_r	40.00	38.20	-4.50	± 5
		σ	1.40	1.409	+0.64	± 5
Ambient Conditions: 21°C 52%					**Test Date: July 27, 2004**	
Muscle 1900MHz	21.0	ε_r	53.30	53.74	+0.83	± 5
		σ	1.52	1.566	+3.03	± 5

SAR MEASUREMENT DATA

Head Configuration Results:

Modulation Type: GSM (Duty Cycle: 12.2 %, Crest Factor: 8.2) **Left Head Position**		**Depth of Liquid: 15.0 cm**					**Test Date: July 26, 2004**	
EUT Set-up Configuration		**Frequency**		**Power [dBm]**		**Limit [mW/g]**	**SAR (1g) [mW/g]**	**Tissue Temp. [°C]**
EUT Position	**Antenna**	**Channel**	**MHz**	**Start**	**End**			
Cheek/Touch	Fixed	0512 0661 0810	1850.20 1880.00 1909.80	29.56 29.49 29.25	29.53 29.45 29.20	1.6	0.540 0.618 0.546	22.0 22.0 22.0
Ear/Tilt	Fixed	0512 0661 0810	1850.20 1880.00 1909.80	29.56 29.49 29.25	29.53 29.45 29.20	1.6	0.155 0.179 0.160	21.6 21.9 21.8
Bluetooth 00ch (2402.00MHz) ON								
Cheek/Touch	Fixed	0661	1880.00	29.49	29.45	1.6	0.608	21.5
Bluetooth 39ch (2441.00MHz) ON								
Cheek/Touch	Fixed	0661	1880.00	29.49	29.45	1.6	0.618	21.8
Bluetooth 78ch (2480.00MHz) ON								
Cheek/Touch	Fixed	0661	1880.00	29.49	29.45	1.6	0.606	21.9
Right Head Position		**Depth of Liquid: 15.0 cm**					**Test Date: July 20, 2004**	
Cheek/Touch	Fixed	0512 0661 0810	1850.20 1880.00 1909.80	29.56 29.49 29.25	29.53 29.45 29.20	1.6	0.476 0.594 0.565	21.0 21.0 21.0
Ear/Tilt	Fixed	0512 0661 0810	1850.20 1880.00 1909.80	29.56 29.49 29.25	29.53 29.45 29.20	1.6	0.158 0.192 0.157	21.0 21.0 21.0

Note 1) Power Measured : ● - Conducted ○ - ERP ○ - EIRP
2) Please refer to Appendix for the result presentation in plot format.

Tester : Yasuhisa Sakai

SAR MEASUREMENT DATA

Body-worn Configuration Results:

Modulation Type: GSM (Duty Cycle: 12.2 %, Crest Factor: 8.2) **Flat Position** **Depth of Liquid: 15.0 cm** **Test Date: July 27, 2004**								
EUT Set-up Configuration		**Frequency**		**Power [dBm]**		**Limit [mW/g]**	**SAR (1g) [mW/g]**	**Liquid Temp. [°C]**
Separation	**Antenna**	**Channel**	**MHz**	**Start**	**End**			
1.5 cm	Fixed	0512 0661 0810	1850.20 1880.00 1909.80	29.56 29.49 29.25	29.53 29.45 29.20	1.6	0.129 0.146 0.125	21.0 21.0 21.0
Bluetooth 00ch (2402.00MHz) ON								
1.5 cm	Fixed	0661	1880.00	29.49	29.45	1.6	0.138	20.9
Bluetooth 39ch (2441.00MHz) ON								
1.5 cm	Fixed	0661	1880.00	29.49	29.45	1.6	0.137	20.9
Bluetooth 78ch (2480.00MHz) ON								
1.5 cm	Fixed	0661	1880.00	29.49	29.45	1.6	0.134	20.9
Modulation Type: GSM+GPRS (Duty Cycle: 24.3 %, Crest Factor: 4.1) **Flat Position** **Depth of Liquid: 15.0 cm** **Test Date: July 27, 2004**								
1.5 cm	Fixed	0512 0661 0810	1850.20 1880.00 1909.80	29.52 29.45 29.20	29.42 29.31 29.07	1.6	0.258 0.282 0.237	21.0 21.0 21.0

Note 1) Power Measured : ● - Conducted ○ - ERP ○ - EIRP
2) Please refer to Appendix for the result presentation in plot format.

Tester : Yasuhisa Sakai

APPENDIX

Exhibit	Content	No. of page(s)
1	System Validation Plots	3
2	SAR Test Plots	25
3	Dosimetric E-Field Probe - ET3DV6, S/N: 1678	8
4	System Validation Dipole - D1800V2, S/N: 2d038	9
5	Transmitted Duty Cycle Plots	2