



Intertek Testing Services

ETL SEMKO

Specific Absorption Rate (SAR) Test Report

for

Shintom Co., Ltd.

on the

TriBand Cellular Phone

Model Number: GDX2002

FCC ID: BFYM5030

Test Report: 30264981

Date of Report: June 17, 2002

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Job #: 3026498

Date of Test: June 4 to 5, 2002

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Warnock Hersey



Tested by: 	Suresh Kondapalli
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Review Date: <u>8/13/02</u>	

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STATEMENT OF COMPLIANCE

The Shintom Co., Ltd., sample device, model # GDX2002, FCC ID: Not Labeled was evaluated in accordance with the requirements for compliance testing defined in FCC OET Bulletin 65, Supplement C (Edition 01-01). Testing was performed at the Intertek Testing Services facility in Menlo Park, California.

For the evaluation, the dosimetric assessment system DASY3 was used. The phantom employed was the "Generic Twin Phantom". The total uncertainty for the evaluation of the spatial peak SAR values averaged over a cube of 1g tissue mass had been assessed for this system to be $\pm 23.5\%$.

The device was tested at their maximum output power declared by the Shintom Co., Ltd..

In summary, the maximum spatial peak SAR value for the Sample device averaged over 1g for left-hand, right-hand and body- worn usage was found to be:

Phantom	SAR _{1g} mW/g
Right-hand Tilt Position	1.25
Body worn Position	1.28

In conclusion, the tested Sample device was found to be in compliance with the requirements defined in OET Bulletin 65, Supplement C (Edition 01-01) for head and body configurations.

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1.0 JOB DESCRIPTION

1.1 Client Information

The GDX2002 has been tested at the request of:

Company: Shintom Co., Ltd.
1-19-20 Shin-Yokohama, Kohoku-ku
Yokohama, Yokohama 222-0033
Japan

Name of contact: Mr. Shuichi Oomomo
Telephone: +81-45-476-3541
Fax: +81-45-476-3540

1.2 Equipment under test (EUT)

Product Descriptions:

Equipment	TriBand Cellular Phone		
Trade Name	Matsushita Electric Works, Ltd.	P/N.	GDX2002
FCC ID	BFYM5030	S/N No.	Not Labeled
Category	Portable	RF Exposure	Uncontrolled Environment
Frequency Band	1850 - 1910 MHz	System	GSM/GPRS

EUT Antenna Description			
Type	Monopole	Configuration	Fixed
Dimensions	16.7 mm	Gain	0 dBi
Location	Right Side		

Use of Product : Wireless communication

Manufacturer: Shintom Co., Ltd.

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

EUT receive date: June 4, 2002

EUT received condition: Good working condition prototype. As declared by Shintom Co., Ltd. the device tested is identical to the production units.

Test start date: June 4, 2002

Test end date: June 5, 2002

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1.3 Test Plan Reference

FCC Rule: Part 2.1093, FCC OET Bulletin 65, Supplement C (Edition 01-01)

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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.



No Support Equipment was used. The test sample was operated in a test mode that allows control of the transmitter without the need to place actual phone calls. For the purposes of this test the device is commanded to test mode and manually set to the proper channel, transmitter power levels and transmit mode of operation. The device was then placed in the SAR Measurement System with a fully charged battery.

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1.4.2 Test Position for Brain

The GDX2002 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 (2001). The GDX2002 was placed against the head phantom in 2 test positions as detailed in Figures 1 and 2 below.

Test Configuration for SAR



Figure 1 – 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.



Figure 2 – 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.

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The positioning procedure is described below.

The EUT was positioned 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”. The “test device reference point” is located at the same level as the center of the earpiece region. The “vertical centerline” is bisecting the front surface of the handset at its top and bottom edges. A “ear reference point” is located on the outer surface of the head phantom on each ear spacer. It is located 1.5 cm above the center of the ear canal entrance in the “phantom reference plane” defined by the three lines joining the center of each “ear reference point” (left and right) and the tip of the mouth.

The EUT is initially positioned with the earpiece region pressed against the ear spacer of a head phantom in “initial ear position”. 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”. While maintaining these three alignments, the body of the handset is gradually adjusted to each of the following positions for evaluating SAR:

1. “Cheek/Touch Position” – the device is brought toward the mouth of the head phantom by pivoting against the “ear reference point”. This test position is established:
 - i) When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.
 - or*
 - ii) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.
2. “Ear/Tilt Position” – With the handset aligned in the “Cheek/Touch Position”:
 - i) If the earpiece of the handset is not in full contact with the phantom’s ear spacer (in the “Cheek/Touch position”) and the peak SAR location for the “Cheek/Touch” position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device is returned to the “initial ear position” by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.
 - otherwise*
 - ii) The handset is moved (translated) away from the cheek perpendicular to the line passes through both “ear reference points” for approximate 2-3 cm. While it is in this position, the handset is tilted away from the mouth with respect to the “test device reference point” by 15°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both “ear reference points” until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process is repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously.

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1.4.3 Test Position for Muscle

The GDX2002 was placed against the flat phantom in the test position as detailed in Figure 3 below. As the belt clip and holster were not supplied with the device, the GDX2002 was positioned 2.5mm from phantom (worst case position).

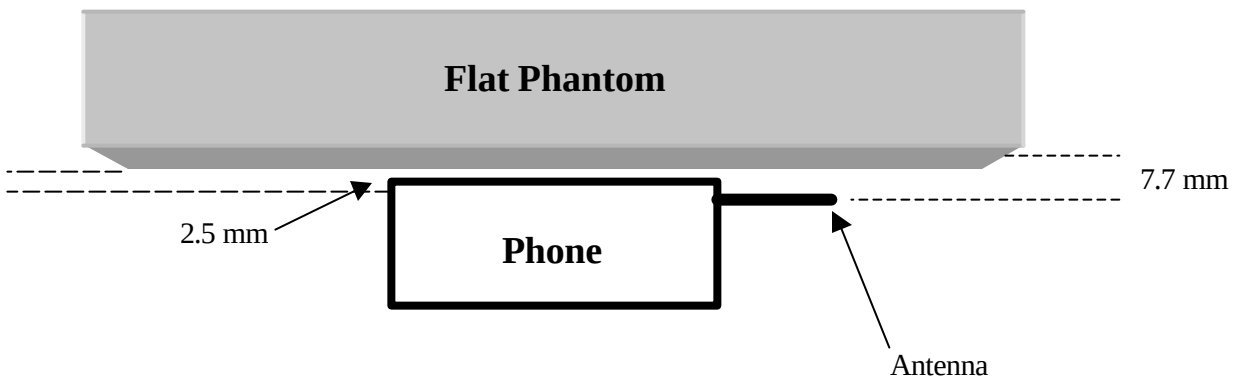


Figure 3 – Intended use position for Muscle SAR (Body Worn)

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1.4.4 Test Condition

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

EUT Antenna	Fixed length	Orientation	On the top
Usage	Right hand, Left hand and body worn.	Distance between antenna and the phantom surface:	<u>Left Side:</u> 12.6 mm, tilt position 15.2 mm, check position
			<u>Right Side:</u> 17.7 mm, tilt position 23.9 mm, check position
			<u>7.7 mm, body worn position</u>
Simulating human Body/hand	Body	EUT Battery	LI-ION battery
Conducted Peak Output Power	Frequency MHz	Output Power Before test dBm	Output Power after test dBm
	1850	28.40	28.31
	1880	28.40	28.37
	1910	28.30	28.23

The spatial peak SAR values were accessed for lowest, middle and highest operating channels defined by the manufacturer.

Antenna port power measurement was performed, with the HP 435A power meter, before and after the SAR tests to ensure that the GDX2002 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.

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2.0 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

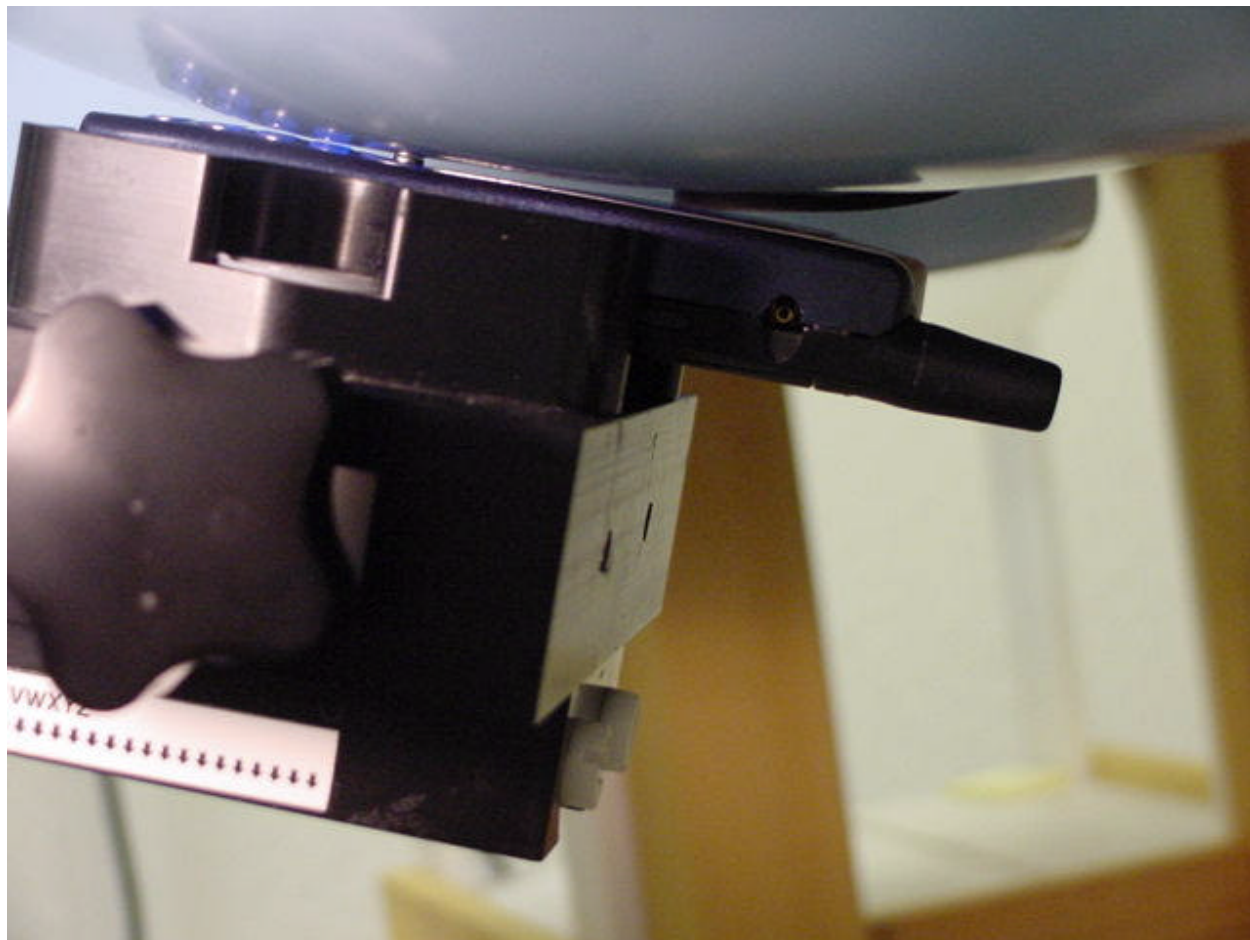
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2.2 Configuration Photographs

SAR Measurement Test Setup

Left Cheek



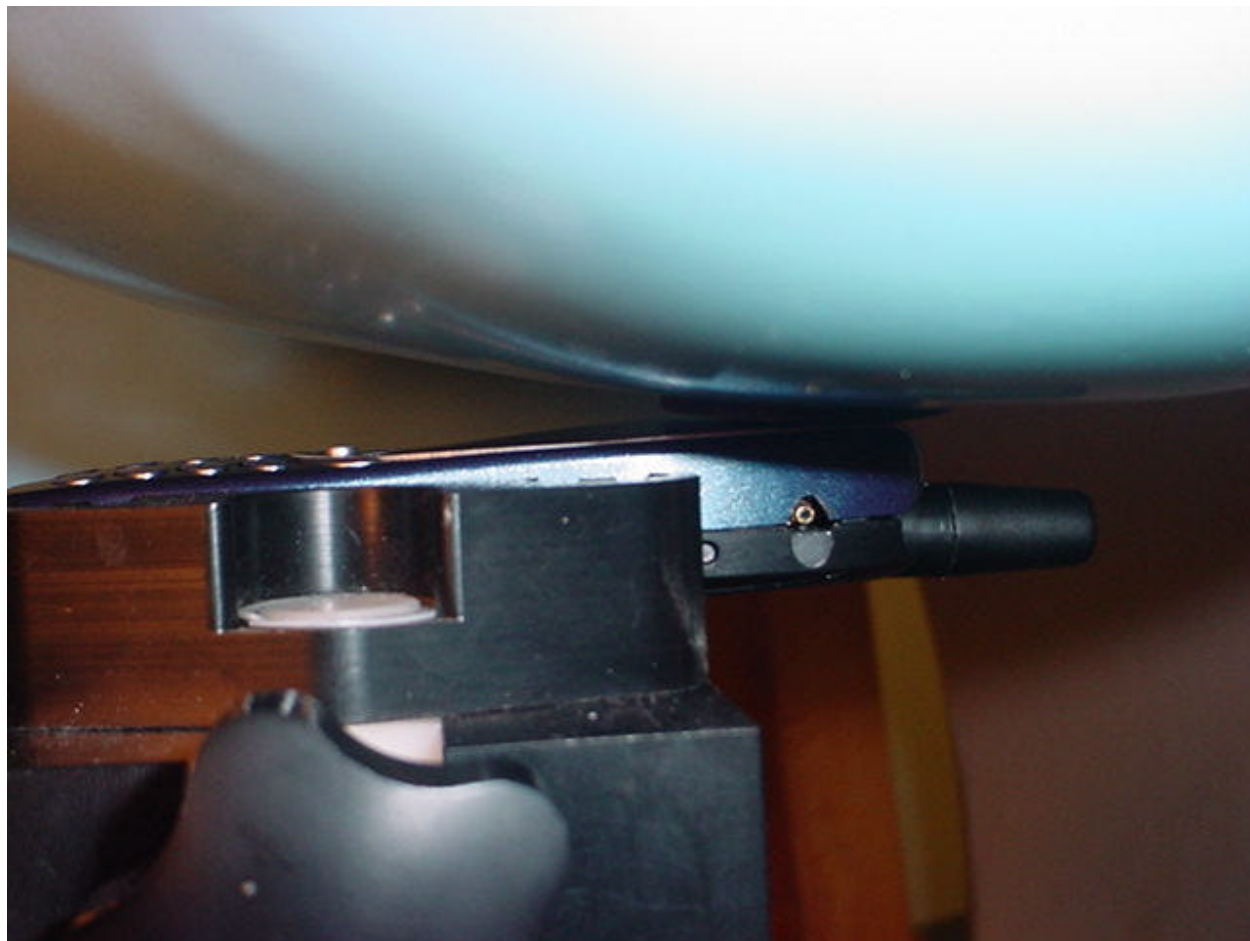
Shintom Co., Ltd., Model No: GDX2002
FCC ID: BFYM5030

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2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

Left Tilt



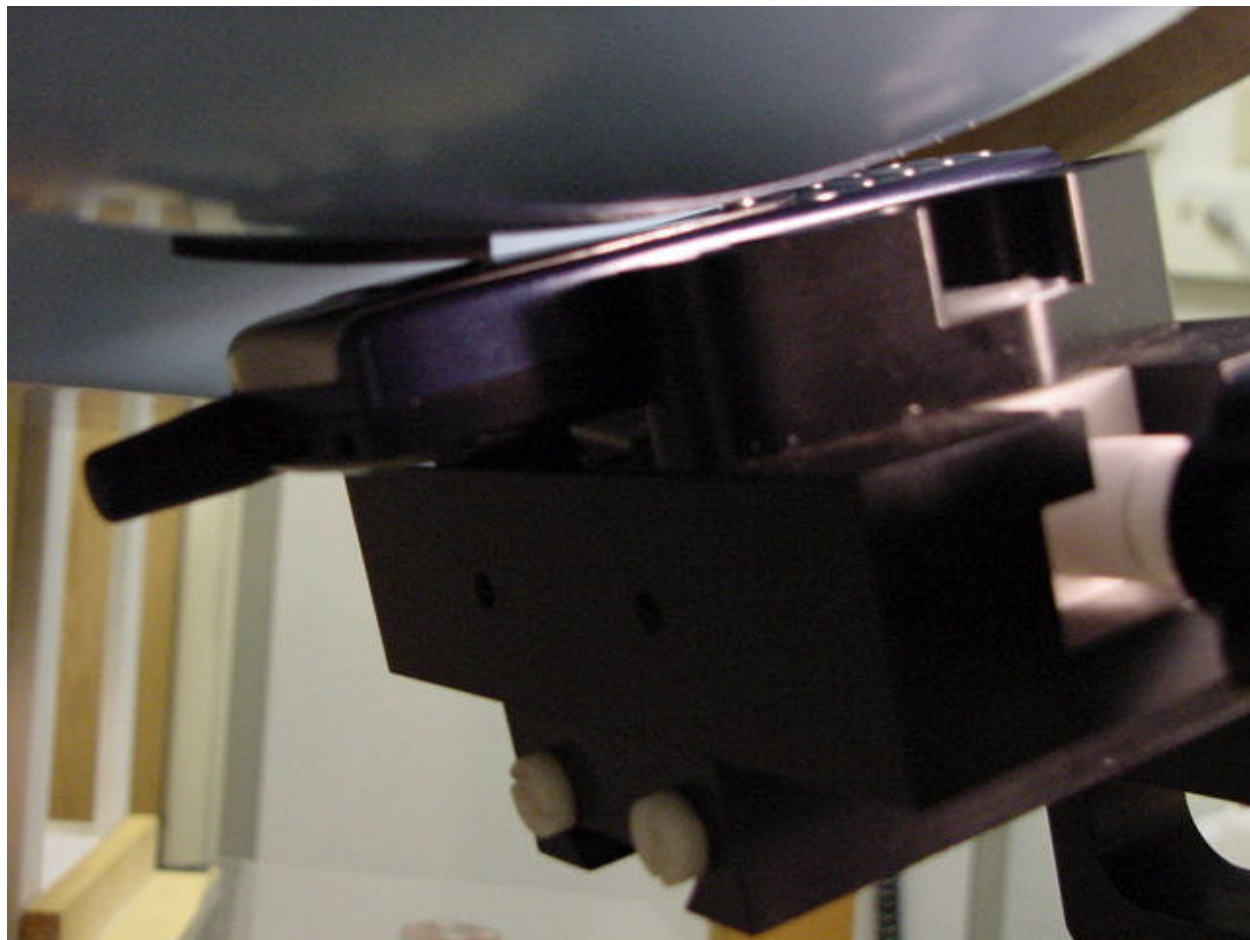
Shintom Co., Ltd., Model No: GDX2002
FCC ID: BFYM5030

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2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

Right Cheek



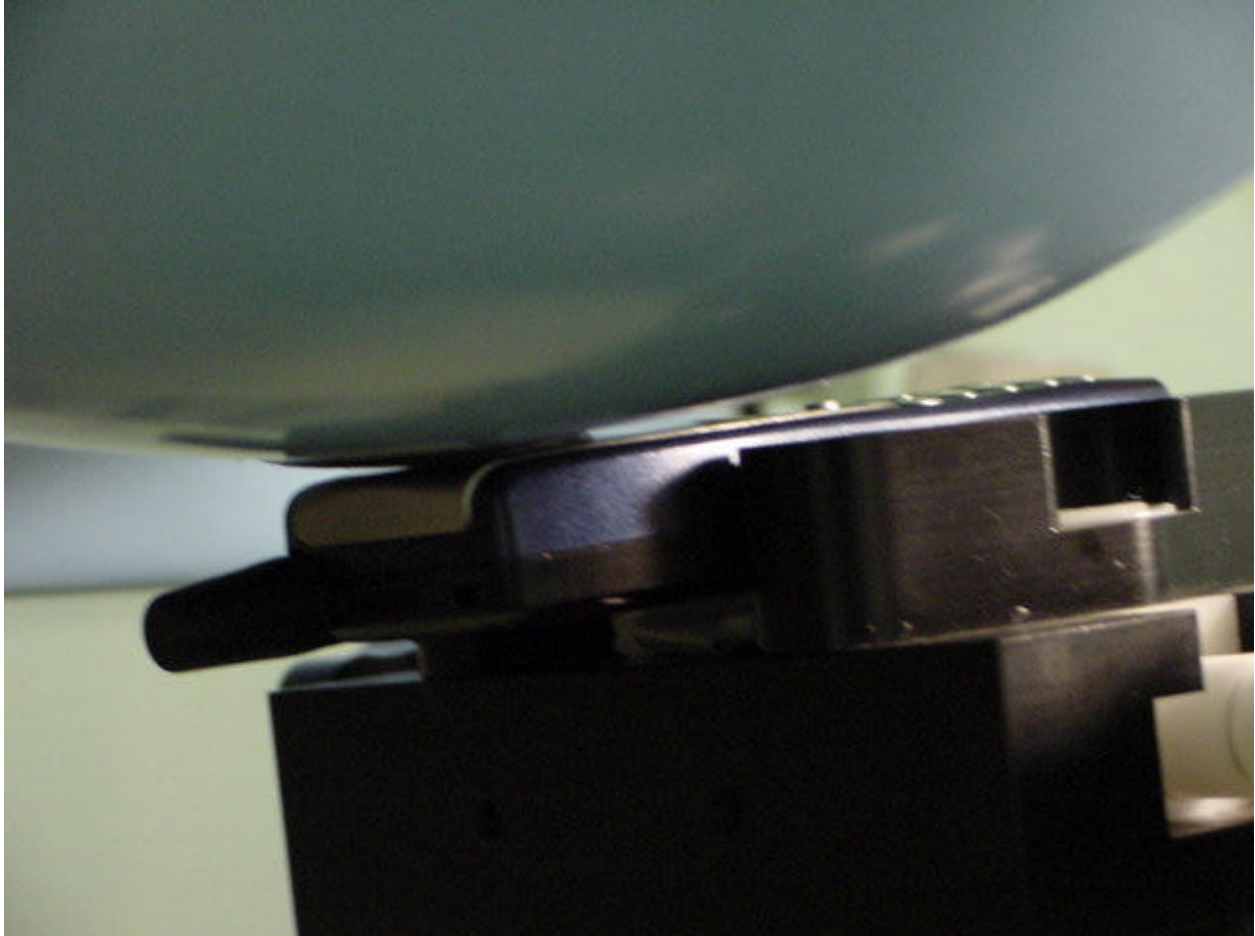
Shintom Co., Ltd., Model No: GDX2002
FCC ID: BFYM5030

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2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

Right Tilt



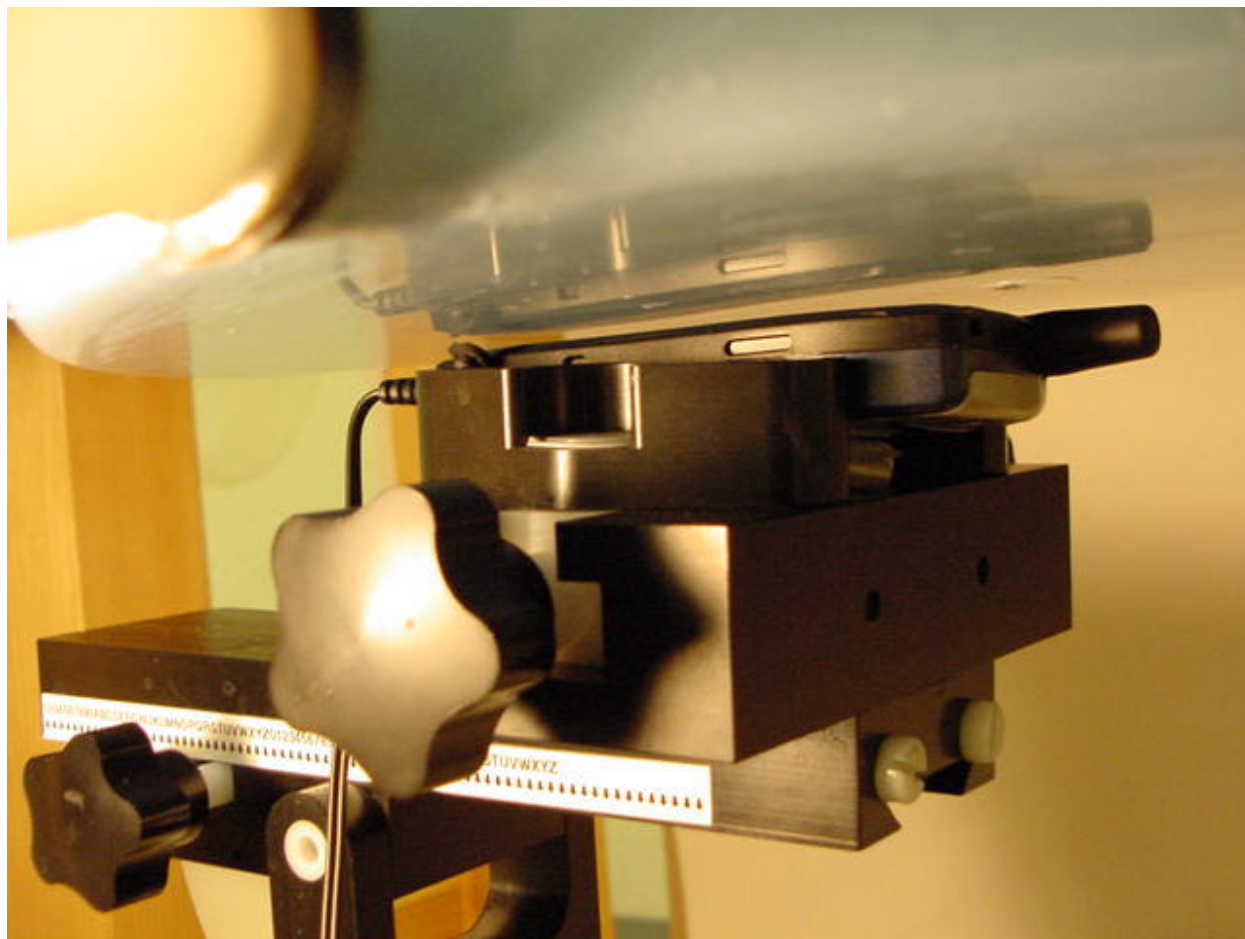
Shintom Co., Ltd., Model No: GDX2002
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2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

Body-worn Position (2.5mm from Phantom)



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2.2 Configuration Photographs (Continued)

EUT Photo



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2.2 Configuration Photographs (Continued)

EUT Photo



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2.2 Configuration Photographs (Continued)

EUT Photo



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2.2 Configuration Photographs (Continued)

EUT Photo



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2.3 System Verification

Prior to the assessment, the system was verified to the $\pm 10\%$ of the specifications by using the system validation kit. The validation was performed at 1800 MHz.

Validation kit	Targeted SAR _{1g} (mW/g)	Measured SAR _{1g} (mW/g)	Plot #
D1800V2, S/N #: 224	9.77	9.91	16

2.4 Evaluation Procedures

The SAR evaluation was performed with the following procedures:

- a. SAR was measured at a fixed location above the reference point and used as a reference value for the assessing the power drop.
- b. The SAR distribution at the exposed side of the flat Phantom was measured at a distance of 30 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 straightforward 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-measurements 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.

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2.5 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.

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Measurement Results

Trade Name:	Shintom	Model No.:	GDX2002
Serial No.:	Not Labeled	Test Engineer:	Suresh Kondapalli

Brain 1800 MHz Band					
Ambient Temperature		23.5 °C	Relative Humidity		55 %
Liquid Temperature		22°C / 0.5°C	Liquid depth		14.8 cm
Test Signal Source		Test Mode	Signal Modulation		GSM
Output Power Before SAR Test		See Page 6	Output Power After SAR Test		See page 6
Test Duration		20 Min. each test	Number of Battery Change		New battery for every scan
Plot No	Frequency MHz	Operating Mode	Crest Factor	Position	Measured SAR_{1g} (mW/g)
1	1850	GSM	8	Left Hand, Cheek Position	0.856
2	1850	GSM	8	Left Hand, Tilt Position	1.17
3	1880	GSM	8	Left Hand, Cheek Position	0.720
4	1880	GSM	8	Left Hand, Tilt Position	1.16
5	1910	GSM	8	Left Hand, Cheek Position	0.787
6	1910	GSM	8	Left Hand, Tilt Position	1.13
7	1850	GSM	8	Right Hand, Cheek Position	0.778
8	1850	GSM	8	Right Hand, Tilt Position	1.20
9	1880	GSM	8	Right Hand, Cheek Position	0.812
10	1880	GSM	8	Right Hand, Tilt Position	1.21
11	1910	GSM	8	Right Hand, Cheek Position	0.806
12	1910	GSM	8	Right Hand, Tilt Position	1.23

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Muscle 1800 MHz Band					
Ambient Temperature		23.5 °C	Relative Humidity		55 %
Liquid Temperature		22°C / 0.5°C	Liquid depth		14.8 cm
Test Signal Source		Test Mode	Signal Modulation		GSM
Output Power Before SAR Test		See Page 6	Output Power After SAR Test		Changes within 0.1dB
Test Duration		20 Min. each test	Number of Battery Change		New battery for every scan
Plot No	Frequency MHz	Operating Mode	Crest Factor	Position	Measured SAR_{1g} (mW/g)
13	1850	GSM	8	2.5 mm from Phantom	1.28
14	1880	GSM	8	2.5 mm from Phantom	1.27
15	1910	GSM	8	2.5 mm from Phantom	1.04
17	1910	GSM	8	Z Scan	

Dipole, System Verification					
Frequency MHz	Operating Mode	Crest Factor	Measured SAR_{1g} (mW/g)	Measured SAR_{10g} (mW/g)	Plot Number
1800	CW	1	9.91	5.13	16

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

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3.0 TEST 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 a 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 #	LAST CAL. DATE
Robot	Stäubli RX60L	597412-01	N/A
	Repeatability: $\pm 0.025\text{mm}$ Accuracy: 0.806×10^{-3} degree Number of Axes: 6		
E-Field Probe	ET3DV5	1333	04/13/01
	Frequency Range: 10 MHz to 3 GHz Linearity: ± 0.2 dB Directivity: ± 0.1 dB in brain tissue Probe outer diameter: 6.5 mm Length: 34.5 cm Distance between the probe tip and the dipole center: 2.7 mm		
Data Acquisition	DAE3	317	N/A
	Measurement Range: $1\mu\text{V}$ to $>200\text{mV}$ Input offset Voltage: $< 1\mu\text{V}$ (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)		
Device holder	Non-conductive holder supplied with DASY3, dielectric constant less than 5.0	N/A	N/A
Simulated Tissue	Mixture	N/A	06/04/02
	Please see section 6.2 for details		
Power Meter	HP 8900D w/ 84811A sensor	3607U00673	08/08/01
	Frequency Range: 100kHz to 18 GHz Power Range: $300\mu\text{W}$ to 3W		

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3.2 Tissue Simulating Liquid

Brain Ingredients Frequency (1800 MHz)	
Water	52.90 %
Salt	0.181%
DGBE Diethylene Glycol	44.92%
ton X-100 (Polyethylene Glycol Mono) Ether	0.1 %

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)	ϵ_r^*	σ^*(mho/m)	ρ^{**}(kg/m³)
1800	42.2	1.40	1000
1880	40.4	1.44	1000

* Worst case uncertainty of the HP 85070A dielectric probe kit

** Worst case assumption

Muscle Ingredients Frequency (1800 MHz)	
DGBE Dilethylene Glycol	44.92%
Toniton X-100 (Polyethylene Glycol Mono) Ether	0.1%
Salt	0.18%
Water	54.8%

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)	ϵ_r^*	σ^*(mho/m)	ρ^{**}(kg/m³)
1800	55.8	1.43	1000
1880	55.8	1.49	1000

* Worst case uncertainty of the HP 85070A dielectric probe kit

** Worst case assumption

Note: The amounts of each ingredient specified in the tables are not the exact amounts of the final test solution. The final test solution was adjusted by adding small amounts of water, sugar, and/or salt to calibrate the solution to meet the proper dielectric parameters.

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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.

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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 Uncertainties				±11.7 %

3.5 Measurement Tractability

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

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4.0 WARNING LABEL INFORMATION - USA

See Users Manual.

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5.0 REFERENCES

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- [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.
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5.0 DOCUMENT HISTORY

Revision/ Job Number	Writer Initials	Date	Change
1.0 /3024181	SS	June 17, 2002	Original document
2.0	Suresh	August 13, 2002	SAR plots