ITS Intertek Testing Services
ETL SEMKO

Specific Absorption Rate (SAR) Test Report

for

M/A-COM, Inc.

on the

Hand Held Portable Radio
Model Number: P800
FCC ID: BV8P800

Test Report: 30236223
Date of Report: June 24, 2002

Job #: 3023622
Date of Test: June 15, 2002

Total No of Pages Contained in this Report: 54 .

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Reviewed by: David Chernomordik	David Chernomordik, Ph.D., EMC Technical Manager

Review Date: 6/28/02

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STATEMENT OF COMPLIANCE

The M/A-COM, Inc., sample device, model # P800, FCC ID: BV8P800 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 of tissue mass, has been assessed for this system to be +/-23.5%.

The device was tested at their maximum output power declared by the M/A-COM, Inc.

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

Position	**Frequency (MHz)**	**SAR_{1g}, (mW/g)**
Held in-front of Mouth	824	0.623
Body	824	0.650

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.

1.0 JOB DESCRIPTION

1.1 Client Information

The P800 has been tested at the request of:

Company: M/A-COM, Inc.
1011 Pawtucket Blvd.
PO Bow 3295
Lowell, MA 01853-3295
USA

Name of contact: Ms. Dale Shaw
Telephone: 978/442-4474
Fax: 978/442-5353

1.2 Equipment under test (EUT)

Product Descriptions:

Equipment	Hand Held Portable Radio		
Trade Name	M/A-COM	**P/N.**	P800
FCC ID	BV8P800	**S/N No.**	A4000110014C
Category	Portable	**RF Exposure**	Uncontrolled Environment
Frequency Band	806 - 824 MHz	**System**	GFSK

EUT Antenna Description			
Type	Monopole	**Configuration**	Fixed
Dimensions	155 mm	**Gain**	0 dBi
Location	Right Side		

Use of Product: **W**ireless communication

Manufacturer: TYCO Electronics Inc

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

EUT receive date: Jun14, 2002

EUT received condition: Good working condition prototype, identical to the production units.

Test start date: June 15, 2002

Test end date: June 15, 2002

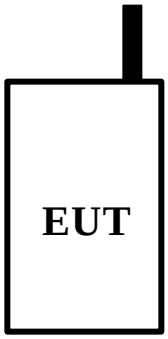
1.3 Test Plan Reference

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

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.

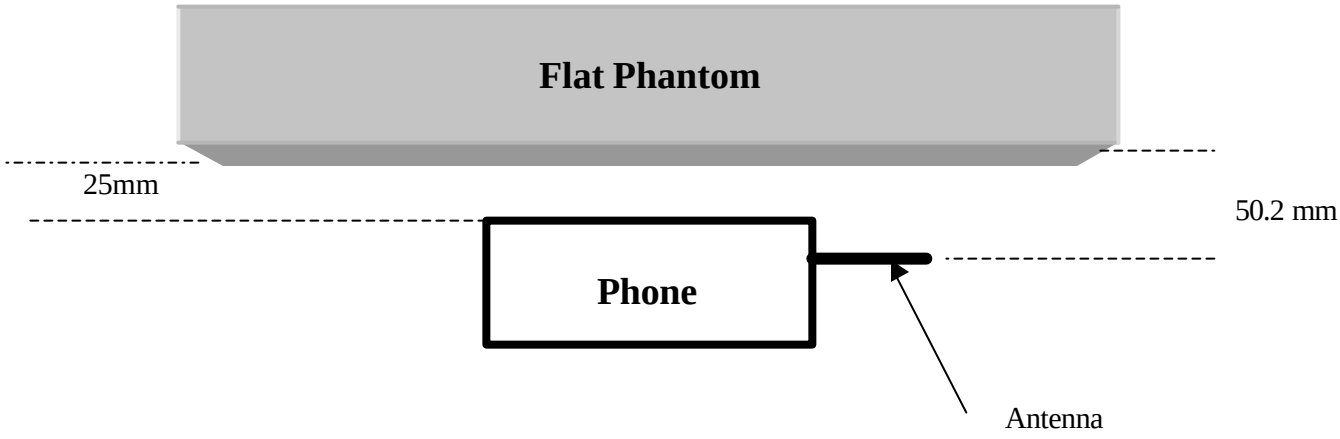


No Support Equipment was used. The test sample was operated in a test mode that allows control of the transmitter without the need to place actual phone calls. For the purposes of this test the device is commanded to test mode and manually set to the proper channel, transmitter power levels and transmit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

1.4.2 Test Position for held in-front of Face

The P800 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 P800 was placed at a distance of 25mm from flat phantom.

Test Configuration for SAR



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 "reference point" of the flat Phantom. The "test device reference point" is located at the same level as the center of the region of flat Phantom. The "vertical centerline" is bisecting the front surface of the handset at its top and bottom edges. The "reference point" is located at center on the outer surface of the flat phantom.

1.4.3 Test Position for Muscle

The P800 was placed against the flat phantom in the test position as detailed in Figure 3 below. The belt clip and Leather case was supplied with the device. The P800 was positioned by touching phantom (worst case position) with Leather case and belt Clip.

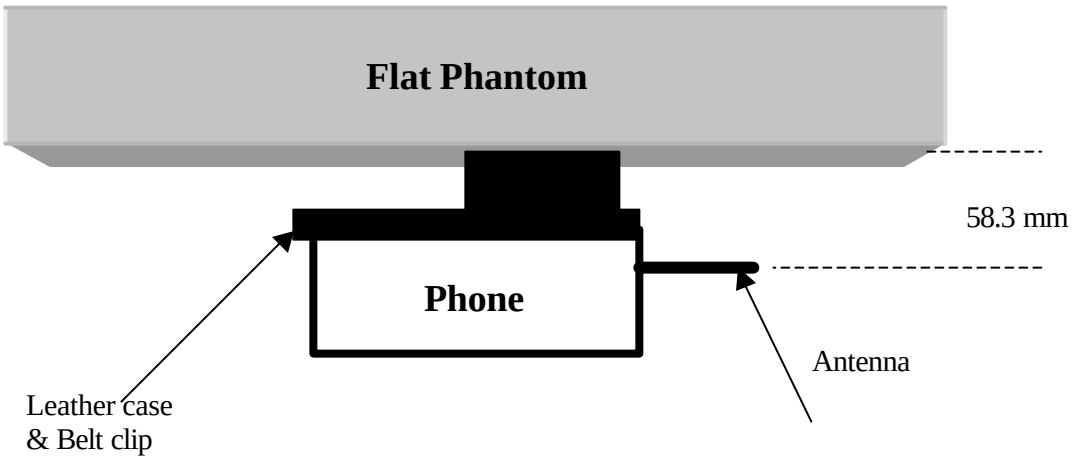


Figure 3 – Intended use position for Muscle SAR (Body Worn)

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	Head in front of face and body worn	**Distance between antenna and the phantom surface:**	In front of Mouth: 50.2 mm
			Body worn with holder: 58.3 mm *
		EUT Battery	LI-ION battery
Conducted Peak Output Power	**Frequency MHz**		**Output Power Watts**
	806		2.94
	816		2.96
	824		2.98

* Leather case is 9.4 mm thick. Belt clip is 29.2 mm thick.

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 P800 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.

2.0 SAR EVALUATION

2.1 SAR Limits

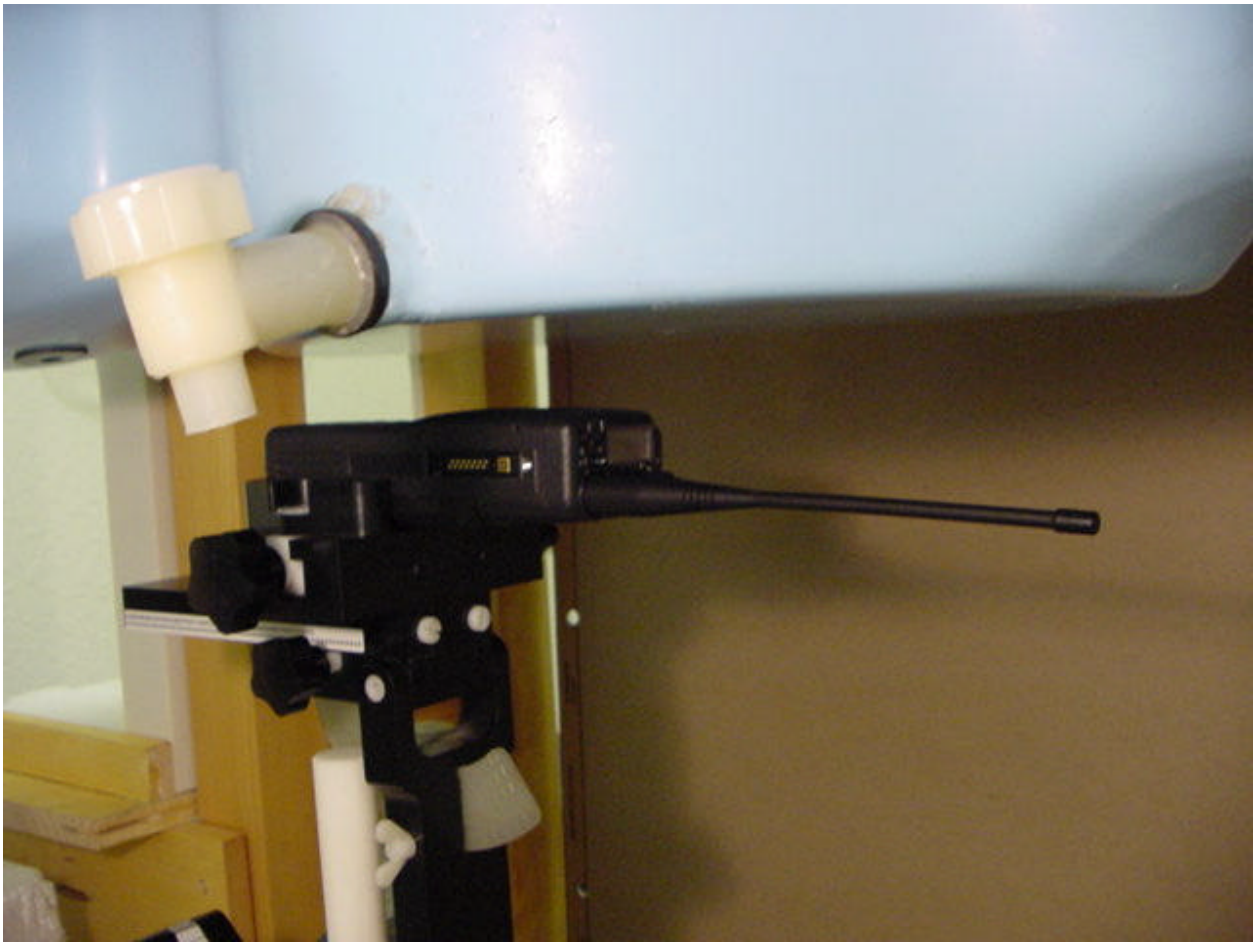
The following FCC limits for SAR apply to devic es operate in General Population/Uncontrolled Exposure environment:

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

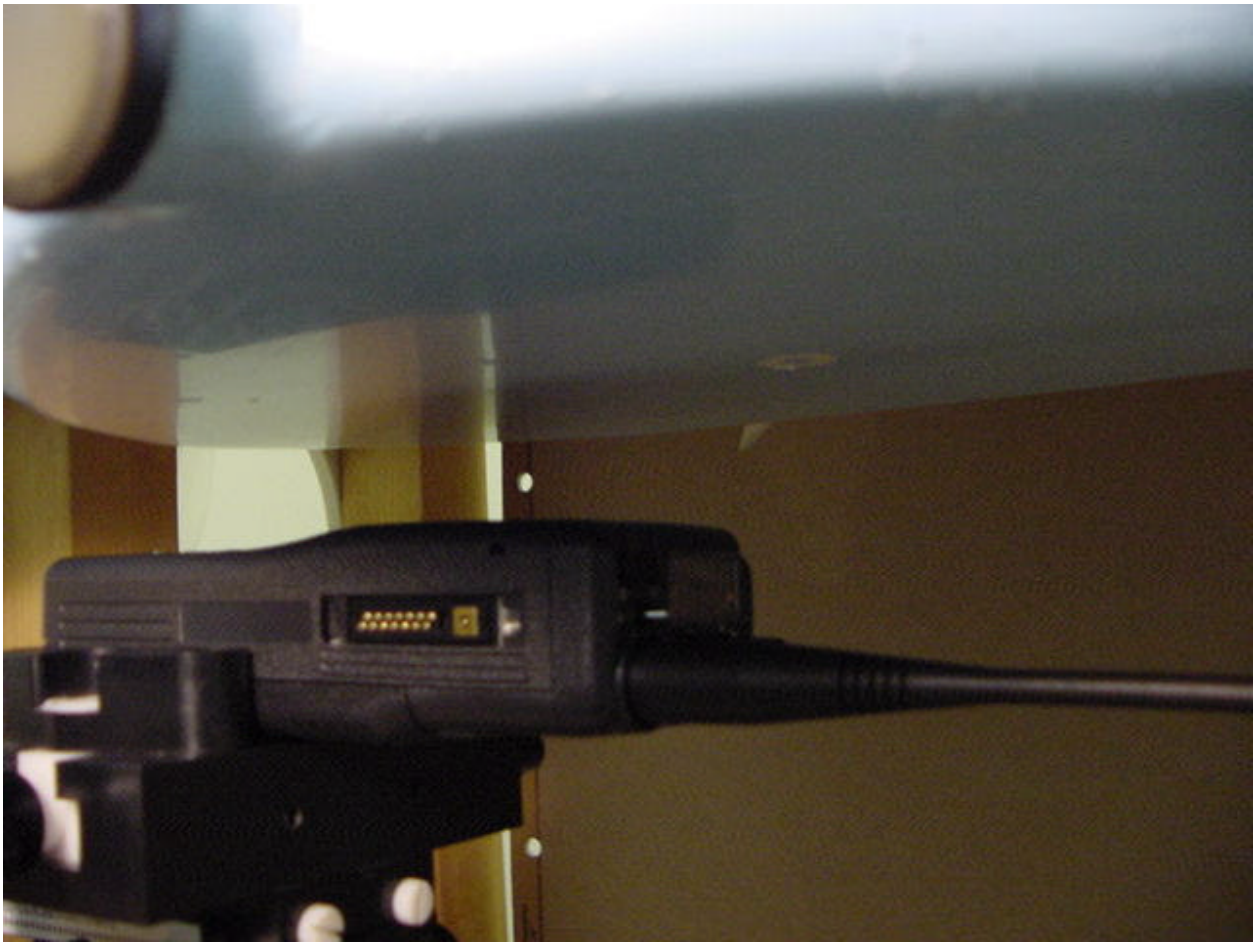
SAR Measurement Test Setup

Head, 25mm from Phantom



SAR Measurement Test Setup

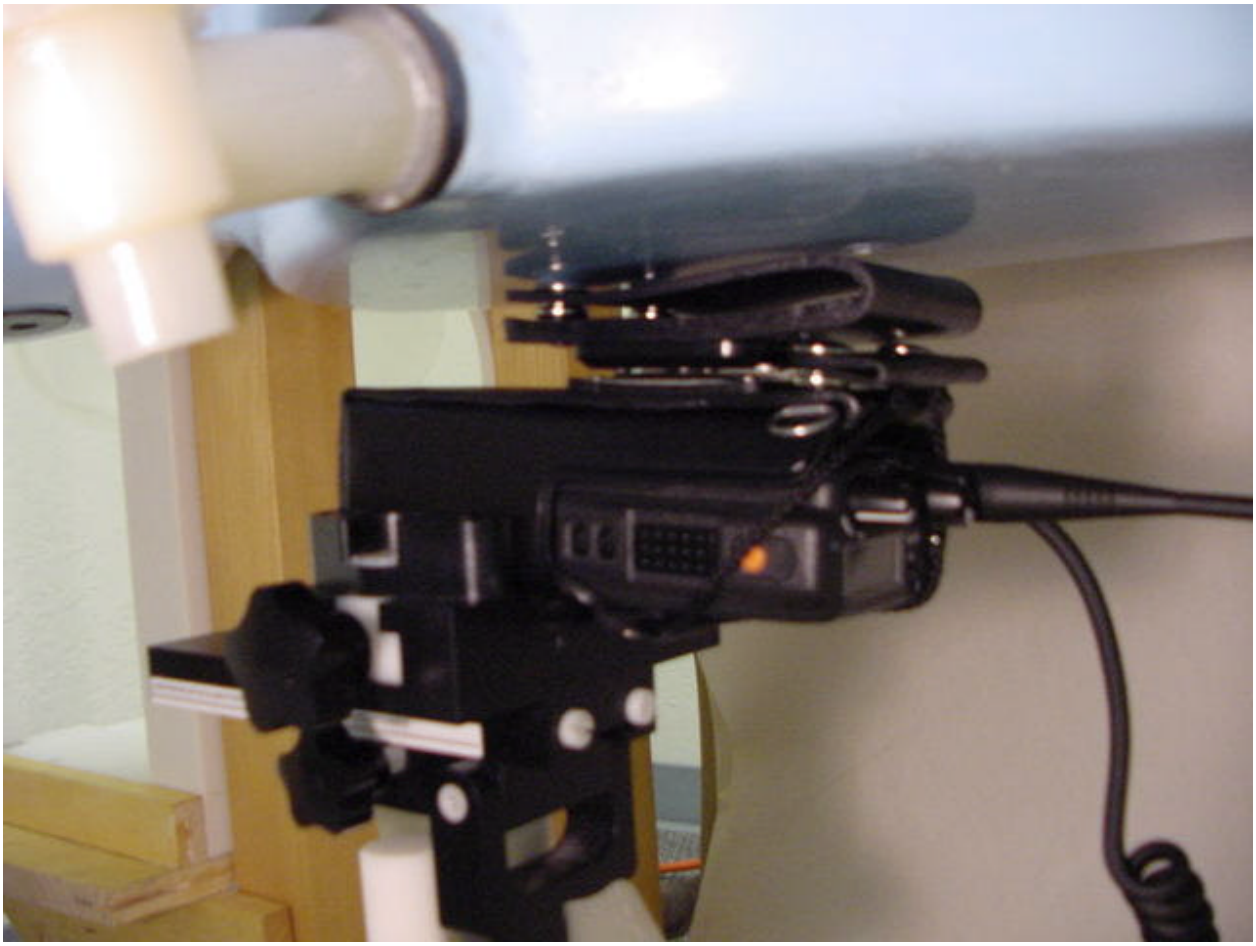
Head, 25mm from Phantom



2.2 Configuration Photographs (Continued)

SAR Measurement Test Setup

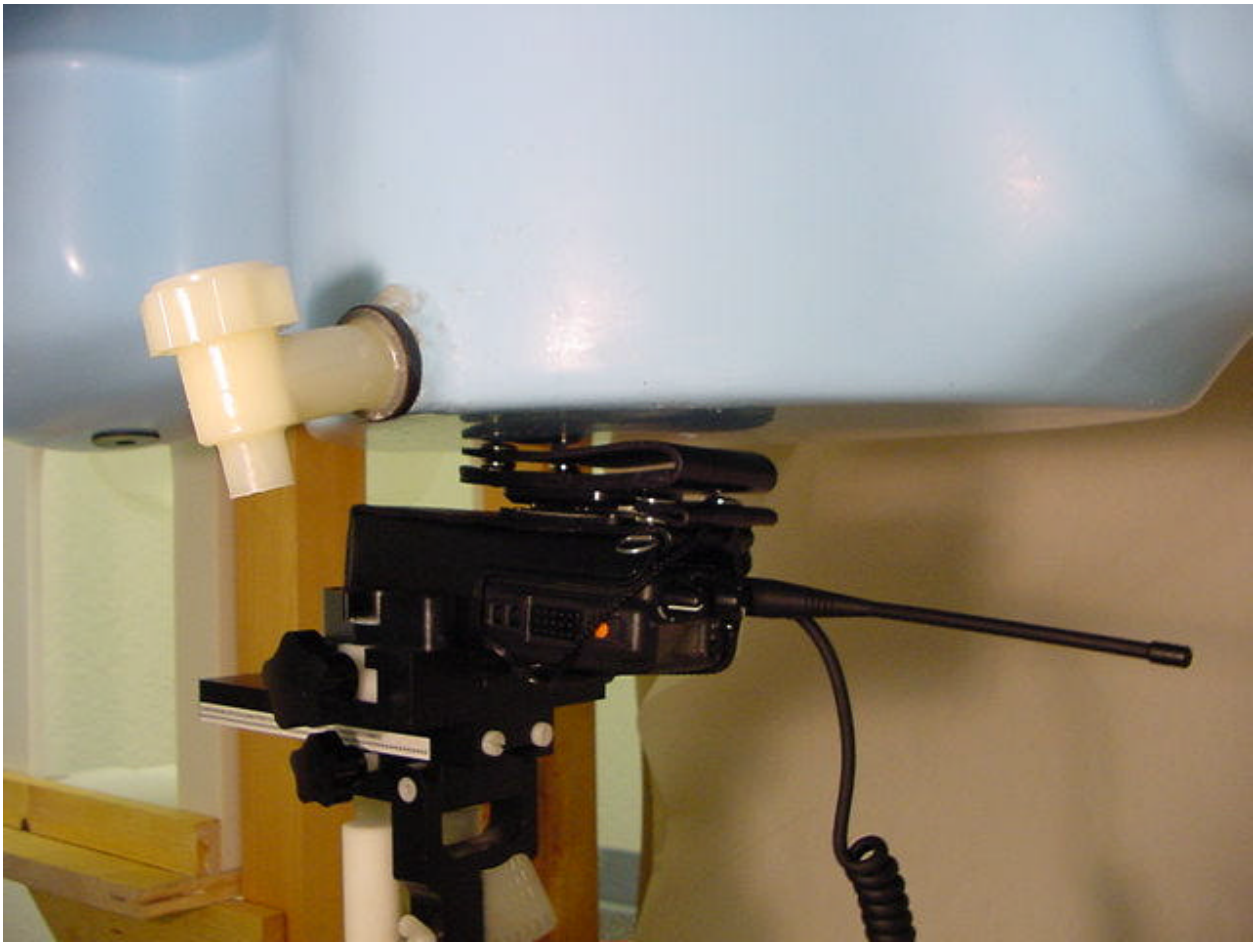
Touching Phantom with leather case and belt clip



2.2 Configuration Photographs (Continued)

SAR Measurement Test Setup

Touching Phantom with leather case and belt clip



2.2 Configuration Photographs (Continued)

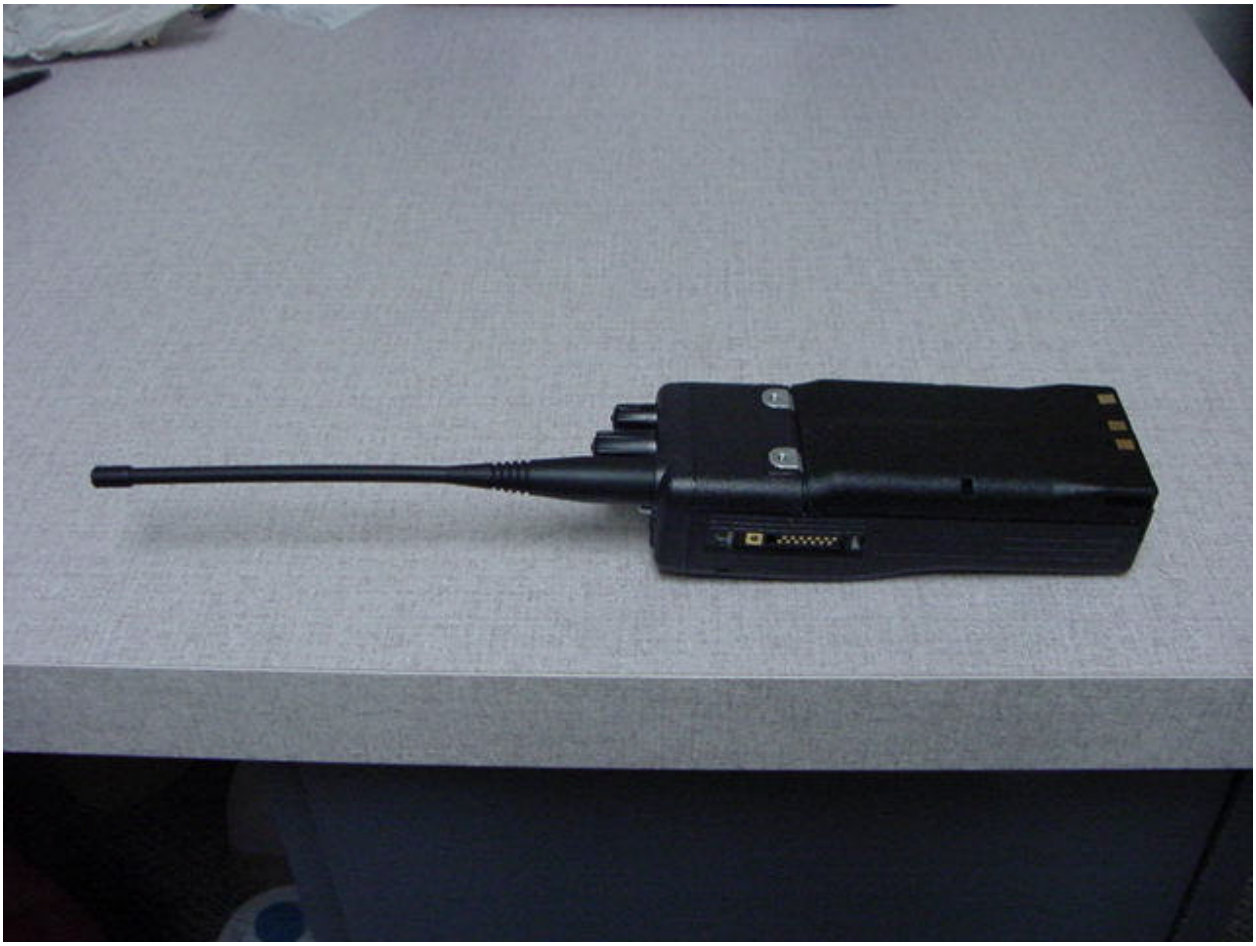
EUT Photo

2.2 Configuration Photographs (Continued)

EUT Photo

2.2 Configuration Photographs (Continued)

EUT Photo



2.2 Configuration Photographs (Continued)

EUT Photo

2.2 Configuration Photographs (Continued)

EUT Photo

EUT with Leather Case

2.2 Configuration Photographs (Continued)

EUT Photo

Leather Case

2.2 Configuration Photographs (Continued)

EUT Photo

Remote Speaker

2.3 System Verification

Prior to the assessment, the system was verified to the ±10% 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)	Plot #
D900V2, S/N #: 013	2.77	2.48	8

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.

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.

Measurement Results

Trade Name:	M/A-COM	**Model No.:**	P800
Serial No.:	Not Labeled	**Test Engineer:**	Suresh Kondapalli

Brain 900 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**	See note
Output Power Before SAR Test	See Page 6	**Output Power After SAR Test**	Changes within ?0.2dB
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	806	See Note	2	2.5 cm From Phantom	0.449
2	816	See Note	2	2.5 cm From Phantom	0.472
3	824	See Note	2	2.5 cm From Phantom	0.623
4	824	See Note	2	Z Scan	

Note: EUT was programmed to transmit 50% of the time, which simulates actual usage conditions.

Muscle 900 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**	See Note
Output Power Before SAR Test	See Page 6	**Output Power After SAR Test**	Changes within ?0.2dB
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)
5	806	See Note	2	Touching phantom with holder & belt clip	0.544
6	816	See Note	2	Touching phantom with holder & belt clip	0.503
7	824	See Note	2	Touching phantom with holder & belt clip	0.650

Note: EUT was programmed to transmit 50% of the time, which simulates actual usage conditions

Dipole, System Verification					
Frequency MHz	**Operating Mode**	**Crest Factor**	**Measured SAR_{1g} (mW/g)**	**Measured SAR_{10g} (mW/g)**	**Plot Number**
900	CW	1	2.48	1.60	8

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

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 Measure ment System			
EQUIPMENT	**SPECIFICATIONS**	S/N #	LAST CAL. DATE
Robot	**Stäubi RX60L**	597412-01	N/A
	Repeatability: ± 0.025mm 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: 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)		
Device holder	Non-conductive holder supplied with DASY3, dielectric constant less than 5.0	N/A	N/A
Simulated Tissue	**Mixture**	N/A	06/15/02
	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: 300µW to 3W		

3.2 Tissue Simulating Liquid

Brain Ingredients Frequency (900 MHz)	
Water	41.05 %
Sugar	56.5 %
Salt	1.35%
Bactericide	0.1%
HEC	1.0 %

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$^{3)}$**
816	43.1	0.89	1000

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

Muscle Ingredients Frequency (900 MHz)	
Water	52.5 %
Sugar	45.0 %
Salt	1.4%
Bactericide	0.1%
HEC	1.0 %

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)**
816	53.1	0.93	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 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.

4.0 WARNING LABEL INFORMATION - USA

See 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 Institute of Standards and Technology, 1994.

5.0 DOCUMENT HISTORY

Revision/ Job Number	Writer Initials	Date	Change
1.0 /3024181	SS	April 27, 2002	Original document