



Exhibit 11 Reference SAR Test Procedures

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Federal Communications Commission
Authorization & Evaluation Division
7435 Oakland Mills Rd
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Attention: Equipment Authorization Branch

We hereby certify that the testing procedures contained within are used for determination of compliance for a Motorola portable cellular with respect to ANSI/IEEE C951-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz and the Federal Communications Commission rule §2.1093(d)(2).

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1. Introduction

This document is intended to be kept on file by the Federal Communications Commission (FCC) so that ongoing applications that contain Exhibit 11 can refer to this document for procedural details.

2. Description of the Test Measurement

The Motorola Personal Communications Sector Product Safety & Compliance Laboratories utilize a Dosimetric Assessment System (Dasy3™) professional SAR measurement system manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. This system utilizes a computer controlled six axis robot to move a measurement probe to measure the SAR. This system utilizes the DASY3.1c version of software from SPEAG™. A photo of the Dasy3™ system with the Motorola phantom is shown in figure 1. The measurements are reference to the Federal Communications Commission rule §2.1093(d)(2), the ANSI/IEEE C95.1 1992 and the NCRP Report Number 86 that specify the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20cm of the user in the uncontrolled environment.

The measurement methodology is described in IEEE Transactions on Vehicular Technology, vol. 44, no. 3, August 1995, titled Electromagnetic Energy Exposure of Simulated users of Portable Cellular Telephones. The Dasy3™ system is operated per the instructions in the Dasy3™ Users Manual. The entire manual is available directly from SPEAG™ (<http://www.speag.com>).



Figure 1. Dasy™ System

3. System Accuracy Verification

The measurement system will be validated as per the SPEAG™ *Application Note: Validation and System Check* (Appendix A). This validation uses the following equipment:

Test Equipment	Manufacturer	Model
Signal generator	Hewlet Packard	8648C
Amplifier	Mini-Circuits	ZHL-42W
Dual Bidirectional Coupler	Hewlet Packard	778D
Power Meter	Hewlet Packard	E4419B
Power Sensor	Hewlet Packard	8481A
Dipole	SPEAG	Frequency Dependent

4. Simulated Head Tissue Ingredients

The following tables indicate the ingredients used for the simulated tissue mixtures that are used in the phantoms during the SAR measurements. Prior to conducting SAR measurements the simulated tissue is measured for its dielectric parameters as per the SPEAG™ *Application Note: Testing Tissue Simulating Liquids using HP85070* (Appendix B). This procedure uses a Hewlet Packard Network Analyzer model number 8753C with a Hewlet Packard S-Parameter Test Set model number 85046A or a Hewlet Packard Network Analyzer model number 8753D and a HP85070 Dielectric Probe Kit.

SIMULATED HEAD TISSUE INGREDIENTS (800MHz Band)

INGREDIENT	HEAD MIXTURE (percentage by weight)
De-Ionized Water	43.75
Sugar	54.00
Salt	1.15
HEC	1.00
Bactericide	0.10

SIMULATED HEAD TISSUE INGREDIENTS (1900MHz Bands)

INGREDIENT	HEAD MIXTURE (percentage by weight)
De-Ionized Water	54.90
Glycol	44.92
Salt	0.18
HEC	0.00
Bactericide	0.00

APPLICANT: MOTOROLA, INC.

SIMULATED MUSCLE TISSUE INGREDIENTS (800MHz Band)

INGREDIENT	MUSCLE MIXTURE (percentage by weight)
De-Ionized Water	53.5
Sugar	44.25
Salt	1.15
HEC	1.0
Bactericide	0.1

SIMULATED MUSCLE TISSUE INGREDIENTS (1900MHz Band)

INGREDIENT	MUSCLE MIXTURE (percentage by weight)
De-Ionized Water	66.1
Glycol	34.4
Salt	0.5
HEC	0.0
Bactericide	0.0

5. Test Sample Conditions

For the purposes of SAR measurement tests the test sample will be positioned on the measurement phantom as per the instructions in the users manual for the test sample. The position used for the tests is typically the 3-point contact position. In this position the test sample contacts the phantom's ear and cheek and is positioned with a repeatability of better than $\pm 6\%$. The SAR was measured with the phone on both the left hand and right hand talk positions.

The Analog, TDMA, and GSM test samples are capable of operation in a test mode that allows control of the transmitter without the need to place actual phone calls. This guarantees that the unit does not change its transmitter power, and that the resultant SAR values will not be affected by external connections. For the purposes of Analog, TDMA, and GSM mode tests the unit will be commanded to test mode and manually set to the proper channel, transmitter power level and transmit mode of operation. For the purposes of the CDMA mode tests, the unit will be placed in an over-the-air phone call using an HP8924 and is commanded to the highest possible power by means of the "always up" command.

The test sample will then be placed in the SAR measurement system with a fully charged battery. At the end of each test the Dasy3™ system measures the drift of the SAR at a fixed point in the phantom so as to ensure that the test sample has not changed in transmitter power.

6. Measurement of Output Power

Unless otherwise stated in the Exhibit 11 test report supplied with the individual application, test samples have output power measured from the external antenna connector. The test samples are set to the maximum power as described in section 5 above. . Either a Keithley 7001 switch or a Gigatronics 8652A power meter are used to measure the power. All cable losses are measured and compensated for in the final values.

7. Method of Measurement

The system is initially instructed to scan as much of the face of the test sample and its antenna, as is possible, in close proximity to the phantom using a 10mm x 10mm grid. From this coarse scan, the location at which the maximum values is measure is used as the center for a second, more detailed “cube” scan. During this cube scan the system automatically measures the fall off of electric field strength as the measurement probe is moved away from the inner surface of the phantom in the direction of the local normal to the phantom surface. Using appropriate probe calibration techniques, the SAR in 1 gram of phantom tissue is then calculated.

8. Measurement Uncertainty

The total RSS uncertainty (K=1) of the measurement system is ±12.0%. The breakdown of the individual uncertainties is as follows:

Probe Uncertainty	±%
Isotropy error	7.2
Calibration error	3.3
Spatial resolution	0.5
SAR Evaluation	±%
Conductivity measurement	5.0
Environmental errors	1.0
Peak SAR Evaluation	±%
Probe positioning	1.0
Volumetric averaging	4.2
Device positioning	6.0

9. SAR in the Hand Measurements

The test samples that have a “clam-shell” form factor will be measured for total radiated power in the presence of a human phantom complete with a hand holding the test sample. The test sample will be positioned on a full body measurement phantom per the instructions in the users manual for the test sample. Total radiated power was measured without a hand holding the test sample, and then as a second measurement with a phantom hand holding the test sample in a normal position. One can see the placement of the phantom hand relative to the test sample in figure 2. The phantom hand has the same dimensions as a real human hand, and is made of a thin pliable shell that is filled with muscle tissue simulant. The phantom and test sample are

placed inside of an anechoic chamber capable of performing full spherical scans of the test samples radiation characteristics, specifically total radiated power. The difference in total radiated with and without the phantom hand is then measured for both the antenna retracted and extended cases on low, mid and high channels in each band of operation. The test sample was set to transmit on maximum power in the mode that has the highest average power (if a multimode product). This difference in total radiated power is then the maximum power that is deposited in the hand. Included are two pictures. Figure 2 shows the test sample in the normal talk position with the phantom hand in the test position. Figure 3 shows the full body phantom in the anechoic chamber.



Figure 2. Simulated Hand Against Phantom Head.

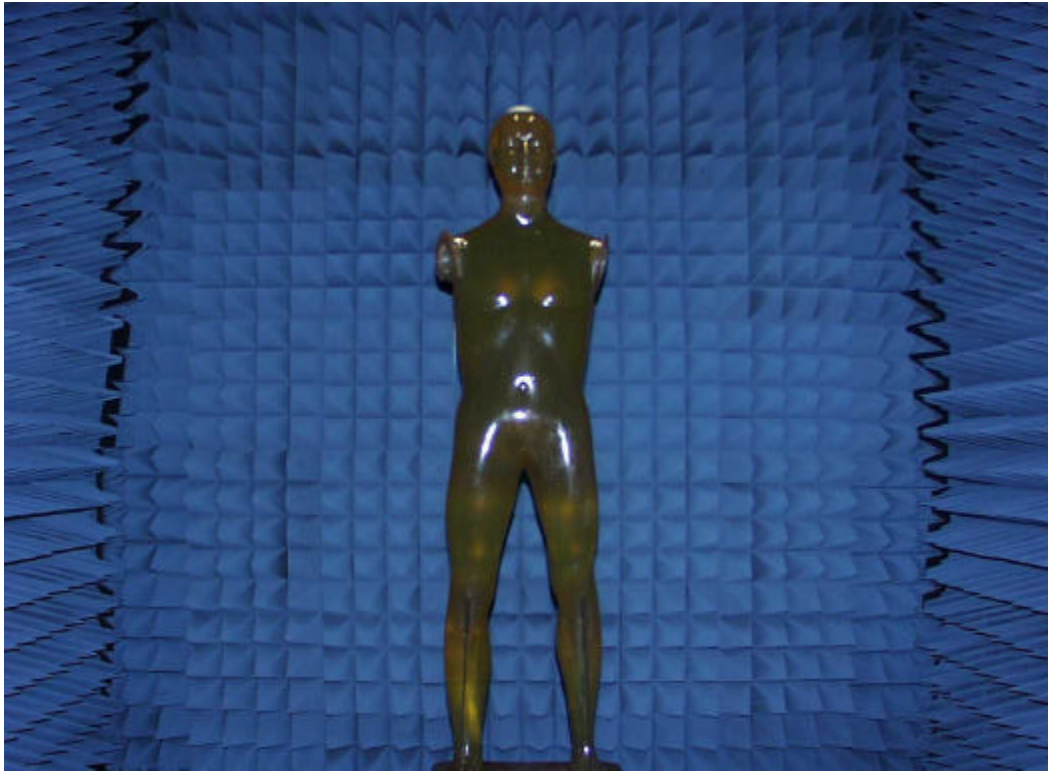


Figure 3. Phantom in Anechoic Chamber.

10. Body Worn Configuration

If the test sample can be used in a body-worn configuration using a supplied belt-clip/holster, body worn testing will be done. The test sample will be placed into the supplied belt-clip/holster and positioned on the below the measurement phantom with the belt-clip/holster parallel to the phantom as demonstrated in Figure 4. A second position will also be tested with the bottom of the test sample in the belt clip/holster touching the measurement phantom.



Figure 4. Example of Body Worn Placement

11. Battery Options

Unless otherwise stated in the report supplied with the Exhibit 11, most test samples do have several battery options. These battery options do not affect the attachment to the belt-clip/holster, or the distance of the test sample's body or antenna to the phantom, and thus should not affect the SAR values. The SAR will be measured with the battery that has the highest capacity.