Certificate Number: 1449-01

CGISS EME Test Laboratory

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S.A.R. EME Compliance Test Report
Part 1 of 2

Date of Report:	June 9, 2004
Report Revision:	Rev. O
Manufacturer:	Motorola
Product Description:	MOC4600i 458-470MHz, 0.25/0.50/0.75 Watts, Service prompter (call box)
FCC ID:	AZ489FT4868
Device Model:	RLE1062A

Test Period:	05/28/04 – 06/01/04
EME Tech:	Kim Uong (Lead EME Engineer)
EME Eng.:	Kim Uong (Lead EME Engineer)
Author:	Kim Uong (Lead EME Engineer)

Note: Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 2.0 of this report.

Signature on file

Ken Enger
Senior Resource Manager, Laboratory Director, CGISS EME Lab

6/9/04

Date Approved

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REVISION HISTORY

Date	Revision	Comments
06/09/04	O	Release of Prototype results

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (S.A.R.) measurements performed at the CGISS EME Test Lab for model number RLE1062A, FCC ID: AZ489FT4868.

The applicable exposure environment is General Population/Uncontrolled.

2.0 Reference Standards and Guidelines

This product is designed to comply with the following national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; 47CFR part 2 sub-part J
- IEEE 1528, 2003 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques"
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Terminal frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 2003
- ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio frequency range between 9KHz and 300 GHz." and “Attachment to resolution # 303 from July 2, 2002”.

3.0 Description of Test Sample

FCC ID: AZ489FT4868 is a Motorola On Call (M.O.C.) service prompter device using Frequency Modulation (FM). This device is intended to be used in the retail stores environment to send a "customer need assistance" message to the retail store worker when the customer presses the button on the front of the device. Once the button is pressed the outgoing message can be set to repeat a maximum of 8 repetitions. The out going message length is 1 second minimum and 8 seconds maximum; time between the messages is 3 seconds minimum and 120 seconds maximum. The maximum transmission duty cycle of this M.O.C. is 73%.

FCC ID: AZ489FT4868 is capable of operating in the 458 - 470 MHz* band and can be programmed to operate in three different rated power levels 0.25watts, 0.5watts, and 0.75 watts with a maximum output capability of 0.760 watts as defined by the upper limit of the production line final test station.

*Note: The U.S. frequency band is 460-470MHz.

FCC ID: AZ489FT4868 is offered with the following:

Antenna	**Description**
Fixed	Helical 1/4 wave antenna; 458-470 MHz; -2.0dBi gain
Battery	
C-Cell	Standard C Alkaline battery

3.1 Test Signal

Test Signal mode:

Test Mode	X	Base Station		Simulator	

Transmission Mode:

CW	X
Native Transmission	
TDMA: 1:6, 1:3, 81:120, 114:120	
Other:	

3.2 Test Output Power

A table of the characteristic power slump versus time is provided in Appendix A .

4.0 Description of Test Equipment

4.1 Descriptions of S.A.R. Measurement System

The laboratory utilizes a Dosimetric Assessment System (DASY3™) S.A.R. measurement system manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot with an ET3DV6 E-Field probe. Please reference the SPEAG user manual and application notes for detailed probe, robot, and S.A.R. computational procedures.
The S.A.R. measurements were conducted with probe model/serial number ET3DV6/SN1545. The system performance check was conducted daily and within 24 hours prior to testing. DASY output files of the system performance test results and the probe/dipole calibration certificates are included in appendices C and D respectively. The table below summarizes the system performance check results normalized to 1W.

Probe Serial #	Tissue Type	Probe Cal Date	Dipole Kit / Serial #	System Perf. 1-g S.A.R. Result when normalized to 1W (mW/g)	Reference 1-g S.A.R @ 1W (mW/g)	Test Date(s)
1545	FCC Body	8/28/03	D450V2/1002	4.63 +/- 0.02	4.71 +/- 10%	5/28/04-6/01/04 2 test days

The DASY3™ system is operated per the instructions in the DASY3™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess S.A.R. EME compliance was calibrated according to 17025 A2LA guidelines.

4.2 Description of Phantom

4.2.1 Flat Phantom

A rectangular shaped box made of high density polyethylene (HDPE) material. The phantom is mounted on a wooden supporting structure that has a loss tangent of <0.05. The structure has a 68.58 cm x 25.4 cm opening at its center to allow positioning the DUT to the phantom's surface. The flat phantom dimensions used for S.A.R. performance assessment are L = 80cm, W = 60cm, H = 20cm, Surface Thickness = 0.2cm.

4.2.2 SAM Phantom

SAM Phantom assessment was not applicable for this filing.

4.3 Simulated Tissue Properties

4.3.1 Type of Simulated Tissue

The simulated tissues used are compliant to that specified in FCC Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)

Simulated Tissue	Body Position
FCC Body	Torso
IEEE Head	NA

4.3.2 Simulated Tissue Composition (System Performance)

Tissue Ingredient (%) @ 450 MHz		
	Head	**Body**
Sugar	NA	46.5
DGBE (Glycol)	NA	NA
De ionized -Water	NA	50.53
Salt	NA	1.87
HEC	NA	1
Bact.	NA	0.1

Characterization of Simulated tissue materials and ambient conditions:

Simulated tissue prepared for S.A.R. measurements is measured daily and within 24 hours prior to actual S.A.R. testing to verify that the tissue is within 5% of target parameters at the center of the transmit band. This measurement is done using the Agilent (HP) probe kit model 85070C and a HP8753D Network Analyzer.

Tested Tissue Target Parameters

FCC Body				
Frequency (MHz)	**Di-electric Constant Target**	**Di-electric Constant Meas. (Range)**	**Conductivity Target S/m**	**Conductivity Meas. (Range) S/m**
450	56.7	54.0 - 54.4	0.94	0.94 - 0.94
464	56.6	53.9 - 54.3	0.94	0.95 - 0.95

4.4 Test conditions

The EME Laboratory ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/- 2°C of the temperature at which the dielectric properties were determined. The liquid depth in the phantom used for measurements was 15cm +/- 0.5cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the S.A.R. tests reported herein:

	Target	**Measured**
Ambient Temperature	20 - 25 ˚C	Range: 20.8-22.9˚C Avg. 21.7˚C
Relative Humidity	30 - 70 %	Range: 47.5-53.9% Avg. 51.4%
Tissue Temperature	NA	Range: 19.1-20.5˚C Avg. 19.98˚C

The EME Lab RF environment uses a Spectrum Analyzer to monitor for extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the S.A.R scans are repeated. However, the lab environment is sufficiently protected such that no S.A.R. impacting interference has been experienced to date.

5.0 Description of Test Procedure

All assessments were done using the flat phantom containing applicable FCC body tissue simulant.

Assessments at the body

The DUT was assessed at the TX center frequency of the band using the C Alkaline batteries, with the front, the bottom and both sides of the device against the phantom.

The DUT was assessed at the TX band edges, using the test configuration from above that produced the highest S.A.R results.

A "shortened" scan was performed using the test configuration that produced the highest S.A.R. results overall at the body.

5.1 Device Test Positions

Reference Figure 1 for the device orientation and position which exhibited the highest S.A.R. performance.

5.1.1 Body

The DUT was positioned such that it was centered against the flat phantom.

5.1.2 Head

Not applicable

5.1.3 Face

Not applicable

5.2 Test Position Photographs

Figure 1: Highest S.A.R. Test Position; Front of DUT against the flat phantom

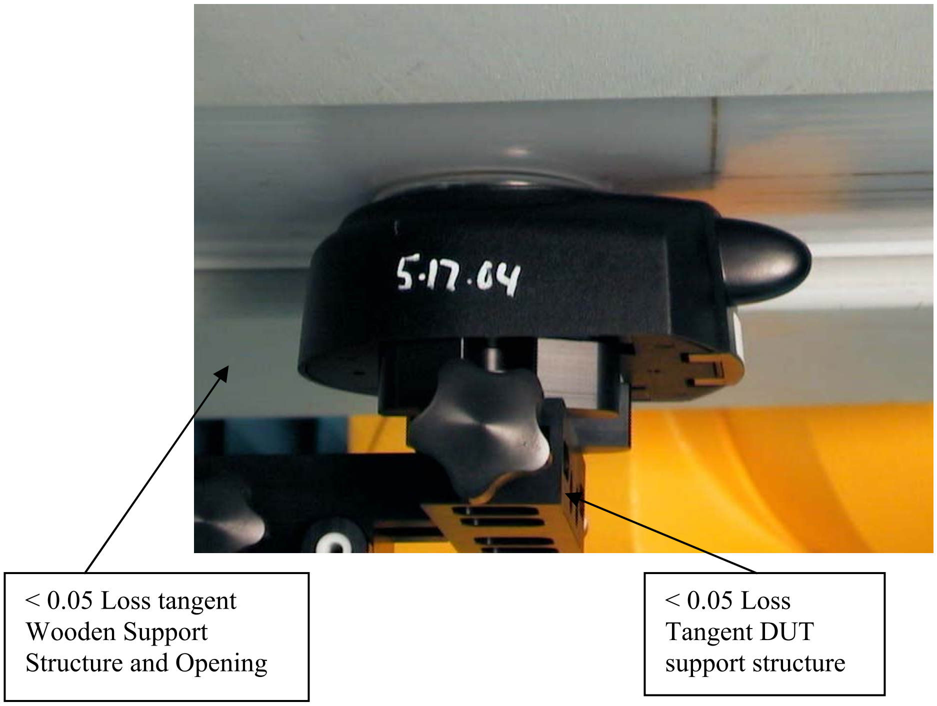

Figure 2: Assessment @ the Body; Right side of DUT against the flat phantom

Figure 3: Assessment @ the Body; Left side of DUT against the flat phantom

Figure 4: Assessment @ the Body; Bottom side of DUT against the flat phantom

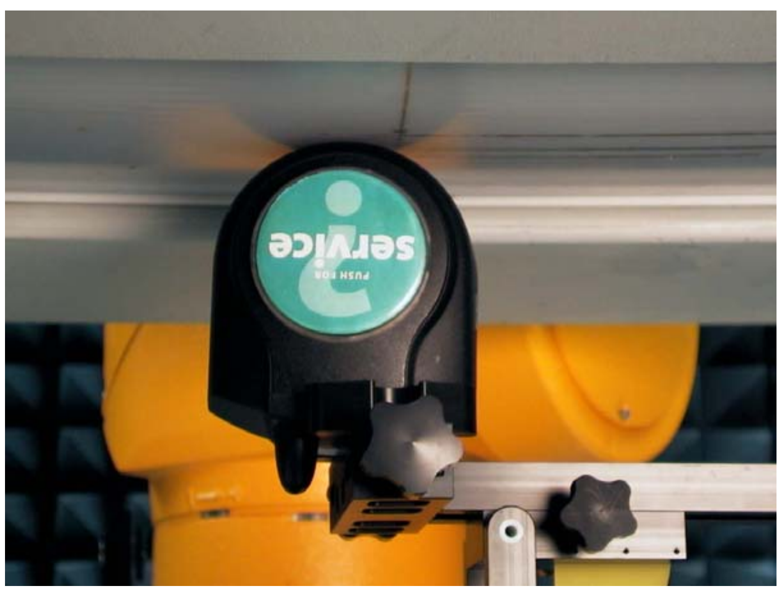

Figure 5: Robot Test Setup

5.3 Probe Scan Procedures

The E-field probe scans in a coarse grid over a large area inside the phantom in order to locate the interpolated maximum S.A.R. distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

6.0 Measurement Uncertainty

Table 1: Uncertainty Budget for Device Under Test: 75 – 3000 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	**Tol. (± %)**	**Prob Dist**	**Div.**	c_i **(1 g)**	c_i **(10 g)**	**1 g** u_i **(±%)**	**10 g** u_i **(±%)**	v_i
Measurement System									
Probe Calibration	E.2.1	4.8	N	1.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	1.3	R	1.73	1	1	0.8	0.8	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t Phantom	E.6.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.4	N	1.00	1	1	3.4	3.4	29
Device Holder Uncertainty	E.4.1	3.8	N	1.00	1	1	3.8	3.8	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	6.5	N	1.00	0.64	0.43	4.2	2.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	4.0	N	1.00	0.6	0.49	2.4	2.0	∞
Combined Standard Uncertainty			RSS				12	11	601
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				23	22	

Table 2: Uncertainty Budget for System Check: 75 – 3000 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob. Dist.	Div.	c_i (1 g)	c_i (10 g)	1 g u_i (±%)	10 g u_i (±%)	v_i
Measurement System									
Probe Calibration	E.2.1	4.8	N	1.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	1.3	R	1.73	1	1	0.8	0.8	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	6.0	R	1.73	0.64	0.43	2.2	1.5	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	6.0	R	1.73	0.6	0.49	2.1	1.7	∞
Combined Standard Uncertainty			RSS				9	8	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				17	17	

Notes for Tables 1 and 2
a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty.

7.0 S.A.R. Test Results

All S.A.R. results obtained by the tests described in Section 5.0 are listed in section 7.1 below. The bolded result indicates the highest observed S.A.R. performance. DASY3™ S.A.R. measurement scans are provided in APPENDIX B for the highest observed S.A.R.
Appendix A presents shortened S.A.R. cube scans to assess the validity of the calculated results presented herein.
Note: The results of the shortened cube scans presented in Appendix A demonstrate that the scaling methodology used to determine the calculated S.A.R. results presented herein are valid.

7.1 S.A.R. results

DUT assessment at the Body												
Serial number	**Antenna Position**	**Test Freq**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**S.A.R Drift (dB)**	**Meas. 1g-S.A.R. (mW/g)**	**Max Calc. 1g-S.A.R. (mW/g)**	**Meas. 10g-S.A.R. (mW/g)**	**Max Calc. 10g-S.A.R. (mW/g)**
KU-R2-040528-05/158ABC0006	Fix	464.5500	C - Alkalines	DUT front adjacent	None	None	0.768	-0.54	1.150	0.95	0.802	0.66
KU-R2-040528-06/158ABC0006	Fix	464.5500	C - Alkalines	DUT left adjacent	None	None	0.768	-0.31	0.683	0.54	0.485	0.38
KU-R2-040601-02/158ABC0006	Fix	464.5500	C - Alkalines	DUT right adjacent	None	None	0.768	-0.45	0.330	0.27	0.240	0.19
KU-R2-040601-03/158ABC0006	Fix	464.5500	C - Alkalines	DUT bottom adjacent	None	None	0.768	-0.26	0.115	0.09	0.067	0.05
KU-R2-040601-05/158ABC0006	Fix	458.6625	C - Alkalines	DUT front adjacent	None	None	0.760	-0.42	1.430	**1.15**	0.990	0.80
KU-R2-040601-07/158ABC0003	Fix	458.6625	C - Alkalines	DUT front adjacent	None	None	0.769	-0.63	1.290	1.09	0.896	0.76
KU-R2-040601-06/158ABC0006	Fix	469.5625	C - Alkalines	DUT front adjacent	None	None	0.779	-0.55	0.970	0.80	0.673	0.56

7.2 Peak S.A.R. location

Refer to APPENDIX B for detailed S.A.R. scan distributions.

7.3 Highest S.A.R. results calculation methodology

The calculated maximum 1-gram and 10-gram averaged S.A.R. values are determined by scaling the measured S.A.R. to account for power leveling variations and power slump. For this device the Maximum Calculated 1-gram and 10-gram averaged peak S.A.R. is calculated using the following formula:

Max. Calc. 1-g Avg. SAR = ((S.A.R. meas. / (10^(Pdrift/10))*(Pmax/Pint))* DC%
P_{max} = Maximum Power (W)
P_{int} = Initial Power (W)
Pdrift = DASY drift results (dB)
$SAR_{meas.}$ = Measured 1 gram averaged peak S.A.R. (mW/g)
DC % = Transmission mode duty cycle in % where applicable
Note that the use of the above formula should consider the relationship between the initial power, max power, and drift. Also, a 73% duty cycle is applied for this product operation.

8.0 Conclusion

The highest Operational Maximum Calculated 1-gram and 10-gram average S.A.R. values found for FCC ID: AZ489FT4868 model RLE1062A

At the Body: 1-g Avg. = 1.15 mW/g; 10-g Avg. = 0.80 mW/g

These test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of **1.6 mW/g** per the requirements of 47 CFR 2.1093(d)