



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

**Attention:** FCC  
**Date of Report:** March 07, 2003  
**Report Revision:** Rev. A  
**Manufacturer:** Motorola China  
**Product Description:** 1.5 Watts fixed antenna UHF/RBR/ 4 channel w/ display  
**FCC ID:** AZ489FT4860  
**Device Model:** HCUE1081A

**Test Period:** 2/13/03 – 2/14/03

**EME Technician:** Ed Church (EME Technician)

**EME Engineer:** Deanna Zakharia (Sr. Staff Eng.)

**Author:** Michael Sailsman  
(EME Regulatory Affairs Liaison)

**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, Product Safety and EME Director

3/7/03

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Date Approved

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# TABLE OF CONTENTS

1.0	Introduction
2.0	Reference Standards and Guidelines
3.0	Description of Test Sample
3.1	Test Signal
3.2	Test Output Power
4.0	Description of Test Equipment
4.1	Description of S.A.R Measurement System
4.2	Description of Phantom
4.2.1	Flat Phantom
4.2.2	SAM phantom
4.3	Simulated Tissue Properties
4.3.1	Type of Simulated Tissue
4.3.2	Simulated Tissue Composition
4.4	Test condition
5.0	Description of Test Procedure
5.1	Device Test Positions
5.1.1	Abdomen
5.1.2	Head
5.1.3	Face
5.2	Test Position Photographs
5.3	Probe Scan Procedures
6.0	Measurement Uncertainty
7.0	S.A.R. Test Results
7.1	S.A.R. results
7.2	Peak S.A.R. location
7.3	Highest S.A.R. results calculation methodology
8.0	Conclusion
	Appendix A: Power Slump Data/Shortened scan
	Appendix B: Data Results
	Appendix C: Dipole System Performance Check Results
	Appendix D: Calibration Certificates
	Appendix E: Illustration of Body-worn Accessories
	Appendix F: Accessories and options test status and separation distances

## REVISION HISTORY

Date	Revision	Comments
2/18/03	O	Release of Prototype Results
3/07/03	A	Corrected previously reported frequency range

## **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 HCUE1081A, FCC ID: AZ489FT4860.

The applicable exposure environment is Occupational/Controlled.

The test results included herein represent the highest S.A.R. levels applicable to this product and clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8.0 mW/g per the requirements of 47 CFR 2.1093(d).

## **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
- 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 Terminal communications (Electromagnetic Radiation - Human Exposure) Standard 2001
- ANATEL, Brazil Regulatory Authority, Resolution 256 (April 11, 2001) "additional requirements for SMR, cellular and PCS product certification."

### 3.0 Description of Test Sample



FCC ID: AZ489FT4860 is a wireless communication device that allows one-to-one or group communication using Zero IF analog FM technology. The intended operating positions are “at the face” in a vertical position 1 to 2 inches from the mouth of the user and “at the abdomen” by means of the offered body-worn accessories. Audio and PTT operation while at the abdomen is accomplished by means of optional remote accessories that connect to the radio.

This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies, who can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means. Motorola also makes available to its customers training classes on the proper use of two-way radios and wireless data devices.

FCC ID: AZ489FT4860 operates in the 458.6625-469.5625 MHz band.

The rated and maximum power is 1.5 watts and reflects the final test station upper limit.

FCC ID: AZ489FT4860 is offered with the following options and accessories:

**Antenna**

Fixed                      458-470MHz Fixed ¼ wave UHF Helical antenna; -2dBi

**Batteries**

SNN5571A                3.6V Lithium Ion Battery  
AAA                      Standard AAA Alkaline

**Body-worn Accessories**

HCLN4013A              Swivel Belt Holster CLS

**Other attachments**

HMN9026B              Remote Speaker Microphone (53862)  
HMN9039B              Earpiece w/ microphone (53863)  
HMN9038A              Headset w/ Swivel Boom Mic (53865)  
HMN9025B              Ear bud w/ PTT Mic (53866)  
NTN9159C              Headset w/ Boom Mic RBR (53815)  
RLN5598A              Headset w/ Boom Mic (NFL)

**3.1 Test Signal**

**Test Signal mode:**

Test Mode	<input checked="" type="checkbox"/>	Base Station	<input type="checkbox"/>	Simulator	<input type="checkbox"/>
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**Transmission Mode:**

CW	<input checked="" type="checkbox"/>
Native Transmission	<input type="checkbox"/>
TDMA:	<input type="checkbox"/>
Other:	<input type="checkbox"/>

**3.2 Test Output Power**

A table of the characteristic power slump versus time is provided in Appendix A for all tested batteries.

## 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 following websites for detailed specifications of the robot and E-Field probe: [http://www.speag.com/robot\\_acc.html](http://www.speag.com/robot_acc.html), <http://www.speag.com/probes.html>.

The S.A.R. measurements were conducted with probe model/serial number ET3DV6/SN1393. 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. Result when normalized to 1W (mW/g)	Reference S.A.R @ 1W (mW/g)	Test Date(s)
1393	FCC Body	3/22/02	D450V2/1001	4.21 +/- 0.04	4.41+/- 10%	2/13/03-2/14/03 2 test days
1393	IEEE Head	3/22/02	D450V2/1001	4.52+/- 0.08	4.63 +/- 10%	2/14/03 & 2/17/03

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 EME S.A.R. 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) with a dielectric constant of 2.26 and a loss tangent of less than 0.00031 was used for assessments at the abdomen. A rectangular shaped box made of loss acrylic material was used for assessment at the face. 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 table below shows the flat phantom dimensions used for S.A.R. performance assessment.

	Abdomen	Face
Length	80cm	40cm
Width	30cm	23cm
Height	20cm	20cm
Surface Thickness	0.2cm	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 tissue used is compliant to that specified in FCC Supplement C (Edition 01 - 01) to OET Bulletin 65 (Edition 97 - 01).

Simulated Tissue	Body Position
FCC Body	Abdomen
IEEE Head	Face

#### 4.3.2 Simulated Tissue Composition

	Tissue Ingredients (%)					
	450 MHz		NA		NA	
	Head	Body	Head	Body	Head	Body
Sugar	56	46.5	NA	NA	NA	NA
DGBE (Glycol)	NA	NA	NA	NA	NA	NA
De ionized -Water	39.1	50.53	NA	NA	NA	NA
Salt	3.8	1.87	NA	NA	NA	NA
HEC	1	1	NA	NA	NA	NA
Bact.	0.1	0.1	NA	NA	NA	NA

#### 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.

### Target tissue 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	54.9-55.1	0.94	0.92-0.92
IEEE HEAd				
Frequency (MHz)	Di-electric Constant Target	Di-electric Constant Meas. (Range)	Conductivity Target S/m	Conductivity Meas. (Range) S/m
450	43.5	44.2-44.2	0.87	0.86-0.86

#### 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. 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
<b>Ambient Temperature</b>	20 - 25 °C	Range: 22.1-23.8°C Avg. 22.9°C
<b>Relative Humidity</b>	30 - 70 %	Range: 35.2-49.2% Avg. 44.1%
<b>Tissue Temperature</b>	NA	Range: 20.9-21.5°C Avg. 21.28 °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 options and accessories listed in section 3.0 were considered in order to develop the S.A.R. test plan for this product. S.A.R. measurements were performed using a flat phantom to assess performance at the abdomen and hand. All assessments were done using the flat phantom with the DUT in CW mode.

The DUT was assessed at 466.2625 MHz (Ch 2) with the offered batteries, the offered body-worn accessory, and the RSM model HMN9026A to determine the battery that produces the highest

S.A.R. results.

The configuration from above that produced the highest S.A.R. results was used to assess the performance of the offered audio accessories.

An assessment with the DUT's front, back, and antenna at 2.5cm separation distances was performed.

An assessment with the DUT's microphone separated 2.5cm from the phantom was performed.

## **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 Abdomen**

The DUT and the offered body-worn accessory were positioned such that the body-worn accessory was centered against the flat phantom. The DUT's back, front, and antenna were positioned 2.5cm separation distance from the phantom.

### **5.1.2 Head**

Assessment at the head was not applicable for this filing

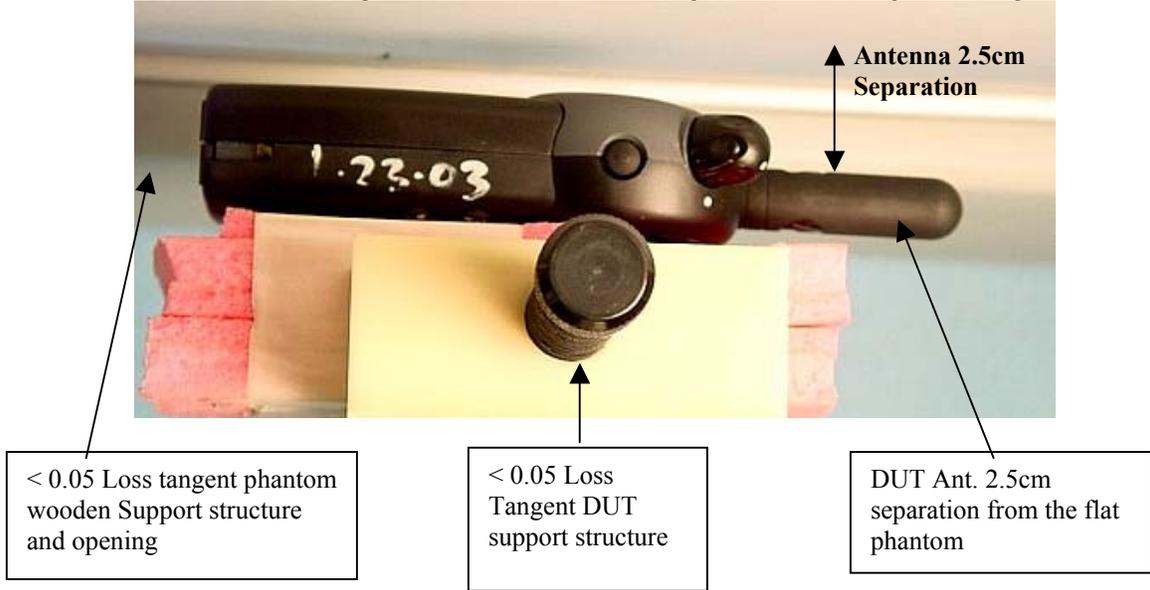
### **5.1.3 Face**

The DUT was positioned with a 2.5cm separation distance from the flat phantom.

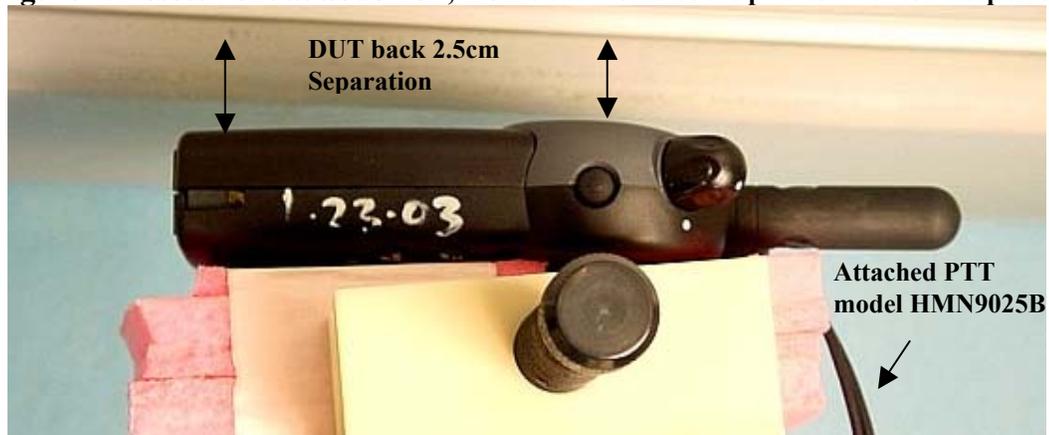
## 5.2 Test Position Photographs

**Figure 1: Highest S.A.R. Test Position**

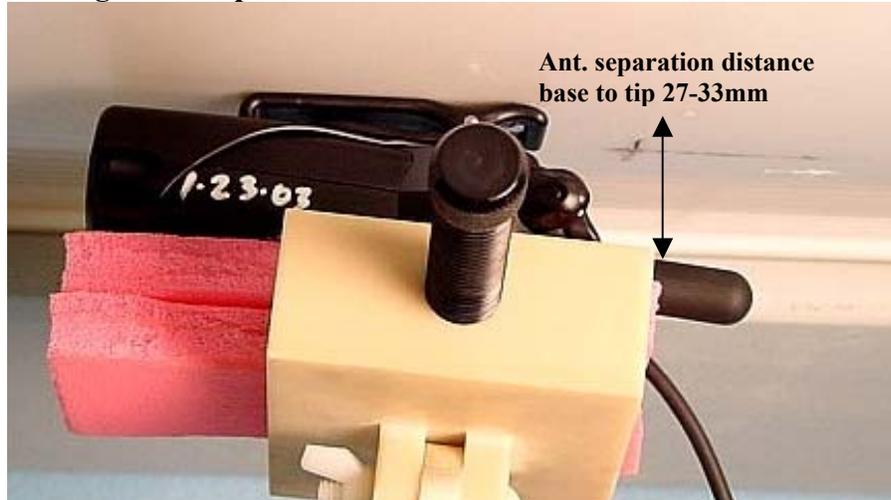
DUT's back toward the phantom with the antenna separated from the phantom by 2.5cm



**Figure 2. Assessment at abdomen; DUT's back towards the phantom w/ 2.5cm separation**



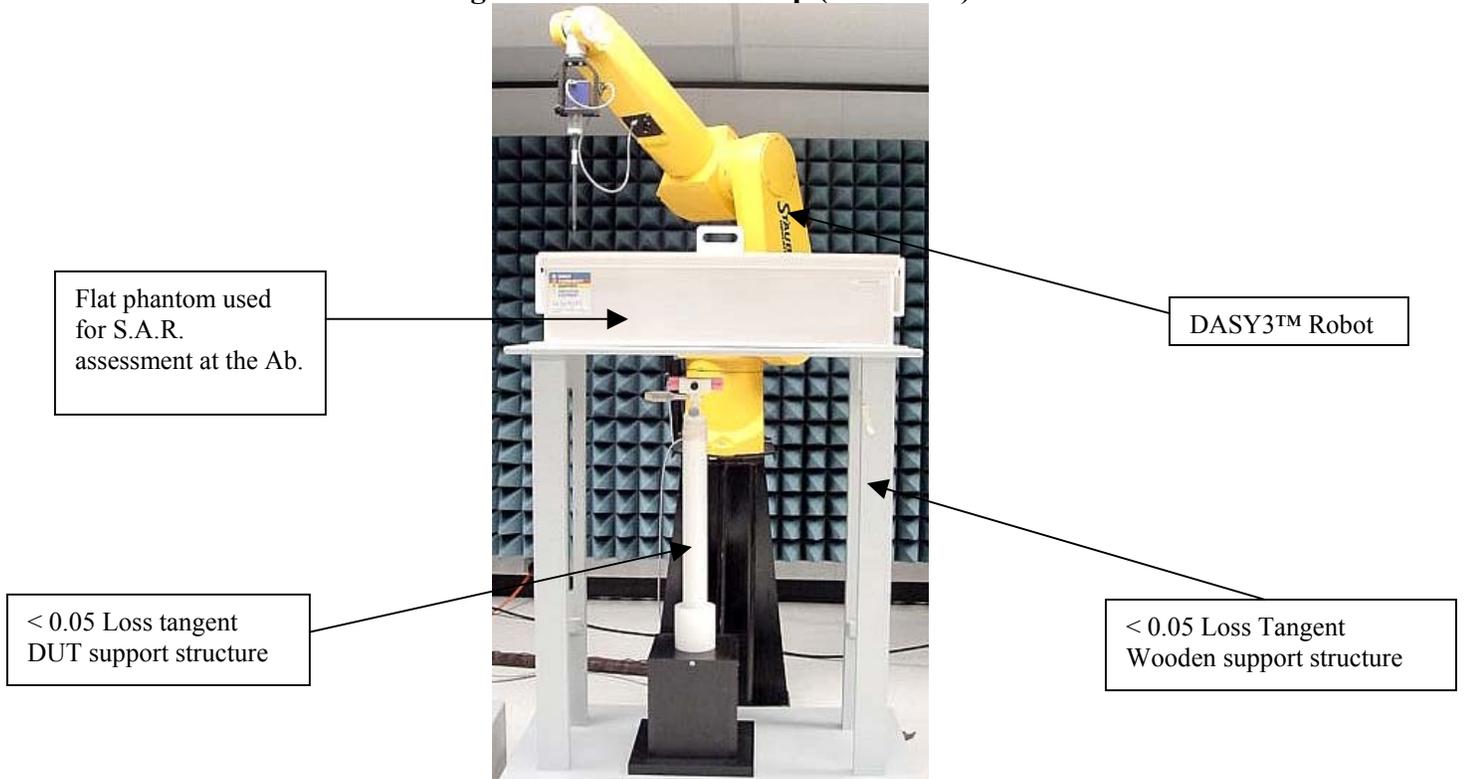
**Figure 3. Assessment at abdomen; DUT with HCLN4013A carry case against the phantom w/ attached HMN9025B PTT**



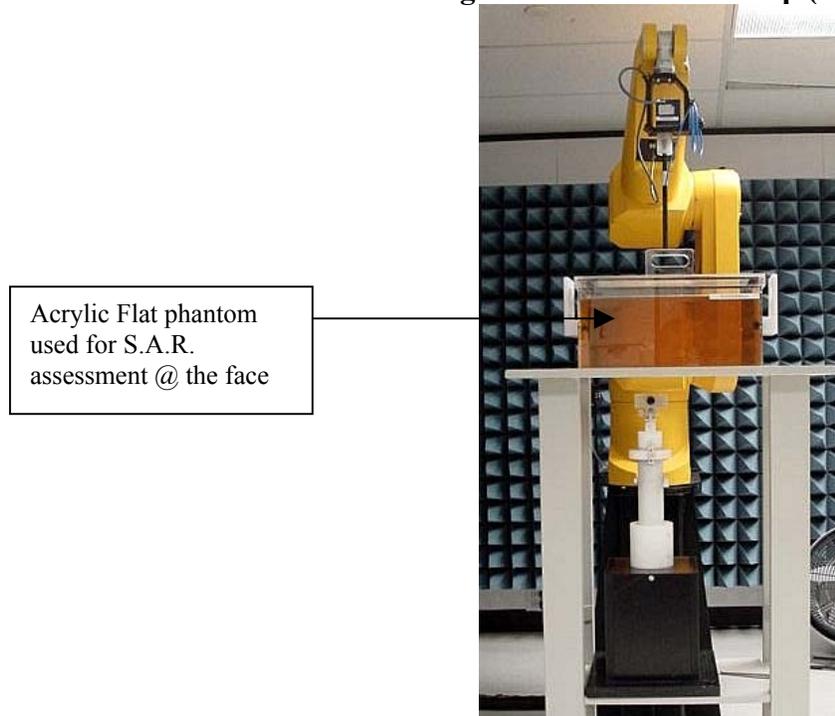
**Figure 4. Assessment @ Face;  
Front of DUT 2.5cm separation distance from phantom**



**Figure 5: Robot Test Setup (Abdomen)**



**Figure 6: Robot Test Setup (Face)**



### 5.3 Probe Scan Procedures

The E-field probe is first scanned 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**

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	Section of IEEE P1528	Tol. (± %)	Prob. Dist.	Divisor	<i>c<sub>f</sub></i> (1 g)	<i>c<sub>g</sub></i> (10 g)	1 g <i>u<sub>f</sub></i> (±%)	10 g <i>u<sub>g</sub></i> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
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	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	5.8	R	1.73	1	1	3.3	3.3	∞
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	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
<b>Test sample Related</b>									
Test Sample Positioning	E.4.2	3.6	N	1.00	1	1	3.6	3.6	29
Device Holder Uncertainty	E.4.1	2.8	N	1.00	1	1	2.8	2.8	8
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
<b>Combined Standard Uncertainty</b>			RSS				11.72	11.09	1363
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<i>k</i> =2				22.98	21.75	

**Table 2: Uncertainty Budget for System Performance Check**

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i> =		<i>h</i> =	<i>i</i> =	<i>k</i>	
				<i>f</i> ( <i>d,k</i> )	<i>g</i>				<i>c x f / e</i>
Uncertainty Component	Section of IEEE P1528	Tol. (± %)	Prob. Dist.	Div.	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	1 g <i>u<sub>i</sub></i> (±%)	10 g <i>u<sub>i</sub></i> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
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	5.8	R	1.73	1	1	3.3	3.3	∞
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	0.0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
<b>Dipole</b>									
Dipole Axis to Liquid Distance	8, E.4.2	1.0	R	1.73	1	1	0.6	0.6	∞
Input Power and SAR Drift Measurement	8, 6.6.2	4.7	R	1.73	1	1	2.7	2.7	∞
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
<b>Combined Standard Uncertainty</b>			RSS				10.16	9.43	∞
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<i>k</i> =2				19.92	18.48	

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) *c<sub>i</sub>* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- g) *u<sub>i</sub>* – SAR uncertainty
- h) *v<sub>i</sub>* - 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 a shortened S.A.R. cube scan 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

Compliance assessment at the abdomen CW mode										
Run Number/ SN	Freq. (MHz)	Antenna	Battery	Test position	Carry Case	Additional attachments	Initial Power (mW)	DASY Drift (dB)	Measured 1g-S.A.R. (mW/g)	DASY Drift Max Calc. 1g-S.A.R. (mW/g)
<b>Assessment at the abdomen (Battery/frequency search)</b>										
Ab-R1-030213-05/134ABC0001	466.2625	Fixed	SNN5571A	Against phantom	HCLN4013A	HMN9026A	1.552	-0.85	1.55	0.91
Ab-R1-030213-06/134ABC0001	466.2625	Fixed	AAA Alkaline	Against phantom	HCLN4013A	HMN9026A	1.442	-1.5	1.25	<b>0.92</b>
<b>Assessment at abdomen; (Audio accessories)</b>										
Ab-R1-030213-08/134ABC0001	466.2625	Fixed	AAA Alkaline	Against phantom	HCLN4013A	HMN9039B	1.442	-1.66	1.01	0.77
Ab-R1-030213-09/134ABC0001	466.2625	Fixed	AAA Alkaline	Against phantom	HCLN4013A	HMN9038A	1.442	-1.62	0.95	0.72
Ab-R1-030214-02/134ABC0001	466.2625	Fixed	AAA Alkaline	Against phantom	HCLN4013A	HMN9025B	1.442	-1.46	1.58	<b>1.15</b>
Ab-R1-030214-03/134ABC0001	466.2625	Fixed	AAA Alkaline	Against phantom	HCLN4013A	NTN9159C	1.442	-1.58	1.22	0.91
Ab-R1-030214-04/134ABC0001	466.2625	Fixed	AAA Alkaline	Against phantom	HCLN4013A	RLN5598A	1.442	-1.52	1.22	0.90
<b>Assessment at abdomen; (DUT 2.5cm separation)</b>										
Ab-R1-030214-05/134ABC0001	466.2625	Fixed	AAA Alkaline	Back to phantom ant. @ 2.5cm	None	HMN9025B	1.442	-1.68	1.63	<b>1.25</b>
Ab-R1-030214-06/134ABC0001	466.2625	Fixed	AAA Alkaline	Back @ 2.5cm	None	HMN9025B	1.442	-1.73	1.08	0.84
Ab-R1-030214-07/134ABC0001	466.2625	Fixed	AAA Alkaline	Front @ 2.5cm	None	HMN9025B	1.442	-1.66	1.20	0.91

Compliance assessment at the Face (Flat phantom); CW mode										
Run Number/ SN	Freq. (MHz)	Antenna	Battery	Test position	Carry Case	Additional attachments	Initial Power (mW)	Dasy Drift (dB)	Measured 1g-S.A.R. (mW/g)	DASY Drift Max Calc. 1g-S.A.R. (mW/g)
<b>DUT assessment with 2.5cm separation</b>										
Face-R1-030214- 11/134ABC0001	466.2625	Fixed	SNN5571A	Front @ 2.5cm	None	None	1.552	-0.75	2.78	1.60
Face-R1-030214- 12/134ABC0001	466.2625	Fixed	AAA Alkaline	Front @ 2.5cm	None	None	1.442	-2.02	1.95	<b>1.61</b>

## 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 averaged S.A.R. value is determined by scaling the measured S.A.R. to account for power leveling variations and power output slump below the reported maximum power during the S.A.R. measurements. For this device the Maximum Calculated 1-gram averaged peak S.A.R. is calculated using the following formula:

$$\text{Max. Calc. 1-g Avg. SAR} = ((\text{S.A.R. meas.} / (10^{(\text{Pdrift}/10)})) * (\text{Pmax}/\text{Pint})) * \text{DC}\%$$

$P_{\text{max}}$  = Maximum Power (W)

$P_{\text{int}}$  = Initial Power (W)

$P_{\text{drift}}$  = DASY drift results (dB)

$\text{SAR}_{\text{meas.}}$  = Measured 1 gram averaged peak S.A.R. (mW/g)

DC % = Transmission mode duty cycle in % where applicable

## 8.0 Conclusion

The highest Operational Maximum Calculated 1-gram average S.A.R. values found for FCC ID: AZ489FT4860

**At the abdomen: 1.25 mW/g**

**At the Face: 1.61 mW/g**

**At the Head: N/A**

These test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of **8.0 mW/g** per the requirements of 47 CFR 2.1093(d)