The science of Zorb

zorb

CIEMS

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CALIFORNIA INSTITUTE OF ELECTRONICS AND MATERIALS SCIENCE

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The test was performed per:
MILLENIUM PRODUCTS LETTER of 23 APRIL 2014

DIVISION OF ELECTRONIC MEASUREMENTS AND DEVICES

TEST REPORT

NO. 1541740592 of 29 APRIL 2014

SHIELDING EFFECTIVENESS TEST

Material Tested: Samples of *CELL SHIELD* Electromagnetic Radiation Shield

Table 1. Test Results

S A M P L E	*Shielding Effectiveness in percent and deciBells (dB) at the Frequency of 9.375 GHz* SE_{pw}	SE_m
Oval 9.15×16.25 mm^2 Electromagnetic Radiation Shield	91.7 (10.8)	90.4 (10.2)

CONCLUSION: ***The samples tested possess satisfactory electromagnetic SE parameters in the test frequency range***

TEST DESCRIPTION

1. The test per ASTM D4935, IEEE-STD-299, FED-STD-1037, MIL-STD-188-125A, MIL-STD-461C and MIL-STD-462. Test conditions: T=22°C, RH=32%, P=101.8 kPa.

2. The magnitudes of the plane-wave shielding effectiveness (SE_{pw}) and the magnetic shielding effectiveness (SE_m) in Table 1 above are the average from six test runs at each of the three identical specimens tested. The experimental error evaluated by the partial derivatives and least squares methods does not exceed 6%. The data on the standard deviation are kept on file at CIEMS.

3. The linear arrangement of the generator and receiver antennas and the test specimens meets the requirements of MIL-STD-188-125A and the EM Performance Test Plan CIEMS-3RFRT-393001.

(continued on page 2)

4. INSTRUMENTS AND DEVICES USED
   - Signal Generator Model 8592B HP (50 MHz to 22 GHz)
   - Analyzer Model 8593E HP (9 kHz to 22 GHz)
   - Gunn Diode Microwave Transmitter Model WA-9314B PSC
   - Dual Preamplifier Model 8847F HP
   - Oscilloscope Model IO-4540 HK with Amplifier Model 8347A HP
   - Antennas: HP11968C, HP11966E, HP11966F and Dipole Antenna Set HP11966H
   - Magnetic Field Pickup Coil HP11966K, Active Loop H-Field HP11966A
   - Goniometer Model 3501-08 F-DM, Starrett Dial Indicator Model 25-109 (1.25 µm/div)
   - Digital Hygrothermometer Model 63-844 MI, Barometer Model 602650 SB.

5. The equipment meets the applicable NIST, ASTM, ASME, OSHA and State requirements and was calibrated with the standards traceable to the NIST. The calibration was performed per ANSI/ASQ M1-1996, ANSI/ASO/ASQ-Q9004-2008, ISO/IEC 17025:2005, ISO 10012:2003, MIL-STD-45662, MIL-I-45208, NAVAIR-17-35-MTL-1, and CSP-1/03-93.

6. The equipment passed a periodic accuracy test in June 2013. Next test – June 2014. The last semiannual calibration of the linear and angular measure instruments and weights was performed in December 2013.

TEST ENGINEER: 29

DIVISION MANAGER:

Cynthia Smythe

Cynthia L. Smythe
<csmythe@ciems.com>

The science of Zorb

SAR-Cell-Shield-Report

Millennium Product Inc.
Cell Shield / Zorb

Prepared by PCTEST LAB
Issued on: 10/22/2015
Report Version 2.6

NOTE: SAR results only apply to the device tested. Although the device may have had different modes, a single operating mode (4G mode) evaluated. Other modes were not evaluated. The SAR reduction may be higher or lower for other modes used and environmental conditions.

1 INTRODUCTION

1.1 Specific Absorption Rate (SAR)

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-2005 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. (c) 2005 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [3] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

2 ANSI/IEEE C95.1-1992 RF EXPOSURE LIMITS

2.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

2.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 2-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

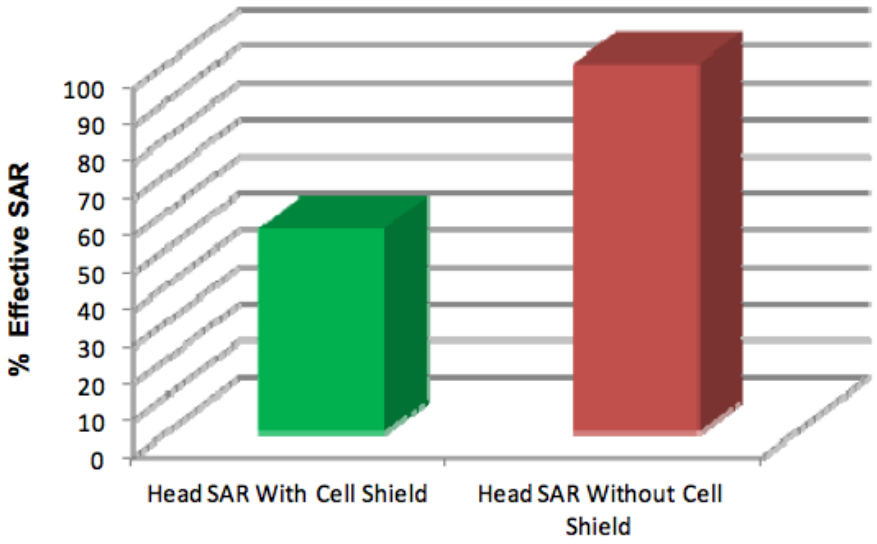
1 The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2 The Spatial Average value of the SAR averaged over the whole body.
3 The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

3 DATA SUMMARY

3.1 Test Results

		Phone Model:	iPhone 6	With Cell Shield / Zorb	
Configuration	Mode	Band (MHz)	Original SAR (W/Kg)	SAR with Cell Shield (W/Kg)	% Effective SAR
Body	LTE	1700	0.265	0.142	**53.6**
Head	LTE	1700	0.159	0.088	**55.3**

NOTE: SAR results only apply to the device tested. Although the device may have had different modes, a single operating mode (4G mode) evaluated. Other modes were not evaluated. The SAR reduction may be higher or lower for other modes used and environmental conditions.



Explanation:

% Effective SAR	Description
100%	**Wireless Device Operating Without Cell Shield/ Zorb**
50% - 60%	**Wireless Device Operating with Cell Shield/Zorb;** energy absorbed by human tissue is reduced during normal wireless device operation
0%	Wireless Device Not Transmitting

3.2 SAR Test Plots

Figure 3.2-1
Original Body SAR without Cell Shield / Zorb device attached

0.265 W/kg

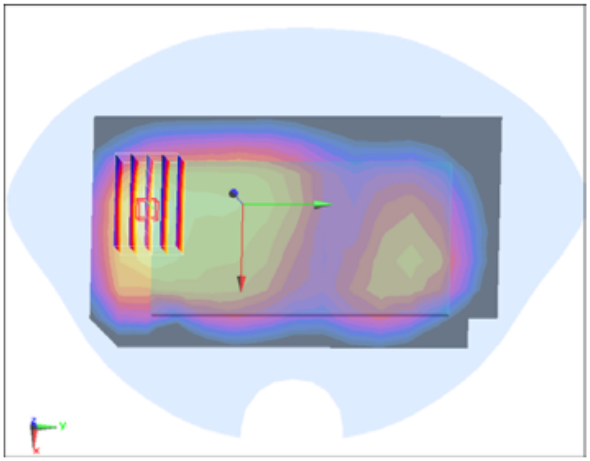


Figure 3.2-2
Body SAR with Cell Shield / Zorb device attached

0.142 W/kg

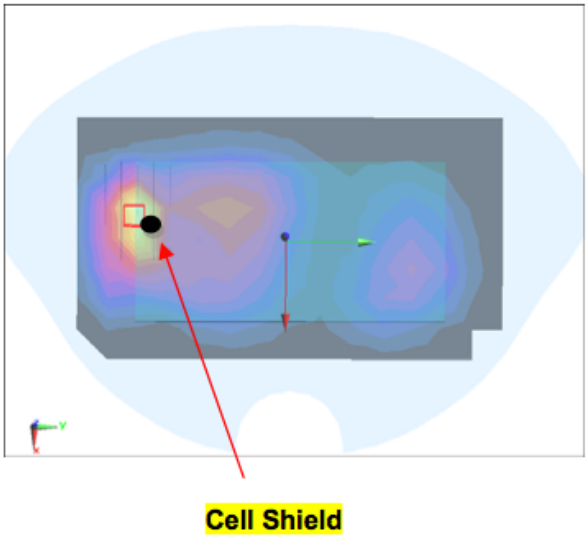


Figure 3.2-3
CAD Model of body back side view with Cell Shield / Zorb placed on Iphone 6

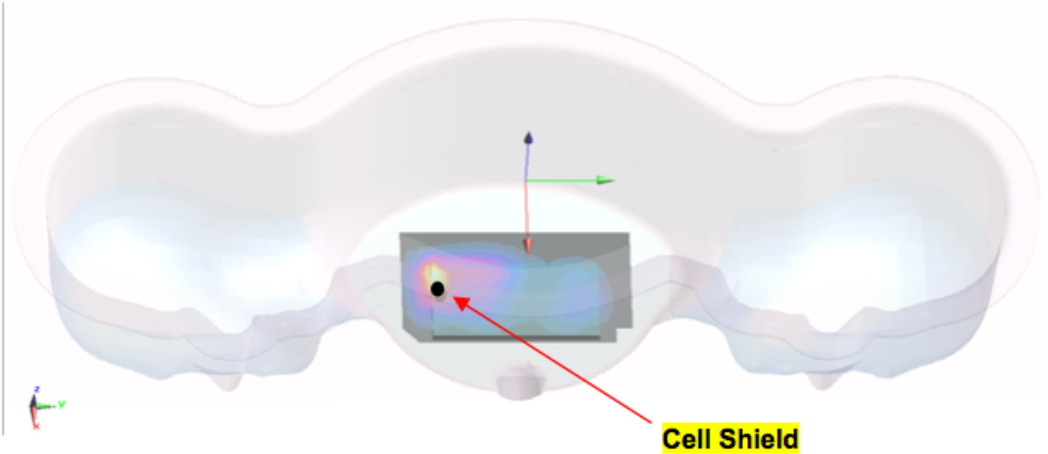


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Figure 3.2-4
Original Head SAR without Cell Shield / Zorb device attached

0.159 W/kg

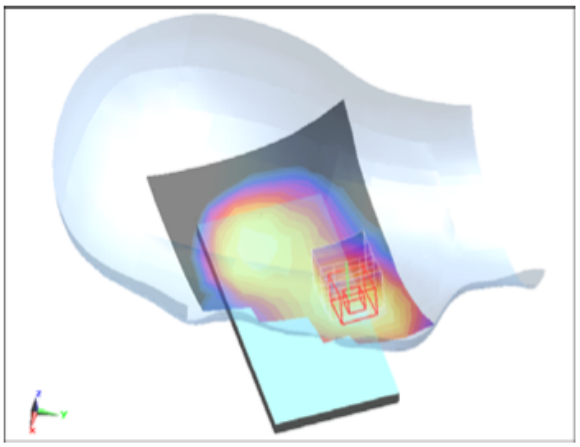


Figure 3.2-5
Head SAR with Cell Shield / Zorb device attached

0.088 W/kg

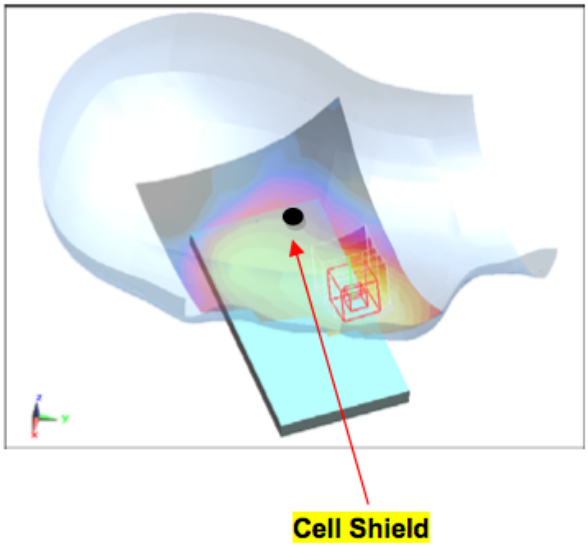
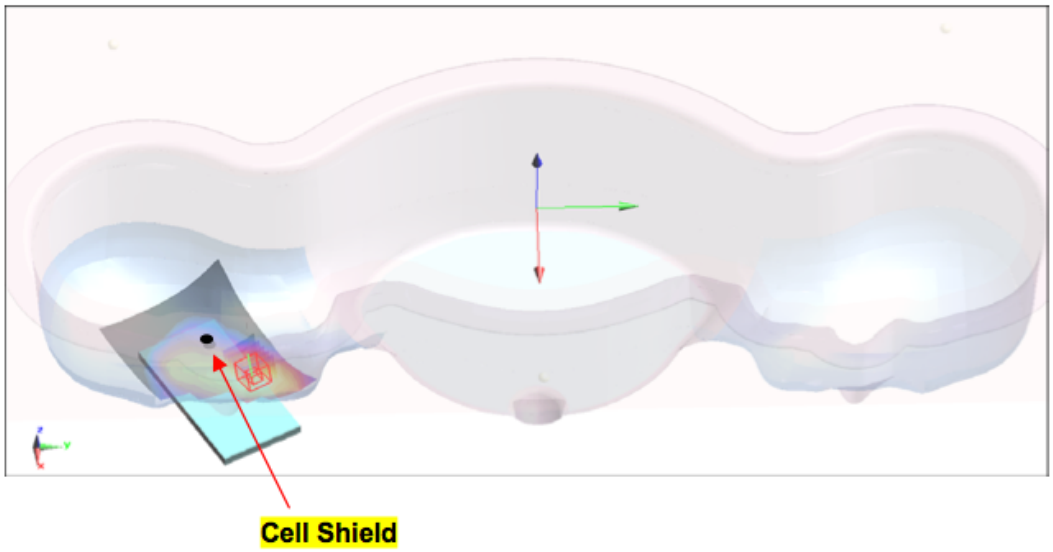


Figure 3.2-6
CAD Model of Head view with Cell Shield / Zorb placed on iphone 6



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5 PHOTOGRAGHS

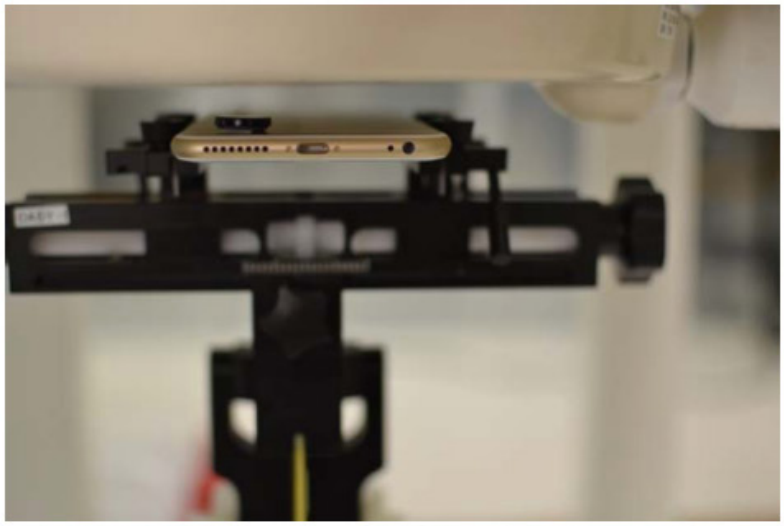

Figure 1: Body Back side view with Cell Shield / Zorb with DASY Test System

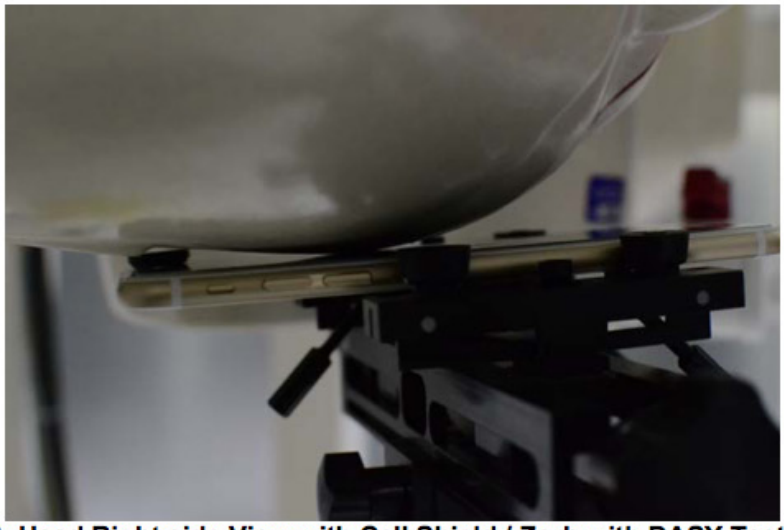

Figure 2: Head Right side View with Cell Shield / Zorb with DASY Test System

Figure 3: Full SAR Setup


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