**FCC OET BULLETIN 65 SUPPLEMENT C**
**INDUSTRY CANADA RSS-102**

# SAR EVALUATION REPORT

**FOR**

**PCA, EVDO MINI-PCI EXPRESS CARD CDMA MODEM**

**MODEL: AC402**

**FCC ID: N7NAC402**
**IC: 2417C-AC402**

**REPORT NUMBER: 08U12312-5**

**ISSUE DATE: FEBRUARY 11, 2009**

*Prepared for*

**SIERRA WIRELESS INC.**
**2290 COSMOS CT.**
**CARLSBAD, CA 92011**

*Prepared by*

**COMPLIANCE CERTIFICATION SERVICES**
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NVLAP LAB CODE 200065-0

**Revision History**

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | February 11, 2009 | Initial Issue | -- |

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## 1 ATTESTATION OF TEST RESULTS

| | |
|---|---|
| **COMPANY NAME:** | SIERRA WIRELESS INC.<br>2290 COSMOS CT.<br>CARLSBAD, CA 92011 |
| **EUT DESCRIPTION:** | CDMA/1x EVDO Rel 0 / EVDO Rev. A |
| **MODEL:** | AC402 |
| **DEVICE CATEGORY:** | Portable |
| **EXPOSURE CATEGORY:** | General Population/Uncontrolled Exposure |
| **DATE TESTED:** | January 26 and February 3, 2009 |

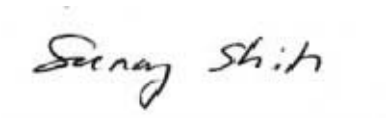
**THE HIGHEST SAR VALUES:**

| FCC / IC Rule Parts | Frequency Range [MHz] | The Highest 1g_SAR Values (mW/g) | 1g_Limit (mW/g) |
|---|---|---|---|
| 22H / RSS-102 | 824 - 849 | 1.04 (Express Card) | 1.6 |
| 24E / RSS-102 | 1850 - 1910 | 1.51 (Express Card) | 1.6 |

| **REFERENCE STANDARDS/TEST PROCEDURES** |
|---|
| FCC OET BULLETIN 65 SUPPLEMENT C, and the following specific FCC Test Procedures.<br>o KDB 941225 D01 SAR Test for 3G Devices<br>o KDB447498 Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies<br>IC RSS 102 Issue 2 |

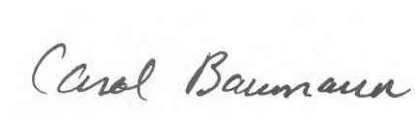
Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:



SUNNY SHIH
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:



CAROL BAUMANN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

## 2 TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C, IC RSS 102 Issue 2 and the following specific FCC Test Procedures.

- KDB 941225 D01 SAR Test for 3G Devices
- KDB447498 Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

## 3 FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.
CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/Standards/scopes/2000650.htm.

# 4 CALIBRATION AND UNCERTAINTY

## 4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 4.2 MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz – 3000 MHz

| Uncertainty component | Tol. (±%) | Probe Dist. | Div. | Ci (1g) | Ci (10g) | Std. Unc.(±%) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Ui (1g) | Ui(10g) |
| **Measurement System** | | | | | | | |
| Probe Calibration | 4.80 | N | 1 | 1 | 1 | 4.80 | 4.80 |
| Axial Isotropy | 4.70 | R | 1.732 | 0.707 | 0.707 | 1.92 | 1.92 |
| Hemispherical Isotropy | 9.60 | R | 1.732 | 0.707 | 0.707 | 3.92 | 3.92 |
| Boundary Effects | 1.00 | R | 1.732 | 1 | 1 | 0.58 | 0.58 |
| Linearity | 4.70 | R | 1.732 | 1 | 1 | 2.71 | 2.71 |
| System Detection Limits | 1.00 | R | 1.732 | 1 | 1 | 0.58 | 0.58 |
| Readout Electronics | 1.00 | N | 1 | 1 | 1 | 1.00 | 1.00 |
| Response Time | 0.80 | R | 1.732 | 1 | 1 | 0.46 | 0.46 |
| Integration Time | 2.60 | R | 1.732 | 1 | 1 | 1.50 | 1.50 |
| RF Ambient Conditions - Noise | 1.59 | R | 1.732 | 1 | 1 | 0.92 | 0.92 |
| RF Ambient Conditions - Reflections | 0.00 | R | 1.732 | 1 | 1 | 0.00 | 0.00 |
| Probe Positioner Mechnical Tolerance | 0.40 | R | 1.732 | 1 | 1 | 0.23 | 0.23 |
| Probe Positioning With Respect to Phantom Shell | 2.90 | R | 1.732 | 1 | 1 | 1.67 | 1.67 |
| Extrapolation, interpolation, and integration algorithms for max. SAR evaluation | 3.90 | R | 1.732 | 1 | 1 | 2.25 | 2.25 |
| **Test sample Related** | | | | | | | |
| Test Sample Positioning | 1.10 | N | 1 | 1 | 1 | 1.10 | 1.10 |
| Device Holder Uncertainty | 3.60 | N | 1 | 1 | 1 | 3.60 | 3.60 |
| Power and SAR Drift Measurement | 5.00 | R | 1.732 | 1 | 1 | 2.89 | 2.89 |
| **Phantom and Tissue Parameters** | | | | | | | |
| Phantom Uncertainty | 4.00 | R | 1.732 | 1 | 1 | 2.31 | 2.31 |
| Liquid Conductivity - Target | 5.00 | R | 1.732 | 0.64 | 0.43 | 1.85 | 1.24 |
| Liquid Conductivity - Meas. | 8.60 | N | 1 | 0.64 | 0.43 | 5.50 | 3.70 |
| Liquid Permittivity - Target | 5.00 | R | 1.732 | 0.6 | 0.49 | 1.73 | 1.41 |
| Liquid Permittivity - Meas. | 3.30 | N | 1 | 0.6 | 0.49 | 1.98 | 1.62 |
| **Combined Standard Uncertainty** | RSS | | | | | 11.44 | 10.49 |
| **Expanded Uncertainty (95% Confidence Interval)** | K=2 | | | | | 22.87 | 20.98 |

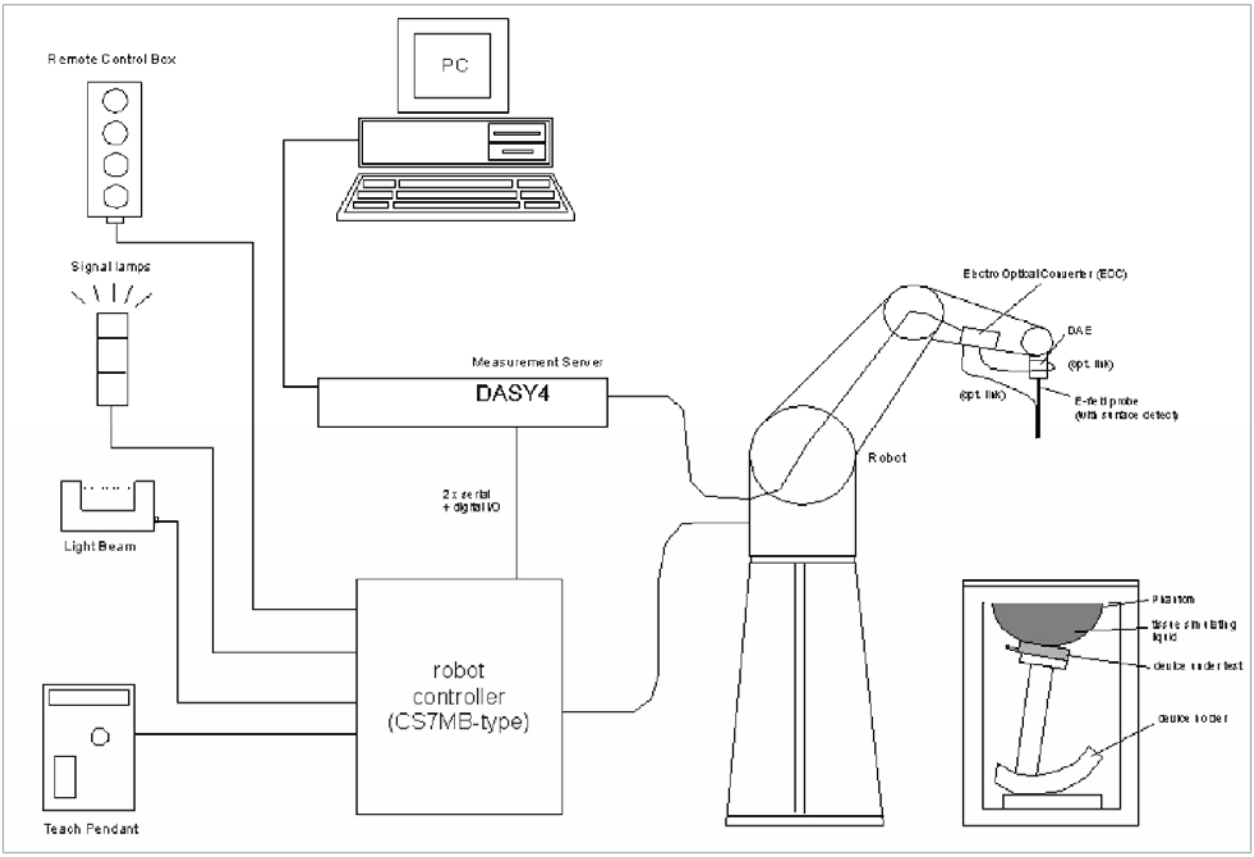
Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

# 5 DEVICE UNDER TEST (DUT) DESCRIPTION

## 5.1 DESCRIPTION OF EUT

| PCA, EVDO MINI-PCI EXPRESS CARD CDMA MODEM | |
|---|---|
| Network: | 3G-CDMA2000 EV-DO Rel 0, Rev A. This device also supports 1x RTT voice and/or data operations |
| Host Device: | Toshiba Satellite P105-S9337 (for Express Card)<br>Toshiba Satellite A105-S4344 (for Card Bus PC Card) |
| Antenna(s): | Internal |
| Power Supply: | Power is supplied through laptop computer (host device) |

## 6 SYSTEM DESCRIPTION




**The DASY4 system for performing compliance tests consists of the following items:**

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits to validate the proper functioning of the system.

## 6.1 COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUIDS

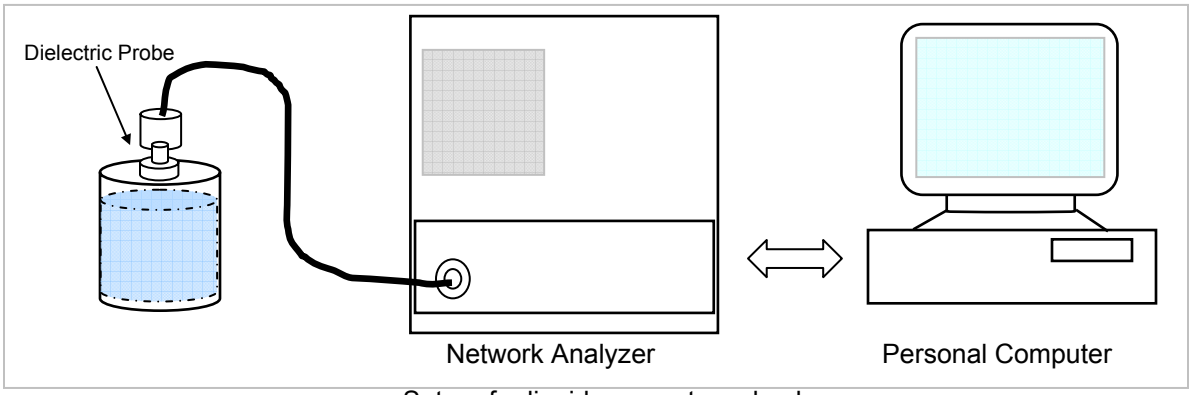
The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

| Ingredients (% by weight) | Frequency (MHz) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 450 | | 835 | | 915 | | 1900 | | 2450 | |
| Tissue Type | Head | Body | Head | Body | Head | Body | Head | Body | Head | Body |
| Water | 38.56 | 51.16 | 41.45 | 52.4 | 41.05 | 56.0 | 54.9 | 40.4 | 62.7 | 73.2 |
| Salt (NaCl) | 3.95 | 1.49 | 1.45 | 1.4 | 1.35 | 0.76 | 0.18 | 0.5 | 0.5 | 0.04 |
| Sugar | 56.32 | 46.78 | 56.0 | 45.0 | 56.5 | 41.76 | 0.0 | 58.0 | 0.0 | 0.0 |
| HEC | 0.98 | 0.52 | 1.0 | 1.0 | 1.0 | 1.21 | 0.0 | 1.0 | 0.0 | 0.0 |
| Bactericide | 0.19 | 0.05 | 0.1 | 0.1 | 0.1 | 0.27 | 0.0 | 0.1 | 0.0 | 0.0 |
| Triton X-100 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.8 | 0.0 |
| DGBE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.92 | 0.0 | 0.0 | 26.7 |
| Dielectric Constant | 43.42 | 58.0 | 42.54 | 56.1 | 42.0 | 56.8 | 39.9 | 54.0 | 39.8 | 52.5 |
| Conductivity (S/m) | 0.85 | 0.83 | 0.91 | 0.95 | 1.0 | 1.07 | 1.42 | 1.45 | 1.88 | 1.78 |

Salt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ resistivity HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

## 7 SIMULATING LIQUID CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below.




Set-up for liquid parameters check

**Reference Values of Tissue Dielectric Parameters for Head and Body Phantom (for 150 – 3000 MHz and 5800 MHz)**

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE Standard 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

| Target Frequency (MHz) | Head | | Body | |
|---|---|---|---|---|
| | $\varepsilon_r$ | $\sigma$ (S/m) | $\varepsilon_r$ | $\sigma$ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.90 | 55.2 | 0.97 |
| 900 | 41.5 | 0.97 | **55.0** | **1.05** |
| 915 | 41.5 | 0.98 | 55.0 | 1.06 |
| 1450 | 40.5 | 1.20 | 54.0 | 1.30 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 |
| 1800 – 2000 | 40.0 | 1.40 | **53.3** | **1.52** |
| 2450 | 39.2 | 1.80 | 52.7 | 1.95 |
| 3000 | 38.5 | 2.40 | 52.0 | 2.73 |
| 5800 | 35.3 | 5.27 | 48.2 | 6.00 |

($\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m$^3$)

### 7.1 SIMULATING LIQUID PARAMETER CHECK RESULT

Simulating Liquid Dielectric Parameters Check Result @ Muscle 1900 MHz

Room Ambient Temperature = 25°C; Relative humidity = 46% Measured by: Carol Baumann

| Simulating Liquid | | Parameters | | | Measured | Target | Deviation (%) | Limit (%) |
|---|---|---|---|---|---|---|---|---|
| f (MHz) | Depth (cm) | | | | | | | |
| 1900 | 15 | e' | 51.3365 | Relative Permittivity ($\epsilon_r$): | 51.3365 | 53.3 | -3.68 | ± 5 |
| | | e" | 14.9148 | Conductivity (σ): | 1.57649 | 1.52 | 3.72 | ± 5 |

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
January 26, 2009 09:28 AM

| Frequency | e' | e" |
|---|---|---|
| 1710000000. | 52.4543 | 14.1112 |
| 1720000000. | 52.3621 | 14.0927 |
| 1730000000. | 52.2857 | 14.1094 |
| 1740000000. | 52.2716 | 14.1559 |
| 1750000000. | 52.2357 | 14.3105 |
| 1760000000. | 52.1284 | 14.4801 |
| 1770000000. | 51.9942 | 14.5821 |
| 1780000000. | 51.9005 | 14.5939 |
| 1790000000. | 51.8749 | 14.5898 |
| 1800000000. | 51.8833 | 14.5901 |
| 1810000000. | 51.8582 | 14.5573 |
| 1820000000. | 51.8315 | 14.4829 |
| 1830000000. | 51.8707 | 14.4640 |
| 1840000000. | 51.8767 | 14.5555 |
| 1850000000. | 51.8016 | 14.7165 |
| 1860000000. | 51.6060 | 14.8423 |
| 1870000000. | 51.4017 | 14.8839 |
| 1880000000. | 51.3326 | 14.8565 |
| 1890000000. | 51.3204 | 14.8766 |
| **1900000000.** | **51.3365** | **14.9148** |
| 1910000000. | 51.3182 | 14.9724 |

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

*where* $f = target\ f * 10^6$

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameters Check Result @ Muscle 835 MHz

Room Ambient Temperature = 25°C; Relative humidity = 32% Measured by: Carol Baumann

| Simulating Liquid | | Parameters | | | Measured | Target | Deviation (%) | Limit (%) |
|---|---|---|---|---|---|---|---|---|
| f (MHz) | Depth (cm) | | | | | | | |
| 835 | 15 | e' | 53.8969 | Relative Permittivity ($\varepsilon_r$): | 53.8969 | 55.2 | -2.36 | ± 5 |
| | | e" | 20.4694 | Conductivity (σ): | 0.95085 | 0.97 | -1.97 | ± 5 |

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
February 03, 2009 09:13 AM

| Frequency | e' | e" |
|---|---|---|
| 750000000. | 54.7316 | 20.8737 |
| 755000000. | 54.7063 | 20.8943 |
| 760000000. | 54.7105 | 20.9283 |
| 765000000. | 54.7505 | 20.9611 |
| 770000000. | 54.7557 | 20.9581 |
| 775000000. | 54.7269 | 20.9896 |
| 780000000. | 54.7100 | 21.0515 |
| 785000000. | 54.6663 | 21.0988 |
| 790000000. | 54.6311 | 21.1657 |
| 795000000. | 54.5175 | 21.1680 |
| 800000000. | 54.3753 | 21.1807 |
| 805000000. | 54.2642 | 21.1150 |
| 810000000. | 54.1301 | 20.9966 |
| 815000000. | 54.0346 | 20.8886 |
| 820000000. | 53.9714 | 20.7593 |
| 825000000. | 53.9059 | 20.6378 |
| 830000000. | 53.8802 | 20.5638 |
| **835000000.** | **53.8969** | **20.4694** |
| 840000000. | 53.8270 | 20.4073 |
| 845000000. | 53.8092 | 20.4247 |
| 850000000. | 53.8005 | 20.4058 |
| 855000000. | 53.8031 | 20.4150 |
| 860000000. | 53.7897 | 20.4084 |
| 865000000. | 53.7479 | 20.4660 |
| 870000000. | 53.7458 | 20.5400 |
| 875000000. | 53.7060 | 20.5957 |
| 880000000. | 53.6525 | 20.6670 |
| 885000000. | 53.5839 | 20.7224 |
| 890000000. | 53.4715 | 20.7421 |
| 895000000. | 53.3551 | 20.7740 |
| 900000000. | 53.2514 | 20.6866 |

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

*where* $f = target\ f * 10^6$

$\varepsilon_0 = 8.854 * 10^{-12}$

## 8 SYSTEM PERFORMANCE CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%.

**System Performance Check Measurement Conditions**

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3-SN: 3531 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7 x 7 x 7 fine cube was chosen for cube integration(dx=dy=5mm; dz=5mm).
  For 5 GHz band - Special 7 x 7 x 7 fine cube was chosen for cube integration (dx=dy=4.3mm; dz=3mm)
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 250 mW±3%.
- The results are normalized to 1 W input power.

**Reference SAR Values for body-tissue**

In the table below, the numerical reference SAR values of a SPEAG validation dipoles placed below the flat phantom filled with body-tissue simulating liquid are given. The reference SAR values were calculated using the finite-difference time-domain method and the geometry parameters.

| Dipole Type | Distance (mm) | Frequency (MHz) | SAR (1g) [W/kg] | SAR (10g) [W/kg] | SAR (peak) [W/kg] |
|---|---|---|---|---|---|
| D450V2 | 15 | 450 | 5.01 | 3.36 | 7.22 |
| D835V2 | 15 | 835 | **9.71** | **6.38** | 14.1 |
| D900V2 | 15 | 900 | 11.1 | 7.17 | 16.3 |
| D1450V2 | 10 | 1450 | 29.6 | 16.6 | 49.8 |
| D1800V2 | 10 | 1800 | 38.5 | 20.3 | 67.5 |
| D1900V2 | 10 | 1900 | **39.8** | **20.8** | 69.6 |
| D2000V2 | 10 | 2000 | 40.9 | 21.2 | 71.5 |
| D2450V2 | 10 | 2450 | 51.2 | 23.7 | 97.6 |

Note: All SAR values normalized to 1 W forward power.

## 8.1 SYSTEM PERFORMANCE CHECK RESULTS

**System Validation Dipole: D1900V2 SN:5d043**

**The dipole input power (forward power): 250 mW**

**Results**

Date: January 26, 2009

Ambient Temperature = 25°C; Relative humidity = 46% Measured by: Carol Baumann

| Body Simulating Liquid | | | Normalized to 1 W | | Target | Deviation (%) | Limit (%) |
|---|---|---|---|---|---|---|---|
| f (MHz) | Temp. (°C) | Depth (cm) | | | | | |
| 1900 | 24 | 15 | 1g | 38.4 | 39.8 | -3.52 | ± 10 |
| | | | 10g | 20 | 20.8 | -3.85 | ± 10 |

**System Validation Dipole: D835V2 SN: 4d002**

**The dipole input power (forward power): 250 mW**

**Results**

Date: February 3, 2009

Ambient Temperature = 25°C; Relative humidity = 32% Measured by: Carol Baumann

| Body Simulating Liquid | | | Normalized to 1 W | | Target | Deviation (%) | Limit (%) |
|---|---|---|---|---|---|---|---|
| f (MHz) | Temp. (°C) | Depth (cm) | | | | | |
| 2450 | 24 | 15 | 1g | 10.1 | 9.7 | 4.02 | ± 10 |
| | | | 10g | 6.66 | 6.4 | 4.39 | ± 10 |

# 9 OUTPUT POWER VERIFICATION

## 9.1 RF POWER OUTPUT FOR WWAN

Maximum output power is verified on the Low, Middle and High channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E for 1xRTT, section 3.1.2.3.4 of 3GPP2 C.S0033-0/TIA-866 for Rel. 0 and section 4.3.4 of 3GPP2 C.S0033-A for Rev. A

## 9.2 RF POWER OUTPUT FOR 1xRTT

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

| Application | Rev, License |
|---|---|
| CDMA2000 Mobile Test | B.13.08, L |

- Call Setup > Shift & Preset
- Cell Info > Cell Parameters > System ID (SID) > 8
  > Network ID (NID) > 65535
- Protocol Rev > 6 (IS-2000-0)
- Radio Config (RC) > Please see following table or details
- FCH Service Option (SO) Setup > Please see following table or details
- Traffic Data Rate > Full
- TDSO SCH Info > F-SCH Parameters > F-SCH Data Rate > 153.6 kbps
  > R-SCH Parameters > R-SCH Data Rate > 153.6 kbps
- Rvs Power Ctrl > Active bits
  - Rvs Power Ctrl > All Up bits (Maximum TxPout)

**RF Power Output Results for 1xRTT**

RF Power Output for 1xRTT - Cell Band

| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Ch. 1013/824.7MHz | | Ch. 384/836.52MHz | | Ch. 777/848.31MHz | |
| | | Average | Peak | Average | Peak | Average | Peak |
| RC1 (Fwd1, Rvs1) | 1 (Voice) | | | | | | |
| | 2 (Loopback) | 23.75 | 28.41 | 23.6 | 28.36 | 23.6 | 28.3 |
| | 3 (Voice) | | | | | | |
| | 55 (Loopback) | 23.80 | 28.57 | 23.6 | 28.42 | 23.65 | 28.25 |
| | 68 (Voice) | | | | | | |
| RC2 (Fwd2, Rvs2) | 9 (Loopback) | 23.65 | 28.43 | 23.5 | 28.28 | 23.50 | 28.20 |
| | 17 (Voice) | | | | | | |
| | 55 (Loopback) | 23.70 | 28.53 | 23.5 | 28.3 | 23.5 | 28.09 |
| | 32768 (Voice) | | | | | | |
| RC3 (Fwd3, Rvs3) | 1 (Voice) | | | | | | |
| | 2 (Loopback) | 23.6 | 27.96 | 23.40 | 27.84 | 23.50 | 27.68 |
| | 3 (Voice) | | | | | | |
| | 55 (Loopback) | 23.60 | 28.07 | 23.6 | 27.81 | 23,60 | 27.67 |
| | 32 (+ F-SCH) | 23.80 | 27.98 | 23.50 | 27.71 | 23.6 | 27.65 |
| | 32 (+ SCH) | 23.6 | 27.89 | 23.50 | 28.07 | 23.75 | 28.00 |
| RC4 (Fwd4, Rvs3) | 1 (Voice) | | | | | | |
| | 2 (Loopback) | 23,6 | 27.96 | 23.50 | 27.82 | 23.6 | 27.78 |
| | 3 (Voice) | | | | | | |
| | 55 (Loopback) | 23.60 | 27.84 | 23.5 | 27.87 | 23.5 | 27.88 |
| | 32 (+ F-SCH) | 23.70 | 28.05 | 23.5 | 27.86 | 23.60 | 27.78 |
| | 32 (+ SCH) | 23.60 | 28.06 | 23.40 | 27.71 | 23.6 | 27.76 |
| RC5 (Fwd5, Rvs4) | 9 (Loopback) | 23.80 | 28.05 | 23.5 | 27.73 | 23.50 | 27.72 |
| | 17 (Voice) | | | | | | |
| | 55 (Loopback) | 23.6 | 28.02 | 23.4 | 27.77 | 23.50 | 27.71 |
| | 32768 (Voice) | | | | | | |

**RF Power Output Results for 1xRTT**

| RF Power Output for 1xRTT - PCS Band | | | | | | | |
|---|---|---|---|---|---|---|---|
| Radio Configuration (RC) | Service Option (SO) | Conducted Output Power (dBm) | | | | | |
| | | Ch. 25/1851.25MHz | | Ch. 600/1880MHz | | Ch. 1175/1908.75 MHz | |
| | | Average | Peak | Average | Peak | Average | Peak |
| RC1 (Fwd1, Rvs1) | 1 (Voice) | | | | | | |
| | 2 (Loopback) | 23.20 | 28.22 | 23.40 | 28.95 | 23.30 | 27.97 |
| | 3 (Voice) | | | | | | |
| | 55 (Loopback) | 23.4 | 28.27 | 23.5 | 28.33 | 23.4 | 27.96 |
| | 68 (Voice) | | | | | | |
| RC2 (Fwd2, Rvs2) | 9 (Loopback) | 23.5 | 28.28 | 23.6 | 28.50 | 23.5 | 28 |
| | 17 (Voice) | | | | | | |
| | 55 (Loopback) | 23.3 | 28.22 | 23.5 | 28.44 | 23.4 | 28.11 |
| | 32768 (Voice) | | | | | | |
| RC3 (Fwd3, Rvs3) | 1 (Voice) | | | | | | |
| | 2 (Loopback) | 23.5 | 27.90 | 23.6 | 28.01 | 23.4 | 27.76 |
| | 3 (Voice) | | | | | | |
| | 55 (Loopback) | 23.5 | 27.87 | 23.60 | 28.1 | 23.4 | 27.62 |
| | 32 (+ F-SCH) | 23.4 | 28 | 23.40 | 28.21 | 23.50 | 27.77 |
| | 32 (+ SCH) | 23.50 | 27.96 | 23.60 | 28.02 | 23.50 | 28.07 |
| RC4 (Fwd4, Rvs3) | 1 (Voice) | | | | | | |
| | 2 (Loopback) | 23.5 | 27.94 | 23.5 | 28.05 | 23.4 | 27.66 |
| | 3 (Voice) | | | | | | |
| | 55 (Loopback) | 23.5 | 27.97 | 23.50 | 28.12 | 23.5 | 27.79 |
| | 32 (+ F-SCH) | 23.5 | 27.98 | 23.50 | 27.91 | 23.60 | 27.93 |
| | 32 (+ SCH) | 23.50 | 27.97 | 23.50 | 28.11 | 23.5 | 27.83 |
| RC5 (Fwd5, Rvs4) | 9 (Loopback) | 23.4 | 28.07 | 23.50 | 27.88 | 23.4 | 27.7 |
| | 17 (Voice) | | | | | | |
| | 55 (Loopback) | 235 | 27.99 | 23.60 | 28.06 | 23..4 | 27.65 |
| | 32768 (Voice) | | | | | | |

### 9.3 RF POWER OUTPUT FOR EV-DO REL 0

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

| Application | Rev, License |
|---|---|
| 1xEV-DO Terminal Test | A.09.13 |

EVDO Release 0 - RTAP

- Call Setup > Shift & Preset
- Call Control:
  - Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
  - Generator Info > Termination Parameters > Max Forward Packet Duration > 16 Slots
- Call Parms:
  - Cell Power > -105.5 dBm/1.23 MHz
  - Cell Band > (Select US Cellular or US PCS)
  - Channel > (Enter channel number)
  - Application Config > Enhanced Test Application Protocol > RTAP
  - RTAP Rate > 153.6 kbps
  - Rvs Power Ctrl > Active bits
  - Protocol Rel > 0 (1xEV-DO)
- Press “Start Data Connection” when “Session Open” appear in “Active Cell”
- Rvs Power Ctrl > All Up bits (Maximum TxPout)

EVDO Release 0 - FTAP

- Call Setup > Shift & Preset
- Call Control:
  - Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
  - Generator Info > Termination Parameters > Max Forward Packet Duration > 16 Slots
- Call Parms:
  - Cell Power > -105.5 dBm/1.23 MHz
  - Cell Band > (Select US Cellular or US PCS)
  - Channel > (Enter channel number)
  - Application Config > Enhanced Test Application Protocol > FTAP (default)
  - FTAP Rate > 307.2 kbps (2 Slot, QPSK)
  - Rvs Power Ctrl > Active bits
  - Protocol Rel > 0 (1xEV-DO)
- Press “Start Data Connection” when “Session Open” appear in “Active Cell”
- Rvs Power Ctrl > All Up bits (Maximum TxPout)

**RF Power Output for EV-DO Rel 0**

Cell Band

| FTAP Rate | RTAP Rate | Channel | f (MHz) | Conducted power (dBm) | |
|---|---|---|---|---|---|
| | | | | Average | Peak |
| 307.2 kbps (2 slot, QPSK) | 153.6 kbps | 1013 | 824.70 | 23.55 | 28.17 |
| | | 384 | 836.52 | **23.50** | **28.12** |
| | | 777 | 848.31 | 23.50 | 28.10 |

PCS Band

| FTAP Rate | RTAP Rate | Channel | f (MHz) | Conducted power (dBm) | |
|---|---|---|---|---|---|
| | | | | Average | Peak |
| 307.2 kbps (2 slot, QPSK) | 153.6 kbps | 25 | 1851.25 | 23.50 | 28.64 |
| | | 600 | 1880.00 | **23.50** | **28.63** |
| | | 1175 | 1908.75 | 23.50 | 28.04 |

### 9.4 RF POWER OUTPUT FOR EV-DO REV A

This procedure assumes the Agilent 8960 Test Set has the following applications installed and with valid license.

| Application | Rev, License |
|---|---|
| 1xEV-DO Terminal Test | A.09.13 |

EVDO Release A – RETAP
- Call Setup > Shift & Preset
- Cell Power > -60 dBm/1.23 MHz
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > RETAP
- R-Data Pkt Size > 4096
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2

> PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots > ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

EVDO Release A - FETAP
- Call Setup > Shift & Preset
- Cell Power > -60 dBm/1.23 MHz
- Protocol Rev > A (1xEV-DO-A)
- Application Config > Enhanced Test Application Protocol > FETAP
- F-Traffic Format > 4 (1024, 2,128) Canonical (307.2k, QPSK)
- Protocol Subtype Config > Release A Physical Layer Subtype > Subtype 2

> PL Subtype 2 Access Channel MAC Subtype > Default (Subtype 0)
- Access Network Info > Cell Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration >16 Slots > ACK R-Data After > Subpacket 0 (All ACK)
- Rvs Power Ctrl > All Up bits (to get the maximum power)

**RF Power Output Results for EV-DO Rev A**

Cell Band

| FETAP-Traffic Format | RETAP-Data Payload Size | Channel | f (MHz) | Conducted power (dBm) | |
|---|---|---|---|---|---|
| | | | | Average | Peak |
| 307.2k, QPSK/ ACK channel is transmitted at all the slots | 4096 | 1013 | 824.70 | 23.70 | 29.19 |
| | | 384 | 836.52 | **23.60** | **29.21** |
| | | 777 | 848.31 | 23.60 | 28.94 |

PCS Band

| FETAP-Traffic Format | RETAP-Data Payload Size | Channel | f (MHz) | Conducted power (dBm) | |
|---|---|---|---|---|---|
| | | | | Average | Peak |
| 307.2k, QPSK/ ACK channel is transmitted at all the slots | 4096 | 25 | 1851.25 | 23.70 | 29.11 |
| | | 600 | 1880.00 | **23.75** | **29.23** |
| | | 1175 | 1908.75 | 23.70 | 28.93 |

## 10 SAR MEASURMENT RESULTS FOR WWAN

### 10.1 PCS BAND

| Test Configurations | Separation Distance (mm) | Mode | Channel | f (MHz) | 1g_SAR (mW/g) | |
|---|---|---|---|---|---|---|
| | | | | | Measured | Limit |
| Express Card (inserted into Toshiba Satellite P105-S9337) | 10 | Rel 0 | 25 | 1851.25 | 1.35 | 1.6 |
| | | Rel 0 | 600 | 1880 | 1.46 | |
| | | Rel 0 | 1175 | 1908.75 | 1.13 | |
| | | Rev A | 25 | 1851.25 | 1.37 | |
| | | Rev A | 600 | 1880 | **1.51** | |
| | | Rev A | 1175 | 1908.75 | 1.30 | |
| Card Bus PC Card (inserted into Toshiba Satellite A105-S4344) | 10 | Rel 0 | 25 | 1851.25 | 1.00 | 1.6 |
| | | Rel 0 | 600 | 1880 | 1.07 | |
| | | Rel 0 | 1175 | 1908.75 | 0.789 | |
| | | Rev A | 600 | 1880 | 1.14 | |

Notes:

1. The modes with highest output power channel were chosen for the testing.
2. SAR for Subtype 2 Physical Layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical Layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rel. 0.
3. SAR is not required for 1xRTT when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rel. 0.

### 10.2 CELL BAND

| Test Configurations | Separation Distance (mm) | Mode | Channel | f (MHz) | 1g_SAR (mW/g) | |
|---|---|---|---|---|---|---|
| | | | | | Measured | Limit |
| Express Card (inserted into Toshiba Satellite P105-S9337) | 10 | Rel 0 | 1013 | 824.7 | 0.869 | 1.6 |
| | | Rel 0 | 384 | 836.52 | 0.953 | |
| | | Rel 0 | 777 | 848.31 | 0.726 | |
| | | Rev A | 1013 | 824.7 | 0.986 | |
| | | Rev A | 384 | 836.52 | **1.04** | |
| | | Rev A | 777 | 848.31 | 0.781 | |
| Card Bus PC Card (inserted into Toshiba Satellite A105-S4344) | 10 | Rel 0 | 1013 | 824.7 | 0.739 | 1.6 |
| | | Rel 0 | 384 | 836.52 | 0.860 | |
| | | Rel 0 | 777 | 848.31 | 0.658 | |
| | | Rev A | 384 | 836.52 | 0.926 | |

Notes:

1. The modes with highest output power channel were chosen for the testing.
2. SAR for Subtype 2 Physical Layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical Layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rel. 0.
3. SAR is not required for 1xRTT when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rel. 0.

## PCS BAND WORST-CASE SAR TEST PLOT: Express Card

Date/Time: 1/26/2009 11:37:21 AM

Test Laboratory: Compliance Certification Services

### Lapheld - Express Card

DUT: Sierra Wireless; Type: AC402; Serial: 608EBD6D

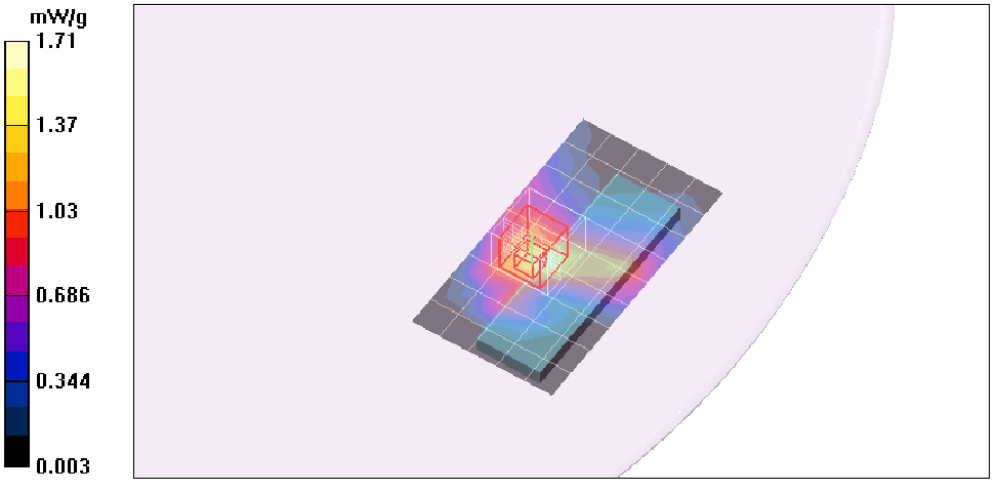
Communication System: CDMA PCS band; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.55 mho/m; $\varepsilon_r$ = 51.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(8.7, 8.7, 8.7); Calibrated: 4/23/2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**EV-DO Rev. A - Mid-ch (d=10 mm) 2/Area Scan (6x10x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.71 mW/g

**EV-DO Rev. A - Mid-ch (d=10 mm) 2/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 33.0 V/m; Power Drift = 0.221 dB
Peak SAR (extrapolated) = 2.61 W/kg
**SAR(1 g) = 1.51 mW/g; SAR(10 g) = 0.838 mW/g**
Maximum value of SAR (measured) = 1.84 mW/g



## CELL BAND WORST-CASE SAR TEST PLOT: Express Card

Date/Time: 2/3/2009 11:51:25 AM

Test Laboratory: Compliance Certification Services

### Lapheld - Express Card

DUT: Sierra Wireless; Type: AC402; Serial: 608EBD6D

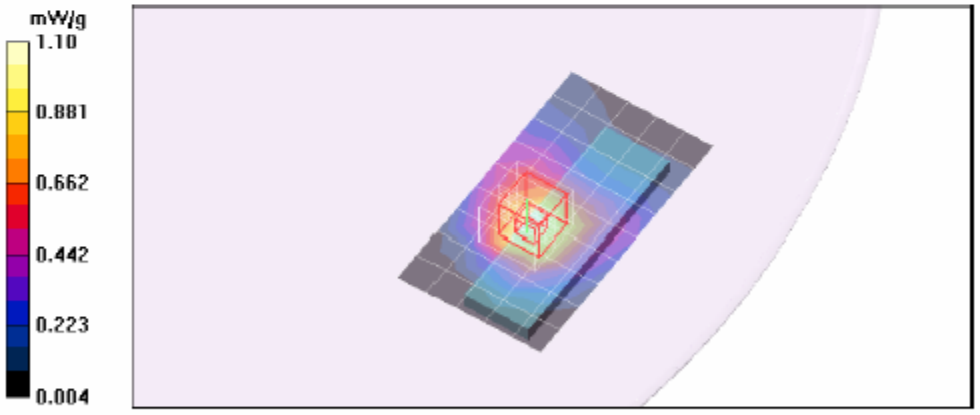
Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.52 MHz; $\sigma$ = 0.952 mho/m; $\varepsilon_r$ = 53.9; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(10.22, 10.22, 10.22); Calibrated: 4/23/2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**EV-DO Rev. A - Mid-ch (d=10 mm)/Area Scan (6x10x1):** Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.10 mW/g

**EV-DO Rev. A - Mid-ch (d=10 mm)/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 2.22 V/m; Power Drift = -0.971 dB
Peak SAR (extrapolated) = 1.56 W/kg
**SAR(1 g) = 1.04 mW/g; SAR(10 g) = 0.675 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.21 mW/g



## 11 EQUIPMENT LIST AND CALIBRATION

| Name of Equipment | Manufacturer | Type/Model | Serial Number | Cal. Due date | | |
|---|---|---|---|---|---|---|
| | | | | MM | DD | Year |
| Robot - Six Axes | Stäubli | RX90BL | N/A | | | N/A |
| Robot Remote Control | Stäubli | CS7MB | 3403-91535 | | | N/A |
| DASY4 Measurement Server | SPEAG | SEUMS001BA | 1041 | | | N/A |
| Probe Alignment Unit | SPEAG | LB (V2) | 261 | | | N/A |
| SAM Phantom (SAM1) | SPEAG | QD000P40CA | 1185 | | | N/A |
| SAM Phantom (SAM2) | SPEAG | QD000P40CA | 1050 | | | N/A |
| Oval Flat Phantom (ELI 4.0) | SPEAG | QD OVA001 B | 1003 | | | N/A |
| Electronic Probe kit | HP | 85070C | N/A | | | N/A |
| S-Parameter Network Analyzer | Agilent | 8753ES-6 | MY40001647 | 11 | 22 | 2010 |
| E-Field Probe | SPEAG | EX3DV3 | 3531 | 4 | 24 | 2009 |
| Thermometer | ERTCO | 639-1S | 1718 | 5 | 28 | 2009 |
| Data Acquisition Electronics | SPEAG | DAE3 V1 | 427 | 10 | 20 | 2009 |
| System Validation Dipole | SPEAG | D835V2 | 4d002 | 6 | 22 | 2009 |
| System Validation Dipole | SPEAG | D1900V2 | 5d043 | 1 | 29 | 2010 |
| System Validation Dipole | SPEAG | D2450V2 | 748 | 4 | 14 | 2010 |
| Signal Generator | R&S | SMP 04 | DE34210 | 2 | 16 | 2009 |
| Power Meter | Giga-tronics | 8651A | 8651404 | 1 | 11 | 2010 |
| Power Sensor | Giga-tronics | 80701A | 1834588 | 1 | 11 | 2010 |
| Amplifier | Mini-Circuits | ZHL-42W | D072701-5 | | | N/A |
| Radio Communication Tester | R &S | CMU 200 | 838114/032 | 5 | 16 | 2009 |
| Simulating Liquid | CCS | H835 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | CCS | M835 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | CCS | H1900 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | CCS | M1900 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | CCS | H2450 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | CCS | M2450 | N/A | Within 24 hrs of first test | | |

## 12 ATTACHMENTS

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