



**FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS-102 ISSUE 4**

SAR EVALUATION REPORT

For
iPhone

MODEL: A1332

FCC ID: BCG-E2380A

IC: 579C-E2380A

REPORT NUMBER: 10U13135-2C1

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Prepared for
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NVLAP LAB CODE 200065-0

Revision History

| <u>Rev.</u> | <u>Issue Date</u> | <u>Revisions</u> | <u>Revised By</u> |
|-------------|-------------------|--|-------------------|
| -- | April 15, 2010 | Initial Issue | -- |
| A | June 2, 2010 | Updated average power table in section 9.5 WiFi RF output power. | Sunny Shih |
| B | June 3, 2010 | Modify section 5 by including model variation statement between Model No:A1332 and A1332A. | Sunny Shih |
| C | June 16, 2010 | Modify SAR-to-Peak location distance | Sunny Shih |
| C1 | June 17, 2010 | Revised based upon TCB review comments | Sunny Shih |

TABLE OF CONTENTS

| | |
|---|-----------|
| 1. ATTESTATION OF TEST RESULTS | 5 |
| 2. TEST METHODOLOGY | 6 |
| 3. FACILITIES AND ACCREDITATION | 6 |
| 4. CALIBRATION AND UNCERTAINTY | 7 |
| 4.1. <i>MEASURING INSTRUMENT CALIBRATION</i> | 7 |
| 4.2. <i>MEASUREMENT UNCERTAINTY</i> | 8 |
| 5. EQUIPMENT UNDER TEST | 9 |
| 6. SYSTEM SPECIFICATIONS | 10 |
| 7. LIQUID PARAMETERS CHECK | 11 |
| 7.1. <i>LIQUID CHECK RESULTS FOR 835 MHZ</i> | 12 |
| 7.2. <i>LIQUID CHECK RESULTS FOR 1900 MHZ</i> | 14 |
| 7.3. <i>LIQUID CHECK RESULTS FOR 2450 MHZ</i> | 16 |
| 8. SYSTEM VERIFICATION | 18 |
| 8.1. <i>SYSTEM CHECK RESULTS FOR D835V2</i> | 19 |
| 8.2. <i>SYSTEM CHECK RESULTS FOR D1900V2</i> | 19 |
| 8.3. <i>SYSTEM CHECK RESULTS FOR D2450V2</i> | 19 |
| 9. OUTPUT POWER VERIFICATION | 20 |
| 9.1. <i>GSM</i> | 20 |
| 9.2. <i>UMTS RELEASE 99</i> | 21 |
| 9.3. <i>UMTS HSDPA</i> | 22 |
| 9.4. <i>UMTS Rel 6 HSPA (HSDPA & HSUPA)</i> | 23 |
| 9.5. <i>WIFI RF OUTPUT POWER</i> | 25 |
| 10. SUMMARY OF TEST RESULTS | 26 |
| 10.1. <i>GSM850</i> | 26 |
| 10.2. <i>GSM1900</i> | 27 |
| 10.3. <i>UMTS BAND V</i> | 28 |
| 10.4. <i>UMTS BAND II</i> | 29 |
| 10.5. <i>WIFI</i> | 30 |
| 11. WORST-CASE SAR TEST PLOTS | 31 |
| 12. KDB 648474 SIMULTANEOUS TRANSMISSION CONSIDERATION | 37 |
| 13. ANTENNA LOCATIONS | 41 |

14. TEST SETUP PHOTOS..... 42

15. EXTERNAL PHOTOS..... 46

1. ATTESTATION OF TEST RESULTS

| | |
|--------------------|---|
| COMPANY NAME: | APPLE INC 1 INFINITE LOOP, MS-26A CUPERTINO, CA 95014 |
| EUT DESCRIPTION: | iPhone |
| MODEL NUMBER: | A1332 |
| DEVICE CATEGORY: | Portable |
| EXPOSURE CATEGORY: | General Population/Uncontrolled Exposure |
| DATE TESTED: | March 29 – April 2, 2010 |

| FCC / IC Rule Parts | Frequency Range [MHz] | Highest 1-g SAR (mW/g) | Limit (mW/g) |
|---------------------|-----------------------|---|--------------|
| 22H / RSS-132 | 824 - 849 | Head: 1.00 (LHS Touch) Body: 1.11 (Face down) | 1.6 |
| 24E / RSS-133 | 1850 - 1910 | Head: 1.17 (RHS Touch) Body: 0.433 (Face down) | |
| 15.247 / RSS-102 | 2400 – 2483.5 | Head: 0.871 (LHS Tilt) Body: 0.073 (Face down) | |

| Applicable Standards | Test Results |
|--|--------------|
| FCC OET Bulletin 65 Supplement C 01-01 IC RSS 102 Issue 4 | Pass |

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. Measurement Uncertainties were not taken into account and are published for informational purposes only. 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. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released For CCS By:



Tested By:



SUNNY SHIH
 ENGINEERING SUPERVISOR
 COMPLIANCE CERTIFICATION SERVICES

DEVIN CHANG
 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 01-01, IC RSS 102 Issue 4 and the following specific FCC Test Procedures.

- KDB 941225 D01 SAR test for 3G devices v02
- KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE vo1
- KDB 648474 D01 SAR Handsets Multi Xmitter and Ant, v01r05
- KDB 248227 D01 SAR meas for 802 11abg v01r02

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://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

| Name of Equipment | Manufacturer | Type/Model | Serial No. | 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 |
| Signal Generator | Agilent | 8753ES-6 | MY40001647 | 11 | 22 | 2010 |
| E-Field Probe | SPEAG | EX3DV4 | 3531 | 2 | 22 | 2011 |
| Thermometer | ERTCO | 639-1S | 1718 | 5 | 1 | 2010 |
| Data Acquisition Electronics | SPEAG | DAE3 V1 | 500 | 9 | 15 | 2010 |
| System Validation Dipole | SPEAG | D835V2 | 4d002 | 4 | 22 | 2011 |
| System Validation Dipole | SPEAG | D900V2 | 108 | 11 | 23 | 2011 |
| System Validation Dipole | SPEAG | D1800V2 | 294 | 11 | 24 | 2011 |
| System Validation Dipole | SPEAG | D1900V2 | 5d043 | 11 | 23 | 2011 |
| System Validation Dipole | SPEAG | D2450V2 | 748 | 4 | 13 | 2011 |
| System Validation Dipole | SPEAG | D5GHzV2 | 1075 | 9 | 3 | 2011 |
| Amplifier | Mini-Circuits | ZVE-8G | 90606 | N/A | | |
| Amplifier | Mini-Circuits | ZHL-42W | D072701-5 | N/A | | |
| 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 | H1800 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | CCS | M1800 | N/A | Within 24 hrs of first test | | |
| 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 | H900 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | CCS | M900 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | SPEAG | H2450 | N/A | Within 24 hrs of first test | | |
| Simulating Liquid | SPEAG | M2450 | N/A | Within 24 hrs of first test | | |

Note: Per KDB 450824 D02 requirements for dipole calibration, CCS has adopted three years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement (test data on file in CCS)
4. Impedance is within 5Ω of calibrated measurement (test data on file in CCS)

4.2. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

| Component | error, % | Probe Distribution | Divisor | Sensitivity | U (Xi), % |
|--|----------|--------------------|---------|-------------|-----------|
| Measurement System | | | | | |
| Probe Calibration (k=1) @ 835, 1900 and 2450 MHz | 5.50 | Normal | 1 | 1 | 5.50 |
| Axial Isotropy | 1.15 | Rectangular | 1.732 | 0.7071 | 0.47 |
| Hemispherical Isotropy | 9.20 | Rectangular | 1.732 | 0.7071 | 3.76 |
| Boundary Effect | 0.90 | Rectangular | 1.732 | 1 | 0.52 |
| Probe Linearity | 3.45 | Rectangular | 1.732 | 1 | 1.99 |
| System Detection Limits | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Readout Electronics | 0.30 | Normal | 1 | 1 | 0.30 |
| Response Time | 0.80 | Rectangular | 1.732 | 1 | 0.46 |
| Integration Time | 2.60 | Rectangular | 1.732 | 1 | 1.50 |
| RF Ambient Conditions - Noise | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| RF Ambient Conditions - Reflections | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| Probe Positioner Mechanical Tolerance | 0.40 | Rectangular | 1.732 | 1 | 0.23 |
| Probe Positioning with respect to Phantom | 2.90 | Rectangular | 1.732 | 1 | 1.67 |
| Extrapolation, Interpolation and Integration | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Test Sample Related | | | | | |
| Test Sample Positioning | 2.90 | Normal | 1 | 1 | 2.90 |
| Device Holder Uncertainty | 3.60 | Normal | 1 | 1 | 3.60 |
| Output Power Variation - SAR Drift | 5.00 | Rectangular | 1.732 | 1 | 2.89 |
| Phantom and Tissue Parameters | | | | | |
| Phantom Uncertainty (shape and thickness) | 4.00 | Rectangular | 1.732 | 1 | 2.31 |
| Liquid Conductivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.64 | 1.85 |
| Liquid Conductivity - measurement @ head 835 MHz | 4.94 | Normal | 1 | 0.64 | 3.16 |
| Liquid Permittivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.6 | 1.73 |
| Liquid Permittivity - measurement @ body 835 MHz | 2.53 | Normal | 1 | 0.6 | 1.52 |
| Combined Standard Uncertainty Uc(y) = | | | | | 10.71 |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | | | | | 21.41 % |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | | | | | 1.69 dB |

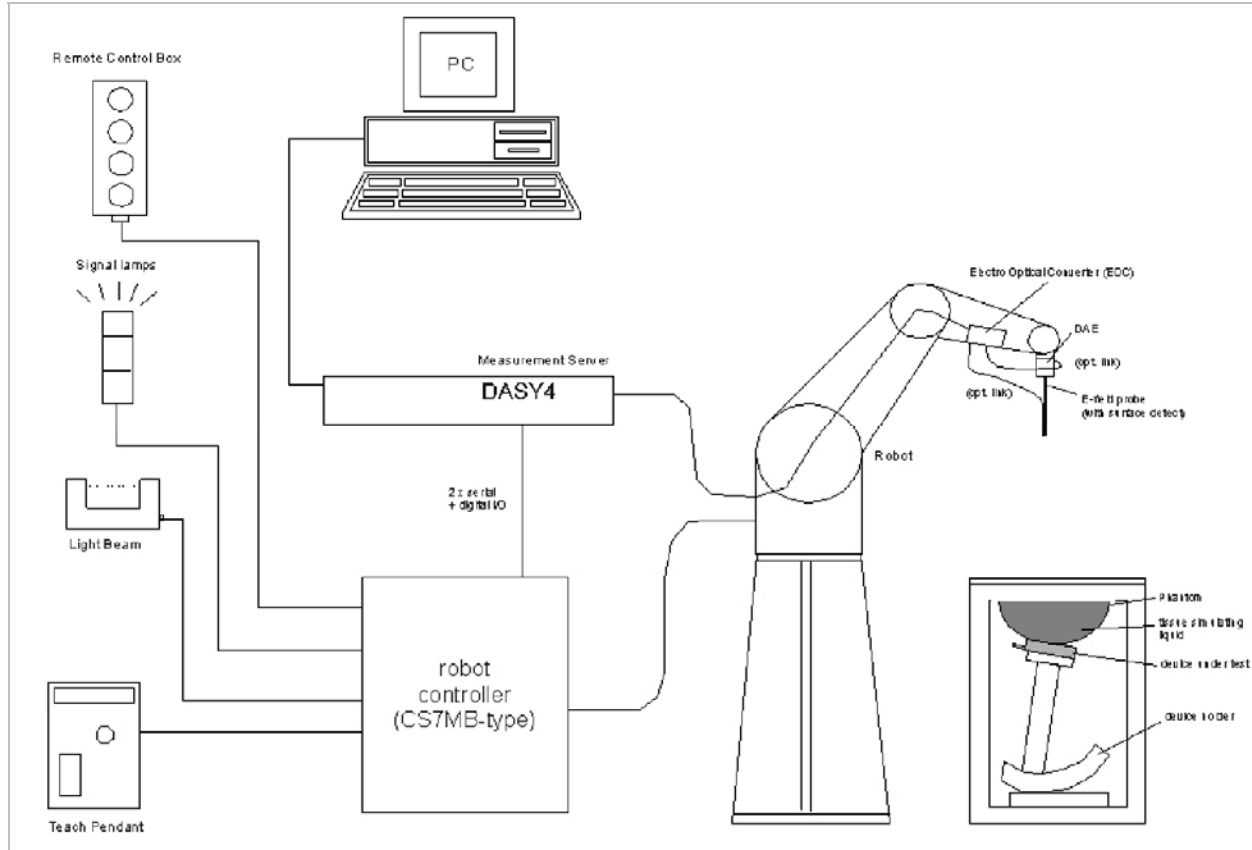
Measurement uncertainty for 300 MHz to 3 GHz averaged over 10 gram

| Component | error, % | Probe Distribution | Divisor | Sensitivity | U (Xi), % |
|--|----------|--------------------|---------|-------------|-----------|
| Measurement System | | | | | |
| Probe Calibration (k=1) @ 2450 MHz | 5.50 | Normal | 1 | 1 | 5.50 |
| Axial Isotropy | 1.15 | Rectangular | 1.732 | 0.7071 | 0.47 |
| Hemispherical Isotropy | 9.20 | Rectangular | 1.732 | 0.7071 | 3.76 |
| Boundary Effect | 0.90 | Rectangular | 1.732 | 1 | 0.52 |
| Probe Linearity | 3.45 | Rectangular | 1.732 | 1 | 1.99 |
| System Detection Limits | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Readout Electronics | 0.30 | Normal | 1 | 1 | 0.30 |
| Response Time | 0.80 | Rectangular | 1.732 | 1 | 0.46 |
| Integration Time | 2.60 | Rectangular | 1.732 | 1 | 1.50 |
| RF Ambient Conditions - Noise | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| RF Ambient Conditions - Reflections | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| Probe Positioner Mechanical Tolerance | 0.40 | Rectangular | 1.732 | 1 | 0.23 |
| Probe Positioning with respect to Phantom | 2.90 | Rectangular | 1.732 | 1 | 1.67 |
| Extrapolation, Interpolation and Integration | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Test Sample Related | | | | | |
| Test Sample Positioning | 2.90 | Normal | 1 | 1 | 2.90 |
| Device Holder Uncertainty | 3.60 | Normal | 1 | 1 | 3.60 |
| Output Power Variation - SAR Drift | 5.00 | Rectangular | 1.732 | 1 | 2.89 |
| Phantom and Tissue Parameters | | | | | |
| Phantom Uncertainty (shape and thickness) | 4.00 | Rectangular | 1.732 | 1 | 2.31 |
| Liquid Conductivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.43 | 1.24 |
| Liquid Conductivity - measurement @ head 835 MHz | 4.94 | Normal | 1 | 0.43 | 2.12 |
| Liquid Permittivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.49 | 1.41 |
| Liquid Permittivity - measurement @ body 835 MHz | 2.53 | Normal | 1 | 0.49 | 1.24 |
| Combined Standard Uncertainty Uc(y), % = | | | | | 10.27 |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | | | | | 20.54 % |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | | | | | 1.62 dB |

5. EQUIPMENT UNDER TEST

| iPhone with 802.11bgn and Bluetooth radio modules. | | | | | | | |
|--|--|----------------|--------------------------|----|----------|---------|---------------------------|
| Mobile phone capability: | Class B | | | | | | |
| GPRS Multi-slot class: | Class 10 | | | | | | |
| Serial Number | 88012096FRZ | | | | | | |
| Normal operation: | Held to head, Worn on body (LCD facing-up; LCD facing-down) with 15 mm separation distance | | | | | | |
| Body Worn Accessory | Headset | | | | | | |
| Antenna tested: | <table border="0"> <thead> <tr> <th><u>Antenna</u></th> <th><u>Apple part number</u></th> </tr> </thead> <tbody> <tr> <td>3G</td> <td>817-0286</td> </tr> <tr> <td>WiFi/BT</td> <td>817-0286 (shared with BT)</td> </tr> </tbody> </table> | <u>Antenna</u> | <u>Apple part number</u> | 3G | 817-0286 | WiFi/BT | 817-0286 (shared with BT) |
| <u>Antenna</u> | <u>Apple part number</u> | | | | | | |
| 3G | 817-0286 | | | | | | |
| WiFi/BT | 817-0286 (shared with BT) | | | | | | |
| Antenna-to-antenna separation distances: | 8.7 cm from 3G main antenna-to-WiFi/BT main antenna | | | | | | |
| Simultaneous transmission: | <ul style="list-style-type: none"> - 3G can transmit simultaneously with WiFi - 3G can transmit simultaneously with Bluetooth - WiFi can not transmit simultaneously with Bluetooth | | | | | | |

6. SYSTEM SPECIFICATIONS



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 allowing validating the proper functioning of the system.

7. LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within $\pm 5\%$ of the target values. The measured relative permittivity tolerance can be relaxed to no more than $\pm 10\%$.

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom

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 | |
|------------------------|--------------|----------------|--------------|----------------|
| | ϵ_r | σ (S/m) | ϵ_r | σ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.8 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.9 | 55.2 | 0.97 |
| 900 | 41.5 | 0.97 | 55 | 1.05 |
| 915 | 41.5 | 0.98 | 55 | 1.06 |
| 1450 | 40.5 | 1.2 | 54 | 1.3 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.4 |
| 1800 – 2000 | 40 | 1.4 | 53.3 | 1.52 |
| 2450 | 39.2 | 1.8 | 52.7 | 1.95 |
| 3000 | 38.5 | 2.4 | 52 | 2.73 |
| 5800 | 35.3 | 5.27 | 48.2 | 6 |

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

7.1. LIQUID CHECK RESULTS FOR 835 MHZ

Simulating Liquid Dielectric Parameters for Head 835 MHz

Room Ambient Temperature = 25°C; Relative humidity = 40%

Measured by: Devin Chang

| f (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit (%) |
|---------|-------------------|-------|---|----------|--------|-------------|-----------|
| 835 | e' | 43.55 | Relative Permittivity (ϵ_r): | 43.551 | 41.5 | 4.94 | ± 5 |
| | e" | 19.00 | Conductivity (σ): | 0.882 | 0.90 | -1.96 | ± 5 |
| 900 | e' | 42.81 | Relative Permittivity (ϵ_r): | 42.814 | 41.5 | 3.17 | ± 5 |
| | e" | 18.99 | Conductivity (σ): | 0.951 | 0.97 | -1.97 | ± 5 |

Liquid Check

Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C

March 30, 2010 10:34 AM

| Frequency | e' | e" |
|-------------------|----------------|----------------|
| 800000000. | 44.0101 | 19.1991 |
| 805000000. | 43.9755 | 19.1593 |
| 810000000. | 43.9296 | 19.1204 |
| 815000000. | 43.9077 | 19.0973 |
| 820000000. | 43.8792 | 19.0563 |
| 825000000. | 43.8130 | 19.0229 |
| 830000000. | 43.7171 | 19.0150 |
| 835000000. | 43.5508 | 18.9953 |
| 840000000. | 43.5995 | 18.9698 |
| 845000000. | 43.5113 | 18.9318 |
| 850000000. | 43.4459 | 18.9256 |
| 855000000. | 43.3972 | 18.9369 |
| 860000000. | 43.3272 | 18.9333 |
| 865000000. | 43.2623 | 18.9761 |
| 870000000. | 43.1686 | 18.9673 |
| 875000000. | 43.0999 | 18.9762 |
| 880000000. | 43.0545 | 18.9991 |
| 885000000. | 42.9743 | 19.0214 |
| 890000000. | 42.8872 | 19.0155 |
| 895000000. | 42.8529 | 19.0105 |
| 900000000. | 42.8136 | 18.9922 |
| 905000000. | 42.7602 | 18.9843 |
| 910000000. | 42.7316 | 18.9424 |
| 915000000. | 42.7330 | 18.8796 |
| 920000000. | 42.6731 | 18.8604 |
| 925000000. | 42.6552 | 18.8301 |
| 930000000. | 42.6288 | 18.7964 |
| 935000000. | 42.6050 | 18.7924 |
| 940000000. | 42.5321 | 18.7958 |

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

Simulating Liquid Dielectric Parameters for Body 835 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Devin Chang

| f (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit (%) |
|---------|-------------------|-------|---|----------|--------|-----------|-----------|
| 835 | e' | 55.12 | Relative Permittivity (ϵ_r): | 55.115 | 55.2 | -0.15 | ± 5 |
| | e'' | 21.41 | Conductivity (σ): | 0.995 | 0.97 | 2.53 | ± 5 |
| 900 | e' | 55.50 | Relative Permittivity (ϵ_r): | 55.497 | 55.0 | 0.90 | ± 5 |
| | e'' | 21.42 | Conductivity (σ): | 1.073 | 1.05 | 2.15 | ± 5 |

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C

March 30, 2010 10:37 PM

| Frequency | e' | e'' |
|-------------------|----------------|----------------|
| 800000000. | 55.5302 | 21.8371 |
| 805000000. | 55.4445 | 21.7861 |
| 810000000. | 55.3672 | 21.7135 |
| 815000000. | 55.3059 | 21.6517 |
| 820000000. | 55.2709 | 21.5861 |
| 825000000. | 55.2133 | 21.5104 |
| 830000000. | 55.1378 | 21.4586 |
| 835000000. | 55.1151 | 21.4109 |
| 840000000. | 55.0835 | 21.3863 |
| 845000000. | 55.0393 | 21.3777 |
| 850000000. | 54.9779 | 21.3922 |
| 855000000. | 54.9279 | 21.3918 |
| 860000000. | 54.9175 | 21.3965 |
| 865000000. | 54.8534 | 21.4132 |
| 870000000. | 54.8310 | 21.4467 |
| 875000000. | 54.7927 | 21.4801 |
| 880000000. | 54.7526 | 21.4840 |
| 885000000. | 54.6919 | 21.4954 |
| 890000000. | 54.6069 | 21.4686 |
| 895000000. | 54.5616 | 21.4634 |
| 900000000. | 54.4969 | 21.4221 |
| 905000000. | 54.4574 | 21.3325 |
| 910000000. | 54.4488 | 21.2731 |
| 915000000. | 54.4015 | 21.1980 |
| 920000000. | 54.3946 | 21.0957 |
| 925000000. | 54.4223 | 21.0374 |
| 930000000. | 54.4049 | 21.0100 |
| 935000000. | 54.3445 | 20.9873 |
| 940000000. | 54.3251 | 20.9743 |
| 945000000. | 54.2904 | 21.0045 |
| 950000000. | 54.1988 | 21.0355 |

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

7.2. LIQUID CHECK RESULTS FOR 1900 MHZ

Simulating Liquid Dielectric Parameters for Head 1900 MHz

Room Ambient Temperature = 25°C; Relative humidity = 35% Measured by: Devin Chang

| f (MHz) | Liquid Parameters | | Measured Results | | Target | Delta (%) | Limit (%) |
|---------|-------------------|--------|---|---------|--------|-----------|-----------|
| 1900 | e' | 39.091 | Relative Permittivity (ϵ_r): | 39.0913 | 40.0 | -2.27 | ± 5 |
| | e" | 12.830 | Conductivity (σ): | 1.35617 | 1.40 | -3.13 | ± 5 |

Liquid Check

Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C

March 29, 2010 09:49 AM

| Frequency | e' | e" |
|--------------------|----------------|----------------|
| 1710000000. | 39.8598 | 12.2955 |
| 1720000000. | 39.8352 | 12.2904 |
| 1730000000. | 39.8012 | 12.3049 |
| 1740000000. | 39.7248 | 12.3515 |
| 1750000000. | 39.6682 | 12.3868 |
| 1760000000. | 39.6157 | 12.4247 |
| 1770000000. | 39.5756 | 12.4745 |
| 1780000000. | 39.5571 | 12.5246 |
| 1790000000. | 39.5194 | 12.5759 |
| 1800000000. | 39.5058 | 12.5752 |
| 1810000000. | 39.4805 | 12.5965 |
| 1820000000. | 39.4655 | 12.6033 |
| 1830000000. | 39.4151 | 12.5821 |
| 1840000000. | 39.3641 | 12.6008 |
| 1850000000. | 39.3205 | 12.6437 |
| 1860000000. | 39.2725 | 12.6829 |
| 1870000000. | 39.2238 | 12.7401 |
| 1880000000. | 39.1721 | 12.7922 |
| 1890000000. | 39.1167 | 12.8239 |
| 1900000000. | 39.0913 | 12.8304 |
| 1910000000. | 39.0792 | 12.7804 |

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

Simulating Liquid Dielectric Parameters for Body 1900 MHz
 Room Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

| f (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit (%) |
|---------|-------------------|--------|---|----------|--------|-----------|-----------|
| 1900 | e' | 53.321 | Relative Permittivity (ϵ_r): | 53.3210 | 53.3 | 0.04 | ± 5 |
| | e'' | 14.181 | Conductivity (σ): | 1.49890 | 1.52 | -1.39 | ± 5 |

Liquid Check

Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C

March 29, 2010 04:00 PM

| Frequency | e' | e'' |
|--------------------|----------------|----------------|
| 1710000000. | 53.7503 | 13.7620 |
| 1720000000. | 53.7109 | 13.8322 |
| 1730000000. | 53.6955 | 13.8796 |
| 1740000000. | 53.6407 | 13.9186 |
| 1750000000. | 53.6403 | 13.8852 |
| 1760000000. | 53.6668 | 13.8236 |
| 1770000000. | 53.7017 | 13.7981 |
| 1780000000. | 53.6989 | 13.8092 |
| 1790000000. | 53.6625 | 13.8566 |
| 1800000000. | 53.5996 | 13.9029 |
| 1810000000. | 53.5292 | 13.9979 |
| 1820000000. | 53.4297 | 14.0844 |
| 1830000000. | 53.3250 | 14.1565 |
| 1840000000. | 53.2381 | 14.1691 |
| 1850000000. | 53.2505 | 14.1402 |
| 1860000000. | 53.3423 | 14.1166 |
| 1870000000. | 53.4158 | 14.1363 |
| 1880000000. | 53.4418 | 14.1658 |
| 1890000000. | 53.3862 | 14.1963 |
| 1900000000. | 53.3210 | 14.1808 |
| 1910000000. | 53.2479 | 14.1506 |

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

7.3. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Head 2450 MHz

Room Ambient Temperature = 25°C; Relative humidity = 40%

Measured by: Devin Chang

| f (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit (%) |
|---------|-------------------|-------|---|----------|--------|-----------|-----------|
| 2450 | e' | 39.76 | Relative Permittivity (ϵ_r): | 39.756 | 39.2 | 1.42 | ± 5 |
| | e'' | 13.19 | Conductivity (σ): | 1.797 | 1.80 | -0.16 | ± 5 |

Liquid Check

Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C

April 02, 2010 02:06 PM

| Frequency | e' | e'' |
|--------------------|----------------|----------------|
| 2400000000. | 39.8777 | 12.9447 |
| 2405000000. | 39.8551 | 12.9906 |
| 2410000000. | 39.8216 | 13.0484 |
| 2415000000. | 39.7894 | 13.0711 |
| 2420000000. | 39.7613 | 13.1008 |
| 2425000000. | 39.7529 | 13.1068 |
| 2430000000. | 39.7500 | 13.1210 |
| 2435000000. | 39.7506 | 13.1242 |
| 2440000000. | 39.7499 | 13.1417 |
| 2445000000. | 39.7560 | 13.1684 |
| 2450000000. | 39.7556 | 13.1858 |
| 2455000000. | 39.7195 | 13.2037 |
| 2460000000. | 39.6928 | 13.1839 |
| 2465000000. | 39.6497 | 13.1566 |
| 2470000000. | 39.6364 | 13.1373 |
| 2475000000. | 39.6130 | 13.1108 |
| 2480000000. | 39.6116 | 13.0997 |
| 2485000000. | 39.6152 | 13.0879 |
| 2490000000. | 39.6265 | 13.1117 |
| 2495000000. | 39.6104 | 13.1621 |
| 2500000000. | 39.5867 | 13.2111 |

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

Simulating Liquid Dielectric Parameters for Body 2450 MHz

Room Ambient Temperature = 25°C; Relative humidity = 40%

Measured by: Devin Chang

| f (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit (%) |
|---------|-------------------|-------|---|----------|--------|-----------|-----------|
| 2450 | e' | 52.90 | Relative Permittivity (ϵ_r): | 52.901 | 52.7 | 0.38 | ± 5 |
| | e'' | 14.30 | Conductivity (σ): | 1.949 | 1.95 | -0.03 | ± 5 |

Liquid Check

Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C

April 02, 2010 02:01 PM

| Frequency | e' | e'' |
|--------------------|----------------|----------------|
| 2400000000. | 53.0014 | 14.0434 |
| 2405000000. | 52.9818 | 14.1003 |
| 2410000000. | 52.9627 | 14.1618 |
| 2415000000. | 52.9226 | 14.1641 |
| 2420000000. | 52.9110 | 14.1984 |
| 2425000000. | 52.9009 | 14.2126 |
| 2430000000. | 52.8963 | 14.2197 |
| 2435000000. | 52.8955 | 14.2349 |
| 2440000000. | 52.9158 | 14.2379 |
| 2445000000. | 52.9057 | 14.2830 |
| 2450000000. | 52.9013 | 14.3027 |
| 2455000000. | 52.8668 | 14.3193 |
| 2460000000. | 52.8630 | 14.2934 |
| 2465000000. | 52.8189 | 14.2786 |
| 2470000000. | 52.8047 | 14.2572 |
| 2475000000. | 52.7793 | 14.2360 |
| 2480000000. | 52.7867 | 14.2296 |
| 2485000000. | 52.7952 | 14.2438 |
| 2490000000. | 52.7963 | 14.2774 |
| 2495000000. | 52.7908 | 14.3285 |
| 2500000000. | 52.7693 | 14.4046 |

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

8. SYSTEM VERIFICATION

The system performance check is performed prior to any usage of the system in order to verify SAR system measurement accuracy. The system performance check verifies that the system operates within its specifications of $\pm 10\%$.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head or Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3 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 7x7x7 fine cube was chosen for cube
- 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 100 mW
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

| System validation dipole | Cal. certificate # | Cal. due date | SAR Avg (mW/g) | | |
|--------------------------|---------------------|---------------|----------------------|------|------|
| | | | Tissue: | Head | Body |
| D835V2 | D835V2-5d043_Nov09 | Nov-12 | SAR _{1g} : | 9.64 | 9.96 |
| | | | SAR _{10g} : | 6.28 | 6.56 |
| D1900V2 | D1900V2-4d002_Apr09 | Apr-12 | SAR _{1g} : | 39.8 | 40.4 |
| | | | SAR _{10g} : | 20.7 | 21.4 |
| D2450V2 | D2450V2-748_Apr08 | Apr-11 | SAR _{1g} : | / | 50.8 |
| | | | SAR _{10g} : | / | 23.7 |

8.1. SYSTEM CHECK RESULTS FOR D835V2

Ambient Temperature = 25°C; Relative humidity = 40%

Measured by: Devin Chang

| System validation dipole | Date Tested | Measured (Normalized to 1 W) | | Target | Delta (%) | Tolerance (%) |
|--------------------------|-------------|------------------------------|------|--------|-----------|---------------|
| | | Tissue: | Head | | | |
| D835V2 | 03/30/10 | SAR _{1g} : | 9.12 | 9.64 | -5.39 | ±10 |
| | | SAR _{10g} : | 5.98 | 6.28 | -4.78 | |

8.2. SYSTEM CHECK RESULTS FOR D1900V2

Ambient Temperature = 25°C; Relative humidity = 37%

Measured by: Devin Chang

| System validation dipole | Date Tested | Measured (Normalized to 1 W) | | Target | Delta (%) | Tolerance (%) |
|--------------------------|-------------|------------------------------|------|--------|-----------|---------------|
| | | Tissue: | Head | | | |
| D1900V2 | 03/29/10 | SAR _{1g} : | 38.0 | 39.8 | -4.52 | ±10 |
| | | SAR _{10g} : | 19.1 | 20.7 | -7.73 | |

8.3. SYSTEM CHECK RESULTS FOR D2450V2

Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Devin Chang

| System validation dipole | Date Tested | Measured (Normalized to 1 W) | | Target | Delta (%) | Tolerance (%) |
|--------------------------|-------------|------------------------------|------|--------|-----------|---------------|
| | | Tissue: | Body | | | |
| D2450V2 | 04/02/10 | SAR _{1g} : | 51.8 | 50.8 | 1.97 | ±10 |
| | | SAR _{10g} : | 24.1 | 23.7 | 1.69 | |

9. OUTPUT POWER VERIFICATION

9.1. GSM

GSM (GMSK)

| Band | Ch No. | f (MHz) | Avg burst Pwr (dBm) |
|---------|--------|---------|---------------------|
| GSM850 | 128 | 824.2 | 32.4 |
| | 190 | 836.6 | 32.5 |
| | 251 | 848.8 | 32.5 |
| GSM1900 | 512 | 1850.2 | 30.4 |
| | 661 | 1880 | 30.3 |
| | 810 | 1909.8 | 30.4 |

GPRS (GMSK) - Coding Scheme: CS1

| Band | Ch No. | f (MHz) | Avg burst Pwr (dBm) | | | |
|---------|--------|---------|---------------------|---------------|--------|---------------|
| | | | 1 slot | Frame Avg Pwr | 2 slot | Frame Avg Pwr |
| GSM850 | 128 | 824.2 | 32.50 | 23.50 | 31.50 | 25.50 |
| | 190 | 836.6 | 32.40 | 23.40 | 31.50 | 25.50 |
| | 251 | 848.8 | 32.50 | 23.50 | 31.50 | 25.50 |
| GSM1900 | 512 | 1850.2 | 30.40 | 21.40 | 28.60 | 22.60 |
| | 661 | 1880 | 30.40 | 21.40 | 28.70 | 22.70 |
| | 810 | 1909.8 | 30.30 | 21.30 | 28.70 | 22.70 |

EGPRS (8PSK) - Coding Scheme: MCS5

| Band | Ch No. | f (MHz) | Avg burst Pwr (dBm) | | | |
|---------|--------|---------|---------------------|---------------|--------|---------------|
| | | | 1 slot | Frame Avg Pwr | 2 slot | Frame Avg Pwr |
| GSM850 | 128 | 824.2 | 27.00 | 18.00 | 27.10 | 21.10 |
| | 190 | 836.6 | 27.00 | 18.00 | 27.00 | 21.00 |
| | 251 | 848.8 | 27.00 | 18.00 | 27.10 | 21.10 |
| GSM1900 | 512 | 1850.2 | 26.10 | 20.10 | 26.10 | 20.10 |
| | 661 | 1880 | 26.10 | 20.10 | 26.10 | 20.10 |
| | 810 | 1909.8 | 26.10 | 20.10 | 26.10 | 20.10 |

9.2. UMTS RELEASE 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

| | | |
|------------------------|-------------------------|--------------|
| WCDMA General Settings | Mode | Rel99 |
| | Subtest | - |
| | Loopback Mode | Test Mode 1 |
| | Rel99 RMC | 12.2kbps RMC |
| | Power Control Algorithm | Algorithm2 |
| | β_c/β_d | 8/15 |

Results

| Rel 99 (12.2kps RMC) | | | | | |
|-----------------------|---------------------------|-----------|-----------|---------|------------------|
| Band | Mode | UL Ch No. | DL Ch No. | f (MHz) | Avg Tx Pwr (dBm) |
| UMTS850 (Band V) | Rel 99 12.2kbps RMC | 4132 | 4357 | 826.4 | 23.69 |
| | | 4183 | 4408 | 836.6 | 23.43 |
| | | 4233 | 4458 | 846.6 | 23.61 |
| UMTS1900 (Band II) | Rel 99 12.2kbps RMC | 9262 | 9662 | 1852.4 | 22.85 |
| | | 9400 | 9800 | 1880.0 | 22.86 |
| | | 9538 | 9938 | 1907.6 | 22.81 |

9.3. UMTS HSDPA

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

| | Mode | Rel6 HSDPA | Rel6 HSDPA | Rel6 HSDPA | Rel6 HSDPA |
|-------------------------------|--------------------------------------|--------------|------------|------------|------------|
| | Subtest | 1 | 2 | 3 | 4 |
| WCDMA General Settings | Loopback Mode | Test Mode 1 | | | |
| | Rel99 RMC | 12.2kbps RMC | | | |
| | HSDPA FRC | H-Set1 | | | |
| | Power Control Algorithm | Algorithm 2 | | | |
| | β_c | 2/15 | 12/15 | 15/15 | 15/15 |
| | β_d | 15/15 | 15/15 | 8/15 | 4/15 |
| | Bd (SF) | 64 | | | |
| | β_c/β_d | 2/15 | 12/15 | 15/8 | 15/4 |
| | β_{hs} | 4/15 | 24/15 | 30/15 | 30/15 |
| CM (dB) | 0 | 1 | 1.5 | 1.5 | |
| HSDPA Specific Settings | D_{ACK} | 8 | | | |
| | D_{NAK} | 8 | | | |
| | DCQI | 8 | | | |
| | Ack-Nack repetition factor | 3 | | | |
| | CQI Feedback (Table 5.2B.4) | 4ms | | | |
| | CQI Repetition Factor (Table 5.2B.4) | 2 | | | |
| | $A_{hs} = \beta_{hs}/\beta_c$ | 30/15 | | | |

Results

Rel 6 HSDPA

| Band | Mode | UL Ch No. | DL Ch No. | f (MHz) | Avg Tx Pwr (dBm) |
|-----------------------|-----------|-----------|-----------|---------|------------------|
| UMTS850 (Band V) | Subtest 1 | 4132 | 4357 | 826.4 | 23.65 |
| | | 4183 | 4408 | 836.6 | 23.42 |
| | | 4233 | 4458 | 846.6 | 23.60 |
| | Subtest 2 | 4132 | 4357 | 826.4 | 22.69 |
| | | 4183 | 4408 | 836.6 | 22.43 |
| | | 4233 | 4458 | 846.6 | 22.61 |
| | Subtest 3 | 4132 | 4357 | 826.4 | 22.29 |
| | | 4183 | 4408 | 836.0 | 22.13 |
| | | 4233 | 4458 | 846.6 | 22.21 |
| | Subtest 4 | 4132 | 4357 | 826.4 | 22.19 |
| | | 4183 | 4408 | 836.4 | 22.03 |
| | | 4233 | 4458 | 846.6 | 22.11 |
| UMTS1900 (Band II) | Subtest 1 | 9262 | 9662 | 1852.4 | 22.84 |
| | | 9400 | 9800 | 1880.0 | 22.83 |
| | | 9538 | 9938 | 1907.6 | 22.81 |
| | Subtest 2 | 9262 | 9662 | 1852.4 | 21.85 |
| | | 9400 | 9800 | 1880.0 | 21.85 |
| | | 9538 | 9938 | 1907.6 | 21.81 |
| | Subtest 3 | 9262 | 9662 | 1852.4 | 21.45 |
| | | 9400 | 9800 | 1880.0 | 21.55 |
| | | 9538 | 9938 | 1907.6 | 21.41 |
| | Subtest 4 | 9262 | 9662 | 1852.4 | 21.55 |
| | | 9400 | 9800 | 1880.0 | 21.45 |
| | | 9538 | 9938 | 1907.6 | 21.51 |

Note: KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.

9.4. UMTS Rel 6 HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

| Mode | Rel6 HSPA | Rel6 HSPA | Rel6 HSPA | Rel6 HSPA | Rel6 HSPA | |
|--------------------------------------|------------------------------------|--|-----------|---|-----------|--|
| Subtest | 1 | 2 | 3 | 4 | 5 | |
| WCDMA General Settings | Loopback Mode | | | | | |
| | Test Mode 1 | | | | | |
| | Rel99 RMC | | | | | |
| | 12.2kbps RMC | | | | | |
| | HSDPA FRC | | | | | |
| | H-Set1 | | | | | |
| | HSUPA Test | | | | | |
| | HSUPA Loopback | | | | | |
| | Power Control Algorithm | | | | | |
| | Algorithm2 | | | | | |
| | β_c | 11/15 | 6/15 | 15/15 | 2/15 | 15/15 |
| | β_d | 15/15 | 15/15 | 9/15 | 15/15 | 15/15 |
| | β_{ec} | 209/225 | 12/15 | 30/15 | 2/15 | 24/15 |
| β_c/β_d | 11/15 | 6/15 | 15/9 | 2/15 | 15/15 | |
| β_{hs} | 22/15 | 12/15 | 30/15 | 4/15 | 30/15 | |
| β_{ed} | 1309/225 | 94/75 | 47/15 | 56/75 | 134/15 | |
| CM (dB) | 1.0 | 3.0 | 2.0 | 3.0 | 1.0 | |
| MPR (dB) | 0 | 2 | 1 | 2 | 0 | |
| HSDPA Specific Settings | DACK | | | | | |
| | 8 | | | | | |
| | DNAK | | | | | |
| | 8 | | | | | |
| | DCQI | | | | | |
| | 8 | | | | | |
| | Ack-Nack repetition factor | | | | | |
| 3 | | | | | | |
| CQI Feedback (Table 5.2B.4) | | | | | | |
| 4ms | | | | | | |
| CQI Repetition Factor (Table 5.2B.4) | | | | | | |
| 2 | | | | | | |
| Ahs = β_{hs}/β_c | | | | | | |
| 30/15 | | | | | | |
| HSUPA Specific Settings | D E-DPCCH | 6 | 8 | 8 | 5 | 7 |
| | DHARQ | 0 | 0 | 0 | 0 | 0 |
| | AG Index | 20 | 12 | 15 | 17 | 21 |
| | ETFCI (from 34.121 Table C.11.1.3) | 75 | 67 | 92 | 71 | 81 |
| | Associated Max UL Data Rate kbps | 242.1 | 174.9 | 482.8 | 205.8 | 308.9 |
| | Reference E_TFCIs | E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27 | | E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18 | | E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27 |

Results

Rel 6 HSDPA/HSUPA

| Band | Mode | UL Ch No. | DL Ch No. | f (MHz) | Avg Tx Pwr (dBm) |
|-----------------------|-----------|-----------|-----------|---------|------------------|
| UMTS850 (Band V) | Subtest 1 | 4132 | 4357 | 826.4 | 23.66 |
| | | 4182 | 4407 | 836.4 | 23.42 |
| | | 4233 | 4458 | 846.6 | 23.62 |
| | Subtest 2 | 4132 | 4357 | 826.4 | 21.96 |
| | | 4182 | 4407 | 836.4 | 21.82 |
| | | 4233 | 4458 | 846.6 | 21.92 |
| | Subtest 3 | 4132 | 4357 | 826.4 | 22.76 |
| | | 4182 | 4407 | 836.4 | 22.62 |
| | | 4233 | 4458 | 846.6 | 22.72 |
| | Subtest 4 | 4132 | 4357 | 826.4 | 21.86 |
| | | 4182 | 4407 | 836.4 | 21.72 |
| | | 4233 | 4458 | 846.6 | 21.77 |
| | Subtest 5 | 4132 | 4357 | 826.4 | 23.61 |
| | | 4182 | 4407 | 836.4 | 23.38 |
| | | 4233 | 4458 | 846.6 | 23.58 |
| UMTS1900 (Band II) | Subtest 1 | 9262 | 9662 | 1852.4 | 22.83 |
| | | 9400 | 9800 | 1880.0 | 22.82 |
| | | 9538 | 9938 | 1907.6 | 22.82 |
| | Subtest 2 | 9262 | 9662 | 1852.4 | 21.13 |
| | | 9400 | 9800 | 1880.0 | 21.12 |
| | | 9538 | 9938 | 1907.6 | 21.02 |
| | Subtest 3 | 9262 | 9662 | 1852.4 | 21.93 |
| | | 9400 | 9800 | 1880.0 | 21.97 |
| | | 9538 | 9938 | 1907.6 | 21.95 |
| | Subtest 4 | 9262 | 9662 | 1852.4 | 21.03 |
| | | 9400 | 9800 | 1880.0 | 21.05 |
| | | 9538 | 9938 | 1907.6 | 21.04 |
| | Subtest 5 | 9262 | 9662 | 1852.4 | 22.81 |
| | | 9400 | 9800 | 1880.0 | 22.81 |
| | | 9538 | 9938 | 1907.6 | 22.80 |

Note: KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

9.5. WIFI RF OUTPUT POWER

MURATA unit

802.11b

| Channel # | Freq. (MHz) | Avg Power (dBm) |
|--------------|-------------|-----------------|
| Low | 2412 | 16.5 |
| Middle | 2437 | 16.6 |
| High | 2462 | 16.6 |
| 802.11g | | |
| Low | 2412 | 13.0 |
| Middle | 2437 | 16.5 |
| High | 2462 | 14.0 |
| 802.11n HT20 | | |
| Low | 2412 | 13.0 |
| Middle | 2437 | 16.5 |
| High | 2462 | 14.1 |

Note: KDB 248227 - SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

10. SUMMARY OF TEST RESULTS

10.1. GSM850

Left Hand Side

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|--------|------|---------------|--------|-------------|------------|-------|
| | | | | | 1-g | 10-g |
| GSM850 | GSM | Touch | 128 | 824.2 | 0.677 | 0.492 |
| | | | 190 | 836.6 | 0.860 | 0.626 |
| | | | 251 | 848.8 | 0.977 | 0.713 |
| | | Tilt (15°C) | 128 | 824.2 | | |
| | | | 190 | 836.6 | 0.300 | 0.232 |
| | | | 251 | 848.8 | | |

Right Hand Side

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|--------|------|---------------|--------|-------------|------------|-------|
| | | | | | 1-g | 10-g |
| GSM850 | GSM | Touch | 128 | 824.2 | | |
| | | | 190 | 836.6 | 0.656 | 0.457 |
| | | | 251 | 848.8 | | |
| | | Tilt (15°C) | 128 | 824.2 | | |
| | | | 190 | 836.6 | 0.372 | 0.282 |
| | | | 251 | 848.8 | | |

Body with 1.5 cm separation distance

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|------------|---------------|---------------|--------|-------------|--------------|-------|
| | | | | | 1-g | 10-g |
| GSM850 | GSM | Face up | 190 | 836.6 | 0.760 | 0.559 |
| | | Face down | 128 | 824.2 | 0.740 | 0.540 |
| | | | 190 | 836.6 | 0.824 | 0.603 |
| | | | 251 | 848.8 | 0.838 | 0.615 |
| | | w/ headset | 251 | 848.8 | 0.586 | 0.407 |
| | GPRS 1 slots | Face up | 190 | 836.6 | 0.620 | 0.456 |
| | | Face down | 190 | 836.6 | 0.635 | 0.464 |
| | GPRS 2 slots | Face up | 128 | 824.2 | 0.937 | 0.688 |
| | | | 190 | 836.6 | 0.994 | 0.732 |
| | | | 251 | 848.8 | 1.020 | 0.751 |
| | | Face down | 128 | 824.2 | 0.953 | 0.693 |
| | | | 190 | 836.6 | 1.050 | 0.766 |
| | | | 251 | 848.8 | 1.110 | 0.809 |
| | w/ headset | 251 | 848.8 | 0.871 | 0.618 | |
| | EGPRS 1 slots | Face up | 190 | 836.6 | 0.193 | 0.141 |
| | | Face down | 190 | 836.6 | 0.198 | 0.143 |
| | EGPRS 2 slots | Face up | 190 | 836.6 | 0.378 | 0.280 |
| | | Face down | 190 | 836.6 | 0.392 | 0.286 |
| w/ headset | | 190 | 836.6 | 0.229 | 0.161 | |

10.2. GSM1900

Left Hand Side

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|---------|------|---------------|--------|-------------|------------|-------|
| | | | | | 1-g | 10-g |
| GSM1900 | GSM | Touch | 512 | 1850.2 | | |
| | | | 661 | 1880.0 | 0.732 | 0.478 |
| | | | 810 | 1909.8 | | |
| | | Tilt (15°C) | 512 | 1850.2 | | |
| | | | 661 | 1880.0 | 0.303 | 0.198 |
| | | | 810 | 1909.8 | | |

Right Hand Side

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|---------|------|---------------|--------|-------------|------------|-------|
| | | | | | 1-g | 10-g |
| GSM1900 | GSM | Touch | 512 | 1850.2 | | |
| | | | 661 | 1880.0 | 0.736 | 0.492 |
| | | | 810 | 1909.8 | | |
| | | Tilt (15°C) | 512 | 1850.2 | | |
| | | | 661 | 1880.0 | 0.358 | 0.218 |
| | | | 810 | 1909.8 | | |

Body with 1.5 cm separation distance

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|---------|---------------|---------------|--------|-------------|------------|-------|
| | | | | | 1-g | 10-g |
| GSM1900 | GSM | Face up | 661 | 1880.0 | 0.271 | 0.170 |
| | | w/ headset | 661 | 1880.0 | 0.200 | 0.131 |
| | | Face down | 661 | 1880.0 | 0.267 | 0.174 |
| | GPRS 1 slots | Face up | 661 | 1880.0 | 0.255 | 0.163 |
| | | Face down | 661 | 1880.0 | 0.263 | 0.173 |
| | GPRS 2 slots | Face up | 661 | 1880.0 | 0.321 | 0.211 |
| | | Face down | 661 | 1880.0 | 0.346 | 0.227 |
| | | w/ headset | 661 | 1880.0 | 0.281 | 0.177 |
| | EGPRS 1 slots | Face up | 661 | 1880.0 | 0.090 | 0.060 |
| | | Face down | 661 | 1880.0 | 0.096 | 0.063 |
| | EGPRS 2 slots | Face up | 661 | 1880.0 | 0.183 | 0.121 |
| | | Face down | 661 | 1880.0 | 0.195 | 0.127 |
| | | w/ headset | 661 | 1880.0 | 0.162 | 0.107 |

10.3. UMTS BAND V

Left Hand Side

| Band | Mode | Test position | UL Ch No. | DL Ch No. | f (MHz) | SAR (mW/g) | |
|--------|------------------------|---------------|-----------|-----------|---------|--------------|-------|
| | | | | | | 1-g | 10-g |
| Band V | R99 12.2kbps RMC | Touch | 4132 | 4357 | 826.4 | 0.891 | 0.647 |
| | | | 4183 | 4408 | 836.6 | 1.000 | 0.729 |
| | | | 4233 | 4458 | 846.6 | 0.998 | 0.723 |
| | | Tilt (15°C) | 4132 | 4357 | 826.4 | | |
| | | | 4183 | 4408 | 836.6 | 0.433 | 0.332 |
| | | | 4233 | 4458 | 846.6 | | |

Right Hand Side

| Band | Mode | Test position | UL Ch No. | DL Ch No. | f (MHz) | SAR (mW/g) | |
|--------|------------------------|---------------|-----------|-----------|---------|------------|-------|
| | | | | | | 1-g | 10-g |
| Band V | R99 12.2kbps RMC | Touch | 4132 | 4357 | 826.4 | 0.642 | 0.457 |
| | | | 4183 | 4408 | 836.6 | 0.833 | 0.587 |
| | | | 4233 | 4458 | 846.6 | 0.802 | 0.568 |
| | | Tilt (15°C) | 4132 | 4357 | 826.4 | | |
| | | | 4183 | 4408 | 836.6 | 0.450 | 0.341 |
| | | | 4233 | 4458 | 846.6 | | |

Body with 1.5 cm separation distance

| Band | Mode | Test position | UL Ch No. | DL Ch No. | f (MHz) | SAR (mW/g) | |
|--------|------------------------|---------------|-----------|-----------|---------|------------|-------|
| | | | | | | 1-g | 10-g |
| Band V | R99 12.2kbps RMC | Face up | 4132 | 4357 | 826.4 | | |
| | | | 4183 | 4408 | 836.6 | 0.728 | 0.536 |
| | | | 4233 | 4458 | 846.6 | | |
| | | Face down | 4132 | 4357 | 826.4 | | |
| | | | 4183 | 4408 | 836.6 | 0.774 | 0.567 |
| | | | 4233 | 4458 | 846.6 | | |
| | | w/ headset | 4233 | 4458 | 846.6 | 0.540 | 0.385 |

Notes:

- 1) KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.
- 2) KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

10.4. UMTS BAND II

Left Hand Side

| Band | Mode | Test position | UL Ch No. | DL Ch No. | f (MHz) | SAR (mW/g) | |
|---------|------------------------|---------------|-----------|-----------|---------|--------------|-------|
| | | | | | | 1-g | 10-g |
| Band II | R99 12.2kbps RMC | Touch | 9262 | 9662 | 1850.2 | 1.110 | 0.720 |
| | | | 9400 | 9800 | 1880.0 | 1.090 | 0.711 |
| | | | 9538 | 9938 | 1907.6 | 1.170 | 0.756 |
| | | Tilt (15°C) | 9262 | 9662 | 1850.2 | | |
| | | | 9400 | 9800 | 1880.0 | 0.411 | 0.261 |
| | | | 9538 | 9938 | 1907.6 | | |

Right Hand Side

| Band | Mode | Test position | UL Ch No. | DL Ch No. | f (MHz) | SAR (mW/g) | |
|---------|------------------------|---------------|-----------|-----------|---------|------------|-------|
| | | | | | | 1-g | 10-g |
| Band II | R99 12.2kbps RMC | Touch | 9262 | 9662 | 1850.2 | 1.140 | 0.771 |
| | | | 9400 | 9800 | 1880.0 | 1.130 | 0.756 |
| | | | 9538 | 9938 | 1907.6 | 1.170 | 0.786 |
| | | Tilt (15°C) | 9262 | 9662 | 1850.2 | | |
| | | | 9400 | 9800 | 1880.0 | 0.549 | 0.335 |
| | | | 9538 | 9938 | 1907.6 | | |

Body with 1.5 cm separation distance

| Band | Mode | Test position | UL Ch No. | DL Ch No. | f (MHz) | SAR (mW/g) | |
|---------|------------------------|---------------|-----------|-----------|---------|--------------|-------|
| | | | | | | 1-g | 10-g |
| Band II | R99 12.2kbps RMC | Face up | 9262 | 9662 | 1850.2 | | |
| | | | 9400 | 9800 | 1880.0 | 0.424 | 0.275 |
| | | | 9538 | 9938 | 1907.6 | | |
| | | Face down | 9262 | 9662 | 1850.2 | | |
| | | | 9400 | 9800 | 1880.0 | 0.433 | 0.283 |
| | | | 9538 | 9938 | 1907.6 | | |
| | | w/ headset | 9400 | 9800 | 1880.0 | 0.331 | 0.219 |

Notes:

- 1) KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.
- 2) KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

10.5. WIFI

MURATA unit

Left Hand Side

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|---------|---------|---------------|--------|-------------|--------------|-------|
| | | | | | 1-g | 10-g |
| 2.4 GHz | 802.11b | Touch | 1 | 2412 | | |
| | | | 6 | 2437 | 0.651 | 0.296 |
| | | | 11 | 2462 | | |
| | | Tilt (15°C) | 1 | 2412 | 0.741 | 0.326 |
| | | | 6 | 2437 | 0.826 | 0.363 |
| | | | 11 | 2462 | 0.871 | 0.385 |

Right Hand Side

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|---------|---------|---------------|--------|-------------|------------|-------|
| | | | | | 1-g | 10-g |
| 2.4 GHz | 802.11b | Touch | 1 | 2412 | | |
| | | | 6 | 2437 | 0.583 | 0.263 |
| | | | 11 | 2462 | | |
| | | Tilt (15°C) | 1 | 2412 | | |
| | | | 6 | 2437 | 0.698 | 0.311 |
| | | | 11 | 2462 | | |

Body with 1.5 cm separation distance

| Band | Mode | Test position | Ch No. | Freq. (MHz) | SAR (mW/g) | |
|---------|---------|---------------|--------|-------------|--------------|-------|
| | | | | | 1-g | 10-g |
| 2.4 GHz | 802.11b | Face up | 1 | 2412 | | |
| | | | 6 | 2437 | 0.055 | 0.030 |
| | | | 11 | 2462 | | |
| | | Face down | 1 | 2412 | | |
| | | | 6 | 2437 | 0.073 | 0.041 |
| | | | 11 | 2462 | | |
| | | w/ headset | 6 | 2437 | 0.072 | 0.040 |

Note: KDB 248227 - SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels

11. WORST-CASE SAR TEST PLOTS

Worst-case HEAD SAR Plot for Part 22

Date/Time: 3/30/2010 2:42:12 PM

Test Laboratory: Compliance Certification Services

UMTS band V_Left Hand Side

DUT: Apple; Type: N/A; Serial: N/A

Communication System: UMTS850; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 836.6 \text{ MHz}$; $\sigma = 0.884 \text{ mho/m}$; $\epsilon_r = 43.6$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left 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(10.13, 10.13, 10.13); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_M-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.08 mW/g

Touch_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

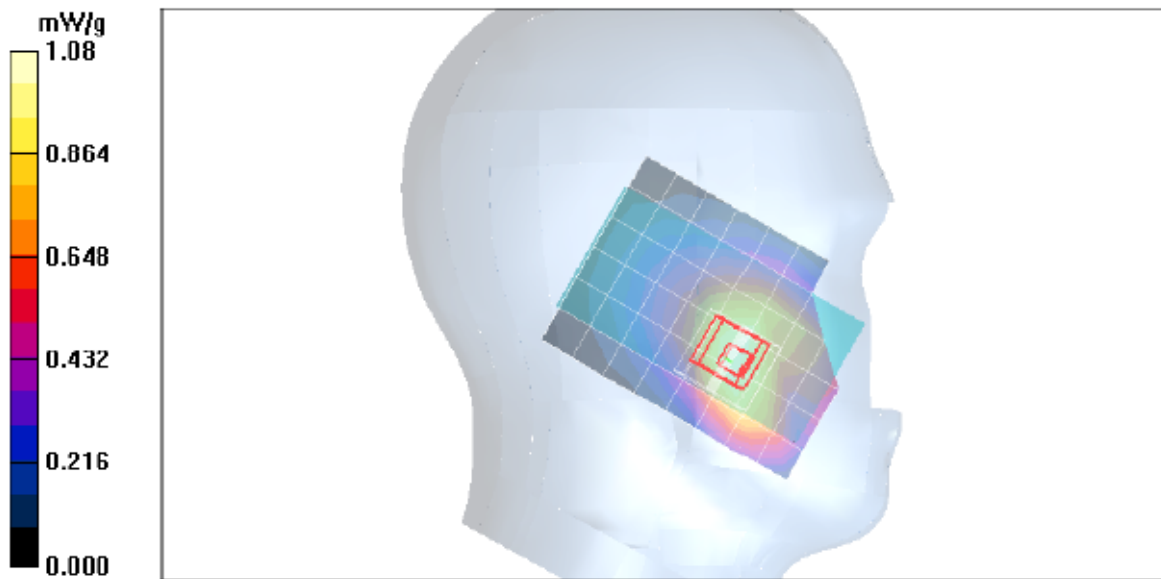
Reference Value = 12.0 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 1.27 W/kg

SAR(1 g) = 1 mW/g; SAR(10 g) = 0.729 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.11 mW/g



Worst-case HEAD SAR Plot for Part 24

Date/Time: 3/29/2010 1:09:50 PM

Test Laboratory: Compliance Certification Services

UMTS band II_Left Hand Side

DUT: Apple; Type: N/A; Serial: N/A

Communication System: PCS 1900; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 1907.6$ MHz; $\sigma = 1.36$ mho/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³
Phantom section: Left 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(8.64, 8.64, 8.64); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_H-ch/Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.30 mW/g

Touch_H-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

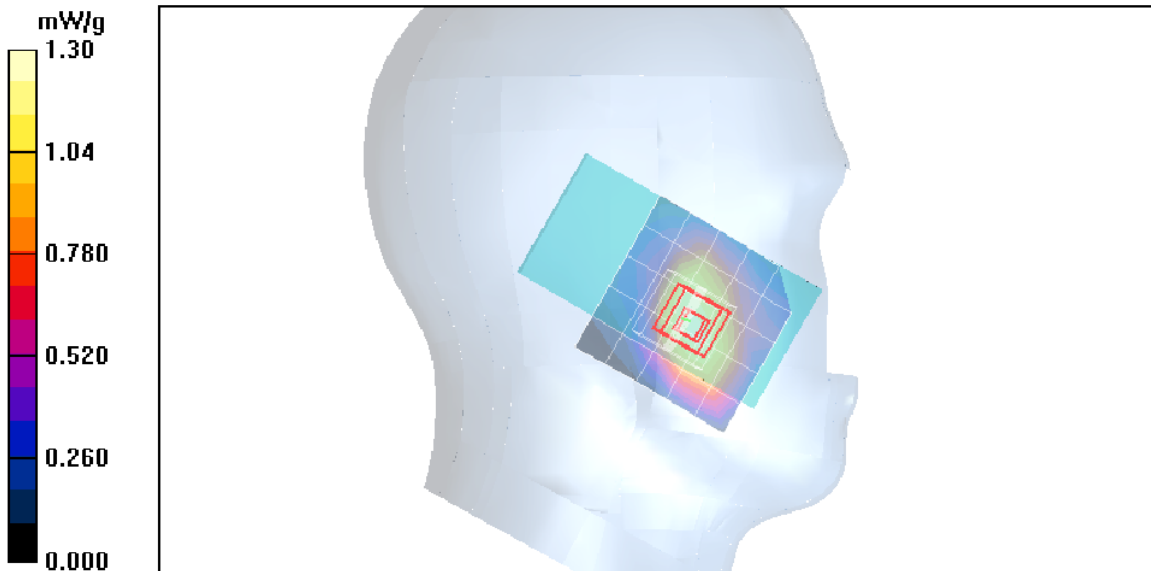
Reference Value = 10.1 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 1.65 W/kg

SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.756 mW/g

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.35 mW/g



Worst-case HEAD SAR Plot for Part 15 C

Date/Time: 4/2/2010 11:46:49 PM

Test Laboratory: Compliance Certification Services

MURATA_WiFi_Left Hand Side

DUT: Apple; Type: N/A; Serial: N/A

Communication System: 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2462$ MHz; $\sigma = 1.86$ mho/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³

Phantom section: Left 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(7.6, 7.6, 7.6); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: SAM 2 (Twin); Type: SAM 2; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt_H-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.06 mW/g

Tilt_H-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

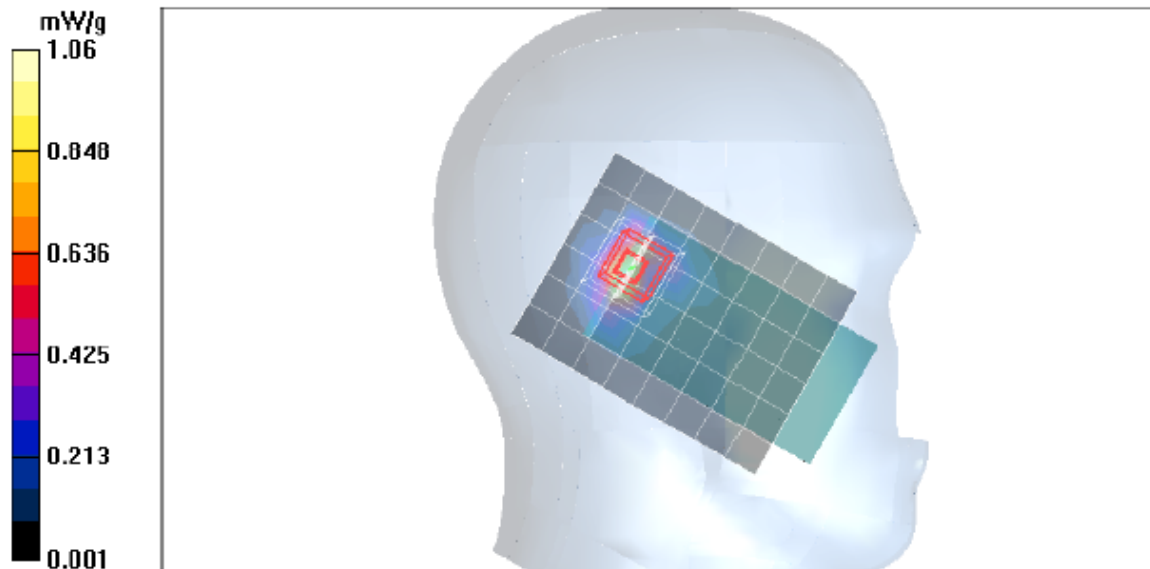
Reference Value = 13.2 V/m; Power Drift = -0.203 dB

Peak SAR (extrapolated) = 1.89 W/kg

SAR(1 g) = 0.871 mW/g; SAR(10 g) = 0.385 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.17 mW/g



Worst-case BODY SAR plot for Part 22

Date/Time: 3/31/2010 12:38:15 PM

Test Laboratory: Compliance Certification Services

GPRS850_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: GSM850; Frequency: 848.8 MHz; Duty Cycle: 1:4
Medium parameters used (interpolated): $f = 848.8 \text{ MHz}$; $\sigma = 1.01 \text{ mho/m}$; $\epsilon_r = 55$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 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(10.18, 10.18, 10.18); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Face down_GPRS 2 slots H-ch/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.22 mW/g

Face down_GPRS 2 slots H-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

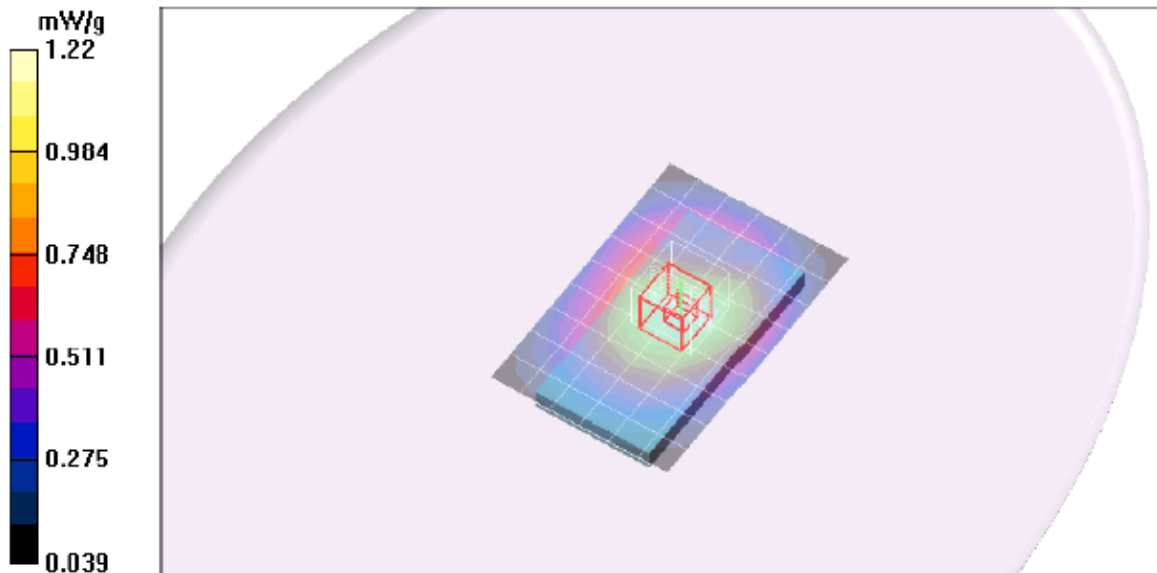
Reference Value = 15.9 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 1.47 W/kg

SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.809 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.24 mW/g



Worst-case BODY SAR plot for Part 24

Date/Time: 3/29/2010 7:38:26 PM

Test Laboratory: Compliance Certification Services

UMTS band II_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: PCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.48 \text{ mho/m}$; $\epsilon_r = 53.4$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

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

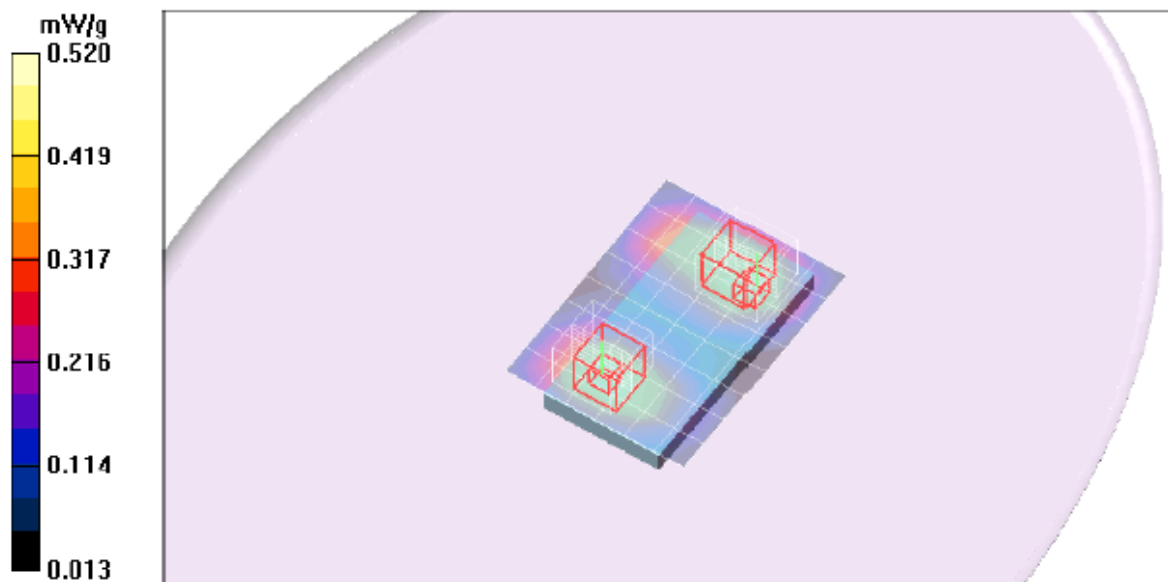
DASY4 Configuration:

- 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(8.04, 8.04, 8.04); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Face down_M-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.476 mW/g

Face down_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 14.9 V/m; Power Drift = 0.049 dB
Peak SAR (extrapolated) = 0.634 W/kg
SAR(1 g) = 0.433 mW/g; SAR(10 g) = 0.283 mW/g
Maximum value of SAR (measured) = 0.503 mW/g

Face down_M-ch/Zoom Scan 2 (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 14.9 V/m; Power Drift = 0.049 dB
Peak SAR (extrapolated) = 0.630 W/kg
SAR(1 g) = 0.401 mW/g; SAR(10 g) = 0.257 mW/g
Maximum value of SAR (measured) = 0.474 mW/g



Worst-case BODY SAR plot for Part 15 C

Date/Time: 4/2/2010 9:51:58 PM

Test Laboratory: Compliance Certification Services

MURATA_WiFi_Body

DUT: Apple; Type: NA; Serial: NA

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.93$ mho/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³
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(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Face down_M-ch/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.083 mW/g

Face down_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

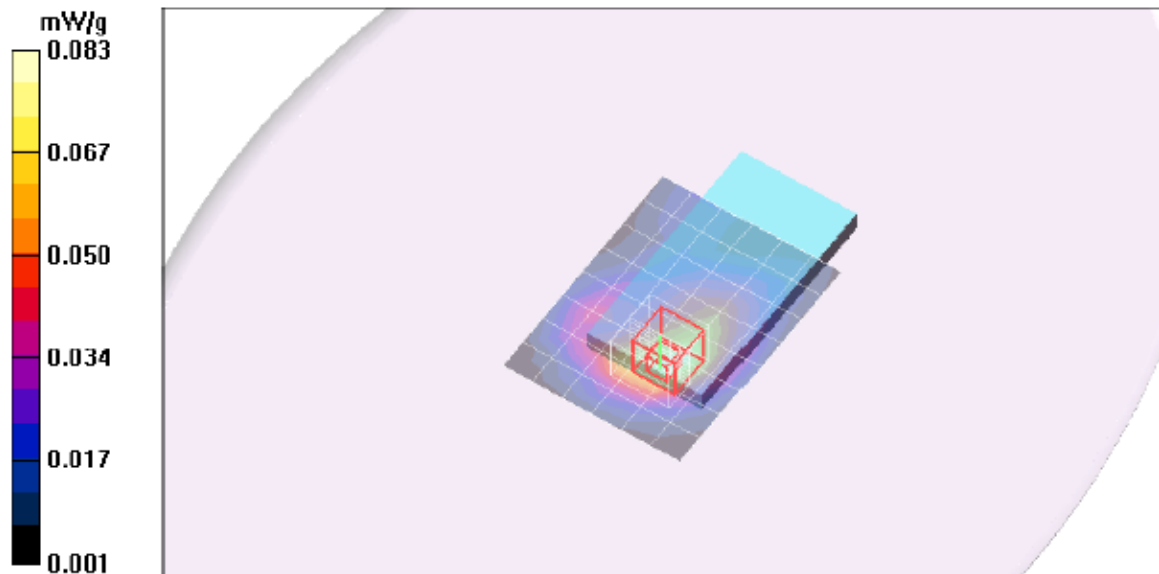
Reference Value = 5.74 V/m; Power Drift = -0.140 dB

Peak SAR (extrapolated) = 0.131 W/kg

SAR(1 g) = 0.073 mW/g; SAR(10 g) = 0.041 mW/g

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.090 mW/g



12. KDB 648474 SIMULTANEOUS TRANSMISSION CONSIDERATION

SUMMARY OF SAR EVALUATION FOR A CELL PHONE WITH MULTIPLE TRANSMITTERS

| <u>Individual Transmitter</u> | <u>Stand-alone SAR</u> |
|-------------------------------|--|
| 3G | Yes |
| WiFi | Yes |
| Bluetooth | Not required (average output is < P _{Ref} / 12mW) |

SIMULTANEOUS TRANSMISSION

- 3G can transmit simultaneously with WiFi
- 3G can transmit simultaneously with Bluetooth
- WiFi can not transmit simultaneously with Bluetooth

Highest SAR value and the sum of the 1-g SAR for 3G & WiFi

| Tes position | Highest 1-g SAR (W/kg) | | | Σ 1-g SAR (W/kg) |
|------------------|------------------------|-------|-------|------------------|
| | 3G | | WiFi | |
| Head (LHS Touch) | UMTS850 | 1.00 | 0.651 | 1.651 |
| | UMTS1900 | 1.17 | | 1.821 |
| Body (LCD down) | GPRS850 2 slots | 1.11 | 0.073 | 1.183 |
| | UMTS1900 | 0.433 | | 0.433 |

Antenna Pair SAR to Peak Location Separation Ratio if Σ 1-g SAR > 1.6 W/kg

| Σ 1-g SAR (W/kg) | Separation distance of peak location (cm) (3G-to-WiFi antenna) | Antenna Pair SAR to Peak Location Separation Ratio |
|------------------|---|---|
| 1.651 | 7.34 | 0.22 |
| 1.821 | 7.02 | 0.26 |

Highest SAR value and the sum of the 1-g SAR for WiFi & 3G

| Tes position | Highest 1-g SAR (W/kg) | | | Σ 1-g SAR (W/kg) |
|-----------------|------------------------|-----------------|-------|------------------|
| | WiFi | 3G | | |
| Head (LHS Tilt) | 0.871 | UMTS850 | 0.433 | 1.304 |
| | | UMTS1900 | 0.411 | 1.282 |
| Body (LCD down) | 0.073 | GPRS850 2 slots | 1.110 | 1.183 |
| | | UMTS1900 | 0.433 | 0.506 |

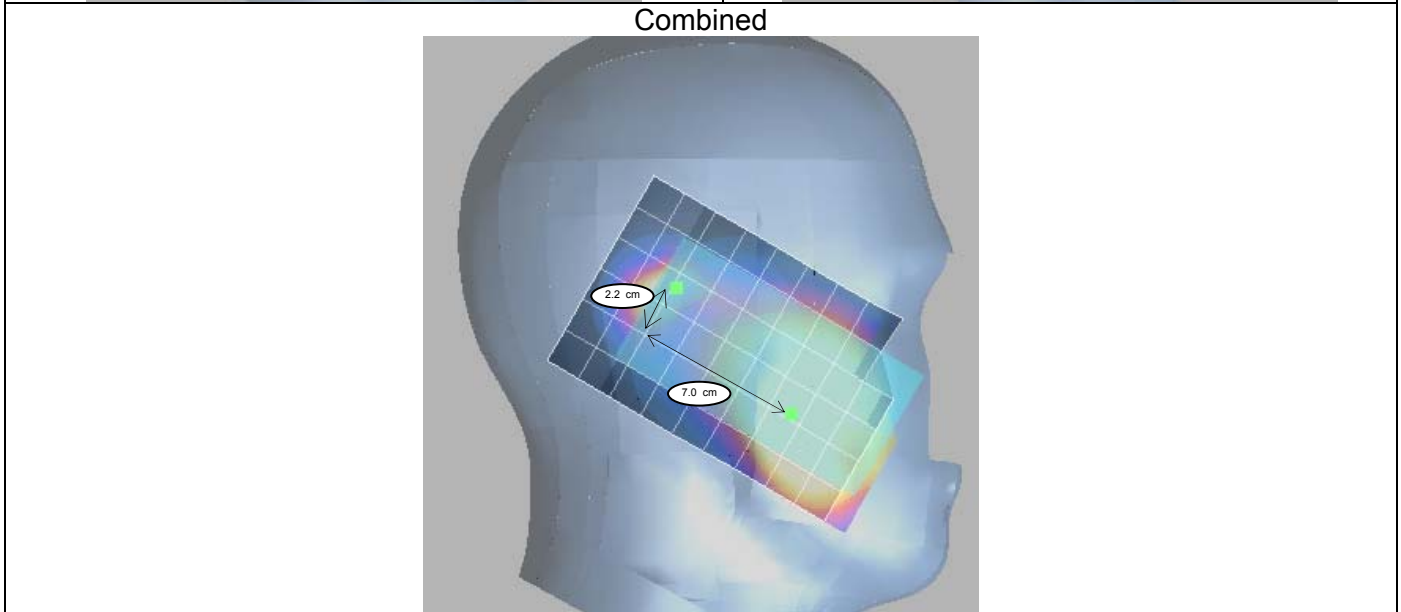
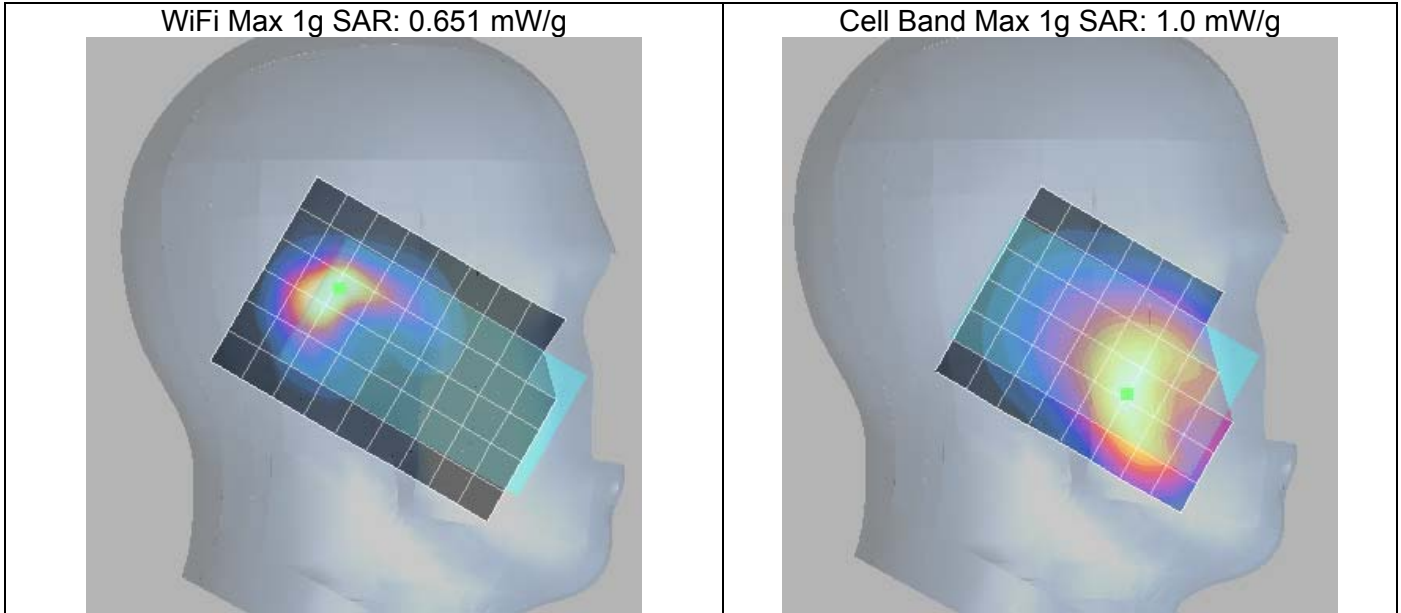
CONCLUSION:

| <u>Simultaneous transmission</u> | <u>Simultaneous SAR</u> |
|----------------------------------|---|
| 3G & Bluetooth | No (Stand-alone SAR not required for Bluetooth) |
| WiFi & Bluetooth | No (Stand-alone SAR not required for Bluetooth) |
| 3G & WiFi | No (see note below) |

Note: SAR not required:

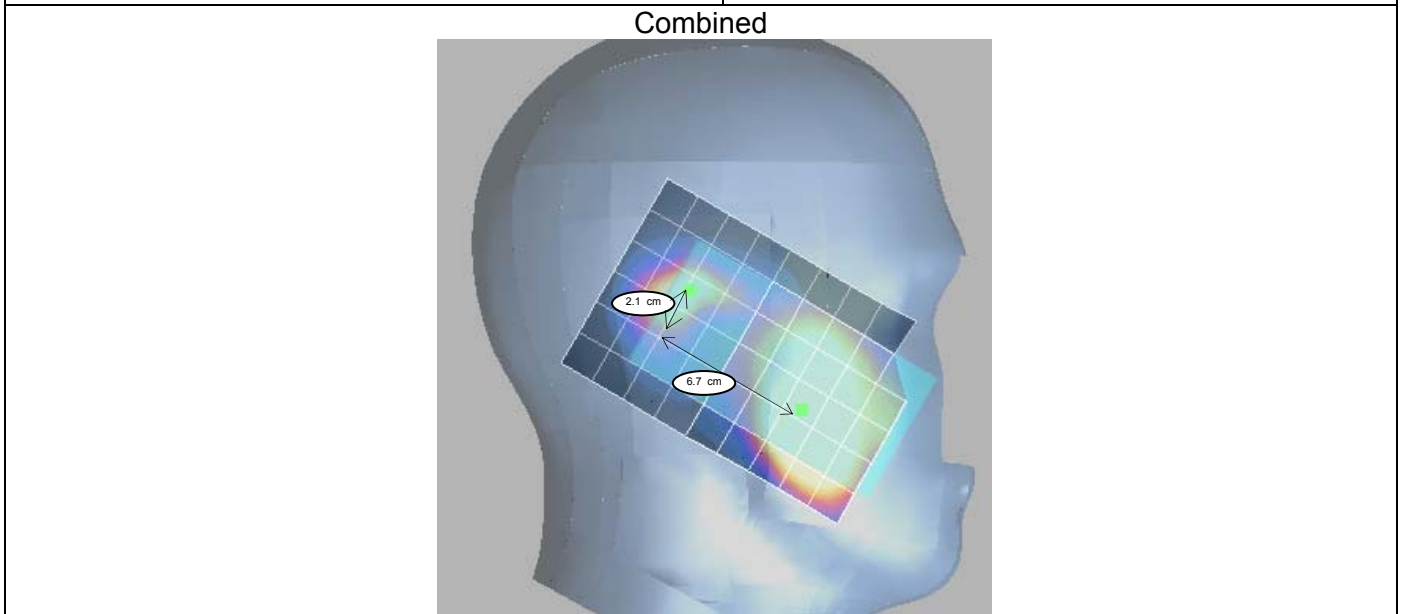
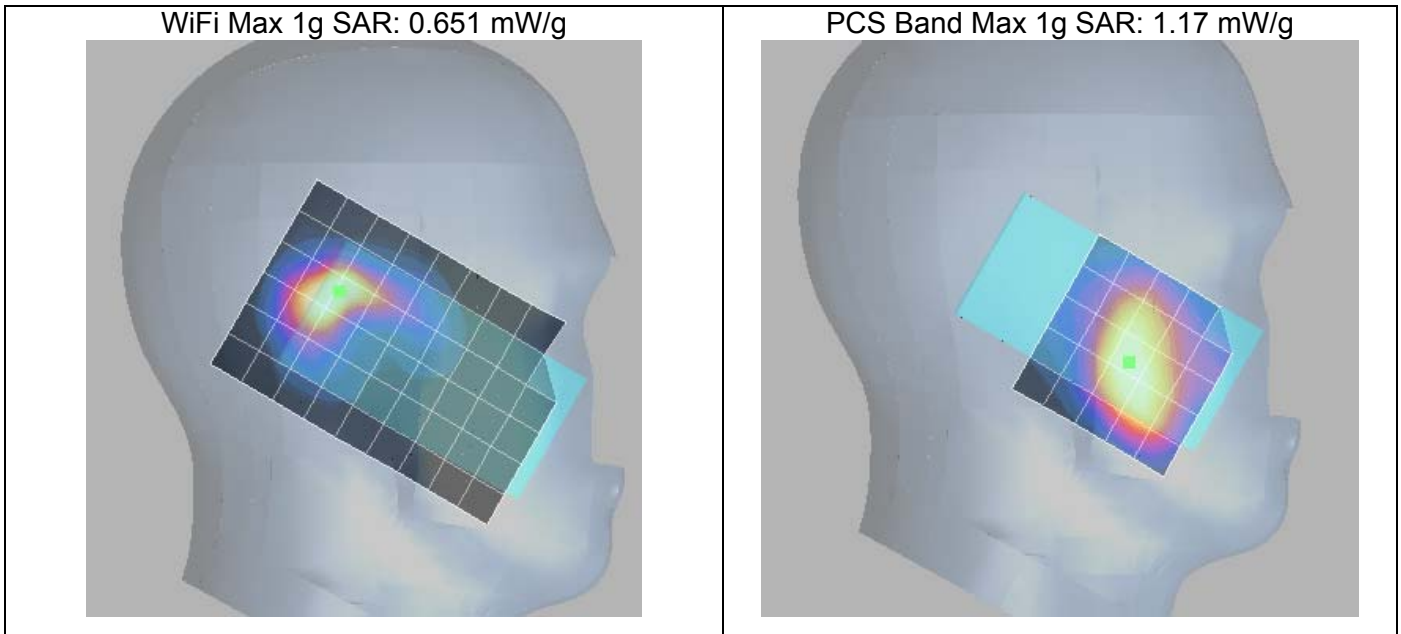
- when the sum of the 1-g SAR is < 1.6 W/kg for 3G and WiFi
- when the sum of the 1-g SAR is > 1.6 W/kg for 3G and WiFi but SAR-to-peak location separation ratio of simultaneous transmitting antenna pair is < 0.3

Separation distances between Peaks SAR in area scans for Head (LHS Touch) position



The sum of the 1g SAR = 1.651 mW/g (0.651 + 1.0)
Separation distances between peaks SAR in area scans = 7.34 cm (SQRT(7^2+2.2^2))
SAR to Peak location separation ratio: 0.225 (1.651 / 7.34), < 0.3

Separation distances between Peaks SAR in area scans for Head (LHS Touch) position



The sum of the 1g SAR = 1.821 mW/g (0.651 + 1.17)
Separation distances between peaks SAR in area scans = 7.02 cm (SQRT(6.7^2)+(2.1^2))
SAR to Peak location separation ratio: 0.259 (1.821 / 7.02), < 0.3

ATTACHMENTS

| <u>No.</u> | <u>Contents</u> | <u>No. of page (s)</u> |
|------------|--|------------------------|
| 1 | System Performance Check Plots | 6 |
| 2-1 | SAR Test Plots for GSM850 | 25 |
| 2-2 | SAR Test Plots for GSM1900 | 17 |
| 2-3 | SAR Test Plots for UMTS BAND V | 11 |
| 2-4 | SAR Test Plots for UMTS BAND II | 12 |
| 2-5 | SAR Test Plots for WiFi | 9 |
| 3 | Certificate of E-Field Probe - EX3DV3 SN 3531 | 11 |
| 4 | Certificate of System Validation Dipole - D835V2 SN:4d002 | 9 |
| 5 | Certificate of System Validation Dipole - D1900V2 SN:5d043 | 9 |
| 6 | Certificate of System Validation Dipole - D2450V2 SN:748 | 6 |