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SAR EVALUATION REPORT

For

Cellular/PCS GSM/GPRS/EDGE and AWS WCDMA/HSPA Phone with Bluetooth and WLAN

MODEL: E739, LG-E739

FCC ID: ZNFE739

REPORT NUMBER: 11U13937-5C1

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Prepared for

**LG ELECTRONICS MOBILECOMM U.S.A., INC.
10101 OLD GROVE ROAD
SAN DIEGO, CA 92131**

Prepared by

**COMPLIANCE CERTIFICATION SERVICES (UL CCS)
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History



| <u>Rev.</u> | <u>Issue Date</u> | <u>Revisions</u> | <u>Revised By</u> |
|-------------|--------------------|---|-------------------|
| -- | August 4, 2011 | Initial Issue | -- |
| A | August 15, 2011 | Updated report based on TCB reviewer's comments. 1. Added section 5.3 Simultaneous Transmission Conditions | Sunny Shih |
| B | September 13, 2011 | Updated report based on reviewer's comments. 1. Section 5.2: Removed power reduction algorithm chart and graphic and updated description of power reduction items. 2. Removed VOIP SAR results in section 11.1 and 11.2 as this model does not supported VOIP function in GSM. 3. Section 1: Changed "Head: 1.03 W/kg" to "Head: 0.599 W/kg" 4. Section 11: Changed "GPRS 2 Slot, CS1 (VOIP mode), 1.03" to "GSM voice, 0.599" 5. Section 5: Changed model "LG-E939" to "LG-E739" 6. Section 10.1: Removed "Power reduction enable" data and updated formula for 1 tx slot frame average power. 7. Section 11.1 & 11.2: Removed body-hotspot w/ headsets attached SAR data, because this device is not support GSM DTM mode. | Sunny Shih |
| C | September 15, 2011 | Corrected separation distance in section 5.2 | Aliza Zaffar |
| C1 | September 23, 2011 | Update based upon PBA comment | Sunny Shih |

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1. Attestation of Test Results

| Applicant: | LG ELECTRONICS MOBILECOMM U.S.A., INC. | | |
|--|---|---|--------------|
| EUT description: | Cellular/PCS GSM/GPRS/EDGE and AWS WCDMA/HSPA Phone with Bluetooth and WLAN | | |
| Model number: | E739, LG-E739 | | |
| Device category: | Portable | | |
| Exposure category: | General Population/Uncontrolled Exposure | | |
| Date tested: | July 12 - 26, 2011 | | |
| FCC Rule Parts | Freq. Range [MHz] | Highest 1-g SAR (W/kg) | Limit (W/kg) |
| 22H | 824-849 | Head: 0.499 W/kg (Right Touch) Body-worn: 1.02 W/kg (Rear w/ 15 mm distance) Body-hotspot: 0.676 W/kg (Rear w/ 10 mm distance) | 1.6 |
| 24E | 1850-1910 | Head: 0.599 W/kg (Left Touch) Body-worn: 0.46 W/kg (Rear w/ 15 mm distance) Body-hotspot: 0.578 W/kg (Bottom w/ 10 mm distance) | |
| 27 | 1714-1754 | Head: 1.30 W/kg (Left Touch) Body-worn: 0.739 W/kg (Rear w/ 15 mm distance) Body-hotspot: 1.05 W/kg (Front w/ 10 mm distance) | |
| 15.247 | 2412-2462 | Head: 0.135 W/kg (Left Touch) Body-worn: 0.045 W/kg (Rear w/ 10 mm distance) Body-hotspot: 0.045 W/kg (Rear w/ 10 mm distance) | |
| Applicable Standards | | | Test Results |
| FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528:2003 & IC RSS 102 Issue 4 | | | Pass |
| <p>Compliance Certification Services, Inc. (UL 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 UL 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.</p> <p>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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL 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.</p> <p>Approved & Released For UL CCS By:  Tested By: </p> | | | |
| Sunny Shih Engineering Team Leader Compliance Certification Services (UL CCS) | | Chakrit Thammanavarat EMC Associate Engineer Compliance Certification Services (UL CCS) | |

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528:2003, IC RSS 102 Issue 4 and the following KDB Test Procedures.

- 648474 D01 SAR Handsets Multi Xmitter and Ant, v01r05
- 248227 D01 SAR meas for 802 11abg v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 Guidance for 3GPP R6 and R7 HSPA v02v01
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D06 Hot Spot SAR v01

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL 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 |
| Dielectronic Probe kit | HP | 85070C | N/A | N/A | | |
| ESA Series Network Analyzer | Agilent | E5071B | MY42100131 | 8 | 2 | 2011 |
| Synthesized Signal Generator | HP | 83732B | US34490599 | 7 | 14 | 2012 |
| E-Field Probe | SPEAG | EX3DV4 | 3749 | 12 | 13 | 2011 |
| E-Field Probe | SPEAG | EX3DV4 | 3686 | 1 | 24 | 2012 |
| Thermometer | ERTCO | 639-1S | 1718 | 7 | 19 | 2012 |
| Data Acquisition Electronics | SPEAG | DAE3 | 427 | 7 | 21 | 2011 |
| Data Acquisition Electronics | SPEAG | DAE4 | 1239 | 11 | 11 | 2011 |
| System Validation Dipole | SPEAG | D750V3 | 1024 | 4 | 20 | 2012 |
| System Validation Dipole | SPEAG | D835V2 | 4d117 | 4 | 15 | 2012 |
| System Validation Dipole | SPEAG | D1900V2 | 5d140 | 4 | 18 | 2012 |
| System Validation Dipole | SPEAG | *D2450V2 | 706 | 4 | 19 | 2012 |
| Power Meter | Giga-tronics | 8651A | 8651404 | 5 | 13 | 2012 |
| Power Sensor | Giga-tronics | 80701A | 1834588 | 5 | 13 | 2012 |
| Power Meter | HP | 437B | 3125U16345 | 5 | 13 | 2012 |
| Power Sensor | HP | 8481A | 2702A60780 | 5 | 13 | 2012 |
| Amplifier | MITEQ | 4D00400600-50-30P | 1620606 | N/A | | |
| Directional coupler | Werlatone | C8060-102 | 2141 | N/A | | |

Notes:

Per KDB 450824 D02 requirements for dipole calibration, UL CCS has adopted two 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. (See Appendix J_Calibration Certificate for D2450V2 - SN 706 incl. extended cal. data)
4. Impedance is within 5Ω of calibrated measurement (See Appendix J_Calibration Certificate for D2450V2 - SN 706 incl. extended cal. data)

4.2. Measurement Uncertainty

| Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram | | | | | |
|---|----------|--------------------|---------|-------------|----------|
| Component | error, % | Probe Distribution | Divisor | Sensitivity | U (X), % |
| Measurement System | | | | | |
| Probe Calibration (k=1) | 5.50 | Normal | 1 | 1 | 5.50 |
| Axial Isotropy | 1.15 | Rectangular | 1.732 | 0.7071 | 0.47 |
| Hemispherical Isotropy | 2.30 | Rectangular | 1.732 | 0.7071 | 0.94 |
| 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 1750) | 2.73 | Normal | 1 | 0.64 | 1.75 |
| Liquid Permittivity - deviation from target | | Rectangular | 1.732 | 0.6 | 0.00 |
| Liquid Permittivity - measurement uncertainty (Head 2450) | 2.95 | Normal | 1 | 0.6 | 1.77 |
| Combined Standard Uncertainty U _c (y) = | | | | | 9.61 |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | | | | 19.22 | % |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | | | | 1.53 | dB |

5. Equipment Under Test

Cellular/PCS GSM/GPRS/EDGE and AWS WCDMA/HSPA Phone with Bluetooth and WLAN.

Model: E739, LG-E939

| | |
|--|---|
| Normal operation: | <ul style="list-style-type: none"> - Held to head, - Body-worn (Rear and Front) with 15 mm separation distance without Personal hotspot enabled. - Personal Hotspot with 10 mm separation distance to all sides and edges. |
| Body Worn Accessory | - None provided during the tests. Tested with 15 mm separation distance |
| Audio Accessory | - Headset |
| Antenna-to-antenna and antenna-to-edges' separation distances: | Please refer to Section "13 Antenna Locations & Separation Distances" for details |

5.1. Band and Air interlaces

| | |
|------------------------|--|
| Tx Frequency Bands: | Cellular: 824 – 849 MHz PCS: 1850 – 1910 MHz AWS: 1714 – 1754 MHz 802.11b/g/n: 2412 – 2462MHz, HT20 Bluetooth: 2402-2480 MHz |
| Air Interfaces: | GSM, GPRS, EGPRS. WCDMA (Rel 99), HSDPA (Rel 6, CAT 10), HSUPA (Rel 6, CAT 6). 802.11b/g/n. Bluetooth |
| Uplink Modulations: | GSM Modes: GMSK, 8PSK UMTS Modes: BPSK, QPSK 802.11b: DSS CCK 802.11g: OFDM 802.11n: OFDM Bluetooth: DQPSK, 8DPSK, GFSK |
| GPRS Multi-Slot Class: | 10 |
| Capability Class: | B |

5.2. Personal Hotspot Mode

The device is capable of personal hotspot mode. The hotspot mode can be enabled by the users. SAR measurements in the Personal hot spot function are performed with 10mm separation distance to all sides and edges to the body phantom.

Hotspot mode Power Reduction items:

- GPRS mode
- UMTS (WCDMA) Voice mode
- UMTS (WCDMA) HSPA mode

No power reduction items:

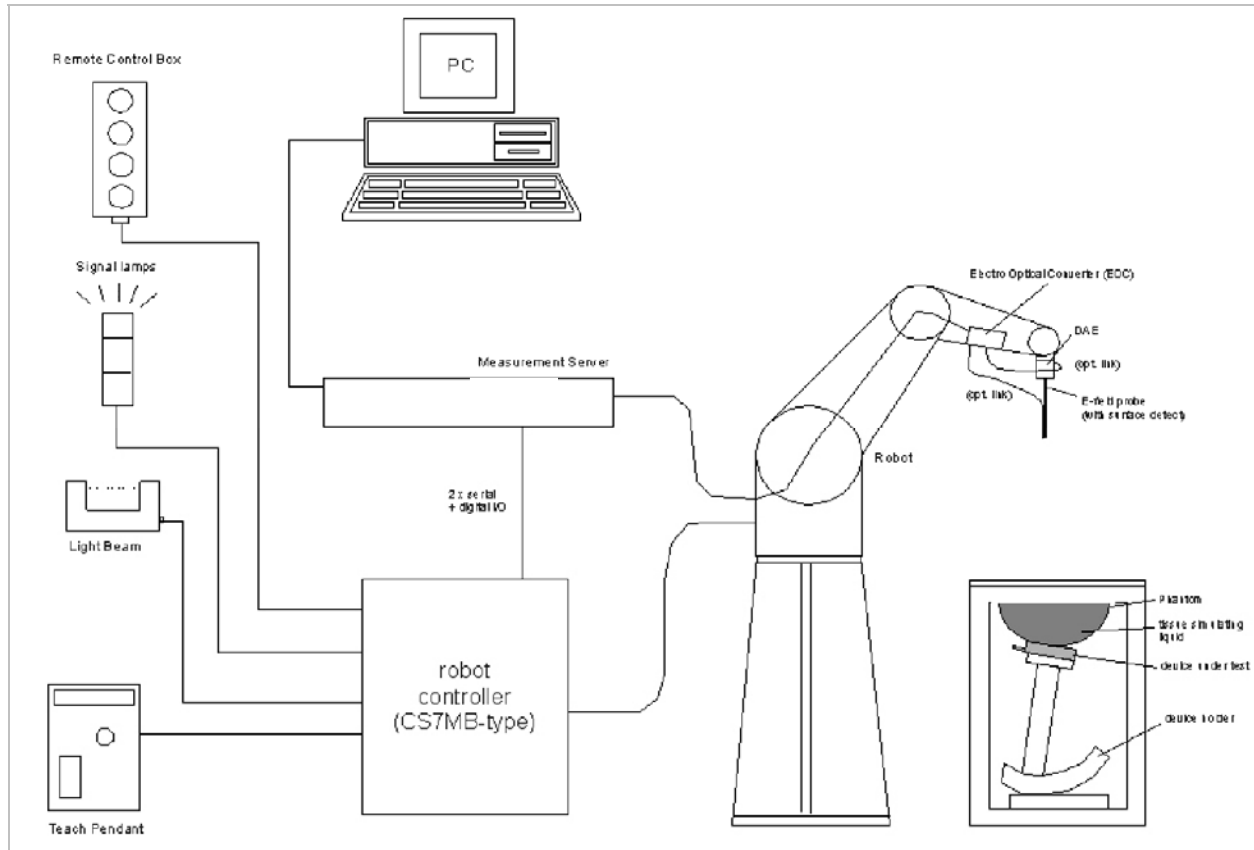
- GSM DTM is not supported.
- EDGE mode

5.3. Simultaneous Transmission Conditions

| No. | Capable TX Configurations | Note |
|-----|----------------------------------|------------------------|
| 1 | GSM850 voice + WiFi | |
| 2 | GSM1900 voice + WiFi | |
| 3 | UMTS (WCDMA) Band IV R99 + WiFi | |
| 5 | GPRS850 data + WiFi | Supported hotspot mode |
| 6 | GPRS1900 data + WiFi | Supported hotspot mode |
| 7 | UMTS (WCDMA) Band IV HSPA + WiFi | Supported hotspot mode |

Note:
BT and WLAN are not simultaneous transmission

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 & Body Phantom

The 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 |
| 750 | 41.96 | 0.89 | 55.6 | 0.96 |
| 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 |
| 1750 | 40.08 | 1.37 | 53.44 | 1.49 |
| 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 |

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

7.1. Liquid Check Results

| Date | Freq. (MHz) | Liquid Parameters | | Measured | Target | Delta (%) | Limit ±(%) | |
|-----------|-------------|-------------------|---------|---|--------|-----------|------------|---|
| 7/21/2011 | Body 1750 | e' | 54.0600 | Relative Permittivity (ϵ_r): | 54.06 | 53.44 | 1.16 | 5 |
| | | e" | 14.8135 | Conductivity (σ): | 1.44 | 1.49 | -3.01 | 5 |
| 7/22/2011 | Head 1750 | e' | 41.1770 | Relative Permittivity (ϵ_r): | 41.18 | 40.08 | 2.73 | 5 |
| | | e" | 13.8242 | Conductivity (σ): | 1.35 | 1.37 | -1.74 | 5 |
| 7/23/2011 | Body 835 | e' | 55.9600 | Relative Permittivity (ϵ_r): | 55.96 | 55.20 | 1.38 | 5 |
| | | e" | 21.3470 | Conductivity (σ): | 0.99 | 0.97 | 2.18 | 5 |
| 7/24/2011 | Body 835 | e' | 55.5700 | Relative Permittivity (ϵ_r): | 55.57 | 55.20 | 0.67 | 5 |
| | | e" | 21.2798 | Conductivity (σ): | 0.99 | 0.97 | 1.85 | 5 |
| 7/25/2011 | Head 835 | e' | 42.3200 | Relative Permittivity (ϵ_r): | 42.32 | 41.50 | 1.98 | 5 |
| | | e" | 19.0921 | Conductivity (σ): | 0.89 | 0.90 | -1.51 | 5 |
| 7/26/2011 | Head 1900 | e' | 39.0502 | Relative Permittivity (ϵ_r): | 39.05 | 40.00 | -2.37 | 5 |
| | | e" | 13.3138 | Conductivity (σ): | 1.41 | 1.40 | 0.47 | 5 |
| 7/26/2011 | Body 1900 | e' | 52.9733 | Relative Permittivity (ϵ_r): | 52.97 | 53.30 | -0.61 | 5 |
| | | e" | 14.3073 | Conductivity (σ): | 1.51 | 1.52 | -0.56 | 5 |
| 7/26/2011 | Head 2450 | e' | 39.8247 | Relative Permittivity (ϵ_r): | 39.82 | 39.20 | 1.59 | 5 |
| | | e" | 13.6024 | Conductivity (σ): | 1.85 | 1.80 | 2.95 | 5 |
| 7/26/2011 | Body 2450 | e' | 50.8801 | Relative Permittivity (ϵ_r): | 50.88 | 52.70 | -3.45 | 5 |
| | | e" | 14.1419 | Conductivity (σ): | 1.93 | 1.95 | -1.20 | 5 |

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 DASY5 system with an E-Field Probe EX3DV4, SN: 3686 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. date | SAR Avg (mW/g) | | |
|--------------------------|---------------------|-----------|----------------|-------|-------|
| | | | Tissue: | Head | Body |
| D1750V2 | D1750V2-1053_May11 | 5/27/11 | 1g SAR: | 36.08 | 36.88 |
| | | | 10g SAR: | 19.16 | 19.72 |
| D835V2 | D835V2-4d117_Arp11 | 4/15/11 | 1g SAR: | 9.64 | 10.12 |
| | | | 10g SAR: | 6.28 | 6.60 |
| D1900V2 | D1900V2-5d140_Apr11 | 4/18/11 | 1g SAR: | 41.6 | 41.2 |
| | | | 10g SAR: | 21.5 | 21.6 |
| D2450V2 | D2450V2-706_Apr10 | 4/19/10 | 1g SAR: | 51.6 | 52.4 |
| | | | 10g SAR: | 24.4 | 24.5 |

8.1. System Check Results

Measured by: Hung Thai

| System validation dipole | Date Tested | Measured (Normalized to 1 W) | | Target | Delta (%) | Tolerance (%) |
|--------------------------|-------------|------------------------------|------|--------|-----------|---------------|
| D1750V2 Body | 07/21/11 | 1g SAR: | 37.9 | 36.88 | 2.77 | ±10 |
| | | 10g SAR: | 20.3 | 19.72 | 2.94 | |
| D1750V2 Head | 07/22/11 | 1g SAR: | 35.2 | 36.08 | -2.44 | ±10 |
| | | 10g SAR: | 18.7 | 19.16 | -2.40 | |
| D835V2 Body | 07/23/11 | 1g SAR: | 9.34 | 10.12 | -7.71 | ±10 |
| | | 10g SAR: | 6.15 | 6.6 | -6.82 | |
| D835V2 Body | 07/24/11 | 1g SAR: | 9.37 | 10.12 | -7.41 | ±10 |
| | | 10g SAR: | 6.17 | 6.6 | -6.52 | |
| D835V2 Head | 07/25/11 | 1g SAR: | 9.5 | 9.64 | -1.45 | ±10 |
| | | 10g SAR: | 6.22 | 6.28 | -0.96 | |
| D1900V2 Body | 07/26/11 | 1g SAR: | 42.6 | 41.2 | 3.40 | ±10 |
| | | 10g SAR: | 22.3 | 21.6 | 3.24 | |
| D1900V2 Head | 07/26/11 | 1g SAR: | 38.3 | 41.6 | -7.93 | ±10 |
| | | 10g SAR: | 19.8 | 21.5 | -7.91 | |
| D2450V2 Head | 07/26/11 | 1g SAR: | 52.9 | 51.6 | 2.52 | ±10 |
| | | 10g SAR: | 24.2 | 24.4 | -0.82 | |
| D2450V2 Body | 07/26/11 | 1g SAR: | 49.7 | 52.4 | -5.15 | ±10 |
| | | 10g SAR: | 23.2 | 24.5 | -5.31 | |

9. SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties (for example, 1.2 mm for an EX3DV3 probe type).

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures $\geq 7 \times 7 \times 9$ (above 4.5 GHz) or $5 \times 5 \times 7$ (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

10. RF Output Power Measurement

10.1. GSM850 & GSM1900

GSM (GMSK) voice mode

| Band | Ch No. | f (MHz) | Avg burst Pwr (dBm) |
|---------|--------|---------|---------------------|
| GSM850 | 128 | 824.2 | 33.7 |
| | 190 | 836.6 | 33.7 |
| | 251 | 848.8 | 33.7 |
| GSM1900 | 512 | 1850.2 | 31.1 |
| | 661 | 1880.0 | 31.3 |
| | 810 | 1909.8 | 31.5 |

GPRS (GMSK) - Coding Scheme: CS1

| Band | Ch No. | f (MHz) | Avg burst Pwr (dBm) | | | | Power Reduction Enable | | | |
|---------|--------|---------|---------------------|---------------|---------|---------------|------------------------|---------------|---------|---------------|
| | | | 1 slot | Frame Avg Pwr | 2 slots | Frame Avg Pwr | 1 slots | Frame Avg Pwr | 2 slots | Frame Avg Pwr |
| GSM850 | 128 | 824.2 | 33.3 | 24.3 | 30.9 | 24.9 | 31.4 | 22.4 | 29.1 | 23.1 |
| | 190 | 836.6 | 33.4 | 24.4 | 30.8 | 24.8 | 31.4 | 22.4 | 29.1 | 23.1 |
| | 251 | 848.8 | 33.3 | 24.3 | 30.8 | 24.8 | 31.3 | 22.3 | 29.1 | 23.1 |
| GSM1900 | 512 | 1850.2 | 30.9 | 21.9 | 30.8 | 24.8 | 28.7 | 19.7 | 28.6 | 22.6 |
| | 661 | 1880 | 31.1 | 22.1 | 31.0 | 25.0 | 29.0 | 20.0 | 28.9 | 22.9 |
| | 810 | 1909.8 | 31.3 | 22.3 | 31.0 | 25.0 | 29.4 | 20.4 | 29.2 | 23.2 |

EGPRS (8PSK) - Coding Scheme: MCS5

| Band | Ch No. | f (MHz) | Avg burst Pwr (dBm) | | | | No Power Reduction Supported | | | |
|---------|--------|---------|---------------------|---------------|---------|---------------|------------------------------|---------------|---------|---------------|
| | | | 1 slot | Frame Avg Pwr | 2 slots | Frame Avg Pwr | 1 slots | Frame Avg Pwr | 2 slots | Frame Avg Pwr |
| GSM850 | 128 | 824.2 | 26.6 | 17.6 | 26.6 | 20.6 | | | | |
| | 190 | 836.6 | 26.6 | 17.6 | 26.5 | 20.5 | | | | |
| | 251 | 848.8 | 26.6 | 17.6 | 26.5 | 20.5 | | | | |
| GSM1900 | 512 | 1850.2 | 25.9 | 16.9 | 25.8 | 19.8 | | | | |
| | 661 | 1880 | 26.2 | 17.2 | 26.1 | 20.1 | | | | |
| | 810 | 1909.8 | 26.2 | 17.2 | 26.1 | 20.1 | | | | |

Notes:

According to KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE vo1, noted in the following sections indicated below may be considered to determine SAR test reduction requirements for devices operating in GSM/GPRS/EDGE modes to demonstrate RF exposure compliance.

1. Since the source-based time-averaged output power for EGPRS mode is lower than that in the GPRS mode, therefore Body SAR test reduction is applicable for this device.
2. Based on output power above and time slots, the following worst-case configurations were chosen for Body SAR testing.
 - a. GPRS850 2 time slots
 - b. GPRS1900 2 time slots

10.2. UMTS Band IV

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 (12.2kbps RMC) | | | | |
|---------------------------|----------------------------|-----------|-------------|------------------|
| Band | Mode | UL Ch No. | Freq. (MHz) | Avg Tx Pwr (dBm) |
| WCDMA (UMTS) (Band IV) | Rel 99 (RMC, 12.2 kbps) | 1312 | 1712.4 | 23.5 |
| | | 1412 | 1732.4 | 23.7 |
| | | 1513 | 1754.0 | 23.7 |

Results w/ power reduction enabled

| Rel 99 (12.2kbps RMC) | | | | |
|---------------------------|----------------------------|-----------|-------------|------------------|
| Band | Mode | UL Ch No. | Freq. (MHz) | Avg Tx Pwr (dBm) |
| WCDMA (UMTS) (Band IV) | Rel 99 (RMC, 12.2 kbps) | 1312 | 1712.4 | 21.6 |
| | | 1412 | 1732.4 | 21.7 |
| | | 1513 | 1754.0 | 21.7 |

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} = β_{hs}/β_c | 30/15 | | | |

Results

Rel 6 HSDPA

| Band | Mode | UL Ch No. | DL Ch No. | f (MHz) | Avg Tx Pwr (dBm) |
|----------------------------|-----------|-----------|-----------|---------|------------------|
| WCDMA (UMTS) Band IV | Subtest 1 | 1312 | 1537 | 1712.4 | 23.5 |
| | | 1412 | 1637 | 1732.4 | 23.7 |
| | | 1513 | 1738 | 1754.0 | 23.6 |
| | Subtest 2 | 1312 | 1537 | 1712.4 | 23.5 |
| | | 1412 | 1637 | 1732.4 | 23.7 |
| | | 1513 | 1738 | 1754.0 | 23.6 |
| | Subtest 3 | 1312 | 1537 | 1712.4 | 23.0 |
| | | 1412 | 1637 | 1732.4 | 23.2 |
| | | 1513 | 1738 | 1754.0 | 23.2 |
| | Subtest 4 | 1312 | 1537 | 1712.4 | 23.0 |
| | | 1412 | 1637 | 1732.4 | 23.1 |
| | | 1513 | 1738 | 1754.0 | 23.2 |

Results w/ power reduction enabled

| Band | Mode | UL Ch No. | DL Ch No. | f (MHz) | Avg Tx Pwr (dBm) |
|----------------------------|-----------|-----------|-----------|---------|------------------|
| WCDMA (UMTS) Band IV | Subtest 1 | 1312 | 1537 | 1712.4 | 21.5 |
| | | 1412 | 1637 | 1732.4 | 21.7 |
| | | 1513 | 1738 | 1754.0 | 21.7 |
| | Subtest 2 | 1312 | 1537 | 1712.4 | 21.6 |
| | | 1412 | 1637 | 1732.4 | 21.7 |
| | | 1513 | 1738 | 1754.0 | 21.7 |
| | Subtest 3 | 1312 | 1537 | 1712.4 | 21.0 |
| | | 1412 | 1637 | 1732.4 | 21.2 |
| | | 1513 | 1738 | 1754.0 | 21.2 |
| | Subtest 4 | 1312 | 1537 | 1712.4 | 21.0 |
| | | 1412 | 1637 | 1732.4 | 21.2 |
| | | 1513 | 1738 | 1754.0 | 21.1 |

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.

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 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 |
| | $A_{hs} = \beta_{hs}/\beta_c$ | | | | | 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) |
|-------------------------|-----------|-----------|-----------|---------|------------------|
| WCDMA (UMTS) Band IV | Subtest 1 | 1312 | 1537 | 1712.4 | 22.9 |
| | | 1412 | 1637 | 1732.4 | 23.0 |
| | | 1513 | 1738 | 1754.0 | 23.0 |
| | Subtest 2 | 1312 | 1537 | 1712.4 | 21.5 |
| | | 1412 | 1637 | 1732.4 | 21.6 |
| | | 1513 | 1738 | 1754.0 | 22.0 |
| | Subtest 3 | 1312 | 1537 | 1712.4 | 22.1 |
| | | 1412 | 1637 | 1732.4 | 22.1 |
| | | 1513 | 1738 | 1754.0 | 22.3 |
| | Subtest 4 | 1312 | 1537 | 1712.4 | 22.0 |
| | | 1412 | 1637 | 1732.4 | 22.4 |
| | | 1513 | 1738 | 1754.0 | 22.1 |
| | Subtest 5 | 1312 | 1537 | 1712.4 | 22.7 |
| | | 1412 | 1637 | 1732.4 | 22.8 |
| | | 1513 | 1738 | 1754.0 | 22.8 |

Results w/ power reduction enabled

| Band | Mode | UL Ch No. | DL Ch No. | f (MHz) | Avg Tx Pwr (dBm) |
|-------------------------|-----------|-----------|-----------|---------|------------------|
| WCDMA (UMTS) Band IV | Subtest 1 | 1312 | 1537 | 1712.4 | 21.00 |
| | | 1412 | 1637 | 1732.4 | 21.00 |
| | | 1513 | 1738 | 1754.0 | 21.10 |
| | Subtest 2 | 1312 | 1537 | 1712.4 | 19.70 |
| | | 1412 | 1637 | 1732.4 | 19.90 |
| | | 1513 | 1738 | 1754.0 | 19.90 |
| | Subtest 3 | 1312 | 1537 | 1712.4 | 19.90 |
| | | 1412 | 1637 | 1732.4 | 19.90 |
| | | 1513 | 1738 | 1754.0 | 20.20 |
| | Subtest 4 | 1312 | 1537 | 1712.4 | 20.00 |
| | | 1412 | 1637 | 1732.4 | 20.10 |
| | | 1513 | 1738 | 1754.0 | 20.20 |
| | Subtest 5 | 1312 | 1537 | 1712.4 | 21.20 |
| | | 1412 | 1637 | 1732.4 | 20.70 |
| | | 1513 | 1738 | 1754.0 | 20.70 |

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.

10.1. WiFi

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
|-------------------|-----------|-------------|---------------------|-------|
| | | | (dBm) | (mW) |
| 802.11b | 1 | 2412 | 15.5 | 35.48 |
| | 6 | 2437 | 15.8 | 37.58 |
| | 11 | 2462 | 15.8 | 38.02 |
| 802.11g | 1 | 2412 | 13.6 | 22.91 |
| | 6 | 2437 | 13.9 | 24.55 |
| | 11 | 2462 | 13.9 | 24.55 |
| 802.11n (HT20) | 1 | 2412 | 12.5 | 17.78 |
| | 6 | 2437 | 12.8 | 19.05 |
| | 11 | 2462 | 12.8 | 19.05 |

Note(s):

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.

10.2. Bluetooth

| Bluetooth | | | | |
|-----------|-----------|-------------|---------------------|------|
| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
| | | | (dBm) | (mW) |
| GFSK | 0 | 2402 | 9.5 | 8.9 |
| | 39 | 2441 | 9.9 | 9.8 |
| | 78 | 2480 | 9.4 | 8.7 |
| 8PSK | 0 | 2402 | 7.4 | 5.5 |
| | 39 | 2441 | 8.0 | 6.3 |
| | 78 | 2480 | 7.4 | 5.5 |

Note(s): According to KDB 648474, Table 2, Unlicensed transmitters

When there is simultaneous transmission, Stand-alone SAR not required due to

- Output $\leq 2 \cdot P_{Ref}$ (24 mW) and antenna is ≥ 5.0 cm from other antennas
- Output $\leq P_{Ref}$ (12 mW) and antenna is ≥ 2.5 cm from other antennas
- Output $\leq P_{Ref}$ (12 mW) and antenna is < 2.5 cm from other antennas

11. Standalone SAR Test Results

The test configuration for each body exposure condition (head, body-worn, and body-hotspot) is dependent on the applicable voice or data modes, and antenna selected.

Summary of test results for highest 1g SAR

| Technology | Test configuration | Mode | Separation distance (mm) | Highest 1g SAR (W/kg) |
|--------------------------------------|----------------------|----------------------|--------------------------|-----------------------|
| GSM850 (Part 22) | Head: Right touch | GSM voice | -- | 0.499 |
| | Body-worn: Rear | GPRS 2 Slot, CS1 | 15 | 1.02 |
| | Body-hotspot: Rear | GPRS 2 Slot, CS1 | 10 | 0.676 |
| GSM1900 (Part 24) | Head: Left touch | GSM voice | -- | 0.559 |
| | Body worn: Rear | GPRS 2 Slot, CS1 | 15 | 0.460 |
| | Body-hotspot: Bottom | GPRS 2 Slot, CS1 | 10 | 0.578 |
| UMTS (WCDMA) Band IV (Part 27) | Head: Left touch | R99 (RMC, 12.2 kbps) | -- | 1.30 |
| | Body worn: Rear | R99 (RMC, 12.2 kbps) | 15 | 0.739 |
| | Body-hotspot: Rear | R99 (RMC, 12.2 kbps) | 10 | 1.05 |
| WiFi 2.4 GHz (Part 15 C) | Head: Left touch | 802.11b, 1 kbps | -- | 0.135 |
| | Body-worn: Rear | 802.11b, 1 kbps | 10 | 0.045 |
| | Body-hotspot: Rear | 802.11b, 1 kbps | 10 | 0.045 |

11.1. GSM850

Head SAR

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Left Touch | Voice | 128 | 824.2 | 33.7 | | | 1 |
| | | 190 | 836.6 | 33.7 | 0.392 | 0.292 | |
| | | 251 | 848.8 | 33.7 | | | 1 |
| Left Tilt | Voice | 128 | 824.2 | 33.7 | | | 1 |
| | | 190 | 836.6 | 33.7 | 0.383 | 0.288 | |
| | | 251 | 848.8 | 33.7 | | | 1 |
| Right Touch | Voice | 128 | 824.2 | 33.7 | | | 1 |
| | | 190 | 836.6 | 33.7 | 0.499 | 0.377 | |
| | | 251 | 848.8 | 33.7 | | | 1 |
| Right Tilt | Voice | 128 | 824.2 | 33.7 | | | 1 |
| | | 190 | 836.6 | 33.7 | 0.377 | 0.284 | |
| | | 251 | 848.8 | 33.7 | | | 1 |

Body-worn SAR with 15 mm separation distance

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Rear | GPRS 2 Slot | 128 | 824.2 | 30.9 | 0.806 | 0.598 | 1 |
| | | 190 | 836.6 | 30.8 | 0.838 | 0.623 | 1 |
| | | 251 | 848.8 | 30.8 | 1.020 | 0.759 | 1 |
| | | 251 | 848.8 | 30.8 | 0.669 | 0.495 | 1,2 |
| Front | GPRS 2 Slot | 128 | 824.2 | 30.9 | | | |
| | | 190 | 836.6 | 30.8 | 0.656 | 0.403 | 1 |
| | | 251 | 848.8 | 30.8 | | | |

Body-hotspot SAR with 10 mm separation distance (with hotspot function enabled)

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Rear | GPRS 2 Slot | 128 | 824.2 | 29.1 | | | 1 |
| | | 190 | 836.6 | 29.1 | 0.676 | 0.499 | |
| | | 251 | 848.8 | 29.1 | | | 1 |
| Front | GPRS 2 Slot | 128 | 824.2 | 29.1 | | | 1 |
| | | 190 | 836.6 | 29.1 | 0.355 | 0.266 | |
| | | 251 | 848.8 | 29.1 | | | 1 |
| Left | GPRS 2 Slot | 128 | 824.2 | 29.1 | | | 1 |
| | | 190 | 836.6 | 29.1 | 0.342 | 0.168 | |
| | | 251 | 848.8 | 29.1 | | | 1 |
| Right | GPRS 2 Slot | 128 | 824.2 | 29.1 | | | 1 |
| | | 190 | 836.6 | 29.1 | 0.374 | 0.247 | |
| | | 251 | 848.8 | 29.1 | | | 1 |
| Bottom | GPRS 2 Slot | 128 | 824.2 | 29.1 | | | 1 |
| | | 190 | 836.6 | 29.1 | 0.062 | 0.037 | |
| | | 251 | 848.8 | 29.1 | | | 1 |
| Top | GPRS 2 Slot | 128 | 824.2 | 29.1 | | | 3 |
| | | 190 | 836.6 | 29.1 | | | 3 |
| | | 251 | 848.8 | 29.1 | | | 3 |

Note(s):

- SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
- With headset attached
- SAR is not required due to antenna-to-top edge's distance is greater than 2.5 cm.

11.2. GSM1900

Head SAR

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Left Touch | Voice | 512 | 1850.2 | 31.1 | | | 1 |
| | | 661 | 1880.0 | 31.3 | 0.559 | 0.326 | |
| | | 810 | 1909.8 | 31.5 | | | 1 |
| Left Tilt | Voice | 512 | 1850.2 | 31.1 | | | 1 |
| | | 661 | 1880.0 | 31.3 | 0.188 | 0.106 | |
| | | 810 | 1909.8 | 31.5 | | | 1 |
| Right Touch | Voice | 512 | 1850.2 | 31.1 | | | 1 |
| | | 661 | 1880.0 | 31.3 | 0.313 | 0.196 | |
| | | 810 | 1909.8 | 31.5 | | | 1 |
| Right Tilt | Voice | 512 | 1850.2 | 31.1 | | | 1 |
| | | 661 | 1880.0 | 31.3 | 0.176 | 0.106 | |
| | | 810 | 1909.8 | 31.5 | | | 1 |

Body-worn SAR with 15 mm separation distance

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Rear | GPRS 2 Slot | 512 | 1850.2 | 30.8 | | | 1 |
| | | 661 | 1880.0 | 31.0 | 0.460 | 0.293 | |
| | | 810 | 1909.8 | 31.0 | | | 1 |
| | | 661 | 1880.0 | 31.0 | 0.390 | 0.245 | 2 |
| Front | GPRS 2 Slot | 128 | 824.2 | 30.8 | | | 1 |
| | | 190 | 836.6 | 31.0 | 0.376 | 0.236 | |
| | | 251 | 848.8 | 31.0 | | | 1 |

Body-hotspot SAR with 10 mm separation distance (with hotspot function enabled)

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Rear | GPRS 2 Slot | 512 | 1850.2 | 28.6 | | | 1 |
| | | 661 | 1880.0 | 28.9 | 0.494 | 0.305 | |
| | | 810 | 1909.8 | 29.2 | | | 1 |
| Front | GPRS 2 Slot | 512 | 1850.2 | 28.6 | | | 1 |
| | | 661 | 1880.0 | 28.9 | 0.391 | 0.239 | |
| | | 810 | 1909.8 | 29.2 | | | 1 |
| Left | GPRS 2 Slot | 512 | 1850.2 | 28.6 | | | 1 |
| | | 661 | 1880.0 | 28.9 | 0.231 | 0.134 | |
| | | 810 | 1909.8 | 29.2 | | | 1 |
| Right | GPRS 2 Slot | 512 | 1850.2 | 28.6 | | | 1 |
| | | 661 | 1880.0 | 28.9 | 0.090 | 0.053 | |
| | | 810 | 1909.8 | 29.2 | | | 1 |
| Bottom | GPRS 2 Slot | 512 | 1850.2 | 28.6 | | | 1 |
| | | 661 | 1880.0 | 28.9 | 0.578 | 0.326 | |
| | | 810 | 1909.8 | 29.2 | | | 1 |
| Top | GPRS 2 Slot | 512 | 1850.2 | 28.6 | | | 3 |
| | | 661 | 1880.0 | 28.9 | | | 3 |
| | | 810 | 1909.8 | 29.2 | | | 3 |

Note(s):

- SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
- With headset attached
- SAR is not required due to antenna-to-top edge's distance is greater than 2.5 cm.

11.3. WCDMA (UMTS Band IV)

Head SAR

| Test Position | Mode | UL Ch #. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|----------------------|----------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Left Touch | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 23.5 | 1.300 | 0.818 | |
| | | 1412 | 1732.4 | 23.7 | 1.060 | 0.654 | |
| | | 1513 | 1754.0 | 23.7 | 1.260 | 0.776 | |
| Left Tilt | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 23.5 | | | 1 |
| | | 1412 | 1732.4 | 23.7 | 0.260 | 0.159 | |
| | | 1513 | 1754.0 | 23.7 | | | 1 |
| Right Touch | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 23.5 | 1.050 | 0.664 | |
| | | 1412 | 1732.4 | 23.7 | 0.815 | 0.494 | |
| | | 1513 | 1754.0 | 23.7 | 0.885 | 0.531 | |
| Right Tilt | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 23.5 | | | 1 |
| | | 1412 | 1732.4 | 23.7 | 0.237 | 0.142 | |
| | | 1513 | 1754.0 | 23.7 | | | 1 |

Note(s):

- SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
- With headset attached.

Body-worn SAR with 15 mm separation distance

| Test Position | Mode | UL Ch #. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------------------------|----------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Rear | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 23.5 | | | 1 |
| | | 1412 | 1732.4 | 23.7 | 0.724 | 0.445 | |
| | | 1412 | 1732.4 | 23.7 | 0.739 | 0.449 | 2 |
| | | 1513 | 1754 | 23.7 | | | 1 |
| Front | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 23.5 | | | 1 |
| | | 1412 | 1732.4 | 23.7 | 0.721 | 0.443 | |
| | | 1513 | 1754 | 23.7 | | | 1 |

Body-hotspot SAR with 10 mm separation distance (with hotspot function enabled)

| Test Position | Mode | UL Ch #. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|-------------------------|----------|-------------|---------------|-------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Rear | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 21.6 | 0.975 | 0.591 | |
| | | 1412 | 1732.4 | 21.7 | 0.822 | 0.5 | |
| | | 1513 | 1754 | 21.7 | 0.938 | 0.572 | |
| Front | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 21.6 | 0.983 | 0.59 | |
| | | 1312 | 1714.4 | 21.6 | 1.05 | 0.625 | 2 |
| | | 1412 | 1732.4 | 21.7 | 0.839 | 0.505 | |
| | | 1513 | 1754 | 21.7 | 0.923 | 0.558 | |
| Left | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 21.6 | | | 1 |
| | | 1412 | 1732.4 | 21.7 | 0.210 | 0.127 | |
| | | 1513 | 1754 | 21.7 | | | 1 |
| Right | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 21.6 | | | 1 |
| | | 1412 | 1732.4 | 21.7 | 0.090 | 0.054 | |
| | | 1513 | 1754 | 21.7 | | | 1 |
| Bottom | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 21.6 | | | 1 |
| | | 1412 | 1732.4 | 21.7 | 0.266 | 0.161 | |
| | | 1513 | 1754 | 21.7 | | | 1 |
| Top | R99 (RMC, 12.2 kbps) | 1312 | 1714.4 | 21.6 | | | 3 |
| | | 1412 | 1732.4 | 21.7 | | | 3 |
| | | 1513 | 1754 | 21.7 | | | 3 |

Note(s):

- SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
- With headset attached.
- SAR is not required due to antenna-to-top edge's distance is greater than 2.5 cm.

11.4. WiFi

Head SAR

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|---------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Left Touch | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.135 | 0.068 | |
| | | 11 | 2462 | 15.8 | | | 1 |
| Left Tilt | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.116 | 0.055 | |
| | | 11 | 2462 | 15.8 | | | 1 |
| Right Touch | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.092 | 0.050 | |
| | | 11 | 2462 | 15.8 | | | 1 |
| Right Tilt | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.102 | 0.052 | |
| | | 11 | 2462 | 15.8 | | | 1 |

Body-worn & Body-hotspot SAR with 10 mm separation distance

| Test position | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) | | Note |
|---------------|---------|--------|-------------|---------------|--------------|--------------|------|
| | | | | | 1-g | 10-g | |
| Rear | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.039 | 0.019 | |
| | | 11 | 2462 | 15.8 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.045 | 0.020 | 2 |
| Front | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.031 | 0.018 | |
| | | 11 | 2462 | 15.8 | | | 1 |
| Left | 802.11b | 1 | 2412 | 15.5 | | | 3 |
| | | 6 | 2437 | 15.8 | | | 3 |
| | | 11 | 2462 | 15.8 | | | 3 |
| Right | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.031 | 0.016 | |
| | | 11 | 2462 | 15.8 | | | 1 |
| Bottom | 802.11b | 1 | 2412 | 15.5 | | | 3 |
| | | 6 | 2437 | 15.8 | | | 3 |
| | | 11 | 2462 | 15.8 | | | 3 |
| Top | 802.11b | 1 | 2412 | 15.5 | | | 1 |
| | | 6 | 2437 | 15.8 | 0.036 | 0.020 | |
| | | 11 | 2462 | 15.8 | | | 1 |

Note(s):

- SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
- With headset attached.
- SAR is not required due to antenna-to-left/bottom edge's distances are greater than 2.5 cm.

4. Simultaneous Transmission SAR Analysis (KDB 648474)

4.1. Head Exposure Condition

| Band | Test Position | WWAN | Wi-Fi (2.4GHz) | Σ 1-g SAR (W/kg) |
|-------------------------|---------------|-------|----------------|-------------------------|
| GSM850 | Left Touch | 0.393 | 0.135 | 0.528 |
| | Left Tilt | 0.383 | 0.116 | 0.499 |
| | Right Touch | 0.499 | 0.092 | 0.591 |
| | Right Tilt | 0.377 | 0.102 | 0.479 |
| GSM1900 | Left Touch | 1.030 | 0.135 | 1.165 |
| | Left Tilt | 0.338 | 0.116 | 0.454 |
| | Right Touch | 0.560 | 0.092 | 0.652 |
| | Right Tilt | 0.318 | 0.102 | 0.420 |
| UMTS (WCDMA) Band IV | Left Touch | 1.300 | 0.135 | 1.435 |
| | Left Tilt | 0.260 | 0.116 | 0.376 |
| | Right Touch | 1.050 | 0.092 | 1.142 |
| | Right Tilt | 0.237 | 0.102 | 0.339 |

CONCLUSIONS:

- Simultaneous transmission SAR is not required for WWAN & WiFi because the sum of the 1-g SAR is < 1.6 W/kg
- Simultaneous transmission SAR is not required for WiFi & WWAN because the SAR to peak location separation ratios is < 0.3 for WiFi and WWAN antenna pairs.

4.2. Body-worn Exposure Condition

| Band | Test Position | WWAN | Wi-Fi (2.4GHz) | ∑ 1-g SAR (W/kg) |
|-------------------------|---------------|-------|----------------|------------------|
| GSM850 | Rear | 1.020 | 0.045 | 1.065 |
| | Front | 0.656 | 0.031 | 0.687 |
| GSM1900 | Rear | 0.460 | 0.045 | 0.505 |
| | Front | 0.376 | 0.031 | 0.407 |
| UMTS (WCDMA) Band IV | Rear | 0.739 | 0.045 | 0.784 |
| | Front | 0.721 | 0.031 | 0.752 |

CONCLUSIONS:

- Simultaneous transmission SAR is not required for WWAN & WiFi because the sum of the 1-g SAR is < 1.6 W/kg
- Simultaneous transmission SAR is not required for WiFi & WWAN because the SAR to peak location separation ratios is < 0.3 for WiFi and WWAN antenna pairs.

4.3. Body-hotspot Exposure Condition

| Band | Test Position | WWAN | Wi-Fi (2.4GHz) | ∑ 1-g SAR (W/kg) |
|-------------------------|---------------|-------|----------------|------------------|
| GSM850 | Rear | 0.676 | 0.045 | 0.721 |
| | Front | 0.355 | 0.031 | 0.386 |
| | Left | 0.342 | 0.000 | 0.342 |
| | Right | 0.374 | 0.031 | 0.405 |
| | Bottom | 0.062 | 0.000 | 0.062 |
| | Top | 0.000 | 0.036 | 0.036 |
| GSM1900 | Rear | 0.494 | 0.045 | 0.539 |
| | Front | 0.391 | 0.031 | 0.422 |
| | Left | 0.231 | 0.000 | 0.231 |
| | Right | 0.090 | 0.031 | 0.121 |
| | Bottom | 0.578 | 0.000 | 0.578 |
| | Top | 0.000 | 0.036 | 0.036 |
| UMTS (WCDMA) Band IV | Rear | 0.975 | 0.045 | 1.020 |
| | Front | 1.050 | 0.031 | 1.081 |
| | Left | 0.210 | 0.000 | 0.210 |
| | Right | 0.090 | 0.031 | 0.121 |
| | Bottom | 0.266 | 0.000 | 0.266 |
| | Top | 0.000 | 0.036 | 0.036 |

Note: Since device does not support DTM mode in GSM, GSM voice and GPRS/EDGE data transmit simultaneously does not support.

WCDMA can operate voice and data using one Antenna. WCDMA can use (or share) to divide packet one part is for voice, another part is for data. WCDMA can support DTM (dual transfer mode) Therefore It is possible WCDMA voice and WCDMA data transmit simultaneously in hotspot mode

CONCLUSIONS:

- Simultaneous transmission SAR is not required for WWAN & WiFi because the sum of the 1-g SAR is < 1.6 W/kg
- Simultaneous transmission SAR is not required for WiFi & WWAN because the SAR to peak location separation ratios is < 0.3 for WiFi and WWAN antenna pairs.

12. Appendixes

Refer to separated files for the following appendixes.

12.1. Appendix A: System check plots

Refer to Appendix A "A_System check plots"

12.2. Appendix B: SAR test plots for GSM850

Refer to Appendix B "B_SAR test plots for GSM850"

12.3. Appendix C: SAR test plots for GSM1900

Refer to Appendix C "C_SAR test plots for GSM1900"

12.4. Appendix D: SAR test plots for UMTS band IV

Refer to Appendix D "D_SAR test plots for UMTS band IV"

12.5. Appendix E: SAR test plots for WiFi

Refer to Appendix E "E_SAR test plots for WiFi"

12.6. Appendix F: Calibration certificate for E-Field Probe EX3DV4 SN 3686

Refer to Appendix F "F_Calibration certificate for E-Field Probe EX3DV4 SN 3686"

12.7. Appendix G: Calibration Certificate for D835V2 - SN 4d117

Refer to Appendix G "G_Calibration Certificate for D835V2 - SN 4d117"

12.8. Appendix H: Calibration certificate for D1750V2 SN 1053

Refer to Appendix H "H_Calibration certificate for D1750V2 SN 1053"

12.9. Appendix I: Calibration certificate for D1900V2 SN 5d140

Refer to Appendix I "I_Calibration certificate for D1900V2 SN 5d140"

12.10. Appendix J: Calibration certificate for D2450V2 SN: 706 w/ extended cal. data

Refer to Appendix J "J_Calibration certificate for D2450V2 SN: 706 w/ extended cal. data"