Specific Absorption Rate (SAR)

FCC 47 CFR Part 2

Test Report

For

Kyocera Corporation
c/o Kyocera Communication, Inc.

Product:	Dual-Band CDMA Mobile Phone
Model:	S2150

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ATTESTATION

The tested device complies with the requirements in respect of all parameters subject to the test.

The test results and statements relate only to the items tested.

The test equipment used was suitable for the tests performed and within manufacturer's published specifications and operating parameters.

The test methods were consistent with the methods described in the relevant standards.

Product:	Dual-Band CDMA Mobile Phone with Bluetooth
Model #:	S2150
FCC ID:	V65S2150A1
Tested in accordance with:	FCC §2.1093/OET-65 Supplement C IEEE P2528/D1.2 – 2003 FCC KDB 248227 D01 v01r02 FCC KDB 648474 D01 v01r05 FCC KDB 941225 v2
Test Requested by:	KYOCERA Corporation C/o KYOCERA Communication Inc. 8611 Balboa Avenue San Diego, CA 92123 United States
Test performed by:	CompTest Services LLC
Date of Test:	February 18 – April 15, 2013

Responsible Engineer

Benjamin Nguyen

Benjamin Nguyen
Test Engineer

Reviewed and approved by:

Kelly Hill

Kelly Hill
Quality Manager

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1 SUMMARY OF TESTING

The equipment is deemed to fulfill the requirements if the reported values are less than or equal to the limit.

Equipment Class	Mode-Band	Highest Reported SAR_{1g} (W/kg)	
		Head	Body (15mm)
PCE	CDMA-800 BC-0	0.47	1.43
	CDMA-1900 BC-1	1.56	1.22
DSS	Bluetooth 2.4GHz	N/A	0.04
Highest Simultaneous Transmission SAR		N/A	1.47

2 EQUIPMENT UNDER TEST INFORMATION

2.1 Decive Overview

Product:	Dual-Band CDMA Mobile Phone with Bluetooth		
FCC ID:	V65S2150A1		
Model Number:	S2150		
EUT Serial Number:	268435457816731776		
Type:	[ ] Identical Prototype, [**X**] Pre-Production, [ ] Production		
Device Category:	Portable		
RF Exposure Environment:	General Population / Uncontrolled		
CDMA Antenna:	Internal	**Detachable:**	No
WiFi/Bluetooth Antenna:	Internal	**Detachable:**	No
External Input:	Audio/Digital Data		
Quantity:	Quantity production is planned		

Mode/Band	TX Freq (MHz)	Operating Modes
CDMA BC-0	824.7 -848.3	Voice/Data
CDMA BC-1	1851.25 – 1908.75	Voice/Data
Bluetooth	2402 – 2480	Data

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2.2 Normal and Maximum Conducted Power

The nominal and maximum (including tune-up tolerance) conducted power is shown as below. SAR values were scaled to the maximum allowed power to determine compliance per KDB 447498 D01v05.

Mode	Band	Configuration	Nominal (dBm)	Maximum (dBm)
CDMA	BC-0	All	24.41	25.20
	BC-1	All	24.38	24.70
Bluetooth	2.4GHz	All	3.54	4.00

2.3 DUT Antenna Locations

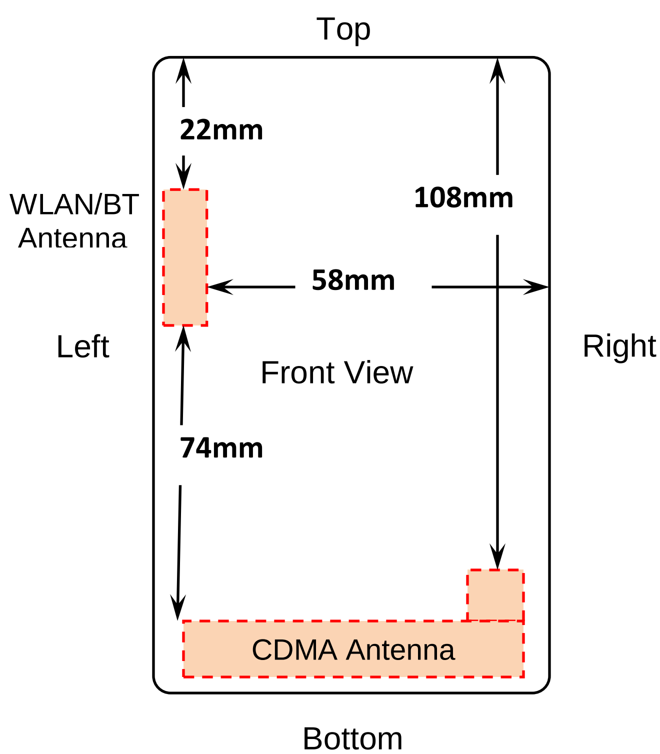

Diagram Not to Scale

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2.4 Simultaneous Transmission Capabilities

Per FCC KDB 447498 D05v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission.

This device:

☐ does not contain simultaneous multiple transmitters.

☒ contains multiple transmitters that may operate simultaneously.

The simultaneous transmission possibilities of this device are listed as below:

#	Combination Configuration	Head	Body	Hotspot
		Data		Data
1	CDMA (800 or 1900) Voice + BT	No	Yes	N/A
2	CDMA (800 or 1900) Data + BT	No	Yes	N/A
3	CDMA (800 or 1900) Voice + CDMA (800 or 1900) Data	No	No	N/A
4	CDMA 800 (Voice or Data) + CDMA 1900 (Voice or Data)	No	No	N/A
5	CDMA 800 (Voice or Data) + CDMA 1900 (Voice or Data) + BT	No	No	N/A

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3 ACCESSORIES

3.1 Body Worn Accessories

The device has been tested with the following body worn accessories that contains metal parts and separation distance between the device and the user's body is listed in the table below.

Accessory	Model	Separation (mm)
Air	N/A	15.0

3.2 Batteries

The device was tested with the following battery packs:

Battery	Model	Specifications
Standard	SCP-44LBPS	3.7V, 870mAh

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4 TEST CONDITIONS

4.1 Test Facilities

The test sites and measurement facilities used to collect data are located at 8611 Balboa Avenue, San Diego, CA 92123, USA

4.2 Ambient Conditions

All tests were performed under the following environmental conditions:

Ambient Temperature:	22 ± 1 Degrees C
Tissue simulating liquid temperature:	22 ± 1 Degrees C
Humidity:	38 %
Pressure:	1015 mB

4.3 RF characteristics of the test site

All SAR measurements were performed inside a shielded room that provides isolation from external EM fields.

External fields are minimizing by the shielded room, leaving the phone as the dominant radiation source. Two 2-foot square ferrite panels are placed on the floor of the room beneath the phantom area of the DASY system to minimize reflected energy that would otherwise re-enter the phantom and combine constructively or destructively with the desired fields. These ferrite panels provide roughly 12 to 13 dB of attenuation in the frequency range of 900 MHz, and 7 to 8 dB of attenuation in the frequency range of 1.9 GHz.

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4.4 Test Signal, Frequencies and Output Power

In all operating bands, the measurements were performed on low, mid and high channels.
The phone was set to nominal maximum power level during all tests and at the beginning of each test.

DASY system measures power drift during SAR testing by comparing E-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

4.4.1 CDMA2000/EVDO Test conditions

The device supports CDMA2000 in 1X (Phase I, Protocol revision 6) and 1x EvDo Rev 0 modes. CDMA2000 1X includes TIA/EIA-95B as a subset and was approved for publishing in July 1999. It provides voice and data capabilities within a standard 1.25 MHz CDMA channel. This RF bandwidth is identical to the legacy IS-95 B system standard.

4.4.1.1 <u>SAR Test Reduction</u>

When maximum output variation across channels of each band/mode is < ½ dB, either maximum output or middle channels may be used to determine test reduction for each mode in a cellphone; otherwise, the maximum output channel was used to determine test reduction for each band/mode.

If the SAR measured at the reduction tested channel is at least 3dB lower than the SAR limit, testing at other channels were optional.

4.4.1.2 <u>Head SAR Measurements</u>

SAR for head exposure configurations was measured in RC3 with the EUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 was not required when the maximum average output of each channel was less than ¼ dB higher than that measured in RC3. Otherwise, SAR was measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

4.4.1.3 <u>Body SAR Measurements</u>

SAR for body exposure configurations was measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH_n) was not required when the maximum average output of each RF channel was less than ¼ dB higher than that measured with FCH only. Otherwise, SAR was measured on the maximum output channel (FCH + SCH_n) with FCH at full rate and SCH_0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels were enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts.

Body SAR in RC1 was not required when the maximum average output of each channel was less than ¼ dB higher than that measured in RC3. Otherwise, SAR was measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that resulted in the highest SAR for that channel in RC3.

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4.4.1.4 Devices with Ev-Do

For devices with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 was less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for Ev-Do was not required. Otherwise, SAR for Rev. 0 was measured on the maximum output channel at 153.6 kbps using the body exposure configuration that resulted in the highest SAR for that channel in RC3. SAR for Rev. A was not required when the maximum average output of each channel was less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR was measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots should be configured in the downlink for both Rev. 0 and Rev. A

4.4.1.5 Power Reduction (PR)

The device does:

☒ not implement power reduction.

☐ implement power reduction only at the following conditions:

Configuration:	
Band:	
Mode:	
Power Reduction:	

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4.5 Device Test Conditions

The EUT was tested with a fully charged battery as supplied with the handset. Conducted RF power measurements were performed before and after each SAR measurements to confirm the output power.

4.6 SAR Test Reduction and Exclusion

Per FCC KDB 447498 D01v05, the following SAR test reduction and exclusion were evaluated:

a) Determine Standalone SAR Exclusion
b) SAR estimation for unlicensed transmitter simultaneous transmission
c) Determine simultaneous transmission test exclusion

4.6.1 Standalone SAR Test Exclusion

Per FCC KDB 447498 D01v05, standalone 1-g head or body and 10-g extremity SAR measurement (for 100 MHz to 6 GHz at test separation distances ≤ 50 mm) is not required when the following SAR Exclusion Threshold condition is satisfied:

$$\frac{\text{Max Tuneup Power, mW}}{\text{Min. Test Separation Distance, mm}} \times \sqrt{f_{(GHz)}} \leq T$$

Where T=3.0 for 1-g SAR and 7.5 for 10-g extremity SAR

The SAR test exclusion conditions are based on source-based time-averaged maximum conducted output power, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.

Please see Simultaneous Transmission SAR Test Exclusion section below for Standalone SAR test exclusion analysis results.

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4.6.2 Simultaneous Transmission SAR Test Exclusion

4.6.2.1 Estimated Bluetooth standalone SAR

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR is estimated. The following procedures, adopted from FCC KDB 447498 D01 v05, are applicable to handsets with built-in unlicensed transmitters such as WLAN (802.11) and Bluetooth devices that may simultaneously transmit with the licensed transmitter. The SAR test exclusion condition is based on source-based time-averaged maximum conducted output power, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. For Test separation distances ≤ 50mm, the estimated SAR is determined by the following formula:

$$\text{Estimated SAR} = \frac{\text{Max Tuneup Power, mW}}{\text{Min. Test Separation Distance, mm}} \text{ x } \frac{\sqrt{f_{(GHz)}}}{7.5}$$

Based on the Antenna separation and output power, Stand-Alone and Simultaneous Transmission SAR testing requirements are listed below:

Mode	Config.	Freq. (GHz)	Max Tune-up Power (mW)	Separation Distance (mm)	Standalone SAR_{1g} Exclusion Threshold	Standalone SAR_{1g} Test?	Est. SAR_{1g} (W/kg)
BT	Body	2.441	3.0	15	0.31	No	0.04
	Head	2.441	N/A	N/A	N/A	N/A	N/A
	Hotspot	2.441	N/A	N/A	N/A	N/A	N/A

1) When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
2) Power and distance rounded to the nearest mW and mm before calculation.
3) Voice call in head configuration is not supported with Bluetooth mode.
4) BT Hotspot not applicable.

4.6.2.2 Simultaneous Transmission SAR Summation

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the *reported* standalone SAR of each applicable simultaneous transmitting antenna. The following test procedures are applied for Simultaneous transmission SAR:

a) When the sum of SAR_{1g} < SAR_{1g} 1.6 W/kg, simultaneous transmission SAR test is not required.
b) When the sum of SAR_{1g} > SAR_{1g} 1.6 W/kg), SAR test exclusion is determined by the SAR to peak location separation ratio (SPLSR). The ratio is determined by $(SAR_1 + SAR_2)^{1.5}/R_i$, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

Where SAR_1 and SAR_2 are the highest *reported* or estimated SAR for each antenna in the pair, and R_i is the separation distance between the peak SAR locations for the antenna pair in mm.

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4.6.3 WLAN Test Conditions

4.6.3.1 WLAN RF Conducted Power Data

Unlicensed transmitters are controlled by chipset based test mode software to establish maximum output power.

Per KDB 248227 D01, highest average output power channel for the lowest data rate are selected for SAR evaluation in 802.11b. 802.11g/n modes and higher data rates for 802.11b are not investigated if the average output powers are not greater than 0.25dB than the power of the SAR configurations tested in the 802.11b mode.

4.7 Router SAR Evaluations

For portable devices equipped with wireless router (Hotspot) feature, SAR evaluation is performed according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).

This device:

☒ is not capable of functioning as a wireless router. Testing was not performed at 10 mm.
☐ is capable of functioning as a wireless router. Testing was performed at 10 mm as below:

Mobile Hotspot SAR Test Requirements						
Mode/Side	Front	Back	Left	Right	Top	Bottom
CDMA						
WiFi						

4.8 Hand SAR Evaluations

When applicable, Hand SAR was evaluated with following test procedures:

- Test separation distance: 0 (zero) mm
- SAR is averaged over 10g of tissue

Hand SAR required: ☐ Yes ☒ No

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4.9 SAR Tests in Mouth and Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. It has been known for some time that there are SAR measurement difficulties in these regions of the SAM phantom. SAR probes are calibrated in tissue-equivalent liquids with sufficient separation between the probe sensors and nearby physical boundaries to ensure scattering does not affect probe calibration. When the probe tip is moved into tight regions, such as the mouth and jaw region of the SAM phantom, with multiple boundaries surrounding its sensors, probe calibration and measurement accuracy can become questionable. In addition, these measurement locations often require a probe to be tilted at steep angles, where it may no longer comply with calibration requirements and measurement protocols, or satisfy the required measurement accuracy and uncertainty. In some situations it is not feasible to tilt the probe or rotate the phantom, as suggested by measurement standards, to conduct these measurements.

In order to ensure there is sufficient conservativeness for demonstrating compliance until practical solutions are available, additional measurement considerations are necessary to address these technical difficulties. When measurements are required in tight regions or along steep curved surfaces of the SAM phantom, the measured SAR distribution is often truncated. While measurements with truncated SAR distributions may be repeated using a properly rotated SAM phantom, the rotated SAM configuration is generally unacceptable when measurements are required in the mouth or jaw regions. Under these circumstances, the following procedures, per FCCKDB 648474 D04_v01, apply:

The SAR measurement should be repeated using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone is lowered from the phantom to establish the same separation distance between the peak SAR location identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone should be determined by the straight line passing perpendicularly through the phantom surface. If it is not feasible to maintain 4 mm separation at the ERP while establishing the required separation at the peak SAR location, the top edge of the phone should be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone must not be tilted to the left or right while placed in this inclined position to the flat phantom.

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5 DESCRIPTION OF THE TEST EQUIPMENT

5.1 Dosimetric System

The measurements were performed with an automated near-field scanning system (as shown in Figure 5.1), DASY4/5, manufactured by Schmid & Partner Engineering AG (SPEAG) of Zurich, Switzerland. The system is comprised of high precision robot, robot controller, computer, near-field probe, probe alignment sensor and the SAM phantom containing brain or muscle equivalent material. The measurement uncertainty budget is given in section 8.

Below is a list of the calibrated equipment used for the measurements:

Test Equipment	Serial Number	Cal. Due Date	Used
DAE4	675	05-23-13	☒
DAE4	603	09-12-13	☒
DAE4	530	05-30-13	☒
E-field Probe ET3DV6	1618	09-13-13	☒
E-field Probe ES3DV3	3035	02-22-13	☒
E-field Probe ES3DV3	3036	05-29-13	☒
E-field Probe ES3DV3	3078	07-19-13	☐
Dipole Validation kit, D835V2	467	09-12-14	☒
Dipole Validation kit, D1700V2	220	09-15-13	☐
Dipole Validation kit, D1900V2	5d016	09-14-14	☒
Dipole Validation kit, D2450V2	776	07-09-14	☐

The calibration records of E-field probe and dipoles are attached in Appendix C and Appendix D respectively.

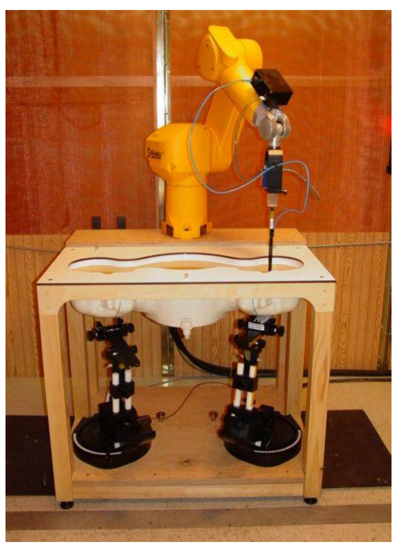

Figure 5.1 DASY 4/5 System

5.1.1 Extended SAR Dipole Calibrations

Dipoles are calibrated on a 2-year intervals. Return-loss and input impedances are measured annually to confirm in maintaining requirements per KDB Publication 450824 DO2, Dipole SAR Validation Verification v01:

- Return Loss is <-20dB or within 20% of calibrated measurement
- Impedance is within 5Ω of calibrated measurement

1700 MHz - HEAD						
Dipole S/N	**Date**	**Description**	**Return Loss (dB)**	**Impedance (Ω)**		**Comments**
				Real	***Img***	
220	**09/15/11**	**Target**	**-27.6**	**48.4**	**-3.8**	Within 1 year of calibration
	N/A					
	Delta					

5.2 Additional equipment needed in validation

Test Equipment	Serial Number	Cal. Due Date
Communication Test Set Agilent 8960	US41070147	02-24-14
Signal Generator, Agilent E4438C	MY44270167	05-16-13
Power meter, Giga-tronics 8541C	1833762	11-20-13
Power Sensor, Giga-tronics 80601A	1831776	05-16-13
Network Analyzer, Agilent E5062A	MY44100250	05-16-13
Electronic Calibration Module, Agilent	1763	05-16-13
Thermometer	186700	08-03-13
Dielectric Probe, HP 85070E	--	No cal required

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5.3 Tissue Stimulants

All dielectric parameters of tissue stimulants were measured within 24 hours of SAR measurements. The depth of the tissue stimulant in the ear reference point and flat reference point of the phantom were at least 15 cm. during all the tests. The depth of the liquid is measured by running a program that brings the probe to the bottom surface of the phantom then raise it up 15 centimeters. The operator at this point performs a visual inspection and makes sure that the liquid level is at or above the probe tip.

The list of ingredients and the percent composition used for the Head and Muscle tissue simulates are listed in the table below:

	835 MHz		1700 MHz		1900 MHz		2450 MHz	
INGREDIENT	***HEAD***	***MUSCLE***	***HEAD***	***MUSCLE***	***HEAD***	***MUSCLE***	***HEAD***	***MUSCLE***
Water	51.07%	65.45%	56.6%	68%	54%	69.91%	55 %	68.64%
Cellulose	0.23%	--	--	--	--	--	--	--
Glycol monobuthyl	--	--	43%	31.5%	44.91%	29.96%	45%	31.37%
Sugar	47.31%	34.31%	--	--	--	--	--	--
Preventol	0.24%	0.1%	--	--	--	--	--	--
Salt	1.15%	0.62%	0.4%	0.5%	0.21%	0.13%	--	--

The ingredients above are adopted from Application Note: Recipes for Head/Muscle Tissue Simulating Liquid by SPEAG.

5.4 Phantoms Description

SAM v4.0 phantom, manufactured by SPEAG, was used during the measurement. It has fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined in IEEE 1528/D1.2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference markings on the phantom allow the complete set-up of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

The thickness of phantom shell is 2mm except for the ear, where an integrated ear spacer provides 6mm spacing from the tissue boundary. Manufacturer reports tolerance in shell thickness to be ± 0.1mm.

Figure 5.4 SAM Twin Phantom

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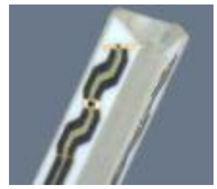
5.5 Isotropic E-Field Probe

Model:	• ET3DV6 
Construction:	• Symmetrical design with triangular core • Built-in optical fiber for surface detection system • Built-in shielding against static charges • PEEK enclosure material (resistant to organic solvents, e.g., glycol)
Calibration:	• Calibration certificate in Appendix C
Frequency:	• 10MHz to 3GHz (dosimetry); Linearity: ± 0.2dB (30MHz to 3GHz)
Optical Surface:	• ± 0.2mm repeatability in air and clear liquid over diffuse reflecting
Detection:	• Surface
Directivity:	• ± 0.2dB in HSL (rotation around probe axis) • ± 0.4dB in HSL (rotation normal to probe axis)
Dynamic Range:	• 5 uW/g to > 100 mW/g; Linearity: ± 0.2dB
Dimensions:	• Overall length: 330mm • Tip length: 16mm • Body diameter: 12mm • Tip diameter: 6.8mm • Distance from probe tip to dipole centers: 2.7mm
Application:	• General dosimetry up to 3GHz • Compliance tests of mobile phones • Fast automatic scanning in arbitrary phantoms.

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6 SYSTEM VALIDATION

The probes are calibrated annually by the manufacturer. Dielectric parameters of the stimulating liquids are measured with an automated Hewlett Packard 85070E dielectric probe in conjunction with an Agilent E5062A ENA serial network analyzer.

The SAR measurements of the device were done within 24 hours of system accuracy verification, which was done using the dipole validation kit. Power level of 20dBm was supplied to a dipole antenna placed under the flat section of SAM phantom. The validation results are in the table below and printouts of the validation test are attached in Appendix A. All the measured parameters are within the specification.

The system validation with head tissues was used for the device testing in muscle. Based on OET 65 Supplement C EAB Part 22/27/24 SAR review Reminder Sheet 01/2002, this is a valid test.

System/Tissue Verification - HEAD

Freq. (MHz)	Date	Description	Validation SAR (mW/g), 1g	Dielectric Parameters ε_r	Dielectric Parameters σ (S/m)	Temp. (°C)	Comments
835			FCC Reference*:	**41.50**	**0.90**	**20-26**	
	09/12/12	**Target**	**0.957**				From Speag Certificate
	02/20/13	Measured	0.96	40.50	0.91	22±1	For device testing in Head.
1900			FCC Reference*:	**40.00**	**1.40**	**20-26**	
	09/14/12	**Target**	**3.98**				From Speag Certificate
	02/18/13	Measured	3.74	38.45	1.45	22±1	For device testing in Head.
	04/15/13	Measured	3.88	38.70	1.43	22±1	For device testing in Head.

System/Tissue Verification - BODY

Freq. (MHz)	Date	Description	Validation SAR (mW/g), 1g	Dielectric Parameters ε_r	Dielectric Parameters σ (S/m)	Temp. (°C)	Comments
835			FCC Reference*:	**55.20**	**0.97**	**20-26**	
	09/12/12	**Target**	**0.958**				From Speag Certificate
	03/14/13	Measured	0.97	54.10	0.95	22±1	For device testing in Muscle
	03/15/13	Measured	0.97	53.90	0.95	22±1	For device testing in Muscle
1900			FCC Reference*:	**53.30**	**1.52**	**20-26**	
	09/14/12	**Target**	**4.11**				From Speag Certificate
	02/21/13	Measured	3.74	51.26	1.53	22±1	For device testing in Muscle
	02/22/13	Measured	3.86	52.50	1.55	22±1	For device testing in Muscle

*FCC reference values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

When applicable, the measured 10g SAR were verified within 10% of the expected target values for Hand SAR measurements.

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7 DESCRIPTION OF THE TEST PROCEDURE

Measurements were made on both left hand side and right hand side of the phantom.

The device was position against phantom according to OET Bulletin 65 (97-01) Supplement C (01-01). Definitions of terms used in aligning the device to a head phantom are available in IEEE Standard P1528/D1.2 "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

7.1 Test Positions

The device was placed in the holder. The bottom of the device aligns with the bottom of the holder clamp to provide a standard positioning and ensure enough free space for antenna.

Device holder was provided by SPEAG together with DASY4.

7.1.1 Initial Ear Position

The device was initially positioned with the earpiece region pressed against the ear spacer of a head phantom parallel to the "Neck-Front" (N-F) line defined along the base of the ear spacer that contains the "Ear Reference Point" (ERP). The "test device reference point" (point A) is aligned to the ERP on the head phantom and the "vertical centerline" is aligned to the "phantom reference plane".

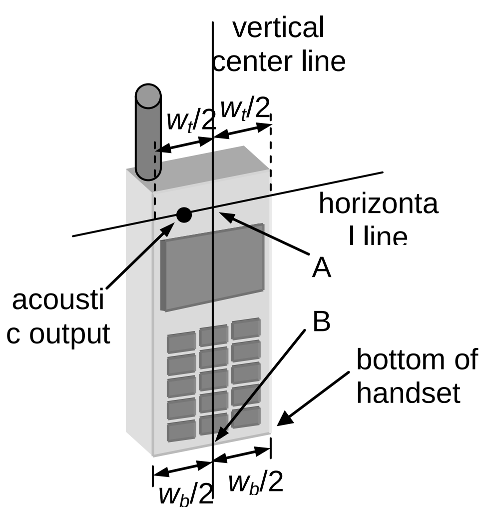

Figure 7-1a – Handset vertical and horizontal reference lines.

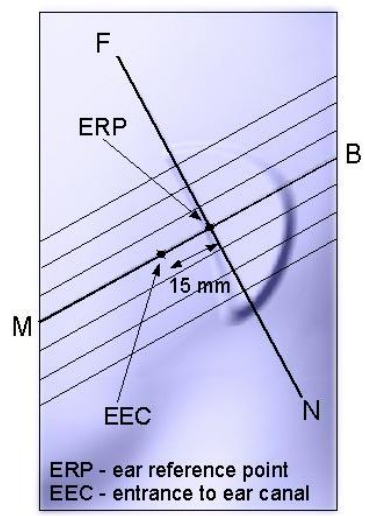

Figure 7-1b - Close up side view of phantom showing the ear region.

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7.1.2 Cheek Position

"Initial ear position" alignments are maintained and the device is brought toward the mouth of the head phantom by pivoting along the "Neck-Front" line until any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom or when any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

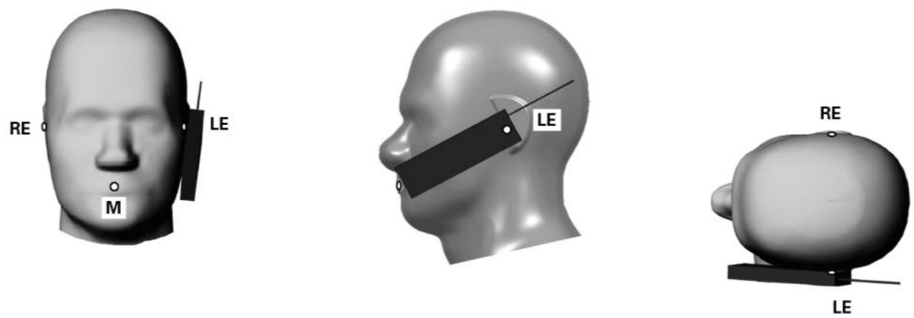

Figure 7.1c - Phone position 1, "cheek" or "touch" position.

7.1.3 Tilt Position

In the "cheek position", if the earpiece of the device is not in full contact with the phantom's ear spacer and the peak SAR location for the "cheek position" is located at the ear spacer region or corresponds to the earpiece region of the handset, the device is returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer. Otherwise, the device is moved away from the cheek perpendicular to the line passes through both "ear reference points" for approximate 2-3cm. While it is in this position, the device is tilted away from the mouth with respect to the "test device reference point" by 15^{o}. After the tilt, it is then moved back toward the head perpendicular to the line passes through both "ear reference point" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process is repeated with a tilt angle less than 15^{o} so that the device and its antenna would touch the phantom simultaneously.

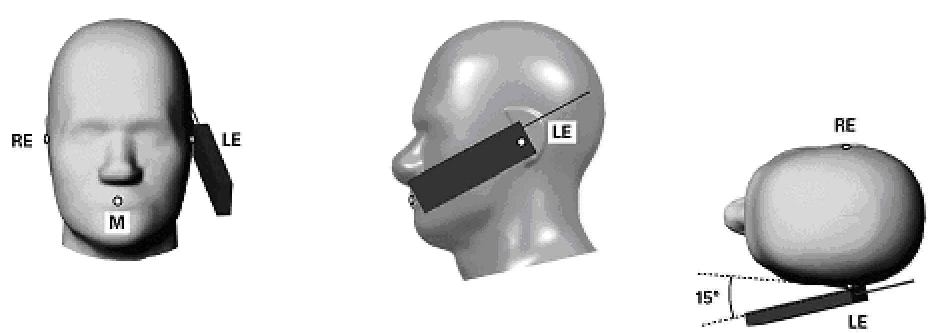

Figure 7.1d - Phone position 2, "tilted" position.

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7.1.4 Body Worn Configuration

Body worn accessories, when available, were tested for the FCC RF exposure compliance. The device was positioned into the carrying case and placed below the flat phantom. Hands-free headset was connected during measurements.

The SAR levels were also measured with air space for the hands-free application, which allow user to use other body-worn accessories that contains no metal and provides at least specified separation from the closest point of the handset to the body.

7.2 Scan Procedures

First, coarse scans are used for a quick determination of the field distribution. Then an area scan measures all reachable points, it computes all of the field maxima found in the scanned area, within a range of 2dB as specified in IEEE P1528, (see the configuration below). For cases where multiple maxima were detected, the number of zoom scans could be increased accordingly.

Next in order to determine the EMfield distribution in a three-dimensional spatial extension, Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 1g. If two peaks are within 2dB of the highest one, two zoom scans are performed to provide the evaluations.

According to KDB 865664D01v01, the resolution for Area and Zoom scan is specified as table below:

Frequency (GHz)			≤ 2	2 – 3	3 – 4	4 – 5	5 – 6
Area Scan (Δx, Δy),(mm)			≤ 15	≤ 12	≤ 12	≤ 10	≤ 10
Zoom Scan (Δx, Δy), (mm)			≤ 8	≤ 5	≤ 5	≤ 4	≤ 4
Zoom Scan (Δz), (mm)	**Uniform grid (n)**		≤ 5	≤ 5	≤ 4	≤ 3	≤ 2
	Graded grid	**(1)**	≤ 4	≤ 4	≤ 3	≤ 2.5	≤ 2
		(n>1)	≤ B	≤ B	≤ B	≤ B	≤ B
Zoom Scan Volume (x, y, z), (mm)			≥ 30	≥ 30	≥ 28	≥ 25	≥ 22

Note: B=≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$

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7.3 SAR Averaging Methods

The maximum SAR value is average over its volume using interpolation and extrapolation.

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the “Not a knot” –condition [W. Gander, Computermathematik, p. 141-150] (x, y and z – directions) [numerical Recipes in C, Second Edition, p 123].

The extrapolation is based on least square algorithm [W. Gander, Computermathematik, p. 168-180]. Through the points in the first 30mm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1mm from one another.

8 SAR MEASUREMENT VARIABILITY

8.1 Measurement Variability

Per FCC KDB 865664 D01 v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band.

SAR measurement variability was accessed using the following procedures for each frequency band:

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

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9 MEASUREMENT UNCERTAINTY

Table 8.1 shows the uncertainty budget for SAR assessment according to IEEE P1528.

Uncertainty Description	Uncert. Value (± %)	Prob. Dist.	Div	C_i^1 1g	Stand. Uncert (1g) (±%)	V_i^2 or V_{eff}
Measurement system						
Probe calibration	5.9	N	1	1	5.9	∞
Axial isotropy	4.7	R	√3	0.7	1.9	∞
Hemispherical Isotropy	9.6	R	√3	0.7	3.9	∞
Boundary effects	1.0	R	√3	1	0.6	∞
Linearity	4.7	R	√3	1	2.7	∞
System Detection limit	1.0	R	√3	1	0.6	∞
Readout Electronics	0.3	N	1	1	0.3	∞
Response Time	0.8	R	√3	1	0.5	∞
Integration Time	2.6	R	√3	1	1.5	∞
RF ambient conditions	3.0	R	√3	1	1.7	∞
Mech. Constrains of robot	0.4	R	√3	1	0.2	∞
Probe po itioning	29	R	√3	1	1.7	∞
Max. SAR Evaluation (ext., int., avg.)	1.0	R	√3	1	0.6	∞
Test Sample Related						
Device positioning	3.0	N	1	1	.0	∞
Device Holder	3.6	N	1	1	3.6	∞
Power drift	5.0	N	√3	1	2.9	∞
Phantom and setup						
Phantom uncertainty	4.0	R	√3	1	2.3	∞
Liquid conductivity (target)	5.0	R	√3	0.64	1.8	∞
Liquid conductivity (meas.)	3.5	N	1	0.64	2.2	∞
Liquid permittivity (target)	0		√3	0.6	1.7	∞
Liquid permittivity (meas.)	3.5	N	1	0.6	2.1	∞
Combined Standard Uncertainty:					**11.0**	
Extended Standard Uncert inty (=2):					**22.1**	

N: Normal
R: Rectangular

Table 8.1 Worst-Case uncertainty budget for SAR assessment

10 TEST DATA

10.1 Conducted Power Results

The following tables list the conducted power results in each configuration and operating mode.

10.1.1 CDMA

CONFIGURATION (Full Rate) Average		CONDUCTED POWER (dBm)					
		CDMA 800 BC-0			CDMA 1900 BC-1		
		Ch 1013	**Ch 384**	**Ch 777**	**Ch 25**	**Ch 600**	**Ch 1175**
SO2	RC1	24.40	24.20	24.31	24.20	24.38	24.20
	RC3	24.39	24.23	24.32	24.22	24.38	24.19
SO55	RC1	24.40	24.22	24.32	24.22	24.39	24.21
	RC3	**24.41**	**24.25**	**24.34**	**24.23**	**24.38**	**24.20**
TDSO SO32	RC3 (+SCH)	24.45	24.24	24.43	24.29	24.37	24.35
	RC3 (+FCH-SCH)	24.45	24.27	24.42	24.34	24.38	24.34

10.2 Standalone Head SAR Test Results

The following tables list the SAR results in each configuration and operating mode. The channels tested for each configuration have similar SAR distributions. Highest SAR (bold blue color) plots for each configuration is provided in Appendix B.

10.2.1 Cellular BC-0

CDMA 800 BC-0 Head				Mode: RC3/SO55	Phone: Open	
Test Position	Ch	Max Tune-up power (dBm)	Measured Power (dBm)	Scaling Factor	Measured SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
Left Cheek	1013	25.2	24.41	1.20	0.35	0.42
Left Tilt	1013	25.2	24.41	1.20	0.15	0.18
Right Cheek	1013	25.2	24.41	1.20	0.39	**0.47**
Right Tilt	1013	25.2	24.41	1.20	0.19	0.23

Note:
1. Battery used: ☒ Standard ☐ Extended
2. ☒ SAR Test Reduction procedures applied. SAR is performed on the highest power channel. When the reported SAR value of highest power channel is ≤ 0.8 W/kg, SAR testing for optional channel is not required.

10.2.2 PCS BC-1

CDMA 1900 BC-1 Head				Mode: RC3/SO55	Phone: Open	
Test Position	Ch	Max Tune-up power (dBm)	Measured Power (dBm)	Scaling Factor	Measured SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
Left Cheek	25	24.7	24.23	1.11	1.40	**1.56**
Left Cheek	600	24.7	24.38	1.08	1.45	**1.56**
Left Cheek	1175	24.7	24.20	1.12	0.87	0.98
Left Tilt	600	24.7	24.38	1.08	0.18	0.19
Right Cheek	600	24.7	24.38	1.08	0.59	0.64
Right Tilt	600	24.7	24.38	1.08	0.13	0.14
Jaw	600	24.7	24.38	1.08	0.55	0.59

Note:
1. Battery used: ☒ Standard ☐ Extended
2. ☒ SAR Test Reduction procedures applied. SAR is performed on the highest power channel. When the reported SAR value of highest power channel is ≤ 0.8 W/kg, SAR testing for optional channel is not required.

10.3 Standalone Body-Worn SAR Test Results

10.3.1 Cellular BC-0

CDMA 800 BC-0 Body-15mm				Mode:	RC3/SO55	Phone:	Closed
Test Position	Ch	Max Tune-up power (dBm)	Measured Power (dBm)	Scaling Factor	Measured SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)	
Front	1013	25.2	24.41	1.20	0.52	0.62	
Back	1013	25.2	24.41	1.20	1.18	**1.42**	
Back	384	25.2	24.25	1.24	1.15	1.43	
Back	777	25.2	24.34	1.22	1.02	1.24	

CDMA 800 BC-0 Body-15mm				Mode:	RC3/SO55	Phone:	Open
Test Position	Ch	Max Tune-up power (dBm)	Measured Power (dBm)	Scaling Factor	Measured SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)	
Back	1013	25.2	24.41	1.20	0.92	1.10	
Back	384	25.2	24.25	1.24	0.83	1.03	
Back	777	25.2	24.34	1.22	0.80	0.98	

Note:

1. Battery used: ☒ Standard ☐ Extended
2. ☒ SAR Test Reduction procedures applied. SAR is performed on the highest power channel. When the reported SAR value of highest power channel is ≤ 0.8 W/kg, SAR testing for optional channel is not required.

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10.3.2 PCS Band

CDMA 1900 BC-1 Body-15mm				Mode:	RC3/SO55	Phone: Closed
Test Position	Ch	Max Tune-up power (dBm)	Measured Power (dBm)	Scaling Factor	Measured SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
Front	600	24.7	24.38	1.08	0.28	0.30
Back	25	24.7	24.23	1.11	1.03	1.15
Back	600	24.7	24.38	1.08	1.13	**1.22**
Back	1175	24.7	24.20	1.12	0.76	0.85

CDMA 1900 BC-1 Body-15mm				Mode:	RC3/SO55	Phone: Open
Test Position	Ch	Max Tune-up power (dBm)	Measured Power (dBm)	Scaling Factor	Measured SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
Back	600	24.7	24.38	1.08	0.72	0.78

Note:

1. Battery used: ☒ Standard ☐ Extended
2. ☒ SAR Test Reduction procedures applied. SAR is performed on the highest power channel. When the reported SAR value of highest power channel is ≤ 0.8 W/kg, SAR testing for optional channel is not required.

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10.4 SAR Measurement Variability Results

10.4.1 Head and Body

Band	Ch	Mode	Test Position	Config.	Original Measured SAR	1st Repeated SAR-1g	Ratio	2nd Repeated SAR-1g	Ratio	3rd Repeated SAR-1g	Ratio
CDMA BC-0	1013	RC3/SO55	Body	Open	1.18	1.20	1.02		0.00		N/A
CDMA BC-1	600	RC3/SO55	Left Cheek	Open	1.45	1.31	1.11	1.40	1.11		N/A

Note:

a) All measured SAR values should be rounded to two decimal digits for comparison with the required thresholds.

b) The measured SAR results do not have to be scaled to the maximum tune-up tolerance to determine if repeated measurements are required.

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11 SIMULTANEOUS TRANSMISSION SAR ANALYSIS

11.1 Head Simultaneous SAR Analysis

Condition (SAR1+SAR2)	Test Position	SAR1	SAR2	∑ SAR (W/kg)	SPLSR
CDMA BC-0 + BT	Left Cheek	0.42	N/A	0.42	--
	Left Tilt	0.18	N/A	0.18	--
	Right Cheek	0.47	N/A	0.47	--
	Right Tilt	0.23	N/A	0.23	--
CDMA BC-1 + BT	Left Cheek	1.56	N/A	1.56	--
	Left Tilt	0.19	N/A	0.19	--
	Right Cheek	0.64	N/A	0.64	--
	Right Tilt	0.14	N/A	0.14	--
	Jaw	0.55	N/A	0.55	--

Note: —: Test not required
N/A: Not Applicable

11.2 Body Simultaneous SAR Analysis

Condition (SAR1+SAR2)	Test Position	SAR1	SAR2	∑ SAR (W/kg)	SPLSR
CDMA BC-0 + BT	Back	1.43	0.04	**1.47**	--
CDMA BC-1 + BT	Back	1.22	0.04	1.26	--

Note: —: Test not required
N/A: Not Applicable

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12 LIST OF APPENDIX

Appendix	Description	Note
A	Validation Test Plots	*Please see separate attachment*
B	SAR Distribution Plots	*Please see separate attachment*
C	Probe Calibration Certificate	*Please see separate attachment*
D	Dipole Calibration Certificate	*Please see separate attachment*
E	EUT Setup Photos	*Please see separate attachment*

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