SAMSUNG ELECTRONICS Co., Ltd.,
Regulatory Compliance Group
IT R&D Center

416, Maetan-3dong,
Yeongtong-gu, Suwon-si,
Gyeonggi-do, Korea 443-742

TEST REPORT ON SAR

Model Tested:	**GT-B5330B**
FCC ID (Requested):	**A3LGTB5330B**
Job No:	**FJ-154**
Report No:	**FJ-154-S1**

- Abstract –

This document reports on SAR Tests carried out in accordance with FCC/OET Bulletin 65, Supplement C(June 2001).

Prepared By

JO LEE - Test Engineer

Authorized By

JD JANG - Technical Manager

Contents

1. GENERAL INFORMATION

Test Dates :	Jun.04, 2012 ~ Jun.08, 2012
Manufacturer :	SAMSUNG ELECTRONICS Co., Ltd.
Address :	416 Maetan3-Dong, Suwon City, Korea
Test Standard :	§2.1093; FCC/OET Bulletin 65, Supplement C(June 2001)
FCC Classification :	Licensed Portable Transmitter Held to Ear (PCE) Digital Transmitter System (DTS)
Tested for :	FCC/TCB Certification

2. DESCRIPTION OF DEVICE

Test Sample :	850/1900 GSM/GPRS, 850 WCDMA/HSDPA Phone with Bluetooth, WLAN and EDGE Rx only
Model Number :	GT-B5330B
Serial Number :	Identical prototype (S/N : # FJ-154-A)
Tx Freq.Range :	824.2 ~ 848.8 MHz (GSM850) 1850.20 ~ 1909.80 MHz (GSM1900) 826.4 ~ 846.6 MHz (WCDMA850) 2412 ~ 2462 MHz (WLAN)
Rx Freq.Range :	869.2 ~ 893.8 MHz (GSM850) 1930.20 ~ 1989.80 MHz (GSM1900) 871.4 ~ 891.6 MHz (WCDMA850) 2412 ~ 2462 MHz (WLAN)
Antenna Manufacturer :	Partron Model No.: Main Ant.
Antenna Dimensions :	53.27*18.88*7.4(mm)
Separation distance between Main and Bluetooth antenna :	81mm

3. DESCRIPTION OF TEST EQUIPMENT

3.1 SAR Measurement Setup

Robotic System

Measurements are performed using the DASY4 (or DASY5) automated dosimetric assessment system. Which is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Stäubli), robot controller, measurement server, Samsung computer, near-field probe, probe alignment sensor, and the SAM twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 3.1).

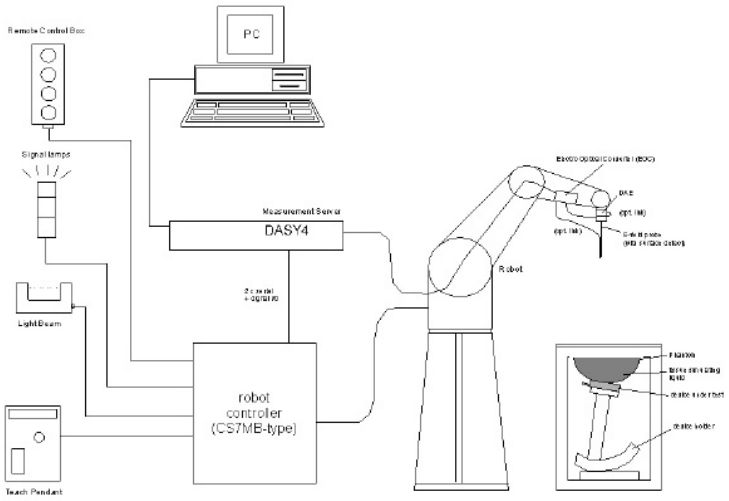


Figure 3.1 SAR Measurement System Setup

System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control is used to drive the robot motors. The PC consists of the Samsung computer with Windows XP system and SAR Measurement Software DASY4 (or DASY5), LCD monitor, mouse and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the measurement server.

System Electronics

The DAE4(or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

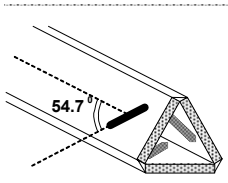
3.2 E-field Probe

Figure 3.2 DAE System

The SAR measurement were conducted with the dosimetric probe ES3DV2, ES3DV3, EX3DV4 and ET3DV6, designed in the classical triangular configuration (see Fig.3.3) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Fig.3.2). The approach is stopped at reaching the maximum.

Probe Specifications

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Basic Broad Band Calibration in air: 10-3000 MHz Conversion Factors (CF) for HSL 900 and HSL 1800



Δ - BEAM

Figure 3.3 Triangular Probe Configuration

Additional CF for other liquids and frequencies upon request

Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity **[ES3DV3], [ET3DV6]**

± 0.2 dB in HSL (rotation around probe axis)

± 0.3 dB in tissue material (rotation normal to probe axis)

[EX3DV4]

± 0.3 dB in HSL (rotation around probe axis)

± 0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range **[ES3DV3], [ET3DV6]**

5μW/g to > 100mW/g; Linearity: ± 0.2dB

[EX3DV4]

10 μW/g to > 100 mW/g; Linearity: ± 0.2 dB

Dimensions **[ES3DV3], [ES3DV2]**

Overall length: 330 mm (Tip: 20 mm)

Tip diameter: 3.9 mm (Body: 12 mm)

Distance from probe tip to dipole centers: 2.1 mm

[ES3DV3] ,[ES3DV2]

[EX3DV4]

Overall length: 330 mm (Tip: 20 mm)

Tip diameter: 2.5 mm (Body: 12 mm)

Typical distance from probe tip to dipole centers: 1 mm

[ET3DV6]

Overall length: 330mm

Tip length: 16mm

Body diameter: 12mm

Tip diameter: 6.8mm

Distance from probe tip to dipole centers: 2.7mm

[EX3DV4]

Application	**[ES3DV3], [ES3DV2]** General dosimetry up to 5 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones **[EX3DV4]** High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields).Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30 %. **[ET3DV6]** General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms
Optical Surface Detection	**[ET3DV6]** ± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces

[ET3DV6]

3.3 Phantom

SAM Twin Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid.

Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. (See Figure 3.5)

Figure3.5 SAM Twin Phantom

SAM Twin Phantom Specification

Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, EN 50361:2001 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Height: 810 mm; Length: 1000 mm; Width: 500 mm

Modular Flat Phantom

The Modular Flat Phantom V5.1 is constructed of a fiberglass shell integrated in a wooden table. Also It consists of three identical flat phantoms (modules) which can be installed and removed separately without emptying the liquid, as well as a wooden support.. It enables the dosimetric evaluation of body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid.

Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. (See Figure 3.6)

Figure 3.6 Modular Flat Phantom

Modular Flat Phantom Specification

Construction	The shell corresponds to the specifications of IEEE 1528-2003. It enables the dosimetric evaluation of body mounted usage above 800 MHz at the flat phantom region. A cover prevents evaporation of the liquid
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 10 liters
Dimension	Wooden support - Height: 810 mm; Length: 830 mm; Width: 500 mm Each Module - Height:190 mm; Length: 200 mm; width: 300 mm

3.4 Brain Simulating Mixture Characterization

The brain mixtures consist of a viscous gel using hydroxethylcellullose (HEC) gelling agent and saline solution (see Table 3.1). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue.

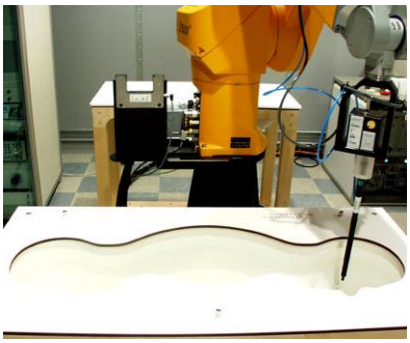


Figure 3.7 Simulated Tissue

Table 3.1 Composition of the Brain Tissue Equivalent Matter

INGREDIENTS	835MHz Brain	835MHz Muscle	1900MHz Brain	1900MHz Muscle	2450MHz Brain	2450MHz Muscle
WATER	40.29%	50.75%	55.24%	70.23%	62.7%	73.2%
SUGAR	57.90%	48.21%	-	-	-	-
SALT	1.38%	0.94%	0.24%	0.21%	-	0.04%
TWEEN20	-	-	44.52%	29.56%	37.3%	26.76%
BACTERIACIDE	0.18%	0.10%	-	-	-	-
HEC	0.25%	-	-	-	-	-
Dielectric Constant Target	41.50	55.20	40.00	53.30	39.2	52.7
Conductivity Target (S/m)	0.900	0.970	1.400	1.520	1.80	1.95

3.5 Device Holder for Transmitters

In combination with the Twin SAM Phantom V4.0, the Mounting Device (see Fig. 3.7) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately and repeatedly be positioned according to the EN 50360:2001 and FCC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Figure 3.8 Device Holder

*Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configuration. To produce worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

3.6 Validation Dipole

The reference dipole should have a return loss better than –20 dB (measured in the setup) at the resonant frequency to reduce the uncertainty in the power measurement.

Frequency	835, 1900, 2450 MHz
Return Loss	< -20 dB at specified validation position
Dimensions	D835V2: dipole length: 161 mm; overall height: 330 mm D1900V2: dipole length: 68 mm; overall height: 300 mm D2450V2: dipole length: 51.8 mm; overall height: 300 mm

Note:

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibration in KDB 450824

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3.7 Equipment Calibration

Table 3.2 Test Equipment Calibration

Type	Calibration Due Date	Serial No.
SPEAG E-Field Probe EX3DV4	Jan.27, 2013	3752
SPEAG DAE4	Jan.19, 2013	486
SPEAG Validation Dipole D835V2	Nov.18, 2013	4d111
SPEAG Validation Dipole D1900V2	Jan.26, 2014	5d023
SPEAG Validation Dipole D2450V2	Feb.23, 2013	807
Stäubli Robot TX90XL	Not Required	F06/546ZA1/A/01
SPEAG SAM Twin Phantom V4.0	Not Required	TP-1364
SPEAG SAM Twin Phantom V4.0	Not Required	TP-1604
Modular Phantom	Not Required	MP-1010
E4438C Signal Generator	Jan.19, 2013	MY45094010
NRVD Dual Channel Power Meter	Feb.10, 2013	836416/028
NRV-Z53 Thermal Power Sensor	Feb.10, 2013	835324/001
NRV-Z53 Thermal Power Sensor	Feb.10, 2013	835324/006
E4419B Power Meter	Nov.08, 2012	GB43312299
E9300B Power Sensor	Feb.13, 2013	MY41495557
BBS3Q7ECK Power Amp	Jan.18, 2013	1052
HP-8753ES Network Analyzer	Apr.16, 2013	US39173712
HP85070C Dielectric Probe Kit	Not Required	US99360087
Digital thermo-hygrometer	Feb.10, 2013	1367
Digital thermo-hygrometer	Feb.10, 2013	1375
DASY5 S/W (ver 5.0)	Not Required	-
E4440A Spectrum Analyzer	Feb.20, 2013	MY45304704
778D Dual Directional Coupler	Dec.02, 2012	50189
777D Dual Directional Coupler	Feb.20, 2013	07526
Base Station Simulator	Jan.18, 2013	GB45360270
Spectrum Analyzer	Mar.08,2013	MY46187454
Communication tester(E5515C)	Nov.27,2012	GB42230535
11636B	Jul.05,2012	51942

NOTE:
The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Validation measurement is performed by Samsung Lab. before each test. (see § 7.2) The brain simulating material is calibrated by Samsung using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material. (see § 7.1)

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4. SAR MEASUREMENT PROCEDURE

The evaluation was performed using the following procedure.

STEP 1

The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

STEP 2

The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20mm x 20mm. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

STEP 3

Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluated the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

STEP 4

The SAR value at the same location as in step 1 was again measured.

(If the value changed by more than 5%, the evaluation is repeated.)

5. DESCRIPTION OF TEST POSITION

5.1 SAM Phantom Shape

Figure 5.1 shows the front, back and side views of SAM. The point “M” is the reference point for the center of mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERPs are 15 mm posterior to the entrance to ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5.2.

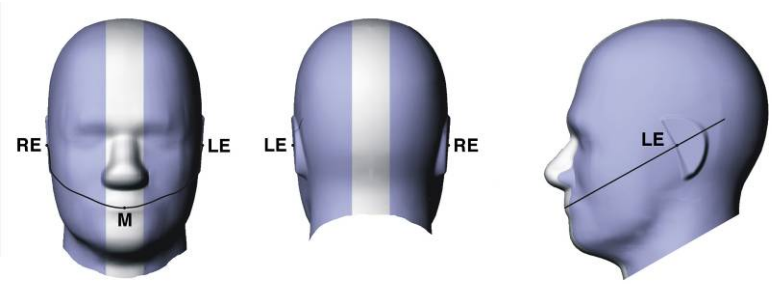


Figure 5.1 Front, back and side view of SAM

The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 5.3). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines should be marked on the external phantom shell to facilitate handset positioning. Posterior to the N-F line, the thickness of the phantom shell with the shape of an ear is a flat surface 6 mm thick at the ERPs.

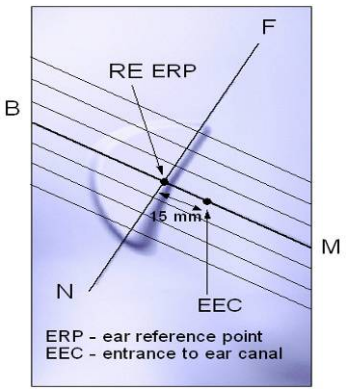
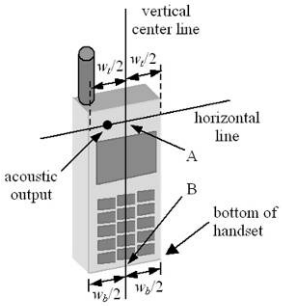


Figure 5.2 Close up side view

5.2 “cheek” Position

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (see Fig. 5.4). The “test device reference point” was than located at the same level as the center of the eat reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at it’s tip and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point



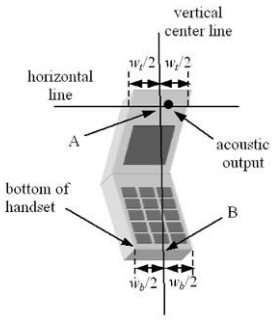


Figure 5.4 Handset vertical and horizontal reference lines

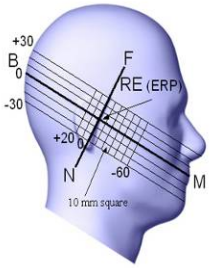


Figure 5.3 Side view of the phantom showing relevant markings

Step 1

The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 5.5), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom

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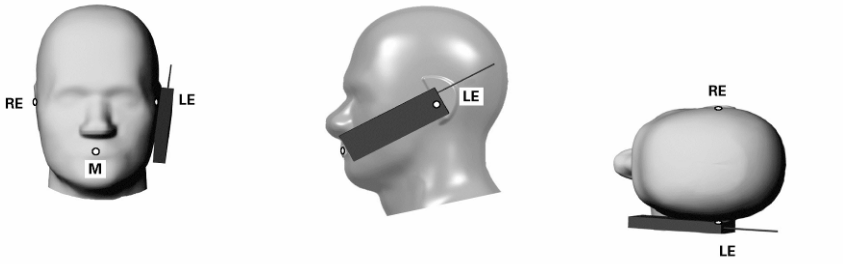

Figure 5.5 Front, Side and Top View of Cheek/Touch Position

Step 2

The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

Step 3

While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

Step 4

Rotate the handset around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.

Step 5

While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek). See Figure 5.2.

5.3 “tilted” Position

With the test device aligned in the “cheek” position :

Step 1

Repeat steps 1 to 5 of 5.2 to place the device in the “Cheek/Touch Position”

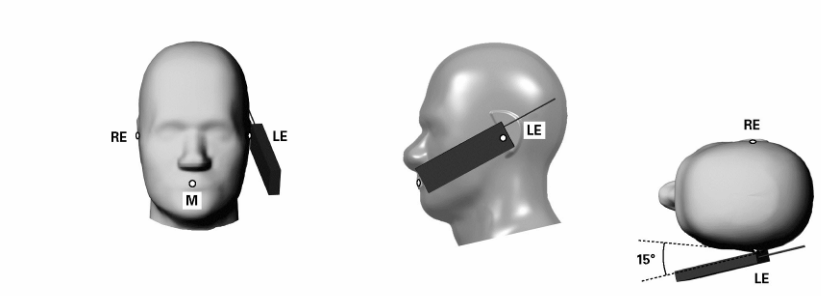

Figure 5.6 Front, side and Top View of Ear/Tilt 15° Position

Step 2

While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.

Step 3

The phone was then rotated around the horizontal line by 15 degree.

Step 4

While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head.

5.4 Body Holster/Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 5.7). A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains unique metallic component. If multiple accessory share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested. Body-worn accessories may not always be supplied or available as options for some Devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), Including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing. In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements must be included in the user's manual.

5.5 FCC Personal Wireless Router Configurations

5.5.1 Personal Wireless Router

Some battery-operated handsets have the capability to transmit and receive internet connectivity through simultaneous transmission of WIFI in conjunction with a separate licensed transmitter. The FCC has provided guidance in KDB Publication 941225 D06 for handsets greater than 9cm x 5cm where SAR test considerations are based on a composite test separation distance of 10mm from the edges, front and back of the device with antennas 2.5cm or closer to the edge of the device, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR test.

5.5.2 SAR test Setup for Personal Wireless Router Features

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus connot be evaluated for SAR under actual use conditions. Therefore, SAR must be evaluated for each frequency transmission and mode separately and summed with the WIFI transmitter according to KDB 648474 publication procedures. The “Portable Hotspot: feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

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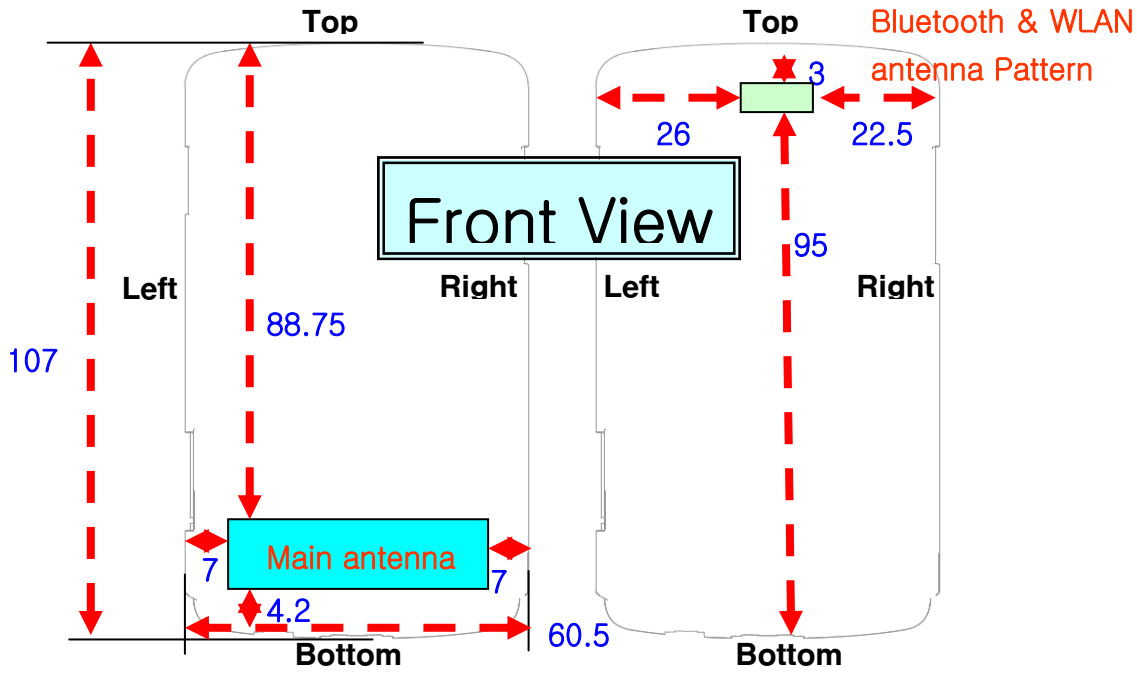
Table 5.1 Mobile Hotspot Sides for SAR Testing

Mode	Back	Front	Right	Left	Top	Bottom
GPRS850	Yes	Yes	Yes	Yes	No	Yes
GPRS1900	Yes	Yes	Yes	Yes	No	Yes
WCDMA850	Yes	Yes	Yes	Yes	No	Yes
WIFI	Yes	Yes	Yes	No	Yes	No



(Unit :mm)

Figure 5.7 Identification of Sides for SAR Testing

Note : Particular DUT edges were not necessary to be evaluated for Wireless Router SAR if the edges were greater than 2.5cm from the transmitting antenna according to FCC KDB Publication 941225 D06 guidance.

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6. MEASUREMENT UNCERTAINTY

Table 6.1 Uncertainty Budget at 835MHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	c_i	Standard uncertainty (±%)	v_i^2 or v_{eff}
Measurement System						
Probe Calibration	11.00	normal	2.000	1	5.50	∞
Axial Isotropy	4.70	rectangular	1.732	0.7	1.90	∞
Hemispherical Isotropy	9.60	rectangular	1.732	0.7	3.88	∞
Linearity	4.70	rectangular	1.732	1	2.71	∞
System Detection Limits	0.25	rectangular	1.732	1	0.14	∞
Boundary effects	1.00	rectangular	1.732	1	0.58	∞
Readout electronics	0.30	normal	1.000	1	0.30	∞
Response time	0.80	rectangular	1.732	1	0.46	∞
RF ambient conditions	3.00	rectangular	1.732	1	1.73	∞
Integration time	1.73	rectangular	1.732	1	1.00	∞
Mechanical constrains of robot	1.50	rectangular	1.732	1	0.87	∞
Probe positioning	2.90	rectangular	1.732	1	1.67	∞
Extrapolation and integration	1.00	rectangular	1.732	1	0.58	∞
Test Sample Related						
Test Sample positioning	1.12	normal	1.000	1	1.12	14
Device holded uncertainty	3.44	normal	1.000	1	3.44	∞
Power Drift	5.00	rectangular	1.732	1	2.89	∞
Phantom and Setup						
Modular Phantom uncertainty	5.62	normal	1.000	1	5.62	2
Phantom uncertainty	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 error)	0.38	normal	1.000	0.64	0.24	∞
Liquid permittivity (deviation from target)	5.00	rectangular	1.732	0.6	1.73	∞
Liquid permittivity (measurement error)	5.44	normal	1.000	0.6	3.26	∞
Combined Standard Uncertainty		Normal	-	-	**11.84**	**172776**
Extended Standard Uncertainty(K=2.00)					**23.69**	**172776**

Table 6.2 Uncertainty Budget at 1900MHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	c_i	Standard uncertainty (±%)	v_i^2 or v_{eff}
Measurement System						
Probe Calibration	11.00	normal	2.000	1	5.50	∞
Axial Isotropy	4.70	rectangular	1.732	0.7	1.90	∞
Hemispherical Isotropy	9.60	rectangular	1.732	0.7	3.88	∞
Linearity	4.70	rectangular	1.732	1	2.71	∞
System Detection Limits	0.25	rectangular	1.732	1	0.14	∞
Boundary effects	1.00	rectangular	1.732	1	0.58	∞
Readout electronics	0.30	normal	1.000	1	0.30	∞
Response time	0.80	rectangular	1.732	1	0.46	∞
RF ambient conditions	3.00	rectangular	1.732	1	1.73	∞
Integration time	0.00	rectangular	1.732	1	0.00	∞
Mechanical constrains of robot	1.50	rectangular	1.732	1	0.87	∞
Probe positioning	2.90	rectangular	1.732	1	1.67	∞
Extrapolation and integration	1.00	rectangular	1.732	1	0.58	∞
Test Sample Related						
Test Sample positioning	1.50	normal	1.000	1	1.50	14
Device holded uncertainty	3.44	normal	1.000	1	3.44	∞
Power Drift	5.00	rectangular	1.732	1	2.89	∞
Phantom and Setup						
Modular Phantom uncertainty	6.02	normal	1.000	1	6.02	2
Phantom uncertainty	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 error)	1.84	normal	1.000	0.64	1.18	∞
Liquid permittivity (deviation from target)	5.00	rectangular	1.732	0.6	1.73	∞
Liquid permittivity (measurement error)	4.54	normal	1.000	0.6	2.73	∞
Combined Standard Uncertainty		Normal	-	-	**12.00**	**60176**
Extended Standard Uncertainty(K=2.00)					**24.00**	**60176**

Table 6.3 Uncertainty Budget at 2450MHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	c_i	Standard uncertainty (±%)	v_i^2 or v_{eff}
Measurement System						
Probe Calibration	11.00	normal	2.000	1	5.00	∞
Axial Isotropy	4.70	rectangular	1.732	0.7	1.90	∞
Hemispherical Isotropy	9.60	rectangular	1.732	0.7	3.88	∞
Linearity	4.70	rectangular	1.732	1	2.71	∞
System Detection Limits	0.25	rectangular	1.732	1	0.14	∞
Boundary effects	1.00	rectangular	1.732	1	0.58	∞
Readout electronics	0.30	normal	1.000	1	0.30	∞
Response time	0.80	rectangular	1.732	1	0.46	∞
RF ambient conditions	3.00	rectangular	1.732	1	1.73	∞
Integration time	0.00	rectangular	1.732	1	0.00	∞
Mechanical constrains of robot	1.50	rectangular	1.732	1	0.87	∞
Probe positioning	2.90	rectangular	1.732	1	1.67	∞
Extrapolation and integration	1.00	rectangular	1.732	1	0.58	∞
Test Sample Related						
Test Sample positioning	4.22	normal	1.000	1	4.22	14
Device holded uncertainty	3.44	normal	1.000	1	3.44	∞
Power Drift	5.00	rectangular	1.732	1	2.89	∞
Phantom and Setup						
Modular Phantom uncertainty	2.32	Normal	1.0001	1	2.32	2
Phantom uncertainty	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 error)	2.04	normal	1.000	0.64	1.30	∞
Liquid permittivity (deviation from target)	5.00	rectangular	1.732	0.6	1.73	∞
Liquid permittivity (measurement error)	4.27	normal	1.000	0.6	2.56	∞
Combined Standard Uncertainty		Normal	-	-	**11.32**	**728**
Extended Standard Uncertainty(K=2.00)					**22.64**	**728**

7. SYSTEM VERIFICATION

7.1 Tissue Verification

Table 7.1 MEASURED TISSUE PARAMETERS

	835MHz Head		835MHz Body		1900MHz Head		1900MHz Body		2450MHz Head		2450MHz Body	
	Target	Measured	Target	Measured	Target	Measured	Target	Measured	Target	Measured	Target	Measured
Date	Jun.04, 2012		Jun.04, 2012		Jun.05, 2012		Jun.05, 2012		Jun.08, 2012		Jun.07, 2012	
Liquid Temperature(°C)	21.9		22.1		22.3		22.2		22.2		22.1	
Dielectric Constant: â'	41.5	41.6	55.2	55	40	39.4	53.3	52	39.2	39.2	52.7	51.8
Conductivity:	0.9	0.88	0.97	0.958	1.4	1.37	1.52	1.49	1.8	1.82	1.95	1.95
Tissue Batch Number	835DF4001C		835B1001V		1900F4001R		1900B2002L		2450MF4001I		2450B1001X	

The measured value must be within ±5% of the target value.

7.2 Test System Validation

Prior to assessment, the system is verified to the ±10% of the specification at 835MHz, 1900MHz and 2450MHz by using the system validation kit(s). (see Appendix D, Graphic Plot Attached)

Table 7.2 System Validation Results

System Validation Kit	Tissue	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)	Normalized SAR_{1g} (mW/g)	Deviation (%)	Date	Liquid Temperature(°C)	Ambient Temperature(°C)	Input Power (mW)
4d111	835MHz Brain	9.43	0.901	9.01	-4.45	Jun.04, 2012	21.9	22.4	100
	835MHz Body	9.54	0.954	9.54	0	Jun.04, 2012	22.1	22.4	100
5d023	1900MHz Brain	39	3.78	37.8	-3.08	Jun.05, 2012	22.3	22.7	100
	1900MHz Body	38.8	3.71	37.1	-4.38	Jun.05, 2012	22.2	22.6	100
807	2450MHz Brain	53.5	5.16	51.6	-3.55	Jun.08, 2012	22.2	22.7	100
	2450MHz Body	50.3	5.11	51.1	1.59	Jun.07, 2012	22.1	22.5	100

*Validation was measured with input power 100 mW and normalized to 1W.

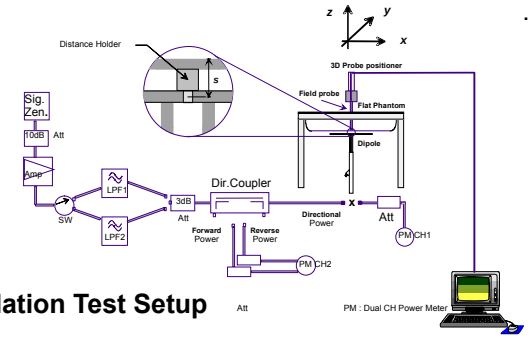

Figure 7.1 Dipole Validation Test Setup

8. SAR MEASUREMENT RESULTS

Procedures Used To Establish Test Signal

The handset was placed into simulated call mode using base station simulator. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR. When test modes are not available or inappropriate for testing a handset, the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

SAR Measurement Conditions for WCDMA

These procedures were followed according to FCC "SAR Measurement Procedures for 3G Devices" v02, October 2007

Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1s”. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes) should be tabulated in the test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations should be clearly identified.

Head SAR Measurements

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all “1s”. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than ¼ dB higher than that measured in 12.2kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4kbps SRB (signaling radio bearer) using the exposure configuration that results in the highest SAR for that RF channel in 12.2 RMC.

Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all “1s”. SAR for other spreading codes and multiple DPDCHn, when supported by the DUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCHn configuration, are less than ¼ dB higher than those measured in

12.2 RMC. Otherwise, SAR is measured on the maximum output channel with an applicable RMC configuration for the corresponding spreading code or DPDCHn using the exposure configuration that results in the highest SAR with 12.2 RMC. When more than 2 DPDCHn are supported by the DUT, it may be necessary to configure the additional DPDCHn for the DUT using FTM(Factory Test Mode) with parameters similar to those used in 384 kbps and 768 kbps RMC.

Table 8.1 Max. Power Output Table for GT-B5330B

Operation Band Channel	Channel	12.2 Kbps RMC		12.2 Kbps AMR
		HSDPA Inactive	HSDPA Active	
WCDMA850 (dBm)	4132	22.42	22.38	22.46
	4183	22.50	22.43	22.46
	4233	22.37	22.17	22.23

	HSDPA	4132	4183	4233	MPR
WCDMA850 (dBm)	Subtest1	22.38	22.43	22.17	0
	Subtest2	22.48	22.35	22.13	0
	Subtest3	20.98	22.33	21.98	0.5
	Subtest4	22.39	22.30	22.07	0.5

Device Test Conditions

The handset is battery operated. Each SAR measurement was taken with a fully charged battery. In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power. If a conducted power deviation of more than 5% occurred, the test was repeated. And all Tx(1~4Tx) conducted power were also investigated for Body-Worn SAR Measurement

Table 8.2 GPRS Power Table for GT-B5330B

Band	Channel	Voice	1Tx	2Tx	3Tx	4Tx
850 (dBm)	128	32.39	32.38	29.91	27.87	26.88
	190	32.37	32.35	29.89	27.86	26.88
	251	32.2	32.18	29.72	27.71	26.72
1900 (dBm)	512	29.72	29.72	27.22	25.26	24.26
	661	29.76	29.75	27.26	25.31	24.31
	810	29.76	29.74	27.25	25.29	24.29

Table 8.3 Calculated Frame-Averaged Output Power Table for GT-B5330B

Band	Channel	Voice	1Tx	2Tx	3Tx	4Tx
850 (dBm)	128	23.36	23.35	23.89	23.61	23.87
	190	23.34	23.32	23.87	23.60	23.87
	251	23.17	23.15	23.70	23.45	23.71
1900 (dBm)	512	20.69	20.69	21.20	21.00	21.25
	661	20.73	20.72	21.24	21.05	21.30
	810	20.73	20.71	21.23	21.03	21.28

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. CS1 coding scheme was used in GPRS output power measurements and SAR Testing, as a condition where GMSK modulation was ensured. It was investigated that CS1 – CS4 setting do not have any impact on the output levels in the GPRS modes.
3 The conducted powers are reported and measured by base station simulator E5515C when the equipment was calibrated.

GSM Class : B

GPRS Multislot Class : 12 (max 4 Tx Uplink slots)

EDGE Multislot class : EDGE Rx only

DTM Multislot Class : N/A

Table 8.4 Bluetooth Conducted Output Power

Mode	Channel#	Ferq.(MHz)	Conducted Avg Power	
			(dBm)	(mW)
GFSK	0	2402	10.00	10
	39	2441	9.70	9.333
	78	2480	8.50	7.079
8PSK	0	2402	7.70	5.888
	39	2441	7.80	6.026
	78	2480	6.70	4.677

Table 8.5 WLAN Conducted Output average Power

Mode	Channel#	Ferq.(MHz)	Conducted Avg Power	
			(dBm)	(mW)
802.11b	1	2412	14.98	31.477
	6	2437	15.07	32.137
	11	2462	15.09	32.285
802.11g	1	2412	13.1	20.417
	6	2437	13.13	20.559
	11	2462	13.10	20.417
802.11n (HT20)	1	2412	10.9	12.303
	6	2437	11	12.589
	11	2462	11	12.589

Simultaneous Transmission

Refer to the FCC OET document, 'SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas' (Feb 2008)

Table 8.2 Output Power Thresholds for Unlicensed Transmitters

	2.45	5.15 - 5.35	5.47 - 5.85	GHz
P Ref	**12**	**6**	**5**	**mW**
Device output power should be rounded to the nearest mW to compare with values specified in this table				

Table 8.3 Summary of SAR Evaluation Requirements for Cell phones with Multiple Transmitters

	Individual Transmitter	**Simultaneous Transmission**
Licensed Transmitters	**Routine evaluation required**	**SAR not required:** **Unlicensed only** o when stand-alone 1-g SAR is not required and antenna is > 5 cm from other antennas **Licensed & Unlicensed** o when the sum of the 1-g SAR is <1.6 W/kg for all simultaneous transmitting antennas o when SAR to antenna separation ratio of simultaneous transmitting antenna pair is < 0.3 **SAR required:** **Licensed & Unlicensed** antenna pairs with SAR to antenna separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in standalone configuration for each wireless mode and exposure condition Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply
Unlicensed Transmitters	**When there is no simultaneous transmission –** o output < 60/f: SAR not required o output ≥ 60/f: stand-alone SAR required **When there is simultaneous transmission –** **Stand-alone SAR not required when** O output ≤ 2.P_{Ref} and antenna is > 5.0 cm from other antennas O output ≤ PRef and antenna is ≥ 2.5 cm from other antennas O output ≤ PRef and antenna is < 2.5 cm from other antennas, each with either output power ≤ PRef or 1-g SAR < 1.2 W/kg **Otherwise stand-alone SAR is required** **When stand-alone SAR is required** o test SAR on highest output channel for each wireless mode and exposure condition o if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedures	

Table 8.10 Simultaneous Transmission Summation for Held to Ear Voice Call

Simult Tx	Configuration	GSM850 SAR(W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)	Simult Tx	Configuration	GSM1900 SAR(W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)
Head SAR	Right Cheek	0.360	0.144	0.504	Head SAR	Right Cheek	0.379	0.144	0.523
	Right Tilt	0.196	0.080	0.276		Right Tilt	0.220	0.080	0.3
	Left Cheek	0.318	0.335	0.653		Left Cheek	0.514	0.335	**0.849**
	Left Tilt	0.194	0.183	0.377		Left Tilt	0.229	0.183	0.412
Simult Tx	**Configuration**	**WCDMA850 SAR(W/Kg)**	**WIFI SAR (W/Kg)**	**Σ SAR (W/Kg)**					
Head SAR	Right Cheek	0.425	0.144	0.144					
	Right Tilt	0.241	0.080	0.08					
	Left Cheek	0.402	0.335	0.335					
	Left Tilt	0.232	0.183	0.183					

Table 8.11 Simultaneous Transmission Summation for 2G/3G Data and WIFI(Body-Worn)

Configuration	Mode	2G/3G SAR (W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)
Back	GPRS850 SAR	0.967	0.121	**1.088**
	GPRS1900 SAR	0.558	0.121	0.679
	WCDMA850 SAR	0.825	0.121	0.946

Table 8.12 Simultaneous Transmission Summation for 2G/3G Data and WIFI(Hotspot)

Simult Tx	Configuration	GPRS850 SAR(W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)	Simult Tx	Configuration	GPRS1900 SAR(W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)
Body SAR	Back	0.967	0.121	1.088	Body SAR	Back	0.558	0.121	0.679
	Front	0.397	0.000257	0.397257		Front	0.388	0.000257	0.338257
	Left	0.352	-	0.352		Right	0.183	-	0.183
	Right	0.401	0.104	0.505		Left	0.090	0.104	0.194
	Bottom	0.044	-	0.044		Bottom	0.200	-	0.200
	Top	-	0.231	0.231		Top	-	0.231	0.231
Simult Tx	**Configuration**	**WCDMA850 SAR(W/Kg)**	**WIFI SAR (W/Kg)**	**Σ SAR (W/Kg)**					
Body SAR	Back	0.825	0.121	0.946					
	Front	0.440	0.000257	0.440257					
	Left	0.381	-	0.381					
	Right	0.376	0.104	0.490					
	Bottom	0.034	-	0.034					
	Top	-	0.231	0.231					

Note :

1. Per FCC KDB Publication941225 D06, the edges with antennas more than 2.5cm are not required to be evaluated for SAR("-"). The above tables represent a portable hotspot condition.

Multiple Antenna/Transmission Information for GT-B5330B

The separation between the main antenna and the Bluetooth and WLAN antennas is 81mm.

RF Conducted Power of Bluetooth Tx is 10.0 dBm.

RF Conducted Power of WLAN is 15.09 dBm.

Conclusion

The above tables represent the worst-case simultaneous transmission scenarios possible with this device. The above numerical summed SAR was below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. Therefore, no volumetric SAR summation is required since the numerical sums are below the limit.

Based on the output power, antenna separation distance, and Body SAR, a stand-alone BT SAR test is not required. The summation of BT SAR and Licensed Transmitter SAR is 0.967 + 0 = 0.967, which is less than 1.6 W/Kg, therefore, a simultaneous SAR evaluation is not required.

8.1 GSM850 Head SAR Results

Frequency		Mode	Conducted		Side	Test Position	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
836.6	190	GSM850	32.35	32.39	Right	Cheek/Touch	Intenna	Standard	0.017	**0.360**
836.6	190	GSM850	32.34	32.37	Right	Ear/Tilt 15°	Intenna	Standard	-0.036	0.196
836.6	190	GSM850	32.39	32.35	Left	Cheek/Touch	Intenna	Standard	-0.006	0.318
836.6	190	GSM850	32.31	32.33	Left	Ear/Tilt 15°	Intenna	Standard	-0.081	0.194
ANSI / IEEE C95.1 1992 – SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure / General Population**						**1.6W/kg (mW/g)** averaged over 1 gram				

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☐ Manu. Test Codes ☒ Base Station Simulator
6. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.2 GPRS850 Body SAR Results

Frequency		Mode	Conducted		Separation Distance	Test Position	Antenna Type	Battery	Tx GPRS Slots	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End							
836.6	190	GPRS850	29.87	29.89	1.0 cm	Back	Intenna	Standard	2	-0.054	0.844
824.2	128	GPRS850	29.82	29.86	1.0 cm	Back	Intenna	Standard	2	-0.004	0.665
824.2	251	GPRS850	29.74	29.73	1.0 cm	Back	Intenna	Standard	2	0.012	0.930
836.6	190	GPRS850	27.85	27.53	1.0 cm	Back	Intenna	Standard	3	-0.062	0.801
836.6	128	GPRS850	27.89	27.85	1.0 cm	Back	Intenna	Standard	3	-0.048	0.645
836.6	251	GPRS850	27.73	27.69	1.0 cm	Back	Intenna	Standard	3	0.063	0.911
836.6	190	GPRS850	26.85	26.81	1.0 cm	Back	Intenna	Standard	4	-0.008	0.846
836.6	190	GPRS850	26.89	26.85	1.0 cm	Back	Intenna	Standard	4	0.151	*0.666
836.6	128	GPRS850	26.78	26.89	1.0 cm	Back	Intenna	Standard	4	-0.017	0.687
848.8	251	GPRS850	26.75	26.71	1.0 cm	Back	Intenna	Standard	4	-0.007	**0.967**
836.6	190	GPRS850	26.89	26.85	1.0 cm	Front	Intenna	Standard	4	-0.001	0.397
836.6	190	GPRS850	26.81	26.80	1.0 cm	Left	Intenna	Standard	4	-0.029	0.352
836.6	190	GPRS850	26.80	26.76	1.0 cm	Right	Intenna	Standard	4	0.037	0.401
836.6	190	GPRS850	26.83	26.85	1.0 cm	Bottom	Intenna	Standard	4	0.104	0.044
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g) averaged over 1 gram**					

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☐ Manu. Test Codes ☒ Base Station Simulator
6. Justification for reduced test configurations: This model supports GPRS CLASS "12" (4Tx) So the burst power and timing period is more than 2dB higher in GPRS mode than in GSM850 mode. Hence, the GSM850 mode was not measured.
7. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8. Body SAR was tested at 1cm distance because battery operated personal wireless routers(hotspots) enable multiple Wi-Fi connections, per KDB 941225 D06. But position 'Top' was not tested because antenna distance was >2.5cm.
9. Per FCC KDB Publication 941225 D06, when the same wireless modes and device transmission configurations are required for body-worn accessories and hotspot mode, it is not necessary to additionally test body-worn accessory SAR for the same device orientation. Therefore, the hotspot data for the back side configuration additionally shows body-worn compliance.
10. During SAR Testing for the Wireless Router conditions per KDB 941225 D06, the actual Portable Hotspot operation (with actual simultaneous transmission with WIFI) was not activated.
11. '*' With Headset Attached.

8.3 GSM1900 Head SAR Results

Frequency		Mode	Conducted		Side	Test Position	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
1880	661	GSM1900	29.75	29.75	Right	Cheek/Touch	Intenna	Standard	-0.172	0.379
1880	661	GSM1900	29.73	29.76	Right	Ear/Tilt 15°	Intenna	Standard	-0.048	0.220
1880	661	GSM1900	29.71	29.74	Left	Cheek/Touch	Intenna	Standard	-0.060	**0.514**
1880	661	GSM1900	29.76	29.75	Left	Ear/Tilt 15°	Intenna	Standard	0.097	0.229
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g) averaged over 1 gram**				

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☐ Manu. Test Codes ☒ Base Station Simulator
6. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

8.4 GSM1900 Body SAR Results

Frequency		Mode	Conducted		Separation Distance	Test Position	Antenna Type	Battery	Tx GPRS Slots	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End							
1880	661	GPRS1900	27.31	27.25	1.0 cm	Back	Intenna	Standard	2	-0.191	0.542
1880	661	GPRS1900	25.28	25.24	1.0 cm	Back	Intenna	Standard	3	-0.054	0.526
1880	661	GPRS1900	24.29	24.32	1.0 cm	Back	Intenna	Standard	4	-0.043	**0.558**
1880	661	GPRS1900	24.32	24.25	1.0 cm	Back	Intenna	Standard	4	0.074	*0.519
1880	661	GPRS1900	24.25	24.29	1.0 cm	Front	Intenna	Standard	4	-0.012	0.388
1880	661	GPRS1900	24.24	24.30	1.0 cm	Left	Intenna	Standard	4	0.091	0.183
1880	661	GPRS1900	24.22	24.27	1.0 cm	Right	Intenna	Standard	4	-0.081	0.090
1880	661	GPRS1900	24.29	24.24	1.0 cm	Bottom	Intenna	Standard	4	0.047	0.200
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g) averaged over 1 gram**					

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☐ Manu. Test Codes ☒ Base Station Simulator
6. Justification for reduced test configurations: This model supports GPRS CLASS "12" (4Tx) So the burst power and timing period is more than 2dB higher in GPRS mode than in GSM1900 mode. Hence, the GSM1900 mode was not measured.
7. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
8. Body SAR was tested at 1cm distance because battery operated personal wireless routers(hotspots) enable multiple Wi-Fi connections, per KDB 941225 D06. But position 'Top' was not tested because antenna distance was >2.5cm.
9. During SAR Testing for the Wireless Router conditions per KDB 941225 D06, the actual Portable Hotspot operation (with actual simultaneous transmission with WIFI) was not activated.
10. '*' With Headset Attached.

8.5 WCDMA850 Head SAR Results

Frequency		Mode	Conducted Power		Side	Test Position	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
836.6	4183	WCDMA850	22.49	22.47	Right	Cheek/Touch	Intenna	Standard	0.179	**0.425**
836.6	4183	WCDMA850	22.47	22.45	Right	Ear/Tilt 15°	Intenna	Standard	0.158	0.241
836.6	4183	WCDMA850	22.55	22.54	Left	Cheek/Touch	Intenna	Standard	-0.018	0.402
836.6	4183	WCDMA850	22.51	22.50	Left	Ear/Tilt 15°	Intenna	Standard	0.115	0.232
ANSI / IEEE C95.1 1992 – SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure / General Population**						**1.6W/kg (mW/g)** averaged over 1 gram				

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☐ Manu. Test Codes ☒ Base Station Simulator
6. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
7. WCDMA mode was tested under RMC 12.2 kbps with HSDPA Inactive per KDB Publication 941225 D01.

8.6 WCDMA850 Body SAR Results

Frequency		Mode	Conducted Power		Separation Distance	Test Position	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
836.6	4183	WCDMA850	22.49	22.52	1.0 cm	Back	Intenna	Standard	-0.025	**0.825**
836.6	4183	WCDMA850	22.52	22.50	1.0 cm	Back	Intenna	Standard	-0.006	*0.747
826.4	4132	WCDMA850	22.51	22.43	1.0 cm	Back	Intenna	Standard	0.000	0.678
846.6	4233	WCDMA850	22.50	22.45	1.0 cm	Back	Intenna	Standard	-0.074	0.766
836.6	4183	WCDMA850	22.55	22.47	1.0 cm	Front	Intenna	Standard	-0.077	0.440
836.6	4183	WCDMA850	22.47	22.49	1.0 cm	Left	Intenna	Standard	0.010	0.381
836.6	4183	WCDMA850	22.49	22.46	1.0 cm	Right	Intenna	Standard	-0.030	0.376
836.6	4183	WCDMA850	22.51	22.49	1.0 cm	Bottom	Intenna	Standard	0.102	0.034
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g) averaged over 1 gram**				

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☐ Manu. Test Codes ☒ Base Station Simulator
6. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June, 2001), if the SAR measured at the middle channel for each test configuration is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
7. Body SAR was tested at 1cm distance because battery operated personal wireless routers(hotspots) enable multiple Wi-Fi connections, per KDB 941225 D06. But position 'Top' was not tested because antenna distance was >2.5cm.
8. WCDMA mode was tested under RMC 12.2 kbps with HSDPA Inactive per KDB Publication 941225 D01. HSDPA SAR was not required since the average output of the HSDPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/Kg.
9. During SAR Testing for the Wireless Router conditions per KDB 941225 D06, the actual PortableHotspot operation (with actual simultaneous transmission with WIFI) was not activated.
10. '*' With Headset Attached.

8.7 WLAN Head SAR Results

Frequency		Mode	Conducted		Side	Test Position	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
2462	11	WLAN	15.11	15.08	Right	Cheek/Touch	Intenna	Standard	-0.012	0.144
2462	11	WLAN	15.08	15.13	Right	Ear/Tilt 15°	Intenna	Standard	0.161	0.080
2462	11	WLAN	15.07	15.05	Left	Cheek/Touch	Intenna	Standard	0.112	**0.335**
2462	11	WLAN	15.13	15.15	Left	Ear/Tilt 15°	Intenna	Standard	0.070	0.183
ANSI / IEEE C95.1 1992 – SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure / General Population**						**1.6W/kg (mW/g)** averaged over 1 gram				

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☒ Manu. Test Codes ☐ Base Station Simulator
6. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g and n) were not investigated since the average output powers were not greater than 0.25dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
7. WLAN Transmission was verified using a spectrum analyzer.
8. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6W/Kg and the 1g averaged SAR is <0.8W/Kg, SAR testing on other default (and corresponding required) channels was not required.

8.8 WLAN Body SAR Results

Frequency		Mode	Conducted		Separation Distance	Test Position	Antenna Type	Battery	Data Rate (Mbps)	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End							
2462	11	WLAN	15.12	15.10	1.0 cm	Back	Intenna	Standard	1	0.103	0.121
2462	11	WLAN	15.08	15.05	1.0 cm	Back	Intenna	Standard	1	-0.161	*0.073
2462	11	WLAN	15.04	15.08	1.0 cm	Front	Intenna	Standard	1	-0.116	0.000257
2462	11	WLAN	15.03	15.04	1.0 cm	Right	Intenna	Standard	1	0.031	0.104
2462	11	WLAN	15.07	15.09	1.0 cm	Top	Intenna	Standard	1	-0.035	**0.231**
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**1.6W/kg (mW/g) averaged over 1 gram**					

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. Tissue parameters and temperatures are listed on the SAR plot.
3. Liquid tissue depth is 15.2 ± 0.2cm
4. Battery is fully charged for all readings.
5. Test Configuration ☒ Manu. Test Codes ☐ Base Station Simulator
6. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g and n) were not investigated since the average output powers were not greater than 0.25dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
7. Body SAR was tested at 1cm distance because battery operated personal wireless routers(hotspots) enable multiple Wi-Fi connections, per KDB 941225 D06. But position 'Left, Bottom' was not tested because antenna distance was >2.5cm.
8. During SAR Testing for the Wireless Router conditions per KDB 941225 D06, the actual Portable Hotspot operation (with actual simultaneous transmission with WIFI) was not activated.
9. WLAN Transmission was verified using a spectrum analyzer.
10. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6W/Kg and the 1g averaged SAR is <0.8W/Kg, SAR testing on other default (and corresponding required) channels was not required.
11. '*' With Headset Attached.

9. CONCLUSION

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

The highest reported SAR values are as follows:
GSM850: Head: 0.36W/Kg : Body-worn: 0.967W/Kg : Hotspot : 0.967W/Kg
GSM1900: Head: 0.514W/Kg : Body-worn: 0.558W/Kg : Hotspot : 0.558W/Kg
WCDMA850: Head: 0.425W/Kg : Body-worn: 0.825W/Kg : Hotspot : 0.825W/Kg
WLAN: Head: 0.335W/Kg : Body-worn: 0.121W/Kg : Hotspot : 0.231W/Kg
Highest simultaneous transmission: Head:0.849W/Kg : Body-worn: 1.088W/Kg : Hotspot: 1.088W/Kg

10. REFERENCES

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz, New York: IEEE, 2006.

[3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz, New York: IEEE, Sept. 1992.

[4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[5] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, June 2001.

[6] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.

[7] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[8] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[9] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 120-124.

[10] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[11] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[12] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Head Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[13] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[14] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[15] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[16] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[17] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[18] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.

[19] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[20] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

[21] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hoschschule Zürich, Dosimetric Evaluation of the Cellular Phone.

[22] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.

[23] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.

[24] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009

[25] FCC Public Notice DA-02-1438. Office of Engineering and Technology Announces a Transition Period for the Phantom Requirements of Supplement C to OET Bulletin 65, June 19, 2002

[26] FCC SAR Measurement Procedures for 3G Devices KDB 941225

[27] SAR Measurement procedures for IEEE 802.11a/b/g KDB 248227

[28] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB 648474

[29] FCC Application Note for SAR Probe Calibration and System Verification Consideration for Measurements at 150 MHz – 3 GHz, KDB 450824

[30] FCC SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens, KDB 616217

[31] FCC SAR Measurement Requirements for 3 – 6 GHz, KDB 865664

[32] FCC Mobile Portable RF Exposure Procedure, KDB 447498

[33] FCC SAR Procedures for Dongle Transmitters, KDB 447498

[34] Anexo à Resolução No. 533, de 10 de Septembro de 2009.

[35] FCC SAR Test Considerations for LTE Handsets and Data Modems, KDB Publication 941225

[36] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.

[37] FCC Hot Spot SAR v01, KDB Publication 941225 D06.