FCC SAR Compliance Test Report

Project Name: cdma2000 Digital Mobile Phone

Model : HUAWEI M868, M868

FCC ID : QISH868C

Report No. : SYBH(Z-SAR)008052013-2

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2013-05-29	GongZhong
Rev.1.1	UpdateTable 6: 1g SAR target values for 1900 head and body	2013-06-05	Gong Zhong

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HUAWEI M868, M868 are as below Table 1.

Band	Position*	MAX Reported SAR_{1g} (W/kg)
CDMA BC0	Head	1.251
	Body Worn(15mm)	**1.175**
	Hotspot(10mm)	**0.930**
CDMA BC1	Head	**1.295**
	Body Worn(15mm)	0.729
	Hotspot(10mm)	0.869
WiFi	Head	0.070
	Body Worn(15mm)	0.125
	Hotspot(10mm)	0.210
The highest simultaneous SAR is 1.481W/kg per KDB690783 D01		

Table 1:Summary of test result

Note: *For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and that positions the handset a minimum of 15 mm from the body. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The device is in compliance with Specific Absorption Rate（SAR）for general population/uncontraolled exposure limits of 1.6 W/Kg as averaged over any 1 g tissue according to the FCC rule §2.1093, the ANSI/IEEE C95.1:1992, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2003 & IEEE Std 1528a-2005 and FCC OET Bulletin 65 Supplement C Edition 01-01.

1.2 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain/Body/Arms/Legs)	**1.60 mW/g**	8.00 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g	0.40 mW/g
Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

Table 2: RF exposure limits

The limit applied in this test report is shown in **bold** letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation.

1.3 EUT Description

Device Information：			
DUT Name:	cdma2000 Digital Mobile Phone		
Type Identification:	HUAWEI M868, M868		
FCC ID:	QISH868C		
SN No.:	V3L01A92B0800091		
Device Type :	portable device		
Device Phase:	Identical Prototype		
Exposure Category:	uncontrolled environment / general population		
Hardware Version :	HC1H868CM		
Software Version :	M868V100R001C00B961		
Antenna Type :	internal antenna		
Others Accessories	Headset		
Device Operating Configurations:			
Supporting Mode(s)	CDMA BC0/BC1, WiFi (tested), BT		
Test Modulation	QPSK		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	CDMA BC0	824-849	869-894
	CDMA BC1	1850-1910	1930-1990
	WiFi	2412-2462	2412-2462
	Bluetooth	2402-2480	2402-2480
Power Class:	Tested with power control all up (CDMA BC0)		
	Tested with power control all up (CDMA BC1)		
Test Channels (low-mid-high):	1013-384-777 (CDMA BC0)		
	1175-600-25 (CDMA BC1)		
	1-6-11 (WiFi 2450)		

Table 3:Device information and operating configuration

1.3.1 General Description

cdma2000 Digital Mobile Phone- HUAWEI M868, M868 is subscriber equipment in the CDMA/EVDO system. The frequency band is US Cellular and N. American PCS, Their band test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, CDMA2000 1x and 1XEV-DO protocol processing, voice, MMS service, GPS, AGPS and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service). It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

Battery

Name	Manufacture	Serials number	Description
Rechargeable Li-ion	Huawei Technologies Co., Ltd.	1#: MAIC903XXXX0091 2#: MPCCA13919100157	Battery Model: HB4W1H Rated capacity: 1750mAh Nominal Voltage: ⎓ +3.7V Charging Voltage: ⎓ +4.2V

1.4 Test specification(s)

ANSI Std C95.1-1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)
IEEE Std 1528-2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEEE Std 1528a-2005	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques Amendment 1: CAD File for Human Head Model (SAM Phantom)
OET Bulletin No. 65, Supplement C Edition 01-01– 2001	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields---Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 4 of March 2010)
KDB941225 D01	SAR test for 3G devices v02
KDB941225 D06	Hot Spot SAR v01
KDB248227 D01	SAR meas for 802.11 a/b/g v01r02
KDB447498 D01	General RF Exposure Guidance v05
KDB648474 D04	SAR Handsets Multi Xmiter and Ant v01
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01
KDB865664 D02	SAR Reporting v01

1.5 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Zone K3,Huawei Industrial Base, Bantian Industry Area, Longgang District, Shenzhen, Guangdong, China
Telephone	+86 755 28780808
Fax	+86 755 89652518
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310 A2LA TESTING CERT #2174.01

1.6 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

1.7 Application details

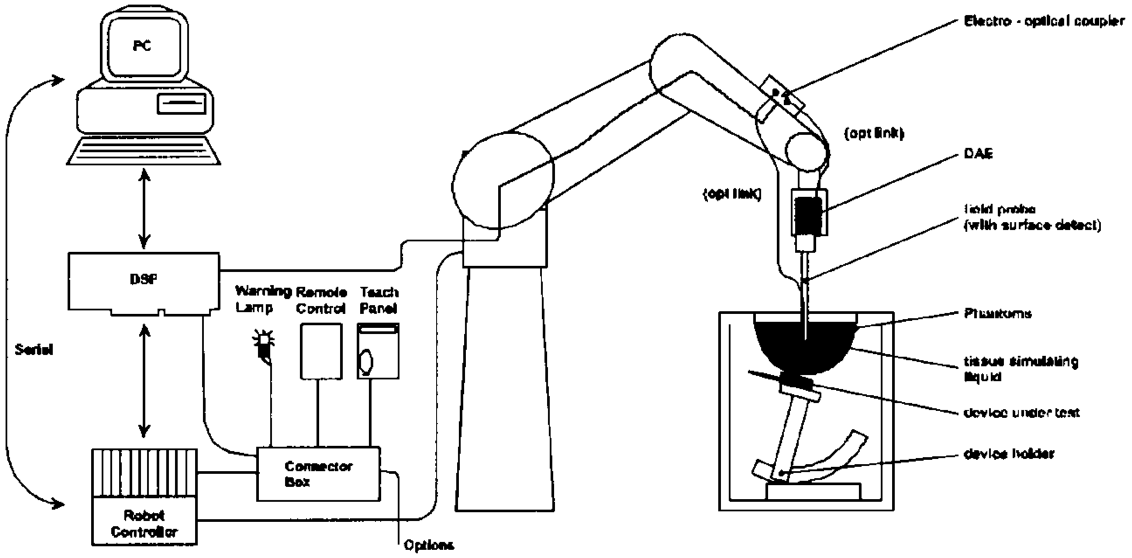
Start Date of test	2013-05-18
End Date of test	2013-05-25

1.8 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

2 SAR Measurement System

2.1 SAR Measurement Set-up



The DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
- The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows XP.
- DASY5 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System check dipoles allowing to validate the proper functioning of the system.

2.2 Test environment

The DASY4 measurement system is placed at the head end of a room with dimensions:
5 x 2.5 x 3 m³, the SAM phantom is placed in a distance of 75 cm from the side walls and 1.1m from the rear wall. Above the test system a 1.5 x 1.5 m² array of pyramid absorbers is installed to reduce reflections from the ceiling.
Picture 1 of the photo documentation shows a complete view of the test environment.
The system allows the measurement of SAR values larger than 0.005 mW/g.

2.3 Data Acquisition Electronics description

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

DAE4

Input Impedance	200MOhm	
The Inputs	symmetrical and floating	
Common mode rejection	above 80 dB	

2.4 Probe description

These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

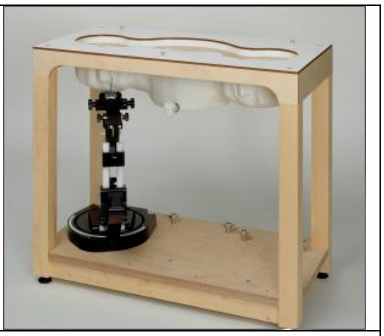
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones	

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

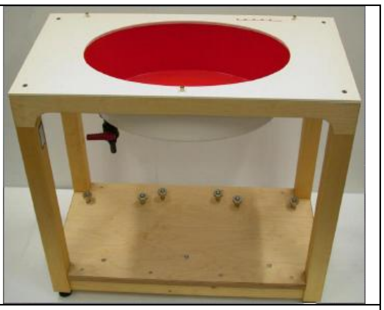
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic range	10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB(noise:typically<1µW/g)	
Dimensions	Overall length: 337 mm (Tip:20 mm) Tip diameter:2.5 mm (Body:12 mm) Typical distance from probe tip to dipole centers: 1mm	
Application	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%	

2.5 Phantom description

SAM Twin Phantom

Shell Thickness	2mm +/- 0.2 mm; The ear region: 6mm	
Filling Volume	Approximately 30 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Left hand Right hand Flat phantom	
The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to cover the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible. Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.		

ELI4 Phantom

Shell Thickness	2mm +/- 0.2 mm	
Filling Volume	Approximately 30 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Flat phantom	
The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.		

2.6 Device holder description

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used.

Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.
Therefore those devices are normally only tested at the flat part of the SAM.

2.7 Test Equipment List

This table gives a complete overview of the SAR measurement equipment
Devices used during the test described are marked ☒

	Manufacturer	Device	Type	Serial number	Date of last calibration)*	Valid period
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3898	2013-01-14	One year
☐	SPEAG	Dosimetric E-Field Probe	ES3DV3	3168	2012-10-02	One year
☒	SPEAG	835 MHz Dipole	D835V2	4d126	2011-11-07	Three years
☐	SPEAG	1800 MHz Dipole	D1800V2	2d184	2011-03-08	Three years
☒	SPEAG	1900 MHz Dipole	D1900V2	5d143	2011-09-26	Three years
☐	SPEAG	2000 MHz Dipole	D2000V2	1052	2011-03-10	Three years
☐	SPEAG	2300 MHz Dipole	D2300V2	1016	2011-11-22	Three years
☒	SPEAG	2450 MHz Dipole	D2450V2	860	2011-03-08	Three years
☐	SPEAG	2600 MHz Dipole	D2600V2	1021	2011-11-22	Three years
☒	SPEAG	Data acquisition electronics	DAE4	852	2012-11-22	One year
☐	SPEAG	Data acquisition electronics	DAE4	851	2012-07-25	One year
☒	SPEAG	Software	DASY 5	N/A	N/A	N/A
☒	SPEAG	Twin Phantom	SAM1	TP-1475	N/A	N/A
☒	SPEAG	Twin Phantom	SAM2	TP-1474	N/A	N/A
☐	SPEAG	Twin Phantom	SAM3	TP-1597	N/A	N/A
☐	SPEAG	Twin Phantom	SAM4	TP-1620	N/A	N/A
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1038	N/A	N/A
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1111	N/A	N/A
☒	R & S	Universal Radio Communication Tester	CMU 200	111379	2012-08-13	One year
☒	Agilent)*	Network Analyser	E5071B	MY42404956	2013-02-27	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	N/A	N/A
☒	Agilent	Signal Generator	N5181A	MY47420989	2013-02-27	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA0746001	N/A	N/A
☒	Agilent	Power Meter	E4417A	MY45101339	2013-02-26	One year
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2013-02-26	One year

Note: All the test equipments are calibrated once a year, except the dipoles, which are calibrated every three years. Moreover, we have self-calibration every year to the dipoles.

1) Huawei SAR lab has adopted three years calibration interval. But each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.
a) There is no physical damage on the dipole;
b) System check with specific dipole is within 10% of calibrated value;
c) Return-loss is within 10% of calibrated measurement;
d) Impedance is within 5Ω from the previous measurement.

2) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

3 SAR Measurement Procedure

3.1 Scanning procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and system check. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. +/- 5 %.

- The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

- The “area scan” measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension(≤2GHz)， 12 mm in x- and y- dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation.
  Results of this coarse scan are shown in Appendix B.

- A “zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous “coarse” scan. This is a fine grid with maximum scan spatial resolution: Δx_{zoom}, Δy_{zoom} ≤ 4GHz - ≤ 5 mm and 4-6 GHz-≤ 4 mm; Δz_{zoom} ≤ 3GHz - ≤ 5 mm, 3-4 GHz- ≤ 4 mm and 4-6GHz-≤2mm where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in Appendix B. Test results relevant for the specified standard (see chapter 1.4.)are shown in table form form in chapter 7.2.
- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2 mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth. A z-axis scan of the measurement with maximum SAR value is shown in Appendix B.

3.2 Spatial Peak SAR Evaluation

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 7 x 7 x 7 points. The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.

- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.

- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

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 -direction) [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

Advanced Extrapolation

DASY5 uses the advanced extrapolation option which is able to compansate boundary effects on E-field probes.

3.3 Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension "DAE4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \bullet cf/dcp_i$$

with V_i = compensated signal of channel i (i = x, y, z)
U_i = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes: $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2)/f$

with
- V_i = compensated signal of channel i (i = x, y, z)
- $Norm_i$ = sensor sensitivity of channel i (i = x, y, z) $[mV/(V/m)^2]$ for E-field Probes
- ConvF = sensitivity enhancement in solution
- a_{ij} = sensor sensitivity factors for H-field probes
- f = carrier frequency [GHz]
- E_i = electric field strength of channel i in V/m
- H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot}^2 \cdot \sigma) / (\rho \cdot 1000)$$

with
- SAR = local specific absorption rate in mW/g
- E_{tot} = total field strength in V/m
- σ = conductivity in [mho/m] or [Siemens/m]
- ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with
- P_{pwe} = equivalent power density of a plane wave in mW/cm^2
- E_{tot} = total electric field strength in V/m
- H_{tot} = total magnetic field strength in A/m

4 System Verification Procedure

4.1 Tissue Verification

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 5% of the target values.

The following materials are used for producing the tissue-equivalent materials.

Ingredients (% of weight)	Head Tissue					
Frequency Band (MHz)	450	**835**	1800	**1900**	**2450**	2600
Water	38.56	41.45	52.64	55.242	62.7	55.242
Salt (NaCl)	3.95	1.45	0.36	0.306	0.5	0.306
Sugar	56.32	56.0	0.0	0.0	0.0	0.0
HEC	0.98	1.0	0.0	0.0	0.0	0.0
Bactericide	0.19	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	47.0	44.542	36.8	44.452
Ingredients (% of weight)	Body Tissue					
Frequency Band (MHz)	450	**835**	1800	**1900**	**2450**	2600
Water	51.16	52.4	69.91	69.91	73.2	64.493
Salt (NaCl)	1.49	1.40	0.13	0.13	0.04	0.024
Sugar	46.78	45.0	0.0	0.0	0.0	0.0
HEC	0.52	1.0	0.0	0.0	0.0	0.0
Bactericide	0.05	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	26.7	32.252

Table 4: Tissue Dielectric Properties

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

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (+/-5%)	σ (S/m) (+/-5%)	εr	σ (S/m)		
835H	825	41.60 (39.52~43.68)	0.90 (0.86~0.95)	41.36	0.912	21.4°C	2013-05-19
	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	41.39	0.918		
	850	41.50 (39.43~43.58)	0.92 (0.87~0.96)	41.08	0.927		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	53.92	0.939	21.4°C	2013-05-18
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	53.86	0.943		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	53.74	0.959		
1900H	1850	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.59	1.378	21.4°C	2013-05-22
	1880	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.39	1.407		
	1900	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.42	1.424		
	1910	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.32	1.433		

1900B	1850	53.3 (50.64~55.97)	1.52 (1.44~1.60)	53.15	1.515	21.4°C	2013-05-23
	1880	53.3 (50.64~55.97)	1.52 (1.44~1.60)	53.09	1.547		
	1900	53.3 (50.64~55.97)	1.52 (1.44~1.60)	53.06	1.569		
	1910	53.3 (50.64~55.97)	1.52 (1.44~1.60)	53.04	1.580		
2450H	2410	39.30 (37.34~41.26)	1.76 (1.67~1.85)	39.77	1.796	21.4°C	2013-05-24
	2435	39.20 (37.24~41.16)	1.79 (1.70~1.88)	39.72	1.841		
	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	39.68	1.849		
	2460	39.20 (37.24~41.16)	1.81 (1.72~1.90)	39.60	1.854		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	52.16	1.94	21.4°C	2013-05-25
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	52.00	1.976		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	51.86	1.985		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	51.95	2.015		
ε_r= Relative permittivity, σ= Conductivity							

Table 5:Measured Tissue Parameter

Note: 1）The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

2）KDB 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.

3）The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

4.2 System Check

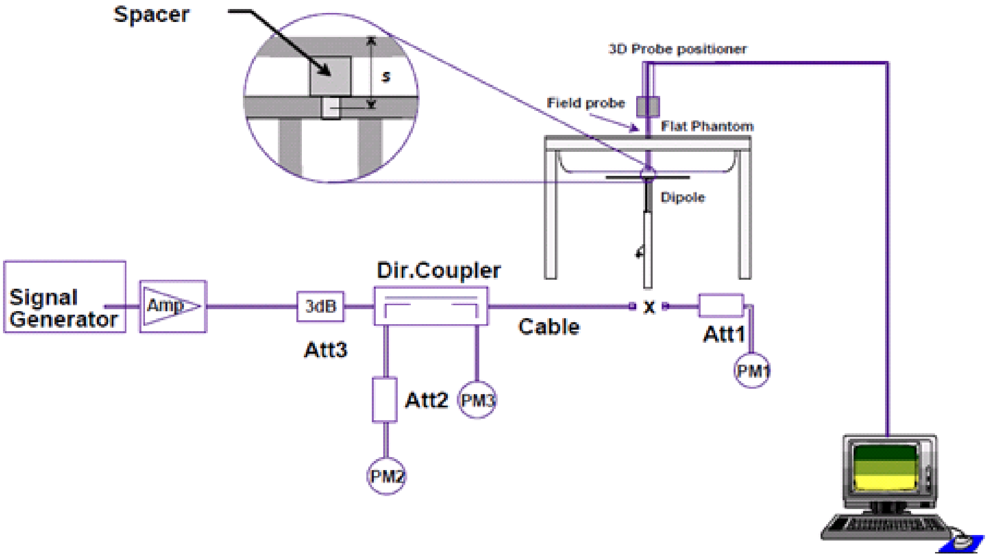
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests (Graphic Plot(s) see Appendix A).

System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D835V2 Head	9.40 (8.46~10.34)	6.16 (5.54~6.78)	10.20	6.52	21.4°C	2013-05-19
D1900V2 Head	40.60 (36.54~44.66)	21.20 (19.08~23.32)	38.92	19.72	21.4°C	2013-05-22
D2450V2 Head	53.70 (48.33~59.07)	24.90 (22.41~27.39)	57.60	25.96	21.4°C	2013-05-24
D835V2 Body	9.54 (8.59~10.49)	6.29 (5.66~6.92)	9.72	6.36	21.4°C	2013-05-18
D1900V2 Body	41.40 (37.26~45.54)	21.80 (19.62~23.98)	43.60	22.04	21.4°C	2013-05-23
D2450V2 Body	52.80 (47.52~58.08)	24.50 (22.05~26.95)	56.40	24.84	21.4°C	2013-05-25

Table 6:System Check Results

4.3 System check Procedure

The system check is performed by using a system check dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250 mW. To adjust this power a power meter is used. The power sensor is connected to the cable before the system check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system check to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).
System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system.



5 Measurement Uncertainty Evaluation

5.1 Measurement uncertainty evaluation for SAR test

The overall combined measurement uncertainty of the measurement system is ± 10.9% (K=1).
The expanded uncertainty (k=2) is assessed to be ± 21.9%
This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divi-sor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	± 6.0%	Normal	1	1	1	± 6.0%	± 6.0%	∞
Axial isotropy	± 4.7%	Rectangular	√3	0.7	0.7	± 1.9%	± 1.9%	∞
Hemispherical isotropy	± 9.6%	Rectangular	√3	0.7	0.7	± 3.9%	± 3.9%	∞
Spatial resolution	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	∞
Boundary effects	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Probe linearity	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
System detection limits	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Readout electronics	± 0.3%	Normal	1	1	1	± 0.3%	± 0.3%	∞
Response time	± 0.8%	Rectangular	√3	1	1	± 0.5%	± 0.5%	∞
Integration time	± 2.6%	Rectangular	√3	1	1	± 1.5%	± 1.5%	∞
RF ambient conditions	± 3.0%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
Probe positioner	± 0.4%	Rectangular	√3	1	1	± 0.2%	± 0.2%	∞
Probe positioning	± 2.9%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
Max. SAR evaluation	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Test Sample Related								
Device positioning	± 2.9%	Normal	1	1	1	± 2.9%	± 2.9%	145
Device holder uncertainty	± 3.6%	Normal	1	1	1	± 3.6%	± 3.6%	5
Power drift	± 5.0%	Rectangular	√3	1	1	± 2.9%	± 2.9%	∞
Phantom and Set-up								
Phantom uncertainty	± 4.0%	Rectangular	√3	1	1	± 2.3%	± 2.3%	∞
Liquid conductivity (target)	± 5.0%	Rectangular	√3	0.64	0.43	± 1.8%	± 1.2%	∞
Liquid conductivity (meas.)	± 2.5%	Normal	1	0.64	0.43	± 1.6%	± 1.1%	∞
Liquid permittivity (target)	± 5.0%	Rectangular	√3	0.6	0.49	± 1.7%	± 1.4%	∞
Liquid permittivity (meas.)	± 2.5%	Normal	1	0.6	0.49	± 1.5%	± 1.2%	∞
Combined Uncertainty	$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					± 10.9%	± 10.7%	387
Expanded Std. Uncertainty	$u_e = 2u_c$	Normal	**K=2**			**± 21.9%**	**± 21.4%**	

Table 7:Measurement uncertainties

5.2 Measurement uncertainty evaluation for system check

The overall combined measurement uncertainty of the measurement system is ± 9.5% (K=1).
The expanded uncertainty (k=2) is assessed to be ± 18.9%
This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	± 6.0%	Normal	1	1	1	± 6.0%	± 6.0%	∞
Axial isotropy	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
Hemispherical isotropy	± 9.6%	Rectangular	√3	0.7	0.7	± 0.0%	± 0.0%	∞
Boundary effects	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Probe linearity	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
System detection limits	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Readout electronics	± 0.3%	Normal	1	1	1	± 0.3%	± 0.3%	∞
Response time	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	∞
Integration time	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	∞
RF ambient conditions	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Probe positioner	± 0.4%	Rectangular	√3	1	1	± 0.2%	± 0.2%	∞
Probe positioning	± 2.9%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
Max. SAR evaluation	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Dipole								
Deviation of experimental dipole	± 5.5%	Rectangular	√3	1	1	± 3.2%	± 3.2%	∞
Dipole axis to liquid distance	± 2.0%	Rectangular	1	1	1	± 1.2%	± 1.2%	∞
Power drift	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
Phantom and Set-up								
Phantom uncertainty	± 4.0%	Rectangular	√3	1	1	± 2.3%	± 2.3%	∞
Liquid conductivity (target)	± 5.0%	Rectangular	√3	0.64	0.43	± 1.8%	± 1.2%	∞
Liquid conductivity (meas.)	± 2.5%	Normal	1	0.64	0.43	± 1.6%	± 1.1%	∞
Liquid permittivity (target)	± 5.0%	Rectangular	√3	0.6	0.49	± 1.7%	± 1.4%	∞
Liquid permittivity (meas.)	± 2.5%	Normal	1	0.6	0.49	± 1.5%	± 1.2%	∞
Combined Uncertainty	$u_c' = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					**± 9.5%**	**± 9.2%**	
Expanded Std. Uncertainty	$u_e = 2u_c$	Normal		**K=2**		**± 18.9%**	**± 18.4%**	

Table 8:Measurement uncertainties

6 SAR Test Configuration

6.1 CDMA Test Configuration

6.1.1 CDMA 1x Devices

For SAR test, the maximum power output is very important and essential; it is identical under the measurement uncertainty. It is proper to use typical Test Mode 3(FW RC3, RVS RC3, SO55) as the worst case for SAR test.

Test Parameter setup for maximum RF output power according to section 4.4.5 of 3GPP2;

Parameter	Units	Value
I or	dBm/1.23MHz	-104
PilotE c/I or	dB	-7
TrafficE c /I or	dB	-7.4

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

SAR for body exposure configurations is measured in RC3 with the DUT configured using TDSO / SO32,to transmit at full rate on FCH with all other code channele disabled. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCHn) with FCH at full rate and SCH0 enabled at 9600 bps, using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are 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 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

Test communication setup meet as followings:

Communication standard between mobile station and base station simulator	3GPP2 C.S0011-B
Radio configuration	RC3(Supporting CDMA 1X)
Spreading Rate	SR1
Data Rate	9600bps
Service Options	SO55(Loopback service)
Service Options	SO32(Test Data service)
Multiplex Options	The mobile station does not support this service

6.1.2 CDMA EV-DO Devices

For handsets with EV-DO capabilities, when the maximum average output of each channel in Rev.0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for EV-DO is not required. Otherwise, SAR for Rev. 0 is measured on the maximum output channel at 153.6 kbps using the body exposure configuration that results in the highest SAR for that channel in RC3. SAR for Rev.A is not required when the maximum average output of each channel is less than that measured in Rev.0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is 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.

6.2 WiFi Test Configuration

For the 802.11b/g SAR tests, a communication link is set up with the test mode software for WiFi mode test. The Absolute Radio Frequency Channel Number(ARFCN) is allocated to 1 ,6 and 11 respectively in the case of 2450 MHz.During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frquency band. 802.11b/g modes are tested on channel 1, 6, 11; however,if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1#	√	△
		2.437	6	√	△
		2.462	11#	√	△

Notes:
√ = "default test channels"
△= possible 802.11g channels with maximum average output ¼ dB the "default test channels"
= when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

802.11 Test Channels per FCC Requirements

7 SAR Measurement Results

7.1 Conducted power measurements

For the measurements a Rohde & Schwarz Radio Communication Tester CMU 200 was used.

SAR drift measured at the same position in liquid before and after each SAR test as below 7.2 chapter.

7.1.1 Conducted power measurements CDMA BC0

CDMA&EVDO BC0		Average Power (dBm)		
		1013CH	384CH	777CH
RC1	SO55	24.08	24.08	24.15
RC3	SO55	24.03	24.03	24.07
	TDSO32（FCH）	24.03	24.13	24.14
	TDSO32（FCH+SCH）	24.11	24.09	24.12
Rev 0	RTAP 153.6	23.94	23.97	24.04
Rev A	RETAP 4096	23.94	24.06	24.02

Table 9: Test results conducted power measurement CDMA BC0(Hotspot disabled)

Note: The conducted power of CDMA BC0 is measured with RMS detector.

CDMA&EVDO BC0		Average Power (dBm)		
		1013CH	384CH	777CH
RC1	SO55	22.22	22.19	22.30
RC3	SO55	22.12	22.11	22.14
	TDSO32（FCH）	22.11	22.09	22.12
	TDSO32（FCH+SCH）	22.17	22.07	22.13
Rev 0	RTAP 153.6	22.09	22.18	22.21
Rev A	RETAP 4096	22.12	22.20	22.23

Table 10: Test results conducted power measurement CDMA BC0(Hotspot activated)

Note: The conducted power of CDMA BC0 is measured with RMS detector.

7.1.2 Conducted power measurements CDMA BC1

CDMA&EVDO BC1		Average Power (dBm)		
		1175CH	600CH	25CH
RC1	SO55	23.98	24.14	23.71
RC3	SO55	24.07	24.17	23.84
	TDSO32（FCH）	24.06	24.20	23.87
	TDSO32（FCH+SCH）	24.01	24.15	23.73
Rev 0	RTAP 153.6	23.96	24.02	23.90
Rev A	RETAP 4096	23.83	24.01	23.76

Table 11: Test results conducted power measurement CDMA BC1(Hotspot disabled)

Note: The conducted power of CDMA BC1 is measured with RMS detector.

CDMA&EVDO BC1		Average Power (dBm)		
		1175CH	600CH	25CH
RC1	SO55	22.07	22.14	21.85
RC3	SO55	22.17	22.18	21.81
	TDSO32（FCH）	22.19	22.20	21.87
	TDSO32（FCH+SCH）	22.05	22.12	21.86
Rev 0	RTAP 153.6	21.98	22.05	21.79
Rev A	RETAP 4096	22.02	21.98	21.90

Table 12: Test results conducted power measurement CDMA BC1(Hotspot activated)

Note: The conducted power of CDMA BC1 is measured with RMS detector.

7.1.3 Conducted power measurements WiFi&BT

The output power of BT antenna is as following:

BT 2450	Average Conducted Power (dBm)		
	0CH	39CH	78CH
	3.72	5.30	**6.42**

Table 13:Test results conducted power measurement BT.

Note: The conducted power of BT is measured with RMS detector.

The output power of WiFi antenna is as following:

Wi-Fi 2450	Channel	Average Power (dBm) for Data Rates (Mbps)							
		1	2	5.5	11	/	/	/	/
802.11b	1	14.02	14.01	14.00	13.98	/	/	/	/
	6	14.33	14.31	14.30	14.28	/	/	/	/
	11	**14.77**	14.75	14.73	14.72	/	/	/	/
802.11g	Channel	6	9	12	18	24	36	48	54
	1	11.59	11.58	11.57	11.59	11.58	11.57	11.56	11.55
	6	11.80	11.79	11.77	11.78	11.76	11.75	11.74	11.73
	11	12.15	12.14	12.13	12.10	12.08	12.10	12.09	12.07
802.11n HT20	Channel	6.5	13	19.5	26	39	52	58.5	65
	1	11.01	11.00	10.58	10.56	10.53	10.5	10.49	10.48
	6	11.32	11.30	11.29	11.27	11.20	11.25	11.24	11.23
	11	11.55	11.54	11.53	11.52	11.50	11.49	11.48	11.47

Table 14:Test results conducted power measurement WiFi .

Note:

1) The Average conducted power of WiFi is measured with RMS detector.

2) Per KDB248227, for each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate.

7.2 SAR measurement Result

1) Per KDB447498 D01v05,testing of other required channels within the operating mode of a frequency band is not required when the reported(Scaled) SAR for the middle channel or highest output power channels is ≤0.8W/kg. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
2) Per KDB865664 D01v01,for each frequency band,repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg,only one repeated measurement is required.
3).Per KDB648474 D04v01,SAR is evaluated without a headset connected to the device.When the standalone reported SAR is ≤1.2 W/kg, no additional SAR evaluations using a headset are required.
4) Per KDB941225 D06, the DUT Dimension is 117mmx62mm, which is bigger than 9 cm x 5 cm, so 10mm is chosen as Hotspot mode test separation distance.
5) Per KDB248227, for each frequency band of WiFi, SAR test at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate.
6) All measurement SAR result is scaled-up to account for tune-up tolerance is compliant

7.2.1 SAR measurement Result of CDMA BC0

Test Position of Head	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Left Hand Touched	777/848.31	RC3 SO55	0.867	0.627	0.090	24.07	24.75	1.014	21.4°C
Left Hand Touched	384/836.52	RC3 SO55	0.742	0.538	-0.100	24.03	24.75	0.876	21.4°C
Left Hand Touched	1013/824.7	RC3 SO55	0.621	0.453	-0.050	24.03	24.75	0.733	21.4°C
Left Hand Tilted 15°	384/836.52	RC3 SO55	0.509	0.401	-0.080	24.03	24.75	0.601	21.4°C
Right Hand Touched	777/848.31	RC3 SO55	1.050	0.790	-0.140	24.07	24.75	1.228	21.4°C
Right Hand Touched	384/836.52	RC3 SO55	0.892	0.678	-0.120	24.03	24.75	1.053	21.4°C
Right Hand Touched	1013/824.7	RC3 SO55	0.768	0.582	-0.140	24.03	24.75	0.906	21.4°C
Right Hand Tilted 15°	384/836.52	RC3 SO55	0.570	0.451	-0.050	24.03	24.75	0.673	21.4°C
Tested at worst position with the battery 2#									
Right Hand Touched	777/848.31	RC3 SO55	1.060	0.805	-0.180	24.07	24.75	1.240	21.4°C
Right Hand Touched-Repeated*	777/848.31	RC3 SO55	1.070	0.810	-0.140	24.07	24.75	1.251	21.4°C

Table 15: Test results head SAR CDMA BC0

Note: * - repeated at the highest SAR measurement according to the FCC KDB 865664

Test Position of Body-Worn with 15mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Towards Phantom	384/836.52	RC3 SO32	0.686	0.511	0.040	24.13	24.75	0.791	21.4°C
Towards Ground	777/848.31	RC3 SO32	0.898	0.657	-0.040	24.14	24.75	1.033	21.4°C
Towards Ground	384/836.52	RC3 SO32	0.865	0.635	0.000	24.13	24.75	0.998	21.4°C
Towards Ground	1013/824.7	RC3 SO32	0.807	0.591	-0.010	24.03	24.75	0.953	21.4°C
Towards Ground	777/848.31	Rev.0	0.817	0.594	0.050	24.04	24.75	0.962	21.4°C
Towards Ground	777/848.31	Rev.A	0.976	0.707	0.170	24.02	24.75	1.155	21.4°C
Tested at worst position with the battery 2#									
Towards Ground	777/848.31	Rev.A	0.993	0.730	-0.010	24.02	24.75	1.175	21.4°C
Towards Ground-Repeated*	777/848.31	Rev.A	0.988	0.727	0.040	24.02	24.75	1.169	21.4°C

Table 16:Test results Body-worn SAR CDMA BC0(Hotspot disabled)

Note: * - repeated at the highest SAR measurement according to the FCC KDB 865664

Test Position of Hotspot with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Towards Phantom	384/836.52	Rev.0	0.567	0.411	-0.180	22.18	22.75	0.647	21.4°C
Towards Ground	777/848.31	Rev.0	0.738	0.535	0.060	22.21	22.75	0.836	21.4°C
Towards Ground	384/836.52	Rev.0	0.723	0.526	0.080	22.18	22.75	0.824	21.4°C
Towards Ground	1013/824.7	Rev.0	0.703	0.514	0.050	22.09	22.75	0.818	21.4°C
Left edge	384/836.52	Rev.0	0.429	0.292	-0.140	22.18	22.75	0.489	21.4°C
Right edge	384/836.52	Rev.0	0.459	0.318	0.090	22.18	22.75	0.523	21.4°C
Bottom edge	384/836.52	Rev.0	0.077	0.045	0.160	22.18	22.75	0.088	21.4°C
Towards Ground	777/848.31	Rev.A	0.825	0.599	0.110	22.23	22.75	0.930	21.4°C
Towards Ground-Repeated*	777/848.31	Rev.A	0.819	0.588	-0.170	22.23	22.75	0.923	21.4°C
Towards Ground	777/848.31	RC3 SO32	0.775	0.566	-0.060	22.12	22.75	0.896	21.4°C
Tested at worst position with the battery 2#									
Towards Ground	777/848.31	Rev.A	0.779	0.580	-0.060	22.23	22.75	0.878	21.4°C

Table 17:Test results Hotspot SAR CDMA BC0(Hotspot activated)

Note:

1) Per KDB941225 D06,for the antenna-to-edge distance is greater than 2.5 cm,so the top edge does not need to be tested.

2) * - repeated at the highest SAR measurement according to the FCC KDB 865664.

7.2.2 SAR measurement Result of CDMA BC1

Test Position of Head	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Left Hand Touched	1175/1908.75	RC3 SO55	1.070	0.593	0.090	23.84	24.55	1.260	21.4°C
Left Hand Touched	600/1880	RC3 SO55	1.070	0.598	0.050	24.17	24.55	1.168	21.4°C
Left Hand Touched	25/1851.25	RC3 SO55	0.959	0.540	0.090	24.07	24.55	1.071	21.4°C
Left Hand Tilted 15°	600/1880	RC3 SO55	0.238	0.145	0.100	24.17	24.55	0.260	21.4°C
Right Hand Touched	1175/1908.75	RC3 SO55	0.770	0.458	0.120	23.84	24.55	0.907	21.4°C
Right Hand Touched	600/1880	RC3 SO55	0.834	0.504	0.040	24.17	24.55	0.910	21.4°C
Right Hand Touched	25/1851.25	RC3 SO55	0.724	0.442	0.160	24.07	24.55	0.809	21.4°C
Right Hand Tilted 15°	600/1880	RC3 SO55	0.185	0.119	-0.110	24.17	24.55	0.202	21.4°C
Tested at worst position with the battery 2#									
Left Hand Touched	1175/1908.75	RC3 SO55	1.100	0.605	-0.060	23.84	24.55	1.295	21.4°C
Left Hand Touched-Repeated*	1175/1908.75	RC3 SO55	1.090	0.597	0.120	23.84	24.55	1.284	21.4°C

Table 18: Test results head SAR CDMA BC1

Test Position of Body-Worn with 15mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Towards Phantom	600/1880	RC3 SO32	0.528	0.331	0.000	24.20	24.55	0.572	21.4°C
Towards Ground	600/1880	RC3 SO32	0.600	0.363	-0.150	24.20	24.55	0.650	21.4°C
Towards Ground	600/1880	Rev.0	0.569	0.341	0.010	24.02	24.55	0.643	21.4°C
Towards Ground	600/1880	Rev.A	0.644	0.372	-0.100	24.01	24.55	0.729	21.4°C
Tested at worst position with the battery 2#									
Towards Ground	600/1880	Rev.A	0.640	0.385	-0.170	24.01	24.55	0.725	21.4°C

Table 19:Test results Body-worn SAR CDMA BC1(Hotspot disabled)

Test Position of Hotspot with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Towards Phantom	600/1880	Rev.0	0.562	0.337	-0.110	22.05	22.55	0.631	21.4°C
Towards Ground	600/1880	Rev.0	0.657	0.376	0.110	22.05	22.55	0.737	21.4°C
Left edge	600/1880	Rev.0	0.241	0.126	0.120	22.05	22.55	0.270	21.4°C
Right edge	600/1880	Rev.0	0.138	0.058	0.000	22.05	22.55	0.142	21.4°C
Bottom edge	600/1880	Rev.0	0.682	0.354	0.030	22.05	22.55	0.765	21.4°C
Bottom edge	1175/1908.75	Rev.A	0.738	0.378	0.040	21.90	22.55	0.857	21.4°C
Bottom edge	600/1880	Rev.A	0.758	0.397	0.150	21.98	22.55	0.864	21.4°C
Bottom edge	25/1851.25	Rev.A	0.671	0.355	0.100	22.02	22.55	0.758	21.4°C
Bottom edge	600/1880	RC3 SO32	0.682	0.363	0.050	22.05	22.55	0.765	21.4°C
Tested at worst position with the battery 2#									
Bottom edge	600/1880	Rev.A	0.762	0.407	0.020	21.98	22.55	0.869	21.4°C

Table 20:Test results Hotspot SAR CDMA BC1(Hotspot activated)

Note:

1) Per KDB941225 D06,for the antenna-to-edge distance is greater than 2.5 cm,so the top edge does not need to be tested.

7.2.3 SAR measurement Result of WiFi

Test Position of Head	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Left Hand Touched	11/2462	802.11 b	0.030	0.013	0.030	14.77	16.00	0.040	21.4°C
Left Hand Tilted 15°	11/2462	802.11 b	0.037	0.017	0.170	14.77	16.00	0.049	21.4°C
Right Hand Touched	11/2462	802.11 b	0.046	0.019	-0.160	14.77	16.00	0.061	21.4°C
Right Hand Tilted 15°	11/2462	802.11 b	0.053	0.016	0.000	14.77	16.00	0.070	21.4°C
Tested at worst position with the battery 2#									
Right Hand Tilted 15°	11/2462	802.11 b	0.050	0.018	0.020	14.77	16.00	0.066	21.4°C

Table 21: Test results head SAR WiFi 2450MHz

Test Position of Body-Worn with 15mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Towards Phantom	11/2462	802.11 b	0.026	0.023	-0.040	14.77	16.00	0.035	21.4°C
Towards Ground	11/2462	802.11 b	0.091	0.039	0.160	14.77	16.00	0.121	21.4°C
Tested at worst position with the battery 2#									
Towards Ground	11/2462	802.11 b	0.094	0.028	-0.060	14.77	16.00	0.125	21.4°C

Table 22: Test results Body-Worn SAR WiFi 2450MHz

Test Position of Hotspot with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with the battery 1#									
Towards Phantom	11/2462	802.11 b	0.028	0.023	-0.040	14.77	16.00	0.037	21.4°C
Towards Ground	11/2462	802.11 b	0.158	0.068	0.050	14.77	16.00	0.210	21.4°C
Left edge	11/2462	802.11 b	0.017	0.002	0.150	14.77	16.00	0.024	21.4°C
Top edge	11/2462	802.11 b	0.001	NA	-0.190	14.77	16.00	0.001	21.4°C
Tested at worst position with the battery 2#									
Towards Ground	11/2462	802.11 b	0.119	0.043	-0.020	14.77	16.00	0.158	21.4°C

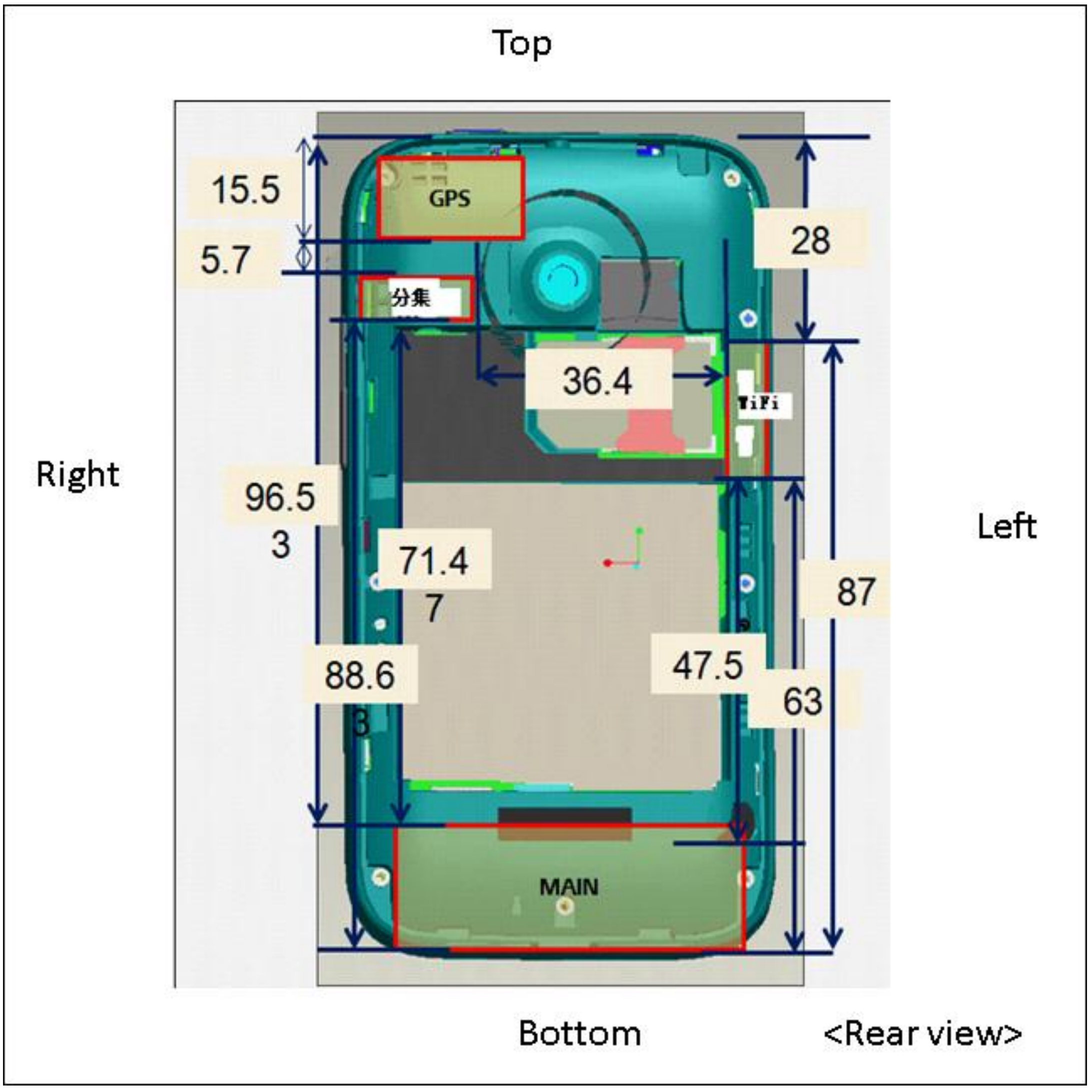
Table 23: Test results Hotspot SAR WiFi 2450MHz

Note: Per KDB941225 D06,for the antenna-to-edge distance is greater than 2.5 cm,so the Bottom and Right edge does not need to be tested.

7.3 Multiple Transmitter Evaluation

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498D01 General RF Exposure Guidance v05.

The closest distance between BT/WiFi antenna and main antenna is 4.75cm, and the location of the antennas inside mobile phone is shown as below picture:



7.3.1 Stand-alone SAR test exclusion

The 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR, where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

a) Head position

Mode	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	Exclusion threshold	SAR test exclusion
CDMA800	24.75	298.54	5	0.800	53.40	3.00	No
CDMA1900	24.55	285.10	5	1.900	78.60	3.00	No
WiFi	16.00	39.81	5	2.450	12.46	3.00	No
BT	6.50	4.47	5	2.450	1.40	3.00	Yes

Table 24: Standalone SAR test exclusion in head position

Note: * - maximum possible output power declared by manufacturer

b) Body-Worn position

Mode	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	Exclusion threshold	SAR test exclusion
CDMA800	24.75	298.54	15	0.800	17.80	3.00	No
CDMA1900	24.55	285.10	15	1.900	26.20	3.00	No
WiFi	16.00	39.81	15	2.450	4.15	3.00	No
BT	6.50	4.47	15	2.450	0.47	3.00	Yes

Table 25: Standalone SAR test exclusion in body-worn position

Note: * - maximum possible output power declared by manufacturer

c) Hotspot position

Mode	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	Exclusion threshold	SAR test exclusion
CDMA800	24.75	298.54	10	0.800	26.70	3.00	No
CDMA1900	24.55	285.10	10	1.900	39.30	3.00	No
WiFi	16.00	39.81	10	2.450	6.23	3.00	No
BT	6.50	4.47	10	2.450	0.70	3.00	Yes

Table 26: Standalone SAR test exclusion in hotspot position

Note: * - maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] •
[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm,where x = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	X	Estimated SAR (W/Kg)*
BT	Head	6.50	4.47	5	2.450	7.5	0.186
BT	Body-Worn	6.50	4.47	15	2.450	7.5	0.062
BT	Hotspot	6.50	4.47	10	2.450	7.5	0.093

Table 27: Estimated SAR calculation for BT

Note: * - maximum possible output power declared by manufacturer

7.3.2 Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities are as below:

Simultaneous Transmission Possibilities				
Simultaneous Tx Combination	**Configuration**	**Head**	**Body-Worn**	**Hotspot**
1	CDMA BC0/BC1 + WiFi	Yes	Yes	Yes
2	CDMA BC0/BC1 + BT	Yes	Yes	Yes

Table 28: Simultaneous Transmission Possibilities

Note: The device does not support simultaneous BT and WiFi, because they share the same antenna.

7.3.3 SAR Summation Scenario

Test Position		Scaled SAR_{Max}		Σ1-g SAR	SPLSR	Remark
		CDMA BC0	WiFi			
Head	Left Hand Touched	1.014	0.040	1.054	N/A	N/A
	Left Hand Tilted 15°	0.601	0.049	0.650	N/A	N/A
	Right Hand Touched	1.251	0.061	**1.312**	N/A	N/A
	Right Hand Tilted 15°	0.673	0.070	0.743	N/A	N/A
Body-Worn	Towards Phantom	0.791	0.035	0.826	N/A	N/A
	Towards Ground	1.175	0.125	1.300	N/A	N/A
Hotspot	Towards Phantom	0.647	0.037	0.684	N/A	N/A
	Towards Ground	0.930	0.210	1.140	N/A	N/A
	Left edge	0.489	0.024	0.513	N/A	N/A
	Right edge	0.523	0.000	0.523	N/A	N/A
	Top edge	0.000	0.001	0.001	N/A	N/A
	Bottom edge	0.088	0.000	0.088	N/A	N/A

Table 29: Simultaneous Tx Combination of CDMA BC0 and WiFi.

Test Position		Scaled SAR_{Max} CDMA BC1	Scaled SAR_{Max} WiFi	Σ1-g SAR	SPLSR	Remark
Head	Left Hand Touched	1.295	0.040	**1.335**	N/A	N/A
	Left Hand Tilted 15°	0.260	0.049	0.309	N/A	N/A
	Right Hand Touched	0.910	0.061	0.971	N/A	N/A
	Right Hand Tilted 15°	0.202	0.070	0.272	N/A	N/A
Body-Worn	Towards Phantom	0.572	0.035	0.607	N/A	N/A
	Towards Ground	0.729	0.125	0.854	N/A	N/A
Hotspot	Towards Phantom	0.631	0.037	0.668	N/A	N/A
	Towards Ground	0.737	0.210	0.947	N/A	N/A
	Left edge	0.270	0.024	0.294	N/A	N/A
	Right edge	0.142	0.000	0.142	N/A	N/A
	Top edge	0.000	0.001	0.001	N/A	N/A
	Bottom edge	0.869	0.000	0.869	N/A	N/A

Table 30: Simultaneous Tx Combination of CDMA BC1 and WiFi.

Test Position		Scaled SAR_{Max} CDMA BC0	Scaled SAR_{Max} BT	Σ1-g SAR	SPLSR	Remark
Head	Left Hand Touched	1.014	0.186	1.200	N/A	N/A
	Left Hand Tilted 15°	0.601	0.186	0.787	N/A	N/A
	Right Hand Touched	1.251	0.186	**1.437**	N/A	N/A
	Right Hand Tilted 15°	0.673	0.186	0.859	N/A	N/A
Body-Worn	Towards Phantom	0.791	0.062	0.853	N/A	N/A
	Towards Ground	1.175	0.062	1.237	N/A	N/A
Hotspot	Towards Phantom	0.647	0.093	0.740	N/A	N/A
	Towards Ground	0.930	0.093	1.023	N/A	N/A
	Left edge	0.489	0.093	0.582	N/A	N/A
	Right edge	0.523	0.093	0.616	N/A	N/A
	Top edge	0.000	0.093	0.093	N/A	N/A
	Bottom edge	0.088	0.093	0.181	N/A	N/A

Table 31: Simultaneous Tx Combination of CDMA BC0 and BT

Test Position		Scaled SAR_{Max} CDMA BC1	Scaled SAR_{Max} BT	Σ1-g SAR	SPLSR	Remark
Head	Left Hand Touched	1.295	0.186	**1.481**	N/A	N/A
	Left Hand Tilted 15°	0.260	0.186	0.446	N/A	N/A
	Right Hand Touched	0.910	0.186	1.096	N/A	N/A
	Right Hand Tilted 15°	0.202	0.186	0.388	N/A	N/A
Body-Worn	Towards Phantom	0.572	0.062	0.634	N/A	N/A
	Towards Ground	0.729	0.062	0.791	N/A	N/A
Hotspot	Towards Phantom	0.631	0.093	0.724	N/A	N/A
	Towards Ground	0.737	0.093	0.830	N/A	N/A
	Left edge	0.270	0.093	0.363	N/A	N/A
	Right edge	0.142	0.093	0.235	N/A	N/A
	Top edge	0.000	0.093	0.093	N/A	N/A
	Bottom edge	0.869	0.093	0.962	N/A	N/A

Table 32: Simultaneous Tx Combination of CDMA BC1 and BT

Conclusion:

Simultaneous Transmission SAR evaluation is not required for CDMA and WiFi&BT, because the highest Σ1-g SAR of all combinations of simultaneous transmission is 1.481W/kg < 1.6W/kg.

Appendix A. System Check Plots

(Pls See Appendix A.)

Appendix B. SAR Measurement Plots

(Pls See Appendix B.)

Appendix C. Calibration Certificate

(Pls See Appendix C.)

Appendix D. Photo documentation

(Pls See Appendix D.)

End