FCC SAR Compliance Test Report

Product Name: Smart Phone

Model: HUAWEI Y336-A2, Y336-A2

Report No.: SYBH(Z-SAR)051032014-2

FCC ID: QISY336-A2

	APPROVED (Lab Manager)	PREPARED (Test Engineer)
BY	Wei Huanbin	Li Wei
DATE	2014-05-04	2014-05-04

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2014-05-04	Li Wei

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HUAWEI Y336-A2, Y336-A2 are as below Table 1.

Band	Max Reported SAR(W/kg)		
	1-g Head	1-g Body-worn (15mm) *	1-g Hotspot (10mm)
CDMA BC0	0.670	0.897	0.531
CDMA BC1	**1.379**	**0.915**	**1.237**
WiFi	0.380	0.108	0.183
The highest simultaneous SAR value is 1.379W/kg per KDB690783 D01			

Table 1:Summary of test result

Note:

1)* 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 15mm 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 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.

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

<table>
<tr><td colspan="4">Device Information：</td></tr>
<tr><td>DUT Name:</td><td colspan="3">Smart Phone</td></tr>
<tr><td>Type Identification:</td><td colspan="3">HUAWEI Y336-A2, Y336-A2</td></tr>
<tr><td>FCC ID :</td><td colspan="3">QISY336-A2</td></tr>
<tr><td>MEID DEC:</td><td colspan="3">268435463313167043</td></tr>
<tr><td>Device Type :</td><td colspan="3">Portable device</td></tr>
<tr><td>Device Phase:</td><td colspan="3">Identical Prototype</td></tr>
<tr><td>Exposure Category:</td><td colspan="3">Uncontrolled environment / general population</td></tr>
<tr><td>Hardware Version :</td><td colspan="3">HD1H871GM</td></tr>
<tr><td>Software Version :</td><td colspan="3">Y336-A2V100R001C378B111</td></tr>
<tr><td>Antenna Type :</td><td colspan="3">Internal antenna</td></tr>
<tr><td>Others Accessories</td><td colspan="3">Headset</td></tr>
<tr><td colspan="4">Device Operating Configurations:</td></tr>
<tr><td>Supporting Mode(s)</td><td colspan="3">CDMA BC0/BC1,WiFi 2.4G (tested),BT</td></tr>
<tr><td>Test Modulation</td><td colspan="3">CDMA(QPSK),WiFi(OFDM)</td></tr>
<tr><td rowspan="5">Operating Frequency Range(s)</td><td>Band</td><td>Tx (MHz)</td><td>Rx (MHz)</td></tr>
<tr><td>CDMA BC0</td><td>824-849</td><td>869-894</td></tr>
<tr><td>CDMA BC1</td><td>1850-1910</td><td>1930-1990</td></tr>
<tr><td>BT</td><td colspan="2">2402-2480</td></tr>
<tr><td>WiFi 2.4G</td><td colspan="2">2412-2462</td></tr>
<tr><td rowspan="2">Power Class:</td><td colspan="3">Tested with power control “All up” (CDMA BC0)</td></tr>
<tr><td colspan="3">Tested with power control “All up” (CDMA BC1)</td></tr>
<tr><td rowspan="3">Test Channels (low-mid-high):</td><td colspan="3">1013-384-777(CDMA BC0)</td></tr>
<tr><td colspan="3">25-600-1175(CDMA BC1)</td></tr>
<tr><td colspan="3">1-6-11 (WiFi 2.4G 802.11b)</td></tr>
</table>

Table 3:Device information and operating configuration

1.3.1 General Description

cdma2000 Digital Mobile Phone- HUAWEI Y336-A2, Y336-A2 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.

Bttery information:

Name	Manufacture	Serials number	Description
Rechargeable Li-ion	Huawei Technologies Co., Ltd.	1#: YAIDC04X51900285 2#: UQCDC05951908853	Battery Model: Hb5V1HV Rated capacity: 1950mAh Nominal Voltage:+3.8V Charging Voltage:+4.35V

1.3.2 Hotspot power reduction specification for SAR

This device uses a single fixed level of power reduction through static table look-up for SAR complience and it is triggered by a single event or operation. A fixed level power reduction is applied when hotspot mode becomes active. When the hotspot is disabled, the power value will be recovered.

Item	Description
Supporting power reduction or not	Yes
Frequency Band(s) using power reduction	CDMA BC0/BC1
Power reduction feature	A fixed power reduction is applied when hotspot mode becomes active. When the hotspot is disabled, the power value will be recovered.
Triggering conditions	Only hotspot mode (wireless routing) and nothing else is used to trigger this power reduction.
Full power and reduced power specifications	See Section 7.1
All simultaneous voice and data transmissions combinations and considerations	See Section 7.3

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)
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 v01r01
KDB447498 D01	General RF Exposure Guidance v05r02
KDB648474 D04	Handsets SAR v01r02
KDB248227 D01	SAR meas for 802.11 a/b/g v01r02
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r03
KDB865664 D02	SAR Reporting v01r01
KDB690783 D01	SAR Listings on Grants v01r03

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

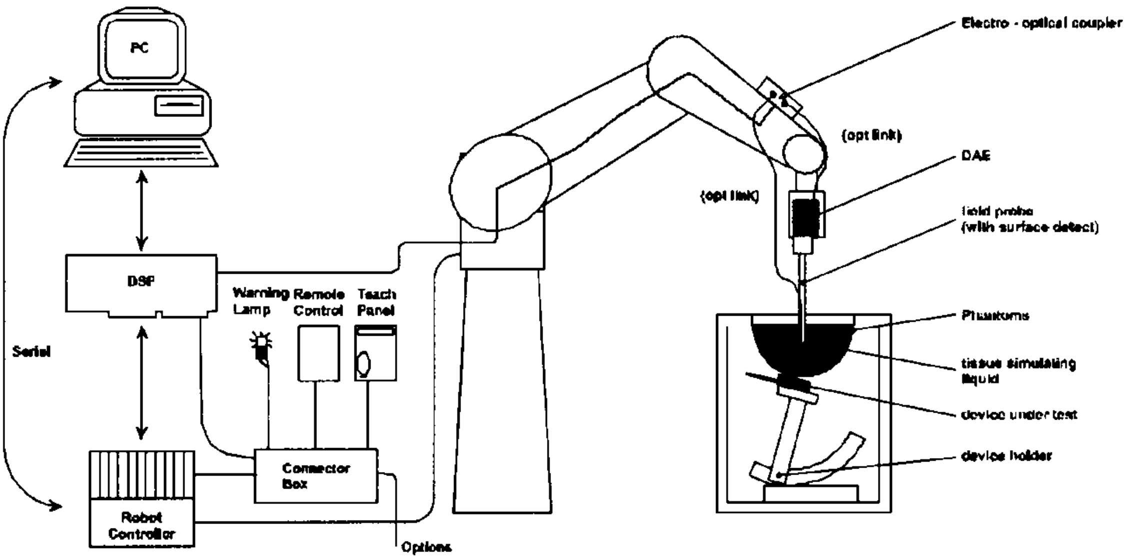
Start Date of test	2014-04-12
End Date of test	2014-04-18

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 7.
- 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.

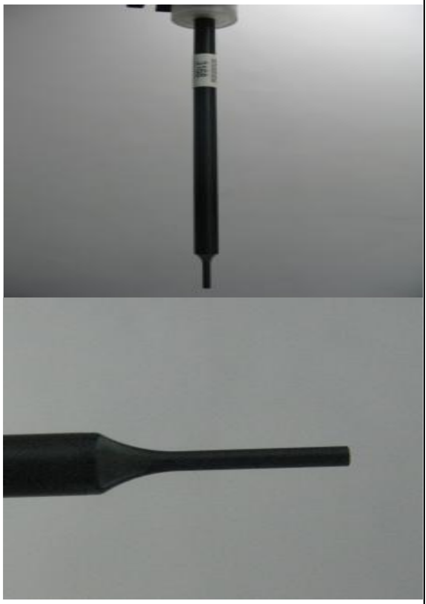
DAE4

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

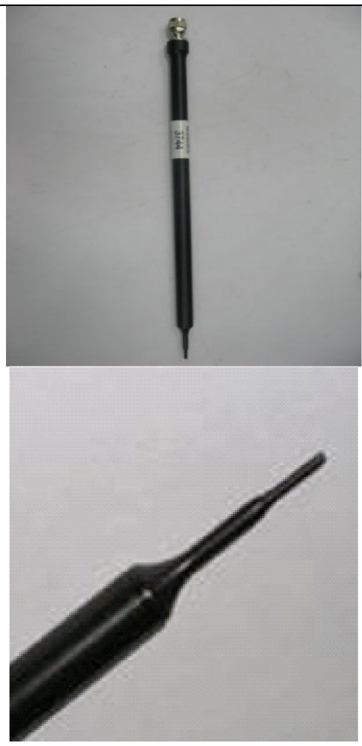
2.4 Probe description

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	

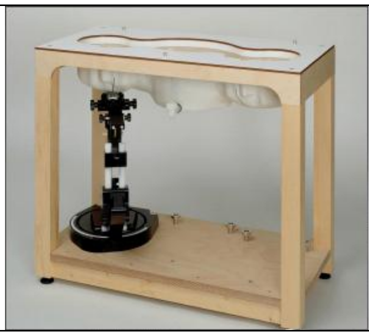
Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

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

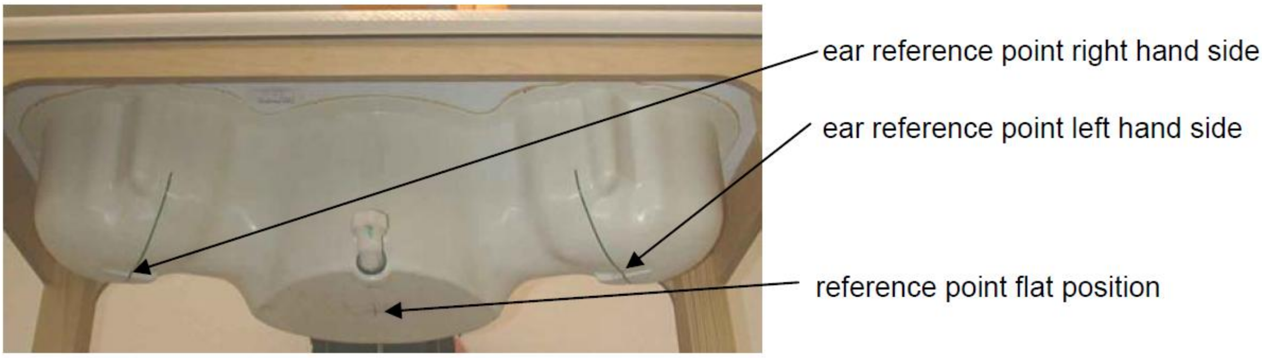
SAM Twin Phantom

Shell Thickness	2mm±0.2mm;The ear region:6.0±0.2mm
Filling Volume	Approximately 25 liters
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet
Measurement Areas	Left hand Right hand Flat phantom



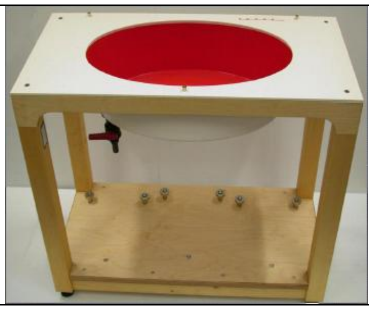
The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.
A white cover is provided to cover the phantom during off-periods to prevent water evaporation and changes in the liquid 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.

The following figure shows the definition of reference point:



ELI4 Phantom

Shell Thickness	2mm±0.2mm
Filling Volume	Approximately 30 liters
Dimensions	Major axis:600mm; Minor axis:400mm;
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.

The phantom shell material is resistant to all ingredients used in the tissue-equivalent liquid recipes. The shell of the phantom including ear spacers is constructed from low permittivity and low loss material, with a relative permittivity $2 \le \varepsilon r \le 5$ at ≤3 GHz,$3 \le \varepsilon r \le 4$ at >3 GHz and and a loss tangent ≤0.05.

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.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent σ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.
The device holder permits the device to be positioned with a tolerance of ±1° in the tilt angle.

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	3744	2013-07-26	One year
☐	SPEAG	Dosimetric E-Field Probe	EX3DV4	3736	2013-05-10	One year
☐	SPEAG	Dosimetric E-Field Probe	ES3DV3	3168	2013-09-30	One year
☐	SPEAG	750 MHz Dipole	D750V3	1044	2011-09-16	Three years
☒	SPEAG	835 MHz Dipole	D835V2	4d059	2013-05-02	Three years
☐	SPEAG	1800 MHz Dipole	D1800V2	2d157	2013-11-27	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	2014-01-23	Three years
☐	SPEAG	2600 MHz Dipole	D2600V2	1021	2011-11-22	Three years
☐	SPEAG	5GHz Dipole	D5GHzV2	1155	2013-06-04	Three years
☒	SPEAG	Data acquisition electronics	DAE4	851	2013-07-31	One year
☐	SPEAG	Data acquisition electronics	DAE4	1236	2013-11-25	One year
☒	SPEAG	Software	DASY 5	N/A	NCR	NCR
☐	SPEAG	Twin Phantom	SAM1	TP-1475	NCR	NCR
☐	SPEAG	Twin Phantom	SAM2	TP-1474	NCR	NCR
☒	SPEAG	Twin Phantom	SAM3	TP-1597	NCR	NCR
☒	SPEAG	Twin Phantom	SAM4	TP-1620	NCR	NCR
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1038	NCR	NCR
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1111	NCR	NCR
☒	R & S	Universal Radio Communication Tester	CMU 200	111379	2013-08-09	One year
☐	R & S	Universal Radio Communication Tester	CMW 500	126855	2013-08-10	Two years
☒	Agilent	Network Analyser	E5071B	MY42404956	2014-01-11	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	NCR	NCR
☒	Agilent	Signal Generator	N5181A	MY47420989	2014-01-18	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1123001	NCR	NCR
☐	MINI-CIRCUITS	Amplifier	ZVE-8G+	129601322	NCR	NCR
☒	AR	Directional Coupler	DC7144M1	311190	2013-05-13	One year
☐	SHX	Directional Coupler	DDTO/4/20	07122401	2013-10-17	One year
☒	R & S	Power Meter	NRP	MY44420359	2013-08-28	One year
☒	R & S	Power Meter Sensor	NRP-Z11	100740	2013-08-28	One year
☒	Agilent	Power Meter	E4417A	MY45101339	2014-01-18	One year
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2014-01-18	One year

Note:
1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. 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) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually 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}≤ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; Δz_{zoom} ≤3GHz - ≤5 mm, 3-4 GHz- ≤4mm 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.

The following table summarizes the area scan and zoom scan resolutions per FCC KDB 865664D01:

Frequency	Maximun Area Scan resolution (Δx_{area}, Δy_{area})	Maximun Zoom Scan spatial resolution (Δx_{Zoom}, Δy_{Zoom})	Maximun Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			$\Delta z_{Zoom}(n)$	$\Delta z_{Zoom}(1)$*	$\Delta z_{Zoom}(n>1)$*	
≤2GHz	≤15mm	≤8mm	≤5mm	≤4mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥30mm
3-4GHz	≤12mm	≤5mm	≤4mm	≤3mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥22mm

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 5 x 5 x 7 points(with 8mm horizontal resolution) or 7 x 7 x 7 points(with 5mm horizontal resolution) or 8 x 8 x 7 points(with 4mm horizontal resolution). 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:

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

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.

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

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)	750	**835**	1800	**1900**	**2450**	2600
Water	39.2	41.45	52.64	55.242	62.7	55.242
Salt (NaCl)	2.7	1.45	0.36	0.306	0.5	0.306
Sugar	57.0	56.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.0	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)	750	**835**	1800	**1900**	**2450**	2600
Water	50.3	52.4	69.91	69.91	73.2	64.493
Salt (NaCl)	1.60	1.40	0.13	0.13	0.04	0.024
Sugar	47.0	45.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.0	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

Simulating Head Liquid for 5G(HBBL3500-5800MHz), Manufactured by SPEAG:

Ingredients	(% by weight)
Water	50-65%
Mineral oil	10-30%
Emulsifiers	8-25%
Sodium salt	0-1.5%

Simulating Body Liquid for 5G (HBBL3500-5800MHz),Manufactured by SPEAG:

Ingredients	(% by weight)
Water	60-80%
Esters,Emulsifiers,Inhibitors	20-40%
Sodium salt	0-1.5%

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)	42.49	0.914	21.4°C	2014-04-12
	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	42.53	0.919		
	850	41.50 (39.43~43.58)	0.92 (0.87~0.96)	42.61	0.931		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	53.38	0.943	21.4°C	2014-04-12
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	53.18	0.952		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	52.93	0.958		
1900H	1850	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.49	1.334	21.4°C	2014-04-13
	1880	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.41	1.360		
	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.29	1.373		
	1910	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.24	1.396		
1900B	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.77	1.494	21.4°C	2014-04-13
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.59	1.524		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.54	1.533		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.47	1.553		
2450H	2410	39.30 (37.34~41.26)	1.76 (1.67~1.85)	38.1	1.842	21.4°C	2014-04-18
	2435	39.20 (37.24~41.16)	1.79 (1.70~1.88)	37.96	1.872		
	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	37.92	1.879		
	2460	39.20 (37.24~41.16)	1.81 (1.72~1.90)	37.85	1.897		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	52.13	1.972	21.4°C	2014-04-18
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	52.08	2.006		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	52.01	2.026		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	52.01	2.042		
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 865664 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).

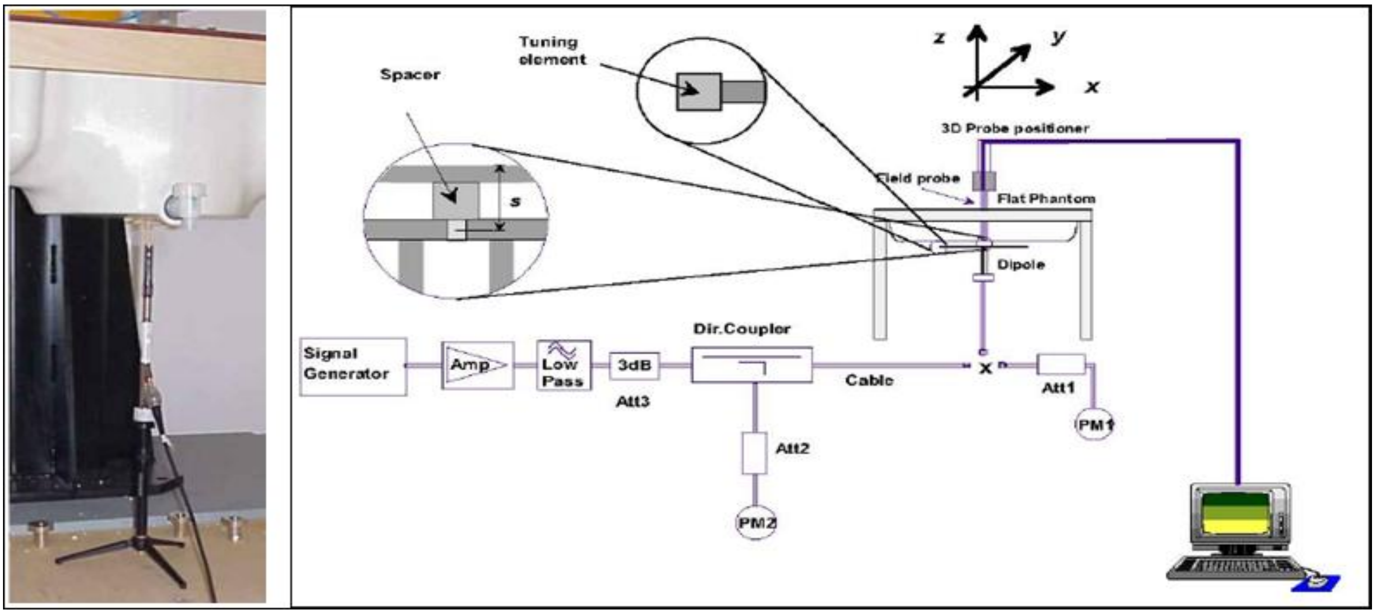
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D835V2 Head	9.49 (8.54~10.44)	6.18 (5.56~6.80)	9.52	6.20	21.4°C	2014-04-12
D1900V2 Head	40.60 (36.54~44.66)	21.20 (19.08~23.32)	39.32	20.64	21.4°C	2014-04-13
D2450V2 Head	52.60 (47.34~57.86)	24.50 (22.05~26.95)	55.60	25.84	21.4°C	2014-04-18
D835V2 Body	9.42 (8.48~10.36)	6.19 (5.57~6.80)	9.52	6.28	21.4°C	2014-04-12
D1900V2 Body	41.40 (37.26~45.54)	21.80 (19.62~23.98)	42.80	22.16	21.4°C	2014-04-13
D2450V2 Body	50.6 (45.54~55.66)	23.7 (21.33~26.07)	50.40	23.48	21.4°C	2014-04-18

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(below 5GHz) or 100mW(above 5GHz). 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 SAR measurement variability and uncertainty

5.1 SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r03, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The detailed repeated measurement results are shown in Section 7.2.

5.2 SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03,when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2003 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

6 SAR 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

1) Head SAR measurement

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.

2) Body SAR measurement

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.

6.1.3 Body SAR Measurements for EV-DO Hotspot

Hotspot body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev.0. SAR for Subtype 2 Physical Layer configurations is not required for Rev. A when the maximum average output of each RF channel is less that measured in Subtype 0/1 Physical Layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channels in Rev.0 .The AT is tested with a Reverse Data Channel rate of 153.6kbps IN Subtype 0/1 Physical Layer configuration; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slot in Subtype 2 Physical Layer configurations. Both FTAP and FETAP are configured with a Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2kbps with the ACK channel transmitting in all slots. AT power control should be in "All Bits Up" conditions for TAP/ETAP.

SAR is not required for 1x RTT for EV-DO devices that also support 1x RTT voice and/or data operations,when the maximun average output of each RF channel is less that ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev.0. Otherwise CDMA Body-SAR Measurement procedures for CDMA 2000 1x Handsets were applied.

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 KDB 248227

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 of CDMA BC0

CDMA&EVDO BC0		Average Power (dBm)		
		1013CH	384CH	777CH
RC1	SO55	23.89	23.91	23.46
RC3	SO55	23.76	23.89	23.55
	TDSO32(FCH)	23.80	23.92	23.58
	TDSO32(FCH+SCH)	23.84	23.88	23.51
Rev 0	RTAP 153.6	23.90	23.92	23.62
Rev A	RETAP 4096	23.88	23.85	23.57

Table 7: Conducted power measurement results of 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	20.99	20.94	20.75
RC3	SO55	20.93	20.91	20.81
	TDSO32(FCH)	20.95	20.89	20.66
	TDSO32(FCH+SCH)	20.91	20.84	20.61
Rev 0	RTAP 153.6	20.89	20.91	20.67
Rev A	RETAP 4096	20.86	20.89	20.64

Table 8: Conducted power measurement results of CDMA BC0(Hotspot activated)

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

7.1.2 Conducted power measurements of CDMA BC1

CDMA&EVDO BC1		Average Power (dBm)		
		25CH	600CH	1175CH
RC1	SO55	24.37	24.18	24.29
RC3	SO55	24.31	24.15	24.24
	TDSO32(FCH)	24.21	24.10	24.24
	TDSO32(FCH+SCH)	24.22	24.13	24.21
Rev 0	RTAP 153.6	24.41	24.31	24.42
Rev A	RETAP 4096	24.33	24.16	24.28

Table 9: Conducted power measurement results of CDMA BC1(Hotspot disabled)

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

CDMA&EVDO BC1		Average Power (dBm)		
		25CH	600CH	1175CH
RC1	SO55	21.60	21.43	21.53
RC3	SO55	21.56	21.41	21.50
	TDSO32(FCH)	21.49	21.35	21.48
	TDSO32(FCH+SCH)	21.44	21.38	21.42
Rev 0	RTAP 153.6	21.47	21.37	21.48
Rev A	RETAP 4096	21.45	21.34	21.46

Table 10: Conducted power measurement results of CDMA BC1(Hotspot activated)

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

7.1.3 Conducted power measurements of WiFi 2.4G

The output power of WiFi antenna is as following:

Wi-Fi 2450MHz	Channel	Average Power (dBm) for Data Rates (Mbps)							
		1	2	5.5	11	/	/	/	/
802.11b	1	16.87	16.75	16.62	16.25	/	/	/	/
	6	16.97	16.85	16.77	16.39	/	/	/	/
	11	17.68	17.55	17.47	17.10	/	/	/	/
802.11g	Channel	6	9	12	18	24	36	48	54
	1	11.52	11.25	11.04	10.64	10.24	9.63	9.11	8.91
	6	11.85	11.61	11.40	11.00	10.60	10.00	9.46	9.28
	11	12.81	12.58	12.37	11.97	11.60	11.00	10.48	10.28
802.11n (HT20,800ns)	Channel	6.5	13	19.5	26	39	52	58.5	65
	1	9.52	9.00	8.60	8.21	7.59	7.11	6.94	6.71
	6	9.76	9.30	8.90	8.52	7.94	7.46	7.26	7.06
	11	10.93	10.44	10.05	9.65	9.07	8.60	8.42	8.20

Table 11: Conducted power measurement results of WiFi 2.4G.

Note:

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

2) Per KDB248227, for WiFi 2.4GHz, highest average RF output power channel for the lowest data rate of 802.11b mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11g/n) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11b mode.

7.1.4 Conducted power measurements of BT

The output power of BT antenna is as following:

BT 2450	Average Conducted Power (dBm)		
	0CH	39CH	78CH
BT(2.0)	4.51	5.21	5.13

BT 2450	Average Conducted Power (dBm)		
	0CH	19CH	39CH
BT(4.0)	0.78	1.09	1.02

Table 12: Conducted power measurement results of BT.

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

7.2 SAR measurement Results

General Notes:

1) Per KDB447498 D01v05r02, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demostrate compliant.

2) Per KDB447498 D01v05r02, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz. 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.

3) Per KDB865664 D01v01r03,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.

4) Per KDB941225 D06v01r01, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm,such position does not need to be tested.

5) Per KDB648474 D04v01r02, SAR is evaluated without a headset connected to the device.When the standalone reported Body-Worn SAR is ≤1.2 W/kg, no additional SAR evaluations using a headset are required.

6) Per KDB865664 D02v01r01, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to appendix B for details).

WLAN Notes:

Per KDB248227D01v01r02 and October 2012/April 2013 FCC/TCB workshop meeting notes:

1) For WiFi 2.4GHz, highest average RF output power channel for the lowest data rate of 802.11b mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11g/n) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11b mode.

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 Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Left Hand Touched	384/836.52	RC3 SO55	0.607	0.456	-0.090	23.89	24.25	0.659	21.4°C
Left Hand Tilted 15°	384/836.52	RC3 SO55	0.441	0.333	0.190	23.89	24.25	0.479	21.4°C
Right Hand Touched	384/836.52	RC3 SO55	0.526	0.397	0.170	23.89	24.25	0.571	21.4°C
Right Hand Tilted 15°	384/836.52	RC3 SO55	0.427	0.321	0.000	23.89	24.25	0.464	21.4°C
Tested data at the worst position with battery 2#									
Left Hand Touched	384/836.52	RC3 SO55	0.617	0.465	-0.160	23.89	24.25	**0.670**	21.4°C

Table 13: Head SAR test results of CDMA BC0

Test Position of Body-Worn with 15mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Front Side	384/836.52	RC3 TDSO32	0.629	0.479	-0.030	23.92	24.25	0.679	21.4°C
Back Side	384/836.52	RC3 TDSO32	0.751	0.564	-0.020	23.92	24.25	0.810	21.4°C
Back Side	1013/824.7	RC3 TDSO32	0.808	0.611	-0.050	23.92	24.25	0.872	21.4°C
Back Side	777/848.31	RC3 TDSO32	0.608	0.455	0.000	23.92	24.25	0.656	21.4°C
Tested data at the worst position with battery 2#									
Back Side	1013/824.7	RC3 TDSO32	0.831	0.625	-0.050	23.92	24.25	**0.897**	21.4°C
Back Side-repeated*	1013/824.7	RC3 TDSO32	0.816	0.616	-0.030	23.92	24.25	0.880	21.4°C

Table 14: Body-Worn SAR test results of CDMA BC0

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 Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Front Side	384/836.52	Rev.0	0.384	0.297	0.010	20.91	21.25	0.415	21.4°C
Back Side	384/836.52	Rev.0	0.479	0.362	0.030	20.91	21.25	0.518	21.4°C
Left Side	384/836.52	Rev.0	0.395	0.278	-0.050	20.91	21.25	0.427	21.4°C
Right Side	384/836.52	Rev.0	0.338	0.237	-0.050	20.91	21.25	0.366	21.4°C
Bottom Side	384/836.52	Rev.0	0.086	0.049	0.160	20.91	21.25	0.093	21.4°C
Tested data at the worst position with battery 2#									
Back Side	384/836.52	Rev.0	0.491	0.371	-0.060	20.91	21.25	**0.531**	21.4°C

Table 15: Hotspot SAR test results of CDMA BC0

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 Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Left Hand Touched	600/1880	RC3 SO55	1.050	0.645	0.020	24.15	24.50	1.138	21.4°C
Left Hand Touched	25/1851.25	RC3 SO55	1.290	0.796	0.060	24.31	24.50	1.348	21.4°C
Left Hand Touched	1175/1908.75	RC3 SO55	1.120	0.682	-0.010	24.24	24.50	1.189	21.4°C
Left Hand Tilted 15°	600/1880	RC3 SO55	0.386	0.230	0.090	24.15	24.50	0.418	21.4°C
Right Hand Touched	600/1880	RC3 SO55	0.849	0.522	0.040	24.15	24.50	0.920	21.4°C
Right Hand Touched	25/1851.25	RC3 SO55	0.891	0.550	0.100	24.31	24.50	0.931	21.4°C
Right Hand Touched	1175/1908.75	RC3 SO55	0.871	0.532	0.030	24.24	24.50	0.925	21.4°C
Right Hand Tilted 15°	600/1880	RC3 SO55	0.431	0.282	-0.020	24.15	24.50	0.467	21.4°C
Tested data at the worst position with battery 2#									
Left Hand Touched	25/1851.25	RC3 SO55	1.320	0.826	0.050	24.31	24.50	**1.379**	21.4°C
Left Hand Touched-repeated*	25/1851.25	RC3 SO55	1.300	0.807	0.000	24.31	24.50	1.358	21.4°C

Table 16: Head SAR test results of CDMA BC1

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 Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Front Side	600/1880	RC3 TDSO32	0.809	0.504	0.190	24.10	24.50	0.887	21.4°C
Front Side	25/1851.25	RC3 TDSO32	0.832	0.512	0.140	24.21	24.50	0.889	21.4°C
Front Side	1175/1908.75	RC3 TDSO32	0.746	0.469	0.150	24.24	24.50	0.792	21.4°C
Back Side	600/1880	RC3 TDSO32	0.701	0.438	0.000	24.10	24.50	0.769	21.4°C
Back Side	25/1851.25	RC3 TDSO32	0.708	0.447	0.000	24.21	24.50	0.757	21.4°C
Back Side	1175/1908.75	RC3 TDSO32	0.704	0.444	0.020	24.24	24.50	0.747	21.4°C
Tested data at the worst position with battery 2#									
Front Side	25/1851.25	RC3 TDSO32	0.856	0.526	-0.010	24.21	24.50	**0.915**	21.4°C
Front Side-repeated*	25/1851.25	RC3 TDSO32	0.825	0.507	0.050	24.21	24.50	0.882	21.4°C

Table 17: Body-Worn SAR test results of CDMA BC1

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 Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Front Side	600/1880	Rev.0	0.776	0.461	0.150	21.37	22.00	0.897	21.4°C
Front Side	25/1851.25	Rev.0	0.800	0.470	0.010	21.47	22.00	0.904	21.4°C
Front Side	1175/1908.75	Rev.0	0.763	0.455	0.040	21.48	22.00	0.860	21.4°C
Back Side	600/1880	Rev.0	0.643	0.393	0.120	21.37	22.00	0.743	21.4°C
Left Side	600/1880	Rev.0	0.196	0.119	0.040	21.37	22.00	0.227	21.4°C
Right Side	600/1880	Rev.0	0.194	0.115	0.070	21.37	22.00	0.224	21.4°C
Bottom Side	600/1880	Rev.0	1.050	0.573	-0.150	21.37	22.00	1.214	21.4°C
Bottom Side-repeated*	600/1880	Rev.0	1.070	0.587	-0.170	21.37	22.00	**1.237**	21.4°C
Bottom Side	25/1851.25	Rev.0	0.959	0.524	-0.030	21.47	22.00	1.083	21.4°C
Bottom Side	1175/1908.75	Rev.0	0.973	0.528	0.080	21.48	22.00	1.097	21.4°C
Tested data at the worst position with battery 2#									
Bottom Side	600/1880	Rev.0	1.040	0.568	-0.070	21.37	22.00	1.202	21.4°C

Table 18: Hotspot SAR test results of CDMA BC1

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

7.2.3 SAR measurement Result of WiFi 2.4G

Test Position of Head	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Left Hand Touched	11/2462	802.11 b	0.353	0.172	0.150	17.68	18.00	**0.380**	21.4°C
Left Hand Tilted 15°	11/2462	802.11 b	0.344	0.159	-0.140	17.68	18.00	0.370	21.4°C
Right Hand Touched	11/2462	802.11 b	0.251	0.129	-0.120	17.68	18.00	0.270	21.4°C
Right Hand Tilted 15°	11/2462	802.11 b	0.247	0.121	0.100	17.68	18.00	0.266	21.4°C
Tested data at the worst position with battery 2#									
Left Hand Touched	11/2462	802.11 b	0.334	0.165	-0.050	17.68	18.00	0.360	21.4°C

Table 19: Head SAR test results of 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 Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Front Side	11/2462	802.11 b	0.054	0.029	0.060	17.68	18.00	0.058	21.4°C
Back Side	11/2462	802.11 b	0.088	0.049	0.150	17.68	18.00	0.095	21.4°C
Tested data at the worst position with battery 2#									
Back Side	11/2462	802.11 b	0.100	0.055	0.010	17.68	18.00	**0.108**	21.4°C

Table 20: Body-Worn SAR test results of WiFi 2450MHz

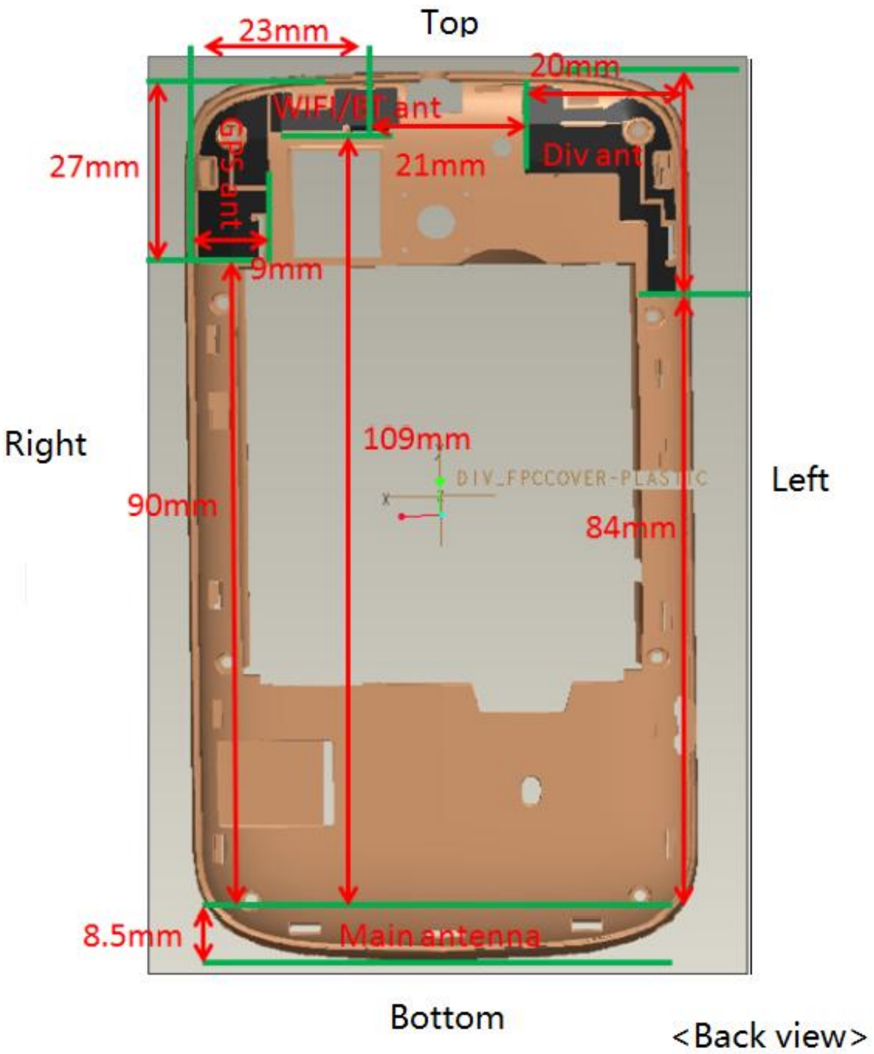
Test Position of Hotspot with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
Front Side	11/2462	802.11 b	0.088	0.048	-0.010	17.68	18.00	0.095	21.4°C
Back Side	11/2462	802.11 b	0.168	0.090	0.050	17.68	18.00	0.181	21.4°C
Top Side	11/2462	802.11 b	0.130	0.064	0.000	17.68	18.00	0.140	21.4°C
Right Side	11/2462	802.11 b	0.107	0.058	0.010	17.68	18.00	0.115	21.4°C
Tested data at the worst position with battery 2#									
Back Side	11/2462	802.11 b	0.170	0.091	0.040	17.68	18.00	**0.183**	21.4°C

Table 21: Hotspot SAR test results of WiFi 2450MHz

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 v05r02.

The location of the antennas inside mobile phone is shown as below picture:



Note:

1) Diversity antenna is used to improve the acceptance of performance of the main antenna. It does not have a transmitter function.

Mode	Exposure Condition	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
CDMA	Hotspot	Yes	Yes	Yes	Yes	No	Yes
WiFi 2.4G	Hotspot	Yes	Yes	No	Yes	Yes	No

Table 22: Sides for SAR testing

Note: 1) Per KDB 941225 D06 and KDB 648474 D04, particular DUT edges were not required to be evaluated for Hotspot and SAR if the antenna-to-edge distance is greater than 2.5cm.

7.3.1 Stand-alone SAR test exclusion

Per FCC KDB 447498D01v05, the 1-g SAR and 10-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 and ≤ 7.5 for 10-g extremity 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.

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
BT	Body-Worn	6.0	3.98	15	2.450	0.42	3.00	Yes

Table 23: Standalone SAR test exclusion for BT

Note:

1)* - maximum possible output power declared by manufacturer

2) Held to ear configurations are not applicable to Bluetooth for this device.

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 and x = 18.75 for 10-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	Body-worn	6.0	3.98	15	2.450	7.5	0.055

Table 24: Estimated SAR calculation for BT

Note:

1) * - maximum possible output power declared by manufacturerS

2) Held to ear configurations are not applicable to Bluetooth and therefore were not considered for simultaneous transmission.

7.3.2 Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration	Head	Body-worn	Hotspot
1	CDMA BC0/BC1(Voice) + WiFi 2.4G	Yes	Yes	N/A
2	CDMA BC0/BC1(DATA) + WiFi 2.4G	N/A	Yes	Yes
3	CDMA BC0/BC1(Voice) + BT	N/A	Yes	N/A
4	CDMA BC0/BC1(DATA) + BT	N/A	Yes	N/A

Table 25: Simultaneous Transmission Possibilities

Note:

1) Wi-Fi 2.4G and Bluetooth share the same Tx antenna and can’t transmit simultaneously.

2) Held to ear configurations are not applicable to Bluetooth and therefore were not considered for simultaneous transmission.

3) VOIP is not available for this device with EV-DO.

7.3.3 SAR Summation Scenario

Test Position		Scaled SARMax		Σ1-g SAR (W/kg)	SPLSR	Remark
		CDMA BC0	WiFi 2.4G			
Head	Left Hand Touched	0.670	0.380	**1.050**	N/A	N/A
	Left Hand Tilted 15°	0.479	0.370	0.849	N/A	N/A
	Right Hand Touched	0.571	0.270	0.841	N/A	N/A
	Right Hand Tilted 15°	0.464	0.266	0.730	N/A	N/A
Body-Worn	Front Side	0.679	0.058	0.737	N/A	N/A
	Back Side	0.897	0.108	1.005	N/A	N/A
Hotspot	Front Side	0.415	0.095	0.510	N/A	N/A
	Back Side	0.531	0.183	0.714	N/A	N/A
	Left Side	0.427	/	0.427	N/A	N/A
	Right Side	0.366	0.115	0.481	N/A	N/A
	Top Side	/	0.140	0.140	N/A	N/A
	Bottom Side	0.093	/	0.093	N/A	N/A

Table 26: Simultaneous Tx Combination of CDMA BC0 and WiFi 2.4G.

Test Position		Scaled SARMax		Σ1-g SAR (W/kg)	SPLSR	Remark
		CDMA BC1	WiFi 2.4G			
Head	Left Hand Touched	1.348	0.380	See Note*	0.026	battery 1#
	Left Hand Touched	1.379	0.360	See Note*	0.026	battery 2#
	Left Hand Tilted 15°	0.418	0.370	0.788	N/A	N/A
	Right Hand Touched	0.931	0.270	1.201	N/A	N/A
	Right Hand Tilted 15°	0.467	0.266	0.733	N/A	N/A
Body-Worn	Front Side	0.915	0.058	0.973	N/A	N/A
	Back Side	0.769	0.108	0.877	N/A	N/A
Hotspot	Front Side	0.904	0.095	0.999	N/A	N/A
	Back Side	0.743	0.183	0.926	N/A	N/A
	Left Side	0.227	/	0.227	N/A	N/A
	Right Side	0.224	0.115	0.339	N/A	N/A
	Top Side	/	0.140	0.140	N/A	N/A
	Bottom Side	1.237	/	**1.237**	N/A	N/A

Table 27: Simultaneous Tx Combination of CDMA BC1 and WiFi 2.4G.

Test Position		Scaled SARMax		Σ1-g SAR (W/kg)	SPLSR	Remark
		CDMA BC0	BT			
Body-Worn	Front Side	0.679	0.055	0.734	N/A	N/A
	Back Side	0.897	0.055	**0.952**	N/A	N/A

Table 28: Simultaneous Tx Combination of CDMA BC0 and BT.

Test Position		Scaled SAR_{Max}		Σ1-g SAR (W/kg)	SPLSR	Remark
		CDMA BC1	BT			
Body-Worn	Front Side	0.915	0.055	**0.970**	N/A	N/A
	Back Side	0.769	0.055	0.824	N/A	N/A

Table 29: Simultaneous Tx Combination of CDMA BC1 and BT.

Note:

1) *-No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SAR to peak location separation ratio(SPLSR) between the antenna pairs was below 0.04 per FCC KDB447498 D01v05r02.See Section 7.3.4 for detailed SPLSR analysis.

2) When SAR to peak location separation ratio is applied to determine simultaneous transmission SAR test exclusion, the highest of the reported stand-alone SAR and estimated SAR is used per KDB690783D01.

7.3.4 SPLSR Evaluation Analysis

According to KDB447498 D01v05, When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio(SPLSR).When the SAR to peak location ratio for each pair of antennas is ≤1-g 0.04 and 10-g 0.10，simultaneous SAR evaluation is not required. When SAR is measured for both antennas in the pair, the peak location separation distance is computed by the following fomula:

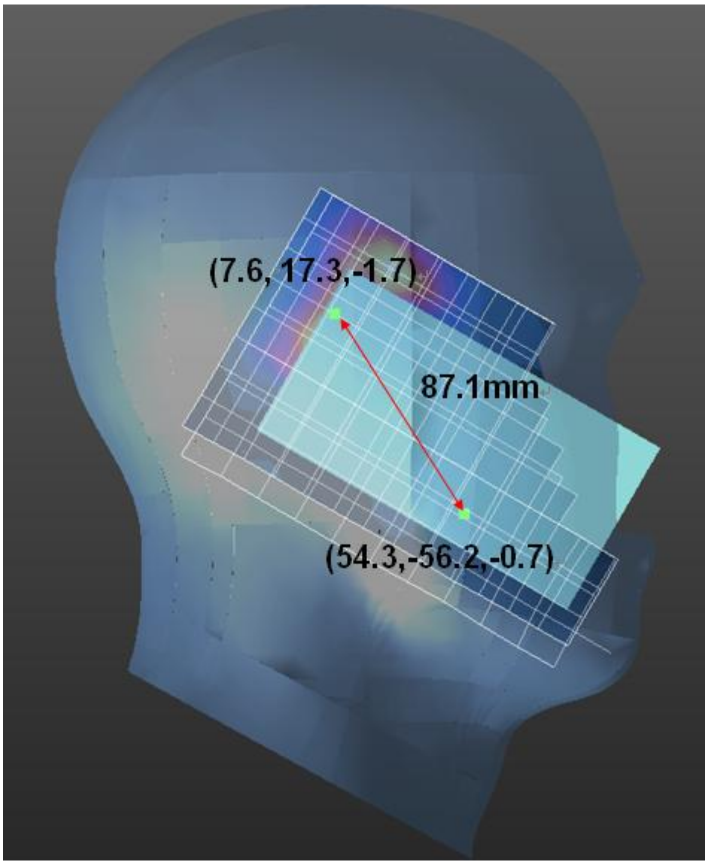
$$\text{Distance}_{Tx1\text{-}Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

$$\text{SPLS Ratio} = (SAR_1 + SAR_2)^{1.5}/R_i$$

When standalone test exclusion applies, SAR is estimated; the peak location is assumed to be at the feed-point or geometric center of the antenna.

1) The sum of aggregate 1-g SAR was above 1.6W/kg for Back Side configuration with CDMA BC1 and WiFi 2.4G(with battery 1#).

The Peak SAR location plot is as below:

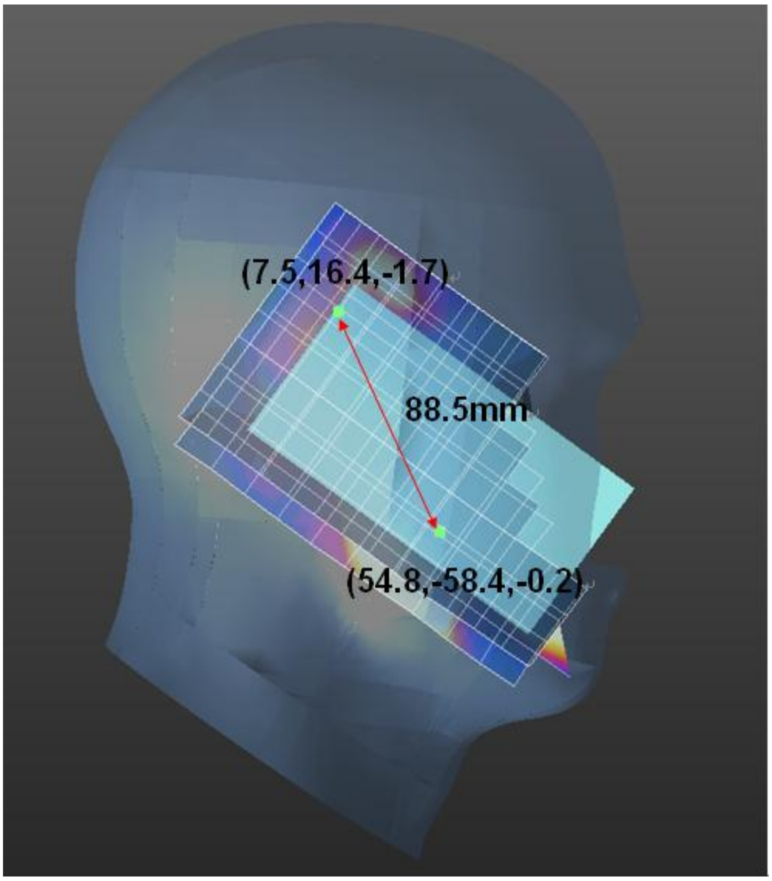


The SAR to peak location ratio calculation is as below:

Test Position	CDMA BC1 (W/kg)	WiFi 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched with battery 1#	1.348	0.380	87.1	0.026	0.04	Not required

2) The sum of aggregate 1-g SAR was above 1.6W/kg for Back Side configuration with CDMA BC1 and WiFi 2.4G(with battery 2#).

The Peak SAR location plot is as below:



The SAR to peak location ratio calculation is as below:

Test Position	CDMA BC1 (W/kg)	WiFi 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched with battery 2#	1.379	0.360	88.5	0.026	0.04	Not required

7.3.5 Simultaneous Transmission Conlcusion

The above numeral summed SAR results and SPLSR analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scans is not required per KDB 447498 D01v05r02

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