FCC SAR Compliance Test Report

Product Name: Smart Phone

Model: HUAWEI Y336-A1, Y336-A1

Report No.: SYBH(Z-SAR)002062014-2

FCC ID: QISY336-A1

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DATE	2014-06-16	2014-06-16

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2014-06-16	Gong Zhong

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HUAWEI Y336-A1, Y336-A1 are as below Table 1.

Band	Max Reported SAR(W/kg)	
	1-g Head	1-g Body-worn (15mm) *
GSM850	0.548	0.420
GSM1900	0.573	0.361
UMTS Band V	0.729	0.958
UMTS Band IV	**1.460**	**1.352**
UMTS Band II	1.363	0.801
WiFi 2.4G	0.413	0.802
The highest simultaneous SAR value is 1.460W/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-A1, Y336-A1</td></tr>
<tr><td>FCC ID :</td><td colspan="3">QISY336-A1</td></tr>
<tr><td>IMEI:</td><td colspan="3">864705020018247</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-A1V100R001C421B123</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">GSM850/1900,UMTS Band II/IV/V,WiFi 2.4G(tested),BT</td></tr>
<tr><td>Test Modulation</td><td colspan="3">GSM(GMSK/8PSK),UMTS(QPSK),WiFi(OFDM)</td></tr>
<tr><td>Device Class</td><td colspan="3">B</td></tr>
<tr><td rowspan="8">Operating Frequency Range(s)</td><td>Band</td><td>Tx (MHz)</td><td>Rx (MHz)</td></tr>
<tr><td>GSM850</td><td>824-849</td><td>869-894</td></tr>
<tr><td>GSM1900</td><td>1850-1910</td><td>1930-1990</td></tr>
<tr><td>UMTS Band V</td><td>824-849</td><td>869-894</td></tr>
<tr><td>UMTS Band IV</td><td>1713-1753</td><td>2113-2153</td></tr>
<tr><td>UMTS Band II</td><td>1850-1910</td><td>1930-1990</td></tr>
<tr><td>BT</td><td colspan="2">2402-2480</td></tr>
<tr><td>2.4G WiFi</td><td colspan="2">2412-2462</td></tr>
<tr><td rowspan="3">GPRS Multislot Class(10)</td><td colspan="2">Max Number of Timeslots in Uplink:</td><td>2</td></tr>
<tr><td colspan="2">Max Number of Timeslots in Downlink:</td><td>4</td></tr>
<tr><td colspan="2">Max Total Timeslot:</td><td>5</td></tr>
<tr><td rowspan="3">EGPRS Multislot Class(10)</td><td colspan="2">Max Number of Timeslots in Uplink:</td><td>2</td></tr>
<tr><td colspan="2">Max Number of Timeslots in Downlink:</td><td>4</td></tr>
<tr><td colspan="2">Max Total Timeslot:</td><td>5</td></tr>
<tr><td>HSDPA UE Category</td><td colspan="3">10</td></tr>
<tr><td>HSUPA UE Category</td><td colspan="3">6</td></tr>
<tr><td rowspan="5">Power Class:</td><td colspan="3">4,tested with power level 5(GSM850)</td></tr>
<tr><td colspan="3">1,tested with power level 0(GSM1900)</td></tr>
<tr><td colspan="3">3, tested with power control “all 1”(UMTS Band II)</td></tr>
<tr><td colspan="3">3, tested with power control “all 1”(UMTS Band IV)</td></tr>
<tr><td colspan="3">3, tested with power control “all 1”(UMTS Band V)</td></tr>
<tr><td rowspan="6">Test Channels (low-mid-high):</td><td colspan="3">128-190-251(GSM850)</td></tr>
<tr><td colspan="3">512-661-810(GSM1900)</td></tr>
<tr><td colspan="3">9262-9400-9538(UMTS Band II)</td></tr>
<tr><td colspan="3">1312-1413-1512(UMTS Band IV)</td></tr>
<tr><td colspan="3">4132-4182-4233(UMTS Band V)</td></tr>
<tr><td colspan="3">1-6-11 (WiFi 2.4G 11b)</td></tr>
</table>

Table 3:Device information and operating configuration

1.3.1 General Description

HUAWEI Y336-A1, Y336-A1 is subscriber equipment in the WCDMA/GSM system. The HSPA/UMTS frequency band is Band II, Band IV, and Band V, The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900, but only Band IV and Band II and Band V and GSM850 and PCS1900 bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, HSPA/UMTS and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS, AGPS and WIFI etc. Externally it provides micro SD card interface, earphone port(to provide voice service) and USIM card interface. 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.

The mobile phone Y336-A1(Old) and Y336-A1(New) are mobile phone with Bluetooth and wifi ;
The only difference between Y336-A1(Old) and Y336-A1(New) is the wifi hotspot. Y336-A1(Old) support wifi hotspot, while Y336-A1(New) doesn't support wifi hotspot. Other parts of the mobile phone are the same, including the appearance, the antenna, Chipset, Adapter, Battery, Mainboard and so on.

Note: According to the difference description above, full test is performed on Y336-A1(Old) (report No.: SYBH(Z-SAR)052032014-2). Y336-A1(New) shares the same test data of Y336-A1(Old) for each frequency band and RF exposure condition, except the hotspot test data.

Battery 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

1.4 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 D02	HSPA and 1x Advanced v02r02
KDB941225 D03	SAR Test Reduction GSM GPRS EDGE v01
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

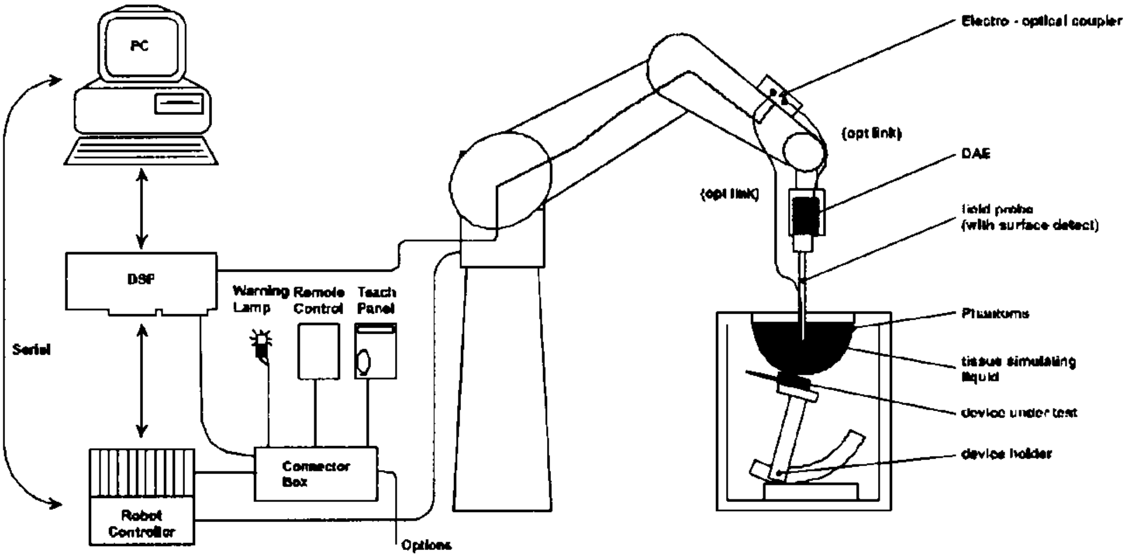
Start Date of test	2014-04-10
End Date of test	2014-04-19

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 DASY5 measurement system is placed at the head end of a room with dimensions:
5 x 2.5 x 3 m^3, 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 m^2 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

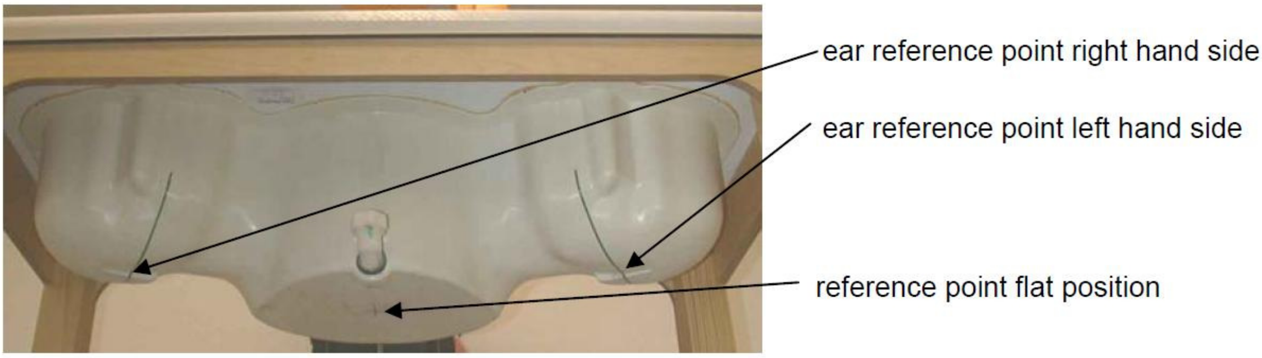
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 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

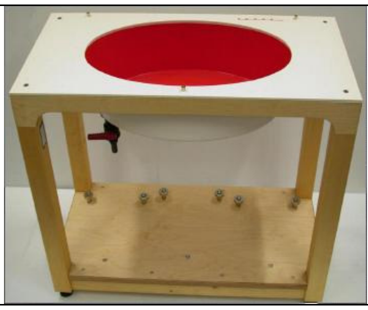
SAM Twin Phantom

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≤εr≤5 at ≤3 GHz,3≤ εr≤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	ES3DV3	3168	2013-09-30	One year
☒	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	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: $E_i = (V_i / Norm_i \bullet ConvF)^{1/2}$

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

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.

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

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.

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

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

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)	43.02	0.919	21.4°C	2014-04-10
	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	42.90	0.929		
	850	41.50 (39.43~43.58)	0.92 (0.87~0.96)	42.71	0.944		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	55.20	0.991	21.4°C	2014-04-10
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	55.20	0.986		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	54.87	1.007		
1800H	1710	40.1 (38.10~42.11)	1.35 (1.28~1.42)	39.50	1.320	21.4°C	2014-04-16
	1730	40.1 (38.10~42.11)	1.36 (1.29~1.43)	39.39	1.341		
	1750	40.1 (38.10~42.11)	1.37 (1.30~1.44)	39.25	1.364		
	1800	40.0 (38.00~42.00)	1.40 (1.33~1.47)	39.05	1.410		
1800B	1710	53.5 (50.83~56.18)	1.46 (1.39~1.53)	54.02	1.501	21.4°C	2014-04-13
	1730	53.5 (50.83~56.18)	1.48 (1.41~1.55)	53.95	1.515		
	1750	53.4 (50.73~56.07)	1.49 (1.42~1.56)	53.86	1.541		
	1800	53.3 (50.64~55.97)	1.52 (1.44~1.60)	53.87	1.571		
1900H	1850	40.00 (38.00~42.00)	1.40 (1.33~1.47)	40.52	1.339	21.4°C	2014-04-12
	1880	40.00 (38.00~42.00)	1.40 (1.33~1.47)	40.35	1.361		
	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	40.33	1.388		
	1910	40.00 (38.00~42.00)	1.40 (1.33~1.47)	40.21	1.401		
1900B	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	53.43	1.448	21.4°C	2014-04-11
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	53.28	1.482		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	53.16	1.492		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	53.08	1.503		

2450H	2410	39.30 (37.34~41.26)	1.76 (1.67~1.85)	37.36	1.803	21.4°C	2014-04-19
	2435	39.20 (37.24~41.16)	1.79 (1.70~1.88)	37.34	1.838		
	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	37.25	1.861		
	2460	39.20 (37.24~41.16)	1.81 (1.72~1.90)	37.32	1.853		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	51.34	1.978	21.4°C	2014-04-19
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	51.26	2.008		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	51.22	2.029		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	51.18	2.040		
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).

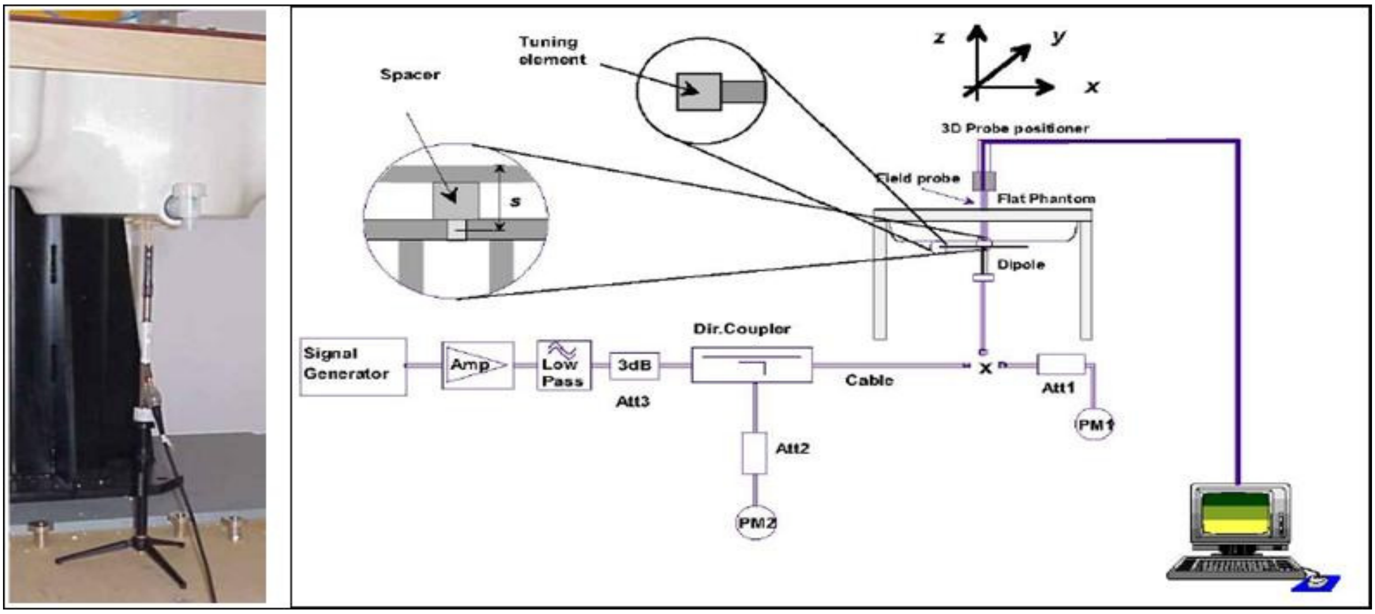
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D835V2 Head	9.49 (8.54~10.44)	6.18 (5.56~6.80)	9.52	6.16	21.4°C	2014-04-10
D1800V2 Head	39.0 (35.1~42.9)	20.4 (18.36~22.44)	37.60	19.84	21.4°C	2014-04-16
D1900V2 Head	40.60 (36.54~44.66)	21.20 (19.08~23.32)	38.60	20.12	21.4°C	2014-04-12
D2450V2 Head	52.60 (47.34~57.86)	24.50 (22.05~26.95)	54.80	25.16	21.4°C	2014-04-19
D835V2 Body	9.42 (8.48~10.36)	6.19 (5.57~6.80)	10.04	6.60	21.4°C	2014-04-10
D1800V2 Body	39.0 (35.1~42.9)	20.6 (18.54~22.66)	40.40	21.00	21.4°C	2014-04-13
D1900V2 Body	41.40 (37.26~45.54)	21.80 (19.62~23.98)	39.52	20.76	21.4°C	2014-04-11
D2450V2 Body	50.6 (45.54~55.66)	23.7 (21.33~26.07)	54.80	25.28	21.4°C	2014-04-19

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 GSM Test Configuration

SAR tests for GSM850 and GSM1900, a communication link is set up with a base station by air link. Using CMU200 the power lever is set to “5”and “0” in SAR of GSM850 and GSM1900. The tests in the band of GSM850 and GSM1900 are performed in the mode of GPRS/EGPRS function. Since the GPRS class is 10 for this EUT, it has at most 2 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 10 for this EUT, it has at most 2 timeslots in uplink, and at most 4 timeslots in downlink, the maximum total timeslot is 5.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot.

The allowed power reduction in the multi-slot configuration is as following:

Number of timeslots in uplink assignment		Reduction of maximum output power (dB)		
Band	Time Slots	GPRS (GMSK）	EGPRS (GMSK)	EGPRS (8PSK)
GSM850	1 TX slot	0	0	0
	2 TX slots	2.2	2.2	1
GSM1900	1 TX slot	0	0	0
	2 TX slots	2.5	2.5	1

Table 7: The allowed power reduction in the multi-slot configuration of GSM

6.2 UMTS Test Configuration

1) Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the procedures description in section 5.2 of 3GPP TS 34.121,using the appropriate RMC or AMR with TPC(transmit power control) set to all “1s” for WCDMA/HSDPA or applying the required inner loop power control procedure to maintain maximum output power while HSUPA is active. Result for all applicable physical channel configurations(DPCCH,DPDCHn and spreading codes, HSDPA, HSPA)

Should be tabulated in the SAR report .All configuration that are not supported by the DUT or cannot be measured due to technical or equipment limitation should be clearly identified.

2) WCDMA

a. Head SAR Measurements

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

b. Body SAR Measurements

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

3) HSDPA

SAR for body exposure configurations is measured according to the "Body SAR Measurements'' procedures of 3G device. In addition, body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HAPRQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the below table, β_{hs} for HS-DPCCH is set automatically to the correct value when ΔACK, ΔNACK, ΔCQI = 8. The variation of the β_c /β_d ratio causes a power reduction at sub-tests 2 - 4.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM(dB)(2)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: ΔACK, ΔNACK and ΔCQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2 : CM=1 for β_c/β_d= 12/15, β_{hs}/β_c = 24/15. For all other combinations of DPDCH,DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 3 : For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to β_c = 11/15 and β_d = 15/15

Table 8: Sub-tests for UMTS Release 5 HSDPA

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI's
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

Table 9:settings of required H-Set 1 QPSK acc. to 3GPP 34.121

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	Maximum HS-DSCH Transport Block Bits/HS-DSCH TTI	Total Soft Channel Bits
1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

Table 10:HSDPA UE category

4) HSUPA

Body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-set 1 and QPSK for FRC and 12.2kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.

Due to inner loop power control requirements in HSDPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSDPA should be configured according to the values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Device' sections of 3G device.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ec} (SF)	β_{ed} (code)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ ACK, Δ NACK and Δ CQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference

Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$

Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$

Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Table 11:Subtests for UMTS Release 6 HSUPA

<table>
<tr><th>UE E-DCH Category</th><th>Maximum E-DCH Codes Transmitted</th><th>Number of HARQ Processes</th><th>E-DCH TTI(ms)</th><th>Minimum Speading Factor</th><th>Maximum E-DCH Transport Block Bits</th><th>Max Rate (Mbps)</th></tr>
<tr><td>1</td><td>1</td><td>4</td><td>10</td><td>4</td><td>7110</td><td>0.7296</td></tr>
<tr><td rowspan="2">2</td><td>2</td><td>8</td><td>2</td><td>4</td><td>2798</td><td rowspan="2">1.4592</td></tr>
<tr><td>2</td><td>4</td><td>10</td><td>4</td><td>14484</td></tr>
<tr><td>3</td><td>2</td><td>4</td><td>10</td><td>4</td><td>14484</td><td>1.4592</td></tr>
<tr><td rowspan="2">4</td><td>2</td><td>8</td><td>2</td><td>2</td><td>5772</td><td>2.9185</td></tr>
<tr><td>2</td><td>4</td><td>10</td><td>2</td><td>20000</td><td>2.00</td></tr>
<tr><td>5</td><td>2</td><td>4</td><td>10</td><td>2</td><td>20000</td><td>2.00</td></tr>
<tr><td rowspan="2">6
(No DPDCH)</td><td>4</td><td>8</td><td>10</td><td rowspan="2">2SF2&2SF4</td><td>11484</td><td>5.76</td></tr>
<tr><td>4</td><td>4</td><td>2</td><td>20000</td><td>2.00</td></tr>
<tr><td rowspan="2">7
(No DPDCH)</td><td>4</td><td>8</td><td>2</td><td rowspan="2">2SF2&2SF4</td><td>22996</td><td>?</td></tr>
<tr><td>4</td><td>4</td><td>10</td><td>20000</td><td>?</td></tr>
<tr><td colspan="7">NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4.UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM.(TS25.306-7.3.0).</td></tr>
</table>

Table 12:HSUPA UE category

6.3 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.

Note: CMU200 measures GSM peak and average output power for active timeslots.For SAR the timebased average power is relevant. The difference in between depends on the duty cycle of the TDMA signal :

No. of timeslots	1	2	3	4
Duty Cycle	1:8.3	1:4.1	1:2.77	1:2.08
timebased avg. power compared to slotted avg. power	-9.19dB	-6.13dB	-4.42dB	-3.18dB

The signalling modes differ as follows:

mode	coding scheme	modulation
GPRS	CS1 to CS4	GMSK
EDGE	MCS1 to MCS4	GMSK
EDGE	MCS5 to MCS9	8PSK

Apart from modulation change (GMSK/8PSK) coding schemes differ in code rate without influence on the RF signal. Therefore one coding scheme per mode was selected for conducted power measurements.

7.1.1 Conducted power measurements of GSM850

GSM850		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		128CH	190CH	251CH		128CH	190CH	251CH
GSM (CS)		33.30	33.30	33.18	-9.19	24.11	24.11	23.99
GPRS/ EDGE (GMSK)	1 Tx Slot	33.34	33.31	33.20	-9.19	24.15	24.12	24.01
	2 Tx Slots	31.23	31.22	31.12	-6.13	25.10	25.09	24.99
EDGE (8PSK)	1 Tx Slot	26.72	26.80	26.82	-9.19	17.53	17.61	17.63
	2 Tx Slots	26.04	26.11	26.16	-6.13	19.91	19.98	20.03

Table 13:Conducted power measurement results of GSM850

Note:
1) The conducted power of GSM850 is measured with RMS detector.
2) Frame-averaged output power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timesolts.

7.1.2 Conducted power measurements of GSM1900

GSM1900		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		512CH	661CH	810CH		512CH	661CH	810CH
GSM (CS)		30.13	29.83	29.91	-9.19	20.94	20.64	20.72
GPRS/ EDGE (GMSK)	1 Tx Slot	30.17	29.83	29.93	-9.19	20.98	20.64	20.74
	2 Tx Slots	27.84	27.45	27.42	-6.13	21.71	21.32	21.29
EDGE (8PSK)	1 Tx Slot	25.72	25.60	25.66	-9.19	16.53	16.41	16.47
	2 Tx Slots	25.08	25.07	25.11	-6.13	18.95	18.94	18.98

Table 14:Conducted power measurement results of GSM1900

Note:
1) The conducted power of GSM1900 is measured with RMS detector.
2) Frame-averaged output power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timesolts.

7.1.3 Conducted power measurements of UMTS Band V

UMTS Band V		Conducted Power (dBm)		
		4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	23.83	23.86	23.89
	64kbps RMC	23.82	23.90	23.87
	144kbps RMC	23.89	23.85	23.93
	384kbps RMC	23.86	23.95	23.90
HSDPA	Subtest 1	22.95	22.91	22.96
	Subtest 2	22.74	22.96	23.00
	Subtest 3	22.26	22.54	22.66
	Subtest 4	22.21	22.18	22.66
HSUPA	Subtest 1	22.59	21.92	22.79
	Subtest 2	21.61	21.71	21.65
	Subtest 3	20.95	20.95	21.77
	Subtest 4	22.01	21.97	22.18
	Subtest 5	22.17	22.28	22.27

Table 15: Conducted power measurement results of UMTS Band V

Note:

1) The conducted power of UMTS Band V is measured with RMS detector.
2) Per KDB941225 D01v02, when maximum output of each RF channel with HSDPA/HSUPA active is ≤ ¼ dB higher than without HSDPA/HSUPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75% of SAR limit, SAR evaluation for HSDPA/HSUPA is not required.

7.1.4 Conducted power measurements of UMTS Band IV

UMTS Band IV		Conducted Power (dBm)		
		1312CH	1413CH	1513CH
WCDMA	12.2kbps RMC	22.95	23.06	22.96
	64kbps RMC	22.85	23.13	23.01
	144kbps RMC	22.90	23.08	22.98
	384kbps RMC	22.86	23.08	22.97
HSDPA	Subtest 1	21.80	22.08	21.88
	Subtest 2	21.72	21.85	21.73
	Subtest 3	21.45	21.60	21.46
	Subtest 4	21.52	21.62	21.51
HSUPA	Subtest 1	21.63	21.95	21.22
	Subtest 2	20.81	20.87	20.34
	Subtest 3	20.34	21.05	20.49
	Subtest 4	21.14	21.19	21.26
	Subtest 5	21.30	21.86	21.06

Table 16: Conducted power measurement results of UMTS Band IV

Note:

1) The conducted power of UMTS Band IV is measured with RMS detector.
2) Per KDB941225 D01v02, when maximum output of each RF channel with HSDPA/HSUPA active is ≤ ¼ dB higher than without HSDPA/HSUPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75% of SAR limit, SAR evaluation for HSDPA/HSUPA is not required.

7.1.5 Conducted power measurements of UMTS Band II

UMTS Band II		Conducted Power (dBm)		
		9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	23.60	23.57	23.69
	64kbps RMC	23.62	23.64	23.70
	144kbps RMC	23.59	23.60	23.78
	384kbps RMC	23.66	23.59	23.75
HSDPA	Subtest 1	22.56	22.57	22.75
	Subtest 2	22.37	22.32	22.55
	Subtest 3	21.89	22.04	21.98
	Subtest 4	22.20	21.81	21.95
HSUPA	Subtest 1	21.82	22.07	22.09
	Subtest 2	21.66	21.48	21.68
	Subtest 3	20.77	20.53	21.57
	Subtest 4	21.64	21.54	21.68
	Subtest 5	21.92	21.84	21.90

Table 17: Conducted power measurement results of UMTS Band II

Note:

1) The conducted power of UMTS Band II is measured with RMS detector.
2) Per KDB941225 D01v02, when maximum output of each RF channel with HSDPA/HSUPA active is ≤ ¼ dB higher than without HSDPA/HSUPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75% of SAR limit, SAR evaluation for HSDPA/HSUPA is not required.

7.1.6 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	16.18	15.87	15.35	15.14	/	/	/	/
	6	16.17	15.83	15.48	15.24	/	/	/	/
	11	16.88	16.77	16.42	16.18	/	/	/	/
802.11g	Channel	6	9	12	18	24	36	48	54
	1	14.72	14.65	14.57	14.43	14.35	14.22	14.13	14.02
	6	14.76	14.67	14.52	14.41	14.39	14.27	14.18	14.06
	11	14.58	14.53	14.49	14.39	14.31	14.31	14.17	14.05
802.11n (HT20,800ns)	Channel	6.5	13	19.5	26	39	52	58.5	65
	1	10.51	10.47	10.35	10.28	10.25	10.21	10.14	10.03
	6	10.62	10.54	10.44	10.31	10.26	10.22	10.18	10.06
	11	10.37	10.34	10.3	10.26	10.19	10.15	10.11	10.01

Table 18: 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.

7.1.7 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 19: 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 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.

5) 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).

GSM Notes:

1) Per KDB648474 D04v01r02, body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.

UMTS Notes:

1) Per KDB941225 D01v02, when maximum output of each RF channel with HSDPA/HSUPA active is ≤1/4 dB higher than without HSDPA/HSUPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75% of SAR limit, SAR evaluation for HSDPA/HSUPA is not required.

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 GSM850

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Left Hand Touched	190/836.6	GSM	0.519	0.392	0.020	33.30	33.50	0.543	21.4°C
Left Hand Tilted 15°	190/836.6	GSM	0.409	0.306	0.090	33.30	33.50	0.428	21.4°C
Right Hand Touched	190/836.6	GSM	0.459	0.348	0.090	33.30	33.50	0.481	21.4°C
Right Hand Tilted 15°	190/836.6	GSM	0.439	0.330	-0.020	33.30	33.50	0.460	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	190/836.6	GSM	0.523	0.394	0.100	33.30	33.50	**0.548**	21.4°C

Table 20: Head SAR test results of GSM850

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Front Side	190/836.6	GSM	0.304	0.232	0.010	33.30	33.50	0.318	21.4°C
Back Side	190/836.6	GSM	0.391	0.294	0.020	33.30	33.50	0.409	21.4°C
Tested at the worst position with battery 2#									
Back Side	190/836.6	GSM	0.401	0.301	0.050	33.30	33.50	**0.420**	21.4°C

Table 21: Body-Worn SAR test results of GSM850

7.2.2 SAR measurement Result of GSM1900

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Left Hand Touched	661/1880	GSM	0.490	0.305	0.190	29.83	30.50	0.572	21.4°C
Left Hand Tilted 15°	661/1880	GSM	0.131	0.078	0.080	29.83	30.50	0.153	21.4°C
Right Hand Touched	661/1880	GSM	0.314	0.192	-0.060	29.83	30.50	0.366	21.4°C
Right Hand Tilted 15°	661/1880	GSM	0.168	0.107	-0.080	29.83	30.50	0.196	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	661/1880	GSM	0.491	0.304	0.050	29.83	30.50	**0.573**	21.4°C

Table 22: Head SAR test results of GSM1900

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Front Side	661/1880	GSM	0.309	0.194	0.070	29.83	30.50	**0.361**	21.4°C
Back Side	661/1880	GSM	0.272	0.174	0.060	29.83	30.50	0.317	21.4°C
Tested at the worst position with battery 2#									
Front Side	661/1880	GSM	0.301	0.189	0.070	29.83	30.50	0.351	21.4°C

Table 23: Body-Worn SAR test results of GSM1900

7.2.1 SAR measurement Result of UMTS Band V

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Left Hand Touched	4182/836.4	RMC	0.616	0.466	0.000	23.86	24.30	0.682	21.4°C
Left Hand Tilted 15°	4182/836.4	RMC	0.442	0.332	0.020	23.86	24.30	0.489	21.4°C
Right Hand Touched	4182/836.4	RMC	0.550	0.418	-0.030	23.86	24.30	0.609	21.4°C
Right Hand Tilted 15°	4182/836.4	RMC	0.490	0.368	0.110	23.86	24.30	0.542	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	4182/836.4	RMC	0.659	0.498	-0.050	23.86	24.30	**0.729**	21.4°C

Table 24: Head SAR test results of UMTS Band V

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Front Side	4182/836.4	RMC	0.657	0.501	0.010	23.86	24.30	0.727	21.4°C
Back Side	4182/836.4	RMC	0.784	0.589	0.000	23.86	24.30	0.868	21.4°C
Back Side	4132/826.4	RMC	0.860	0.647	0.060	23.83	24.30	**0.958**	21.4°C
Back Side-repeated*	4132/826.4	RMC	0.855	0.644	-0.010	23.83	24.30	0.953	21.4°C
Back Side	4233/846.6	RMC	0.848	0.636	0.000	23.89	24.30	0.932	21.4°C
Tested at the worst position with battery 2#									
Back Side	4132/826.4	RMC	0.842	0.633	-0.060	23.83	24.30	0.938	21.4°C

Table 25: Body-Worn SAR test results of UMTS Band V

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

7.2.2 SAR measurement Result of UMTS Band IV

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Left Hand Touched	1413/1732.6	RMC	0.879	0.557	-0.030	23.06	24.30	1.169	21.4°C
Left Hand Touched	1312/1712.4	RMC	1.070	0.680	0.160	22.95	24.30	**1.460**	21.4°C
Left Hand Touched-repeated*	1312/1712.4	RMC	1.000	0.632	-0.040	22.95	24.30	1.365	21.4°C
Left Hand Touched	1513/1752.6	RMC	1.070	0.674	-0.090	22.96	24.30	1.457	21.4°C
Left Hand Tilted 15°	1413/1732.6	RMC	0.343	0.199	-0.020	23.06	24.30	0.456	21.4°C
Right Hand Touched	1413/1732.6	RMC	0.558	0.352	-0.030	23.06	24.30	0.742	21.4°C
Right Hand Tilted 15°	1413/1732.6	RMC	0.386	0.246	0.080	23.06	24.30	0.514	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	1312/1712.4	RMC	1.020	0.644	-0.090	22.95	24.30	1.392	21.4°C

Table 26: Head SAR test results of UMTS Band IV

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Front Side	1413/1732.6	RMC	0.850	0.528	-0.100	23.06	24.30	1.131	21.4°C
Front Side	1312/1712.4	RMC	0.965	0.600	0.080	22.95	24.30	1.317	21.4°C
Front Side	1513/1752.6	RMC	0.895	0.557	0.130	22.96	24.30	1.218	21.4°C
Back Side	1413/1732.6	RMC	0.860	0.532	0.120	23.06	24.30	1.144	21.4°C
Back Side	1312/1712.4	RMC	0.991	0.611	0.110	22.95	24.30	**1.352**	21.4°C
Back Side-repeated*	1312/1712.4	RMC	0.982	0.606	0.090	22.95	24.30	1.340	21.4°C
Back Side	1513/1752.6	RMC	0.914	0.566	0.130	22.96	24.30	1.244	21.4°C
Tested at the worst position with battery 2#									
Back Side	1312/1712.4	RMC	0.972	0.601	0.060	22.95	24.30	1.326	21.4°C

Table 27: Body-Worn SAR test results of UMTS Band IV

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

7.2.3 SAR measurement Result of UMTS Band II

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Left Hand Touched	9400/1880	RMC	1.130	0.696	0.020	23.57	24.30	1.337	21.4°C
Left Hand Touched	9262/1852.4	RMC	1.160	0.730	0.160	23.60	24.30	**1.363**	21.4°C
Left Hand Touched-repeated*	9262/1852.4	RMC	1.160	0.724	0.010	23.60	24.30	1.363	21.4°C
Left Hand Touched	9538/1907.6	RMC	1.040	0.636	0.120	23.69	24.30	1.197	21.4°C
Left Hand Tilted 15°	9400/1880	RMC	0.310	0.183	0.040	23.57	24.30	0.367	21.4°C
Right Hand Touched	9400/1880	RMC	0.720	0.444	-0.040	23.57	24.30	0.852	21.4°C
Right Hand Touched	9262/1852.4	RMC	0.717	0.449	-0.010	23.60	24.30	0.842	21.4°C
Right Hand Touched	9538/1907.6	RMC	0.690	0.425	0.040	23.69	24.30	0.794	21.4°C
Right Hand Tilted 15°	9400/1880	RMC	0.409	0.261	0.000	23.57	24.30	0.484	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	9262/1852.4	RMC	1.120	0.689	-0.010	23.60	24.30	1.316	21.4°C

Table 28: Head SAR test results of UMTS Band II

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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Front Side	9400/1880	RMC	0.663	0.417	0.060	23.57	24.30	0.784	21.4°C
Back Side	9400/1880	RMC	0.637	0.406	0.080	23.57	24.30	0.754	21.4°C
Tested at the worst position with battery 2#									
Front Side	9400/1880	RMC	0.677	0.425	0.060	23.57	24.30	**0.801**	21.4°C
Front Side	9262/1852.4	RMC	0.631	0.398	0.030	23.60	24.30	0.741	21.4°C
Front Side	9538/1907.6	RMC	0.603	0.384	0.100	23.69	24.30	0.694	21.4°C

Table 29: Body-Worn SAR test results of UMTS Band II

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

7.2.4 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					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Left Hand Touched	11/2462	802.11 b	0.318	0.148	0.070	16.88	18.00	0.412	21.4°C
Left Hand Tilted 15°	11/2462	802.11 b	0.300	0.135	0.120	16.88	18.00	0.388	21.4°C
Right Hand Touched	11/2462	802.11 b	0.205	0.106	0.060	16.88	18.00	0.265	21.4°C
Right Hand Tilted 15°	11/2462	802.11 b	0.203	0.101	0.100	16.88	18.00	0.263	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	11/2462	802.11 b	0.319	0.147	0.050	16.88	18.00	**0.413**	21.4°C

Table 30: Head SAR test results of WiFi 2450MHz

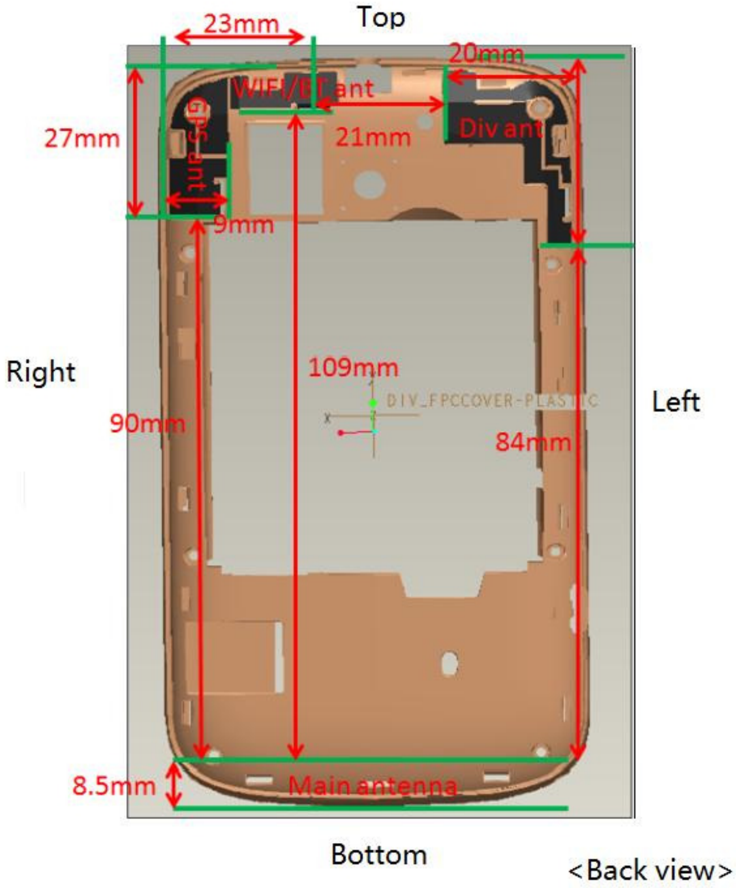
Test Position of Body-Worn with 15mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
The data from report No.: SYBH(Z-SAR)052032014-2									
Test data with battery 1#									
Front Side	11/2462	802.11 b	0.038	0.021	0.090	16.88	18.00	0.050	21.4°C
Back Side	11/2462	802.11 b	0.063	0.035	0.130	16.88	18.00	**0.082**	21.4°C
Tested at the worst position with battery 2#									
Back Side	11/2462	802.11 b	0.061	0.034	0.130	16.88	18.00	0.078	21.4°C

Table 31: Body-Worn 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.

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 32: 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 33: Estimated SAR calculation for BT

Note:

1) * - maximum possible output power declared by manufacturer

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
1	GSM 850/1900(Voice) + WiFi 2.4G	Yes	Yes
2	GPRS/EDGE 850/1900 (DATA) + WiFi 2.4G	N/A	N/A
3	GSM 850/1900(Voice) +BT	N/A	Yes
4	GPRS/EDGE 850/1900 (DATA) + BT	N/A	N/A
5	UMTS 850/1700/1900(Voice) + WiFi 2.4G	Yes	Yes
6	UMTS 850/1700/1900(DATA) + WiFi 2.4G	N/A	Yes
7	UMTS 850/1700/1900(Voice)+BT	N/A	Yes
8	UMTS 850/1700/1900(DATA) +BT	N/A	Yes

Table 34: Simultaneous Transmission Possibilities

Note:

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

2) The device does not support DTM function.

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

7.3.3 SAR Summation Scenario

Test Position		Scaled SAR_{Max} GSM850	Scaled SAR_{Max} WiFi 2.4G	Σ1-g SAR (W/kg)	SPLSR	Remark
Head	Left Hand Touched	0.548	0.413	**0.961**	N/A	N/A
Head	Left Hand Tilted 15°	0.428	0.388	0.816	N/A	N/A
Head	Right Hand Touched	0.481	0.265	0.746	N/A	N/A
Head	Right Hand Tilted 15°	0.460	0.263	0.723	N/A	N/A
Body-Worn	Front Side	0.318	0.050	0.368	N/A	N/A
Body-Worn	Back Side	0.420	0.082	0.502	N/A	N/A

Table 35: Simultaneous Tx Combination of GSM850 and WiFi 2.4G.

Test Position		Scaled SAR_{Max} GSM1900	Scaled SAR_{Max} WiFi 2.4G	Σ1-g SAR (W/kg)	SPLSR	Remark
Head	Left Hand Touched	0.573	0.413	**0.986**	N/A	N/A
Head	Left Hand Tilted 15°	0.153	0.388	0.541	N/A	N/A
Head	Right Hand Touched	0.366	0.265	0.631	N/A	N/A
Head	Right Hand Tilted 15°	0.196	0.263	0.459	N/A	N/A
Body-Worn	Front Side	0.361	0.050	0.411	N/A	N/A
Body-Worn	Back Side	0.317	0.082	0.399	N/A	N/A

Table 36: Simultaneous Tx Combination of GSM1900 and WiFi 2.4G.

Test Position		Scaled SAR_{Max} UMTS Band V	Scaled SAR_{Max} WiFi 2.4G	Σ1-g SAR (W/kg)	SPLSR	Remark
Head	Left Hand Touched	0.729	0.413	**1.142**	N/A	N/A
Head	Left Hand Tilted 15°	0.489	0.388	0.877	N/A	N/A
Head	Right Hand Touched	0.609	0.265	0.874	N/A	N/A
Head	Right Hand Tilted 15°	0.542	0.263	0.805	N/A	N/A
Body-Worn	Front Side	0.727	0.050	0.777	N/A	N/A
Body-Worn	Back Side	0.958	0.082	1.040	N/A	N/A

Table 37: Simultaneous Tx Combination of UMTS Band V and WiFi 2.4G.

Test Position		Scaled SAR_{Max} UMTS Band IV	Scaled SAR_{Max} WiFi 2.4G	Σ1-g SAR (W/kg)	SPLSR	Remark
Head	Left Hand Touched	1.460	0.412	See Note*	0.028	battery 1#
Head	Left Hand Touched	1.392	0.413	See Note*	0.027	battery 2#
Head	Left Hand Tilted 15°	0.456	0.388	0.844	N/A	N/A
Head	Right Hand Touched	0.742	0.265	1.007	N/A	N/A
Head	Right Hand Tilted 15°	0.514	0.263	0.777	N/A	N/A
Body-Worn	Front Side	1.317	0.050	1.367	N/A	N/A
Body-Worn	Back Side	1.352	0.082	**1.434**	N/A	N/A

Table 38: Simultaneous Tx Combination of UMTS Band IV and WiFi 2.4G.

Test Position		Scaled SAR$_{Max}$ UMTS Band II	Scaled SAR$_{Max}$ WiFi 2.4G	Σ1-g SAR (W/kg)	SPLSR	Remark
Head	Left Hand Touched	1.363	0.412	See Note*	0.026	battery 1#
	Left Hand Touched	1.316	0.413	See Note*	0.026	battery 2#
	Left Hand Tilted 15°	0.367	0.388	0.755	N/A	N/A
	Right Hand Touched	0.852	0.265	**1.117**	N/A	N/A
	Right Hand Tilted 15°	0.484	0.263	0.747	N/A	N/A
Body-Worn	Front Side	0.784	0.050	0.834	N/A	N/A
	Back Side	0.801	0.082	0.883	N/A	N/A

Table 39: Simultaneous Tx Combination of UMTS Band II and WiFi 2.4G.

Test Position		Scaled SAR$_{Max}$ GSM850	Scaled SAR$_{Max}$ BT	Σ1-g SAR (W/kg)	SPLSR	Remark
Body-Worn	Front Side	0.318	0.055	0.373	N/A	N/A
	Back Side	0.420	0.055	**0.475**	N/A	N/A

Table 40: Simultaneous Tx Combination of GSM850 and BT.

Test Position		Scaled SAR$_{Max}$ GSM1900	Scaled SAR$_{Max}$ BT	Σ1-g SAR (W/kg)	SPLSR	Remark
Body-Worn	Front Side	0.361	0.055	**0.416**	N/A	N/A
	Back Side	0.317	0.055	0.372	N/A	N/A

Table 41: Simultaneous Tx Combination of GSM1900 and BT.

Test Position		Scaled SAR$_{Max}$ UMTS Band V	Scaled SAR$_{Max}$ BT	Σ1-g SAR (W/kg)	SPLSR	Remark
Body-Worn	Front Side	0.727	0.055	0.782	N/A	N/A
	Back Side	0.958	0.055	**1.013**	N/A	N/A

Table 42: Simultaneous Tx Combination of UMTS Band V and BT.

Test Position		Scaled SAR$_{Max}$ UMTS Band IV	Scaled SAR$_{Max}$ BT	Σ1-g SAR (W/kg)	SPLSR	Remark
Body-Worn	Front Side	1.317	0.055	1.372	N/A	N/A
	Back Side	1.352	0.055	**1.407**	N/A	N/A

Table 43: Simultaneous Tx Combination of UMTS Band IV and BT.

Test Position		Scaled SAR$_{Max}$ UMTS Band II	Scaled SAR$_{Max}$ BT	Σ1-g SAR (W/kg)	SPLSR	Remark
Body-Worn	Front Side	0.784	0.055	0.839	N/A	N/A
	Back Side	0.801	0.055	**0.856**	N/A	N/A

Table 44: Simultaneous Tx Combination of UMTS Band II 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:

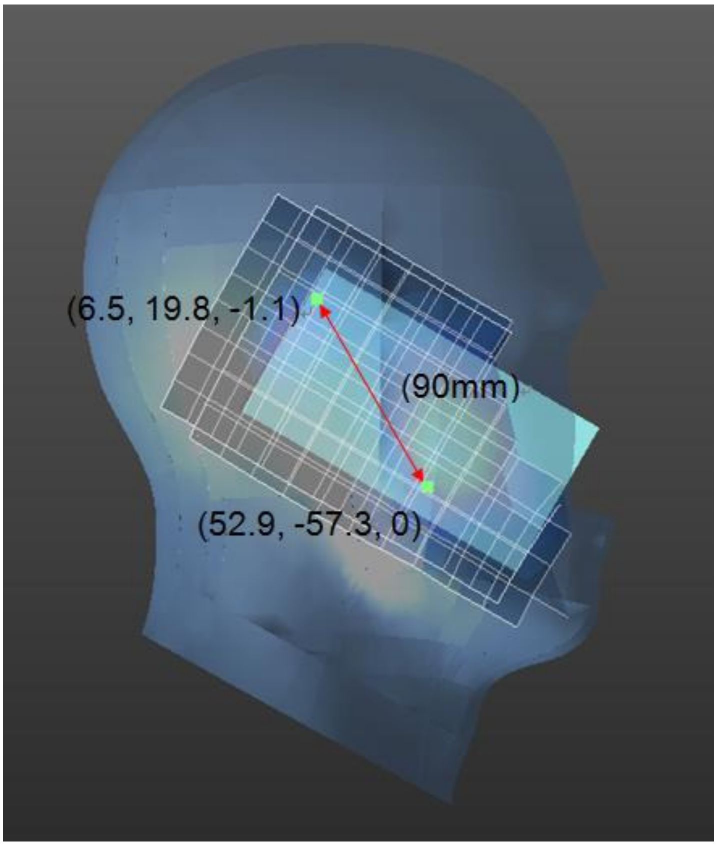
$$\text{Distance}_{Tx1\text{-}Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

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

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 Left Hand Touched configuration with UMTS Band IV and WiFi 2.4G(with battery 1#).

The Peak SAR location plot is as below:

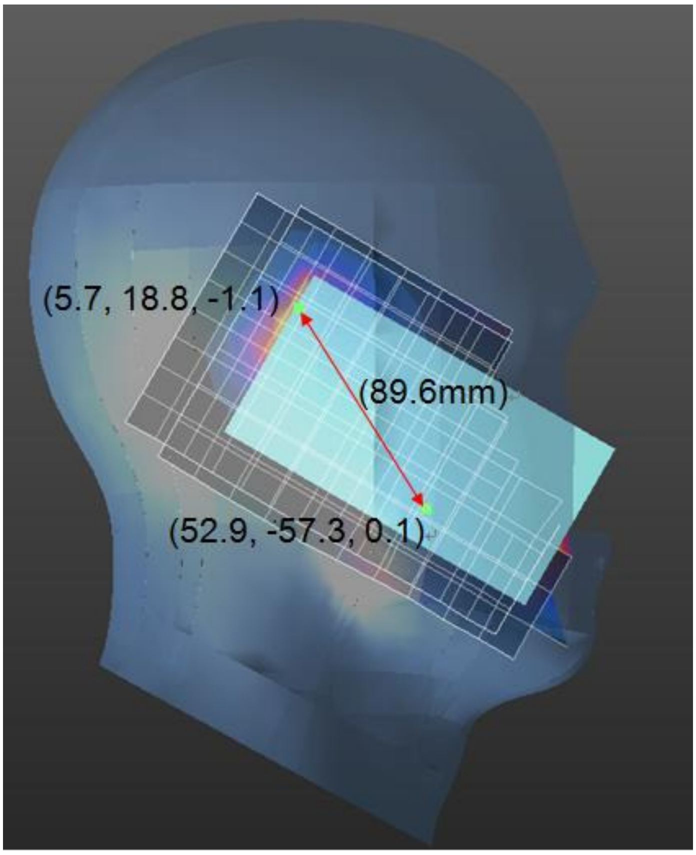


The SAR to peak location ratio calculation is as below:

Test Position	UMTS Band IV (W/kg)	WiFi 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched with battery 1#	1.460	0.412	90	0.028	0.04	Not required

2) The sum of aggregate 1-g SAR was above 1.6W/kg for Left Hand Touched configuration with UMTS Band IV and WiFi 2.4G(with battery 2#).

The Peak SAR location plot is as below:

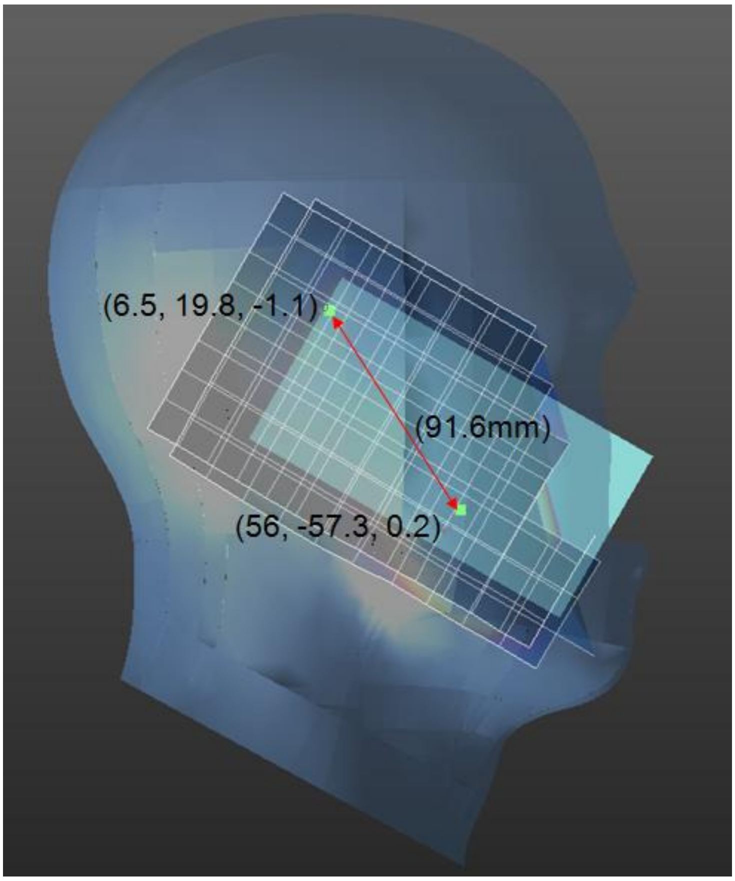


The SAR to peak location ratio calculation is as below:

Test Position	UMTS Band IV (W/kg)	WiFi 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched with battery 2#	1.392	0.413	89.6	0.027	0.04	Not required

3) The sum of aggregate 1-g SAR was above 1.6W/kg for Left Hand Touched configuration with UMTS Band II and WiFi 2.4G(with battery 1#).

The Peak SAR location plot is as below:

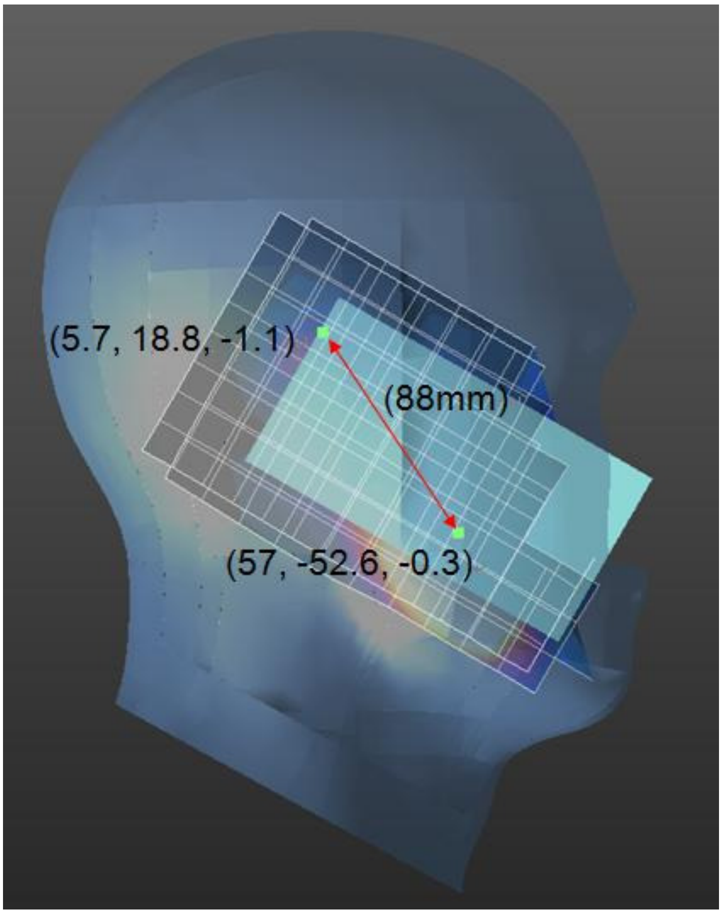


The SAR to peak location ratio calculation is as below:

Test Position	UMTS Band II (W/kg)	WiFi 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched with battery 1#	1.363	0.412	91.6	0.026	0.04	Not required

4) The sum of aggregate 1-g SAR was above 1.6W/kg for Left Hand Touched configuration with UMTS Band II 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	UMTS Band II (W/kg)	WiFi 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched with battery 2#	1.316	0.413	88	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 from report No.: SYBH(Z-SAR)052032014-2.)

Appendix B. SAR Measurement Plots

(Pls See Appendix B from report No.: SYBH(Z-SAR)052032014-2.)

Appendix C. Calibration Certificate

(Pls See Appendix C from report No.: SYBH(Z-SAR)052032014-2.)

Appendix D. Photo documentation

(Pls See Appendix D from report No.: SYBH(Z-SAR)052032014-2.)

End