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CNAS L0310

TESTING CERT #2174.01

FCC SAR Compliance Test Report

Product Name: Smart Phone

Model: HUAWEI CUN-U29,CUN-U29

Report No.: SYBH(Z-SAR)018122015-2

FCC ID: QISCUN-U29

	APPROVED (Lab Manager)	PREPARED (Test Engineer)
BY	Wei Huanbin	Li wei
DATE	2016-01-20	2016-01-20

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※ ※ Notice ※ ※

1. The laboratory has passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.

2. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.

3. The laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named as “Global Compliance and Testing Center of Huawei Technologies Co., Ltd”, the both names have coexisted since 2009.

4. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

5. The test report is invalid if there is any evidence of erasure and/or falsification.

6. The test report is only valid for the test samples.

7. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2016-01-20	Li Wei

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HUAWEI CUN-U29, CUN-U29 is as below Table 1.

Band	Max Reported SAR(W/kg)		
	1-g Head	1-g Body-worn (15mm) *	1-g Hotspot (10mm)
GSM850	0.45	**0.60**	**1.12**
GSM1900	0.35	0.22	0.79
UMTS Band II	0.72	0.36	1.08
UMTS Band V	0.37	0.46	0.51
WiFi 2.4G	**1.29**	0.11	0.23
The highest simultaneous SAR value is 1.48 W/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 C95.1:1992/IEEE C95.1:1991, 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 1528-2013.

1.2 RF exposure limits

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

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>Product Name:</td><td colspan="3">Smart Phone</td></tr>
<tr><td>Model:</td><td colspan="3">HUAWEI CUN-U29,CUN-U29</td></tr>
<tr><td>FCC ID :</td><td colspan="3">QISCUN-U29</td></tr>
<tr><td>SN.:</td><td colspan="3">CCMBBBB5B0902245</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">Ver.A</td></tr>
<tr><td>Software Version :</td><td colspan="3">CUN-U29C464B010</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/V, WiFi 2.4G, BT</td></tr>
<tr><td>Test Modulation</td><td colspan="3">GSM(GMSK/8PSK),UMTS(QPSK/16QAM),WiFi(DSSS/OFDM),BT(GFSK)</td></tr>
<tr><td>Device Class</td><td colspan="3">B</td></tr>
<tr><td rowspan="7">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 II</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>BT</td><td colspan="2">2400-2483.5</td></tr>
<tr><td>WiFi 2.4G</td><td colspan="2">2412-2462</td></tr>
<tr><td rowspan="3">GPRS Multislot Class(12)</td><td colspan="2">Max Number of Timeslots in Uplink:</td><td>4</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(12)</td><td colspan="2">Max Number of Timeslots in Uplink:</td><td>4</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">14</td></tr>
<tr><td>HSUPA UE Category</td><td colspan="3">6</td></tr>
<tr><td rowspan="4">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 V)</td></tr>
<tr><td rowspan="5">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">4132-4182-4233(UMTS Band V)</td></tr>
<tr><td colspan="3">802.11b/g/n 20M:1-6-11(WiFi 2.4G)
802.11n 40M:3-6-9(WiFi 2.4G)</td></tr>
</table>

Table 3:Device information and operating configuration

Note:The device supports two SIM cards. SIM1 supports GSM& UMTS and SIM2 supports GSM only.

1.3.1 General Description

HUAWEI CUN-U29,CUN-U29 is subscriber equipment in the GSM/UMTS system.
The GSM frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. but only GSM850/1900 test data included in this report.
The UMTS frequency band is Band I and Band II and Band V and Band VIII,but only Band II and Band V test data included in this report.
The Mobile Phone implements such functions as RF signal receiving/transmitting, UMTS and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS and Wi-Fi 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.

Battery information:

<table>
<tr><th>Name</th><th>Manufacture</th><th>Serials number</th><th>Description</th></tr>
<tr><td rowspan="2">Li-Polymer Battery</td><td>SCUD(FUJIAN) Electronics Co.,Ltd</td><td>1834ACFA24(G153BC)</td><td rowspan="2">Battery Model: HB4342A1RBC
Rated capacity: 2200mAh
Nominal Voltage: ⎓ +3.8V</td></tr>
<tr><td>Sunwoda Electronics Co.,Ltd</td><td>1834UIFA08(X96096)</td></tr>
</table>

1.4 Test specification(s)

ANSI 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 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 5 of March 2015)
KDB941225 D01	3G SAR Procedures v03r01
KDB941225 D06	Hotspot SAR v02r01
KDB447498 D01	General RF Exposure Guidance v06
KDB648474 D04	Handsets SAR v01r03
KDB248227 D01	SAR Guidance for IEEE 802 11 Wi-Fi SAR v02r02
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r04
KDB865664 D02	SAR Reporting v01r02
KDB690783 D01	SAR Listings on Grants v01r03

1.5 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Section G1,Huawei Base Bantian, Longgang District, Shenzhen 518129, P.R. 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

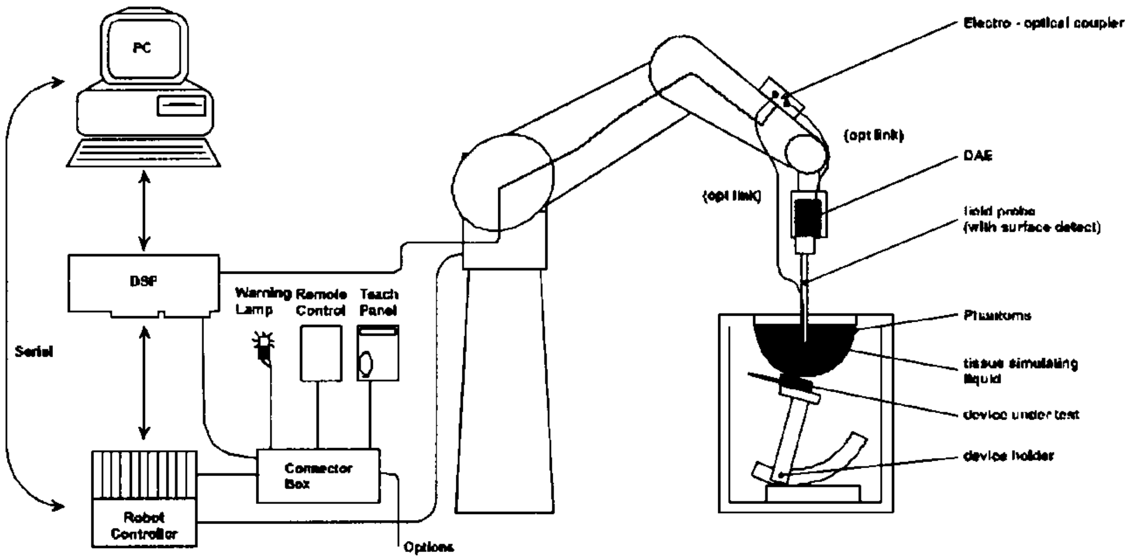
Start Date of test	2015-12-20
End Date of test	2016-01-13

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 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

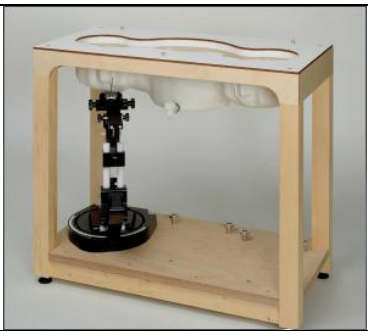
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 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

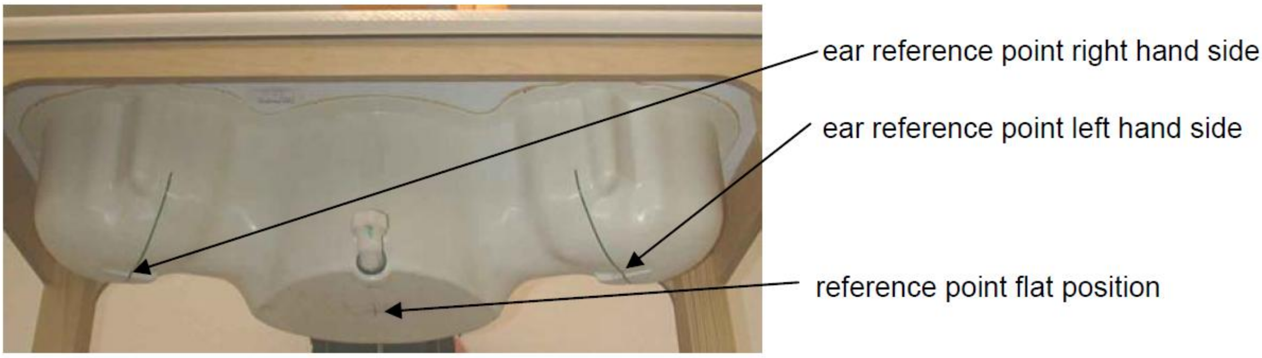
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity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

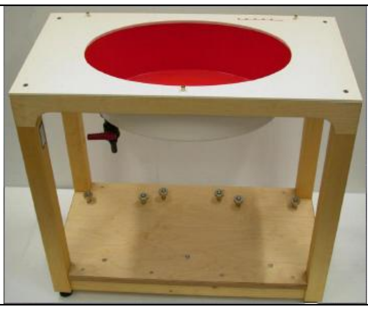
SAM Twin Phantom

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	3736	2015-04-30	One year
☐	SPEAG	Dosimetric E-Field Probe	EX3DV4	3744	2015-07-24	One year
☒	SPEAG	Dosimetric E-Field Probe	ES3DV3	3168	2015-09-28	One year
☐	SPEAG	750MHz Dipole	D750V3	1044	2015-09-14	Three years
☒	SPEAG	835MHz Dipole	D835V2	4d059	2013-05-02	Three years
☐	SPEAG	1750MHz Dipole	D1750V2	1123	2014-07-08	Three years
☒	SPEAG	1900MHz Dipole	D1900V2	5d091	2015-09-21	Three years
☐	SPEAG	2300MHz Dipole	D2300V2	1016	2014-11-19	Three years
☒	SPEAG	2450MHz Dipole	D2450V2	860	2015-11-25	Three years
☐	SPEAG	2600MHz Dipole	D2600V2	1021	2015-07-24	Three years
☐	SPEAG	5GHz Dipole	D5GHzV2	1155	2015-04-27	Three years
☒	SPEAG	Data acquisition electronics	DAE4	851	2015-07-20	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	113989	2015-05-18	One year
☐	R & S	Universal Radio Communication Tester	CMW 500	126855	2015-07-02	One year
☒	Agilent	Network Analyser	E5071C	MY46213349	2015-02-13	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	NCR	NCR
☒	Agilent	Signal Generator	N5181A	MY47420989	2015-10-30	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1402001	NCR	NCR
☐	MINI-CIRCUITS	Amplifier	ZVE-8G+	N523101139	NCR	NCR
☒	AR	Directional Coupler	DC7144M1	0423264	2015-03-31	One year
☒	R & S	Power Meter	NRP	100740	2015-07-02	One year
☒	R & S	Power Meter Sensor	NRP-Z11	106288	2015-07-02	One year
☒	Agilent	Power Meter	E4417A	MY54100027	2015-03-31	One year
☒	Agilent	Power Meter Sensor	E9321A	MY54130001	2015-05-05	One year
☒	Agilent	Power Meter Sensor	E9321A	MY54130007	2015-05-05	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.

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

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

4 System Verification Procedure

4.1 Tissue Verification

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

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

Ingredients (% of weight)	**Head Tissue**						
Frequency Band (MHz)	750	**835**	1750	**1900**	2300	**2450**	2600
Water	39.2	41.45	52.64	55.242	62.82	62.7	55.242
Salt (NaCl)	2.7	1.45	0.36	0.306	0.51	0.5	0.306
Sugar	57.0	56.0	0.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	47.0	44.542	36.67	36.8	44.452
Ingredients (% of weight)	**Body Tissue**						
Frequency Band (MHz)	750	**835**	1750	**1900**	2300	**2450**	2600
Water	50.3	52.4	69.91	69.91	73.32	73.2	64.493
Salt (NaCl)	1.60	1.40	0.13	0.13	0.06	0.04	0.024
Sugar	47.0	45.0	0.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	26.62	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(MBBL3500-5800MHz),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)	41.95	0.907	21.4°C	2015-12-20
	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	41.81	0.916		
	850	41.50 (39.43~43.58)	0.92 (0.87~0.96)	41.60	0.931		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.12	0.979	21.4°C	2015-12-21
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.00	0.988		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	53.80	1.004		
1900H	1850	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.92	1.372	21.4°C	2015-12-22
	1880	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.70	1.413		
	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.75	1.427		
	1910	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.75	1.432		
1900B	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.67	1.493	21.4°C	2015-12-21
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.58	1.532		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.50	1.552		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.46	1.561		
2450H	2410	39.30 (37.34~41.26)	1.76 (1.67~1.85)	39.67	1.816	21.4°C	2016-01-07
	2435	39.20 (37.24~41.16)	1.79 (1.70~1.88)	39.55	1.846		
	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	39.47	1.866		
	2460	39.20 (37.24~41.16)	1.81 (1.72~1.90)	39.42	1.879		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	50.97	1.921	21.4°C	2016-01-13
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	50.90	1.949		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	50.85	1.966		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	50.82	1.978		

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).

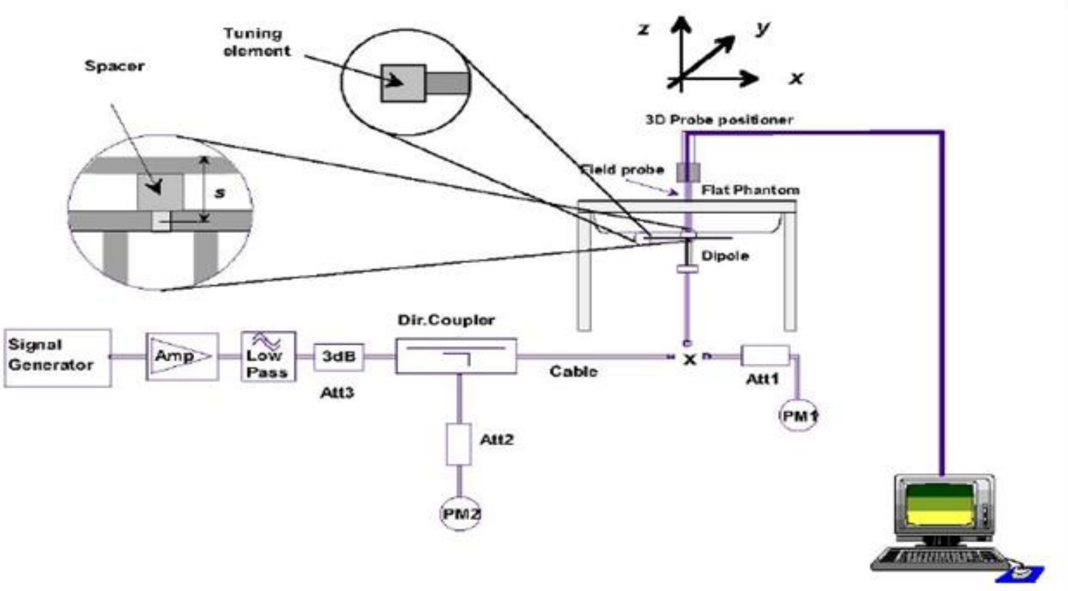
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
835MHz Head	9.49 (8.54~10.44)	6.18 (5.56~6.80)	9.49	6.18	21.4°C	2015-12-20
1900MHz Head	40.20 (36.18~44.22)	21.10 (18.99~23.21)	40.20	21.10	21.4°C	2015-12-22
2450MHz Head	50.80 (45.72~55.88)	23.70 (21.33~26.07)	52.30	24.50	21.4°C	2016-01-07
835MHz Body	9.42 (8.48~10.36)	6.19 (5.57~6.80)	9.42	6.19	21.4°C	2015-12-21
1900MHz Body	39.90 (35.91~43.89)	21.00 (18.90~23.10)	39.90	21.00	21.4°C	2015-12-21
2450MHz Body	51.90 (46.71~57.09)	24.30 (21.87~26.73)	51.90	24.30	21.4°C	2016-01-13

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 v01r04, 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 v01r04,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 1528-2013 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 Test Positions Configuration

6.1.1 General considerations

Per IEEE 1528-2013，two imaginary lines on the handset were established: the vertical centerline and the horizontal line (See Figure 1).

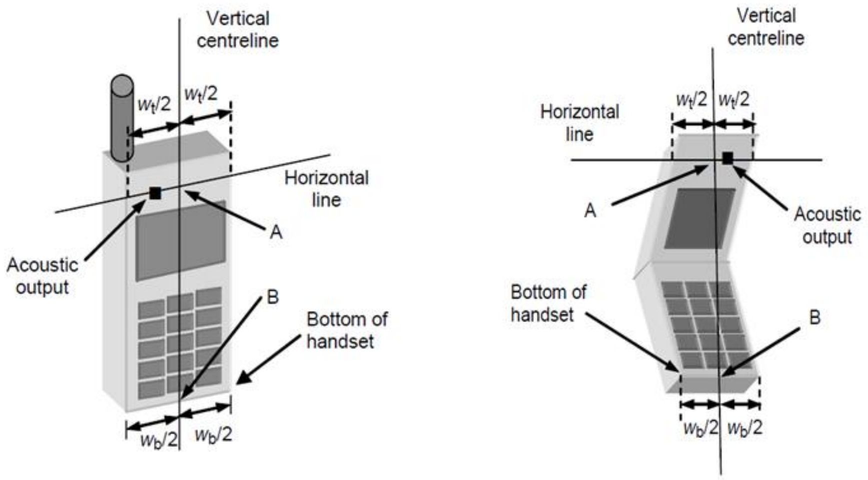


Figure 1 Hand Vertical Center & Horizontal Line Reference Points

6.1.2 Head Exposure Condition

Per IEEE 1528-2013, Head SAR measurements were made in the “cheek” position (See Figure 2) and the “tilt” position (See Figure 3). The device should be tested in both positions on left and right sides of the SAM phantom.

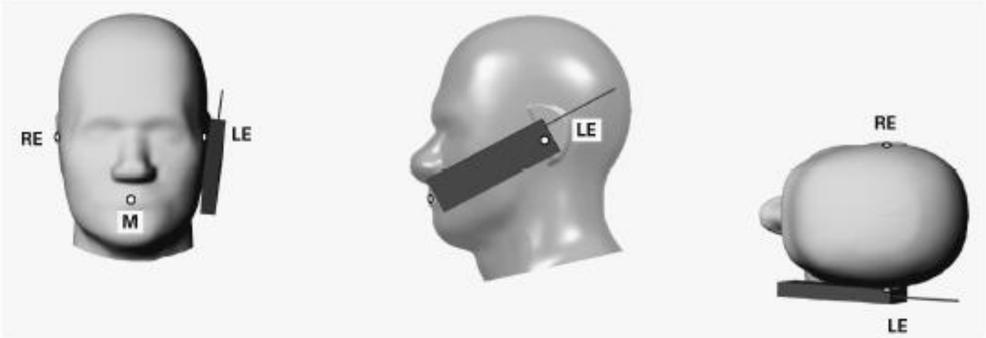


Figure 2 Front, Side and Top View of Cheek Position

Figure 3 Front, Side and Top View of Tilt 15° Position

Note:

M Mouth reference point

LE Left ear reference point (ERP)

RE Right ear reference point(ERP)

6.1.3 Body-worn Exposure Condition

Body-worn operating configurations are tested with the holder attached to the device and positioned against a flat phantom with test separation distance of 15mm in a normal use configuration (See Figure 4). Per FCC KDB648474 D04v01, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

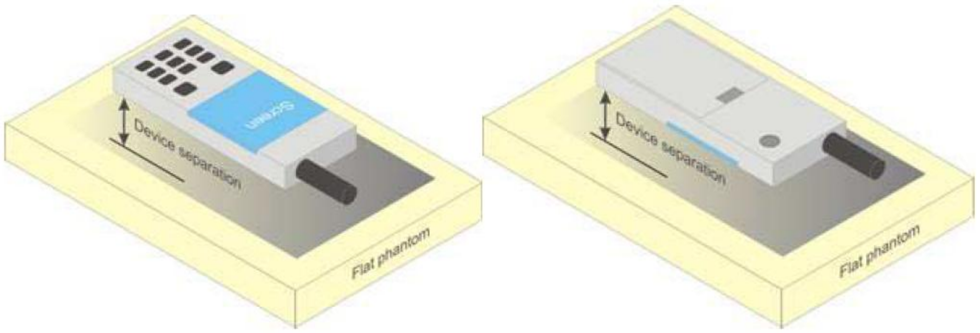


Figure 4 Test position for Body-Worn device

6.1.4 Hotspot Exposure Condition

Per FCC KDB 941225D06, The SAR test separation distance for hotspot mode is determined according to device form factor. When the overall length and width of a device is > 9 cm x 5 cm, a test separation distance of 10 mm is required for hotspot mode SAR measurements. A test separation distance of 5 mm or less is required for smaller devices. Hotspot mode SAR is measured for all edges and surfaces of the device with a transmitting antenna located within 25 mm from that surface or edge; for the data modes, wireless technologies and frequency bands supporting hotspot mode. The SAR results are used to determine simultaneous transmission SAR test exclusion for hotspot mode; otherwise, simultaneous transmission SAR measurement is required.

6.2 3G SAR Test Reduction Procedure

Per KDB941225 D01, in the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

6.3 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 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 12 for this EUT, it has at most 4 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.

6.4 UMTS Test Configuration

1) Output Power Verification

Maximum output power is verified on the high, middle and low channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1’s” for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) are requied in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

2) WCDMA

a. Head SAR Measurements

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

b. Body SAR Measurements

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode

3) HSDPA

SAR for body exposure configurations is measured according to the “Body SAR Measurements’’ procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

Per KDB941225 D01v03, the 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures for the highest reported SAR body exposure configuration in 12.2 kbps RMC.

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: △ACK, △NACK and △CQI = 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 7: 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 8: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 9:HSDPA UE category

4) HSUPA

SAR for body exposure configurations is measured according to the “Body SAR Measurements’’ procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

Per KDB941225 D01v03, the 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures for the highest reported body exposure SAR configuration in 12.2 kbps RMC.

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} (codes)	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 10:Subtests for UMTS Release 6 HSUPA

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Speading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF4	11484	5.76
	4	4	2		20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF4	22996	?
	4	4	10		20000	?

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).

Table 11:HSUPA UE category

6.5 WiFi Test Configuration

For WiFi SAR testing, a communication link is set up with the testing software for WiFi mode test. During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227D01v02r02 are applied.

6.5.1 Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet , procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated(peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

6.5.2 Initial Test Configuration Procedure

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2 of KDB 248227D01). SAR test reduction of subsequent highest output test channels is based on the *reported* SAR of the initial test configuration.

For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.

When the *reported* SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

6.5.3 Sub Test Configuration Procedure

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units.

When the highest reported SAR for the initial test configuration, according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

6.5.4 WiFi 2.4G SAR Test Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions.

A) 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the *reported* SAR of the highest measured maximum output power channel (section 3.1 of of KDB 248227D01v02) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2) When the *reported* SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any *reported* SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

B) 2.4GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3 of of KDB 248227D01v02r02). SAR is not required for the following 2.4 GHz OFDM conditions.

1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.

2) When the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

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)			
		Tune-up	128CH	190CH	251CH		Tune-up	128CH	190CH	251CH
GSM (CS)		33.50	32.56	32.59	32.43	-9.19	24.31	23.37	23.40	23.24
GPRS/ EDGE (GMSK)	1 Tx Slot	33.50	32.54	32.60	32.44	-9.19	24.31	23.35	23.41	23.25
	2 Tx Slots	32.50	31.84	31.89	31.72	-6.13	**26.37**	**25.71**	**25.76**	**25.59**
	3 Tx Slots	30.50	30.28	30.32	30.18	-4.42	26.08	25.86	25.90	25.76
	4 Tx Slots	29.50	29.14	29.18	29.04	-3.18	26.32	25.96	26.00	25.86
EDGE (8PSK)	1 Tx Slot	27.50	26.39	26.35	26.42	-9.19	18.31	17.20	17.16	17.23
	2 Tx Slots	26.50	25.20	25.13	25.09	-6.13	20.37	19.07	19.00	18.96
	3 Tx Slots	24.50	23.21	23.18	23.22	-4.42	20.08	18.79	18.76	18.80
	4 Tx Slots	23.50	22.13	21.97	21.99	-3.18	20.32	18.95	18.79	18.81

Table 12: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.

3) Per KDB941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

7.1.2 Conducted power measurements of GSM1900

GSM1900		Burst-Averaged output Power (dBm)				Division Factors	Frame-Averaged output Power (dBm)			
		Tune-up	512CH	661CH	810CH		Tune-up	512CH	661CH	810CH
GSM (CS)		30.50	29.41	29.29	29.62	-9.19	21.31	20.22	20.10	20.43
GPRS/ EDGE (GMSK)	1 Tx Slot	30.50	29.42	29.30	29.64	-9.19	21.31	20.23	20.11	20.45
	2 Tx Slots	29.50	28.51	28.62	28.94	-6.13	**23.37**	**22.38**	**22.49**	**22.81**
	3 Tx Slots	27.50	26.78	26.78	27.33	-4.42	23.08	22.36	22.36	22.91
	4 Tx Slots	26.50	25.67	25.68	26.30	-3.18	23.32	22.49	22.50	23.12
EDGE (8PSK)	1 Tx Slot	26.50	26.11	25.85	26.05	-9.19	17.31	16.92	16.66	16.86
	2 Tx Slots	25.50	24.73	24.50	24.64	-6.13	19.37	18.60	18.37	18.51
	3 Tx Slots	23.50	22.60	22.34	22.47	-4.42	19.08	18.18	17.92	18.05
	4 Tx Slots	22.50	21.34	21.04	21.29	-3.18	19.32	18.16	17.86	18.11

Table 13: 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.

3) Per KDB941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

7.1.3 Conducted power measurements of UMTS Band II

UMTS Band II		Tune-up	Conducted Power (dBm)		
			9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	**24.0**	**23.18**	**23.32**	**23.05**
	12.2kbps AMR	24.0	23.05	23.21	23.00
HSDPA	Subtest 1	23.0	22.48	22.45	22.38
	Subtest 2	22.5	22.26	22.22	22.08
	Subtest 3	22.0	21.77	21.69	21.55
	Subtest 4	22.0	21.73	21.66	21.54
HSUPA	Subtest 1	21.0	20.30	20.29	20.21
	Subtest 2	21.0	19.83	19.81	19.74
	Subtest 3	22.0	21.32	21.32	21.22
	Subtest 4	20.5	19.68	19.80	19.71
	Subtest 5	22.5	21.92	21.95	21.84

Table 14: Conducted power measurement results of UMTS Band II

Note:

1) The conducted power of UMTS Band II is measured with RMS detector.

2) The bolded 12.2kbps RMC mode was selected for SAR testing(the primary mode).

3) Per KDB941225 D01, When the maximum output power and tune-up tolerance specified for production units in a Second mode is ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of Second to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the Second mode.

7.1.4 Conducted power measurements of UMTS Band V

UMTS Band V		Tune-up	Conducted Power (dBm)		
			4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	**24.0**	**23.52**	**23.58**	**23.51**
	12.2kbps AMR	24.0	23.50	23.51	23.44
HSDPA	Subtest 1	23.0	22.41	22.48	22.38
	Subtest 2	22.5	22.40	22.20	22.10
	Subtest 3	22.0	21.91	21.66	21.47
	Subtest 4	22.0	21.53	21.62	21.43
HSUPA	Subtest 1	21.0	20.22	20.18	20.01
	Subtest 2	21.0	19.17	19.82	19.64
	Subtest 3	22.0	21.21	21.18	21.03
	Subtest 4	20.5	19.68	19.73	19.66
	Subtest 5	22.5	21.91	21.97	21.81

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) The bolded 12.2kbps RMC mode was selected for SAR testing(the primary mode).

3) Per KDB941225 D01, When the maximum output power and tune-up tolerance specified for production units in a Second mode is ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of Second to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the Second mode.

7.1.5 Conducted power measurements of WiFi 2.4G

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	1	2412	1	16.5	**15.16**	Yes
	6	2437		16.5	**15.21**	Yes
	11	2462		16.5	**15.48**	Yes
802.11g	1	2412	6	15.0	Not Required	No
	6	2437		15.0	Not Required	No
	11	2462		15.0	Not Required	No
802.11n-20M	1	2412	6.5	14.0	Not Required	No
	6	2437		14.0	Not Required	No
	11	2462		14.0	Not Required	No
802.11n-40M	3	2422	13.5	14.0	Not Required	No
	6	2437		14.0	Not Required	No
	9	2452		14.0	Not Required	No

Table 16: Conducted power measurement results of WiFi 2.4G.

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

2) An entry of “Not Required” means power measurement is not required according to the default power measurement procedures in KDB248227D01.

7.1.6 Conducted power measurements of BT

The output power of BT antenna is as following:

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	39CH	78CH
DH5	6.0	4.95	**5.90**	5.76
2DH5	6.0	4.48	5.39	5.23
3DH5	6.0	4.57	5.26	5.42

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	19CH	39CH
BT 4.0	-1.0	-1.78	-1.44	-1.65

Table 17: 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 D01, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.

2) Per KDB447498 D01, 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:

● ≤ 0.8W/kg for 1-g or 2.0W/kg for 10-g respectively, when the transmission band is ≤ 100MHz.

● ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.

● ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 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 D01,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 D06, 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 D04, 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 D02, 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 detailed SAR plots).

GSM Notes:

1) Per KDB941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

2) Per KDB648474 D04, the device does not support DTM function. Body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.

UMTS Notes:

1) Per KDB941225 D01, When the maximum output power and tune-up tolerance specified for production units in a Second mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of Second to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the Second mode.

WiFi Notes:

Per KDB248227D01:

1) When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

2) When the DSSS *reported* SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

3) When the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for 2.4 GHz 802.11g/n OFDM configurations

4) The highest SAR measured for the initial test position or initial test configuration should be used to determine SAR test exclusion according to the sum of 1-g SAR and SAR peak to location ratio provisions in KDB 447498. In addition, a test lab may also choose to perform standalone SAR measurements for test positions and 802.11 configurations that are not required by the initial test position or initial test configuration procedures and apply the results to determine simultaneous transmission SAR test exclusion, according to sum of 1-g and SAR peak to location ratio requirements to reduce the number of simultaneous transmission SAR measurements.

7.2.1 SAR measurement Result of GSM850

Test Position of Head	Test channel /Freq.(MHz)	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	190/836.6	GSM	0.339	0.256	0.050	32.59	33.50	0.418	21.4°C
Left Hand Tilted 15°	190/836.6	GSM	0.233	0.179	-0.030	32.59	33.50	0.287	21.4°C
Right Hand Touched	190/836.6	GSM	0.312	0.239	-0.070	32.59	33.50	0.385	21.4°C
Right Hand Tilted 15°	190/836.6	GSM	0.234	0.180	0.020	32.59	33.50	0.289	21.4°C
Left Hand Touched	128/824.2	GSM	0.359	0.273	0.080	32.56	33.50	0.446	21.4°C
Left Hand Touched	251/848.8	GSM	0.298	0.205	0.060	32.43	33.50	0.381	21.4°C
Tested at the worst position with SIM2									
Left Hand Touched	128/824.2	GSM	0.362	0.275	0.020	32.56	33.50	**0.449**	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	128/824.2	GSM	0.345	0.238	-0.060	32.56	33.50	0.428	21.4°C

Table 18: Head SAR test results of GSM850

Test Position of Body-Worn with 15mm	Test channel /Freq.(MHz)	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	190/836.6	GSM	0.382	0.296	0.080	32.59	33.50	0.471	21.4°C
Back Side	190/836.6	GSM	0.485	0.371	-0.020	32.59	33.50	0.598	21.4°C
Tested at the worst position with SIM2									
Back Side	190/836.6	GSM	0.487	0.374	-0.040	32.59	33.50	**0.601**	21.4°C
Tested at the worst position with battery 2#									
Back Side	190/836.6	GSM	0.481	0.369	-0.010	32.59	33.50	0.593	21.4°C

Table 19: Body-Worn SAR test results of GSM850

Test Position of Hotspot with 10mm	Test channel /Freq.(MHz)	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	190/836.6	GPRS 2TS	0.614	0.477	0.040	31.89	32.50	0.707	21.4°C
Back Side	190/836.6	GPRS 2TS	0.875	0.677	-0.020	31.89	32.50	1.007	21.4°C
Back Side	128/824.2	GPRS 2TS	0.954	0.741	-0.040	31.84	32.50	1.111	21.4°C
Back Side	251/848.8	GPRS 2TS	0.770	0.594	0.040	31.72	32.50	0.921	21.4°C
Left Side	190/836.6	GPRS 2TS	0.890	0.613	-0.050	31.89	32.50	1.024	21.4°C
Left Side	128/824.2	GPRS 2TS	0.941	0.649	-0.070	31.84	32.50	1.095	21.4°C
Left Side	251/848.8	GPRS 2TS	0.786	0.540	-0.090	31.72	32.50	0.941	21.4°C
Right Side	190/836.6	GPRS 2TS	0.720	0.495	-0.010	31.89	32.50	0.829	21.4°C
Right Side	128/824.2	GPRS 2TS	0.784	0.544	-0.020	31.84	32.50	0.913	21.4°C
Right Side	251/848.8	GPRS 2TS	0.606	0.416	0.030	31.72	32.50	0.725	21.4°C
Bottom Side	190/836.6	GPRS 2TS	0.112	0.058	0.060	31.89	32.50	0.129	21.4°C
Tested at the worst position with SIM2									
Back Side	128/824.2	GPRS 2TS	0.964	0.748	-0.020	31.84	32.50	**1.122**	21.4°C
Back Side-Repeated	128/824.2	GPRS 2TS	0.951	0.737	0.020	31.84	32.50	1.107	21.4°C
Tested at the worst position with battery 2#									
Back Side	128/824.2	GPRS 2TS	0.949	0.736	-0.020	31.84	32.50	1.105	21.4°C

Table 20: Hotspot SAR test results of GSM850

7.2.2 SAR measurement Result of GSM1900

Test Position of Head	Test channel /Freq.(MHz)	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	661/1880	GSM	0.150	0.093	0.120	29.29	30.50	0.198	21.4°C
Left Hand Tilted 15°	661/1880	GSM	0.122	0.072	-0.130	29.29	30.50	0.161	21.4°C
Right Hand Touched	661/1880	GSM	0.262	0.165	-0.120	29.29	30.50	0.346	21.4°C
Right Hand Tilted 15°	661/1880	GSM	0.147	0.095	0.110	29.29	30.50	0.194	21.4°C
Right Hand Touched	512/1850.2	GSM	0.237	0.152	0.050	29.41	30.50	0.305	21.4°C
Right Hand Touched	810/1909.8	GSM	0.283	0.177	0.040	29.62	30.50	**0.347**	21.4°C
Right Hand Touched	810/1909.8	GSM	0.273	0.169	0.110	29.62	30.50	0.334	21.4°C
Tested at the worst position with battery 2#									
Right Hand Touched	810/1909.8	GSM	0.261	0.163	0.050	29.62	30.50	0.320	21.4°C

Table 21: Head SAR test results of GSM1900

Test Position of Body-Worn with 15mm	Test channel /Freq.(MHz)	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	661/1880	GSM	0.149	0.080	-0.050	29.29	30.50	0.197	21.4°C
Back Side	661/1880	GSM	0.154	0.101	-0.040	29.29	30.50	0.203	21.4°C
Tested at the worst position with SIM2									
Back Side	661/1880	GSM	0.144	0.078	0.020	29.29	30.50	0.190	21.4°C
Tested at the worst position with battery 2#									
Back Side	661/1880	GSM	0.163	0.088	0.070	29.29	30.50	**0.215**	21.4°C

Table 22: Body-Worn SAR test results of GSM1900

Test Position of Hotspot with 10mm	Test channel /Freq.(MHz)	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	661/1880	GPRS 2TS	0.400	0.250	-0.040	28.62	29.50	0.490	21.4°C
Back Side	661/1880	GPRS 2TS	0.574	0.284	0.150	28.62	29.50	0.703	21.4°C
Left Side	661/1880	GPRS 2TS	0.164	0.092	-0.060	28.62	29.50	0.201	21.4°C
Right Side	661/1880	GPRS 2TS	0.328	0.186	0.060	28.62	29.50	0.402	21.4°C
Bottom Side	661/1880	GPRS 2TS	0.393	0.211	-0.180	28.62	29.50	0.481	21.4°C
Tested at the worst position with SIM2									
Back Side	661/1880	GPRS 2TS	0.471	0.239	0.060	28.62	29.50	0.577	21.4°C
Tested at the worst position with battery 2#									
Back Side	661/1880	GPRS 2TS	0.645	0.322	0.010	28.62	29.50	**0.790**	21.4°C

Table 23: Hotspot SAR test results of GSM1900

7.2.3 SAR measurement Result of UMTS Band II

Test Position of Head	Test channel /Freq.(MHz)	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	9400/1880	RMC	0.334	0.221	-0.070	23.32	24.00	0.391	21.4°C
Left Hand Tilted 15°	9400/1880	RMC	0.260	0.163	-0.030	23.32	24.00	0.304	21.4°C
Right Hand Touched	9400/1880	RMC	0.530	0.336	0.170	23.32	24.00	0.620	21.4°C
Right Hand Tilted 15°	9400/1880	RMC	0.295	0.179	0.080	23.32	24.00	0.345	21.4°C
Right Hand Touched	9262/1852.4	RMC	0.595	0.380	-0.070	23.18	24.00	**0.719**	21.4°C
Right Hand Touched	9538/1907.6	RMC	0.522	0.326	0.000	23.05	24.00	0.650	21.4°C
Tested at the worst position with battery 2#									
Right Hand Touched	9262/1852.4	RMC	0.589	0.378	0.190	23.18	24.00	0.711	21.4°C

Table 24: Head SAR test results of UMTS Band II

Test Position of Body-Worn with 15mm	Test channel / Freq.(MHz)	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	9400/1880	RMC	0.303	0.203	-0.010	23.32	24.00	0.354	21.4°C
Back Side	9400/1880	RMC	0.292	0.156	0.110	23.32	24.00	0.341	21.4°C
Tested at the worst position with battery 2#									
Front Side	9400/1880	RMC	0.307	0.205	-0.010	23.32	24.00	**0.359**	21.4°C

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

Test Position of Hotspot with 10mm	Test channel / Freq.(MHz)	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	9400/1880	RMC	0.516	0.301	-0.050	23.32	24.00	0.603	21.4°C
Back Side	9400/1880	RMC	0.675	0.336	0.060	23.32	24.00	0.789	21.4°C
Left Side	9400/1880	RMC	0.198	0.117	-0.100	23.32	24.00	0.232	21.4°C
Right Side	9400/1880	RMC	0.379	0.227	-0.080	23.32	24.00	0.443	21.4°C
Bottom Side	9400/1880	RMC	0.600	0.334	-0.040	23.32	24.00	0.702	21.4°C
Tested at the worst position with battery 2#									
Back Side	9400/1880	RMC	0.763	0.385	0.080	23.32	24.00	0.892	21.4°C
Back Side	9262/1852.4	RMC	0.750	0.384	0.130	23.18	24.00	0.906	21.4°C
Back Side	9538/1907.6	RMC	0.868	0.431	0.050	23.05	24.00	**1.080**	21.4°C
Back Side-Repeated	9538/1907.6	RMC	0.866	0.430	0.090	23.05	24.00	1.078	21.4°C

Table 26: Hotspot SAR test results of UMTS Band II

7.2.4 SAR measurement Result of UMTS Band V

Test Position of Head	Test channel / Freq.(MHz)	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	4182/836.4	RMC	0.304	0.230	0.080	23.58	24.00	0.335	21.4°C
Left Hand Tilted 15°	4182/836.4	RMC	0.200	0.155	0.040	23.58	24.00	0.220	21.4°C
Right Hand Touched	4182/836.4	RMC	0.276	0.212	0.140	23.58	24.00	0.304	21.4°C
Right Hand Tilted 15°	4182/836.4	RMC	0.193	0.150	0.060	23.58	24.00	0.213	21.4°C
Left Hand Touched	4132/826.4	RMC	0.246	0.186	0.050	23.52	24.00	0.275	21.4°C
Left Hand Touched	4233/846.6	RMC	0.328	0.247	0.180	23.51	24.00	**0.367**	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	4233/846.6	RMC	0.325	0.247	0.150	23.51	24.00	0.364	21.4°C

Table 27: Head SAR test results of UMTS Band V

Test Position of Body-Worn with 15mm	Test channel / Freq.(MHz)	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	4182/836.4	RMC	0.341	0.261	-0.060	23.58	24.00	0.376	21.4°C
Back Side	4182/836.4	RMC	0.413	0.317	0.010	23.58	24.00	**0.455**	21.4°C
Tested at the worst position with battery 2#									
Back Side	4182/836.4	RMC	0.412	0.316	-0.050	23.58	24.00	0.454	21.4°C

Table 28: Body-Worn SAR test results of UMTS Band V

Test Position of Hotspot with 10mm	Test channel / Freq.(MHz)	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	4182/836.4	RMC	0.339	0.262	0.000	23.58	24.00	0.373	21.4°C
Back Side	4182/836.4	RMC	0.462	0.358	-0.010	23.58	24.00	**0.509**	21.4°C
Left Side	4182/836.4	RMC	0.462	0.320	-0.060	23.58	24.00	0.509	21.4°C
Right Side	4182/836.4	RMC	0.378	0.261	-0.030	23.58	24.00	0.416	21.4°C
Bottom Side	4182/836.4	RMC	0.062	0.031	0.040	23.58	24.00	0.068	21.4°C
Tested at the worst position with battery 2#									
Back Side	4182/836.4	RMC	0.459	0.356	-0.020	23.58	24.00	0.506	21.4°C

Table 29: Hotspot SAR test results of UMTS Band V

7.2.5 SAR measurement Result of WiFi 2.4G

Test Position of Head	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg) 1-g Area Scan	SAR Value (W/kg) 1-g Zoom Scan	Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
Test data with battery 1#									
Left Hand Touched	11/2462	802.11 b	0.877	0.888	-0.030	15.48	16.50	1.123	21.4°C
Left Hand Touched	6/2437	802.11 b	0.905	0.934	0.050	15.21	16.50	1.257	21.4°C
Left Hand Touched	1/2412	802.11 b	0.908	0.944	0.020	15.16	16.50	**1.285**	21.4°C
Left Hand Touched-Repeated	1/2412	802.11 b	0.820	0.848	-0.040	15.16	16.50	1.155	21.4°C
Left Hand Tilted 15°	11/2462	802.11 b	0.526	0.524	-0.020	15.48	16.50	0.663	21.4°C
Right Hand Touched	11/2462	802.11 b	0.383	0.391	0.160	15.48	16.50	0.495	21.4°C
Right Hand Tilted 15°	11/2462	802.11 b	0.248	0.124	0.070	15.48	16.50	0.157	21.4°C
Tested at the worst position with battery 2#									
Left Hand Touched	1/2412	802.11 b	0.795	0.822	-0.040	15.16	16.50	1.119	21.4°C

Table 30: Head SAR test results of WiFi 2450MHz

Note: Per KDB248227D01, for Head SAR test of WiFi 2.4G, SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure. As the highest reported SAR for DSSS is adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg, so SAR for 802.11g/n is not required.

WiFi 2.4G	Tune-up Limit（dBm）	Tune-up Limit（mW）	Hightest Reported SAR(W/kg)	Adjusted SAR (W/kg)	SAR test
802.11b	16.50	44.67	1.285	/	Yes
802.11g	15.00	31.62	/	0.910	Yes
802.11n 20n	14.00	25.12	/	0.723	No
802.11n 40n	14.00	25.12	/	0.723	No

Test Position of Body-Worn with 15mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g Area Scan	1-g Zoom Scan					
Test data with battery 1#									
Front Side	11/2462	802.11 b	0.087	/	0.100	15.48	16.50	/	21.4°C
Back Side	11/2462	802.11 b	0.089	0.090	0.120	15.48	16.50	0.114	21.4°C
Tested at the worst position with battery 2#									
Back Side	11/2462	802.11 b	0.090	0.090	0.140	15.48	16.50	**0.114**	21.4°C

Table 31: Body-Worn SAR test results of WiFi 2450MHz

Note: Per KDB248227D01, for Body-Worn SAR test of WiFi 2.4G, SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure. As the highest reported SAR for DSSS is adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg, so SAR for 802.11g/n is not required.

Test Position of Hotspot with 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g Area Scan	1-g Zoom Scan					
Test data with battery 1#									
Front Side	11/2462	802.11 b	0.167	0.169	-0.070	15.48	16.50	0.214	21.4°C
Back Side	11/2462	802.11 b	0.167	/	0.150	15.48	16.50	/	21.4°C
Left Side	11/2462	802.11 b	0.017	/	-0.040	15.48	16.50	/	21.4°C
Right Side	11/2462	802.11 b	0.160	/	0.000	15.48	16.50	/	21.4°C
Top Side	11/2462	802.11 b	0.052	/	0.060	15.48	16.50	/	21.4°C
Tested at the worst position with battery 2#									
Front Side	11/2462	802.11 b	0.177	0.178	0.030	15.48	16.50	**0.225**	21.4°C

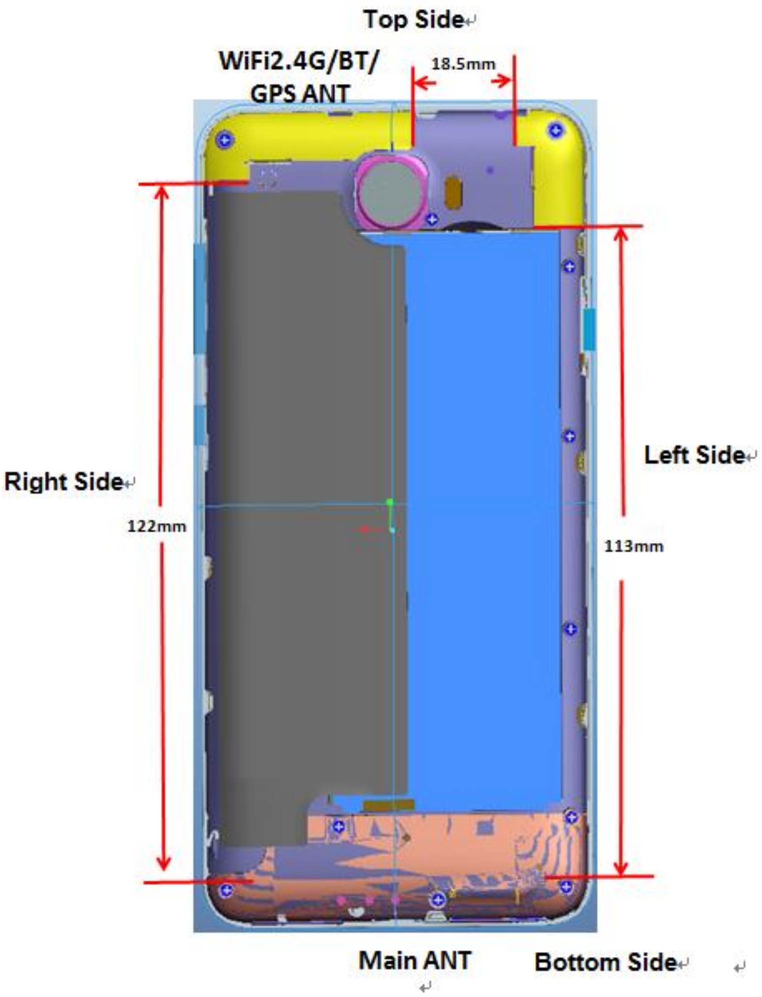
Table 32: Hotspot SAR test results of WiFi 2450MHz

Note :

1) Per KDB248227D01, for Hotspot SAR test of WiFi 2.4G, SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure. As the highest reported SAR for DSSS is adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg, so SAR for 802.11g/n is not required.

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 v06.
The location of the antennas inside the device is shown as below picture:



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

Table 33: Sides for Hotspot SAR testing

Note:

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

7.3.1 Stand-alone SAR test exclusion

Per FCC KDB 447498D01v06

1) 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	6.00	3.98	15	2.450	0.42	3.00	Yes

Table 34: 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	6.00	3.98	15	2.450	7.50	0.056

Table 35: 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	Hotspot
1	GSM(Voice) + BT	No	Yes	No
2	GSM(Data) + BT	No	No	No
3	GSM(Voice)+ WiFi 2.4G	Yes	Yes	No
4	GSM(Data) + WiFi 2.4G	No	No	Yes
5	UMTS(Voice) + BT	No	Yes	No
6	UMTS(Data) + BT	No	Yes	No
7	UMTS(voice) + WiFi 2.4G	Yes	Yes	No
8	UMTS(Data) + WiFi 2.4G	No	Yes	Yes

Table 36: Simultaneous Transmission Possibilities

Note:

1) WiFi 2.4G and BT can't transmit simultaneously.

2) The device does not support WiFi VOIP function.

3) The device does not support DTM function. Body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.

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

5) * VOIP 3rd party applications may possibly be installed and used by the end user.

7.3.3 SAR Summation Scenario

Test Position		Main antenna SAR$_{Max}$				WiFi/BT antenna SAR$_{Max}$		Σ1-g SAR (1.6W/kg Limit)	SPLSR
		GSM850	GSM1900	UMTS Band II	UMTS Band V	WiFi 2.4G	BT		
Head	Left Hand Touched	0.449	0.198	0.391	0.367	1.285	/	1.735	See 7.3.4
	Left Hand Tilted 15°	0.287	0.161	0.304	0.220	0.663	/	0.967	N/A
	Right Hand Touched	0.385	0.347	0.719	0.304	0.495	/	1.213	N/A
	Right Hand Tilted 15°	0.289	0.194	0.345	0.213	0.157	/	0.502	N/A
Body-worn	Front side	0.471	0.197	0.359	0.376	0.114	0.056	0.585	N/A
	Back side	0.601	0.215	0.341	0.455	0.114	0.056	0.714	N/A
Hotspot 10mm	Front side	0.707	0.490	0.603	0.373	0.225	/	0.932	N/A
	Back side	1.122	0.790	1.080	0.509	0.225	/	1.347	N/A
	Left side	1.095	0.201	0.232	0.509	0.225	/	1.321	N/A
	Right side	0.913	0.402	0.443	0.416	0.225	/	1.138	N/A
	Top side	/	/	/	/	0.225	/	0.225	N/A
	Bottom side	0.129	0.481	0.702	0.068	/	/	0.702	N/A

Table 37: SAR Simultaneous Tx Combination of Main antenna and WiFi/BT.

Test Position	Main antenna SAR$_{Max}$				WiFi/BT antenna SAR$_{Max}$	Σ1-g SAR (1.6W/kg Limit)	SPLSR	Volume scan
	GSM850	GSM1900	UMTS Band II	UMTS Band V	WiFi 2.4G			
Left Hand Touched	0.449	/	/	/	1.285	1.735	0.032	Not required
Left Hand Touched	/	0.198	/	/	1.285	**1.483**	N/A	Not required
Left Hand Touched	/	/	0.391	/	1.285	1.676	0.038	Not required
Left Hand Touched	/	/	/	0.367	1.285	1.652	0.030	Not required

Table 38: SAR Simultaneous Tx Combination of Main Antenna and WiFi 2.4G

7.3.4 SPLSR Evaluation Analysis

According to KDB447498 D01v06, 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:

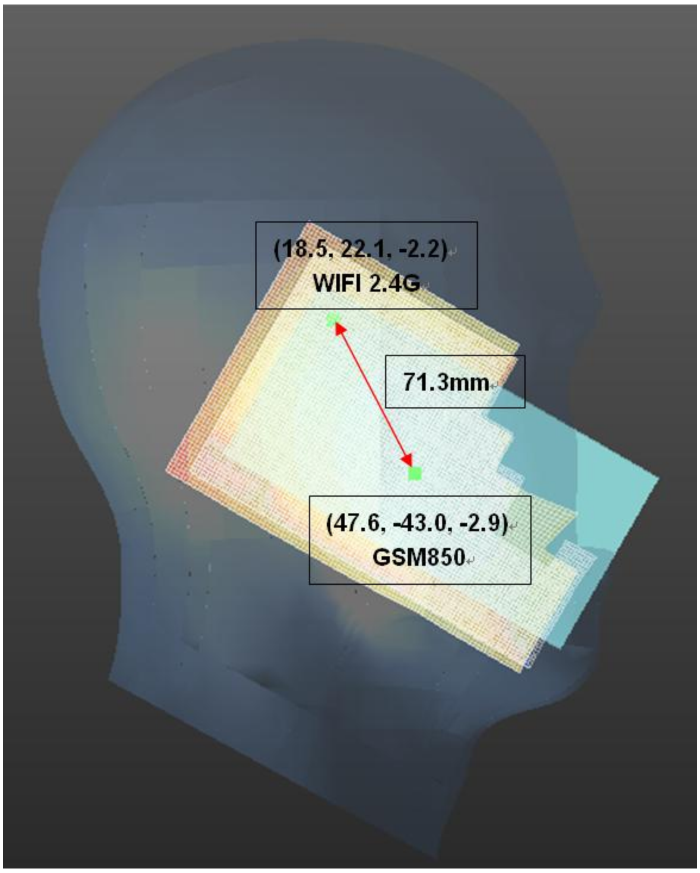
$$Distance_{Tx1\text{-}Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

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

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 GSM850 and WiFi 2.4G.

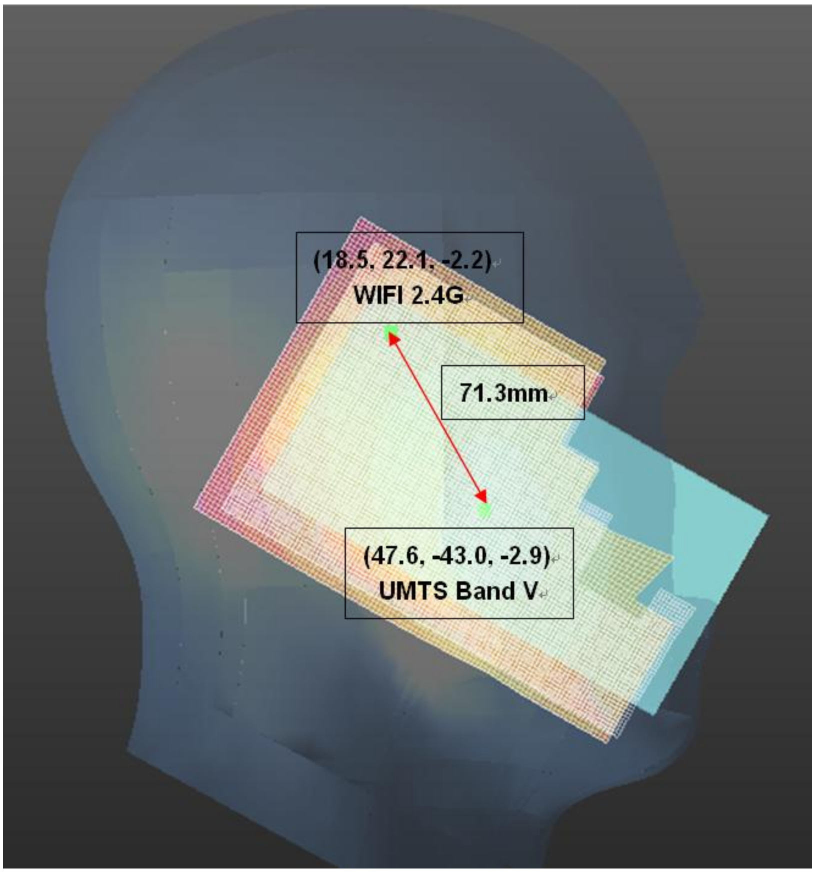
   The Peak SAR location plot is as below:



   The SAR to peak location ratio calculation is as below:

Test Position	GSM850 (W/kg)	WIFI 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched	0.449	1.285	71.3	0.032	0.04	Not required

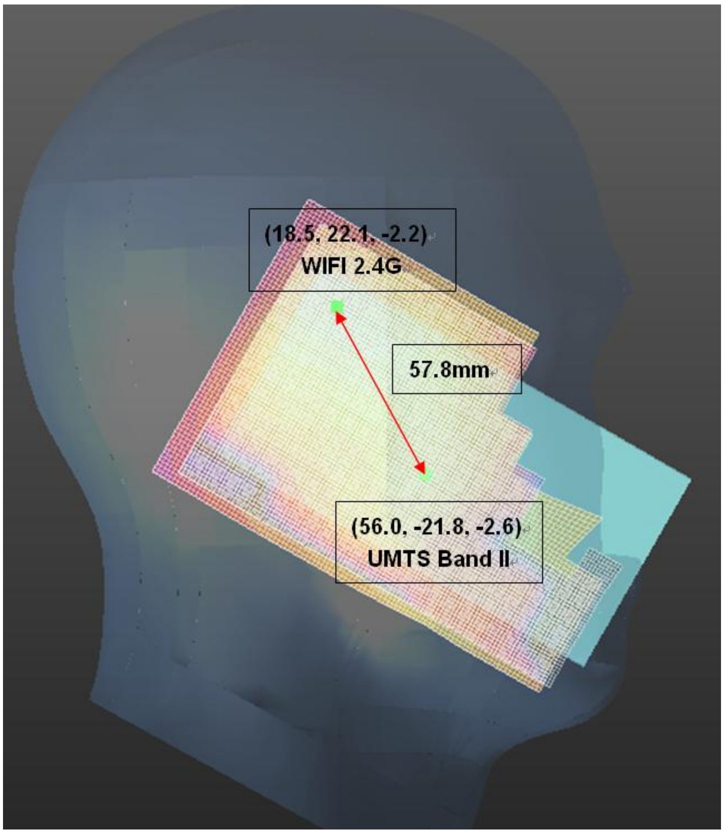
2) The sum of aggregate 1-g SAR was above 1.6W/kg for Left Hand Touched configuration with UMTS Band V and WiFi 2.4G.
   The Peak SAR location plot is as below:



The SAR to peak location ratio calculation is as below:

Test Position	UMTS Band V (W/kg)	WIFI 2.4G (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Simultaneous SAR
Left Hand Touched	0.367	1.285	71.3	0.030	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.
   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	0.391	1.285	57.8	0.038	0.04	Not required

7.3.5 Simultaneous Transmission Conlcusion

The above numeral summed SAR results and/or 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 D01v06.

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