FCC SAR Compliance Test Report

Product Name: Smart Phone

Model: HUAWEI SCL-L01, SCL-L01

Report No.: SYBH(Z-SAR)017082015-2

FCC ID: QISSCL-L01

	APPROVED (Lab Manager)	PREPARED (Test Engineer)
BY	Wei Huanbin	Li wei
DATE	2015-09-11	2015-09-11

Reliability Laboratory of Huawei Technologies Co., Ltd.

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

Tel: +86 755 28780808 Fax: +86 755 89652518

Table of Contents

※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2015-09-11	Li Wei

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HUAWEI SCL-L01, SCL-L01 are as below Table 1.

Band	**Max Reported SAR(W/kg)**		
	1-g Head	**1-g Body-worn (15mm) ***	**1-g Hotspot (10mm)**
GSM850	0.40	**0.65**	0.74
GSM1900	0.31	0.24	0.50
LTE Band VII	**0.53**	0.46	**1.27**
WiFi 2.4G	0.34	0.03	0.07
The highest simultaneous SAR value is 1.27 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

Device Information：			
Product Name:	Smart Phone		
Model:	HUAWEI SCL-L01, SCL-L01		
FCC ID :	QISSCL-L01		
SN No.:	NQL7N15701000297		
Device Type :	Portable device		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment / general population		
Hardware Version :	HL3SCALEM		
Software Version :	SCL-L01V100R001C900B007		
Antenna Type :	Internal antenna		
Others Accessories	Headset		
Device Operating Configurations:			
Supporting Mode(s)	GSM850/1900, LTE Band VII,WiFi 2.4G,BT		
Test Modulation	GSM(GMSK/8PSK), LTE(QPSK/16QAM), WiFi(DSSS/OFDM),BT(GFSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM850	824-849	869-894
	GSM1900	1850-1910	1930-1990
	LTE Band VII	2500-2570	2620-2690
	BT	2400-2483.5	
	WiFi 2.4G	2412-2462	
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink:	4	
	Max Number of Timeslots in Downlink:	4	
	Max Total Timeslot:	5	
EGPRS Multislot Class(12)	Max Number of Timeslots in Uplink:	4	
	Max Number of Timeslots in Downlink:	4	
	Max Total Timeslot:	5	
Power Class:	4,tested with power level 5(GSM850)		
	1,tested with power level 0(GSM1900)		
	3, tested with power control all Max.(LTE Band VII)		
Test Channels (low-mid-high):	128-190-251(GSM850)		
	512-661-810(GSM1900)		
	20775-21100-21425(LTE Band VII BW=5MHz)		
	20800-21100-21400(LTE Band VII BW=10MHz)		
	20825-21100-21375(LTE Band VII BW=15MHz)		
	20850-21100-21350(LTE Band VII BW=20MHz)		
	802.11b/g/n 20M:1-6-11 (WiFi 2.4G)		

Table 3:Device information and operating configuration

1.3.1 General Description

HUAWEI SCL-L01, SCL-L01 is subscriber equipment in the GSM/UMTS/LTE 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 VIII,no band test data included in this report.The LTE frequency band is Band I and Band III and band VII and band VIII and band XX , but only Band VII test data included in this report.
The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/UMTS and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and USIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

Battery information：

Name	Manufacture	Serials number	Description
Li-Polymer Battery	Huawei Technologies Co., Ltd.	1#:1834UIF615 2#:1834ACF314	Battery Model: HB4342A1RBC Rated capacity: 2200mAh Nominal Voltage: +3.8V

1.4 Test specification(s)

ANSI Std C95.1-1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)
IEEE Std 1528-2013	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 v03
KDB941225 D05	SAR for LTE Devices v02r03
KDB941225 D06	Hotspot SAR v02
KDB447498 D01	General RF Exposure Guidance v05r02
KDB648474 D04	Handsets SAR v01r02
KDB248227 D01	SAR Guidance for IEEE 802 11 Wi-Fi SAR v02r01
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r04
KDB865664 D02	SAR Reporting v01r01
KDB690783 D01	SAR Listings on Grants v01r03

1.5 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Zone G1,Huawei Industrial Base, Bantian Industry Area, Longgang District, Shenzhen, Guangdong, China
Telephone	+86 755 28780808
Fax	+86 755 89652518
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310 A2LA TESTING CERT #2174.01

1.6 Applicant and Manufacturer

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

1.7 Application details

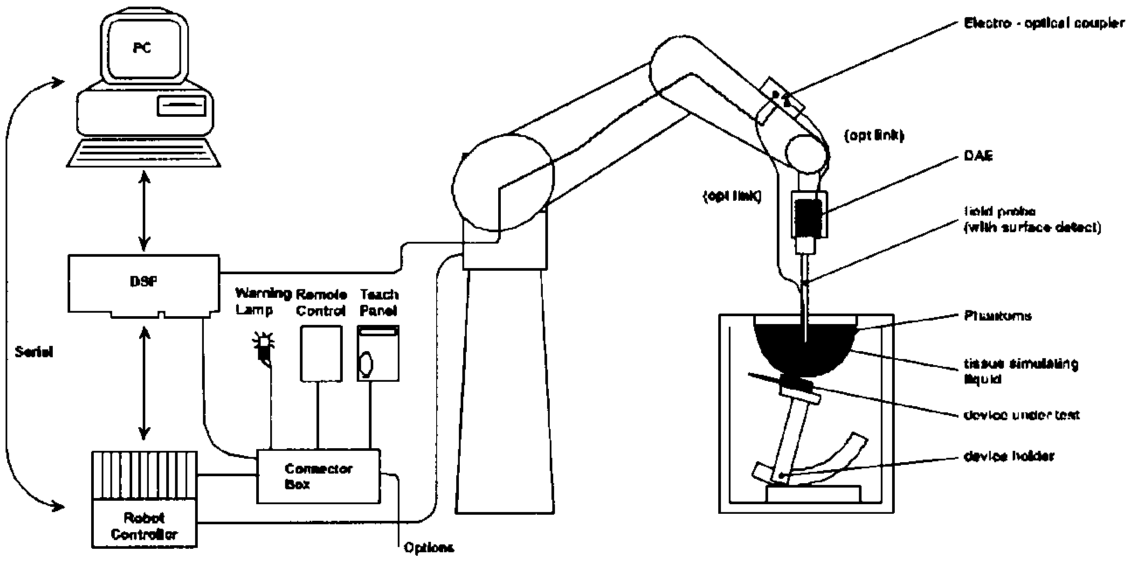
Start Date of test	2015-08-30
End Date of test	2015-09-03

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

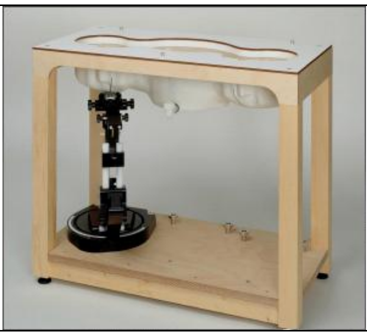
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to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

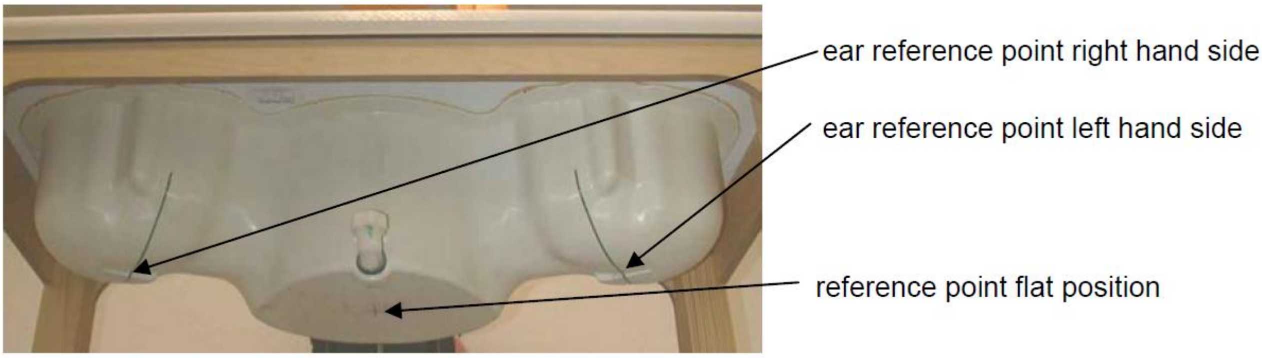
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity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

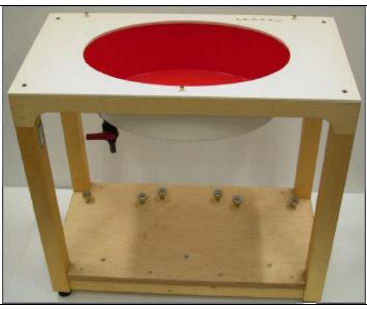
SAM Twin Phantom

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≤εr≤5 at ≤3 GHz,3≤ εr≤4 at >3 GHz and and a loss tangent ≤0.05.

2.6 Device holder description

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

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

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

2.7 Test Equipment List

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

	Manufacturer	Device	Type	Serial number	Date of last calibration	Valid period
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	7350	2015-01-08	One year
☒	SPEAG	835 MHz Dipole	D835V2	4d126	2015-07-23	Three years
☐	SPEAG	900 MHz Dipole	D900V2	1d063	2014-11-19	Three years
☒	SPEAG	1900 MHz Dipole	D1900V2	5d143	2014-09-23	Three years
☐	SPEAG	2000 MHz Dipole	D2000V2	1036	2014-11-19	Three years
☐	SPEAG	2300 MHz Dipole	D2300V2	1016	2014-11-19	Three years
☒	SPEAG	2450 MHz Dipole	D2450V2	860	2014-11-19	Three years
☒	SPEAG	2600 MHz Dipole	D2600V2	1021	2015-07-24	Three years
☒	SPEAG	Data acquisition electronics	DAE4	852	2015-04-27	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	WideBand Radio Communication Tester	CMW 500	126855	2015-07-01	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	2015-01-07	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1402001	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	MY45101339	2015-01-07	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;
System check with specific dipole is within 10% of calibrated value;
The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
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:

$$Vi = Ui + Ui2 \bullet cf/dcpi$$

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

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

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

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

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

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

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

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

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

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

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

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

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

4 System Verification Procedure

4.1 Tissue Verification

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

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

Ingredients (% of weight)	**Head Tissue**					
Frequency Band (MHz)	750	**835**	1750	**1900**	**2450**	**2600**
Water	39.2	41.45	52.64	55.242	62.7	55.242
Salt (NaCl)	2.7	1.45	0.36	0.306	0.5	0.306
Sugar	57.0	56.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	47.0	44.542	36.8	44.452
Ingredients (% of weight)	**Body Tissue**					
Frequency Band (MHz)	750	**835**	1750	**1900**	**2450**	**2600**
Water	50.3	52.4	69.91	69.91	73.2	64.493
Salt (NaCl)	1.60	1.40	0.13	0.13	0.04	0.024
Sugar	47.0	45.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	26.7	32.252

Table 4: Tissue Dielectric Properties

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

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (+/-5%)	σ (S/m) (+/-5%)	εr	σ (S/m)		
835H	825	41.60 (39.52~43.68)	0.90 (0.86~0.95)	40.61	0.892	21.7°C	2015-08-30
	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	40.48	0.901		
	850	41.50 (39.43~43.58)	0.92 (0.87~0.96)	40.26	0.916		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	56.88	0.995	21.3°C	2015-09-01
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	56.69	1.006		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	56.44	1.021		
1900H	1850	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.86	1.375	21.6°C	2015-09-02
	1880	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.75	1.404		
	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.66	1.426		
	1910	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.62	1.432		
1900B	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.96	1.483	21.1°C	2015-09-01
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.90	1.516		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.78	1.536		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.82	1.547		
2450H	2410	39.30 (37.34~41.26)	1.76 (1.67~1.85)	38.99	1.801	20.8°C	2015-09-02
	2435	39.20 (37.24~41.16)	1.79 (1.70~1.88)	38.91	1.829		
	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	38.86	1.846		
	2460	39.20 (37.24~41.16)	1.81 (1.72~1.90)	38.83	1.858		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	52.06	1.932	21.4°C	2015-09-02
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	51.97	1.960		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	51.92	1.977		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	51.88	1.988		

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (+/-5%)	σ (S/m) (+/-5%)	εr	σ (S/m)		
2600H	2510	39.12 (37.16~41.01)	1.86 (1.77~1.96)	38.09	1.878	21.7°C	2015-09-01
	2535	39.1 (37.13~41.04)	1.89 (1.80~1.98)	38.02	1.906		
	2560	39 (37.05~40.95)	1.917 (1.82~2.01)	37.93	1.934		
	2600	39 (37.05~40.95)	1.96 (1.86~2.05)	37.78	1.984		
2600B	2510	52.62 (49.99~55.25)	2.03 (1.93~2.13)	50.76	2.104	21.5°C	2015-08-31
	2535	52.59 (49.96~55.22)	2.07 (1.97~2.17)	50.67	2.140		
	2560	52.57 (49.94~55.20)	2.09 (1.99~2.19)	50.57	2.175		
	2600	52.5 (49.88~55.13)	2.16 (2.05~2.27)	50.46	2.229		
ε_r= Relative permittivity, σ= Conductivity							

Table 5:Measured Tissue Parameter

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

2) KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.

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

4.2 System Check

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

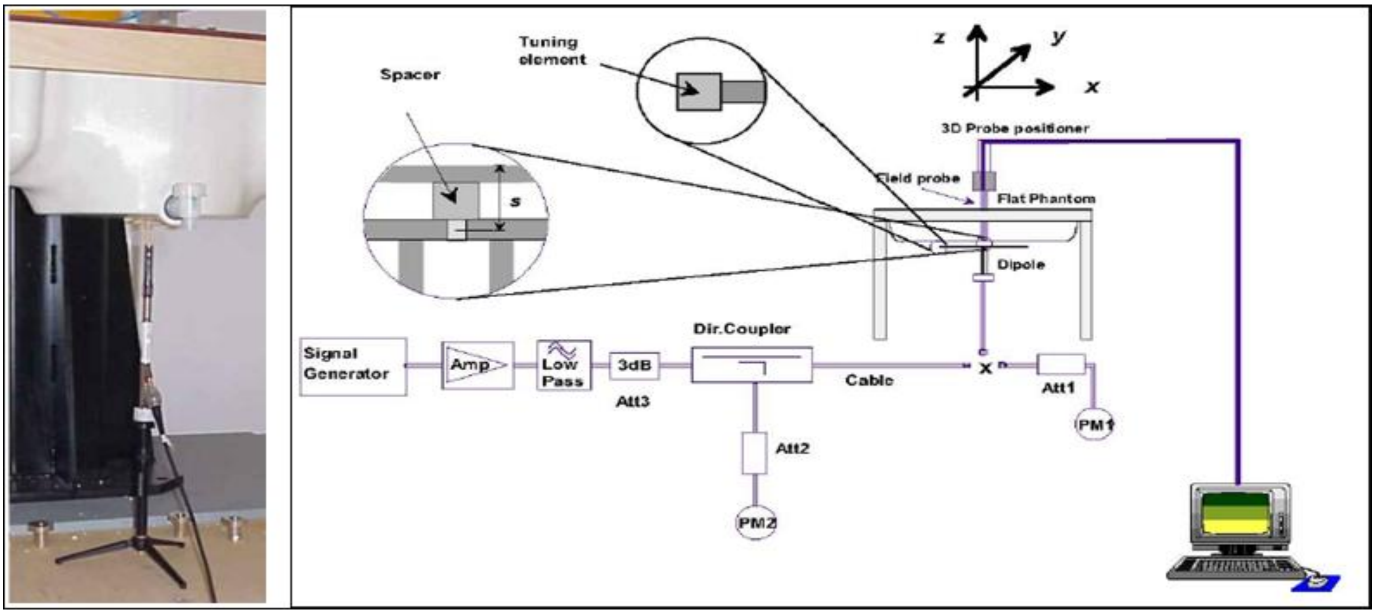
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
835MHz Head	9.49 (8.54~10.44)	6.18 (5.56~6.80)	9.72	6.40	21.7°C	2015-08-30
1900MHz Head	40.80 (36.72~44.88)	21.40 (19.26~23.54)	40.80	21.48	21.6°C	2015-09-02
2450MHz Head	52.30 (47.07~57.53)	24.50 (22.05~26.95)	54.40	25.88	20.8°C	2015-09-02
2600MHz Head	57.8 (52.02~63.58)	26.3 (23.67~28.93)	60.80	27.52	21.7°C	2015-09-01
835MHz Body	9.42 (8.48~10.36)	6.19 (5.57~6.80)	9.76	6.52	21.3°C	2015-09-01
1900MHz Body	40.20 (36.18~44.22)	21.30 (19.17~23.43)	42.00	22.28	21.1°C	2015-09-01
2450MHz Body	51.4 (46.26~56.54)	23.9 (21.51~26.29)	53.20	25.04	21.4°C	2015-09-02
2600MHz Body	57.5 (51.75~63.25)	25.9 (23.31~28.49)	58.40	25.96	21.5°C	2015-08-31

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 3G SAR Test Reduction Procedure

Per KDB941225 D01v03, 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.

6.2 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.

6.3 LTE Test Configuration

SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02r03. The CMW500 WideBand Radio Communication Tester was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.SAR test were performed with the same number of RB and RB offsets transmitting on all TTI frames(Maximum TTI)

1) Spectrum Plots for RB configurations

A properly configured base station simulator was used for LTE output power measurements and SAR testing.Therefore, spectrum plots for RB configurations were not required to be included in this report.

2) MPR

When MPR is implemented permanently within the UE, regardless of network requirements, only those RB configurations allowed by 3GPP for the channel bandwidth and modulation combinations may be tested with MPR active. Configurations with RB allocations less than the RB thresholds required by 3GPP must be tested without MPR.

The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

3) A-MPR

A-MPR(Additional MPR) has been disabled for all SAR tests by using Network Signalling Value of “NS_01”on the base station simulator.

4) LTE procedures for SAR testing

Largest channel bandwidth standalone SAR test requirements

i) QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

ii) QPSK with 50% RB allocation

The procedures required for 1 RB allocation in i) are applied to measure the SAR for QPSK with 50% RB allocation.

iii) QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in i) and ii) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

iv) Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

B) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

6.4 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 248227D01v02r01 are applied. (Refer to KDB 248227D01v02r01 for more details)

6.4.1 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.

6.4.2 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 248227D01v02r01). 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.

6.4.3 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.

6.4.4 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 248227D01v02). 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&CMW500 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)		33.5	32.06	32.09	32.20	-9.19	24.31	22.87	22.90	23.01
GPRS/ EDGE (GMSK)	1 Tx Slot	33.5	32.04	32.10	32.16	-9.19	24.31	22.85	22.91	22.97
	2 Tx Slots	30.5	29.19	28.92	29.11	-6.13	**24.37**	**23.06**	**22.79**	**22.98**
	3 Tx Slots	28.5	27.13	27.16	27.30	-4.42	24.08	22.71	22.74	22.88
	4 Tx Slots	27.5	26.25	26.04	26.23	-3.18	24.32	23.07	22.86	23.05
EDGE (8PSK)	1 Tx Slot	27.0	26.33	26.21	26.26	-9.19	17.81	17.14	17.02	17.07
	2 Tx Slots	25.0	23.72	23.54	23.59	-6.13	18.87	17.59	17.41	17.46
	3 Tx Slots	23.0	21.60	21.72	21.83	-4.42	18.58	17.18	17.30	17.41
	4 Tx Slots	22.0	20.48	20.27	20.47	-3.18	18.82	17.30	17.09	17.29

Table 7: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 D01v03, 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)		30.5	28.90	28.89	28.9	-9.19	21.31	19.71	19.70	19.71
GPRS/ EDGE (GMSK)	1 Tx Slot	30.5	28.80	28.74	28.68	-9.19	21.31	19.61	19.55	19.49
	2 Tx Slots	27.5	26.49	26.47	26.38	-6.13	**21.37**	**20.36**	**20.34**	**20.25**
	3 Tx Slots	25.5	24.58	24.48	24.41	-4.42	21.08	20.16	20.06	19.99
	4 Tx Slots	24.5	23.22	23.21	23.2	-3.18	21.32	20.04	20.03	20.02
EDGE (8PSK)	1 Tx Slot	26.0	24.93	24.77	24.61	-9.19	16.81	15.74	15.58	15.42
	2 Tx Slots	24.0	22.28	22.07	22.02	-6.13	17.87	16.15	15.94	15.89
	3 Tx Slots	22.0	20.52	20.34	20.22	-4.42	17.58	16.10	15.92	15.80
	4 Tx Slots	21.0	19.26	19.08	19.06	-3.18	17.82	16.08	15.90	15.88

Table 8: 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 D01v03, 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 LTE Band VII

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 20775CH	Channel 21100CH	Channel 21425CH
5MHz	QPSK	1	0	23.4	22.16	22.25	22.24
		1	13	23.4	22.00	22.05	22.22
		1	24	23.4	22.28	22.11	22.10
		12	0	22.4	21.09	20.98	21.09
		12	6	22.4	21.08	21.00	21.11
		12	13	22.4	21.11	21.05	21.11
		25	0	22.4	21.04	21.12	21.22
	16QAM	1	0	22.4	20.59	20.74	21.09
		1	13	22.4	20.88	20.62	21.02
		1	24	22.4	20.77	20.94	20.96
		12	0	21.4	19.99	20.07	20.01
		12	6	21.4	19.84	19.89	19.95
		12	13	21.4	20.06	19.95	19.92
		25	0	21.4	20.07	20.06	20.06
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 20800CH	Channel 21100CH	Channel 21400CH
10MHz	QPSK	1	0	23.4	22.23	22.31	22.38
		1	25	23.4	22.29	22.21	22.37
		1	49	23.4	22.27	22.35	22.31
		25	0	22.4	21.05	21.14	21.31
		25	13	22.4	21.09	21.10	21.20
		25	25	22.4	21.15	21.11	21.21
		50	0	22.4	21.19	21.16	21.22
	16QAM	1	0	22.4	21.25	21.30	21.06
		1	25	22.4	21.19	21.14	21.18
		1	49	22.4	20.96	21.03	21.07
		25	0	21.4	19.94	20.13	20.18
		25	13	21.4	20.05	19.98	20.09
		25	25	21.4	19.94	20.01	20.11
		50	0	21.4	20.05	20.02	20.09

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 20825CH	Channel 21100CH	Channel 21375CH
15MHz	QPSK	1	0	23.4	22.37	22.49	22.32
		1	38	23.4	22.30	22.08	22.16
		1	74	23.4	22.40	22.37	22.12
		36	0	22.4	21.13	21.20	21.20
		36	18	22.4	21.07	21.02	21.11
		36	39	22.4	21.15	21.11	21.18
		75	0	22.4	21.21	21.15	21.21
	16QAM	1	0	22.4	21.86	21.63	21.79
		1	38	22.4	21.18	20.93	21.07
		1	74	22.4	21.66	21.71	21.59
		36	0	21.4	20.28	20.08	20.06
		36	18	21.4	20.13	19.91	20.08
		36	39	21.4	20.10	20.00	20.17
		75	0	21.4	20.19	20.22	20.05
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 20850CH	Channel 21100CH	Channel 21350CH
20MHz	QPSK	1	0	23.4	22.40	22.11	22.34
		1	50	23.4	21.99	22.10	22.04
		1	99	23.4	22.18	22.31	22.10
		50	0	22.4	21.22	21.14	21.20
		50	25	22.4	21.10	21.08	21.15
		50	50	22.4	21.06	21.11	21.14
		100	0	22.4	21.08	21.10	21.11
	16QAM	1	0	22.4	21.74	21.82	21.92
		1	50	22.4	21.13	20.88	21.21
		1	99	22.4	21.74	21.05	21.20
		50	0	21.4	20.12	20.14	20.11
		50	25	21.4	20.15	20.06	20.05
		50	50	21.4	20.14	20.05	20.15
		100	0	21.4	20.18	20.10	20.14

Table 9: Conducted power measurement results of LTE Band VII

7.1.4 Conducted power measurements of WiFi 2.4G

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)	Power Setting Level
802.11b	1	2412	1	16	14.81	Yes	13
	6	2437		16	**14.99**	Yes	
	11	2462		16	14.62	Yes	
802.11g	1	2412	6	12	10.61	No	9
	6	2437		12	10.80	No	
	11	2462		12	10.25	No	
802.11n-20M	1	2412	6.5	11	9.65	No	8
	6	2437		11	9.76	No	
	11	2462		11	9.13	No	

Table 10: Conducted power measurement results of WiFi 2.4G.

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

7.1.5 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	12	8.38	10.58	8.17
2DH5	12	5.34	9.07	6.54
3DH5	12	5.42	9.09	6.63

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	19CH	39CH
BLE	3	-2.48	0.22	-2.7

Table 11: Conducted power measurement results of BT.

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

7.2 SAR measurement Results

General Notes:

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

2) Per KDB447498 D01v05r02, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

● ≤ 0.8W/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 D01v01r03,for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%, and the measured SAR <1.45W/Kg, only one repeated measurement is required.

4) Per KDB941225 D06v02, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested.

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

6) Per KDB865664 D02v01r01, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to the blue SAR test results in the tables of Section 7.3 and appendix B for detailed SAR plots).

GSM Notes:

1) Per KDB941225 D01v03, 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 D04v01r02, 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.

LTE Notes:

1) The LTE test configurations are determined according to KDB941225 D05 SAR for LTE Devices v02r03.The general test procedures used for SAR testing can be found in Section 6.4.

2) A-MPR was disabled for all SAR test by setting NS_01 on the base station simulator.SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames(maximum TTI)

WiFi Notes:

Per KDB248227D01v02r01:

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	0.250	0.192	0.070	32.09	33.50	0.346	21.7°C
Left Hand Tilted 15°	190/836.6	GSM	0.154	0.108	-0.110	32.09	33.50	0.213	21.7°C
Right Hand Touched	190/836.6	GSM	0.242	0.188	0.120	32.09	33.50	0.335	21.7°C
Right Hand Tilted 15°	190/836.6	GSM	0.161	0.112	-0.080	32.09	33.50	0.223	21.7°C
Left Hand Touched	128/824.2	GSM	0.209	0.144	-0.030	32.06	33.50	0.291	21.7°C
Left Hand Touched	251/848.8	GSM	0.272	0.209	-0.010	32.20	33.50	0.367	21.7°C
Tested at the worst position with battery 2#									
Left Hand Touched	251/848.8	GSM	0.294	0.224	0.170	32.20	33.50	0.397	21.7°C

Table 12: 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	0.368	0.288	-0.020	32.09	33.50	0.509	21.4°C
Back Side	190/836.6	GSM	0.453	0.352	-0.160	32.09	33.50	0.627	21.4°C
Tested at the worst position with battery 2#									
Back Side	190/836.6	GSM	0.470	0.366	-0.160	32.09	33.50	0.650	21.4°C

Table 13: 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	0.345	0.273	-0.090	28.92	30.50	0.496	21.4°C
Back Side	190/836.6	GPRS 2TS	0.513	0.401	-0.010	28.92	30.50	0.738	21.4°C
Left Side	190/836.6	GPRS 2TS	0.392	0.256	-0.110	28.92	30.50	0.564	21.4°C
Right Side	190/836.6	GPRS 2TS	0.392	0.275	-0.090	28.92	30.50	0.564	21.4°C
Bottom Side	190/836.6	GPRS 2TS	0.052	0.028	-0.050	28.92	30.50	0.075	21.4°C
Tested at the worst position with battery 2#									
Back Side	190/836.6	GPRS 2TS	0.506	0.396	0.070	28.92	30.50	0.728	21.4°C

Table 14: 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	0.197	0.128	0.140	28.89	30.50	0.285	21.6°C
Left Hand Tilted 15°	661/1880	GSM	0.083	0.049	0.000	28.89	30.50	0.120	21.6°C
Right Hand Touched	661/1880	GSM	0.125	0.083	-0.110	28.89	30.50	0.181	21.6°C
Right Hand Tilted 15°	661/1880	GSM	0.102	0.058	0.040	28.89	30.50	0.148	21.6°C
Left Hand Touched	512/1850.2	GSM	0.186	0.120	0.110	28.90	30.50	0.269	21.6°C
Left Hand Touched	810/1909.8	GSM	0.202	0.130	0.000	28.90	30.50	0.292	21.6°C
Tested at the worst position with battery 2#									
Left Hand Touched	810/1909.8	GSM	0.216	0.138	0.090	28.90	30.50	0.312	21.6°C

Table 15: 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	0.121	0.072	-0.110	28.89	30.50	0.175	21.4°C
Back Side	661/1880	GSM	0.166	0.094	-0.080	28.89	30.50	0.240	21.4°C
Tested at the worst position with battery 2#									
Back Side	661/1880	GSM	0.164	0.092	-0.010	28.89	30.50	0.238	21.4°C

Table 16: 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	0.248	0.140	-0.070	26.47	27.50	0.314	21.4°C
Back Side	661/1880	GPRS 2TS	0.396	0.203	-0.180	26.47	27.50	0.502	21.4°C
Left Side	661/1880	GPRS 2TS	0.105	0.065	-0.130	26.47	27.50	0.133	21.4°C
Right Side	661/1880	GPRS 2TS	0.074	0.045	-0.150	26.47	27.50	0.094	21.4°C
Bottom Side	661/1880	GPRS 2TS	0.367	0.199	-0.110	26.47	27.50	0.465	21.4°C
Tested at the worst position with battery 2#									
Back Side	661/1880	GPRS 2TS	0.376	0.194	0.040	26.47	27.50	0.477	21.4°C

Table 17: Hotspot SAR test results of GSM1900

7.2.3 SAR measurement Result of LTE Band VII

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 SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data with battery 1#									
1RB									
Left Hand Touched	20850/2510	20M QPSK 1RB#0	0.334	0.183	-0.140	22.40	23.40	0.420	21.6°C
Left Hand Tilted 15°	20850/2510	20M QPSK 1RB#0	0.060	0.033	0.160	22.40	23.40	0.075	21.6°C
Right Hand Touched	20850/2510	20M QPSK 1RB#0	0.170	0.096	0.150	22.40	23.40	0.214	21.6°C
Right Hand Tilted 15°	20850/2510	20M QPSK 1RB#0	0.080	0.039	0.190	22.40	23.40	0.101	21.6°C
Left Hand Touched	21100/2535	20M QPSK 1RB#99	0.404	0.217	0.160	22.31	23.40	0.519	21.6°C
Left Hand Touched	21350/2560	20M QPSK 1RB#0	0.413	0.224	0.170	22.34	23.40	0.527	21.6°C
50%RB									
Left Hand Touched	20850/2510	20M QPSK 50%RB#0	0.259	0.138	0.190	21.22	22.40	0.340	21.6°C
Left Hand Tilted 15°	20850/2510	20M QPSK 50%RB#0	0.048	0.026	0.170	21.22	22.40	0.062	21.6°C
Right Hand Touched	20850/2510	20M QPSK 50%RB#0	0.129	0.071	0.170	21.22	22.40	0.169	21.6°C
Right Hand Tilted 15°	20850/2510	20M QPSK 50%RB#0	0.062	0.030	0.120	21.22	22.40	0.082	21.6°C
Tested at the worst position with battery 2#									
Left Hand Touched	21350/2560	20M QPSK 1RB#0	0.411	0.222	0.020	22.34	23.40	0.525	21.6°C

Table 18: Head SAR test results of LTE Band VII

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	10-g					
Test data with battery 1#									
1RB									
Front Side	20850/2510	20M QPSK 1RB#0	0.332	0.192	0.030	22.40	23.40	0.418	21.7°C
Back Side	20850/2510	20M QPSK 1RB#0	0.363	0.202	-0.080	22.40	23.40	0.457	21.7°C
50%RB									
Front Side	20850/2510	20M QPSK 50%RB#0	0.270	0.151	0.160	21.22	22.40	0.354	21.7°C
Back Side	20850/2510	20M QPSK 50%RB#0	0.295	0.160	-0.140	21.22	22.40	0.387	21.7°C
Tested at the worst position with battery 2#									
Back Side	20850/2510	20M QPSK 1RB#0	0.363	0.203	0.030	22.40	23.40	0.457	21.7°C

Table 19: Body-Worn SAR test results of LTE Band VII

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	10-g					
Test data with battery 1#									
1RB									
Front Side	20850/2510	20M QPSK 1RB#0	0.604	0.338	-0.110	22.40	23.40	0.760	21.7°C
Back Side	20850/2510	20M QPSK 1RB#0	0.699	0.353	-0.130	22.40	23.40	0.880	21.7°C
Back Side	21100/2535	20M QPSK 1RB#99	0.710	0.355	-0.030	22.40	23.40	0.894	21.7°C
Back Side	21350/2560	20M QPSK 1RB#0	0.856	0.424	0.030	22.40	23.40	1.078	21.7°C
Left Side	20850/2510	20M QPSK 1RB#0	0.207	0.113	0.010	22.40	23.40	0.261	21.7°C
Right Side	20850/2510	20M QPSK 1RB#0	0.047	0.028	0.030	22.40	23.40	0.060	21.7°C
Bottom Side	20850/2510	20M QPSK 1RB#0	0.833	0.425	0.140	22.40	23.40	1.049	21.7°C
Bottom Side	21100/2535	20M QPSK 1RB#99	0.947	0.489	0.020	22.31	23.40	1.217	21.7°C
Bottom Side	21350/2560	20M QPSK 1RB#0	0.950	0.499	-0.030	22.34	23.40	1.213	21.7°C
50%RB									
Front Side	20850/2510	20M QPSK 50%RB#0	0.440	0.247	0.160	21.22	22.40	0.577	21.7°C
Back Side	20850/2510	20M QPSK 50%RB#0	0.592	0.294	-0.060	21.22	22.40	0.777	21.7°C
Left Side	20850/2510	20M QPSK 50%RB#0	0.153	0.083	0.050	21.22	22.40	0.201	21.7°C
Right Side	20850/2510	20M QPSK 50%RB#0	0.037	0.023	0.150	21.22	22.40	0.049	21.7°C
Bottom Side	20850/2510	20M QPSK 50%RB#0	0.686	0.338	-0.040	21.22	22.40	0.900	21.7°C
Bottom Side	21100/2535	20M QPSK 50%RB#0	0.694	0.352	-0.180	21.14	22.40	0.928	21.7°C
Bottom Side	21350/2560	20M QPSK 50%RB#0	0.784	0.401	-0.080	21.20	22.40	1.034	21.7°C
100%RB									
Back Side	21350/2560	20M QPSK 100%RB#0	0.632	0.312	-0.060	21.11	22.40	0.851	21.7°C
Bottom Side	21350/2560	20M QPSK 100%RB#0	0.801	0.411	-0.010	21.11	22.40	1.078	21.7°C
Tested at the worst position with battery 2#									
Bottom Side	21350/2560	20M QPSK 1RB#0	0.982	0.508	-0.110	22.34	23.40	1.253	21.7°C
Bottom Side-repeated	21350/2560	20M QPSK 1RB#0	0.995	0.513	-0.150	22.34	23.40	1.270	21.7°C

Table 20: Hotspot SAR test results of LTE Band VII

7.2.4 SAR measurement Result of WiFi 2.4G

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 SAR_{1-g} (W/kg)	Liquid Temp.
			1-g Area Scan	1-g Zoom Scan					
Test data with battery 1#									
Left Hand Touched	6/2437	802.11 b	0.153	0.161	-0.160	14.99	16.00	0.203	21.5°C
Left Hand Tilted 15°	6/2437	802.11 b	0.148	/	0.150	14.99	16.00	/	21.5°C
Right Hand Touched	6/2437	802.11 b	0.084	/	0.190	14.99	16.00	/	21.5°C
Right Hand Tilted 15°	6/2437	802.11 b	0.087	/	-0.150	14.99	16.00	/	21.5°C
Left Hand Touched	1/2412	802.11 b	0.249	0.261	-0.170	14.81	16.00	0.343	21.5°C
Left Hand Touched	11/2462	802.11 b	0.157	0.165	-0.030	14.62	16.00	0.227	21.5°C
Tested at the worst position with battery 2#									
Left Hand Touched	1/2412	802.11 b	0.199	0.207	-0.060	14.81	16.00	0.272	21.5°C

Table 21: Head SAR test results of WiFi 2450MHz

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	6/2437	802.11 b	0.026	0.026	-0.110	14.99	16.00	0.033	21.5°C
Back Side	6/2437	802.11 b	0.025	/	-0.080	14.99	16.00	/	21.5°C
Tested at the worst position with battery 2#									
Front Side	6/2437	802.11 b	0.022	0.021	0.170	14.99	16.00	0.026	21.5°C

Table 22: Body-Worn SAR test results of WiFi 2450MHz

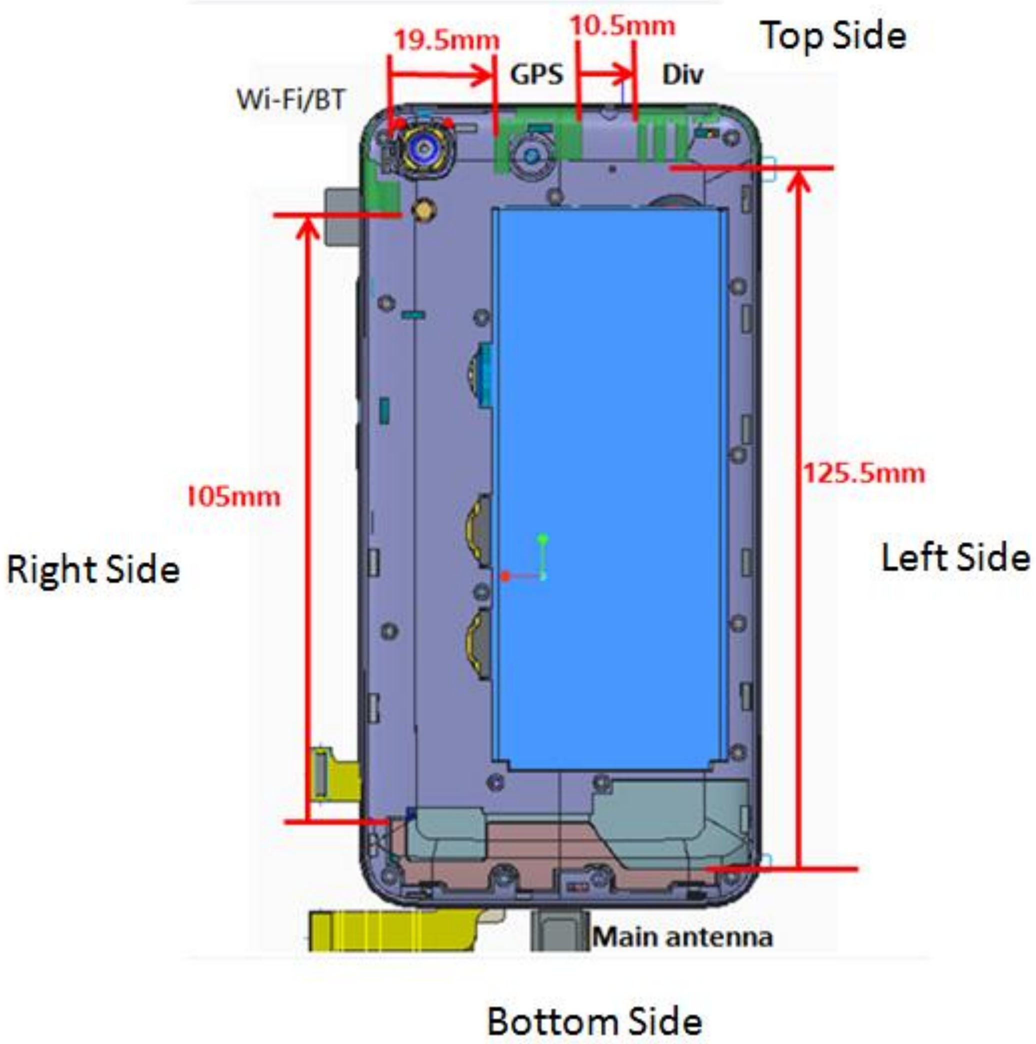
Test Position of Hotspot with 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g Area Scan	1-g Zoom Scan					
Test data with battery 1#									
Front Side	6/2437	802.11 b	0.044	/	0.120	14.99	16.00	/	21.5°C
Back Side	6/2437	802.11 b	0.056	0.054	0.100	14.99	16.00	0.068	21.5°C
Right Side	6/2437	802.11 b	0.028	/	-0.130	14.99	16.00	/	21.5°C
Top Side	6/2437	802.11 b	0.036	/	-0.170	14.99	16.00	/	21.5°C
Tested at the worst position with battery 2#									
Back Side	6/2437	802.11 b	0.045	0.046	0.150	14.99	16.00	0.058	21.5°C

Table 23: Hotspot SAR test results of WiFi 2450MHz

7.3 Multiple Transmitter Evaluation

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498D01 General RF Exposure Guidance v05r02.

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



Note:

1)The Diversity antenna does not support Tx function.

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

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	No	Yes	Yes	No

Table 24: Sides for Hotspot SAR testing

7.3.1 Stand-alone SAR test exclusion

Per FCC KDB 447498D01v05, the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

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

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

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
BT	Body-Worn	12.00	15.85	15	2.450	1.65	3.00	Yes

Table 25: 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	12.00	15.85	15	2.450	7.50	0.221

Table 26: 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) + WiFi 2.4G	Yes	Yes	N/A
2	GPRS/EDGE (DATA) + WiFi 2.4G	N/A	N/A	Yes
3	GSM (Voice) +BT	N/A	Yes	N/A
4	GPRS/EDGE (DATA) + BT	N/A	N/A	N/A
5	LTE (DATA) + WiFi 2.4G	Yes*	Yes*	Yes
6	LTE (DATA) + BT	N/A	Yes*	N/A

Table 27: Simultaneous Transmission Possibilities

Note:

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

2) The device does not support DTM function.

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

4) * 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	Volume scan
		GSM 850	GSM 1900	LTE Band VII	WiFi 2.4G	BT			
Head	Left Hand Touched	0.397	0.312	0.527	0.343	/	0.870	N/A	N/A
	Left Hand Tilted 15°	0.213	0.120	0.075	0.343	/	0.556	N/A	N/A
	Right Hand Touched	0.335	0.181	0.214	0.343	/	0.678	N/A	N/A
	Right Hand Tilted 15°	0.223	0.148	0.101	0.343	/	0.566	N/A	N/A
Body-worn 15mm	Front side	0.509	0.175	0.418	0.033	0.221	0.730	N/A	N/A
	Back side	0.650	0.240	0.457	0.033	0.221	0.871	N/A	N/A
Hotspot 10mm	Front side	0.496	0.314	0.760	0.068	/	0.828	N/A	N/A
	Back side	0.738	0.502	1.078	0.068	/	1.146	N/A	N/A
	Left side	0.564	0.133	0.261	/	/	0.564	N/A	N/A
	Right side	0.564	0.094	0.060	0.068	/	0.632	N/A	N/A
	Top side	/	/	/	0.068	/	0.068	N/A	N/A
	Bottom side	0.075	0.465	1.270	/	/	**1.270**	N/A	N/A

Table 28: SAR Simultaneous Tx Combination of Main antenna and WiFi/BT.

7.3.4 Simultaneous Transmission Conlcusion

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

Appendix A. System Check Plots

(Pls See Appendix A.)

Appendix B. SAR Measurement Plots

(Pls See Appendix B.)

Appendix C. Calibration Certificate

(Pls See Appendix C.)

Appendix D. Photo documentation

(Pls See Appendix D.)

End