Sony Mobile Communications (China) Co., Ltd.
Test Laboratory
Test Report

Report Title: PM-0821-BV SAR FCC Test Report
Report NO: TARC-PM-0821-BV-SAR-FCC-02
Report Date: 2014-07-10

☒ Initial Test Report / ☐ Test Report replace <document ID>

Prepared by: Zhou, Zhili	Reviewed by: Tang, Hailiang	Approval by: Wu, Yusheng
Title： Test Engineer	Title：Lab Supervisor	Title：Authorized Signatory
Date: 2014/07/10	Date: 2014/07/10	Date: 2014/07/10

Note:
The test results in this test report relate only to the devices listed in this report. This report shall not be reproduced except in full without the written approval of Sony Mobile Communications (China) Co., Ltd. Test Laboratory.

Test Laboratory:
CNAS (17025) : No.L6619
FCC 2.948 Listed: No.634550
Sony Mobile Communications (China) Co., Ltd. Test Laboratory
Address: 20 Tian Zhu West Road, A Area Tian Zhu airport Industrial Zone. Shun Yi District, Beijing 101312 P. R. China
Tel: +86 1080481188 - 68138, Fax: +86 1058659049
Email: gang.ma@sonymobile.com

Report Edition

Report Number	Edition	Date	Memo
TARC-PM-0821-BV-SAR-FCC-01	1	2014-06-30	Initial creation of test report
TARC-PM-0821-BV-SAR-FCC-02	2	2014-07-10	Updated test report per *15862 - TCB Comments*

Applicant Information	
Company Name:	Sony Mobile Communications INC
Address:	No.15 Tian Zhu Road, ShunYi District
City:	Beijing
Country:	P. R. China
Contact Window:	Chen, Lei
Telephone:	+86 10 80481188-68125
Fax:	+86 10 58656688

Manufacturer Information	
Company Name:	Sony Mobile Communications INC
Address:	1-8-15 Konan, Minato-ku, Tokyo, 108-0075, Japan
City:	Tokyo
Postal Code:	108-0075
Country:	Japan

Laboratory Name:	Sony Mobile Communications (China) Co., Ltd. Test Laboratory
Contact window:	Ma, Gang
Title:	Laboratory Manager
Telephone:	+86 10 80481188-68138
E-mail:	gang.ma@sonymobile.com

PM-0821-BV SAR FCC Test Report

Catalog

Content

1 SUMMARY

The Sony Mobile Communications (China) Co., Ltd. Test Laboratory has performed measurements of the maximum potential exposure to the user of the portable cellular phone covered by this test report. The Specific Absorption Rate (SAR) of this product was measured. The portable cellular phone was tested in accordance with IEEE 1528:2003. The SAR values measured for the portable cellular phone are below the maximum recommended levels of 1.6 W/kg in a 1 g average set in IEEE Std C95-1:1992.

For IEEE (1g), the final stand-alone SAR readings for this phone are given in the table below. These measurements were performed using a DASY52™ system manufactured by SPEAG, of Zurich Switzerland.

1.1 Highest Standalone Reported SAR

Exposure configuration	Band	Mode	Highest reported 1g SAR (w/kg)	Equipment class	Highest reported 1g SAR (w/kg)
Head (Separation distance 0mm)	GSM 850	DTM	0.281	PCE	0.328
	GSM 1900	DTM	0.265		
	WCDMA 850	RMC	0.265		
	WCDMA 1900	RMC	0.328		
	WLAN 2.4GHz	802.11b	0.907	DTS	0.907

Exposure configuration	Band	Mode	Highest reported 1g SAR (w/kg)	Equipment class	Highest reported 1g SAR (w/kg)
Hotspot (Separation distance 10mm)	GSM 850	GPRS	0.276	PCE	0.839
	GSM 1900	GPRS	0.437		
	WCDMA 850	RMC	0.341		
	WCDMA 1900	RMC	0.839		
	WLAN 2.4GHz	802.11b	0.224	DTS	0.224

Exposure configuration	Band	Mode	Highest reported 1g SAR (w/kg)	Equipment class	Highest reported 1g SAR (w/kg)
Body worn (Separation distance 15mm)	GSM 850	GPRS	0.153	PCE	0.338
	GSM 1900	GPRS	0.172		
	WCDMA 850	RMC	NP		
	WCDMA 1900	RMC	0.338		
	WLAN 2.4GHz	802.11b	0.082	DTS	0.082

1.2 Statement of Compliance

The SAR values found for the Mobile Phone are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1g tissue according to the ANSI C95.1-1992 and FCC rule §2.1093.

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 which provides a minimum separation distance of 10 mm for data and 15mm for speech between this device and the body of the user. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

1.3 EUT Information

1.3.1 Basic Information

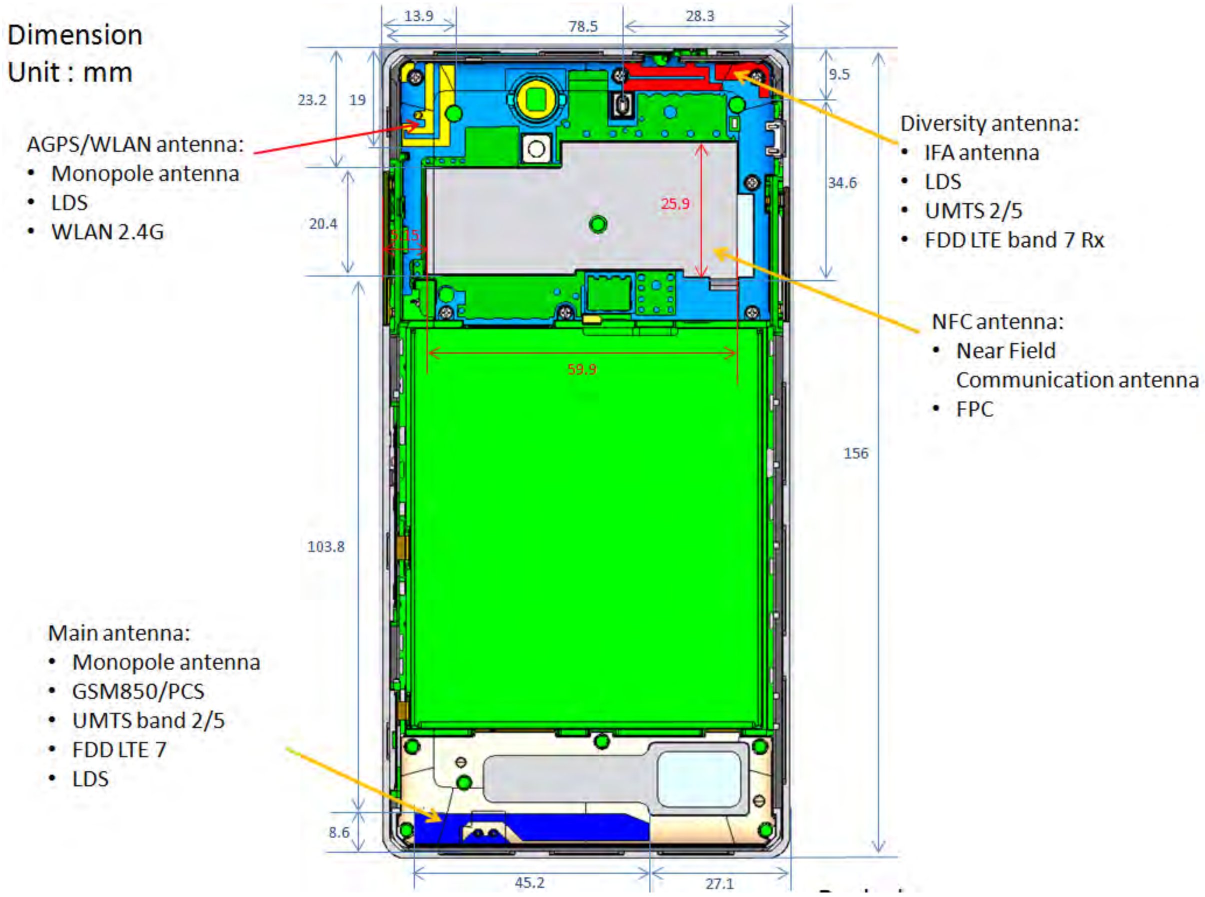
Description	Smartphone handset
EUT Model	PM-0821-BV
FCC ID	PY7PM-0821
IC ID	N/A
Operating Mode(s)	GSM 850/1900, WCDMA 850/1900, Wlan 2.4GHz, BT
GPRS/ EGPRS Class	33
DTM Multislot Class	11
WCDMA UE Category	6
RF Exposure Limits	General Population / Uncontrolled

Band	Modulation	Maximum Output Power Setting	Duty Cycle	Transmitting Frequency Range(s)
GSM 850	GMSK	33.7 dBm	1:8	824.2 – 848.8 MHz
GSM 1900	GMSK	31 dBm	1:8	1850.2 – 1910 MHz
WCDMA850	QPSK	25 dBm	1:1	826.4 – 846.6 MHz
WCDMA1900	QPSK	23.5 dBm	1:1	1852.4 – 1907.6 MHz
Wlan 2.4G	QPSK	16 dBm	1:1	2412 – 2462 MHz
Bluetooth	GFSK	9.5 dBm	1:1	2402.0 – 2480.0 MHz

1.3.2 Antenna Description

Main Antenna

Type	Internal- antenna	
Location	Bottom of phone	
Main and Wlan antennas distance	103.8mm	
Dimensions	Max length	41.6mm
	Max width	10mm



Antenna positioning diagram with separation distance

1.3.3 Internal Identification of EUT

Module	Received Date	IMEI	HW	SW	Test Case
PM-0820-BV	2014-05-30	004402452817882	AP 1.0	19.2.A.0.174	GSM/WCDMA/LTE
PM-0820-BV	2014-05-30	004402452818978	AP 1.0	19.2.A.0.174	GSM/WCDMA/LTE
PM-0820-BV	2014-05-30	004402452817962	AP 1.0	19.2.A.0.174	GSM/WCDMA/LTE
PM-0820-BV	2014-05-30	004402452817921	AP 1.0	19.2.A.0.174	GSM/WCDMA/LTE
PM-0820-BV	2014-05-27	CB5A1ZDQN3	AP 1.0	Wukong_0_22_3_13	Wlan
PM-0820-BV	2014-05-27	CB5A1ZDRNS	AP 1.0	Wukong_0_22_3_13	Wlan

Note:

1. Wlan conducted power was measured by TMC lab in Beijing.
2. The HW designs of PM-0821-BV are identical with PM-0820-BV but without LTE capability supported, so test results are inherited from PM-0820-BV.

1.3.4 Identification of Ancillary Equipment

No.	Description	SN
1	Integrated Battery	N/A
2	Headset	N/A

1.3.5 Reference Standard and Criteria

Reference	Version	Test Standard Description
IEEE 1528	2003-04	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
RSS-102 Issue 4	2010-03	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Canada's Safety Code No. 6	99-EHD-237	Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
IEEE Std. C95-3	2002	IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave
IEEE Std. C95-1	1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
KDB 865664D01	v01r02	FCC OET SAR measurement requirements 100 MHz to 6 GHz
KDB 865664D02	v01r01	RF Exposure Compliance Reporting and Documentation Considerations
KDB 447498D01	v05r02	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
KDB 648474D04	v01r02	SAR Evaluation Considerations for Wireless Handsets
KDB 248227D01	v01	SAR Measurement Procedures for 802.11 a/b/g Transmitters
KDB 941225D01	v02	SAR Measurements Procedures for 3G Devices
KDB 941225D02	v02r02	3GPP R6 HSPA and R7 HSPA+ SAR Guidance
KDB 941225D03	v01	SAR Test Reduction Procedure for GSM/GPRS/EDGE
KDB 941225D04	v01	Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode
KDB 941225D05	v02r03	SAR Evaluation Considerations for LTE Devices
KDB 941225D06	v01r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

1.3.6 RF Exposure Limits

Human Exposure	Uncontrolled Environment General Population (W/Kg)	Controlled Environment Occupational (W/Kg)
Spatial Peak SAR (Head and Body)	**1.6**	8.00
Spatial Average SAR (Whole Body)	0.08	0.40
Spatial Peak SAR (Hands/Feet/Ankle/Wrist)	4.00	20.00

Note that the limit applied in this test report is shown in bold letters

1.3.7 Test Basic Information

Testing Engineers	Yao, JuMing / Zhou, ZhiLi
Testing Start Date	2014-05-28
Testing End Date	2014-07-03
Ambient Temperature	18~25 ℃
Relative Humidity	30~70%

2 SPECIFIC ABSORPTION RATE (SAR)

2.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

2.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = c\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δ T is the temperature rise and δ t is the exposure duration, or related to the electrical field in the tissue by

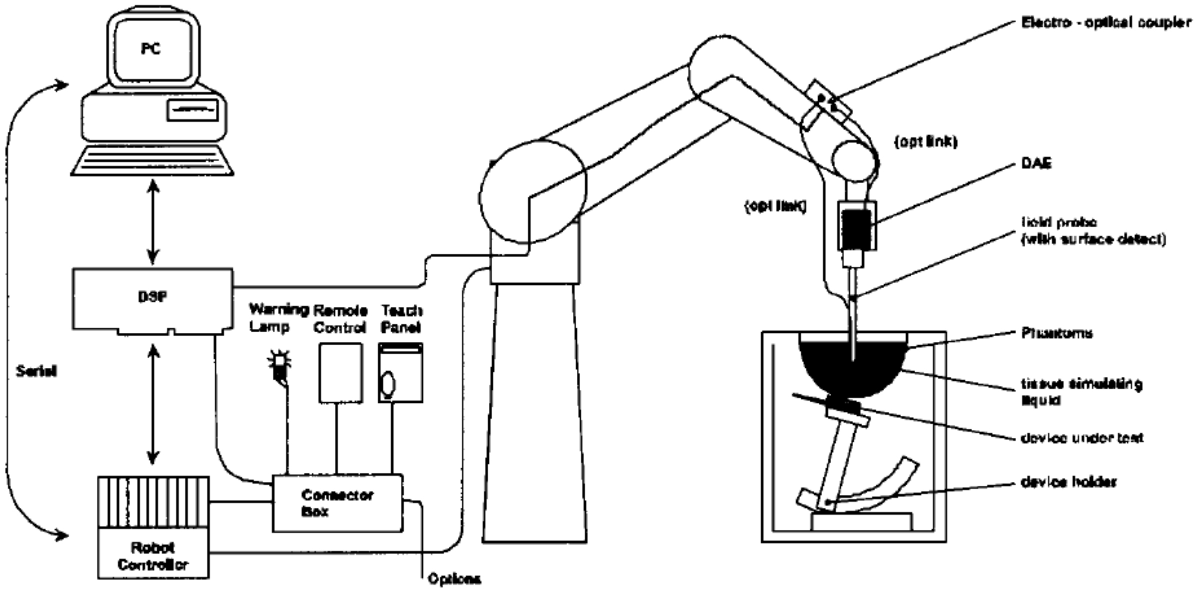
$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where: δ is the conductivity of the tissue, ρ is the mass density of tissue and E is the RMS electrical field strength.
However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

3 TEST SET UP AND PROCESS

3.1 SAR System set-up

3.1.1 System Description



• The DASY 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 DASY measurement server.

• The DASY measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows XP or Windows 7.

• DASY 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.

3.1.2 Probe Description

EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to > 6 GHz Linearity: ±0.2 dB (30 MHz to 6 GHz)	
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 μW/g to > 100 mW/g Linearity: ±0.2 dB (noise: typically < 1 μW/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: 1 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

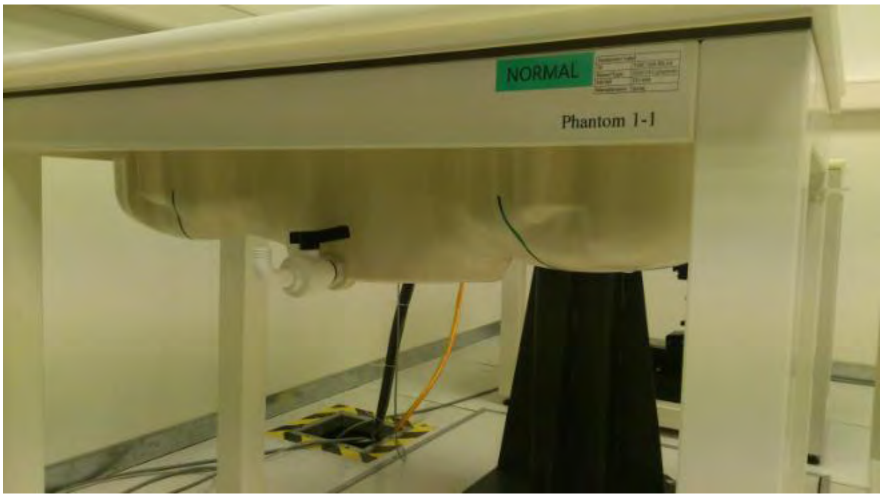
ES3DV3 E-Field Probe

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 4 GHz; Linearity: ±0.2 dB (30 MHz to 4 GHz)	
Directivity	±0.2 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (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	

3.1.3 Phantom Description

The used SAM and ELI Phantom meet the requirements specified in IEEE 1528 and EN 62209-1 for Specific Absorption Rate (SAR) measurements.

SAM phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.



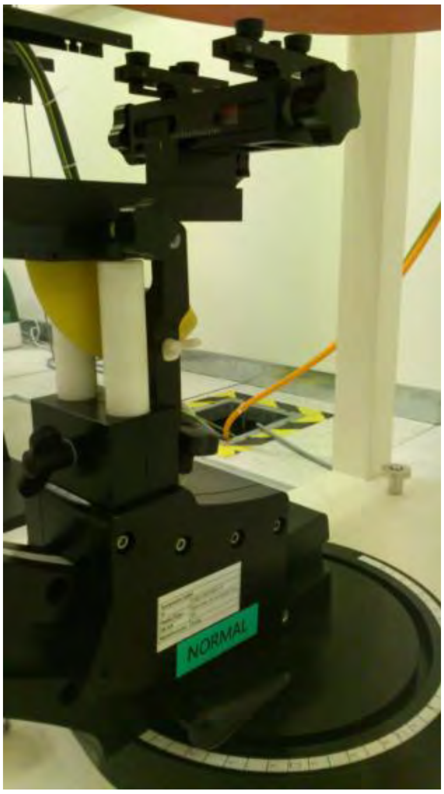
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2 ±0.2 mm (6 ±0.2 mm at ear point)
Dimensions (incl. Wooden Support)	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters
Wooden Support	SPEAG standard phantom table

ELI phantom is fully compatible with the EN 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ±0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters
Wooden Support	SPEAG standard phantom table

3.1.4 Device Holder Description

The DASY 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.



3.1.5 Scanning Procedure

• The DASY 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 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 DASY 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. 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 C.

• 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 7x7 grid where the robot additionally moves the probe in 7 steps along the z-axis away from the bottom of the Phantom. Grid spacing for the cube measurement is 5 mm / 4 mm in x and y-direction and 5 mm / 2 mm in z-direction. 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 annex 2. Test results relevant for the specified standard.

3.1.6 Spatial Peak SAR Evaluation

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

• The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2 or 3 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 neighbouring volumes are evaluated until no neighbouring 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

DASY uses the advanced extrapolation option which is able to compensate boundary effect on E-field probes.

3.2 Electrical Parameters of the Tissue Simulating Liquid

Prior to conducting SAR measurements, the relative permittivity, ε_r, and the conductivity, σ, of the tissue simulating liquids were measured with a HP85070 Dielectric Probe Kit.

These values, along with the temperature of the simulated tissue are shown in the table below. The recommended limits for permittivity and conductivity are also shown. A mass density of ρ= 1 $^{g}/_{cm^3}$ was entered into the system in all the cases. It can be seen that the measured parameters are within tolerance of the recommended limits specified in IEEE 1528.

Freq. (MHz)	Target head tissue		Measurement head tissue				Measurement date
	Permittivity	Conductivity (S/m)	Permittivity	Dev. %	Conductivity (S/m)	Dev. %	
835	**41.5**	**0.90**	**42.53**	**2.5**	**0.87**	**-3.4**	**2014-06-03**
835	**41.5**	**0.90**	**42**	**1.2**	**0.87**	**-3.3**	**2014-07-03**
1900	**40**	**1.4**	**39**	**-2.5**	**1.4**	**0.0**	**2014-06-04**
1900	**40**	**1.4**	**38.6**	**-3.5**	**1.34**	**-4.1**	**2014-06-12**
1900	**40**	**1.4**	**38.63**	**-3.4**	**1.36**	**-2.9**	**2014-07-03**
2450	**39.2**	**1.8**	**38.24**	**-2.4**	**1.89**	**5**	**2014-05-28**

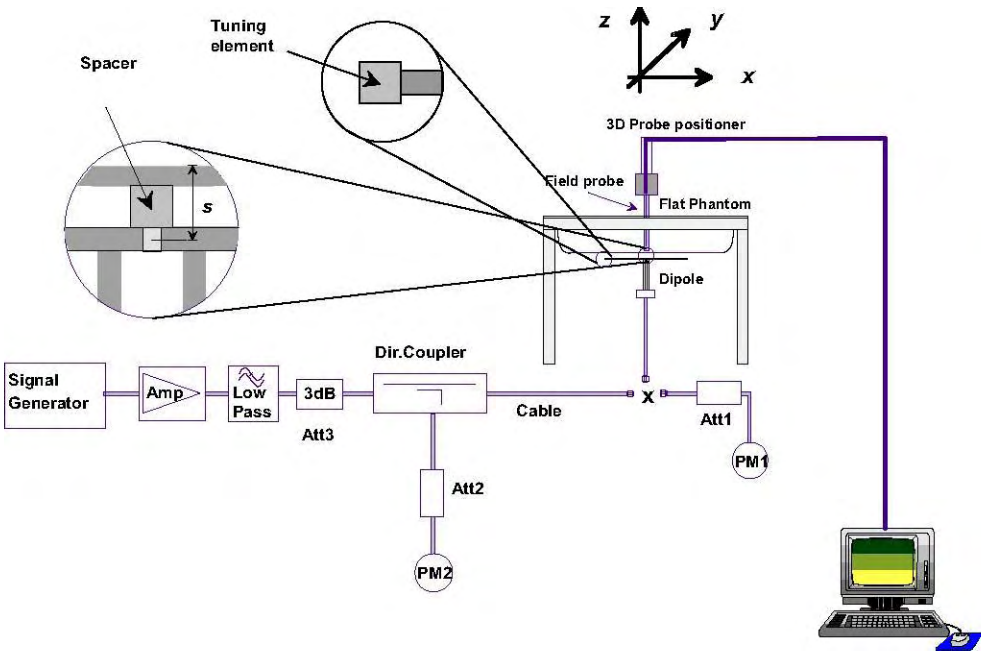
Freq. (MHz)	Target body tissue		Measurement body tissue				Measurement date
	Permittivity	Conductivity (S/m)	Permittivity	Dev. %	Conductivity (S/m)	Dev. %	
835	**55.2**	**0.97**	**52.62**	**-4.7**	**0.98**	**0.6**	**2014-06-04**
1900	**53.3**	**1.52**	**50.8**	**-4.7**	**1.53**	**0.7**	**2014-06-04**
1900	**53.3**	**1.52**	**51.23**	**-3.9**	**1.5**	**-1.3**	**2014-06-06**
2450	**52.7**	**1.95**	**50.1**	**-4.9**	**2**	**2.6**	**2014-06-06**
2450	**52.7**	**1.95**	**50.6**	**-4.0**	**2**	**2.6**	**2014-06-09**

All of the stimulating liquid used in this test report are supplied and manufactured by SPEAG.
The list of ingredients and the percent composition are indicated in the table below.

Ingredients (% of weight)	**Frequency (MHz)**											
	835		**900**		**1800**		**1900**		**2450**		**5000**	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	41.45	52.4	40.92	56.0	52.64	69.91	54.9	69.91	62.7	73.2	64-78	64-78
Salt (NaCl)	1.45	1.4	1.48	0.76	0.36	0.13	0.18	0.13	0.5	0.04	2-3	2-3
Sugar	56.0	45.0	56.5	41.76	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEC	1.0	1.0	1.0	1.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.1	0.27	0.0	0.0	0.0	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	0.0	36.8	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	0.0	47.0	29.96	44.92	29.96	0.0	26.7	0.0	0.0
Emulsifiers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9-15	9-15
Mineral Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11-18	11-18

3.3 System Accuracy Verifications

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed by using a validation 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. A forward power of 250mW (or 100mW for a 5 GHz system validation) was applied to the dipoles. 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 validation to make sure that emitted power at the dipole is kept constant.



System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. The following tables show system check results for all frequency bands and tissue liquids used during the tests (see Appendix B).

The simulated tissue depth was verified to be 15.0 cm ±0.5 cm. (see Appendix A).

System Accuracy Verification Measurements for Head

Frequency (MHz)	Target value (W/Kg)		Measured value (W/Kg)		Dev.		Measurement date
	1g	10g	1g	10g	1g	10g	
900	10.5	6.7	9.56	6.16	-8.95%	-8.06%	6/3/2014
835	9.43	6.14	8.72	5.72	-7.53%	-6.84%	7/3/2014
1900	40.7	21.2	39	20.12	-4.18%	-5.09%	6/3/2014
1900	40.7	21.2	39.64	20.48	-2.60%	-3.40%	6/4/2014
1900	40.4	21.3	38.56	19.96	-4.55%	-6.29%	7/3/2014
2450	51.6	24.1	52.4	23.92	1.55%	-0.75%	5/28/2014

System Accuracy Verification Measurements for Body

Frequency (MHz)	Target value (W/Kg)		Measured value (W/Kg)		Dev.		Measurement date
	1g	10g	1g	10g	1g	10g	
835	9.3	6.11	9.48	6.24	1.94%	2.13%	6/4/2014
1900	40.4	21.3	39.08	20.52	-3.27%	-3.66%	6/4/2014
1900	40.4	21.3	37.88	19.8	-6.24%	-7.04%	6/6/2014
2450	51.1	23.8	50.8	23.84	-0.59%	0.17%	5/30/2014
2450	51.1	23.8	51.2	23.64	0.20%	-0.67%	6/9/2014

4 POWER MEASUREMENT

4.1 Power Reduction for SAR

This device does NOT utilize any power reduction scheme under mobile hotspot conditions for SAR compliance, therefore conducted power were measured only in “hotspot off mode” for all bands at the RF port.

4.2 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB 447498 D01.

4.2.1 Hotspot Mode Disabled

4.2.1.1 GSM

GSM Speech

		GSM	
		Target [dBm]	Tolerance +-[dB]
GSM850	low	33.0	-1.0~+0.7
	mid	33.0	-1.0~+0.7
	high	33.0	-1.0~+0.7
GSM1900	low	30.0	-1.0~+1.0
	mid	30.0	-1.0~+1.0
	high	30.0	-1.0~+1.0

GRRS tolerance

		GPRS							
		TX Slot 1		TX Slot 2		TX Slot 3		TX Slot 4	
		Target [dBm]	Tolerance +-[dB]	Target [dBm]	Tolerance +-[dB]	Target [dBm]	Tolerance +-[dB]	Target [dBm]	Tolerance +-[dB]
GSM850	low	33.0	-1.0~+0.7	30.0	-1.0~+1.0	28.5	-1.0~+1.0	27.0	-1.0~+1.0
	mid	33.0	-1.0~+0.7	30.0	-1.0~+1.0	28.5	-1.0~+1.0	27.0	-1.0~+1.0
	high	33.0	-1.0~+0.7	30.0	-1.0~+1.0	28.5	-1.0~+1.0	27.0	-1.0~+1.0
GSM1900	low	30.0	-1.0~+1.0	27.0	-1.0~+1.0	25.5	-1.0~+1.0	24.0	-1.0~+1.0
	mid	30.0	-1.0~+1.0	27.0	-1.0~+1.0	25.5	-1.0~+1.0	24.0	-1.0~+1.0
	high	30.0	-1.0~+1.0	27.0	-1.0~+1.0	25.5	-1.0~+1.0	24.0	-1.0~+1.0

EGPRS tolerance

		EGPRS 8PSK Modulation (MCS 5-9)							
		TX Slot 1		TX Slot 2		TX Slot 3		TX Slot 4	
		Target [dBm]	Tolerance +-[dB]	Target [dBm]	Tolerance +-[dB]	Target [dBm]	Tolerance +-[dB]	Target [dBm]	Tolerance +-[dB]
GSM850	low	27.0	-1.0~+1.0	24.0	-1.0~+1.0	22.5	-1.0~+1.0	21.0	-1.0~+1.0
	mid	27.0	-1.0~+1.0	24.0	-1.0~+1.0	22.5	-1.0~+1.0	21.0	-1.0~+1.0
	high	27.0	-1.0~+1.0	24.0	-1.0~+1.0	22.5	-1.0~+1.0	21.0	-1.0~+1.0
GSM1900	low	26.0	-1.0~+1.0	23.0	-1.0~+1.0	21.5	-1.0~+1.0	20.0	-1.0~+1.0
	mid	26.0	-1.0~+1.0	23.0	-1.0~+1.0	21.5	-1.0~+1.0	20.0	-1.0~+1.0
	high	26.0	-1.0~+1.0	23.0	-1.0~+1.0	21.5	-1.0~+1.0	20.0	-1.0~+1.0

4.2.1.2 WCDMA

WCDMA tolerance

		CS		HSDPA(CS)		HSDPA(1/2/3/4)		HSUPA(1/5)		HSUPA(2/3/4)	
		Target [dBm]	Tolerance +- [dB]	Target [dBm]	Tolerance +- [dB]	Target [dBm]	Tolerance +- [dB]	Target [dBm]	Tolerance +- [dB]	Target [dBm]	Tolerance +- [dB]
WCDMA 1900	low	22.8	-0.7~+0.7	22.8	-0.7~+0.7	21.8	-0.7~+0.7	22.8	-0.7~+0.7	21.8	-0.7~+0.7
	mid	22.8	-0.7~+0.7	22.8	-0.7~+0.7	21.8	-0.7~+0.7	22.8	-0.7~+0.7	21.8	-0.7~+0.7
	high	22.8	-0.7~+0.7	22.8	-0.7~+0.7	21.8	-0.7~+0.7	22.8	-0.7~+0.7	21.8	-0.7~+0.7
WCDMA 850	low	24	-1.0~+1.0	24	-1.0~+1.0	23	-1.0~+1.0	24	-1.0~+1.0	23	-1.0~+1.0
	mid	24	-1.0~+1.0	24	-1.0~+1.0	23	-1.0~+1.0	24	-1.0~+1.0	23	-1.0~+1.0
	high	24	-1.0~+1.0	24	-1.0~+1.0	23	-1.0~+1.0	24	-1.0~+1.0	23	-1.0~+1.0

4.2.1.3 WLAN and BT

WLAN tolerance

Band	Data Rates(Mbps)		target (dBm)	Tolerance(dBm)
2.4GHz	11b	1	15	-2dBm / +1dBm
		2	15	-2dBm / +1dBm
		5.5	15	-2dBm / +1dBm
		11	15	-2dBm / +1dBm
	11g	6	11	-2dBm / +1dBm
		9	11	-2dBm / +1dBm
		12	11	-2dBm / +1dBm
		18	11	-2dBm / +1dBm
		24	11	-2dBm / +1dBm
		36	11	-2dBm / +1dBm
		48	11	-2dBm / +1dBm
		54	11	-2dBm / +1dBm
	11n	MCS0~MCS4	10	-2dBm / +1dBm
		MCS5,MCS6	10	-2dBm / +1dBm
		MCS7	10	-2dBm / +1dBm

Bluetooth tolerance

BR	low	8	-1.5dBm / +1.5dBm
	mid	8	-1.5dBm / +1.5dBm
	high	8	-1.5dBm / +1.5dBm
EDR	low	6.5	-1.5dBm / +1.5dBm
	mid	6.5	-1.5dBm / +1.5dBm
	high	6.5	-1.5dBm / +1.5dBm

*BLE Max Tx power is lower than EDR's max power.

4.3 Conducted Power Results

4.3.1 Hotspot Mode Disabled

4.3.1.1 GSM

Technical Description

The phone under test contains a GSM transmitter that supports voice (circuit-switched) capability, and data (packet switched) capabilities over GPRS/EDGE (GMSK) or EDGE (8PSK).

Exposure Conditions and Test Exclusions

Mode	Type	Head Adjacent	Body Worn Accessory	WiFi Hotspot
GSM (GMSK 1 slot)	Voice	Tested	Tested	N/A
GPRS/EDGE (GMSK Multi-slots)	Data	Tested	Tested	Tested
EDGE (8PSK Multi-slots)	Data	Excluded	Excluded	Excluded

GSM850	Conducted Power (dBm)		
	Channel 251(848.8MHz)	Channel 190(836.6MHz)	Channel 128(824.2MHz)
	32.97	32.92	32.91
GSM1900	Conducted Power (dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	29.71	29.74	29.84

GPRS POWER LEVELS

GSM850 GPRS (GMSK)	Measured Power(dBm)			Calculation	Averaged Power(dBm)		
	251	190	128		251	190	128
1TX Slot	33.02	32.98	32.96	-9.03dBm	**23.99**	**23.95**	**23.93**
2TX Slots	29.31	29.42	29.34	-6.02dBm	23.29	23.4	23.32
3TX Slots	27.51	27.82	27.64	-4.26dBm	23.25	23.56	23.38
4TX Slots	26.49	26.65	26.58	-3.01dBm	23.48	23.64	23.57
GSM1900 GPRS (GMSK)	Measured Power(dBm)			Calculation	Averaged Power(dBm)		
	810	661	512		810	661	512
1TX Slot	29.83	29.85	29.96	-9.03dBm	**20.8**	**20.82**	**20.93**
2TX Slots	26.66	26.74	26.71	-6.02dBm	20.64	20.72	20.69
3TX Slots	25.05	25.11	25.14	-4.26dBm	20.79	20.85	20.88
4TX Slots	23.58	23.7	23.48	-3.01dBm	20.57	20.69	20.47

GSM DTM POWER LEVELS

GSM850 (CS GMSK+PS)	Measured Power(dBm)			Calculation	Averaged Power(dBm)		
	251	190	128		251	190	128
1TX + GMSK 1TX Slot	29.52	29.52	29.4	-6.02dBm	23.5	23.5	23.38
1TX + GMSK 2TX Slots	27.83	27.81	27.67	-4.26dBm	**23.57**	**23.55**	**23.41**
1TX + 8PSK 1TX Slot	23.67	23.82	23.75	-6.02dBm	17.65	17.8	17.73
1TX + 8PSK 2TX Slots	23.7	23.86	23.76	-4.26dBm	19.44	19.6	19.5
GSM1900 (CS GMSK+PS GMSK)	Measured Power(dBm)			Calculation	Averaged Power(dBm)		
	810	661	512		810	661	512
1TX + GMSK 1TX Slot	26.66	26.74	26.71	-6.02dBm	**20.64**	**20.72**	**20.69**
1TX + GMSK 2TX Slots	24.85	24.97	24.9	-4.26dBm	20.59	20.71	20.64
1TX + 8PSK 1TX Slot	22.87	23.01	22.88	-6.02dBm	16.85	16.99	16.86
1TX + 8PSK 2TX Slots	22.71	22.85	22.62	-4.26dBm	18.45	18.59	18.36

EGPRS POWER LEVELS

GSM850 EGPRS (8PSK)	Measured Power(dBm)			Calculation	Averaged Power(dBm)		
	251	190	128		251	190	128
1TX Slot	27.01	27.21	27.12	-9.03dBm	17.98	18.18	18.09
2TX Slots	23.81	23.99	23.92	-6.02dBm	17.79	17.97	17.9
3TX Slots	22.22	22.41	22.25	-4.26dBm	17.96	18.15	17.99
4TX Slots	20.61	20.74	20.67	-3.01dBm	17.6	17.73	17.66
GSM1900 EGPRS (8PSK)	Measured Power(dBm)			Calculation	Averaged Power(dBm)		
	810	661	512		810	661	512
1TX Slot	26.02	26.21	26.13	-9.03dBm	16.99	17.18	17.1
2TX Slots	22.87	23.01	22.88	-6.02dBm	16.85	16.99	16.86
3TX Slots	21.27	21.47	21.36	-4.26dBm	17.01	17.21	17.1
4TX Slots	20.31	20.45	20.27	-3.01dBm	17.3	17.44	17.26

Burst Average Power was measured using a power meter set to the appropriate profile to capture average power in the transmitting timeslot(s). Source-Based Time-Averaged Power, being related to the Burst Average Power by a fixed factor dependent on the number of time slots active in the frame, was calculated as follows (in dB), where x is the number of time slots active:

$$P_{Source} = P_{Burst} - 10 * \log\left(\frac{x}{8.3}\right)$$

So the scale factor for uplink time slots to calculate Source-Based Time-Averaged Power:
1 Tx slot = 9.03 dB
2 Tx slots = 6.02 dB
3 Tx slots = 4.26 dB
4 Tx slots = 3.01 dB

Justification of SAR measurements in GSM mode
SAR measurements were performed in GPRS mode with 1 active timeslots because highest time based averaged output power was calculated for that configuration. For comparison an additional delta measurement was performed with 1 timeslot in speech mode. In EDGE mode no delta measurement was performed.

4.3.1.2 WCDMA

Technical Description
The phone under test contains a WCDMA transmitter designed per 3GPP TS 25.101, that supports both voice and data capabilities.

Exposure Conditions and Test Exclusions

Mode	Type	Head Adjacent	Body Worn Accessory	WiFi Hotspot
RMC	Voice/Data	Tested	Tested	Tested
AMR	Voice/Data	Excluded	Excluded	Excluded
HSDPA (Rel 5) Modes	Data	Excluded	Excluded	Excluded
HSPA (Rel 6) Modes	Data	Excluded	Excluded	Excluded
DC-HSDPA (Rel 8) Modes	Data	Excluded	Excluded	Excluded

Notes:
AMR, HSDPA, HSPA, DC-HSDPA were excluded from testing per FCC KDB 941225 D01, as the measured output power in these modes is not more than ¼ dB higher than that measured in RMC.

Device Test Setup
For WCDMA modes, the test sample was operated using transmission to a base station simulator. The base station simulator was set up for the proper channel and transmit mode of operation on the phone’s uplink. The transmitter power level and transmit power control were set to “All 1’s” for RMC and AMR modes in WCDMA or HSDPA, or inner loop power control procedures were applied to maintain maximum output power while HSUPA was active.

a). HSDPA
HSDPA adds the HS-DPCCH in uplink as a control channel for high speed data transfer in downlink.
In HSDPA mode 4 sub-tests are defined by 3GPP 34.121 according to the following table:

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

Note 1: Δ_{ACK}, Δ_{NACK}, Δ_{CQI} = 8 $\Longleftrightarrow$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\Longleftrightarrow$ $\beta_{hs} = 30/15 * \beta_c$
Note 2 : CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$
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

The βc and βd gain factors for DPCCH and DPDCH were set according to the values in the above table, βhs for HS-DPCCH is set automatically to the correct value when ΔACK, ΔNACK, ΔCQI = 8. The variation of the βc /βd ratio causes a power reduction at sub-tests 2 - 4.

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

Settings of required H-Set 1 QPSK acc. to 3GPP 34.121

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

b). HSUPA

In HSUPA mode additional code channels (E-DPCCH, E-DPDCHn) are added for data transfer in uplink at higher bit rates.

5 sub-tests are defined by 3GPP 34.121 according to the following table :

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

Note 1: Δ_{ACK}, Δ_{NACK}, Δ_{CQI} = 8 $\Longleftrightarrow$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\Longleftrightarrow$ $\beta_{hs} = 30/15 * \beta_c$
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 β_c = 10/15 and β_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 β_c = 14/15 and β_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

To achieve the settings above some additional procedures were defined by 3GPP 34.121. Those have been included in an application note for the CMU200 and were exactly followed :

- Test mode connection (BS signal tab) :
RMC 12.2 kbit/s + HSPA 34.108 with loop mode 1
- HS-DSCH settings (BS signal tab):
- FRC with H-set 1 QPSK
- ACK-NACK repetition factor = 3
- CQI feedback cycle = 4ms
- CQI repetition factor = 2
- HSUPA-specific signalling settings (UE signal tab) :
- E-TFCI table index = 0
- E-DCH minimum set E-TFCI = 9
- Puncturing limit non-max = 0.84
- max. number of channelisation codes = 2x SF4
- Initial Serving Grant Value = Off
- HSDPA and HSUPA Gain factors (UE signal tab)

Sub-test	β_c	β_d	Δ_{ACK}, Δ_{NACK}, Δ_{CQI}	ΔE–**DPCCH)***
1	10	15	8	6
2	6	15	8	8
3	15	9	8	8
4	2	15	8	5
5	14	15	8	7

)* : β_{ec} and β_{ed} ratios (relative to β_c and β_d) are set by ΔE–DPCCH

- HSUPA Reference E-TFCIs (UE signal tab > HSUPA gain factors) :

Sub-test	**1, 2, 4, 5**				
Number of E-TFCIs	5				
Reference E-TFCI	11	67	71	75	81
Reference E-TFCI power offset	4	18	23	26	27

Sub-test	**3**	
Number of E-TFCIs	2	
Reference E-TFCI	11	92
Reference E-TFCI power offset	4	18

- HSUPA-specific generator parameters (BS Signal tab > HSUPA > E-AGCH > AG Pattern)

Sub-test	***Absolute Grant Value (AG Index)***
1	20
2	12
3	15
4	17
5	21

- Power Level settings (BS Signal tab > Node B-settings):
- Level reference : Output Channel Power (lor)
- Output Channel Power (lor) : -86 dBm
- Downlink Physical Channel Settings (BS signal tab)

- P-CPICH : -10 dB
- S-CPICH : Off
- P-SCH : -15 dB
- S-SCH : -15 dB
- P-CCPCH : -12 dB
- S-CCPCH : -12 dB
- PICH : -15 dB
- AICH : -12 dB
- DPDCH : -10 dB
- HS-SCCH : -8 dB
- HS-PDSCH : -3 dB
- E-AGCH : -20 dB
- E-RGCH/E-HICH - 20 dB
- E-RGCH Active : Off

The settings above were stored once for each sub-test and recalled before the measurement.
HSUPA test procedure :
To reach maximum output power in HSUPA mode the following procedures were followed:
3 different TPC patterns were defined :
Set 1 : Closed loop with target power 10 dBm
Set 2 : Single Pattern+Alternating with binary pattern '11111' for 1 dB steps 'up'
Set 3 : Single Pattern+Alternating with binary pattern '00000' for 1 dB steps 'down'

After recalling a certain HSUPA sub-test the HSUPA E-AGCH graph with E-TFCI event counter is displayed. After starting with the closed loop command the power is increased in 1 dB steps by activating pattern set 2 until the UE decreases the transmitted E-TFCI.
At this point set 3 is activated once to reduce the output power to the value at which the original E-TFCI, which is required for the sub-test, appears again.
For conducted power measurements the same steps are repeated in the power menu to read out the corresponding maximum RMS output power with the target E-TFCI.
For SAR measurements it is useful to switch to Code Domain Power vs. Time display.
Here the CMU200 shows relative power values (max. and min.) of each code channel which should roughly correspond to the numerators of the gain factors e.g. :

Sub-test	β_c	β_d	β_{hs}	β_{ec}	β_{ed}
5	15	15	30	24	134

By this way a surveillance of signaling conditions is possible to make sure that HSUPA code channels are active during the complete SAR measurement.

c) DC-HSDPA (3GPP Release 8)
Dual Cell – HSDPA has been signalized using the following settings for connection setup:

Parameter During Connection Setup	Value
P-CPICH_Ec/Ior	-10 dB
P-CCPCH	-12
SCH_Ec/Ior	-12
PICH_Ec/Ior	-15
HS-PDSCH	off
HS-SCCH_1	off
DPCH_Ec/Ior	-5
OCNS_Ec/Ior	-3.1

Downlink Physical Channels according to 3GPP 34.121 Table E.5.0

The fixed reference channel has been set to H-set 12 according to 3GPP TS 34.121 Table C.8.1.12:

Parameter	Unit	Value
Nominal Average Inf. Bit Rate	kbit/s	60
Inter-TTI Distance	TTI's	1
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Process	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codecs	Codecs	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

H-Set 12 QPSK configuration

Power measurements were executed per FCC KDB 941225 D01:

Sets\Modes		WCDMA	HSDPA				HSUPA					DC-HSDPA			
Band	Channel	RMC	1	2	3	4	1	2	3	4	5	1	2	3	4
WCDMA 1900	9262	22.91	22.21	21.67	21.66	21.69	22.2	21.34	21.1	21.56	22.45	21.31	21.73	21.66	21.65
	9400	22.92	22.01	21.48	21.41	21.38	22.31	21.44	21.01	21.61	22.29	21.47	21.52	21.48	21.54
	9538	22.99	22.3	21.37	21.34	21.36	22.39	21.31	20.89	21.63	22.36	21.21	21.47	21.37	21.41
WCDMA 850	4132	24.37	23.25	22.96	22.89	23.02	23.42	22.57	22.1	22.49	23.23	22.94	23.07	23	22.99
	4183	24.36	23.31	22.93	22.81	22.98	23.47	22.51	22.03	22.5	23.43	22.75	22.96	22.85	22.86
	4233	24.36	23.37	22.94	22.91	22.91	23.41	22.59	22.08	22.55	23.47	22.83	22.94	22.88	22.84

4.3.1.3 WLAN

Technical Description
The phone under test contains a Wi-Fi 802.11b/g/n transmitter capable of data transmission in the 2.45 GHz ISM band.

Exposure Conditions and Test Exclusions

Mode	Type	Head Adjacent	Body Worn Accessory	WiFi Hotspot
802.11b/g/n	Data	Tested	Tested	Tested

Notes:
(1) Per FCC KDB 248227 D01 and the April 2010 FCC/TCB Meeting Notes, the highest average output power channel for the lowest data rate for 802.11b or 802.11a was selected for SAR evaluation. Other 802.11 modes (including 802.11g, 802.11n) were not investigated when the average output powers over all channels and data rates were not more than ¼ dB higher than the tested channel in the lowest data rate of the 802.11b or 802.11a mode. The bolded data rates and channels in the following conducted power tables were used for SAR testing. For cases where alternate channels, higher data rates, or 802.11 modes resulted in output power more than ¼ dB higher than the tested configuration, additional SAR tests were conducted.

Device Test Setup
Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

In order to testing the conducted power of WLAN, the DUT is controlled to transmit WLAN TX as maximum power by the terminal software installed on the PC. The procedure how to control is presented as blew:
1. Connect DUT and PC via the USB cable and check the port is opened.
2. Input the command "WLPU" to power on WLAN.
3. Input the command "WTFD" to firmware download.
4. Input the WBTX command to start transmit (i.e., WBTX=1,0,1,1500,25,0,12).
5. Input the command "WIDL" to stop transmit.
6. Input the command "WLPD" to power off WLAN.

The average conducted power for Wi-Fi is as following:

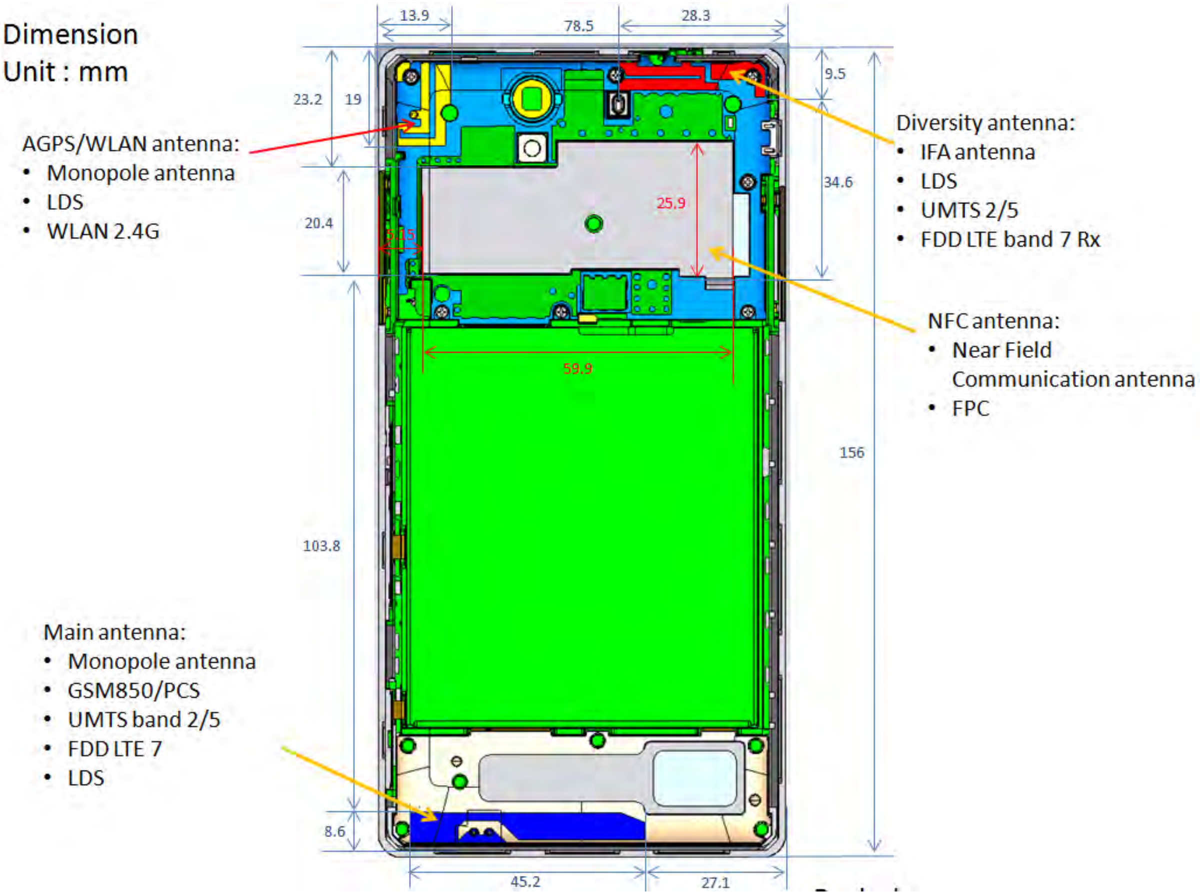
802.11b(dBm)								
Channel\data rate	1Mbps	2Mbps	5.5Mbps	11Mbps				
1(2412MHz)	14.76	14.57	15.42	15.03				
6(2437MHz)	14.20	14.01	14.86	14.57				
11(2462MHz)	14.32	14.08	14.92	14.62				
802.11g(dBm)								
Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
1(2412MHz)	10.49	11.13	10.90	10.48	11.09	10.48	10.96	10.74
6(2437MHz)	10.02	10.64	10.40	9.99	10.63	10.03	10.51	10.32
11(2462MHz)	10.05	10.78	10.55	10.17	10.83	10.23	10.68	10.52
802.11n(dBm)-20MHz								
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
1(2412MHz)	9.42	9.89	9.46	10.09	9.51	10.06	9.87	9.66
6(2437MHz)	9.03	9.58	9.15	9.82	9.26	9.70	9.52	9.26
11(2462MHz)	9.07	9.60	9.13	9.88	9.30	9.73	9.53	9.30

5 SAR MEASUREMENTS

5.1 Mobile Hotspot SAR Measurement Positions

Mobile hotspot SAR measurement positions						
Mode	**Front**	**Rear**	**Left edge**	**Right edge**	**Top edge**	**Bottom edge**
GSM 850	Yes	Yes	No	Yes	No	Yes
GSM 1900	Yes	Yes	No	Yes	No	Yes
WCDMA 850	Yes	Yes	No	Yes	No	Yes
WCDMA 1900	Yes	Yes	No	Yes	No	Yes
Wlan 2450	Yes	Yes	No	Yes	Yes	No

The edges with less than 2.5 cm distance to the TX antennas need to be tested for hotspot SAR.



Antenna positioning diagram with separation distance

5.2 Results Overview

The device was put into operation by using a base station simulator. Communication between the device and the call tester was established by air link. The device output power was set to maximum power level for all tests. A fully charged battery was used for every test sequence.

5.2.1 Head Adjacent Test Results

Test results head SAR GSM 850 MHz

Place-ment	Position	Channel Number	Test setup	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Cheek	Right	190	Speech	8,3 (1TX)	22.5	32.92	33.70	0.094	0.112
Tilt	Right	190	Speech	8,3 (1TX)	22.5	32.92	33.70	0.042	0.051
Cheek	Left	190	Speech	8,3 (1TX)	22.5	32.92	33.70	0.109	0.130
Tilt	Left	190	Speech	8,3 (1TX)	22.5	32.92	33.70	0.039	0.047
Cheek	Left	128	Speech	8,3 (1TX)	22.5	32.91	33.70	0.064	0.077
Cheek	Left	251	Speech	8,3 (1TX)	22.5	32.97	33.70	0.163	0.193

Cheek	Right	190	Data_GPRS	4 (2TX)	22.5	27.81	29.50	0.079	0.055	0.116	0.081
Tilt	Right	190	Data_GPRS	4 (2TX)	22.5	27.81	29.50	0.039	0.028	0.057	0.041
Cheek	Left	190	Data_GPRS	4 (2TX)	22.5	27.81	29.50	0.087	0.060	0.129	0.088
Tilt	Left	190	Data_GPRS	4 (2TX)	22.5	27.81	29.50	0.032	0.022	0.047	0.033

Per KDB 941225 D04, SAR for DTM may be evaluated either with the device operating in DTM using one CS plus the maximum PS timeslots or by summing the single timeslot CS and multislot PS SAR. So the lab made the calculation on the worst case of both CS and PS timeslots, the worst DTM SAR for GSM850 can be found below

Cheek	Left	190	Data_GPRS	4 (2TX)	0.088	Sum reported SAR **0.281**
Cheek	Left	251	Speech	8,3 (1TX)	**0.193**	

Test results head SAR GSM 1900 MHz

Place-ment	Position	Channel Number	Test setup	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Cheek	Left	661	Speech	8,3 (1TX)	22.5	29.74	31.00	0.069	0.092
Tilt	Left	661	Speech	8,3 (1TX)	22.5	29.74	31.00	0.051	0.068
Cheek	Right	661	Speech	8,3 (1TX)	22.5	29.74	31.00	0.131	**0.175**
Tilt	Right	661	Speech	8,3 (1TX)	22.5	29.74	31.00	0.061	0.081

Cheek	Left	661	Data_GPRS	8,3 (1TX)	22.5	29.85	31.00	0.048	0.028	0.062	0.037
Tilt	Left	661	Data_GPRS	8,3 (1TX)	22.5	29.85	31.00	0.043	0.024	0.056	0.031
Cheek	Right	661	Data_GPRS	8,3 (1TX)	22.5	29.85	31.00	0.119	0.069	0.155	0.090
Tilt	Right	661	Data_GPRS	8,3 (1TX)	22.5	29.85	31.00	0.048	0.026	0.063	0.034

Per KDB 941225 D04, SAR for DTM may be evaluated either with the device operating in DTM using one CS plus the maximum PS timeslots or by summing the single timeslot CS and multislot PS SAR. So the lab made the calculation on the worst case of both CS and PS timeslots, the worst DTM SAR for GSM1900 can be found below

Cheek	Right	661	Data_GPRS	4 (2TX)	0.175	Sum reported SAR **0.265**
Cheek	Right	661	Speech	8,3 (1TX)	0.090	

Test results head SAR WCDMA 1900

Place-ment	Position	Channel Number	Test setup	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Cheek	Left	9400	Data_RMC	1	22.2	22.62	23.50	0.137	0.168
Tilt	Left	9400	Data_RMC	1	22.2	22.62	23.50	0.095	0.117
Cheek	Right	9400	Data_RMC	1	22.2	22.62	23.50	0.268	**0.328**
Tilt	Right	9400	Data_RMC	1	22.2	22.62	23.50	0.114	0.140

Test results head SAR WCDMA 850

Place-ment	Position	Channel Number	Test setup	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Cheek	Right	4183	Data_RMC	1	22.5	24.36	25.00	0.157	0.182
Tilt	Right	4183	Data_RMC	1	22.5	24.36	25.00	0.077	0.089
Cheek	Left	4183	Data_RMC	1	22.5	24.36	25.00	0.177	0.205
Tilt	Left	4183	Data_RMC	1	22.5	24.36	25.00	0.070	0.081
Cheek	Left	4132	Data_RMC	1	22.5	24.37	25.00	0.161	0.186
Cheek	Left	4233	Data_RMC	1	22.5	24.36	25.00	0.229	**0.265**

Test results head SAR Wi-Fi 802.11b

Place-ment	Position	Channel Number	Test setup	Link Config	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Cheek	Right	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.211	0.319
Tilt	Right	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.216	0.327
Cheek	Left	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.539	0.816
Tilt	Left	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.376	0.569
Cheek	Left	1	IEEE802.11b	1 Mbps	1	22.5	14.76	16.00	0.682	**0.907**
Cheek	Left	11	IEEE802.11b	1 Mbps	1	22.5	14.32	16.00	0.563	0.829

5.2.2 Body Worn Test Results

There are no body-worn accessories available for this phone at the time of testing thus the device was tested per the Supplement C testing guidelines for devices that do not have body-worn accessories.

A separation distance of 15 mm between the device and the flat phantom was used for testing body-worn SAR. The device was tested with the front and back of the device facing the phantom. Both sides of the device were tested for Body SAR for the purpose of including the SAR evaluation for body-worn accessories that support the device with the front side facing the user.

A separation distance of 10mm between the device and the flat phantom was used for testing Wi-Fi hotspot mode SAR. Detailed test configurations can be found in Section 5.1 in this test report.

Test results body SAR GSM 850 MHz

Place-ment	Position	Separ-ation	Channel Number	Test setup	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Body	Back	15mm	190	Speech	8,3 (1TX)	22.3	32.92	33.70	0.128	0.153
Body	Front	15mm	190	Speech	8,3 (1TX)	22.3	32.92	33.70	0.102	0.122
Body	Back	10mm	190	Data_GPRS	8,3 (1TX)	22.3	32.98	33.70	0.225	0.266
Body	Front	10mm	190	Data_GPRS	8,3 (1TX)	22.3	32.98	33.70	0.149	0.176
Body	Left edge	10mm	190	Data_GPRS	8,3 (1TX)	22.3	32.98	33.70	0.113	0.133
Body	Right edge	10mm	190	Data_GPRS	8,3 (1TX)	22.3	32.98	33.70	0.055	0.064
Body	Bottom edge	10mm	190	Data_GPRS	8,3 (1TX)	22.3	32.98	33.70	0.067	0.080
Body	Back	10mm	128	Data_GPRS	8,3 (1TX)	22.3	32.96	33.70	0.122	0.145
Body	Back	10mm	251	Data_GPRS	8,3 (1TX)	22.3	33.02	33.70	0.236	**0.276**

Test results body SAR GSM 1900 MHz

Place-ment	Position	Separ-ation	Channel Number	Test setup	Link Config	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Body	Front	15mm	661	Data_GPRS	1TX	8,3 (1TX)	22.4	29.85	31.00	0.125	0.163
Body	Back	15mm	661	Data_GPRS	1TX	8,3 (1TX)	22.4	29.85	31.00	0.132	0.172
Body	Back	15mm	512	Data_GPRS	1TX	8,3 (1TX)	22.4	29.96	31.00	0.129	0.164
Body	Back	15mm	810	Data_GPRS	1TX	8,3 (1TX)	22.4	29.83	31.00	0.111	0.145
Body	Front	10mm	661	Data_GPRS	1TX	8,3 (1TX)	22.4	29.85	31.00	0.335	0.437
Body	Back	10mm	661	Data_GPRS	1TX	8,3 (1TX)	22.4	29.85	31.00	0.246	0.321
Body	Left edge	10mm	661	Data_GPRS	1TX	8,3 (1TX)	22.4	29.85	31.00	0.035	0.046
Body	Right edge	10mm	661	Data_GPRS	1TX	8,3 (1TX)	22.4	29.85	31.00	0.081	0.106
Body	Bottom edge	10mm	661	Data_GPRS	1TX	8,3 (1TX)	22.4	29.85	31.00	0.275	0.358
Body	Front	10mm	512	Data_GPRS	1TX	8,3 (1TX)	22.4	29.96	31.00	0.344	**0.437**
Body	Front	10mm	810	Data_GPRS	1TX	8,3 (1TX)	22.4	29.83	31.00	0.251	0.329

Test results body SAR WCDMA 850 MHz

Place-ment	Position	Separ-ation	Channel Number	Test setup	Link Config	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Body	Back	10mm	4183	Data_RMC	RMC 12.2Kps	1	22.3	24.36	25.00	0.261	0.302
Body	Front	10mm	4183	Data_RMC	RMC 12.2Kps	1	22.3	24.36	25.00	0.176	0.204
Body	Left edge	10mm	4183	Data_RMC	RMC 12.2Kps	1	22.3	24.36	25.00	0.134	0.155
Body	Right edge	10mm	4183	Data_RMC	RMC 12.2Kps	1	22.3	24.36	25.00	0.074	0.086
Body	Bottom edge	10mm	4183	Data_RMC	RMC 12.2Kps	1	22.3	24.36	25.00	0.078	0.090
Body	Back	10mm	4132	Data_RMC	RMC 12.2Kps	1	22.3	24.37	25.00	0.220	0.254
Body	Back	10mm	4233	Data_RMC	RMC 12.2Kps	1	22.3	24.36	25.00	0.294	**0.341**

Test results body SAR WCDMA 1900 MHz

Place-ment	Position	Separ-ation	Channel Number	Test setup	Link Config	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Body	Front	15mm	9400	Data_RMC	RMC 12.2Kps	1	22.4	22.62	23.50	0.276	0.338
Body	Back	15mm	9400	Data_RMC	RMC 12.2Kps	1	22.4	22.62	23.50	0.216	0.265
Body	Front	15mm	9262	Data_RMC	RMC 12.2Kps	1	22.4	22.91	23.50	0.289	0.331
Body	Front	15mm	9538	Data_RMC	RMC 12.2Kps	1	22.4	22.99	23.50	0.286	0.322
Body	Front	10mm	9400	Data_RMC	RMC 12.2Kps	1	22.4	22.62	23.50	0.685	**0.839**
Body	Back	10mm	9400	Data_RMC	RMC 12.2Kps	1	22.4	22.62	23.50	0.437	0.535
Body	Right edge	10mm	9400	Data_RMC	RMC 12.2Kps	1	22.4	22.62	23.50	0.184	0.225
Body	Bottom edge	10mm	9400	Data_RMC	RMC 12.2Kps	1	22.4	22.62	23.50	0.546	0.669
Body	Front	10mm	9262	Data_RMC	RMC 12.2Kps	1	22.4	22.91	23.50	0.716	0.820
Body	Front	10mm	9538	Data_RMC	RMC 12.2Kps	1	22.4	22.99	23.50	0.709	0.797

Test results Body SAR Wi-Fi 802.11b

Place-ment	Position	Separ-ation	Channel Number	Test setup	Link Config	Crest Factor	Liquid Temp (℃)	Meas. Avg. power [dBm]	Max. Output power [dBm]	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)
Body	Front	15mm	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.032	0.048
Body	Back	15mm	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.042	0.063
Body	Back	15mm	1	IEEE802.11b	1 Mbps	1	22.5	14.76	16.00	0.056	0.074
Body	Back	15mm	11	IEEE802.11b	1 Mbps	1	22.5	14.32	16.00	0.056	0.082
Body	Front	10mm	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.096	0.145
Body	Back	10mm	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.148	0.224
Body	Right edge	10mm	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.075	0.114
Body	Top edge	10mm	6	IEEE802.11b	1 Mbps	1	22.5	14.20	16.00	0.054	0.082
Body	Back	10mm	1	IEEE802.11b	1 Mbps	1	22.5	14.76	16.00	0.152	0.202
Body	Back	10mm	11	IEEE802.11b	1 Mbps	1	22.5	14.32	16.00	0.152	**0.224**

5.2.3 SAR measurement variability

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.

When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.
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.

Frequency band	Test configuration	Highest measurement result at worst case position (W/kg)	Second measurement result at worst case position (W/kg)	Ratio <1.2GSM
WCDMA 1900	Body Front, 10mm	0.839	0.792	1.06

5.2.4 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.
The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

The 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[√f(GHz)] ≤ 3.0 for 1-g SAR, where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

Frequency Band	Freq. (MHz)	Max. declared Pavg(dBm)	Max. declared Pavg(mW)	Test Exclusion
WiFi 2450	2450	16	39.8	No
Bluetooth	2450	9.5	8.9	Yes

SAR test exclusion evaluation for Head position (min test separation distance=5mm)

Frequency Band	Freq. (MHz)	Max. declared Pavg(dBm)	Max. declared Pavg(mW)	Test Exclusion
WiFi 2450	2450	16	39.8	No
Bluetooth	2450	9.5	8.9	Yes

SAR test exclusion evaluation for Body position (min test separation distance=10mm)

5.2.5 Multiple Transmitter Information

Evaluations of the head, body simultaneous SAR summations for the worst-case SAR transmitter configurations are presented in the tables below.

Exposure Configuration	Frequency Band	Highest Reported SAR (W/kg) 1g	Equipment Class	Highest Reported SAR (W/kg) 1g	SPLSR
Head (Separation Distance 0 mm)	**GSM 850**	0.281	PCE	1.188	N/A
	WLAN 2.4 GHz	0.907	DTS		N/A
Body-Worn (Separation Distance 15 mm)	**WCDMA 1900**	0.338	PCE	0.42	N/A
	WLAN 2.4 GHz	0.082	DTS		N/A
	WCDMA 1900	0.338	PCE	0.458	N/A
	Bluetooth*	0.12	DSS		N/A
Wi-Fi hotspot mode (Separation Distance 10mm)	**WCDMA 1900**	0.839	PCE	1.063	N/A
	WLAN 2.4 GHz	0.224	DTS		N/A

For the transmitters requiring stand-alone SAR testing, the KDB guidelines direct that if the sum of the 1 g SAR measured for the simultaneously transmitting antennas is less than the SAR limit, SAR measurement for simultaneous transmission is not required.

*Where the estimated SAR for Bluetooth can be get from below table

Estimated SAR					
Frequency band	**Freq. (GHz)**	**Distance (mm)**	**Max. declared Pavg(dBm)**	**Max. declared Pavg(mW)**	**Estimated 1g (W/kg)**
Bluetooth Body	2.45	15	9.5	8.9	0.12

Calculated SARmax for Bluetooth 2450MHz

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR.

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

5.2.6 Extremity SAR Evaluation

The overall diagonal dimension is > 16.0cm, so the phone is classified as a phablet. According to the KDB648474 D04, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

Per this requirement, the phone are exempted from extremity SAR testing as the hotspot mode 1-g reported SAR for all air interfaces are below 1.2 W/kg.

6 TEST EQUIPMENT UTILIZED

6.1 Dosimetric System

The Laboratory utilizes a Dosimetric Assessment System (DASY52™) manufactured by SPEAG, of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure.

The list of calibrated equipment used for the measurements is shown in the following table.

Instrument	Type	Manufacture	Serial Number	Cal Date	Cal Due Date
DAE	DAE4	SPEAG	853	2013-12-16	2014-12-15
DAE	DAE4	SPEAG	854	2013-12-16	2014-12-15
Probe	EX3DV4	SPEAG	3843	2014-02-21	2015-02-20
Probe	ES3DV3	SPEAG	3169	2013-12-19	2014-12-18
Dipole Validation Kit	D835V2	SPEAG	4d061	2014-02-21	2015-02-20
Dipole Validation Kit	D900V2	SPEAG	1d065	2014-02-21	2015-02-20
Dipole Validation Kit	D1800V2	SPEAG	2d158	2012-01-12	2015-01-11
Dipole Validation Kit	D1900V2	SPEAG	5d093	2014-02-19	2015-02-18
Dipole Validation Kit	D2450V2	SPEAG	806	2014-02-18	2015-02-17
Dipole Validation Kit	D2600V2	SPEAG	1012	2013-07-05	2014-07-04
SAM Phantom	V4.0	SPEAG	TP-1488	-	-
SAM Phantom	V4.0	SPEAG	TP-1489	-	-
ELI4 Phantom	ELI4	SPEAG	1041	-	-
SAM Phantom	V4.0	SPEAG	TP-1696	-	-
SAM Phantom	V4.0	SPEAG	TP-1697	-	-
ELI4 Phantom	ELI4	SPEAG	1164	-	-

6.2 Additional Equipment

Instrument	Type	Manufacture	Serial Number	Cal Date	Cal Due Date
Signal generator	SML03	R&S	103818	2014-05-21	2015-05-20
Directional coupler	HP778D	Agilent	20500	2014-05-21	2015-05-20
Power meter	NRVD	R&S	102081	2014-05-21	2015-05-20
Power sensor	NRV-Z5	R&S	100538	2014-05-21	2015-05-20
Power sensor	NRV-Z5	R&S	100539	2014-05-21	2015-05-20
Network analyzer	E5071C	Agilent	MY46104758	2014-05-20	2015-05-19
Amplifier	0.3-3GHz	Bonn Elektronik	087193A	2014-05-20	2015-05-19
Amplifier	2-6GHz	Bonn Elektronik	087193B	2014-05-20	2015-05-19
Wireless Communication Test Set	CMU200	R&S	117336	2014-05-09	2015-05-08
Wireless Communication Test Set	CMW500	R&S	115793	2014-05-09	2015-05-08

7 MEASUREMENT UNCERTAINTY

According to IEEE 1528 and IEC 62209, Valid for frequency range 300MHz - 3GHz

Uncertainty Component	Uncert. 1g (%)	Uncert. 10g (%)	Prob. Dist.	Div.	1g mass		10g mass	
					Ci	Calc (%)	Ci	Calc (%)
Measurement System								
Probe Calibration*	±6.0	±6.0	N	1	1	±6.0	1	±6.0
Axial Isotropy*	±4.7	±4.7	R	√3	0.71	±1.9	0.71	±1.9
Hemispherical Isotropy*	±9.6	±9.6	R	√3	0.71	±3.9	0.71	±3.9
Boundary effect*	±1.0	±1.0	R	√3	1	±0.6	1	±0.6
Linearity*	±4.7	±4.7	R	√3	1	±2.7	1	±2.7
System Detection limits*	±1.0	±1.0	R	√3	1	±0.6	1	±0.6
Readout electronics*	±0.3	±0.3	N	1	1	±0.3	1	±0.3
Response time*	±0.0	±0.0	R	√3	1	±0.0	1	±0.0
Integration time*	±2.6	±2.6	R	√3	1	±1.5	1	±1.5
RF Ambient Conditions (noise)*	±3.0	±3.0	R	√3	1	±1.7	1	±1.7
RF Ambient Conditions (Reflections)*	±3.0	±3.0	R	√3	1	±1.7	1	±1.7
Probe positioner mech. Tolerance*	±0.4	±0.4	R	√3	1	±0.2	1	±0.2
Probe positioning with respect to phantom*	±2.9	±2.9	R	√3	1	±1.7	1	±1.7
Extrap, interpolation and integration*	±1.0	±1.0	R	√3	1	±0.6	1	±0.6
Measurement System Uncertainty						*±8.6*		*±8.6*
Test Sample Related								
Test sample positioning	±3.6	±1.7	N	1	1	±3.6	1	±1.7
Device holder uncertainty	±0.3	±1.0	N	1	1	±0.3	1	±1.0
Power drift*	±5.0	±5.0	R	√3	1	±2.9	1	±2.9
Test Sample Related Uncertainty						*±4.6*		*±3.5*
Phantom and Tissue Parameters								
Phantom uncertainty*	±4.0	±4.0	R	√3	1	±2.3	1	±2.3
Liquid conductivity (target)*	±5.0	±5.0	R	√3	0.64	±1.8	0.43	±1.2
Liquid conductivity (measured)	±2.8	±2.8	N	1	0.64	±1.8	0.43	±1.2
Liquid Permittivity (target)*	±5.0	±5.0	R	√3	0.60	±1.7	0.49	±1.4
Liquid Permittivity (measured)	±3.3	±3.3	N	1	0.60	±2.0	0.49	±1.6
Phantom and Tissue Parameters Uncertainty						*±4.3*		*±3.6*
Combined standard uncertainty (%)						*±10.7*		*±10.0*
Expanded standard uncertainty (%) (k=2)						***±21.4***		***±20.0***