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TEST REPORT

Report Reference No. ....: **CTL1601120121-SAR**

Compiled by: (position+printed name+signature)	Jacky Chen (File administrators)	Jacky chen
Tested by: (position+printed name+signature)	Allen Wang (Test Engineer)	Allen Wang
Approved by: (position+printed name+signature)	Tracy Qi (Manager)	Tracy Qi

Product Name..............................:	Smart POS
Model/Type reference ....:	WIZARHAND Q1
List Model(s)...............................:	/
Trade Mark ....:	wizarPOS
FCC ID ....:	**2AG97-Q1**
Applicant's name ....:	**WizarPos International Co., Ltd.**
Address of applicant ....:	3F, D5, JBC, 808 HONGQIAO RD., SHANGHAI, CHINA
Authorized Lab............................:	**Shenzhen CTL Testing Technology Co., Ltd.**
Address...:	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification ....:	
Standard...:	**ANSI C95.1–1999** **47CFR §2.1093** **KDB 447498**
TRF Originator ....:	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF ....:	Dated 2011-01
Date of Receipt............................:	Jan. 12, 2016
Date of Test Date.........................:	Jan. 25, 2016 –Jan. 27, 2016
Data of Issue................................:	Jan. 27, 2016
Result ....:	Positive

TEST REPORT

Test Report No. :	CTL1601120121-SAR	Jan. 27, 2016
		Date of issue

Equipment under Test	:	Smart POS
Model /Type	:	WIZARHAND Q1
Listed Models	:	/
Applicant	:	**WizarPos International Co.,Ltd.**
Address	:	3F, D5, JBC, 808 HONGQIAO RD., SHANGHAI, CHINA
Manufacturer	:	**WizarPos International Co.,Ltd.**
Address	:	3F, D5, JBC, 808 HONGQIAO RD., SHANGHAI, CHINA

Test result	**Pass ***

∗ In the configuration tested, the EUT complied with the standards specified page 5.

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

** Modified History **

Version	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2016-01-27	CTL1601120121-SAR	Tracy Qi

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1 SUMMARY

1.1 TEST STANDARDS

IEEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

IEEE Std 1528™-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

FCC Part 2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices

KDB 447498 D01 Mobile Portable RF Exposure v6: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz

KDB865664 D02 SAR Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

KDB648474 D04 Handset SAR V01r03: SAR Evaluation Considerations for Wireless Handsets.

KDB248227 D01 802.11 Wi-Fi SAR v02r01: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

KDB941225 D01 3G SAR Procedures v03: 3G SAR MEAUREMENT PROCEDURES

KDB 941225 D06 Hotspot Mode v02: SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES

1.2 Summary SAR Results

The maximum results of Specific Absorption Rate (SAR) found during testing for EUT are as follows:

Body-Worn& Hotspot Mode Configuration

Mode	Test Position	Channel /Frequency(MHz)	Limit SAR_{1g} 1.6 W/kg	
			Highest Tested 1g-SAR(W/Kg)	Highest Scaled Maximum SAR(W/Kg)
GSM 850	Rear Side	190/836.6	0.263	0.273
PCS 1900	Rear Side	661/1880	0.249	0.255
WCDMA Band II	Front Side	9400/1880	0.259	0.272
WCDMA Band V	Rear Side	4183/836.6	0.212	0.219
WLAN2450	Rear Side	6/2437	0.198	0.204

Highest Simultaneous transmission SAR Summary

Exposure Position	Transmission Combination	Highest Simultaneous Maximum SAR(W/Kg)
Body	GSM850+ WLAN	0.477

Note:

1. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/Kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1, and had been tested in accordance with measurement methods and procedures specified in IEEE 1528-2003 and the relevant KDB files.

1.3 Test Facility

1.3.1 Address of the test laboratory

SHENZHEN YIDAJIETONG INFORMATION TECHNOLOGY CO., LTD
No.12 Building Shangsha, Innovation & Technology Park, Futian District, Shenzhen, P.R. China

1.3.2 Test Lab Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: 7547

SHENZHEN YIDA JIETONG INFORMATION TECHNOLOGY CO., LTD has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: Mar 17, 2015. Valid time is until Mar 17, 2018.

1.4 Statement of the measurement uncertainty

No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.55%	N	1	1	1	6.55%	6.55%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.88%	3.88%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.71%	2.71%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
7	Readout Electronics	A	0.30%	N	1	1	1	0.30%	0.30%	∞
8	Response Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Integration Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
10	RF ambient conditions-noise	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
11	RF ambient conditions-reflection	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
12	Probe positioned mech. restrictions	B	0.80%	R	$\sqrt{3}$	1	1	0.46%	0.46%	∞
13	Probe positioning with respect to phantom shell	B	6.70%	R	$\sqrt{3}$	1	1	3.87%	3.87%	∞
14	Max.SAR evaluation	B	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
Test Sample Related										
15	Test sample positioning	A	1.86%	N	1	1	1	1.86%	1.86%	∞
16	Device holder uncertainty	A	1.70%	N	1	1	1	1.70%	1.70%	∞
17	Drift of output power	B	5.00%	R	$\sqrt{3}$	1	1	2.89%	2.89%	∞

Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.31%	2.31%	∞
19	Liquid conductivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.85%	1.24%	∞
20	Liquid conductivity (meas.)	A	2.50%	N	1	0.64	0.43	1.60%	1.08%	∞
21	Liquid permittivity (target)	B	5.00%	R	$\sqrt{3}$	0.60	0.49	1.73%	1.41%	∞
22	Liquid permittivity (meas.)	A	2.50%	N	1	0.60	0.49	1.50%	1.23%	∞
Combined standard uncertainty	$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	/	10.87 %	10.63 %	∞
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$		/	R	K=2	/	/	21.73 %	21.27 %	∞

1.5 System Check Uncertainty

No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.55%	N	1	1	1	6.55%	6.55%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.88%	3.88%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.71%	2.71%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
7	Readout Electronics	A	0.30%	N	1	1	1	0.30%	0.30%	∞
8	Response Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Integration Time	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
10	RF ambient conditions-noise	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
11	RF ambient conditions-reflection	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
12	Probe positioned mech. restrictions	B	0.80%	R	$\sqrt{3}$	1	1	0.46%	0.46%	∞
13	Probe positioning with respect to phantom shell	B	6.70%	R	$\sqrt{3}$	1	1	3.87%	3.87%	∞
14	Max.SAR evaluation	B	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
Dipole Related										

15	Dev. of experimental dipole	B	5.50%	R	$\sqrt{3}$	1	1	3.18%	3.18%	∞
16	Dipole Axis to Liquid Dist.	B	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
17	Input power & SAR drift	B	3.40%	R	$\sqrt{3}$	1	1	1.96%	1.96%	∞
Phantom and Setup										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.31%	2.31%	∞
19	SAR correction	B	1.90%	R	$\sqrt{3}$	1	0.84	1.10%	0.92%	
20	Liquid conductivity (meas.)	A	2.50%	N	1	0.78	0.71	1.95%	1.78%	∞
21	Liquid permittivity (meas.)	A	2.50%	N	1	0.26	0.26	0.65%	0.65%	∞
22	Temp. unc. - Conductivity	B	1.70%	R	$\sqrt{3}$	0.78	0.71	0.77%	0.70%	∞
23	Temp. unc. - Permittivity	B	0.30%	R	$\sqrt{3}$	0.23	0.26	0.04%	0.05%	∞
Combined standard uncertainty	$u_c = \sqrt{\sum_{i=1}^{23} c_i^2 u_i^2}$		/	/	/	/	/	10.65 %	10.60 %	∞
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$		/	R	K=2	/	/	21.31 %	21.20 %	∞

2 GENERAL INFORMATION

2.1 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	15°C -35°C
Relative Humidity	25% -55 %
Air Pressure	101 kPa

2.2 General Description of EUT

Product Name:	Smart POS
Model/Type reference:	WIZARHAND Q1
Power supply:	DC 7.4V from battery
Adapter information:	Model:SK02G-0900200U Input:AC100-240V 50/60Hz 0.6A Max Output:9V⎓2A
Hardware version:	1.0.0
Software version:	1.0.0
2G	
Operation Band:	GSM850, GSM900, DCS1800, PCS1900
Supported type:	GPRS, EGPRS
Power Class:	GSM850,GSM900:Power Class 4 DCS1800, PCS1900:Power Class 1
Modulation Type:	GMSK for GPRS, 8-PSK for EGPRS
GSM Release Version	R99
GPRS Multisport Class	12
EGPRS Multislot Class	12
Antenna type:	PFC antenna
Antenna gain:	0.70dBi
WCDMA	
Operation Band:	FDD Band I , FDD Band II, FDD Band V, FDD Band VIII
Power Class:	Power Class 3
Modilation Type:	QPSK for HSUPA/HSDPA
WCDMA Release Version:	R8
HSDPA Release Version:	Release 7, CAT14
HSUPA Release Version:	Release 6, CAT6
DC-HSUPA Release Version:	Not Supported
Antenna type:	PFC antenna
Antenna gain:	1.30dBi
WIFI :	
Supported type:	802.11b/802.11g/802.11n(H20)/802.11n(H40)
Modulation:	802.11b: DSSS 802.11g/802.11n(H20)/802.11n(H40): OFDM

Operation frequency:	802.11b/802.11g/802.11n(H20): 2412MHz~2462MHz 802.11n(H40): 2422MHz~2452MHz
Channel number:	802.11b/802.11g/802.11n(H20): 11 802.11n(H40): 7
Channel separation:	5MHz
Antenna type:	FPC Antenna
Antenna gain:	0.85dBi
Bluetooth BLE	
Supported type:	Version 4.0 for low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz
Antenna type:	FPC Antenna
Antenna gain:	0.85dBi
Bluetooth :	
Version:	BT3.0
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC Antenna
Antenna gain:	0.85dBi
GPS(RX only)	
Modulation:	MSK
Operation frequency:	1575.42MHz
Antenna type:	FPC Antenna
RFID	
Operation frequency:	13.56MHz
Modulation :	ASK
No. of Channel :	1
Antenna type:	Loop Antenna

Note: For more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.

2.3 Description of Test Modes

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power the EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.4 Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval
Data Acquisition Electronics DAEx	SPEAG	DAE4	905	2015.07.16	1
E-field Probe	SPEAG	ES3DV3	3221	2015-01-31	1
System Validation Dipole D1900V2	SPEAG	D1900V2	5d194	2015.01.07	3
System Validation Dipole D900V2	SPEAG	D900V2	1d086	2013.08.09	3
System Validation Dipole 2450V2	SPEAG	D2450V2	955	2015/01/08	3
Network analyzer	Agilent	E5071B	MY42404001	2015-11-21	1
Universal Radio Communication Tester	ROHDE & SCHWARZ	E5515C	GB47200762	2015-08-29	1
Dielectric Probe Kit	Agilent	85070E	NA#F-EP-00777	/	/
Power meter	Agilent	NRVD	835843/014	2015-12-02	1
Power meter	Agilent	NRVD	835843/017	2015-12-02	1
Power meter	Agilent	NRVD	835843/025	2015-12-02	1
Power sensor	Agilent	NRV-Z2	100211	2015-12-02	1
Power sensor	Agilent	NRV-Z2	100219	2015-12-02	1
Power sensor	Agilent	NRV-Z2	100220	2015-12-02	1
Signal generator	ROHDE & SCHWARZ	SME03	100029	2015-11-25	1
Amplifier	AR	2HL-42W-S	100206	/	/

2.5 SAR Measurements System

2.5.1 SAR Measurement Set-up

The DASY4 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 DASY4 measurement server.

The DASY4 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 2003.

DASY4 software and SEMCAD data evaluation software.

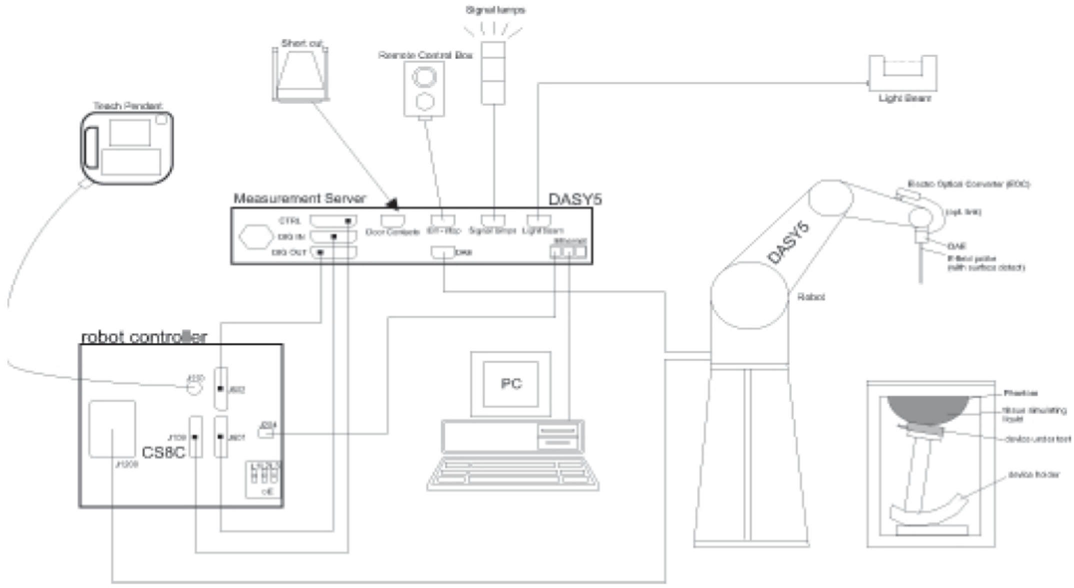
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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 validation dipoles allowing to validate the proper functioning of the system.



2.5.2 DASY4 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

Probe Specification

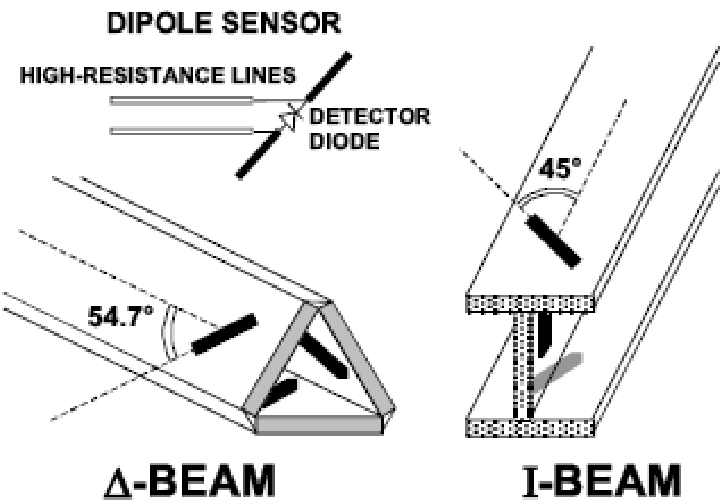
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.

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
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



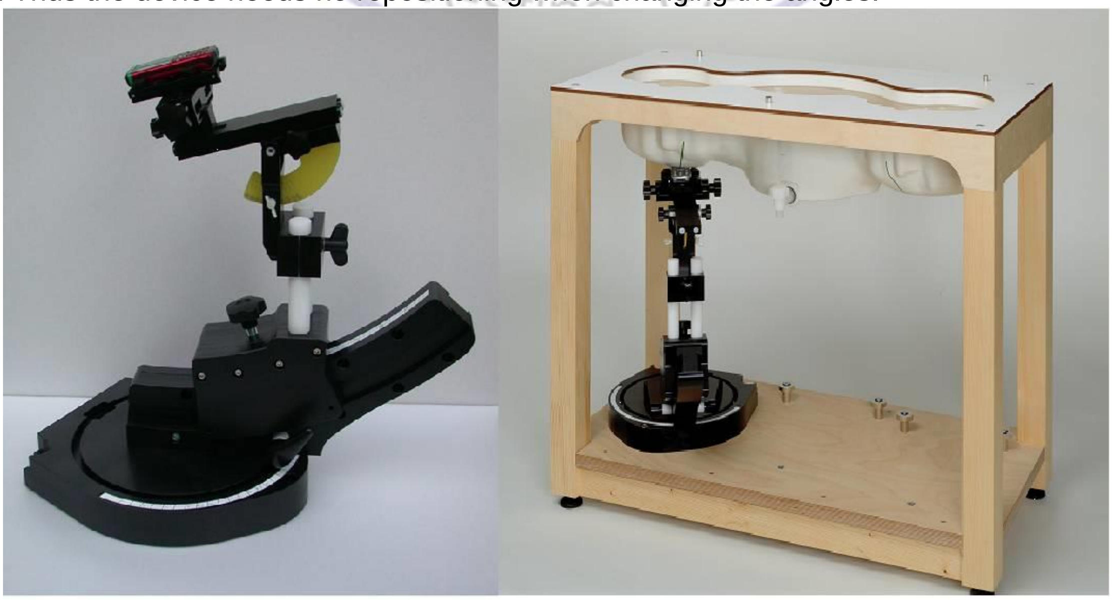
2.5.3 Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

2.5.4 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.



Device holder supplied by SPEAG

2.5.5 Scanning Procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. 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°.)

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement

(b) Area scan

(c) Zoom scan

(d) Power drift measurement

Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan

(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)

(c) Generation of a high-resolution mesh within the measured volume

(d) Interpolation of all measured values form the measurement grid to the high-resolution grid

(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface

(f) Calculation of the averaged SAR within masses of 1g and 10g

2.5.6 Data Storage and Evaluation

Data Storage

The DASY4 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 ".DA4". 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

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	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- 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 DASY4 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

With Vi = compensated signal of channel i (i = x, y, z)
Ui = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcpi = diode compression point (DASY parameter)

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

$$\text{E} - \text{fieldprobes :} \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes :} \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

With Vi = compensated signal of channel i (i = x, y, z)
Normi = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m
Hi = magnetic field strength of channel i in A/m

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

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

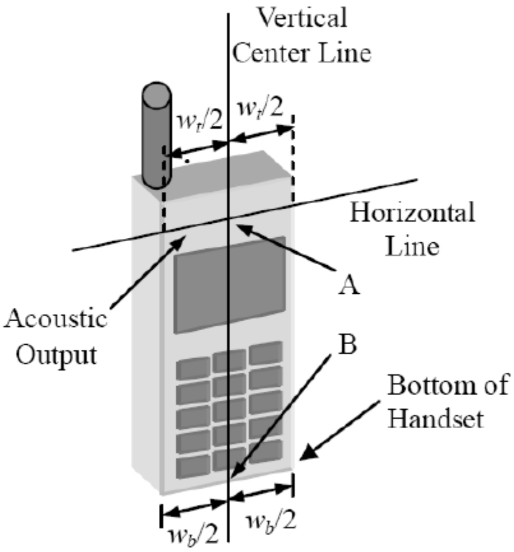
with SAR = local specific absorption rate in mW/g
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

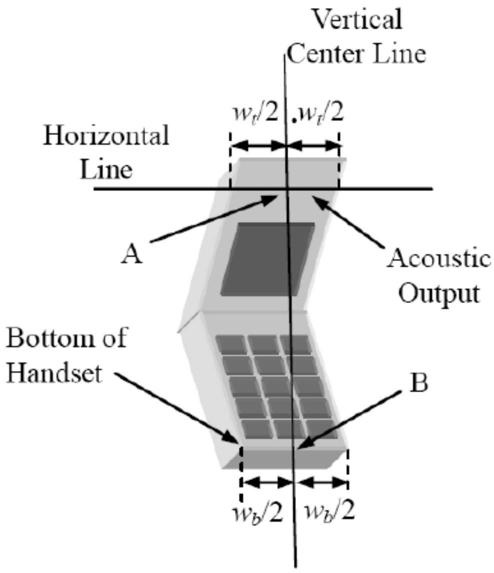
Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

3 Position of the wireless device in relation to the phantom

3.1 General considerations

This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.





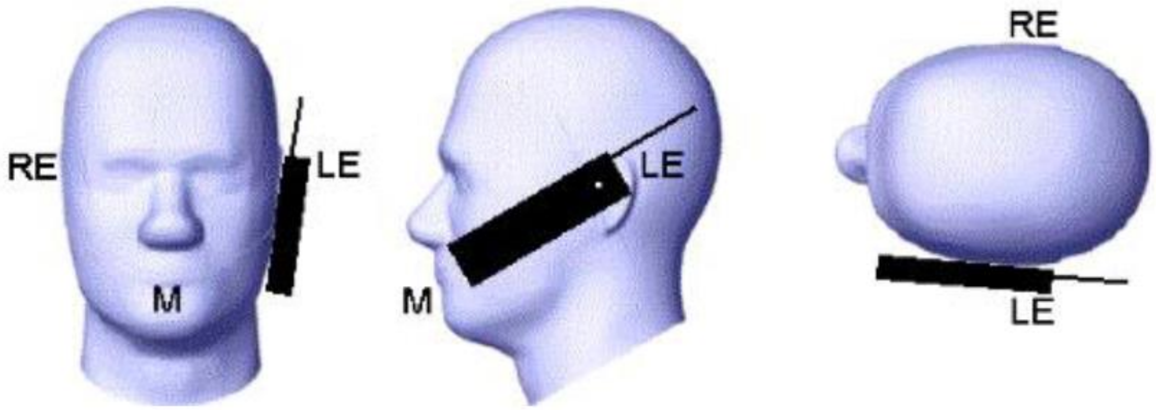
W_t Width of the handset at the level of the acoustic

W_b Width of the bottom of the handset

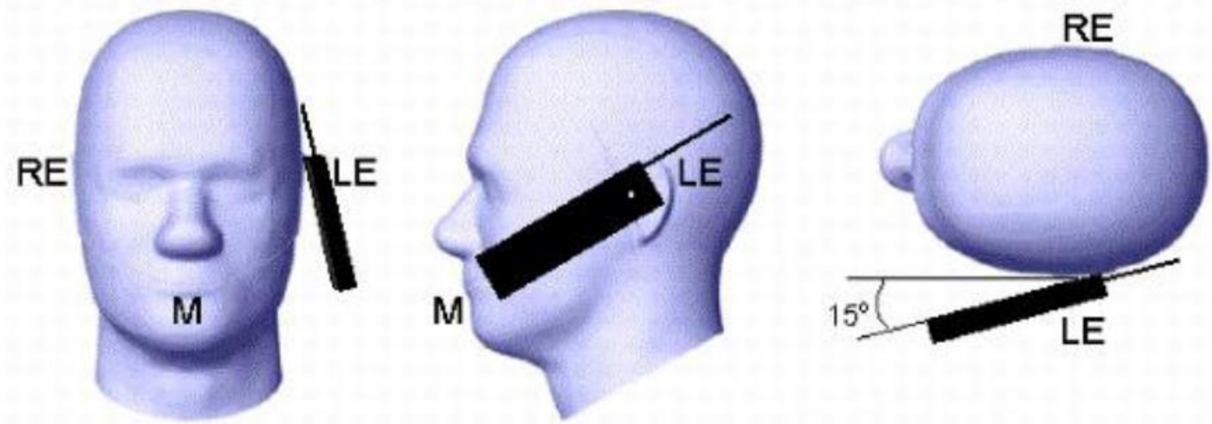
A Midpoint of the width w_t of the handset at the level of the acoustic output

B Midpoint of the width w_b of the bottom of the handset

Picture 1-a Typical “fixed” case handset Picture 1-b Typical “clam-shell” case handset



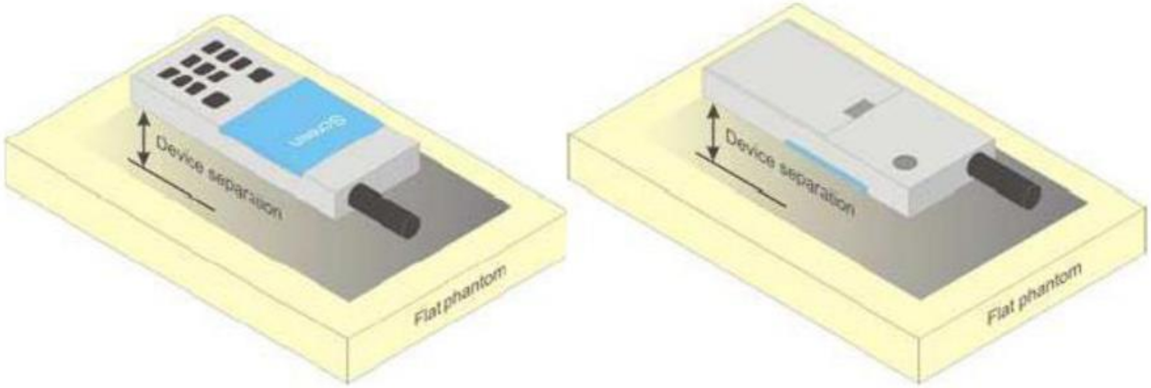
Picture 2 Cheek position of the wireless device on the left side of SAM



Picture 3 Tilt position of the wireless device on the left side of SAM

3.2 Body-worn device

A typical example of a body-worn device is aMoblie Phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.



Picture 4 Test positions for body-worn devices

4 Measurement Procedures

The measurement procedures are as follows:

4.1 Conducted power measurement

a) For WWAN power measurement, use base station simulator connection with RF cable, at maximum power in each supported wireless interface and frequency band.
b) Read the WWAN RF power level from the base station simulator.
c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously Transmission, at maximum RF power in each supported wireless interface and frequency band.
d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power.

4.2 SAR measurement

4.2.1 GSM Test Configuration

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. The power level is set to “5” for GSM 850, set to “0” for GSM 1900. 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 timeslots 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 timeslots is 5.

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

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction calculation method are shown in chapter8.1 NOTES 1).

4.2.2 UMTS Test Configuration

3G SAR Test Reduction Procedure
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.3 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.

<u>Output power Verification</u>

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

Head SAR

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

Body-Worn Accessory SAR

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreaing code or DPDCHn, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the handset, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

Handsets with Release 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures in the “Release 5 HSDPA Data Devices” section of this document, for the highest reported SAR body-worn accessory exposure configuration in 12.2 kbps RMC. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

HSDPA should be configured according to the UE category of a test device.The number of HSDSCH/ HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors(βc, βd), and HS-DPCCH power offset parameters (ΔACK, ΔNACK, ΔCQI) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

Table 2: Subtests for UMTS Release 5 HSDPA

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

Note1: $\triangle_{ACK}$, $\triangle_{NACK}$ and $\triangle_{CQI}$=8 $A_{hs} = \beta_{hs}/\beta_c$=30/15 β_{hs}=30/15*β_c

Note2: CM=1 for β_c/β_d =12/15, β_{hs}/β_c=24/15.

Note3: For subtest 2 the $\beta_c\beta_d$ ratio of 12/15 for the TFC during the measurement period(TF1,TF0) is achieved by setting the signaled gain factors for the reference TFC (TFC1,TF1) to β_c=11/15 and β_d=15/15.

HSUPA Test Configuration

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures in the “Release 6 HSPA Data Devices” section of this document, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When VOIP is applicable for next to the ear head exposure in HSPA, the 3G SAR test reduction procedure is applied to HSPA with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body-worn accessory measurements is tested for next to the ear head exposure.

Due to inner loop power control requirements in HSPA, a communication test set is required for output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA are configured according to the β values indicated in Table 2 and other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of this document

Table 3: Sub-Test 5 Setup for Release 6 HSUPA

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

Note 1: Δ_{ACK}, ΔNACK and Δ_{CQI} = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c$ = 30/15 ⇔ β_{hs}= 30/15 *β_c.

Note 2: CM = 1 for βc/βd =12/15, β_{hs}/β_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 βc/βd ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 10/15 and βd = 15/15.

Note 4: For subtest 5 the βc/βd ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 14/15 and βd = 15/15.

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

Note 6: βed can not be set directly; it is set by Absolute Grant Value.

4.2.3 WIFI Test Configuration

The SAR measurement and test reduction procedures are structured according to either the DSSS or OFDM transmission mode configurations used in each standalone frequency band and aggregated band. For devices that operate in exposure configurations that require multiple test positions, additional SAR test reduction may be applied. The maximum output power specified for production units, including tune-up tolerance, are used to determine initial SAR test requirements for the 802.11 transmission modes in a frequency band. SAR is measured using the highest measured maximum output power channel for the initial test configuration. SAR measurement and test reduction for the remaining 802.11 modes and test channels are determined according to measured or specified maximum output power and reported SAR of the initial measurements. The general test reduction and SAR measurement approaches are summarized in the following:

1. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. Channels with measured maximum output power within ¼ dB are considered to have the same maximum output.

2. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, an "initial test configuration" is first determined for each standalone and aggregated frequency band according to the maximum output power and tune-up tolerance specified for production units.

a. When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.

b. SAR is measured for OFDM configurations using the initial test configuration procedures. Additional frequency band specific SAR test reduction may be considered for individual frequency bands

c. Depending on the reported SAR of the highest maximum output power channel tested in the initial test configuration, SAR test reduction may apply to subsequent highest output channels in the initial test configuration to reduce the number of SAR measurements.

3. The Initial test configuration does not apply to DSSS. The 2.4 GHz band SAR test requirements and 802.11b DSSS procedures are used to establish the transmission configurations required for SAR measurement.

4. An "initial test position"is applied to further reduce the number of SAR tests for devices operating in next to the ear, UMPC mini-tablet or hotspot mode exposure configurations that require multiple test positions .
a. SAR is measured for 802.11b according to the 2.4 GHz DSSS procedure using the exposure condition established by the initial test position.
b. SAR is measured for 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration. 802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on the maximum average output channel.
5. The Initial test position does not apply to devices that require a fixed exposure test position. SAR is measured in a fixed exposure test position for these devices in 802.11b according to the 2.4 GHz DSSS procedure or in 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration procedures .
6. The "subsequent test configuration"procedures are applied to determine if additional SAR measurements are required for the remaining OFDM transmission modes that have not been tested in the initial test configuration. SAR test exclusion is determined according to reported SAR in the initial test configuration and maximum output power specified or measured for these other OFDM configurations.

2.4 GHz SAR 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. When SAR measurement is required for an OFDM configuration, the initial test configuration, subsequent test configuration and initial test position procedures are applied. The SAR test exclusion requirements for 802.11g/n OFDM configurations are described in section 5.2.2.

1. 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:

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

1. 2.4 GHz 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). SAR is not required for the following 2.4 GHz OFDM conditions.

a. When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration
b. 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.

2. SAR Test Requirements for OFDM Configurations

When SAR measurement is required for 802.11 a/g/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 band are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements.20 In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

3. OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements

The initial test configuration for 2.4 GHz and 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures (section 4). When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.

a. The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
b. If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
c. If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
d. When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.

After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following. These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s), with respect to the default power measurement procedures or additional power measurements required for further SAR test reduction. The same procedures also apply to subsequent highest output power channel(s) selection.

a. Channels with measured maximum output power within ¼ dB of each other are considered to have the same maximum output.
b. When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement.
c. When there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

4. Initial Test Configuration Procedures

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). 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.23

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.

5. Subsequent Test Configuration Procedures

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. The initial test position procedure is applied to next to the ear, UMPC mini-tablet and hotspot mode configurations. When the same maximum output power is specified for multiple transmission modes, the procedures in section 5.3.2 are applied to determine the test configuration. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. The subsequent test configuration and SAR measurement procedures are described in the following.

a. When SAR test exclusion provisions of KDB Publication 447498 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.

b. When the highest reported SAR for the initial test configuration (when applicable, include subsequent highest output channels), 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.

c. The number of channels in the initial test configuration and subsequent test configuration can be different due to differences in channel bandwidth. When SAR measurement is required for a subsequent test configuration and the channel bandwidth is smaller than that in the initial test configuration, all channels in the subsequent test configuration that overlap with the larger bandwidth channel tested in the initial test configuration should be used to determine the highest maximum output power channel. This step requires additional power measurement to identify the highest maximum output power channel in the subsequent test configuration to determine SAR test reduction.

   1). SAR should first be measured for the channel with highest measured output power in the subsequent test configuration.

   2). SAR for subsequent highest measured maximum output power channels in the subsequent test configuration is required only when the reported SAR of the preceding higher maximum output power channel(s) in the subsequent test configuration is > 1.2 W/kg or until all required channels are tested.

   a) For channels with the same measured maximum output power, SAR should be measured using the channel closest to the center frequency of the larger channel bandwidth channel in the initial test configuration.

d. SAR measurements for the remaining highest specified maximum output power OFDM transmission mode configurations that have not been tested in the initial test configuration (highest maximum output) or subsequent test configuration(s) (subsequent next highest maximum output power) is determined by applying the subsequent test configuration procedures in this section to the remaining configurations according to the following:

   1) replace “subsequent test configuration” with “next subsequent test configuration” (i.e., subsequent next highest specified maximum output power configuration)

   2) replace “initial test configuration” with “all tested higher output power configurations”

5 TISSUE SIMULATING LIQUID

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm. For head SAR testing the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm.The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in 5.2

5.1 The composition of the tissue simulating liquid

Ingredient	835MHz		1900MHz		2450MHz	
(% Weight)	Head	Body	Head	Body	Head	Body
Water	41.45	52.5	55.242	69.91	62.7	73.2
Salt	1.45	1.40	0.306	0.13	0.50	0.10
Sugar	56	45.0	0.00	0.00	0.00	0.00
Preventol	0.10	0.10	0.00	0.00	0.00	0.00
HEC	1.00	1.00	0.00	0.00	0.00	0.00
DGBE	0.00	0.00	44.452	29.96	36.8	26.7

5.2 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using Agilent Dielectric Probe Kit and Agilent Network Analyzer 8753E.

Frequency (MHz)		Dielectric Parameters (±5%)		Tissue Temp [°C]	Test Date
835	body	εr 52.44-57.96	δ[s/m] 0.9215-1.0185	22	Jan.25,2016
		55.88	0.96		

Frequency (MHz)		Dielectric Parameters (±5%)		Tissue Temp [°C]	Test Date
1900	body	εr 50.635-55.965	δ[s/m] 1.444-1.596	22	Jan.26,2016
		51.13	1.57		

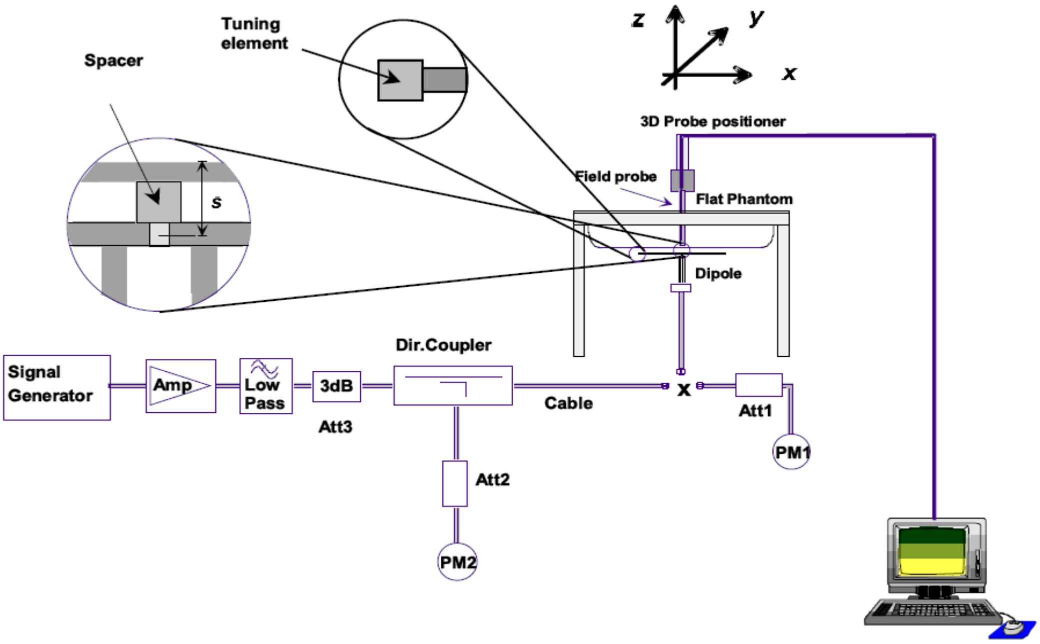
Frequency (MHz)		Dielectric Parameters (±5%)		Tissue Temp [°C]	Test Date
2450	body	εr 50.065-55.335	δ[s/m] 1.8525-2.0475	22	Jan.27,2016
		50.74	2.01		

6 System Check

The purpose of the system check is to verify that the system operates within its specifications at the device test frequency. The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected.

Photo of Dipole Setup

System Check in Body Tissue Simulating Liquid

Measurement is made at temperature 22.0 ℃ and relative humidity 55%.						Measurement Date
Verification results	Frequency (MHz)	Target value (W/kg)	Measured 250mW value (W/kg)	Normalized 1W value (W/kg)	Deviation	
	835	10.7	2.63	10.52	-1.68%	Jan.25,2016
	1900	40.1	9.83	39.32	-1.95%	Jan.26,2016
	2450	53.7	13.09	52.36	-2.50%	Jan.27,2016
Note：1. The graph results see Chapter 9. 2. Target Values used derive from the calibration certificate						

7 TEST CONDITIONS AND RESULTS

7.1 Conducted Power Results

Max Conducted power measurement results and power drift from tune-up tolerance provide by manufacturer:

Conducted power measurement results (GSM850/1900)

Mode	Txslot	Burst Average Power (dBm)			Tune-up Limit (dBm)	Calculation (dB)	Frame-Averaged Power (dBm)			Tune-up Limit (dBm)
		128	190	251			128	190	251	
GPRS 850 (GMSK)	1 Txslot	32.54	32.74	32.14	33	-9.03	23.51	23.71	23.11	23.97
	2 Txslot	29.68	29.84	29.90	30	-6.02	23.66	23.82	23.88	23.98
	3 Txslot	27.47	27.24	27.86	28	-4.26	23.21	22.98	23.60	23.74
	4 Txslot	26.54	26.26	26.69	27	-3.01	23.53	23.25	23.68	23.99
EGPRS 850 (8PSK)	1 Txslot	27.55	27.55	27.25	27	-9.03	18.52	18.52	18.22	17.97
	2 Txslot	26.54	26.87	26.98	27	-6.02	20.52	20.85	20.96	20.98
	3 Txslot	24.87	24.25	24.56	25	-4.26	20.61	19.99	20.30	20.74
	4 Txslot	23.15	23.26	23.09	24	-3.01	20.14	20.25	20.08	20.99
Mode	Txslot	Burst Average Power (dBm)			Tune-up Limit (dBm)	Calculation (dB)	Frame-Averaged Power (dBm)			Tune-up Limit (dBm)
		512	661	810			512	661	810	
GPRS 1900 (GMSK)	1 Txslot	29.65	29.78	29.15	30	-9.03	20.62	20.75	20.12	20.97
	2 Txslot	27.68	27.90	27.88	28	-6.02	21.66	21.88	21.86	21.98
	3 Txslot	25.24	25.75	25.33	26	-4.26	20.98	21.49	21.07	21.74
	4 Txslot	24.23	24.46	24.24	25	-3.01	21.22	21.45	21.23	21.99
EGPRS 1900 (8PSK)	1 Txslot	24.74	24.85	24.22	25	-9.03	15.71	15.82	15.19	15.97
	2 Txslot	22.45	22.65	22.26	23	-6.02	16.43	16.63	16.24	16.98
	3 Txslot	21.15	21.20	21.19	22	-4.26	16.89	16.94	16.93	17.74
	4 Txslot	20.62	20.45	20.33	21	-3.01	17.61	17.44	17.32	17.99

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

2) According to the conducted power as above, the GPRS measurements are performed with 2Txslots for GPRS850 and GPRS1900. the EPRS measurements are performed with 2Txslots for EGPRS850 and 4Txslots for EGPRS1900

Conducted power measurement results (WCDMA Band II/V)

Item	Band	FDD Band II result (dBm)			Tune-up Limit (dBm)
		Test Channel			
	ARFCN	9262	9400	9538	
AMR	12.2kbps AMR	22.72	22.74	22.72	23
RMC	12.2kbps RMC	22.74	22.78	22.73	23
HSDPA	Sub - Test 1	22.47	22.63	22.45	23
	Sub - Test 2	21.54	21.10	21.53	22
	Sub - Test 3	21.33	21.41	21.32	22
	Sub - Test 4	21.25	21.26	21.25	22
HSUPA	Sub - Test 1	22.05	22.34	22.08	23
	Sub - Test 2	21.32	21.47	21.88	22
	Sub - Test 3	21.55	21.68	21.78	22
	Sub - Test 4	21.29	21.13	21.06	22
	Sub - Test 5	21.39	21.33	21.14	22

Item	Band	FDD Band V result (dBm)			Tune-up Limit (dBm)
		Test Channel			
	ARFCN	4132	4183	4233	
AMR	12.2kbps AMR	22.79	22.58	22.76	23
RMC	12.2kbps RMC	22.82	22.85	22.80	23
HSDPA	Sub - Test 1	22.12	22.74	22.35	23
	Sub - Test 2	21.32	21.36	21.15	22
	Sub - Test 3	21.16	21.19	21.13	22
	Sub - Test 4	21.18	21.17	21.15	22
HSUPA	Sub - Test 1	22.73	22.78	22.77	23
	Sub - Test 2	21.71	21.74	21.72	22
	Sub - Test 3	21.12	21.16	21.13	22
	Sub - Test 4	21.21	21.22	21.14	22
	Sub - Test 5	21.45	21.59	21.56	22

Conducted Power Measurement Results (Wifi 802.11 b/g/n)

Conducted Power of 802.11b mode					
Power Comparison of Channels			Power Comparison of Date Rates		
Channel	Frequency (MHz)	Data rate	CH6 2Mbps	CH6 5.5Mbps	CH6 11Mbps
		1Mbps			
CH 1	2412	16.25	16.48	16.50	16.49
CH 6	2437	16.86			
CH 11	2462	16.24			

Conducted Power of 802.11g mode									
Power Comparison of Channels			Power Comparison of Date Rates						
Channel	Frequency (MHz)	Data rate	CH6 9Mbps	CH6 12Mbps	CH6 18Mbps	CH6 24Mbps	CH6 36Mbps	CH6 48MBps	CH6 54Mbps
		6Mbps							
CH 1	2412	13.54	13.48	13.51	13.62	13.55	13.60	13.52	13.58
CH 6	2437	13.65							
CH 11	2462	13.41							

Conducted Power of 802.11n(20MHz) mode									
Power Comparison of Channels			Power Comparison of Date Rates						
Channel	Frequency (MHz)	Data rate 6.5Mbps	CH6 MCS1	CH6 MCS2	CH6 MCS3	CH6 MCS4	CH6 MCS5	CH6 MCS6	CH6 MCS7
CH 1	2412	12.25	12.39	12.40	12.40	12.38	12.39	12.40	12.38
CH 6	2437	12.41							
CH 11	2462	12.22							

Conducted Power of 802.11n(40MHz) mode									
Power Comparison of Channels			Power Comparison of Date Rates						
Channel	Frequency (MHz)	Data rate 13.5 Mbps	CH6 MCS1	CH6 MCS2	CH6 MCS3	CH6 MCS4	CH6 MCS5	CH6 MCS6	CH6 MCS7
CH 3	2422	12.25	12.30	12.28	12.26	12.28	12.29	12.28	12.27
CH 6	2437	12.32							
CH 9	2452	12.28							

Conducted Power Measurement Results (Bluetooth)

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power	
			(dBm)	(mW)
GFSK	00	2402	1.308	1.351
	39	2441	0.481	1.117
	78	2480	0.192	1.045
π/4DQPSK	00	2402	1.084	1.284
	39	2441	0.246	1.058
	78	2480	0.032	1.007
8DPSK	00	2402	0.548	1.134
	39	2441	0.543	1.133
	78	2480	0.230	1.054
BLE (GFSK)	00	2402	-2.69	0.538
	19	2440	-2.65	0.543
	39	2480	-2.52	0.560

Note:
Per KDB 447498 D01, the 1-g 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 for 1-g SAR and] ≤ 7.5 for 10-g extremity SAR

- 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

Bluetooth Max Power Allowed (dBm)	Bluetooth Max Power Rounded (mW)	Calculated Value Rounded	Separation Distance (mm)	Frequency (GHz)	Exclusion thresholds
2	**2**	**0.6**	**5**	**2402**	**3**

Note:
Per KDB 447498 D01, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 0.6 which is≤ 3, SAR testing is not required.

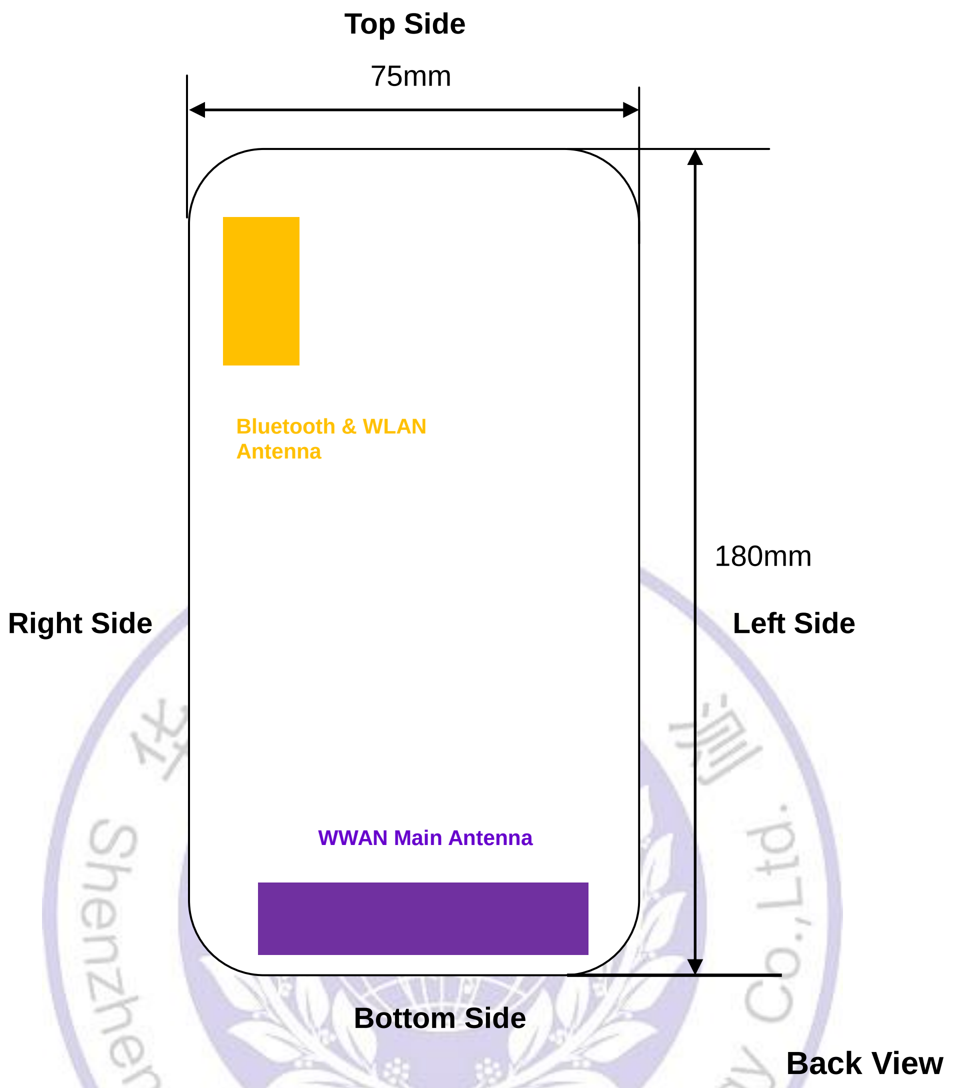
7.2 SAR Test Results Summary

7.2.1 General Remark

1. The DUT is tested using CMU 200 communications testers as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted peak power.
2. Test positions as described in the tables above are in accordance with the specified test standard.
3. Tests in body position were performed in that configuration, which generates the highest time based averaged output power (see conducted power results).
4. Tests in head position with GSM were performed in voice mode with 1 timeslot unless GPRS/EGPRS/DTM function allows parallel voice and data traffic on 2 or more timeslots.
5. UMTS was tested in RMC mode with 12.2 kbit/s and TPC bits set to 'all 1'.
6. WiFi was tested in 802.11b/g/n mode with 1 Mbit/s and 6 Mbit/s. According to KDB 248227 the SAR testing for 802.11g/n is not required since 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. Required WiFi test channels were selected according to KDB 248227
8. According to FCC KDB pub 248227 D01, Channels with measured maximum output power within ¼ dB of each other are considered to have the same maximum output, When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement and when there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.
9. According to FCC KDB pub 941225 D06 this device has been tested with 10 mm distance to the phantom for operation in WiFi hot spot mode.
10. Per FCC KDB pub 941225 D06 the edges with antennas within 2.5 cm are required to be evaluated for SAR to cover WiFi hot spot function.
11. According to IEEE 1528 the SAR test shall be performed at middle channel. Testing of top and bottom channel is optional.
12. According to KDB 447498 D01 testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
    ● ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
    ● ≤ 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
13. IEEE 1528-2003 require the middle channel to be tested first. This generally applies to wireless devices that are designed to operate in technologies with tight tolerances for maximum output power variations across channels in the band. 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.
14. Per KDB648474 D04 require when the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is < 1.2 W/kg.

15. Per KDB648474 D04 require when the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, using the same wireless mode test configuration for voice and data, such as UMTS, LTE and Wi-Fi, and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface)
16. 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.
17. Per KDB648474 D04 require for phablet SAR test considerations，For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, 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.
18. 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.
19. Maximum Scaling SAR in order to calculate the Maximum SAR values to test under the standard Peak Power, Calculation method is as follows:
    Maximum Scaling SAR =tested SAR (Max.) × [maximum turn-up power (mw)/ maximum measurement output power(mw)]

7.2.2 Transmit Antennas and SAR Measurement Position



Distance of The Antenna to the EUT surface and edge						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
BT&WLAN	/	/	/	>25mm	>25mm	/
WWAN	/	/	>25mm	/	/	/

Positions for SAR tests						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
BT&WLAN	Yes	Yes	Yes	No	No	Yes
WWAN	Yes	Yes	No	Yes	Yes	Yes

General Note: Referring to KDB 941225 D06 v02, SAR must be measured for all sides and surfaces with a transmitting antenna located with 25mm from that surface or edge.
(EUT diagonal dimension less than 20 cm)

7.2.3 Standalone SAR

SAR Values [GSM 850 (GPRS/EGPRS)]

Test Position	Channel/ Frequency(MHz)	Test Mode	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB: Drift (dB)	Limit SAR_{1g} 1.6 W/kg: Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test position of Body-worn accessory(Distance 0mm)										
Rear Side	190/836.6	2Txslots	1:4.15	23.98	23.82	-0.05	0.263	1.04	0.273	Figure.1
Front Side	190/836.6	2Txslots	1:4.15	23.98	23.82	0.03	0.154	1.04	0.160	N/A
Test position of Body (Distance 0mm)										
Left Edge	190/836.6	2Txslots	1:4.15	23.98	23.82	0.05	0.098	1.04	0.102	N/A
Right Edge	190/836.6	2Txslots	1:4.15	23.98	23.82	0.05	0.087	1.04	0.090	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	190/836.6	2Txslots	1:4.15	23.98	23.82	-0.03	0.159	1.04	0.165	N/A
Worst Case Position of Body with EGPRS 8PSK (Distance 0mm)										
Rear Side	190/836.6	2Txslots	1:4.15	20.98	20.85	-0.06	0.231	1.03	0.238	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.
4. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
5. 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

SAR Values [GSM 1900 (GPRS/EGPRS)]

Test Position	Channel/ Frequency (MHz)	Test Mode	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit SAR_{1g} 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test position of Body-worn accessory (Distance 0mm)										
Rear Side	661/1880	2Txslots	1:4.15	21.98	21.88	0.02	0.249	1.02	0.255	Figure.2
Front Side	661/1880	2Txslots	1:4.15	21.98	21.88	-0.05	0.145	1.02	0.148	N/A
Test position of Body (Distance 0mm)										
Left Edge	661/1880	2Txslots	1:4.15	21.98	21.88	-0.07	0.087	1.02	0.089	N/A
Right Edge	661/1880	2Txslots	1:4.15	21.98	21.88	0.05	0.086	1.02	0.088	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	661/1880	2Txslots	1:4.15	21.98	21.88	-0.05	0.154	1.02	0.158	N/A
Worst Case Position of Body With EGPRS 8PSK (Distance 0mm)										
Rear Side	661/1880	4Txslots	1:208	17.99	17.44	-0.03	0.224	1.14	0.254	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.
4. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg; no additional SAR evaluations using a headset cable were required.
5.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

SAR Values [WCDMA Band II (WCDMA/HSDPA/HSUPA)]

Test Position	Channel/ Frequency (MHz)	Channel Type	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit SAR_{1g} 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test position of Body-worn accessory (Distance 0mm)										
Rear Side	9400/1880	RMC 12.2K	1:1	23	22.78	0.06	0.259	1.05	0.272	Figure.3
Front Side	9400/1880	RMC 12.2K	1:1	23	22.78	0.11	0.141	1.05	0.148	N/A
Test position of Body (Distance 0mm)										
Left Edge	9400/1880	RMC 12.2K	1:1	23	22.78	0.15	0.089	1.05	0.094	N/A
Right Edge	9400/1880	RMC 12.2K	1:1	23	22.78	0.10	0.088	1.05	0.093	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	9400/1880	RMC 12.2K	1:1	23	22.78	0.08	0.231	1.05	0.243	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).

3. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.

4. Per KDB 941225 D02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is < 0.25 dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA SAR evaluation can be excluded.

SAR Values [WCDMA Band V (WCDMA/HSDPA/HSUPA)]

Test Position	Channel/ Frequency (MHz)	Channel Type	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit SAR_{1g} 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test position of Body-worn accessory (Distance 0mm)										
Rear Side	4183/836.6	RMC 12.2K	1:1	23	22.85	0.07	0.212	1.04	0.219	Figure.4
Front Side	4183/836.6	RMC 12.2K	1:1	23	22.85	-0.05	0.145	1.04	0.150	N/A
Test position of Body (Distance 0mm)										
Left Edge	4183/836.6	RMC 12.2K	1:1	23	22.85	0.05	0.078	1.04	0.081	N/A
Right Edge	4183/836.6	RMC 12.2K	1:1	23	22.85	-0.08	0.080	1.04	0.083	N/A
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	4183/836.6	RMC 12.2K	1:1	23	22.85	0.07	0.205	1.04	0.212	N/A

Note: 1.The value with green color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
4. Per KDB 941225 D02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is < 0.25 dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA SAR evaluation can be excluded.

SAR Values (802.11b)

Test Position	Channel/ Frequency (MHz)	Service	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21dB	Limit of SAR 1.6 W/kg			
						Drift (dB)	Measured SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)	Graph Results
Test position of Body-worn accessory (Distance 0mm)										
Rear Side	6/2437	DSSS	1:1	17	16.86	0.05	0.198	1.03	0.204	Figure.5
Front Side	6/2437	DSSS	1:1	17	16.86	0.10	0.110	1.03	0.114	N/A
Test position of Body (Distance 0mm)										
Left Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Right Edge	6/2437	DSSS	1:1	17	16.86	-0.07	0.175	1.03	0.181	N/A
Top Edge	6/2437	DSSS	1:1	17	16.86	0.06	0.095	1.03	0.098	N/A
Bottom Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: 1. The value with green color is the maximum SAR Value of each test band.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is optional for such test configuration(s).
3. Per KDB 248227-SAR is measured using the highest measured maximum output power channel for the initial test configuration.
4. Per KDB 248227- Channels with measured maximum output power within ¼ dB of each other are considered to have the same maximum output, When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement. And when there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.
5. Per KDB 248227- 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 the ODFM SAR test is not required.
6. Almost 100% duty cycle was tuned during the tests.

Remark: The highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power was 0.165 W/Kg (0.204*(13.65/16.86)=0.428) So ODFM SAR test is not required.

7.2.4 Simultaneous SAR Evaluation

Application Simultaneous Transmission information:

NO.	Simultaneous Transmission Configurations	EUT		Note
		Head	Body	
5	GPRS/EDGE(Data) + WLAN2.4GHz(data)	No	Yes	
6	WCDMA(Data) + WLAN2.4GHz(data)	No	Yes	
7	GPRS/EDGE(Data) + Bluetooth(data)	No	Yes	
8	WCDMA(Data) + Bluetooth(data)	No	Yes	

NOTE:

1) WLAN2.4GHz and Bluetooth share the same antenna, and cannot transmit simultaneously.
2) The Reported SAR summation is calculated based on the same configuration and test position.
3) Per KDB 447498 D01, simultaneous transmission SAR is compliant if,
   a) Scalar SAR summation < 1.6W/kg.
   b) SPLSR = $(SAR1 + SAR2)^{1.5}$ / (min. separation distance, mm), and the peak separation distance is determined from the square root of \[$(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2$], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan
   c) If SPLSR≦ 0.04, simultaneously transmission SAR measurement is not necessary
   d) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg
4) For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r02 based on the formula below.
   a) (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.
   b) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   c) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.
   d) Bluetooth estimated SAR is conservatively determined by 5mm separation, for all applicable exposure positions.

Bluetooth Max Power Allowed (dBm)	Bluetooth Max Power Rounded(mW)	Exposure Position	Estimated SAR (W/kg)
2	2	All Positions	0.082

Simultaneous transmission SAR for WIFI and GSM/WCDMA

SAR_{1g}(W/kg) / Test Position	GSM 850	GSM 1900	WCDMA Band II	WCDMA Band V	WIFI	MAX. ΣSAR_{1g}	Peak location separation ratio
Rear Side	**0.273**	0.255	0.272	0.219	0.204	0.477	N/A
Front Side	**0.160**	0.148	0.148	0.150	0.114	0.274	N/A
Left Edge	**0.102**	0.089	0.094	0.081	N/A	0.102	N/A
Right Edge	0.090	0.088	**0.093**	0.083	0.181	0.274	N/A
Top Edge	N/A	N/A	N/A	N/A	0.098	0.098	N/A
Bottom Edge	0.165	0.158	**0.243**	0.212	N/A	0.243	N/A

Note: 1.The value with blue color is estimated by the maximum tune-up power per KDB 447498 D01v05r02.

MAX. ΣSAR_{1g} = 0.477 W/kg<1.6 W/kg, so the Simultaneous transmission SAR with volume scan are not required for WIFI and GSM/WCDMA

Simultaneous transmission SAR for Bluetooth and GSM/WCDMA

SAR_{1g}(W/kg) / Test Position	GSM 850	GSM 1900	WCDMA Band II	WCDMA Band V	Estimated SAR of Bluetooth (W/kg)	MAX. ΣSAR_{1g}	Peak location separation ratio
Rear Side	**0.273**	0.255	0.272	0.219	0.082*	0.355	N/A
Front Side	**0.160**	0.148	0.148	0.150	0.082*	0.242	N/A
Left Edge	**0.102**	0.089	0.094	0.081	N/A	0.102	N/A
Right Edge	0.090	0.088	**0.093**	0.083	0.082*	0.175	N/A
Top Edge	N/A	N/A	N/A	N/A	0.082*	0.082	N/A
Bottom Edge	0.165	0.158	**0.243**	0.212	N/A	0.243	N/A

Note: 1.The value with blue color is estimated by the maximum tune-up power per KDB 447498 D01v05r02.

MAX. ΣSAR_{1g} = 0.355 W/kg <1.6 W/kg, so the Simultaneous transmission SAR with volume scan are not required for BT and GSM/WCDMA

7.3 System Check Results

System Performance Check at 835 MHz Body

Date: 01/25/2016

DUT: Dipole 900MHz; Type: D900V2; Serial: 1d086
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.96 mho/m; εr = 55.88; ρ = 1000 kg/m3
Phantom section: Flat Section

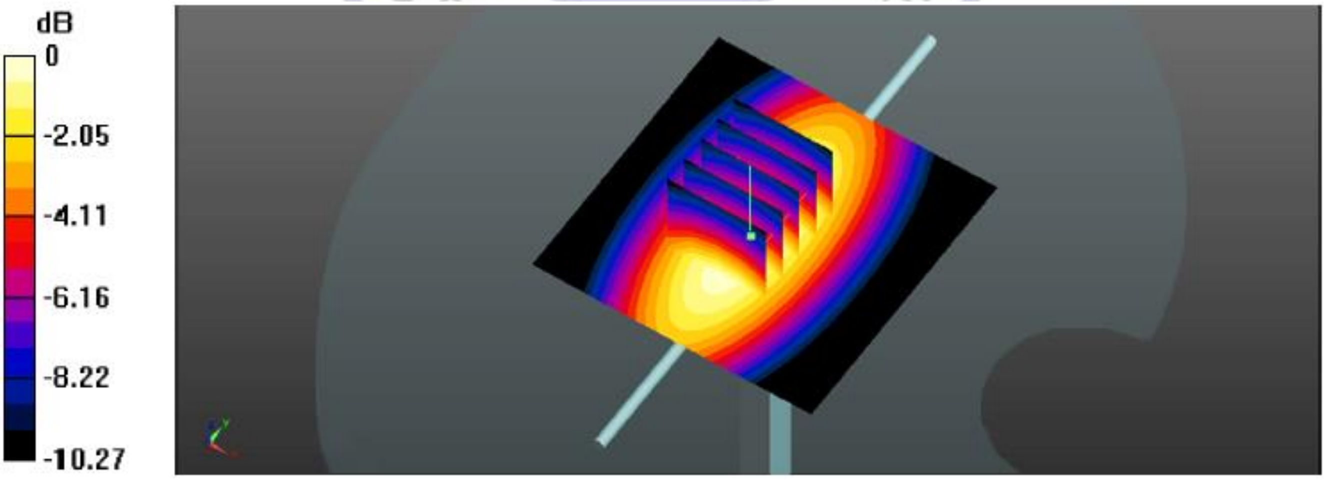
DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF (6.29, 6.29, 6.29); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (61x61x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 3.25 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 46.531 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.568 W/kg

SAR(1 g) = 2.63 W/kg; SAR(10 g) = 1.58 W/kg
Maximum value of SAR (measured) = 3.17 W/kg



0 dB = 3.25 W/kg = 10.24dB W/kg

System Performance Check 835MHz Body 250mW

System Performance Check at 1900 MHz Body

Date: 01/26/2016

DUT: Dipole 1900MHz; Type: D1900V2; Serial: 5d194

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 1900 MHz; σ = 1.57 mho/m; εr = 51.13; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF(4.79, 4.79, 4.79); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (61x61x1): Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 12.49 W/kg

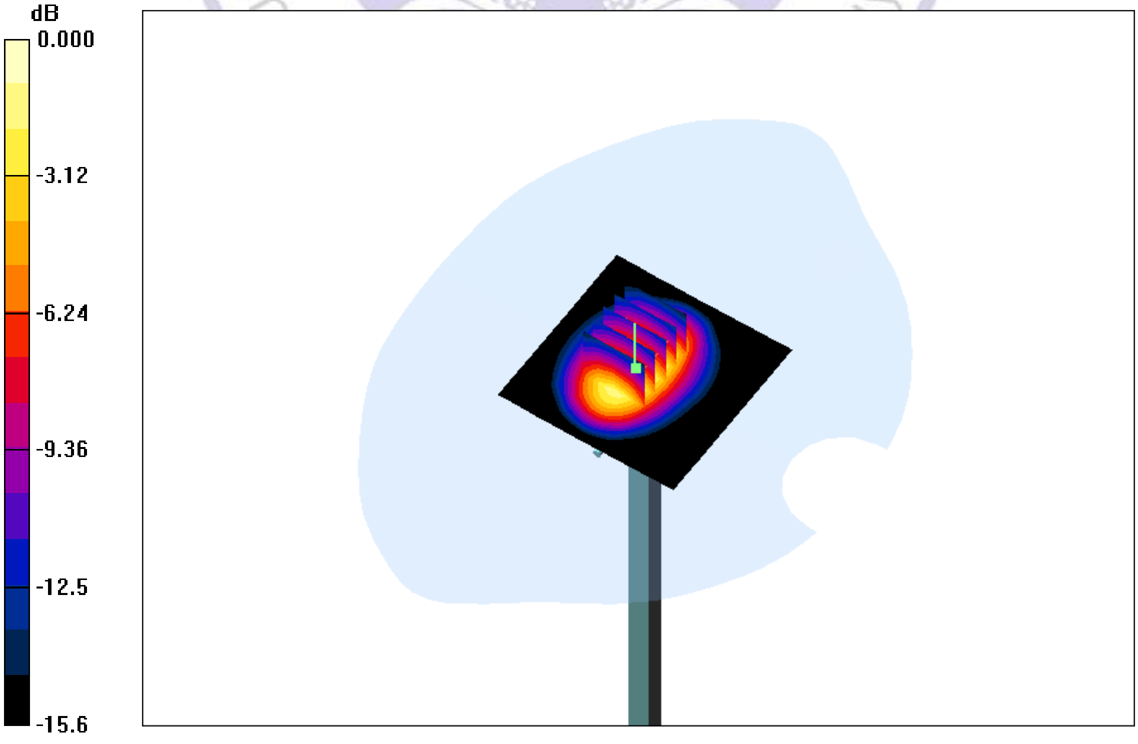
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 83.826 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 16.824 W/kg

SAR (1 g) = 9.83 W/kg; SAR (10 g) = 5.17 W/kg

Maximum value of SAR (measured) = 12.38 W/kg



0 dB = 12.5mW/g

System Performance Check 1900MHz Body 250mW

System Performance Check at 2450 MHz Body

Date: 1/27/2016

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 955

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2450 MHz; σ = 2.01 S/m; εr = 50.74; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF(4.49, 4.49, 4.49); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x81x1): Measurement grid: dx=12.00 mm, dy=12.00 mm

Maximum value of SAR (interpolated) = 16.73 W/kg

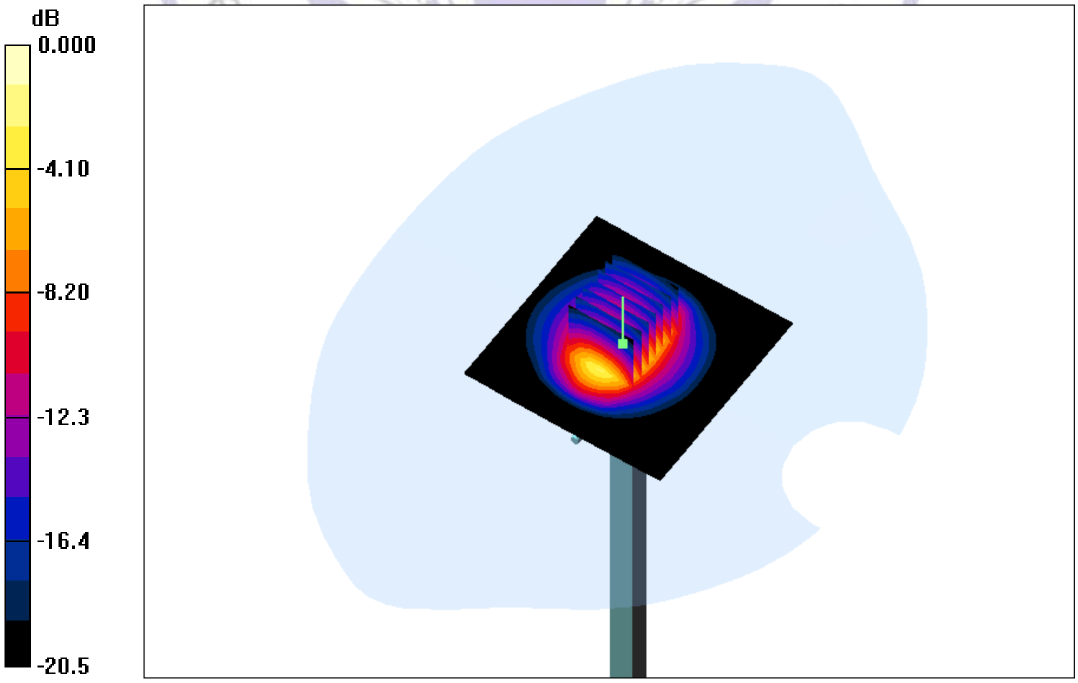
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.982 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 26.51 W/kg

SAR (1 g) = 13.09 mW/g; SAR (10 g) = 6.45 mW/g

Maximum value of SAR (measured) = 16.2 mW/g



0 dB = 16.2mW/g

System Performance Check 2450MHz Body 250mW

7.4 SAR Test Graph Results

GSM850_Rear side_0mm_Middle Channel

Date: 2016-01-25

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f =836.6 MHz; σ = 0.965 mho/m; εr = 55.94; ρ = 1000 kg/m3;
Phantom section: Flat Section

DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF(6.29, 6.29, 6.29); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (58x127x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.768 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.15 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.198 W/kg

SAR(1 g) = 0.263 mW/g; SAR(10 g) = 0.184 mW/g
Maximum value of SAR (measured) = 0.272 mW/g

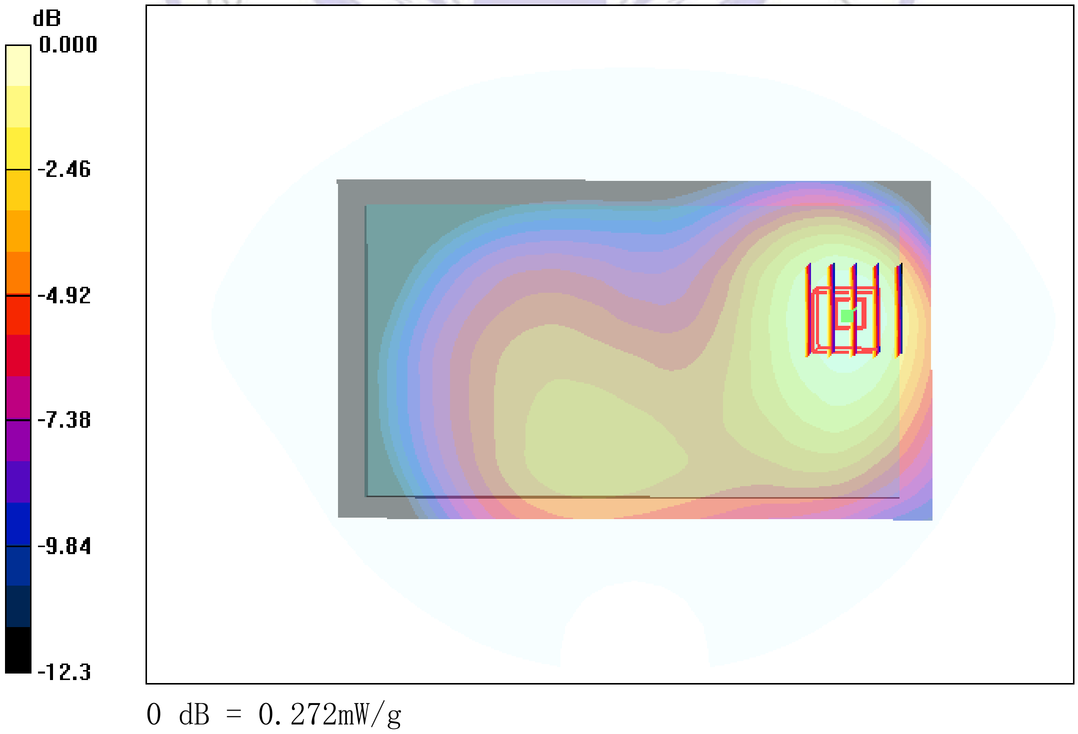


Figure 1: GSM850_Rear side_0mm_Middle Channel

PCS1900_Rear side_0mm_Middle Channel

Date: 2016-01-26

Communication System: PCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1880 MHz; σ = 1.558 mho/m; εr = 50.99; ρ = 1000 kg/m3
Phantom section: Flat Section

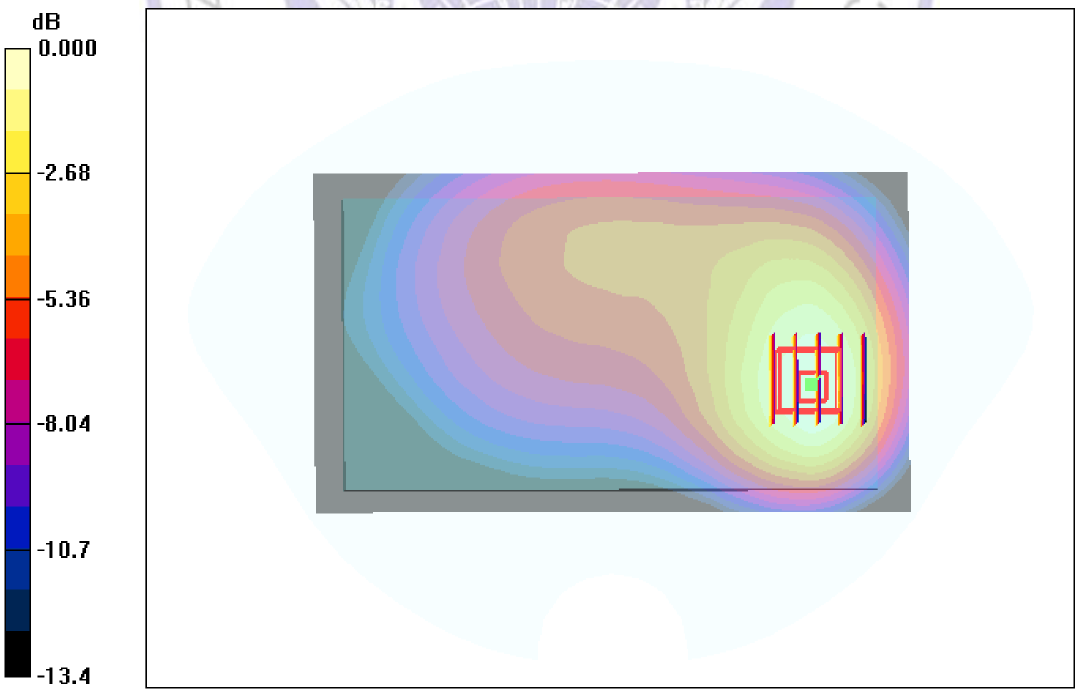
DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF(4.79, 4.79, 4.79); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (58x127x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.622 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.87 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.367 W/kg

SAR(1 g) = 0.249 mW/g; SAR(10 g) = 0.164 mW/g
Maximum value of SAR (measured) = 0.268 mW/g



0 dB = 0.268mW/g

Figure 2: PCS1900_Rear side_0mm_Middle Channel

WCDMA Band II_Rear side_0mm_Middle Channel

Date: 2016-1-26

Communication System: WCDMA B2; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1880 MHz; σ = 1.558 mho/m; εr = 50.99; ρ = 1000 kg/m3
Phantom section: Flat Section

DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF(4.79, 4.79, 4.79); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (58x127x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.291 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.87 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.427 W/kg

SAR(1 g) = 0.259 mW/g; SAR(10 g) = 0.143 mW/g
Maximum value of SAR (measured) = 0.255 mW/g

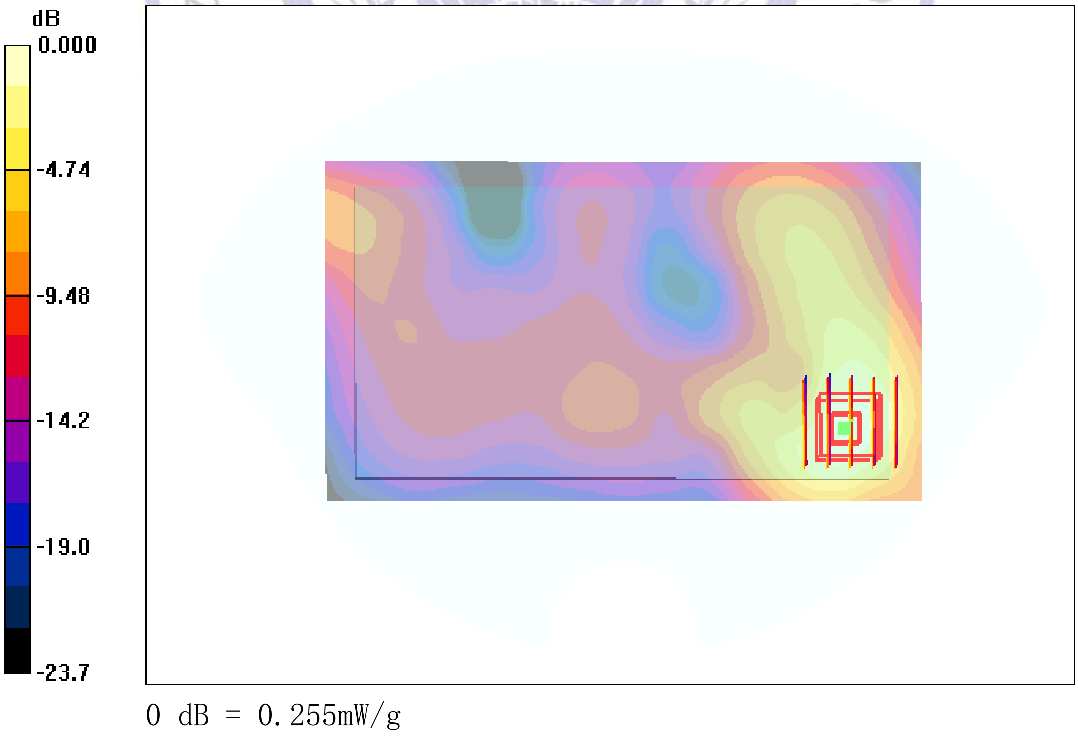


Figure 3: WCDMA Band II_Rear side_0mm_Middle Channel

WCDMA Band V_Rear side_0mm_Middle Channel

Date: 2016-1-25

Communication System: WCDMA B5; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f =836.6 MHz; σ = 0.965 mho/m; εr = 55.94; ρ = 1000 kg/m3;
Phantom section: Flat Section

DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF(6.29, 6.29, 6.29); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (58x127x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.199 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.75 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.312 W/kg

SAR(1 g) = 0.212 mW/g; SAR(10 g) = 0.133 mW/g
Maximum value of SAR (measured) = 0.243 mW/g

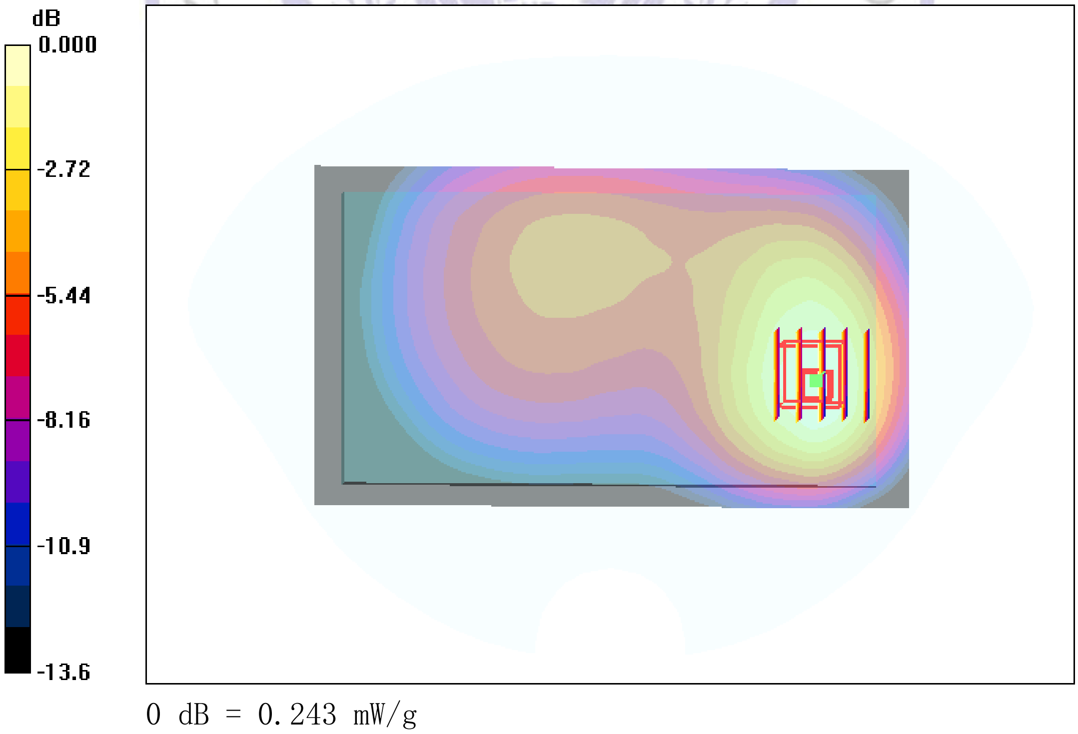


Figure 4: WCDMA Band V_Rear side_0mm_Middle Channel

WLAN_Rear side_0mm_Middle Channel

Date: 2016-01-27

Communication System: 802.11; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.97 mho/m; εr = 52.4; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- •Probe: ES3DV3 - SN3221; ConvF(4.49, 4.49, 4.49); Calibrated: 1/31/2015
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE4 Sn905; Calibrated: 7/16/2015
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (73x158x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.68 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.54 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.288 W/kg

SAR(1 g) = 0.198 mW/g; SAR(10 g) = 0.125 mW/g

Maximum value of SAR (measured) = 0.189 mW/g

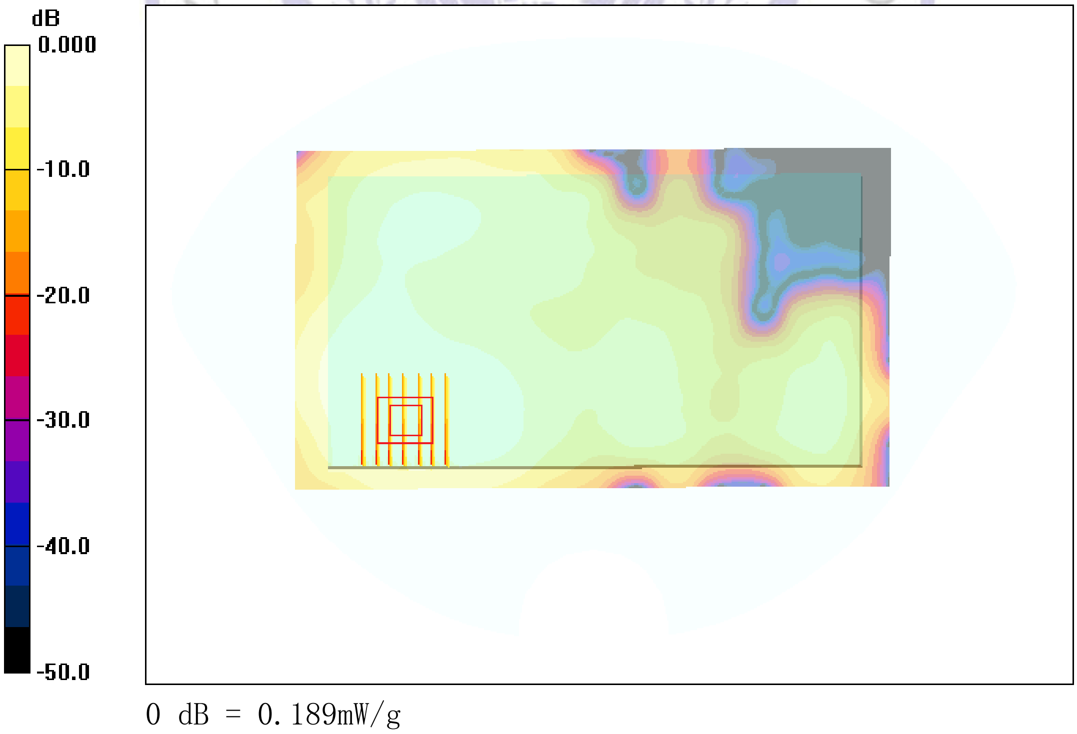


Figure 5: WLAN_Rear side_0mm_Middle Channel