SAR TEST REPORT

Report Reference No.	**LCS180412044-SAR**
Date of Issue	May 02, 2018
Testing Laboratory Name	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Applicant's Name	**Epik One America Corporation**
Address	170 Ocean Lane Dr. #705, Key Biscayne, FL 33149, USA
Test Specification	
Standard	IEEE 1528:2013 47CFR §2.1093
Test Report Form No.	LCSEMC-1.0
TRF Originator	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	Dated 2011-03

Test Item Description.	Smart phone
Trade Mark	EPIK ONE
Model/Type reference.	K400
Listed Models	N/A
Ratings	DC 3.70V
Hardware version	V1.0
Software version	V1.0
Date of Test	Apr. 23, 2018- Apr. 28, 2018
Result	**Pass**

Compiled by:	**Supervised by:**	**Approved by:**
Ada Liang/ File administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

TEST REPORT

Test Report No. :	**CTL1612072101-SAR**	May 02, 2018 Date of issue

Equipment under Test : Smart phone

Model /Type : K400

Listed Models : N/A

Applicant : **Epik One America Corporation**

Address : 170 Ocean Lane Dr. #705, Key Biscayne, FL 33149, USA

Manufacturer : **HUAWO TECHNOLOGY LIMITED**

Address : 3 floor west, B building, New world shopping plaza,Gushu 2nd road, Xixiang street, Baoan District, Shenzhen, 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 **

Revision	Issue Date	Revisions	Revised By
00	May 02, 2018	Initial Issue	Gavin Liang

Contents

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 v03r01: 3G SAR MEAUREMENT PROCEDURES

KDB 941225 D06 Hotspot Mode v02r0: SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES

KDB941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices

1.2 Summary SAR Results

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

Head SAR Configuration

Mode	Test Position	Channel /Frequency(MHz)	(Report 1g SAR(W/Kg)
GSM 850	Left Cheek	190/836.6	0.577
GSM 1900	Right Cheek	661/1880	0.389
WCDMA Band II	Right Cheek	9400/1880	0.383
WCDMA Band V	Left Cheek	4183/836.6	0.326
WLAN2450	Right Cheek	6/2437	0.513

Body-Worn& Hotspot Mode Configuration

Mode	Test Position	Channel /Frequency(MHz)	(Report 1g SAR(W/Kg)
GSM 850	Rear Side	190/836.6	0.650
GSM 1900	Rear Side	661/1880	0.697
WCDMA Band II	Rear Side	9400/1880	0.322
WCDMA Band V	Rear Side	4183/836.6	0.262
WLAN2450	Rear Side	6/2437	0.151

Highest Simultaneous transmission SAR Summary

Exposure Position	Transmission Combination	Highest Simultaneous Maximum SAR(W/Kg)
Rear Side	GSM850+ WIFI	1.080
Rear Side	DCS1900+ BT	0.743

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

Address of the test laboratory
Shenzhen LCS Compliance Testing Laboratory Ltd.
1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China

There is one 3m semi-anechoic chamber fulfils CISPR 16-1-4 according to ANSI C63.10:2013 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

Laboratory accreditation
The test facility is recognized, certified, or accredited by the following organizations:
CNAS Registration Number. is L4595.
FCC Registration Number. is 254912.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001
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	B	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞

	conditions-noise									
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 phone
Model/Type reference:	K400
Power supply:	DC 3.7V from battery
Adapter information:	Model: 0501000EU Input: 100-240V~, 50/60Hz, 0.2A Output: 5V⎓700mA
2G	
Operation Band:	GSM850, PCS1900
Supported type:	GSM/GPRS/EGPRS
Power Class:	GSM850:Power Class 4 PCS1900:Power Class 1
Modulation Type:	GMSK for GSM/GPRS/EGPRS, 8PSK for EGPRS downlink only
GSM Release Version	R99
GPRS Multisport Class	12
EGPRS Multislot Class	12
Antenna type:	PIFA antenna
Antenna gain:	GSM850：-6dBi；GSM900：-5dBi；DCS1800：-5.5dBi；PCS1900：-4.5dBi
WCDMA	
Operation Band:	FDD Band II & Band V
Power Class:	Power Class 3
Modulation Type:	QPSK for WCDMA/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:	PIFA antenna
Antenna gain:	WCDMA 850：-4.5dBi；WCDMA 1900：-5dBi

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:	PIFA antenna
Antenna gain:	-6dBi
Bluetooth	
Supported type:	Bluetooth BR/EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	PIFA antenna
Antenna gain:	-6dBi
Bluetooth LE	
Supported type:	Bluetooth low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz
Antenna type:	PIFA antenna
Antenna gain:	-6dBi

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	1315	2017/07/26	1
E-field Probe	SPEAG	EX3DV4	3836	2017/07/07	1
System Validation Dipole D835V2	SPEAG	D835V2	4d069	2016/07/20	3
System Validation Dipole 1900V2	SPEAG	D1900V2	5d155	2016-04-14	3
System Validation Dipole 2450V2	SPEAG	D2450V2	869	2016-06-21	3
Network analyzer	Agilent	E5071B	MY42404001	2017-07-25	1
Communication Tester	R&S	CMW500	116581	2017-07-25	1
Dielectric Probe Kit	Agilent	85070E	NA#F-EP-007 77	/	/
Power meter	Agilent	NRVD	835843/014	2017-07-25	1
Power meter	Agilent	NRVD	835843/018	2017-07-25	1
Power meter	Agilent	NRVD	835843/021	2017-07-25	1
Power sensor	Agilent	NRV-Z2	100211	2017-07-25	1
Power sensor	Agilent	NRV-Z2	100215	2017-07-25	1
Power sensor	Agilent	NRV-Z2	100219	2017-07-25	1
Signal generator	ROHDE & SCHWARZ	SME03	100029	2017-07-25	1
Amplifier	AR	2HL-42W-S	100206	/	/

Note:
Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with following criteria at least on annual interval.

a) There is no physical damage on the dipole;
b) System check with specific dipole is within 10% of calibrated values;
c) The most recent return-loss results, measured at least annually, deviates by no more than 20% from the previous measurement;
d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 50 Ω from the previous measurement.

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.

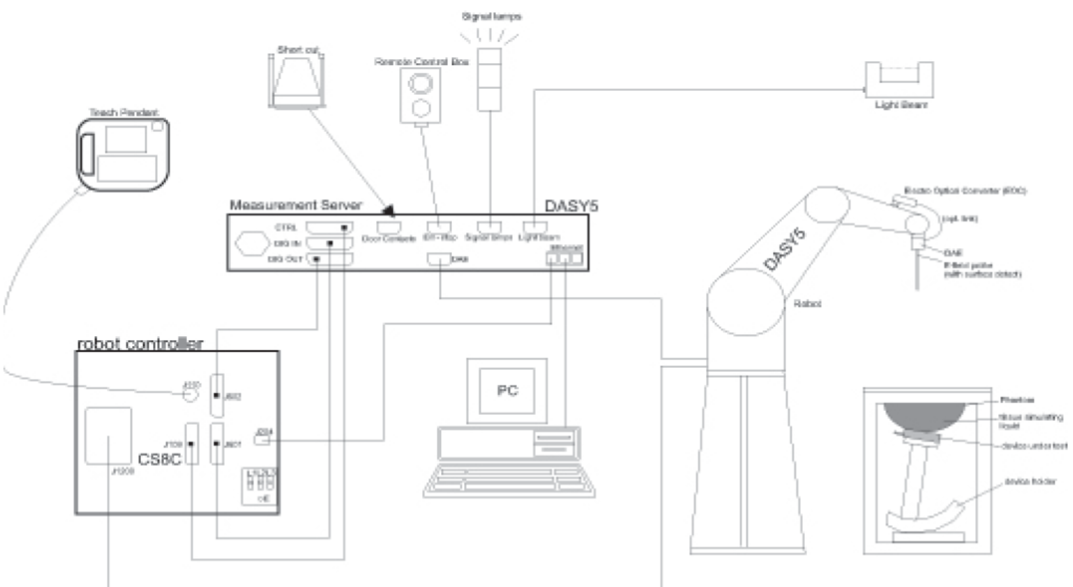
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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.

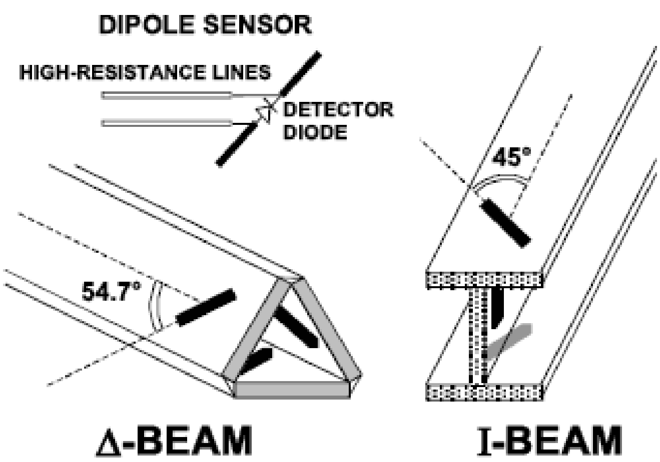
Probe Specification

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.

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:

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

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

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.

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

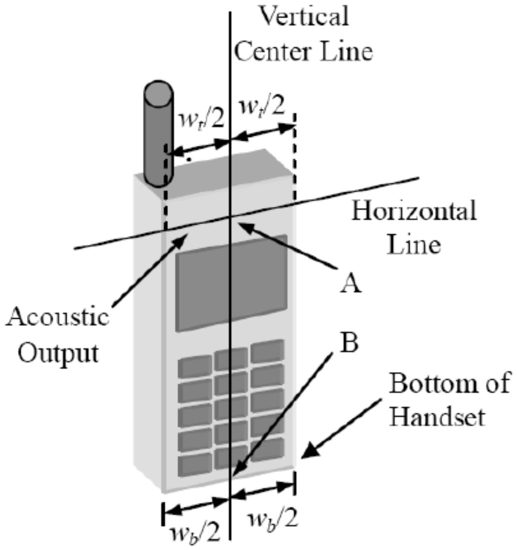
with SAR = local specific absorption rate in mW/g
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

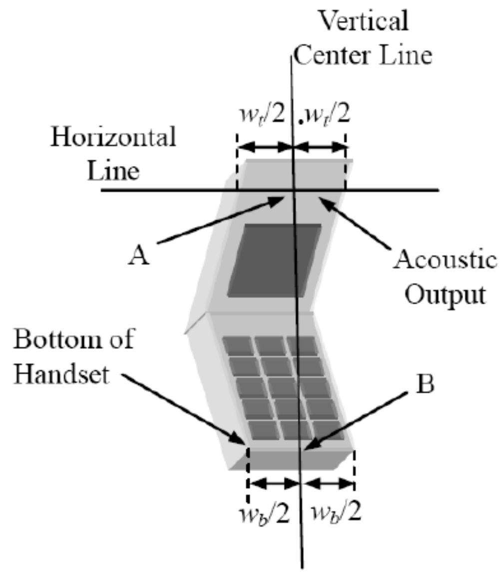
Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

3 Position of the wireless device in relation to the phantom

3.1 General considerations

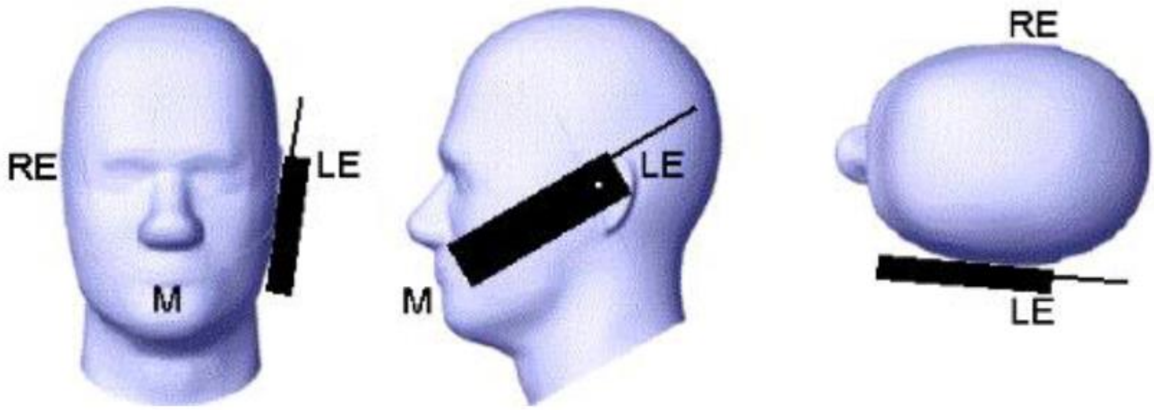
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



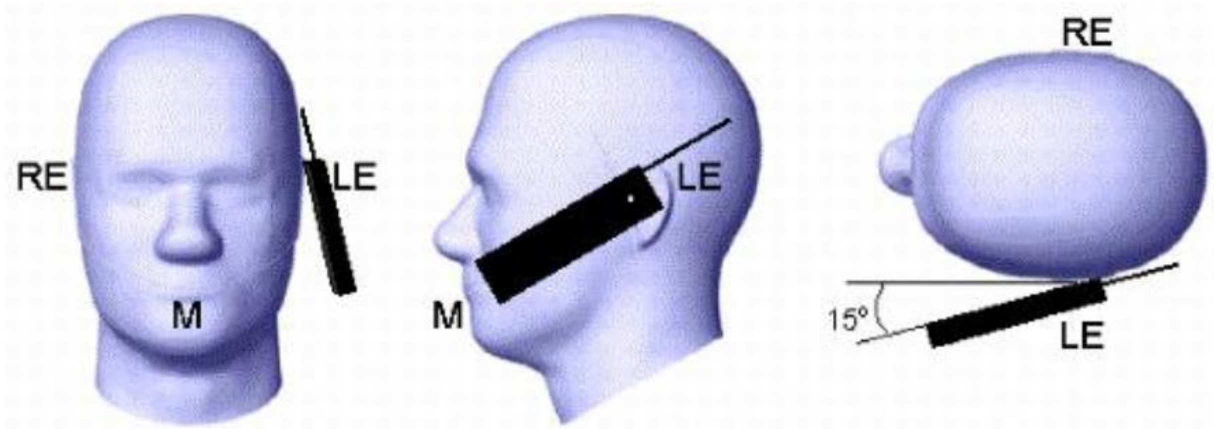


W_t Width of the handset at the level of the acoustic
W_b Width of the bottom of the handset
A Midpoint of the width w_t of the handset at the level of the acoustic output
B Midpoint of the width w_b of the bottom of the handset

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



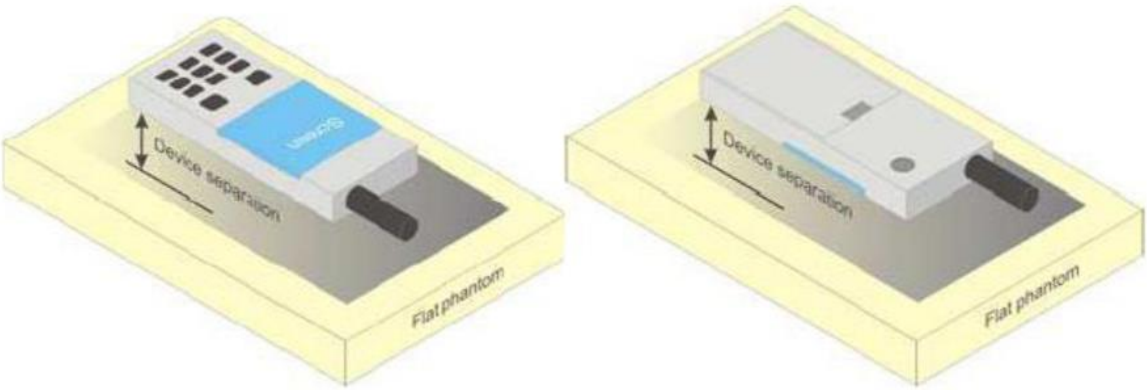
Picture 2 Cheek position of the wireless device on the left side of SAM



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.

Output power Verification

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

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} = β_{hs}/β_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.

<u>2.4 GHz SAR Procedures</u>

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

5.1 Tissue Dielectric Parameters for Head and Body Phantoms

The liquid used for the frequency range of 400-3000 MHz consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table below shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

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

Tissue Dielectric Parameters for Head and Body Phantoms

Ingredient	835MHz		1900MHz		1750 MHz		2450MHz		2600MHz	
(% Weight)	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	41.45	52.5	55.242	69.91	55.782	69.82	62.7	73.2	62.3	72.6
Salt	1.45	1.40	0.306	0.13	0.401	0.12	0.50	0.10	0.20	0.10
Sugar	56	45.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Preventol	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEC	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DGBE	0.00	0.00	44.452	29.96	43.817	30.06	36.8	26.7	37.5	27.3

Targets for tissue simulating liquid

Target Frequency	Head		Body	
(MHz)	ε_r	σ(S/m)	ε_r	σ(S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

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 E5071B.

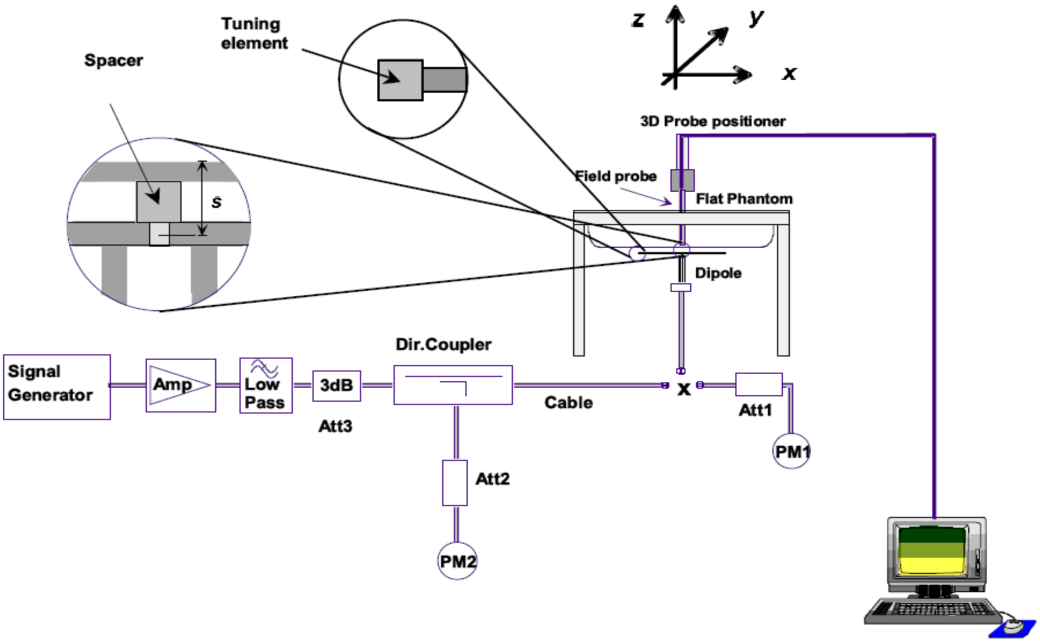
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue				Liquid Temp.	Test Data
		ε_r	σ	ε_r	Dev. (±5%)	σ	Dev. (±5%)		
835H	850	0.90	41.5	0.88	-2.35%	42.23	1.77%	22.3	4/23/2018
1900H	1900	1.40	40.0	1.35	-3.57%	40.15	0.38%	22.6	4/24/2018
2450H	2450	1.80	39.2	1.76	-2.22%	38.91	-0.75%	22.4	4/25/2018
835B	850	0.97	55.2	0.95	-2.06%	54.76	-0.79%	22.6	4/26/2018
1900B	1900	1.52	53.3	1.55	1.97%	53.43	0.25%	22.6	4/27/2018
2450B	2450	1.95	52.7	2.00	2.45%	51.22	-2.81%	22.7	4/28/2018

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 HeadTissue 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	9.44	2.35	9.40	-0.42%	4/23/2018
	1900	4100	9.89	39.56	-3.51%	4/24/2018
	2450	53.50	13.05	52.20	-2.43%	4/25/2018
Note：1. The graph results see Chapter 7.3. 2. Target Values used derive from the calibration certificate						

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	9.69	2.39	9.56	-1.34%	4/26/2018
	1900	39.90	9.97	39.88	-0.05%	4/27/2018
	2450	51.40	12.65	50.60	-1.56%	4/28/2018
Note：1. The graph results see Chapter 7.3. 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)		
		128	190	251			128	190	251
GSM		32.58	32.62	32.53	33	-9.03	23.55	23.59	23.50
GPRS 850 (GMSK)	1Txslot	32.32	32.54	32.56	33	-9.03	23.29	23.51	23.53
	2Txslot	29.78	29.83	29.75	30	-6.02	23.76	23.81	23.73
	3 Txslot	27.50	27.51	27.54	28	-4.26	23.24	23.25	23.28
	4 Txslot	26.32	26.24	26.28	27	-3.01	23.31	23.23	23.27
Mode	**Txslot**	**Burst Average Power (dBm)**			**Tune-up Limit (dBm)**	**Calculation (dB)**	**Frame-Averaged Power (dBm)**		
		512	**661**	**810**			**128**	**190**	**251**
GSM		29.39	29.58	29.44	30	-9.03	20.36	20.55	20.41
GPRS 1900 (GMSK)	1 Txslot	29.25	29.63	29.54	30	-9.03	20.22	20.60	20.51
	2 Txslot	27.89	27.94	27.88	28	-6.02	21.87	21.92	21.86
	3 Txslot	25.20	25.57	25.30	26	-4.26	20.94	21.31	21.04
	4 Txslot	24.19	24.36	24.38	25	-3.01	21.18	21.35	21.37

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/EGPRS measurements are performed with 2Txslots for GPRS/EGPRS 850 and GPRS/EGPRS 1900.

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	23.21	23.68	23.21	24
RMC	12.2kbps RMC	23.24	23.74	23.25	24
HSDPA	Sub - Test 1	22.25	22.34	22.29	23
	Sub - Test 2	21.40	21.36	21.31	22
	Sub - Test 3	21.24	21.32	21.26	22
	Sub - Test 4	20.45	20.54	20.58	21
HSUPA	Sub - Test 1	22.50	22.48	22.35	23
	Sub - Test 2	21.23	21.31	21.48	22
	Sub - Test 3	21.51	21.47	21.57	22
	Sub - Test 4	20.41	20.39	20.32	21
	Sub - Test 5	20.36	20.42	20.41	21

Item	Band	FDD Band V result (dBm)			Tune-up Limit (dBm)
		Test Channel			
	ARFCN	4132	4183	4233	
AMR	12.2kbps AMR	23.32	23.48	23.39	24
RMC	12.2kbps RMC	23.36	23.56	23.41	24
HSDPA	Sub - Test 1	22.15	22.25	22.35	23
	Sub - Test 2	21.35	21.38	21.15	22
	Sub - Test 3	21.14	21.20	21.13	22
	Sub - Test 4	20.15	20.19	20.15	21
HSUPA	Sub - Test 1	22.76	22.69	22.77	23
	Sub - Test 2	21.72	21.75	21.72	22
	Sub - Test 3	21.13	21.17	21.13	22
	Sub - Test 4	20.34	20.46	20.14	21
	Sub - Test 5	20.39	20.55	20.56	21

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 1Mbps	CH6 2Mbps	CH6 5.5Mbps	CH6 11Mbps
CH 1	2412	17.48	16.42	16.35	15.87
CH 6	2437	17.59			
CH 11	2462	17.33			

Conducted Power of 802.11g mode									
Power Comparison of Channels			Power Comparison of Date Rates						
Channel	Frequency (MHz)	Data rate 6Mbps	CH6 9Mbps	CH6 12Mbps	CH6 18Mbps	CH6 24Mbps	CH6 36Mbps	CH6 48MBps	CH6 54Mbps
CH 1	2412	16.54	16.31	15.77	15.25	14.98	14.75	14.52	14.31
CH 6	2437	16.65							
CH 11	2462	16.41							

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	15.25	15.21	15.19	15.08	14.78	14.63	14.52	14.38
CH 6	2437	15.53							
CH 11	2462	15.69							

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	14.35	14.23	14.19	13.88	13.74	13.69	13.54	13.31
CH 6	2437	14.45							
CH 9	2452	14.30							

Conducted Power Measurement Results (Bluetooth)

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power	
			(dBm)	(mW)
GFSK	00	2402	3.106	2.045
	39	2441	2.481	1.771
	78	2480	2.367	1.725
π/4DQPSK	00	2402	2.823	1.916
	39	2441	2.491	1.775
	78	2480	2.110	1.626
8DPSK	00	2402	3.062	2.024
	39	2441	2.243	1.676
	78	2480	2.397	1.737
BLE (GFSK)	00	2402	-3.545	0.442
	19	2440	-4.179	0.382
	39	2480	-4.563	0.350

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

Test Frequency (MHz)	Minimum Separation Distance (mm)	Max. Output Power (dBm)	Output Power with tune up (dBm)	Output Power (mW)	calculated value	exclusion thresholds
2402.00	5	3.106	3.5	2.239	0.7	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 .07 which is≤ 3, SAR testing is not required.

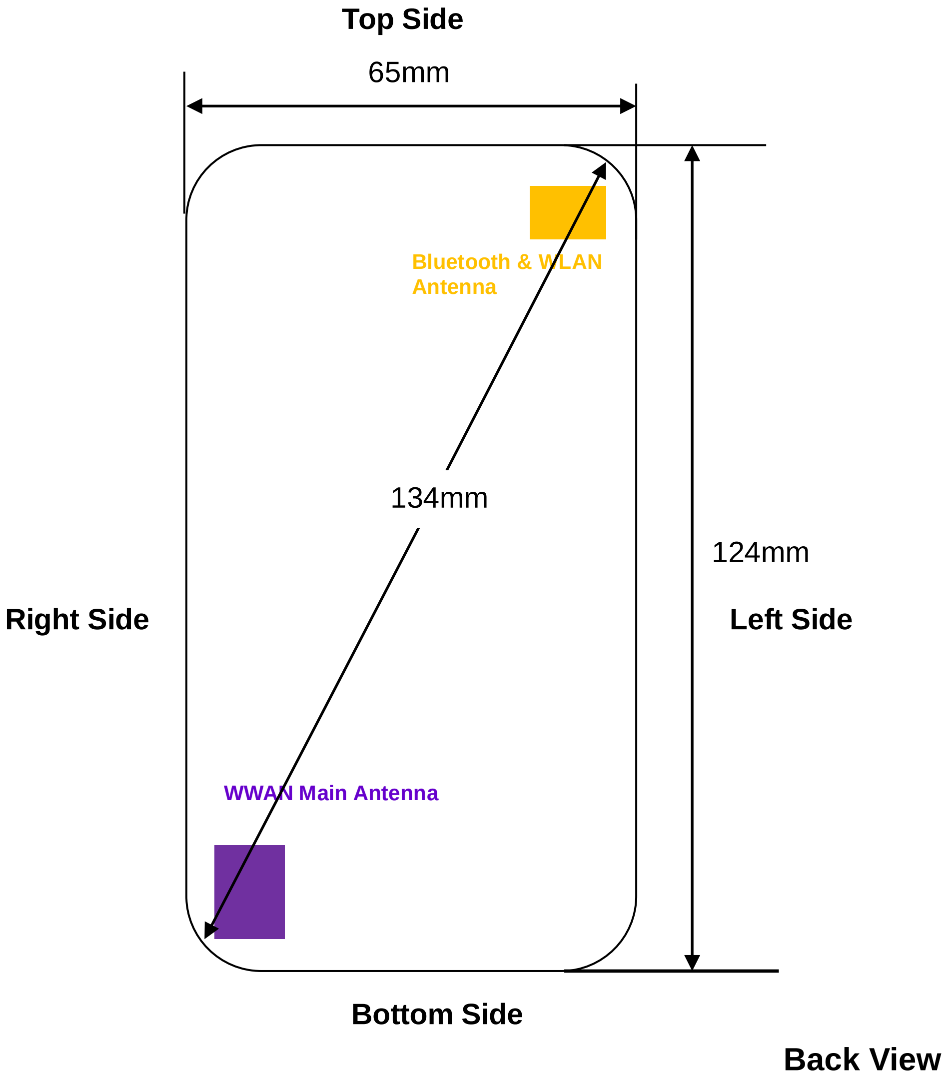
7.2 SAR Test Results Summary

7.2.1 General Remark

1. The DUT is tested using CMW500 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	/	>25mm	/

Positions for SAR tests; Hotspot mode						
Antennas	**Front**	**Back**	**Top Side**	**Bottom Side**	**Left Side**	**Right Side**
BT&WLAN	Yes	Yes	Yes	No	Yes	No
WWAN	Yes	Yes	No	Yes	No	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.

7.2.3 Standalone SAR

SAR Values GSM 850

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 Head										
Left/Cheek	190/836.6	Voice	1:1	33.00	32.62	-0.05	0.529	1.09	0.577	Figure 1
Left/Tilt	190/836.6	Voice	1:1	33.00	32.62	-0.04	0.174	1.09	0.190	N/A
Right/Cheek	190/836.6	Voice	1:1	33.00	32.62	-0.06	0.515	1.09	0.562	N/A
Right/Tilt	190/836.6	Voice	1:1	33.00	32.62	0.03	0.168	1.09	0.183	N/A
Test position of Body-worn accessory(Distance 10mm)										
Rear Side	190/836.6	2Txslots	1:4.15	30.00	29.83	-0.04	0.625	1.04	0.650	Figure 6
Front Side	190/836.6	2Txslots	1:4.15	30.00	29.83	0.05	0.311	1.04	0.323	N/A
Test position of Hotspot Mode (Distance 10mm)										
Rear Side	190/836.6	2Txslots	1:4.15	30.00	29.83	0.04	0.625	1.04	0.650	N/A
Front Side	190/836.6	2Txslots	1:4.15	30.00	29.83	-0.05	0.311	1.04	0.323	N/A
Left Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Right Edge	190/836.6	2Txslots	1:4.15	30.00	29.83	0.06	0.189	1.04	0.197	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	30.00	29.83	-0.02	0.436	1.04	0.453	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]

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 Head										
Left/Cheek	661/1880	Voice	1:1	30.00	29.58	-0.04	0.348	1.10	0.383	N/A
Left/Tilt	661/1880	Voice	1:1	30.00	29.58	-0.03	0.049	1.10	0.054	N/A
Right/Cheek	661/1880	Voice	1:1	30.00	29.58	0.05	0.353	1.10	0.389	Figure 2
Right/Tilt	661/1880	Voice	1:1	30.00	29.58	0.05	0.056	1.10	0.062	N/A
Test position of Body-worn accessory(Distance 10mm)										
Rear Side	661/1880	2Txslots	1:4.15	28.00	27.94	-0.07	0.687	1.01	0.697	Figure.7
Front Side	661/1880	2Txslots	1:4.15	28.00	27.94	0.05	0.398	1.01	0.404	N/A
Test position of Hotspot Mode (Distance 10mm)										
Rear Side	661/1880	2Txslots	1:4.15	28.00	27.94	-0.07	0.687	1.01	0.697	N/A
Front Side	661/1880	2Txslots	1:4.15	28.00	27.94	0.05	0.398	1.01	0.404	N/A
Left Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Right Edge	661/1880	2Txslots	1:4.15	28.00	27.94	0.04	0.245	1.01	0.248	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	28.00	27.94	-0.02	0.398	1.01	0.404	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 V]

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 Head										
Left/Cheek	4183/836.6	RMC 12.2K	1:1	24.00	23.56	-0.05	0.295	1.11	0.326	Figure 3
Left/Tilt	4183/836.6	RMC 12.2K	1:1	24.00	23.56	-0.03	0.098	1.11	0.108	N/A
Right/Cheek	4183/836.6	RMC 12.2K	1:1	24.00	23.56	-0.05	0.287	1.11	0.318	N/A
Right/Tilt	4183/836.6	RMC 12.2K	1:1	24.00	23.56	0.05	0.062	1.11	0.069	N/A
Test position of Body-worn accessory(Distance 10mm)										
Rear Side	4183/836.6	RMC 12.2K	1:1	24.00	23.56	0.05	0.237	1.11	0.262	Figure.8
Front Side	4183/836.6	RMC 12.2K	1:1	24.00	23.56	-0.05	0.114	1.11	0.126	N/A
Test position of Hotspot Mode (Distance 10mm)										
Rear Side	4183/836.6	RMC 12.2K	1:1	24.00	23.56	0.05	0.237	1.11	0.262	N/A
Front Side	4183/836.6	RMC 12.2K	1:1	24.00	23.56	-0.05	0.114	1.11	0.126	N/A
Left Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Right Edge	4183/836.6	RMC 12.2K	1:1	24.00	23.56	0.05	0.098	1.11	0.108	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	24.00	23.56	-0.07	0.168	1.11	0.186	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]

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 Head										
Left/Cheek	9400/1880	RMC 12.2K	1:1	24.00	23.74	-0.06	0.359	1.06	0.381	N/A
Left/Tilt	9400/1880	RMC 12.2K	1:1	24.00	23.74	-0.05	0.141	1.06	0.150	N/A
Right/Cheek	9400/1880	RMC 12.2K	1:1	24.00	23.74	-0.11	0.361	1.06	0.383	Figure 4
Right/Tilt	9400/1880	RMC 12.2K	1:1	24.00	23.74	0.03	0.137	1.06	0.145	N/A
Test position of Body-worn accessory(Distance 10mm)										
Rear Side	9400/1880	RMC 12.2K	1:1	24.00	23.74	-0.10	0.303	1.06	0.322	Figure.9
Front Side	9400/1880	RMC 12.2K	1:1	24.00	23.74	0.08	0.158	1.06	0.168	N/A
Test position of Hotspot Mode (Distance 10mm)										
Rear Side	9400/1880	RMC 12.2K	1:1	24.00	23.74	-0.10	0.303	1.06	0.322	N/A
Front Side	9400/1880	RMC 12.2K	1:1	24.00	23.74	0.08	0.158	1.06	0.168	N/A
Left Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Right Edge	9400/1880	RMC 12.2K	1:1	24.00	23.74	0.05	0.086	1.06	0.091	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	24.00	23.74	-0.08	0.169	1.06	0.179	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 [WIFI2.4G]

Test Position	Channel/ Frequency (MHz)	Service	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 Head										
Left/Cheek	6/2437	DSSS	1:1	18.00	17.59	-0.07	0.458	1.10	0.503	N/A
Left/Tilt	6/2437	DSSS	1:1	18.00	17.59	-0.04	0.387	1.10	0.425	N/A
Right/Cheek	6/2437	DSSS	1:1	18.00	17.59	-0.11	0.467	1.10	0.513	Figure 5
Right/Tilt	6/2437	DSSS	1:1	18.00	17.59	0.05	0.392	1.10	0.431	N/A
Test position of Body-worn accessory(Distance 10mm)										
Rear Side	6/2437	DSSS	1:1	18.00	17.59	-0.03	0.137	1.10	0.151	Figure.10
Front Side	6/2437	DSSS	1:1	18.00	17.59	0.06	0.087	1.10	0.096	N/A
Test position of Hotspot Mode (Distance 10mm)										
Rear Side	6/2437	DSSS	1:1	18.00	17.59	-0.03	0.137	1.10	0.151	N/A
Front Side	6/2437	DSSS	1:1	18.00	17.59	0.06	0.087	1.10	0.096	N/A
Left Edge	6/2437	DSSS	1:1	18.00	17.59	0.05	0.057	1.10	0.063	N/A
Right Edge	6/2437	DSSS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Top Edge	6/2437	DSSS	1:1	18.00	17.59	0.05	0.049	1.10	0.054	N/A
Bottom Edge	6/2437	DSSS	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. Duty cycle is 100% during the test.

Remark: The highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power was 0.456 W/Kg(0.513*(16/18)=0.343) So ODFM SAR test is not required.

7.2.4 Simultaneous SAR Evaluation

Application Simultaneous Transmission information:

Mode	Air-Interface
1	GSM+BT
2	GSM+WLAN
3	WCDMA+BT
4	WCDMA +WLAN

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.

Estimated stand alone SAR					
Communication system	Frequency (MHz)	Configuration	Maximum Power (including tune-up tolerance) (dBm)	Separation Distance (mm)	Estimated SAR_{1-g} (W/kg)
Bluetooth*	2402	Head	3.5	5	0.093
Bluetooth*	2402	Hotspot	3.5	10	0.046
Bluetooth*	2402	Body Worn	3.5	10	0.046

Simultaneous transmission SAR for WIFI and GSM/WCDMA

SAR_{1g}(W/kg) / Test Position	GSM 850	GSM 1900	WCDMA Band V	WCDMA Band II	WIFI	MAX. ΣSAR_{1g}	Peak location separation ratio
Left, Cheek	0.577	0.383	0.326	0.381	0.503	1.080	N/A
Left, Tilt	0.190	0.054	0.108	0.150	0.425	0.615	N/A
Right, Cheek	0.562	0.389	0.318	0.383	0.513	1.075	N/A
Right, Tilt	0.183	0.062	0.069	0.145	0.431	0.614	N/A
Rear Side	0.650	0.697	0.262	0.322	0.151	0.848	N/A
Front Side	0.323	0.404	0.126	0.168	0.096	0.500	N/A
Left Edge	N/A	N/A	N/A	N/A	0.063	0.063	N/A
Right Edge	0.197	0.248	0.108	0.091	N/A	0.248	N/A
Top Edge	N/A	N/A	N/A	N/A	0.054	0.054	N/A
Bottom Edge	0.453	0.404	0.186	0.179	N/A	0.453	N/A

MAX. ΣSAR_{1g} = 1.080 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 V	WCDMA Band II	BT	MAX. ΣSAR_{1g}	Peak location separation ratio
Left, Cheek	0.577	0.383	0.326	0.381	0.093	0.670	N/A
Left, Tilt	0.190	0.054	0.108	0.150	0.093	0.283	N/A
Right, Cheek	0.562	0.389	0.318	0.383	0.093	0.655	N/A
Right, Tilt	0.183	0.062	0.069	0.145	0.093	0.276	N/A
Rear Side	0.650	0.697	0.262	0.322	0.046	0.743	N/A
Front Side	0.323	0.404	0.126	0.168	0.046	0.450	N/A
Left Edge	N/A	N/A	N/A	N/A	0.046	0.046	N/A
Right Edge	0.197	0.248	0.108	0.091	0.046	0.294	N/A
Top Edge	N/A	N/A	N/A	N/A	0.046	0.046	N/A
Bottom Edge	0.453	0.404	0.186	0.179	0.046	0.499	N/A

MAX. ΣSAR_{1g} = 0.743 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 Head

Date: 4/23/2018

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d069

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f =835MHz; σ = 0.90 mho/m; εr = 41.5; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(9.42, 9.42, 9.42); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 2.82 mW/g

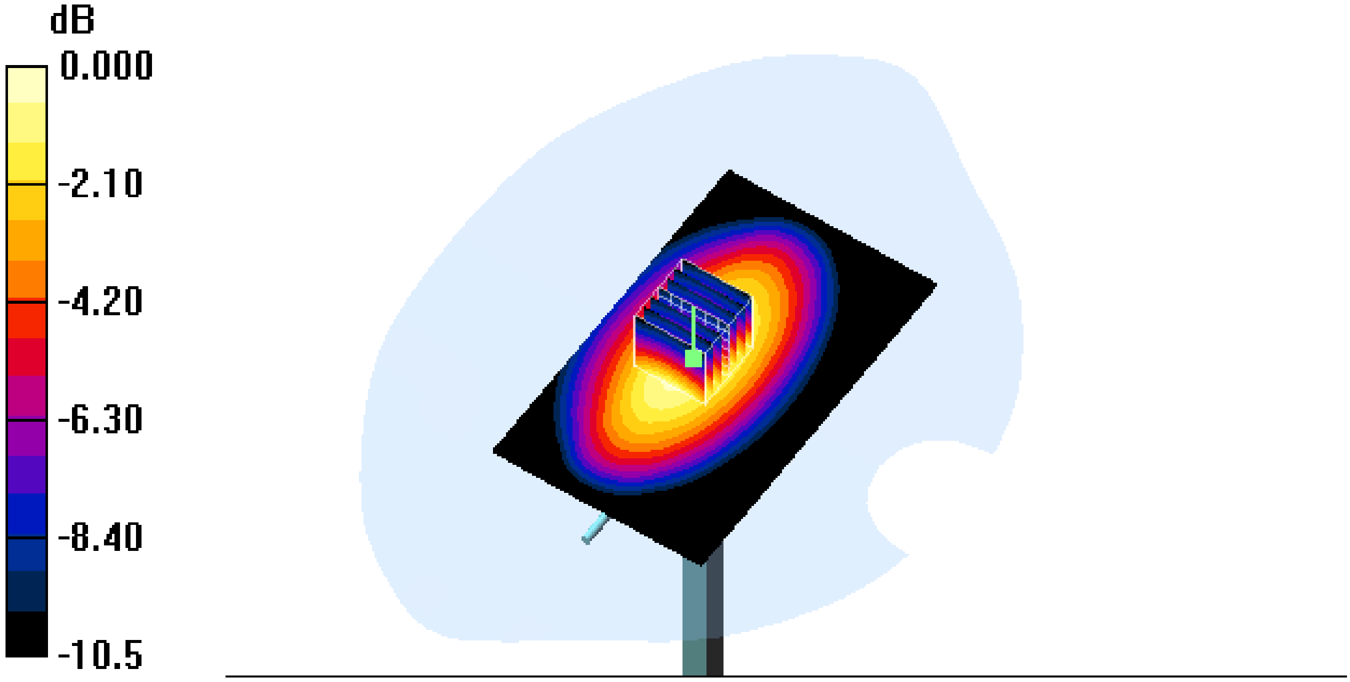
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 54.523 V/m; Power Drift = -0.01dB

Peak SAR (extrapolated) = 4.068 W/kg

SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.68 mW/g

Maximum value of SAR (measured) = 2.90 mW/g



0 dB = 2.90mW/g

System Performance Check 835MHz Head 250mW

System Performance Check at 835 MHz Body

Date: 4/26/2018

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d069

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f =835MHz; σ = 0.97 mho/m; εr = 55.2; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(9.25, 9.25, 9.25); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 2.72 mW/g

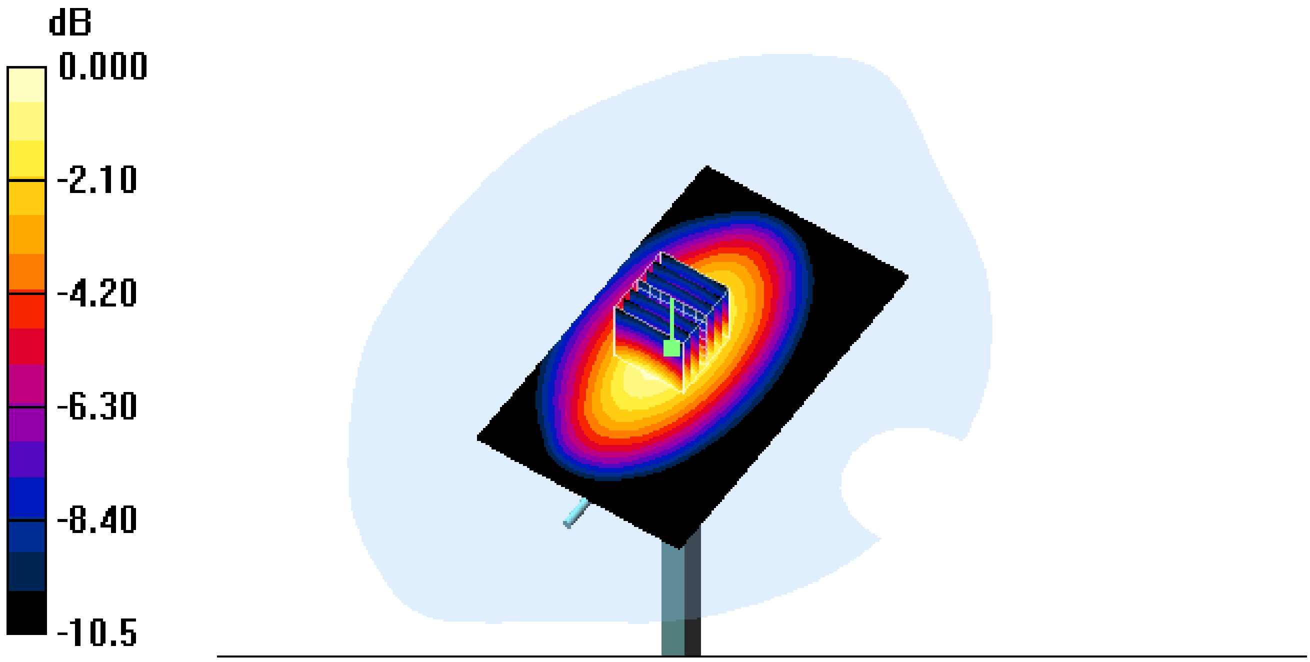
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 54.523 V/m; Power Drift = -0.01dB

Peak SAR (extrapolated) = 4.068 W/kg

SAR(1 g) = 2.39 mW/g; SAR(10 g) = 1.55 mW/g

Maximum value of SAR (measured) = 2.81 mW/g



0 dB = 2.81mW/g

System Performance Check 835MHz Body 250mW

System Performance Check at 1900 MHz Head

Date: 4/24/2018

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

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

Medium parameters used: f =1900MHz; σ = 1.40 mho/m; εr = 40.0; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.60, 7.60, 7.60); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 11.3 mW/g

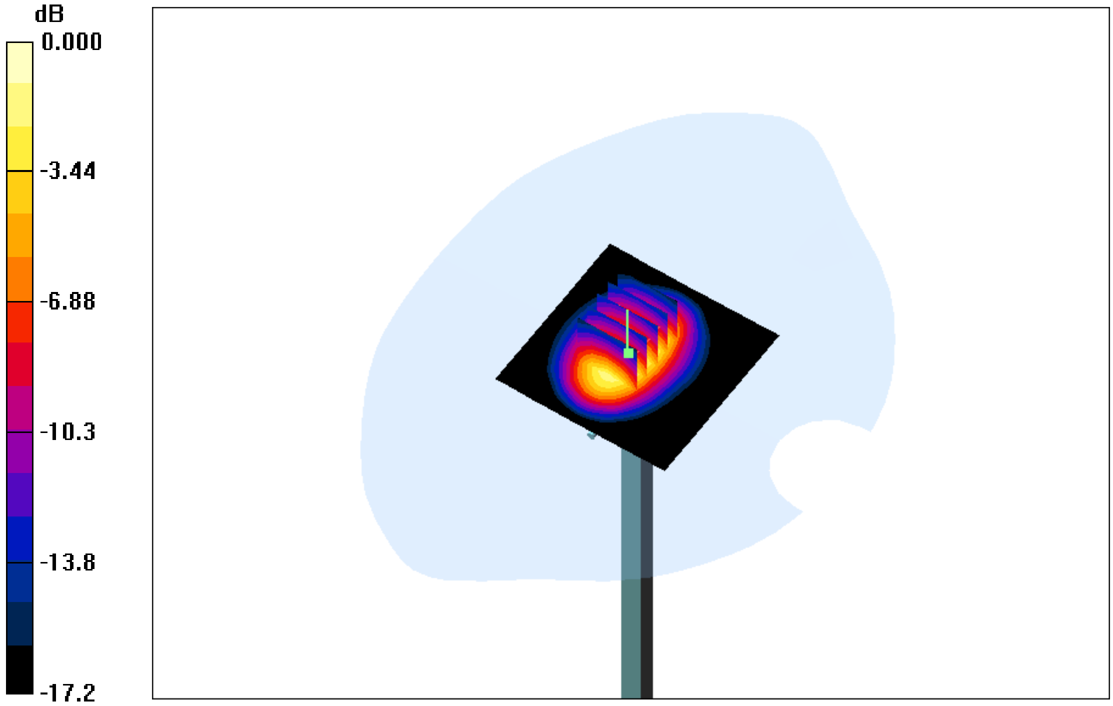
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 80.6 V/m; Power Drift = -0.005 dB

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 9.89 mW/g; SAR(10 g) = 5.28 mW/g

Maximum value of SAR (measured) = 11.24 mW/g



0 dB = 11.24mW/g

System Performance Check 1900MHz Head 250mW

System Performance Check at 1900 MHz Body

Date: 4/27/2018

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

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

Medium parameters used: f =1900MHz; σ = 1.52 mho/m; εr = 53.3; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.33, 7.33, 7.33); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 12.8 mW/g

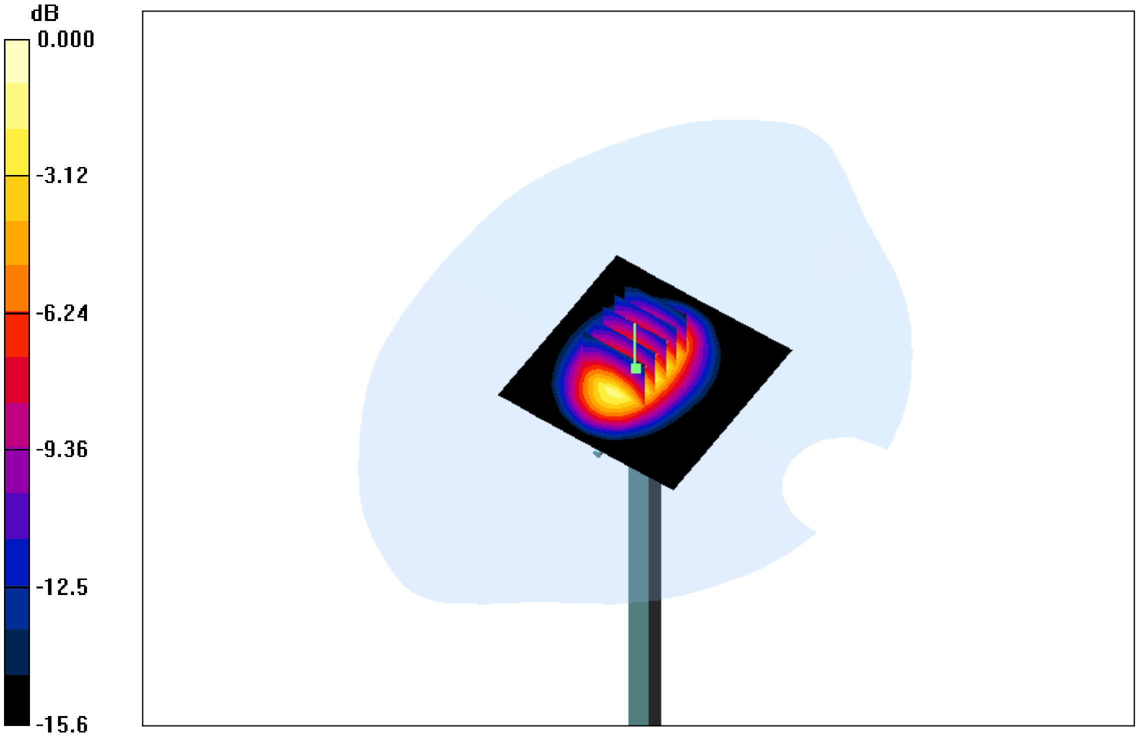
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 85.9 V/m; Power Drift = 0.109 dB

Peak SAR (extrapolated) = 19.7 W/kg

SAR(1 g) = 9.97 mW/g; SAR(10 g) = 5.39 mW/g

Maximum value of SAR (measured) = 12.47 mW/g



0 dB = 12.47mW/g

System Performance Check 1900MHz Body 250mW

System Performance Check at 2450 MHz Head

Date: 4/25/2018

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

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

Medium parameters used: f =2450MHz; σ = 1.80 mho/m; εr = 39.2; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.07, 7.07, 7.07); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 16.7 mW/g

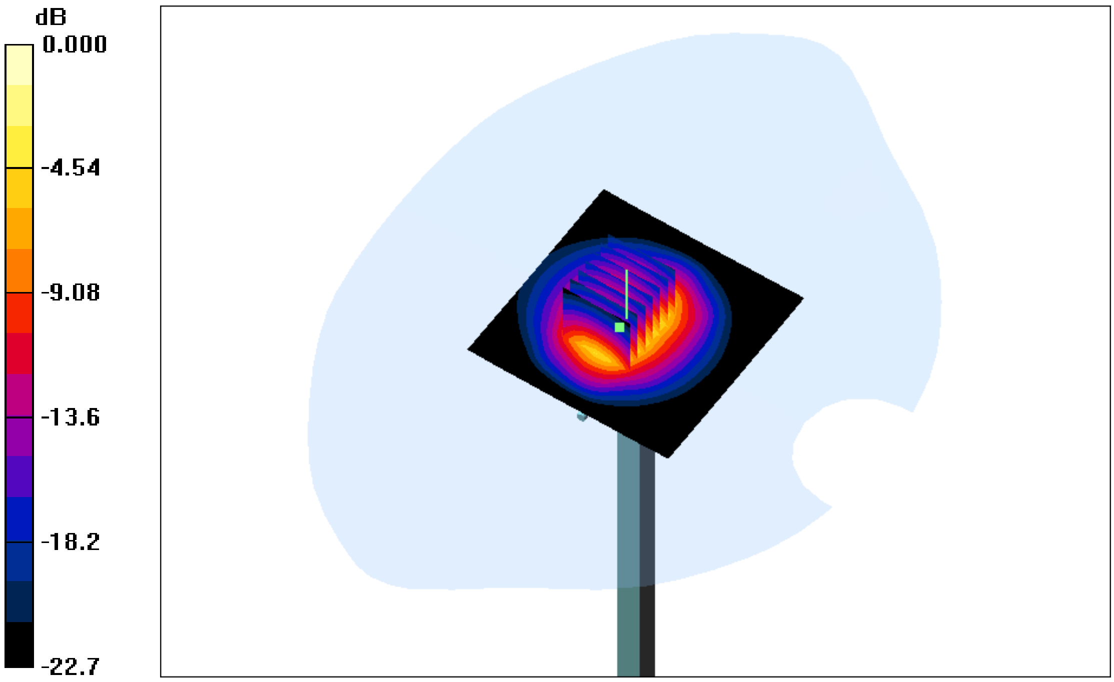
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 87.0 V/m; Power Drift = 0.019 dB

Peak SAR (extrapolated) = 30.7 W/kg

SAR(1 g) = 13.05 mW/g; SAR(10 g) = 6.24 mW/g

Maximum value of SAR (measured) = 16.07 mW/g



0 dB = 16.07mW/g

System Performance Check 2450MHz Head 250mW

System Performance Check at 2450MHz Body

Date: 4/28/2018

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

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

Medium parameters used: f =2450MHz; σ = 1.95 mho/m; εr = 52.7; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.20, 7.20, 7.20); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 16.2 mW/g

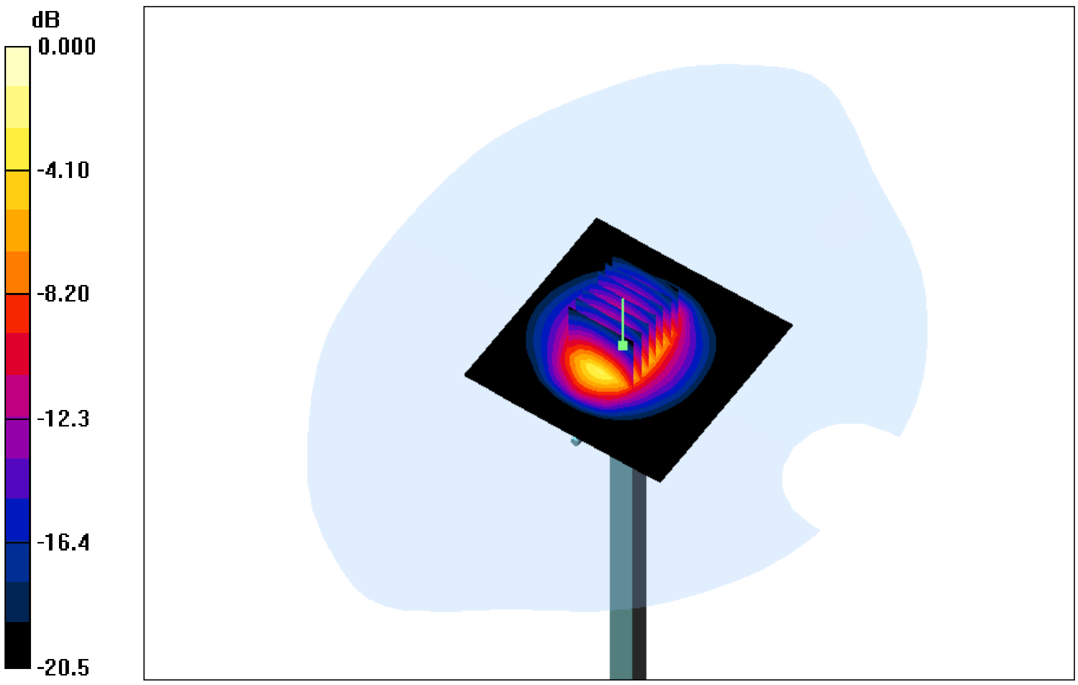
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 89.5 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 12.65 mW/g; SAR(10 g) = 6.47 mW/g

Maximum value of SAR (measured) = 15.59 mW/g



0 dB = 15.59mW/g

System Performance Check 2450MHz Body 250mW

7.4 SAR Test Graph Results

GSM850_GSM Voice_Left Cheek_Middle Channel

Date: 4/23/2018

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.883 mho/m; εr = 41.25; ρ = 1000 kg/m3
Phantom section: Left Section

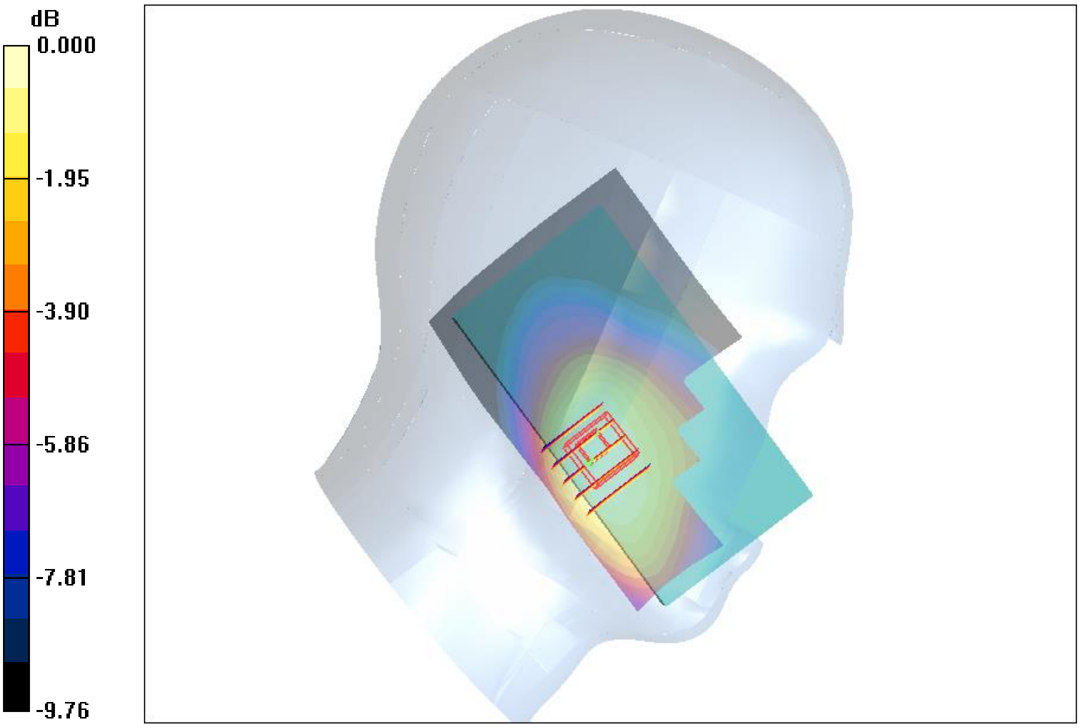
DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(9.42, 9.42, 9.42); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.538 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.42 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.566 W/kg

SAR(1 g) = 0.529 mW/g; SAR(10 g) = 0.399 mW/g
Maximum value of SAR (measured) = 0.544 mW/g



0 dB = 0.544mW/g

Figure 1: GSM850_GSM Voice_Left Cheek_Middle Channel

GSM1900_GSM Voice_ Right Cheek_Mid Channel

Date: 4/24/2018

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 1880 MHz; σ = 1.405 mho/m; εr = 39.62; ρ = 1000 kg/m3

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.60, 7.60, 7.60); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.356 mW/g

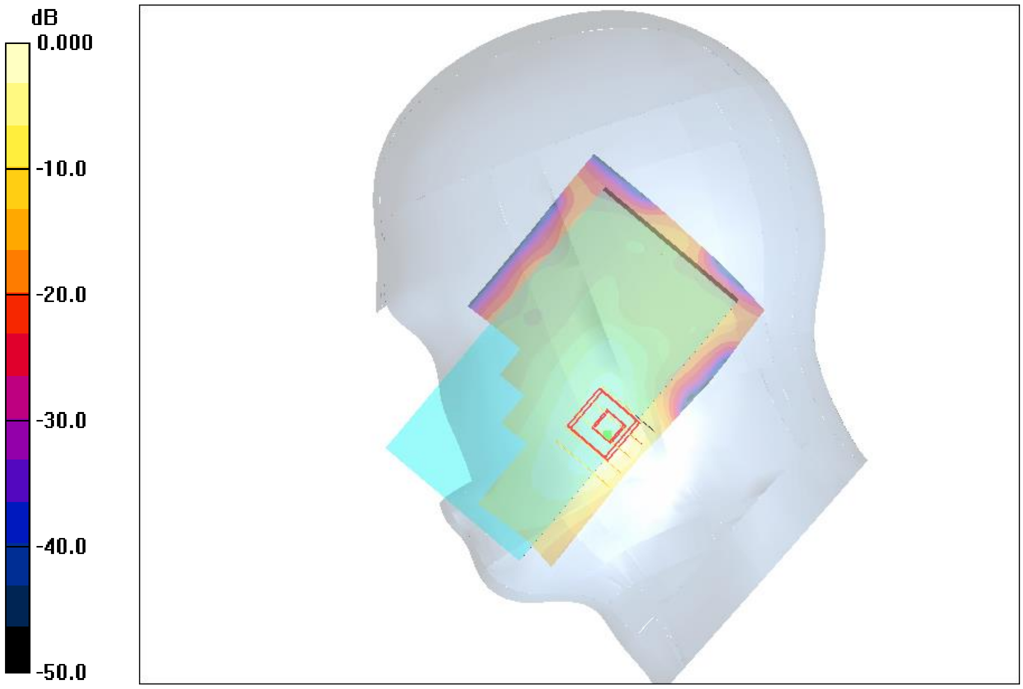
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.50 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.390 W/kg

SAR(1 g) = 0.353 mW/g; SAR(10 g) = 0.129 mW/g

Maximum value of SAR (measured) = 0.359 mW/g



0 dB = 0.359mW/g

Figure 2: GSM1900_GSM Voice_Right Cheek_Mid Channel

WCDMA Band V_RCM _Left Check_Middle Channel

Date: 4/23/2018

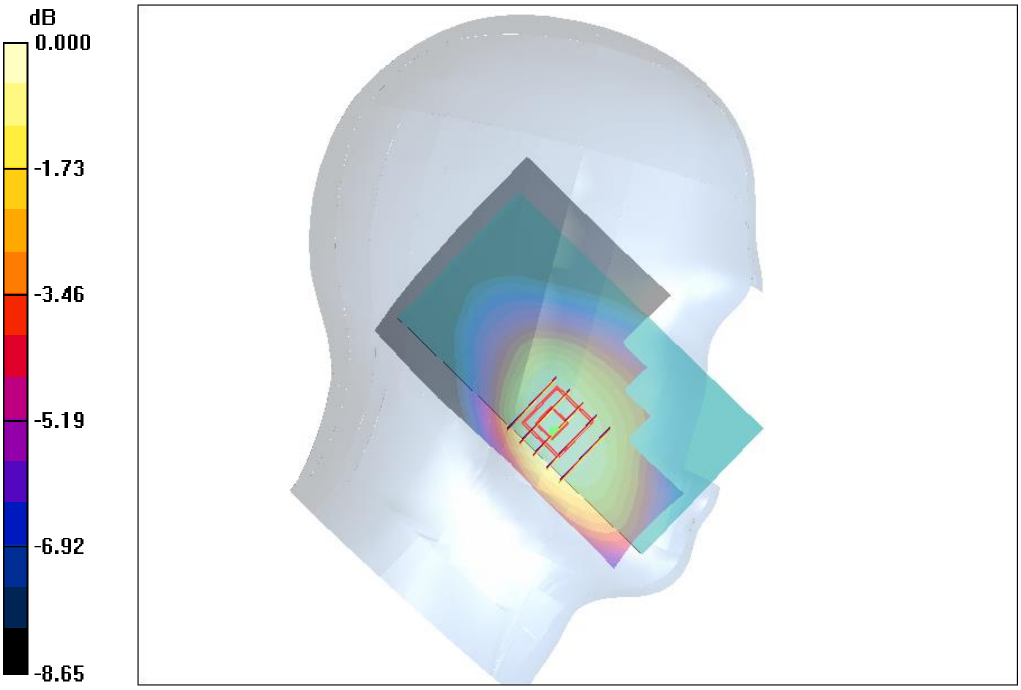
Communication System: W850; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 835 MHz; σ = 0.898 mho/m; εr = 41.4; ρ = 1000 kg/m3
Phantom section: Left Section

- Probe: ES3DV4 – SN3836;ConvF(9.42, 9.42, 9.42); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.301 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.60 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.317 W/kg

SAR(1 g) = 0.295 mW/g; SAR(10 g) = 0.073 mW/g
Maximum value of SAR (measured) = 0.298 mW/g



0 dB = 0.298mW/g

Figure 3: WCDMA Band V_RCM _Left Check_Middle Channel

WCDMA Band II_RCM _Left Check_Middle Channel

Date: 4/24/2018

Communication System: W1900; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1880 MHz; σ = 1.36 mho/m; εr = 39.8; ρ = 1000 kg/m3
Phantom section: Right Section

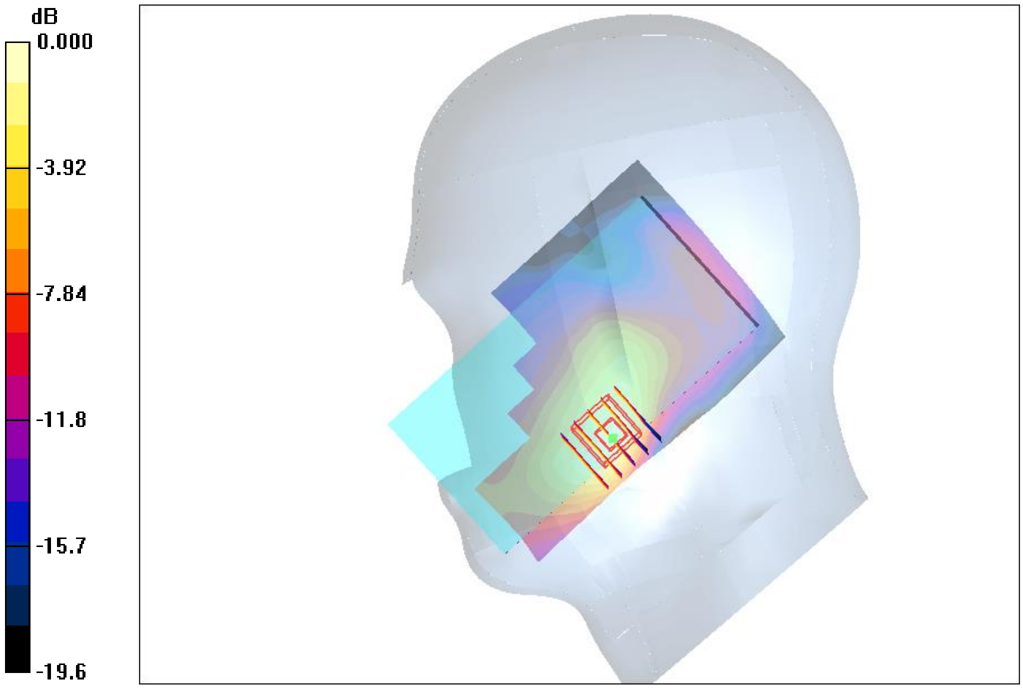
DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.60, 7.60, 7.60); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.274 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.04 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.303 W/kg

SAR(1 g) = 0.361 mW/g; SAR(10 g) = 0.134 mW/g
Maximum value of SAR (measured) = 0.367 mW/g



0 dB = 0.367mW/g

Figure 4: WCDMA Band II_RCM _Right Check_Middle Channel

WLAN _ Right Check _ Middle Channel

Date: 4/25/2018

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

Medium parameters used: f = 2437 MHz; σ = 1.84 mho/m; εr = 38.7; ρ = 1000 kg/m3

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.07, 7.07, 7.07); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.588 mW/g

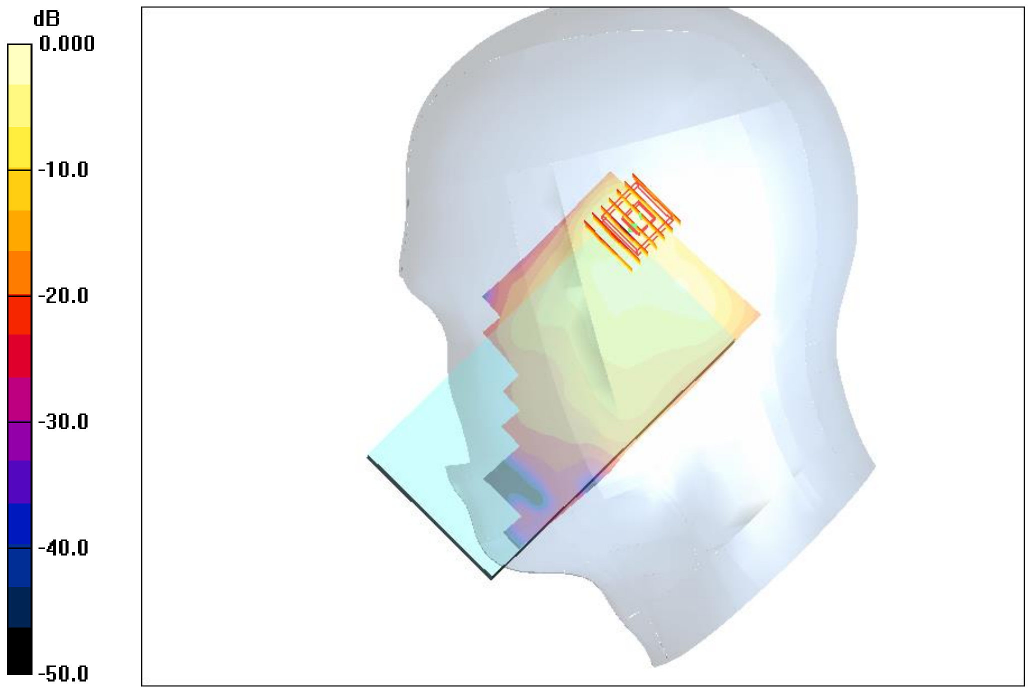
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.47 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0716 W/kg

SAR(1 g) = 0.467 mW/g; SAR(10 g) = 0.277 mW/g

Maximum value of SAR (measured) = 0.563 mW/g



0 dB = 0.563mW/g

Figure 5: WLAN _ Right Check _ Middle Channel

GSM850_Rear side_10mm_Middle Channel

Date: 4/26/2018

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

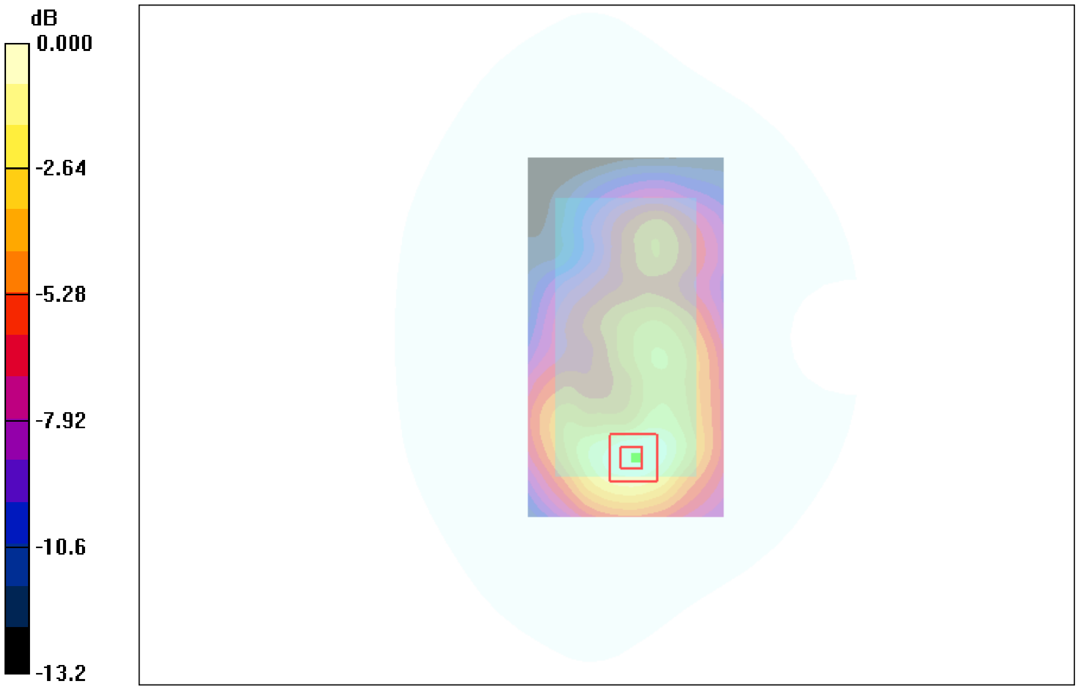
DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(9.25, 9.25, 9.25); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 0.811 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.5 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.22 W/kg

SAR(1 g) = 0.625 mW/g; SAR(10 g) = 0.436 mW/g
Maximum value of SAR (measured) = 0.785 mW/g



0 dB = 0.785mW/g

Figure 6: GSM850_Rear side_10mm_Middle Channel

GSM1900_Rear side_10mm_Middle Channel

Date: 4/27/2018

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1880 MHz; σ = 1.558 mho/m; εr = 52.99; ρ = 1000 kg/m3
Phantom section: Flat Section

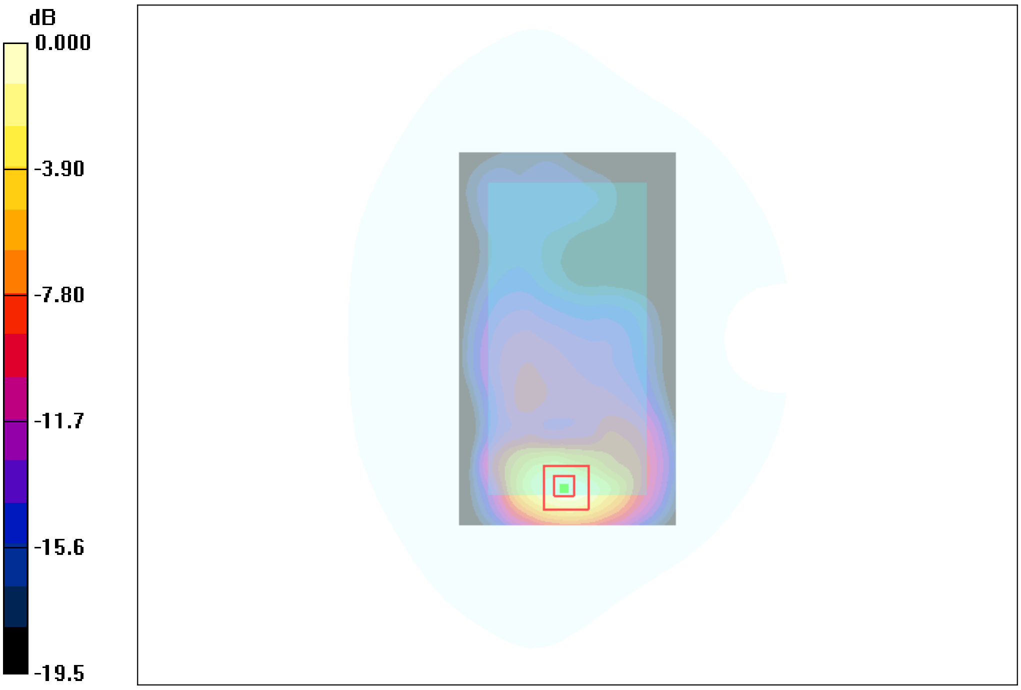
DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.60, 7.60, 7.60); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- 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) = 0.720 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.43 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.24 W/kg

SAR(1 g) = 0.687 mW/g; SAR(10 g) = 0.353 mW/g
Maximum value of SAR (measured) = 0.760 mW/g



0 dB = 0.760mW/g

Figure 7: GSM1900_Rear side_10mm_Middle Channel

WCDMA Band V_RCM _ Rear side_10mm_Middle Channel

Date: 4/26/2018

Communication System: W850; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used: f = 837 MHz; σ = 1.01 mho/m; εr = 55.5; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(9.25, 9.25, 9.25); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.265 mW/g

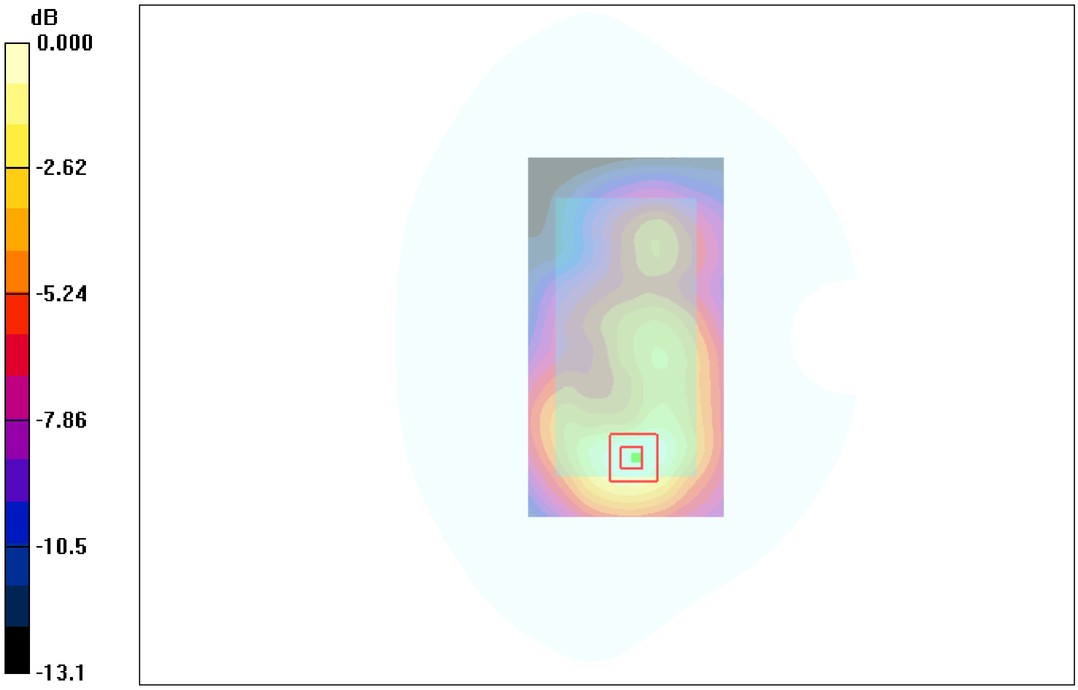
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.4 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.391 W/kg

SAR(1 g) = 0.237 mW/g; SAR(10 g) = 0.142 mW/g

Maximum value of SAR (measured) = 0.260 mW/g



0 dB = 0.260mW/g

Figure 8: WCDMA Band V_RCM _ Rear side_10mm_Middle Channel

WCDMA Band II_RCM _ Rear side_10mm_Middle Channel

Date: 4/27/2018

Communication System: W1900; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 1907.6 MHz; σ = 1.48 mho/m; εr = 52.9; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.60, 7.60, 7.60); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.347 mW/g

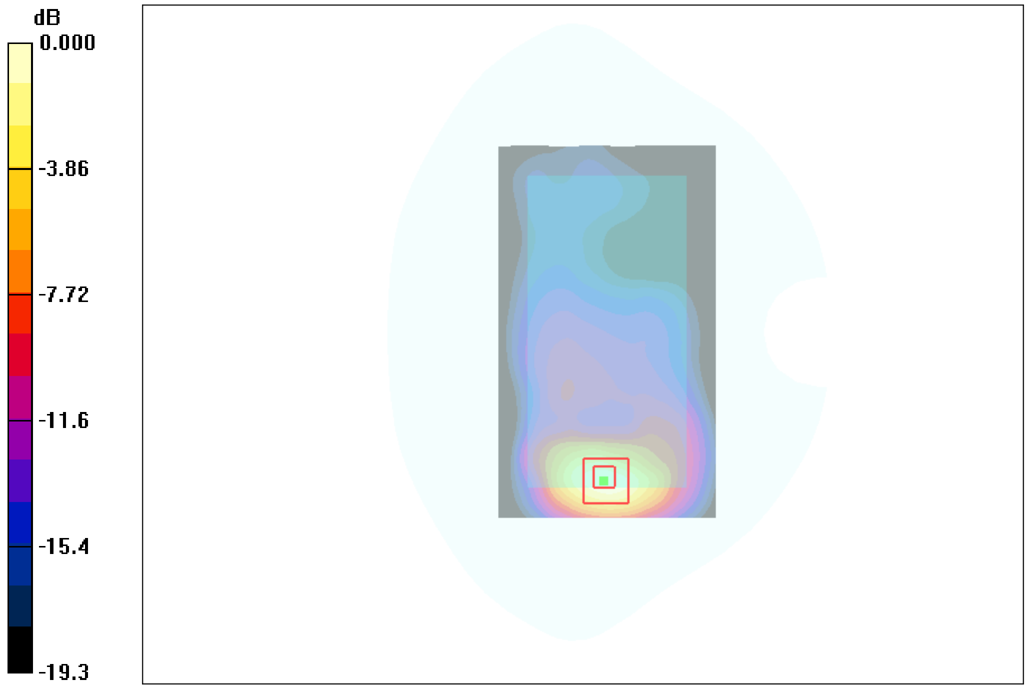
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.45 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 3.28 W/kg

SAR(1 g) = 0.303 mW/g; SAR(10 g) = 0.159 mW/g

Maximum value of SAR (measured) = 0.381 mW/g



0 dB = 0.381mW/g

Figure 9: WCDMA Band II_RCM _ Rear side_10mm_Middle Channel

WLAN _ Rear side_10mm_ Middle Channel

Date: 4/28/2018

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

Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; εr = 52.4; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV4 – SN3836;ConvF(7.20, 7.20, 7.20); Calibrated: 07/07/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1315; Calibrated: 7/26/2017
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (81x151x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.141 mW/g

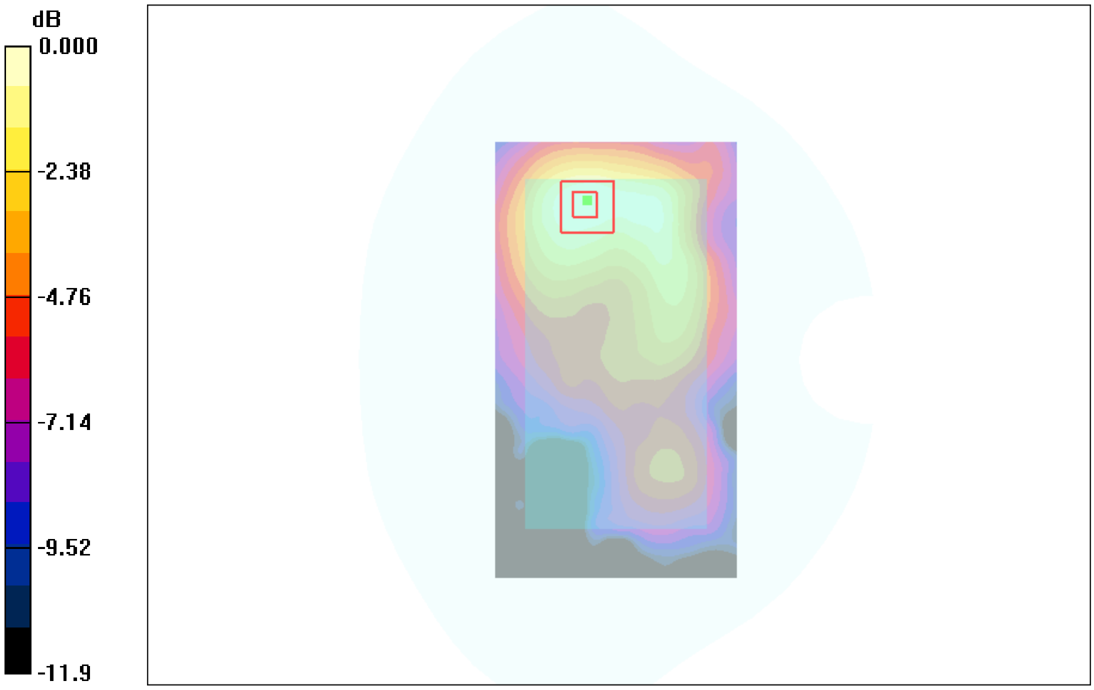
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.3 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.15 W/kg

SAR(1 g) = 0.137 mW/g; SAR(10 g) = 0.052 mW/g

Maximum value of SAR (measured) = 0.185 mW/g



0 dB = 0.185mW/g

Figure 10: WLAN _ Rear side_10mm_ Middle Channel

8 Calibration Certificate

8.1 Probe Calibration Certificate

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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
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中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client Sunway

Certificate No: Z16-97101

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3836
Calibration Procedure(s)	FD-Z11-2-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	July 07, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-17 (CTTL, No.J17X04777)	Jun-18
Power sensor NRP-Z91	101547	27-Jun-17 (CTTL, No.J17X04777)	Jun-18
Power sensor NRP-Z91	101548	27-Jun-17 (CTTL, No.J17X04777)	Jun-18
Reference10dBAttenuator	18N50W-10dB	13-Mar-17(CTTL,No.J17X01547)	Mar-19
Reference20dBAttenuator	18N50W-20dB	13-Mar-17(CTTL, No.J17X01548)	Mar-19
Reference Probe EX3DV4	SN 3617	26-Aug-16(SPEAG,No.EX3-3617_Aug15)	Aug-17
DAE4	SN 1331	21-Jan-17(SPEAG, No.DAE4-1331_Jan16)	Jan -18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-17 (CTTL, No.J17X04776)	Jun-18
Network Analyzer E5071C	MY46110673	26-Jan-17 (CTTL, No.J17X00894)	Jan -18

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: July 08, 2017

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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i θ=0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f＞1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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E-mail: cttl@chinattl.com Http://www.chinattl.cn

Probe EX3DV4

SN: 3836

Calibrated: July 07, 2017

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3836

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$)[A]	0.40	0.46	0.43	±10.8%
DCP(mV)[B]	93.2	100.2	98.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	167.8	±2.0%
		Y	0.0	0.0	1.0		182.5	
		Z	0.0	0.0	1.0		176.7	

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5 and Page 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Certificate No: Z16-97101 Page 4 of 11

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Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3836

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
450	43.5	0.87	7.12	7.12	7.12	0.20	1.30	±13.3%
750	41.9	0.89	9.43	9.43	9.43	0.30	0.80	±12%
835	41.5	0.90	9.42	9.42	9.42	0.15	1.58	±12%
900	41.5	0.9	9.03	9.03	9.03	0.15	1.46	±12%
1750	40.1	1.37	8.04	8.04	8.04	0.14	1.63	±12%
1900	40.0	1.40	7.60	7.60	7.60	0.16	1.59	±12%
2300	39.5	1.67	7.45	7.45	7.45	0.53	0.68	±12%
2450	39.2	1.80	7.07	7.07	7.07	0.54	0.71	±12%
2600	39.0	1.96	6.96	6.96	6.96	0.61	0.66	±12%
5200	36.0	4.66	5.32	5.32	5.32	0.40	1.42	±13%
5300	35.9	4.76	5.13	5.13	5.13	0.40	1.40	±13%
5500	35.6	4.96	4.85	4.85	4.85	0.40	1.35	±13%
5600	35.5	5.07	4.59	4.59	4.59	0.40	1.45	±13%
5800	35.3	5.27	4.71	4.71	4.71	0.40	1.45	±13%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cttl@chinattl.com Http://www.chinattl.cn

DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3836

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
450	56.7	0.94	7.33	7.33	7.33	0.13	1.50	±13.3%
750	55.5	0.96	9.38	9.38	9.38	0.30	0.85	±12%
835	55.2	0.97	9.25	9.25	9.25	0.17	1.44	±12%
900	55.0	1.05	8.95	8.95	8.95	0.14	1.60	±12%
1750	53.4	1.49	7.64	7.64	7.64	0.17	1.71	±12%
1900	53.3	1.52	7.33	7.33	7.33	0.18	1.80	±12%
2300	52.9	1.81	7.45	7.45	7.45	0.51	0.80	±12%
2450	52.7	1.95	7.20	7.20	7.20	0.62	0.70	±12%
2600	52.5	2.16	6.99	6.99	6.99	0.52	0.79	±12%
5200	49.0	5.30	4.83	4.83	4.83	0.50	1.25	±13%
5300	48.9	5.42	4.60	4.60	4.60	0.50	1.35	±13%
5500	48.6	5.65	4.32	4.32	4.32	0.50	1.35	±13%
5600	48.5	5.77	4.20	4.20	4.20	0.50	1.40	±13%
5800	48.2	6.00	4.30	4.30	4.30	0.50	1.30	±13%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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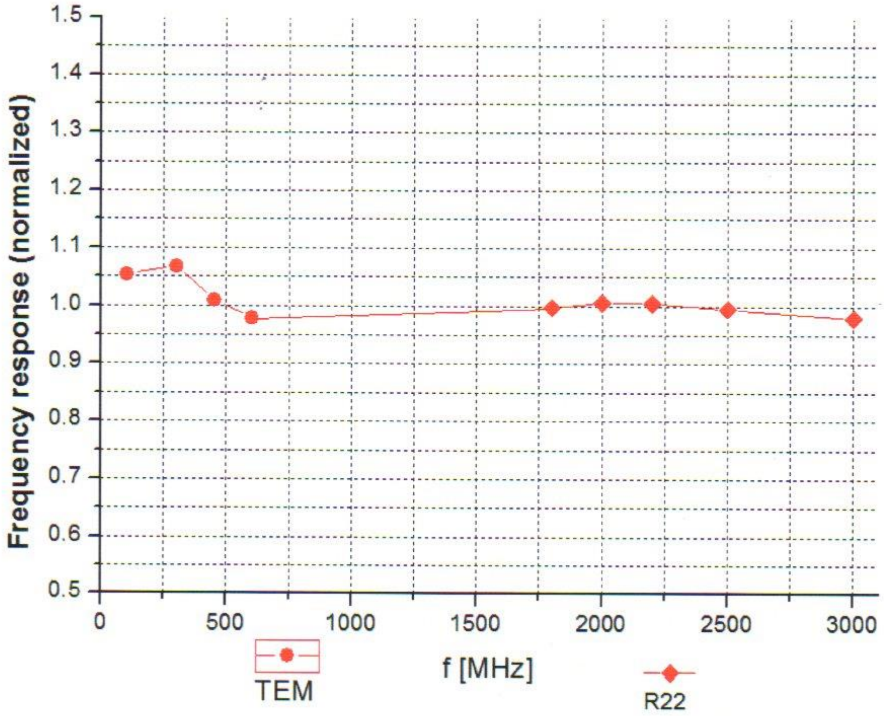
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.5% (k=2)

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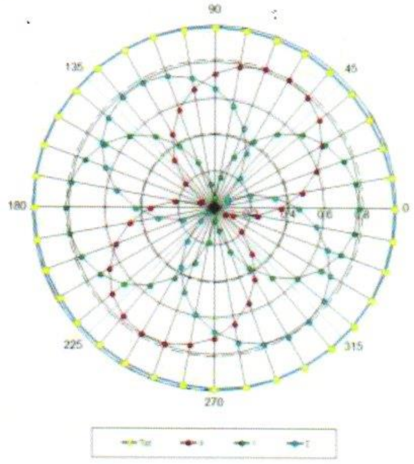
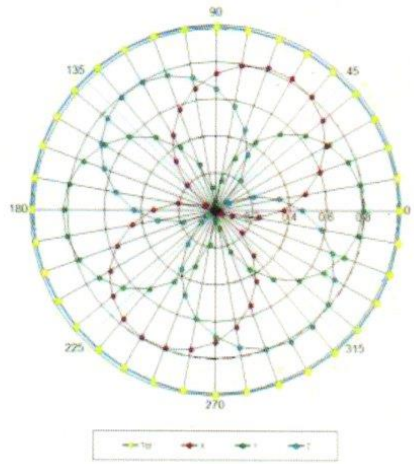
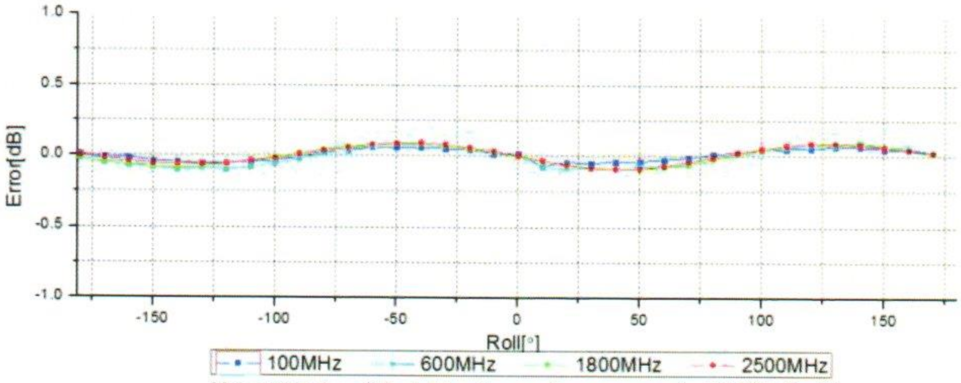
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





Uncertainty of Axial Isotropy Assessment: ±0.9% (k=2)

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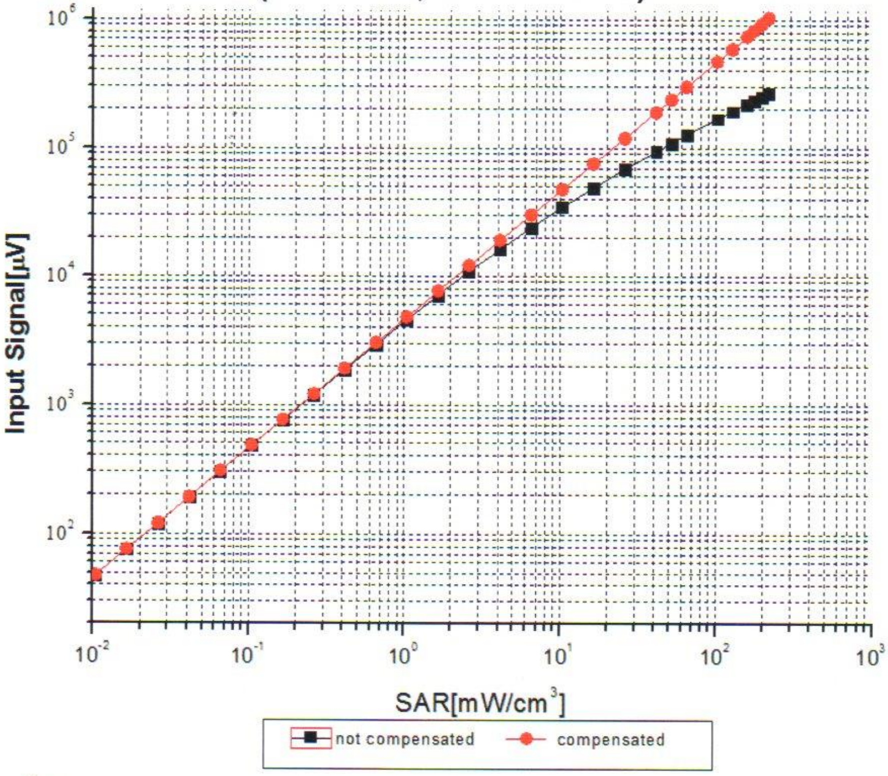
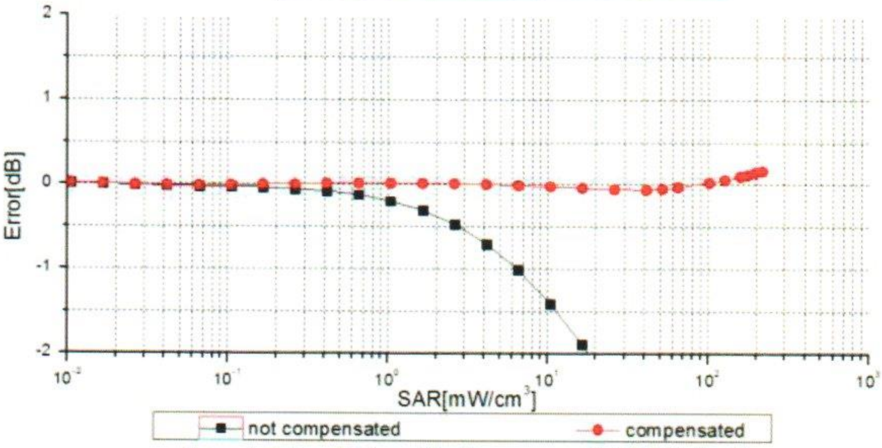
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)





Uncertainty of Linearity Assessment: ±0.9% (k=2)

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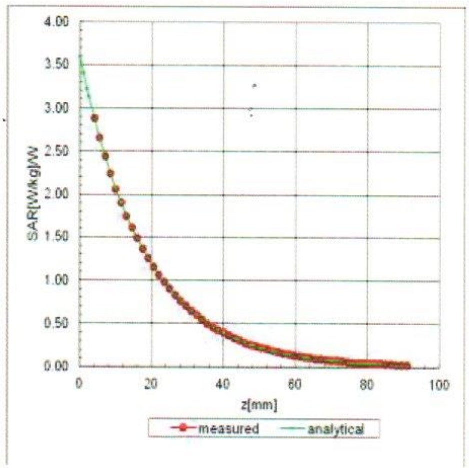
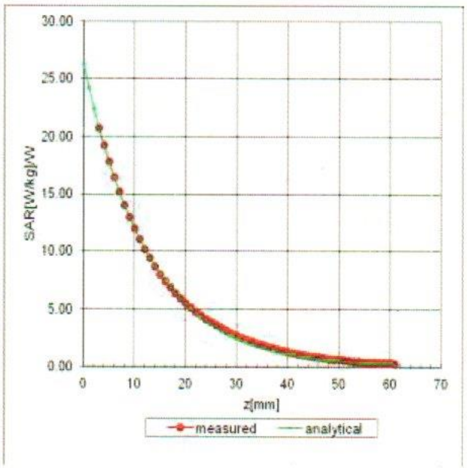
Conversion Factor Assessment

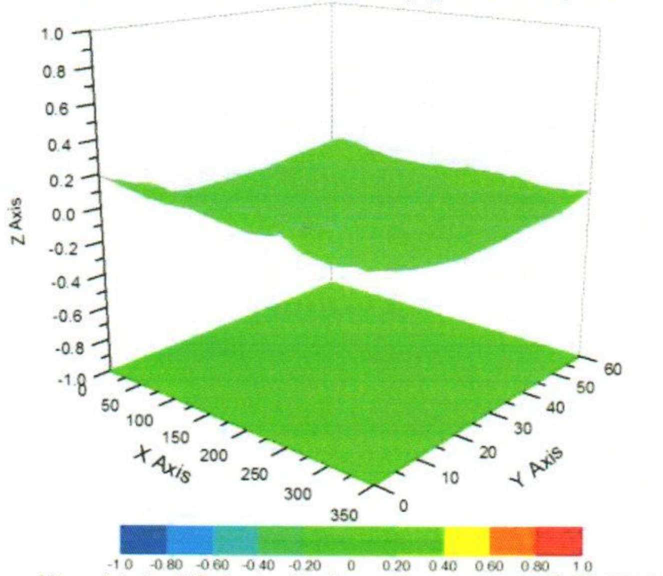
f=900 MHz, WGLS R9(H_convF)



f=1900 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3836

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	47.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm