SAR TEST REPORT

For

ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.

4G Smart phone Athos Pro

Model No.: QA5616

Additional Model No.: WF5003

Prepared for	:	ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.
Address	:	OFICINA 440, EDIFICIO TRADE BUILDING, AV. JOAQUIN ORRANTIA Y LEOPOLDO BENITEZ, GUAYAQUIL, Ecuador

Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	:	June 13, 2016
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	June 13, 2016~June 30, 2016
Date of Report	:	June 30, 2016

SAR TEST REPORT

Report Reference No. ....:	**LCS1606130892E**
Date Of Issue ....:	June 30, 2016
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
Testing Location/ Procedure.......:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name......................:	**ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.**
Address ....:	OFICINA 440, EDIFICIO TRADE BUILDING, AV. JOAQUIN ORRANTIA Y LEOPOLDO BENITEZ, GUAYAQUIL, Ecuador
Test Specification:	
Standard ....:	IEEE 1528:2013/KDB865664 47CFR §2.1093
Test Report Form No. ....:	LCSEMC-1.0
TRF Originator ....:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF ....:	Dated 2014-09

Test Item Description. ....:	**4G Smart phone Athos Pro**
Trade Mark ....:	QUADE
Model/Type Reference ....:	QA5616
Operation Frequency ....:	GSM 850/PCS1900, WCDMA Band II/ V, LTE Band2/4, WLAN2.4G, Bluetooth4.0
Modulation Type ....:	GSM(GMSK,8PSK), WCDMA/HSDPA/HSUPA(QPSK), LTE(QPSK,16QAM), WIFI(DSSS,OFDM), Bluetooth(GFSK,8DPSK, π/4DQPSK)
Ratings ....:	DC 3.7V by Lithium ion polymer battery(2000mAh) Recharged by DC 5V/1A Travel Charger
Result ....:	**Positive**

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

SAR -- TEST REPORT

Test Report No. : LCS1606130892E	June 30, 2016 Date of issue

Type / Model.........................	:	QA5616
EUT.......................................	:	4G Smart phone Athos Pro
Applicant..............................	**:**	**ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.**
Address..................................	:	OFICINA 440, EDIFICIO TRADE BUILDING, AV. JOAQUIN ORRANTIA Y LEOPOLDO BENITEZ, GUAYAQUIL, Ecuador
Telephone..............................	:	+59345103027
Fax...	:	+59342004140-104
Manufacturer.......................	**:**	**Neway Communication Co., Limited**
Address..................................	:	15/b-15/F Cheuk Nang Plaza 250 Hennessy Road, Hong Kong
Telephone..............................	:	00852-21349819
Fax...	:	00852-30697659
Factory..................................	**:**	**Neway Communication Co., Limited**
Address..................................	:	15/b-15/F Cheuk Nang Plaza 250 Hennessy Road, Hong Kong
Telephone..............................	:	00852-21349819
Fax...	:	00852-30697659

Test Result	**Positive**

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.

Revison History

Revision	Issue Date	Revisions	Revised By
00	2016-06-30	Initial Issue	Gavin Liang

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1.TEST STANDARDS AND TEST DESCRIPTION

1.1. Test Standards

IEEE Std C95.1, 2005: 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™-2013: 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
KDB447498 D01 General RF Exposure Guidance v06 : Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB648474 D04, Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets
KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 : SAR Measurement Requirements for 100 MHz to 6 GHz
KDB865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations
KDB248227 D01 802.11 Wi-Fi SAR v02r02: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS
KDB941225 D01 3G SAR Procedures v03r01: 3G SAR MEAUREMENT PROCEDURES
KDB 941225 D06 Hotspot Mode v02r01: SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES
KDB 941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices

1.2. Test Description

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power .
And Test device is identical prototype.

1.3. General Remarks

Date of receipt of test sample	:	June 13, 2016
Testing commenced on	:	June 18, 2016
Testing concluded on	:	June 22, 2016

1.4. Product Description

The **ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.'s** Model: QA5616 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

General Description	
Product Name:	4G Smart phone Athos Pro
Trade Mark:	QUADE
Model/Type reference:	QA5616
Listed Model(s):	QA5616, WF5003
Modulation Type:	GMSK for GSM/GPRS and 8PSK for EGPRS;QPSK for WCDMA; QPSK/16QAM for LTE; DSSS/OFDM for WIFI2.4G and OFDM for WIFI5G; GFSK/8DPSK/π-4DQPSK for Bluetooth
Device category:	Common mobile Device
Exposure category:	General population/uncontrolled environment
EUT Type:	Production Unit
Hardware Version	1490SF_MMI_V01
Software Version:	WD_B258
Power supply:	DC 3.7V by Lithium ion polymer battery(2000mAh) Recharged by DC 5V/1A Travel Charger
Hotspot:	Supported, power not reduced when Hotspot open
The EUT is GSM,WCDMA,LTE, mobile phone. the mobile phone is intended for speech and Multimedia Message Service (MMS) transmission. It is equipped with GPRS/EDGE class 12 for GSM850, PCS1900, WCDMA Band II, Band V, LTE Band2, Band4 and Bluetooth, WiFi2.4G and camera functions. For more	

information see the following datasheet	
Technical Characteristics	
GSM	
Support Networks	GSM, GPRS, EDGE
Support Band	GSM850, PCS1900
Frequency	GSM850: 824.2~848.8MHz GSM1900: 1850.2~1909.8MHz
Power Class:	GSM850:Power Class 5 PCS1900:Power Class 0
Modulation Type:	GMSK for GSM/GPRS; 8PSK For EGPRS
Antenna Type	Internal Antenna, 1.12dBi(Max.)
GSM Release Version	R99
GPRS Multislot Class	12
EGPRS Multislot Class	12
DTM Mode	Not Supported
UMTS	
Support Networks	WCDMA RMC12.2K,HSDPA,HSUPA
Operation Band:	WCDMA Band II, Band V
Frequency Range	WCDMA Band II: 1852.4 ~ 1907.6MHz WCDMA Band V: 826.4 ~ 846.6MHz
Modulation Type:	QPSK for WCDMA/HSUPA/HSDPA
Power Class:	Class 3
WCDMA Release Version:	R99
HSDPA Release Version:	R10
HSUPA Release Version:	R6
DC-HSUPA Release Version:	Not Supported
Antenna Type	Internal Antenna, 1.12dBi(Max.)
LTE	
Support Band	LTE Band2, Band4
Frequency Range	LTE Band2:1850 ~ 1910MHz LTE Band4:1710 ~ 1755MHz
Power Class:	Class 3
Modulation Type:	QPSK/16QAM
LTE Release Version:	R8
Antenna Type	Internal Antenna, 1.12dBi(Max.)

WIFI 2.4G	
Supported Standards:	802.11b/802.11g/802.11n(HT20&HT40)
Operation frequency:	2412-2462MHz for 11b/g/n(HT20) 2422-2452MHz for 11n(HT40)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Channel number:	802.11b/802.11g/802.11n(HT20): 11; 802.11n(HT40): 6
Channel separation:	5MHz
Antenna Description	PIFA Antenna, -0.5dBi(Max.)
Bluetooth	
Bluetooth Version:	V4.0
Modulation:	GFSK(1Mbps) , π/4-DQPSK(2Mbps), 8DPSK(3Mbps)
Operation frequency:	2402MHz~2480MHz
Channel number:	40/79
Channel separation:	1MHz/2MHz
Antenna Description	PIFA Antenna, -0.5dBi(Max.)

1.5. Statement of Compliance

The maximum of results of SAR found during testing for QA5616 are follows:

<Highest Reported standalone SAR Summary>

Classment Class	Frequency Band	Head (Report SAR_{1-g} (W/Kg)	Hotspot (Report SAR_{1-g} (W/Kg)	Body-worn (Report SAR_{1-g} (W/Kg)
PCE	GSM 850	0.354	0.628	0.628
	GSM1900	0.146	0.261	0.261
	WCDMA Band V	0.212	0.358	0.358
	WCDMA Band II	0.210	0.282	0.282
	LTE Band 2	0.256	0.627	0.627
	LTE Band 4	0.342	0.682	0.682
DTS	WIFI2.4G	0.513	0.306	0.306

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

<Highest Reported simultaneous SAR Summary>

Exposure Position	Frequency Band	Reported SAR_{1-g} (W/kg)	Classment Class	Highest Reported Simultaneous Transmission SAR_{1-g} (W/Kg)
Hotspot	LTE Band 4	0.682	PCE	**0.988**
	WIFI2.4G	0.306	DTS	

2.TEST ENVIRONMENT

2.1. Test Facility

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

Site Description

EMC Lab. : CNAS Registration Number. is L4595.
FCC Registration Number. is 899208.
Industry Canada Registration Number. is 9642A-1.
VCCI Registration Number. is C-4260 and R-3804.
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.

2.2. Environmental conditions

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

Temperature:	18-25 ° C
Humidity:	40-65 %
Atmospheric pressure:	950-1050mbar

2.3. SAR Limits

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average(averaged over the whole body)	0.08	0.4
Spatial Peak(averaged over any 1 g of tissue)	1.6	8.0
Spatial Peak(hands/wrists/ feet/anklesaveraged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.
Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

2.4. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Calibration Date	Calibration Due
PC	Lenovo	G5005	MY42081102	N/A	N/A
Signal Generator	Angilent	E4438C	MY42081396	09/25/2015	09/24/2016
Multimeter	Keithley	MiltiMeter 2000	4059164	10/01/2015	09/30/2016
S-parameter Network Analyzer	Agilent	8753ES	US38432944	09/25/2015	09/24/2016
Wireless Communication Test Set	R & S	CMU200	105988	09/25/2015	09/24/2016
Wideband Radia Communication Tester	R&S	CMW500	1201.0002K50	03/06/2015	03/05/2016
Power Meter	R & S	NRVS	100469	09/25/2015	09/24/2016
Power Sensor	R & S	NRV-Z51	100458	09/25/2015	09/24/2016
Power Sensor	R & S	NRV-Z32	10057	09/25/2015	09/24/2016
E-Field Probe	SATIMO	SSE5	SN 17/14 EP220	10/01/2015	09/30/2018
E-Field Probe	SATIMO	SSE5	SN 17/14 EP221	09/01/2015	08/31/2018
E-Field Probe	SATIMO	SSE5	SN 13/14 EPG214	10/01/2015	09/31/2018
DIPOLE 835	SATIMO	SID 835	SN 07/14 DIP 0G835-303	10/01/2015	09/30/2016
DIPOLE 1800	SATIMO	SID 1800	SN 07/14 DIP 1G800-301	10/01/2015	9/30/2016
DIPOLE 1900	SATIMO	SID 1900	SN 30/14 DIP 1G900-333	09/01/2015	08/31/2016
DIPOLE 2450	SATIMO	SID 2450	SN 07/14 DIP 2G450-306	10/01/2015	09/30/2016
COMOSAR OPEN Coaxial Probe	SATIMO	OCPG 68	SN 40/14 OCPG68	10/01/2015	09/30/2016
Communication Antenna	SATIMO	ANTA57	SN 39/14 ANTA57	10/01/2015	09/30/2016
Mobile Phone POSITIONING DEVICE	SATIMO	MSH98	SN 40/14 MSH98	N/A	N/A
DUMMY PROBE	SATIMO	DP60	SN 03/14 DP60	N/A	N/A
SAM PHANTOM	SATIMO	SAM117	SN 40/14 SAM117	N/A	N/A
6 AXIS ROBOT	KUKA	KR6-R900	501217	N/A	N/A
High Power Solid State Amplifier (80MHz~1000MHz)	Instruments for Industry	CMC150	M631-0627	09/25/2015	09/24/2016
Medium Power Solid State Amplifier (0.8~4.2GHz)	Instruments for Industry	S41-25	M629-0539	09/25/2015	09/24/2016
Wave Tube Amplifier 48 GHz at 20Watt	Hughes Aircraft Company	1277H02F000	102	09/25/2015	09/24/2016

Note:

1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three year extended calibration interval. Each measured dipole is expected to evalute 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,measued at least annually,deviates by no more than 20% from the previous measurement;
d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the provious measurement.
2) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

3.SAR MEASUREMENTS SYSTEM CONFIGURATION

3.1. SARMeasurement Set-up

The OPENSAR system for performing compliance tests consist of the following items:

A standard high precision 6-axis robot (KUKA) with controller and software.

KUKA Control Panel (KCP)

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with a Video Positioning System(VPS).

The stress sensor is composed with mechanical and electronic when the electronic part detects a change on the electro-mechanical switch,It sends an “Emergency signal” to the robot controller that to stop robot’s moves

A computer operating Windows XP.

OPENSAR software

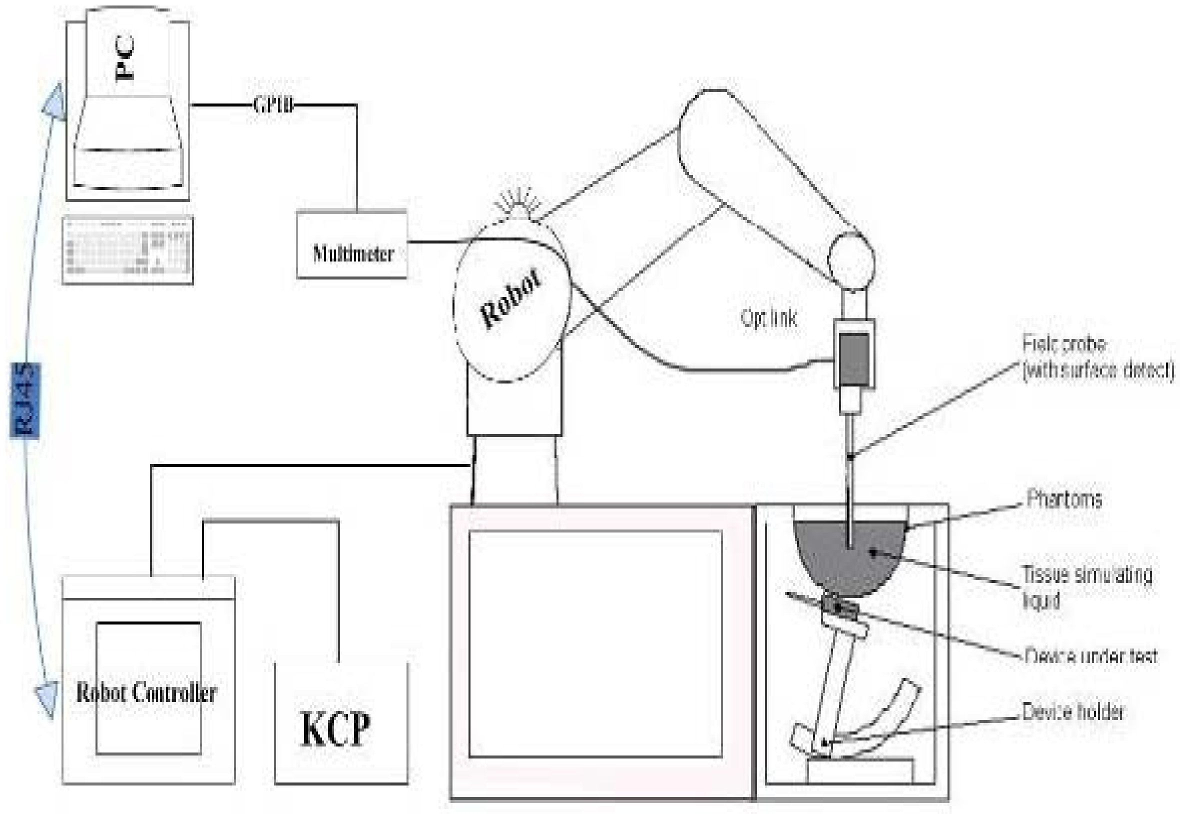
Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

The SAM phantom enabling testing left-hand right-hand and body usage.

The Position device for handheld EUT

Tissue simulating liquid mixed according to the given recipes .

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



3.2. OPENSAR E-field Probe System

The SAR measurements were conducted with the dosimetric probe EP220 (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.

Probe Specification

ConstructionSymmetrical design with triangular core
Interleaved sensors
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

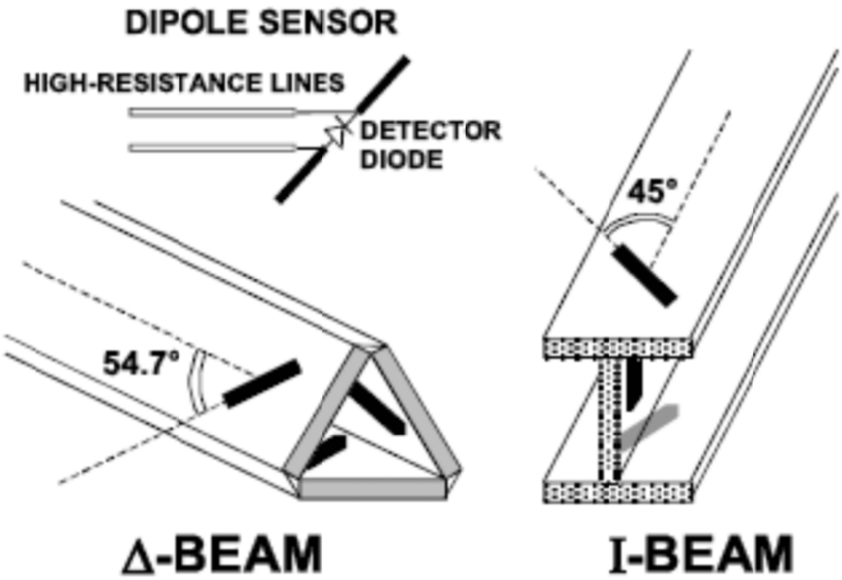
CalibrationISO/IEC 17025 calibration service available.

Frequency	700 MHz to 3 GHz; Linearity:0.25dB(700 MHz to 3GHz)
Directivity	0.25 dB in HSL (rotation around probe axis) 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	0.01W/kg to > 100 W/kg; Linearity: 0.25 dB
Dimensions	Overall length: 330 mm (Tip: 16mm) Tip diameter: 5 mm (Body: 8 mm) Distance from probe tip to sensor centers: 2.5 mm
Application	General dosimetry up to 3 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones

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.

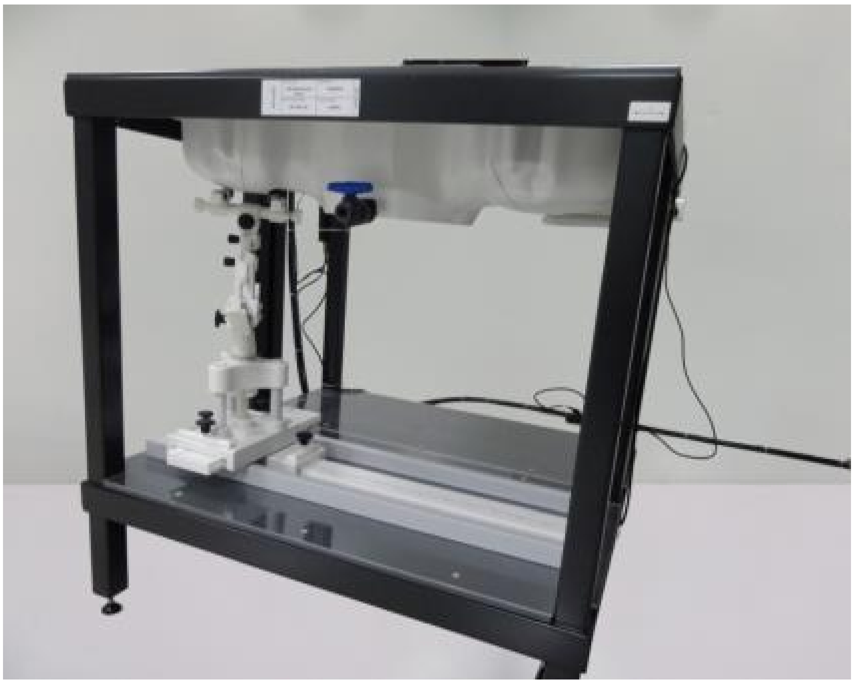
The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



3.3. Phantoms

The SAM Phantom SAM117 is constructed of a fiberglass shell ntegrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE P1528 and CENELEC EN62209-1 , EN62209-2:2010.The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid.   Reference markings on the Phantom allow the complete setup of allpredefined phantom positions and measurement grids by manually teaching three points in the robo

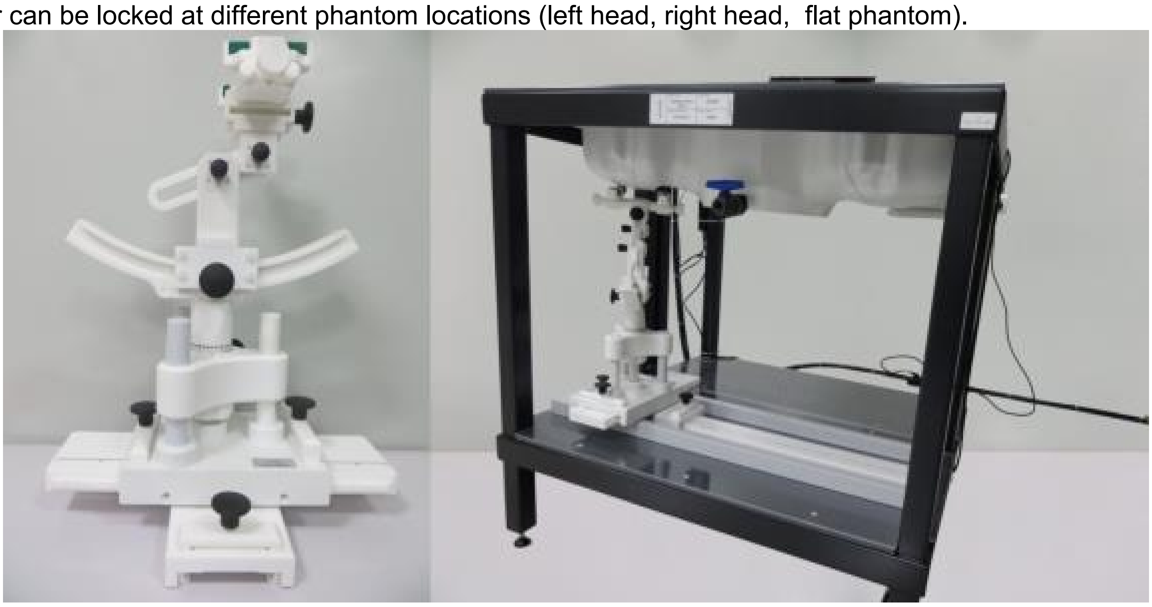
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.



SAM Twin Phantom

3.4. Device Holder

In combination with the Generic Twin PhantomSAM117, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).



Device holder supplied by SATIMO

3.5. Scanning Procedure

The procedure for assessing the peak spatial-average SAR value consists of the following steps

Power Reference Measurement
The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

<table>
<tr><th></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>½·δ·ln(2) mm ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

Zoom Scan
Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

<table>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 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.</td></tr>
</table>

Power Drift measurement
The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have OPENSAR software stop the measurements if this limit is exceeded.

3.6. Data Storage and Evaluation

Data Storage
The OPENSAR 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 . 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 OPENSAR 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 OPENSAR 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
dcpi = diode compression point

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

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

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

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 primary 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.

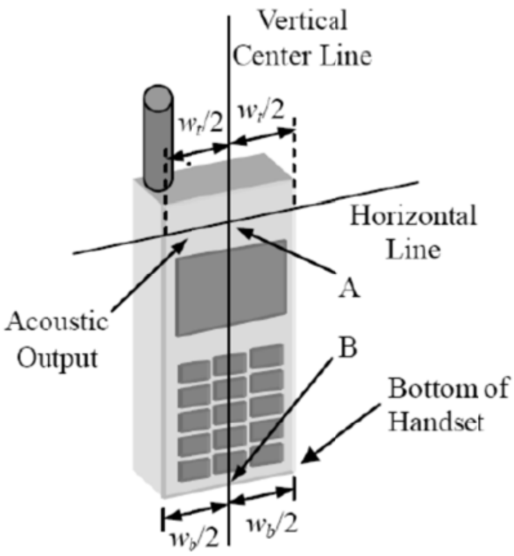
3.7. Position of the wireless device in relation to the phantom

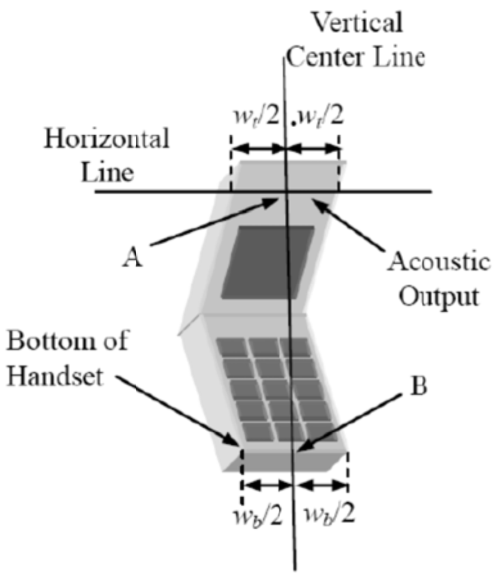
General considerations
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.

The power flow density is calculated assuming the excitation field as a free space field

$$P_{(pwe)} = \frac{E_{tot}^2}{3770} \text{ or } P_{(pwe)} = H_{tot}^2 .37.7$$

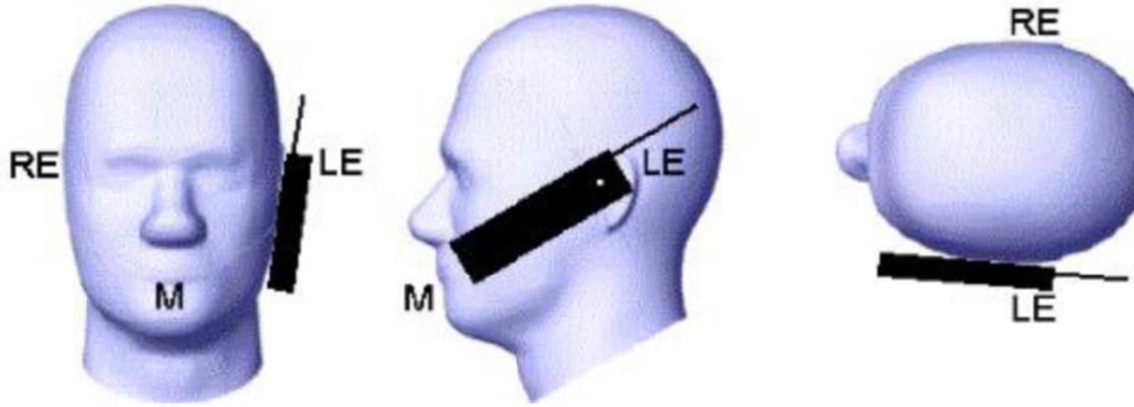
Where P_{pwe}=Equivalent power density of a plane wave in mW/cm2
E_{tot}=total electric field strength in V/m
H_{tot}=total magnetic field strength in A/m



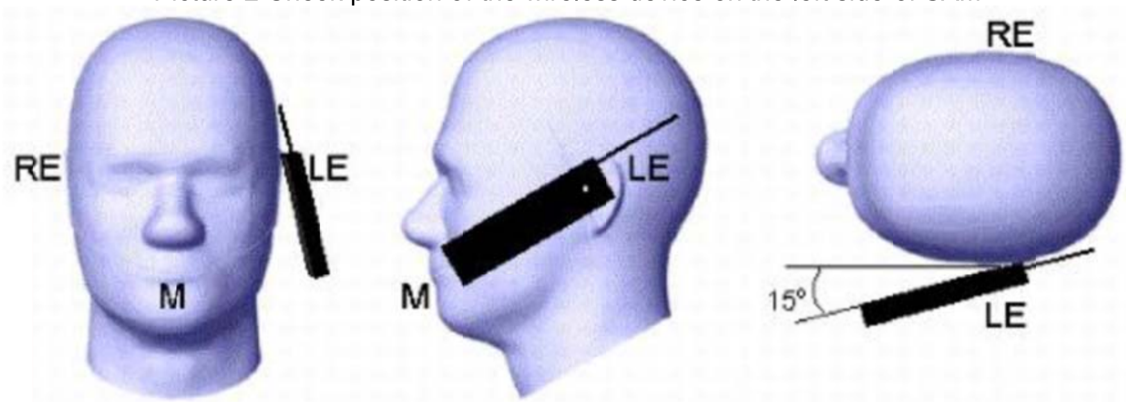


W_t Width of the handset at the level of the acoustic
W_b Width of the bottom of the handset
A Midpoint of the width w_t of the handset at the level of the acoustic output
B Midpoint of the width w_b of the bottom of the handset

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

For body SAR test we applied to FCC KDB941225 D01v03r01, KDB447498 D01v06, KDB248227 D01v02r02,

3.8. Tissue Dielectric Parameters for Head and Body Phantoms

The liquid is consisted of water,salt,Glycol,Sugar,Preventol and Cellulose.The liquid has previously been proven to be suited for worst-case.It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664.

The composition of the tissue simulating liquid

Frequency (MHz)	Bactericide	DGBE	HEC	NaCl	Sucrose	1,2-Propanediol	X100	Water	Conductivity	Permittivity
	%	%	%	%	%	%	%	%	σ	εr
750	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
835	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
900	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
1800	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
1900	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
2000	/	7.99	/	0.16	/	/	19.97	71.88	1.55	41.1
2450	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3
2600	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3

Target Frequency (MHz)	Head		Body	
	ε_r	$\sigma(S/m)$	ε_r	$\sigma(S/m)$
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
2600	39.0	1.96	52.5	2.16
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

3.9. Tissue equivalent liquid properties

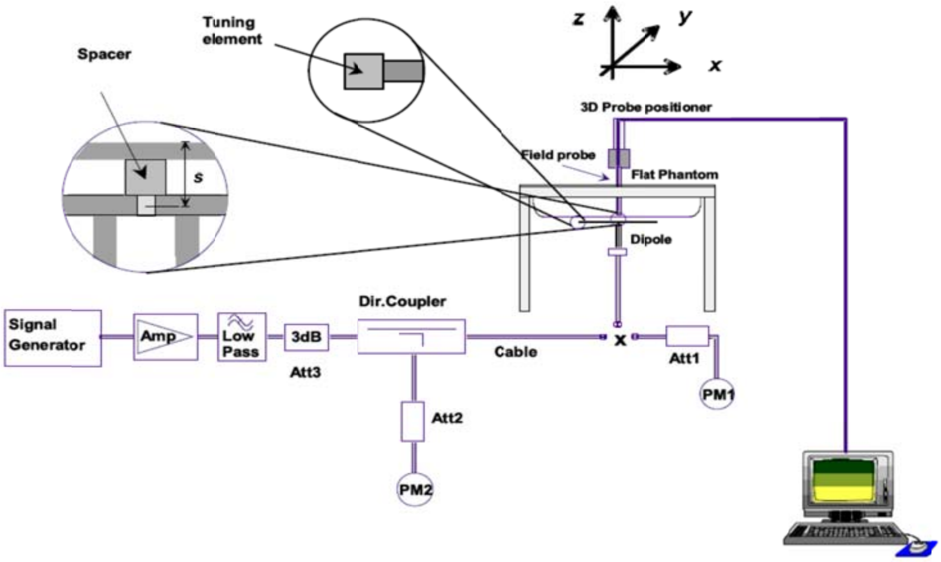
Dielectric Performance of Head and Body Tissue Simulating Liquid

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue				Liquid Temp.	Test Data
		ε_r	σ	ε_r	Dev.	σ	Dev.		
835H	835	41.50	0.90	43.22	4.14%	0.93	3.33%	21.5	06/18/2016
1800H	1800	40.00	1.40	41.91	4.77%	1.44	2.86%	21.5	06/19/2016
1900H	1900	40.00	1.40	41.50	3.75%	1.45	3.57%	21.5	06/20/2016
2450H	2450	39.20	1.80	40.74	3.93%	1.86	3.33%	21.5	06/22/2016
835B	835	55.20	0.97	57.18	3.59%	0.98	1.03%	21.5	06/18/2016
1800B	1800	53.30	1.52	55.44	4.02%	1.55	1.97%	21.5	06/19/2016
1900B	1900	53.30	1.52	54.83	2.87%	1.56	2.63%	21.5	06/20/2016
2450B	2450	52.70	1.95	53.26	1.06%	1.99	2.05%	21.5	06/22/2016

3.10. System Check

The purpose of the system check is to verify that the system operates within its specifications at the decice 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 %).



The output power on dipole port must be calibrated to 20 dBm (100mW) before dipole is connected.

Photo of Dipole Setup

Mixture Type	Frequency (MHz)	Power	SAR_{1g} (W/Kg)	SAR_{10g} (W/Kg)	Drift (%)	1W Target		Difference percentage		Liquid Temp	Date
						SAR_{1g} (W/Kg)	SAR_{10g} (W/Kg)	1g	10g		
Head	835	100 mW	0.947	0.605	-1.57	9.60	6.20	-1.35%	-2.42%	21.5	06/18/2016
		Normalize to 1 Watt	9.47	6.05							
Body	835	100 mW	0.980	0.613	0.91	9.90	6.39	-1.01%	-4.07%	21.5	06/18/2016
		Normalize to 1 Watt	9.80	6.13							
Head	1800	100 mW	3.970	2.101	2.03	38.13	20.20	4.12%	5.05%	21.5	06/19/2016
		Normalize to 1 Watt	39.70	21.01							
Body	1800	100 mW	4.147	2.089	-0.94	39.03	20.65	6.25%	1.16%	21.5	06/19/2016
		Normalize to 1 Watt	41.47	20.89							
Head	1900	100 mW	3.700	1.874	-0.43	39.84	20.20	-7.13%	7.23%	21.5	06/20/2016
		Normalize to 1 Watt	37.00	18.74							
Body	1900	100 mW	3.975	1.945	1.53	43.33	21.59	-8.26%	-9.91%	21.5	06/20/2016
		Normalize to 1 Watt	39.75	19.45							
Head	2450	100 mW	4.968	2.316	1.48	53.89	24.15	-7.81%	-4.10%	21.5	06/22/2016
		Normalize to 1 Watt	49.68	23.16							
Body	2450	100 mW	5.042	2.289	-3.07	54.65	24.58	-7.74%	-6.88%	21.5	06/22/2016
		Normalize to 1 Watt	50.42	22.89							

3.11. SAR measurement procedure

The measurement procedures are as follows:

3.11.1 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.

3.11.2 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. Using CMU200 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.

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. GSM voice and GPRS data use GMSK, which is a constant amplitude modulation with minimal peak to average power difference within the time-slot burst. For EDGE, GMSK is used for MCS 1 – MCS 4 and 8-PSK is used for MCS 5 – MCS 9; where 8-PSK has an inherently higher peak-to-average power ratio. The GMSK and 8-PSK EDGE configurations are considered separately for SAR compliance. The GMSK EDGE configurations are grouped with GPRS and considered with respect to time-averaged maximum output power to determine compliance. The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.

3.11.3 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.

1) 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.

2) 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: Δ_{ACK}, Δ_{NACK} and Δ_{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.

3.11.4 LTE Test Configuration

QPSK with 1 RB allocation
Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel.8 When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

QPSK with 50% RB allocation
The procedures required for 1 RB allocation in section 4.2.1 are applied to measure the SAR for QPSK with 50% RB allocation.9

QPSK with 100% RB allocation
For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in sections 4.2.1 and 4.2.2 are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

3.11.5 WIFI Test Configuration

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

procedures. Channels with measured maximum output power within ¼ dB are considered to have the same maximum output.
2. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, an “initial test configuration” is first determined for each standalone and aggregated frequency band according to the maximum output power and tune-up tolerance specified for production units.
a. When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.
b. SAR is measured for OFDM configurations using the initial test configuration procedures. Additional frequency band specific SAR test reduction may be considered for individual frequency bands
c. Depending on the reported SAR of the highest maximum output power channel tested in the initial test configuration, SAR test reduction may apply to subsequent highest output channels in the initial test configuration to reduce the number of SAR measurements.
3. The Initial test configuration does not apply to DSSS. The 2.4 GHz band SAR test requirements and 802.11b DSSS procedures are used to establish the transmission configurations required for SAR measurement.
4. An “initial test position”is applied to further reduce the number of SAR tests for devices operating in next to the ear, UMPC mini-tablet or hotspot mode exposure configurations that require multiple test positions .
a. SAR is measured for 802.11b according to the 2.4 GHz DSSS procedure using the exposure condition established by the initial test position.
b. SAR is measured for 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration. 802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on the maximum average output channel.
5. The Initial test position does not apply to devices that require a fixed exposure test position. SAR is measured in a fixed exposure test position for these devices in 802.11b according to the 2.4 GHz DSSS procedure or in 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration procedures .
6. The “subsequent test configuration”procedures are applied to determine if additional SAR measurements are required for the remaining OFDM transmission modes that have not been tested in the initial test configuration. SAR test exclusion is determined according to reported SAR in the initial test configuration and maximum output power specified or measured for these other OFDM configurations.

2.4 GHz and 5GHz SAR Procedures
Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions. When SAR measurement is required for an OFDM configuration, the initial test configuration, subsequent test configuration and initial test position procedures are applied. The SAR test exclusion requirements for 802.11g/n OFDM configurations are described in section 5.2.2.
1. 802.11b DSSS SAR Test Requirements
SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:
a. When the reported SAR of the highest measured maximum output power channel (section 3.1) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
b. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.
1. 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements
When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3). SAR is not required for the following 2.4 GHz OFDM conditions.
a. When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration
b. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
2. SAR Test Requirements for OFDM Configurations
When SAR measurement is required for 802.11 a/g/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 band are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements.20 In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test

configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

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

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

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

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

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

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.

4. 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.

3.12. Power Reduction

The product without any power reduction.

3.13. Power Drift

To control the output power stability during the SAR test, SAR system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. This ensures that the power drift during one measurement is within 5%.

4.TEST CONDITIONS AND RESULTS

4.1. Conducted Power Results

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

Conducted power measurement results for GSM850/PCS1900

GSM 850		Burst Conducted power (dBm) Channel/Frequency(MHz)			/	Average power (dBm) Channel/Frequency(MHz)		
		128/824.2	190/836.6	251/848.8		128/824.2	190/836.6	251/848.8
GSM		32.77	32.84	32.69	-9.03dB	23.74	23.81	23.66
GPRS (GMSK)	1TX slot	32.21	32.21	32.12	-9.03dB	23.18	23.18	23.09
	2TX slot	30.42	30.55	30.41	-6.02dB	24.40	24.53	24.39
	3TX slot	**29.46**	**29.45**	**28.78**	**-4.26dB**	**25.20**	**25.19**	**24.52**
	4TX slot	27.78	27.71	27.66	-3.01dB	24.77	24.70	24.65
EGPRS (8PSK)	1TX slot	26.63	26.57	26.15	-9.03dB	17.60	17.54	17.12
	2TX slot	23.25	23.32	23.34	-6.02dB	17.23	17.30	17.32
	3TX slot	22.13	22.22	22.56	-4.26dB	17.87	17.96	18.30
	4TX slot	20.24	20.27	20.42	-3.01dB	17.23	17.26	17.41
GSM 1900		Burst Conducted power (dBm) Channel/Frequency(MHz)			/	Average power (dBm) Channel/Frequency(MHz)		
		512/ 1850.2	661/ 1880	810/ 1909.8		512/ 1850.2	661/ 1880	810/ 1909.8
GSM		30.54	30.42	30.25	-9.03dB	21.51	21.39	21.22
GPRS (GMSK)	1TX slot	29.03	29.55	29.78	-9.03dB	20.00	20.52	20.75
	2TX slot	27.03	27.16	27.69	-6.02dB	21.01	21.14	21.67
	3TX slot	**25.48**	**26.52**	**26.15**	**-4.26dB**	**21.22**	**22.26**	**21.89**
	4TX slot	24.33	24.86	24.44	-3.01dB	21.32	21.85	21.43
EGPRS (8PSK)	1TX slot	25.41	25.13	25.58	-9.03dB	16.38	16.10	16.55
	2TX slot	23.78	23.22	23.26	-6.02dB	17.76	17.20	17.24
	3TX slot	21.52	21.75	21.41	-4.26dB	17.26	17.49	17.15
	4TX slot	19.45	19.41	19.73	-3.01dB	16.44	16.40	16.72

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) => -9.00dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.00dB

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) => -3.00dB

2. According to the conducted power as above, the GPRS measurements are performed with 3Txslot for GPRS850 and 3Txslot GPRS1900.

Conducted Power Measurement Results(WCDMA Band II /V)

Item	band	WCDMA Band II result (dBm)			WCDMA Band V result (dBm)		
		Channel/Frequency(MHz)			Channel/Frequency(MHz)		
	sub-test	9262/1852.4	9400/1880	9538/1907.6	4132/826.4	4183/836.6	4233/846.6
RMC	12.2kbps RMC	23.51	23.48	23.41	23.45	23.35	23.23
	64kbps RMC	23.39	23.37	23.30	23.30	23.35	23.27
	144kbps RMC	23.26	23.23	23.21	23.18	23.23	23.14
	384kbps RMC	23.18	23.10	23.16	23.14	23.07	23.06
HSDPA	Sub - Test 1	23.78	23.79	23.52	23.04	23.41	23.64
	Sub - Test 2	22.33	22.02	22.16	22.78	22.03	22.44
	Sub - Test 3	21.02	22.44	21.04	21.58	22.97	22.31
	Sub - Test 4	21.46	21.68	21.76	21.06	21.58	21.62
HSUPA	Sub - Test 1	22.43	22.06	22.26	22.78	22.06	22.88
	Sub - Test 2	21.26	21.26	21.03	21.06	21.78	21.06
	Sub - Test 3	22.07	22.78	22.41	22.44	22.05	22.14
	Sub - Test 4	20.56	21.55	21.03	20.07	21.46	20.85
	Sub - Test 5	21.62	21.07	21.78	21.52	21.32	21.54

Note: When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤1/2dB higher than the primary mode (RMC12.2kbps) 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.

LTE Band2

BW (MHz)	Frequency (MHz)	RB Configuration		Average Power [dBm]	
		Size	Offset	QPSK	16QAM
1.4	1850.7	1	0	21.85	20.92
		1	3	21.88	21.01
		1	5	21.90	20.99
		3	0	21.68	20.82
		3	2	21.66	20.79
		3	3	21.66	20.82
		6	0	20.77	19.82
	1880.0	1	0	21.39	20.72
		1	3	21.24	20.71
		1	5	21.20	20.77
		3	0	21.40	20.48
		3	2	21.32	20.45
		3	3	21.33	20.46
		6	0	20.54	19.60
	1909.3	1	0	21.51	20.80
		1	3	21.32	20.71
		1	5	21.33	20.68
		3	0	21.30	20.52
		3	2	21.28	20.42
		3	3	21.22	20.47
		6	0	20.57	19.86
3	1851.5	1	0	21.07	20.51
		1	7	21.05	20.54
		1	14	21.21	20.56
		8	0	20.46	19.63
		8	4	20.52	19.70
		8	7	20.55	19.72
		15	0	20.55	19.61
	1880.0	1	0	21.06	20.48
		1	7	20.88	20.31
		1	14	20.90	20.24
		8	0	20.29	19.48
		8	4	20.23	19.43
		8	7	20.20	19.39
		15	0	20.29	19.35
	1908.5	1	0	21.42	20.82
		1	7	21.18	20.61
		1	14	21.03	20.51
		8	0	20.63	19.77
		8	4	20.51	19.70
		8	7	20.46	19.68
		15	0	20.49	19.69
5	1852.5	1	0	20.77	20.32
		1	12	20.67	20.08
		1	24	21.16	20.67
		12	0	19.97	19.20
		12	6	19.96	19.22
		12	13	20.14	19.40
		25	0	20.01	19.14
	1880.0	1	0	20.86	20.37
		1	12	20.37	19.79
		1	24	20.71	20.23
		12	0	19.79	19.00
		12	6	19.60	18.86
		12	13	19.66	18.93
		25	0	19.70	18.84
	1907.5	1	0	21.39	20.41
		1	12	20.95	20.01
		1	24	21.01	20.09
		12	0	20.30	19.50
		12	6	20.15	19.37
		12	13	20.12	19.35
		25	0	20.20	19.41

10	1855.0	1	0	20.40	19.69
		1	24	20.85	20.26
		1	49	20.72	20.24
		25	0	19.94	19.04
		25	12	20.09	19.20
		25	25	20.21	19.32
		50	0	20.10	19.18
	1880.0	1	0	20.46	19.89
		1	24	20.30	19.76
		1	49	20.12	19.50
		25	0	19.73	18.83
		25	12	19.62	18.75
		25	25	19.56	18.69
		50	0	19.68	18.79
	1905.0	1	0	20.98	20.56
		1	24	21.03	20.39
		1	49	20.55	20.07
		25	0	20.40	19.55
		25	12	20.34	19.53
		25	25	20.23	19.44
		50	0	20.32	19.52
15	1857.5	1	0	20.62	20.02
		1	37	20.98	20.40
		1	74	20.97	20.41
		37	0	20.09	19.16
		37	18	20.24	19.32
		37	38	20.29	19.42
		75	0	20.25	19.34
	1880.0	1	0	20.84	20.23
		1	37	20.30	19.64
		1	74	20.58	19.99
		37	0	19.79	18.87
		37	18	19.59	18.69
		37	38	19.58	18.73
		75	0	19.72	18.83
	1902.5	1	0	21.32	20.66
		1	37	21.08	20.47
		1	74	20.77	20.26
		37	0	20.46	19.66
		37	18	20.41	19.60
		37	38	20.32	19.55
		75	0	20.46	19.61
20	1860.0	1	0	20.85	20.06
		1	49	21.17	20.38
		1	99	21.18	20.43
		50	0	20.17	19.35
		50	25	20.23	19.42
		50	50	20.26	19.48
		100	0	20.36	19.41
	1880.0	1	0	**21.23**	20.55
		1	49	20.52	19.79
		1	99	21.03	20.30
		50	0	19.94	19.01
		50	25	19.65	18.75
		50	50	19.72	18.82
		100	0	19.86	18.94
	1900.0	1	0	21.21	20.57
		1	49	21.17	20.58
		1	99	20.82	20.36
		50	0	**20.39**	19.57
		50	25	20.37	19.57
		50	50	20.35	19.59
		100	0	20.42	19.57

LTE Band4

BW (MHz)	Frequency (MHz)	RB Configuration		Average Power [dBm]	
		Size	Offset	QPSK	16QAM
1.4	1710.7	1	0	21.38	20.39
		1	3	21.33	20.45
		1	5	21.34	20.37
		3	0	21.24	20.32
		3	2	21.24	20.27
		3	3	20.23	20.26
		6	0	20.46	19.28
	1732.5	1	0	21.30	20.67
		1	3	21.21	20.58
		1	5	21.36	20.74
		3	0	21.21	20.24
		3	2	21.18	20.28
		3	3	21.22	20.33
		6	0	20.36	19.37
	1754.3	1	0	21.58	20.96
		1	3	21.34	20.81
		1	5	21.33	20.74
		3	0	21.50	20.74
		3	2	21.39	20.62
		3	3	21.33	20.61
		6	0	20.77	20.09
3	1711.5	1	0	21.11	20.45
		1	7	21.09	20.46
		1	14	21.10	20.31
		8	0	20.44	19.39
		8	4	20.43	19.40
		8	7	20.39	19.33
		15	0	20.37	19.26
	1732.5	1	0	21.18	20.52
		1	7	21.16	20.50
		1	14	21.39	20.72
		8	0	20.32	19.45
		8	4	20.35	19.52
		8	7	20.45	19.57
		15	0	20.38	19.44
	1753.5	1	0	21.95	21.41
		1	7	21.62	21.12
		1	14	21.38	20.91
		8	0	21.23	20.43
		8	4	21.04	20.25
		8	7	20.93	20.15
		15	0	21.06	20.28
5	1712.0	1	0	21.06	20.45
		1	12	20.79	20.20
		1	24	21.07	20.30
		12	0	20.16	19.34
		12	6	20.11	19.32
		12	13	20.20	19.30
		25	0	20.18	19.22
	1732.5	1	0	21.06	20.49
		1	12	20.72	20.11
		1	24	21.37	20.82
		12	0	19.87	19.08
		12	6	19.84	19.05
		12	13	20.10	19.31
		25	0	19.96	19.05
	1752.5	1	0	21.19	21.33
		1	12	21.56	20.67
		1	24	21.38	20.52
		12	0	21.15	20.37
		12	6	20.87	20.11
		12	13	20.67	19.92
		25	0	20.95	20.13

10	1715.0	1	0	20.63	20.01
		1	24	20.77	20.15
		1	49	20.13	19.54
		25	0	20.13	19.21
		25	12	20.11	19.07
		25	25	19.92	18.88
		50	0	20.07	19.04
	1732.5	1	0	20.53	19.86
		1	24	20.72	19.95
		1	49	20.06	19.45
		25	0	19.80	18.90
		25	12	19.91	18.31
		25	25	20.15	18.23
		50	0	20.00	18.07
	1750.0	1	0	21.82	21.29
		1	24	21.85	21.39
		1	49	20.90	20.45
		25	0	21.36	20.32
		25	12	21.31	20.46
		25	25	20.96	20.18
		50	0	21.20	20.40
15	1717.5	1	0	20.87	20.18
		1	37	20.53	19.90
		1	74	19.85	19.22
		37	0	20.11	19.18
		37	18	19.84	18.93
		37	38	19.42	18.51
		75	0	19.78	18.87
	1732.5	1	0	20.84	19.16
		1	37	20.65	19.00
		1	74	20.69	19.96
		37	0	19.81	19.89
		37	18	19.86	18.94
		37	38	19.25	18.33
		75	0	19.06	18.13
	1747.5	1	0	20.31	19.62
		1	37	20.90	19.29
		1	74	20.09	19.53
		37	0	20.03	19.11
		37	18	20.25	19.43
		37	38	20.06	19.27
		75	0	20.10	19.22
20	1720.0	1	0	21.01	19.23
		1	49	20.35	19.61
		1	99	20.60	19.86
		50	0	19.99	19.06
		50	25	19.55	18.62
		50	50	19.03	18.11
		100	0	19.56	18.68
	1732.5	1	0	20.12	19.39
		1	49	20.76	19.99
		1	99	21.36	20.64
		50	0	19.90	18.95
		50	25	19.91	18.97
		50	50	19.51	18.58
		100	0	19.23	18.34
	1745.0	1	0	21.31	19.69
		1	49	21.81	20.26
		1	99	21.14	20.63
		50	0	20.32	19.45
		50	25	20.81	19.75
		50	50	20.90	19.92
		100	0	20.77	19.89

Conducted power measurement of WLAN2.4G

Mode	Channel	Frequency (MHz)	Worst case Data rate of worst case	Conducted output power	
				Average (dBm)	Peak (dBm)
802.11b	1	2412	1Mbps	17.18	20.87
	6	2437	1Mbps	17.09	20.78
	11	2462	1Mbps	**17.22**	20.93
802.11g	1	2412	6Mbps	14.65	17.64
	6	2437	6Mbps	15.81	19.82
	11	2462	6Mbps	14.14	18.15
802.11n HT20	1	2412	6.5 Mbps	12.55	17.56
	6	2437	6.5 Mbps	13.57	19.58
	11	2462	6.5 Mbps	12.96	17.97
802.11n HT40	3	2422	13.5 Mbps	10.38	15.37
	6	2437	13.5 Mbps	11.88	17.89
	9	2452	13.5 Mbps	10.76	15.77

Note: SAR is not required for the following 2.4 GHz OFDM conditions as 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.

Conducted power measurement of BluetoothV4.0

Mode	channel	Frequency (MHz)	Conducted output power	
			Average (dBm)	Peak (dBm)
BT-LE	0	2402	-4.25	-2.91
	19	2440	-2.77	-1.24
	39	2480	-2.92	-1.43
GFSK	0	2402	2.44	4.18
	39	2441	3.06	4.97
	78	2480	**3.77**	5.54
π/4-DQPSK	0	2402	1.01	2.89
	39	2441	1.88	3.96
	78	2480	2.47	4.49
8DPSK	0	2402	1.05	2.98
	39	2441	2.02	4.20
	78	2480	2.66	4.77

Per KDB 447498 D01v06, 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)] ·[$\sqrt{f(GHz)}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

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

Bluetooth Turn up Power (dBm)	Separation Distance (mm)	Frequency (GHz)	Exclusion Thresholds
4.0	5	2.45	0.8

Per KDB 447498 D01v06, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 0.8 which is < 3, SAR testing is not required.

4.2. Manufacturing tolerance

GSM Speech

GSM 850 (GMSK) (Burst Average Power)			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32.0	32.0	32.0
Tolerance ±(dB)	1.0	1.0	1.0
GSM 1900 (GMSK) (Burst Average Power)			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	30.0	30.0	30.0
Tolerance ±(dB)	1.0	1.0	1.0

GSM 850 GPRS (GMSK) (Burst Average Power)				
Channel		128	190	251
1 Txslot	Target (dBm)	32.0	32.0	32.0
	Tolerance ±(dB)	1.0	1.0	1.0
2 Txslot	Target (dBm)	30.0	30.0	30.0
	Tolerance ±(dB)	1.0	1.0	1.0
3 Txslot	Target (dBm)	29.0	29.0	29.0
	Tolerance ±(dB)	1.0	1.0	1.0
4 Txslot	Target (dBm)	27.0	27.0	27.0
	Tolerance ±(dB)	1.0	1.0	1.0
GSM 850 EDGE (8PSK) (Burst Average Power)				
Channel		128	190	251
1 Txslot	Target (dBm)	26.0	26.0	26.0
	Tolerance ±(dB)	1.0	1.0	1.0
2 Txslot	Target (dBm)	23.0	23.0	23.0
	Tolerance ±(dB)	1.0	1.0	1.0
3 Txslot	Target (dBm)	22.0	22.0	22.0
	Tolerance ±(dB)	1.0	1.0	1.0
4 Txslot	Target (dBm)	20.0	20.0	20.0
	Tolerance ±(dB)	1.0	1.0	1.0
GSM 1900 GPRS (GMSK) (Burst Average Power)				
Channel		512	661	810
1 Txslot	Target (dBm)	29.0	29.0	29.0
	Tolerance ±(dB)	1.0	1.0	1.0
2 Txslot	Target (dBm)	27.0	27.0	27.0
	Tolerance ±(dB)	1.0	1.0	1.0
3 Txslot	Target (dBm)	26.0	26.0	26.0
	Tolerance ±(dB)	1.0	1.0	1.0
4 Txslot	Target (dBm)	24.0	24.0	24.0
	Tolerance ±(dB)	1.0	1.0	1.0
GSM 1900 EDGE (8PSK) (Burst Average Power)				
Channel		512	661	810
1 Txslot	Target (dBm)	25.0	25.0	25.0
	Tolerance ±(dB)	1.0	1.0	1.0
2 Txslot	Target (dBm)	23.0	23.0	23.0
	Tolerance ±(dB)	1.0	1.0	1.0
3 Txslot	Target (dBm)	21.0	21.0	21.0
	Tolerance ±(dB)	1.0	1.0	1.0
4 Txslot	Target (dBm)	19.0	19.0	19.0
	Tolerance ±(dB)	1.0	1.0	1.0

UMTS

UMTS Band V			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	23.0	23.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 1)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	23.0	23.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 2)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 3)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 4)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 1)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 2)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 3)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 4)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 5)			
Channel	Channel 4132	Channel 4183	Channel 4233
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0

UMTS Band II			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	23.0	23.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSDPA(sub-test 1)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	23.0	23.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSDPA(sub-test 2)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSDPA(sub-test 3)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSDPA(sub-test 4)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSUPA(sub-test 1)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSUPA(sub-test 2)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSUPA(sub-test 3)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSUPA(sub-test 4)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band II HSUPA(sub-test 5)			
Channel	Channel 9262	Channel 9400	Channel 9538
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0

LTE Band 2

BW:1.4MHz [<RB=1>]						
Channel	Channel 18607		Channel 18900		Channel 19193	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.5	20.5	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:1.4MHz [<RB=3>, <RB=6>]						
Channel	Channel 18607		Channel 18900		Channel 19193	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:3MHz [<RB=1>]						
Channel	Channel 18615		Channel 18900		Channel 19185	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.5
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:3MHz [<RB=8>, <RB=15>]						
Channel	Channel 18615		Channel 18900		Channel 19185	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:5MHz [<RB=1>]						
Channel	Channel 18625		Channel 18900		Channel 19175	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:5MHz [<RB=12>, <RB=25>]						
Channel	Channel 18625		Channel 18900		Channel 19175	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:10MHz [<RB=1>]						
Channel	Channel 18650		Channel 18900		Channel 19150	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	20.0	19.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:10MHz [<RB=25>, <RB=50>]						
Channel	Channel 18650		Channel 18900		Channel 19150	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	19.0	18.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:15MHz [<RB=1>]						
Channel	Channel 18675		Channel 18900		Channel 19125	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:15MHz [<RB=37>, <RB=75>]						
Channel	Channel 18675		Channel 18900		Channel 19125	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	19.0	18.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:20MHz [<RB=1>]						
Channel	Channel 18700		Channel 18900		Channel 19100	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:20MHz [<RB=50>, <RB=100>]						
Channel	Channel 18700		Channel 18900		Channel 19100	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0

LTE Band 4

BW:1.4MHz [<RB=1>]						
Channel	Channel 19957		Channel 20175		Channel 20393	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.5	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:1.4MHz [<RB=3>, <RB=6>]						
Channel	Channel 19957		Channel 20175		Channel 20393	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:3MHz [<RB=1>]						
Channel	Channel 19965		Channel 20175		Channel 20385	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:3MHz [<RB=8>, <RB=15>]						
Channel	Channel 19965		Channel 20175		Channel 20385	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:5MHz [<RB=1>]						
Channel	Channel 19975		Channel 20175		Channel 20375	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:5MHz [<RB=12>, <RB=25>]						
Channel	Channel 19975		Channel 20175		Channel 20375	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:10MHz [<RB=1>]						
Channel	Channel 20000		Channel 20175		Channel 20350	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	20.0	19.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:10MHz [<RB=25>, <RB=50>]						
Channel	Channel 20000		Channel 20175		Channel 20350	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:15MHz [<RB=1>]						
Channel	Channel 20025		Channel 20175		Channel 20325	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:15MHz [<RB=37>, <RB=75>]						
Channel	Channel 20025		Channel 20175		Channel 20325	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:20MHz [<RB=1>]						
Channel	Channel 20050		Channel 20175		Channel 20300	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	21.0	20.0	21.0	20.0	21.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
BW:20MHz [<RB=50>, <RB=100>]						
Channel	Channel 20050		Channel 20175		Channel 20300	
	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Target (dBm)	20.0	19.0	20.0	19.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0

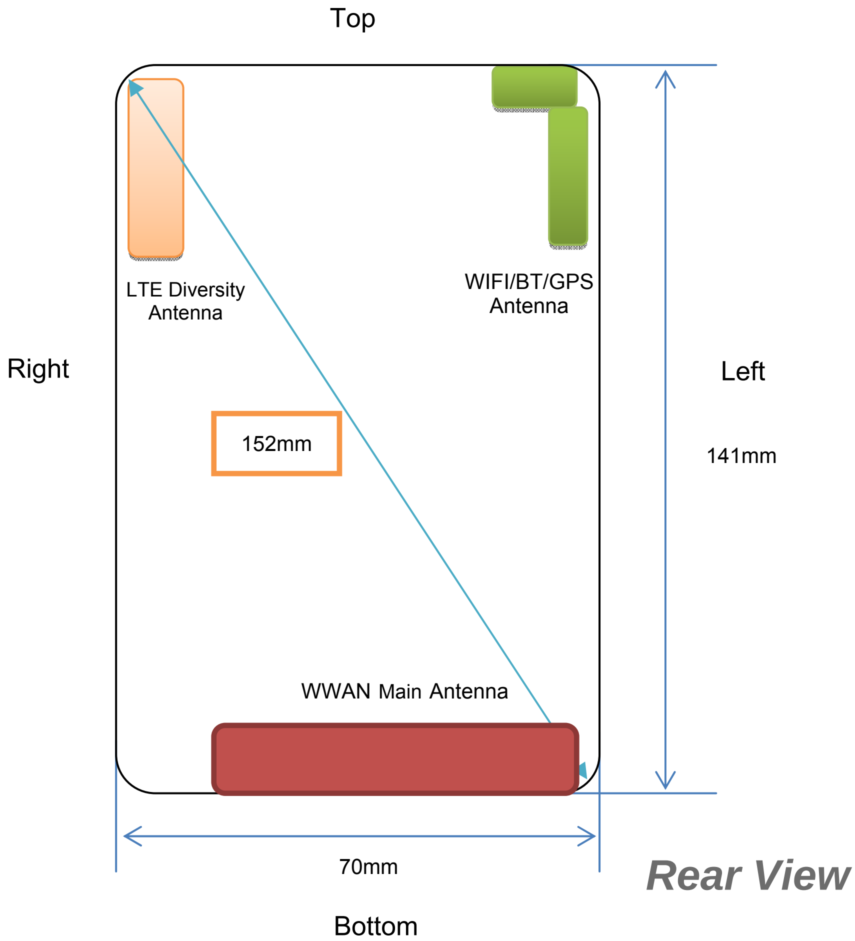
WiFi 2.4G

802.11b (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0
802.11g (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
802.11n HT20 (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	13.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0
802.11n HT40 (Average)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0

Bluetooth V4.0

BLE-GFSK (Average)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-4.0	-2.0	-2.0
Tolerance ±(dB)	1.0	1.0	1.0
GFSK (Average)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Average)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	2.0	2.0	2.0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Average)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	2.0	2.0	2.0
Tolerance ±(dB)	1.0	1.0	1.0

4.3. Transmit Antennas and SAR Measurement Position



Antenna information:

WWAN Main Antenna	GSM/UMTS/LTE TX/RX
LTEDiversity antenna	Only RX
WLAN/GPS/BT Antenna	WLAN/BT TX/RX

Note:
1). Per KDB648474 D04, because the overall diagonal distance of this devices is 152mm<160mm, it is not considered as "Phablets" device.
2). Per KDB648474 D04, 10-g extremity SAR is not required when Body-Worn mode 1-g reported SAR < 1.2 W/Kg.
3). According to the KDB941225 D06 Hot Spot SAR, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

Distance of The Antenna to the EUT surface and edge (mm)						
Antennas	**Front**	**Back**	**Top Side**	**Bottom Side**	**Left Side**	**Right Side**
WWAN	<5	<5	122	<5	<5	14
BT/WLAN	<5	<5	<5	105	<5	50

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

General Note: Referring to KDB 941225 D06, When the overall device length and width are ≥9cm*5cm, the test distance is 10mm, SAR must be measured for all sides and surfaces with a transmitting antenna located with 25mm from that surface or edge.

4.4. SAR Measurement Results

The calculated SAR is obtained by the following formula:

Reported SAR=Measured SAR*$10^{(Ptarget-Pmeasured))/10}$

Scaling factor=$10^{(Ptarget-Pmeasured))/10}$

Reported SAR= Measured SAR* Scaling factor

Where

P_{target} is the power of manufacturing upper limit;

$P_{measured}$ is the measured power;

Measured SAR is measured SAR at measured power which including power drift)

Reported SAR which including Power Drift and Scaling factor

The product with 2 SIMs and 2 SIMs(SIM1 and SIM2) can not used Simultaneous, we tested 2 SIMs(SIM1 and SIM2) and recorded worst case at SIM 1

Duty Cycle

Test Mode	Duty Cycle
Speech for GSM850/1900	1:8
GPRS850	1:2.67
GPRS1900	1:2.67
UMTS	1:1
LTE	1:1
WiFi2450	1:1

5.3.1 SAR Results

SAR Values [GSM 850]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR_{1-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Head										
190	836.6	Voice	Left Cheek	32.84	33.00	2.60	1.04	0.240	0.249	
190	836.6	Voice	Left Tilt	32.84	33.00	2.21	1.04	0.155	0.161	
190	836.6	Voice	Right Cheek	32.84	33.00	1.44	1.04	0.341	0.354	Plot 1
190	836.6	Voice	Right Tilt	32.84	33.00	-1.63	1.04	0.165	0.171	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
128	824.2	3Txslots	Front	29.46	30.00	-2.86	1.13	0.236	0.267	
128	824.2	3Txslots	Rear	29.46	30.00	4.17	1.13	0.555	0.628	Plot 2
128	824.2	3Txslots	Left	29.46	30.00	0.17	1.13	0.215	0.243	
128	824.2	3Txslots	Right	29.46	30.00	-1.14	1.13	0.334	0.378	
128	824.2	3Txslots	Bottom	29.46	30.00	-2.39	1.13	0.289	0.327	

SAR Values [GSM 1900]

Ch.	Freq. (MHz)	time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR_{1-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Head										
512	1850.2	Voice	Left Cheek	30.54	31.00	2.46	1.11	0.131	0.146	Plot 3
512	1850.2	Voice	Left Tilt	30.54	31.00	-0.23	1.11	0.105	0.117	
512	1850.2	Voice	Right Cheek	30.54	31.00	3.58	1.11	0.063	0.070	
512	1850.2	Voice	Right Tilt	30.54	31.00	-0.60	1.11	0.046	0.051	
measured / reported SAR numbers – Body (hotspot open, distance 10mm)										
661	1880.0	3Txslots	Front	26.52	27.00	3.14	1.12	0.116	0.130	
661	1880.0	3Txslots	Rear	26.52	27.00	-2.97	1.12	0.234	0.261	Plot 4
661	1880.0	3Txslots	Left	26.52	27.00	-3.87	1.12	0.204	0.228	
661	1880.0	3Txslots	Right	26.52	27.00	2.15	1.12	0.124	0.138	
661	1880.0	3Txslots	Bottom	26.52	27.00	3.13	1.12	0.219	0.245	

SAR Values [WCDMA Band V]

Ch.	Freq. (MHz)	Channel Type	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR_{1-g} results(W/kg) Measured	Reported	Graph Results
measured / reported SAR numbers - Head										
4132	826.4	RMC	Left Cheek	23.45	24.00	-0.20	1.14	0.169	0.192	
4132	826.4	RMC	Left Tilt	23.45	24.00	2.06	1.14	0.103	0.117	
4132	826.4	RMC	Right Cheek	23.45	24.00	0.50	1.14	0.187	0.212	Plot 5
4132	826.4	RMC	Right Tilt	23.45	24.00	-2.47	1.14	0.153	0.174	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
4132	826.4	RMC	Front	23.45	24.00	1.09	1.14	0.198	0.225	
4132	826.4	RMC	Rear	23.45	24.00	-0.75	1.14	0.315	0.358	Plot 6
4132	826.4	RMC	Left	23.45	24.00	3.54	1.14	0.176	0.200	
4132	826.4	RMC	Right	23.45	24.00	-2.30	1.14	0.207	0.235	
4132	826.4	RMC	Bottom	23.45	24.00	-2.41	1.14	0.268	0.304	

SAR Values [WCDMA Band II]

Ch.	Freq. (MHz)	Channel Type	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR_{1-g} results(W/kg) Measured	Reported	Graph Results
measured / reported SAR numbers – Head										
9262	1852.4	RMC	Left Cheek	23.51	24.00	-0.50	1.12	0.188	0.210	Plot 7
9262	1852.4	RMC	Left Tilt	23.51	24.00	1.20	1.12	0.119	0.133	
9262	1852.4	RMC	Right Cheek	23.51	24.00	1.81	1.12	0.106	0.119	
9262	1852.4	RMC	Right Tilt	23.51	24.00	0.13	1.12	0.085	0.095	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
9262	1852.4	RMC	Front	23.51	24.00	1.17	1.12	0.104	0.116	
9262	1852.4	RMC	Rear	23.51	24.00	-0.68	1.12	0.252	0.282	Plot 8
9262	1852.4	RMC	Left	23.51	24.00	1.25	1.12	0.122	0.137	
9262	1852.4	RMC	Right	23.51	24.00	0.61	1.12	0.170	0.190	
9262	1852.4	RMC	Bottom	23.51	24.00	-1.56	1.12	0.204	0.228	

SAR Values [LTE Band 2]

Ch.	Freq. (MHz)	Channel Type (20M)	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR_{1-g} results(W/kg) Measured	Reported	Graph Results
measured / reported SAR numbers - Head										
18900	1880	1RB	Left Cheek	21.23	22.00	0.00	1.19	0.214	0.256	Plot 9
18900	1880	1RB	Left Tilt	21.23	22.00	1.36	1.19	0.153	0.183	
18900	1880	1RB	Right Cheek	21.23	22.00	2.53	1.19	0.168	0.201	
18900	1880	1RB	Right Tilt	21.23	22.00	3.06	1.19	0.121	0.144	
19100	1900	50%RB	Left Cheek	20.39	21.00	1.21	1.15	0.177	0.204	
19100	1900	50%RB	Left Tilt	20.39	21.00	2.98	1.15	0.116	0.133	
19100	1900	50%RB	Right Cheek	20.39	21.00	-2.07	1.15	0.155	0.183	
19100	1900	50%RB	Right Tilt	20.39	21.00	-1.83	1.15	0.102	0.120	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
18900	1880	1RB	Front	21.23	22.00	-1.61	1.19	0.357	0.426	
18900	1880	1RB	Rear	21.23	22.00	0.14	1.19	0.525	0.627	Plot 10
18900	1880	1RB	Left	21.23	22.00	2.72	1.19	0.259	0.309	
18900	1880	1RB	Right	21.23	22.00	-2.19	1.19	0.411	0.491	
18900	1880	1RB	Bottom	21.23	22.00	1.04	1.19	0.358	0.427	
18900	1880	50%RB	Front	20.39	21.00	-1.33	1.15	0.289	0.333	
18900	1880	50%RB	Rear	20.39	21.00	3.04	1.15	0.428	0.493	
18900	1880	50%RB	Left	20.39	21.00	2.64	1.15	0.226	0.260	
18900	1880	50%RB	Right	20.39	21.00	2.45	1.15	0.376	0.433	
18900	1880	50%RB	Bottom	20.39	21.00	-2.53	1.15	0.307	0.353	

SAR Values [LTE Band 4]

Ch.	Freq. (MHz)	Channel Type (20M)	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR_{1-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Head										
20300	1745.0	1RB	Left Cheek	21.81	22.00	-2.18	1.04	0.328	0.342	Plot 11
20300	1745.0	1RB	Left Tilt	21.81	22.00	2.87	1.04	0.205	0.214	
20300	1745.0	1RB	Right Cheek	21.81	22.00	-1.62	1.04	0.306	0.320	
20300	1745.0	1RB	Right Tilt	21.81	22.00	-1.38	1.04	0.180	0.188	
20300	1745.0	50%RB	Left Cheek	20.90	21.00	2.18	1.02	0.276	0.282	
20300	1745.0	50%RB	Left Tilt	20.90	21.00	1.49	1.02	0.129	0.132	
20300	1745.0	50%RB	Right Cheek	20.90	21.00	2.43	1.02	0.221	0.226	
20300	1745.0	50%RB	Right Tilt	20.90	21.00	1.27	1.02	0.117	0.120	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
20300	1745.0	1RB	Front	21.81	22.00	-0.09	1.04	0.416	0.435	
20300	1745.0	1RB	Rear	21.81	22.00	-1.05	1.04	0.652	0.682	Plot 12
20300	1745.0	1RB	Left	21.81	22.00	-2.24	1.04	0.334	0.349	
20300	1745.0	1RB	Right	21.81	22.00	2.04	1.04	0.395	0.413	
20300	1745.0	1RB	Bottom	21.81	22.00	-3.53	1.04	0.488	0.510	
20300	1745.0	50%RB	Front	20.90	21.00	1.72	1.02	0.346	0.354	
20300	1745.0	50%RB	Rear	20.90	21.00	-1.08	1.02	0.539	0.552	
20300	1745.0	50%RB	Left	20.90	21.00	2.05	1.02	0.298	0.305	
20300	1745.0	50%RB	Right	20.90	21.00	-2.39	1.02	0.319	0.326	
20300	1745.0	50%RB	Bottom	20.90	21.00	-0.24	1.02	0.339	0.347	

SAR Values [WIFI2.4G]

Ch.	Freq. (MHz)	Service	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR_{1-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Head										
11	2462	DSSS	Left Cheek	17.22	18.00	-1.36	1.20	0.429	0.513	Plot 13
11	2462	DSSS	Left Tilt	17.22	18.00	-2.30	1.20	0.227	0.272	
11	2462	DSSS	Right Cheek	17.22	18.00	-2.48	1.20	0.362	0.433	
11	2462	DSSS	Right Tilt	17.22	18.00	3.15	1.20	0.183	0.219	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
11	2462	DSSS	Front	17.22	18.00	0.69	1.20	0.141	0.169	
11	2462	DSSS	Rear	17.22	18.00	-1.76	1.20	0.256	0.306	Plot 14
11	2462	DSSS	Left	17.22	18.00	-0.57	1.20	0.137	0.164	
11	2462	DSSS	Top	17.22	18.00	0.59	1.20	0.206	0.247	

Note:
1. The value with black color is the maximum Reported 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 941225 D02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is < 0.25dBhigher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA SAR evaluation can be excluded.
4. Per KDB 941225 D05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation,using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel
5. Per KDB 941225 D05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
6. Per KDB 941225 D05, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
7. Per KDB 941225 D05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05,16QAM SAR testing is not required.
8. Per KDB 941225 D05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05, smaller bandwidth SAR testing is not required.
9. Per KDB 248227-SAR is measured using the highest measured maximum output power channel for the initial test configuration.
10. 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. So ODFM SAR test is not required.
11. Per KDB 648474 D04, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

5.3.3 Standalone SAR Test Exclusion Considerations and Estimated SAR

Per KDB447498 requires when the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion;
● (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√ f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
● 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
Per FCC KD B447498 D01,simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the transmitting antenna in a specific a physical test configuration is ≤1.6 W/Kg.When the sum is greater than the SAR limit,SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio}=\frac{(\text{SAR}_1+\text{SAR}_2)^{1.5}}{(\text{peak location separation,mm})}<0.04$$

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*	2450	Head	4.0	5	0.104
Bluetooth*	2450	Hotspot	4.0	10	0.052
Bluetooth*	2450	Body-worn	4.0	10	0.052

Remark:

1. *Bluetooth*- Including Lower power Bluetooth*
2. *Maximum average power including tune-up tolerance;*
3. *When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion*
4. *Body as body use distance is 10mm from manufacturer declaration of user manual.*

4.5. Simultaneous TX SAR Considerations

4.5.1 Introduction

The following procedures adopted from "FCC SAR Considerations for Cell Phones with Multiple Transmitters" are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.
For the DUT,the BT and WiFi modules sharing same antenna, GSM/WCDMA and LTE modules sharing same single antenna;
The 2.4G WLAN share a antenna, cannot transmit simultaneous.
Application Simultaneous Transmission information:

Air-Interface	Band (MHz)	Type	Simultaneous Transmissions	Voice over Digital Transport(Data)
GSM	850	VO	Yes,WLAN or BT/BLE	N/A
	1900	VO		
	GPRS/EDGE	DT	Yes,WLAN or BT/BLE	N/A
WCDMA	Band II/ BandV	DT	Yes,WLAN or BT/BLE	N/A
LTE	Band 2/Band 4	DT	Yes,WLAN or BT/BLE	N/A
WLAN	2450	DT	Yes,GSM,GPRS,EDGE,UMTS,LTE	Yes
BT/BLE	2450	DT	Yes,GSM,GPRS,EDGE,UMTS,LTE	N/A
Note:VO-Voice Service only;DT-Digital Transport				

Note: BT and WLAN can be active at the same time, but only with interleaving of packages switched on board level. That means that they don't transmit at the same time.
BLE-Bluetooth low energy;
BT- Classical Bluetooth

4.5.2 Evaluation of Simultaneous SAR

Head Exposure Conditions

Simultaneous transmission SAR for WiFi and GSM

Test Position	GSM850 Reported SAR_{1-g} (W/Kg)	GSM1900 Reported SAR_{1-g} (W/Kg)	WiFi2.4G Reported SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Left Cheek	0.249	0.146	0.513	0.762	1.6	no	no
Left Tilt	0.161	0.117	0.272	0.433	1.6	no	no
Right Cheek	0.354	0.070	0.433	0.787	1.6	no	no
Right Tilt	0.171	0.051	0.219	0.390	1.6	no	no

Simultaneous transmission SAR for WiFi and UMTS

Test Position	UMTS Band V Reported SAR_{1-g} (W/Kg)	UMTS Band II Reported SAR_{1-g} (W/Kg)	WiFi2.4G Reported SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Left Cheek	0.192	0.210	0.513	0.723	1.6	no	no
Left Tilt	0.117	0.133	0.272	0.405	1.6	no	no
Right Cheek	0.212	0.119	0.433	0.645	1.6	no	no
Right Tilt	0.174	0.095	0.219	0.393	1.6	no	no

Simultaneous transmission SAR for WiFi and LTE

Test Position	LTE Band 2 Reported SAR_{1-g} (W/Kg)	LTE Band 4 Reported SAR_{1-g} (W/Kg)	WiFi2.4G Reported SAR1-g (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Left Cheek	0.256	0.342	0.513	0.855	1.6	no	no
Left Tilt	0.183	0.214	0.272	0.486	1.6	no	no
Right Cheek	0.201	0.320	0.433	0.753	1.6	no	no
Right Tilt	0.144	0.188	0.219	0.407	1.6	no	no

Simultaneous transmission SAR for BT and GSM

Test Position	GSM850 Reported SAR_{1-g} (W/Kg)	GSM1900 Reported SAR_{1-g} (W/Kg)	BT Estimated SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Left Cheek	0.249	0.146	0.104	0.353	1.6	no	no
Left Tilt	0.161	0.117	0.104	0.265	1.6	no	no
Right Cheek	0.354	0.070	0.104	0.458	1.6	no	no
Right Tilt	0.171	0.051	0.104	0.275	1.6	no	no

Simultaneous transmission SAR for BT and UMTS

Test Position	UMTS Band V Reported SAR_{1-g} (W/Kg)	UMTS Band II Reported SAR_{1-g} (W/Kg)	BT Estimated SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Left Cheek	0.192	0.210	0.104	0.314	1.6	no	no
Left Tilt	0.117	0.133	0.104	0.237	1.6	no	no
Right Cheek	0.212	0.119	0.104	0.316	1.6	no	no
Right Tilt	0.174	0.095	0.104	0.278	1.6	no	no

Simultaneous transmission SAR for BT and LTE

Test Position	LTE Band 2 Reported SAR_{1-g} (W/Kg)	LTE Band 4 Reported SAR_{1-g} (W/Kg)	BT Estimated SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Left Cheek	0.256	0.342	0.104	0.446	1.6	no	no
Left Tilt	0.183	0.214	0.104	0.318	1.6	no	no
Right Cheek	0.201	0.320	0.104	0.424	1.6	no	no
Right Tilt	0.144	0.188	0.104	0.292	1.6	no	no

Body Hotspot Exposure Conditions

Simultaneous transmission SAR for WiFi and GSM

Test Position	GSM850 Reported SAR_{1-g} (W/Kg)	GSM1900 Reported SAR_{1-g} (W/Kg)	WiFi2.4G Reported SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Front	0.267	0.130	0.169	0.436	1.6	no	no
Rear	0.628	0.261	0.306	0.934	1.6	no	no
Left	0.243	0.228	0.164	0.407	1.6	no	no
Right	0.378	0.138	/	0.378	1.6	no	no
Bottom	0.327	0.245	/	0.327	1.6	no	no
Top	/	/	0.247	0.247	1.6	no	no

Simultaneous transmission SAR for WiFi and UMTS

Test Position	UMTS Band V Reported SAR_{1-g} (W/Kg)	UMTS Band II Reported SAR_{1-g} (W/Kg)	WiFi2.4G Reported SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Front	0.225	0.116	0.169	0.394	1.6	no	no
Rear	0.358	0.282	0.306	0.664	1.6	no	no
Left	0.200	0.137	0.164	0.364	1.6	no	no
Right	0.235	0.190	/	0.235	1.6	no	no
Bottom	0.304	0.228	/	0.304	1.6	no	no
Top	/	/	0.247	0.247	1.6	no	no

Simultaneous transmission SAR for WiFi and LTE

Test Position	LTE Band 2 Reported SAR_{1-g} (W/Kg)	LTE Band 4 Reported SAR_{1-g} (W/Kg)	WiFi2.4G Reported SAR1-g (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Front	0.426	0.435	0.169	0.604	1.6	no	no
Rear	0.627	0.682	0.306	0.988	1.6	no	no
Left	0.309	0.349	0.164	0.513	1.6	no	no
Right	0.491	0.413	/	0.413	1.6	no	no
Bottom	0.427	0.510	/	0.510	1.6	no	no
Top	/	/	0.247	0.247	1.6	no	no

Simultaneous transmission SAR for BT and GSM

Test Position	GSM850 Reported SAR_{1-g} (W/Kg)	GSM1900 Reported SAR_{1-g} (W/Kg)	BT Estimated SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Front	0.267	0.130	0.052	0.319	1.6	no	no
Rear	0.628	0.261	0.052	0.680	1.6	no	no
Left	0.243	0.228	0.052	0.295	1.6	no	no
Right	0.378	0.138	/	0.378	1.6	no	no
Bottom	0.327	0.245	/	0.327	1.6	no	no
Top	/	/	0.052	0.052	1.6	no	no

Simultaneous transmission SAR for BT and UMTS

Test Position	UMTS Band V Reported SAR_{1-g} (W/Kg)	UMTS Band II Reported SAR_{1-g} (W/Kg)	BT Estimated SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Front	0.225	0.116	0.052	0.277	1.6	no	no
Rear	0.358	0.282	0.052	0.410	1.6	no	no
Left	0.200	0.137	0.052	0.252	1.6	no	no
Right	0.235	0.190	/	0.235	1.6	no	no
Bottom	0.304	0.228	/	0.304	1.6	no	no
Top	/	/	0.052	0.052	1.6	no	no

Simultaneous transmission SAR for BT and LTE

Test Position	LTE Band2 Reported SAR_{1-g} (W/Kg)	LTE Band4 Reported SAR_{1-g} (W/Kg)	BT Estimated SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Peak location separation ratio	Simut Meas. Required
Front	0.426	0.435	0.052	0.487	1.6	no	no
Rear	0.627	0.682	0.052	0.734	1.6	no	no
Left	0.309	0.349	0.052	0.361	1.6	no	no
Right	0.491	0.413	/	0.491	1.6	no	no
Bottom	0.427	0.510	/	0.427	1.6	no	no
Top	/	/	0.052	0.052	1.6	no	no

Note:
1. The WiFi and BT share same antenna, so cannot transmit at same time.
2. The value with block color is the maximum values of standalone
3. The value with blue color is the maximum values of $\sum SAR_{1-g}$

4.6. SAR Measurement Variability

According to KDB865664, Repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required. The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.19 The repeated measurement results must be clearly identified in the SAR report. All measured SAR, including the repeated results, must be considered to determine compliance and for reporting according to KDB 690783.Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

3) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
4) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
5) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
6) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20

Frequency Band (MHz)	Air Interface	RF Exposure Configuration	Test Position	Repeated SAR (yes/no)	Highest Measured SAR_{1-g} (W/Kg)	First Repeated	
						Measued SAR_{1-g} (W/Kg)	Largest to Smallest SAR Ratio
850	GSM850	Standalone	Body-Rear	no	0.555	n/a	n/a
	WCDMA Band V	Standalone	Body-Rear	no	0.315	n/a	n/a
1700	LTE Band 4	Standalone	Body-Rear	no	0.652	n/a	n/a
1900	GSM1900	Standalone	Body-Rear	no	0.234	n/a	n/a
	WCDMA Band II	Standalone	Body-Rear	no	0.252	n/a	n/a
	LTE Band 2	Standalone	Body-Rear	no	0.525	n/a	n/a
2450	2.4GWLAN	Standalone	Head-Left Check	no	0.429	n/a	n/a

Remark:
1. *Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the orignal and first repeated measurement is not > 1.20 or 3 (1-g or 10-g respectively)*

4.7. General description of test procedures

1. The DUT is tested using CMU 200 communications testers as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted peak power.
2. Test positions as described in the tables above are in accordance with the specified test standard.
3. Tests in body position were performed in that configuration, which generates the highest time based averaged output power (see conducted power results).
4. Tests in head position with GSM were performed in voice mode with 1 timeslot unless GPRS/EGPRS/DTM function allows parallel voice and data traffic on 2 or more timeslots.
5. UMTS was tested in RMC mode with 12.2 kbit/s and TPC bits set to ‘all 1’.
6. WiFi was tested in 802.11b/g/n mode with 1 Mbit/s and 6 Mbit/s. According to KDB 248227 the SAR testing for 802.11g/n is not required since When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
7. Required WiFi test channels were selected according to KDB 248227
8. According to FCC KDB 941225 D06 this device has been tested with 10 mm distance to the phantom for operation in WiFi hot spot mode.
9. Per FCC KDB 941225 D06 the edges with antennas within 2.5 cm are required to be evaluated for SAR to cover WiFi hot spot function.

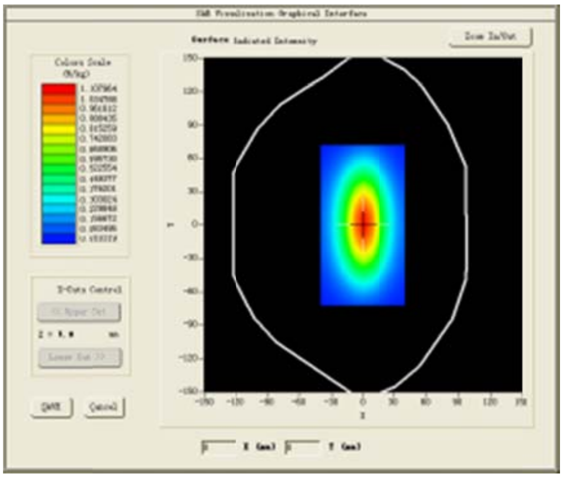
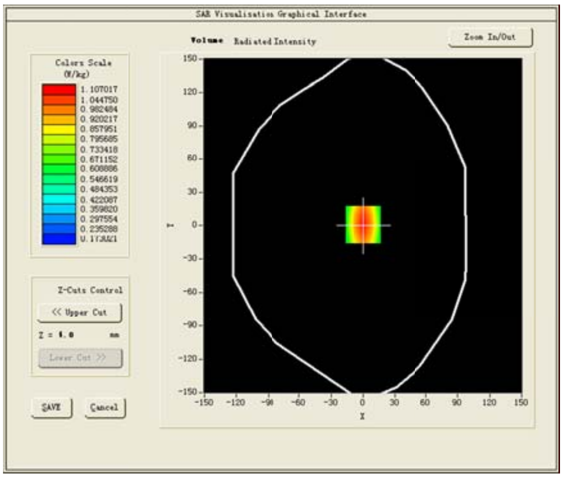
10. According to KDB 447498 D01 testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
    ● ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band 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
11. 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.
12. 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)
13. 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.
14. 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.

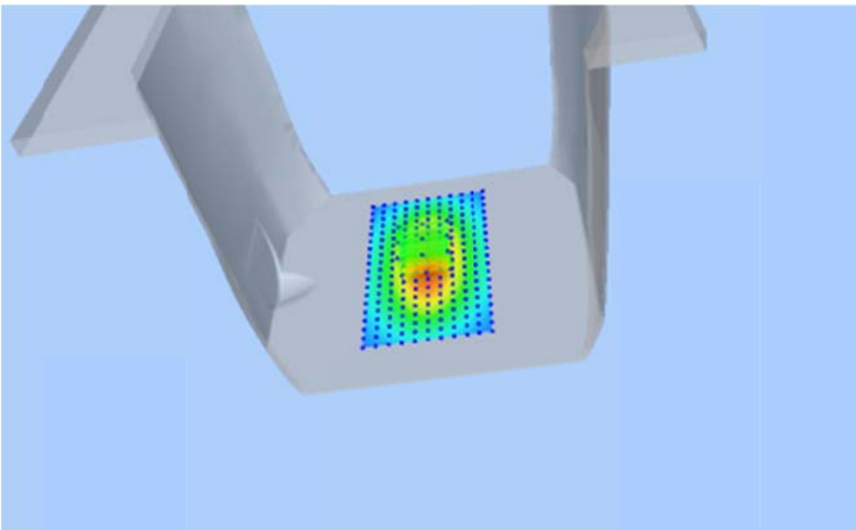
4.8. Measurement Uncertainty (300MHz-6GHz)

Not required as SAR measurement uncertainty analysis is required in SAR reports only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR accoridng to KDB865664D01.

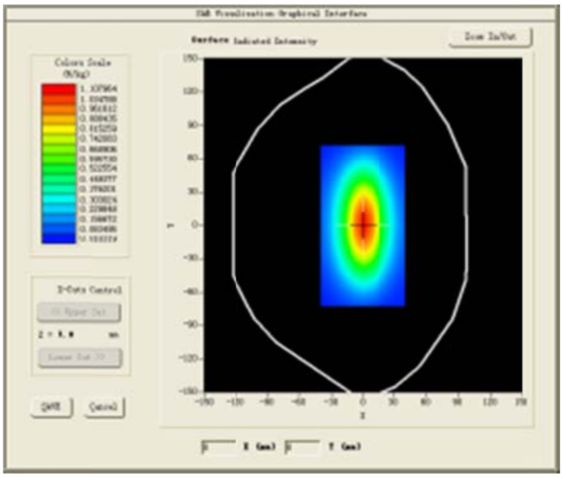
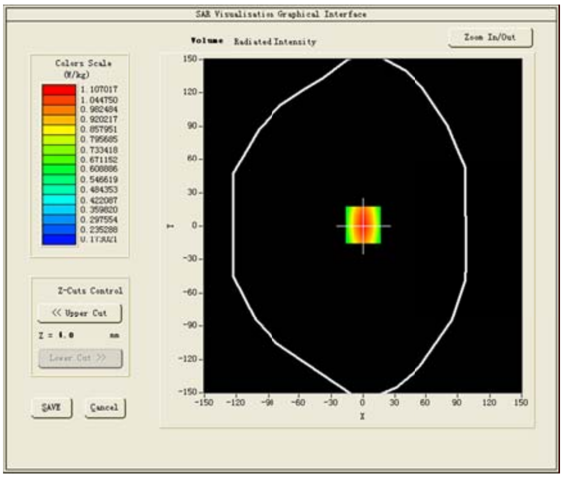
4.9. System Check Results

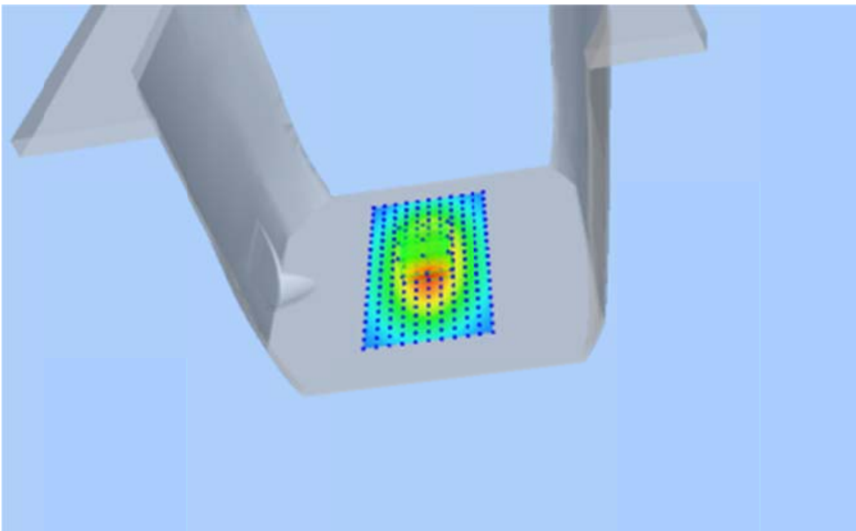
Test mode:835MHz(Head)
Product Description:Validation
Model:Dipole SID835
E-Field Probe:SSE5(SN17/14 EP220)
Test Date: June 18, 2016

Medium(liquid type)	HSL_850
Frequency (MHz)	835.000000
Relative permittivity (real part)	43.22
Conductivity (S/m)	0.93
Input power	100mW
Crest Factor	1.0
Conversion Factor	4.86
Variation (%)	-1.5700000
SAR 10g (W/Kg)	0.6047063
SAR 1g (W/Kg)	0.9471289
SURFACE SAR	**VOLUME SAR**
	

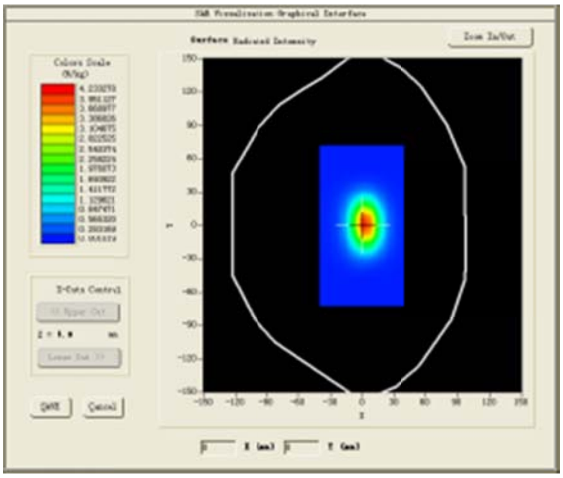
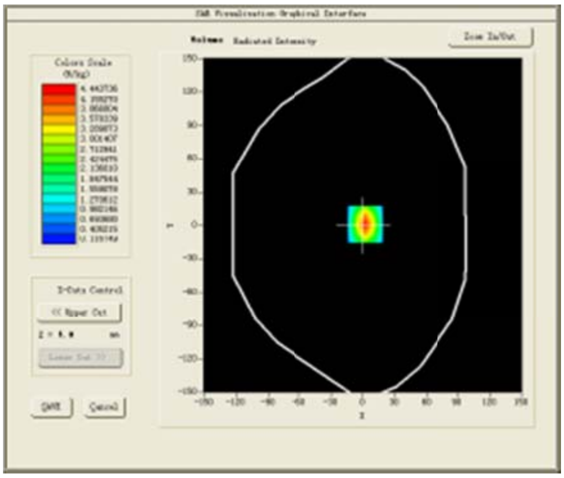
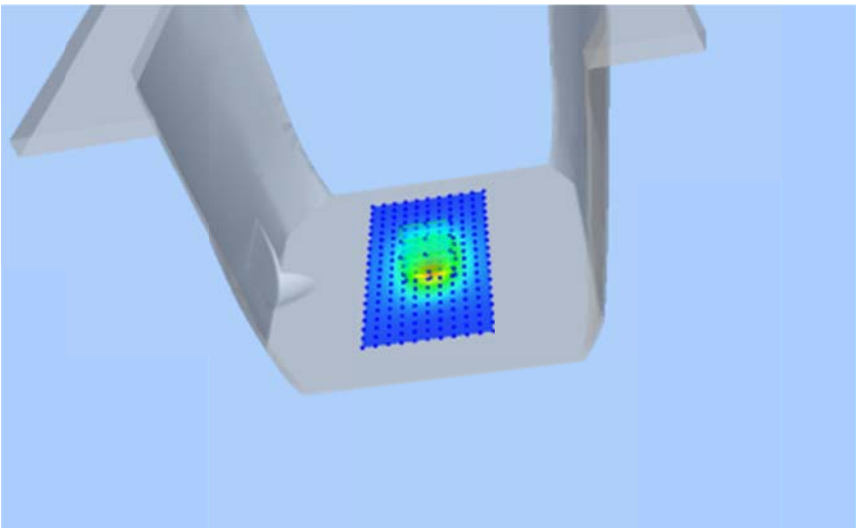


Test mode:835MHz(Body)
Product Description:Validation
Model:Dipole SID835
E-Field Probe:SSE5(SN17/14 EP220)
Test Date: June 18, 2016

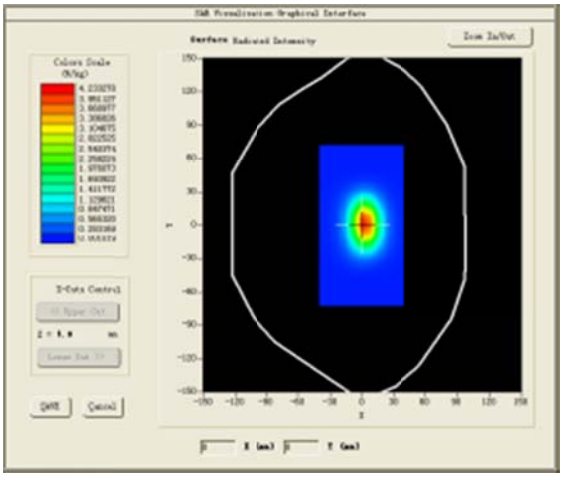
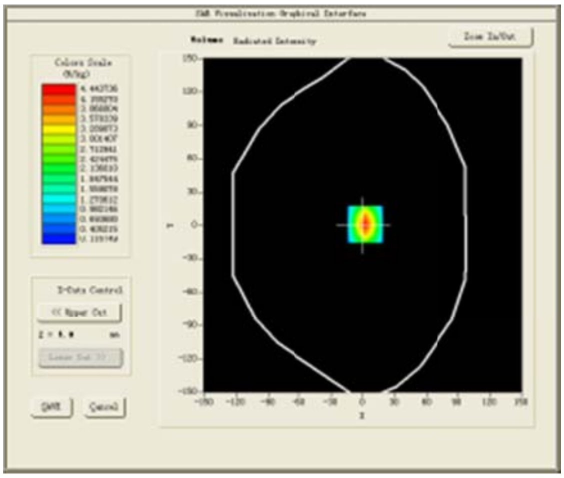
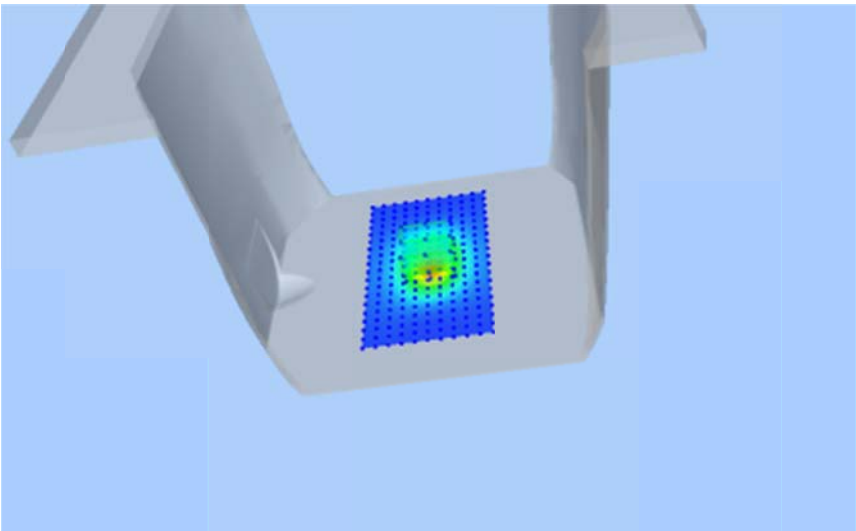
Medium(liquid type)	MSL_850
Frequency (MHz)	835.0000
Relative permittivity (real part)	57.18
Conductivity (S/m)	0.98
Input power	100mW
Crest Factor	1.0
Conversion Factor	5.04
Variation (%)	0.9100000
SAR 10g (W/Kg)	0.6130225
SAR 1g (W/Kg)	0.9800314
SURFACE SAR	**VOLUME SAR**
	



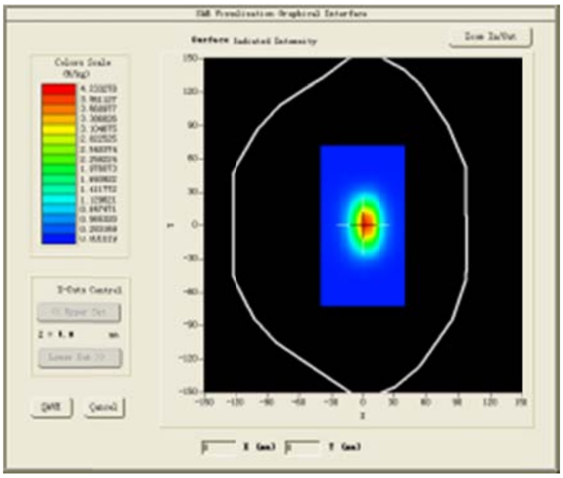
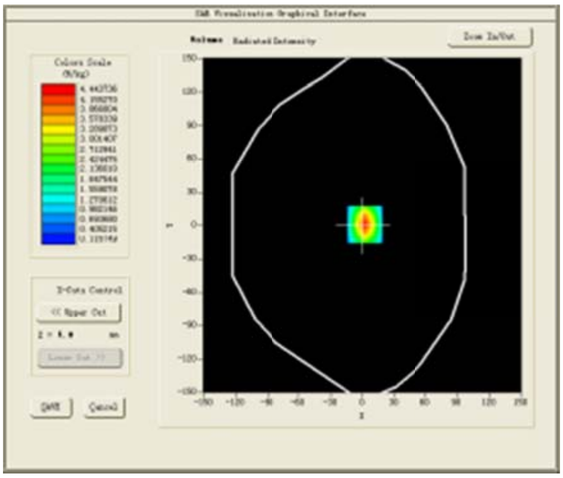
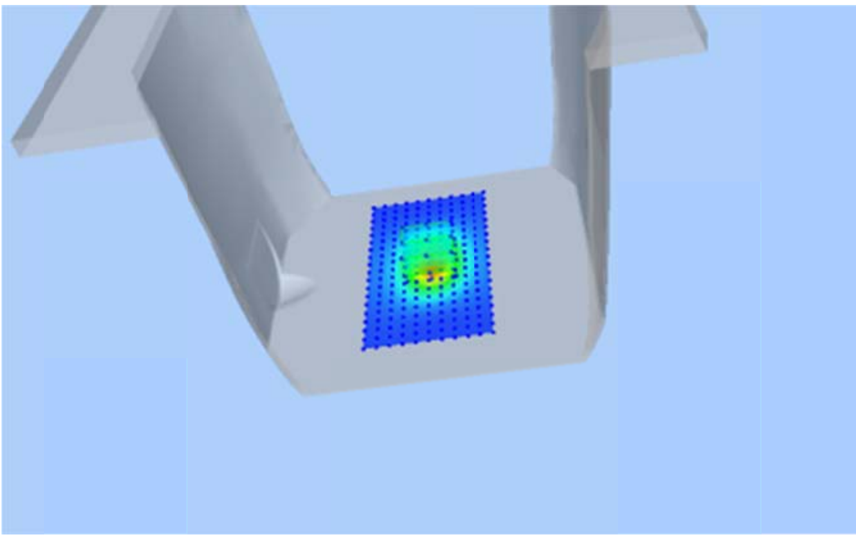
Test mode:1800MHz(Head)
Product Description:Validation
Model :Dipole SID1800
E-Field Probe:SSE5(SN17/14 EP220)
Test Date: June 19, 2016

Medium(liquid type)	HSL_1800
Frequency (MHz)	1800.000000
Relative permittivity (real part)	41.91
Conductivity (S/m)	1.44
Input power	100mW
Crest Factor	1.0
Conversion Factor	4.16
Variation (%)	2.0300000
SAR 10g (W/Kg)	2.1014398
SAR 1g (W/Kg)	3.9703864
SURFACE SAR	**VOLUME SAR**
	
	

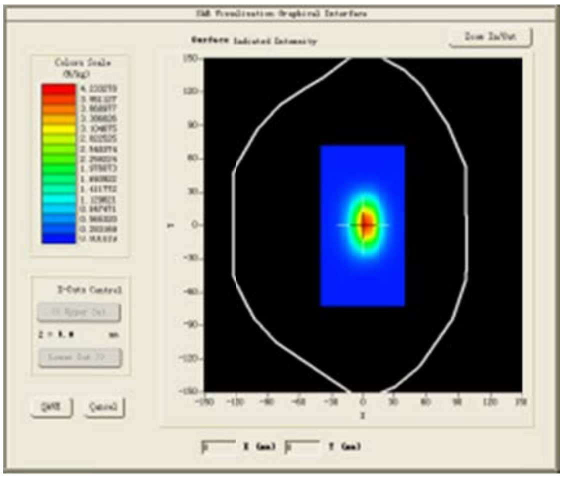
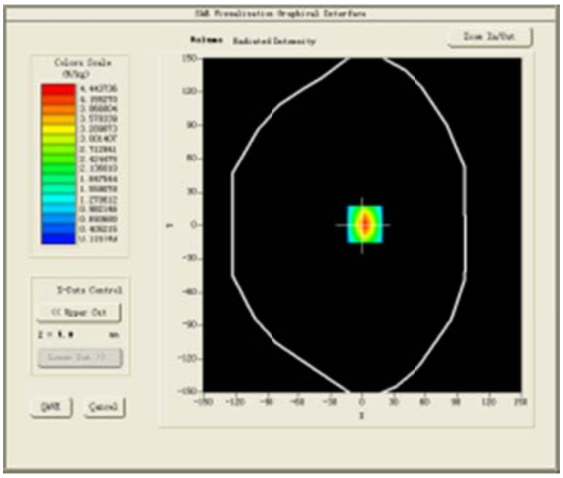
Test mode:1800MHz(Body)
Product Description:Validation
Model :Dipole SID1800
E-Field Probe:SSE5(SN17/14 EP220)
Test Date: June 19, 2016

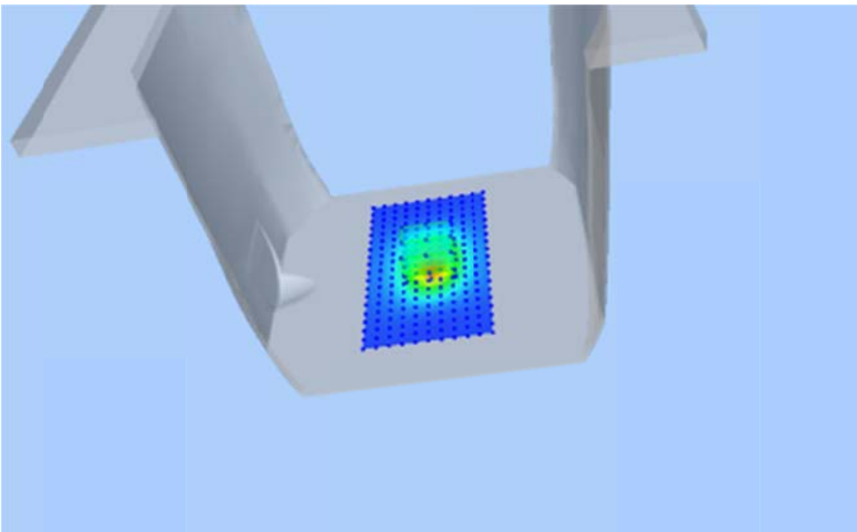
Medium(liquid type)	MSL_1800
Frequency (MHz)	1800.000000
Relative permittivity (real part)	55.44
Conductivity (S/m)	1.55
Input power	100mW
Crest Factor	1.0
Conversion Factor	4.29
Variation (%)	-0.9400000
SAR 10g (W/Kg)	2.0891734
SAR 1g (W/Kg)	4.1468972
SURFACE SAR	**VOLUME SAR**
	
	

Test mode:1900MHz(Head)
Product Description:Validation
Model :Dipole SID1900
E-Field Probe:SSE5(SN17/14 EP221)
Test Date: June 20, 2016

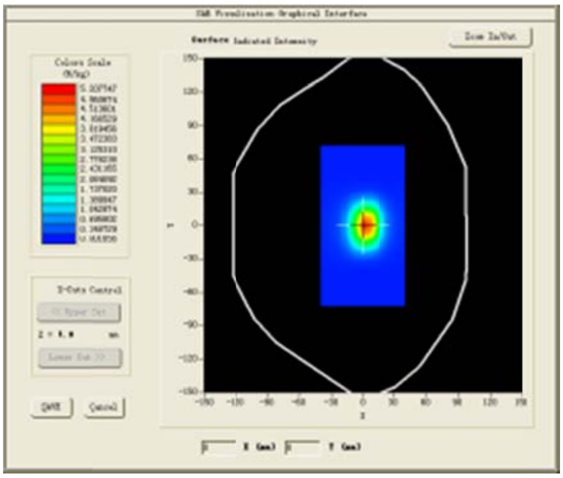
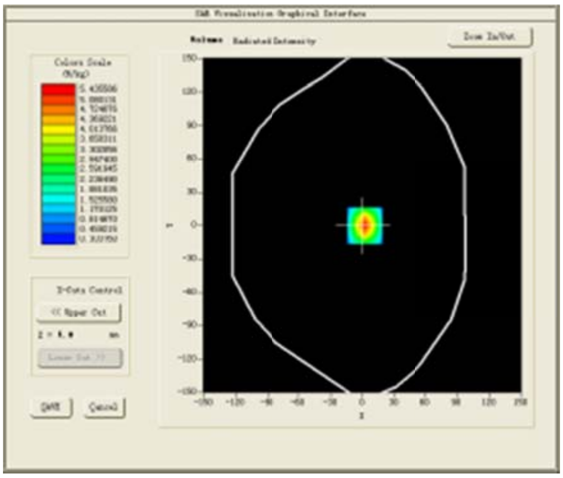
Medium(liquid type)	HSL_1900
Frequency (MHz)	1900.0000
Relative permittivity (real part)	41.50
Conductivity (S/m)	1.45
Input power	100mW
Crest Factor	1.0
Conversion Factor	4.71
Variation (%)	-0.4300000
SAR 10g (W/Kg)	1.8742638
SAR 1g (W/Kg)	3.7003144
SURFACE SAR	**VOLUME SAR**
	
	

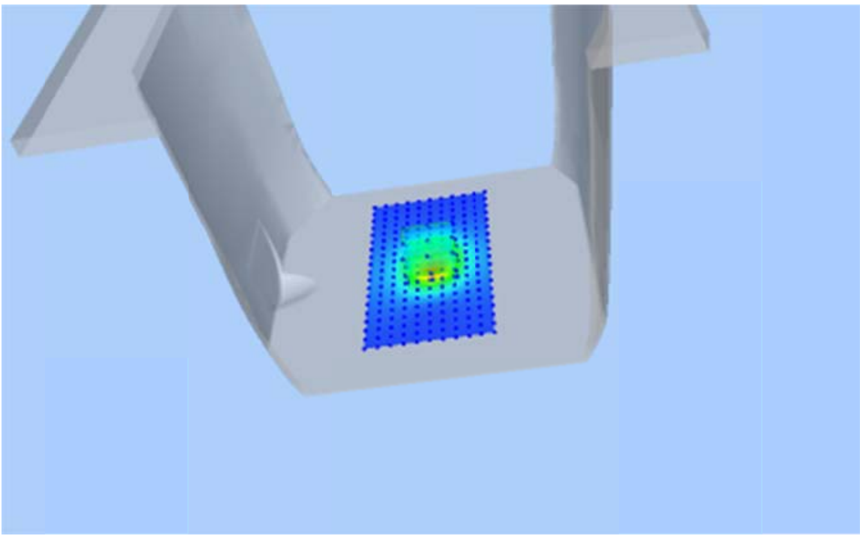
Test mode:1900MHz(Body)
Product Description:Validation
Model :Dipole SID1900
E-Field Probe:SSE5(SN17/14 EP221)
Test Date: June 20, 2016

Medium(liquid type)	MSL_1900
Frequency (MHz)	1900.0000
Relative permittivity (real part)	54.83
Conductivity (S/m)	1.56
Input power	100mW
Crest Factor	1.0
Conversion Factor	4.85
Variation (%)	1.5300000
SAR 10g (W/Kg)	1.9452841
SAR 1g (W/Kg)	3.9754816
SURFACE SAR	**VOLUME SAR**
	

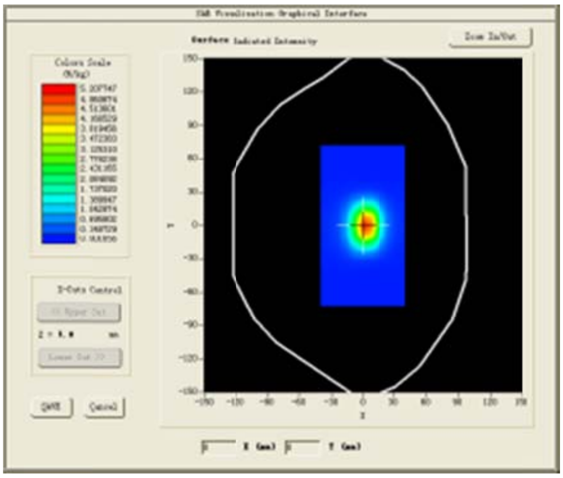
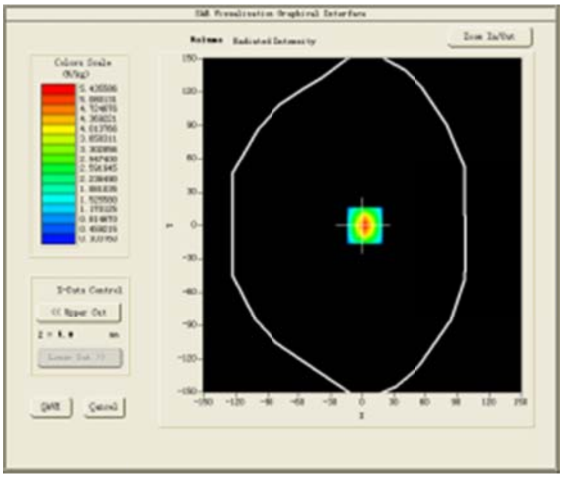


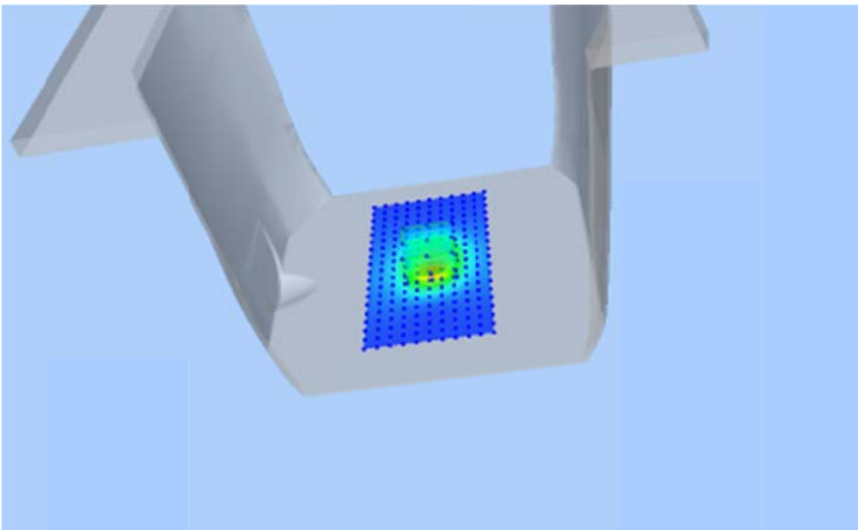
Test mode:2450MHz(Head)
Product Description:Validation
Model:Dipole SID2450
E-Field Probe:SSE5(SN17/14 EP220)
Test Date: June 22, 2016

Medium(liquid type)	HSL_2450
Frequency (MHz)	2450.000000
Relative permittivity (real part)	40.74
Conductivity (S/m)	1.86
Input power	100mW
Crest Factor	1.0
Conversion Factor	3.94
Variation (%)	1.4800000
SAR 10g (W/Kg)	2.3158267
SAR 1g (W/Kg)	4.9679418
SURFACE SAR	**VOLUME SAR**
	



Test mode:2450MHz(Body)
Product Description:Validation
Model:Dipole SID2450
E-Field Probe:SSE5(SN17/14 EP221)
Test Date: June 22, 2016

Medium(liquid type)	MSL_2450
Frequency (MHz)	2450.000000
Relative permittivity (real part)	53.26
Conductivity (S/m)	1.99
Input power	100mW
Crest Factor	1.0
Conversion Factor	4.05
Variation (%)	-3.0700000
SAR 10g (W/Kg)	2.2891476
SAR 1g (W/Kg)	5.0416285
SURFACE SAR	**VOLUME SAR**
	

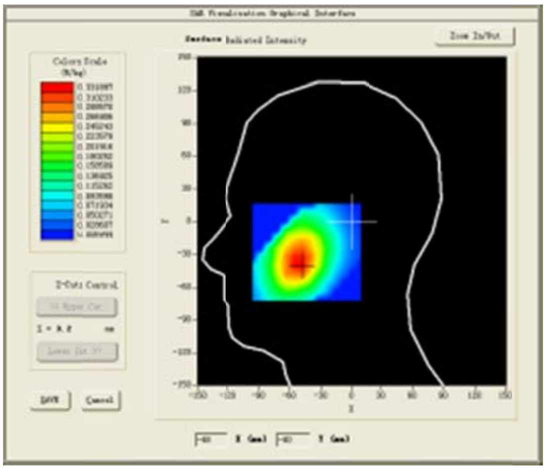
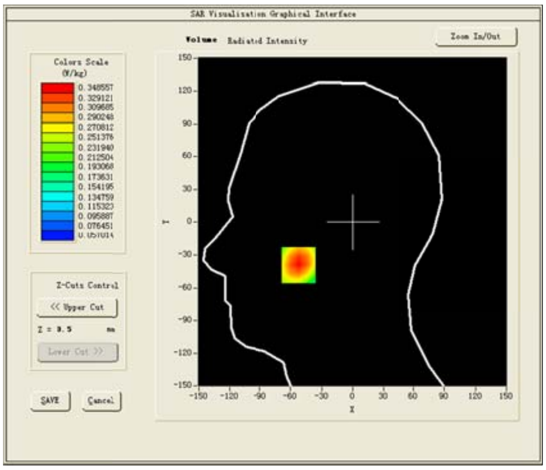


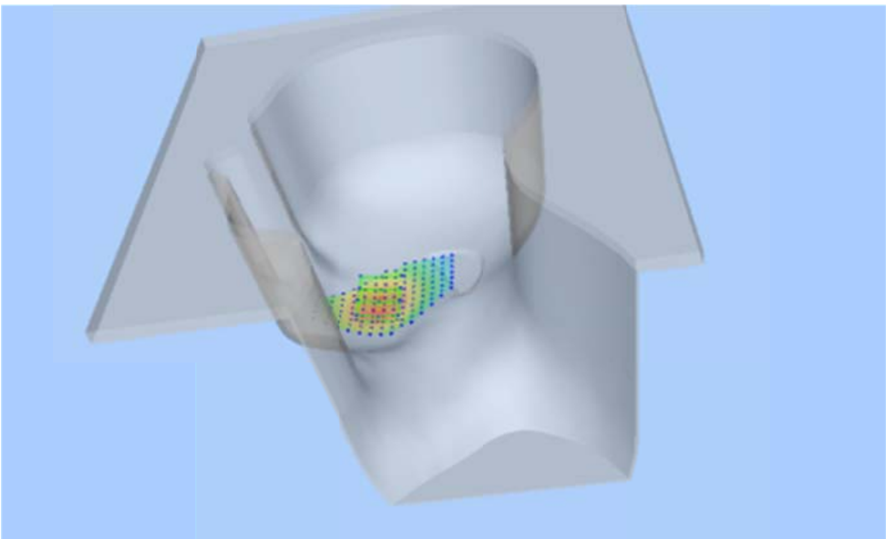
4.10. SAR Test Graph Results

SAR plots for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02

#1

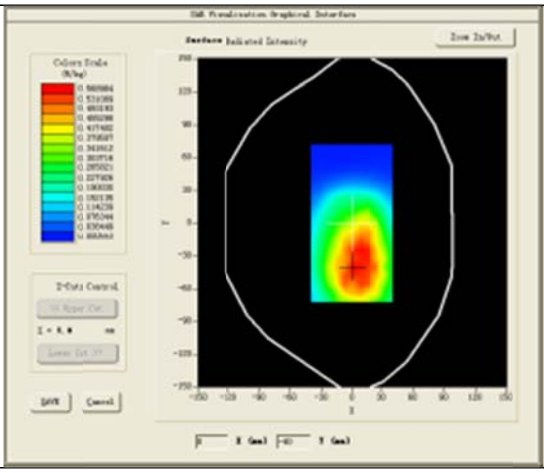
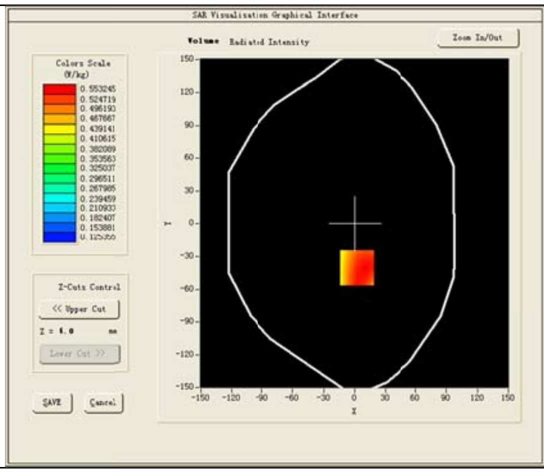
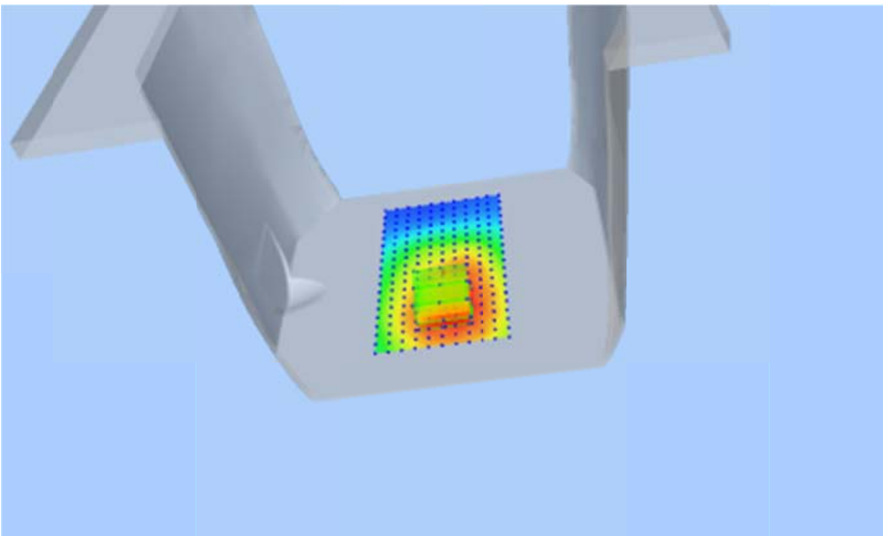
Test Mode:GSM 850MHz,Mid channel(Head Right Cheek)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 18, 2016

Medium(liquid type)	MSL_850
Frequency (MHz)	836.600000
Relative permittivity (real part)	43.22
Conductivity (S/m)	0.93
E-Field Probe	SN 17/14 EP220
Crest Factor	8.0
Conversion Factor	4.86
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	1.440000
SAR 10g (W/Kg)	0.248717
SAR 1g (W/Kg)	0.341011
SURFACE SAR	**VOLUME SAR**
	



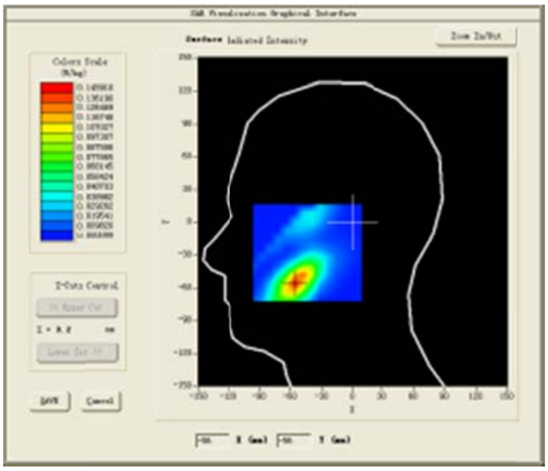
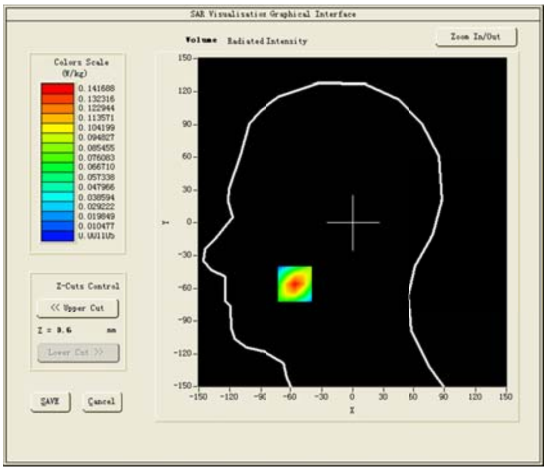
#2

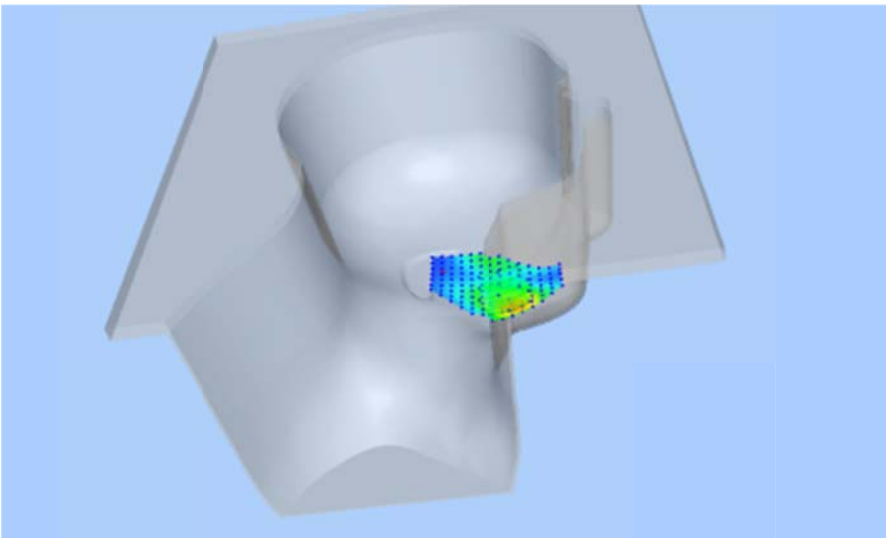
Test Mode: Hotspot GSM850MHz,Low channel (Body Rear Side)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 18, 2016

Medium(liquid type)	MSL_850
Frequency (MHz)	824.200000
Relative permittivity (real part)	57.56
Conductivity (S/m)	0.97
E-Field Probe	SN 17/14 EP220
Crest Factor	6.02
Conversion Factor	5.04
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	4.170000
SAR 10g (W/Kg)	0.416742
SAR 1g (W/Kg)	0.555042
SURFACE SAR	VOLUME SAR
	
	

#3

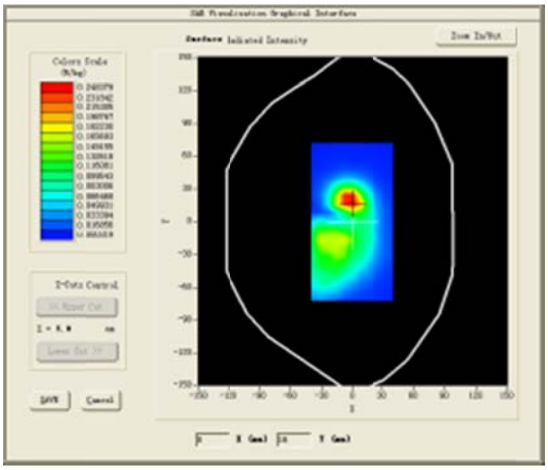
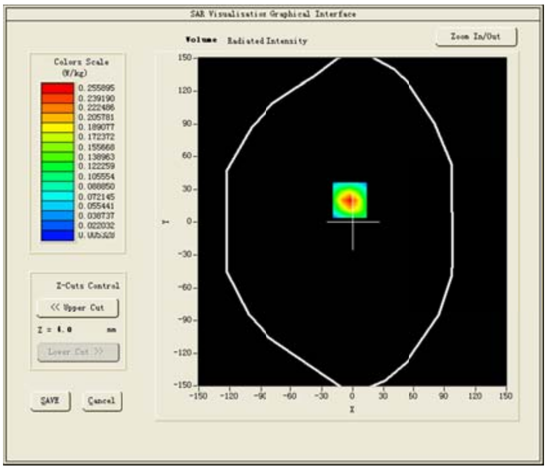
Test Mode:GSM 1900MHz,Low channel(Head Left Cheek)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 20, 2016

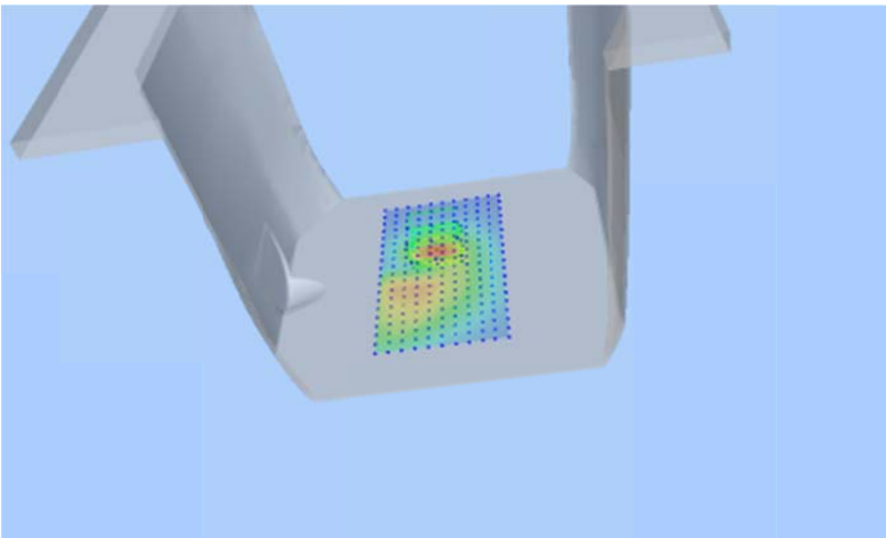
Medium(liquid type)	MSL_1900
Frequency (MHz)	1850.20000
Relative permittivity (real part)	41.82
Conductivity (S/m)	1.44
E-Field Probe	SN17/14 EP221
Crest Factor	8.0
Conversion Factor	4.71
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	2.460000
SAR 10g (W/Kg)	0.072085
SAR 1g (W/Kg)	0.130814
SURFACE SAR	**VOLUME SAR**
	



#4

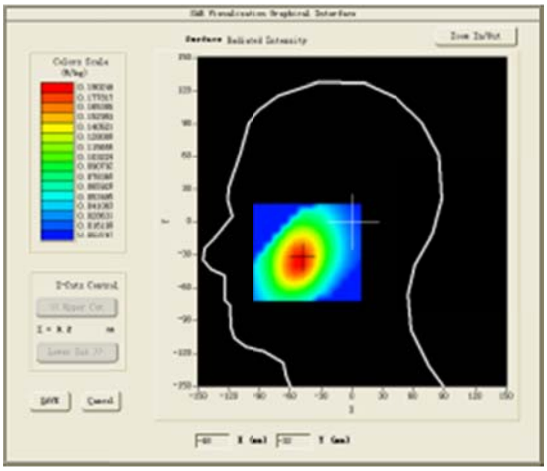
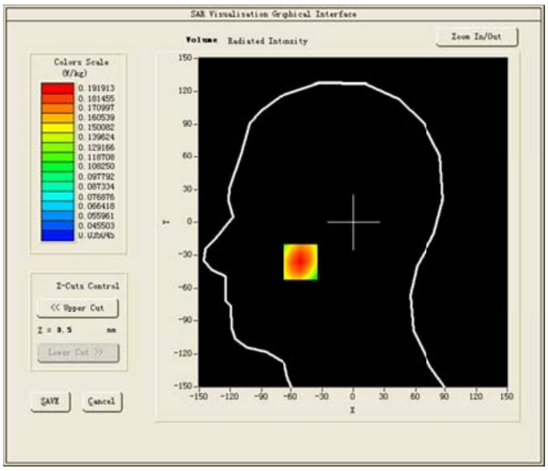
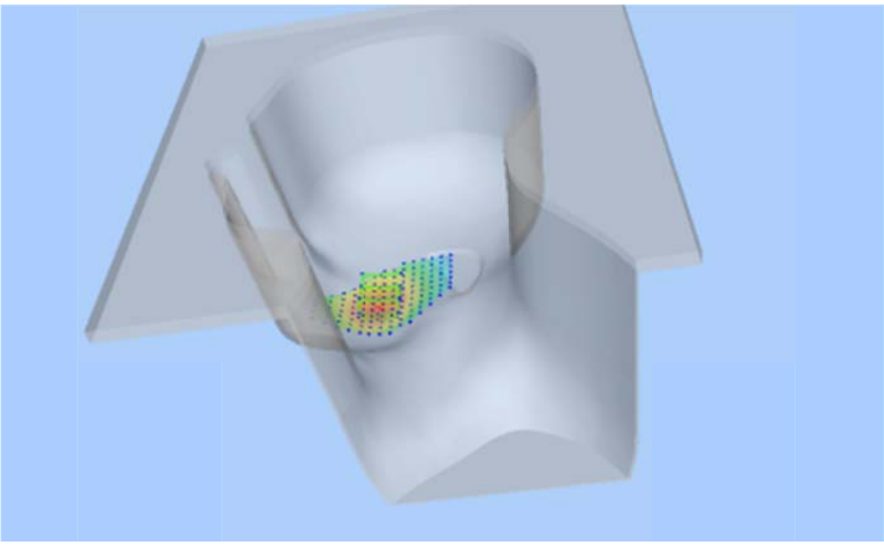
Test Mode: Hotspot GPRS1900MHz,Mid channel (Body Rear Side)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 20, 2016

Medium(liquid type)	MSL_1900
Frequency (MHz)	1880.000000
Relative permittivity (real part)	55.13
Conductivity (S/m)	1.55
E-Field Probe	SN17/14 EP221
Crest Factor	4.06
Conversion Factor	4.85
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.970000
SAR 10g (W/Kg)	0.129176
SAR 1g (W/Kg)	0.233606
SURFACE SAR	**VOLUME SAR**
	



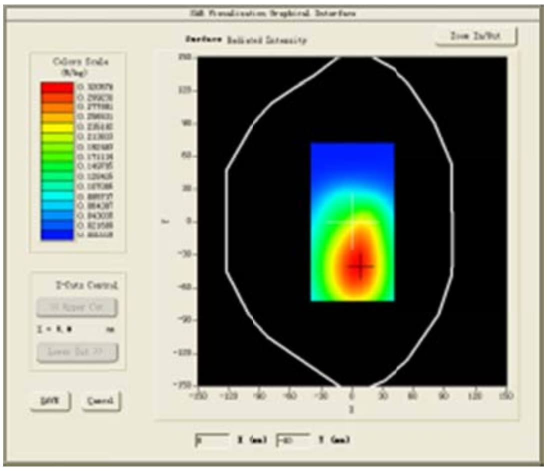
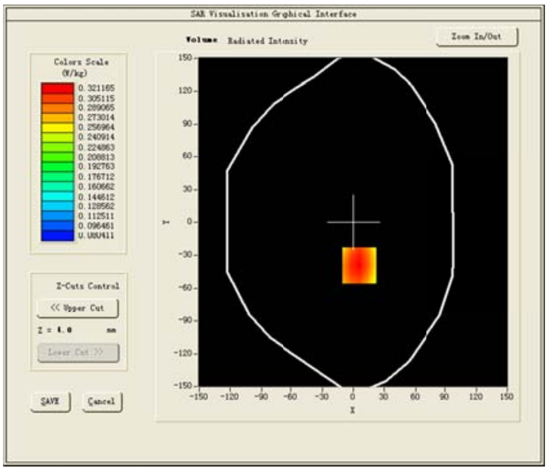
#5

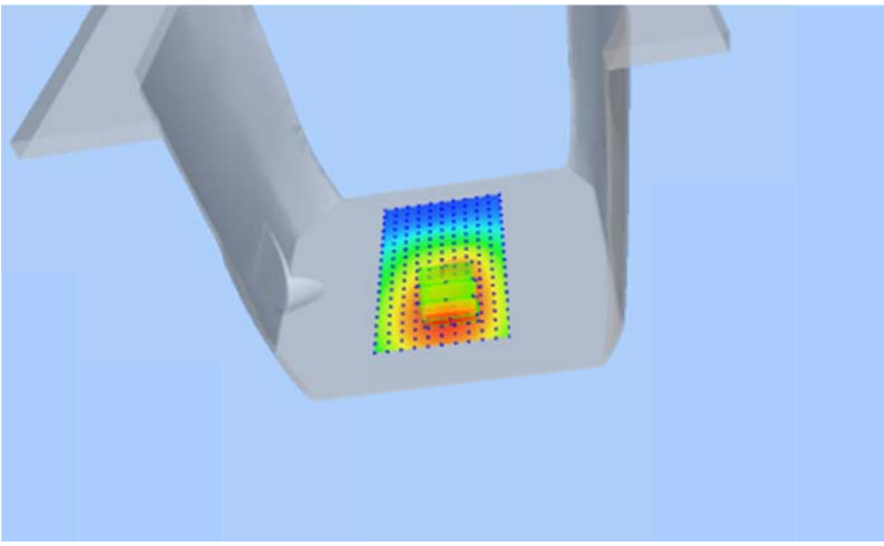
Test Mode:WCDMA Band V,Low channel(Head Right Cheek)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 18, 2016

Medium(liquid type)	MSL_850
Frequency (MHz)	826.400000
Relative permittivity (real part)	43.50
Conductivity (S/m)	0.92
E-Field Probe	SN 17/14 EP220
Crest Factor	1.0
Conversion Factor	4.86
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.500000
SAR 10g (W/Kg)	0.138230
SAR 1g (W/Kg)	0.187451
SURFACE SAR	**VOLUME SAR**
	
	

#6

Test Mode: Hotspot WCDMA Band V,Low channel (Body Rear Side)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 18, 2016

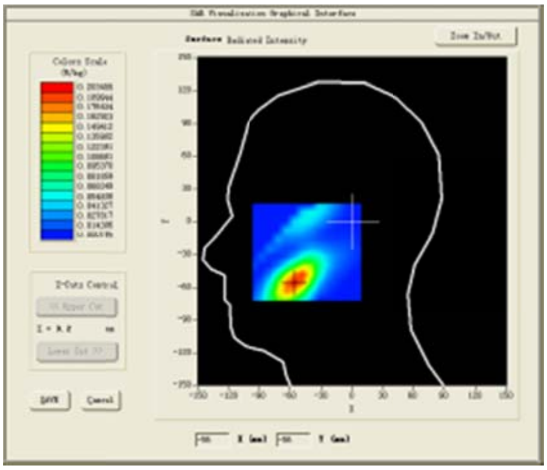
Medium(liquid type)	MSL_850
Frequency (MHz)	826.400000
Relative permittivity (real part)	57.56
Conductivity (S/m)	0.97
E-Field Probe	SN 17/14 EP220
Crest Factor	1.0
Conversion Factor	5.04
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.750000
SAR 10g (W/Kg)	0.230962
SAR 1g (W/Kg)	0.315248
SURFACE SAR	**VOLUME SAR**
	

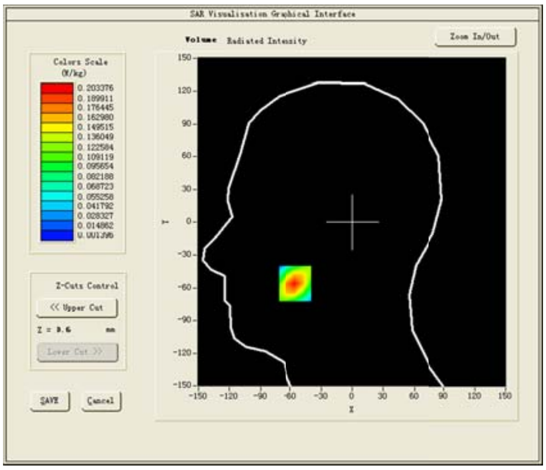


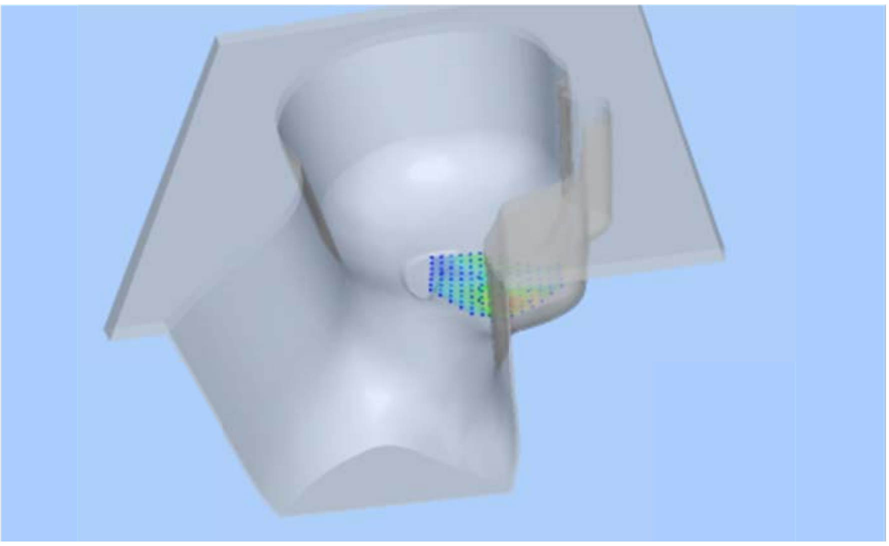
#7

Test Mode:WCDMA Band II,Low channel(Head Left Cheek)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 20, 2016

Medium(liquid type)	MSL_1900
Frequency (MHz)	1852.400000
Relative permittivity (real part)	41.82
Conductivity (S/m)	1.44
E-Field Probe	SN17/14 EP221
Crest Factor	1.0
Conversion Factor	4.71
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.500000
SAR 10g (W/Kg)	0.106286
SAR 1g (W/Kg)	0.188415
SURFACE SAR	**VOLUME SAR**



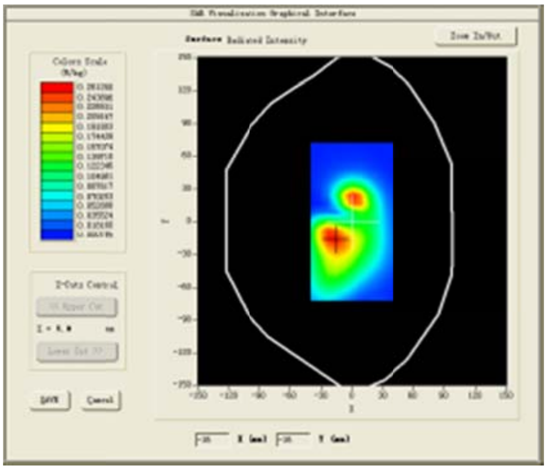


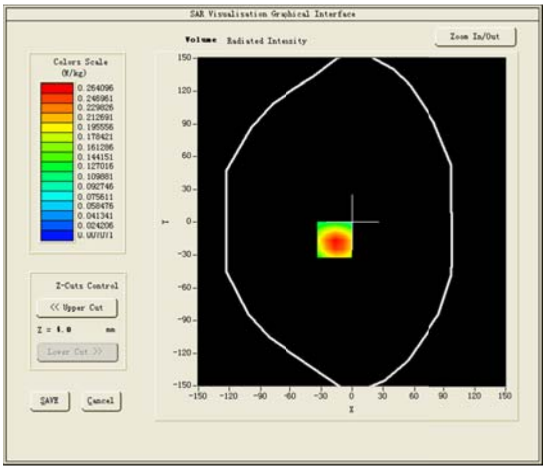


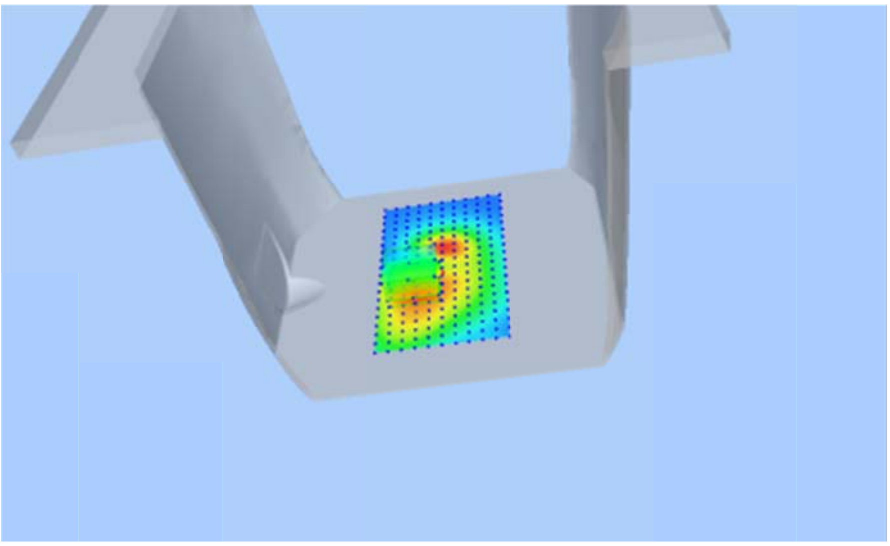
#8

Test Mode: Hotspot WCDMA Band II,Low channel (Body Rear Side)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 21, 2016

Medium(liquid type)	MSL_1900
Frequency (MHz)	1852.400000
Relative permittivity (real part)	55.37
Conductivity (S/m)	1.55
E-Field Probe	SN17/14 EP221
Crest Factor	1.0
Conversion Factor	4.85
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.680000
SAR 10g (W/Kg)	0.150965
SAR 1g (W/Kg)	0.252057
SURFACE SAR	**VOLUME SAR**

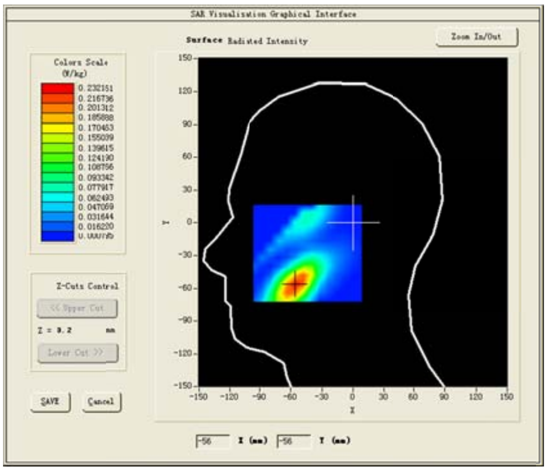
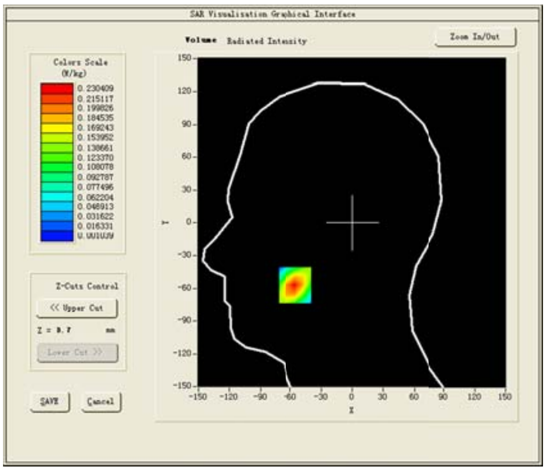


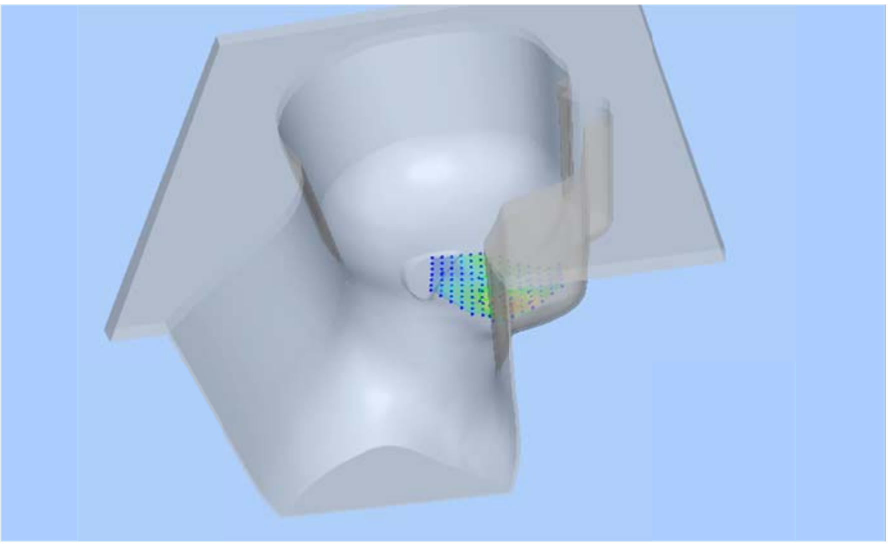




#9

Test Mode: LTE Band 2, Mid channel (Head Left Cheek)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 20, 2016

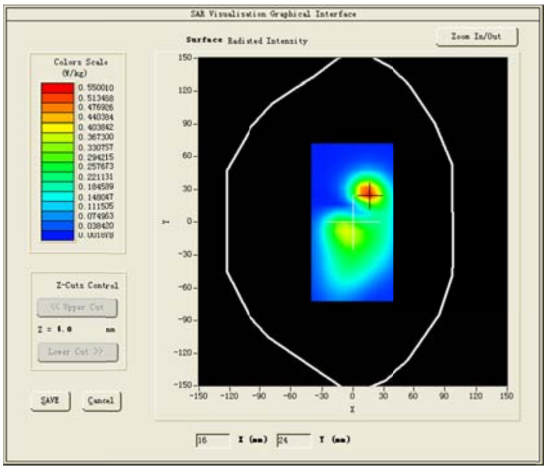
Medium(liquid type)	MSL_1900
Frequency (MHz)	1880.000000
Relative permittivity (real part)	41.71
Conductivity (S/m)	1.45
E-Field Probe	SN17/14 EP221
Crest Factor	1.0
Conversion Factor	4.71
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.000000
SAR 10g (W/Kg)	0.116807
SAR 1g (W/Kg)	0.214019
SURFACE SAR	**VOLUME SAR**
	

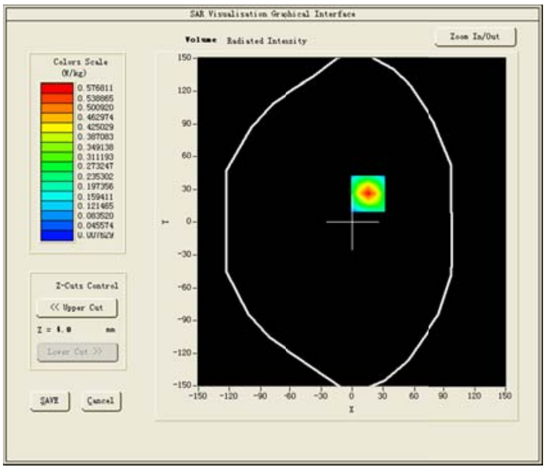


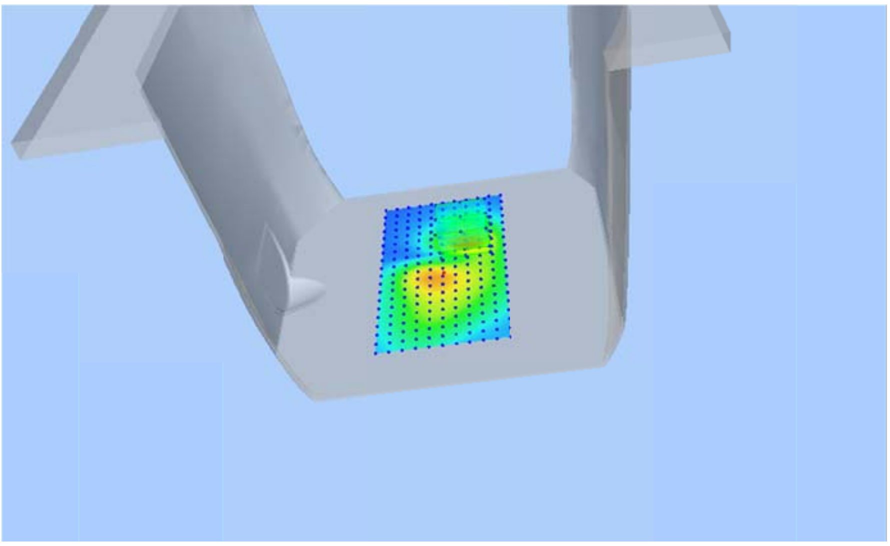
#10

Test Mode: Hotspot LTE Band 2, Mid channel(Body Rear Side)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 21, 2016

Medium(liquid type)	MSL_1900
Frequency (MHz)	1880.000000
Relative permittivity (real part)	55.13
Conductivity (S/m)	1.55
E-Field Probe	SN 17/14 EP221
Crest Factor	1.0
Conversion Factor	4.85
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.140000
SAR 10g (W/Kg)	0.265103
SAR 1g (W/Kg)	0.524505
SURFACE SAR	**VOLUME SAR**

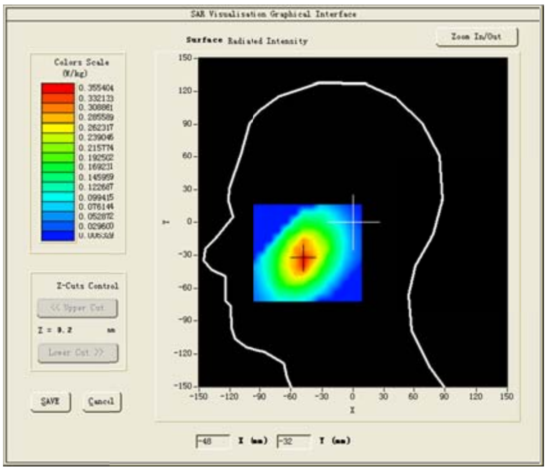
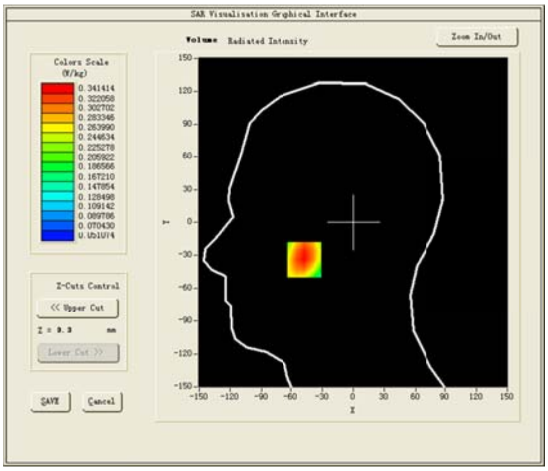
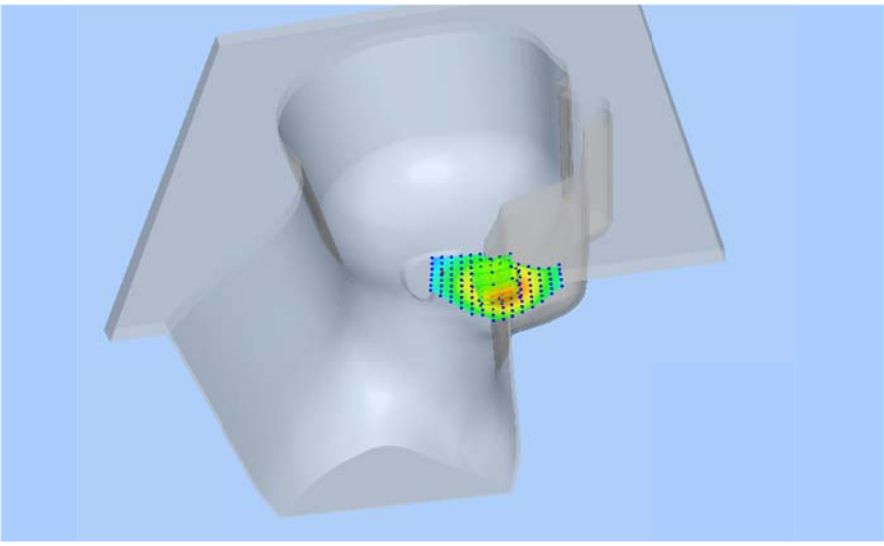






#11

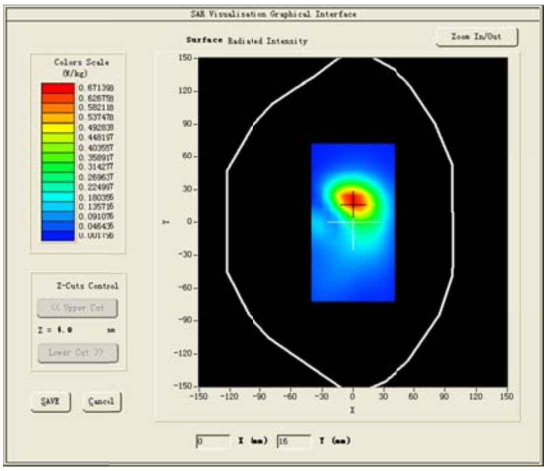
Test Mode:LTE Band 4, High channel (Head Left Cheek)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 19 2016

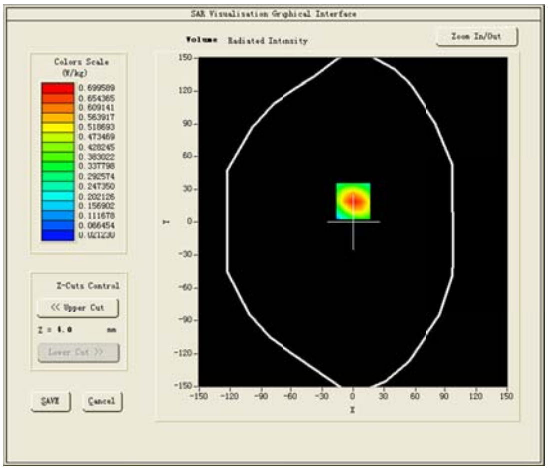
Medium(liquid type)	MSL_1800
Frequency (MHz)	1745.000000
Relative permittivity (real part)	41.94
Conductivity (S/m)	1.43
E-Field Probe	SN17/14 EP220
Crest Factor	1.0
Conversion Factor	4.16
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.180000
SAR 10g (W/Kg)	0.230232
SAR 1g (W/Kg)	0.328252
SURFACE SAR	**VOLUME SAR**
	
	

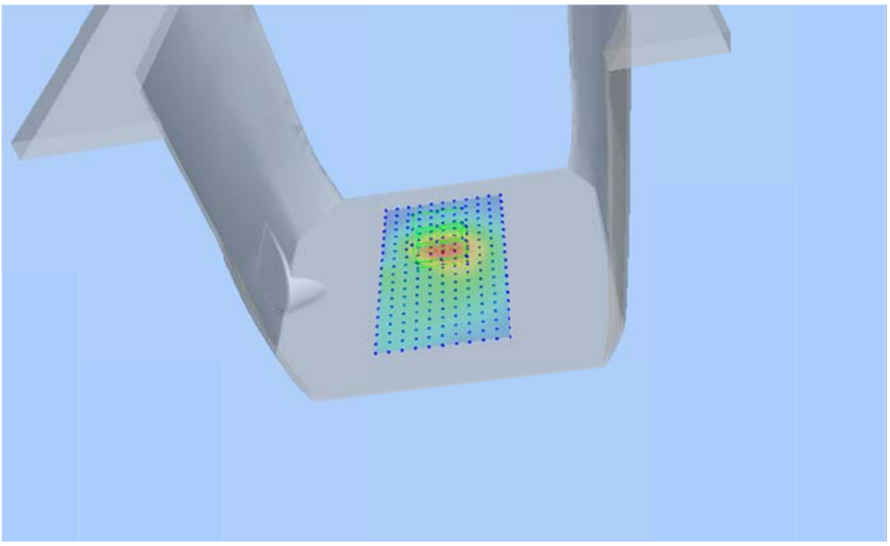
#12

Test Mode: Hotspot LTE Band 4, High channel (Body Rear Side)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 19, 2016

Medium(liquid type)	MSL_1800
Frequency (MHz)	1745.000000
Relative permittivity (real part)	55.71
Conductivity (S/m)	1.54
E-Field Probe	SN 17/14 EP220
Crest Factor	1.0
Conversion Factor	4.29
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.050000
SAR 10g (W/Kg)	0.371382
SAR 1g (W/Kg)	0.652285
SURFACE SAR	**VOLUME SAR**



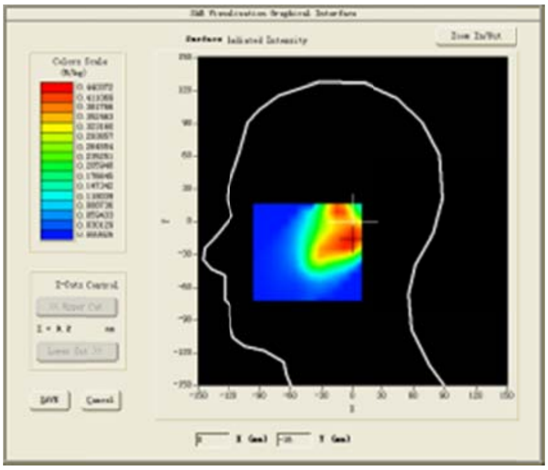


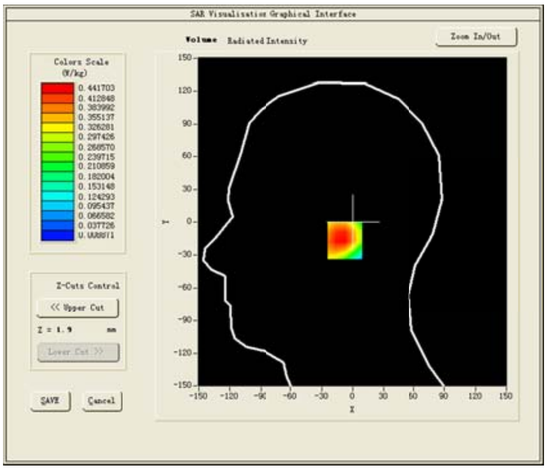


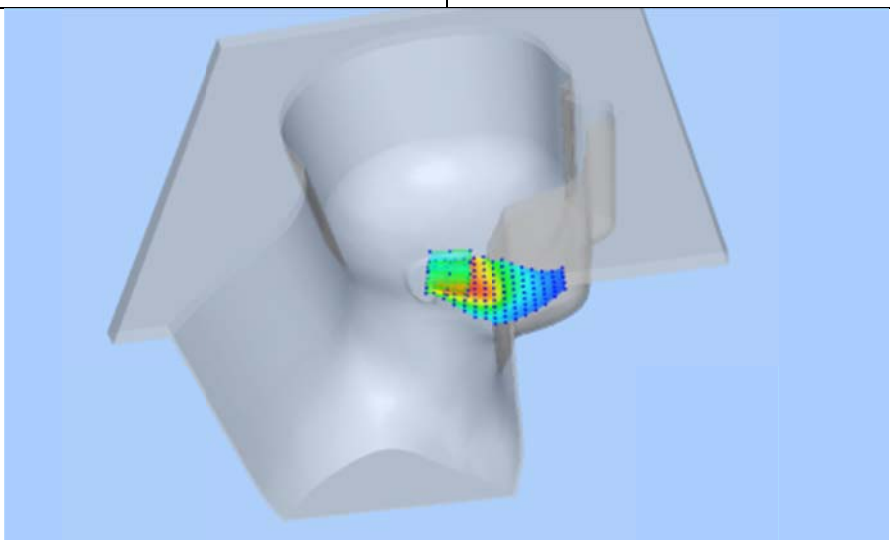
#13

Test Mode:802.11b(WiFi2.4G),High Channel (Head Left Cheek)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 22, 2016

Medium(liquid type)	MSL_2450
Frequency (MHz)	2462.000000
Relative permittivity (real part)	40.59
Conductivity (S/m)	1.88
E-Field Probe	SN 17/14 EP220
Crest Factor	1.0
Conversion Factor	3.94
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.360000
SAR 10g (W/Kg)	0.235507
SAR 1g (W/Kg)	0.428614
SURFACE SAR	**VOLUME SAR**

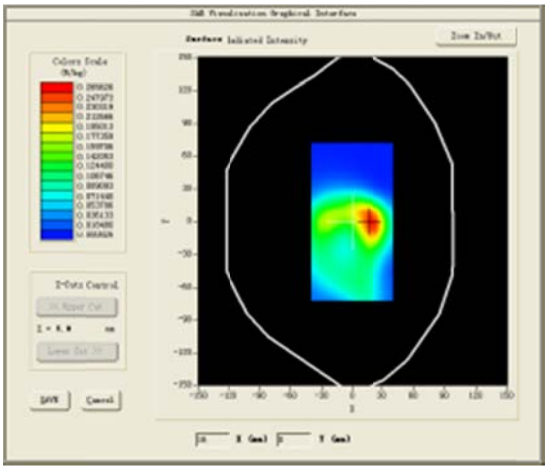
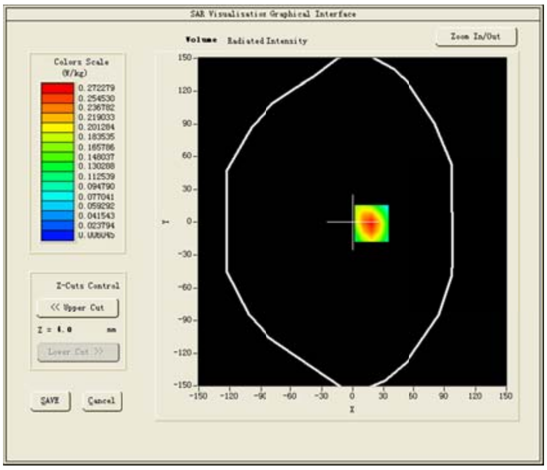


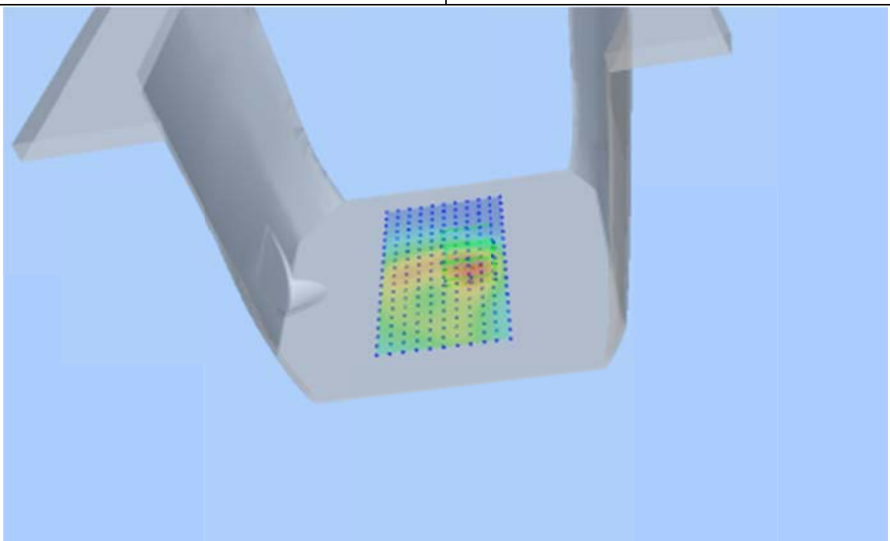




#14

Test Mode: Hotspot 802.11b(WiFi2.4G),High channel (Body Rear Side)
Product Description: 4G Smart phone Athos Pro
Model: QA5616
Test Date: June 22, 2016

Medium(liquid type)	MSL_2450
Frequency (MHz)	2462.000000
Relative permittivity (real part)	52.64
Conductivity (S/m)	2.01
E-Field Probe	SN 17/14 EP220
Crest Factor	1.0
Conversion Factor	4.05
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.760000
SAR 10g (W/Kg)	0.132536
SAR 1g (W/Kg)	0.256484
SURFACE SAR	**VOLUME SAR**
	



5.CALIBRATION CERTIFICATES

5.1 Probe-EP220 Calibration Certificate

SATIMO
The microwave vision company

COMOSAR E-Field Probe Calibration Report

Ref : ACR.287.1.14.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.
1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD, BAO'AN BLVD
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA
SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 17/14 EP220

Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ilac-MRA
ACCREDITED
Calibration CERT #2246-02

10/01/2015

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in SATIMO USA using the CALISAR / CALIBAIR test bench, for use with a SATIMO COMOSAR system only. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/14/2015	
Checked by :	Jérôme LUC	Product Manager	10/14/2015	
Approved by :	Kim RUTKOWSKI	Quality Manager	10/14/2015	

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/14/2015	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE5
Serial Number	SN 17/14 EP220
Product Condition (new / used)	New
Frequency Range of Probe	0.7 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.179 MΩ Dipole 2: R2=0.175 MΩ Dipole 3: R3=0.180 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

Satimo's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.

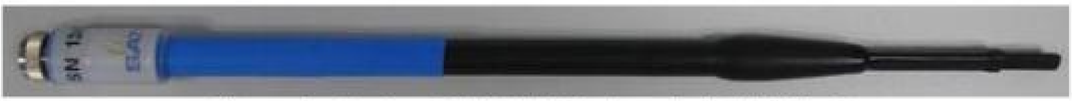


Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 mm

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (%)**
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.309%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%

Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

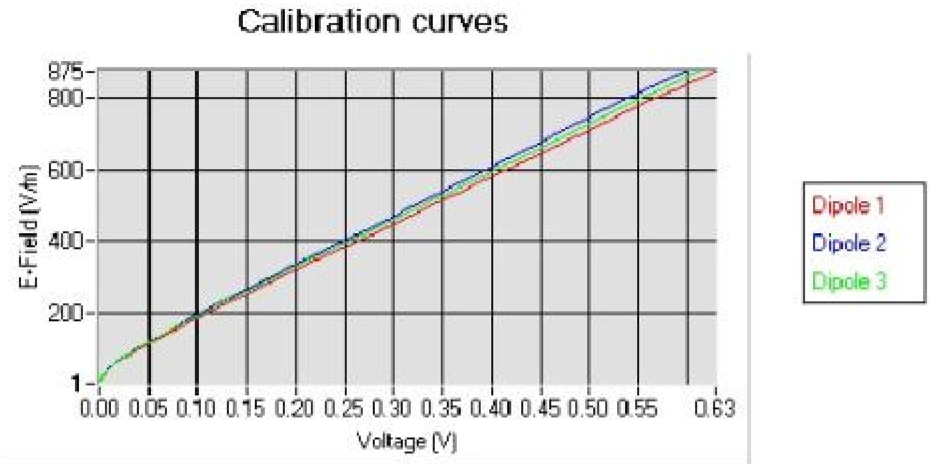
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
6.02	5.52	5.72

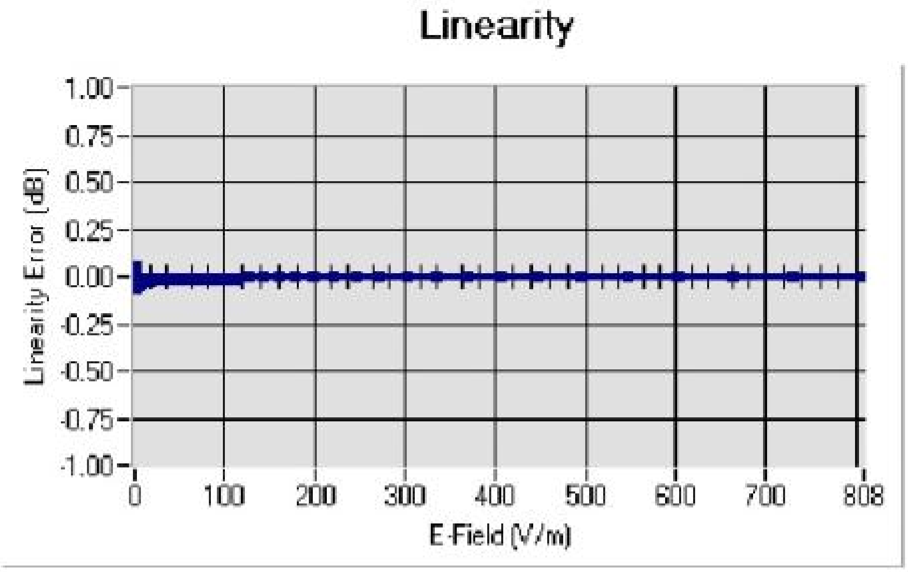
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
99	98	99

Calibration curves ei=f(V) (i=1,2,3) allow to obtain H-field value using the formula:

$$E = \sqrt{E_1^{\ 2} + E_2^{\ 2} + E_3^{\ 2}}$$



5.2 LINEARITY



Linearity:+/-1.47% (+/-0.06dB)

5.3 SENSITIVITY IN LIQUID

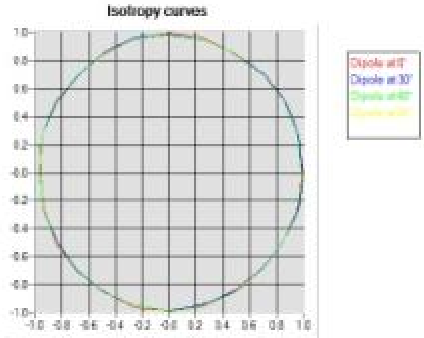
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL750	750	42.06	0.89	4.58
BL750	750	56.57	0.99	4.71
HL850	835	42.81	0.89	4.86
BL850	835	53.46	0.96	5.04
HL900	900	42.47	0.96	4.74
BL900	900	56.69	1.08	4.92
HL1800	1800	41.31	1.38	4.16
BL1800	1800	53.27	1.51	4.29
HL2000	2000	39.72	1.43	4.19
BL2000	2000	53.91	1.53	4.28
HL2450	2450	39.05	1.77	3.94
BL2450	2450	52.97	1.93	4.05

LOWER DETECTION LIMIT: 7mW/kg

5.4 ISOTROPY

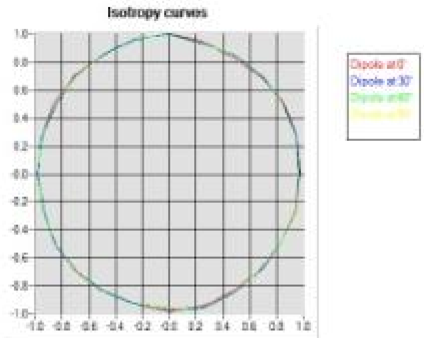
HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.07 dB



HL1800 MHz

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.08 dB



6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	Satimo	EP 94 SN 37/08	10/2015	10/2016
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	8/2013	8/2016

5.2 Probe-EP221 Calibration Certificate

SATIMO
The microwave vision company

COMOSAR E-Field Probe Calibration Report

Ref : ACR.262.1.14.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.
1/F, XINGYUAN INDUSTRIAL PARK, TONGDA ROAD, BAO'AN BLVD
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA
SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 17/14 EP221

Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ilac-MRA · A2LA ACCREDITED Calibration CERT #2246.02

09/01/2015

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in SATIMO USA using the CALISAR / CALIBAIR test bench, for use with a SATIMO COMOSAR system only. All calibration results are traceable to national metrology institutions.

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	9/19/2015	JS
Checked by :	Jérôme LUC	Product Manager	9/19/2015	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	9/19/2015	Kim Rutkowski

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	*Date*	*Modifications*
A	9/19/2015	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE5
Serial Number	SN 17/14 EP221
Product Condition (new / used)	New
Frequency Range of Probe	0.4 GHz- 6 GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.179 MΩ Dipole 2: R2=0.167 MΩ Dipole 3: R3=0.178 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

Satimo's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.

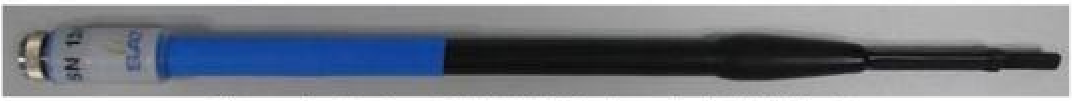


Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 mm

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (%)**
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.309%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%

Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

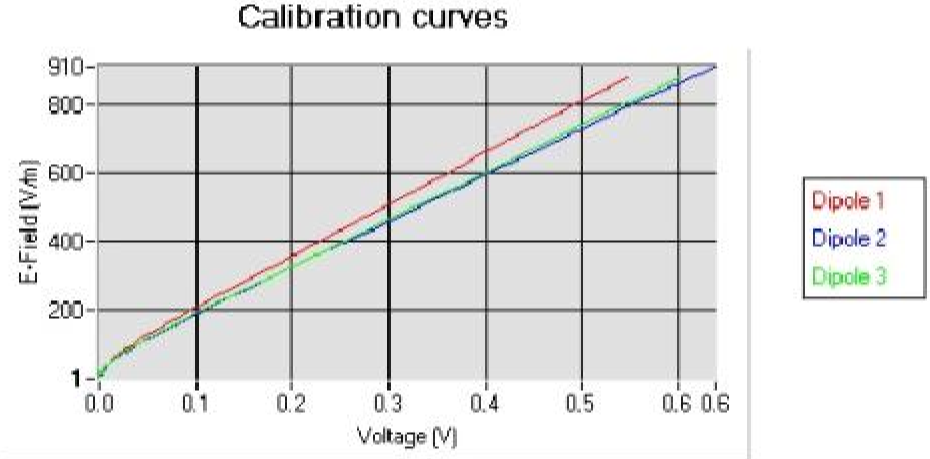
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
4.81	6.15	6.02

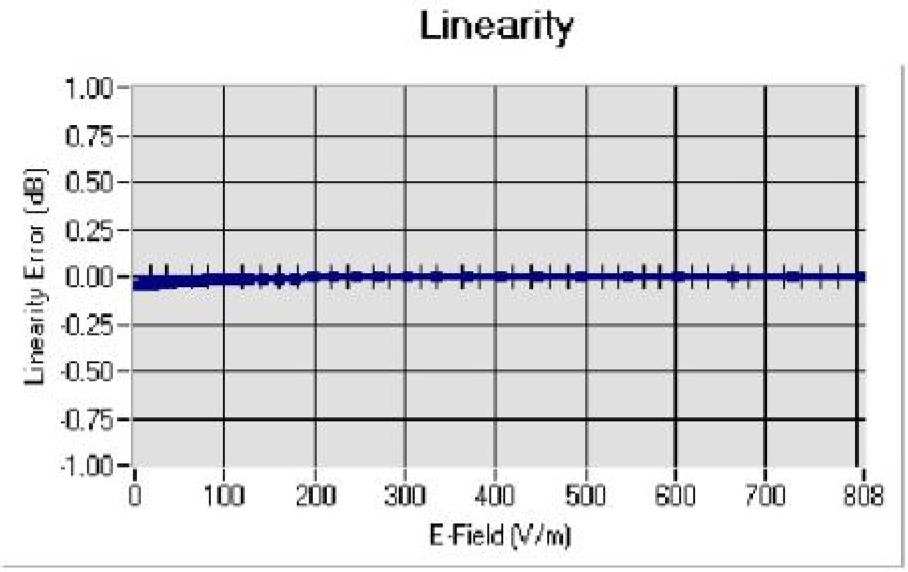
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
95	100	90

Calibration curves ei=f(V) (i=1,2,3) allow to obtain H-field value using the formula:

$$E = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2}}$$



5.2 LINEARITY



Linearity:+/-1.16% (+/-0.05dB)

5.3 SENSITIVITY IN LIQUID

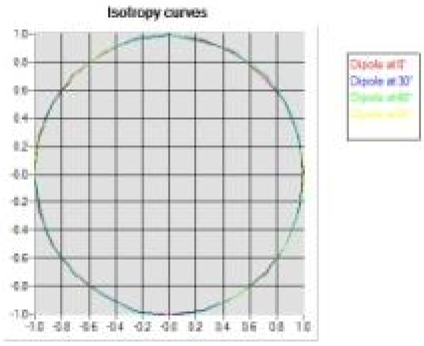
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL450	450	43.90	0.87	4.84
BL450	450	58.63	0.98	4.98
HL750	750	42.06	0.89	4.53
BL750	750	56.57	0.99	4.70
HL850	835	42.81	0.89	4.83
BL850	835	53.46	0.96	5.02
HL900	900	42.47	0.96	4.74
BL900	900	56.69	1.08	4.89
HL1800	1800	41.31	1.38	4.25
BL1800	1800	53.27	1.51	4.34
HL1900	1900	41.09	1.42	4.71
BL1900	1900	54.20	1.54	4.85
HL2000	2000	39.72	1.43	4.27
BL2000	2000	53.91	1.53	4.44
HL2450	2450	39.05	1.77	4.11
BL2450	2450	52.97	1.93	4.25
HL2600	2600	38.35	1.92	4.20
BL2600	2600	51.81	2.19	4.32

LOWER DETECTION LIMIT: 7mW/kg

5.4 ISOTROPY

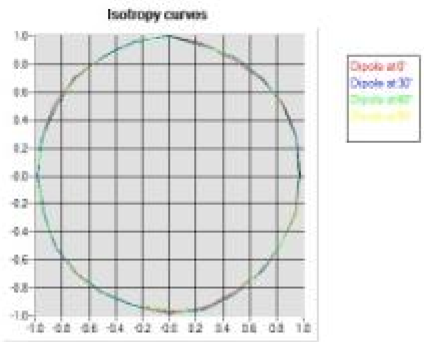
HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.07 dB



HL1800 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.08 dB



6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	Satimo	EP 94 SN 37/08	10/2015	10/2016
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	8/2013	8/2016

5.3 SID835Dipole Calibration Ceriticate

SATIMO
The microwave vision company

SAR Reference Dipole Calibration Report

Ref : ACR.287.4.14.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.
1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD, BAO'AN BLVD
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: SN 07/14 DIP 0G835-303

Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ilac-MRA
ACCREDITED
Calibration CERT #2246-02

10/01/2015

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/14/2015	[signature]
Checked by :	Jérôme LUC	Product Manager	10/14/2015	[signature]
Approved by :	Kim RUTKOWSKI	Quality Manager	10/14/2015	[signature]

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/14/2015	Initial release

TABLE OF CONTENTS

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 835 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID835
Serial Number	SN 07/14 DIP 0G835-303
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

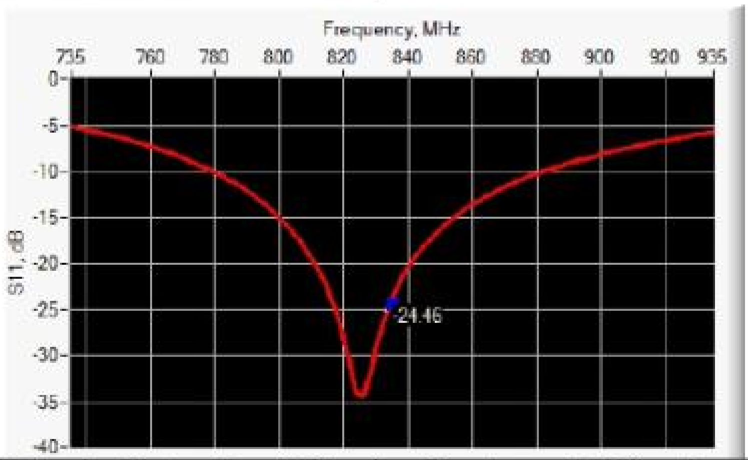
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-24.46	-20	55.4 Ω + 2.4 jΩ

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.	PASS	89.8 ±1 %.	PASS	3.6 ±1 %.	PASS
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %	PASS	0.90 ±5 %	PASS
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

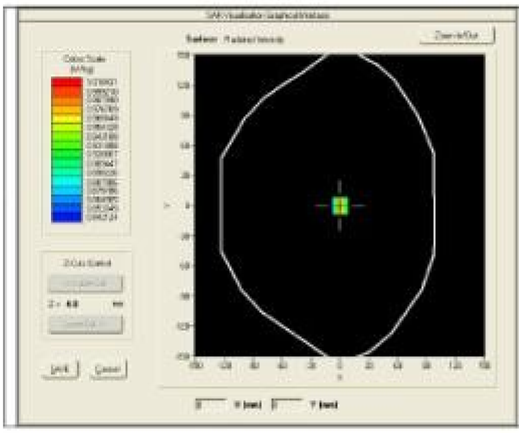
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

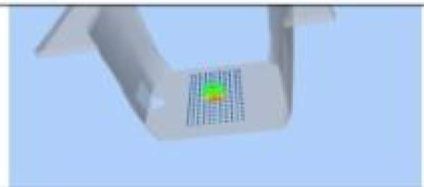
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

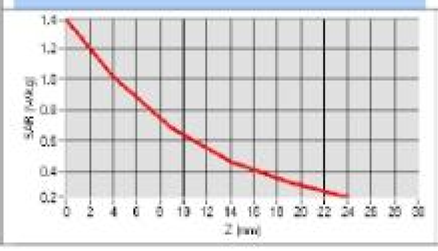
Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 42.3 sigma : 0.92
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm

Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56	9.60 (0.96)	6.22	6.20 (0.62)
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	







7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %	PASS	0.97 ±5 %	PASS
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 54.1 sigma : 0.97
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
835	9.90 (0.99)	6.39 (0.64)