



# SAR EVALUATION REPORT

For

## Nexpro International Limitada

Guadalupe, Barrio Tournon, Frente Al Hotel Villas Oficinas Del Bufete Facio Y Canas, San Jose-Goicoechea, Costa Rica

**FCC ID: ZYPBANG2**

<b>Report Type:</b> Original Report	<b>Product Type:</b> WCDMA Mobile Phone
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<b>Report Number:</b> <u>RSZ150820002-20</u>	
<b>Report Date:</b> <u>2015-09-01</u>	
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**Note:** This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

Attestation of Test Results		
EUT Information	Company Name	Nexpro International Limitada
	EUT Description	WCDMA Mobile Phone
	FCC ID	ZYPBANG2
	Model Number:	BANG 2
	Test Date	2015-08-22
MODE		Max. SAR Level(s) Reported(W/Kg)
GSM 850	1g Head SAR	0.160
	1g Body SAR	0.242
PCS 1900	1g Head SAR	0.123
	1g Body SAR	0.194
WCDMA 850	1g Head SAR	0.138
	1g Body SAR	0.224
WCDMA 1900	1g Head SAR	0.199
	1g Body SAR	0.364
Simultaneous	1g Head SAR	0.571
	1g Body SAR	0.550
Hotspot	1g Body SAR	0.550
Applicable Standards	<b>ANSI / IEEE C95.1 : 2005</b> IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields,3 kHz to 300 GHz.	
	<b>ANSI / IEEE C95.3 : 2002</b> IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to SuchFields,100 kHz—300 GHz.	
	<b>IEC 62209-1:2006</b> Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part1:Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3GHz)	
	<b>IEC 62209-2:2010</b> Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices-Human models, instrumentation, and procedures-Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)	
	<b>FCC 47 CFR part 2.1093</b> Radiofrequency radiation exposure evaluation: portable devices	
	<b>IEEE1528:2013</b> IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	
	<b>KDB procedures</b> KDB 447498 D01 General RF Exposure Guidance v05r02. KDB 648474 D04 Handset SAR v01r02. KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03 KDB 865664 D02 RF Exposure Reporting v01r01 KDB 941225 D01 3G SAR Procedures v03 KDB 941225 D06 Hotspot Mode v02	
<p><b>Note:</b> This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures.</p> <p><b>The results and statements contained in this report pertain only to the device(s) evaluated.</b></p>		

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**DOCUMENT REVISION HISTORY**

Revision Number	Report Number	Description of Revision	Date of Revision
0	RSZ150820002-20	Original Report	2015-09-01

## EUT DESCRIPTION

This report has been prepared on behalf of Nexpro International Limitada and their product, FCC ID: ZYPBANG2, Model: BANG 2 or the EUT (Equipment under Test) as referred to in the rest of this report.

**\*Note:**

The device is capable of personal hotspot mode. Wi-Fi Hotspot mode permits the device to share its cellular data connection with other 2.4 GHz Wi-Fi enabled devices (channels 1 - 13).

## Technical Specification

<b>Product Type</b>	WCDMA Mobile Phone
<b>Exposure Category:</b>	Population / Uncontrolled
<b>Antenna Type(s):</b>	Internal Antenna
<b>Body-Worn Accessories:</b>	Portable
<b>Face-Head Accessories:</b>	None
<b>Multi-slot Class:</b>	Class12
<b>Operation Mode :</b>	GSM Voice, GPRS\EGPRS Data, WCDMA R99 (Voice+Data),HSUPA,HSDPA,WLAN and Bluetooth
<b>Frequency Band:</b>	GSM 850 : 824-849 MHz(TX) ; 869-894 MHz(RX) PCS 1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) WCDMA850: 824-849 MHz(TX) ; 869-894 MHz(RX) WCDMA1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) Wi-Fi(802.11b/g/n20): 2412MHz-2472MHz Wi-Fi(802.11n40): 2422MHz-2462MHz Bluetooth3.0 : 2402MHz-2480MHz BLE:2402MHz-2480MHz
<b>Conducted RF Power:</b>	GSM 850 : 32.59 dBm PCS 1900: 29.35 dBm WCDMA 850: 22.35 dBm WCDMA 1900: 21.77 dBm Wi-Fi(802.11b/g/n20): 9.42 dBm Wi-Fi(802.11n40) : 7.60 dBm Bluetooth3.0: 2.09dBm BLE: -5.19 dBm
<b>Dimensions (L*W*H):</b>	142 mm (L) × 73 mm (W) × 9 mm (H)
<b>Power Source:</b>	3.7 VDC Rechargeable Battery
<b>Normal Operation:</b>	Head and Body-worn

## REFERENCE, STANDARDS, AND GUIDELINES

### FCC:

The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

### CE:

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by EN62209-1 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

## 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)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

CE Limit (10g 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 10 g of tissue)	2.0	10
Spatial Peak (hands/wrists/feet/ankles averaged 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).

General Population/Uncontrolled environments Spatial Peak limit 1.6W/kg (FCC) & 2 W/kg (CE) applied to the EUT.

## FACILITIES

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

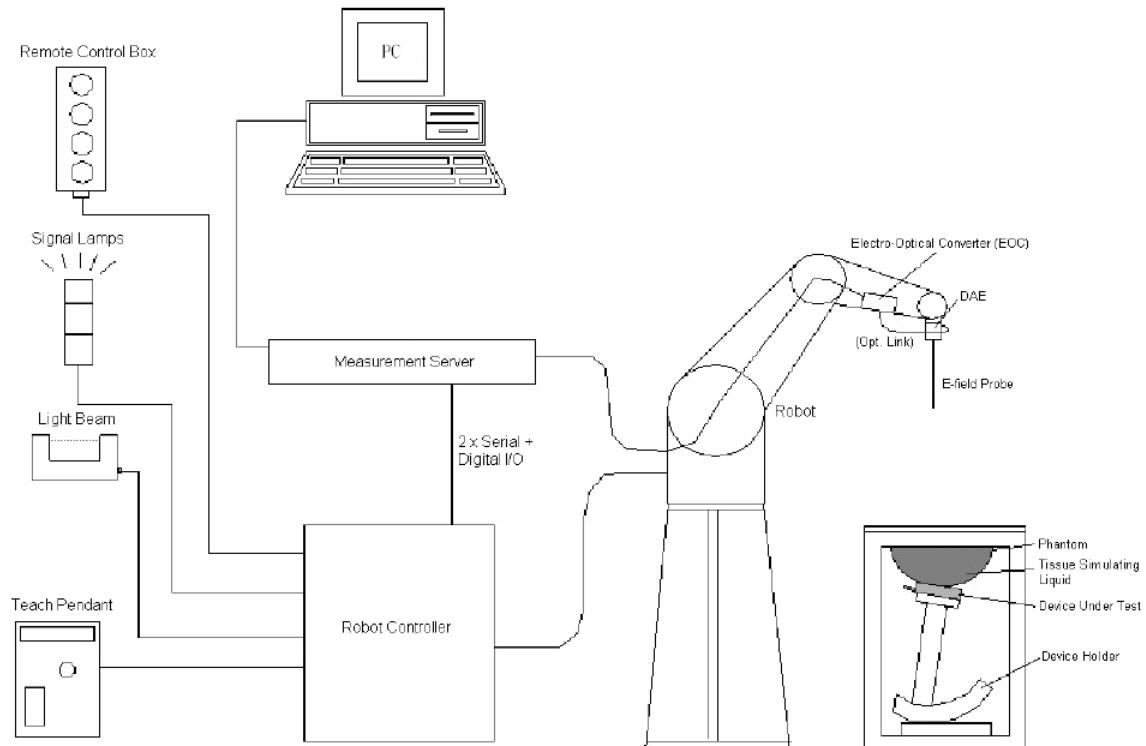
## DESCRIPTION OF TEST SYSTEM

These measurements were performed with the automated near-field scanning system DASY5 from Schmid & Partner Engineering AG (SPEAG) which is the Fifth generation of the system shown in the figure hereinafter:



### DASY5 System Description

The DASY5 system for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot (Staubli TX-RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 professional operating system and the DASY52 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

### DASY5 Measurement Server

The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chip-disk and 128MB RAM. The necessary circuits for communication with the DAE4 (or DAE3) electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.



The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized point out, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

### Data Acquisition Electronics

The data acquisition electronics (DAE4) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of both the DAE4 as well as of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

### EX3DV4 E-Field Probes

<b>Frequency</b>	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
<b>Directivity</b>	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
<b>Dynamic Range</b>	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
<b>Dimensions</b>	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
<b>Application</b>	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.
<b>Compatibility</b>	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

### SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6 mm). The phantom has three measurement areas:

- \_ Left hand
- \_ Right hand
- \_ Flat phantom

The phantom table for the DASY systems based on the TX90XL and RX160L robots have the size of 100 x 50 x 85 cm (L xWx H). The phantom table for the compact DASY systems based on the RX60L robot have the size of 100 x 75 x 91 cm (L xWx H); these tables are reinforced for mounting of the robot onto the table. For easy dislocation these tables have fork lift cut outs at the bottom.

The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different liquids)

A white cover is provided to cover the phantom during o\_-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible.

Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.



## Device Holder for SAM Twin Phantom

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of  $\pm 0.5$  mm would produce a SAR uncertainty of  $\pm 20\%$ . An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.



The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity " $\epsilon_r$ "=3 and loss tangent  $\tan \delta = 0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

## Robots

The DASY5 system uses the high precision industrial robots TX90XL from Staubli SA (France). The TX robot family is the successor of the well known RX robot family and offers the same features important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

The above mentioned robots are controlled by the Staubli CS8c robot controllers. All information regarding the use and maintenance of the robot arm and the robot controller is contained on the CDs delivered along with the robot.

Paper manuals are available upon request direct from Staubli.

## Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm<sup>2</sup> step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

Where the system identifies multiple SAR peaks (which are within 25% of peak value) the system will provide the user with the option of assessing each peak location individually for zoom scan averaging.

## Zoom Scan (Cube Scan Averaging)

The averaging zoom scan volume utilized in the DASY5 software is in the shape of a cube and the side dimension of a 1 g or 10 g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000 kg/m<sup>3</sup> is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm, with the side length of the 10 g cube 21.5mm.

When the cube intersects with the surface of the phantom, it is oriented so that 3 vertices touch the surface of the shell or the center of a face is tangent to the surface. The face of the cube closest to the surface is modified in order to conform to the tangent surface.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 5x5x8 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 35mm in the Z axis.

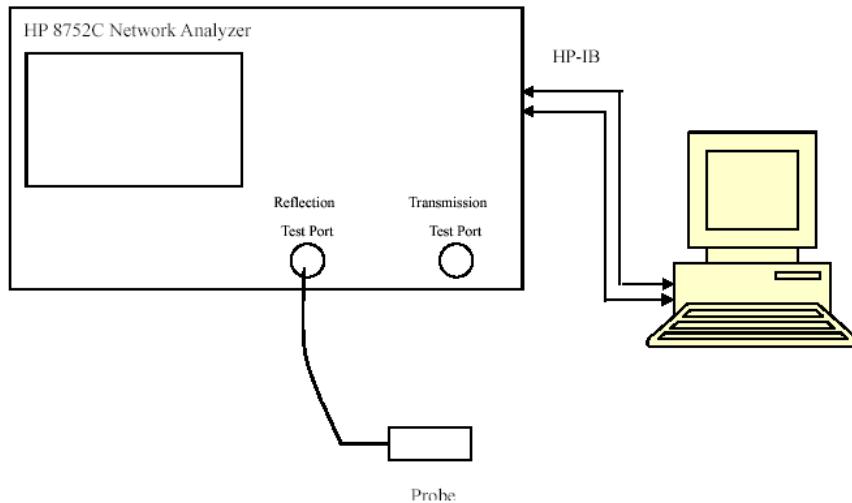
## EQUIPMENT LIST AND CALIBRATION

### Equipments List & Calibration Information

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Robot	RX90	D03636	N/A	N/A
DASY5 Test Software	DASY52.8	N/A	N/A	N/A
DASY5 Measurement Server	DASY5 4.5.12	1470	N/A	N/A
Data Acquisition Electronics	DAE4	1459	2015-01-26	2016-01-26
E-Field Probe	EX3DV4	7329	2015-02-05	2016-02-05
Dipole, 835MHz	ALS-D-835-S-2	180-00558	2014-10-08	2017-10-08
Dipole, 1900MHz	ALS-D-1900-S-2	210-00710	2013-10-09	2016-10-09
R&S, universal Radio Communication Tester	CMU200	105047	2014-11-20	2015-11-20
8960 Series 10 Wireless Communication Test Set	E5515C	MY50266471	2015-01-13	2016-01-13
Mounting Device	MD4HHTV5	SD 000 H01 KA	N/A	N/A
Twin SAM	Twin SAM V5.0	1874	N/A	N/A
Simulated Tissue 835 MHz Head	TS-835-H	201504	Each Time	/
Simulated Tissue 835 MHz Body	TS-835-B	201505	Each Time	/
Simulated Tissue 1900 MHz Head	TS-1900-H	201506	Each Time	/
Simulated Tissue 1900 MHz Body	TS-1900-B	201507	Each Time	/
Network Analyzer	8752C	3140A02356	2015-06-03	2016-06-03
Dielectric probe kit	85070B	US33020324	2015-06-13	2016-06-13
Signal Generator	E4422B	MY41000355	2014-10-27	2015-10-27
Power Meter	EPM-441A	GB37481494	2014-11-03	2015-11-03
Power Meter Sensor	8481A	T-03-EM-127	2014-11-03	2015-11-03
Power Amplifier	5205PE	1015	N/A	N/A
Directional Coupler	488Z	N/A	N/A	N/A
attenuator	20dB, 100W	N/A	N/A	N/A

# SAR MEASUREMENT SYSTEM VERIFICATION

## Liquid Verification



Liquid Verification Setup Block Diagram

## Liquid Verification Results

Frequency	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)	$\Delta\epsilon_r$	$\Delta\sigma$ (S/m)	
824.2	Head	41.08	0.90	41.50	0.90	-1.012	0.000	$\pm 5$
	Body	53.79	0.95	55.20	0.97	-2.554	-2.062	$\pm 5$
826.4	Head	41.06	0.91	41.50	0.90	-1.060	1.111	$\pm 5$
	Body	53.87	0.95	55.20	0.97	-2.409	-2.062	$\pm 5$
836.6	Head	41.02	0.92	41.50	0.90	-1.157	2.222	$\pm 5$
	Body	53.84	0.96	55.20	0.97	-2.464	-1.031	$\pm 5$
846.6	Head	41.06	0.91	41.50	0.90	-1.060	1.111	$\pm 5$
	Body	53.78	0.97	55.20	0.97	-2.572	0.000	$\pm 5$
848.8	Head	41.10	0.92	41.50	0.90	-0.964	2.222	$\pm 5$
	Body	53.83	0.97	55.20	0.97	-2.482	0.000	$\pm 5$
1850.2	Head	39.72	1.38	40.00	1.40	-0.700	-1.429	$\pm 5$
	Body	52.09	1.5	53.30	1.52	-2.270	-1.316	$\pm 5$
1852.4	Head	39.70	1.37	40.00	1.40	-0.750	-2.143	$\pm 5$
	Body	51.94	1.48	53.30	1.52	-2.552	-2.632	$\pm 5$
1880.0	Head	39.56	1.40	40.00	1.40	-1.100	0.000	$\pm 5$
	Body	51.96	1.51	53.30	1.52	-2.514	-0.658	$\pm 5$
1907.6	Head	39.68	1.42	40.00	1.40	-0.800	1.429	$\pm 5$
	Body	52.09	1.54	53.30	1.52	-2.270	1.316	$\pm 5$
1909.8	Head	39.57	1.42	40.00	1.40	-1.075	1.429	$\pm 5$
	Body	52.02	1.54	53.30	1.52	-2.402	1.316	$\pm 5$

\*Liquid Verification was performed on 2015-08-22.

Please refer to the following tables.

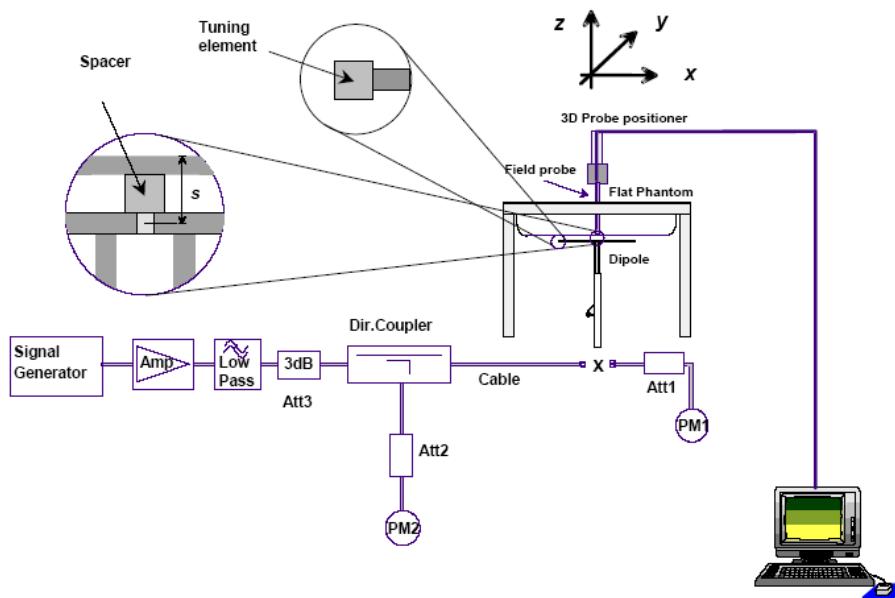
835 MHz Head			835 MHz Body		
Frequency (MHz)	e'	e''	Frequency (MHz)	e'	e''
824.0	41.0842	19.7338	824.0	53.7943	20.6394
824.5	41.0567	19.6881	824.5	53.8371	20.6591
825.0	41.0071	19.7061	825.0	53.8601	20.6235
825.5	41.0893	19.6867	825.5	53.8240	20.6363
826.0	41.0141	19.6638	826.0	53.8149	20.6861
826.5	41.0649	19.7307	826.5	53.8682	20.6916
827.0	41.0769	19.7373	827.0	53.8422	20.7048
827.5	41.0569	19.7432	827.5	53.8065	20.6504
828.0	41.0848	19.7549	828.0	53.8451	20.6505
828.5	41.1002	19.6731	828.5	53.8532	20.7106
829.0	41.0518	19.6703	829.0	53.8106	20.6353
829.5	41.0549	19.7534	829.5	53.7637	20.6740
830.0	41.0193	19.7474	830.0	53.8298	20.6423
830.5	41.0163	19.7075	830.5	53.7887	20.6623
831.0	41.0503	19.7193	831.0	53.7859	20.6689
831.5	41.0207	19.7375	831.5	53.8565	20.6535
832.0	41.1068	19.7096	832.0	53.7791	20.6906
832.5	41.0965	19.6717	832.5	53.8014	20.7072
833.0	40.9971	19.6697	833.0	53.7734	20.6161
833.5	41.1035	19.7677	833.5	53.7859	20.7072
834.0	41.1009	19.6784	834.0	53.8476	20.6825
834.5	41.0447	19.6851	834.5	53.8510	20.6510
835.0	40.9981	19.6660	835.0	53.8414	20.6374
835.5	41.0164	19.6991	835.5	53.8373	20.6471
836.0	41.0705	19.7655	836.0	53.8029	20.6372
836.5	41.0387	19.6758	836.5	53.8549	20.6168
837.0	41.0999	19.7485	837.0	53.7911	20.6331
837.5	41.0265	19.6737	837.5	53.8372	20.6850
838.0	41.0105	19.7617	838.0	53.8213	20.6520
838.5	41.0102	19.6641	838.5	53.7929	20.7058
839.0	41.0900	19.6974	839.0	53.8354	20.6650
839.5	41.0095	19.7405	839.5	53.8210	20.6592
840.0	41.0530	19.4571	840.0	53.8079	20.6682
840.5	41.0982	19.4216	840.5	53.8496	20.6880
841.0	41.0534	19.3635	841.0	53.8404	20.6159
841.5	41.0721	19.4642	841.5	53.8572	20.6369
842.0	41.0299	19.3910	842.0	53.7700	20.6637
842.5	41.0927	19.4500	842.5	53.8345	20.6352
843.0	41.0598	19.3950	843.0	53.7886	20.7004
843.5	41.0909	19.4420	843.5	53.7671	20.6480
844.0	41.0063	19.3702	844.0	53.8332	20.7075
844.5	41.0495	19.4446	844.5	53.8470	20.6966
845.0	41.0825	19.4076	845.0	53.7741	20.6274
845.5	41.0592	19.4404	845.5	53.8498	20.6218
846.0	41.0966	19.4482	846.0	53.8004	20.6687
846.5	41.0576	19.4009	846.5	53.7774	20.6330
847.0	41.0028	19.4334	847.0	53.8495	20.6940
847.5	41.0308	19.4538	847.5	53.8691	20.6256
848.0	41.0481	19.4450	848.0	53.8092	20.6792
848.5	41.0936	19.3844	848.5	53.7839	20.6945
849.0	41.0980	19.3911	849.0	53.8288	20.6398

1900 MHz Head			1900 MHz Body		
Frequency (MHz)	e'	e''	Frequency (MHz)	e'	e''
1850.0	39.7235	13.4055	1850.0	52.0897	14.5359
1851.2	39.7206	13.3485	1851.2	52.0404	14.4620
1852.4	39.7037	13.2547	1852.4	51.9432	14.4122
1853.6	39.5889	13.2424	1853.6	51.9569	14.4839
1854.8	39.6430	13.3286	1854.8	52.0349	14.5616
1856.0	39.7308	13.2660	1856.0	52.0698	14.4479
1857.2	39.5701	13.2675	1857.2	51.7478	14.5361
1858.4	39.5524	13.2838	1858.4	51.8906	14.4127
1859.6	39.5665	13.4020	1859.6	52.0913	14.4385
1860.8	39.7124	13.2840	1860.8	51.8637	14.4256
1862.0	39.6794	13.2801	1862.0	52.0410	14.4972
1863.2	39.6485	13.3819	1863.2	51.7716	14.5373
1864.4	39.6470	13.4105	1864.4	51.8459	14.4524
1865.6	39.6312	13.2661	1865.6	51.7612	14.5212
1866.8	39.7127	13.2948	1866.8	51.8197	14.4617
1868.0	39.7157	13.3315	1868.0	52.0541	14.4485
1869.2	39.6256	13.2419	1869.2	52.0873	14.4843
1870.4	39.6903	13.4301	1870.4	52.0482	14.5210
1871.6	39.7345	13.2390	1871.6	52.0964	14.5226
1872.8	39.5746	13.3111	1872.8	52.0661	14.5028
1874.0	39.6723	13.3317	1874.0	51.9293	14.4261
1875.2	39.5855	13.2714	1875.2	51.8500	14.4952
1876.4	39.7385	13.2944	1876.4	52.0652	14.5462
1877.6	39.7190	13.2469	1877.6	51.7607	14.4891
1878.8	39.7326	13.4130	1878.8	51.9025	14.5676
1880.0	39.5595	13.4187	1880.0	51.9574	14.4799
1881.2	39.5555	13.3486	1881.2	51.7920	14.4920
1882.4	39.7113	13.2867	1882.4	51.8045	14.5093
1883.6	39.5737	13.3793	1883.6	51.8785	14.4156
1884.8	39.5468	13.2874	1884.8	52.0005	14.5663
1886.0	39.7229	13.3438	1886.0	52.0909	14.4286
1887.2	39.7430	13.4151	1887.2	51.7784	14.5479
1888.4	39.6912	13.2511	1888.4	51.7445	14.5519
1889.6	39.6132	13.3386	1889.6	51.7694	14.5782
1890.8	39.6371	13.3047	1890.8	51.9408	14.4794
1892.0	39.6748	13.4339	1892.0	51.9690	14.4760
1893.2	39.6152	13.2585	1893.2	51.7439	14.5623
1894.4	39.6054	13.2881	1894.4	52.0745	14.5760
1895.6	39.6902	13.3429	1895.6	52.0880	14.4902
1896.8	39.6689	13.3733	1896.8	52.0854	14.4541
1898.0	39.5791	13.3494	1898.0	51.8656	14.5213
1899.2	39.5884	13.3083	1899.2	52.0894	14.4707
1900.4	39.5908	13.3149	1900.4	52.0404	14.5569
1901.6	39.6555	13.2972	1901.6	51.9453	14.4386
1902.8	39.6344	13.3462	1902.8	51.8742	14.4748
1904.0	39.5461	13.4303	1904.0	52.0983	14.4681
1905.2	39.6332	13.3490	1905.2	52.0691	14.5004
1906.4	39.6092	13.2976	1906.4	52.0421	14.5147
1907.6	39.6834	13.3744	1907.6	52.0890	14.5517
1908.8	39.7424	13.2996	1908.8	51.8319	14.5496
1910.0	39.5658	13.3834	1910.0	52.0158	14.4764

## System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of  $\pm 10\%$ . The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

### System Verification Setup Block Diagram



### System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2015-08-22	835	Head	1g	9.575	9.773	-2.026	$\pm 10$
		Body	1g	9.725	9.736	-0.113	$\pm 10$
	1900	Head	1g	40.057	39.481	1.459	$\pm 10$
		Body	1g	41.296	39.715	3.981	$\pm 10$

\*All SAR values are normalized to 1 Watt forward power.

## SAR SYSTEM VALIDATION DATA

**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)**

**System Performance 835MHz Head**

**DUT: ALS-D-835-S-2; Type: 835 MHz; Serial: 180-00558**

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.913 \text{ S/m}$ ;  $\epsilon_r = 40.998$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(9.52, 9.52, 9.52); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**System Performance 835MHz /Area Scan (71x131x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 10.7 W/kg

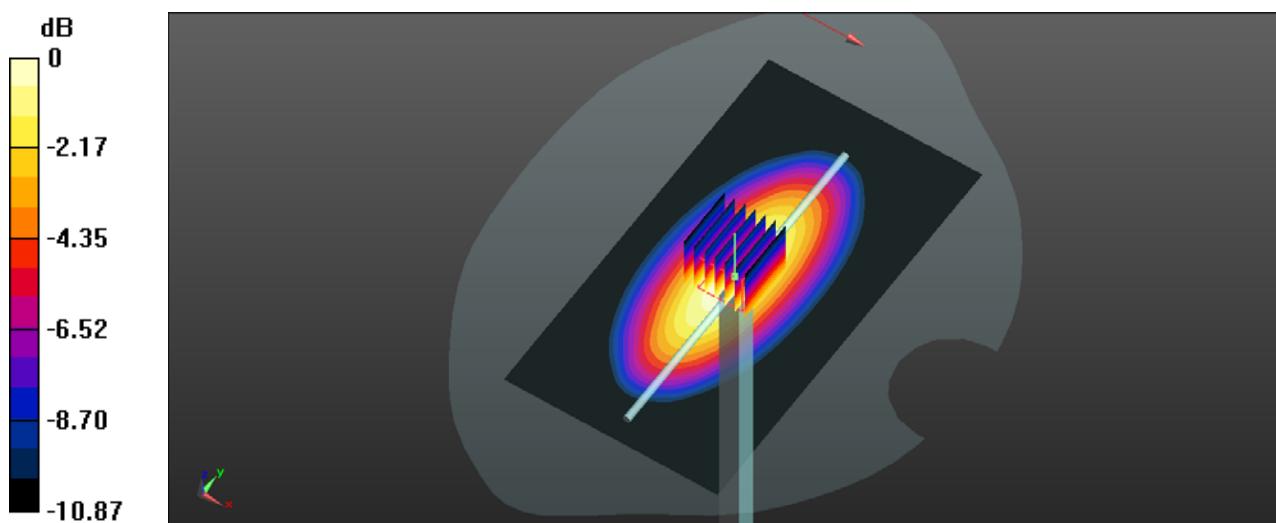
**System Performance 835MHz /Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 106.3 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 15.9 W/kg

**SAR(1 g) = 9.575 W/kg; SAR(10 g) = 6.721 W/kg**

Maximum value of SAR (measured) = 10.2 W/kg



$$0 \text{ dB} = 10.2 \text{ W/kg} = 10.09 \text{ dBW/kg}$$

**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****System Performance 835MHz Body****DUT: ALS-D-835-S-2; Type: 835 MHz; Serial: 180-00558**

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.958 \text{ S/m}$ ;  $\epsilon_r = 53.841$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(9.17, 9.17, 9.17); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**System Performance 835MHz /Area Scan (71x131x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$ 

Maximum value of SAR (interpolated) = 10.96 W/kg

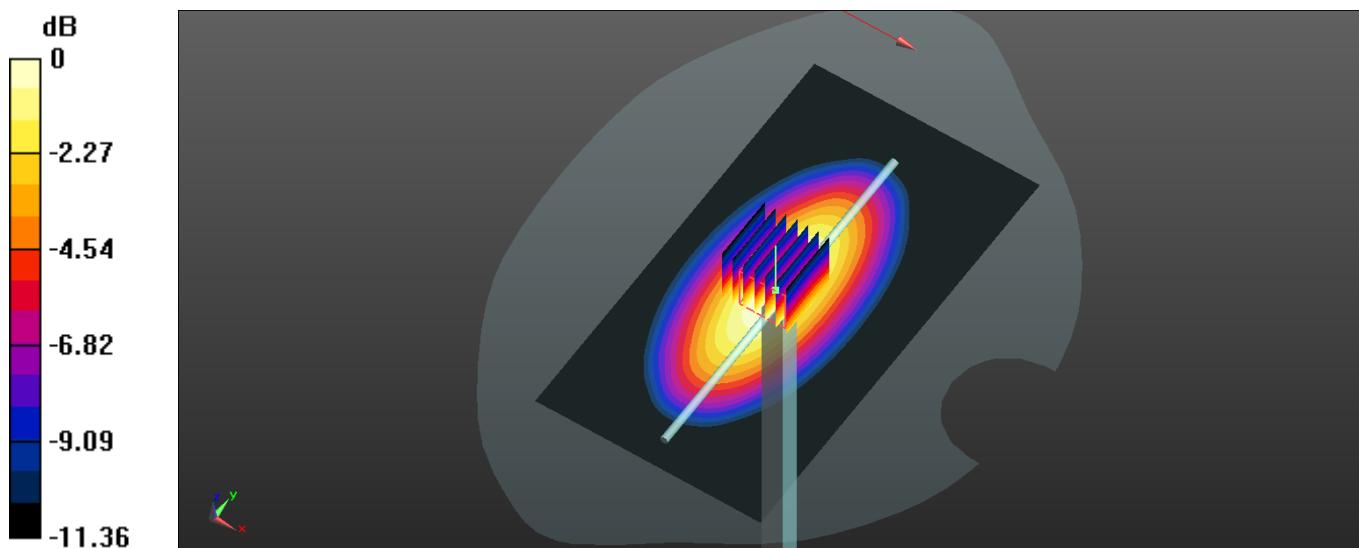
**System Performance 835MHz /Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 100.02 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 15.36 W/kg

**SAR(1 g) = 9.725 W/kg; SAR(10 g) = 6.735 W/kg**

Maximum value of SAR (measured) = 11.5 W/kg



$$0 \text{ dB} = 11.5 \text{ W/kg} = 10.61 \text{ dBW/kg}$$

**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****System Performance 1900MHz Head****DUT: ALS-D-1900-S-2; Type: 1900 MHz; Serial: 210-00710**

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.406 \text{ S/m}$ ;  $\epsilon_r = 39.590$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(7.88, 7.88, 7.88); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**System Performance 1900MHz /Area Scan (61x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$ 

Maximum value of SAR (interpolated) = 44.3 W/kg

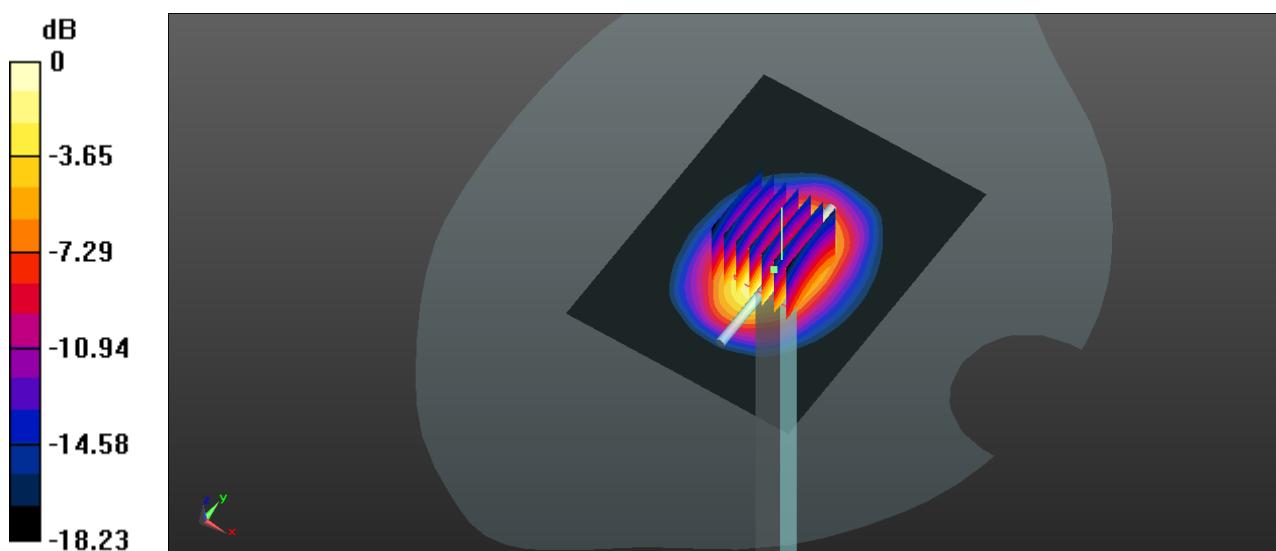
**System Performance 1900MHz /Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 167.8 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 72.3 W/kg

**SAR(1 g) = 40.057 W/kg; SAR(10 g) = 21.217 W/kg**

Maximum value of SAR (measured) = 43.5 W/kg



0 dB = 43.5 W/kg = 16.38 dBW/kg

**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****System Performance 1900MHz Body****DUT: ALS-D-1900-S-2; Type: 1900 MHz; Serial: 210-00710**

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.538 \text{ S/m}$ ;  $\epsilon_r = 52.046$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(7.56, 7.56, 7.56); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**System Performance 1900MHz /Area Scan (61x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$ 

Maximum value of SAR (interpolated) = 46.6 W/kg

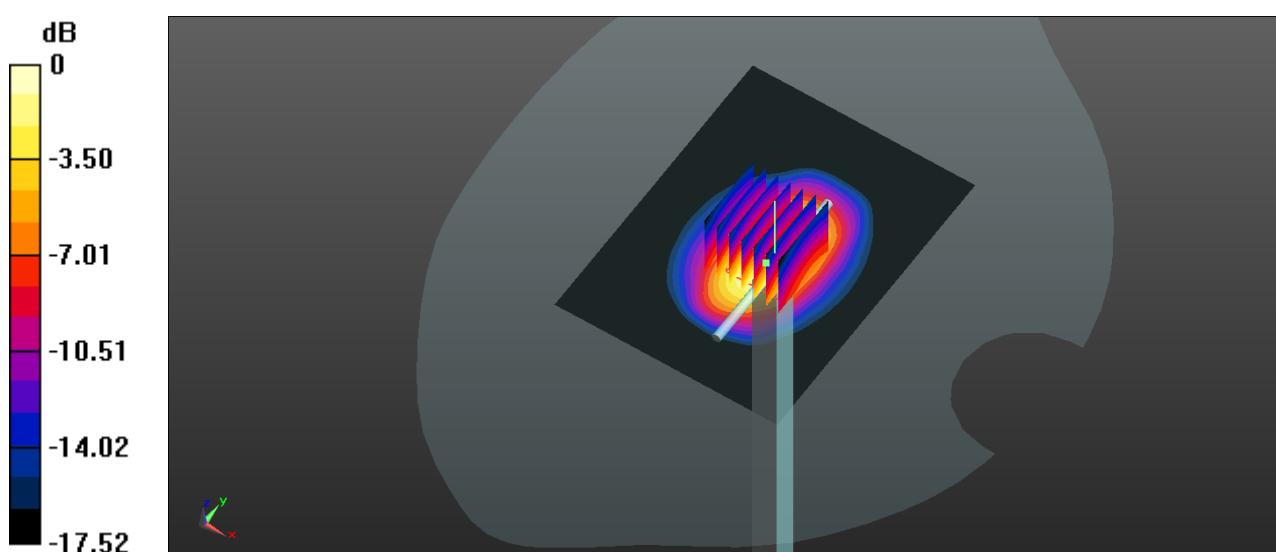
**System Performance 1900MHz /Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 177.3 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 75.9 W/kg

**SAR(1 g) = 41.296 W/kg; SAR(10 g) = 21.551 W/kg**

Maximum value of SAR (measured) = 45.8 W/kg



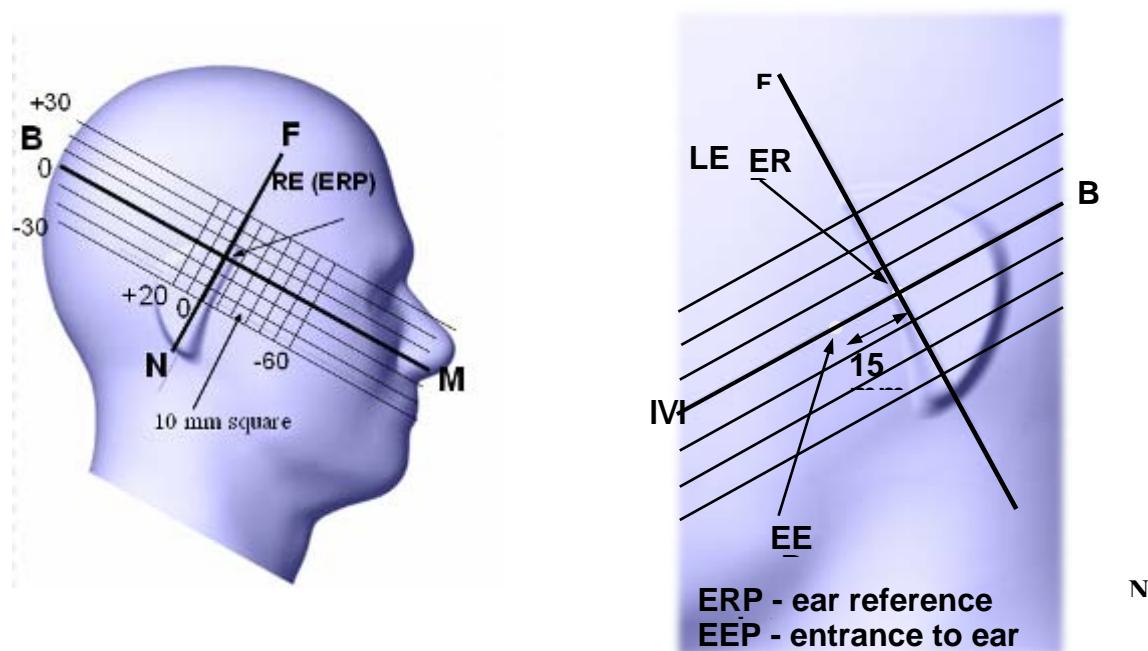
$$0 \text{ dB} = 45.8 \text{ W/kg} = 16.61 \text{ dBW/kg}$$

## EUT TEST STRATEGY AND METHODOLOGY

### Test Positions for Device Operating Next to a Person's Ear

This category includes most wireless handsets with fixed, retractable or internal antennas located toward the top half of the device, with or without a foldout, sliding or similar keypad cover. The handset should have its earpiece located within the upper  $\frac{1}{4}$  of the device, either along the centerline or off-centered, as perceived by its users. This type of handset should be positioned in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point”. The “test device reference point” should be located at the same level as the center of the earpiece region. The “vertical centerline” should bisect the front surface of the handset at its top and bottom edges. A “ear reference point” is located on the outer surface of the head phantom on each ear spacer. It is located 1.5 cm above the center of the ear canal entrance in the “phantom reference plane” defined by the three lines joining the center of each “ear reference point” (left and right) and the tip of the mouth.

A handset should be initially positioned with the earpiece region pressed against the ear spacer of a head phantom. For the SCC-34/SC-2 head phantom, the device should be positioned parallel to the “N-F” line defined along the base of the ear spacer that contains the “ear reference point”. For interim head phantoms, the device should be positioned parallel to the cheek for maximum RF energy coupling. The “test device reference point” is aligned to the “ear reference point” on the head phantom and the “vertical centerline” is aligned to the “phantom reference plane”. This is called the “initial ear position”. While maintaining these three alignments, the body of the handset is gradually adjusted to each of the following positions for evaluating SAR:



## Cheek/Touch Position

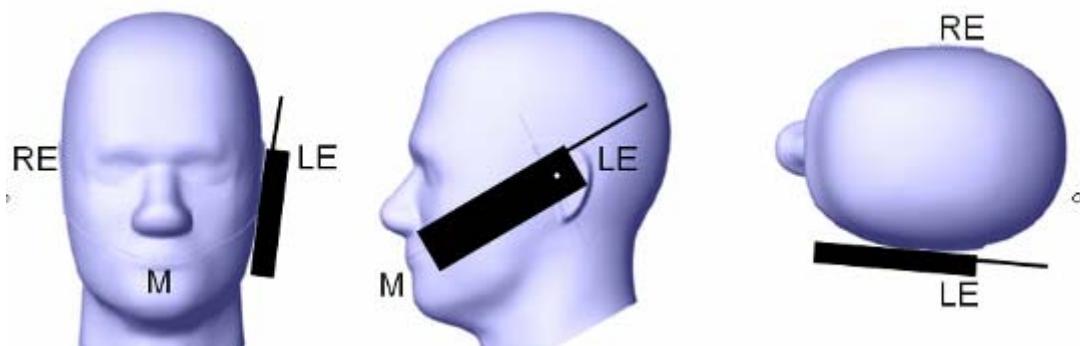
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

This test position is established:

- When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.
- (or) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

For existing head phantoms – when the handset loses contact with the phantom at the pivoting point, rotation should continue until the device touches the cheek of the phantom or breaks its last contact from the ear spacer.

### Cheek /Touch Position



## Ear/Tilt Position

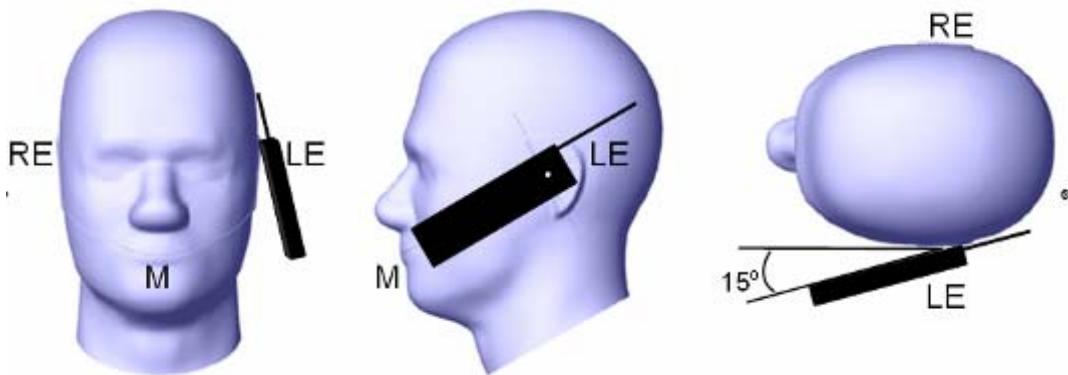
With the handset aligned in the “Cheek/Touch Position”:

1) If the earpiece of the handset is not in full contact with the phantom’s ear spacer (in the “Cheek/Touch position”) and the peak SAR location for the “Cheek/Touch” position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the “initial ear position” by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.

2) (otherwise) The handset should be moved (translated) away from the cheek perpendicular to the line passes through both “ear reference points” (note: one of these ear reference points may not physically exist on a split head model) for approximate 2-3 cm. While it is in this position, the device handset is tilted away from the mouth with respect to the “test device reference point” until the inside angle between the vertical centerline on the front surface of the phone and the horizontal line passing through the ear reference point isby 15 80°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both “ear reference points” until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously. This test position may require a device holder or positioner to achieve the translation and tilting with acceptable positioning repeatability.

If a device is also designed to transmit with its keypad cover closed for operating in the head position, such positions should also be considered in the SAR evaluation. The device should be tested on the left and right side of the head phantom in the “Cheek/Touch” and “Ear/Tilt” positions. When applicable, each configuration should be tested with the antenna in its fully extended and fully retracted positions. These test configurations should be tested at the high, middle and low frequency channels of each operating mode; for example, AMPS, CDMA, and TDMA. If the SAR measured at the middle channel for each test configuration (left, right, Cheek/Touch, Tilt/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s). If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

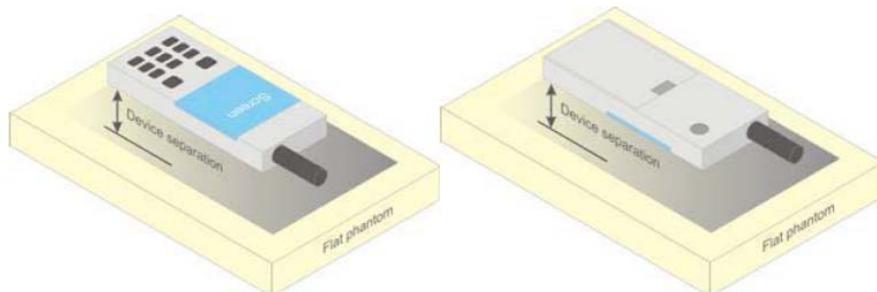
#### Ear /Tilt 15° Position



#### **Test positions for body-worn and other configurations**

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.



**Figure 5 – Test positions for body-worn devices**

## SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or EUT and the horizontal grid spacing was 10 mm x 10 mm. Based on these data, the area of the maximum absorption was determined by spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7x 7 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

- 1) The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
- 2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the "Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

## Test methodology

KDB 447498 D01 General RF Exposure Guidance v05r02.

KDB 648474 D04 Handset SAR v01r02.

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03

KDB 865664 D02 RF Exposure Reporting v01r01

KDB 941225 D01 3G SAR Procedures v03

KDB 941225 D06 Hotspot Mode v02

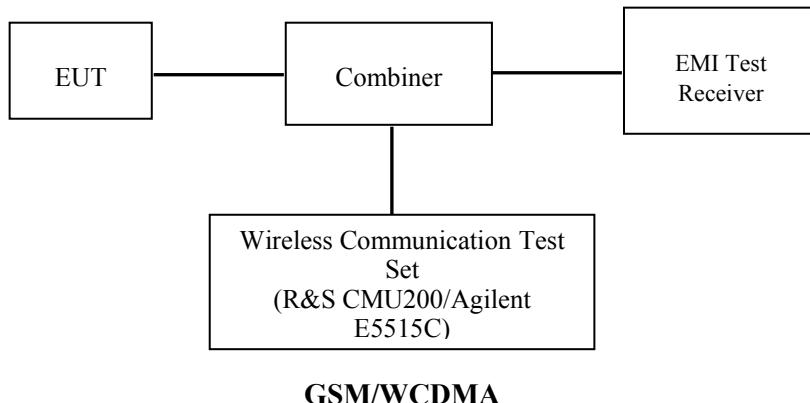
## CONDUCTED OUTPUT POWER MEASUREMENT

### Provision Applicable

The measured peak output power should be greater and within 5% than EMI measurement.

### Test Procedure

The RF output of the transmitter was connected to the input of the EMI Test Receiver through sufficient attenuation.



### Radio Configuration

The power measurement was configured by the Wireless Communication Test Set CMU200 for all Radio configurations except the HSPA+/DC-HSDPA configured by E5515C.

#### GSM

Function: Menu select > GSM Mobile Station > GSM 850/1900

Press Connection control to choose the different menus

Press RESET > choose all the reset all settings

Connection: Press Signal Off to turn off the signal and change settings

Network Support > GSM + only

MS Signal

> 33 dBm for GSM 850

> 30 dBm for GSM 1900

BS Signal: Enter the same channel number for TCH channel (test channel) and BCCH channel

Frequency Offset >+ 0 Hz

Mode > BCCH and TCH

BCCH Level > -85 dBm (May need to adjust if link is not stable)

BCCH Channel >choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off

P0 > 4 dB

TCH > choose desired test channel

Hopping >Off

AF/RF: Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input

Connection: Press Signal on to turn on the signal and change settings

## GPRS

Function: Menu select > GSM Mobile Station > GSM 850/1900

Press Connection control to choose the different menus

Press RESET > choose all the reset all settings

Connection: Press Signal Off to turn off the signal and change settings

Network Support > GSM + GPRS or GSM + EGSM

Main Service > Packet Data

Service selection > Test Mode A – Auto Slot Config. off

MS Signal: Press Slot Config Bottom on the right twice to select and change the number of time slots and power setting

> Slot configuration > Uplink/Gamma

> 33 dBm for GPRS 850

> 30 dBm for GPRS 1900

BS Signal: Enter the same channel number for TCH channel (test channel) and BCCH channel

Frequency Offset >+ 0 Hz

Mode >BCCH and TCH

BCCH Level >-85 dBm (May need to adjust if link is not stable)

BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off

P0 > 4 dB

Slot Config > Unchanged (if already set under MS signal)

TCH > choose desired test channel

Hopping >Off

Main Timeslot >3

Network: Coding Scheme >CS4 (GPRS)

Bit Stream >2E9-1 PSR Bit Stream

AF/RF: Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input

Connection: Press Signal on to turn on the signal and change settings

## WCDMA Release 99

The following tests were conducted according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The EUT has a nominal maximum output power of 24dBm (+1.7/-3.7).

<b>WCDMA General Settings</b>	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	$\beta c / \beta d$	8/15

## HSDPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode Subset	HSDPA 1	HSDPA 2	HSDPA 3	HSDPA 4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	$\beta_d$ (SF)	64			
	$\beta_c / \beta_d$	2/15	12/15	15/8	15/4
HSDPA Specific Settings	$\beta_{hs}$	4/15	24/15	30/15	30/15
	MPR(dB)	0	0	0.5	0.5
	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs= $\beta_{hs} / \beta_c$	30/15			

## HSUPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	<b>Mode Subset</b>	<b>HSUPA 1</b>	<b>HSUPA 2</b>	<b>HSUPA 3</b>	<b>HSUPA 4</b>	<b>HSUPA 5</b>
<b>WCDM A General Settings</b>	Loopback Mode			Test Mode 1		
	Rel99 RMC			12.2kbps RMC		
	HSDPA FRC			H-Set1		
	HSUPA Test			HSUPA Loopback		
	Power Control Algorithm			Algorithm2		
	$\beta_c$	11/15	6/15	15/15	2/15	15/15
	$\beta_d$	15/15	15/15	9/15	15/15	0
	$\beta_{ec}$	209/225	12/15	30/15	2/15	5/15
	$\beta_c / \beta_d$	11/15	6/15	15/9	2/15	-
	$\beta_{hs}$	22/15	12/15	30/15	4/15	5/15
<b>HSDPA Specific Settings</b>	CM(dB)	1.0	3.0	2.0	3.0	1.0
	MPR(dB)	0	2	1	2	0
	DACK			8		
	DNAK			8		
	DCQI			8		
	Ack-Nack repetition factor			3		
	CQI Feedback			4ms		
<b>HSUPA Specific Settings</b>	CQI Repetition Factor			2		
	$A_{hs} = \beta_{hs} / \beta_c$			30/15		
	DE-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_FCI	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27	E-TFCI E-TFCI 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18 E-TFCI	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27	E-TFCI E-TFCI 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18 E-TFCI	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27

## Maximum Output Power among production units

Mode/Band	Max Target Power for Production Unit (dBm)		
	Low	Middle	High
GSM 850	32.70	32.70	32.70
GPRS 1 TX Slot	32.70	32.70	32.70
GPRS 2 TX Slot	31.90	31.90	31.90
GPRS 3 TX Slot	30.00	30.00	30.00
GPRS 4 TX Slot	28.80	28.80	28.80
EDGE 1 TX Slot	28.70	28.70	28.70
EDGE 2 TX Slot	28.20	28.20	28.20
EDGE 3 TX Slot	26.90	26.90	26.90
EDGE 4 TX Slot	26.10	26.10	26.10
GSM 1900	29.50	29.50	29.50
GPRS 1 TX Slot	29.60	29.60	29.60
GPRS 2 TX Slot	28.80	28.80	28.80
GPRS 3 TX Slot	27.10	27.10	27.10
GPRS 4 TX Slot	25.90	25.90	25.90
EDGE 1 TX Slot	23.70	23.70	23.70
EDGE 2 TX Slot	22.90	22.90	22.90
EDGE 3 TX Slot	21.20	21.20	21.20
EDGE 4 TX Slot	20.30	20.30	20.30
WCDMA850	22.50	22.50	22.50
HSDPA	21.30	21.30	21.30
HSUPA	21.60	21.60	21.60
WCDMA1900	21.90	21.90	21.90
HSDPA	20.80	20.80	20.80
HSUPA	20.90	20.90	20.90
Wi-Fi(b/n/n20)	9.50	9.50	9.50
Wi-Fi(n40)	7.70	7.70	7.70
Bluetooth	2.20	2.20	2.20
BLE	-5.00	-5.00	-5.00

**Test Results:****GSM:**

Band	Channel No.	Frequency (MHz)	Time Based Average Power (dBm)
GSM 850	128	824.2	32.49
	190	836.6	32.58
	251	848.8	<b>32.59</b>
PCS 1900	512	1850.2	28.96
	661	1880	29.18
	810	1909.8	<b>29.35</b>

**GPRS:**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slots	3 slots	4 slots
GSM 850	128	824.2	32.53	31.69	29.80	28.56
	190	836.6	32.56	31.75	29.87	28.59
	251	848.8	32.60	31.74	29.83	28.62
PCS 1900	512	1850.2	29.03	28.25	26.45	25.22
	661	1880	29.27	28.49	26.70	25.52
	810	1909.8	29.43	28.69	26.91	25.74

**EGPRS:**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slots	3 slots	4 slots
GSM 850	128	824.2	28.53	28.04	26.77	25.99
	190	836.6	28.46	27.96	26.62	25.84
	251	848.8	28.33	27.84	26.45	25.66
PCS 1900	512	1850.2	23.60	22.78	21.11	20.16
	661	1880	23.47	22.67	21.02	20.09
	810	1909.8	23.24	22.41	20.76	19.81

For SAR, the time based average power is relevant, the difference in between depends on the duty cycle of the TDMA signal.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.25 dB	-3 dB
Crest Factor	8	4	2.66	2

### The time based average power for GPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	23.53	25.69	25.55	25.56
	190	836.6	23.56	<b>25.75</b>	25.62	25.59
	251	848.8	23.60	25.74	25.58	25.62
PCS 1900	512	1850.2	20.03	22.25	22.20	22.22
	661	1880	20.27	22.49	22.45	22.52
	810	1909.8	20.43	22.69	22.66	<b>22.74</b>

### The time based average power for EGPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	19.53	22.04	22.52	<b>22.99</b>
	190	836.6	19.46	21.96	22.37	22.84
	251	848.8	19.33	21.84	22.20	22.66
PCS 1900	512	1850.2	14.60	16.78	16.86	<b>17.16</b>
	661	1880	14.47	16.67	16.77	17.09
	810	1909.8	14.24	16.41	16.51	16.81

**Note:**

1. Rohde & Schwarz Radio Communication Tester (CMU200) was used for the measurement of GSM peak and average output power for active timeslots.
2. For GSM voice, 1 timeslot has been activated with power level 5 (850 MHz band) and 0 (1900 MHz band).
3. For GPRS, 1, 2, 3 and 4 timeslots has been activated separately with power level 3(850 MHz band) and 3(1900 MHz band).
4. For EGPRS, 1, 2, 3 and 4 timeslots has been activated separately with power level 6(850 MHz band) and 5(1900 MHz band).
5. According to KDB941225D06-SAR for EGPRS mode are not required when the source-based time-averaged output power for data mode is lower than that in the normal GPRS mode

**WCDMA:**

**Results (12.2kbps RMC)**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)
WCDMA 850	4132	826.4	<b>22.35</b>
	4183	836.6	22.25
	4233	846.6	22.14
WCDMA 1900	9262	1852.4	<b>21.77</b>
	9400	1880	21.76
	9538	1907.6	21.52

## Results (HSDPA)

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			Subset 1	Subset 2	Subset 3	Subset 4
WCDMA 850	4132	826.4	21.15	21.08	21.21	21.05
	4183	836.6	20.93	20.86	21.01	20.86
	4233	846.6	21.01	20.90	21.13	20.93
WCDMA 1900	9262	1852.4	20.68	20.63	20.75	20.57
	9400	1880	20.55	20.45	20.67	20.49
	9538	1907.6	20.15	20.12	20.23	20.03

## Results (HSUPA)

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)				
			Subset 1	Subset 2	Subset 3	Subset 4	Subset 5
WCDMA 850	4132	826.4	21.31	21.27	21.43	21.20	21.39
	4183	836.6	21.07	20.99	21.16	20.98	21.16
	4233	846.6	21.10	21.02	21.16	21.03	21.18
WCDMA 1900	9262	1852.4	20.68	20.55	20.78	20.64	20.76
	9400	1880	20.64	20.57	20.74	20.57	20.72
	9538	1907.6	20.44	20.33	20.48	20.39	20.47

### Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model 1.
2. KDB 941225 D01-Body SAR is not required for HSDPA/HSUPA when the maximum average output of each RF channel is less than  $\frac{1}{4}$  dB higher than measured 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.

**Bluetooth**

<b>Mode</b>	<b>Channel No.</b>	<b>Channel frequency (MHz)</b>	<b>RF Output Power (dBm)</b>
BDR(GFSK)	0	2402	<b>2.09</b>
	39	2441	2.04
	78	2480	2.04
EDR(4-DQPSK)	0	2402	1.87
	39	2441	1.23
	78	2480	2.03
EDR-8DPSK	0	2402	1.63
	39	2441	1.86
	78	2480	1.64
BLE	0	2402	-5.42
	19	2440	-5.19
	39	2480	-5.56

**WLAN**

<b>Mode</b>	<b>Channel No.</b>	<b>Channel frequency (MHz)</b>	<b>RF Output Power (dBm)</b>
802.11b	1	2412	9.16
	6	2442	9.40
	13	2472	<b>9.42</b>
802.11g	1	2412	8.68
	6	2442	8.71
	13	2472	8.90
802.11n HT20	1	2412	8.69
	6	2442	8.71
	13	2472	8.86
802.11n HT40	1	2422	7.54
	4	2437	7.41
	9	2462	7.60

**Note:**

1. The output power was tested under data rate 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n HT20 and 13.5Mbps for 802.11n HT40.

## SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

The EUT is capable of function as a WLAN to cellular mobile hotspot. Additional SAR test was performed according to KDB941225 D06. Test was performed with a separation of 1cm between the EUT and the flat phantom. The EUT was positioned for SAR tests with the front and back surfaces facing the edge. Each transmit band was utilized for SAR testing. The tested mode has been selected within each band that exhibits the highest time average output power.

### SAR Test Data

#### Environmental Conditions

<b>Temperature:</b>	22.5-24
<b>Relative Humidity:</b>	35 %
<b>ATM Pressure:</b>	1003 mbar

*Testing was performed by Wilson Chen on 2015-08-22*

#### GSM 850:

<b>EUT Position</b>	<b>Frequency (MHz)</b>	<b>Test Mode</b>	<b>Power Drift (%)</b>	<b>Max. Meas. Power (dBm)</b>	<b>Max. Rated Power (dBm)</b>	<b>1g SAR (W/Kg)</b>			
						<b>Scaled Factor</b>	<b>Meas. SAR</b>	<b>Scaled SAR</b>	<b>Plot</b>
Left Head Cheek	824.2	GSM	2.518	32.49	32.70	1.050	0.133	0.140	/
	836.6	GSM	-1.372	32.58	32.70	1.028	0.156	<b>0.160</b>	1#
	848.8	GSM	0.740	32.59	32.70	1.026	0.119	0.122	/
Left Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	3.336	32.58	32.70	1.028	0.0833	0.0861	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-3.319	32.58	32.70	1.028	0.131	0.135	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-2.441	32.58	32.70	1.028	0.0857	0.0876	/
	848.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	1.296	32.58	32.70	1.028	0.181	0.186	/
	848.8	GSM	/	/	/	/	/	/	/

#### Note:

- When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
- The EUT transmit and receive through the same GSM antenna while testing SAR.
- When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.
- When the maximum output power variation across the required test channels is  $> \frac{1}{2} \text{ dB}$ , instead of the middle channel, the highest output power channel must be used.

**PCS Band:**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1850.2	GSM	-0.922	28.96	29.50	1.132	0.0973	0.110	/
	1880	GSM	-1.344	29.18	29.50	1.076	0.106	0.114	/
	1909.8	GSM	2.565	29.35	29.50	1.035	0.119	<b>0.123</b>	3#
Left Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880	GSM	-1.467	29.18	29.50	1.076	0.0536	0.0577	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	1850.2	GSM	/	/	/	/	/	/	/
	1880	GSM	0.963	29.18	29.50	1.076	0.112	0.120	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880	GSM	-1.881	29.18	29.50	1.076	0.0613	0.0659	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	1850.2	GSM	/	/	/	/	/	/	/
	1880	GSM	2.564	29.18	29.50	1.076	0.135	0.145	/
	1909.8	GSM	/	/	/	/	/	/	/

**Note:**

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
2. The EUT transmit and receive through the same GSM antenna while testing SAR.
3. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.
4. When the maximum output power variation across the required test channels is  $> \frac{1}{2} \text{ dB}$ , instead of the middle channel, the highest output power channel must be used.

**WCDMA 850 Band:**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	826.4	WCDMA	1.625	22.35	22.50	1.035	0.133	<b>0.138</b>	5#
	836.6	WCDMA	/	/	/	/	/	/	/
	846.6	WCDMA	/	/	/	/	/	/	/
Left Head Tilt	826.4	WCDMA	1.509	22.35	22.50	1.035	0.0816	0.0845	/
	836.6	WCDMA	/	/	/	/	/	/	/
	846.6	WCDMA	/	/	/	/	/	/	/
Right Head Cheek	826.4	WCDMA	2.072	22.35	22.50	1.035	0.119	0.123	/
	836.6	WCDMA	/	/	/	/	/	/	/
	846.6	WCDMA	/	/	/	/	/	/	/
Right Head Tilt	826.4	WCDMA	-1.123	22.35	22.50	1.035	0.0852	0.0882	/
	836.6	WCDMA	/	/	/	/	/	/	/
	846.6	WCDMA	/	/	/	/	/	/	/

**WCDMA 1900 Band:**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1852.4	WCDMA	0.693	21.77	21.90	1.030	0.193	<b>0.199</b>	7#
	1880	WCDMA	/	/	/	/	/	/	/
	1907.6	WCDMA	/	/	/	/	/	/	/
Left Head Tilt	1852.4	WCDMA	-1.915	21.77	21.90	1.030	0.0896	0.0923	/
	1880	WCDMA	/	/	/	/	/	/	/
	1907.6	WCDMA	/	/	/	/	/	/	/
Right Head Cheek	1852.4	WCDMA	-1.703	21.77	21.90	1.030	0.173	0.178	/
	1880	WCDMA	/	/	/	/	/	/	/
	1907.6	WCDMA	/	/	/	/	/	/	/
Right Head Tilt	1852.4	WCDMA	0.975	21.77	21.90	1.030	0.0957	0.0988	/
	1880	WCDMA	/	/	/	/	/	/	/
	1907.6	WCDMA	/	/	/	/	/	/	/

**Note:**

- When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
- The EUT transmit and receive through the same antenna while testing SAR.
- The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model.
- KDB 941225 D01-Body SAR is not required for HSDPA/HSUPA when the maximum average output of each RF channel is less than  $\frac{1}{4}\text{ dB}$  higher than measured 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is  $< 75\%$  of SAR limit.
- When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

## Mobile Hot-Spot Test Result

The DUT is capable of functioning as a Wi-Fi to Cellular Mobile hotspot. Additional SAR testing was performed according to KDB 941225 D06. Testing was performed with a separation of 1cm between the DUT and the flat phantom. The DUT was positioned for SAR tests with the front and back surfaces facing the phantom, and also with the edges facing the phantom in which the transmitting antenna is <2.5 cm from the edge. Each transmit band was utilized for SAR testing. The tested mode has been selected within each band that exhibits the highest time average output power.

### Hot spot-GPRS (Frequency Band: 850)

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	1.625	31.75	31.90	1.035	0.234	<b>0.242</b>	2#
	848.8	GPRS	/	/	/	/	/	/	/
Body-Left (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	2.104	31.75	31.90	1.035	0.177	0.183	/
	848.8	GPRS	/	/	/	/	/	/	/
Body-Bottom (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	1.082	31.75	31.90	1.035	0.116	0.120	/
	848.8	GPRS	/	/	/	/	/	/	/

#### Note:

The Multi-slot Classes of EUT is Class12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 3DL+2UL is the worst case.

### Hot spot-GPRS (Frequency Band: 1900)

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1850.2	GPRS	/	/	/	/	/	/	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	-0.917	25.74	25.90	1.038	0.187	<b>0.194</b>	4#
Body-Left (10mm)	1850.2	GPRS	/	/	/	/	/	/	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	-0.866	25.74	25.90	1.038	0.0826	0.0857	/
Body-Bottom (10mm)	1850.2	GPRS	/	/	/	/	/	/	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	1.792	25.74	25.90	1.038	0.139	0.144	/

#### Note:

- When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
- The EUT is a Capability Class B mobile phone which can be attached to both GPRS and GSM services.
- The Multi-slot Classes of EUT is Class12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.
- The EUT transmit and receive through the same GSM antenna while testing SAR.
- When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

**Hot Spot-WCDMA850**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	826.4	WCDMA850	-0.917	22.35	22.50	1.035	0.216	<b>0.224</b>	6#
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Left (10mm)	826.4	WCDMA850	2.167	22.35	22.50	1.035	0.155	0.160	/
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Bottom (10mm)	826.4	WCDMA850	1.330	22.35	22.50	1.035	0.0673	0.0697	/
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/

**Hot Spot-WCDMA 1900**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1852.4	WCDMA1900	-1.372	21.77	21.90	1.030	0.353	<b>0.364</b>	8#
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Left (10mm)	1852.4	WCDMA1900	-2.069	21.77	21.90	1.030	0.117	0.121	/
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Bottom (10mm)	1852.4	WCDMA1900	-3.444	21.77	21.90	1.030	0.260	0.268	/
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/

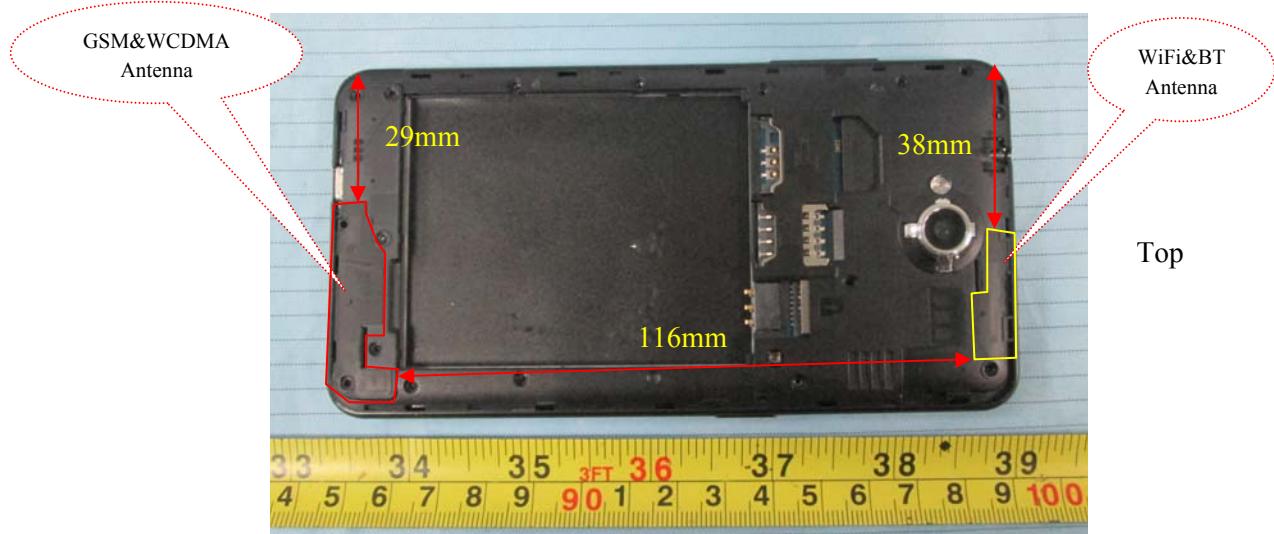
Note:

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
2. The default test configuration is to measure SA R with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (referenced measurement Channel) Configured in Test Loop Model.
3. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

## SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

### BT&WLAN and GSM&3G Antennas Location:

Right



Top

Left

### Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	✗	✗	0
GSM + Bluetooth	✓	✗	116
GSM + WLAN	✓	✓	116
WCDMA+Bluetooth	✓	✗	116
WCDMA + WLAN	✓	✓	116

### Standalone SAR test exclusion considerations

Mode	Frequency (MHz)	Pavg (dBm)	Pavg (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
WLAN	2450	9.50	8.91	0	2.79	3	YES
WLAN	2450	9.50	8.91	10	1.40	3	YES
Bluetooth	2450	2.20	1.66	0	0.52	3	YES
Bluetooth	2450	2.20	1.66	10	0.26	3	YES

#### NOTE:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

1.  $f(\text{GHz})$  is the RF channel transmit frequency in GHz.

2. Power and distance are rounded to the nearest mW and mm before calculation.

3. The result is rounded to one decimal place for comparison.

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

#### Standalone SAR estimation:

Mode	Frequency (GHz)	Pavg (dBm)	Pavg (mW)	Distance (mm)	Estimated 1-g (W/kg)
WLAN Head	2450	9.50	8.91	0	0.372
WLAN Body	2450	9.50	8.91	10	0.186
BT Head	2450	2.20	1.66	0	0.069
BT Body	2450	2.20	1.66	10	0.035

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

$$[(\text{max. power of channel, including tune-up tolerance , mW}) / (\text{min. test separation distance,mm})] \cdot [\sqrt{f(\text{GHz})}/x] \text{ W/kg for test separation distances } \leq 50 \text{ mm;}$$

where  $x = 7.5$  for 1-g SAR.

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

**Simultaneous and Hotspot SAR test exclusion considerations:****GSM with BT:**

Mode (SAR1+SAR2)	Position	Reported SAR (W/kg)		$\Sigma$ SAR < 1.6W/kg
		SAR1	SAR2	
GSM 850+BT	Left Head Cheek	0.160	0.069	0.229
	Left Head Tilt	0.0861	0.069	0.155
	Right Head Cheek	0.135	0.069	0.204
	Right Head Tilt	0.876	0.069	0.945
	Body-Back-Headset	0.186	0.035	0.221
PCS1900 +BT	Left Head Cheek	0.123	0.069	0.192
	Left Head Tilt	0.0577	0.069	0.127
	Right Head Cheek	0.120	0.069	0.189
	Right Head Tilt	0.0659	0.069	0.135
	Body-Back-Headset	0.149	0.035	0.184

**WCDMA with BT:**

Mode (SAR1+SAR2)	Position	Reported SAR (W/kg)		$\Sigma$ SAR < 1.6W/kg
		SAR1	SAR2	
WCDMA 850+BT	Left Head Cheek	0.138	0.069	0.207
	Left Head Tilt	0.0845	0.069	0.154
	Right Head Cheek	0.123	0.069	0.192
	Right Head Tilt	0.0882	0.069	0.157
WCDMA1900 +BT	Left Head Cheek	0.199	0.069	0.268
	Left Head Tilt	0.0923	0.069	0.161
	Right Head Cheek	0.178	0.069	0.247
	Right Head Tilt	0.0988	0.069	0.168

**GSM with WLAN:**

Mode (SAR1+SAR2)	Position	Reported SAR (W/kg)		$\Sigma$ SAR < 1.6W/kg
		SAR1	SAR2	
GSM 850+ WLAN	Left Head Cheek	0.160	0.372	0.532
	Left Head Tilt	0.0861	0.372	0.458
	Right Head Cheek	0.135	0.372	0.507
	Right Head Tilt	0.876	0.372	1.248
	Body-Back-Headset	0.186	0.186	0.372
PCS1900 + WLAN	Left Head Cheek	0.123	0.372	0.495
	Left Head Tilt	0.0577	0.372	0.430
	Right Head Cheek	0.120	0.372	0.492
	Right Head Tilt	0.0659	0.372	0.438
	Body-Back-Headset	0.149	0.372	0.521

**WCDMA with WLAN:**

Mode (SAR1+SAR2)	Position	Reported SAR (W/kg)		$\Sigma$ SAR < 1.6W/kg
		SAR1	SAR2	
WCDMA 850+ WLAN	Left Head Cheek	0.138	0.372	0.510
	Left Head Tilt	0.0845	0.372	0.457
	Right Head Cheek	0.123	0.372	0.495
	Right Head Tilt	0.0882	0.372	0.460
WCDMA1900 + WLAN	Left Head Cheek	0.199	0.372	<b>0.571</b>
	Left Head Tilt	0.0923	0.372	0.464
	Right Head Cheek	0.178	0.372	0.550
	Right Head Tilt	0.0988	0.372	0.471

**Note:** Hotspot mode SAR is only required for the edges within 25mm from the transmitting antenna located.

**Conclusion:**

$\Sigma$  SAR < 1.6 W/kg therefore simultaneous transmission SAR with Volume Scans is **not** required.

**Hotspot:**

Evaluations for Simultaneous SAR, Mobile Hot Spot Positions					
Test Position Mode	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Stand Alone 1-g SAR (W/Kg)					
GRPS 850	0.242	0.183	/	0.120	/
GRPS 1900	0.194	0.0857	/	0.144	/
WCDMA850	0.224	0.160	/	0.0697	/
WCDMA 1900	0.364	0.121	/	0.268	/
WLAN	0.186	0.186	0.186	0.186	0.186
$\Sigma$ 1-g SAR(W/Kg)					
GRPS850 + WLAN	0.428	0.369	/	0.306	/
GRPS1900+ WLAN	0.380	0.272	/	0.330	/
WCDMA850 + WLAN	0.410	0.346	/	0.256	/
WCDMA1900 + WLAN	<b>0.550</b>	0.307	/	0.454	/

**Note:**

If the sum of the 1g SAR measured for the simultaneously transmitting antennas is less than the SAR limit, SAR measurement for simultaneous transmission is not required.

## SAR Plots (Summary of the Highest SAR Values)

Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)

Test Plot 1#:GSM 850-Left Head Check Middle Channel

DUT: WCDMA Mobile Phone; Type: BANG 2;

Communication System: UID 0, GSM 850 (0); Frequency: 836.6 MHz; Duty Cycle: 1:8

Medium parameters used:  $f = 836.6 \text{ MHz}$ ;  $\sigma = 0.92 \text{ S/m}$ ;  $\epsilon_r = 41.02$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(9.52, 9.52, 9.52); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**HEAD/GSM900 Right Check/Area Scan (61x101x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.210 W/kg

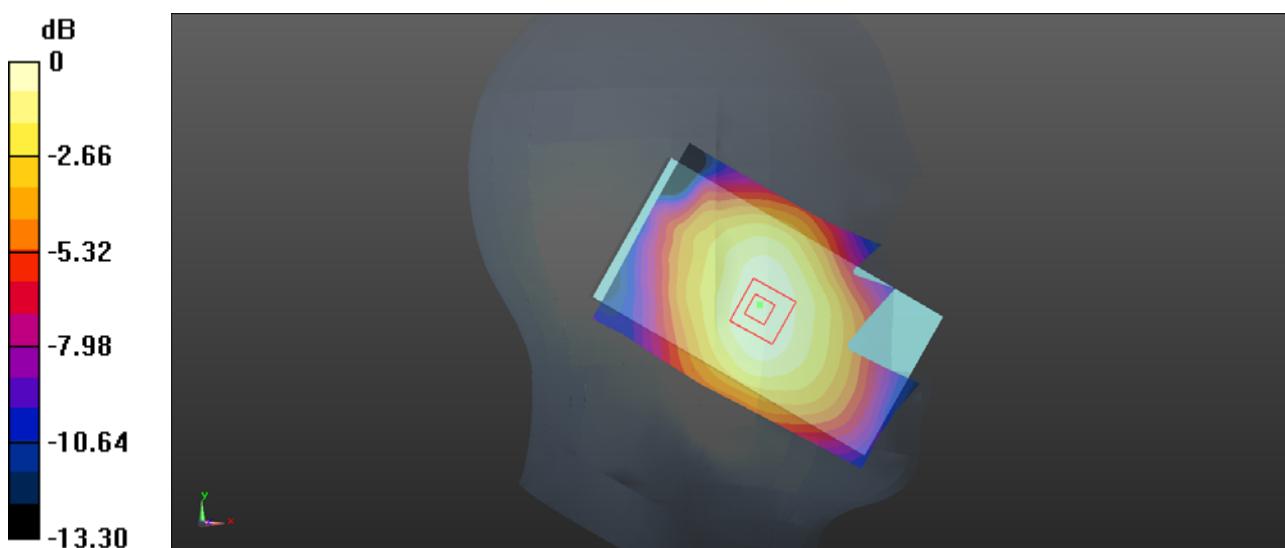
**HEAD/GSM900 Right Check/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.264 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.262 W/kg

**SAR(1 g) = 0.156 W/kg; SAR(10 g) = 0.108 W/kg**

Maximum value of SAR (measured) = 0.185 W/kg



0 dB = 0.185 W/kg = -7.33 dBW/kg

**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****Test Plot 2#: GSM 850 Back High Channel****DUT: WCDMA Mobile Phone; Type: BANG 2;**

Communication System: UID 0, Generic GPRS-2 SLOTS (0); Frequency: 836.6 MHz; Duty Cycle: 1:4

Medium parameters used:  $f = 836.6$  MHz;  $\sigma = 0.96$  S/m;  $\epsilon_r = 53.84$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(9.17, 9.17, 9.17); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**Body/GSM 850 Back/Area Scan (61x81x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.275 W/kg

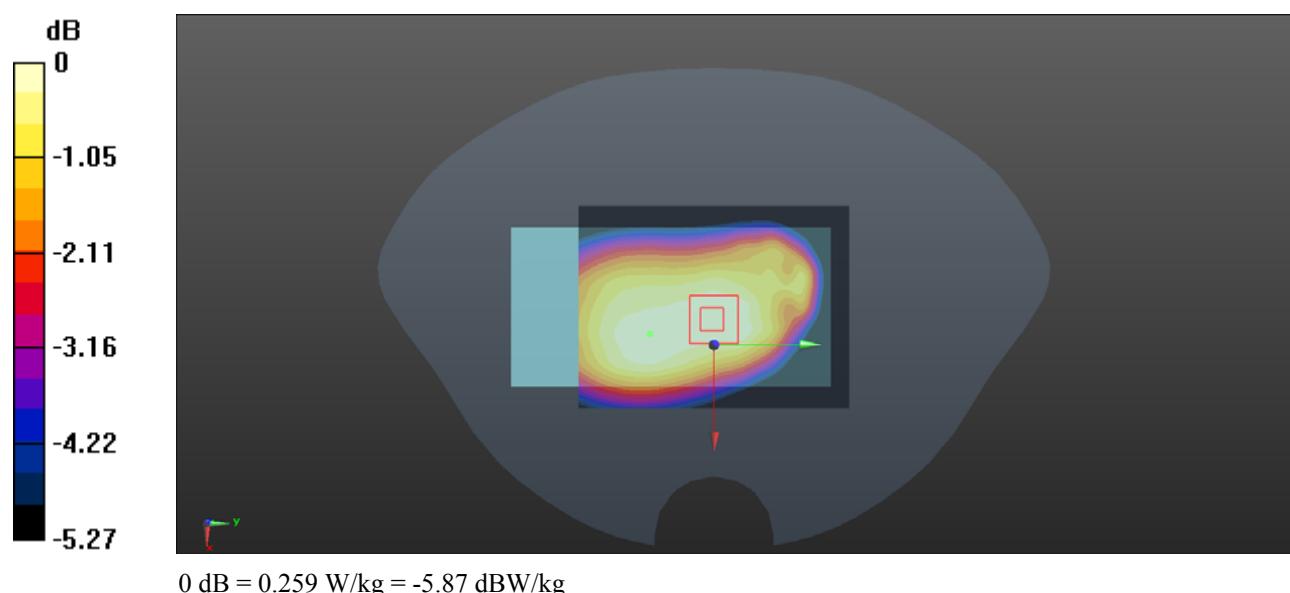
**Body/PCS 850 Back/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.02 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.403 W/kg

**SAR(1 g) = 0.234 W/kg; SAR(10 g) = 0.172 W/kg**

Maximum value of SAR (measured) = 0.259 W/kg



**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****Test Plot 3#:GSM 1900 Left Cheek High Channel****DUT: WCDMA Mobile Phone; Type: BANG 2;**

Communication System: UID 0, Generic GSM (0); Frequency: 1909.8 MHz; Duty Cycle: 1:8

Medium parameters used:  $f = 1909.8 \text{ MHz}$ ;  $\sigma = 1.42 \text{ S/m}$ ;  $\epsilon_r = 39.57$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(7.88, 7.88, 7.88); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**Head/PCS 1900-Left Cheek/Area Scan (61x101x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.157 W/kg

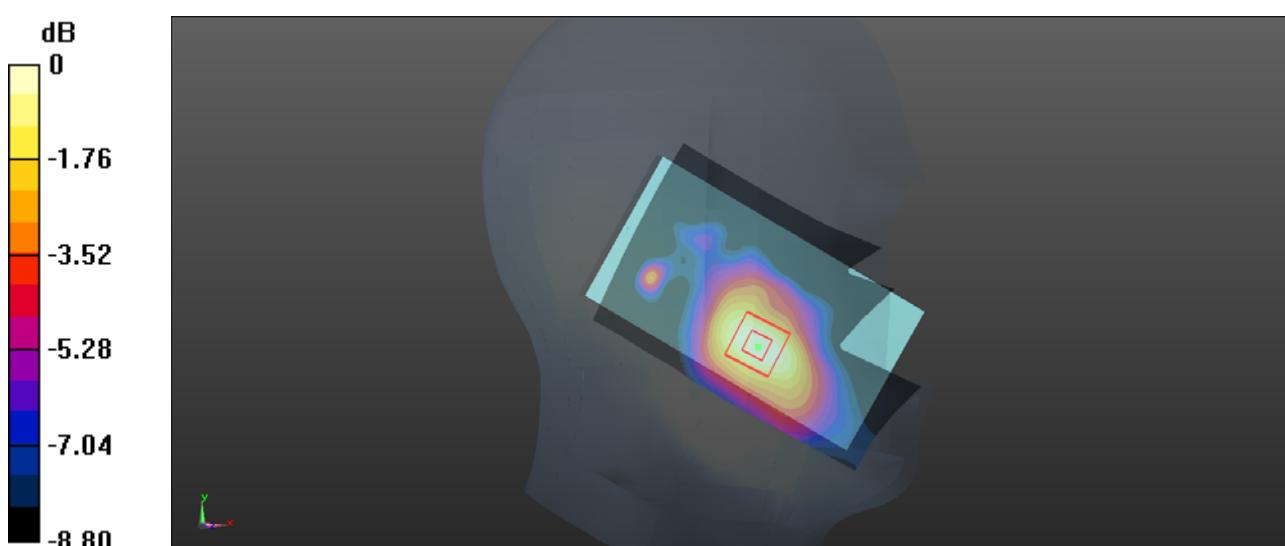
**Head/PCS 1900-Left Cheek/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 1.590 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.211 W/kg

**SAR(1 g) = 0.119 W/kg; SAR(10 g) = 0.0623 W/kg**

Maximum value of SAR (measured) = 0.136 W/kg



0 dB = 0.136 W/kg = -8.66 dBW/kg

**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****Test Plot 4#:PCS 1900 Back High Channel****DUT: WCDMA Mobile Phone; Type: BANG 2;**

Communication System: UID 0, Generic GPRS-4 SLOT (0); Frequency: 1909.8 MHz; Duty Cycle: 1.2

Medium parameters used:  $f = 1909.8 \text{ MHz}$ ;  $\sigma = 1.54 \text{ S/m}$ ;  $\epsilon_r = 52.02$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(7.56, 7.56, 7.56); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**Body/PCS 1900 Back/Area Scan (61x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.207 W/kg

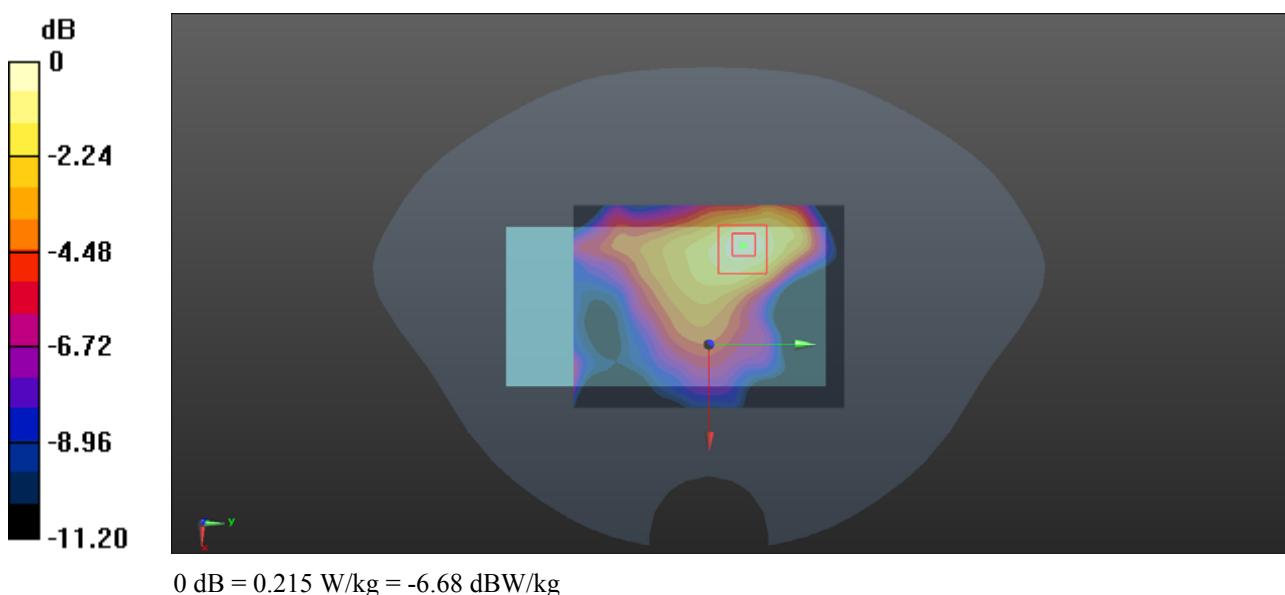
**Body/PCS 1900 Back/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 6.45 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.326 W/kg

**SAR(1 g) = 0.187 W/kg; SAR(10 g) = 0.114 W/kg**

Maximum value of SAR (measured) = 0.215 W/kg



**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****Test Plot 5#:WCDMA 850 Left-Cheek Low Channel****DUT: WCDMA Mobile Phone; Type: BANG 2;**

Communication System: UID 0, BAND V (0); Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 826.4 \text{ MHz}$ ;  $\sigma = 0.91 \text{ S/m}$ ;  $\epsilon_r = 41.06$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(9.52, 9.52, 9.52); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**Head/WCDMA 850 Left Cheek/Area Scan (61x101x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.175 W/kg

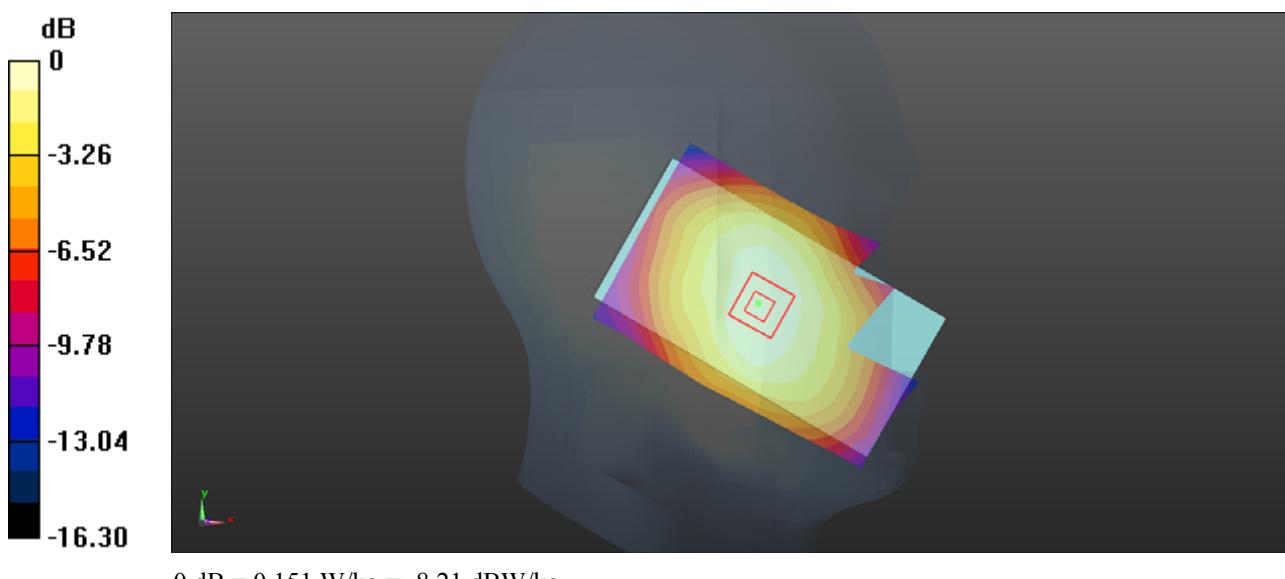
**Head/WCDMA 850 Left Cheek/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 5.458 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.227 W/kg

**SAR(1 g) = 0.133 W/kg; SAR(10 g) = 0.0912 W/kg**

Maximum value of SAR (measured) = 0.151 W/kg



**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****Test Plot 6#:WCDMA 850 Back Low Channel****DUT: WCDMA Mobile Phone; Type: BANG 2;**

Communication System: UID 0, BAND V (0); Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 826.4 \text{ MHz}$ ;  $\sigma = 0.95 \text{ S/m}$ ;  $\epsilon_r = 53.87$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(9.17, 9.17, 9.17); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**Body/WCDMA 850 Back/Area Scan (61x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$ 

Maximum value of SAR (interpolated) = 0.257 W/kg

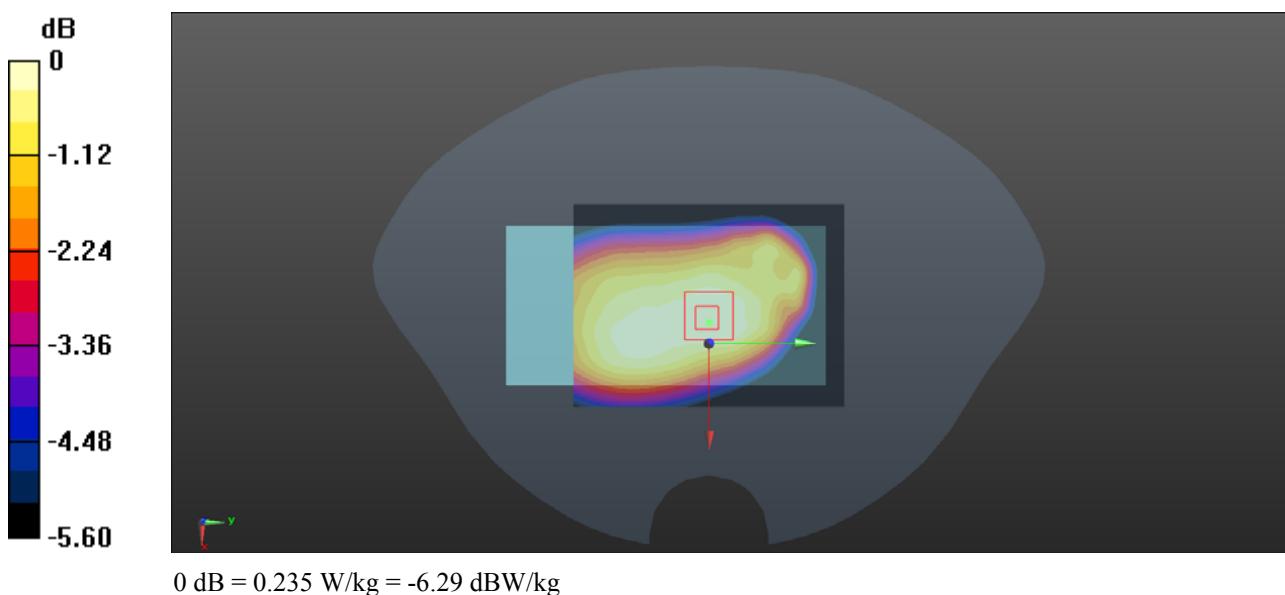
**Body/WCDMA 850 Back/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 14.06 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.341 W/kg

**SAR(1 g) = 0.216 W/kg; SAR(10 g) = 0.158 W/kg**

Maximum value of SAR (measured) = 0.235 W/kg



**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****Test Plot 7#:WCDMA 1900 Left Cheek Low Channel****DUT: WCDMA Mobile Phone; Type: BANG 2;**

Communication System: UID 0, BAND II (0); Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1852.4 \text{ MHz}$ ;  $\sigma = 1.37 \text{ S/m}$ ;  $\epsilon_r = 39.70$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(7.88, 7.88, 7.88); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**Head/WCDMA 1900 Left Cheek /Area Scan (61x101x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$ 

Maximum value of SAR (interpolated) = 0.237 W/kg

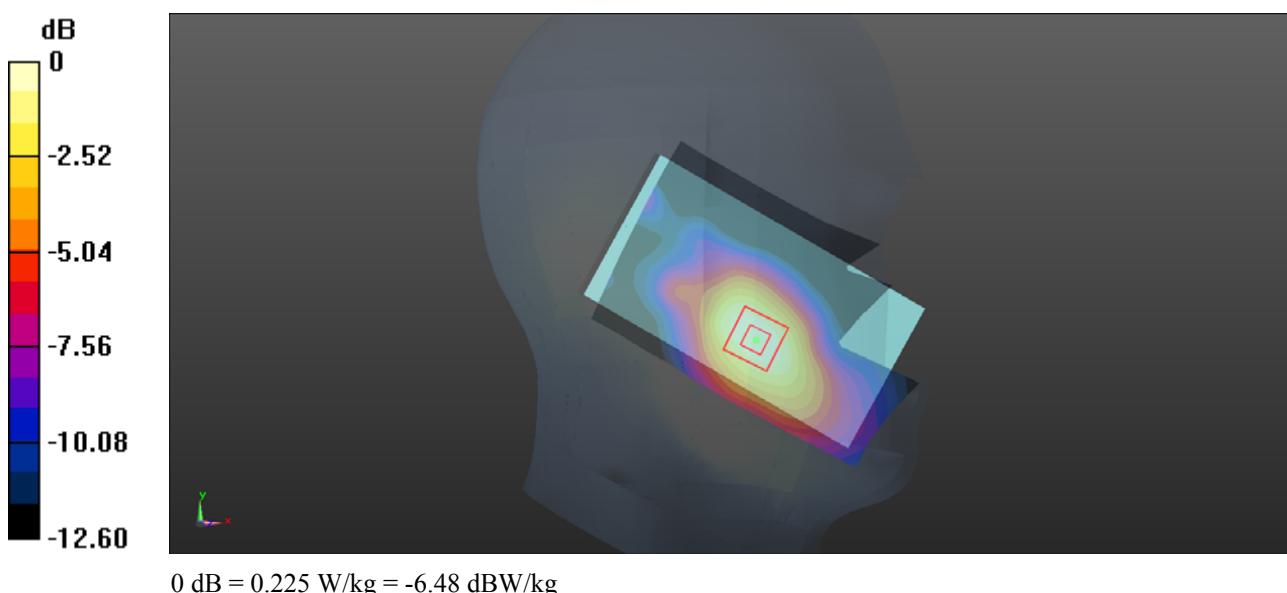
**Head/WCDMA 1900 Left Cheek /Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 3.084 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.316 W/kg

**SAR(1 g) = 0.193 W/kg; SAR(10 g) = 0.102 W/kg**

Maximum value of SAR (measured) = 0.225 W/kg



**Test Laboratory: Bay Area Compliance Labs Corp.(Dongguan)****Test Plot 8#:WCDMA 1900 Back Low Channel****DUT: WCDMA Mobile Phone; Type: BANG 2;**

Communication System: UID 0, BAND II (0); Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1852.4 \text{ MHz}$ ;  $\sigma = 1.48 \text{ S/m}$ ;  $\epsilon_r = 51.94$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7329; ConvF(7.56, 7.56, 7.56); Calibrated: 2015/2/5;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1459; Calibrated: 2015/1/26
- Phantom: SAM (30deg probe tilt) with CRP v5.0\_20150321; Type: QD000P40CD; Serial: TP:1874
- Measurement SW: DASY52, Version 52.8 (8);

**Body/WCDMA 1900 Back/Area Scan (61x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$ 

Maximum value of SAR (interpolated) = 0.396 W/kg

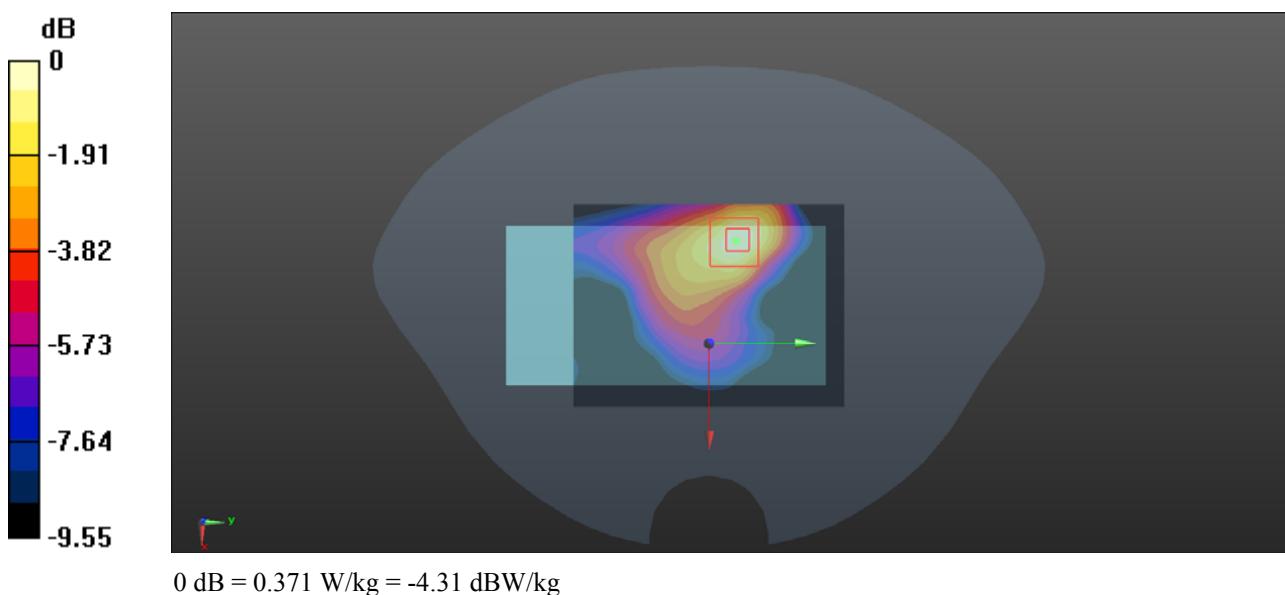
**Body/WCDMA 1900 Back/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5 \text{ mm}$ ,  $dy=5 \text{ mm}$ ,  $dz=5 \text{ mm}$ 

Reference Value = 8.57 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.550 W/kg

**SAR(1 g) = 0.353 W/kg; SAR(10 g) = 0.164 W/kg**

Maximum value of SAR (measured) = 0.371 W/kg



## APPENDIX A MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the measurement system and is given in the following Table.

### Measurement uncertainty evaluation for IEEE1528-2013 SAR test

Source of uncertainty	Tolerance/ uncertainty ± %	Probability distribution	Disisor	ci (1 g)	ci (10 g)	Standard uncertainty ± %, (1 g)	Standard uncertainty ± %, (10 g)
<b>Measurement system</b>							
Probe calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	$\sqrt{3}$	1	1	2.7	2.7
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0	0	0.0	0.0
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7
Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Readout electronics	0.3	N	1	1	1	0.3	0.3
Response time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
Integration time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
RF ambient conditions – noise	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
RF ambient conditions – reflections	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Probe positioner mech. Restrictions	0.8	R	$\sqrt{3}$	1	1	0.5	0.5
Probe positioning with respect to phantom shell	6.7	R	$\sqrt{3}$	1	1	3.9	3.9
Post-processing	2.0	R	$\sqrt{3}$	1	1	1.2	1.2
<b>Test sample related</b>							
Test sample positioning	2.8	N	1	1	1	2.8	2.8
Device holder uncertainty	6.3	N	1	1	1	6.3	6.3
Drift of output power	5.0	R	$\sqrt{3}$	1	1	2.9	2.9
<b>Phantom and set-up</b>							
Phantom uncertainty (shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.3	2.3
Liquid conductivity target)	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2
Liquid conductivity meas.)	2.5	N	1	0.64	0.43	1.6	1.1
Liquid permittivity target)	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4
Liquid permittivity meas.)	2.5	N	1	0.6	0.49	1.5	1.2
Combined standard uncertainty		RSS				12.2	12.0
Expanded uncertainty 95 % confidence interval)						24.3	23.9

### Measurement uncertainty evaluation for IEC62209-2 SAR test

Source of uncertainty	Tolerance/uncertainty ± %	Probability distribution	Disisor	ci (1 g)	ci (10 g)	Standard uncertainty ± %, (1 g)	Standard uncertainty ± %, (10 g)
<b>Measurement system</b>							
Probe calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	$\sqrt{3}$	1	1	2.7	2.7
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0	0	0.0	0.0
Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7
Modulation Response	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Readout electronics	0.3	N	1	1	1	0.3	0.3
Response time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
Integration time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
RF ambient conditions – noise	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
RF ambient conditions–reflections	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Probe positioner mech. Restrictions	0.8	R	$\sqrt{3}$	1	1	0.5	0.5
Probe positioning with respect to phantom shell	6.7	R	$\sqrt{3}$	1	1	3.9	3.9
Post-processing	2.0	R	$\sqrt{3}$	1	1	1.2	1.2
<b>Test sample related</b>							
Device holder Uncertainty	6.3	N	1	1	1	6.3	6.3
Test sample positioning	2.8	N	1	1	1	2.8	2.8
Power scaling	4.5	R	$\sqrt{3}$	1	1	2.6	2.6
Drift of output power	5.0	R	$\sqrt{3}$	1	1	2.9	2.9
<b>Phantom and set-up</b>							
Phantom uncertainty (shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.3	2.3
Algorithm for correcting SAR for deviations in permittivity and conductivity	1.9	N	1	1	0.84	1.1	0.9
Liquid conductivity (meas.)	2.5	N	1	0.64	0.43	1.6	1.1
Liquid permittivity (meas.)	2.5	N	1	0.6	0.49	1.5	1.2
Temp. unc. - Conductivity	1.7	R	$\sqrt{3}$	0.78	0.71	0.8	0.7
Temp. unc. - Permittivity	0.3	R	$\sqrt{3}$	0.23	0.26	0.0	0.0
Combined standard uncertainty		RSS				12.2	12.1
Expanded uncertainty 95 % confidence interval)						24.5	24.2

## APPENDIX B – PROBE CALIBRATION CERTIFICATES

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
**Zeughausstrasse 43, 8004 Zurich, Switzerland**



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **BACL China (Vitec)**

Certificate No: EX3-7329\_Feb15

### CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7329**

Calibration procedure(s) **QA CAL-01,v9, QA CAL-23,v5, QA CAL-25,v6**  
Calibration procedure for dosimetric E-field probes

Calibration date: **February 5, 2015**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S8277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. E53-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 9, 2015

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
**Zeughausstrasse 43, 8004 Zurich, Switzerland**



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalementage  
**S** Servizio svizzero di taratura  
**Swiss Calibration Service**

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

#### Methods Applied and Interpretation of Parameters:

- $NORMx,y,z$ : Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide).  $NORMx,y,z$  are only intermediate values, i.e., the uncertainties of  $NORMx,y,z$  does not affect the  $E^2$ -field uncertainty inside TSL (see below ConvF).
- $NORM(f)x,y,z = NORMx,y,z * frequency\_response$  (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- $DCPx,y,z$ : DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- $PAR$ : PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- $Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z$ :  $A, B, C, D$  are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to  $NORMx,y,z * ConvF$  whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- *Spherical Isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the  $NORMx$  (no uncertainty required).

EX3DV4 – SN:7329

February 5, 2015

# Probe EX3DV4

SN:7329

Manufactured: December 11, 2014  
Calibrated: February 5, 2015

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

EX3DV4- SN:7329

February 5, 2015

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329****Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.48	0.43	0.46	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	96.7	97.6	94.2	

**Modulation Calibration Parameters**

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	137.9	$\pm 3.0 \%$
		Y	0.0	0.0	1.0		147.0	
		Z	0.0	0.0	1.0		150.5	

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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February 5, 2015

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329

**Calibration Parameter Determined in Head Tissue Simulating Media**

f (MHz) <sup>c</sup>	Relative Permittivity <sup>d</sup>	Conductivity (S/m) <sup>e</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>g</sup>	Depth <sup>h</sup> (mm)	Unct. (k=2)
900	41.5	0.97	9.52	9.52	9.52	0.40	0.86	± 12.0 %
1750	40.1	1.37	8.12	8.12	8.12	0.29	0.90	± 12.0 %
1900	40.0	1.40	7.88	7.88	7.88	0.68	0.61	± 12.0 %
2450	39.2	1.80	7.06	7.06	7.06	0.33	0.84	± 12.0 %

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

<sup>d</sup> At frequencies below 3 GHz, the validity of tissue parameters (c and e) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (c and e) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

EX3DV4- SN:7329

February 5, 2015

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
900	55.0	1.05	9.17	9.17	9.17	0.41	0.90	± 12.0 %
1750	53.4	1.49	7.85	7.85	7.85	0.70	0.64	± 12.0 %
1900	53.3	1.52	7.56	7.56	7.56	0.56	0.70	± 12.0 %
2450	52.7	1.95	7.20	7.20	7.20	0.78	0.59	± 12.0 %

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

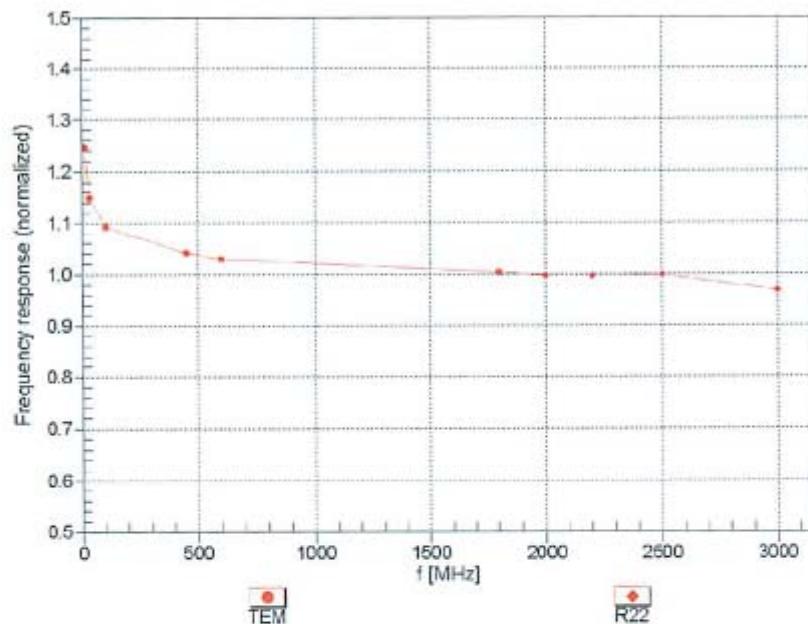
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

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



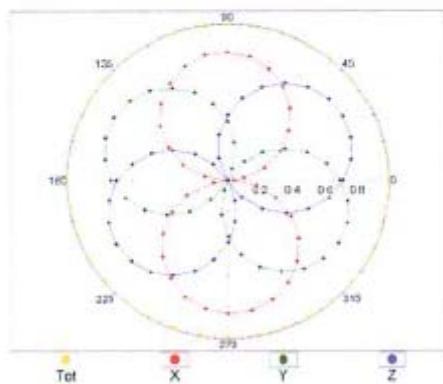
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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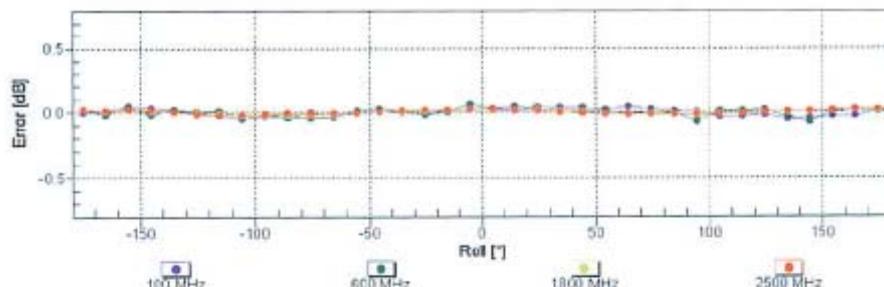
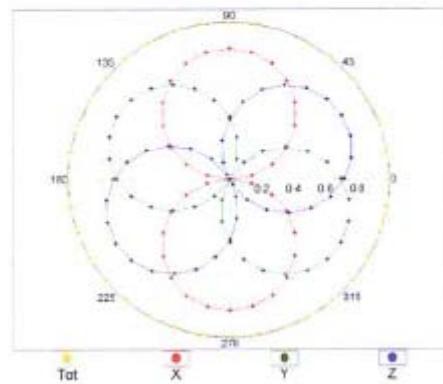
February 5, 2015

**Receiving Pattern ( $\phi$ ),  $\theta = 0^\circ$** 

f=600 MHz, TEM



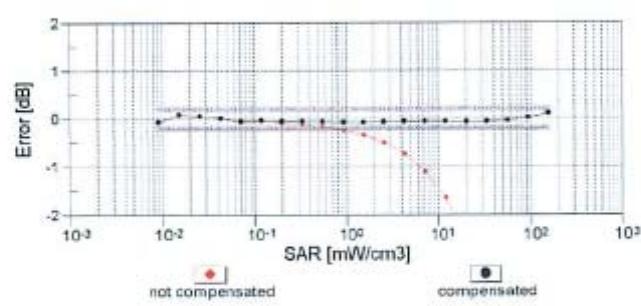
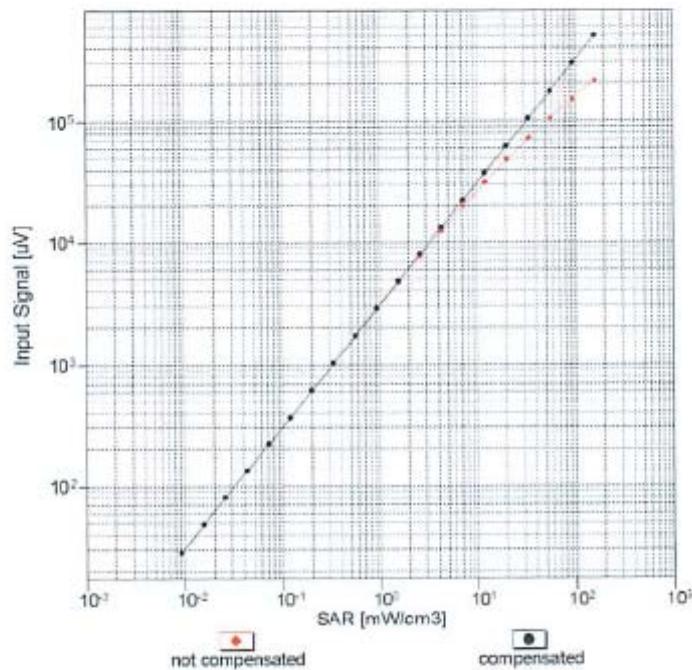
f=1800 MHz, R22

Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

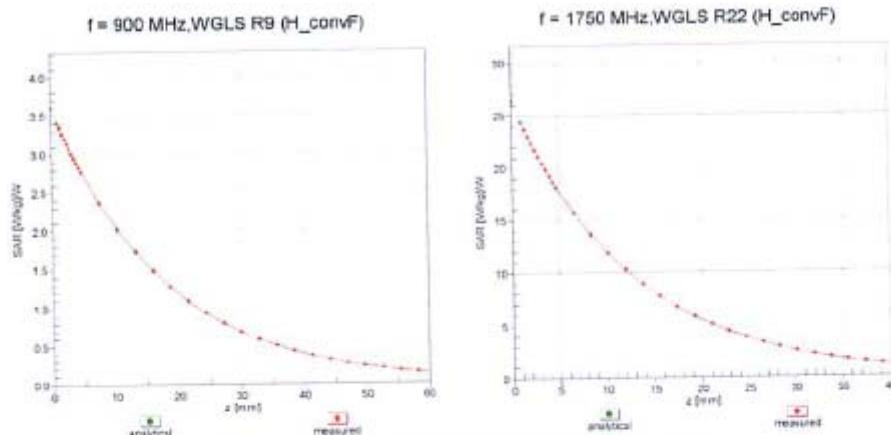


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

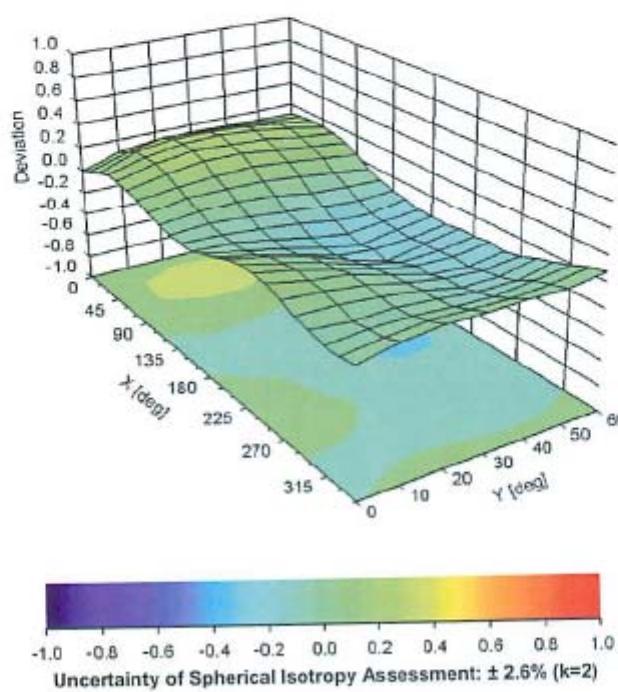
EX3DV4- SN:7329

February 5, 2015

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ),  $f = 900 \text{ MHz}$ 

Certificate No: EX3-7329\_Feb15

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February 5, 2015

**DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329****Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (")	24.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

**APPENDIX C DIPOLE CALIBRATION CERTIFICATES****NCL CALIBRATION LABORATORIES**

Calibration File No: DC-1599  
Project Number: BAC-dipole-cal-5779

**C E R T I F I C A T E   O F   C A L I B R A T I O N**

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Validation Dipole(Head and Body)

Manufacturer: APREL Laboratories  
Part number: ALS-D-835-S-2  
Frequency: 835 MHz  
Serial No: 180-00558

Customer: Bay Area Compliance Laboratory (China)

Calibrated: 8<sup>th</sup> October 2014  
Released on: 8<sup>th</sup> October 2014

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By:

Art Brennan, Quality Manager

**NCL** CALIBRATION LABORATORIES

Suite 102, 303 Terry Fox Dr.  
Kanata, ONTARIO  
CANADA K2K 3J1

Division of APREL Lab.  
TEL: (613) 435-8300  
FAX: (613)435-8306

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conditions**

Dipole 180-00558 was received with a damaged connection for a re-calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C  
**Temperature of the Tissue:** 21 °C +/- 0.5°C

**Attestation**

The below named signatories have conducted the calibration and review of the data which is presented in this calibration report.

We the undersigned attest that to the best of our knowledge the calibration of this subject has been accurately conducted and that all information contained within the results pages have been reviewed for accuracy.



---

Art Brennan, Quality Manager



---

Maryna Nesterova Calibration Engineer

**Primary Measurement Standards**

Instrument	Serial Number	Cal due date
Tektronix USB Power Meter	11C940	May 14, 2015
Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

This page has been reviewed for content and attested to by signature within this document.

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

**Mechanical Dimensions**

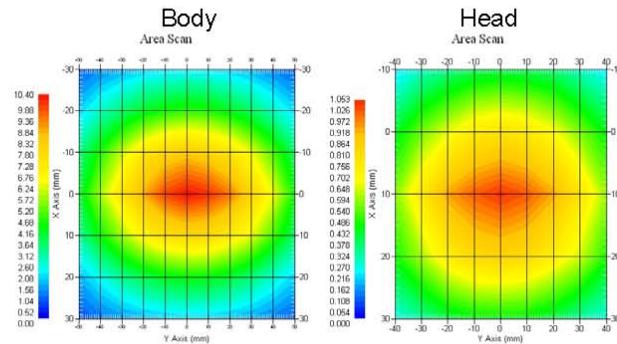
**Length:** 162.2 mm  
**Height:** 89.4 mm

**Electrical Specification**

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	835 MHz	1.066 U	-30.344 dB	49.001 Ω
Body	835 MHz	1.089 U	-28.118 dB	53.117 Ω

**System Validation Results**

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	835 MHz	9.773	6.174	14.713
Body	835 MHz	9.736	6.297	14.513



**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Introduction**

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 180-00558. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

**References**

- IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
- Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

**Conditions**

Dipole 180-00558 was repaired prior to this calibration. The repair reliability depends upon correct usage of the dipole.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C  
**Temperature of the Tissue:** 20 °C +/- 0.5°C

**Dipole Calibration uncertainty**

The calibration uncertainty for the dipole is made up of various parameters presented below.

<b>Mechanical</b>	1 %
<b>Positioning Error</b>	1.22%
<b>Electrical</b>	1.7%
<b>Tissue</b>	2.2%
<b>Dipole Validation</b>	2.2%
<b>TOTAL</b>	<b>8.32% (16.64% K=2)</b>

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**Dipole Calibration Results****Mechanical Verification**

APREL Length	APREL Height	Measured Length	Measured Height
161.0 mm	89.8 mm	162.2 mm	89.4 mm

**Electrical Verification**

Tissue Type	Return Loss:	SWR:	Impedance:
Head	-30.344 dB	1.066 U	49.001Ω
Body	-28.118 dB	1.089 U	53.117 Ω □

**Tissue Validation**

	Dielectric constant, $\epsilon_r$	Conductivity, $\sigma$ [S/m]
Head Tissue 835MHz	43.42	0.94
Body Tissue 835MHz	55.77	1.01

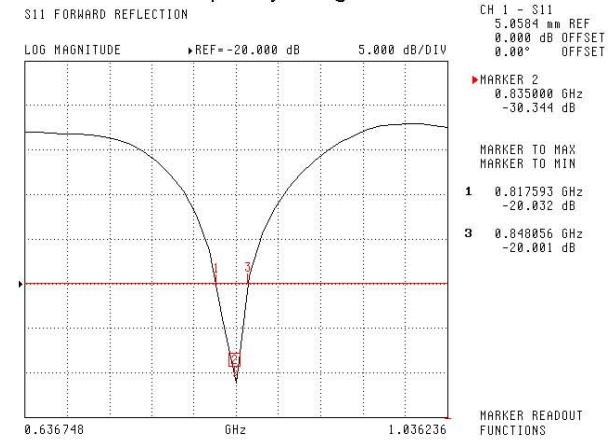
**NCL Calibration Laboratories**

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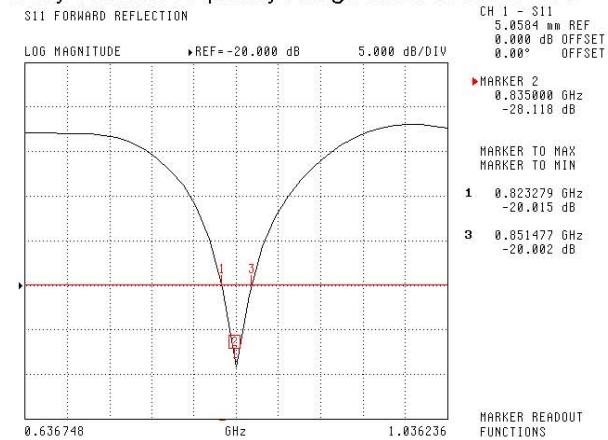
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

Head Tissue: Frequency Range 0.817 to 0.848 GHz



Body Tissue: Frequency Range 0.823 to 0.851 GHz

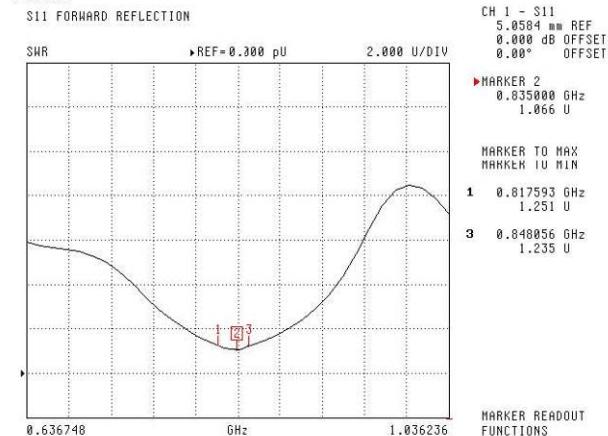
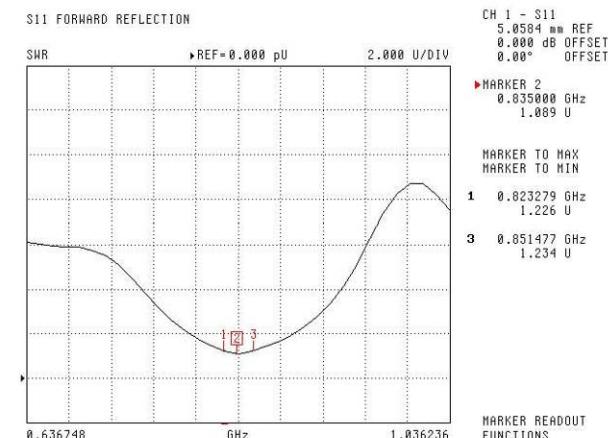


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**SWR****Head****Body**

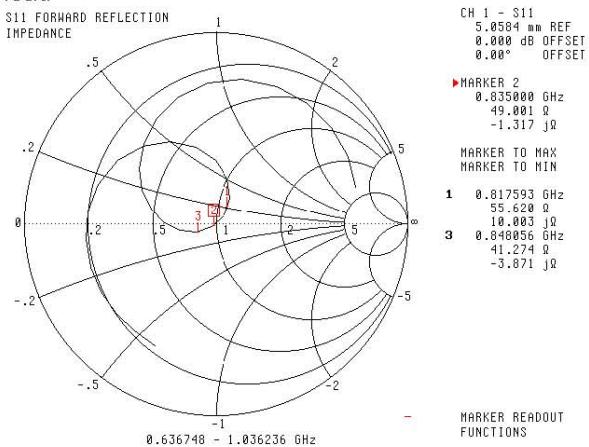
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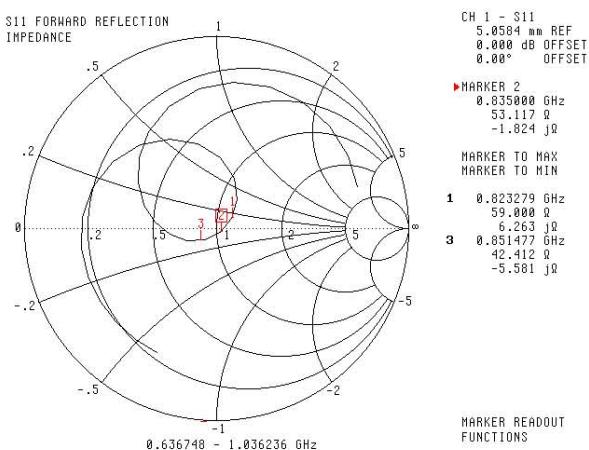
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### Smith Chart Dipole Impedance

#### Head



#### Body



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**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List 2014.

**NCL CALIBRATION LABORATORIES**

Calibration File No: DC-1601  
Project Number: BAC-dipole -cal-5779

**C E R T I F I C A T E   O F   C A L I B R A T I O N**

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Validation Dipole (Head & Body)

Manufacturer: APREL Laboratories

Part number: ALS-D-1900-S-2

Frequency: 1900 MHz

Serial No: 210-00710

Customer: Bay Area Compliance Laboratory (China)

Calibrated: 9<sup>th</sup> October, 2014  
Released on: 9<sup>th</sup> October, 2014

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By:



Art Brennan, Quality Manager

**NCL CALIBRATION LABORATORIES**

Suite 102, 303 Terry Fox Dr.  
Kanata, ONTARIO  
CANADA K2K 3J1

Division of APREL Lab.  
TEL: (613) 435-8300  
FAX: (613)435-8306

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**Conditions**

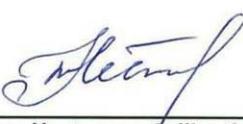
Dipole 210-00710 was received in good condition and was a re-calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C  
**Temperature of the Tissue:** 21 °C +/- 0.5°C

**Attestation**

The below named signatories have conducted the calibration and review of the data which is presented in this calibration report.

We the undersigned attest that to the best of our knowledge the calibration of this subject has been accurately conducted and that all information contained within the results pages have been reviewed for accuracy.

  
Art Brennan, Quality Manager  
Maryna Nesterova, Calibration Engineer**Primary Measurement Standards**

Instrument	Serial Number	Cal due date
Tektronix USB Power Meter	11C940	May 14, 2015
Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

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**Calibration Results Summary**

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

**Mechanical Dimensions**

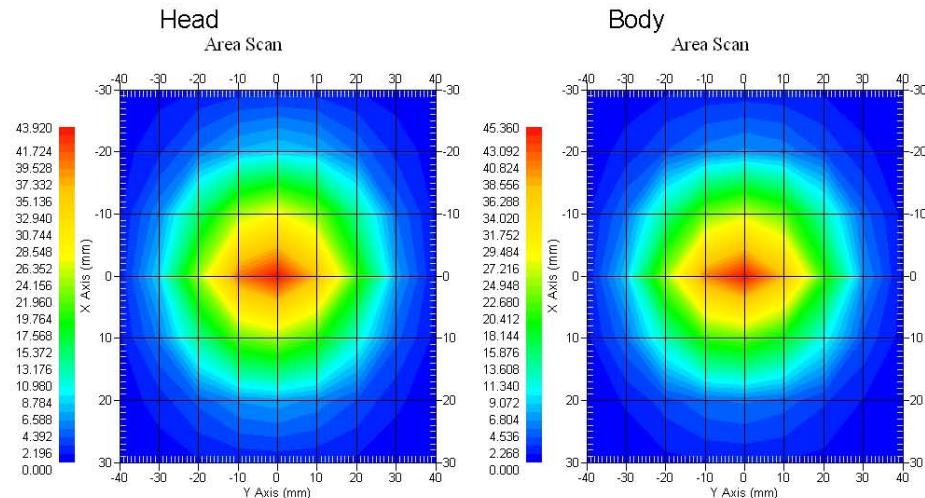
**Length:** 67.1 mm  
**Height:** 38.9 mm

**Electrical Specification**

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	1900MHz	1.084 U	-27.92 dB	52.247 $\Omega$
Body	1900MHz	1.128 U	-24.40 dB	52.618 $\Omega$

**System Validation Results**

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	1900 MHz	39.481	20.44	73.364
Body	1900 MHz	39.715	20.552	73.565



**NCL Calibration Laboratories**

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**Introduction**

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 210-00710. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

**References**

- IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
- Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

**Conditions**

Dipole 210-00710 was a recalibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C  
**Temperature of the Tissue:** 20 °C +/- 0.5°C

**Dipole Calibration uncertainty**

The calibration uncertainty for the dipole is made up of various parameters presented below.

<b>Mechanical</b>	1%
<b>Positioning Error</b>	1.22%
<b>Electrical</b>	1.7%
<b>Tissue</b>	2.2%
<b>Dipole Validation</b>	2.2%
<b>TOTAL</b>	<b>8.32% (16.64% K=2)</b>

**NCL Calibration Laboratories**

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**Dipole Calibration Results****Mechanical Verification**

APREL Length	APREL Height	Measured Length	Measured Height
68.0 mm	39.5 mm	67.1mm	38.9 mm

**Electrical Validation**

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	1900MHz	1.084 U	-27.92 dB	52.247 $\Omega$
Body	1900MHz	1.128 U	-24.40 dB	52.618 $\Omega$

**Tissue Validation**

	Dielectric constant, $\epsilon_r$	Conductivity, $\sigma$ [S/m]
Head Tissue 1900MHz	40.20	1.38
Body Tissue 1900MHz	52.63	1.46

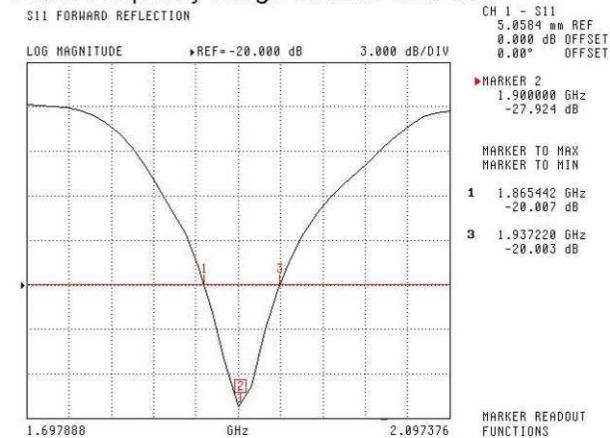
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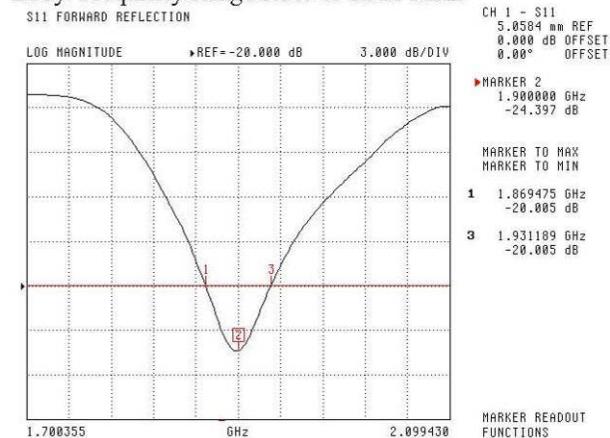
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

Head: Frequency Range 1.865 to 1.937 GHz



Body: Frequency Range 1.869 to 1.931 MHz

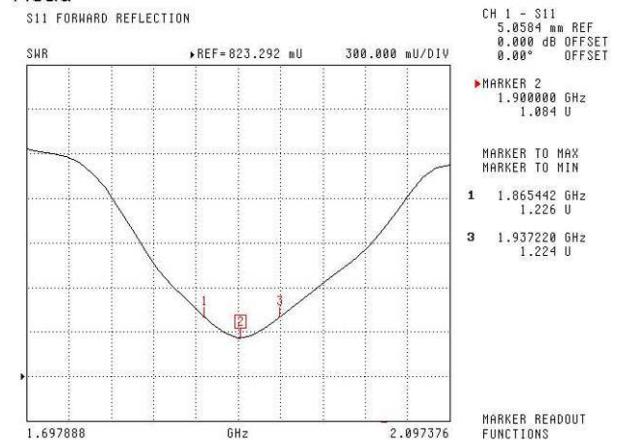
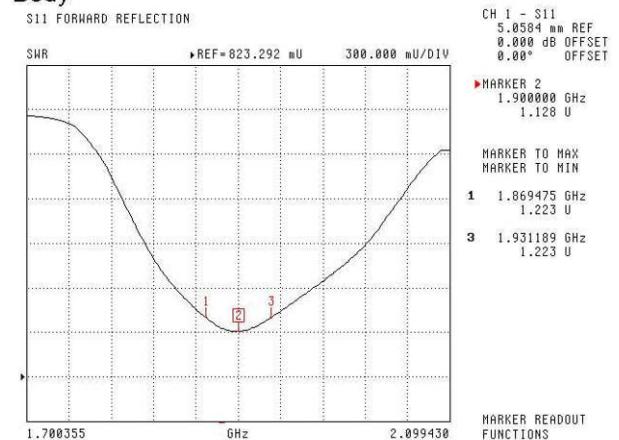


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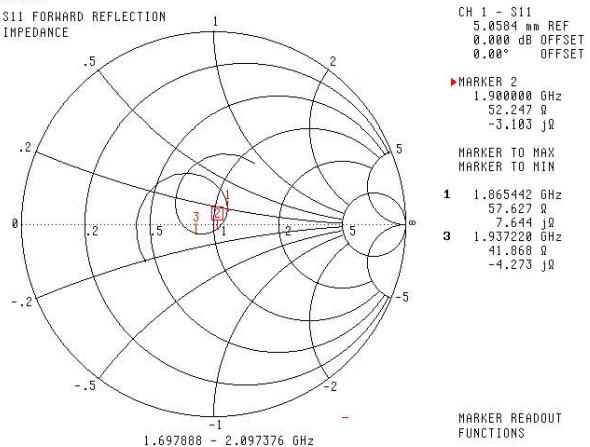
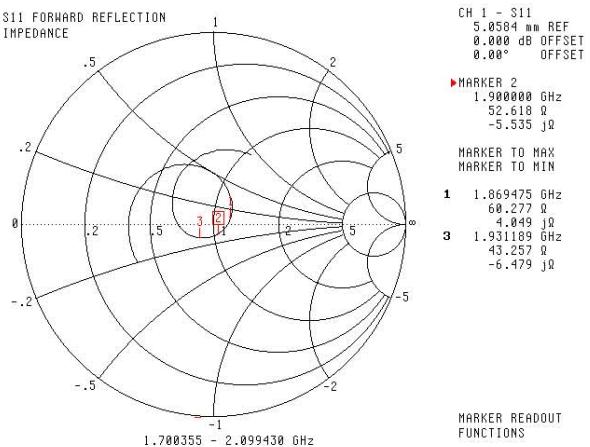
**SWR****Head****Body**

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**NCL Calibration Laboratories**

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**Smith Chart Dipole Impedance****Head****Body**

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

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**Test Equipment**

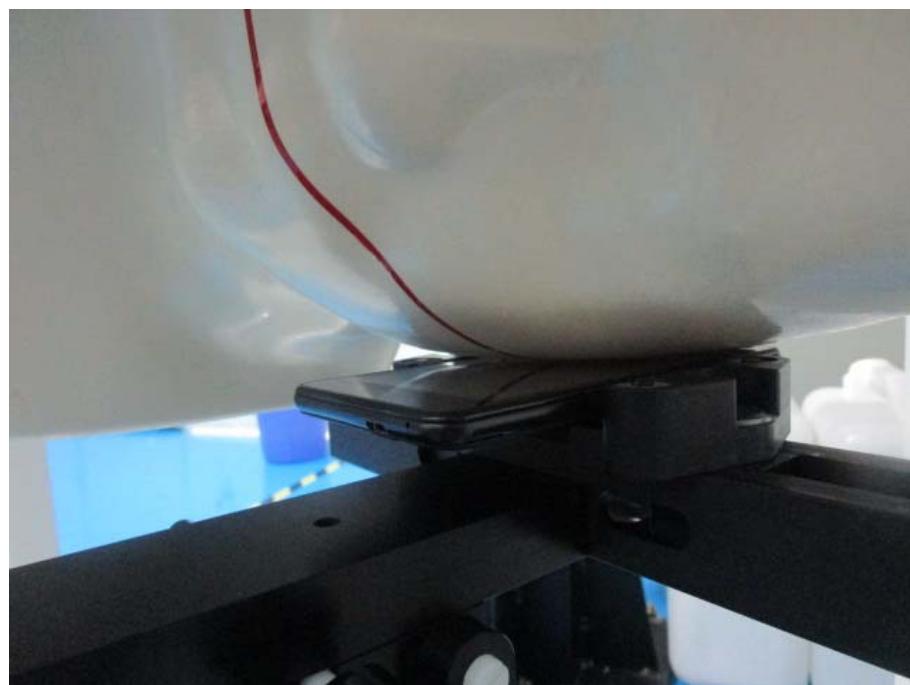
The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List 2014

## APPENDIX D EUT TEST POSITION PHOTOS

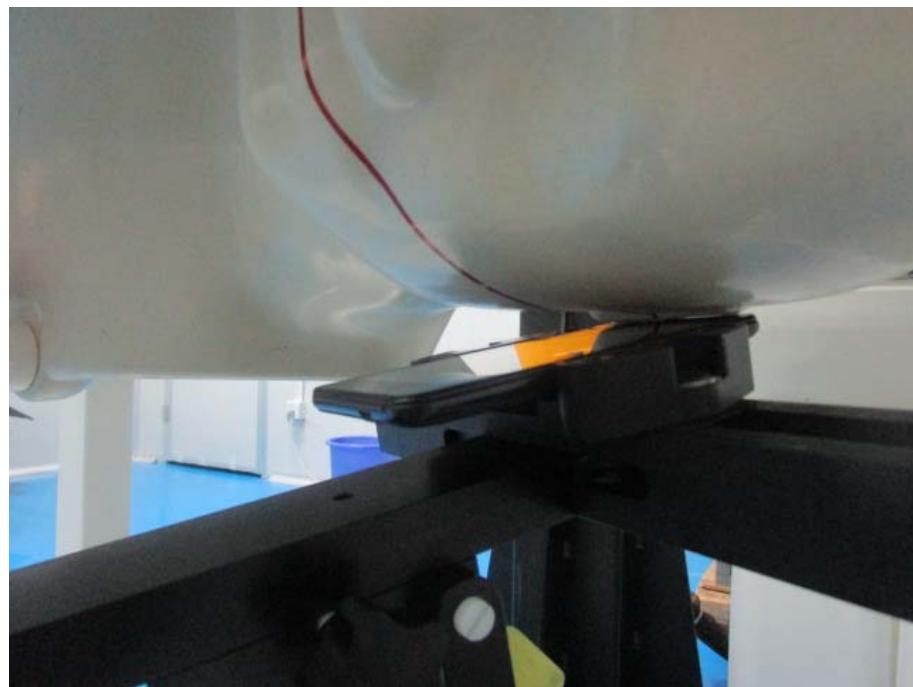
**Liquid depth ≥ 15cm**



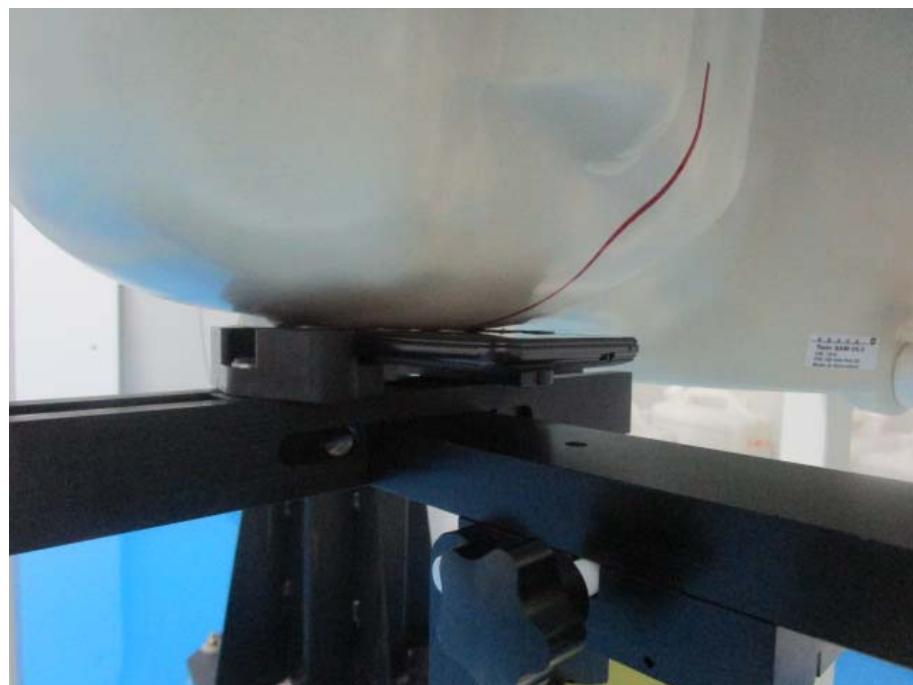
**Left Head Cheek**



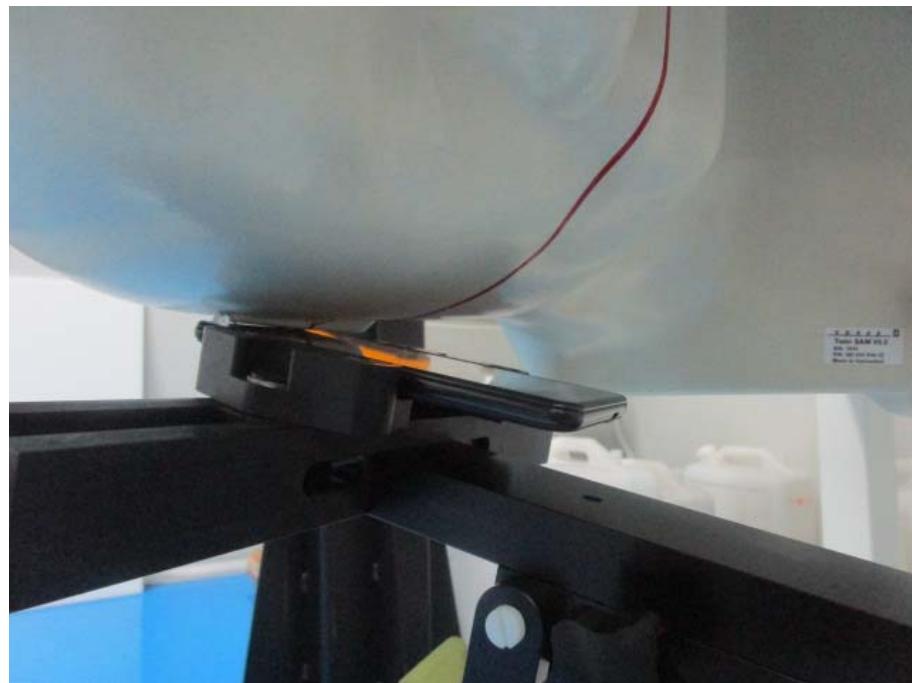
**Left Head Tilt**



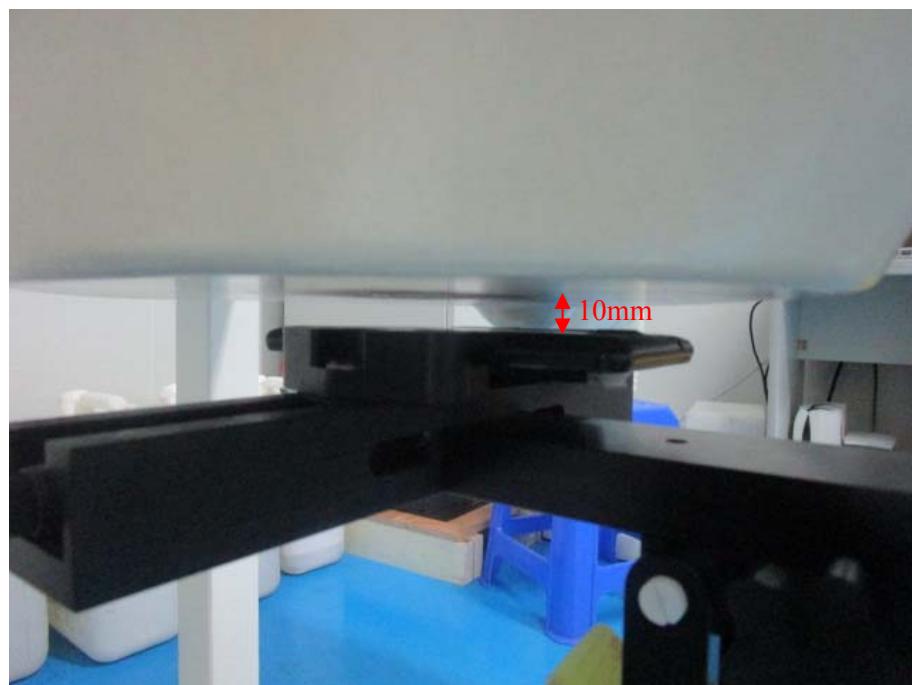
**Right Head Cheek**



**Right Head Tilt**



**Body -Worn-Back (10mm)**



**Body -Worn-Left (10mm)**

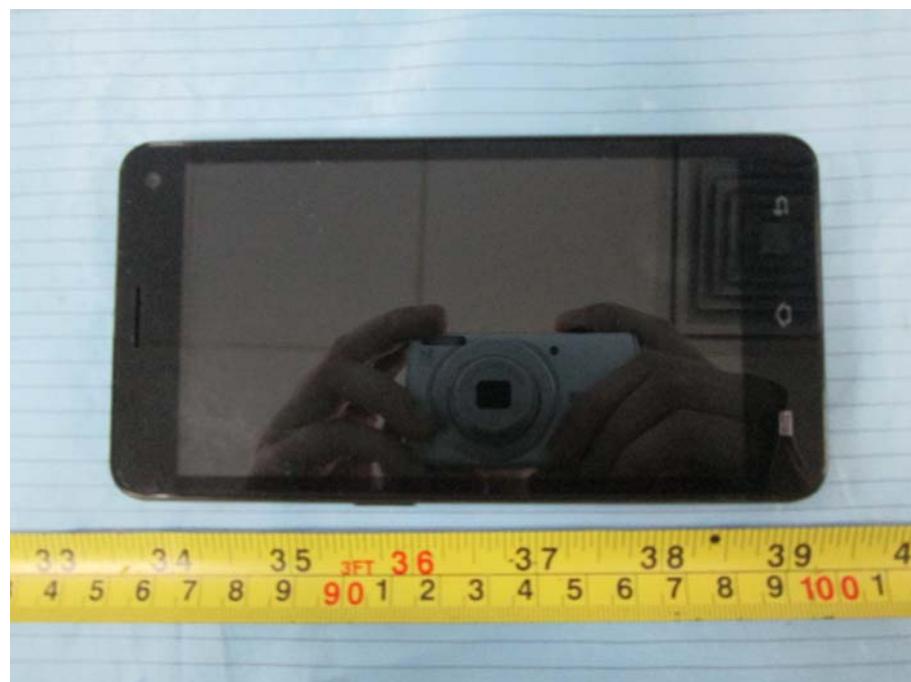


**Body -Worn-Bottom(10mm)**



## APPENDIX E EUT PHOTOS

**EUT – Front View**



**EUT – Back View**



**EUT –Left Side View**



**EUT – Right Side View**



**EUT – Top View**



**EUT – Bottom View**



**EUT – Uncover View**



\*\*\*\*\* END OF REPORT \*\*\*\*\*