

# SAR EVALUATION REPORT

For

## DDM Brands LLC

1616 NW, 84TH Ave., Miami, Florida, U.S.A

**FCC ID: A4JANDY5EI**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Andy 5EI 3G Mobile Phone
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<b>Report Number:</b> RSZ140711006-20	
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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	DDM Brands LLC
	EUT Description	3G Mobile Phone
	FCC ID	A4JANDY5EI
	Model Number	ANDY 5EI
	Test Date	2014-07-11 to 2014-07-12
Frequency	Max. SAR Level(s) Reported	Limit(W/Kg)
GSM 850	0.138 W/kg 1g Head SAR 0.933 W/kg 1g Body SAR	1.6
PCS 1900	0.066 W/kg 1g Head SAR 0.965 W/kg 1g Body SAR	
WCDMA850	0.185 W/kg 1g Head SAR 0.486 W/kg 1g Body SAR	
WCDMA1900	0.098 W/kg 1g Head SAR 1.243 W/kg 1g Body SAR	
Simultaneous	0.538 W/kg 1g Head SAR 1.420 W/kg 1g Body SAR	
Applicable Standards	ANSI/IEEE C95.1: 2005 IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields,3 kHz to 300 GHz.	
	ANSI/IEEE C95.3: 2002 IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields,100 kHz—300 GHz.	
	IEEE1528: 2013 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	
	KDB procedures KDB 447498 D01 Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies. KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets KDB 865664 D01 SAR Measurement Requirements for 100 MHz to 6 GHz KDB 941225 D01 SAR Measurement Procedures for 3G Devices-CDMA 2000/EV-Do WCDMA/HSDPA/HSUPA KDB 941225 D06 SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities.	
	Note: 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 1528-2003 and RF exposure KDB procedures. The results and statements contained in this report pertain only to the device(s) evaluated.	

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RSZ140711006-20	Original Report	2014-07-18

## EUT DESCRIPTION

This report has been prepared on behalf of DDM Brands LLC and their product, FCC ID: A4JANDY5EI, Model: ANDY 5EI or the EUT (Equipment under Test) as referred to in the rest of this report. The EUT is an Andy 5EI 3G mobile phone.

*\*Note: This series products models: ANDY 5EI, A5EI, A5EIBK, ANDY C5EI, AC5EI, AC5EIBK, we select model: ANDY 5EI to test, there is no electrical change has been made to the equipment, please refer to the product similarity letter.*

## Technical Specification

<b>Product Type</b>	Portable
<b>Exposure Category:</b>	Population/Uncontrolled
<b>Antenna Type(s):</b>	Internal Antenna
<b>Body-Worn Accessories:</b>	Headset
<b>Face-Head Accessories:</b>	None
<b>Multi-slot Class:</b>	Class 12
<b>Operation Mode :</b>	GSM Voice, GPRS Data, WCDMA, Wi-Fi and Bluetooth
<b>Frequency Band:</b>	GSM850: 824-849 MHz (TX); 869-894 MHz (RX) PCS1900: 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: 2412-2462 MHz/2422-2452 MHz (TX/RX) Bluetooth: 2402-2480 MHz (TX/RX)
<b>Conducted RF Power:</b>	GSM850: 32.31 dBm PCS1900: 29.75 dBm WCDMA850: 22.16 dBm WCDMA1900: 22.88 dBm Wi-Fi: 9.27 dBm Bluetooth: -0.04 dBm
<b>Dimensions (L*W*H):</b>	143 mm (L) × 78 mm (W) × 9 mm (H)
<b>Power Source:</b>	3.7 V <sub>DC</sub> Rechargeable Battery
<b>Normal Operation:</b>	Head and Body-worn

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## REFERENCE, STANDARDS, AND GUIDELINES

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### **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)**

<b>EXPOSURE LIMITS</b>	<b>SAR (W/kg)</b>	
	(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)**

<b>EXPOSURE LIMITS</b>	<b>SAR (W/kg)</b>	
	(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 1.6 W/kg (FCC) & 2 W/kg (CE) applied to the EUT.



## FACILITIES

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The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect data is located at 6/F, the 3rd Phase of WanLi Industrial Building, Shi Hua Road, Fu Tian Free Trade Zone, Shenzhen, Guangdong, P.R. of China

## DESCRIPTION OF TEST SYSTEM

These measurements were performed with ALSAS 10 Universal Integrated SAR Measurement system from APREL Laboratories.

### ALSAS-10U System Description

ALSAS-10-U is fully compliant with the technical and scientific requirements of IEEE 1528, IEC 62209, CENELEC, ARIB, ACA, and the Federal Communications Commission. The system comprises of a six axes articulated robot which utilizes a dedicated controller.

ALSAS-10U uses the latest methodologies. And FDTD modeling to provide a platform which is repeatable with minimum uncertainty.

### Applications

Predefined measurement procedures compliant with the guidelines of CENELEC, IEEE, IEC, FCC, etc are utilized during the assessment for the device. Automatic detection for all SAR maxima are embedded within the core architecture for the system, ensuring that peak locations used for centering the zoom scan are within a 1mm resolution and a 0.05mm repeatable position. System operation range currently available up-to 6 GHz in simulated tissue.

### 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 ALSAS-10U 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.



## ALSAS-10U Interpolation and Extrapolation Uncertainty

The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

$$f_3(x, y, z) = A \frac{a^2}{\frac{a^2}{4} + x'^2 + y'^2} \cdot \left( e^{-\frac{2z}{a}} + \frac{a^2}{2(a + 2z)^2} \right)$$

## Isotropic E-Field Probe

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

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



SAR is assessed with a calibrated probe which moves at a default height of 5mm from the center of the diode, which is mounted to the sensor, to the phantom surface (in the Z Axis). The 5mm offset height has been selected so as to minimize any resultant boundary effect due to the probe being in close proximity to the phantom surface.

The following algorithm is an example of the function used by the system for linearization of the output from the probe when measuring complex modulation schemes.

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

## Isotropic E-Field Probe Specification

<b>Calibration Method</b>	Frequency Dependent Below 1 GHz Calibration in air performed in a TEM Cell Above 1 GHz Calibration in air performed in waveguide
<b>Sensitivity</b>	$0.70 \mu\text{V}/(\text{V}/\text{m})^2$ to $0.85 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Dynamic Range</b>	0.0005 W/kg to 100 W/kg
<b>Isotropic Response</b>	Better than 0.1 dB
<b>Diode Compression Point (DCP)</b>	Calibration for Specific Frequency
<b>Probe Tip Diameter</b>	< 2.9 mm
<b>Sensor Offset</b>	1.56 (+/- 0.02 mm)
<b>Probe Length</b>	289 mm
<b>Video Bandwidth</b>	@ 500 Hz: 1 dB @ 1.02 kHz: 3 dB
<b>Boundary Effect</b>	Less than 2.1% for distance greater than 0.58 mm
<b>Spatial Resolution</b>	The spatial resolution uncertainty is less than 1.5% for 4.9mm diameter probe. The spatial resolution uncertainty is less than 1.0% for 2.5mm diameter probe

## Boundary Detection Unit and Probe Mounting Device

ALSAS-10U incorporates a boundary detection unit with a sensitivity of 0.05mm for detecting all types of surfaces. The robust design allows for detection during probe tilt (probe normalize) exercises, and utilizes a second stage emergency stop. The signal electronics are fed directly into the robot controller for high accuracy surface detection in lateral and axial detection modes (X, Y, & Z).

The probe is mounted directly onto the Boundary Detection unit for accurate tooling and displacement calculations controlled by the robot kinematics. The probe is connect to an isolated probe interconnect where the output stage of the probe is fed directly into the amplifier stage of the Daq-Paq.

## Daq-Paq (Analog to Digital Electronics)

ALSAS-10U incorporates a fully calibrated Daq-Paq (analog to digital conversion system) which has a 4 channel input stage, sent via a 2 stage auto-set amplifier module. The input signal is amplified accordingly so as to offer a dynamic range from 5 $\mu\text{V}$  to 800mV. Integration of the fields measured is carried out at board level utilizing a Co-Processor which then sends the measured fields down into the main computational module in digitized form via an RS232 communications port. Probe linearity and duty cycle compensation is carried out within the main Daq-Paq module.

<b>ADC</b>	12 Bit
<b>Amplifier Range</b>	20 mV to 200 mV and 150 mV to 800 mV
<b>Field Integration</b>	Local Co-Processor utilizing proprietary integration algorithms
<b>Number of Input Channels</b>	4 in total 3 dedicated and 1 spare
<b>Communication</b>	Packet data via RS232

## Axis Articulated Robot

ALSAS-10U utilizes a six axis articulated robot, which is controlled using a Pentium based real-time movement controller. The movement kinematics engine utilizes proprietary (Thermo CRS) interpolation and extrapolation algorithms, which allow full freedom of movement for each of the six joints within the working envelope. Utilization of joint 6 allows for full probe rotation with a tolerance better than 0.05mm around the central axis.



<b>Robot/Controller Manufacturer</b>	Thermo CRS
<b>Number of Axis</b>	Six independently controlled axis
<b>Positioning Repeatability</b>	0.05 mm
<b>Controller Type</b>	Single phase Pentium based C500C
<b>Robot Reach</b>	710 mm
<b>Communication</b>	RS232 and LAN compatible

## ALSAS Universal Workstation

ALSAS Universal workstation allows for repeatability and fast adaptability. It allows users to do calibration, testing and measurements using different types of phantoms with one set up, which significantly speeds up the measurement process.

## Universal Device Positioner

The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales which form the design used to indicate positioning for any given test scenario in all major axes. A 15° tilt indicator is included for the of aid cheek to tilt movements for head SAR analysis. Overall uncertainty for measurements have been reduced due to the design of the Universal device positioner, which allows positioning of a device in as near to a free-space scenario as possible, and by providing the means for complete repeatability.

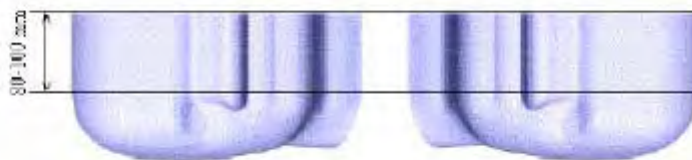


### Phantom Types

The ALSAS-10U allows the integration of multiple phantom types. SAM Phantoms fully compliant with IEEE 1528, Universal Phantom, and Universal Flat.

### APREL SAM Phantoms

The SAM phantoms developed using the IEEE SAM CAD file. They are fully compliant with the requirements for both IEEE 1528 and FCC Supplement C. Both the left and right SAM phantoms are interchangeable, transparent and include the IEEE 1528 grid with visible NF and MB lines.



**APREL Laboratories Universal Phantom**

The Universal Phantom is used on the ALSAS-10U as a system validation phantom. The Universal Phantom has been fully validated both experimentally from 800MHz to 6GHz and numerically using XFDTD numerical software.

The shell thickness is 2mm overall, with a 4mm spacer located at the NF/MB intersection providing an overall thickness of 6mm in line with the requirements of IEEE-1528.

The design allows for fast and accurate measurements, of handsets, by allowing the conservative SAR to be evaluated at on frequency for both left and right head experiments in one measurement.



## Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

## Recommended Tissue Dielectric Parameters for Head and Body

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



## EQUIPMENT LIST AND CALIBRATION

### Equipments List & Calibration Information

Equipment	Model	Calibration Date	S/N
CRS F3 robot	ALS-F3	N/A	RAF0805352
CRS F3 Software	ALS-F3-SW	N/A	N/A
CRS C500C controller	ALS-C500	N/A	RCF0805379
Probe mounting device & Boundary Detection Sensor System	ALS-PMDPS-3	N/A	120-00270
Universal Work Station	ALS-UWS	N/A	100-00157
Data Acquisition Package	ALS-DAQ-PAQ-3	2013-10-08	110-00212
Miniature E-Field Probe	ALS-E-020	2013-10-08	500-00283
Dipole, 835MHz	ALS-D-835-S-2	2011-08-25	180-00558
Dipole, 1900MHz	ALS-D-1900-S-2	2011-08-25	210-00710
Dipole Spacer	ALS-DS-U	N/A	250-00907
Device holder/Positioner	ALS-H-E-SET-2	N/A	170-00510
Left ear SAM phantom	ALS-P-SAM-L	N/A	130-00311
Right ear SAM phantom	ALS-P-SAM-R	N/A	140-00359
UniPhantom	ALS-P-UP-1	N/A	150-00413
Simulated Tissue 835 MHz Head	ALS-TS-835-H	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-TS-835-B	Each Time	270-02101
Simulated Tissue 1900 MHz Head	ALS-TS-1900-H	Each Time	295-01103
Simulated Tissue 1900 MHz Body	ALS-TS-1900-B	Each Time	295-02102
Power Amplifier	5S1G4	N/A	71377
Directional couple	DC6180A	2013-11-12	0325849
Attenuator	3dB	2014-05-08	5402
Network analyzer	8752C	2014-06-13	3410A02356
Dielectric probe kit	HP85070B	2014-06-13	N/A
Synthesized Sweeper	HP 8341B	2014-05-08	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	2013-11-23	106891
EMI Test Receiver	ESCI	2013-11-12	101120

## 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	41.05	0.90	41.50	0.90	-1.084	0.000	$\pm 5$
	Body	53.85	0.94	55.20	0.97	-2.446	-3.093	$\pm 5$
826.4	Head	41.09	0.91	41.50	0.90	-0.988	1.111	$\pm 5$
	Body	53.85	0.94	55.20	0.97	-2.446	-3.093	$\pm 5$
836.6	Head	41.04	0.92	41.50	0.90	-1.108	2.222	$\pm 5$
	Body	53.89	0.95	55.20	0.97	-2.373	-2.062	$\pm 5$
846.6	Head	41.05	0.91	41.50	0.90	-1.084	1.111	$\pm 5$
	Body	53.82	0.97	55.20	0.97	-2.500	0.000	$\pm 5$
848.8	Head	41.05	0.91	41.50	0.90	-1.084	1.111	$\pm 5$
	Body	53.91	0.98	55.20	0.97	-2.337	1.031	$\pm 5$
1850.2	Head	39.75	1.38	40.00	1.40	-0.625	-1.429	$\pm 5$
	Body	52.11	1.47	53.30	1.52	-2.233	-3.289	$\pm 5$
1852.4	Head	39.63	1.37	40.00	1.40	-0.925	-2.143	$\pm 5$
	Body	51.89	1.47	53.30	1.52	-2.645	-3.289	$\pm 5$
1880.0	Head	39.68	1.39	40.00	1.40	-0.800	-0.714	$\pm 5$
	Body	51.91	1.49	53.30	1.52	-2.608	-1.974	$\pm 5$
1907.6	Head	39.58	1.42	40.00	1.40	-1.050	1.429	$\pm 5$
	Body	51.82	1.51	53.30	1.52	-2.777	-0.658	$\pm 5$
1909.8	Head	39.59	1.42	40.00	1.40	-1.025	1.429	$\pm 5$
	Body	51.81	1.52	53.30	1.52	-2.795	0.000	$\pm 5$

\*Liquid Verification was performed on 2014-07-11.

Please refer to the following tables.

835 MHz Head				835 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
824.0	41.0495	19.6850		824.0	53.8499	20.5354
824.5	41.0921	19.6714		824.5	53.8753	20.4542
825.0	41.0292	19.6826		825.0	53.8136	20.5295
825.5	41.0294	19.7159		825.5	53.8840	20.4691
826.0	41.0016	19.7656		826.0	53.8212	20.5332
826.5	41.0896	19.7450		826.5	53.8487	20.5264
827.0	41.0590	19.6980		827.0	53.8932	20.4527
827.5	41.0168	19.6698		827.5	53.9066	20.5313
828.0	41.0862	19.7628		828.0	53.8657	20.5001
828.5	41.0777	19.7266		828.5	53.8788	20.4630
829.0	41.0858	19.6784		829.0	53.8118	20.4710
829.5	41.0406	19.7641		829.5	53.8630	20.5280
830.0	41.0612	19.7172		830.0	53.8050	20.5397
830.5	41.0638	19.7192		830.5	53.8106	20.5439
831.0	41.0651	19.7310		831.0	53.8330	20.5442
831.5	41.0032	19.6792		831.5	53.8967	20.5034
832.0	41.0274	19.7415		832.0	53.9029	20.5280
832.5	41.0199	19.6587		832.5	53.8778	20.4587
833.0	41.0240	19.7017		833.0	53.8133	20.5293
833.5	41.0635	19.7425		833.5	53.8927	20.5016
834.0	41.0588	19.6656		834.0	53.8488	20.5288
834.5	41.0674	19.6808		834.5	53.8527	20.4909
835.0	41.0764	19.7290		835.0	53.9079	20.4530
835.5	41.0047	19.7094		835.5	53.8370	20.5383
836.0	41.0789	19.7323		836.0	53.8199	20.5086
836.5	41.0467	19.7021		836.5	53.8155	20.4846
837.0	41.0371	19.6695		837.0	53.8766	20.5177
837.5	41.0495	19.6605		837.5	53.8660	20.4971
838.0	41.0982	19.6668		838.0	53.8576	20.5331
838.5	41.0353	19.7285		838.5	53.8747	20.5016
839.0	41.0586	19.6581		839.0	53.8493	20.4683
839.5	41.0396	19.6579		839.5	53.9109	20.5410
840.0	41.0342	19.4331		840.0	53.8669	20.5332
840.5	41.1000	19.4662		840.5	53.8335	20.5086
841.0	41.0809	19.4633		841.0	53.8537	20.4722
841.5	41.0614	19.3710		841.5	53.8727	20.5373
842.0	41.0324	19.4154		842.0	53.8994	20.4580
842.5	41.0635	19.4657		842.5	53.8197	20.5063
843.0	41.0756	19.4614		843.0	53.8873	20.5014
843.5	41.0688	19.3710		843.5	53.8024	20.5089
844.0	41.0377	19.3682		844.0	53.8579	20.5001
844.5	41.0700	19.3888		844.5	53.9013	20.5359
845.0	41.1099	19.4270		845.0	53.8825	20.4636
845.5	41.0894	19.3712		845.5	53.8307	20.4682
846.0	41.0590	19.4426		846.0	53.8154	20.5011
846.5	41.0532	19.4205		846.5	53.8178	20.5481
847.0	41.0702	19.3951		847.0	53.8198	20.5354
847.5	41.0856	19.4598		847.5	53.8568	20.5164
848.0	41.1105	19.4110		848.0	53.9075	20.5346
848.5	41.0245	19.3744		848.5	53.8477	20.5130
849.0	41.0485	19.3698		849.0	53.8103	20.5917

1900 MHz Head				1900 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1850.0	39.7452	13.4023		1850.0	52.1145	14.2895
1851.2	39.6845	13.2870		1851.2	51.9959	14.1769
1852.4	39.6250	13.2743		1852.4	51.8881	14.2334
1853.6	39.6672	13.3840		1853.6	51.8511	14.2577
1854.8	39.6608	13.3735		1854.8	51.8685	14.2674
1856.0	39.6497	13.3850		1856.0	52.0406	14.2220
1857.2	39.7164	13.3046		1857.2	51.8542	14.2628
1858.4	39.7352	13.2866		1858.4	52.0088	14.1754
1859.6	39.5955	13.3846		1859.6	51.8288	14.2460
1860.8	39.7196	13.2312		1860.8	51.8511	14.3084
1862.0	39.7055	13.3730		1862.0	52.0447	14.2940
1863.2	39.6815	13.3923		1863.2	52.0951	14.2666
1864.4	39.5585	13.3190		1864.4	51.9489	14.1810
1865.6	39.5886	13.2418		1865.6	52.0428	14.2436
1866.8	39.6684	13.4233		1866.8	52.1085	14.2073
1868.0	39.6718	13.3822		1868.0	51.8618	14.1691
1869.2	39.7392	13.3399		1869.2	51.7915	14.1939
1870.4	39.5724	13.2762		1870.4	51.7905	14.2630
1871.6	39.6047	13.3168		1871.6	52.0082	14.2854
1872.8	39.6423	13.3654		1872.8	52.1153	14.2388
1874.0	39.7099	13.3691		1874.0	52.1275	14.1822
1875.2	39.7158	13.4168		1875.2	51.9603	14.2102
1876.4	39.5814	13.3658		1876.4	52.0429	14.2633
1877.6	39.6024	13.3066		1877.6	52.0694	14.2073
1878.8	39.5974	13.3788		1878.8	52.0863	14.1970
1880.0	39.6804	13.3250		1880.0	51.9066	14.2906
1881.2	39.7350	13.3112		1881.2	51.8259	14.2623
1882.4	39.7300	13.2677		1882.4	52.0104	14.2571
1883.6	39.6830	13.2522		1883.6	51.9104	14.1828
1884.8	39.7288	13.2463		1884.8	52.0144	14.2674
1886.0	39.5826	13.2316		1886.0	52.0178	14.2093
1887.2	39.5772	13.3837		1887.2	51.9462	14.2754
1888.4	39.7143	13.4099		1888.4	51.9185	14.3064
1889.6	39.6693	13.3972		1889.6	52.0445	14.1742
1890.8	39.7507	13.4011		1890.8	51.8814	14.1893
1892.0	39.5579	13.4118		1892.0	51.8430	14.3365
1893.2	39.6576	13.2910		1893.2	51.8769	14.3337
1894.4	39.6067	13.2599		1894.4	51.9836	14.2606
1895.6	39.7199	13.4159		1895.6	51.9854	14.2843
1896.8	39.7309	13.2952		1896.8	51.9719	14.1847
1898.0	39.5734	13.2628		1898.0	52.0931	14.2905
1899.2	39.6894	13.3346		1899.2	52.1196	14.2291
1900.4	39.6720	13.3894		1900.4	52.1455	14.2663
1901.6	39.7243	13.3101		1901.6	52.0495	14.2062
1902.8	39.6846	13.3434		1902.8	52.0556	14.3299
1904.0	39.5799	13.2493		1904.0	51.9176	14.1799
1905.2	39.5786	13.3429		1905.2	52.0452	14.1737
1906.4	39.7395	13.2834		1906.4	52.0699	14.3209
1907.6	39.5820	13.3524		1907.6	51.8248	14.2396
1908.8	39.7396	13.2561		1908.8	52.0844	14.2483
1910.0	39.5876	13.4051		1910.0	51.8067	14.2961

## 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



### Probe and dipole antenna List and Detail

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
APREL	Probe	ALS-E-020	500-00283	2013-10-08	2014-10-07
APREL	Dipole antenna(850MHz)	ALS-D-835-S-2	180-00558	2011-08-25	2014-08-24
APREL	Dipole antenna(1900MHz)	ALS-D-1900-S-2	210-00710	2011-08-25	2014-08-24

### System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2014-07-11	835	Head	1g	9.421	9.590	-1.762	$\pm 10$
		Body	1g	10.312	9.684	6.485	$\pm 10$
	1900	Head	1g	40.535	39.648	2.237	$\pm 10$
		Body	1g	41.126	39.769	3.412	$\pm 10$

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

**SAR SYSTEM VALIDATION DATA****Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 835 MHz Head Liquid****Dipole 835 MHz; Type: ALS-D-835-S-2; S/N: 180-00558****Product Data**

Device Name : Dipole 835 MHz  
Serial No. : 180-00558  
Type : Dipole  
Model : ALS-D-835-S-2  
Frequency Band : 835  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 9.725 W/kg  
Power Drift-Finish : 9.765 W/kg  
Power Drift (%) : 0.411

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Serial No. : System Default  
Location : Center  
Description : Default  
Phantom Data

**Tissue Data**

Type : Head  
Serial No. : 270-01002  
Frequency : 835.0 MHz  
Last Calib. Date : 07-Jul-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 41.08 F/m  
Sigma : 0.92 S/m  
Density : 1000.00 kg/cu. m

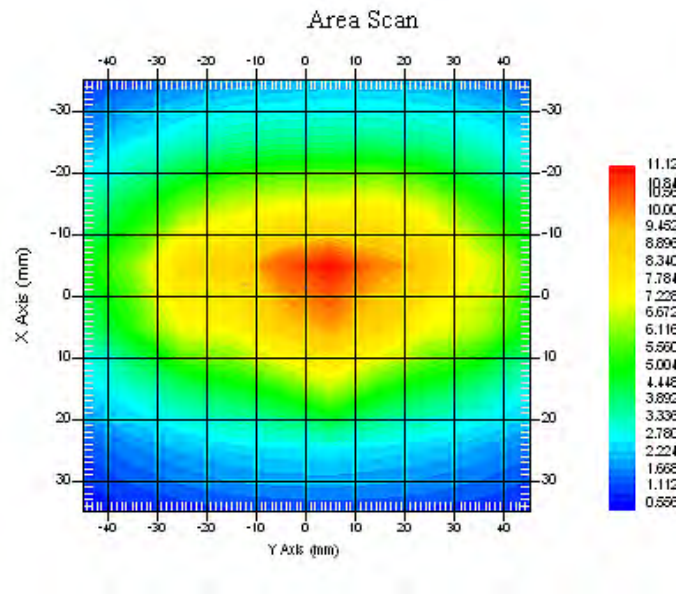
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 08-Oct-2013  
Frequency Band : 835  
Duty Cycle Factor : 1  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

**Measurement Data**

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 21.00 °C  
Ambient Temp. : 21.00 °C  
Area Scan : 7x9x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 9.421 W/kg  
10 gram SAR value : 6.125 W/kg  
Area Scan Peak SAR : 10.925 W/kg  
Zoom Scan Peak SAR : 16.627 W/kg



### 835 MHz System Validation with Head Tissue

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 835 MHz Body Liquid****Dipole 835 MHz; Type: ALS-D-835-S-2; S/N: 180-00558**

## Product Data

Device Name : Dipole 835 MHz  
Serial No. : 180-00558  
Type : Dipole  
Model : ALS-D-835-S-2  
Frequency Band : 835  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 10.557 W/kg  
Power Drift-Finish : 10.422 W/kg  
Power Drift (%) : -1.279

## Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Serial No. : System Default  
Location : Center  
Description : Default  
Phantom Data

## Tissue Data

Type : Body  
Serial No. : 270-02101  
Frequency : 835.0 MHz  
Last Calib. Date : 07-Jul-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 53.91 F/m  
Sigma : 0.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

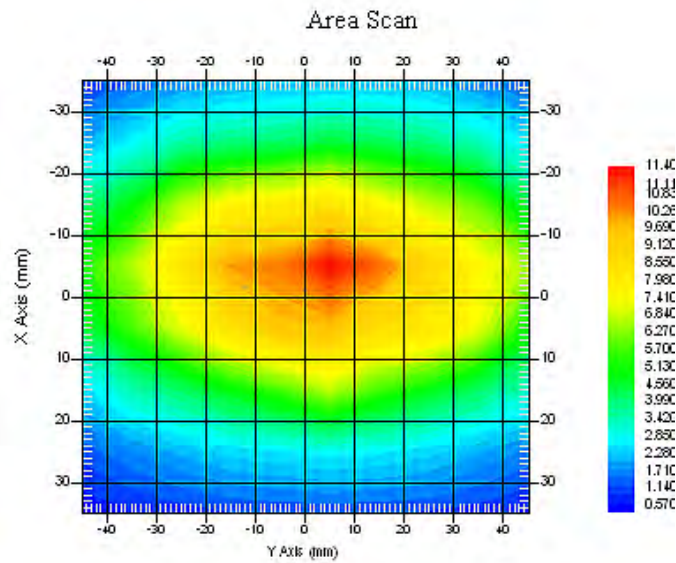
Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 08-Oct-2013  
Frequency Band : 835  
Duty Cycle Factor : 1  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 21.00 °C  
Ambient Temp. : 21.00 °C  
Area Scan : 7x9x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm



1 gram SAR value : 10.312 W/kg  
10 gram SAR value : 6.530 W/kg  
Area Scan Peak SAR : 11.320 W/kg  
Zoom Scan Peak SAR : 15.858 W/kg



### 835 MHz System Validation with Body Tissue

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 1900 MHz Head Liquid****Dipole 1900 MHz; Type: ALS-D-1900-S-2; S/N: 210-00710****Product Data**

Device Name : Dipole 1900MHz  
Serial No. : 210-00710  
Type : Dipole  
Model : ALS-D-1900-S-2  
Frequency Band : 1900  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 39.862 W/kg  
Power Drift-Finish : 39.631 W/kg  
Power Drift (%) : -0.579

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Serial No. : System Default  
Location : Center  
Description : Default

**Tissue Data**

Type : Head  
Serial No. : 295-01103  
Frequency : 1900.00 MHz  
Last Calib. Date : 07-Jul-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 39.68 F/m  
Sigma : 1.42 S/m  
Density : 1000.00 kg/cu. M

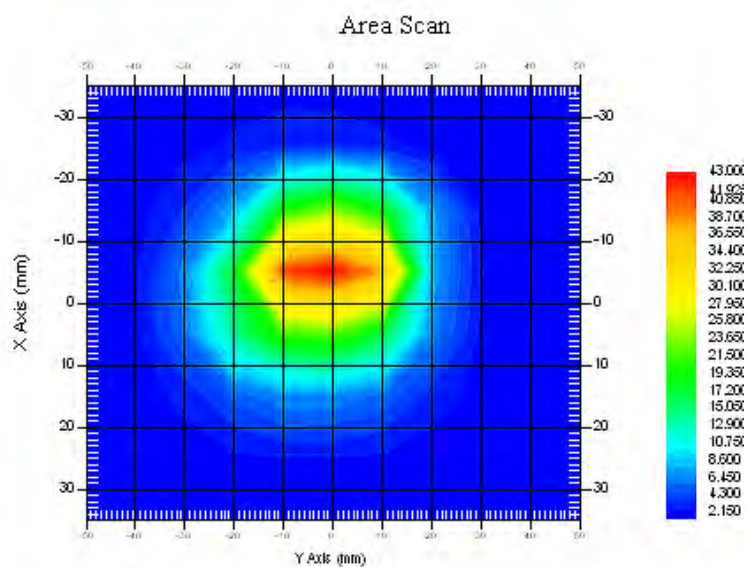
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 08-Oct-2013  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.8  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

**Measurement Data**

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Area Scan : 7x9x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 40.535 W/kg  
10 gram SAR value : 21.531 W/kg  
Area Scan Peak SAR : 42.117 W/kg  
Zoom Scan Peak SAR : 79.857 W/kg



### 1900 MHz System Validation with Head Tissue

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 1900 MHz Body Liquid****Dipole 1900 MHz; Type: ALS-D-1900-S-2; S/N: 210-00710****Product Data**

Device Name : Dipole 1900MHz  
Serial No. : 210-00710  
Type : Dipole  
Model : ALS-D-1900-S-2  
Frequency Band : 1900  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 40.119 W/kg  
Power Drift-Finish : 40.825 W/kg  
Power Drift (%) : 1.760

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Serial No. : System Default  
Location : Center  
Description : Default

**Tissue Data**

Type : Body  
Serial No. : 295-02102  
Frequency : 1900.00 MHz  
Last Calib. Date : 07-Jul-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 52.13 F/m  
Sigma : 1.51 S/m  
Density : 1000.00 kg/cu. m

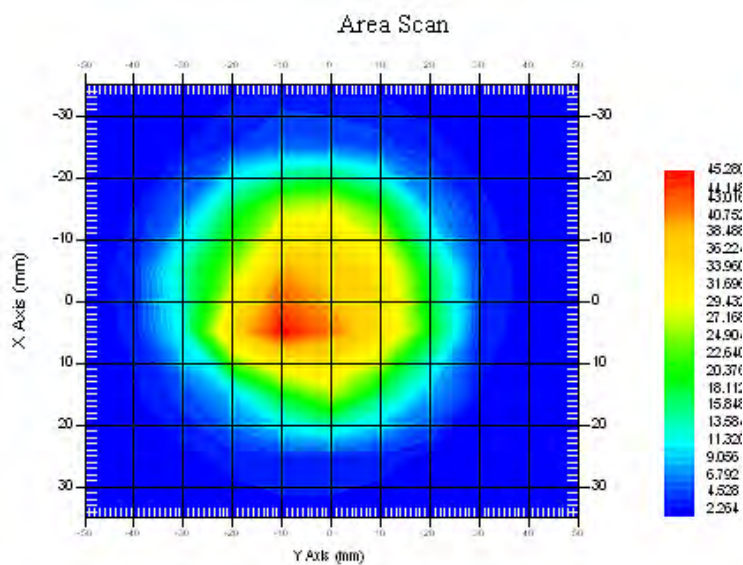
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 08-Oct-2013  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.5  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

**Measurement Data**

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 21.00 °C  
Area Scan : 7x9x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 41.126 W/kg  
10 gram SAR value : 21.755 W/kg  
Area Scan Peak SAR : 42.237 W/kg  
Zoom Scan Peak SAR : 79.852 W/kg



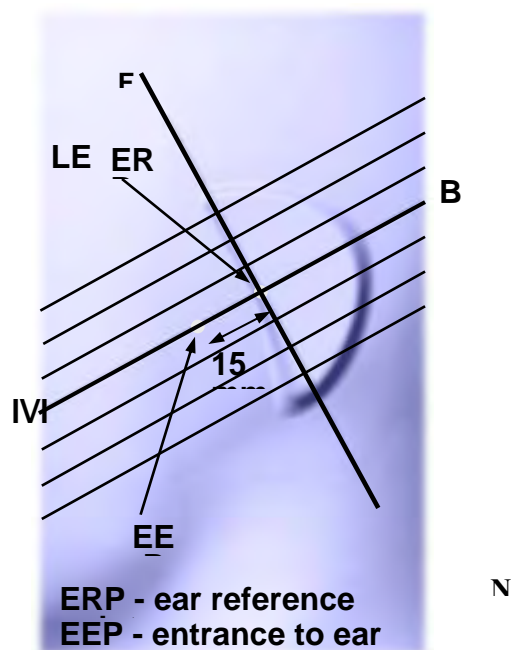
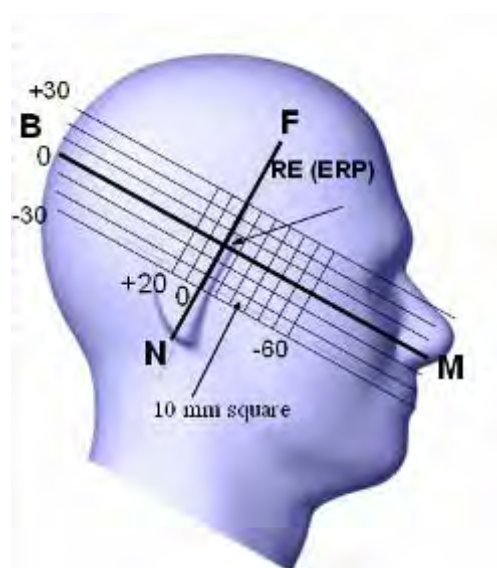
### 1900 MHz System Validation with Body Tissue

## 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

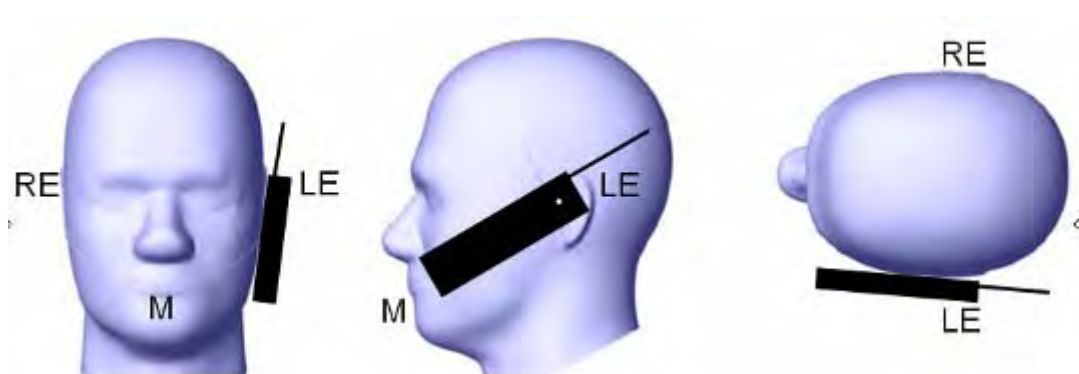
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

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”:

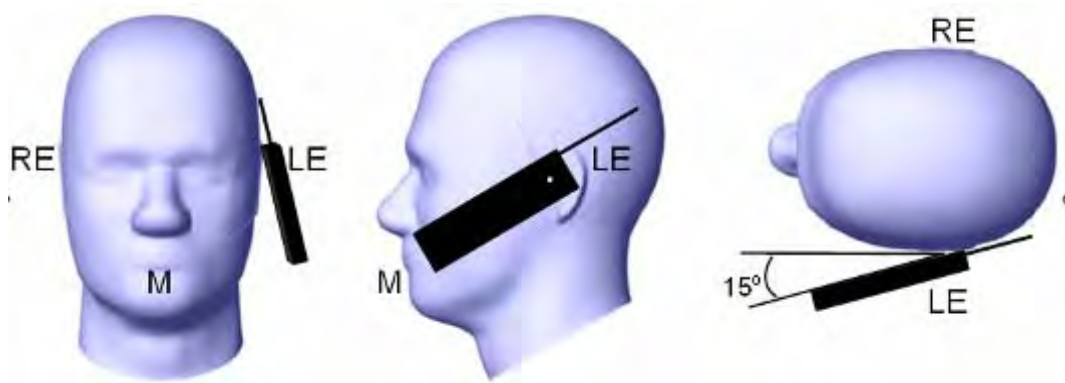
1) If the earpiece of the handset is not in full contact with the phantom’s ear spacer (in the “Cheek/Touch position”) and the peak SAR location for the “Cheek/Touch” position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the “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 is by 15° to 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, Tile/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.

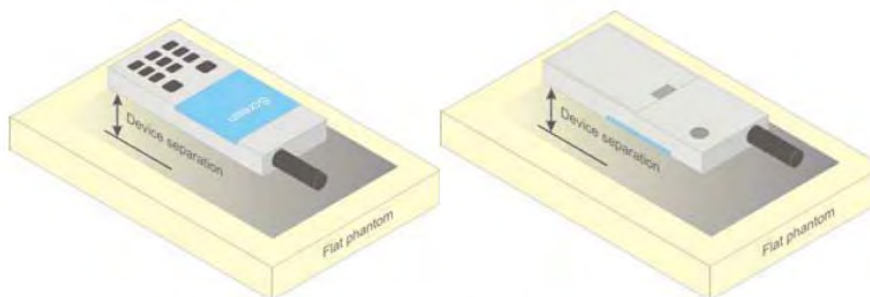
### **Ear /Tilt 15° Position**



### **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 35 mm x 35 mm x 35 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.  
KDB 648474 D04  
KDB 865664 D01  
KDB 941225 D01  
KDB 941225 D06

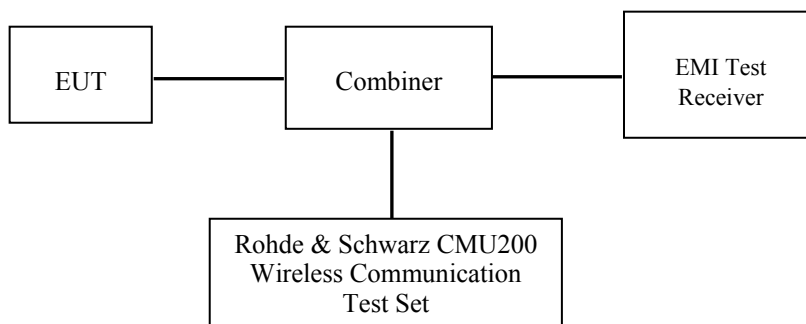
## CONDUCTED OUTPUT POWER MEASUREMENT

### 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.



### GSM&3G

### Maximum Output Power among production units

Max Target Power for Production Unit (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	32.40	32.40	32.40
GPRS 1 slot	32.40	32.40	32.40
GPRS 2 slot	31.80	31.80	31.80
GPRS 3 slot	30.60	30.60	30.60
GPRS 4 slot	29.80	29.80	29.80
PCS 1900	29.00	29.40	29.80
GPRS 1 slot	29.00	29.50	29.90
GPRS 2 slot	28.80	29.30	29.30
GPRS 3 slot	28.00	28.30	28.30
GPRS 4 slot	27.40	27.40	27.40
WCDMA850	22.30	22.00	22.00
WCDMA1900	23.00	22.50	22.50
WiFi	9.27	9.27	9.27
Bluetooth	-0.04	-0.04	-0.04

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

Band	Frequency (MHz)	Conducted Output Power	
		Meas. Power (dBm)	Meas. Power (W)
GSM 850	824.2	32.22	1.667
	836.6	32.22	1.667
	848.8	32.31	1.702
PCS 1900	1850.2	28.79	0.757
	1880.0	29.21	0.834
	1909.8	29.75	0.944

**GPRS :**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	32.21	31.68	30.53	29.78
	190	836.6	32.21	31.66	30.46	29.67
	251	848.8	32.27	31.70	30.47	29.69
PCS 1900	512	1850.2	28.62	28.70	27.96	27.24
	661	1880.0	29.41	29.09	28.12	27.32
	810	1909.8	29.87	29.23	28.14	27.22

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	23.21	25.68	26.28	<b>26.78</b>
	190	836.6	23.21	25.66	26.21	26.67
	251	848.8	23.27	25.70	26.22	26.69
PCS 1900	512	1850.2	19.62	22.70	23.71	24.24
	661	1880.0	20.41	23.09	23.87	<b>24.32</b>
	810	1909.8	20.87	23.23	23.89	24.22

**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).

**WCDMA-Release 99:**

The following tests were conducted according to the test requirements outlines 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>	<b>Loopback Mode</b>	Test Mode 1
	<b>Rel99 RMC</b>	12.2kbps RMC
	<b>Power Control Algorithm</b>	Algorithm2
	<b><math>\beta_c / \beta_d</math></b>	8/15

**WCDMA HSDPA**

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subset	1	2	3	4
<b>WCDMA General Settings</b>	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
	$\beta_{hs}$	4/15	24/15	30/15	30/15
	MPR(dB)	0	0	0.5	0.5
<b>HSDPA Specific Settings</b>	$D_{ACK}$	8			
	$D_{NAK}$	8			
	$D_{CQI}$	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	$A_{hs} = \beta_{hs} / \beta_c$	30/15			

**WCDMA HSUPA**

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

	Mode	HSUPA	HSUPA	HSUPA	HSUPA	HSUPA
	Subset	1	2	3	4	5
WCDMA General Settings	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
	CM(dB)	1.0	3.0	2.0	3.0	1.0
	MPR(dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
	$A_{hs} = \beta_{hs} / \beta_c$	30/15				
HSUPA Specific Settings	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 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18	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	

**Results (12.2kbps RMC)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power	
			(dBm)	(Watt)
WCDMA 850	826.4	4132	<b>22.16</b>	0.164
	836.6	4183	21.85	0.153
	846.6	4233	21.66	0.147
WCDMA 1900	1852.4	9262	<b>22.88</b>	0.194
	1880.0	9400	22.30	0.170
	1907.6	9538	22.25	0.168

**Results (HSDPA)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)			
			Subset 1	Subset 2	Subset 3	Subset 4
WCDMA 850	826.4	4132	21.19	21.24	21.22	21.40
	836.6	4183	20.68	20.47	20.55	20.48
	846.6	4233	20.76	20.53	20.54	21.25
WCDMA 1900	1852.4	9262	21.37	21.40	21.55	21.40
	1880.0	9400	21.26	21.03	21.12	21.25
	1907.6	9538	20.53	20.42	20.64	20.42

**Results (HSUPA)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)				
			Subset 1	Subset 2	Subset 3	Subset 4	Subset 5
WCDMA 850	826.4	4132	21.19	21.10	21.14	21.20	21.40
	836.6	4183	20.69	21.27	21.22	20.33	20.30
	846.6	4233	20.75	21.33	20.49	20.37	20.20
WCDMA 1900	1852.4	9262	21.34	21.27	21.12	21.03	21.10
	1880.0	9400	21.27	21.33	21.49	21.37	21.20
	1907.6	9538	21.23	21.33	21.49	21.37	21.20

**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 when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than measured without HSDPA using 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.
3. KDB 941225 D01-Body SAR is not required for HSUPA when the maximum average output of each RF channel with HSUPA active is less than ¼ dB higher than measured without HSUPA using 12.2kbps RMC and the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.

**Bluetooth**

Mode	Channel frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
BDR(GFSK)	(Low)2402	-1.02	0.79
	(Middle)2441	-0.39	0.91
	(High)2480	-0.14	0.97
EDR(4-DQPSK)	(Low)2402	-1.34	0.73
	(Middle)2441	-0.76	0.84
	(High)2480	-0.39	0.91
EDR-8DPSK	(Low)2402	-1.04	0.79
	(Middle)2441	-0.51	0.89
	(High)2480	<b>-0.04</b>	0.99
BT4.0	(Low)2402	-9.67	0.108
	(Middle)2440	-9.84	0.104
	(High)2480	-10.09	0.098

**Wi-Fi**

Band	Frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
802.11b	2412	9.02	7.798
	2437	8.92	8.453
	2462	9.27	5.445
802.11g	2412	7.36	7.889
	2437	8.97	6.383
	2462	8.05	6.053
802.11n HT20	2412	7.82	7.727
	2437	8.88	6.653
	2462	8.23	3.606
802.11n HT40	2422	5.57	4.786
	2437	6.80	3.581
	2452	5.54	7.798

**Note:**

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

## SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

### SAR Test Data

#### Environmental Conditions

Temperature:	21-24 °C
Relative Humidity:	50-53 %
ATM Pressure:	1001-1002 mbar

Testing was performed by Wilson Chen on 2014-07-11

### GSM 850:

EUT Position	Frequency (MHz)		Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Left Head Cheek	128(Low)	824.2	GSM	/	/	/	/	/	/
	190(Middle)	836.6	GSM	-2.051	32.22	32.40	1.042	0.119	0.124
	251(High)	848.8	GSM	/	/	/	/	/	/
Left Head Tilt	128(Low)	824.2	GSM	/	/	/	/	/	/
	190(Middle)	836.6	GSM	1.024	32.22	32.40	1.042	0.085	0.089
	251(High)	848.8	GSM	/	/	/	/	/	/
Right Head Cheek	128(Low)	824.2	GSM	3.354	32.22	32.40	1.042	0.132	<b>0.138</b>
	190(Middle)	836.6	GSM	-1.659	32.22	32.40	1.042	0.127	0.132
	251(High)	848.8	GSM	-0.959	32.31	32.40	1.021	0.121	0.124
Right Head Tilt	128(Low)	824.2	GSM	/	/	/	/	/	/
	190(Middle)	836.6	GSM	-0.359	32.22	32.40	1.042	0.078	0.081
	251(High)	848.8	GSM	/	/	/	/	/	/
Body-Back-Headset (10mm)	128(Low)	824.2	GSM	/	/	/	/	/	/
	190(Middle)	836.6	GSM	-1.912	32.22	32.40	1.042	0.352	0.367
	251(High)	848.8	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.



**PCS Band:**

EUT Position	Frequency (MHz)		Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Left Head Cheek	512(Low)	1850.2	GSM	0.953	28.79	29.00	1.050	0.057	0.060
	661(Middle)	1880.0	GSM	1.857	29.21	29.40	1.045	0.060	0.063
	810(High)	1909.8	GSM	-2.064	29.75	29.80	1.012	0.065	<b>0.066</b>
Left Head Tilt	512(Low)	1850.2	GSM	/	/	/	/	/	/
	661(Middle)	1880.0	GSM	/	/	/	/	/	/
	810(High)	1909.8	GSM	-1.854	29.75	29.80	1.012	0.035	0.035
Right Head Cheek	512(Low)	1850.2	GSM	/	/	/	/	/	/
	661(Middle)	1880.0	GSM	/	/	/	/	/	/
	810(High)	1909.8	GSM	0.748	29.75	29.80	1.012	0.062	0.063
Right Head Tilt	512(Low)	1850.2	GSM	/	/	/	/	/	/
	661(Middle)	1880.0	GSM	/	/	/	/	/	/
	810(High)	1909.8	GSM	1.337	29.75	29.80	1.012	0.033	0.033
Body-Back-Headset (10mm)	512(Low)	1850.2	GSM	/	/	/	/	/	/
	661(Middle)	1880.0	GSM	/	/	/	/	/	/
	810(High)	1909.8	GSM	-2.459	29.75	29.80	1.012	0.512	0.518

**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  $> \frac{1}{2}$  dB, instead of the middle channel, the highest output power channel must be used.

**WCDMA 850**

EUT Position	Frequency (MHz)		Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Left Head Cheek	4132	826.4	WCDMA 850	-0.825	22.16	22.30	1.033	0.170	0.176
	4183	836.6	WCDMA 850	/	/	/	/	/	/
	4233	846.6	WCDMA 850	/	/	/	/	/	/
Left Head Tilt	4132	826.4	WCDMA 850	1.229	22.16	22.30	1.033	0.098	0.101
	4183	836.6	WCDMA 850	/	/	/	/	/	/
	4233	846.6	WCDMA 850	/	/	/	/	/	/
Right Head Cheek	4132	826.4	WCDMA 850	-2.671	22.16	22.30	1.033	0.179	0.185
	4183	836.6	WCDMA 850	/	/	/	/	/	/
	4233	846.6	WCDMA 850	/	/	/	/	/	/
Right Head Tilt	4132	826.4	WCDMA 850	-1.957	22.16	22.30	1.033	0.102	0.105
	4183	836.6	WCDMA 850	/	/	/	/	/	/
	4233	846.6	WCDMA 850	/	/	/	/	/	/

**WCDMA1900**

EUT Position	Frequency (MHz)		Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Left Head Cheek	9262	1852.4	WCDMA1900	-0.867	22.88	23.00	1.028	0.095	0.098
	9400	1880.0	WCDMA1900	/	/	/	/	/	/
	9538	1907.6	WCDMA1900	/	/	/	/	/	/
Left Head Tilt	9262	1852.4	WCDMA1900	-1.749	22.88	23.00	1.028	0.041	0.042
	9400	1880.0	WCDMA1900	/	/	/	/	/	/
	9538	1907.6	WCDMA1900	/	/	/	/	/	/
Right Head Cheek	9262	1852.4	WCDMA1900	-0.257	22.88	23.00	1.028	0.089	0.091
	9400	1880.0	WCDMA1900	/	/	/	/	/	/
	9538	1907.6	WCDMA1900	/	/	/	/	/	/
Right Head Tilt	9262	1852.4	WCDMA1900	1.883	22.88	23.00	1.028	0.044	0.045
	9400	1880.0	WCDMA1900	/	/	/	/	/	/
	9538	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 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.
5. 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 WiFi 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: 835)

EUT Position	Frequency (MHz)		Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Body-Back (10mm)	128(Low)	824.2	GPRS	2.715	29.78	29.80	1.005	0.928	0.933
	190(Middle)	836.6	GPRS	0.958	29.67	29.80	1.030	0.844	0.869
	251(High)	848.8	GPRS	-2.276	29.69	29.80	1.026	0.715	0.734
Body-Left (10mm)	128(Low)	824.2	GPRS	1.025	29.78	29.80	1.005	0.475	0.477
	190(Middle)	836.6	GPRS	/	/	/	/	/	/
	251(High)	848.8	GPRS	/	/	/	/	/	/
Body-Right (10mm)	128(Low)	824.2	GPRS	-3.341	29.78	29.80	1.005	0.488	0.490
	190(Middle)	836.6	GPRS	/	/	/	/	/	/
	251(High)	848.8	GPRS	/	/	/	/	/	/
Body-Bottom (10mm)	128(Low)	824.2	GPRS	1.846	29.78	29.80	1.005	0.052	0.052
	190(Middle)	836.6	GPRS	/	/	/	/	/	/
	251(High)	848.8	GPRS	/	/	/	/	/	/

#### Note:

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
2. The EUT is a Capability Class B mobile phone which can be attached to both GPRS and GSM services.
3. The Multi-slot Classes of EUT is Class 12 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.
4. The EUT transmit and receive through the same GSM antenna while testing SAR.
5. 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-GPRS (Frequency Band: 1900)**

EUT Position	Frequency (MHz)		Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Body-Back (10mm)	512(Low)	1850.2	GPRS	-0.128	27.24	27.40	1.038	0.894	0.928
	661(Middle)	1880.0	GPRS	2.274	27.32	27.40	1.019	0.947	0.965
	810(High)	1909.8	GPRS	-0.786	27.22	27.40	1.042	0.855	0.891
Body-Left (10mm)	512(Low)	1850.2	GPRS	/	/	/	/	/	/
	661(Middle)	1880.0	GPRS	-2.958	27.32	27.40	1.019	0.098	0.100
	810(High)	1909.8	GPRS	/	/	/	/	/	/
Body-Right (10mm)	512(Low)	1850.2	GPRS	/	/	/	/	/	/
	661(Middle)	1880.0	GPRS	-1.552	27.32	27.40	1.019	0.075	0.076
	810(High)	1909.8	GPRS	/	/	/	/	/	/
Body-Bottom (10mm)	512(Low)	1850.2	GPRS	/	/	/	/	/	/
	661(Middle)	1880.0	GPRS	-4.037	27.32	27.40	1.019	0.447	0.455
	810(High)	1909.8	GPRS	/	/	/	/	/	/

**Note:**

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
2. The EUT is a Capability Class B mobile phone which can be attached to both GPRS and GSM services.
3. 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.
4. The EUT transmit and receive through the same GSM antenna while testing SAR.
5. 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)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Body-Back (10mm)	4132	826.4	WCDMA850	-1.812	22.16	22.30	1.033	0.470	0.486
	4183	836.6	WCDMA850	/	/	/	/	/	/
	4233	846.6	WCDMA850	/	/	/	/	/	/
Body-Left (10mm)	4132	826.4	WCDMA850	0.963	22.16	22.30	1.033	0.112	0.116
	4183	836.6	WCDMA850	/	/	/	/	/	/
	4233	846.6	WCDMA850	/	/	/	/	/	/
Body-Right (10mm)	4132	826.4	WCDMA850	-2.364	22.16	22.30	1.033	0.098	0.101
	4183	836.6	WCDMA850	/	/	/	/	/	/
	4233	846.6	WCDMA850	/	/	/	/	/	/
Body-Bottom (10mm)	4132	826.4	WCDMA850	3.347	22.16	22.30	1.033	0.011	0.011
	4183	836.6	WCDMA850	/	/	/	/	/	/
	4233	846.6	WCDMA850	/	/	/	/	/	/

**Hot Spot-WCDMA1900**

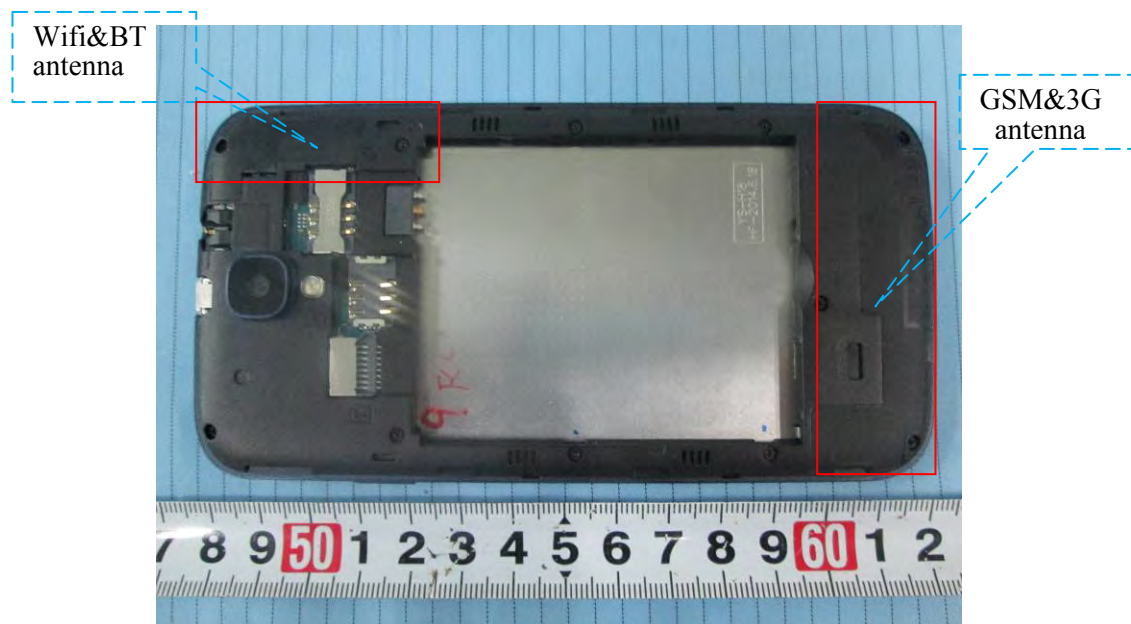
EUT Position	Frequency (MHz)		Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)		
	Channel	MHz					Scaled Factor	Meas. SAR	Scaled SAR
Body-Back (10mm)	9262	1852.4	WCDMA1900	1.658	22.88	23.00	1.028	1.209	1.243
	9400	1880.0	WCDMA1900	1.325	22.30	22.50	1.047	1.117	1.169
	9538	1907.6	WCDMA1900	-0.457	22.25	22.50	1.059	1.074	1.137
Body-Left (10mm)	9262	1852.4	WCDMA1900	0.932	22.88	23.00	1.028	0.352	0.362
	9400	1880.0	WCDMA1900	/	/	/	/	/	/
	9538	1907.6	WCDMA1900	/	/	/	/	/	/
Body-Right (10mm)	9262	1852.4	WCDMA1900	-1.185	22.88	23.00	1.028	0.249	0.256
	9400	1880.0	WCDMA1900	/	/	/	/	/	/
	9538	1907.6	WCDMA1900	/	/	/	/	/	/
Body-Bottom (10mm)	9262	1852.4	WCDMA1900	0.528	22.88	23.00	1.028	0.295	0.303
	9400	1880.0	WCDMA1900	/	/	/	/	/	/
	9538	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 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.
5. 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&WiFi and GSM&3G Antennas Location:



### Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	×	×	0
GSM + Bluetooth	√	×	85
GSM + WiFi	√	×	85
GPRS + WCDMA	×	×	0
GPRS + Bluetooth	√	×	0
GPRS + WiFi	√	√	85
WCDMA + Bluetooth	√	×	85
WCDMA + WiFi	√	√	85

### Standalone SAR test exclusion considerations

#### Head Position:

Mode	Frequency (MHz)	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GSM850	850	23.40	214.29	0	40.34	3.0	No
PCS1900	1900	20.80	118.85	0	33.14	3.0	No
WCDMA850	850	22.30	164.44	0	31.31	3.0	No
WCDMA1900	1900	23.00	194.09	0	55.01	3.0	No
WiFi	2450	9.27	8.45	0	2.65	3.0	Yes
Bluetooth	2450	-0.04	0.99	0	0.32	3.0	Yes

Body Position:

Mode	Frequency (MHz)	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GPRS850	850	26.80	478.63	10.00	44.13	3.0	No
GPRS1900	1900	24.40	275.42	10.00	37.96	3.0	No
WCDMA850	850	22.30	169.82	10.00	15.66	3.0	No
WCDMA1900	1900	23.00	199.53	10.00	27.50	3.0	No
WiFi	2450	9.27	8.45	10.00	1.32	3.0	Yes
Bluetooth	2450	-0.04	0.99	10.00	0.32	3.0	Yes

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

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  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)	Distance (mm)	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Estimated 1-g (W/kg)
BT Head	2.45	0	-0.04	0.77	0.043
BT Body	2.45	10	-1.14	0.77	0.022
Wifi Head	2.45	0	9.27	8.45	0.353
Wifi Body	2.45	10	9.27	8.45	0.177

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:

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

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

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

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

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	BT	< 1.6W/kg
GSM850	Left Head Cheek	0.124	0.043	0.167
	Left Head Tile	0.089	0.043	0.132
	Right Head Cheek	0.138	0.043	0.181
	Right Head Tilt	0.081	0.043	0.124
	Body–Headset-Back	0.367	0.022	0.389
PCS1900	Left Head Cheek	0.066	0.043	0.109
	Left Head Tile	0.035	0.043	0.078
	Right Head Cheek	0.063	0.043	0.106
	Right Head Tilt	0.033	0.043	0.076
	Body–Headset-Back	0.518	0.022	0.540

**WCDMA with BT:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.176	0.043	0.219
	Left Head Tile	0.101	0.043	0.144
	Right Head Cheek	0.185	0.043	0.228
	Right Head Tilt	0.105	0.043	0.148
WCDMA 1900	Left Head Cheek	0.098	0.043	0.141
	Left Head Tile	0.042	0.043	0.085
	Right Head Cheek	0.091	0.043	0.134
	Right Head Tilt	0.045	0.043	0.088

**GSM with WiFi:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	WiFi	< 1.6W/kg
GSM850	Left Head Cheek	0.124	0.353	0.477
	Left Head Tile	0.089	0.353	0.442
	Right Head Cheek	0.138	0.353	<b>0.491</b>
	Right Head Tilt	0.081	0.353	0.434
	Body–Headset-Back	0.367	0.177	0.544
PCS1900	Left Head Cheek	0.066	0.353	0.419
	Left Head Tile	0.035	0.353	0.388
	Right Head Cheek	0.063	0.353	0.416
	Right Head Tilt	0.033	0.353	0.386
	Body–Headset-Back	0.518	0.177	0.695



**WCDMA with WiFi:**

Mode	Position	Reported SAR (W/kg)		$\Sigma$ SAR
		WCDMA	WiFi	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.176	0.353	0.529
	Left Head Tile	0.101	0.353	0.454
	Right Head Cheek	0.185	0.353	<b>0.538</b>
	Right Head Tilt	0.105	0.353	0.458
WCDMA 1900	Left Head Cheek	0.098	0.353	0.451
	Left Head Tile	0.042	0.353	0.395
	Right Head Cheek	0.091	0.353	0.444
	Right Head Tilt	0.045	0.353	0.398

**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	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
GPRS 850	0.933	0.477	0.490	0.052	/
GPRS 1900	0.965	0.100	0.076	0.455	/
WCDMA850	0.486	0.116	0.101	0.011	/
WCDMA 1900	1.243	0.362	0.256	0.303	/
WiFi	0.177	0.177	/	/	0.177
	$\Sigma$ 1-g SAR(W/Kg)				
GPRS850 + WiFi	1.110	0.654	/	/	/
GPRS1900 + WiFi	1.142	0.277	/	/	/
WCDMA850 + WiFi	0.663	0.293	/	/	/
WCDMA 1900 + WiFi	<b>1.420</b>	0.539	/	/	/

**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.

**EUT SCAN RESULTS (Summary of the Highest SAR Values)****Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Right Head Cheek (824.2 MHz Low Channel)**

## Measurement Data

Test mode : GSM  
Crest Factor : 8  
Scan Type : Complete  
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.029 W/kg  
Power Drift-Finish : 0.030 W/kg  
Power Drift (%) : 3.354

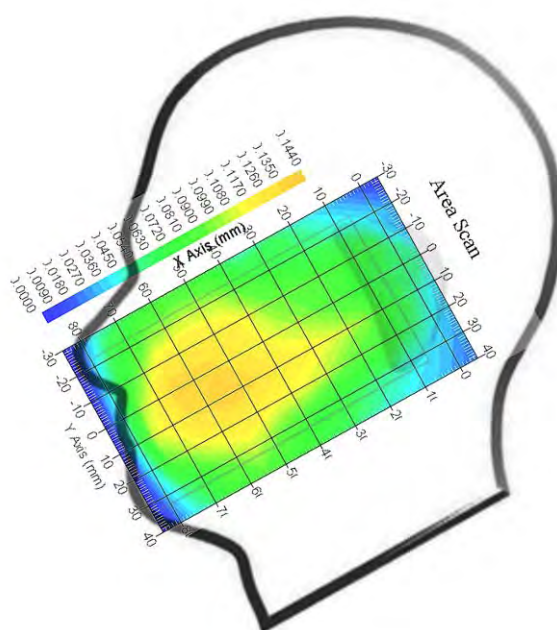
## Tissue Data

Type : Head  
Frequency : 824.2 MHz  
Epsilon : 41.05 F/m  
Sigma : 0.90 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Serial No. : 500-00283  
Frequency Band : 835  
Duty Cycle Factor : 8  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.132 W/kg  
10 gram SAR value : 0.094 W/kg  
Area Scan Peak SAR : 0.144 W/kg  
Zoom Scan Peak SAR : 0.239 W/kg

**Plot 1#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Left Head Cheek(1909.8 MHz High Channel)**

## Measurement Data

Test mode : GSM  
Crest Factor : 8  
Scan Type : Complete  
Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.002 W/kg  
Power Drift-Finish : 0.002 W/kg  
Power Drift (%) : -2.064

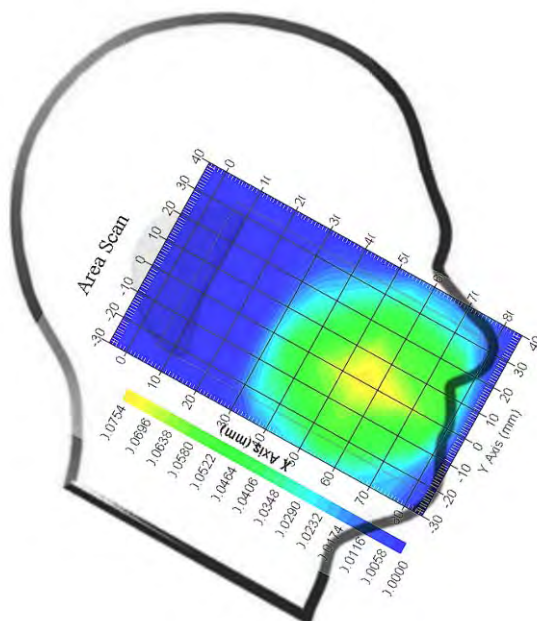
## Tissue Data

Type : Head  
Frequency : 1909.8 MHz  
Epsilon : 39.59 F/m  
Sigma : 1.42 S/m  
Density : 1000.00 kg/cu. M

## Probe Data

Serial No. : 500-00283  
Frequency Band : 1900  
Duty Cycle Factor : 8  
Conversion Factor : 4.8  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.065 W/kg  
10 gram SAR value : 0.034 W/kg  
Area Scan Peak SAR : 0.075 W/kg  
Zoom Scan Peak SAR : 0.118 W/kg

**Plot 2#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA850; Right Head Cheek (826.4 MHz Low Channel)****Measurement Data**

Test mode : WCDMA850  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.039 W/kg  
Power Drift-Finish : 0.038 W/kg  
Power Drift (%) : -2.671

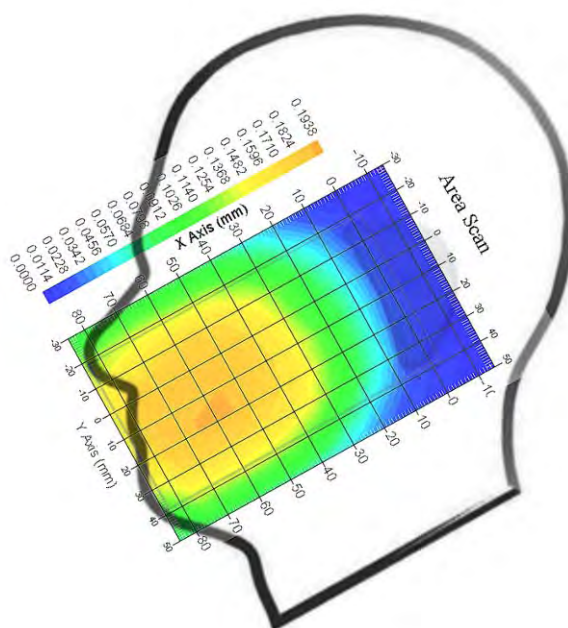
**Tissue Data**

Type : Head  
Frequency : 826.4 MHz  
Epsilon : 41.09 F/m  
Sigma : 0.91 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

Serial No. : 500-00283  
Frequency Band : 835  
Duty Cycle Factor : 1  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.179 W/kg  
10 gram SAR value : 0.112 W/kg  
Area Scan Peak SAR : 0.193 W/kg  
Zoom Scan Peak SAR : 0.325 W/kg

**Plot 3#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA1900; Left Head Cheek (1852.4 MHz Low Channel)****Measurement Data**

Test mode : WCDMA1900  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.002 W/kg  
Power Drift-Finish : 0.002 W/kg  
Power Drift (%) : -0.867

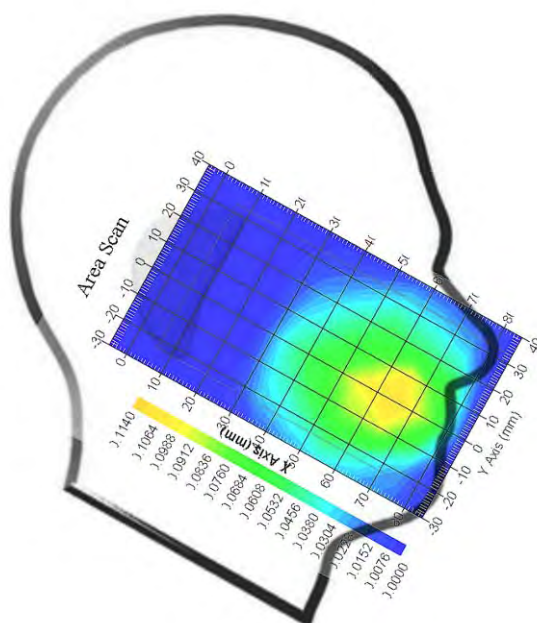
**Tissue Data**

Type : Head  
Frequency : 1852.4 MHz  
Epsilon : 39.75 F/m  
Sigma : 1.38 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

Serial No. : 500-00283  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.8  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.095 W/kg  
10 gram SAR value : 0.043 W/kg  
Area Scan Peak SAR : 0.113 W/kg  
Zoom Scan Peak SAR : 0.169 W/kg

**Plot 4#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Body-worn-Back (824.2 MHz Low Channel)**

## Measurement Data

Test mode : GPRS  
Crest Factor : 2  
Scan Type : Complete  
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.296 W/kg  
Power Drift-Finish : 0.303 W/kg  
Power Drift (%) : 2.715

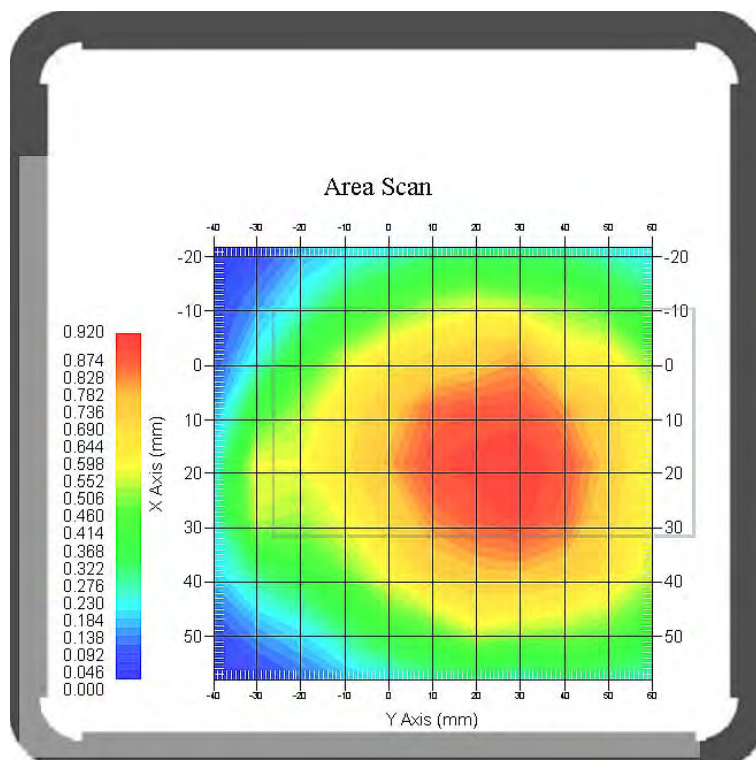
## Tissue Data

Type : Body  
Frequency : 824.2 MHz  
Epsilon : 53.85 F/m  
Sigma : 0.94 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Serial No. : 500-00283  
Frequency Band : 835  
Duty Cycle Factor : 2  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.928 W/kg  
10 gram SAR value : 0.558 W/kg  
Area Scan Peak SAR : 0.917 W/kg  
Zoom Scan Peak SAR : 1.521 W/kg

**Plot 5#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Body-worn-Back (1880.0 MHz Middle Channel)**

## Measurement Data

Test mode : GPRS  
Crest Factor : 2  
Scan Type : Complete  
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.528 W/kg  
Power Drift-Finish : 0.540 W/kg  
Power Drift (%) : 2.274

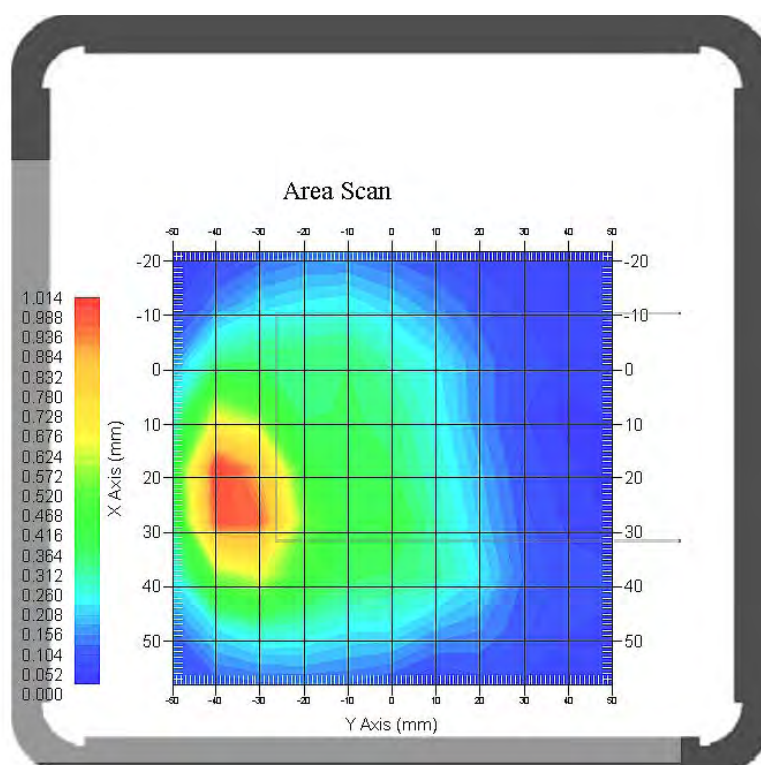
## Tissue Data

Type : Body  
Frequency : 1909.8 MHz  
Epsilon : 51.75 F/m  
Sigma : 1.53 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Serial No. : 500-00283  
Frequency Band : 1900  
Duty Cycle Factor : 2  
Conversion Factor : 4.5  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.947 W/kg  
10 gram SAR value : 0.445 W/kg  
Area Scan Peak SAR : 1.006 W/kg  
Zoom Scan Peak SAR : 1.561 W/kg

**Plot 6#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA850; Body-Worn-Back (826.4 MHz Low Channel)**

## Measurement Data

Test mode : WCDMA850  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.330 W/kg  
Power Drift-Finish : 0.324 W/kg  
Power Drift (%) : -1.812

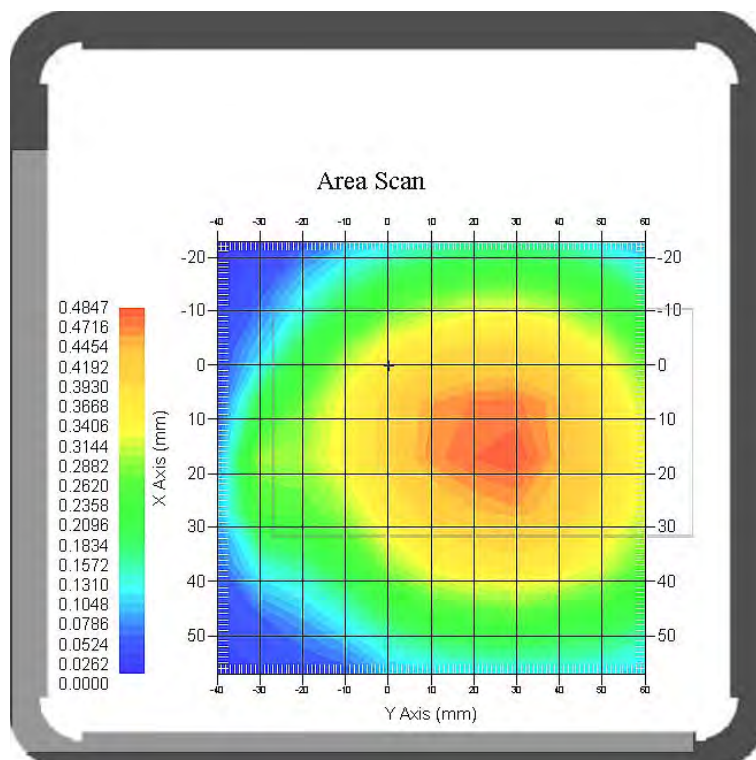
## Tissue Data

Type : Body  
Frequency : 826.4 MHz  
Epsilon : 53.82 F/m  
Sigma : 0.97 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Serial No. : 500-00283  
Frequency Band : 835  
Duty Cycle Factor : 1  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.470 W/kg  
10 gram SAR value : 0.281 W/kg  
Area Scan Peak SAR : 0.485 W/kg  
Zoom Scan Peak SAR : 0.793 W/kg

**Plot 7#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA1900; Body-Worn-Back (1852.4 MHz Low Channel)**

## Measurement Data

Test mode : WCDMA1900  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.714 W/kg  
Power Drift-Finish : 0.725 W/kg  
Power Drift (%) : 1.658

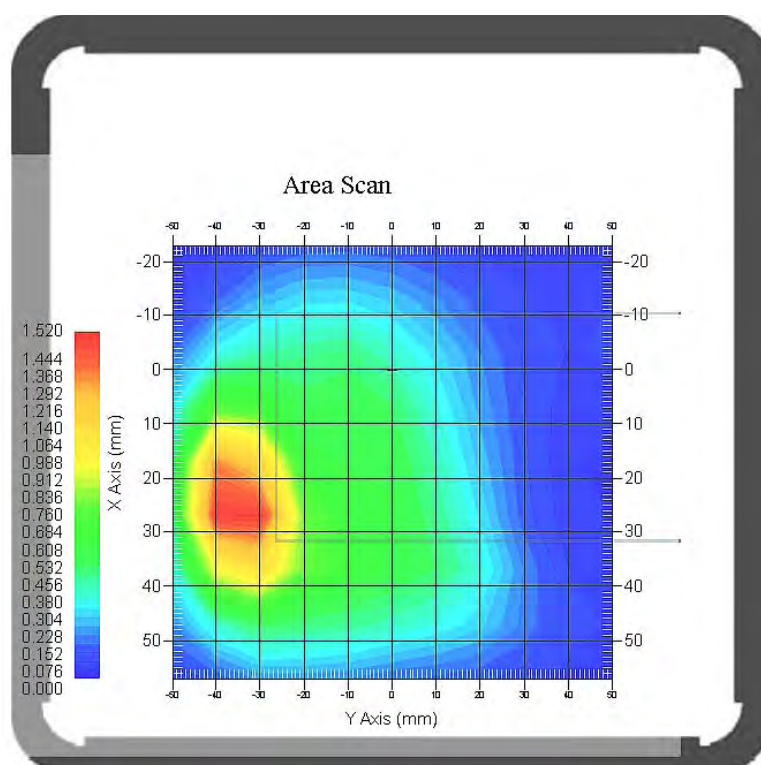
## Tissue Data

Type : Body  
Frequency : 1852.4 MHz  
Epsilon : 51.89 F/m  
Sigma : 1.47 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Serial No. : 500-00283  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.8  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 1.209 W/kg  
10 gram SAR value : 0.574 W/kg  
Area Scan Peak SAR : 1.517 W/kg  
Zoom Scan Peak SAR : 2.396 W/kg

**Plot 8#**

## APPENDIX A MEASUREMENT UNCERTAINTY

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

### Measurement Uncertainty for 300MHz to 3GHz

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^1$ (1-g)	$c_i^1$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
<b>Measurement System</b>							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition -Noise	0.6	rectangular	$\sqrt{3}$	1	1	0.3	0.3
RF Ambient Condition - Reflections	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech. Restrictions	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
<b>Restriction</b>							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	2.3	normal	1	1	1	2.3	2.3
Device Holder Uncertainty	6.215	normal	1	1	1	6.215	6.215
Drift of Output Power	4.627	rectangular	$\sqrt{3}$	1	1	2.67	2.67
<b>Phantom and Setup</b>							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	1.938	normal	1	0.7	0.5	1.36	0.97
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	3.093	normal	1	0.6	0.5	1.86	1.55
Combined Uncertainty		RSS				10.78	10.55
Expanded uncertainty (coverage factor=2)		Normal(k=2)				21.56	21.10

## APPENDIX B – PROBE CALIBRATION CERTIFICATES

### NCL CALIBRATION LABORATORIES

Calibration File No.: PC-1537

Task No: BACL-5745

## CERTIFICATE OF CALIBRATION

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.

Equipment: Miniature Isotropic RF Probe

Record of Calibration

Head and Body

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 500-00283

Calibration Procedure: D01-032-E020-V2, D22-012-Tissue, D28-002-Dipole  
Project No: BACL-5745

Calibrated: 8<sup>th</sup> October 2013

Released on: 8<sup>th</sup> October 2013

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,  
OTTAWA, ONTARIO  
CANADA K2K 3J1

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

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**NCL Calibration Laboratories**

Division of APREL Inc.

**Introduction**

This Calibration Report reproduces the results of the calibration performed in line with the references listed below. Calibration is performed using accepted methodologies as per the references listed below. Probes are calibrated for air, and tissue and the values reported are the results from the physical quantification of the probe through meteorological practices.

**Calibration Method**

Probes are calibrated using the following methods.

&lt;1000MHz

TEM Cell for sensitivity in air

Standard phantom using temperature transfer method for sensitivity in tissue

&gt;1000MHz

Waveguide\* method to determine sensitivity in air and tissue

\*Waveguide is numerically (simulation) assessed to determine the field distribution and power

The boundary effect for the probe is assessed using a standard flat phantom where the probe output is compared against a numerically simulated series of data points

**References**

- IEEE Standard 1528  
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- EN 62209-1  
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- IEC 62209-2  
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 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 Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

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Page 2 of 10

This page has been reviewed for content and attested to on Page 2 of this document.

**NCL Calibration Laboratories**

Division of APREL Inc.

**Conditions**

Probe 500-00283 was a recalibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 1.5°C**Temperature of the Tissue:** 21 °C +/- 1.5°C**Relative Humidity:** < 60%**Primary Measurement Standards**

Instrument	Serial Number	Cal due date
Tektronix USB Power Meter	11C940	May 14, 2015
Signal Generator HP 83640B	3844A00689	Feb 12, 2015

**Secondary Measurement Standards**

Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015
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**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



Dan Brooks, Test Engineer

Page 3 of 10

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**NCL Calibration Laboratories**

Division of APREL Inc.

**Probe Summary**

Probe Type:	E-Field Probe E020
Serial Number:	500-00283
Frequency:	As presented on page 5
Sensor Offset:	1.56
Sensor Length:	2.5
Tip Enclosure:	Composite*
Tip Diameter:	< 2.9 mm
Tip Length:	55 mm
Total Length:	289 mm

\*Resistive to recommended tissue recipes per IEEE-1528

**Sensitivity in Air**

Channel X:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Y:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Z:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point:	95 mV

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**NCL Calibration Laboratories**

Division of APREL Inc.

## Calibration for Tissue (Head H, Body B)

Frequency	Tissue Type	Measured Epsilon	Measured Sigma	Standard Uncertainty (%)	Calibration Frequency Range (MHz)	Conversion Factor
450 H	Head	44.29	0.86	3.5	±50	5.7
450 B	Body	56.6	0.94	3.5	±50	5.8
750 H	Head	42.7	0.85	3.5	±50	5.6
750 B	Body	56.6	0.94	3.5	±50	5.5
835 H	Head	42.35	0.938	3.5	±50	5.9
835 B	Body	56.65	1.018	3.5	±50	5.9
900 H	Head	X	X	X	X	X
900 B	Body	X	X	X	X	X
1450 H	Head	X	X	X	X	X
1450 B	Body	X	X	X	X	X
1500 H	Head	X	X	X	X	X
1500 B	Body	X	X	X	X	X
1640 H	Head	X	X	X	X	X
1640 B	Body	X	X	X	X	X
1750 H	Head	38.51	1.36	3.5	±75	5.4
1750 B	Body	51.79	1.53	3.5	±75	5.3
1800 H	Head	38.26	1.41	3.5	±75	5.0
1800 B	Body	51.61	1.58	3.5	±75	5.0
1900 H	Head	38.03	1.36	3.5	±75	4.8
1900 B	Body	53.13	1.58	3.5	±75	4.5
2000 H	Head	X	X	X	X	X
2000 B	Body	X	X	X	X	X
2100 H	Head	X	X	X	X	X
2100 B	Body	X	X	X	X	X
2300 H	Head	X	X	X	X	X
2300 B	Body	X	X	X	X	X
2450 H	Head	37.64	1.88	3.5	±75	4.9
2450 B	Body	50.7	2.03	3.5	±75	4.3
2600 H	Head	X	X	X	X	X
2600 B	Body	X	X	X	X	X
3000 H	Head	X	X	X	X	X
3000 B	Body	X	X	X	X	X
3600 H	Head	X	X	X	X	X
3600 B	Body	X	X	X	X	X
5250 H	Head	34.65	4.8	3.5	±100	2.7
5250 B	Body	47.6	5.3	3.5	±100	2.6
5600 H	Head	33.2	5.15	3.5	±100	2.5
5600 B	Body	45.21	5.57	3.5	±100	2.2
5800 H	Head	32.72	5.38	3.5	±100	3.2
5800 B	Body	44.28	6.04	3.5	±100	2.5

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**NCL Calibration Laboratories**

Division of APREL Inc.

**Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2.1% for the distance between the tip of the probe and the tissue boundary, when less than 0.58mm.

**Spatial Resolution:**

The spatial resolution uncertainty is less than 1.5% for 4.9mm diameter probe.

The spatial resolution uncertainty is less than 1.0% for 2.5mm diameter probe.

**DAQ-PAQ Contribution**

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

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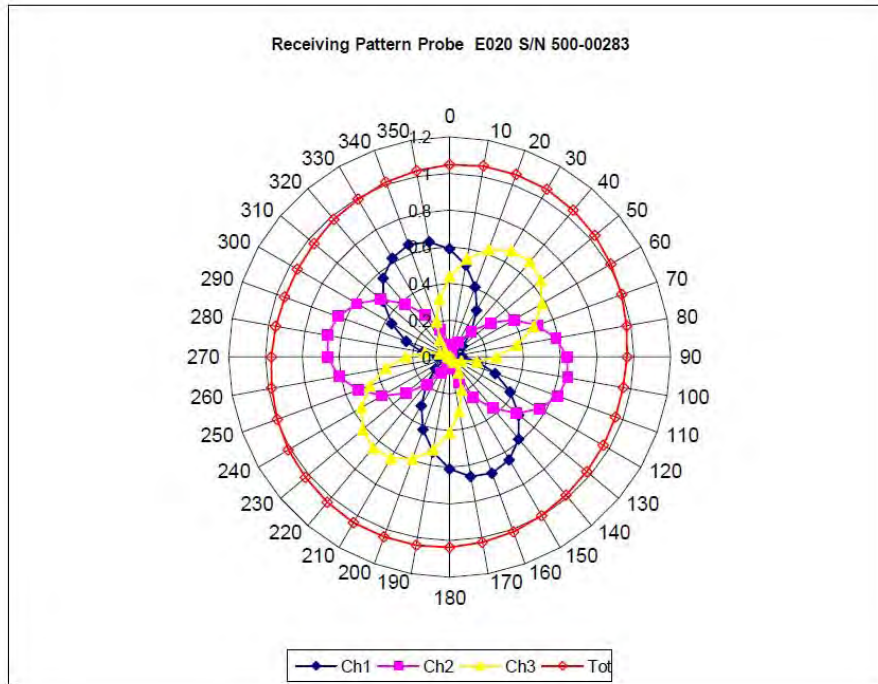
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# **NCL Calibration Laboratories**

Division of APREL Inc.

## **Receiving Pattern Air**



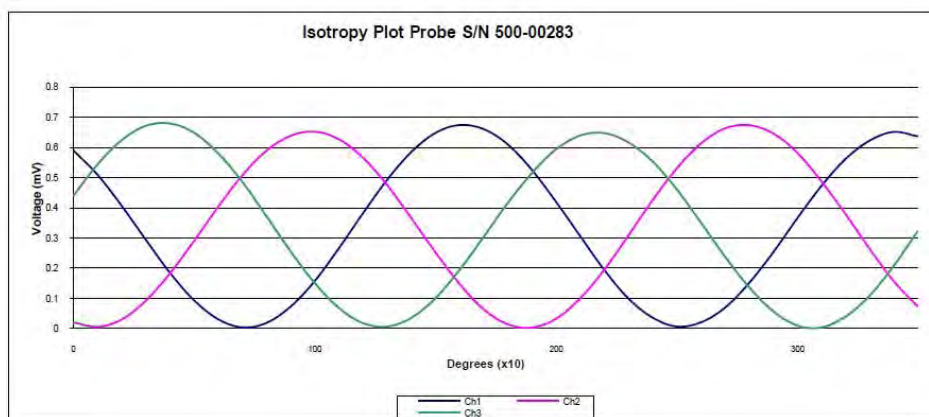
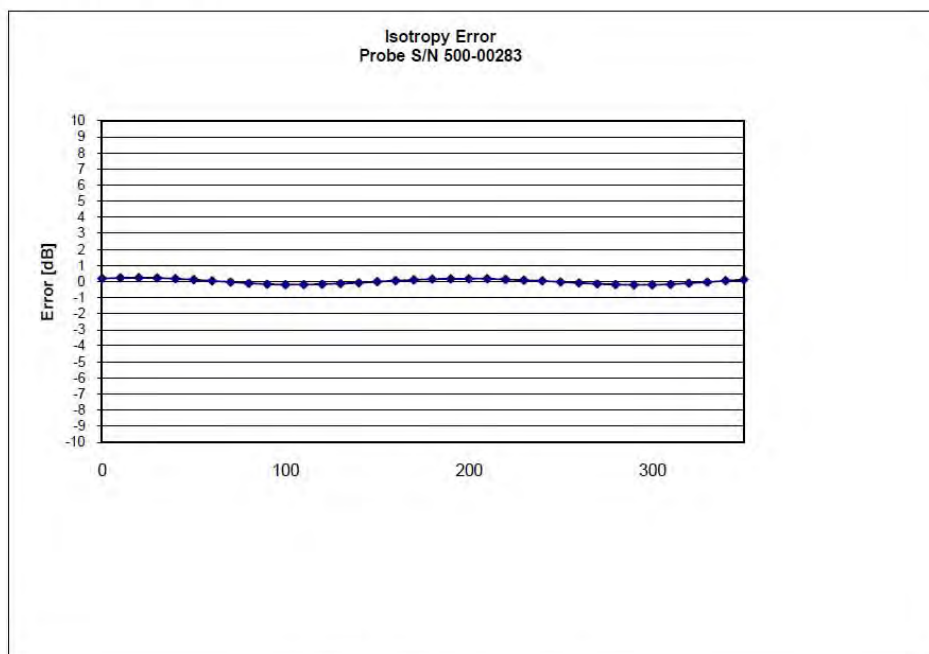
Page 7 of 10

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**NCL Calibration Laboratories**

Division of APREL Inc.

**Isotropy Error Air**



**Isotropicity Tissue:**

0.10 dB

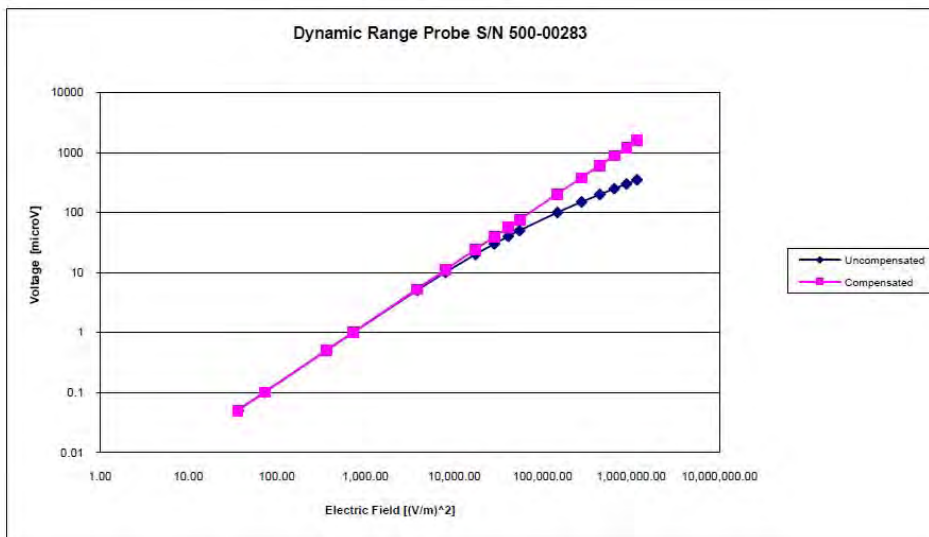
Page 8 of 10

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# NCL Calibration Laboratories

Division of APREL Inc.

## Dynamic Range

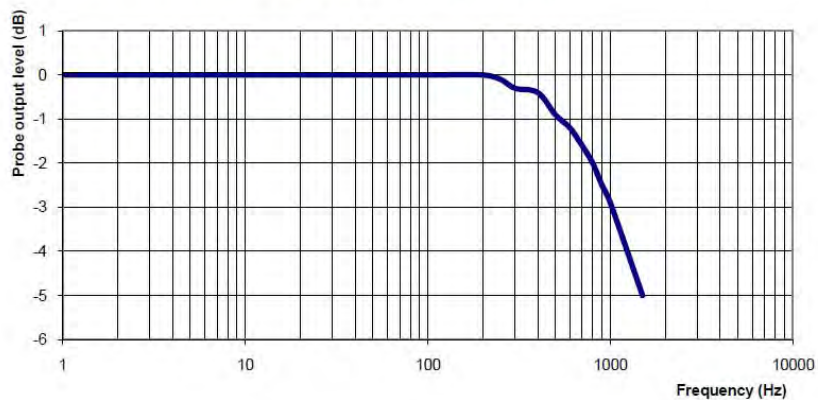


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**NCL Calibration Laboratories**

Division of APREL Inc.

**Video Bandwidth****Probe Frequency Characteristics**

Video Bandwidth at 500 Hz: 1 dB  
Video Bandwidth at 1.02 KHz: 3 dB

**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 May 2013.

Page 10 of 10

This page has been reviewed for content and attested to on Page 2 of this document.

## APPENDIX C DIPOLE CALIBRATION CERTIFICATES

### NCL CALIBRATION LABORATORIES

Calibration File No: DC-1327  
Project Number: BAC-dipole-cal-5618

## CERTIFICATE OF CALIBRATION

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

Calibrated: 25<sup>th</sup> August 2011

Released on: 25<sup>th</sup> August 2011

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

Released By: \_\_\_\_\_

**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.

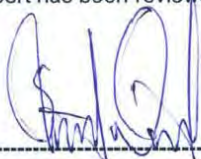
**Conditions**

Dipole 180-00558 was received in good condition and a re-calibration.

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

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

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



Stuart Nicol



C. Teodorian

**Primary Measurement Standards**

Instrument	Serial Number	Cal due date
Power meter Anritsu MA2408A	245025437	Nov.4, 2011
Power Sensor Anritsu MA2481D	103555	Nov 4, 2011
Attenuator HP 8495A (70dB) 1	944A10711	Aug.8, 2012
Network Analyzer Agilent E5071C	1334746J	Feb. 8, 2012
<b>Secondary Measurement Standards</b>		
Signal Generator Agilent E4438C	-506 MY55182336	June 7, 2012

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

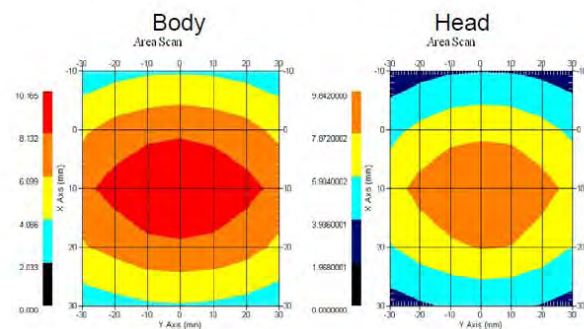
The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

**Mechanical Dimensions****Length:** 162.2 mm**Height:** 89.4 mm**Electrical Specification**

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	835 MHz	1.0417 U	-35.395dB	49.020 $\Omega$
Body	835 MHz	1.1177 U	-25.424dB	55.435 $\Omega$

**System Validation Results**

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	835 MHz	9.590	6.003	15.013
Body	835 MHz	9.684	6.263	14.23



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**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-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

**References**

SSI-TP-018-ALSAS Dipole Calibration Procedure  
SSI-TP-016 Tissue Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

**Conditions**

Dipole 180-00558 was new taken from stock.

**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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**NCL Calibration Laboratories**

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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

Tissue Type	Return Loss:	SWR:	Impedance:
Head	-35.395 dB	1.0417 U	49.020 $\Omega$
Body	-25.454 dB	1.1177 U	55.435 $\Omega$

**Tissue Validation**

	Dielectric constant, $\epsilon_r$	Conductivity, $\sigma$ [S/m]
Head Tissue 835MHz	41.78	0.92
Body Tissue 835MHz	56.37	0.95

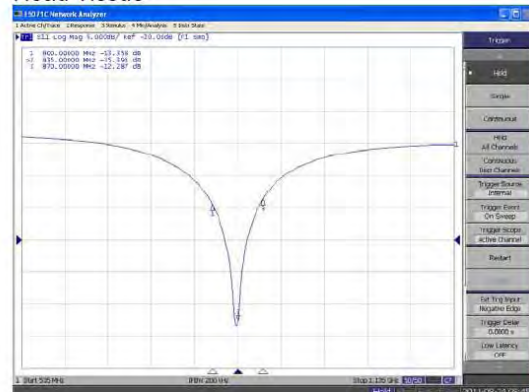
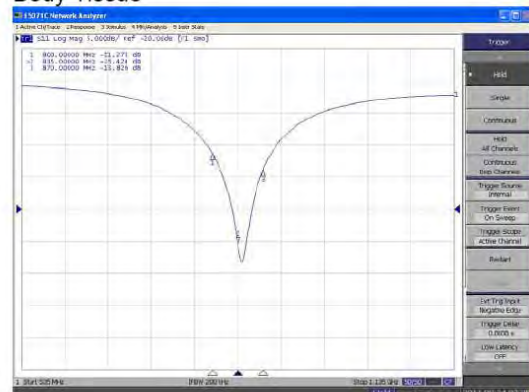
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**NCL Calibration Laboratories**

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

**S11 Parameter Return Loss****Head Tissue****Body Tissue**

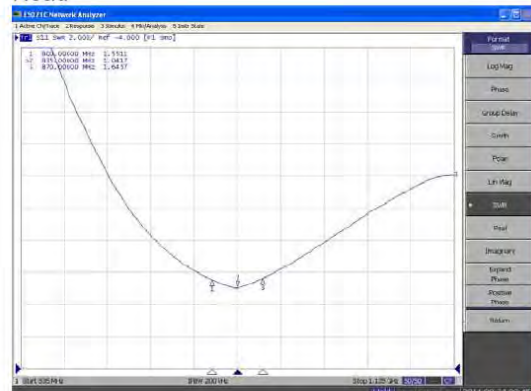
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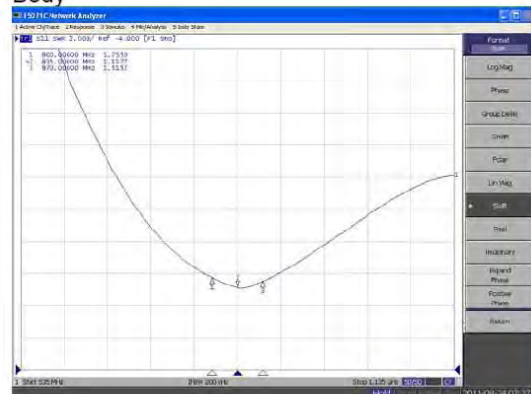
## NCL Calibration Laboratories

Division of APREL Laboratories.

### SWR Head



### Body

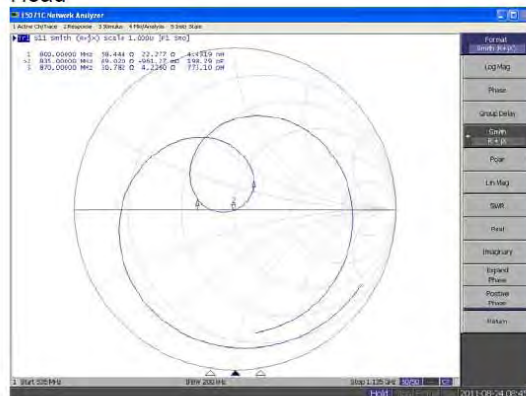
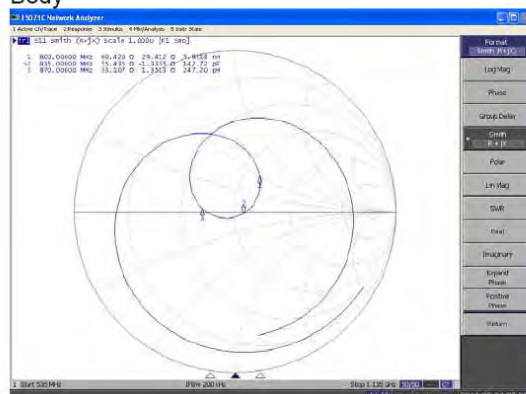


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**NCL Calibration Laboratories**

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

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

**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 2011.

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## 835MHz Dipole Calibration By BACL at 2013-12-20

### Mechanical Verification

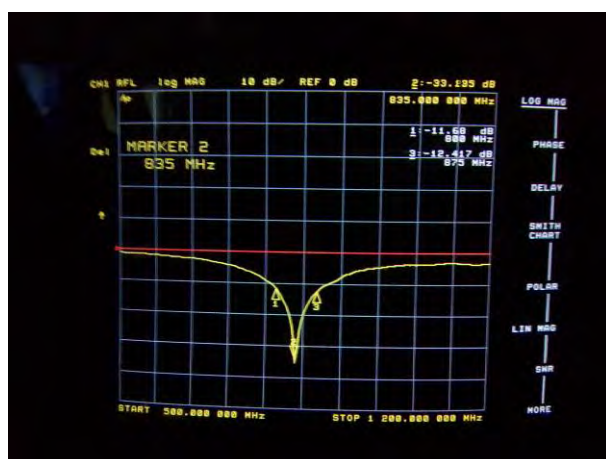
APREL Length	APREL Height	Measured Length	Measured Height
161.0 mm	89.8 mm	161.1 mm	89.7 mm

Tissue Type	Measured Return Loss	Measured Impedance
Head	-33.135 dB	51.898 $\Omega$
Body	-25.362 dB	50.604 $\Omega$

### Test Graphs:

Head Tissue

Return Loss :

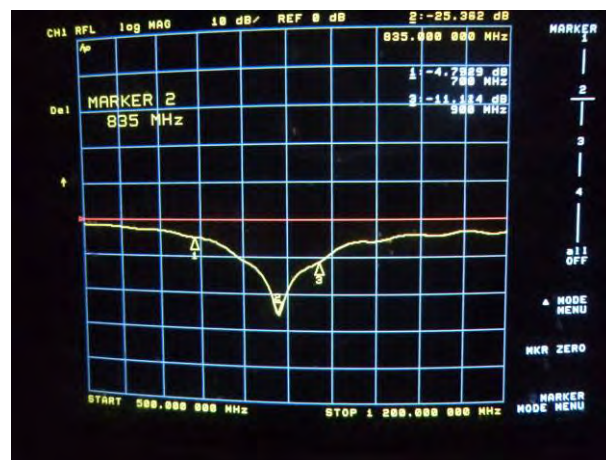


Impedance :

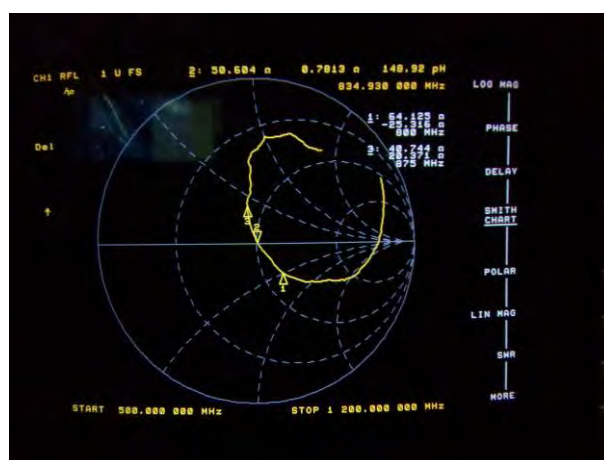


Body Tissue

Return Loss :



Impedance :





## NCL CALIBRATION LABORATORIES

Calibration File No: DC-1331  
Project Number: BAC-dipole -cal-5615

# CERTIFICATE OF CALIBRATION

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

Calibrated: 25<sup>th</sup> August, 2011  
Released on: 25<sup>th</sup> August, 2011

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

Released By: \_\_\_\_\_

***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 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

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



Stuart Nicol



C. Teodorian

**Primary Measurement Standards**

Instrument	Serial Number	Cal due date
Power meter Anritsu MA2408A	245025437	Nov.4, 2011
Power Sensor Anritsu MA2481D	103555	Nov 4, 2011
Attenuator HP 8495A (70dB) 1	944A10711	Aug.8, 2012
Network Analyzer Agilent E5071C	1334746J	Feb. 8, 2012

**Secondary Measurement Standards**

Signal Generator Agilent E4438C	-506 MY55182336	June 7, 2012
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**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**

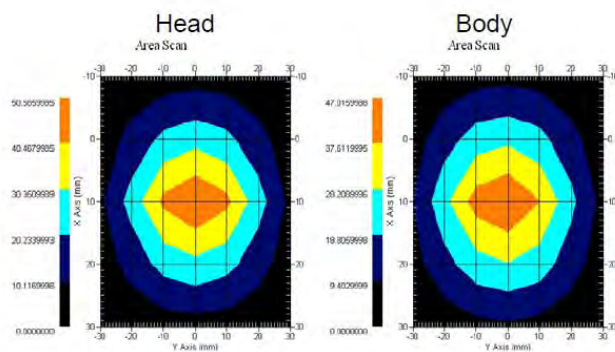
**Length:** 67.1 mm  
**Height:** 38.9 mm

**Electrical Specification**

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	1900MHz	1.0417 U	-35.395dB	49.020 $\Omega$
Body	1900MHz	1.1177 U	-25.424dB	55.435 $\Omega$

**System Validation Results**

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	1900 MHz	39.648	20.311	73.365
Body	1900 MHz	39.769	20.176	75.866



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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-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

**References**

SSI-TP-018-ALSAS Dipole Calibration Procedure  
SSI-TP-016 Tissue Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

**Conditions**

Dipole 210-00710 was new taken from stock.

**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
68.0 mm	39.5 mm	67.1mm	38.9 mm

**Electrical Validation**

Tissue Type	Return Loss:	SWR:	Impedance:
Head	-29.360 dB	1.0732 U	47.869 $\Omega$
Body	-22.799 dB	1.1566 U	48.022 $\Omega$

**Tissue Validation**

	Dielectric constant, $\epsilon_r$	Conductivity, $\sigma$ [S/m]
Head Tissue 1900MHz	38.4	1.43
Body Tissue 1900MHz	51.87	1.59

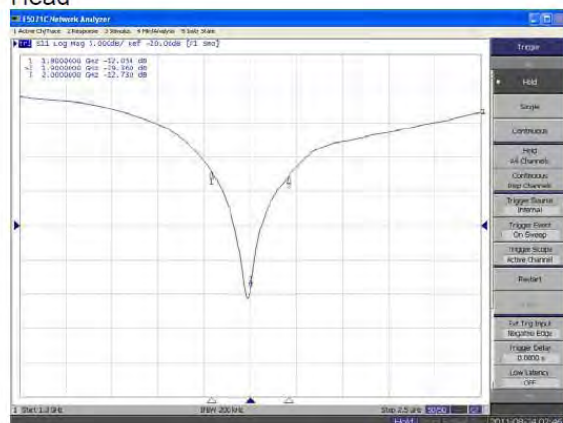
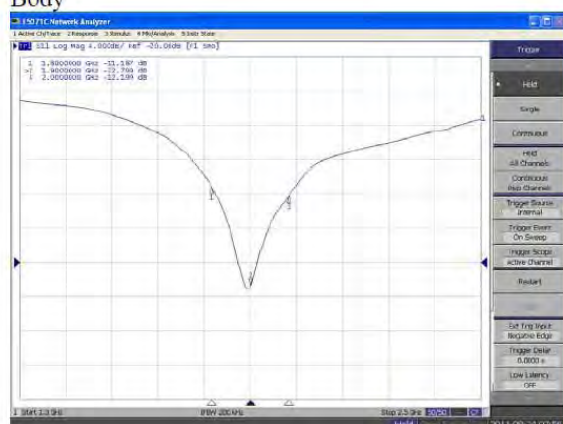
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The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss****Head****Body**

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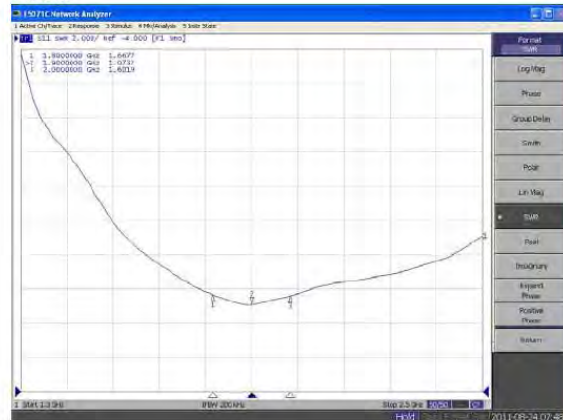
6

## NCL Calibration Laboratories

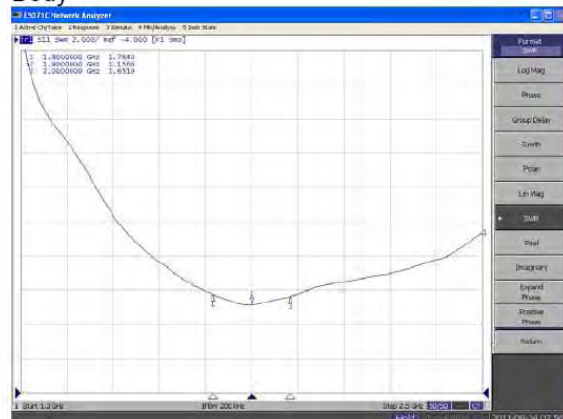
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### SWR

#### Head



#### Body



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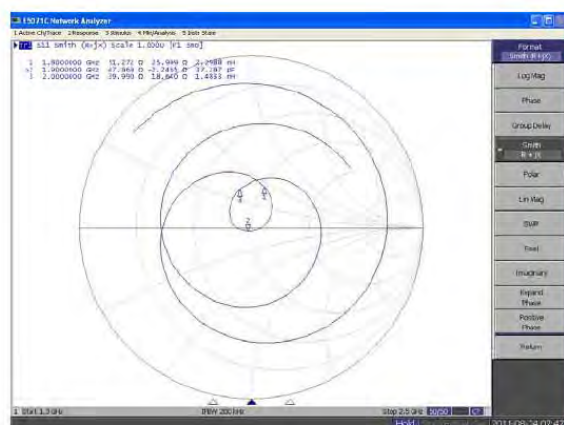


## NCL Calibration Laboratories

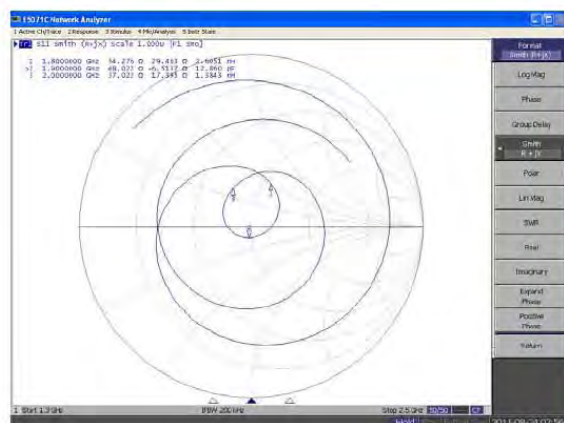
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### Smith Chart Dipole Impedance

Head



Body



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**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 2011

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## 1900MHz Dipole Calibration By BACL at 2013-12-20

### Mechanical Verification

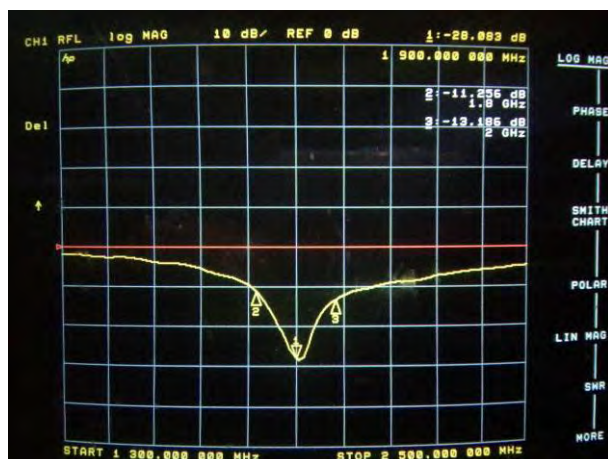
APREL Length	APREL Height	Measured Length	Measured Height
68.0 mm	39.4 mm	68.3 mm	39.2 mm

Tissue Type	Measured Return Loss	Measured Impedance
Head	-28.083 dB	47.477 $\Omega$
Body	-22.022 dB	48.076 $\Omega$

### Test Graphs:

#### Head Tissue

Return Loss :

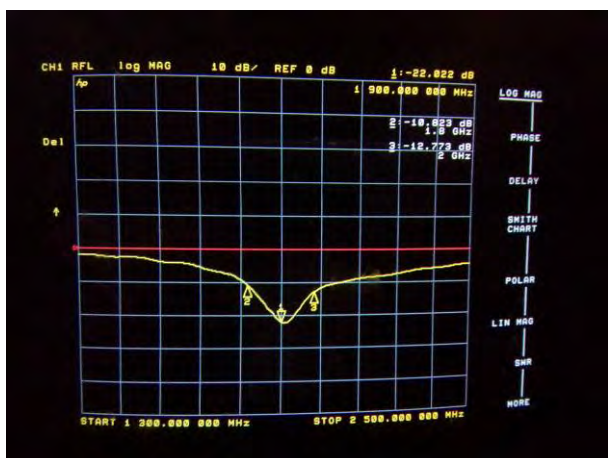


Impedance :



#### Body Tissue

Return Loss :



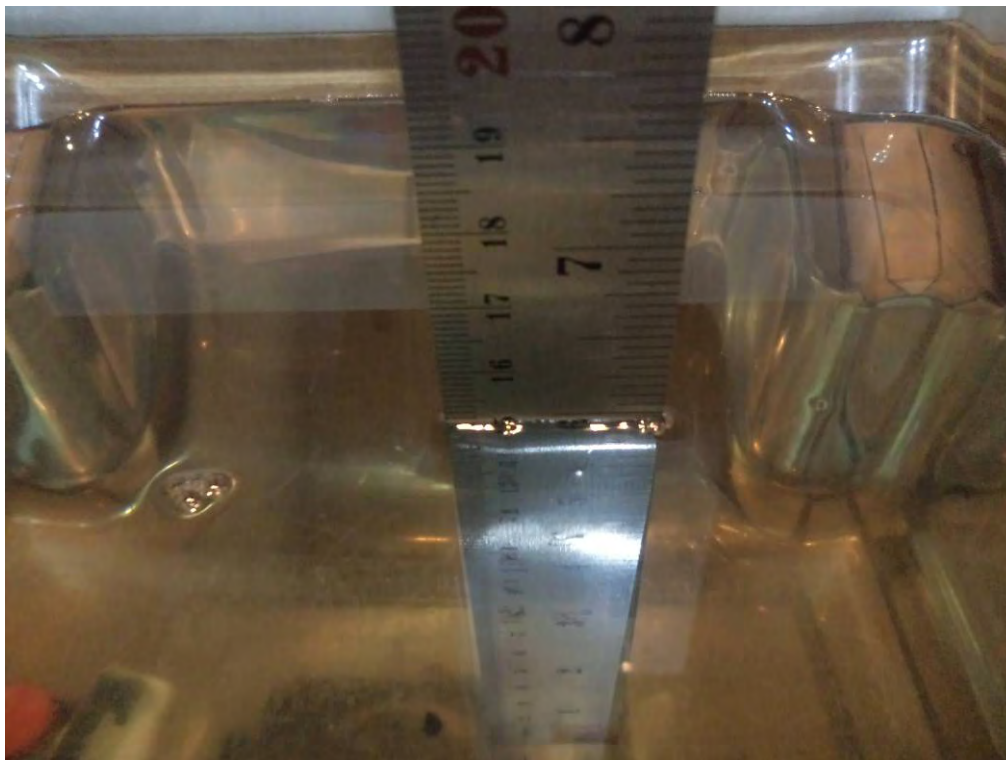
Impedance :



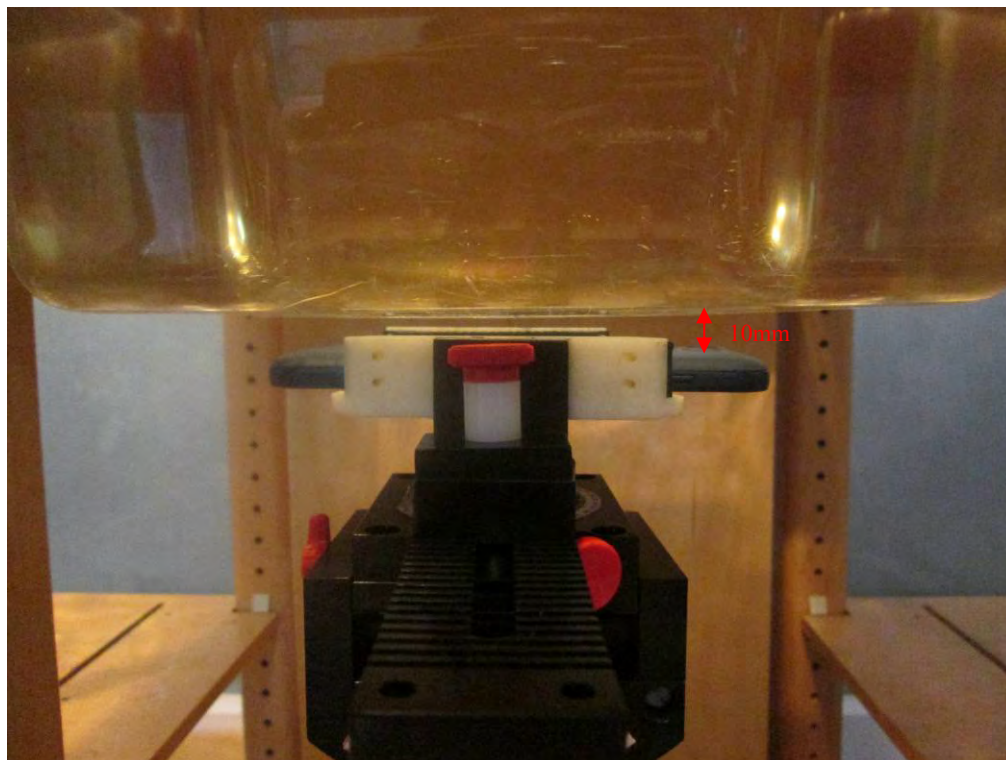


## APPENDIX D EUT TEST POSITION PHOTOS

Liquid depth  $\geq 15\text{cm}$



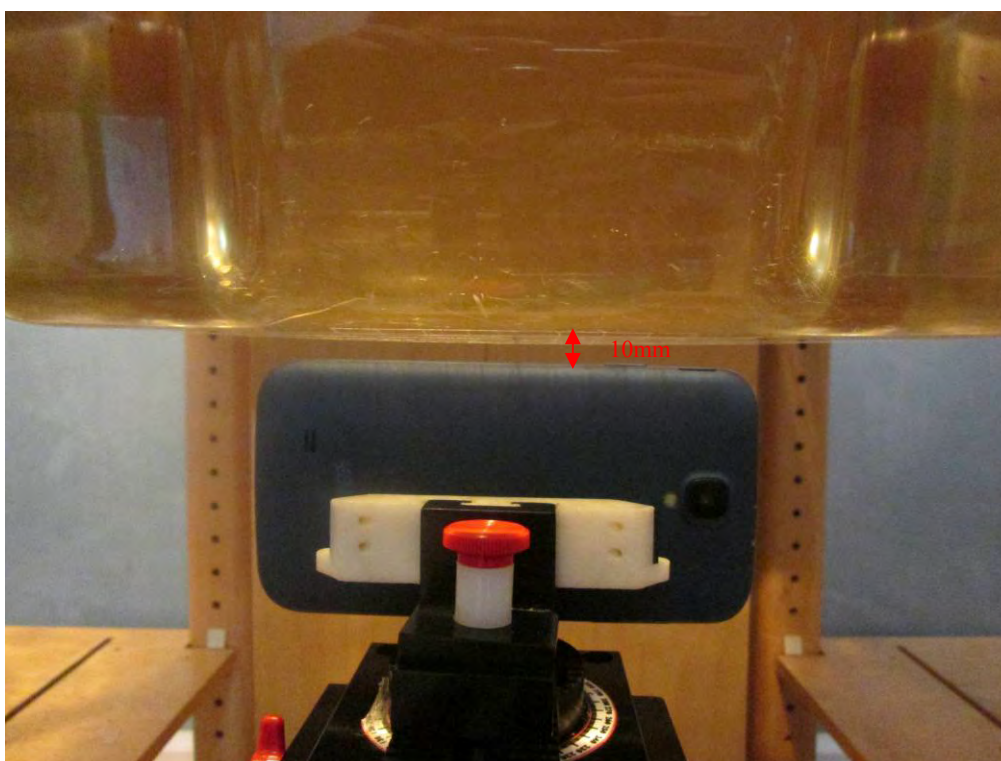
Body-worn Back Setup Photo (10mm)



**Body-worn Left Setup Photo (10mm)**

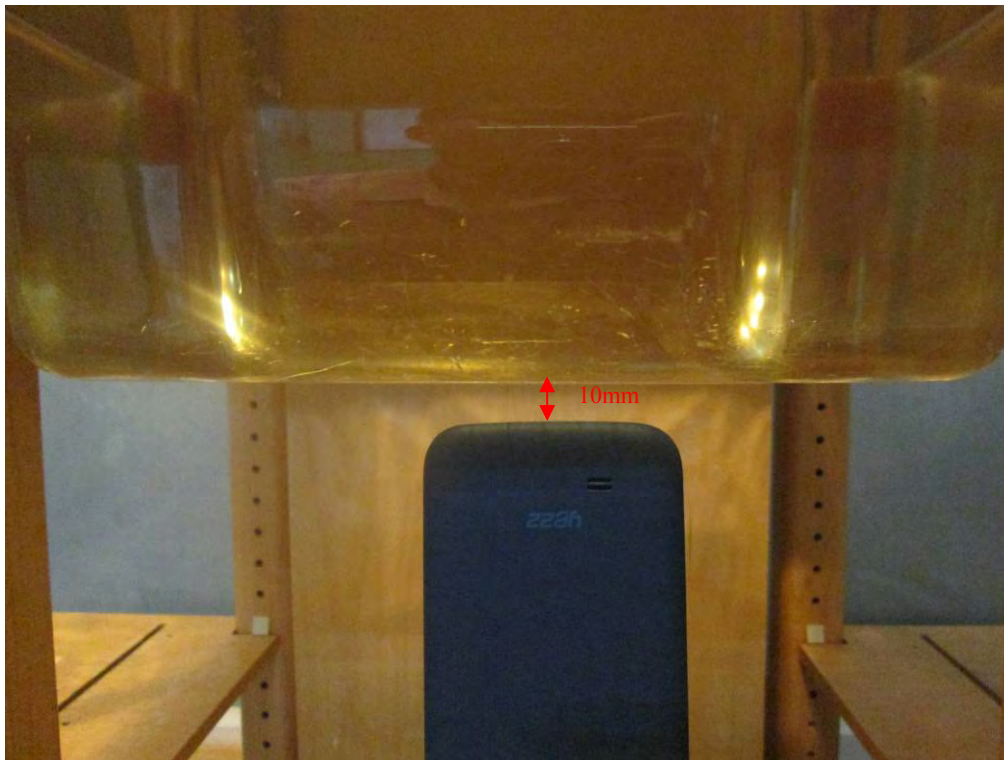


**Body-worn Right Setup Photo (10mm)**

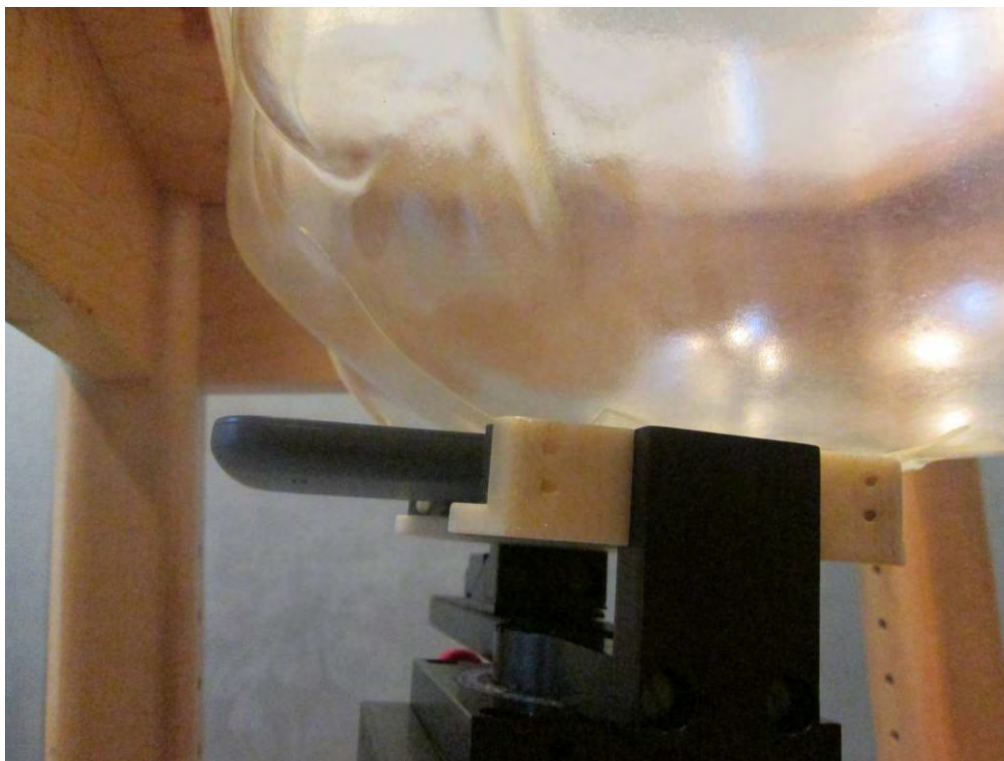




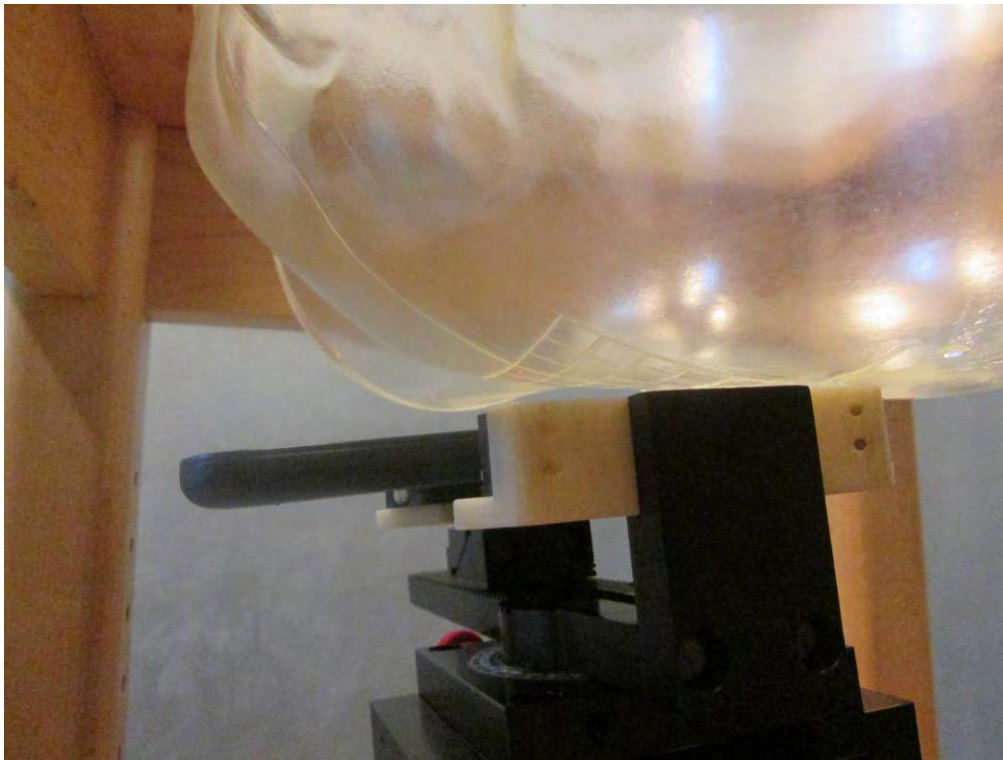
**Body-worn Bottom Setup Photo (10mm)**



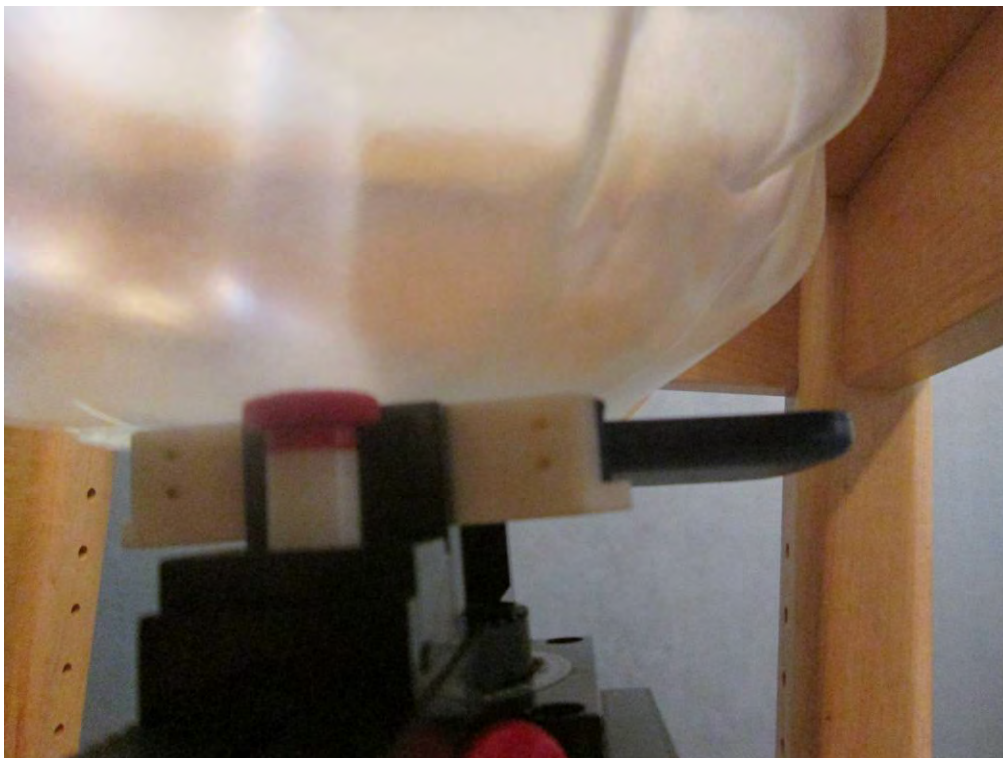
**Left Head Touch Setup Photo**



**Left Head Tilt Setup Photo**



**Right Head Touch Setup Photo**



**Right Head Tilt Setup Photo**





## APPENDIX E EUT PHOTOS

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**EUT – Front View**



**EUT – Back View**



**EUT –Left Side View**



**EUT – Right Side View**





**EUT – Top View**



**EUT – Bottom View**



## APPENDIX F – DECLARATION LETTERS



DDM Brands LLC  
1616NW, 84<sup>TH</sup> Ave. Miami, Florida, U.S.A  
Tel: +13057750325 Fax: +13057750325

2014-6-27

### Product Similarity Declaration Letter

To Whom It May Concern,

We, DDM Brands LLC hereby declare that our product Andy 5EI 3G mobile phone, the model ANDY 5EI , A5EI, A5EIBK, ANDY C5EI, AC5EI and AC5EIBK are electrically identical, they have the same PCB layout and schematic, the only difference is the model number for the purpose of market.

Model ANDY 5EI was tested by BACL.

Please contact me if you have any question.

Signature:

A handwritten signature in dark ink, appearing to read 'Felipe Wang', written over a light background.

Felipe Wang

Project manager

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## APPENDIX G INFORMATIVE REFERENCES

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- [6] ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.
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- [13] NIS81 NAMAS, \The treatment of uncertainty in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.
- [14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10.

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