

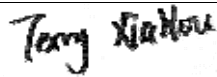
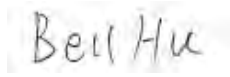
# SAR EVALUATION REPORT

For

## Sky Phone LLC

1348 Washington Av., Suite 350 , Miami Beach, Florida, United States

**FCC ID: 2ABOSGCSKY40D**

<b>Report Type:</b> Original Report	<b>Product Type:</b> WCDMA Mobile Phone
<b>Test Engineer:</b> Terry XiaHou	
<b>Report Number:</b> RSZ150604014-20	
<b>Report Date:</b> 2015-06-12	
<b>Reviewed By:</b> SAR Engineer	
<b>Prepared By:</b> Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 <a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a>	

Attestation of Test Results		
EUT Information	Company Name	Sky Phone LLC
	EUT Description	WCDMA Mobile Phone
	FCC ID	2ABOSGCSKY40D
	Model Number	SKY 4.0D
	Test Date	2015-06-11
Frequency	Max. SAR Level(s) Reported	Limit(W/Kg)
GSM 850	0.690 W/kg 1g Head SAR 1.072 W/kg 1g Body SAR	1.6
PCS 1900	0.458 W/kg 1g Head SAR 0.872 W/kg 1g Body SAR	
WCDMA 850	0.288 W/kg 1g Head SAR 0.506 W/kg 1g Body SAR	
WCDMA 1700	0.351 W/kg 1g Head SAR 0.690 W/kg 1g Body SAR	
WCDMA 1900	0.346 W/kg 1g Head SAR 0.679 W/kg 1g Body SAR	
Simultaneous	1.062 W/kg 1g Head SAR 1.258 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	
	IEC62209-2:2010 Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)	
	KDB procedures KDB 447498 D01 General RF Exposure Guidance v05r02. KDB 648474 D04 Handset SAR v01r02. KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03 KDB 865664 D02 RF Exposure Reporting v01r01 KDB 941225 D01 3G SAR Procedures v03 KDB 941225 D06 Hotspot Mode v02	
<b>Note:</b> This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures.		
<b>The results and statements contained in this report pertain only to the device(s) evaluated.</b>		

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**DOCUMENT REVISION HISTORY**

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Revision Number	Report Number	Description of Revision	Date of Revision
0	RSZ150604014-20	Original Report	2015-06-12

## EUT DESCRIPTION

This report has been prepared on behalf of Sky Phone LLC and their product, FCC ID: 2ABOSGCSKY40D, Model: SKY 4.0D or the EUT (Equipment under Test) as referred to in the rest of this report.

## 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>	Class12
<b>Operation Mode :</b>	GSM Voice, GPRS, WCDMA, Wi-Fi and Bluetooth
<b>Frequency Band:</b>	GSM 850 : 824-849 MHz(TX) ; 869-894 MHz(RX) PCS 1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) WCDMA850: 824-849 MHz(TX) ; 869-894 MHz(RX) WCDMA 1700: 1710-1755 MHz(TX) ; 2110-2155 MHz(RX) WCDMA1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) Wi-Fi(802.11b/g/n20): 2412MHz-2472MHz Wi-Fi(802.11n40): 2422MHz-2462MHz Bluetooth : 2402MHz-2480MHz
<b>Conducted RF Power:</b>	GSM 850 : 32.09 dBm PCS 1900: 29.53 dBm WCDMA 850: 22.29 dBm WCDMA 1900: 21.66 dBm WCDMA 1700:21.87 dBm Wi-Fi(802.11b/g/n20/n40): 9.47 dBm BT3.0: 1.73 dBm BLE: -6.42 dBm
<b>Dimensions (L*W*H):</b>	125 mm (L)×63 mm (W)×10 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 1.6W/kg (FCC) & 2 W/kg (CE) applied to the EUT.



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## 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

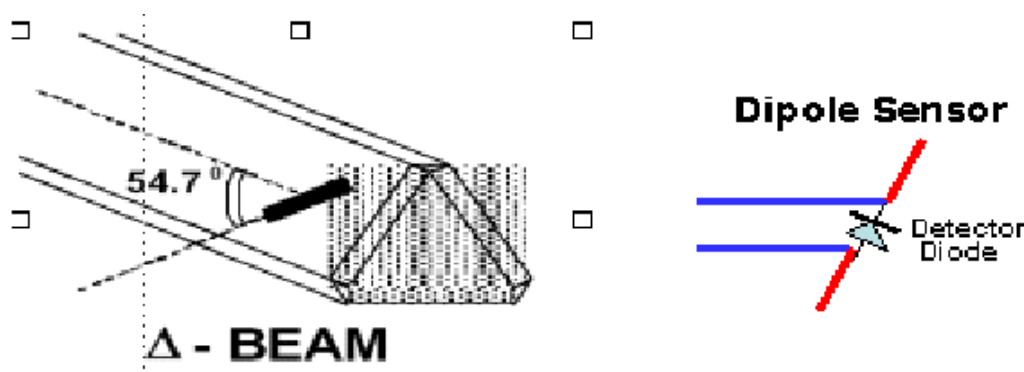
The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

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

## 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.

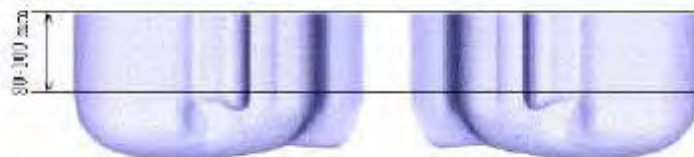


### Phantom Types

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



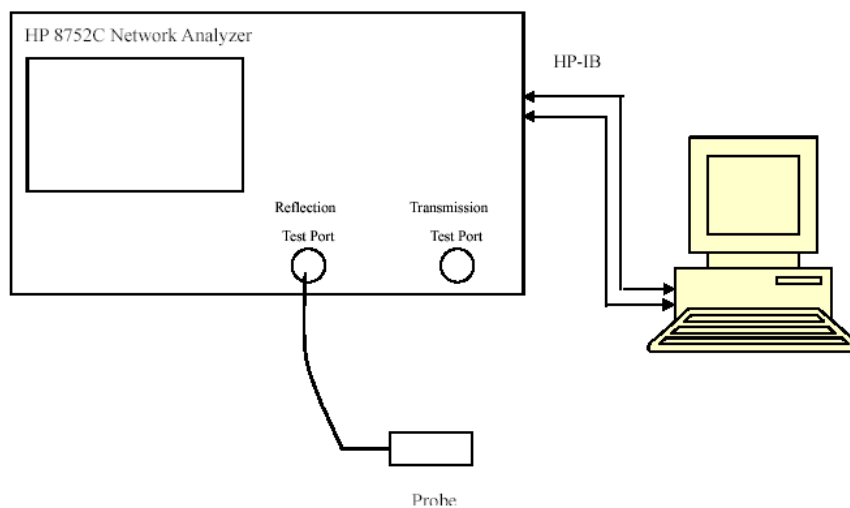
## EQUIPMENT LIST AND CALIBRATION

### 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	2014-10-14	110-00212
Miniature E-Field Probe	ALS-E-020	2014-10-14	500-00283
Dipole, 835MHz	ALS-D-835-S-2	2014-10-08	180-00558
Dipole, 1750MHz	ALS-D-1750-S-2	2013-10-08	198-00304
Dipole, 1900MHz	ALS-D-1900-S-2	2014-10-09	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 1750 MHz Head	ALS-TS-1750-H	Each Time	295-01103
Simulated Tissue 1750 MHz Body	ALS-TS-1750-B	Each Time	295-02102
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
Directional couple	DC6180A	N/A	0325849
Power Amplifier	5S1G4	N/A	71377
Dielectric probe kit	HP85070B	N/A	N/A
Attenuator	3dB	2015-05-07	5402
Network analyzer	8752C	2014-06-03	3410A02356
Synthesized Sweeper	HP 8341B	2014-06-03	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	2014-11-23	106891
EMI Test Receiver	ESCI	2014-06-13	101746

## 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	53.79	0.95	55.20	0.97	-2.554	-2.062	$\pm 5$
826.4	Head	41.06	0.91	41.50	0.90	-1.060	1.111	$\pm 5$
	Body	53.77	0.95	55.20	0.97	-2.591	-2.062	$\pm 5$
836.6	Head	41.02	0.92	41.50	0.90	-1.157	2.222	$\pm 5$
	Body	53.83	0.96	55.20	0.97	-2.482	-1.031	$\pm 5$
846.6	Head	41.08	0.91	41.50	0.90	-1.012	1.111	$\pm 5$
	Body	53.81	0.97	55.20	0.97	-2.518	0.000	$\pm 5$
848.8	Head	41.06	0.92	41.50	0.90	-1.060	2.222	$\pm 5$
	Body	53.87	0.97	55.20	0.97	-2.409	0.000	$\pm 5$
1712.4	Head	39.35	1.38	40.08	1.37	-1.821	0.730	$\pm 5$
	Body	51.93	1.49	53.43	1.49	-2.807	0.000	$\pm 5$
1732.4	Head	39.42	1.36	40.08	1.37	-1.647	-0.730	$\pm 5$
	Body	51.83	1.50	53.43	1.49	-2.995	0.671	$\pm 5$
1752.6	Head	39.42	1.41	40.08	1.37	-1.647	2.920	$\pm 5$
	Body	51.92	1.53	53.43	1.49	-2.826	2.685	$\pm 5$
1850.2	Head	39.64	1.37	40.00	1.40	-0.900	-2.143	$\pm 5$
	Body	51.98	1.48	53.30	1.52	-2.477	-2.632	$\pm 5$
1852.4	Head	39.55	1.37	40.00	1.40	-1.125	-2.143	$\pm 5$
	Body	51.93	1.49	53.30	1.52	-2.570	-1.974	$\pm 5$
1880.0	Head	39.69	1.39	40.00	1.40	-0.775	-0.714	$\pm 5$
	Body	52.07	1.52	53.30	1.52	-2.308	0.000	$\pm 5$
1907.6	Head	39.57	1.41	40.00	1.40	-1.075	0.714	$\pm 5$
	Body	51.94	1.53	53.30	1.52	-2.552	0.658	$\pm 5$
1909.8	Head	39.65	1.42	40.00	1.40	-0.875	1.429	$\pm 5$
	Body	52.03	1.53	53.30	1.52	-2.383	0.658	$\pm 5$

\*Liquid Verification was performed on 2015-06-11.

Please refer to the following tables.

835 MHz Head				835 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
824.0	41.0500	19.6672		824.0	53.7901	20.7091
824.5	41.0613	19.7358		824.5	53.8386	20.6465
825.0	41.0852	19.6790		825.0	53.8671	20.7013
825.5	41.0823	19.7013		825.5	53.8680	20.6972
826.0	41.0122	19.7301		826.0	53.7950	20.6171
826.5	41.0606	19.7161		826.5	53.7689	20.6778
827.0	41.0725	19.7498		827.0	53.7795	20.7071
827.5	41.0391	19.6933		827.5	53.8168	20.6761
828.0	41.0008	19.6756		828.0	53.8355	20.6396
828.5	41.0729	19.7268		828.5	53.7678	20.6526
829.0	41.0749	19.7368		829.0	53.8211	20.6132
829.5	41.0052	19.7706		829.5	53.8154	20.6969
830.0	41.0690	19.7729		830.0	53.8591	20.6789
830.5	41.0168	19.7493		830.5	53.8702	20.6952
831.0	41.0677	19.7729		831.0	53.7852	20.6178
831.5	41.0002	19.7198		831.5	53.7881	20.6456
832.0	41.0403	19.7658		832.0	53.8024	20.6838
832.5	41.0057	19.7645		832.5	53.7888	20.7005
833.0	41.0724	19.7217		833.0	53.7735	20.6249
833.5	41.0984	19.6996		833.5	53.8716	20.6748
834.0	41.0121	19.7401		834.0	53.8125	20.6296
834.5	41.0303	19.7421		834.5	53.7942	20.7105
835.0	41.0617	19.7098		835.0	53.7789	20.6376
835.5	41.0241	19.7545		835.5	53.8311	20.7044
836.0	41.0442	19.7507		836.0	53.7945	20.6741
836.5	41.0484	19.7190		836.5	53.8694	20.7050
837.0	41.0638	19.7272		837.0	53.7752	20.6354
837.5	41.0102	19.6972		837.5	53.8572	20.7094
838.0	41.0827	19.7253		838.0	53.7886	20.6469
838.5	41.0784	19.6696		838.5	53.7844	20.6467
839.0	41.0723	19.7368		839.0	53.8527	20.6156
839.5	41.0035	19.7026		839.5	53.7665	20.7001
840.0	41.0882	19.4333		840.0	53.8136	20.6400
840.5	41.0148	19.3782		840.5	53.8682	20.6330
841.0	41.0983	19.4502		841.0	53.8384	20.7107
841.5	41.0072	19.3742		841.5	53.8412	20.6592
842.0	41.0929	19.4085		842.0	53.8510	20.6328
842.5	41.0078	19.4461		842.5	53.7918	20.6608
843.0	41.0119	19.4087		843.0	53.8592	20.6747
843.5	41.0202	19.4118		843.5	53.8678	20.6616
844.0	41.0207	19.4190		844.0	53.8155	20.7004
844.5	41.0643	19.4559		844.5	53.7923	20.7082
845.0	41.0770	19.4261		845.0	53.8479	20.7052
845.5	41.0867	19.3757		845.5	53.7835	20.6194
846.0	41.0264	19.4519		846.0	53.8574	20.6488
846.5	41.0797	19.4309		846.5	53.8073	20.6829
847.0	40.9981	19.4715		847.0	53.8064	20.7097
847.5	41.0556	19.4724		847.5	53.8051	20.6259
848.0	41.0137	19.4322		848.0	53.8120	20.6906
848.5	41.0100	19.4361		848.5	53.8706	20.6987
849.0	41.0598	19.4253		849.0	53.8699	20.6348

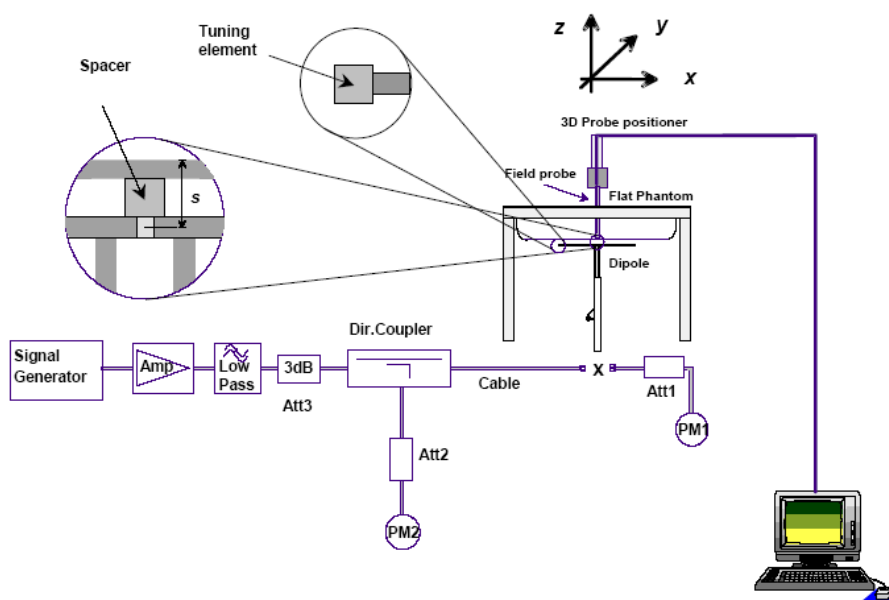
1750 MHz Head				1750 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1710.0	39.2489	14.4409		1710.0	51.9210	15.7063
1711.5	39.4787	14.5415		1711.5	52.0898	15.5613
1713.0	39.2288	14.3710		1713.0	52.1619	15.5462
1714.5	39.1504	14.2893		1714.5	52.2818	15.5855
1716.0	39.1369	14.5262		1716.0	52.4800	15.7060
1717.5	39.4869	14.5469		1717.5	52.6990	15.7772
1719.0	39.5183	14.3869		1719.0	52.3732	15.7068
1720.5	39.1082	14.1456		1720.5	52.2781	15.5875
1722.0	39.3387	14.1325		1722.0	52.2695	15.6008
1723.5	39.5076	14.2746		1723.5	52.2158	15.5342
1725.0	39.1475	14.3350		1725.0	52.4600	15.6465
1726.5	39.5784	14.2945		1726.5	52.3698	15.6190
1728.0	39.3727	14.2460		1728.0	52.1438	15.4919
1729.5	39.4302	14.4863		1729.5	52.2880	15.5379
1731.0	39.1261	14.1263		1731.0	52.1937	15.5266
1732.5	39.4190	14.1385		1732.5	52.5534	15.7503
1734.0	39.5660	14.1327		1734.0	52.5889	15.7358
1735.5	39.2780	14.4851		1735.5	52.1230	15.4825
1737.0	39.3089	14.1170		1737.0	52.0029	15.4192
1738.5	39.4187	14.4757		1738.5	52.3126	15.5597
1740.0	39.5096	14.5761		1740.0	52.5416	15.7159
1741.5	39.5836	14.3242		1741.5	52.3556	15.5669
1743.0	39.3003	14.3379		1743.0	52.1811	15.5034
1744.5	39.4404	14.2295		1744.5	52.5739	15.7673
1746.0	39.3999	14.5611		1746.0	52.6213	15.7694
1747.5	39.5514	14.2510		1747.5	52.2910	15.6522
1749.0	39.1593	14.3977		1749.0	51.9388	15.4463
1750.5	39.3889	14.5239		1750.5	51.9850	15.5049
1752.0	39.4077	14.4832		1752.0	52.5624	15.8026
1753.5	39.4516	14.3832		1753.5	52.6873	15.7853
1755.0	39.1417	14.3773		1755.0	52.4572	15.7096
1756.5	39.4188	14.1455		1756.5	52.3293	15.6401
1758.0	39.4946	14.3699		1758.0	52.5245	15.7111
1759.5	39.5870	14.2472		1759.5	52.6102	15.7639
1761.0	39.2450	14.5697		1761.0	52.3919	15.7252
1762.5	39.4279	14.5833		1762.5	52.4466	15.6620
1764.0	39.3108	14.1576		1764.0	52.7221	15.8530
1765.5	39.1816	14.2157		1765.5	52.6741	15.7972
1767.0	39.5315	14.2253		1767.0	52.5483	15.7545
1768.5	39.5289	14.1416		1768.5	52.3531	15.7437
1770.0	39.2902	14.5224		1770.0	52.5950	15.7495
1771.5	39.4283	14.4607		1771.5	52.6456	15.7515
1773.0	39.5107	14.1488		1773.0	52.3546	15.6818
1774.5	39.1578	14.4825		1774.5	52.3208	15.6430
1776.0	39.6422	14.4598		1776.0	52.6550	15.7872
1777.5	39.2525	14.4700		1777.5	52.7254	15.8787
1779.0	39.6432	14.1802		1779.0	52.6610	15.7959
1780.5	39.2926	14.3640		1780.5	52.4856	15.7328
1782.0	39.1346	14.3572		1782.0	52.6089	15.8156
1783.5	39.2170	14.5534		1783.5	52.7747	15.9088
1785.0	39.3414	14.0862		1785.0	52.8093	15.8736

1900 MHz Head				1900 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1850.0	39.6415	13.3148		1850.0	51.9793	14.4285
1851.2	39.5611	13.3569		1851.2	51.9688	14.5324
1852.4	39.5527	13.3013		1852.4	51.9277	14.4708
1853.6	39.7223	13.3065		1853.6	51.8261	14.4730
1854.8	39.6512	13.4345		1854.8	52.0637	14.5641
1856.0	39.6164	13.2517		1856.0	51.8651	14.4837
1857.2	39.6105	13.2391		1857.2	51.7912	14.5178
1858.4	39.6169	13.3139		1858.4	52.0194	14.4426
1859.6	39.7423	13.3768		1859.6	52.0925	14.5003
1860.8	39.6807	13.4246		1860.8	51.8093	14.4888
1862.0	39.6219	13.3953		1862.0	51.8549	14.4145
1863.2	39.6145	13.2690		1863.2	51.7511	14.4149
1864.4	39.6896	13.2579		1864.4	51.9851	14.5706
1865.6	39.6116	13.3115		1865.6	51.8607	14.5795
1866.8	39.5717	13.3368		1866.8	51.9469	14.5102
1868.0	39.5776	13.3563		1868.0	52.0677	14.4455
1869.2	39.6599	13.2526		1869.2	52.0479	14.4705
1870.4	39.6231	13.2483		1870.4	52.1007	14.4831
1871.6	39.6851	13.2559		1871.6	52.0029	14.4391
1872.8	39.5548	13.2778		1872.8	52.0184	14.4324
1874.0	39.6749	13.3464		1874.0	51.9047	14.4355
1875.2	39.6385	13.3738		1875.2	52.0496	14.5572
1876.4	39.6772	13.2473		1876.4	52.0059	14.4977
1877.6	39.6815	13.2493		1877.6	52.0691	14.5765
1878.8	39.6804	13.3465		1878.8	51.9424	14.5748
1880.0	39.6908	13.3122		1880.0	52.0696	14.5002
1881.2	39.6775	13.3684		1881.2	51.9688	14.5744
1882.4	39.6467	13.3506		1882.4	51.9755	14.4848
1883.6	39.5438	13.4236		1883.6	52.0382	14.5142
1884.8	39.7237	13.3622		1884.8	51.8193	14.4331
1886.0	39.6914	13.2651		1886.0	51.7698	14.5387
1887.2	39.6423	13.3903		1887.2	51.9189	14.4193
1888.4	39.5585	13.3896		1888.4	51.9334	14.4923
1889.6	39.6853	13.3975		1889.6	51.9782	14.5075
1890.8	39.6391	13.4069		1890.8	52.0599	14.5416
1892.0	39.6737	13.2877		1892.0	51.8827	14.5592
1893.2	39.6130	13.4329		1893.2	51.9884	14.4430
1894.4	39.5576	13.4215		1894.4	51.7544	14.5006
1895.6	39.6193	13.2753		1895.6	51.8202	14.4792
1896.8	39.5564	13.4343		1896.8	51.8233	14.5636
1898.0	39.5495	13.3952		1898.0	51.8661	14.5257
1899.2	39.6002	13.4190		1899.2	52.0755	14.5425
1900.4	39.6404	13.3641		1900.4	51.9022	14.4813
1901.6	39.6852	13.3603		1901.6	51.7682	14.5323
1902.8	39.6843	13.2992		1902.8	51.7918	14.4882
1904.0	39.5596	13.2885		1904.0	51.8181	14.5203
1905.2	39.6751	13.2797		1905.2	51.9678	14.4157
1906.4	39.6462	13.3040		1906.4	52.0894	14.4655
1907.6	39.5742	13.3125		1907.6	51.9360	14.4201
1908.8	39.6089	13.3792		1908.8	51.7559	14.5341
1910.0	39.6454	13.3739		1910.0	52.0282	14.4371

## 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	2014-10-14	2015-10-13
APREL	Dipole antenna(850MHz)	ALS-D-835-S-2	180-00558	2014-10-08	2017-10-07
APREL	Dipole antenna(1750MHz)	ALS-D-1750-S-2	198-00304	2013-10-08	2016-10-07
APREL	Dipole antenna(1900MHz)	ALS-D-1900-S-2	210-00710	2014-10-09	2017-10-08

### System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2015-06-11	835	Head	1g	9.606	9.773	-1.709	$\pm 10$
		Body	1g	9.351	9.736	-3.954	$\pm 10$
	1750	Head	1g	35.286	37.02	-4.684	$\pm 10$
		Body	1g	35.82	36.65	-2.265	$\pm 10$
	1900	Head	1g	39.771	39.481	0.735	$\pm 10$
		Body	1g	40.239	39.715	1.319	$\pm 10$

\*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 : 9.613 W/kg  
Power Drift-Finish : 9.632W/kg  
Power Drift (%) : 0.198

**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 : 11-Jun-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 41.06 F/m  
Sigma : 0.92 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

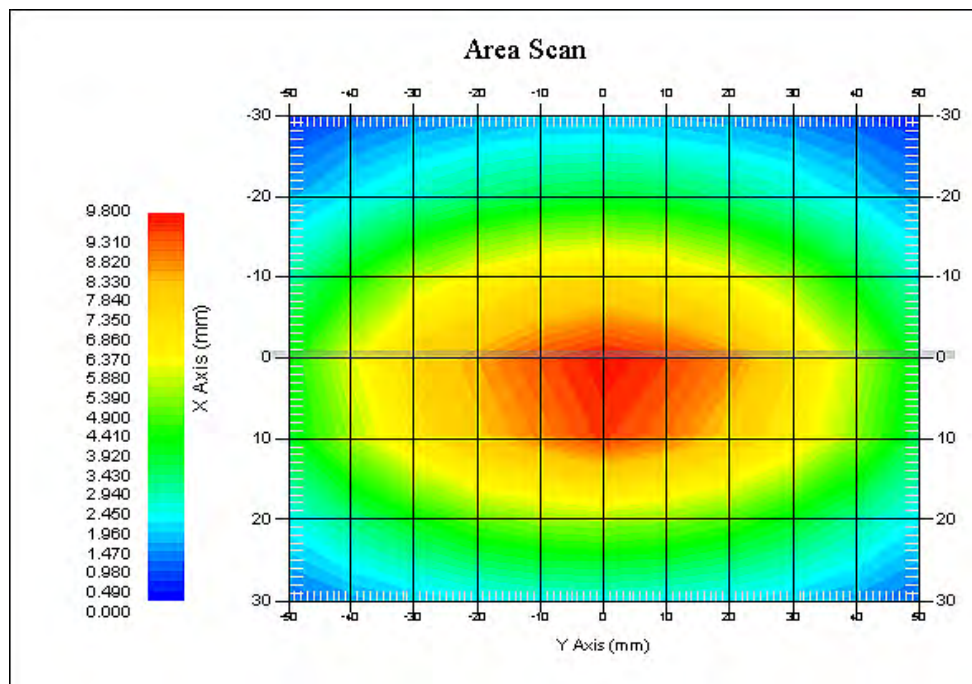
Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 835  
Duty Cycle Factor : 1  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

**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 : 9.606 W/kg  
10 gram SAR value : 6.348 W/kg  
Area Scan Peak SAR : 9.757 W/kg  
Zoom Scan Peak SAR : 16.225 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 : 9.569 W/kg  
Power Drift-Finish : 9.525 W/kg  
Power Drift (%) : -0.460

## 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 : 11-Jun-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 53.78 F/m  
Sigma : 0.96 S/m  
Density : 1000.00 kg/cu. m

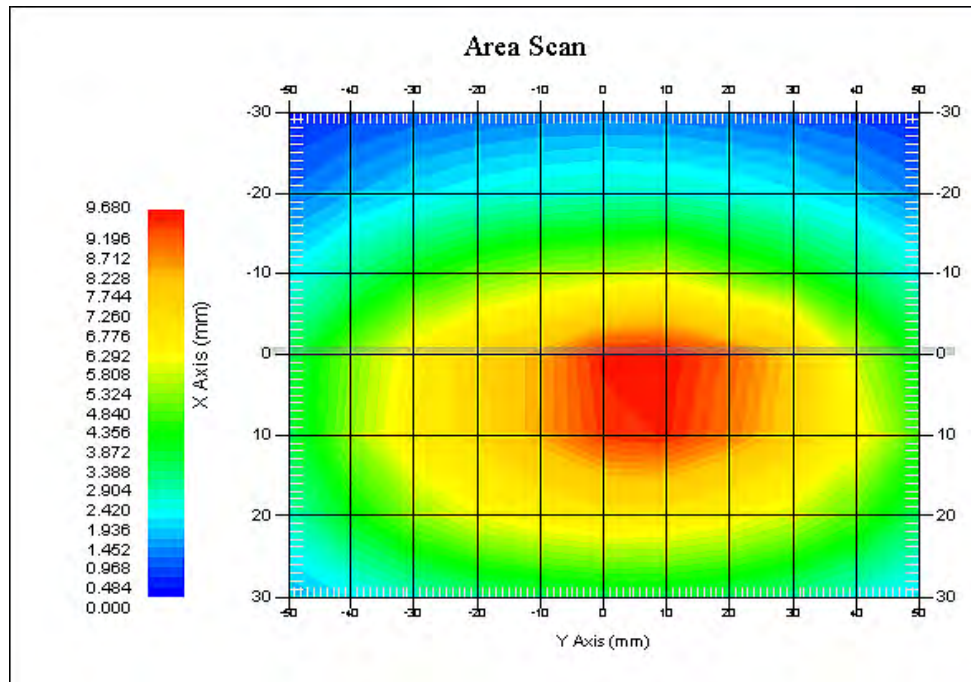
## Probe Data

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
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

## 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 : 9.351 W/kg  
10 gram SAR value : 6.177 W/kg  
Area Scan Peak SAR : 9.642 W/kg  
Zoom Scan Peak SAR : 16.811 W/kg



### 835 MHz System Validation with Body Tissue

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 1750 MHz Head Liquid****Dipole 1750 MHz; Type: ALS-D-1750-S-2; S/N: 198-00304****Product Data**

Device Name : Dipole 1750MHz  
Serial No. : 198-00304  
Type : Dipole  
Model : ALS-D-1750-S-2  
Frequency Band : 1700  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 34.330 W/kg  
Power Drift-Finish : 34.885 W/kg  
Power Drift (%) : 1.617

**Phantom Data**

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

**Tissue Data**

Type : Head  
Serial No. : 295-01101  
Frequency : 1750.00 MHz  
Last Calib. Date : 11-Jun-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 39.39 F/m  
Sigma : 1.41 S/m  
Density : 1000.00 kg/cu. M

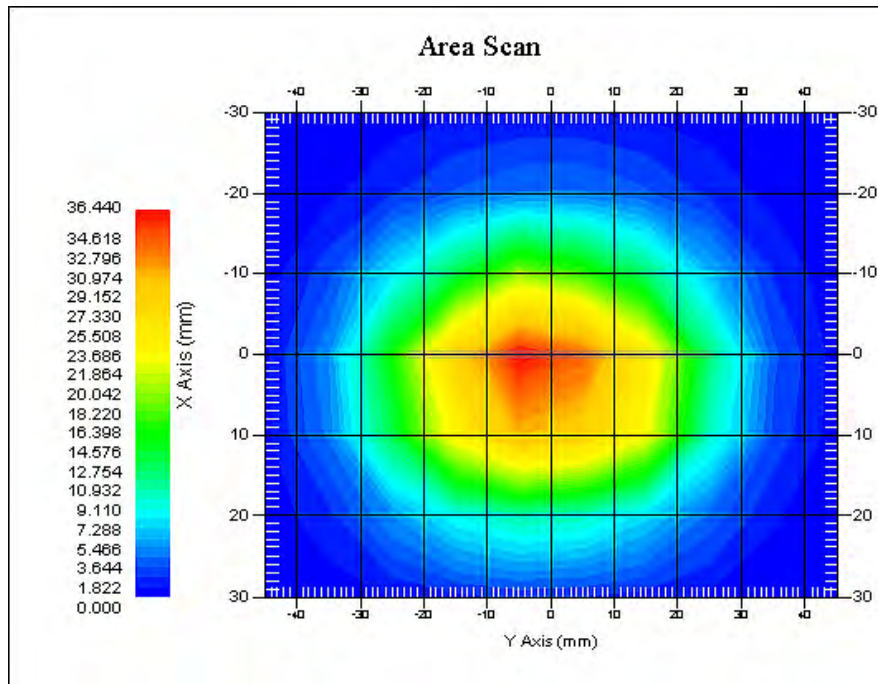
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 1750  
Duty Cycle Factor : 1  
Conversion Factor : 5.4  
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 : 35.286 W/kg  
10 gram SAR value : 19.358 W/kg  
Area Scan Peak SAR : 36.254 W/kg  
Zoom Scan Peak SAR : 63.262 W/kg



### 1750 MHz System Validation with Head Tissue

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 1750 MHz Body Liquid****Dipole 1750 MHz; Type: ALS-D-1750-S-2; S/N: 198-00304****Product Data**

Device Name : Dipole 1750MHz  
Serial No. : 198-00304  
Type : Dipole  
Model : ALS-D-1750-S-2  
Frequency Band : 1700  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 36.719 W/kg  
Power Drift-Finish : 36.042 W/kg  
Power Drift (%) : -1.844

**Phantom Data**

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

**Tissue Data**

Type : Body  
Serial No. : 295-02105  
Frequency : 1750.00 MHz  
Last Calib. Date : 11-Jun-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 51.92 F/m  
Sigma : 1.52 S/m  
Density : 1000.00 kg/cu. m

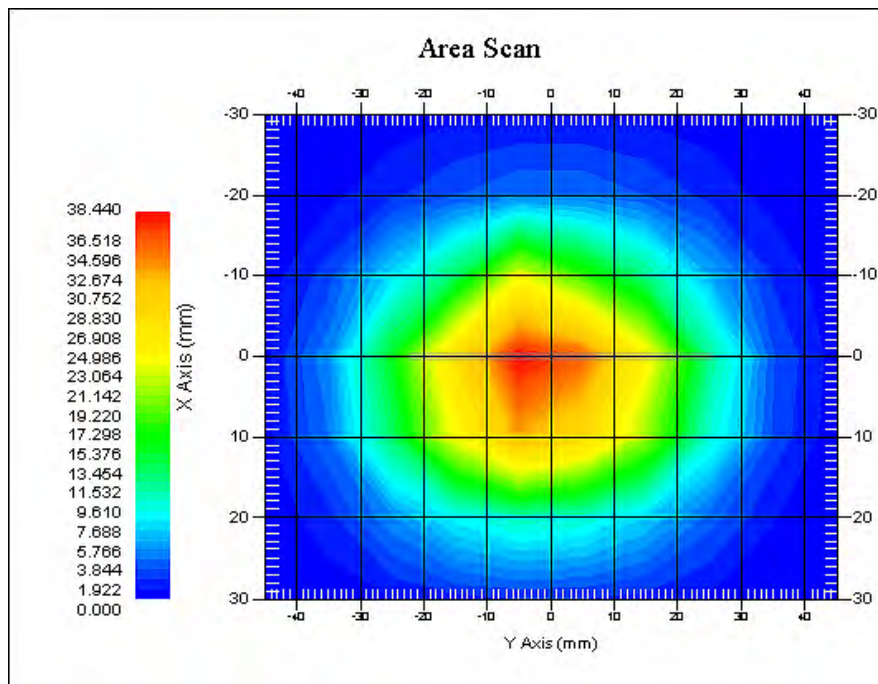
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 1750  
Duty Cycle Factor : 1  
Conversion Factor : 5.3  
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. : 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 : 35.820 W/kg  
10 gram SAR value : 19.802 W/kg  
Area Scan Peak SAR : 38.212 W/kg  
Zoom Scan Peak SAR : 67.545 W/kg



### 1750 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 : 43.661 W/kg  
Power Drift-Finish : 43.319 W/kg  
Power Drift (%) : -0.783

**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 : 11-Jun-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 39.64 F/m  
Sigma : 1.41 S/m  
Density : 1000.00 kg/cu. M

**Probe Data**

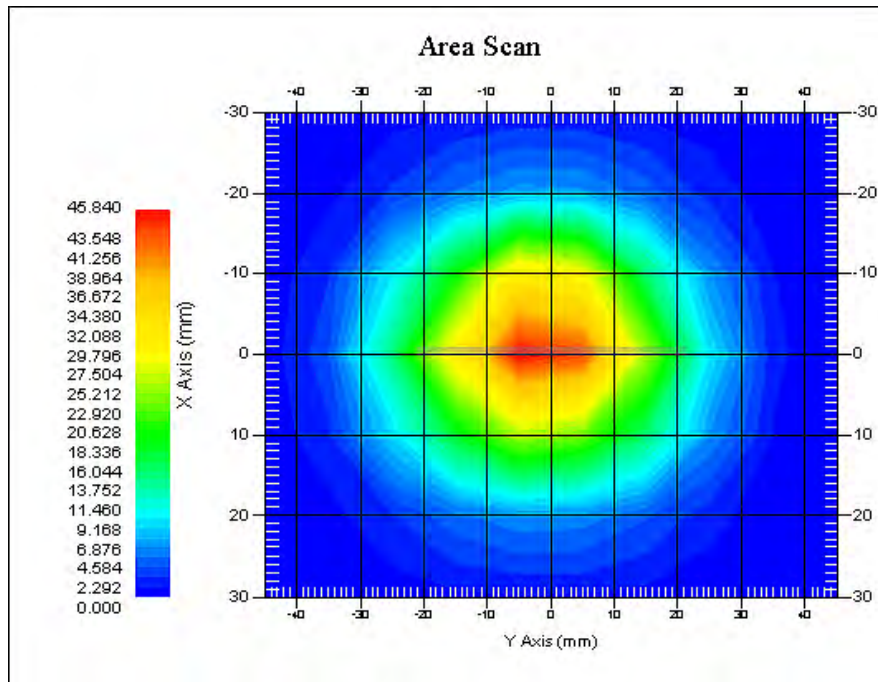
Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.8  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 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 : 39.771 W/kg  
10 gram SAR value : 21.385 W/kg  
Area Scan Peak SAR : 45.773 W/kg  
Zoom Scan Peak SAR : 73.564 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 : 45.302 W/kg  
Power Drift-Finish : 45.964 W/kg  
Power Drift (%) : 1.461

**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 : 11-Jun-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 51.90 F/m  
Sigma : 1.53 S/m  
Density : 1000.00 kg/cu. m

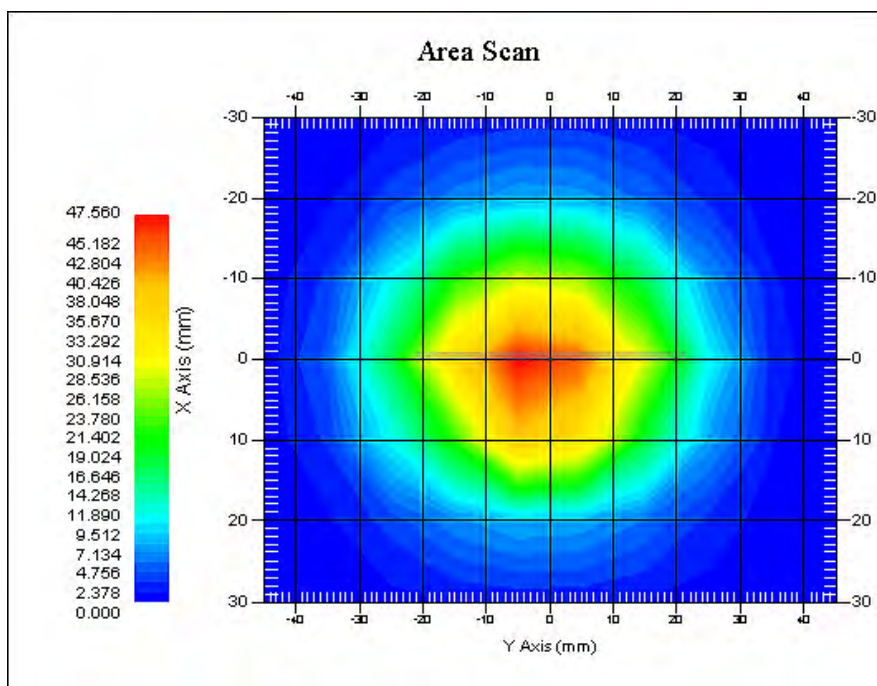
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.5  
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. : 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 : 40.239 W/kg  
10 gram SAR value : 21.586 W/kg  
Area Scan Peak SAR : 47.524 W/kg  
Zoom Scan Peak SAR : 72.838 W/kg



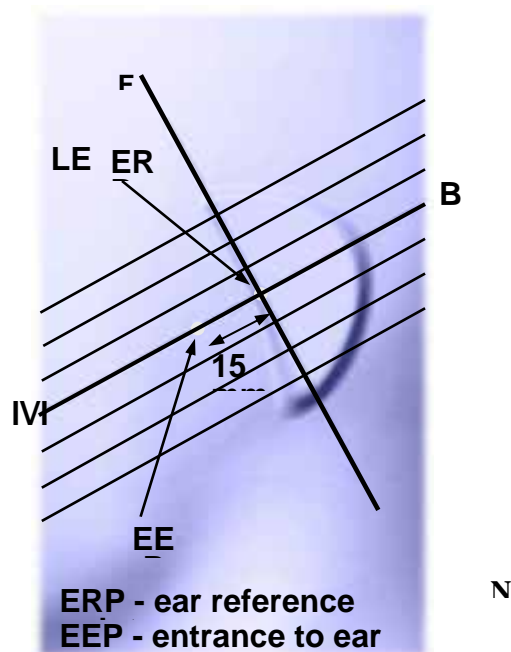
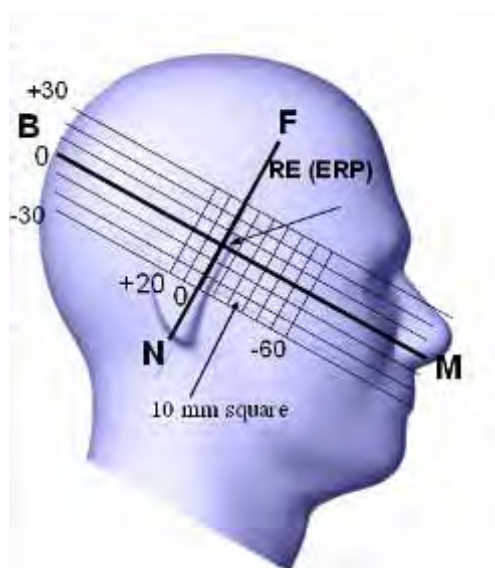
### 1900 MHz System Validation with Body Tissue

## 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 ¼ 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

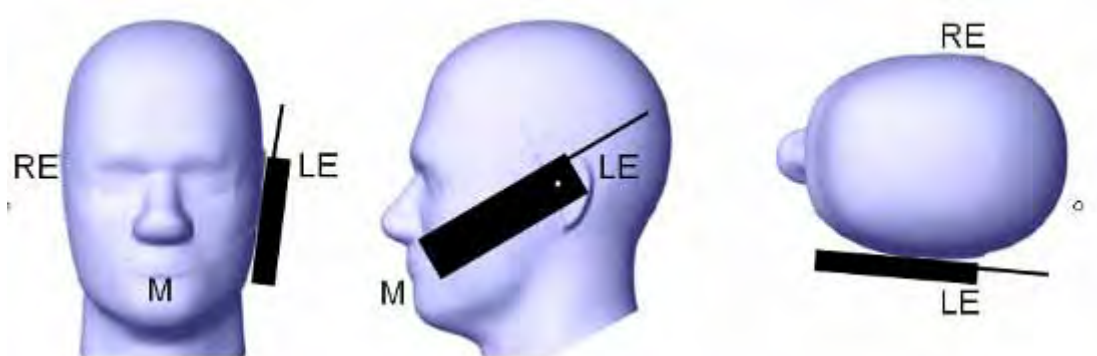
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

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

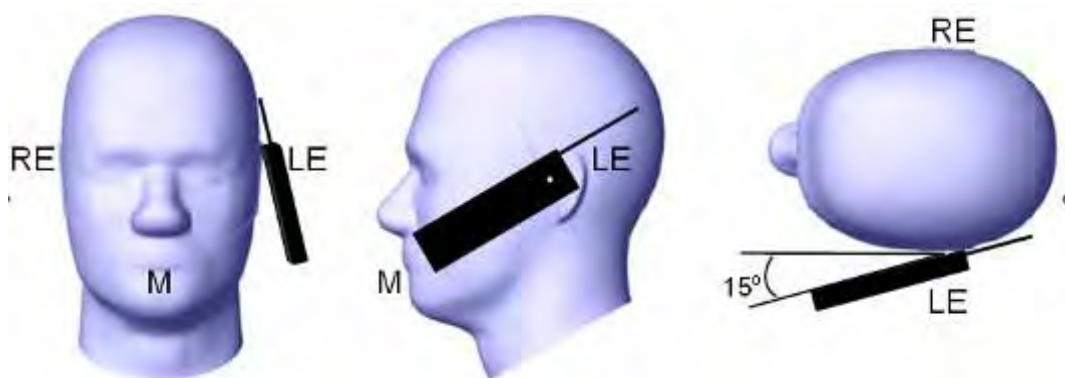
With the handset aligned in the “Cheek/Touch Position”:

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 80°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both “ear reference points” until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously. This test position may require a device holder or positioner to achieve the translation and tilting with acceptable positioning repeatability.

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

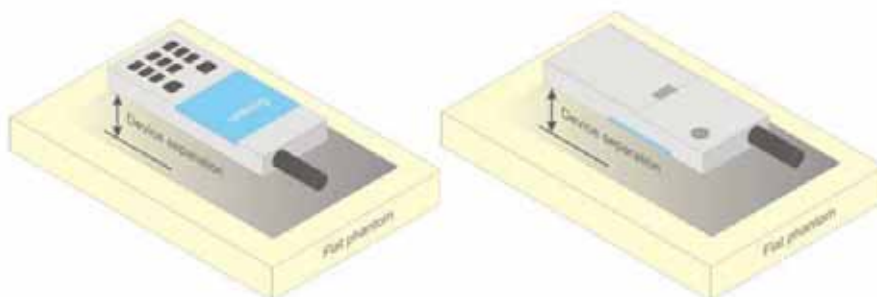
### Ear /Tilt 15° Position



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

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

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



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



## SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

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

Step 3: Around this point, a volume of 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 General RF Exposure Guidance v05r02.  
KDB 648474 D04 Handset SAR v01r02.  
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03  
KDB 865664 D02 RF Exposure Reporting v01r01  
KDB 941225 D01 3G SAR Procedures v03  
KDB 941225 D06 Hotspot Mode v02

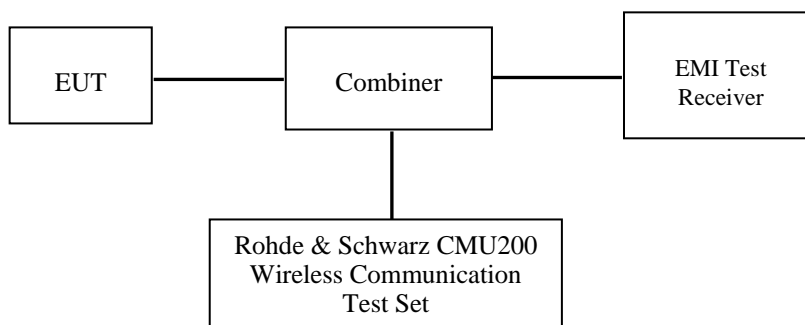
## CONDUCTED OUTPUT POWER MEASUREMENT

### Provision Applicable

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

### Test Procedure

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



### GSM&3G

### Maximum Output Power among production units

Max Target Power for Production Unit (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	32.10	32.10	32.10
GPRS 1 slot	32.10	32.10	32.10
GPRS 2 slot	31.10	31.10	31.10
GPRS 3 slot	29.10	29.10	29.10
GPRS 4 slot	27.90	27.90	27.90
PCS 1900	29.60	29.60	29.60
GPRS 1 slot	28.80	28.80	28.80
GPRS 2 slot	27.80	27.80	27.80
GPRS 3 slot	25.70	25.70	25.70
GPRS 4 slot	24.60	24.60	24.60
WCDMA 850	22.30	22.30	22.30
WCDMA 1700	21.90	21.90	21.90
WCDMA 1900	21.70	21.70	21.70
Wi-Fi(802.11b/g/n20/n40)	9.50	9.50	9.50
BT3.0	1.80	1.80	1.80
BT4.0	-6.40	-6.40	-6.40



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

Band	Frequency (MHz)	Conducted Output Power	
		Meas. Power (dBm)	Meas. Power (W)
GSM 850	824.2	<b>32.09</b>	1.618
	836.6	32.05	1.603
	848.8	31.95	1.567
PCS 1900	1850.2	<b>29.53</b>	0.897
	1880.0	29.43	0.877
	1909.8	29.41	0.873

**GPRS:**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	32.09	<b>31.09</b>	29.03	27.87
	190	836.6	31.95	30.99	29.05	27.86
	251	848.8	32.02	30.95	29.02	27.86
PCS 1900	512	1850.2	28.71	27.78	25.66	24.52
	661	1880.0	28.55	27.61	25.59	24.39
	810	1909.8	28.40	27.44	25.45	24.30

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	23.09	<b>25.09</b>	24.78	24.87
	190	836.6	22.95	24.99	24.80	24.86
	251	848.8	23.02	24.95	24.77	24.86
PCS 1900	512	1850.2	19.71	<b>21.78</b>	21.41	21.52
	661	1880.0	19.55	21.61	21.34	21.39
	810	1909.8	19.40	21.44	21.20	21.30

**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			
	c	2/15	12/15	15/15	15/15
	d	15/15	15/15	8/15	4/15
	d (SF)	64			
	c/ d	2/15	12/15	15/8	15/4
	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			
	$A_{hs} = h_s / c$	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				
	c	11/15	6/15	15/15	2/15	15/15
	d	15/15	15/15	9/15	15/15	0
	ec	209/225	12/15	30/15	2/15	5/15
	c/ d	11/15	6/15	15/9	2/15	-
	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				
	Ahs= hs/ 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	

**HSPA+**

The following tests were conducted according to the test requirements in Table C.11.1.4 of 3GPP TS 34.121-1

Sub-test	$\beta_c$ (Note3)	$\beta_d$	$\beta_{HS}$ (Note1)	$\beta_{ec}$	$\beta_{ed}$ (2xSF2) (Note 4)	$\beta_{ed}$ (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	$\beta_{ed1}$ : 30/15 $\beta_{ed2}$ : 30/15	$\beta_{ed3}$ : 24/15 $\beta_{ed4}$ : 24/15	3.5	2.5	14	105	105
Note 1: $\Delta_{ACK}$ , $\Delta_{NACK}$ and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$ . Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0). Note 3: DPDCH is not configured, therefore the $\beta_c$ is set to 1 and $\beta_d = 0$ by default. Note 4: $\beta_{ed}$ can not be set directly; it is set by Absolute Grant Value. Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.											

**DC-HSDPA**

The following tests were conducted according to the test requirements in Table Table C.8.1.12 of 3GPP TS 34.121-1

**Table C.8.1.12: Fixed Reference Channel H-Set 12**

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload ( $N_{INF}$ )	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

**WCDMA 850**

Mode	3GPP Sub Test	Average Output Power (dBm)		
		Low Channel (Ave. Power)	Middle Channel (Ave. Power)	High Channel (Ave. Power)
Rel 99	1	<b>22.29</b>	22.03	22.12
HSDPA	1	20.54	20.61	20.62
	2	20.59	20.55	20.61
	3	20.61	20.46	20.72
	4	20.47	20.62	20.56
HSUPA	1	20.72	20.46	20.64
	2	20.83	20.51	20.72
	3	20.64	20.62	20.68
	4	20.82	20.43	20.81
	5	20.75	20.41	20.59
DC-HSDPA	1	20.42	20.58	20.43
	2	20.35	20.61	20.31
	3	20.38	20.47	20.52
	4	20.41	20.46	20.63
HSPA+	1	20.36	20.35	20.64

**WCDMA 1700**

Mode	3GPP Sub Test	Average Output Power (dBm)		
		Low Channel (Ave. Power)	Middle Channel (Ave. Power)	High Channel (Ave. Power)
Rel 99	1	21.86	21.81	<b>21.87</b>
HSDPA	1	20.05	19.95	20.29
	2	19.94	19.87	20.24
	3	20.26	20.11	20.62
	4	20.09	19.91	20.24
HSUPA	1	20.02	19.89	20.22
	2	19.95	19.77	20.17
	3	20.16	20.20	20.45
	4	19.95	19.92	20.19
	5	19.89	19.89	20.13
DC-HSDPA	1	20.02	20.05	20.31
	2	20.04	20.06	20.24
	3	19.98	19.99	20.36
	4	19.76	20.04	20.18
HSPA+	1	19.81	19.87	20.14

**WCDMA 1900**

Mode	3GPP Sub Test	Average Output Power (dBm)		
		Low Channel (Ave. Power)	Middle Channel (Ave. Power)	High Channel (Ave. Power)
Rel 99	1	21.66	21.59	21.32
HSDPA	1	20.05	19.95	20.29
	2	19.94	19.87	20.24
	3	20.26	20.11	20.62
	4	20.09	19.91	20.24
HSUPA	1	20.26	20.20	20.05
	2	19.95	20.07	20.17
	3	20.16	20.44	20.45
	4	19.95	20.30	20.19
	5	19.89	20.15	20.13
DC-HSDPA	1	19.98	19.89	20.14
	2	20.01	19.92	20.13
	3	19.89	19.96	20.21
	4	19.93	19.81	20.23
HSPA+	1	19.88	19.79	20.14

**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.
4. KDB 941225 D01-SAR is not required for HSPA+, when SAR is required for Rel. 6 HSPA; SAR is not required for DC-HSDPA when SAR is required for Rel. 5 HSDPA.

**Bluetooth**

Mode	Channel frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
BDR(GFSK)	2402	1.55	1.429
	2441	<b>1.73</b>	1.489
	2480	1.43	1.390
EDR(4-DQPSK)	2402	0.71	1.178
	2441	0.95	1.245
	2480	0.75	1.189
EDR-8DPSK	2402	1.07	1.279
	2441	1.25	1.334
	2480	1.05	1.274
BT4.0	2402	-6.48	0.225
	2440	-6.42	0.228
	2480	-6.68	0.215

**Wi-Fi**

Band	Frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
802.11b	2412	8.47	7.031
	2437	9.07	8.072
	2462	<b>9.47</b>	8.851
802.11g	2412	8.29	6.745
	2437	9.11	8.147
	2462	9.36	8.630
802.11n HT20	2412	8.35	6.839
	2437	9.24	8.395
	2462	9.47	8.851
802.11n HT40	2422	6.37	4.335
	2437	8.84	7.656
	2452	9.07	8.072

**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.
2. KDB 248227 D01 802.11 Wi-Fi SAR v02,§5.2.2: When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is 1.2 W/kg.

## SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

### SAR Test Data

#### Environmental Conditions

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

Testing was performed by Terry Xiahou on 2015-06-11

### GSM 850:

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	824.2	GSM	0.497	32.09	32.10	1.002	0.672	0.674	/
	836.6	GSM	1.235	32.05	32.10	1.012	0.682	<b>0.690</b>	<b>1#</b>
	848.8	GSM	-0.203	31.95	32.10	1.035	0.655	0.678	/
Left Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-3.076	32.05	32.10	1.012	0.361	0.365	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	2.794	32.05	32.10	1.012	0.659	0.667	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	3.573	32.05	32.10	1.012	0.348	0.352	/
	848.8	GSM	/	/	/	/	/	/	/
Body-Back (10mm)	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	2.619	32.05	32.10	1.012	0.668	0.676	/
	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)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1850.2	GSM	1.089	29.53	29.60	1.016	0.426	0.433	/
	1880.0	GSM	-2.124	29.43	29.60	1.040	0.440	<b>0.458</b>	<b>2#</b>
	1909.8	GSM	2.127	29.41	29.60	1.045	0.408	0.426	/
Left Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-2.173	29.43	29.60	1.040	0.233	0.242	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-3.732	29.43	29.60	1.040	0.431	0.448	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-1.925	29.43	29.60	1.040	0.242	0.252	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back (10mm)	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	0.466	29.43	29.60	1.040	0.447	0.465	/
	1909.8	GSM	/	/	/	/	/	/	/

**Note:**

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

**WCDMA 850**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	826.4	RMC	3.442	22.29	22.30	1.002	0.287	<b>0.288</b>	<b>3#</b>
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/
Left Head Tilt	826.4	RMC	2.371	22.29	22.30	1.002	0.154	0.154	/
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/
Right Head Cheek	826.4	RMC	-1.825	22.29	22.30	1.002	0.273	0.274	/
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/
Right Head Tilt	826.4	RMC	-0.373	22.29	22.30	1.002	0.142	0.142	/
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/

**WCDMA 1700**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	0.451	21.87	21.90	1.007	0.327	0.329	/
Left Head Tilt	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	2.630	21.87	21.90	1.007	0.170	0.171	/
Right Head Cheek	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	0.271	21.87	21.90	1.007	0.349	<b>0.351</b>	<b>4#</b>
Right Head Tilt	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	-1.170	21.87	21.90	1.007	0.182	0.183	/

**WCDMA 1900**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1852.4	RMC	2.972	21.66	21.70	1.009	0.332	0.335	/
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/
Left Head Tilt	1852.4	RMC	0.819	21.66	21.70	1.009	0.177	0.179	/
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/
Right Head Cheek	1852.4	RMC	0.577	21.66	21.70	1.009	0.343	<b>0.346</b>	<b>5#</b>
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/
Right Head Tilt	1852.4	RMC	0.258	21.66	21.70	1.009	0.188	0.190	/
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/

**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.
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.

## Mobile Hot-Spot Test Result

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

### Hot spot-GPRS (Frequency Band: 835)

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	824.2	GPRS	-0.986	31.09	31.10	1.002	1.07	<b>1.072</b>	<b>6#</b>
	836.6	GPRS	0.727	30.99	31.10	1.026	0.962	0.987	/
	848.8	GPRS	2.388	30.95	31.10	1.035	0.948	0.981	/
Body-Left (10mm)	824.2	GPRS	-3.137	31.09	31.10	1.002	0.624	0.625	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	/	/	/	/	/	/	/
Body-Right (10mm)	824.2	GPRS	0.017	31.09	31.10	1.002	0.606	0.607	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	/	/	/	/	/	/	/
Body-Bottom (10mm)	824.2	GPRS	2.152	31.09	31.10	1.002	0.314	0.315	/
	836.6	GPRS	/	/	/	/	/	/	/
	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, 3DL+2UL 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)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1850.2	GPRS	-0.593	27.78	27.80	1.005	0.868	<b>0.872</b>	<b>7#</b>
	1880.0	GPRS	-0.882	27.61	27.80	1.045	0.824	0.861	/
	1909.8	GPRS	1.071	27.44	27.80	1.086	0.807	0.877	/
Body-Left (10mm)	1850.2	GPRS	-0.700	27.78	27.80	1.005	0.446	0.448	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Right (10mm)	1850.2	GPRS	3.838	27.78	27.80	1.005	0.425	0.427	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Bottom (10mm)	1850.2	GPRS	-0.226	27.78	27.80	1.005	0.698	0.701	/
	1880.0	GPRS	/	/	/	/	/	/	/
	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, 3DL+2UL 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)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	826.4	RMC	0.648	22.29	22.30	1.002	0.505	<b>0.506</b>	<b>8#</b>
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/
Body-Left (10mm)	826.4	RMC	-3.203	22.29	22.30	1.002	0.267	0.268	/
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/
Body-Right (10mm)	826.4	RMC	1.538	22.29	22.30	1.002	0.254	0.255	/
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/
Body-Bottom (10mm)	826.4	RMC	0.589	22.29	22.30	1.002	0.137	0.137	/
	836.6	RMC	/	/	/	/	/	/	/
	846.6	RMC	/	/	/	/	/	/	/

**Hot Spot-WCDMA1700**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	1.087	21.87	21.90	1.007	0.685	<b>0.690</b>	<b>9#</b>
Body-Left (10mm)	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	1.385	21.87	21.90	1.007	0.372	0.375	/
Body-Right (10mm)	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	-2.974	21.87	21.90	1.007	0.355	0.357	/
Body-Bottom (10mm)	1712.4	RMC	/	/	/	/	/	/	/
	1732.4	RMC	/	/	/	/	/	/	/
	1752.6	RMC	-3.346	21.87	21.90	1.007	0.576	0.580	/

**Hot Spot-WCDMA1900**

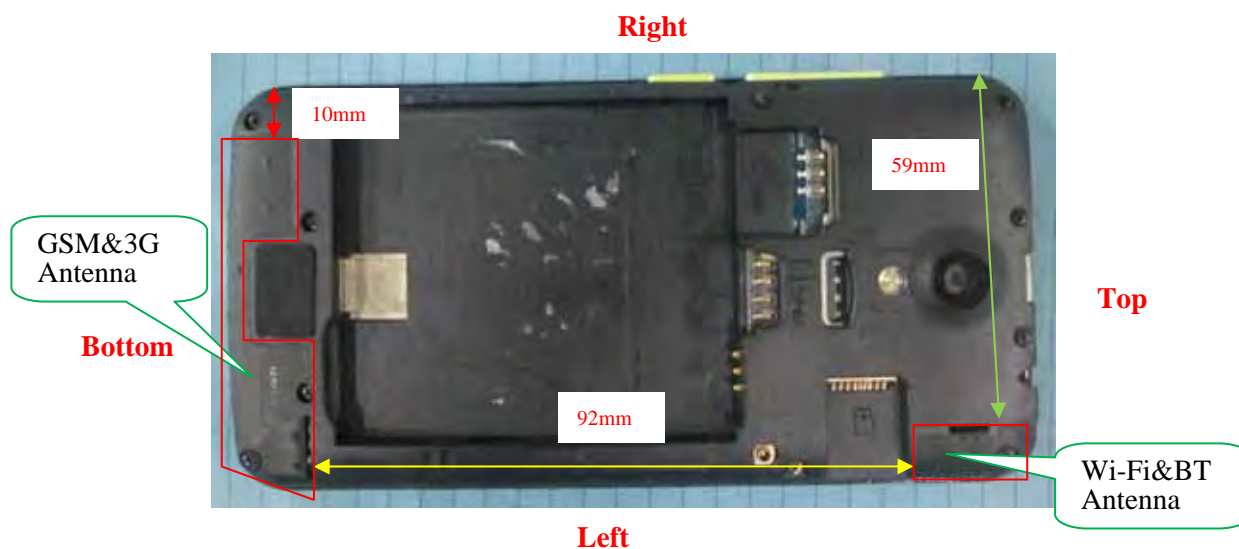
EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1852.4	RMC	-1.909	21.66	21.70	1.009	0.673	<b>0.679</b>	<b>10#</b>
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/
Body-Left (10mm)	1852.4	RMC	-3.308	21.66	21.70	1.009	0.348	0.351	/
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/
Body-Right (10mm)	1852.4	RMC	1.360	21.66	21.70	1.009	0.332	0.335	/
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/
Body-Bottom (10mm)	1852.4	RMC	2.025	21.66	21.70	1.009	0.587	0.592	/
	1880.0	RMC	/	/	/	/	/	/	/
	1907.6	RMC	/	/	/	/	/	/	/

**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.
3. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

## SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

### BT& Wi-Fi and GSM&3G Antennas Location:



### Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	×	×	0
GSM + Bluetooth	√	×	92
GSM + Wi-Fi	√	×	92
GPRS + WCDMA	×	×	0
GPRS + Bluetooth	√	×	0
GPRS + Wi-Fi	√	√	92
WCDMA + Bluetooth	√	×	92
WCDMA + Wi-Fi	√	√	92

### Standalone SAR test exclusion considerations

#### Head Position:

Mode	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GSM850	23.10	204.17	0	37.65	3.0	No
PCS1900	20.60	114.82	0	31.65	3.0	No
WCDMA850	22.30	169.82	0	31.31	3.0	No
WCDMA1700	21.90	154.88	0	42.70	3.0	No
WCDMA1900	21.70	147.91	0	40.78	3.0	No
Wi-Fi	9.50	8.91	0	<b>2.79</b>	3.0	Yes
Bluetooth	1.80	1.51	0	<b>0.47</b>	3.0	Yes

## Body Position:

Mode	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (Mw)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GPRS850	25.10	323.59	10.00	29.83	3.0	No
GPRS1900	21.80	151.36	10.00	20.86	3.0	No
WCDMA850	22.30	169.82	10.00	15.66	3.0	No
WCDMA1700	21.90	154.88	10.00	21.35	3.0	No
WCDMA1900	21.70	147.91	10.00	20.39	3.0	No
Wi-Fi	9.50	8.91	10.00	1.40	3.0	Yes
Bluetooth	1.80	1.51	10.00	0.24	3.0	Yes

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

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  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)
Wi-Fi Head	2.472	0	9.50	8.91	0.372
Wi-Fi Body	2.472	10	9.50	8.91	0.186
BT Head	2.48	0	1.80	1.51	0.063
BT Body	2.48	10	1.80	1.51	0.032

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

$[(\text{max. power of channel, including **tune-up tolerance**, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg}$  for *test separation distances*  $\leq 50$  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	0.690	0.063	0.753
	Left Head Tilt	0.365	0.063	0.428
	Right Head Cheek	0.667	0.063	0.730
	Right Head Tilt	0.352	0.063	0.415
	Body-Back	0.676	0.032	0.708
PCS1900	Left Head Cheek	0.458	0.063	0.521
	Left Head Tilt	0.242	0.063	0.305
	Right Head Cheek	0.448	0.063	0.511
	Right Head Tilt	0.252	0.063	0.315
	Body-Back	0.465	0.032	0.497

**WCDMA with BT:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.288	0.063	0.351
	Left Head Tilt	0.154	0.063	0.217
	Right Head Cheek	0.274	0.063	0.337
	Right Head Tilt	0.142	0.063	0.205
WCDMA 1700	Left Head Cheek	0.329	0.063	0.392
	Left Head Tilt	0.171	0.063	0.234
	Right Head Cheek	0.351	0.063	0.414
	Right Head Tilt	0.183	0.063	0.246
WCDMA 1900	Left Head Cheek	0.335	0.063	0.398
	Left Head Tilt	0.179	0.063	0.242
	Right Head Cheek	0.346	0.063	0.409
	Right Head Tilt	0.190	0.063	0.253

**GSM with Wi-Fi:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	Wi-Fi	< 1.6W/kg
GSM850	Left Head Cheek	0.690	0.372	<b>1.062</b>
	Left Head Tilt	0.365	0.372	0.737
	Right Head Cheek	0.667	0.372	1.039
	Right Head Tilt	0.352	0.372	0.724
	Body-Back	0.676	0.186	0.862
PCS1900	Left Head Cheek	0.458	0.372	0.830
	Left Head Tilt	0.242	0.372	0.614
	Right Head Cheek	0.448	0.372	0.820
	Right Head Tilt	0.252	0.372	0.624
	Body-Back	0.465	0.186	0.651

**WCDMA with Wi-Fi:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	Wi-Fi	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.288	0.372	0.660
	Left Head Tilt	0.154	0.372	0.526
	Right Head Cheek	0.274	0.372	0.646
	Right Head Tilt	0.142	0.372	0.514
WCDMA 1700	Left Head Cheek	0.329	0.372	0.701
	Left Head Tilt	0.171	0.372	0.543
	Right Head Cheek	0.351	0.372	0.723
	Right Head Tilt	0.183	0.372	0.555
WCDMA 1900	Left Head Cheek	0.335	0.372	0.707
	Left Head Tilt	0.179	0.372	0.551
	Right Head Cheek	0.346	0.372	0.718
	Right Head Tilt	0.190	0.372	0.562

**Conclusion:**

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

**Hotspot:**

<b>Evaluations for Simultaneous SAR, BT+GSM/3G</b>					
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	1.072	0.625	0.607	0.315	/
GPRS 1900	0.872	0.448	0.427	0.701	/
WCDMA850	0.506	0.268	0.255	0.137	/
WCDMA1700	0.690	0.375	0.357	0.580	/
WCDMA1900	0.679	0.351	0.335	0.592	/
BT	0.032	0.032	/	0.032	0.032
	$\sum$ 1-g SAR(W/Kg)				
GPRS850 + BT	1.104	0.657	/	0.347	/
GPRS1900 + BT	0.904	0.48	/	0.733	/
WCDMA850 + BT	0.538	0.300	/	0.169	/
WCDMA1700 + BT	0.722	0.407	/	0.612	/
WCDMA1900 + BT	0.711	0.383	/	0.624	/
<b>Evaluations for Simultaneous SAR, Mobile Hot Spot Positions</b>					
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	1.072	0.625	0.607	0.315	/
GPRS 1900	0.872	0.448	0.427	0.701	/
WCDMA850	0.506	0.268	0.255	0.137	/
WCDMA1700	0.690	0.375	0.357	0.580	/
WCDMA1900	0.679	0.351	0.335	0.592	/
Wi-Fi	0.186	0.186	/	0.186	0.186
	$\sum$ 1-g SAR(W/Kg)				
GPRS850 + Wi-Fi	<b>1.258</b>	0.811	/	0.501	/
GPRS1900 + Wi-Fi	1.058	0.634	/	0.887	/
WCDMA850 + Wi-Fi	0.692	0.454	/	0.323	/
WCDMA1700 + Wi-Fi	0.876	0.561	/	0.766	/
WCDMA1900 + Wi-Fi	0.865	0.537	/	0.778	/

**Note:**

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

**SAR Plots (Summary of the Highest SAR Values)****Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Left Head Cheek (836.6 MHz Middle 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 : 0.081 W/kg  
Power Drift-Finish : 0.082 W/kg  
Power Drift (%) : 1.235

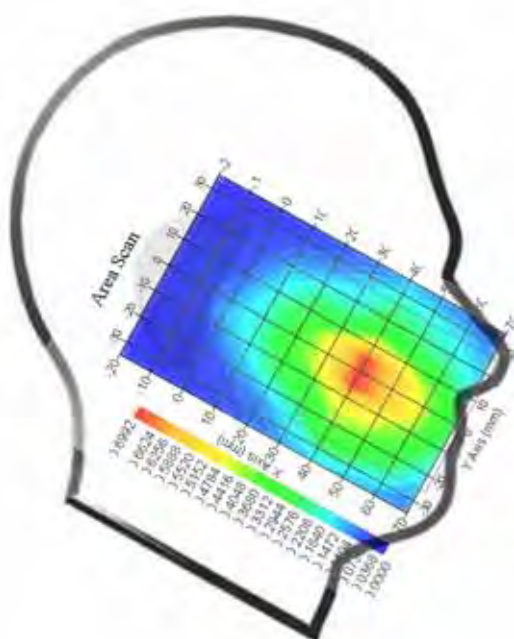
## Tissue Data

Type : Head  
Frequency : 836.6 MHz  
Epsilon : 41.02 F/m  
Sigma : 0.92 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 : 0.682 W/kg  
10 gram SAR value : 0.386 W/kg  
Area Scan Peak SAR : 0.690 W/kg  
Zoom Scan Peak SAR : 1.051 W/kg

**Plot 1#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Left Head Cheek(1880MHz Middle 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 : 0.062 W/kg  
Power Drift-Finish : 0.062W/kg  
Power Drift (%) : -2.124

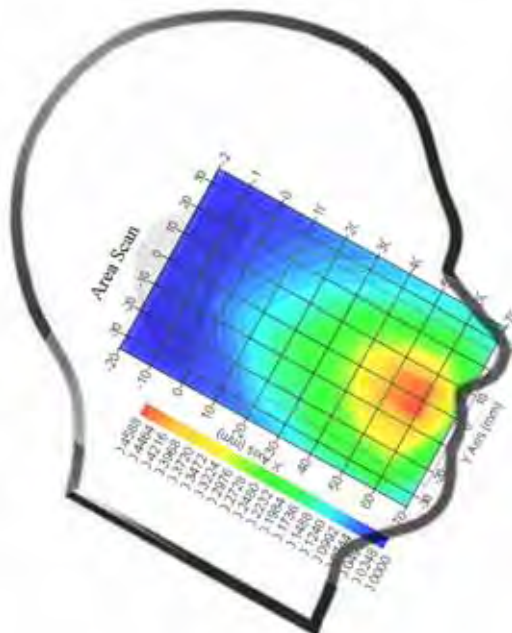
**Tissue Data**

Type : Head  
Frequency : 1880 MHz  
Epsilon : 39.69 F/m  
Sigma : 1.39 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 : 0.440 W/kg  
10 gram SAR value : 0.232 W/kg  
Area Scan Peak SAR : 0.449 W/kg  
Zoom Scan Peak SAR : 0.675 W/kg

**Plot 2#**

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

Test mode : RMC  
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 : 0.050 W/kg  
Power Drift-Finish : 0.050 W/kg  
Power Drift (%) : 3.442

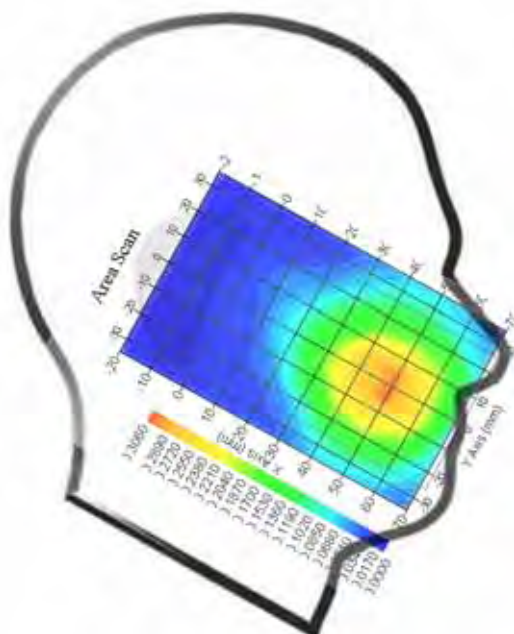
**Tissue Data**

Type : Head  
Frequency : 826.4 MHz  
Epsilon : 41.06 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  $\mu\text{V}/(\text{V/m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.287 W/kg  
10 gram SAR value : 0.159 W/kg  
Area Scan Peak SAR : 0.294 W/kg  
Zoom Scan Peak SAR : 0.448 W/kg

**Plot 3#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA 1700; Right Head Cheek (1752.6 MHz High Channel)****Measurement Data**

Test mode : RMC  
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 : 0.043 W/kg  
Power Drift-Finish : 0.043 W/kg  
Power Drift (%) : 0.271

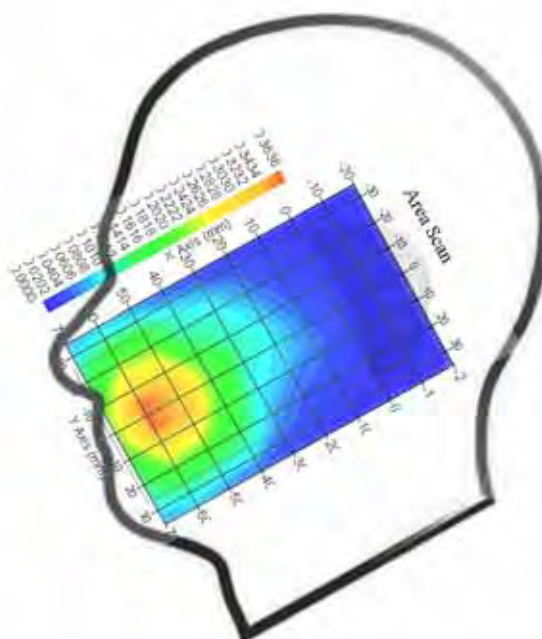
**Tissue Data**

Type : Head  
Frequency : 1752.6 MHz  
Epsilon : 39.42 F/m  
Sigma : 1.41 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

Serial No. : 500-00283  
Frequency Band : 1750  
Duty Cycle Factor : 1  
Conversion Factor : 5.3  
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 : 0.349 W/kg  
10 gram SAR value : 0.188 W/kg  
Area Scan Peak SAR : 0.357 W/kg  
Zoom Scan Peak SAR : 0.542 W/kg

**Plot 4#**

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

Test mode : RMC  
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 : 0.037 W/kg  
Power Drift-Finish : 0.037 W/kg  
Power Drift (%) : 0.577

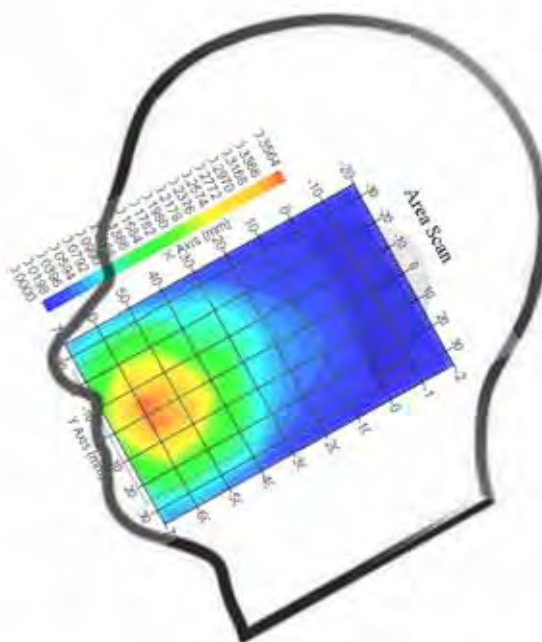
**Tissue Data**

Type : Head  
Frequency : 1852.4 MHz  
Epsilon : 39.55 F/m  
Sigma : 1.37 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 : 0.343 W/kg  
10 gram SAR value : 0.174 W/kg  
Area Scan Peak SAR : 0.350 W/kg  
Zoom Scan Peak SAR : 0.525 W/kg

**Plot 5#**



**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 : 0.913 W/kg  
Power Drift-Finish : 0.904 W/kg  
Power Drift (%) : -0.986

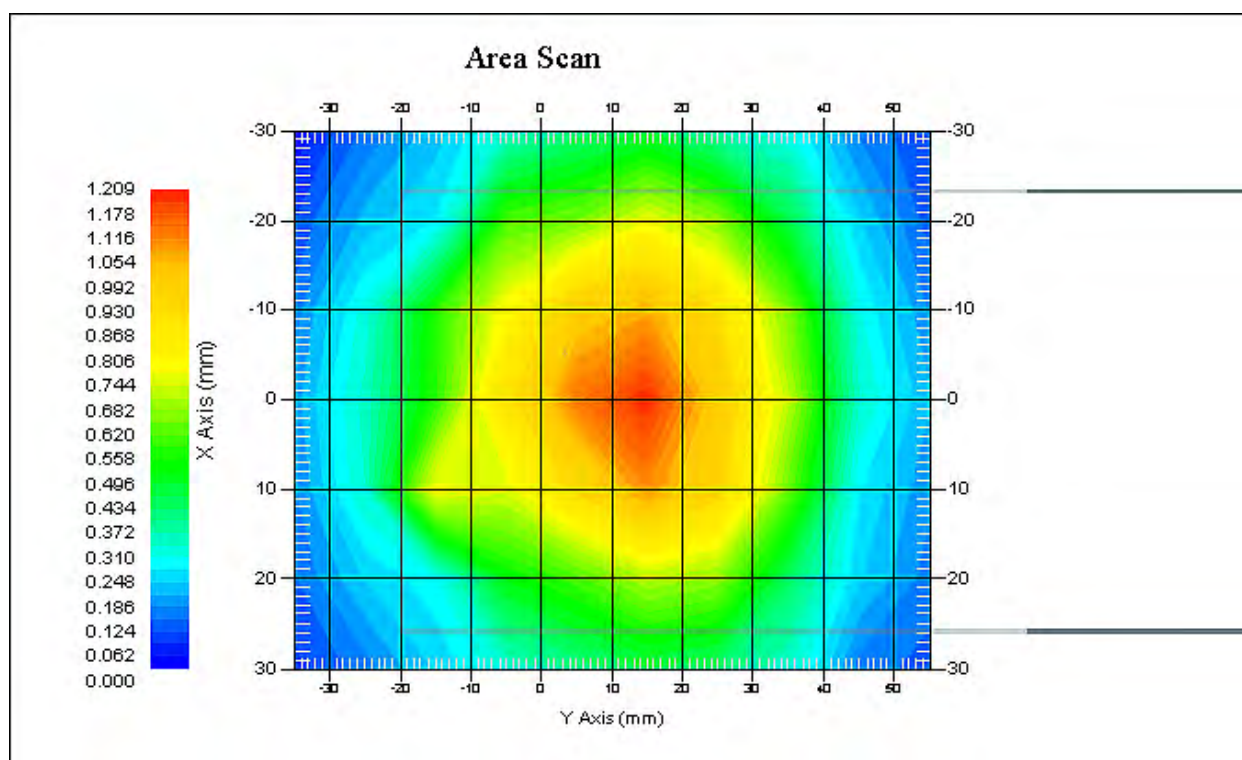
## Tissue Data

Type : Body  
Frequency : 824.2 MHz  
Epsilon : 53.79 F/m  
Sigma : 0.95 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 : 1.070 W/kg  
10 gram SAR value : 0.738 W/kg  
Area Scan Peak SAR : 1.156 W/kg  
Zoom Scan Peak SAR : 1.779 W/kg

**Plot 6#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Body-worn-Back (1850.2MHz Low Channel)**

## Measurement Data

Test mode : GPRS  
Crest Factor : 4  
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 : 0.843 W/kg  
Power Drift-Finish : 0.838 W/kg  
Power Drift (%) : -0.593

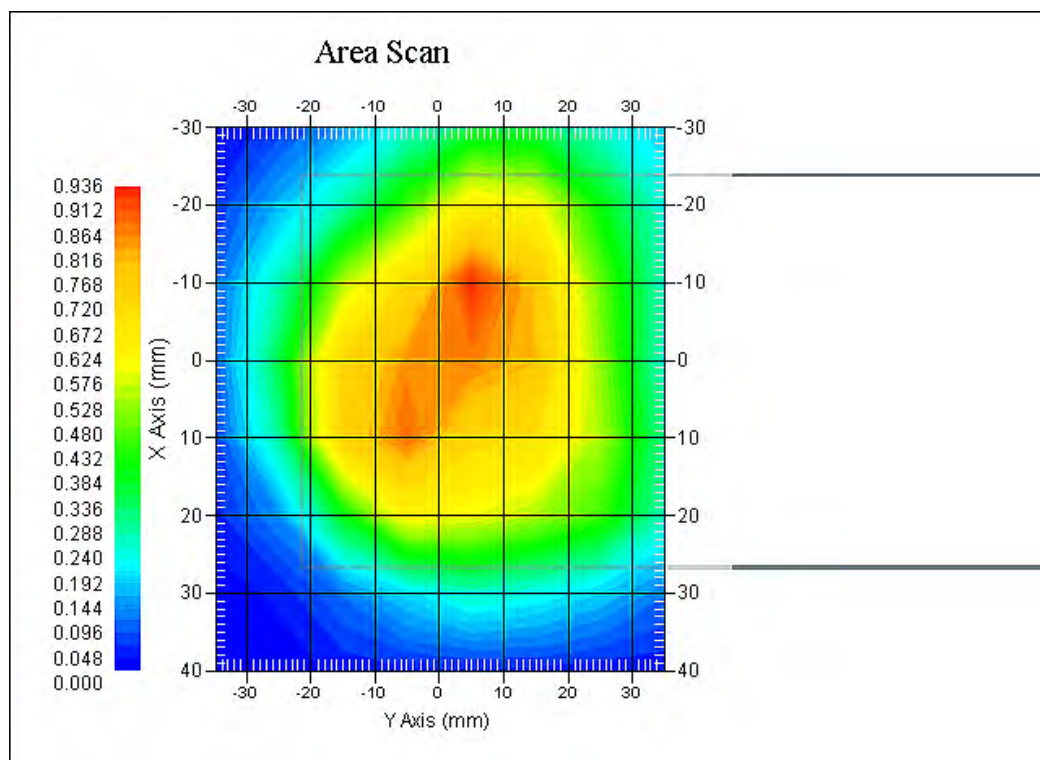
## Tissue Data

Type : Body  
Frequency : 1850.2 MHz  
Epsilon : 51.98 F/m  
Sigma : 1.48 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Serial No. : 500-00283  
Frequency Band : 1900  
Duty Cycle Factor : 4  
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 : 0.868 W/kg  
10 gram SAR value : 0.448 W/kg  
Area Scan Peak SAR : 0.912 W/kg  
Zoom Scan Peak SAR : 1.276 W/kg

**Plot 7#**

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

Test mode : RMC  
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 : 0.463 W/kg  
Power Drift-Finish : 0.466 W/kg  
Power Drift (%) : 0.648

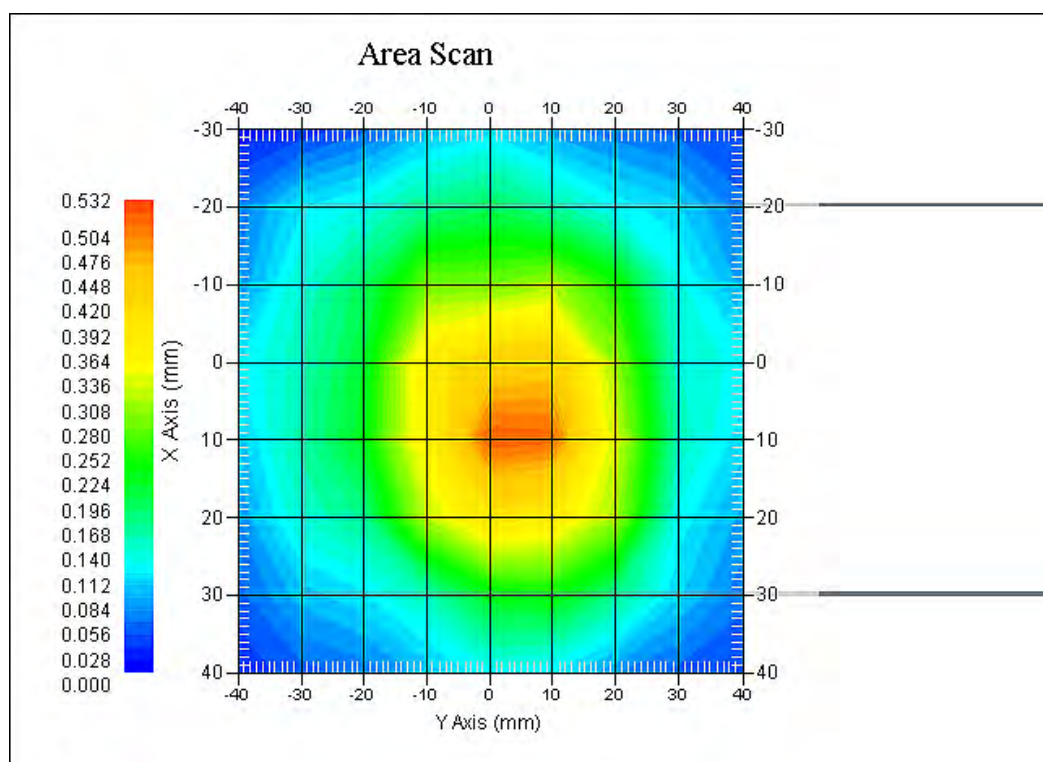
**Tissue Data**

Type : Body  
Frequency : 826.4 MHz  
Epsilon : 53.77 F/m  
Sigma : 0.95 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 : 0.505 W/kg  
10 gram SAR value : 0.346 W/kg  
Area Scan Peak SAR : 0.518 W/kg  
Zoom Scan Peak SAR : 0.767 W/kg

**Plot 8#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA 1700; Body-Worn-Back (1752.6 MHz High Channel)****Measurement Data**

Test mode : RMC  
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 : 0.552 W/kg  
Power Drift-Finish : 0.558 W/kg  
Power Drift (%) : 1.087

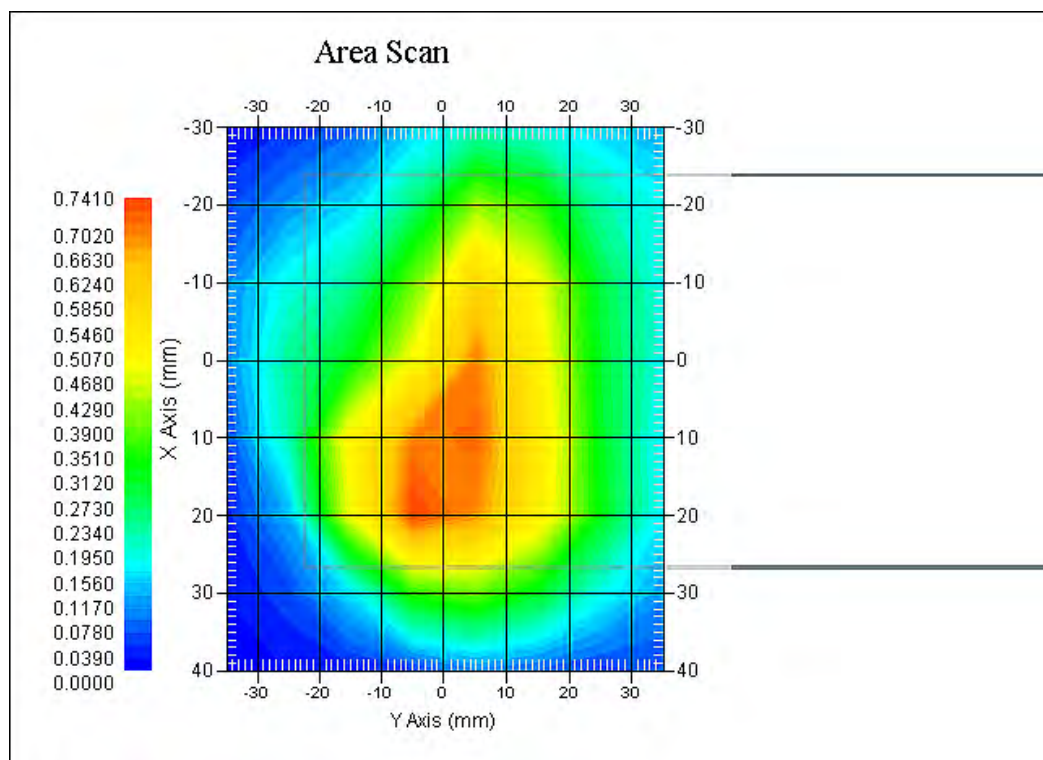
**Tissue Data**

Type : Body  
Frequency : 1752.6 MHz  
Epsilon : 51.92 F/m  
Sigma : 1.53 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

Serial No. : 500-00283  
Frequency Band : 1750  
Duty Cycle Factor : 1  
Conversion Factor : 5.4  
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 : 0.685 W/kg  
10 gram SAR value : 0.388 W/kg  
Area Scan Peak SAR : 0.720 W/kg  
Zoom Scan Peak SAR : 1.092 W/kg

**Plot 9#**

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

## Measurement Data

Test mode : RMC  
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 : 0.681 W/kg  
Power Drift-Finish : 0.668 W/kg  
Power Drift (%) : -1.909

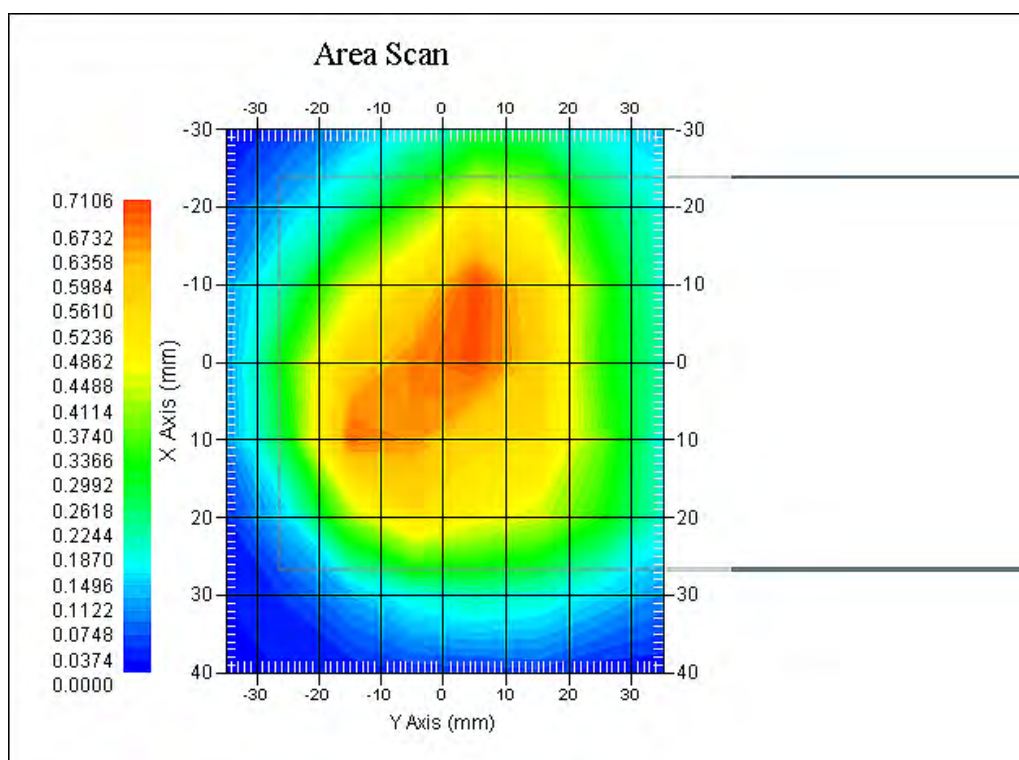
## Tissue Data

Type : Body  
Frequency : 1852.4 MHz  
Epsilon : 51.93 F/m  
Sigma : 1.49 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 : 0.673 W/kg  
10 gram SAR value : 0.392 W/kg  
Area Scan Peak SAR : 0.694 W/kg  
Zoom Scan Peak SAR : 1.044 W/kg

**Plot 10#**

## APPENDIX A MEASUREMENT UNCERTAINTY

According to **IEEE1528:2013**, the uncertainty budget has been determined for the Head SAR measurement system and is given in the following Table.

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_1^1$ (1-g)	$c_1^1$ (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	$\sqrt{3}$	$(1-cp)^{1/2}$	$(\frac{1-cp}{2})^{1/2}$	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
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
<b>Test sample related</b>							
Test sample positioning	2.0	normal	1	1	1	2.0	2.0
Device Holder Uncertainty	4.0	normal	1	1	1	6.215	6.215
Drift of Output Power	5.0	rectangular	$\sqrt{3}$	1	1	2.67	2.67
<b>Phantom and Setup</b>							
Phantom Uncertainty	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
SAR correction in permittivity and conductivity	1.2	normal	1	1	0.85	1.2	1.0
Liquid conductivity measurement	5.0	normal	1	0.78	0.71	3.9	3.6
Liquid permittivity measurement	5.0	normal	1	0.25	0.29	1.3	1.5
conductivity—temperature	1.1	rectangular	$\sqrt{3}$	0.78	0.71	0.5	0.5
permittivity—temperature	1.3	rectangular	$\sqrt{3}$	0.23	0.23	0.2	0.2
Combined Uncertainty		RSS				10.78	10.55
Expanded uncertainty (coverage factor=2)		Normal(k=2)				21.56	21.10



According to **IEC62209-2:2010**, the uncertainty budget has been determined for the Body SAR measurement system and is given in the following Table.

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	1	1.5	1.5
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
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
<b>Test sample related</b>							
Test sample positioning	2.0	normal	1	1	1	2.0	2.0
Device Holder Uncertainty	4.0	normal	1	1	1	6.215	6.215
Drift of Output Power	5.0	rectangular	$\sqrt{3}$	1	1	2.67	2.67
<b>Phantom and Setup</b>							
Phantom Uncertainty	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
SAR correction in permittivity and conductivity	1.2	normal	1	1	0.84	1.2	1.0
Liquid conductivity measurement	5.0	normal	1	0.78	0.71	3.9	3.6
Liquid permittivity measurement	5.0	normal	1	0.23	0.26	1.3	1.5
conductivity—temperature	1.1	rectangular	$\sqrt{3}$	0.78	0.71	0.5	0.5
permittivity—temperature	1.3	rectangular	$\sqrt{3}$	0.23	0.26	0.2	0.2
Combined Uncertainty		RSS				9.58	9.49
Expanded uncertainty (coverage factor=2)		Normal(k=2)				19.16	18.98

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**APPENDIX B – PROBE CALIBRATION CERTIFICATES**

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**NCL CALIBRATION LABORATORIES**

Calibration File No.: PC-1598

Task No: BACL-5778

**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: 14<sup>th</sup> October 2014  
Released on: 14<sup>th</sup> October 2014

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

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



Art Brennan, Quality Manager

**NCL CALIBRATION LABORATORIES**

Suite 102, 303 Terry Fox Dr.  
OTTAWA, ONTARIO  
CANADA K2K 5J1

Division of APREL Lab.  
TEL: (613) 435-6300  
FAX: (613) 435-6306



**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 metrological practices.

**Calibration Method**

Probes are calibrated using the following methods.

<1000MHz

TEM Cell for sensitivity in air

Standard phantom using temperature transfer method for sensitivity in tissue

>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

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
---------------------------------	--------	---------------

**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

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

**NCL Calibration Laboratories**

Division of APREL, Inc.

**Probe Summary**

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

\*Resistive to recommended tissue recipes per IEEE-1528

**Sensitivity in Air**

<b>Channel X:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Y:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Z:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Diode Compression Point:</b>	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	43.59	0.86	3.5	±50	5.7
450 B	Body	56.74	0.94	3.5	±50	5.8
750 H	Head	42.98	0.92	3.5	±50	6.0
750 B	Body	43.05	0.93	3.5	±50	5.5
835 H	Head	43.42	0.94	3.5	±50	5.9
835 B	Body	55.77	1.01	3.5	±50	5.9
900 H	Head	41.87	1.06	3.5	±50	6.0
900 B	Body	55.62	1.05	3.5	±50	5.9
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	38.23	1.38	3.5	±75	5.4
1750 B	Body	52.86	1.54	3.5	±75	5.3
1800 H	Head	X	X	X	X	X
1800 B	Body	X	X	X	X	X
1900 H	Head	40.20	1.38	3.5	±75	4.8
1900 B	Body	52.63	1.46	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	37.26	1.84	3.5	±75	4.9
2450 B	Body	53.61	1.9	3.5	±75	4.3
3000 H	Head	X	X	X	X	X
3000 B	Body	X	X	X	X	X
3600 H	Head	37.49	3.16	3.5	±100	4.5
3600 B	Body	49.94	3.86	3.5	±100	4.0
5250 H	Head	35.51	4.78	3.5	±100	3.0
5250 B	Body	47.54	5.11	3.5	±100	2.8
5600 H	Head	36.05	5.15	3.5	±100	2.8
5600 B	Body	46.49	5.72	3.5	±100	2.2
5800 H	Head	45.99	6.01	3.5	±100	3.2
5800 B	Body	35.6	5.37	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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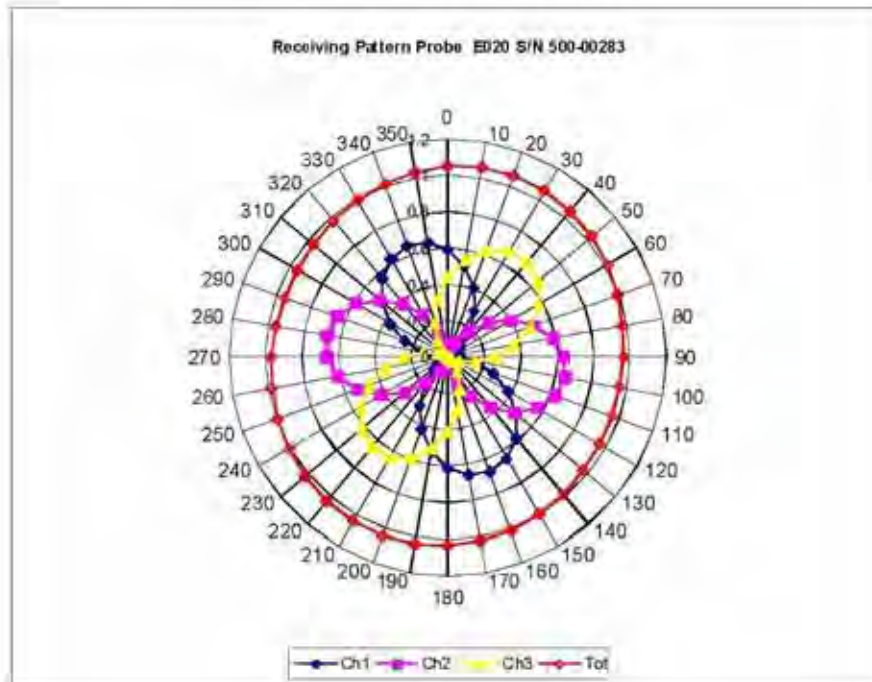
Page 6 of 10

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# **NCL Calibration Laboratories**

Division of APREL Inc.

## **Receiving Pattern Air**



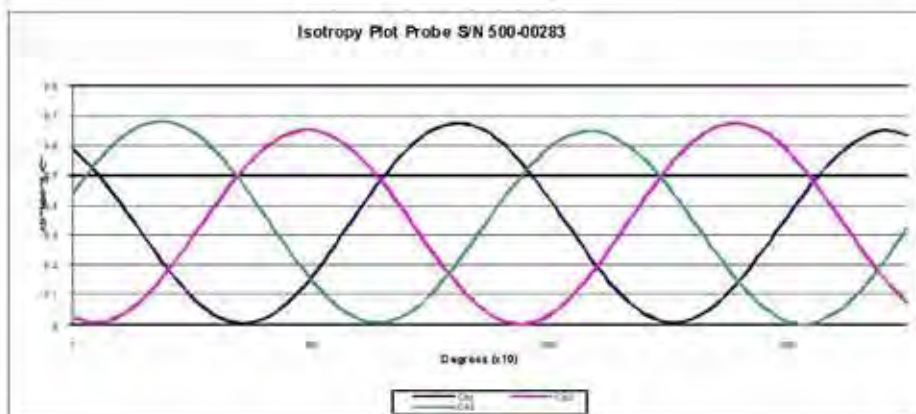
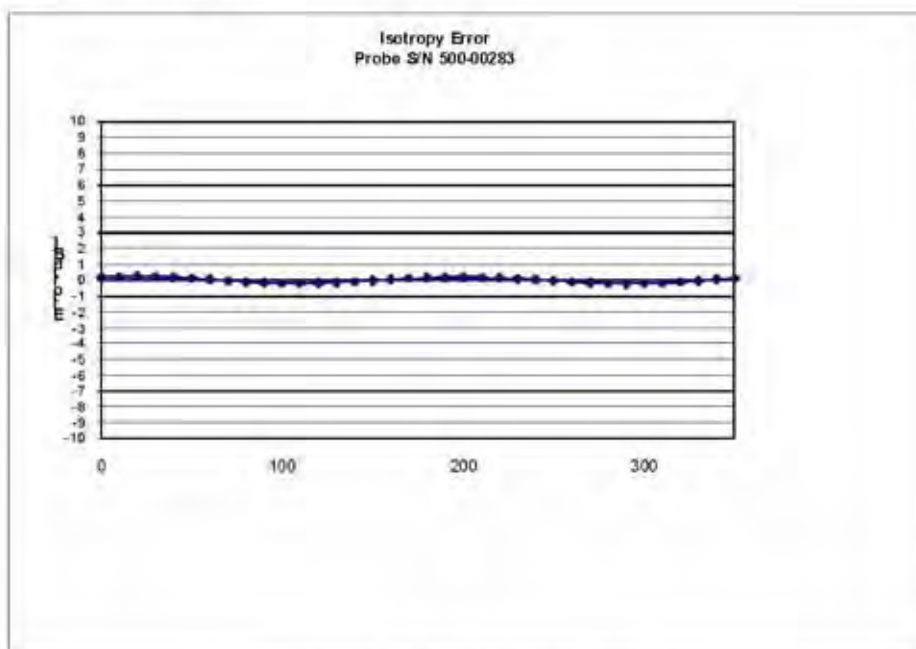
Page 7 of 10

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# **NCL Calibration Laboratories**

Division of APREL, Inc.

## **Isotropy Error Air**



**Isotropy Tissue:**

**0.10 dB**

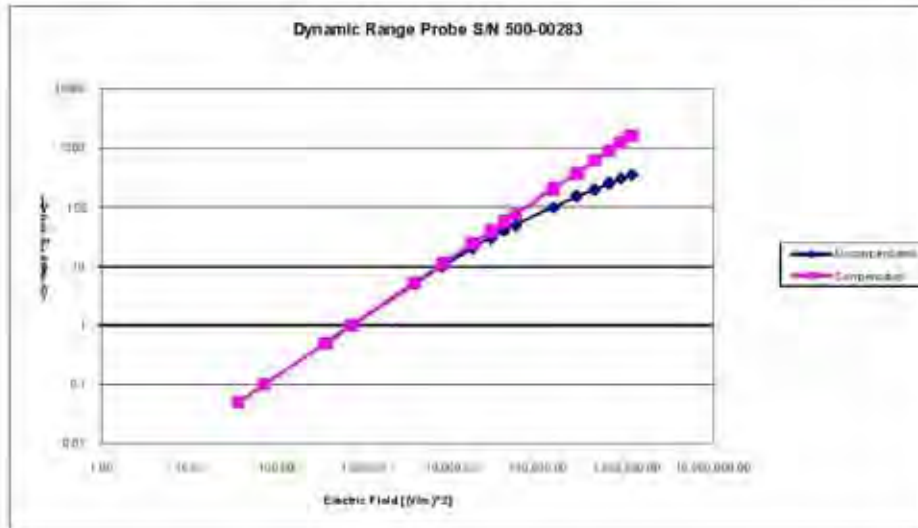
Page 8 of 10

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## NCL Calibration Laboratories

Division of APREL, Inc.

### Dynamic Range



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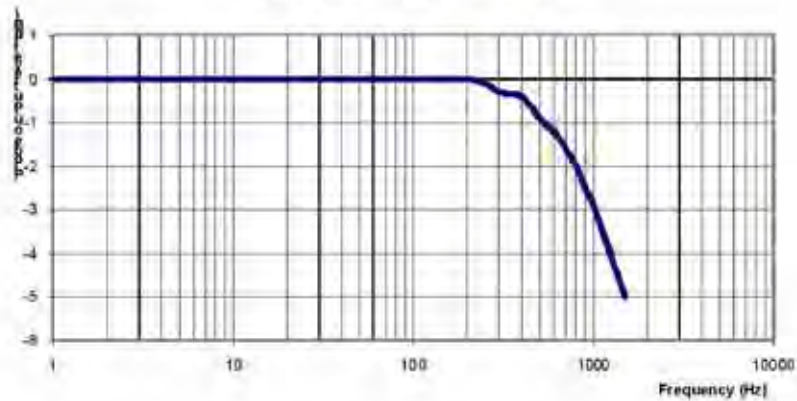


## NCL Calibration Laboratories

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 2014.

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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-1599  
Project Number: BAC-dipole-cal-5779

## 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 (China)

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

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

Released By:



Art Brennan, Quality Manager

**NCL** CALIBRATION LABORATORIES

Suite 102, 393 Terry Fox Dr.  
Kamela, ONTARIO  
CANADA, M2K 3J1

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

**NCL Calibration Laboratories**

Division of APREL Laboratories

**Conditions**

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

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

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

**Attestation**

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

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

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

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

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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

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

**Mechanical Dimensions**

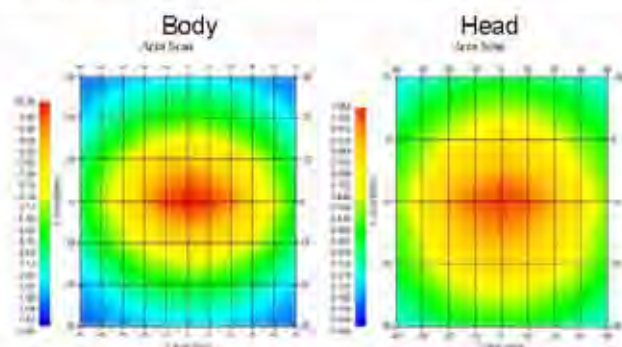
Length: 162.2 mm  
Height: 89.4 mm

**Electrical Specification**

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

**System Validation Results**

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



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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 30 MHz to 6 GHz E-Field Probe Serial Number 225.

**References**

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

**Conditions**

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

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

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

**Dipole Calibration uncertainty**

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

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

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

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

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

**Electrical Verification**

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

**Tissue Validation**

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

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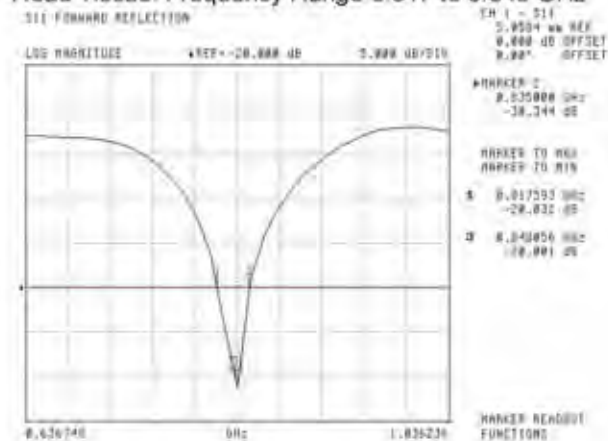
**NCL Calibration Laboratories**

Division of APREL Laboratories.

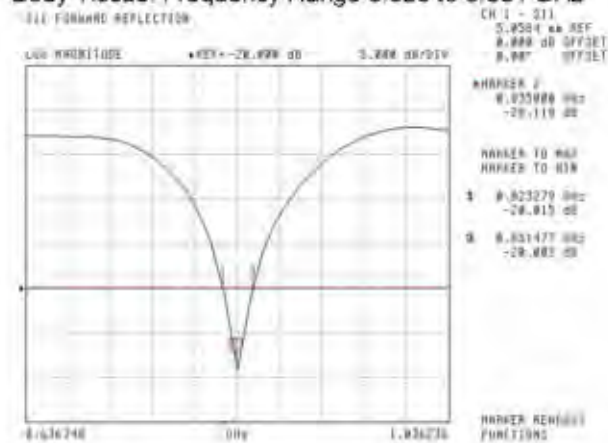
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

Head Tissue: Frequency Range 0.817 to 0.848 GHz



Body Tissue: Frequency Range 0.823 to 0.851 GHz

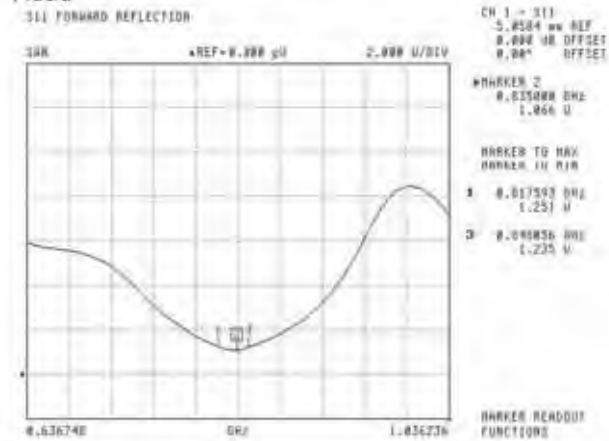
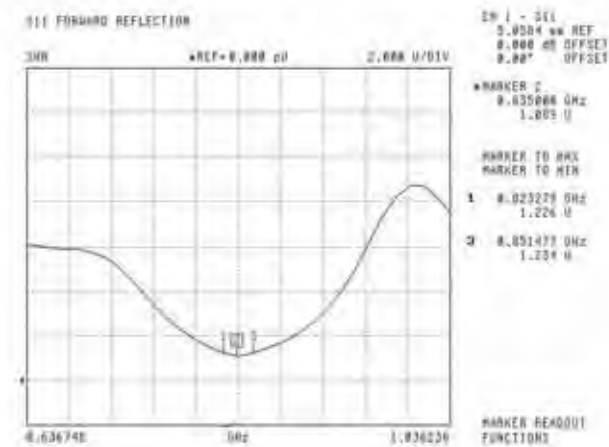


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**NCL Calibration Laboratories**

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

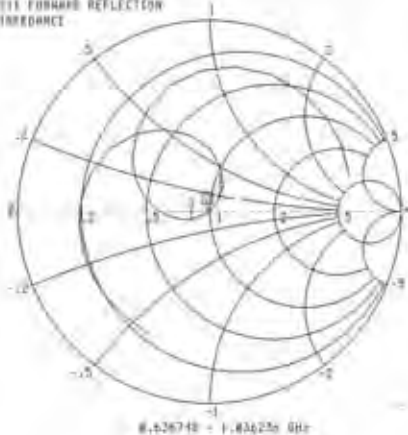
This page has been reviewed for content and attested to by signature within this document.

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**NCL Calibration Laboratories**

Division of APREL Laboratories

**Smith Chart Dipole Impedance****Head**S11 FORWARD REFLECTION  
TOLERANCE

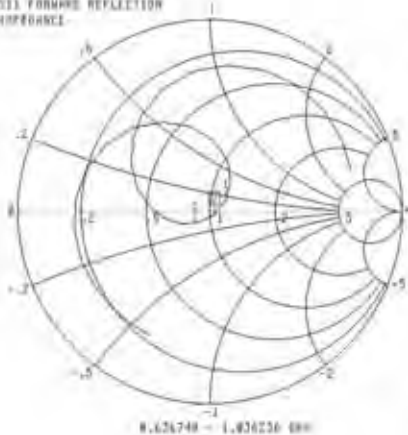
SWR 1 - S11  
 5.8504 dB REF  
 0.000 dB OFFSET  
 0.00° OFFSET

\*MARKER 2  
 8.626748 GHz  
 52.000 Ω  
 -1.517 jΩ

MARKER TO MAX  
 MARKER TO MIN

1 8.621750 GHz  
 52.000 Ω  
 18.000 jΩ  
 2 8.640806 GHz  
 41.074 Ω  
 -3.071 jΩ

MARKER HEADERS  
 FUNCTIONS

**Body**S11 FORWARD REFLECTION  
TOLERANCE

SWR 1 - S11  
 5.8504 dB REF  
 0.000 dB OFFSET  
 0.00° OFFSET

\*MARKER 2  
 8.626748 GHz  
 52.000 Ω  
 -1.517 jΩ

MARKER TO MAX  
 MARKER TO MIN

1 8.623275 GHz  
 52.000 Ω  
 6.765 jΩ  
 2 8.651427 GHz  
 42.410 Ω  
 -3.581 jΩ

MARKER HEADERS  
 FUNCTIONS

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

### **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 2014.

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

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**NCL CALIBRATION LABORATORIES**

Calibration File No: DC-1531  
Project Number: 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.

BACL Head & Body Validation Dipole

Manufacturer: APREL Laboratories

Part number: ALS-D-1750-S-2

Frequency: 1750 MHz

Serial No: 198-00304

Customer: ISL

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, 803 Terry Fox Dr  
OTTAWA, 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 198-00304 was an original 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 subject has been accurately conducted and that all information contained within the results pages have been reviewed for accuracy.

  
Art Brennan, Quality Manager

  
Constantin Teodorian, Test Engineer

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

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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: 75 mm  
Height: 42 mm

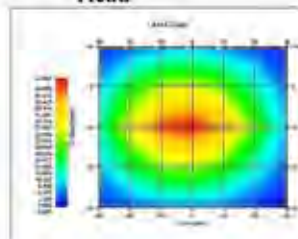
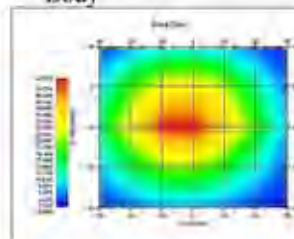
**Electrical Calibration**

Test	Result Head	Result Body
S11 R/L	-25.567	-20.548 dB
SWR	1.111U	1.207 U
Impedance	53.637 $\Omega$	55.929 $\Omega$

**System Validation Results, 1750 MHz**

	1g	10g
Head	37.02	18.99
Body	36.65	18.85

Type	Epsilon	Sigma
Head	38.51	1.36
Body	51.79	1.53

**Head****Body**

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

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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. 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-030 130 MHz to 26 GHz E-Field Probe Serial Number 215.

**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"

IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"

Part 1: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"

IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"

Part 2 *Draft*: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"**Conditions****Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C**Temperature of the Tissue:** 20 °C +/- 0.5°C

This was an original calibration taken from stock.

**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>

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

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

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

Measured Length	Measured Height
75 mm	42 mm

**Tissue Validation**

Frequency	Permittivity $\epsilon$	Conductivity $\sigma$
1750 Head	38.23	1.38
1750 Body	52.86	1.54

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

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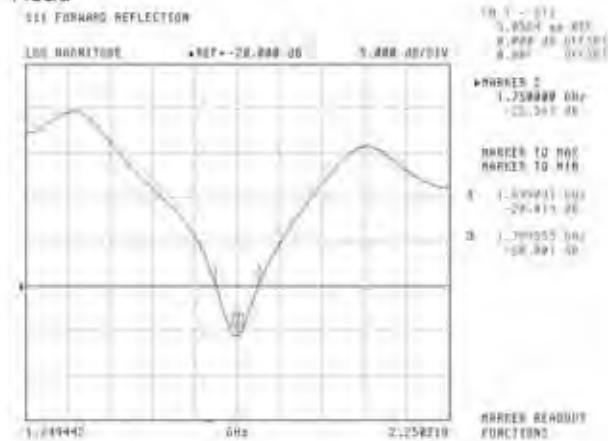
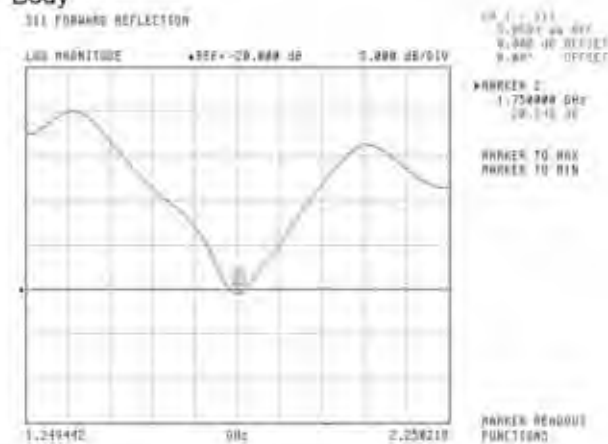
**NCL Calibration Laboratories**

Division of APREL Laboratories

**Electrical Calibration**

Test	Result Head	Result Body
S11 R/L	-25.567	-20.548 dB
SWR	1.111U	1.207 U
Impedance	53.637 $\Omega$	55.929 $\Omega$

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

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

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

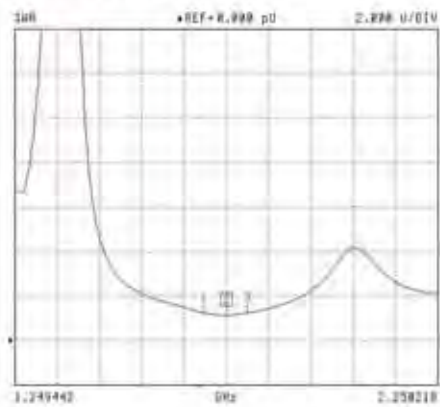


**NCL Calibration Laboratories**

Division of APREL Laboratories.

**SWR  
Head**

S11 FORWARD REFLECTION



SW 1 - 011  
3.0500 uV REF  
0.000 dB OFFSET  
0.00° OFFSET

\*MARKER 2  
1.750000 GHz  
1.111 U

MARKER TO MAX

MARKER TO MIN

1 1.699041 GHz

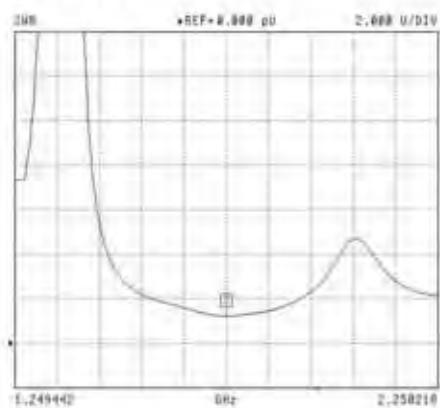
1.723 U

3 1.749033 GHz

1.420 U

MARKER READOUT  
FUNCTIONS**Body**

S11 FORWARD REFLECTION



SW 1 - 011  
3.0500 uV REF  
0.000 dB OFFSET  
0.00° OFFSET

\*MARKER 2  
1.750000 GHz  
1.007 U

MARKER TO MAX

MARKER TO MIN

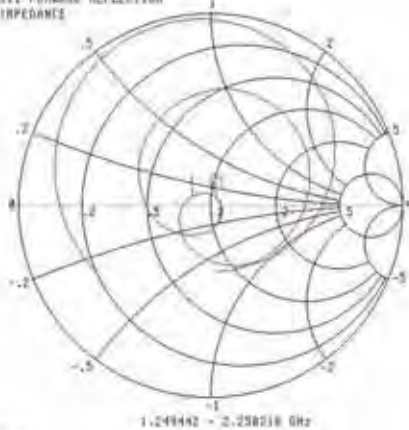
MARKER READOUT  
FUNCTIONS

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

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Smith Chart Dipole Impedance****Head**S11 FORWARD REFLECTION  
IMPEDANCE

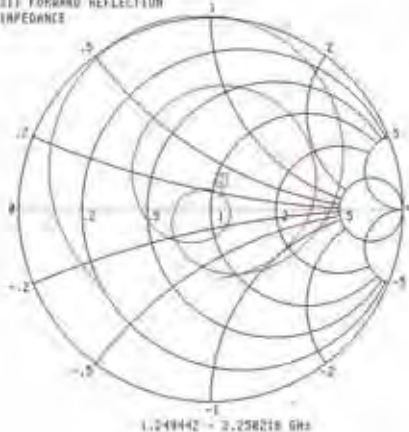
[S11] ~ 21.1  
5.055444e-001  
9.000000e-001  
9.000000e-001

\*MARKER 2  
1.250000e-001  
0.000000e+000  
0.000000e+000

MARKER TO MAX  
MARKER TO MIN

1 1.250000e-001  
0.000000e+000  
0.000000e+000  
1.250000e-001  
0.000000e+000  
0.000000e+000

MARKER READOUT  
FUNCTIONS

**Body**S11 FORWARD REFLECTION  
IMPEDANCE

[S11] ~ 21.1  
5.055444e-001  
9.000000e-001  
9.000000e-001

\*MARKER 2  
1.250000e-001  
0.000000e+000  
0.000000e+000

MARKER TO MAX  
MARKER TO MIN

MARKER READOUT  
FUNCTIONS

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

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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 May 2013

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

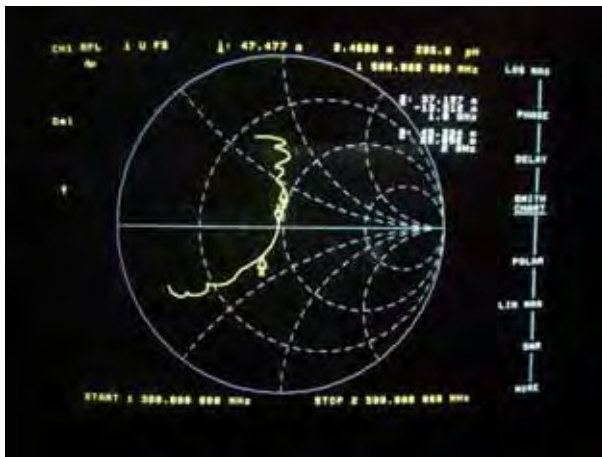
9

## Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
75.0 mm	42 mm	75.1 mm	42.2 mm

Tissue Type	Measured Return Loss	Measured Impedance
Head	-25.083 dB	53.477 $\Omega$
Body	-21.022 dB	55.176 $\Omega$

## Head Tissue



**NCL CALIBRATION LABORATORIES**

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

**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 (China)

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

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

Released By:



Art Brennan, Quality Manager

**NCL CALIBRATION LABORATORIES**

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

Division of APREL Lab  
TEL: (613) 435-8300  
FAX: (613) 435-8308

**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

**Attestation**

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

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



Art Brennan, Quality Manager



Maryna Nesterova Calibration Engineer

**Primary Measurement Standards**

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

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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

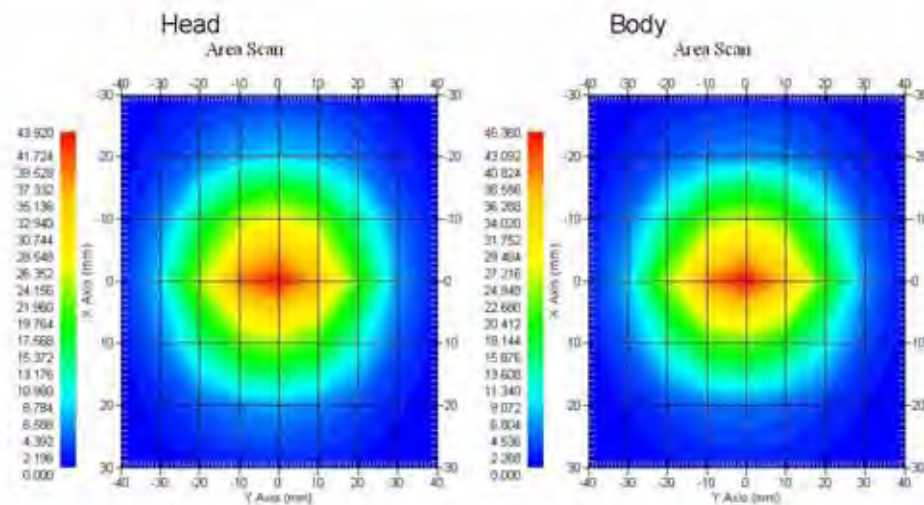
The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

**Mechanical Dimensions****Length:** 67.1 mm**Height:** 38.9 mm**Electrical Specification**

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

**System Validation Results**

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



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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 210-00710. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

**References**

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

**Conditions**

Dipole 210-00710 was a recalibration.

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

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

**Dipole Calibration uncertainty**

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

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

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

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

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

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

**Electrical Validation**

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

**Tissue Validation**

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

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

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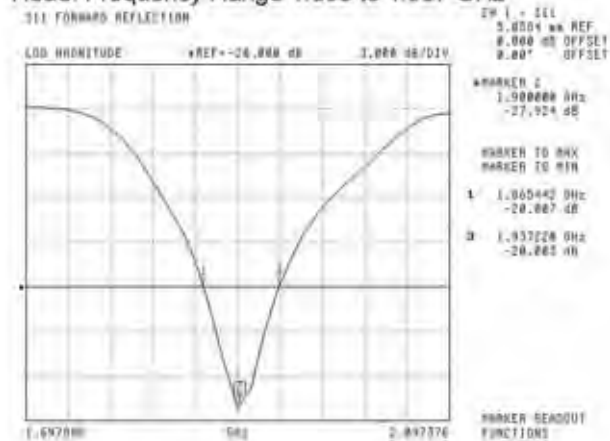
**NCL Calibration Laboratories**

Division of APREL Laboratories,

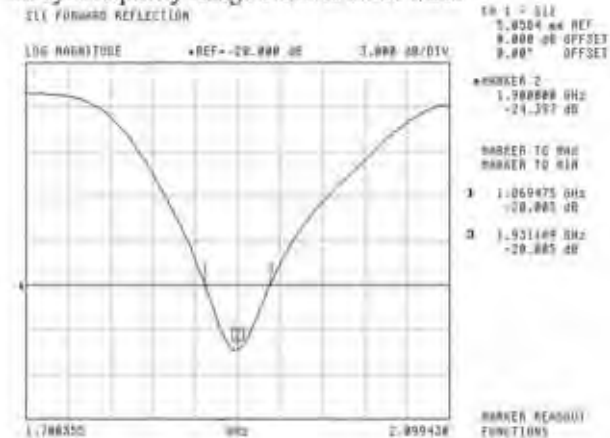
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

Head: Frequency Range 1.865 to 1.937 GHz



Body: Frequency Range 1.869 to 1.931 MHz

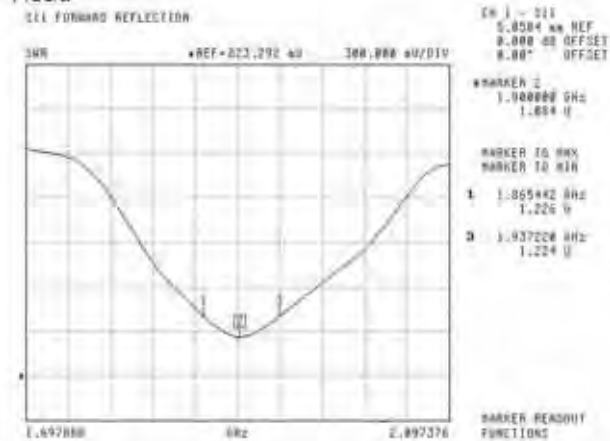
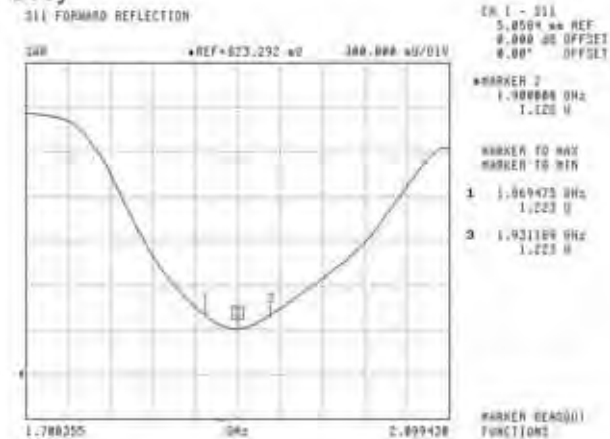


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**NCL Calibration Laboratories**

Division of APREL Laboratories.

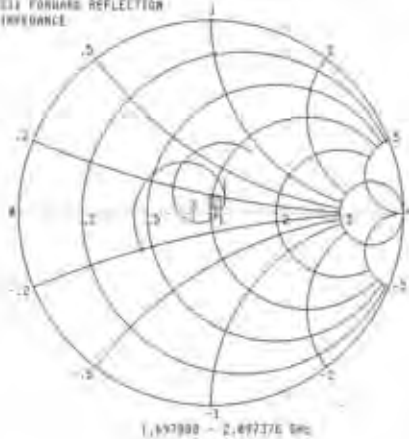
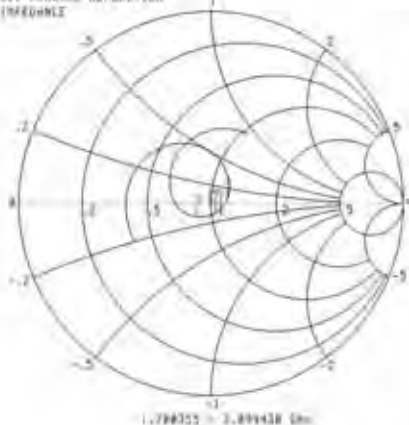
**SWR****Head****Body**

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**NCL Calibration Laboratories**

Division of APREL Laboratories

**Smith Chart Dipole Impedance****Head**S11 FORWARD REFLECTION  
IMPEADANCECH 1 - S11  
5.8504 mm REF  
0.000 dB OFFSET  
0.00° OFFSET\*MARKER 2:  
1.557980 GHz  
52.247 Ω  
-2.182 jΩMARKER TO MAX  
MARKER TO MIN1 1.553442 GHz  
57.627 Ω  
7.444 jΩ  
2 1.557220 GHz  
46.860 Ω  
-4.272 jΩMARKER READOUT  
FUNCTIONS**Body**S11 FORWARD REFLECTION  
IMPEADANCECH 1 - S11  
5.8504 mm REF  
0.000 dB OFFSET  
0.00° OFFSET\*MARKER 2:  
1.798355 GHz  
52.618 Ω  
-5.535 jΩMARKER TO MAX  
MARKER TO MIN1 1.553475 GHz  
66.277 Ω  
6.949 jΩ  
2 1.931109 GHz  
42.257 Ω  
-8.475 jΩMARKER READOUT  
FUNCTIONS

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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 2014

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

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**NCL CALIBRATION LABORATORIES**

Calibration File No: DC-1602  
Project Number: BAC-dipole-cal-5779

**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-2450-S-2

Frequency: 2450 MHz

Serial No: 220-00758

Customer: Bay Area Compliance Laboratory

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

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

Released By:



Art Brennan, Quality Manager

**NCL CALIBRATION LABORATORIES**

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

Division of APREL Lab  
TEL: (613) 435-8300  
FAX: (613) 435-8308

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conditions**

Dipole 220-00758 was received in good condition and was a re-calibration.

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

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

**Attestation**

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

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

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

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

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



**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

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

**Mechanical Dimensions**

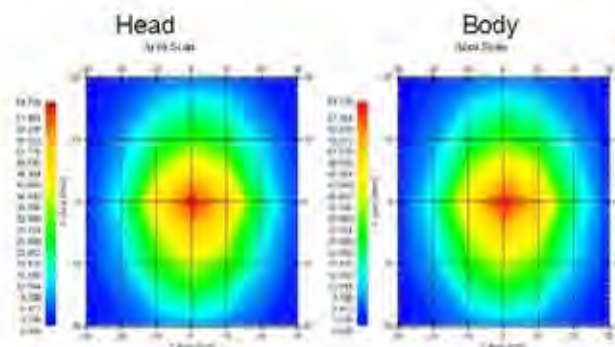
**Length:** 52.4 mm  
**Height:** 30.3 mm

**Electrical Specification**

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	2450 MHz	1.014 U	-45.184 dB	50.006Ω
Body	2450 MHz	1.070 U	-29.453 dB	50.672 Ω

**System Validation Results**

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	2450 MHz	54.916	25.327	111.97
Body	2450 MHz	52.418	24.691	103.91



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

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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 220-00758. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

**References**

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"

IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"

Part 1: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"

IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"

Part 2 *Draft*: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"**Conditions**

Dipole 220-00758 was a re-calibration.

**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>

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

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**NCL Calibration Laboratories**

Division of APREL Laboratories.

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

APREL Length	APREL Height	Measured Length	Measured Height
51.5 mm	30.4 mm	52.4 mm	30.3 mm

**Electrical Specification**

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	2450 MHz	1.014 U	-45.184 dB	50.006Ω
Body	2450 MHz	1.070 U	-29.453 dB	50.672 Ω

**Tissue Validation**

	Dielectric constant, $\epsilon_r$	Conductivity, $\sigma$ [S/m]
Head Tissue 2450MHz	37.26	1.84
Body Tissue 2450MHz	53.61	1.90

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

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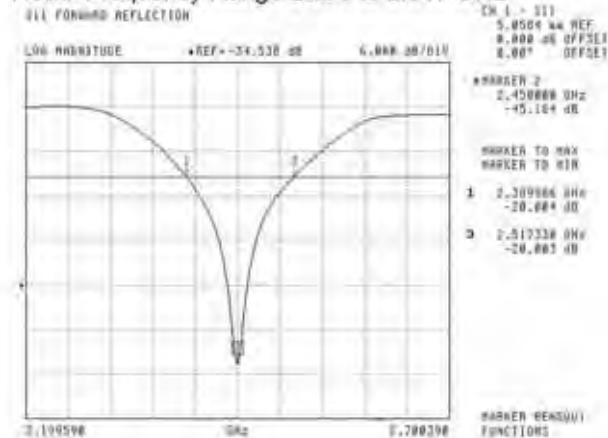
**NCL Calibration Laboratories**

Division of APREL Laboratories,

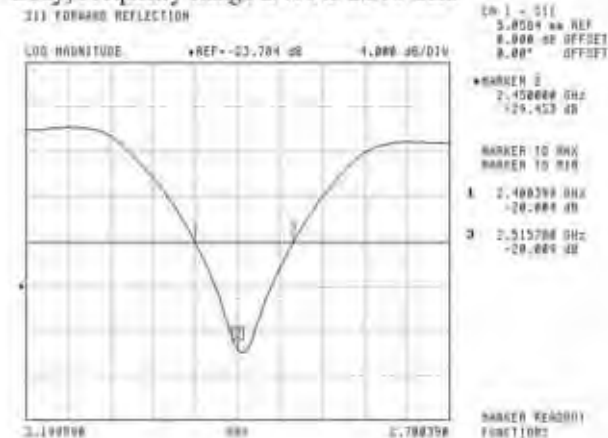
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

Head: Frequency Range 2.390 to 2.517 GHz



Body: Frequency Range 2.400 to 2.516 GHz



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**NCL Calibration Laboratories**

Division of APREL Laboratories.

**SWR****Head**

S11 FORWARD REFLECTION



SW 1 - S11  
5.0504 u0 REF  
0.000 u0 OFFSET  
0.00° OFFSET

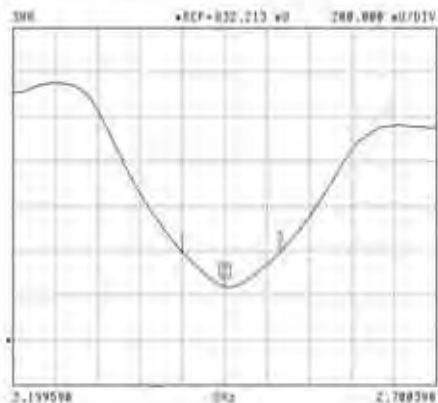
MARKER 2  
2.450000 GHz  
1.014 U

MARKER TO MAX

MARKER TO MIN

**Body**

S11 FORWARD REFLECTION



SW 1 - S11  
5.0504 u0 REF  
0.000 u0 OFFSET  
0.00° OFFSET

MARKER 2  
2.450000 GHz  
1.076 U

MARKER TO MAX

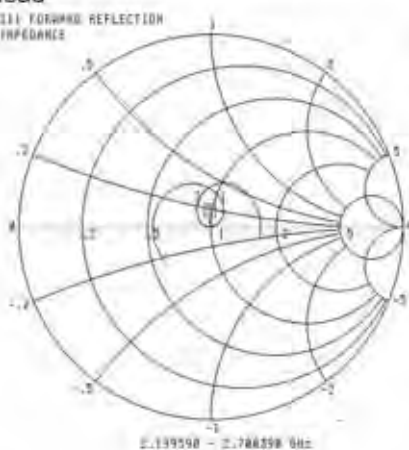
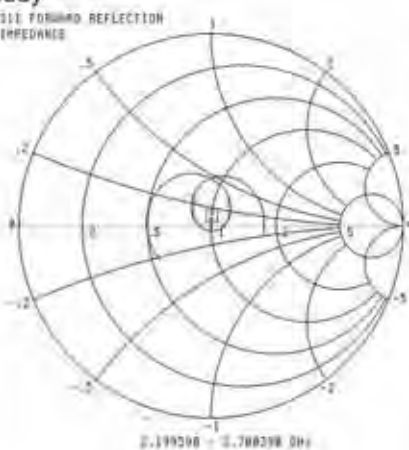
MARKER TO MIN

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

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**NCL Calibration Laboratories**

Division of APREL Laboratories

**Smith Chart Dipole Impedance****Head**S11 FORWARD REFLECTION  
IMPEDANCECW 1 - S11  
5.0504 kW REF  
8.000 dB OFFSET  
8.00° OFFSETMARKER 2  
2.450000 GHz  
50.000 Ω  
-186.117 jΩMARKER TO MAX  
MARKER TO MIN1 2.309956 GHz  
30.981 Ω  
0.254 jΩ  
2 2.517319 GHz  
43.258 Ω  
6.429 jΩMARKER READOUT  
FUNCTIONS**Body**S11 FORWARD REFLECTION  
IMPEDANCECW 1 - S11  
5.0504 kW REF  
8.000 dB OFFSET  
8.00° OFFSETMARKER 2  
2.450000 GHz  
50.672 Ω  
-3.204 jΩMARKER TO MAX  
MARKER TO MIN1 2.400299 GHz  
60.458 Ω  
3.204 jΩ  
2 2.510700 GHz  
41.655 Ω  
3.000 jΩMARKER READOUT  
FUNCTIONS

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

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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 May 2014.

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

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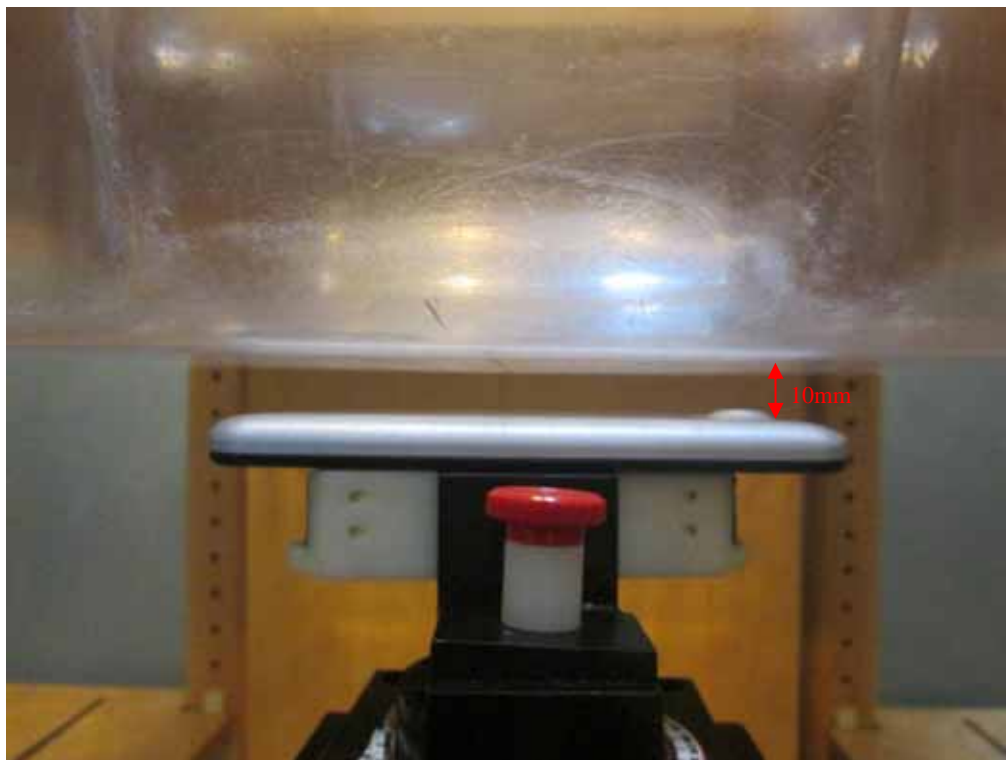


## APPENDIX D EUT TEST POSITION PHOTOS

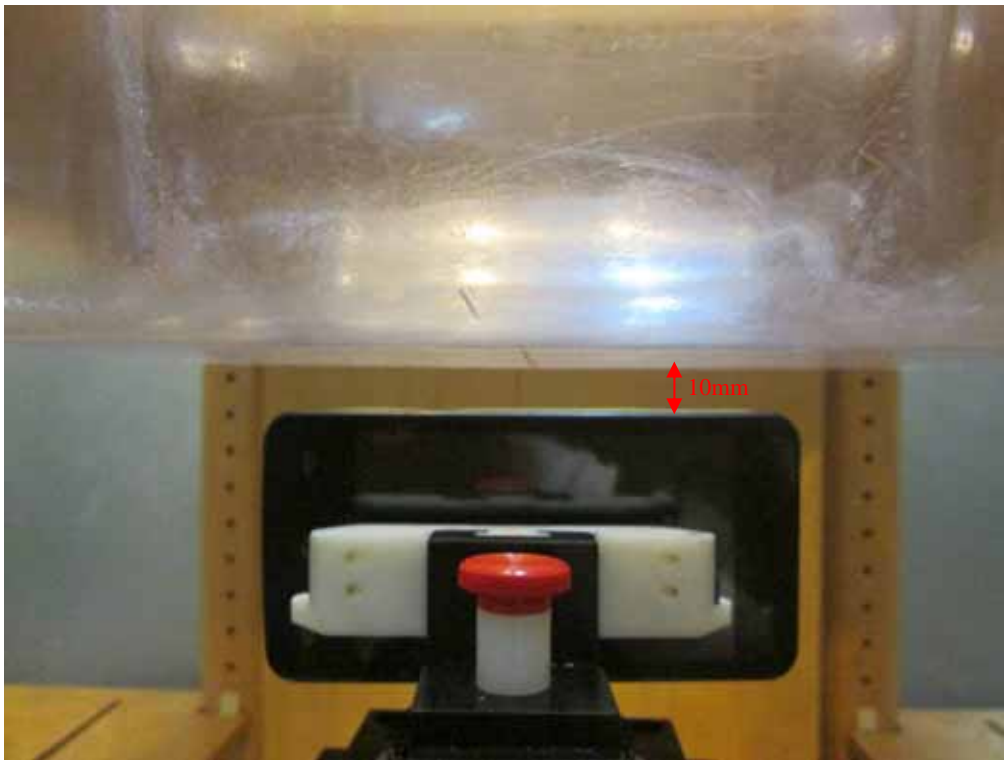
Liquid depth  $\geq 15\text{cm}$



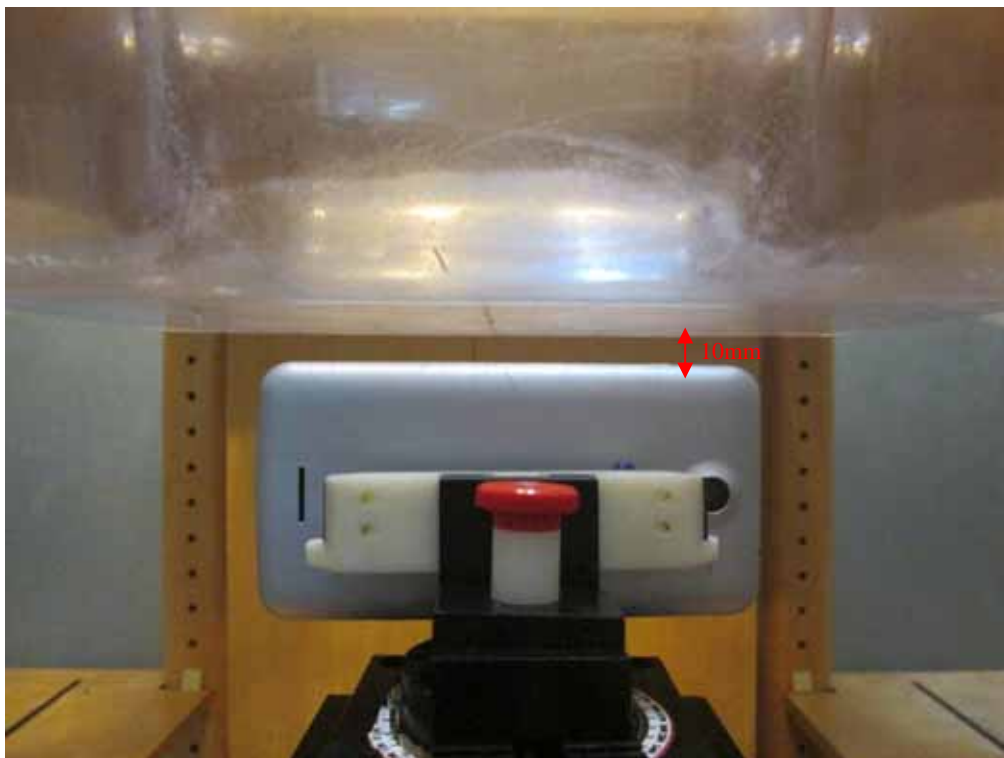
Body-worn Back Setup Photo (10mm)



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



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

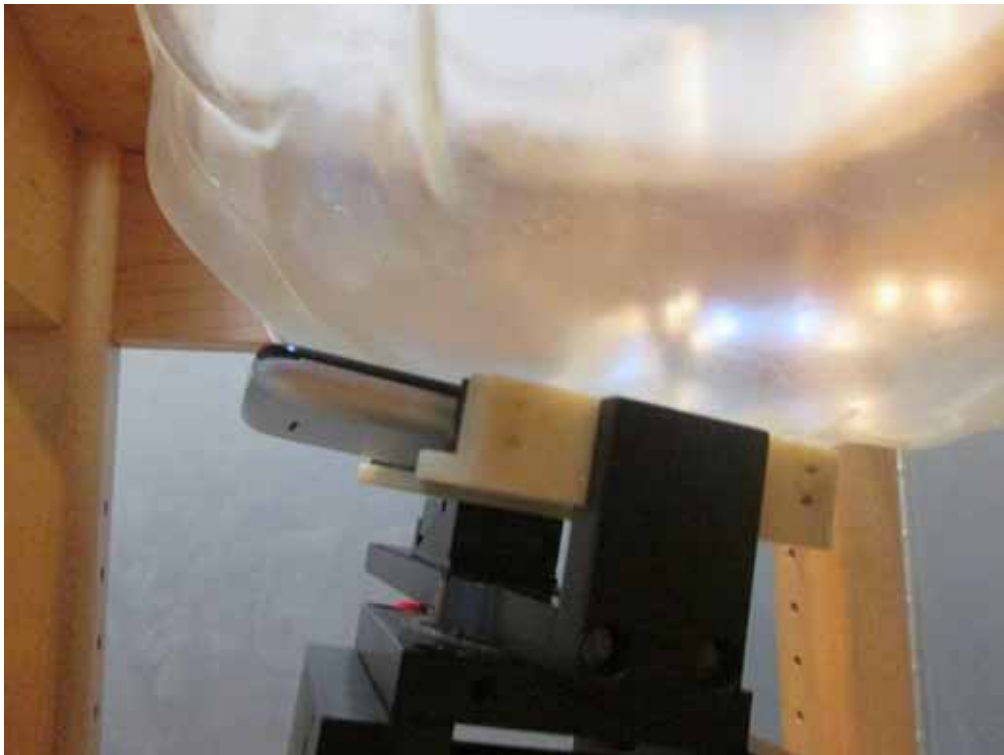




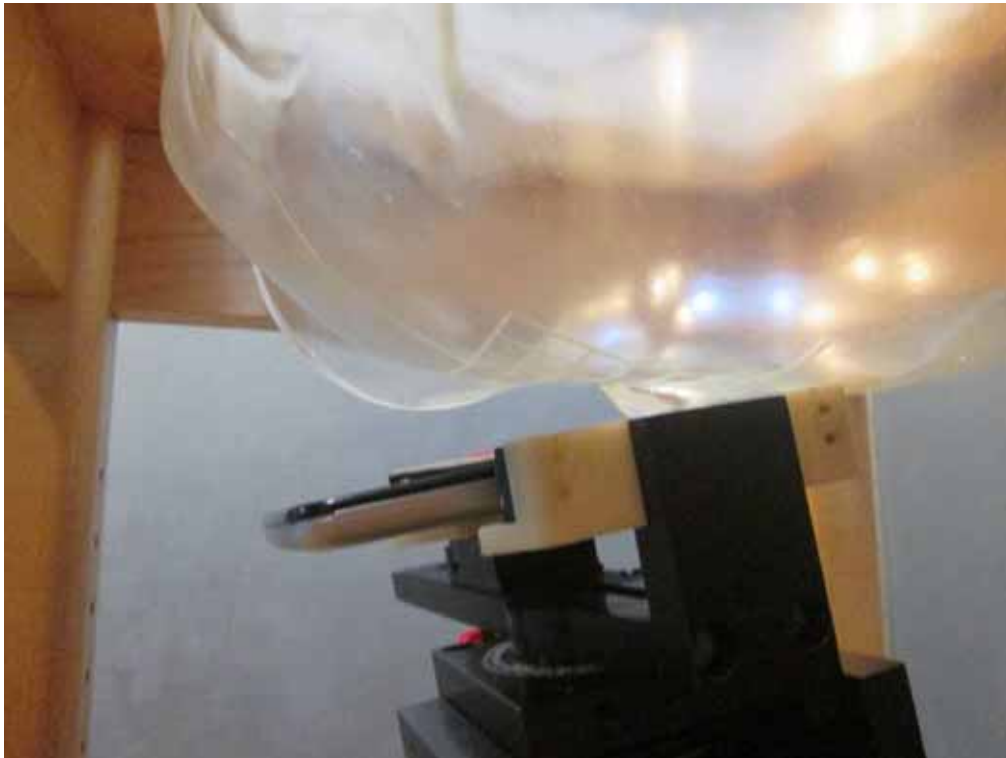
**Body-worn Bottom Setup Photo (10mm)**



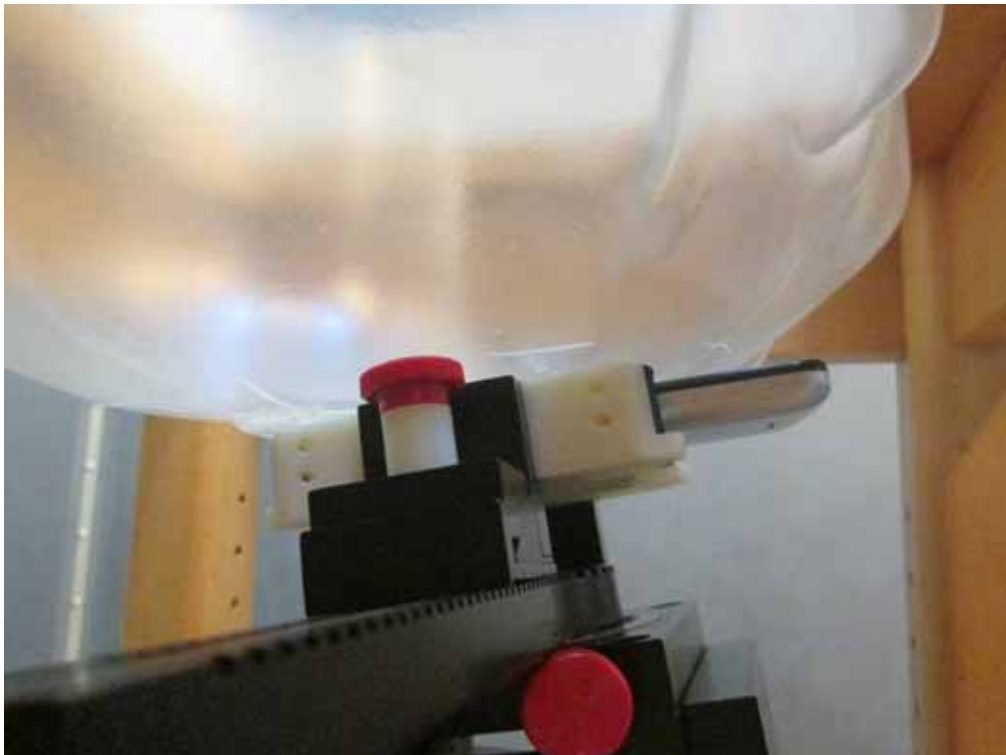
**Left Head Touch Setup Photo**



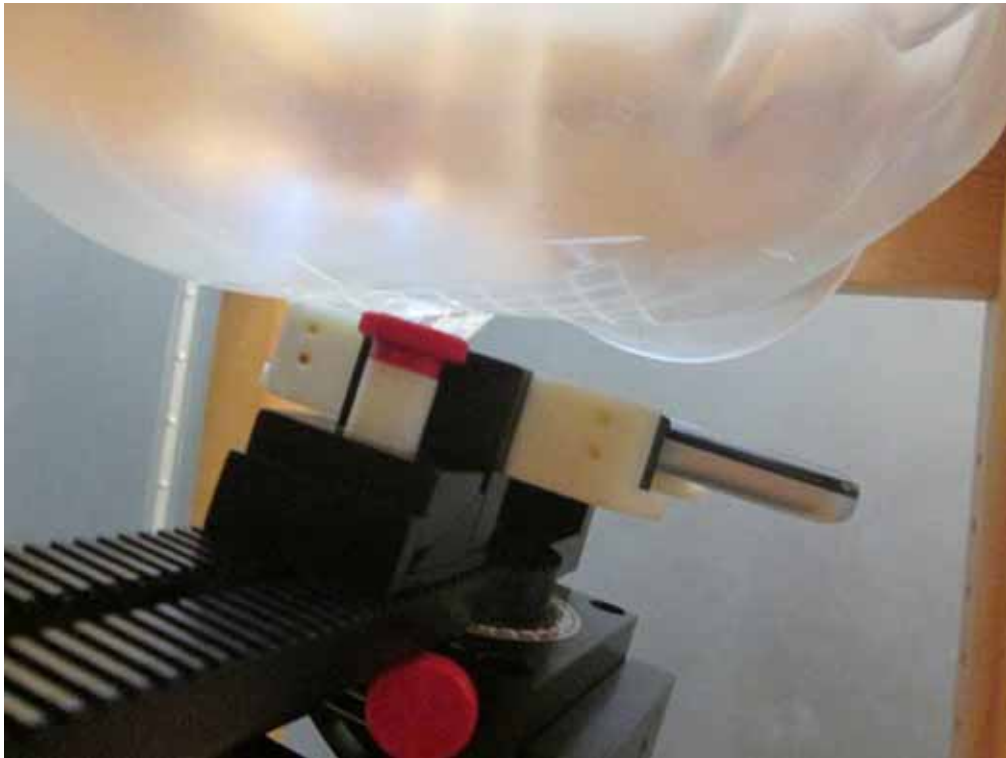
**Left Head Tilt Setup Photo**



**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**



# EUT – Uncover View



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## APPENDIX F INFORMATIVE REFERENCES

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