

# SAR EVALUATION REPORT

For

## Dynamics Hong Kong Limited

Room F, 16/F, Block1, Golden Dragon Industrial Center,  
152-160 Tai Lin Pai Road, Kwai Chung, N.T.

**FCC ID: C89PRIME5PLUS**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Mobile Phone
<b>Test Engineer:</b> Wilson Chen	<i>Wilson Chen</i>
<b>Report Number:</b> RDG150302006-20	
<b>Report Date:</b> 2015-03-13	
<b>Reviewed By:</b> SAR Engineer	<i>Bell Hu</i>
<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	Dynamics Hong Kong Limited
	EUT Description	Mobile Phone
	FCC ID	C89PRIME5PLUS
	Model Number	PRIME5.0PLUS
	Test Date	2015-03-09
Frequency	Max. SAR Level(s) Reported	Limit(W/Kg)
GSM 850	0.322 W/kg 1g Head SAR 0.763 W/kg 1g Body SAR	1.6
PCS 1900	0.224 W/kg 1g Head SAR 0.671 W/kg 1g Body SAR	
WCDMA850	0.145 W/kg 1g Head SAR 0.280 W/kg 1g Body SAR	
WCDMA1900	0.127 W/kg 1g Head SAR 0.438 W/kg 1g Body SAR	
WCDMA Band4	0.138 W/kg 1g Head SAR 0.624 W/kg 1g Body SAR	
Wi-Fi	0.246 W/kg 1g Head SAR 0.158 W/kg 1g Body SAR	
Simultaneous	0.556 W/kg 1g Head SAR 0.921 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 SuchFields,100 kHz—300 GHz.	
	IEEE1528:2013 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	
	KDB procedures KDB 447498 D01 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	
Note: This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures. The results and statements contained in this report pertain only to the device(s) evaluated.		

## **TABLE OF CONTENTS**

<b>DOCUMENT REVISION HISTORY .....</b>	<b>5</b>
<b>EUT DESCRIPTION .....</b>	<b>6</b>
TECHNICAL SPECIFICATION .....	6
<b>REFERENCE, STANDARDS, AND GUIDELINES .....</b>	<b>7</b>
SAR LIMITS .....	8
<b>FACILITIES .....</b>	<b>9</b>
<b>DESCRIPTION OF TEST SYSTEM .....</b>	<b>10</b>
<b>EQUIPMENT LIST AND CALIBRATION .....</b>	<b>17</b>
EQUIPMENTS LIST & CALIBRATION INFORMATION .....	17
<b>SAR MEASUREMENT SYSTEM VERIFICATION .....</b>	<b>18</b>
LIQUID VERIFICATION .....	18
SYSTEM ACCURACY VERIFICATION .....	24
SAR SYSTEM VALIDATION DATA .....	25
<b>EUT TEST STRATEGY AND METHODOLOGY .....</b>	<b>41</b>
TEST POSITIONS FOR DEVICE OPERATING NEXT TO A PERSON'S EAR .....	41
CHEEK/TOUCH POSITION .....	42
EAR/TILT POSITION .....	42
TEST POSITIONS FOR BODY-WORN AND OTHER CONFIGURATIONS .....	43
SAR EVALUATION PROCEDURE .....	44
TEST METHODOLOGY .....	44
<b>CONDUCTED OUTPUT POWER MEASUREMENT .....</b>	<b>45</b>
PROVISION APPLICABLE .....	45
TEST PROCEDURE .....	45
MAXIMUM OUTPUT POWER AMONG PRODUCTION UNITS .....	45
TEST RESULTS: .....	46
<b>SAR MEASUREMENT RESULTS .....</b>	<b>51</b>
SAR TEST DATA .....	51
<b>SAR SIMULTANEOUS TRANSMISSION DESCRIPTION .....</b>	<b>59</b>
SAR PLOTS (SUMMARY OF THE HIGHEST SAR VALUES) .....	63
<b>APPENDIX A MEASUREMENT UNCERTAINTY .....</b>	<b>75</b>
<b>APPENDIX B – PROBE CALIBRATION CERTIFICATES .....</b>	<b>76</b>
<b>APPENDIX C DIPOLE CALIBRATION CERTIFICATES .....</b>	<b>86</b>
<b>APPENDIX D EUT TEST POSITION PHOTOS .....</b>	<b>122</b>
LIQUID DEPTH $\geq 15\text{CM}$ .....	122
BODY-WORN BACK SETUP PHOTO (10MM) .....	122
BODY-WORN LEFT SETUP PHOTO (10MM) .....	123
BODY-WORN RIGHT SETUP PHOTO (10MM) .....	123
BODY-WORN BOTTOM SETUP PHOTO (10MM) .....	124
BODY-WORN TOP SETUP PHOTO (10MM) .....	124
LEFT HEAD TOUCH SETUP PHOTO .....	125
LEFT HEAD TILT SETUP PHOTO .....	125
RIGHT HEAD TOUCH SETUP PHOTO .....	126
RIGHT HEAD TILT SETUP PHOTO .....	126
<b>APPENDIX E EUT PHOTOS .....</b>	<b>127</b>
EUT – FRONT VIEW .....	127

EUT – BACK VIEW ..... 127

EUT –LEFT SIDE VIEW ..... 128

EUT – RIGHT SIDE VIEW ..... 128

EUT – TOP VIEW ..... 129

EUT – BOTTOM VIEW..... 129

EUT – UNCOVER VIEW..... 130

**APPENDIX F INFORMATIVE REFERENCES ..... 131**

---

**DOCUMENT REVISION HISTORY**

---

Revision Number	Report Number	Description of Revision	Date of Revision
0	RDG150302006-20	Original Report	2015-03-13

## EUT DESCRIPTION

This report has been prepared on behalf of Dynamics Hong Kong Limited and their product, FCC ID: C89PRIME5PLUS, Model: PRIME5.0PLUS 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 Data, 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) WCDMA1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) WCDMA 1700: 1710-1755 MHz(TX) ; 2110-2155 MHz(RX) Wi-Fi: 2412MHz-2462MHz Bluetooth : 2402MHz-2480MHz
<b>Conducted RF Power:</b>	GSM 850 : 32.30 dBm PCS 1900: 29.05 dBm WCDMA 850: 22.45 dBm WCDMA 1900: 22.79 dBm WCDMA 1700:21.02 dBm Wi-Fi: 14.28 dBm Bluetooth:4.05 dBm
<b>Dimensions (L*W*H):</b>	146 mm (L) × 74 mm (W) × 8 mm (H)
<b>Power Source:</b>	3.7 V <sub>DC</sub> Rechargeable Battery
<b>Normal Operation:</b>	Head and Body-worn

---

## REFERENCE, STANDARDS, AND GUIDELINES

---

### **FCC:**

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

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

### **CE:**

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

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

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

**SAR Limits****FCC Limit (1g Tissue)**

<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.



---

## FACILITIES

---

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.

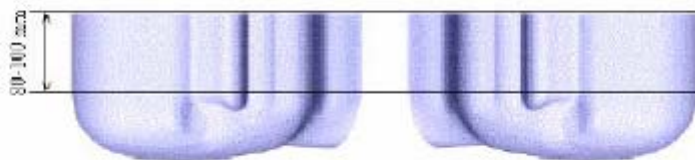


### Phantom Types

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.

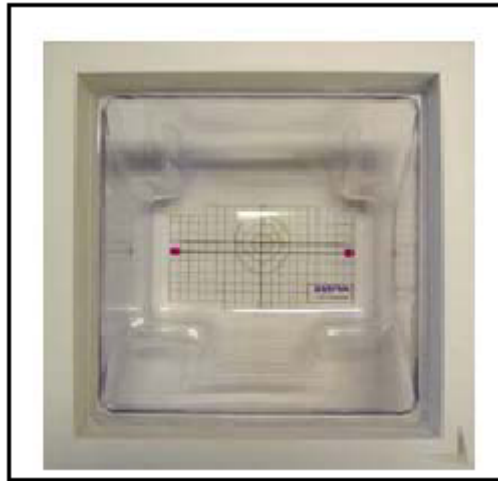


**APREL Laboratories Universal Phantom**

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



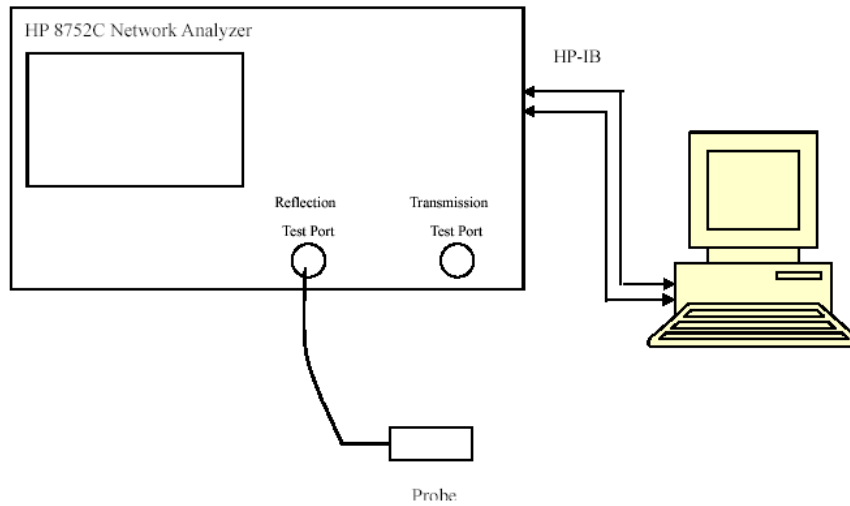
## EQUIPMENT LIST AND CALIBRATION

### 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, 2450MHz	ALS-D-2450-S-2	2014-10-09	220-00758
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
Simulated Tissue 2450 MHz Head	ALS-TS-2450-H	Each Time	290-01108
Simulated Tissue 2450 MHz Body	ALS-TS-2450-B	Each Time	290-01109
Directional couple	DC6180A	N/A	0325849
Power Amplifier	5S1G4	N/A	71377
Dielectric probe kit	HP85070B	2014-06-13	N/A
Attenuator	3dB	2014-05-08	5402
Network analyzer	8752C	2014-06-03	3410A02356
Synthesized Sweeper	HP 8341B	2014-06-03	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	2013-11-23	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	41.08	0.90	41.50	0.90	-1.012	0.000	$\pm 5$
	Body	53.79	0.95	55.20	0.97	-2.554	-2.062	$\pm 5$
826.4	Head	41.06	0.91	41.50	0.90	-1.060	1.111	$\pm 5$
	Body	53.87	0.95	55.20	0.97	-2.409	-2.062	$\pm 5$
836.6	Head	41.02	0.92	41.50	0.90	-1.157	2.222	$\pm 5$
	Body	53.84	0.96	55.20	0.97	-2.464	-1.031	$\pm 5$
846.6	Head	41.06	0.91	41.50	0.90	-1.060	1.111	$\pm 5$
	Body	53.78	0.97	55.20	0.97	-2.572	0.000	$\pm 5$
848.8	Head	41.10	0.92	41.50	0.90	-0.964	2.222	$\pm 5$
	Body	53.83	0.97	55.20	0.97	-2.482	0.000	$\pm 5$
1712.4	Head	39.35	1.35	40.08	1.37	-1.821	-1.460	$\pm 5$
	Body	52.13	1.48	53.43	1.49	-2.433	-0.671	$\pm 5$
1732.4	Head	39.47	1.36	40.08	1.37	-1.522	-0.730	$\pm 5$
	Body	52.55	1.52	53.43	1.49	-1.647	2.013	$\pm 5$
1752.6	Head	39.25	1.39	40.08	1.37	-2.071	1.460	$\pm 5$
	Body	52.59	1.54	53.43	1.49	-1.572	3.356	$\pm 5$
1850.2	Head	39.72	1.38	40.00	1.40	-0.700	-1.429	$\pm 5$
	Body	52.09	1.5	53.30	1.52	-2.270	-1.316	$\pm 5$
1852.4	Head	39.70	1.37	40.00	1.40	-0.750	-2.143	$\pm 5$
	Body	51.94	1.48	53.30	1.52	-2.552	-2.632	$\pm 5$
1880.0	Head	39.56	1.40	40.00	1.40	-1.100	0.000	$\pm 5$
	Body	51.96	1.51	53.30	1.52	-2.514	-0.658	$\pm 5$
1907.6	Head	39.68	1.42	40.00	1.40	-0.800	1.429	$\pm 5$
	Body	52.09	1.54	53.30	1.52	-2.270	1.316	$\pm 5$
1909.8	Head	39.57	1.42	40.00	1.40	-1.075	1.429	$\pm 5$
	Body	52.02	1.54	53.30	1.52	-2.402	1.316	$\pm 5$
2412	Head	39.57	1.80	39.20	1.80	0.944	0.000	$\pm 5$
	Body	52.81	2.01	52.70	1.95	0.247	1.538	$\pm 5$
2437	Head	39.60	1.84	39.20	1.80	1.020	2.222	$\pm 5$
	Body	52.85	1.95	52.70	1.95	0.285	0.000	$\pm 5$
2462	Head	39.66	1.85	39.20	1.80	1.173	2.778	$\pm 5$
	Body	52.87	1.96	52.70	1.95	0.323	0.513	$\pm 5$

\*Liquid Verification was performed on 2015-03-09.

Please refer to the following tables.

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

1750 MHz Head				1750 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1710.0	39.5109	14.5647		1710.0	51.9516	15.6066
1711.5	39.1906	14.2732		1711.5	52.0898	15.5613
1713.0	39.5044	14.1723		1713.0	52.1619	15.5462
1714.5	39.1728	14.5361		1714.5	52.2818	15.5855
1716.0	39.0917	14.0883		1716.0	52.4800	15.7060
1717.5	39.5523	14.2515		1717.5	52.6990	15.7772
1719.0	39.1972	14.4008		1719.0	52.3732	15.7068
1720.5	39.4781	14.5426		1720.5	52.2781	15.5875
1722.0	39.2035	14.1656		1722.0	52.2695	15.6008
1723.5	39.4160	14.0904		1723.5	52.2158	15.5342
1725.0	39.2569	14.2305		1725.0	52.4600	15.6465
1726.5	39.4170	14.3510		1726.5	52.3698	15.6190
1728.0	39.3352	14.2049		1728.0	52.1438	15.4919
1729.5	39.1131	14.5060		1729.5	52.2880	15.5379
1731.0	39.4632	14.2120		1731.0	52.1937	15.5266
1732.5	39.4704	14.1012		1732.5	52.5534	15.7503
1734.0	39.3876	14.3550		1734.0	52.5889	15.7358
1735.5	39.5950	14.1784		1735.5	52.1230	15.4825
1737.0	39.5512	14.1005		1737.0	52.0029	15.4192
1738.5	39.2409	14.5744		1738.5	52.3126	15.5597
1740.0	39.5911	14.5393		1740.0	52.5416	15.7159
1741.5	39.2201	14.5137		1741.5	52.3556	15.5669
1743.0	39.4402	14.3423		1743.0	52.1811	15.5034
1744.5	39.3541	14.1966		1744.5	52.5739	15.7673
1746.0	39.5839	14.3118		1746.0	52.6213	15.7694
1747.5	39.3370	14.5663		1747.5	52.2910	15.6522
1749.0	39.5376	14.0847		1749.0	51.9388	15.4463
1750.5	39.1239	14.1540		1750.5	51.9850	15.5049
1752.0	39.1774	14.1864		1752.0	52.5624	15.8026
1753.5	39.5648	14.5588		1753.5	52.6873	15.7853
1755.0	39.3960	14.3673		1755.0	52.4572	15.7096
1756.5	39.3861	14.0957		1756.5	52.3293	15.6401
1758.0	39.4898	14.4183		1758.0	52.5245	15.7111
1759.5	39.3021	14.4250		1759.5	52.6102	15.7639
1761.0	39.5803	14.1641		1761.0	52.3919	15.7252
1762.5	39.4580	14.4677		1762.5	52.4466	15.6620
1764.0	39.6107	14.3757		1764.0	52.7221	15.8530
1765.5	39.3621	14.5296		1765.5	52.6741	15.7972
1767.0	39.3357	14.4472		1767.0	52.5483	15.7545
1768.5	39.3405	14.5135		1768.5	52.3531	15.7437
1770.0	39.6169	14.2328		1770.0	52.5950	15.7495
1771.5	39.1552	14.1737		1771.5	52.6456	15.7515
1773.0	39.3697	14.5498		1773.0	52.3546	15.6818
1774.5	39.1302	14.1041		1774.5	52.3208	15.6430
1776.0	39.2531	14.3765		1776.0	52.6550	15.7872
1777.5	39.4970	14.5652		1777.5	52.7254	15.8787
1779.0	39.4366	14.3805		1779.0	52.6610	15.7959
1780.5	39.3291	14.4344		1780.5	52.4856	15.7328
1782.0	39.5634	14.1815		1782.0	52.6089	15.8156
1783.5	39.6148	14.2594		1783.5	52.7747	15.9088
1785.0	39.1353	14.4378		1785.0	52.8093	15.8736

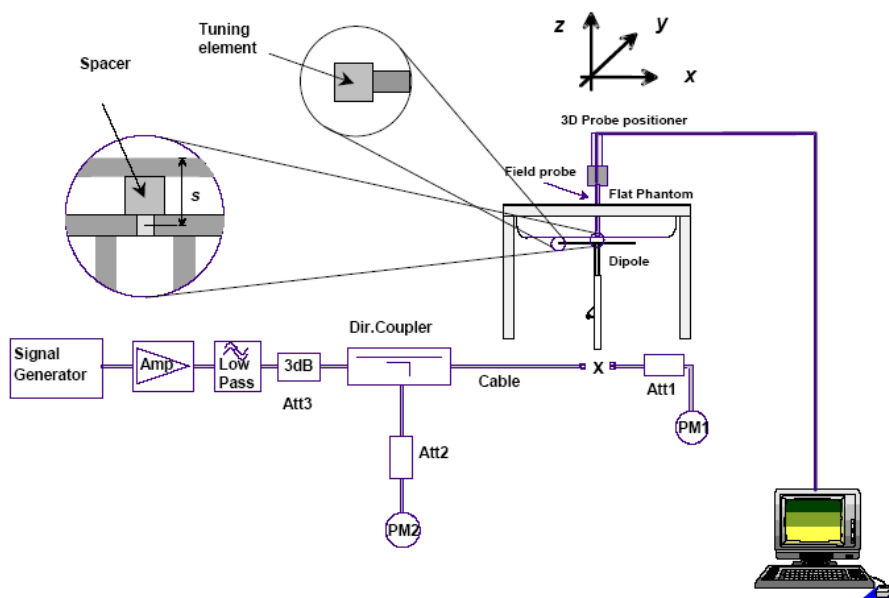
1900 MHz Head				1900 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1850.0	39.7235	13.4055		1850.0	52.0897	14.5359
1851.2	39.7206	13.3485		1851.2	52.0404	14.4620
1852.4	39.7037	13.2547		1852.4	51.9432	14.4122
1853.6	39.5889	13.2424		1853.6	51.9569	14.4839
1854.8	39.6430	13.3286		1854.8	52.0349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

2450 MHz Head				2450 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
2410.0	39.6139	13.3505		2410.0	52.8132	15.0499
2411.0	39.6503	13.4457		2411.0	52.8079	14.8787
2412.0	39.5693	13.3880		2412.0	52.8060	14.8320
2413.0	39.5217	13.4752		2413.0	52.8040	14.9236
2414.0	39.4656	13.3749		2414.0	52.8693	14.3060
2415.0	39.4976	13.4825		2415.0	52.8158	14.2251
2416.0	39.7022	13.4003		2416.0	52.8507	15.0848
2417.0	39.8490	13.2912		2417.0	52.8654	14.0635
2418.0	39.9775	13.5321		2418.0	52.8661	14.0656
2419.0	39.5123	13.4382		2419.0	52.8898	14.7540
2420.0	39.7064	13.4002		2420.0	52.8849	14.8173
2421.0	39.7538	13.3599		2421.0	52.8126	14.8550
2422.0	39.8313	13.5963		2422.0	52.8056	14.1365
2423.0	39.7426	13.4040		2423.0	52.8037	14.4405
2424.0	39.6899	13.3113		2424.0	52.8775	14.6873
2425.0	39.8841	13.4341		2425.0	52.8282	15.1024
2426.0	39.9916	13.4572		2426.0	52.8799	14.6628
2427.0	39.4769	13.4520		2427.0	52.8124	14.8445
2428.0	39.6290	13.4179		2428.0	52.8748	15.0864
2429.0	39.7842	13.2918		2429.0	52.8334	14.8781
2430.0	39.7150	13.4690		2430.0	52.8150	14.2479
2431.0	39.9127	13.5618		2431.0	52.8397	14.0473
2432.0	39.6964	13.5520		2432.0	52.8833	14.0933
2433.0	39.8286	13.3517		2433.0	52.8464	14.4219
2434.0	39.5798	13.3935		2434.0	52.8828	14.3896
2435.0	39.8187	13.4063		2435.0	52.8110	14.0050
2436.0	39.6358	13.3387		2436.0	52.7970	14.1526
2437.0	39.5966	13.5946		2437.0	52.8283	14.3184
2438.0	39.6110	13.5799		2438.0	52.8703	14.9815
2440.0	39.7912	13.4214		2440.0	52.8555	14.8036
2441.0	39.9477	13.5550		2441.0	52.8767	15.0073
2442.0	39.6216	13.3049		2442.0	52.8139	15.0325
2443.0	39.4493	13.5736		2443.0	52.8892	14.4395
2444.0	39.9500	13.5344		2444.0	52.8221	14.4601
2445.0	39.9742	13.5912		2445.0	52.8759	14.6083
2446.0	39.6925	13.4276		2446.0	52.8196	14.3551
2447.0	39.9676	13.5349		2447.0	52.8856	15.0123
2448.0	39.9775	13.4094		2448.0	52.8494	14.6325
2449.0	39.7369	13.3681		2449.0	52.8005	15.0705
2450.0	39.4484	13.4009		2450.0	52.8451	14.9246
2451.0	39.6493	13.3287		2451.0	52.8451	14.9147
2452.0	39.7965	13.3441		2452.0	52.8117	14.8198
2453.0	39.8190	13.5289		2453.0	52.8527	14.3823
2454.0	39.5446	13.5543		2454.0	52.8685	14.7577
2455.0	39.8294	13.3680		2455.0	52.8458	14.5917
2456.0	39.7674	13.4246		2456.0	52.7988	15.0527
2457.0	39.9323	13.3376		2457.0	52.8538	14.0626
2458.0	39.6853	13.5115		2458.0	52.8031	15.1306
2459.0	39.7754	13.5912		2459.0	52.8049	14.9407
2460.0	39.8410	13.2816		2460.0	52.8692	14.3063
2461.0	39.8452	13.5769		2461.0	52.8110	15.1368
2462.0	39.6579	13.4991		2462.0	52.8593	14.8512

## 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
APREL	Dipole antenna(2450MHz)	ALS-D-2450-S-2	220-00758	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 (%)
2015-03-09	835	Head	1g	10.130	9.773	3.653	$\pm 10$
		Body	1g	9.552	9.736	-1.890	$\pm 10$
	1750	Head	1g	35.637	37.020	-3.736	$\pm 10$
		Body	1g	36.315	36.650	-0.914	$\pm 10$
	1900	Head	1g	40.533	39.481	2.665	$\pm 10$
		Body	1g	39.877	39.715	0.408	$\pm 10$
	2450	Head	1g	51.696	54.916	-5.864	$\pm 10$
		Body	1g	52.966	52.418	1.045	$\pm 10$

\*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 : 10.038 W/kg  
Power Drift-Finish : 9.923 W/kg  
Power Drift (%) : -1.061

**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 : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 41.00 F/m  
Sigma : 0.91 S/m  
Density : 1000.00 kg/cu. m

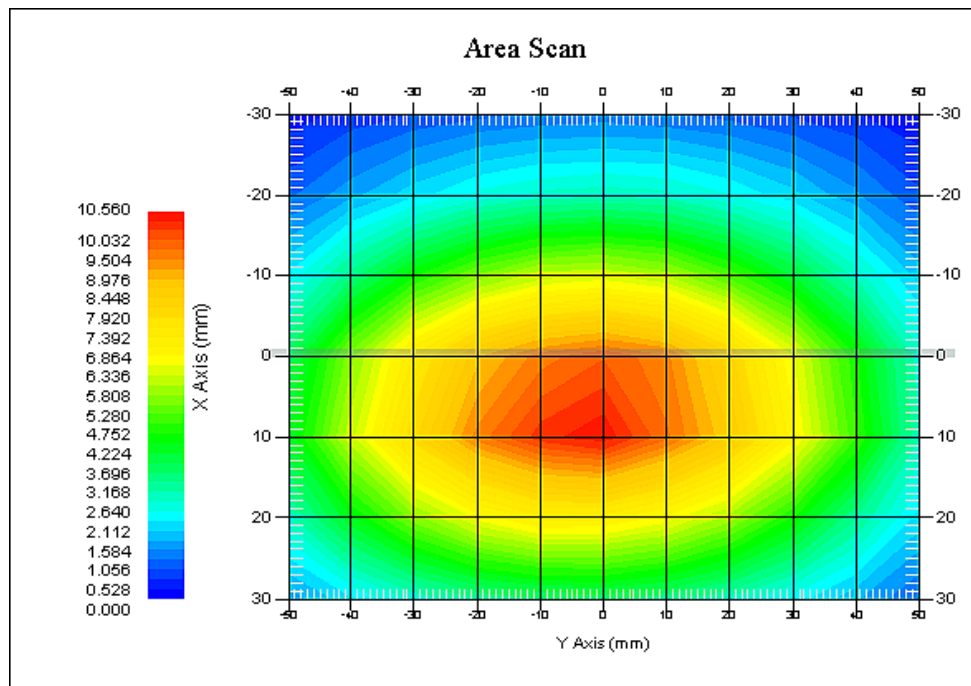
**Probe Data**

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 : 10.130 W/kg  
10 gram SAR value : 6.582 W/kg  
Area Scan Peak SAR : 10.536 W/kg  
Zoom Scan Peak SAR : 17.362 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 : 9.655 W/kg  
Power Drift-Finish : 9.521 W/kg  
Power Drift (%) : 1.379

## 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 : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 53.84 F/m  
Sigma : 0.96 S/m  
Density : 1000.00 kg/cu. m

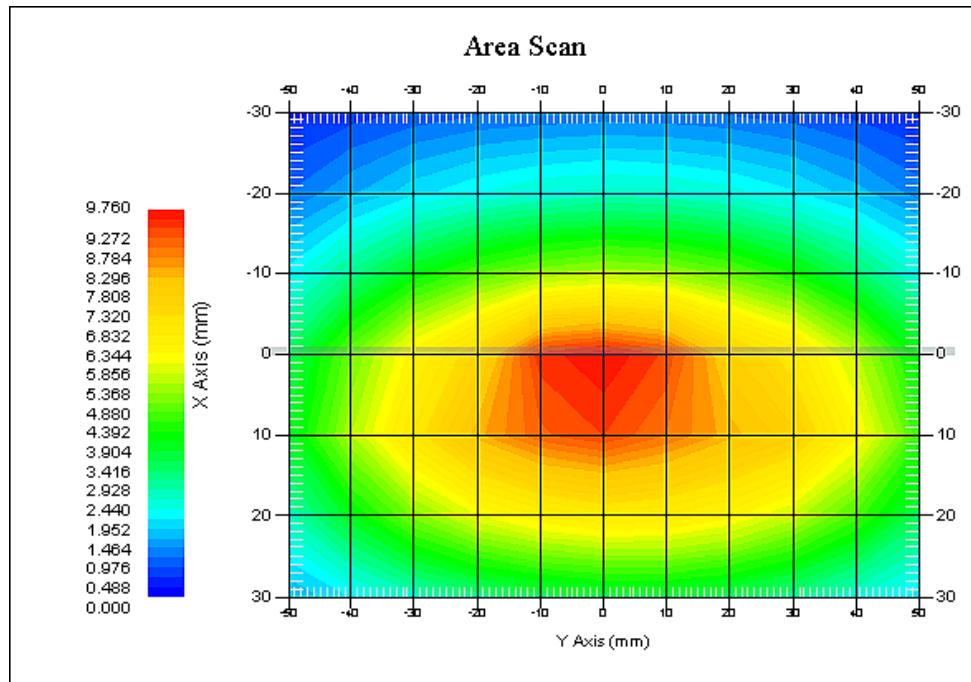
## Probe Data

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  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

## Measurement Data

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

1 gram SAR value : 9.552 W/kg  
10 gram SAR value : 6.222 W/kg  
Area Scan Peak SAR : 9.720 W/kg  
Zoom Scan Peak SAR : 15.598 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 : 32.132 W/kg  
Power Drift-Finish : 32.831 W/kg  
Power Drift (%) : 2.151

**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 : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 39.33 F/m  
Sigma : 1.37 S/m  
Density : 1000.00 kg/cu. M

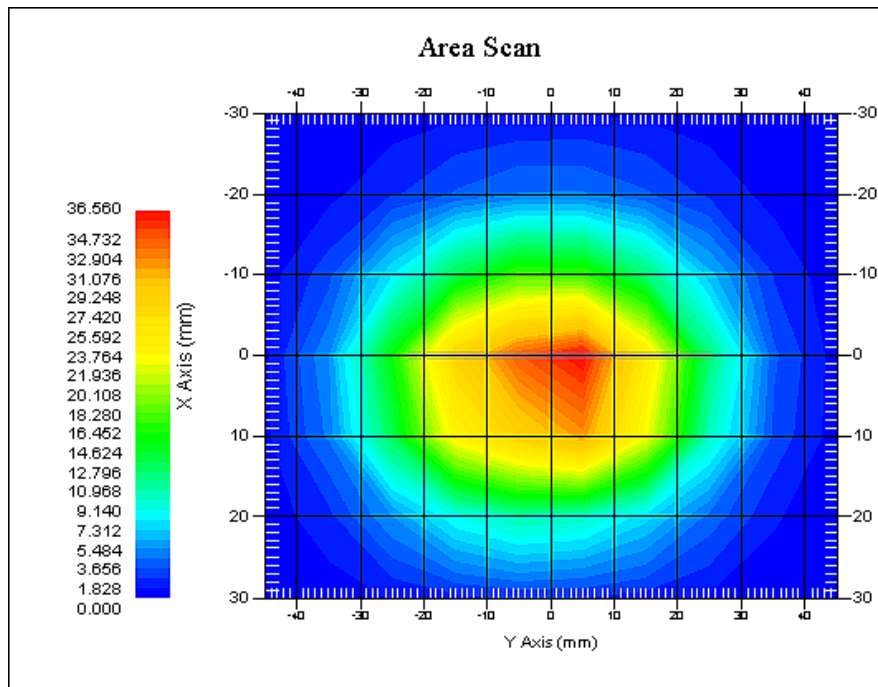
**Probe Data**

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 : 35.637 W/kg  
10 gram SAR value : 19.739 W/kg  
Area Scan Peak SAR : 36.538 W/kg  
Zoom Scan Peak SAR : 68.793 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 : 35.233 W/kg  
Power Drift-Finish : 35.756 W/kg  
Power Drift (%) : 1.426

**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 : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 51.95 F/m  
Sigma : 1.51 S/m  
Density : 1000.00 kg/cu. m

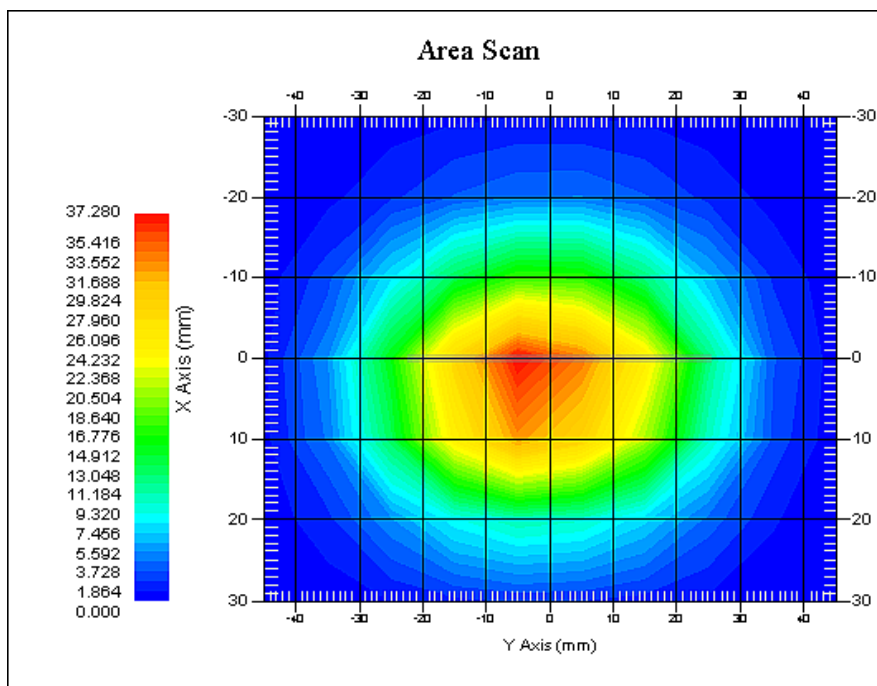
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 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 : 36.315 W/kg  
 10 gram SAR value : 19.137 W/kg  
 Area Scan Peak SAR : 37.157 W/kg  
 Zoom Scan Peak SAR : 66.537 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 : 37.862 W/kg  
Power Drift-Finish : 37.331 W/kg  
Power Drift (%) : -1.316

**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 : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 39.59 F/m  
Sigma : 1.41 S/m  
Density : 1000.00 kg/cu. M

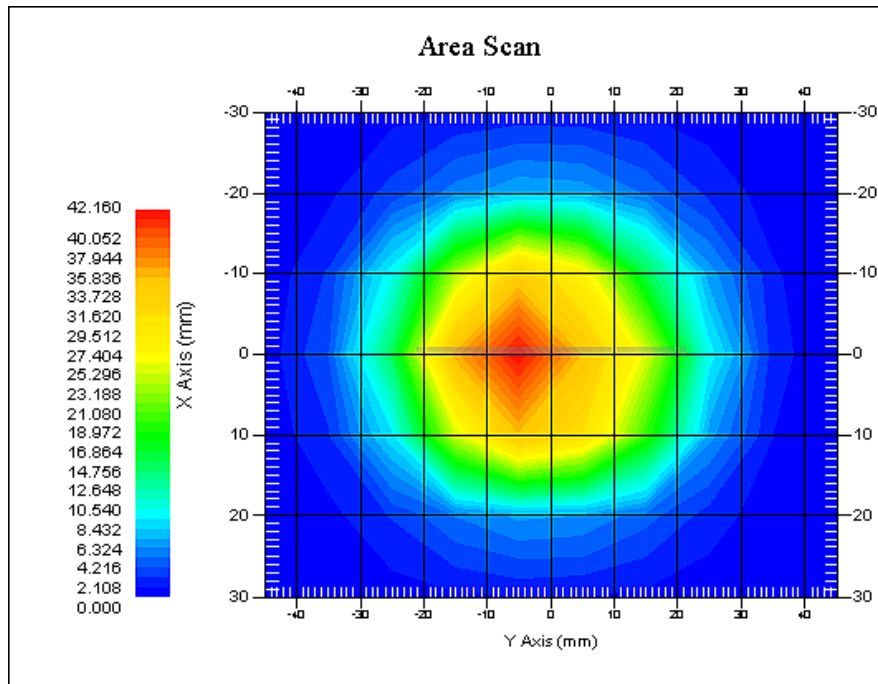
**Probe Data**

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 : 40.533 W/kg  
10 gram SAR value : 20.926 W/kg  
Area Scan Peak SAR : 42.010 W/kg  
Zoom Scan Peak SAR : 71.280 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 : 38.436 W/kg  
Power Drift-Finish : 38.899 W/kg  
Power Drift (%) : 1.185

**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 : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 52.06 F/m  
Sigma : 1.54 S/m  
Density : 1000.00 kg/cu. m

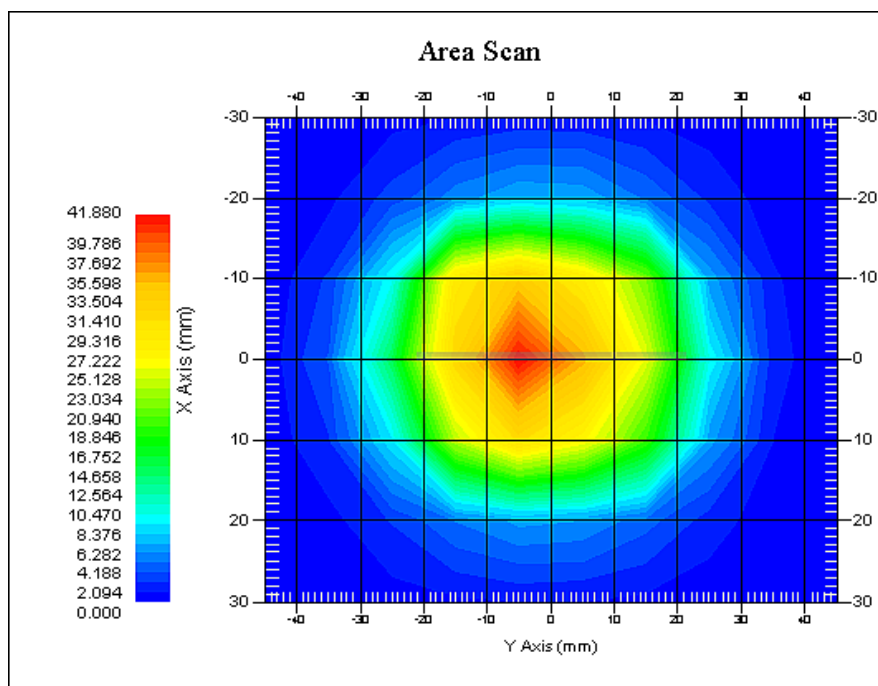
**Probe Data**

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  $\mu\text{V}/(\text{V/m})^2$   
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 : 39.877 W/kg  
10 gram SAR value : 21.233 W/kg  
Area Scan Peak SAR : 41.840 W/kg  
Zoom Scan Peak SAR : 73.802 W/kg



### 1900 MHz System Validation with Body Tissue

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 2450 MHz Head Liquid****Dipole 2450 MHz; Type: ALS-D-2450-S-2; S/N: 220-00758****Product Data**

Device Name : Dipole 2450MHz  
Serial No. : 220-00758  
Type : Dipole  
Model : ALS-D-2450-S-2  
Frequency Band : 2450 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 48.374 W/kg  
Power Drift-Finish : 49.269 W/kg  
Power Drift (%) : 1.736

**Phantom Data**

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

**Tissue Data**

Type : Head  
Serial No. : 290-01109  
Frequency : 2450.0 MHz  
Last Calib. Date : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 50.00 RH%  
Epsilon : 39.54 F/m  
Sigma : 1.83 S/m  
Density : 1000.00 kg/cu. M

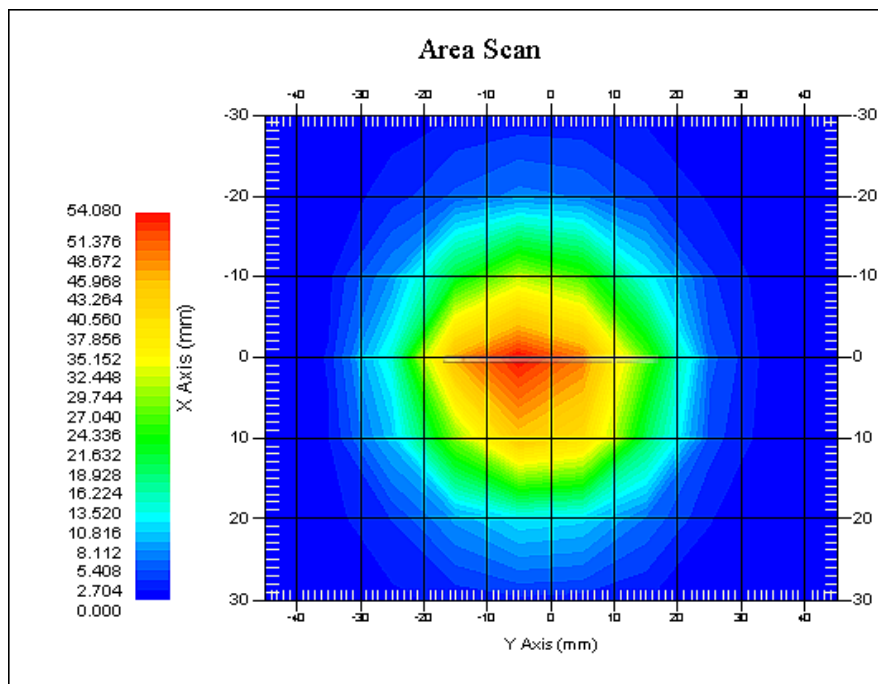
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 2450 MHz  
Duty Cycle Factor : 1  
Conversion Factor : 4.3  
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. : 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 : 51.696 W/kg  
10 gram SAR value : 22.718 W/kg  
Area Scan Peak SAR : 54.025 W/kg  
Zoom Scan Peak SAR : 92.689 W/kg



### 2450 MHz System Validation with Head Tissue

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****System Performance Check 2450 MHz Body Liquid****Dipole 2450 MHz; Type: ALS-D-2450-S-2; S/N: 220-00758****Product Data**

Device Name : Dipole 2450MHz  
Serial No. : 220-00758  
Type : Dipole  
Model : ALS-D-2450-S-2  
Frequency Band : 2450 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 54.355 W/kg  
Power Drift-Finish : 52.986 W/kg  
Power Drift (%) : 2.367

**Phantom Data**

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

**Tissue Data**

Type : BODY  
Serial No. : 290-01109  
Frequency : 2450.0 MHz  
Last Calib. Date : 09-Mar-2015  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 50.00 RH%  
Epsilon : 54.05 F/m  
Sigma : 2.01 S/m  
Density : 1000.00 kg/cu. M

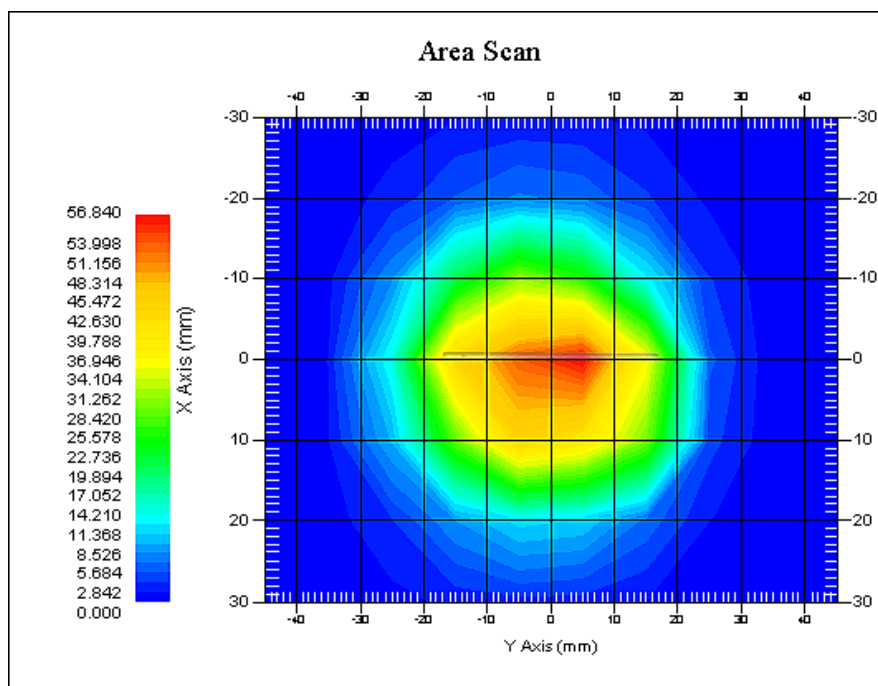
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 2450 MHz  
Duty Cycle Factor : 1  
Conversion Factor : 4.3  
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. : 20.00 °C  
Area Scan : 8x9x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 52.966 W/kg  
10 gram SAR value : 23.711 W/kg  
Area Scan Peak SAR : 56.655 W/kg  
Zoom Scan Peak SAR : 95.396 W/kg



### 2450 MHz System Validation with Body Tissue

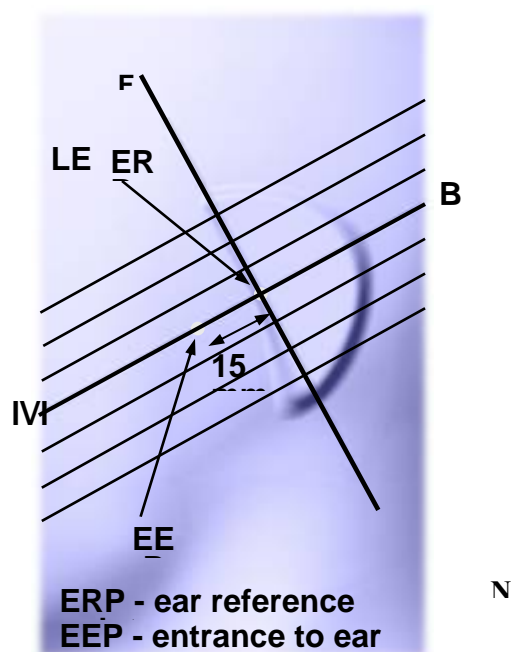
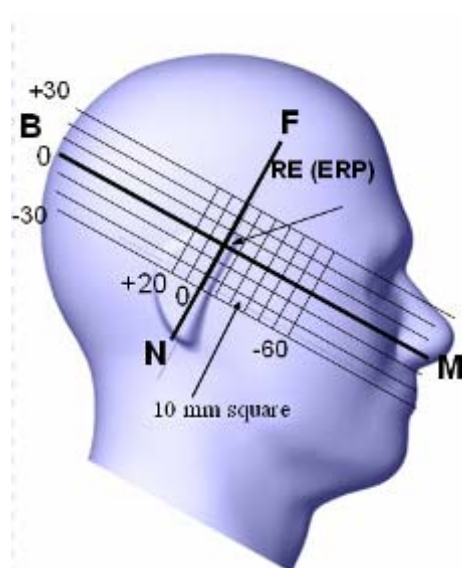


## EUT TEST STRATEGY AND METHODOLOGY

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

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

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



## Cheek/Touch Position

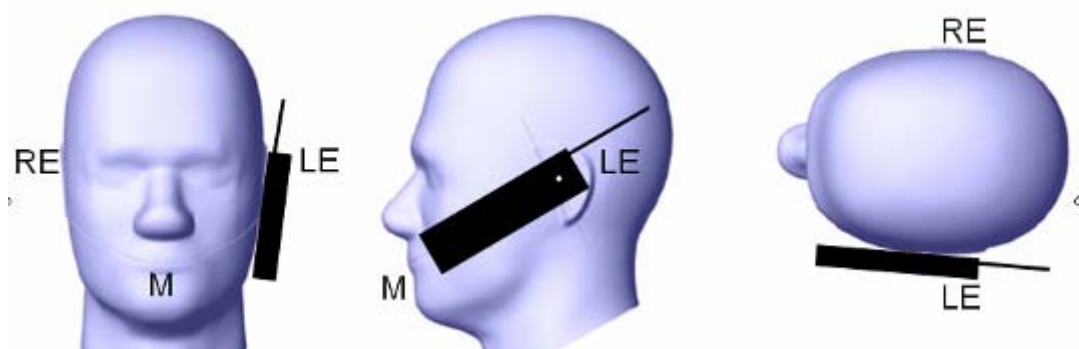
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

This test position is established:

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

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

### Cheek /Touch Position



## Ear/Tilt Position

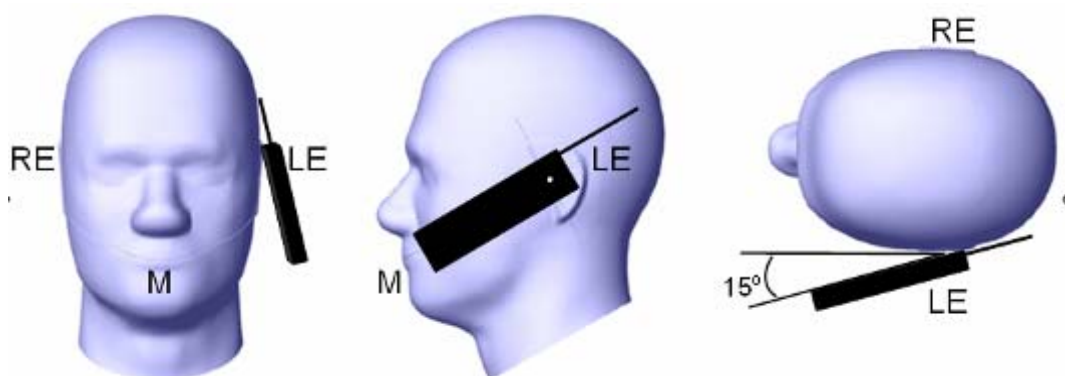
With the handset aligned in the “Cheek/Touch Position”:

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

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

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

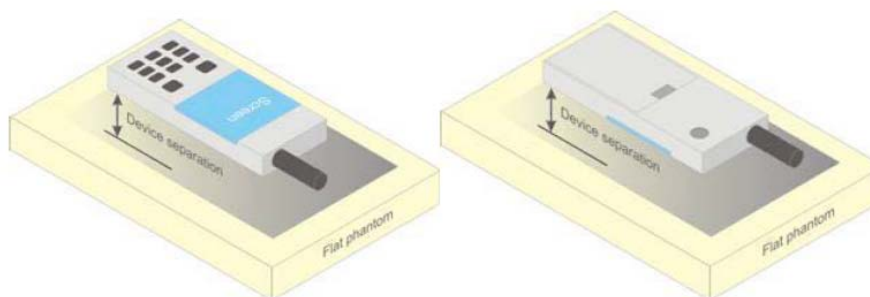
### **Ear /Tilt 15° Position**



### **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.  
KDB 648474 D04  
KDB 865664 D01  
KDB 941225 D01  
KDB 941225 D06

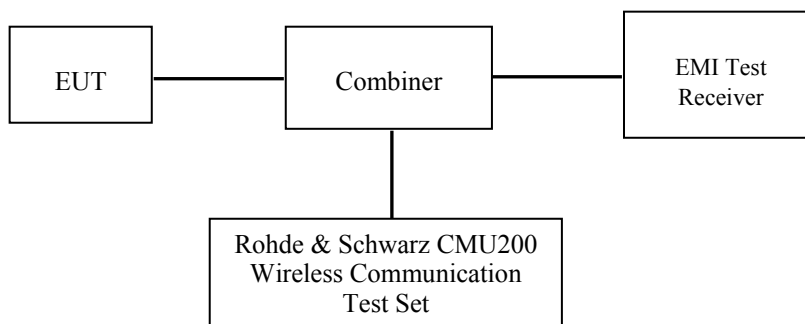
## CONDUCTED OUTPUT POWER MEASUREMENT

### Provision Applicable

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

### Test Procedure

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



### GSM&3G

### Maximum Output Power among production units

Max Target Power for Production Unit (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	32.30	32.30	32.30
GPRS 1 slot	32.30	32.30	32.30
GPRS 2 slot	31.30	31.30	31.30
GPRS 3 slot	29.20	29.20	29.20
GPRS 4 slot	28.50	28.50	28.50
PCS 1900	29.10	29.10	29.10
GPRS 1 slot	29.10	29.10	29.10
GPRS 2 slot	28.10	28.10	28.10
GPRS 3 slot	26.20	26.20	26.20
GPRS 4 slot	25.40	25.40	25.40
WCDMA850	22.50	22.50	22.50
WCDMA1900	22.80	22.80	22.80
WCDMA1700	21.10	21.10	21.10
Wi-Fi	14.30	14.30	14.30
Bluetooth	4.10	4.10	4.10

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

Band	Frequency (MHz)	Conducted Output Power	
		Meas. Power (dBm)	Meas. Power (W)
GSM 850	824.2	32.20	1.660
	836.6	32.25	1.679
	848.8	<b>32.30</b>	1.698
PCS 1900	1850.2	<b>29.05</b>	0.804
	1880.0	29.00	0.794
	1909.8	28.91	0.778

**GPRS:**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	32.14	31.02	29.06	28.23
	190	836.6	32.23	31.15	29.05	28.37
	251	848.8	32.27	31.27	29.16	<b>28.44</b>
PCS 1900	512	1850.2	29.08	28.01	26.11	<b>25.31</b>
	661	1880.0	29.03	27.96	26.03	25.26
	810	1909.8	28.95	27.94	25.94	25.02

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	23.14	25.02	24.81	25.23
	190	836.6	23.23	25.15	24.80	25.37
	251	848.8	23.27	25.27	24.91	<b>25.44</b>
PCS 1900	512	1850.2	20.08	22.01	21.86	<b>22.31</b>
	661	1880.0	20.03	21.96	21.78	22.26
	810	1909.8	19.95	21.94	21.69	22.02

**Note:**

1. Rohde & Schwarz Radio Communication Tester (CMU200) was used for the measurement of GSM peak and average output power for active timeslots.
2. For GSM voice, 1 timeslot has been activated with power level 5 (850 MHz band) and 0 (1900 MHz band).
3. For GPRS, 1, 2, 3 and 4 timeslots has been activated separately with power level 3(850 MHz band) and 3(1900 MHz band).

**WCDMA-Release 99:**

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

<b>WCDMA General Settings</b>	<b>Loopback Mode</b>	Test Mode 1
	<b>Rel99 RMC</b>	12.2kbps RMC
	<b>Power Control Algorithm</b>	Algorithm2
	<b><math>\beta_c / \beta_d</math></b>	8/15

**WCDMA HSDPA**

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

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

**WCDMA HSUPA**

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

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



**Results (12.2kbps RMC)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power	
			(dBm)	(Watt)
WCDMA 850	826.4	4132	<b>22.45</b>	0.176
	836.6	4183	22.29	0.169
	846.6	4233	22.00	0.158
WCDMA 1900	1852.4	9262	22.70	0.186
	1880.0	9400	<b>22.79</b>	0.190
	1907.6	9538	22.48	0.177
WCDMA 1700	1712.4	8562	20.91	0.123
	1732.4	8662	<b>21.02</b>	0.126
	1752.6	8763	20.96	0.125

**Results (HSDPA)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)			
			Subset 1	Subset 2	Subset 3	Subset 4
WCDMA 850	826.4	4132	21.64	21.45	21.63	21.50
	836.6	4183	21.34	21.46	21.40	21.41
	846.6	4233	21.08	21.17	21.19	21.16
WCDMA 1900	1852.4	9262	22.09	22.11	22.08	22.12
	1880.0	9400	22.22	22.28	22.17	22.29
	1907.6	9538	21.82	21.71	21.84	21.79
WCDMA 1700	1712.4	8562	20.76	20.82	20.72	20.80
	1732.4	8662	20.92	20.74	20.87	20.92
	1752.6	8763	20.77	20.70	20.71	20.81

**Results (HSUPA)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)				
			Subset 1	Subset 2	Subset 3	Subset 4	Subset 5
WCDMA 850	826.4	4132	21.55	21.62	21.61	21.63	21.54
	836.6	4183	21.46	21.41	21.36	21.29	21.47
	846.6	4233	21.13	21.13	21.20	21.06	21.03
WCDMA 1900	1852.4	9262	22.19	22.15	22.07	22.01	22.05
	1880.0	9400	22.23	22.10	22.13	22.17	22.11
	1907.6	9538	21.72	21.72	21.80	21.76	21.83
WCDMA 1700	1712.4	8562	20.72	20.81	20.76	20.77	20.85
	1732.4	8662	20.85	20.79	20.73	20.75	20.81
	1752.6	8763	20.75	20.79	20.78	20.76	20.70

**Note:**

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model 1.

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

### Bluetooth

Mode	Channel frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
BDR(GFSK)	(Low)2402	3.29	2.133
	(Middle)2441	3.71	2.350
	(High)2480	<b>4.05</b>	2.541
EDR(4-DQPSK)	(Low)2402	2.65	1.841
	(Middle)2441	3.20	2.089
	(High)2480	3.50	2.239
EDR-8DPSK	(Low)2402	3.07	2.028
	(Middle)2441	3.59	2.286
	(High)2480	3.87	2.438
BT4.0	(Low)2402	-7.09	0.195
	(Middle)2440	-6.33	0.233
	(High)2480	-5.90	0.257

### Wi-Fi

Band	Frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
802.11b	2412	<b>14.28</b>	26.792
	2437	14.15	26.002
	2462	14.13	25.882
802.11g	2412	11.37	13.709
	2437	11.22	13.243
	2462	11.57	14.355
802.11n HT20	2412	10.60	11.482
	2437	10.20	10.471
	2462	10.13	10.304

### Note:

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

## SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

### SAR Test Data

#### Environmental Conditions

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

Testing was performed by Wilson Chen on 2015-03-09

### 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	/	/	/	/	/	/	/
	836.6	GSM	0.749	32.25	32.30	1.012	0.269	0.272	/
	848.8	GSM	/	/	/	/	/	/	/
Left Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	1.282	32.25	32.30	1.012	0.175	0.177	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	824.2	GSM	-3.378	32.20	32.30	1.023	0.275	0.281	/
	836.6	GSM	1.626	32.25	32.30	1.012	0.318	<b>0.322</b>	<b>1#</b>
	848.8	GSM	4.857	32.30	32.30	1.000	0.293	0.293	/
Right Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-4.809	32.25	32.30	1.012	0.168	0.170	/
	848.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-4.931	32.25	32.30	1.012	0.538	0.544	/
	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	-1.077	29.05	29.10	1.012	0.205	0.207	/
	1880.0	GSM	-0.622	29.00	29.10	1.023	0.219	<b>0.224</b>	<b>2#</b>
	1909.8	GSM	2.031	28.91	29.10	1.045	0.183	0.191	/
Left Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	0.072	29.00	29.10	1.023	0.127	0.130	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-3.124	29.00	29.10	1.023	0.21	0.215	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-3.821	29.00	29.10	1.023	0.113	0.116	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	4.205	29.00	29.10	1.023	0.427	0.437	/
	1909.8	GSM	/	/	/	/	/	/	/

**Note:**

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

**WCDMA 850**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	826.4	WCDMA 850	-1.329	22.45	22.50	1.012	0.143	<b>0.145</b>	<b>3#</b>
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Left Head Tilt	826.4	WCDMA 850	0.712	22.45	22.50	1.012	0.087	0.088	/
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Cheek	826.4	WCDMA 850	-1.615	22.45	22.50	1.012	0.132	0.134	/
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Tilt	826.4	WCDMA 850	-4.809	22.45	22.50	1.012	0.079	0.080	/
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/

**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
Left Head Cheek	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-2.156	22.79	22.80	1.002	0.127	<b>0.127</b>	<b>4#</b>
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Left Head Tilt	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-3.385	22.79	22.80	1.002	0.072	0.072	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Cheek	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	0.700	22.79	22.80	1.002	0.123	0.123	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Tilt	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-1.360	22.79	22.80	1.002	0.067	0.067	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/

**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	WCDMA1700	/	/	/	/	/	/	/
	1732.4	WCDMA1700	-4.128	21.02	21.10	1.019	0.129	0.131	/
	1752.6	WCDMA1700	/	/	/	/	/	/	/
Left Head Tilt	1712.4	WCDMA1700	/	/	/	/	/	/	/
	1732.4	WCDMA1700	0.549	21.02	21.10	1.019	0.083	0.085	/
	1752.6	WCDMA1700	/	/	/	/	/	/	/
Right Head Cheek	1712.4	WCDMA1700	/	/	/	/	/	/	/
	1732.4	WCDMA1700	-1.089	21.02	21.10	1.019	0.135	<b>0.138</b>	<b>5#</b>
	1752.6	WCDMA1700	/	/	/	/	/	/	/
Right Head Tilt	1712.4	WCDMA1700	/	/	/	/	/	/	/
	1732.4	WCDMA1700	2.791	21.02	21.10	1.019	0.080	0.081	/
	1752.6	WCDMA1700	/	/	/	/	/	/	/

Note:

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

**Wi-Fi 802.11b**

EUT Position	Frequency (MHz)	Power Drift (%)	Meas. Avg. Power (dBm)	Max. Rated Avg. Power (dBm)	1 g SAR Value (W/Kg)			
					Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	2412	2.273	14.28	14.30	1.005	0.245	<b>0.246</b>	<b>6#</b>
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/
Left Head Tilt	2412	3.051	14.28	14.30	1.005	0.193	0.194	/
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/
Right Head Cheek	2412	2.935	14.28	14.30	1.005	0.233	0.234	/
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/
Right Head Tilt	2412	-3.116	14.28	14.30	1.005	0.187	0.188	/
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/

Note:

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channel is optional.

2. 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.
3. KDB248227-SAR is not required for 802.11g channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

### 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	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	0.544	28.44	28.50	1.014	0.753	<b>0.763</b>	<b>7#</b>
Body-Left (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	-1.037	28.44	28.50	1.014	0.378	0.383	/
Body-Right (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	-1.309	28.44	28.50	1.014	0.157	0.159	/
Body-Bottom (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	0.378	28.44	28.50	1.014	0.339	0.344	/

#### Note:

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
2. The EUT is a Capability Class B mobile phone which can be attached to both GPRS and GSM services.
3. The Multi-slot Classes of EUT is Class 12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.
4. The EUT transmit and receive through the same GSM antenna while testing SAR.
5. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

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

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1850.2	GPRS	1.133	25.31	25.40	1.021	0.657	<b>0.671</b>	<b>8#</b>
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Left (10mm)	1850.2	GPRS	2.698	25.31	25.40	1.021	0.212	0.216	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Right (10mm)	1850.2	GPRS	-3.486	25.31	25.40	1.021	0.107	0.109	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Bottom (10mm)	1850.2	GPRS	4.500	25.31	25.40	1.021	0.482	0.492	/
	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, 1DL+4UL is the worst case.
4. The EUT transmit and receive through the same GSM antenna while testing SAR.
5. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

**Hot Spot-WCDMA850**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	826.4	WCDMA850	0.727	22.45	22.50	1.012	0.277	<b>0.280</b>	<b>9#</b>
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Left (10mm)	826.4	WCDMA850	-2.551	22.45	22.50	1.012	0.175	0.177	/
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Right (10mm)	826.4	WCDMA850	-3.194	22.45	22.50	1.012	0.054	0.055	/
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Bottom (10mm)	826.4	WCDMA850	0.558	22.45	22.50	1.012	0.158	0.160	/
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/



**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	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	0.388	22.79	22.80	1.002	0.437	<b>0.438</b>	<b>10#</b>
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Left (10mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-4.518	22.79	22.80	1.002	0.203	0.203	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Right (10mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	3.100	22.79	22.80	1.002	0.156	0.156	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Bottom (10mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	3.563	22.79	22.80	1.002	0.349	0.350	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/

**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	WCDMA 1700	/	/	/	/	/	/	/
	1732.4	WCDMA 1700	0.733	21.02	21.10	1.019	0.613	<b>0.624</b>	<b>11#</b>
	1752.6	WCDMA 1700	/	/	/	/	/	/	/
Body-Left (10mm)	1712.4	WCDMA 1700	/	/	/	/	/	/	/
	1732.4	WCDMA 1700	0.239	21.02	21.10	1.019	0.332	0.338	/
	1752.6	WCDMA 1700	/	/	/	/	/	/	/
Body-Right (10mm)	1712.4	WCDMA 1700	/	/	/	/	/	/	/
	1732.4	WCDMA 1700	-1.680	21.02	21.10	1.019	0.159	0.163	/
	1752.6	WCDMA 1700	/	/	/	/	/	/	/
Body-Bottom (10mm)	1712.4	WCDMA 1700	/	/	/	/	/	/	/
	1732.4	WCDMA 1700	-1.045	21.02	21.10	1.019	0.470	0.479	/
	1752.6	WCDMA 1700	/	/	/	/	/	/	/

**Note:**

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

**Wi-Fi 802.11b (2412-2462MHz)**

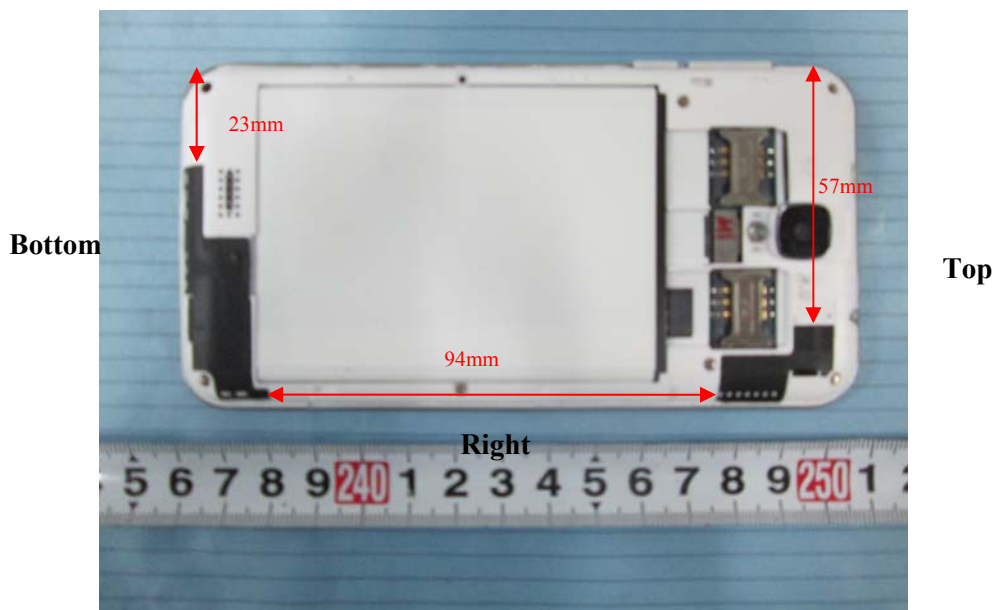
EUT Position	Frequency (MHz)		Power Drift (%)	Meas. Avg. Power (dBm)	Max. Rated Avg. Power (dBm)	1 g SAR Value (W/Kg)			
	Channel	MHz				Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-worn-Back (10mm)	1	2412	-1.250	14.28	14.30	1.005	0.157	<b>0.158</b>	<b>12#</b>
	6	2437	/	/	/	/	/	/	/
	11	2462	/	/	/	/	/	/	/
Body-worn-Right (10mm)	1	2412	2.413	14.28	14.30	1.005	0.102	0.102	/
	6	2437	/	/	/	/	/	/	/
	11	2462	/	/	/	/	/	/	/
Body-worn-Top (10mm)	1	2412	0.565	14.28	14.30	1.005	0.123	0.124	/
	6	2437	/	/	/	/	/	/	/
	11	2462	/	/	/	/	/	/	/

**Note:**

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channel is optional.
2. 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.
3. KDB248227-SAR is not required for 802.11g channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

## 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	√	×	94
GSM + Wi-Fi	√	×	94
GPRS + WCDMA	×	×	0
GPRS + Bluetooth	√	×	0
GPRS + Wi-Fi	√	√	94
WCDMA + Bluetooth	√	×	94
WCDMA + Wi-Fi	√	√	94

### Standalone SAR test exclusion considerations

Head Position:

Mode	Frequency (MHz)	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GSM850	850	23.30	213.796	0	39.4	3.0	No
PCS1900	1900	20.10	102.329	0	28.2	3.0	No
WCDMA850	850	22.50	177.828	0	32.8	3.0	No
WCDMA1900	1900	22.80	190.546	0	52.5	3.0	No
WCDMA1700	1750	21.10	128.825	0	34.1	3.0	No
Wi-Fi	2450	14.30	26.92	0	8.4	3.0	No
Bluetooth	2450	4.10	2.570	0	0.8	3.0	Yes

## Body Position:

Mode	Frequency (MHz)	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (Mw)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GPRS850	850	25.50	354.813	10.00	32.7	3.0	No
GPRS1900	1900	22.40	173.780	10.00	24.0	3.0	No
WCDMA850	850	22.50	177.828	10.00	16.4	3.0	No
WCDMA1900	1900	22.80	190.546	10.00	26.3	3.0	No
WCDMA1700	1750	21.10	128.825	10.00	17.0	3.0	No
Wi-Fi	2450	14.30	26.92	10.00	4.2	3.0	No
Bluetooth	2450	4.10	2.570	10.00	0.4	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)
BT Head	2.45	0	4.10	2.570	0.054
BT Body	2.45	10	4.10	2.570	0.107

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

$[(\text{max. power of channel, including **tune-up tolerance**, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}/x]$   
W/kg for *test separation distances*  $\leq 50$  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	0.272	0.107	0.379
	Left Head Tilt	0.177	0.107	0.284
	Right Head Cheek	0.322	0.107	0.429
	Right Head Tilt	0.170	0.107	0.277
	Body–Headset-Back	0.544	0.054	0.598
PCS1900	Left Head Cheek	0.224	0.107	0.331
	Left Head Tilt	0.130	0.107	0.237
	Right Head Cheek	0.215	0.107	0.322
	Right Head Tilt	0.116	0.107	0.223
	Body–Headset-Back	0.437	0.054	0.491

**WCDMA with BT:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.145	0.107	0.252
	Left Head Tilt	0.088	0.107	0.195
	Right Head Cheek	0.134	0.107	0.241
	Right Head Tilt	0.080	0.107	0.187
WCDMA 1900	Left Head Cheek	0.127	0.107	0.234
	Left Head Tilt	0.072	0.107	0.179
	Right Head Cheek	0.123	0.107	0.23
	Right Head Tilt	0.067	0.107	0.174
WCDMA 1700	Left Head Cheek	0.131	0.107	0.238
	Left Head Tilt	0.085	0.107	0.192
	Right Head Cheek	0.138	0.107	0.245
	Right Head Tilt	0.081	0.107	0.188

**GSM with Wi-Fi:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	Wi-Fi	< 1.6W/kg
GSM850	Left Head Cheek	0.272	0.246	0.518
	Left Head Tilt	0.177	0.194	0.371
	Right Head Cheek	0.322	0.234	<b>0.556</b>
	Right Head Tilt	0.170	0.188	0.358
	Body–Headset-Back	0.544	0.158	0.702
PCS1900	Left Head Cheek	0.224	0.246	0.470
	Left Head Tilt	0.130	0.194	0.324
	Right Head Cheek	0.215	0.234	0.449
	Right Head Tilt	0.116	0.188	0.304
	Body–Headset-Back	0.437	0.158	0.595

**WCDMA with Wi-Fi:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	Wi-Fi	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.145	0.246	0.391
	Left Head Tilt	0.088	0.194	0.282
	Right Head Cheek	0.134	0.234	0.368
	Right Head Tilt	0.080	0.188	0.268
WCDMA 1900	Left Head Cheek	0.127	0.246	0.373
	Left Head Tilt	0.072	0.194	0.266
	Right Head Cheek	0.123	0.234	0.357
	Right Head Tilt	0.067	0.188	0.255
WCDMA 1700	Left Head Cheek	0.131	0.246	0.377
	Left Head Tilt	0.085	0.194	0.279
	Right Head Cheek	0.138	0.234	0.372
	Right Head Tilt	0.081	0.188	0.269

**Conclusion:**

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

**Hotspot:**

Evaluations for Simultaneous SAR, Mobile Hot Spot Positions					
Test Position	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
GPRS 850	0.763	0.383	0.159	0.344	/
GPRS 1900	0.671	0.216	0.109	0.492	/
WCDMA850	0.280	0.177	0.055	0.160	/
WCDMA1900	0.438	0.203	0.156	0.350	/
WCDMA1700	0.624	0.338	0.163	0.479	/
Wi-Fi	0.158	0.102	/	/	0.124
	Σ 1-g SAR(W/Kg)				
GPRS850 + Wi-Fi	<b>0.921</b>	0.485	/	/	/
GPRS1900 + Wi-Fi	0.829	0.318	/	/	/
WCDMA850 + Wi-Fi	0.438	0.279	/	/	/
WCDMA1900 + Wi-Fi	0.596	0.305	/	/	/
WCDMA1700 + Wi-Fi	0.782	0.440	/	/	/

**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)****Right 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 : 0.123 W/kg  
Power Drift-Finish : 0.125 W/kg  
Power Drift (%) : 1.626

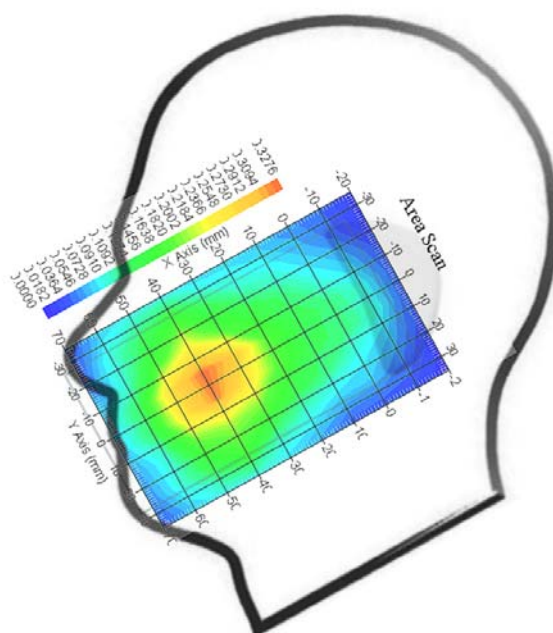
## Tissue Data

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  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.318 W/kg  
10 gram SAR value : 0.235 W/kg  
Area Scan Peak SAR : 0.327 W/kg  
Zoom Scan Peak SAR : 0.537 W/kg

**Plot 1#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Left Head Cheek(1880.0 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 : 0.007 W/kg  
Power Drift-Finish : 0.007 W/kg  
Power Drift (%) : -0.622

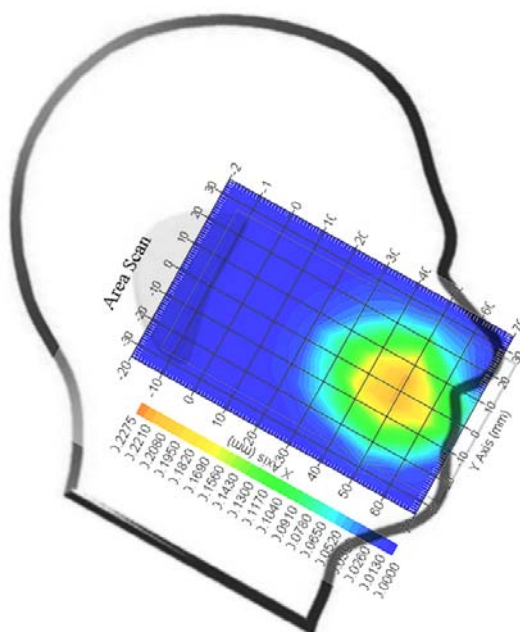
## Tissue Data

Type : Head  
Frequency : 1880.0 MHz  
Epsilon : 39.62 F/m  
Sigma : 1.42 S/m  
Density : 1000.00 kg/cu. M

## Probe Data

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

1 gram SAR value : 0.219 W/kg  
10 gram SAR value : 0.137 W/kg  
Area Scan Peak SAR : 0.227 W/kg  
Zoom Scan Peak SAR : 0.371 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 : WCDMA850  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.003 W/kg  
Power Drift-Finish : 0.003 W/kg  
Power Drift (%) : -1.329

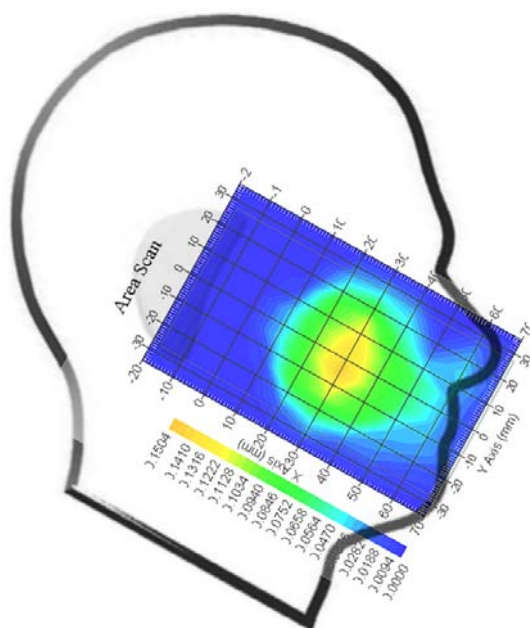
## Tissue Data

Type : Head  
Frequency : 826.4 MHz  
Epsilon : 41.04 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 : 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 : 0.143 W/kg  
10 gram SAR value : 0.076 W/kg  
Area Scan Peak SAR : 0.150 W/kg  
Zoom Scan Peak SAR : 0.263 W/kg

**Plot 3#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA1900; Left Head Cheek (1880 MHz Middle Channel)****Measurement Data**

Test mode : WCDMA1900  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.007 W/kg  
Power Drift-Finish : 0.007 W/kg  
Power Drift (%) : -2.156

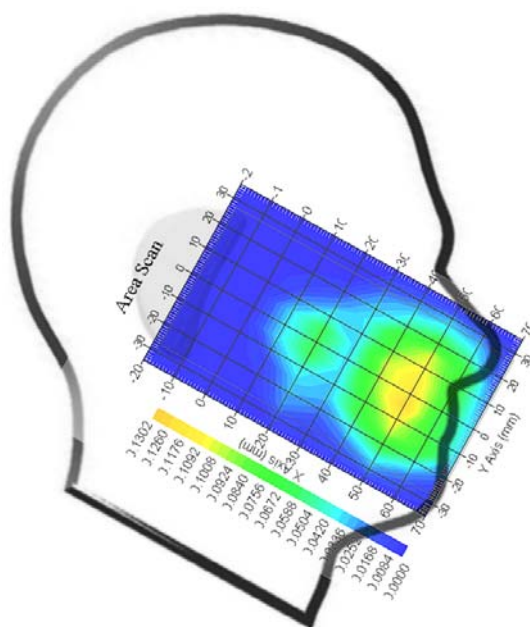
**Tissue Data**

Type : Head  
Frequency : 1880 MHz  
Epsilon : 39.55 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 : 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 : 0.127 W/kg  
10 gram SAR value : 0.075 W/kg  
Area Scan Peak SAR : 0.130 W/kg  
Zoom Scan Peak SAR : 0.193 W/kg

**Plot 4#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA 1700; Right Head Cheek (1732.4 MHz Middle Channel)****Measurement Data**

Test mode : WCDMA Band4  
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 : 0.004 W/kg  
Power Drift-Finish : 0.004 W/kg  
Power Drift (%) : -1.089

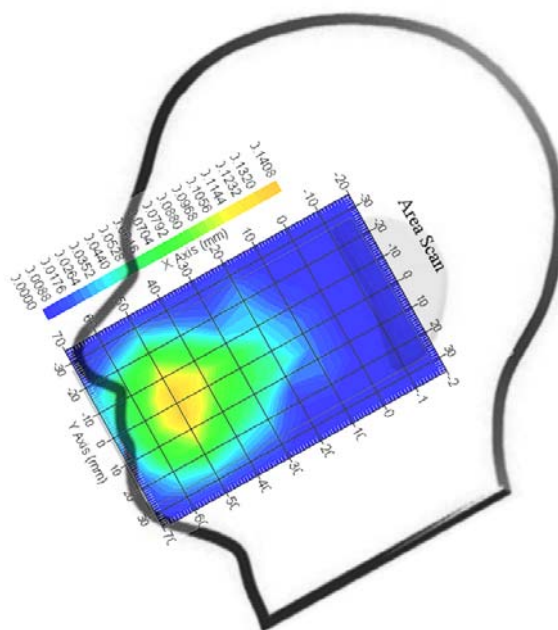
**Tissue Data**

Type : Head  
Frequency : 1732.4 MHz  
Epsilon : 39.55 F/m  
Sigma : 1.39 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 : 0.135 W/kg  
10 gram SAR value : 0.087 W/kg  
Area Scan Peak SAR : 0.140 W/kg  
Zoom Scan Peak SAR : 0.275 W/kg

**Plot 5#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****802.11b; Left Head Cheek (2412 MHz Channel 1)****Measurement Data**

Test mode : 802.11b  
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 : 0.132 W/kg  
Power Drift-Finish : 0.135 W/kg  
Power Drift (%) : 2.273

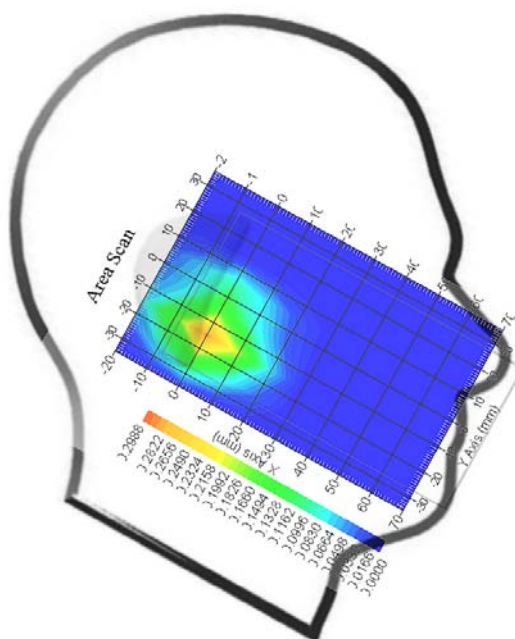
**Tissue Data**

Type : Head  
Frequency : 2412 MHz  
Epsilon : 40.31 F/m  
Sigma : 1.84 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

Serial No. : 500-00283  
Frequency Band : 2450  
Duty Cycle Factor : 1  
Conversion Factor : 4.9  
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 : 0.245 W/kg  
10 gram SAR value : 0.127 W/kg  
Area Scan Peak SAR : 0.293 W/kg  
Zoom Scan Peak SAR : 0.384 W/kg

**Plot 6#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Body-worn-Back (848.8 MHz High 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 : 0.735 W/kg  
Power Drift-Finish : 0.739 W/kg  
Power Drift (%) : 0.544

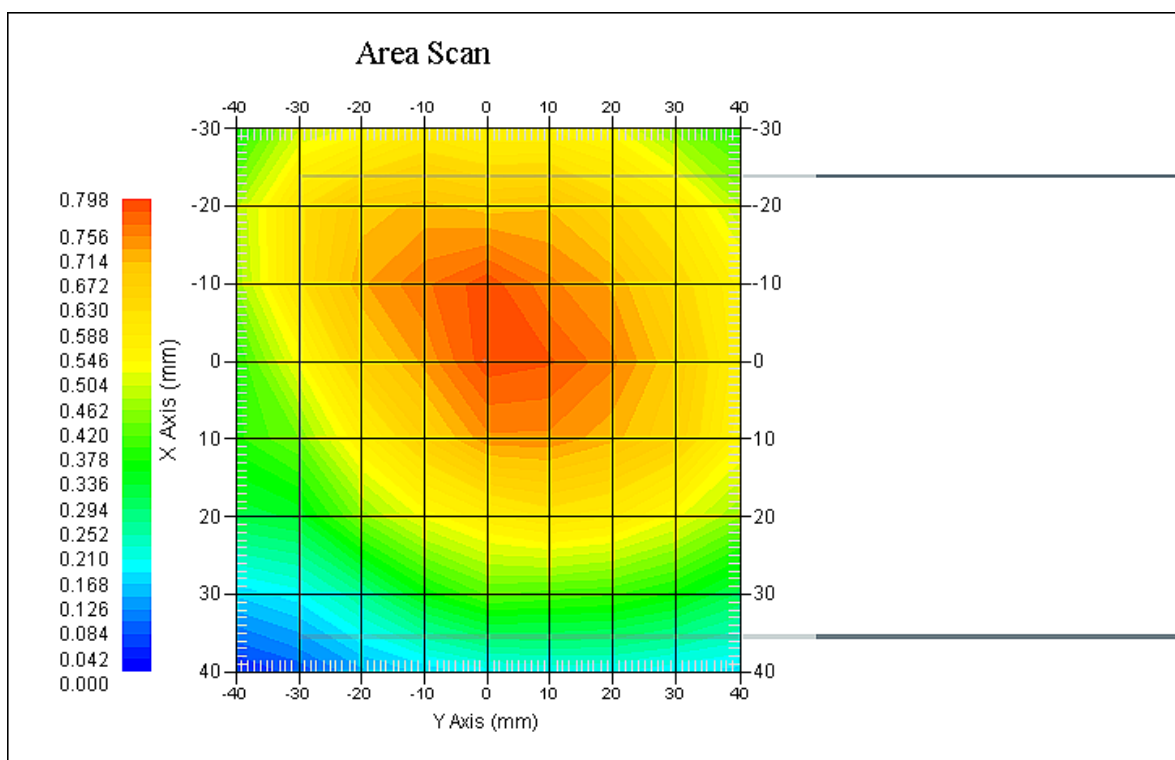
## Tissue Data

Type : Body  
Frequency : 848.8 MHz  
Epsilon : 53.87 F/m  
Sigma : 0.97 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

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

1 gram SAR value : 0.753 W/kg  
10 gram SAR value : 0.589 W/kg  
Area Scan Peak SAR : 0.795 W/kg  
Zoom Scan Peak SAR : 1.220 W/kg

**Plot 7#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Body-worn-Back (1850.2 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 : 0.353 W/kg  
Power Drift-Finish : 0.357 W/kg  
Power Drift (%) : 1.133

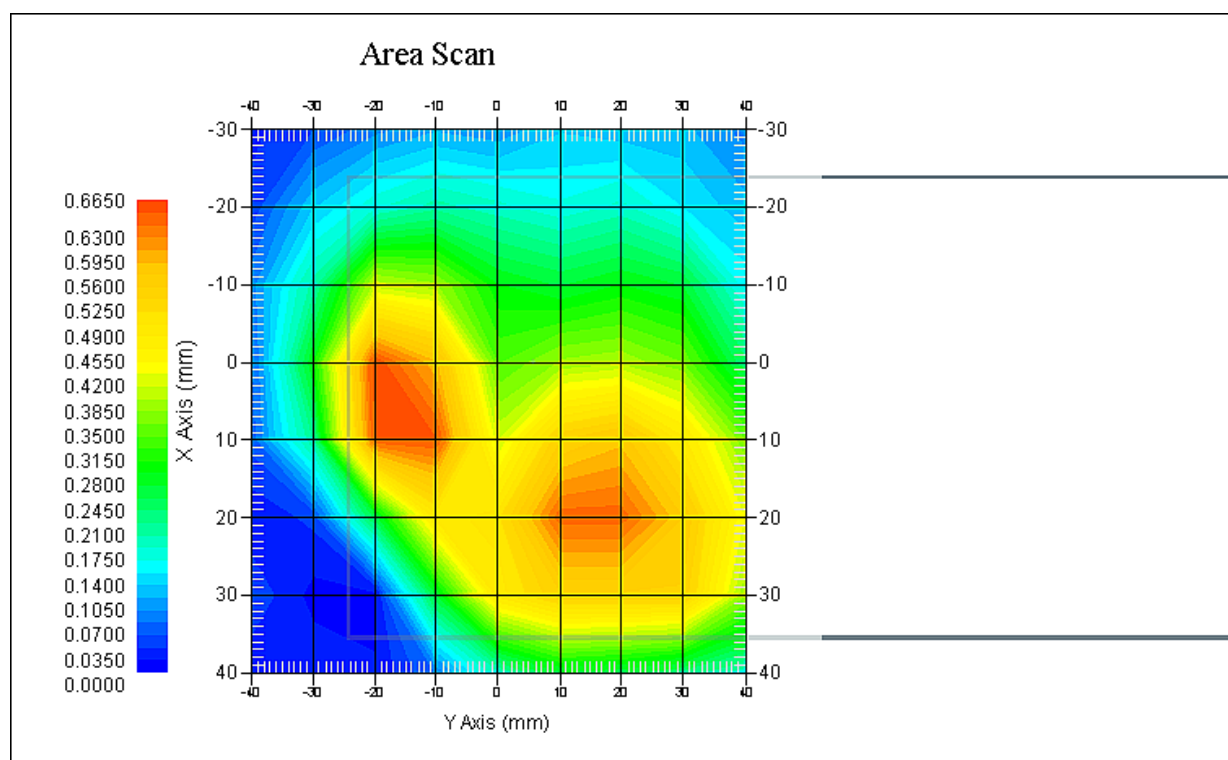
## Tissue Data

Type : Body  
Frequency : 1850.2 MHz  
Epsilon : 52.09 F/m  
Sigma : 1.50 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

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

1 gram SAR value : 0.657 W/kg  
10 gram SAR value : 0.363 W/kg  
Area Scan Peak SAR : 0.663 W/kg  
Zoom Scan Peak SAR : 0.983 W/kg

**Plot 8#**

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

## Measurement Data

Test mode : WCDMA850  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.275 W/kg  
Power Drift-Finish : 0.277 W/kg  
Power Drift (%) : 0.727

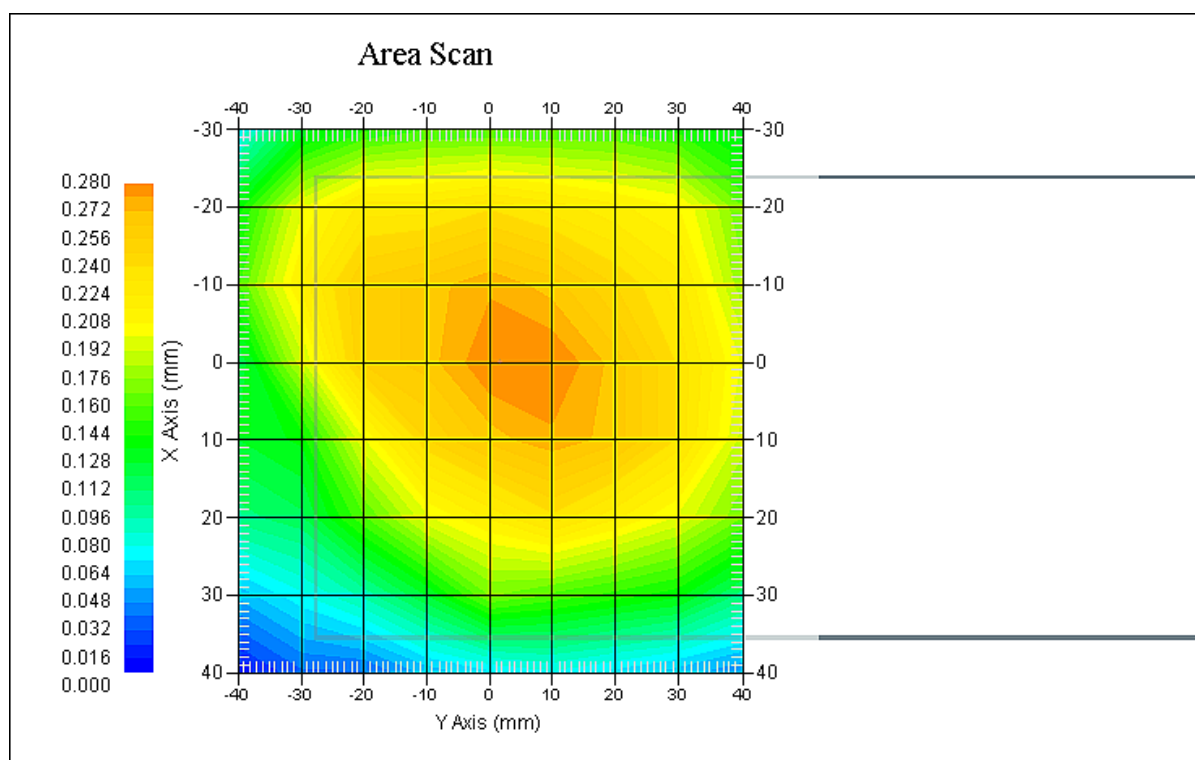
## Tissue Data

Type : Body  
Frequency : 826.4 MHz  
Epsilon : 53.81 F/m  
Sigma : 0.96 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 : 0.277 W/kg  
10 gram SAR value : 0.139 W/kg  
Area Scan Peak SAR : 0.280 W/kg  
Zoom Scan Peak SAR : 0.358 W/kg

**Plot 9#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA1900; Body-Worn-Back (1880 MHz Middle Channel)**

## Measurement Data

Test mode : WCDMA1900  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.258 W/kg  
Power Drift-Finish : 0.259 W/kg  
Power Drift (%) : 0.388

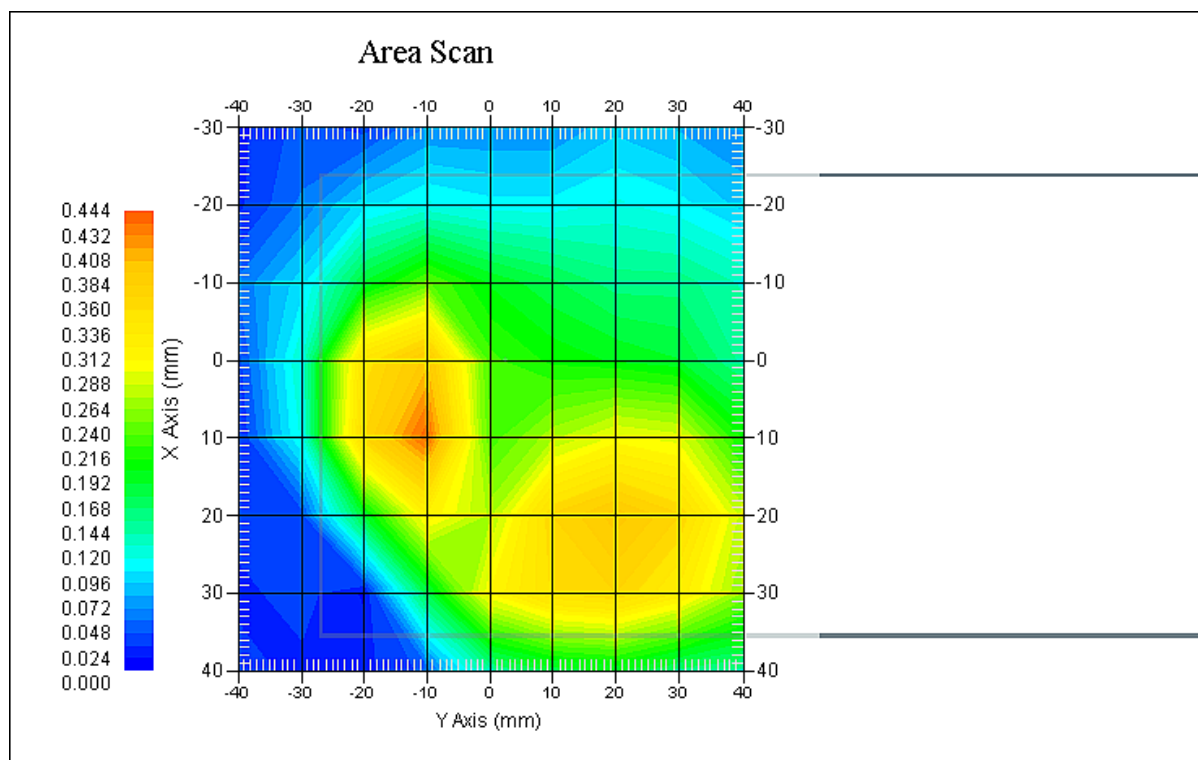
## Tissue Data

Type : Body  
Frequency : 1880 MHz  
Epsilon : 51.96 F/m  
Sigma : 1.52 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 : 0.437 W/kg  
10 gram SAR value : 0.231 W/kg  
Area Scan Peak SAR : 0.443 W/kg  
Zoom Scan Peak SAR : 0.627 W/kg

**Plot 10#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****WCDMA 1700; Body-Worn-Back (1732.4 MHz Middle Channel)****Measurement Data**

Test mode : WCDMA Band4  
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 : 0.273 W/kg  
Power Drift-Finish : 0.275 W/kg  
Power Drift (%) : 0.733

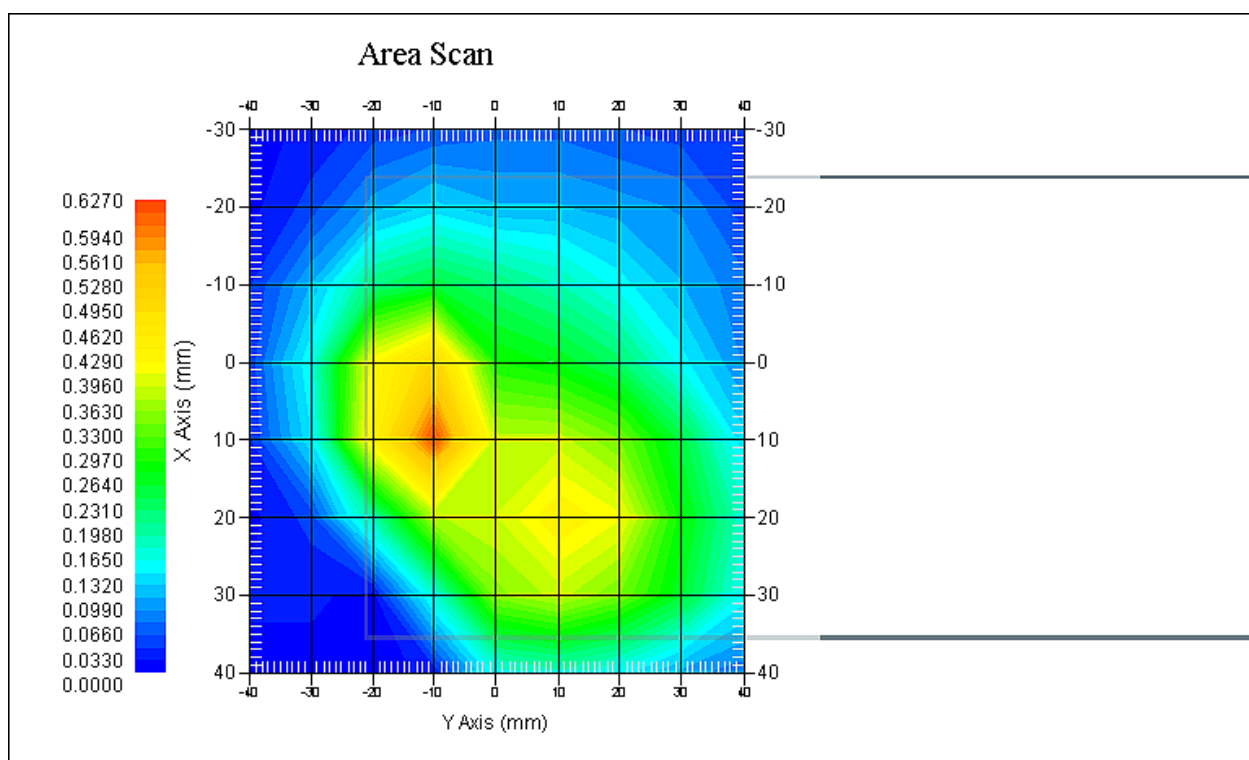
**Tissue Data**

Type : Body  
Frequency : 1732.4 MHz  
Epsilon : 51.84 F/m  
Sigma : 1.50 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 : 0.613 W/kg  
10 gram SAR value : 0.343 W/kg  
Area Scan Peak SAR : 0.627 W/kg  
Zoom Scan Peak SAR : 0.872 W/kg

**Plot 11#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****802.11b; Body-Worn-Back (2412MHz, Channel 1)**

## Measurement Data

Crest Factor : 1  
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 : 0.006 W/kg  
Power Drift-Finish : 0.006 W/kg  
Power Drift (%) : -1.250

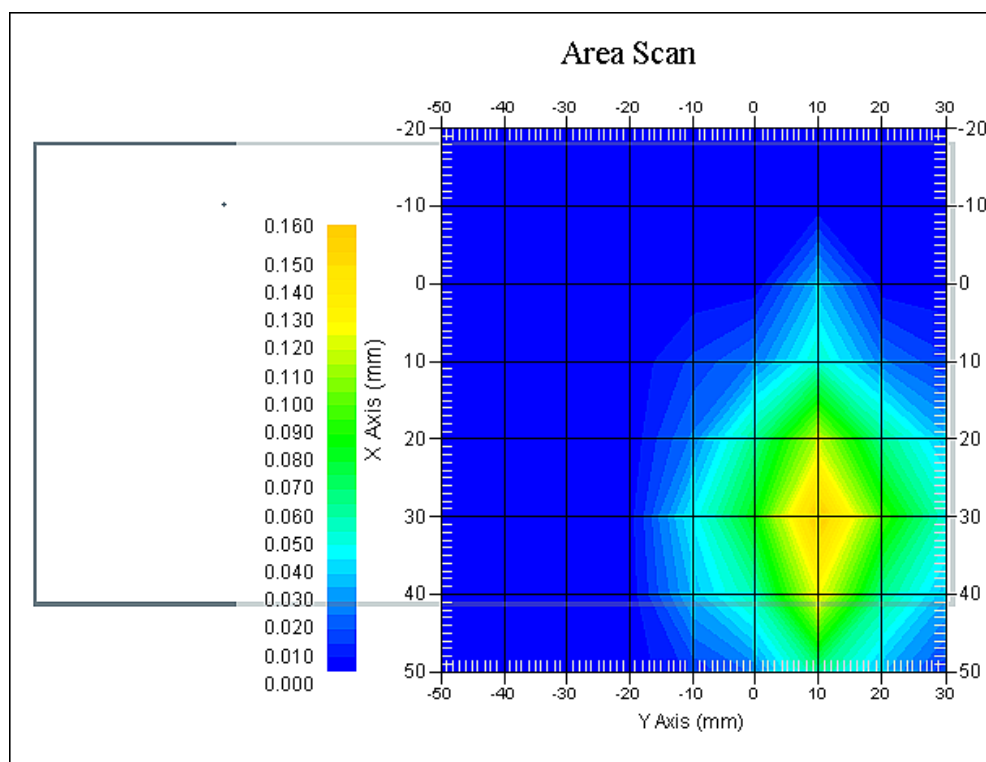
## Tissue Data

Type : Body  
Frequency : 2412 MHz  
Epsilon : 52.81 F/m  
Sigma : 2.01 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Serial No. : 500-00283  
Frequency Band : 2450 MHz  
Duty Cycle Factor : 1  
Conversion Factor : 4.3  
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 : 0.157 W/kg  
10 gram SAR value : 0.088 W/kg  
Area Scan Peak SAR : 0.160 W/kg  
Zoom Scan Peak SAR : 0.235 W/kg

**Plot 12#**

## APPENDIX A MEASUREMENT UNCERTAINTY

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

### Measurement Uncertainty for 30MHz to 6GHz

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

## APPENDIX B – PROBE CALIBRATION CERTIFICATES

### NCL CALIBRATION LABORATORIES

Calibration File No.: PC-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 3J1

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

**NCL Calibration Laboratories**

Division of APREL Inc.

**Introduction**

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

**Calibration Method**

Probes are calibrated using the following methods.

<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

Page 3 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.

**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

Page 4 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.

## 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

Page 5 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.

**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 $\Omega$ .

---

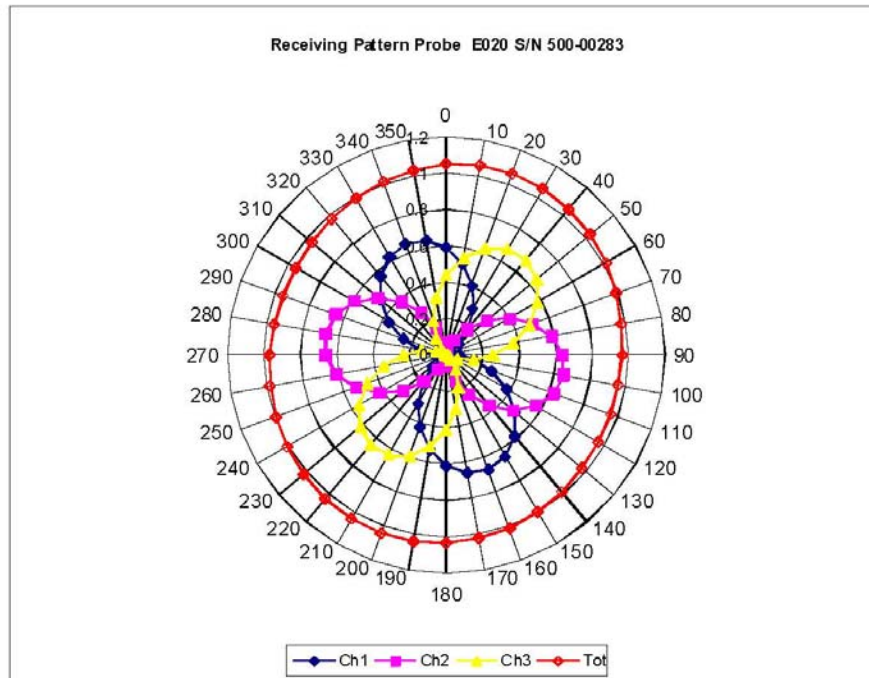
Page 6 of 10

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

**NCL Calibration Laboratories**

Division of APREL Inc.

**Receiving Pattern Air**



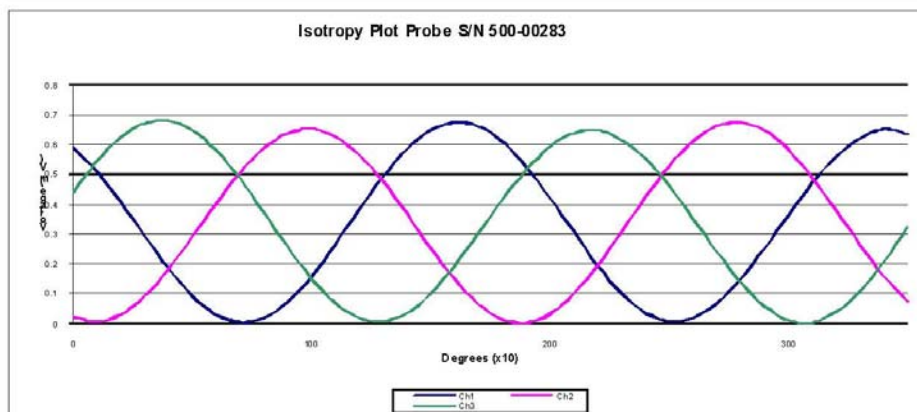
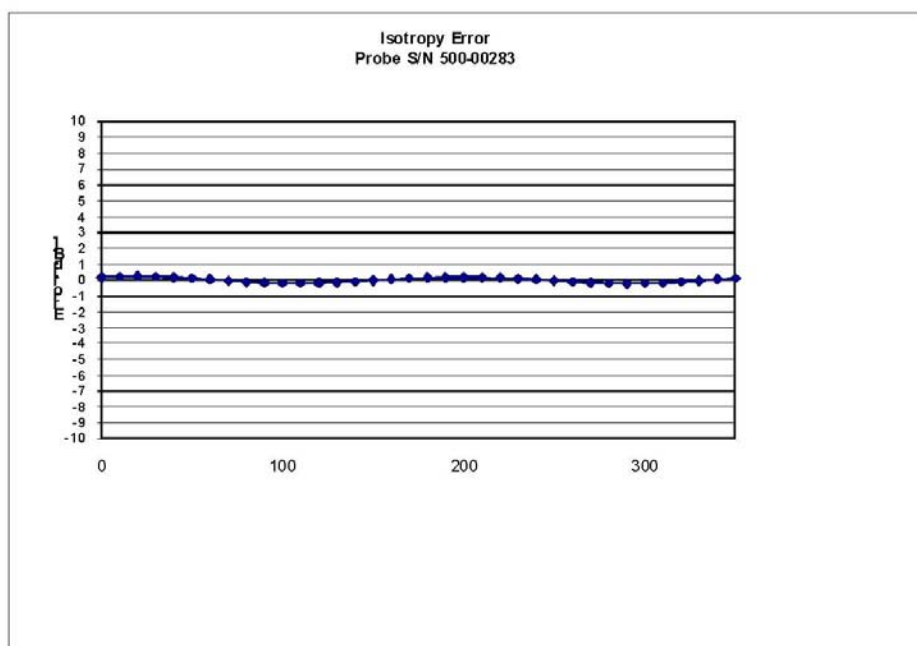
Page 7 of 10

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

**NCL Calibration Laboratories**

Division of APREL Inc.

**Isotropy Error Air**



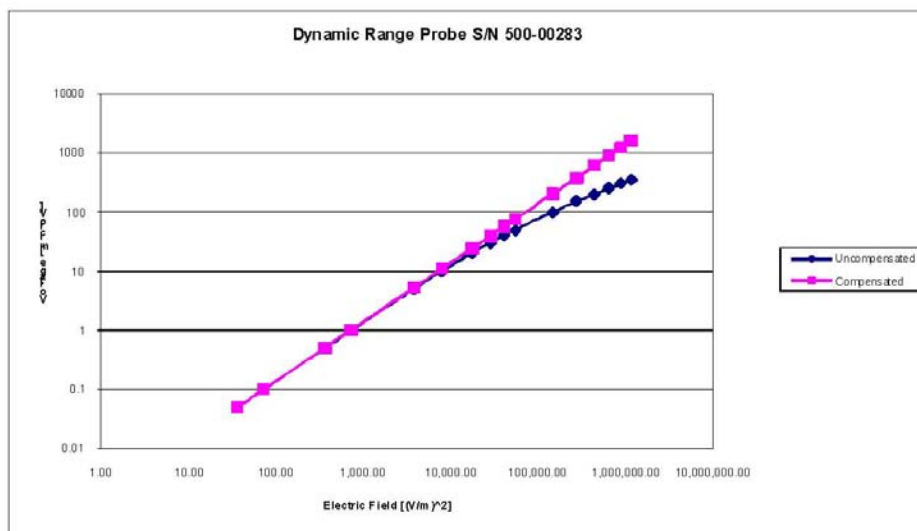
**Isotropy Tissue:**

**0.10 dB**

# **NCL Calibration Laboratories**

Division of APREL Inc.

## **Dynamic Range**

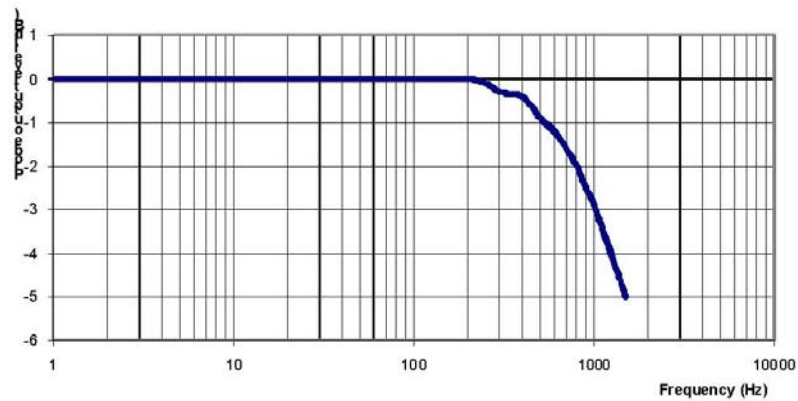


Page 9 of 10

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

**NCL Calibration Laboratories**

Division of APREL Inc.

**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.

---

Page 10 of 10

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

## APPENDIX C DIPOLE CALIBRATION CERTIFICATES

### NCL CALIBRATION LABORATORIES

Calibration File No: DC-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, 303 Terry Fox Dr.  
Kanata, ONTARIO  
CANADA K2K 3J1

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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conditions**

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

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

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

**Attestation**

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

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



Art Brennan, Quality Manager

  
Maryna Nesterova Calibration Engineer**Primary Measurement Standards**

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

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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

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

**Mechanical Dimensions**

Length: 162.2 mm

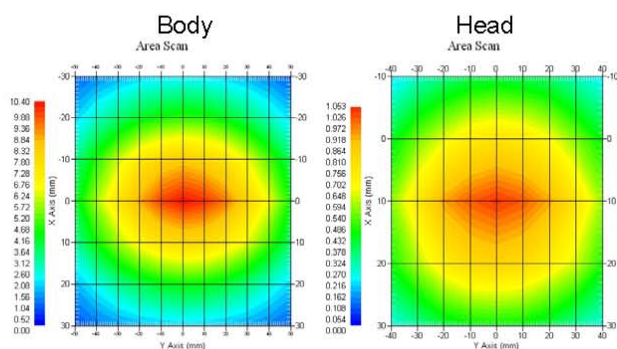
Height: 89.4 mm

**Electrical Specification**

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



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

3



**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>

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

4

**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

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

5

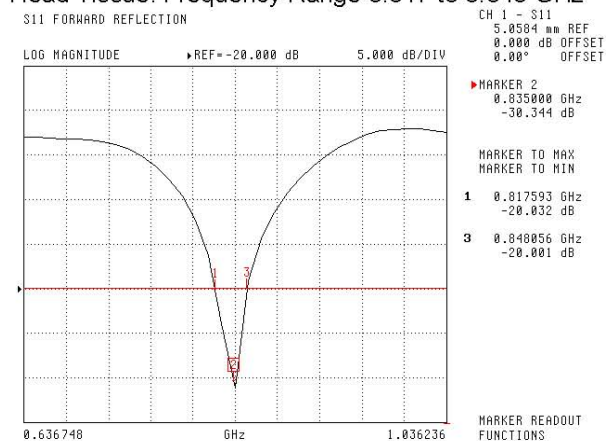
**NCL Calibration Laboratories**

Division of APREL Laboratories.

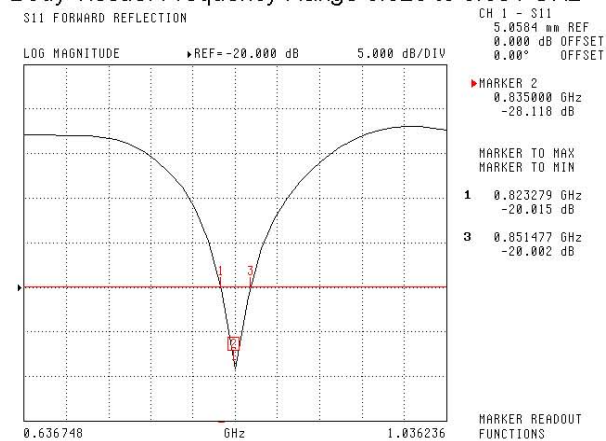
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

Head Tissue: Frequency Range 0.817 to 0.848 GHz



Body Tissue: Frequency Range 0.823 to 0.851 GHz



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

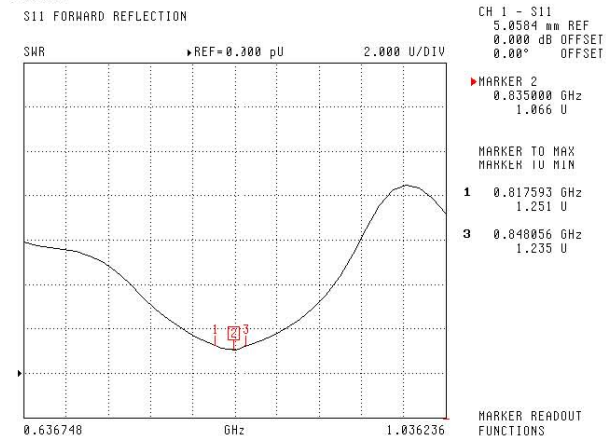
6

## NCL Calibration Laboratories

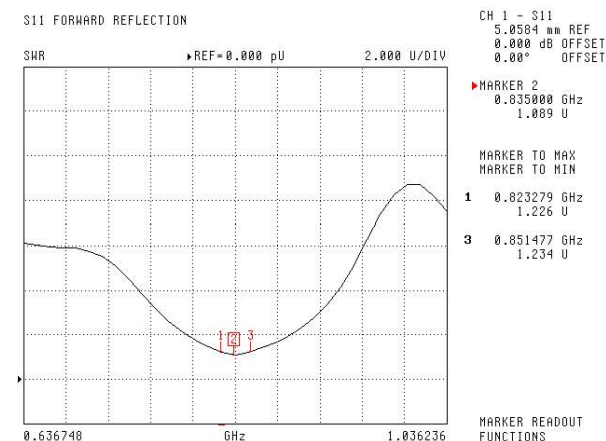
Division of APREL Laboratories.

### SWR

#### Head



#### Body

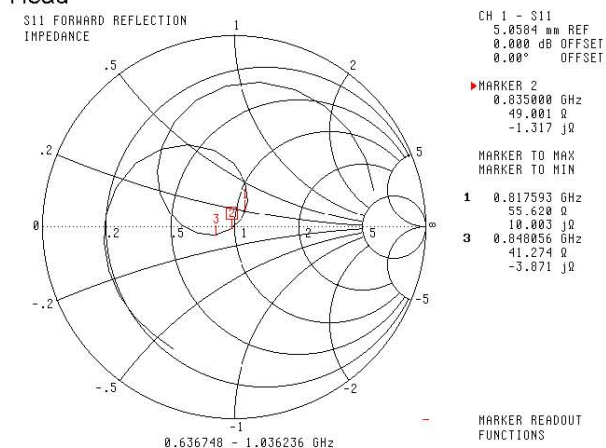
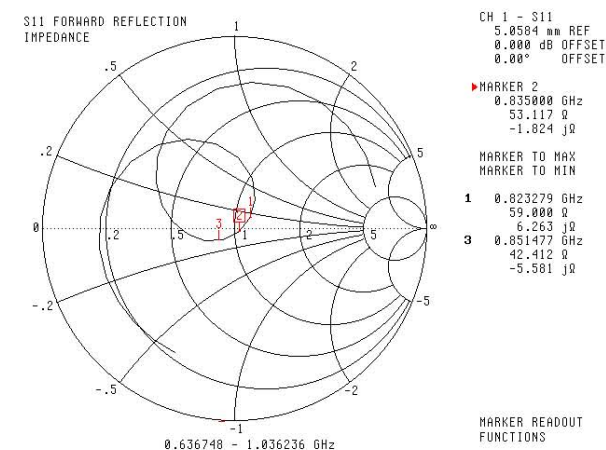


This page has been reviewed for content and attested to by signature within this document.

7

**NCL Calibration Laboratories**

Division of APREL Laboratories.

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

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

8

**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.

9

**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, 303 Terry Fox Dr,  
OTTAWA, ONTARIO  
CANADA K2K 3J1

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