

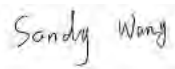

## SAR EVALUATION REPORT

For

### ITALCOM GROUP

1728 Coral Way, Coral Gables, Miami, Florida 518048, USA

**FCC ID: YPVITALCOMKING-TV**

<b>Report Type:</b> Original Report	<b>Product Type:</b> GSM Mobile Phone
<b>Test Engineer:</b> Sandy Wang	
<b>Report Number:</b> RSZ120925001-20	
<b>Report Date:</b> 2012-10-18	
<b>Reviewed By:</b> RF Leader	
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\* This report may contain data that are not covered by the NVLAP accreditation and shall be marked with an asterisk "★"

Attestation of Test Results		
<b>EUT Information</b>	<b>Company Name</b>	ITALCOM GROUP
	<b>EUT Description</b>	Mobile Phone
	<b>FCC ID</b>	YPVITALCOMKING-TV
	<b>Model Number</b>	king-tv
	<b>Test Date</b>	2012.10.14—2012.10.15
<b>Frequency</b>	<b>Max. SAR Level(s) Measured</b>	<b>Limit (W/Kg)</b>
<b>Cellular Band</b>	0.239 W/kg 1g Head SAR 0.189 W/kg 1g Body SAR	1.6
<b>PCS Band</b>	0.159 W/kg 1g Head SAR 0.113 W/kg 1g Body SAR	
<b>Applicable Standards</b>	<b>ANSI/IEEE C95.1: 2005</b> IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields,3 kHz to 300 GHz.	
	<b>ANSI/IEEE C95.3: 2002</b> IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to SuchFields,100 kHz—300 GHz.	
	<b>OET BULLETIN 65 SUPPLEMENT C</b> Evaluating Compliance with FCC Guidelines for Human Exposure To Radiofrequency Electromagnetic Fields	
	<b>IEEE1528: 2003</b> IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	
<p><b>Note:</b> This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C and IEEE 1528-2003.</p> <p><b>The results and statements contained in this report pertain only to the device(s) evaluated.</b></p>		

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**DOCUMENT REVISION HISTORY**

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<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	RSZ120925001-20	Original Report	2012-10-18

## EUT DESCRIPTION

This report has been prepared on behalf of ITALCOM GROUP and their product, FCC ID: YPVITALCOMKING-TV Model: king-tv or the EUT (Equipment Under Test) as referred to in the rest of this report. The EUT is a Mobile phone.

### 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>	None
<b>Operation Mode :</b>	GSM Voice and Bluetooth
<b>Frequency Band:</b>	Cellular Band: 824-849 MHz (TX); 869-894 MHz (RX) PCS Band: 1850-1910 MHz (TX); 1930-1990 MHz (RX) Bluetooth: 2402-2480 MHz
<b>Conducted RF Power:</b>	Cellular Band: 32.52 dBm PCS Band: 30.58 dBm Bluetooth: 5.93 dBm
<b>Dimensions (L*W*H):</b>	107.5mm (L)× 60.5mm (W)× 13mm (H)
<b>Weight:</b>	80.8g
<b>Power Source:</b>	3.7VDC/ 700mAh Rechargeable Battery
<b>Normal Operation:</b>	Head and Body-worn

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## REFERENCE, STANDARDS AND GUIDELINES

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### **FCC:**

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

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

### **CE:**

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

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

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

**SAR Limits**

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

CE Limit (10g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 10 g of tissue)	2.0	10
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

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

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## FACILITIES AND ACCREDITATION

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

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2007070.htm>



## 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

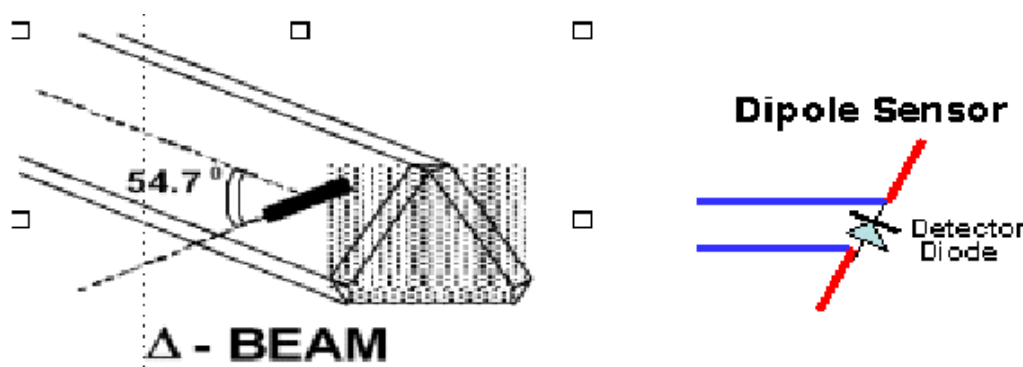
The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

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

### 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.

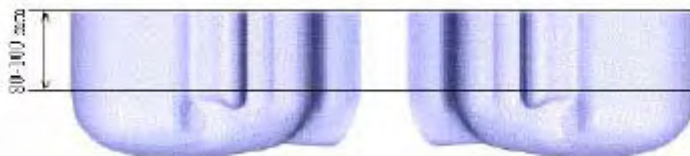


### Phantom Types

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

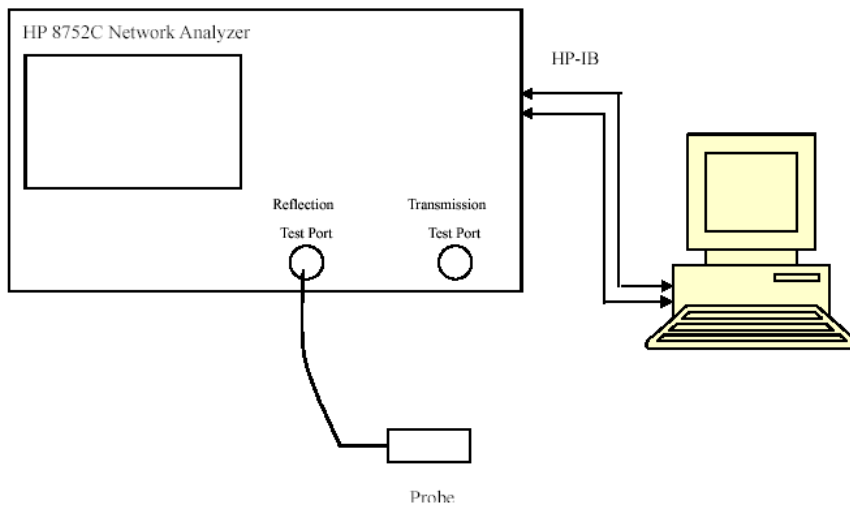
### Equipments List & Calibration Information

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	2012-05-13	110-00212
Miniature E-Field Probe	ALS-E-020	2012-08-09	500-00283
Dipole, 835 MHz	ALS-D-835-S-2	2011-08-25	180-00558
Dipole, 1900 MHz	ALS-D-1900-S-2	2011-08-25	210-00710
Dipole Spacer	ALS-DS-U	N/A	250-00907
Device holder/Positioner	ALS-H-E-SET-2	N/A	170-00510
Left ear SAM phantom	ALS-P-SAM-L	N/A	130-00311
Right ear SAM phantom	ALS-P-SAM-R	N/A	140-00359
UniPhantom	ALS-P-UP-1	N/A	150-00413
Simulated Tissue 835 MHz Head	ALS-TS-835-H	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-TS-835-B	Each Time	270-02101
Simulated Tissue 1900 MHz Head	ALS-TS-1900-H	Each Time	295-01103
Simulated Tissue 1900 MHz Body	ALS-TS-1900-B	Each Time	295-02102
Power Amplifier	5S1G4	N/A	71377
Synthesized Sweeper	HP 8341B	2012-05-17	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU 200	2011.12.16	1100.0008.02
EMI Test Receiver	ESCI	2011-11-17	101122



# 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)	$\Delta \epsilon_r$	$\Delta \sigma$	
824.2	Head	41.45	0.88	41.50	0.90	-0.120	-2.222	$\pm 5$
	Body	54.23	0.95	55.20	0.97	-1.757	-2.062	$\pm 5$
836.6	Head	41.40	0.90	41.50	0.90	-0.241	0.000	$\pm 5$
	Body	54.30	0.97	55.20	0.97	-1.630	0.000	$\pm 5$
848.8	Head	41.17	0.91	41.50	0.90	-0.795	1.111	$\pm 5$
	Body	54.39	0.99	55.20	0.97	-1.467	2.062	$\pm 5$
1850.2	Head	40.07	1.37	40.00	1.40	0.175	-2.143	$\pm 5$
	Body	52.93	1.46	53.30	1.52	-0.694	-3.947	$\pm 5$
1880.0	Head	40.08	1.39	40.00	1.40	0.200	-0.714	$\pm 5$
	Body	52.69	1.55	53.30	1.52	-1.144	1.974	$\pm 5$
1909.8	Head	40.09	1.45	40.00	1.40	0.225	3.571	$\pm 5$
	Body	52.76	1.56	53.30	1.52	-1.013	2.632	$\pm 5$

\*Liquid Verification was performed on 2012-10-14

Please refer to the following tables.

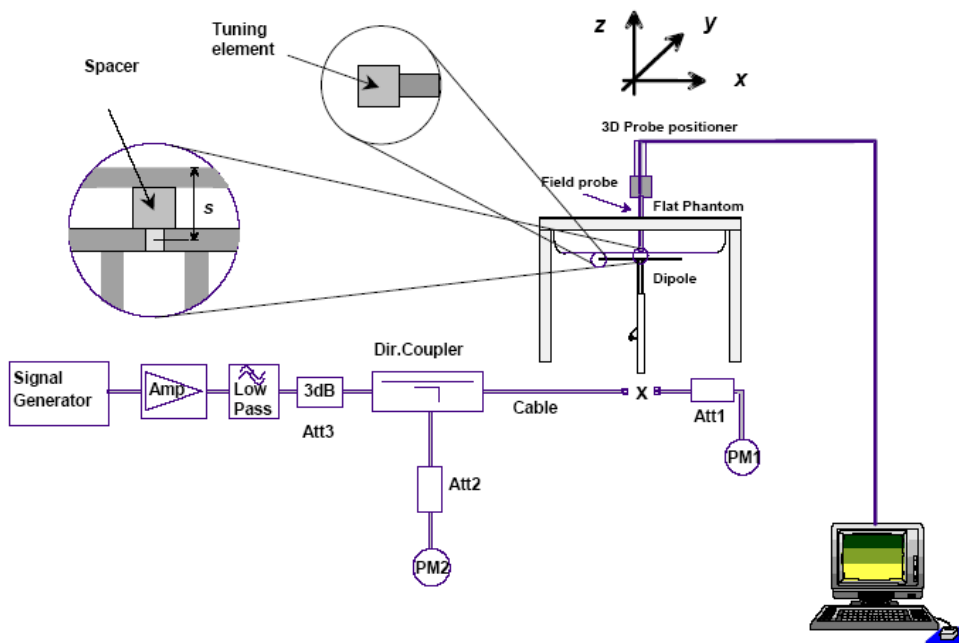
850 MHz Head			850 MHz Body		
Frequency (MHz)	e'	e''	Frequency (MHz)	e'	e''
824.0	41.445982	19.295449	824.0	54.231943	20.774573
824.5	41.414953	19.296003	824.5	54.235081	20.674084
825.0	41.398293	19.296557	825.0	54.238214	20.686602
825.5	41.293153	19.297111	825.5	54.241357	20.699036
826.0	41.311511	19.297666	826.0	54.244495	20.834098
826.5	41.333404	19.298219	826.5	54.247633	20.897829
827.0	41.309891	19.298773	827.0	54.250771	20.812328
827.5	41.357212	19.299327	827.5	54.253909	20.690464
828.0	41.376818	19.299881	828.0	54.257047	20.725026
828.5	41.383244	19.300436	828.5	54.260185	20.682449
829.0	41.434175	19.300989	829.0	54.263323	20.786604
829.5	41.382668	19.301544	829.5	54.266461	20.729433
830.0	41.419036	19.302098	830.0	54.269599	20.60733
830.5	41.379065	19.302652	830.5	54.272737	20.671718
831.0	41.352063	19.303206	831.0	54.275875	20.656893
831.5	41.371618	19.303761	831.5	54.279013	20.864317
832.0	41.333436	19.304314	832.0	54.282151	20.841981
832.5	41.308262	19.304868	832.5	54.285289	20.61868
833.0	41.348796	19.305422	833.0	54.288427	20.552044
833.5	41.380215	19.305976	833.5	54.291565	20.663511
834.0	41.377641	19.306535	834.0	54.294702	20.815368
834.5	41.376224	19.307086	834.5	54.297842	20.708334
835.0	41.401049	19.307639	835.0	54.300978	20.651789
835.5	41.402049	19.308494	835.5	54.304116	20.899496
836.0	41.405649	19.309349	836.0	54.307254	20.906419
836.5	41.390681	19.310204	836.5	54.310392	20.764226
837.0	41.377478	19.311061	837.0	54.313531	20.591309
837.5	41.371685	19.311918	837.5	54.316668	20.627575
838.0	41.394858	19.312775	838.0	54.319806	20.911858
838.5	41.353388	19.313627	838.5	54.322944	20.927062
839.0	41.343319	19.314481	839.0	54.326082	20.849074
839.5	41.345789	19.315336	839.5	54.329223	20.784032
840.0	41.356856	19.316191	840.0	54.332358	20.851175
840.5	41.346218	19.317046	840.5	54.335496	20.896539
841.0	41.329491	19.317902	841.0	54.338634	20.851667
841.5	41.358932	19.318757	841.5	54.341772	20.788404
842.0	41.360634	19.319612	842.0	54.344912	20.964244
842.5	41.364333	19.320467	842.5	54.348048	20.932757
843.0	41.358425	19.311289	843.0	54.351186	20.893155
843.5	41.282128	19.312144	843.5	54.354324	20.848666
844.0	41.358381	19.312996	844.0	54.357462	20.866324
844.5	41.312671	19.313855	844.5	54.360654	20.892231
845.0	41.238689	19.314709	845.0	54.363738	20.801649
845.5	41.253991	19.315561	845.5	54.366876	20.748035
846.0	41.208574	19.336492	846.0	54.370014	20.921036
846.5	41.249513	19.337347	846.5	54.373152	20.982441
847.0	41.229782	19.338203	847.0	54.376294	20.931299
847.5	41.232966	19.339058	847.5	54.379428	20.851612
848.0	41.206568	19.339913	848.0	54.382566	20.941757
848.5	41.211163	19.340768	848.5	54.385704	21.019841
849.0	41.171431	19.341623	849.0	54.388842	21.020023

1900 MHz Head			1900 MHz Body		
Frequency (MHz)	e'	e''	Frequency (MHz)	e'	e''
1850.0	40.071746	13.288993	1850.0	52.933357	14.189408
1851.2	40.073973	13.259017	1851.2	52.865276	14.146825
1852.4	40.074226	13.226298	1852.4	52.884121	14.247929
1853.6	40.074472	13.249669	1853.6	52.860703	14.224202
1854.8	40.074721	13.243625	1854.8	52.763539	14.243685
1856.0	40.074969	13.167738	1856.0	52.866562	14.280106
1857.2	40.075219	13.307596	1857.2	52.859733	14.306091
1858.4	40.075472	13.203798	1858.4	52.841747	14.227307
1859.6	40.075718	13.257735	1859.6	52.823418	14.321651
1860.8	40.075967	13.259055	1860.8	52.719209	14.374446
1862.0	40.076216	13.275754	1862.0	52.746885	14.501649
1863.2	40.076465	13.295031	1863.2	52.692866	14.514454
1864.4	40.076715	13.333015	1864.4	52.727618	14.531537
1865.6	40.076963	13.327591	1865.6	52.734091	14.502572
1866.8	40.077213	13.316401	1866.8	52.809101	14.493142
1868.0	40.077511	13.334908	1868.0	52.877545	14.509215
1869.2	40.077711	13.395668	1869.2	52.886607	14.531641
1870.4	40.077962	13.388409	1870.4	52.800105	14.583092
1871.6	40.078209	13.362339	1871.6	52.742485	14.583801
1872.8	40.078458	13.392394	1872.8	52.780919	14.612791
1874.0	40.078707	13.335047	1874.0	52.707384	14.621112
1875.2	40.078957	13.369110	1875.2	52.770547	14.684357
1876.4	40.079216	13.367077	1876.4	52.673662	14.607138
1877.6	40.079455	13.431577	1877.6	52.775945	14.687179
1878.8	40.079704	13.327181	1878.8	52.803732	14.819015
1880.0	40.079953	13.272403	1880.0	52.686053	14.837971
1881.2	40.080202	13.321143	1881.2	52.644293	14.835006
1882.4	40.080453	13.343741	1882.4	52.739835	14.806384
1883.6	40.080701	13.312514	1883.6	52.705336	14.762407
1884.8	40.080951	13.313092	1884.8	52.730233	14.785148
1886.0	40.081199	13.312418	1886.0	52.765444	14.717342
1887.2	40.081449	13.387568	1887.2	52.746219	14.693508
1888.4	40.081699	13.406664	1888.4	52.835996	14.727817
1889.6	40.081947	13.465672	1889.6	52.766487	14.732429
1890.8	40.082196	13.584013	1890.8	52.812162	14.789258
1892.0	40.082445	13.592022	1892.0	52.800126	14.785441
1893.2	40.082694	13.610673	1893.2	52.772578	14.846362
1894.4	40.082945	13.620003	1894.4	52.745216	14.895443
1895.6	40.083192	13.582606	1895.6	52.738064	14.929245
1896.8	40.083442	13.591935	1896.8	52.727965	14.927352
1898.0	40.083691	13.699412	1898.0	52.728295	14.907912
1899.2	40.083941	13.765459	1899.2	52.805296	14.908352
1900.4	40.084191	13.676766	1900.4	52.770212	14.807009
1901.6	40.084439	13.648967	1901.6	52.773695	14.896355
1902.8	40.084709	13.619066	1902.8	52.742786	14.856377
1904.0	40.084936	13.634244	1904.0	52.824497	14.825194
1905.2	40.085186	13.617447	1905.2	52.736254	14.793715
1906.4	40.085446	13.613561	1906.4	52.726166	14.718649
1907.6	40.085684	13.590431	1907.6	52.651846	14.835444
1908.8	40.085933	13.608802	1908.8	52.736126	14.770868
1910.0	40.086184	13.627166	1910.0	52.762649	14.734490

### System Accuracy Verification

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

### System Verification Setup Block Diagram



### System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2012-10-14	835	Head	1g	10.039	9.590	4.682	$\pm 10$
		Body	1g	9.762	9.684	0.805	$\pm 10$
	1900	Head	1g	40.638	39.648	2.497	$\pm 10$
		Body	1g	40.023	39.769	0.639	$\pm 10$

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

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

## Product Data

Device Name : Dipole 835 MHz  
Serial No. : 180-00558  
Type : Dipole  
Model : ALS-D-835-S-2  
Frequency Band : 835  
Max. Transmit Pwr : 1 w  
Drift Time : 3 min(s)  
Power Drift-Start : 9.987 W/kg  
Power Drift-Finish : 9.632 W/kg  
Power Drift (%) : -3.561

## Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : System Default  
Location : Center  
Description : Default  
Phantom Data

## Tissue Data

Type : HEAD  
Serial No. : 270-01002  
Frequency : 835.00 MHz  
Last Calib. Date : 14-Oct-2012  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 41.40 F/m  
Sigma : 0.90 S/m  
Density : 1000.00 kg/cu. m

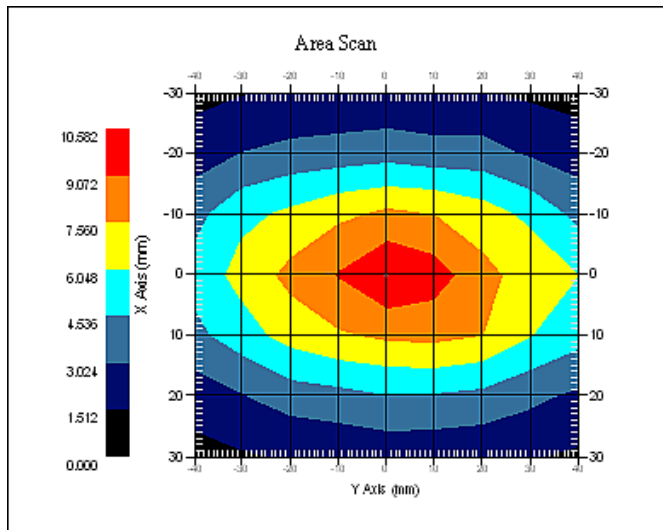
## Probe Data

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 09-Aug-2012  
Frequency Band : 835  
Duty Cycle Factor : 1  
Conversion Factor : 6.6  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

## Measurement Data

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

1 gram SAR value : 10.039 W/kg  
10 gram SAR value : 6.554 W/kg  
Area Scan Peak SAR : 10.582 W/kg  
Zoom Scan Peak SAR : 17.326 W/kg



**835 MHz System Validation with Head Tissue**

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

## Product Data

Device Name : Dipole 835 MHz  
Serial No. : 180-00558  
Type : Dipole  
Model : ALS-D-835-S-2  
Frequency Band : 835  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 10.022 W/kg  
Power Drift-Finish : 9.905 W/kg  
Power Drift (%) : -1.173

## Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : System Default  
Location : Center  
Description : Default  
Phantom Data

## Tissue Data

Type : Body  
Serial No. : 270-02101  
Frequency : 835.00 MHz  
Last Calib. Date : 14-Oct-2012  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 54.30 F/m  
Sigma : 0.97 S/m  
Density : 1000.00 kg/cu. m

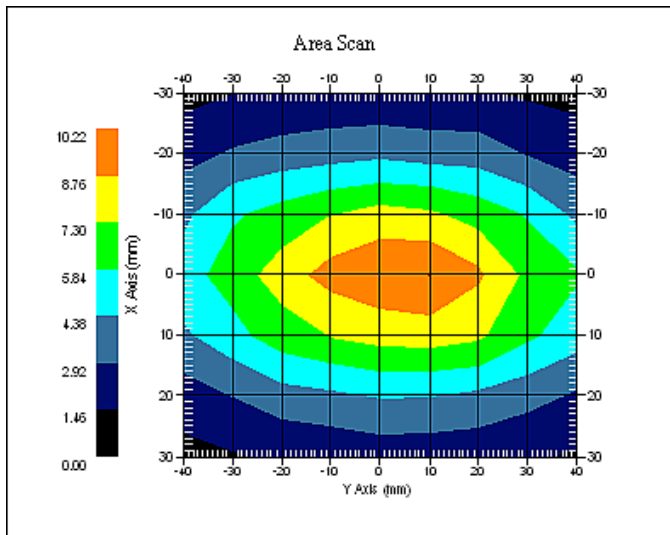
## Probe Data

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 09-Aug-2012  
Frequency Band : 835  
Duty Cycle Factor : 1  
Conversion Factor : 6.6  
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 : 9.762 W/kg  
10 gram SAR value : 6.196 W/kg  
Area Scan Peak SAR : 10.220 W/kg  
Zoom Scan Peak SAR : 16.224 W/kg



**835 MHz System Validation with Body Tissue**



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

## Product Data

Device Name : Dipole 1900MHz  
Serial No. : 210-00710  
Type : Dipole  
Model : ALS-D-1900-S-2  
Frequency Band : 1900  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 41.887 W/kg  
Power Drift-Finish : 40.804W/kg  
Power Drift (%) : -2.592

## Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : System Default  
Location : Center  
Description : Default

## Tissue Data

Type : HEAD  
Serial No. : 1900.00 MHz  
Last Calib. Date : 14-Oct-2012  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 40.08 F/m  
Sigma : 1.39 S/m  
Density : 1000.00 kg/cu. M

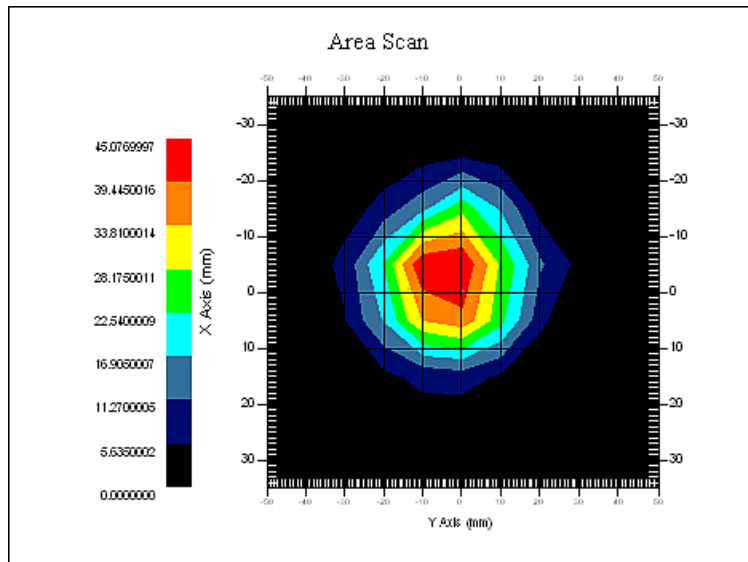
## Probe Data

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 09-Aug-2012  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 5.20  
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 : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 40.638 W/kg  
10 gram SAR value : 22.951 W/kg  
Area Scan Peak SAR : 45.077 W/kg  
Zoom Scan Peak SAR : 96.326W/kg



**1900 MHz System Validation with Head Tissue**

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

## Product Data

Device Name : Dipole 1900MHz  
Serial No. : 210-00710  
Type : Dipole  
Model : ALS-D-1900-S-2  
Frequency Band : 1900  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 40.582 W/kg  
Power Drift-Finish : 41.036 W/kg  
Power Drift (%) : 1.124

## Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : System Default  
Location : Center  
Description : Default

## Tissue Data

Type : Body  
Serial No. : 295-02102  
Frequency : 1900.00 MHz  
Last Calib. Date : 14-Oct-2012  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 52.78 F/m  
Sigma : 1.56 S/m  
Density : 1000.00 kg/cu. m

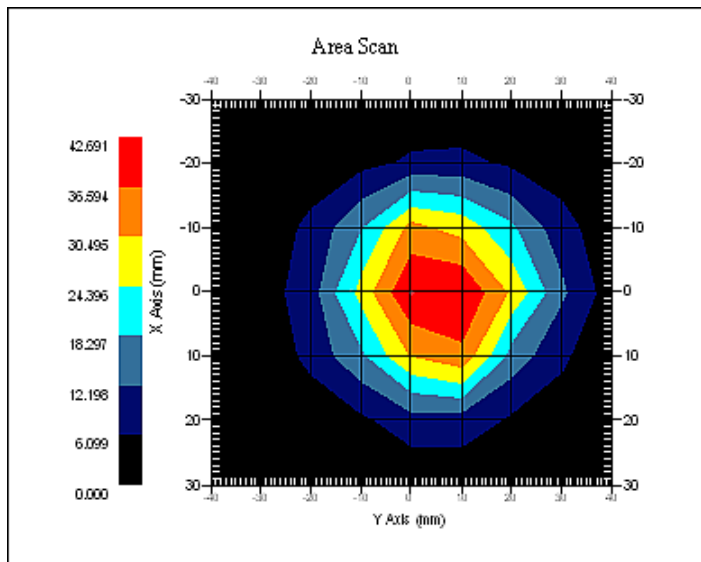
## Probe Data

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 09-Aug-2012  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 5.0  
Probe Sensitivity : 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point : 95.00 mV  
Offset : 1.56 mm

## Measurement Data

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

1 gram SAR value : 40.023 W/kg  
10 gram SAR value : 21.897 W/kg  
Area Scan Peak SAR : 42.690 W/kg  
Zoom Scan Peak SAR : 99.367 W/kg



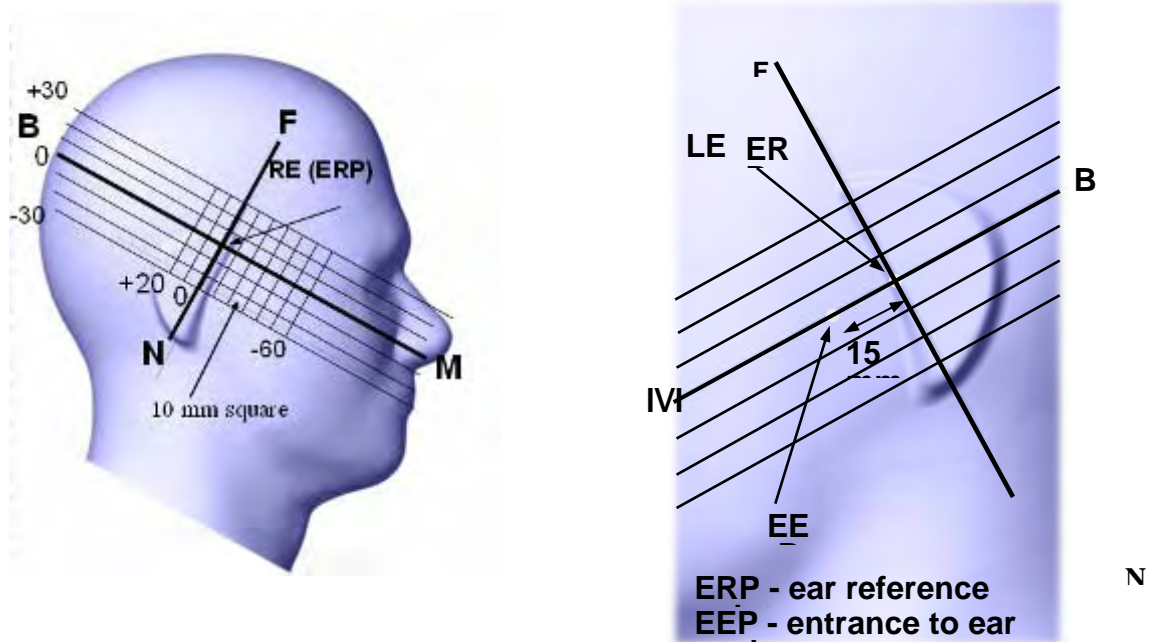
**1900 MHz System Validation with Body Tissue**

## EUT TEST STRATEGY AND METHODOLOGY

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

This category includes most wireless handsets with fixed, retractable or internal antennas located toward the top half of the device, with or without a foldout, sliding or similar keypad cover. The handset should have its earpiece located within the upper ¼ of the device, either along the centerline or off-centered, as perceived by its users. This type of handset should be positioned in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point”. The “test device reference point” should be located at the same level as the center of the earpiece region. The “vertical centerline” should bisect the front surface of the handset at its top and bottom edges. A “ear reference point” is located on the outer surface of the head phantom on each ear spacer. It is located 1.5 cm above the center of the ear canal entrance in the “phantom reference plane” defined by the three lines joining the center of each “ear reference point” (left and right) and the tip of the mouth.

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



## Cheek/Touch Position

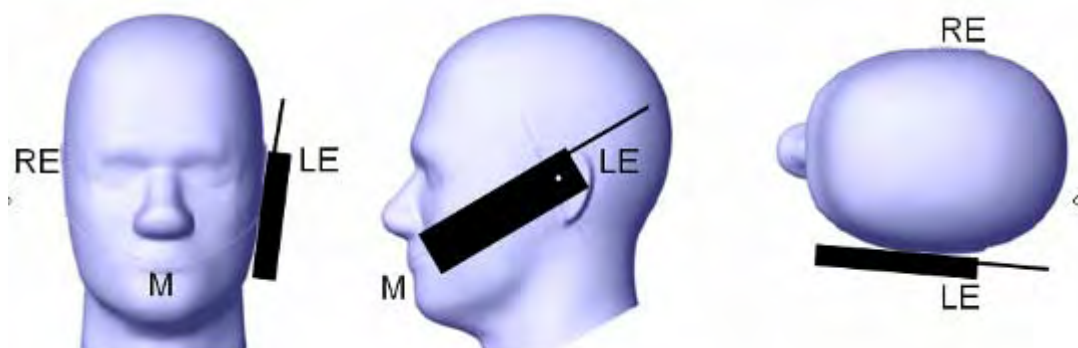
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

This test position is established:

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

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

### Cheek /Touch Position



## Ear/Tilt Position

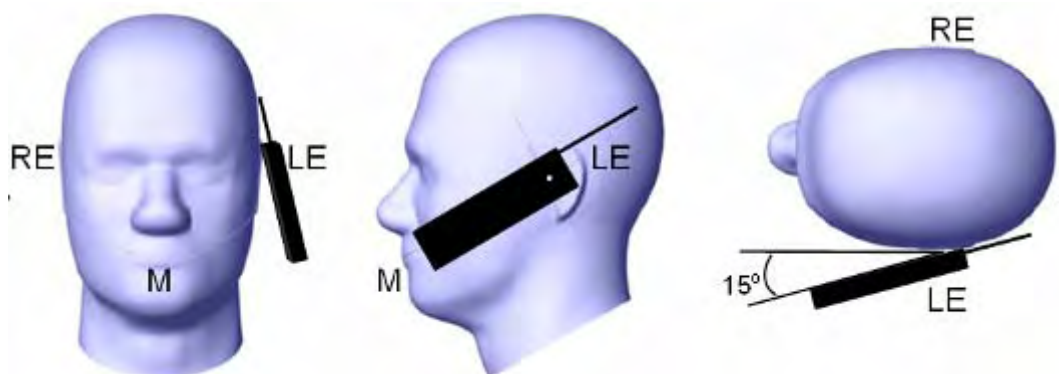
With the handset aligned in the “Cheek/Touch Position”:

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

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

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

### Ear /Tilt 15° Position



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

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

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

## 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.

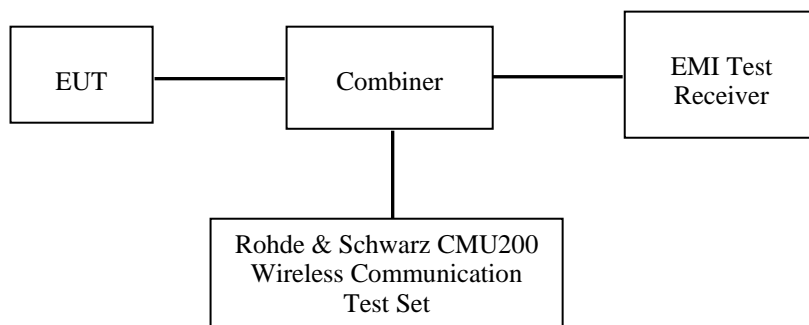
Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.



## CONDUCTED OUTPUT POWER MEASUREMENT

### Test Block Diagram and Procedure

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



### GSM

### Test Results

#### GSM

Band	Frequency (MHz)	Conducted Output Power	
		(dBm)	(Watt)
Cellular Band	824.2	32.33	1.710
	836.6	32.36	1.722
	848.8	32.52	1.786
PCS Band	1850.2	30.58	1.143
	1880.0	30.50	1.122
	1909.8	30.44	1.107

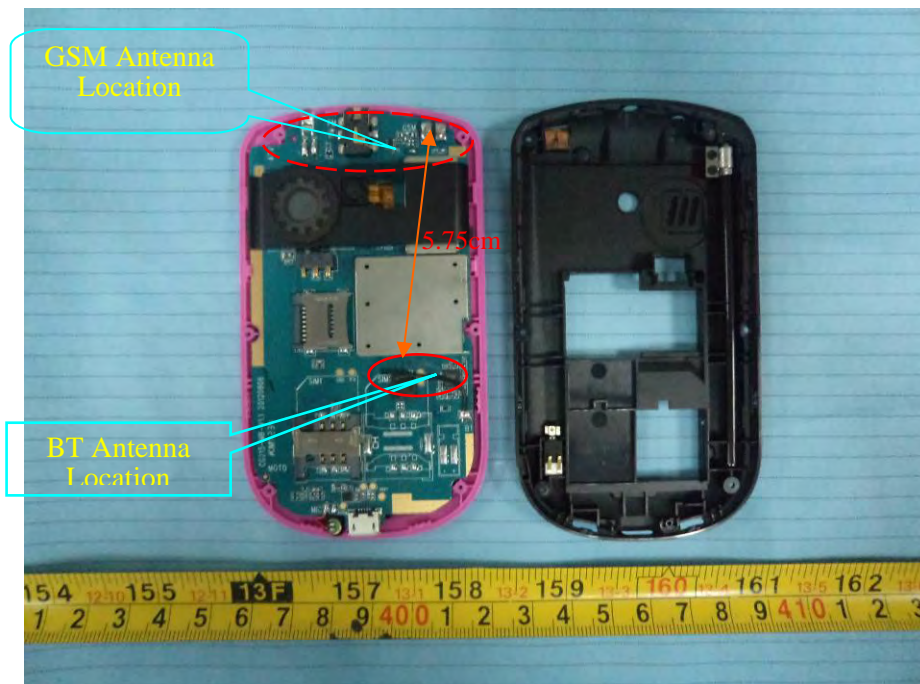
- Note:**
1. Rohde & Schwarz Radio Communication Tester (CMU200) was used for the measurement of GSM peak and average output power for active timeslots.
  2. For GSM voice, 1 timeslot has been activated with power level 5 (850 MHz band) and 0 (1900 MHz band).

## SAR SIMULTANEOUS TRANSMISSION EVALUATION

### KDB648474 SIMULTANEOUS TRANSMISSION CONSIDERATION

Stand-alone and simultaneous SAR evaluation for a cell phone with multiple transmitters is based on the antennas distance of each radio.

#### BT and GSM Antenna Location



#### Antenna Information:

<b>Antenna-to-antenna separation distances:</b>	5.75 cm from GSM main antenna-to-BT main antenna
<b>Simultaneous transmission:</b>	GSM can transmit simultaneously with Bluetooth.

#### CONCLUSION:

Individual transmitter	Stand-alone SAR	Simultaneous SAR
Bluetooth	Not required	Not required
GSM	Required	Simultaneous SAR of Bluetooth and GSM is not required

#### Note:

- 1) The distance between BT and GSM antenna is 5.75cm > 5cm, The max output power of Bluetooth antenna is (5.93dBm) 3.917mW < 2PRef (24mW). According to KDB648474, stand-alone SAR is not required for BT antenna and simultaneous SAR evaluation is not required for Bluetooth with GSM.
- 2) PRef is defined as the maximum conducted power available at the antenna according to source-based time-averaging requirements of Section 2.1093(d)(5).

## SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

### SAR Test Data

#### Environmental Conditions

<b>Temperature:</b>	21° C
<b>Relative Humidity:</b>	56%
<b>ATM Pressure:</b>	1002 mbar

\* Testing was performed by Sandy Wang on 2012.10.14-2012.10.15

#### Cellular Band:

EUT Position	Frequency		Test Mode	Antenna Type	Phantom Type	Power Drift (%)	FCC 1g SAR (W/Kg)	
	Channel	MHz					Measured	Limit
Left Head Cheek	128(Low)	824.2	GSM	Integral	SAM	/	/	1.6
	190(Middle)	836.6	GSM	Integral	SAM	/	/	1.6
	251(High)	848.8	GSM	Integral	SAM	-1.025	0.239	1.6
Left Head Tilt	128(Low)	824.2	GSM	Integral	SAM	/	/	1.6
	190(Middle)	836.6	GSM	Integral	SAM	/	/	1.6
	251(High)	848.8	GSM	Integral	SAM	-1.351	0.215	1.6
Right Head Cheek	128(Low)	824.2	GSM	Integral	SAM	/	/	1.6
	190(Middle)	836.6	GSM	Integral	SAM	/	/	1.6
	251(High)	848.8	GSM	Integral	SAM	-1.143	0.220	1.6
Right Head Tilt	128(Low)	824.2	GSM	Integral	SAM	/	/	1.6
	190(Middle)	836.6	GSM	Integral	SAM	/	/	1.6
	251(High)	848.8	GSM	Integral	SAM	-0.752	0.204	1.6
Body-Worn Headset-Front (1.5 cm)	128(Low)	824.2	GSM	Integral	Universal	/	/	1.6
	190(Middle)	836.6	GSM	Integral	Universal	/	/	1.6
	251(High)	848.8	GSM	Integral	Universal	-1.316	0.070	1.6
Body-Worn Headset-Back (1.5 cm)	128(Low)	824.2	GSM	Integral	Universal	/	/	1.6
	190(Middle)	836.6	GSM	Integral	Universal	/	/	1.6
	251(High)	848.8	GSM	Integral	Universal	4.063	0.189	1.6

**PCS Band:**

EUT Position	Frequency		Test Mode	Antenna Type	Phantom Type	Power Drift (%)	FCC 1g SAR (W/Kg)	
	Channel	MHz					Measured	Limit
Left Head Cheek	512(Low)	1850.2	GSM	Integral	SAM	-1.053	0.159	1.6
	661(Middle)	1880.0	GSM	Integral	SAM	/	/	1.6
	810(High)	1909.8	GSM	Integral	SAM	/	/	1.6
Left Head Tilt	512(Low)	1850.2	GSM	Integral	SAM	3.925	0.120	1.6
	661(Middle)	1880.0	GSM	Integral	SAM	/	/	1.6
	810(High)	1909.8	GSM	Integral	SAM	/	/	1.6
Right Head Cheek	512(Low)	1850.2	GSM	Integral	SAM	-0.614	0.138	1.6
	661(Middle)	1880.0	GSM	Integral	SAM	/	/	1.6
	810(High)	1909.8	GSM	Integral	SAM	/	/	1.6
Right Head Tilt	512(Low)	1850.2	GSM	Integral	SAM	-1.681	0.125	1.6
	661(Middle)	1880.0	GSM	Integral	SAM	/	/	1.6
	810(High)	1909.8	GSM	Integral	SAM	/	/	1.6
Body-Worn Headset-Front (1.5 cm)	512(Low)	1850.2	GSM	Integral	Universal	-0.524	0.037	1.6
	661(Middle)	1880.0	GSM	Integral	Universal	/	/	1.6
	810(High)	1909.8	GSM	Integral	Universal	/	/	1.6
Body-Worn Headset-Back (1.5 cm)	512(Low)	1850.2	GSM	Integral	Universal	-1.205	0.113	1.6
	661(Middle)	1880.0	GSM	Integral	Universal	/	/	1.6
	810(High)	1909.8	GSM	Integral	Universal	/	/	1.6

- Note:**
1. The EUT is a Class A mobile phone which can be attached to GSM services.
  2. The EUT transmit and receive through the same GSM antenna while testing SAR.
  3. When the 1-g SAR is  $\leq 0.8$ W/kg, testing for other channels are optional

## EUT SCAN PLOTS

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Left Head Cheek (848.8 MHz High Channel)**

**Measurement Data**

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.198 W/kg  
 Power Drift-Finish : 0.197 W/kg  
 Power Drift (%) : -1.025

**Tissue Data**

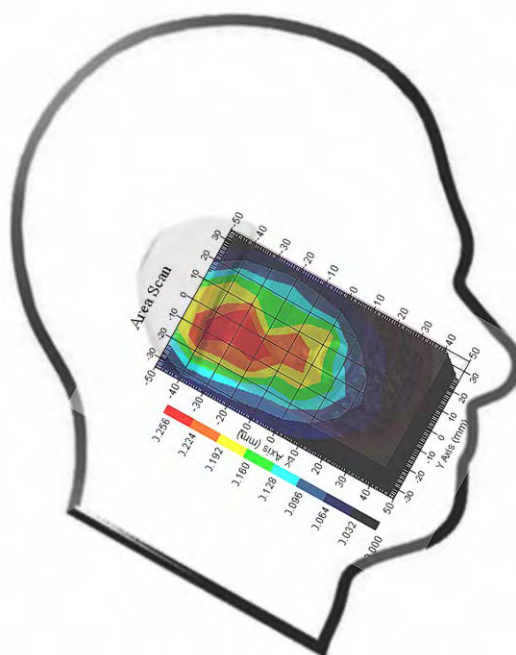
Type : Head  
 Frequency : 848.80 MHz  
 Epsilon : 41.17 F/m  
 Sigma : 0.91 S/m  
 Density : 1000.00 kg/cu. m

**Probe Data**

Serial No. : 500-00283  
 Frequency Band : 835  
 Duty Cycle Factor : 8  
 Conversion Factor : 6.6  
 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 : 0.239 W/kg  
 10 gram SAR value : 0.138 W/kg  
 Area Scan Peak SAR : 0.255 W/kg  
 Zoom Scan Peak SAR : 0.390 W/kg

**Plot 1#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Left Head Tilt (848.8 MHz High Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.150 W/kg  
 Power Drift-Finish : 0.148 W/kg  
 Power Drift (%) : -1.351

Tissue Data

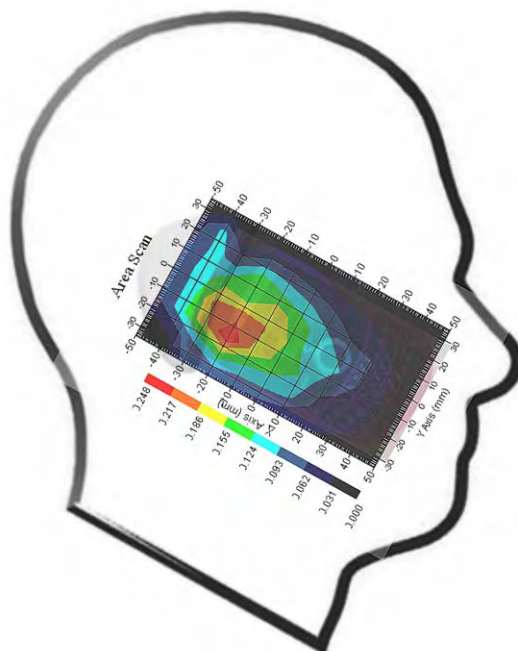
Type : Head  
 Frequency : 848.80 MHz  
 Epsilon : 41.17 F/m  
 Sigma : 0.91 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 835  
 Duty Cycle Factor : 8  
 Conversion Factor : 6.6  
 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 : 0.215 W/kg  
 10 gram SAR value : 0.105 W/kg  
 Area Scan Peak SAR : 0.247 W/kg  
 Zoom Scan Peak SAR : 0.310 W/kg

**Plot 2#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Right Head Cheek (848.8 MHz High Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.177 W/kg  
 Power Drift-Finish : 0.175 W/kg  
 Power Drift (%) : -1.143

Tissue Data

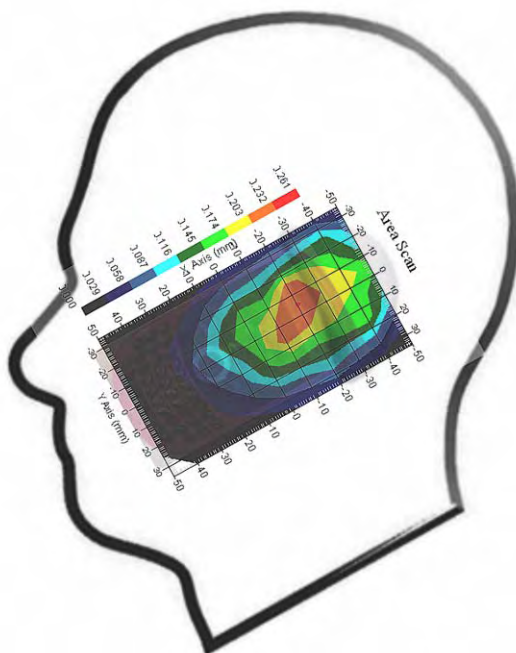
Type : Head  
 Frequency : 848.80 MHz  
 Epsilon : 41.17 F/m  
 Sigma : 0.91 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 835  
 Duty Cycle Factor : 8  
 Conversion Factor : 6.6  
 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 : 0.220 W/kg  
 10 gram SAR value : 0.145 W/kg  
 Area Scan Peak SAR : 0.238 W/kg  
 Zoom Scan Peak SAR : 0.384 W/kg

**Plot 3#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Right Head Tilt (848.8 MHz High Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.134 W/kg  
 Power Drift-Finish : 0.133 W/kg  
 Power Drift (%) : -0.752

Tissue Data

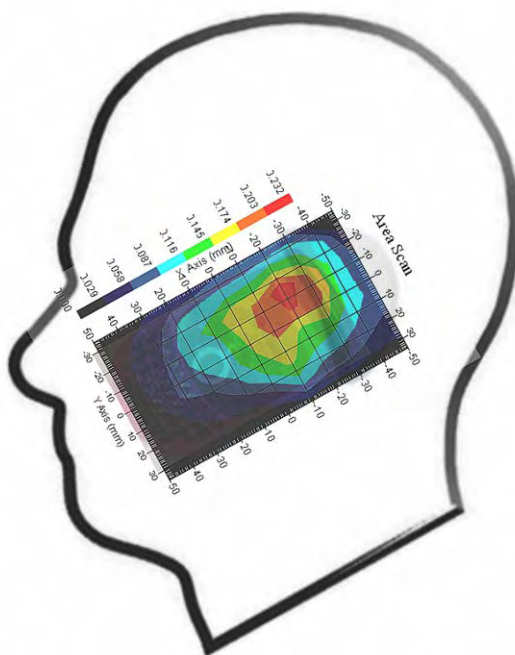
Type : Head  
 Frequency : 848.80 MHz  
 Epsilon : 41.17 F/m  
 Sigma : 0.91 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 835  
 Duty Cycle Factor : 8  
 Conversion Factor : 6.6  
 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 : 0.204 W/kg  
 10 gram SAR value : 0.103 W/kg  
 Area Scan Peak SAR : 0.227 W/kg  
 Zoom Scan Peak SAR : 0.325 W/kg

**Plot 4#**





**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Body-worn Front-Headset (848.8 MHz High Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 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 : 0.077 W/kg  
 Power Drift-Finish : 0.076 W/kg  
 Power Drift (%) : -1.316

Tissue Data

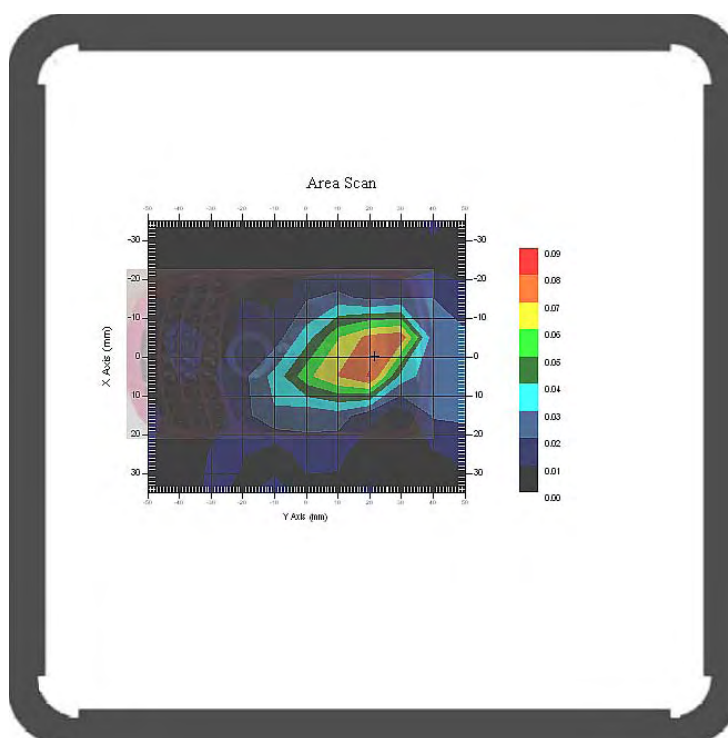
Type : Body  
 Frequency : 848.80 MHz  
 Epsilon : 54.39 F/m  
 Sigma : 0.99 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 835  
 Duty Cycle Factor : 8  
 Conversion Factor : 6.6  
 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 : 0.070 W/kg  
 10 gram SAR value : 0.033 W/kg  
 Area Scan Peak SAR : 0.081 W/kg  
 Zoom Scan Peak SAR : 0.190 W/kg

**Plot 5#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Body-worn Back-Headset (848.8 MHz High Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 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 : 0.115 W/kg  
 Power Drift-Finish : 0.120 W/kg  
 Power Drift (%) : 4.063

Tissue Data

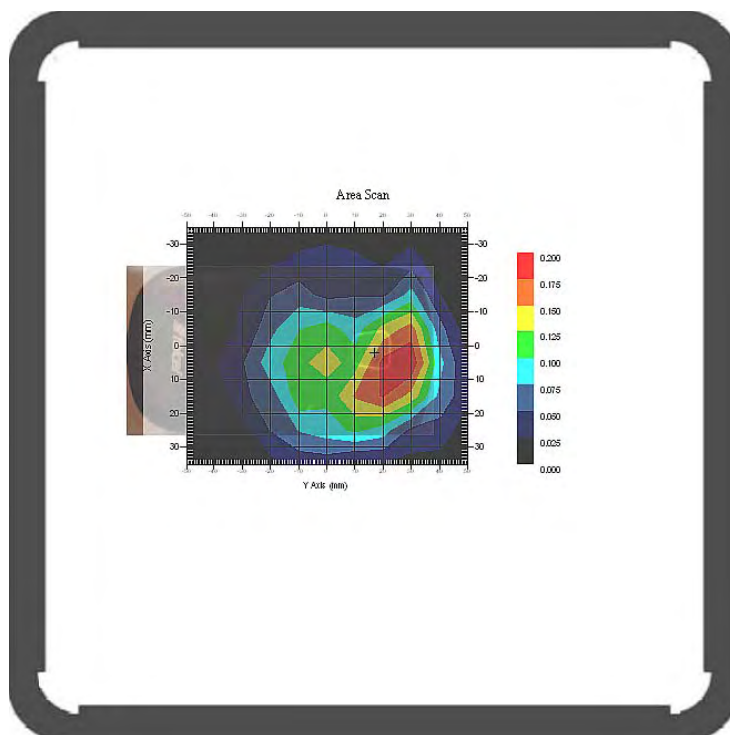
Type : Body  
 Frequency : 848.80 MHz  
 Epsilon : 54.39 F/m  
 Sigma : 0.99 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 835  
 Duty Cycle Factor : 8  
 Conversion Factor : 6.6  
 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 : 0.189 W/kg  
 10 gram SAR value : 0.090 W/kg  
 Area Scan Peak SAR : 0.198 W/kg  
 Zoom Scan Peak SAR : 0.470 W/kg

**Plot 6#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Left Head Cheek (1850.2 MHz Low Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.096 W/kg  
 Power Drift-Finish : 0.095 W/kg  
 Power Drift (%) : -1.053

Tissue Data

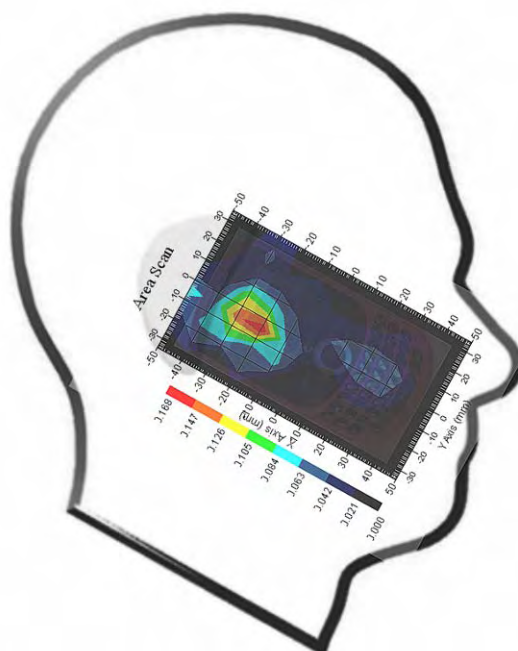
Type : Head  
 Frequency : 1850.20 MHz  
 Epsilon : 40.07 F/m  
 Sigma : 1.37 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 1900  
 Duty Cycle Factor : 8  
 Conversion Factor : 5.2  
 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 : 0.159 W/kg  
 10 gram SAR value : 0.094 W/kg  
 Area Scan Peak SAR : 0.167 W/kg  
 Zoom Scan Peak SAR : 0.200 W/kg

**Plot 7#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Left Head Tilt (1850.2 MHz Low Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.116 W/kg  
 Power Drift-Finish : 0.120 W/kg  
 Power Drift (%) : 3.925

Tissue Data

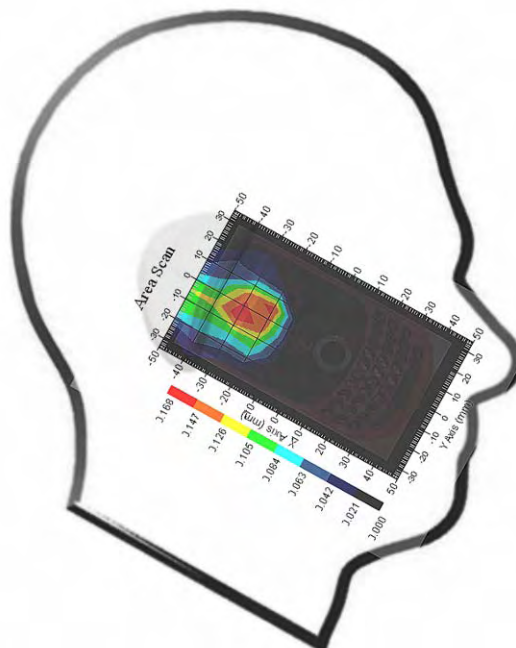
Type : Head  
 Frequency : 1850.20 MHz  
 Epsilon : 40.07 F/m  
 Sigma : 1.37 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 1900  
 Duty Cycle Factor : 8  
 Conversion Factor : 5.2  
 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 : 0.120 W/kg  
 10 gram SAR value : 0.051 W/kg  
 Area Scan Peak SAR : 0.144 W/kg  
 Zoom Scan Peak SAR : 0.200 W/kg

**Plot 8#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Right Head Cheek (1850.2 MHz Low Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.063 W/kg  
 Power Drift-Finish : 0.063 W/kg  
 Power Drift (%) : -0.614

Tissue Data

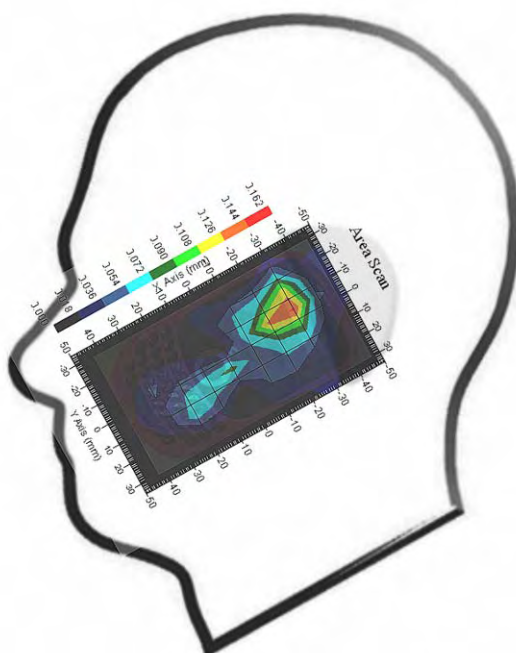
Type : Head  
 Frequency : 1850.20 MHz  
 Epsilon : 40.07 F/m  
 Sigma : 1.37 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 1900  
 Duty Cycle Factor : 8  
 Conversion Factor : 5.2  
 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 : 0.138 W/kg  
 10 gram SAR value : 0.086 W/kg  
 Area Scan Peak SAR : 0.151 W/kg  
 Zoom Scan Peak SAR : 0.160 W/kg

**Plot 9#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Right Head Tilt (1850.2 MHz Low Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 Scan Type : Complete  
 Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.118 W/kg  
 Power Drift-Finish : 0.116 W/kg  
 Power Drift (%) : -1.681

Tissue Data

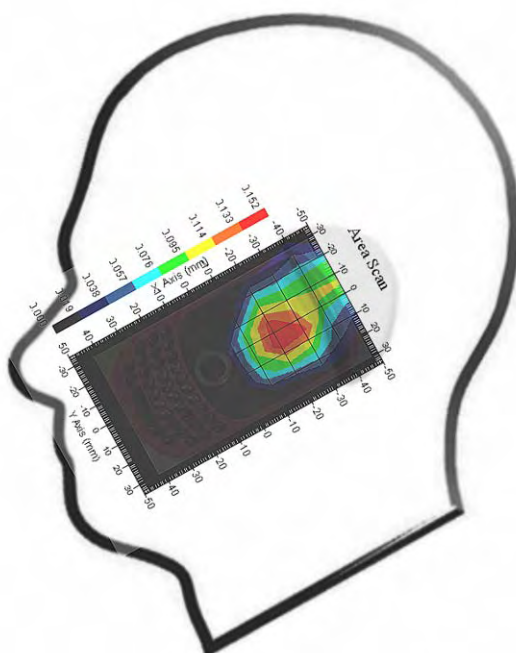
Type : Head  
 Frequency : 1850.20 MHz  
 Epsilon : 40.07 F/m  
 Sigma : 1.37 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 1900  
 Duty Cycle Factor : 8  
 Conversion Factor : 5.2  
 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 : 0.125 W/kg  
 10 gram SAR value : 0.054 W/kg  
 Area Scan Peak SAR : 0.160 W/kg  
 Zoom Scan Peak SAR : 0.216 W/kg

**Plot 10#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Body-worn Front-Headset (1850.2 MHz Low Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 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 : 0.032W/kg  
 Power Drift-Finish : 0.032W/kg  
 Power Drift (%) : -0.524

Tissue Data

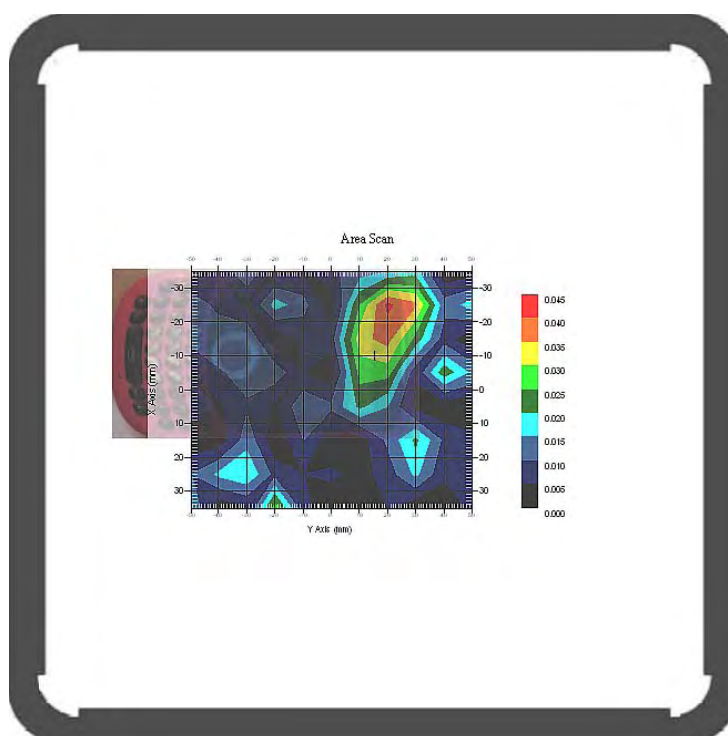
Type : Body  
 Frequency : 1850.20 MHz  
 Epsilon : 52.93 F/m  
 Sigma : 1.46 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 1900  
 Duty Cycle Factor : 8  
 Conversion Factor : 5.0  
 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 : 0.037 W/kg  
 10 gram SAR value : 0.014 W/kg  
 Area Scan Peak SAR : 0.041 W/kg  
 Zoom Scan Peak SAR : 0.110 W/kg

**Plot 11#**



**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**

**Body-worn Back-Headset (1850.2 MHz Low Channel)**

Measurement Data

Test mode : GSM  
 Crest Factor : 8  
 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 : 0.084W/kg  
 Power Drift-Finish : 0.083W/kg  
 Power Drift (%) : -1.205

Tissue Data

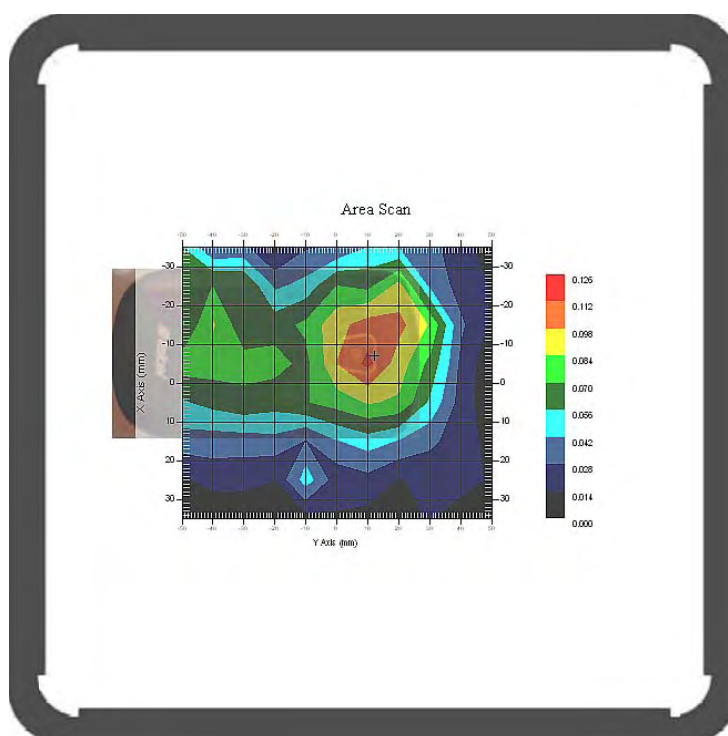
Type : Body  
 Frequency : 1850.20 MHz  
 Epsilon : 52.93 F/m  
 Sigma : 1.46 S/m  
 Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 500-00283  
 Frequency Band : 1900  
 Duty Cycle Factor : 8  
 Conversion Factor : 5.0  
 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 : 0.113 W/kg  
 10 gram SAR value : 0.046 W/kg  
 Area Scan Peak SAR : 0.139 W/kg  
 Zoom Scan Peak SAR : 0.210 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 300MHz to 3GHz

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^1$ (1-g)	$c_i^1$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
<b>Measurement System</b>							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)_2^{1/2}$	$(1-cp)_{1/2}$	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	0.95	rectangular	$\sqrt{3}$	1	1	0.55	0.55
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	2.6	normal	1	1	1	2.6	2.6
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
<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.)	2.6	normal	1	0.7	0.5	1.8	1.3
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	2.7	normal	1	0.6	0.5	1.6	1.4
Combined Uncertainty		RSS				9.1	8.8
Combined Uncertainty (coverage factor=2)		Normal(k=2)				18.2	17.6

## APPENDIX B PROBE CALIBRATION CERTIFICATES

---

### NCL CALIBRATION LABORATORIES

Calibration File No.: 1427-1430

Client.: BACL Lab

## 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-5673

Calibrated: 8<sup>th</sup> August 2012  
Released on: 9<sup>th</sup> August 2012

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 (2003) including Amendment 1  
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 (2006)  
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 Ed. 1.0 (2010-03)  
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 Draft 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 with the exception frequency of 450 MHz which was a new calibration

**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
Power meter Anritsu MA2408A	90025437	Nov.4, 2012
Power Sensor Anritsu MA2481D	103555	Nov 4, 2012
Attenuator HP 8495A (70dB)	1944A10711	Sept. 14, 2012
Network Analyzer Anritsu MT8801C	MB11855	Feb. 8, 2013


**Secondary Measurement Standards**


Signal Generator Agilent E4438C -506 MY55182336 June 7, 2013

**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

**NCL Calibration Laboratories**

Division of APREL Inc.

Calibration for Tissue (Head H, Body B)

Frequency	Tissue Type	Measured Epsilon	Measured Sigma	Calibration Uncertainty	Tolerance Uncertainty for 5%*	Conversion Factor
450 H	Head	43.98	0.9	3.5	3.4	6
450 B	Body	57.07	0.92	3.5	3.4	6
750 H	Head	X	X	X	X	X
750 B	Body	X	X	X	X	X
835 H	Head	42.35	0.938	3.5	3.4	6.6
835 B	Body	56.65	1.018	3.5	3.4	6.6
900 H	Head	41.35	0.98	3.5	3.4	6
900 B	Body	56.08	1.05	3.5	3.4	6
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	X	X	X	X	X
1750 B	Body	X	X	X	X	X
1800 H	Head	X	X	X	X	X
1800 B	Body	X	X	X	X	X
1900 H	Head	38.72	1.35	3.5	2.7	5.2
1900 B	Body	51.62	1.48	3.5	2.7	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	38.06	1.87	3.5	3.5	4.9
2450 B	Body	50.22	2.03	3.5	3.5	4.3
2600 H	Head	X	X	X	X	X
2600 B	Body	X	X	X	X	X
3000 H	Head	X	X	X	X	X
3000 B	Body	X	X	X	X	X
3600 H	Head	X	X	X	X	X
3600 B	Body	X	X	X	X	X
5200 H	Head	X	X	X	X	X
5200 B	Body	X	X	X	X	X
5600 H	Head	X	X	X	X	X
5600 B	Body	X	X	X	X	X
5800 H	Head	X	X	X	X	X
5800 B	Body	X	X	X	X	X

**NCL Calibration Laboratories**

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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 $\Omega$ .

**Boundary Effect:**

For a distance of 0.58mm the worst case evaluated uncertainty (increase in the probe sensitivity) is less than 2.1%.

**NOTES:**

\*The maximum deviation from the centre frequency when comparing the lower to upper range is listed.

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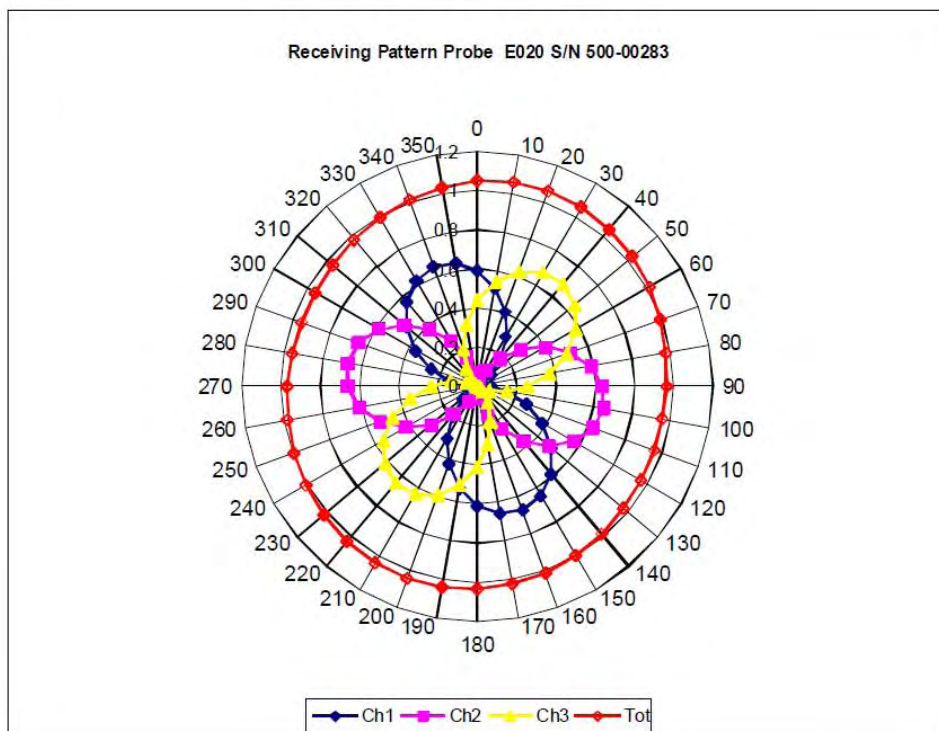
Page 6 of 10

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

**NCL Calibration Laboratories**

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**Receiving Pattern Air**

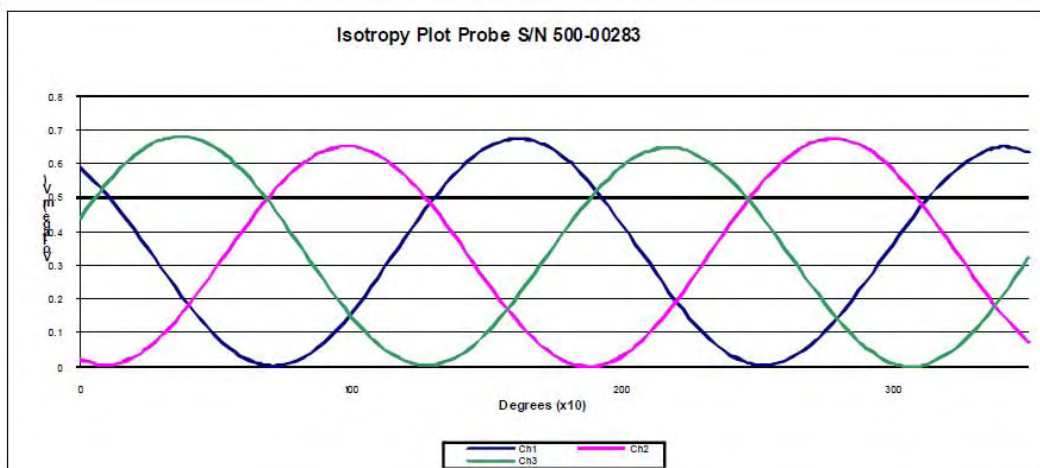
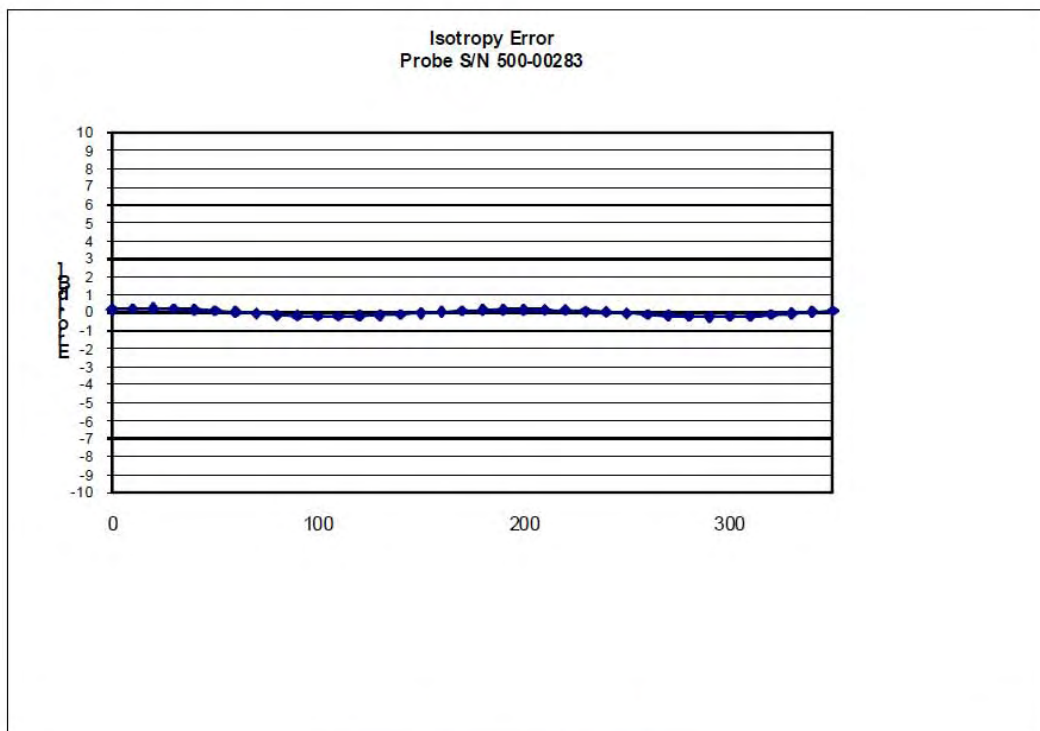




**NCL Calibration Laboratories**

Division of APREL Inc.

**Isotropy Error Air**



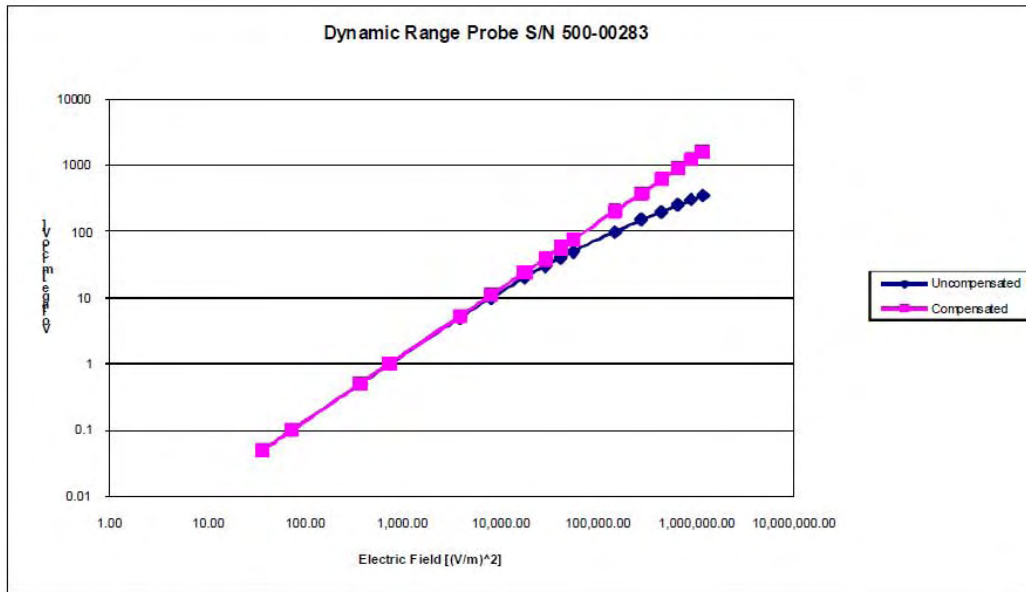
**Isotropy Tissue:**

0.10 dB

**NCL Calibration Laboratories**

Division of APREL Inc.

**Dynamic Range**

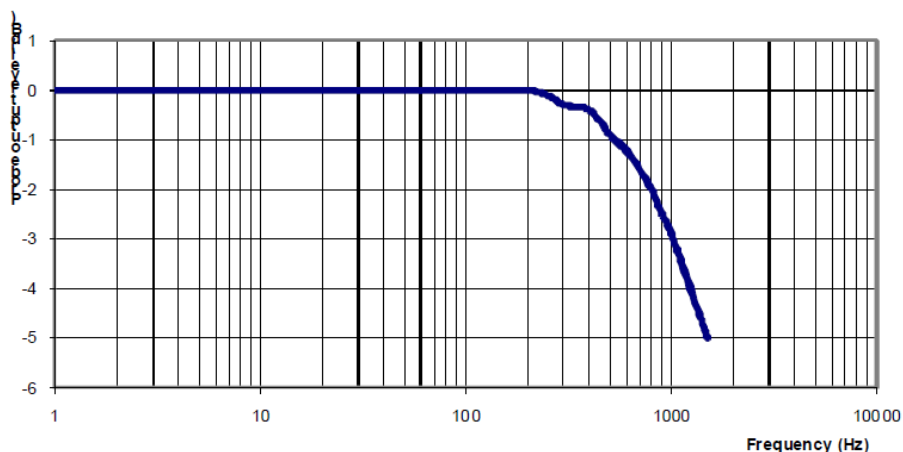


**NCL Calibration Laboratories**

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 2012.

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Page 10 of 10  
This page has been reviewed for content and attested to on Page 2 of this document.

## APPENDIX C DIPOLE CALIBRATION CERTIFICATES

### NCL CALIBRATION LABORATORIES

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

## CERTIFICATE OF CALIBRATION

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

Validation Dipole(Head and Body)

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

Customer: Bay Area Compliance Laboratory

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

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

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

### **NCL** CALIBRATION LABORATORIES

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

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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conditions**

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

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

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

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



-----  
Stuart Nicol



-----  
C. Teodorian

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

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**

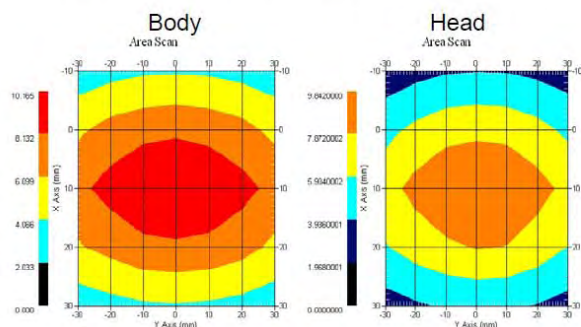
**Length:** 162.2 mm  
**Height:** 89.4 mm

**Electrical Specification**

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

**System Validation Results**

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



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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Introduction**

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 180-00558. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

**References**

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

**Conditions**

Dipole 180-00558 was new taken from stock.

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

**Dipole Calibration uncertainty**

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

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

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

**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

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

**Tissue Validation**

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

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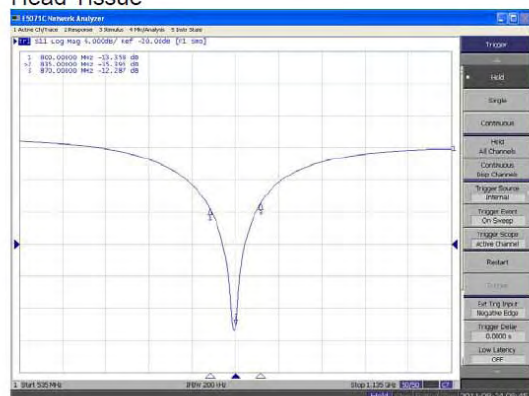
**NCL Calibration Laboratories**

Division of APREL Laboratories.

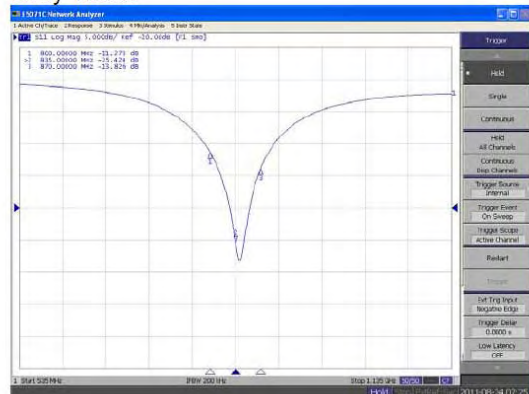
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

**Head Tissue**



**Body Tissue**



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

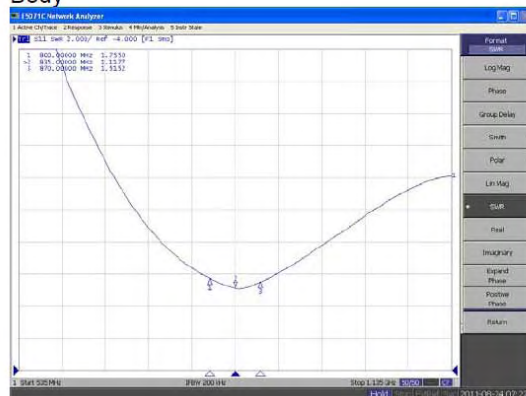
**NCL Calibration Laboratories**

Division of APREL Laboratories.

**SWR  
Head**



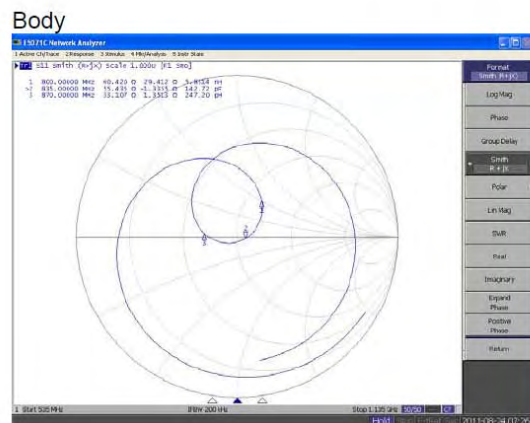
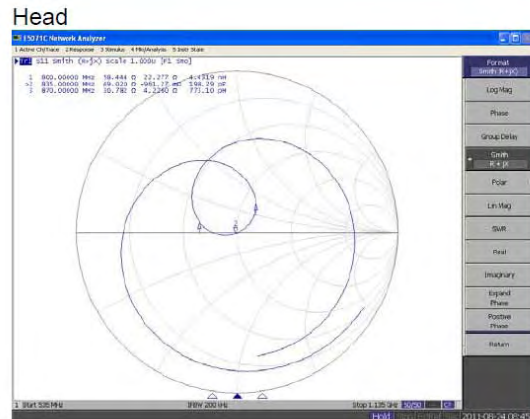
**Body**



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

**NCL Calibration Laboratories**  
Division of APREL Laboratories.

**Smith Chart Dipole Impedance**



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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List 2011.

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

9

**NCL CALIBRATION LABORATORIES**

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

**CERTIFICATE OF CALIBRATION**

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

Validation Dipole (Head & Body)

Manufacturer: APREL Laboratories  
Part number: ALS-D-1900-S-2  
Frequency: 1900 MHz  
Serial No: 210-00710

Customer: Bay Area Compliance Laboratory

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

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

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



**NCL CALIBRATION LABORATORIES**

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

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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

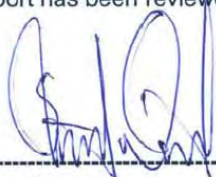
**Conditions**

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

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

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

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



-----  
Stuart Nicol



-----  
C. Teodorian

**Primary Measurement Standards**

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

**Secondary Measurement Standards**

Signal Generator Agilent E4438C	-506 MY55182336	June 7, 2012
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This page has been reviewed for content and attested to by signature within this document.

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

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

**Mechanical Dimensions**

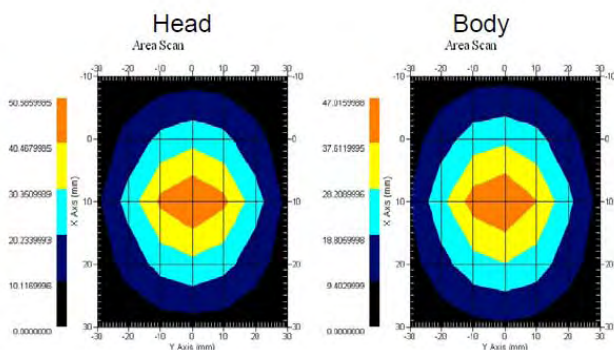
**Length:** 67.1 mm  
**Height:** 38.9 mm

**Electrical Specification**

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

**System Validation Results**

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



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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Introduction**

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 210-00710. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

**References**

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

**Conditions**

Dipole 210-00710 was new taken from stock.

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

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

**Dipole Calibration uncertainty**

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

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

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**Dipole Calibration Results**

**Mechanical Verification**

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

**Electrical Validation**

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

**Tissue Validation**

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

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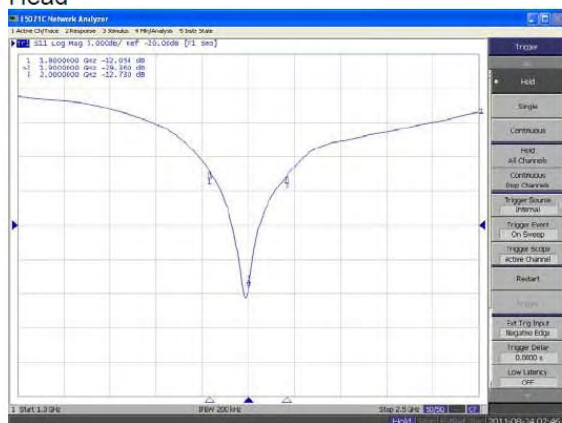
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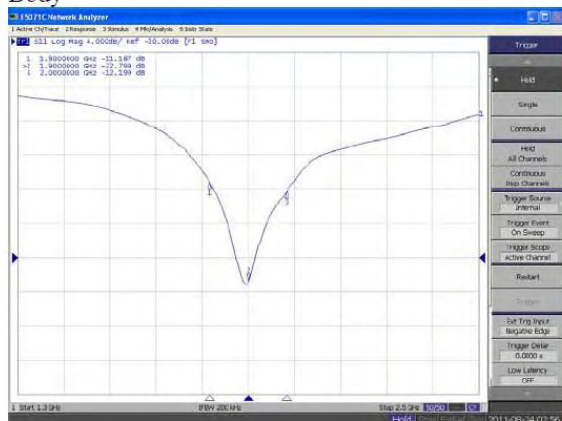
The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

Head



Body



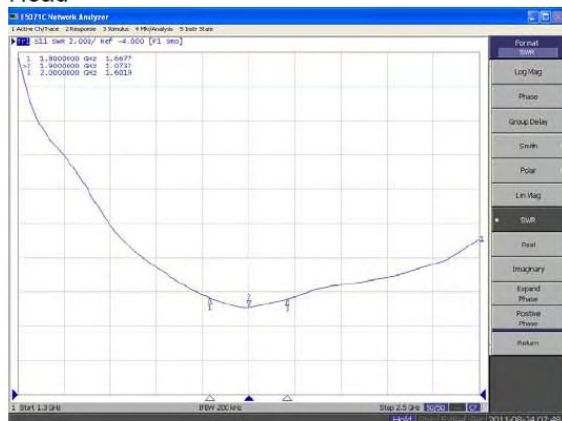
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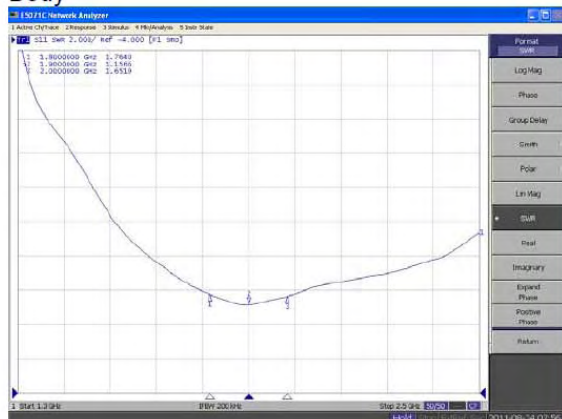
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### SWR

#### Head



#### Body



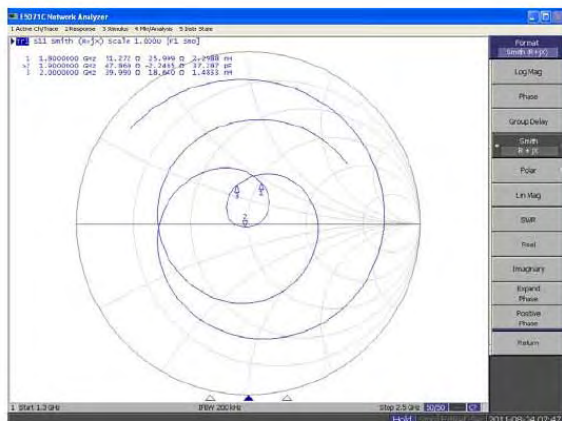
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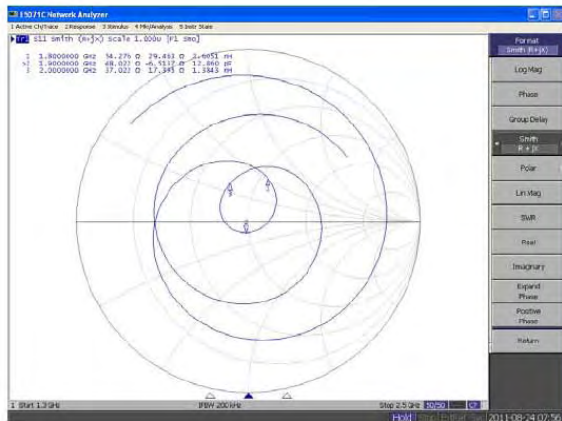
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**Smith Chart Dipole Impedance**

Head



Body



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**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List 2011

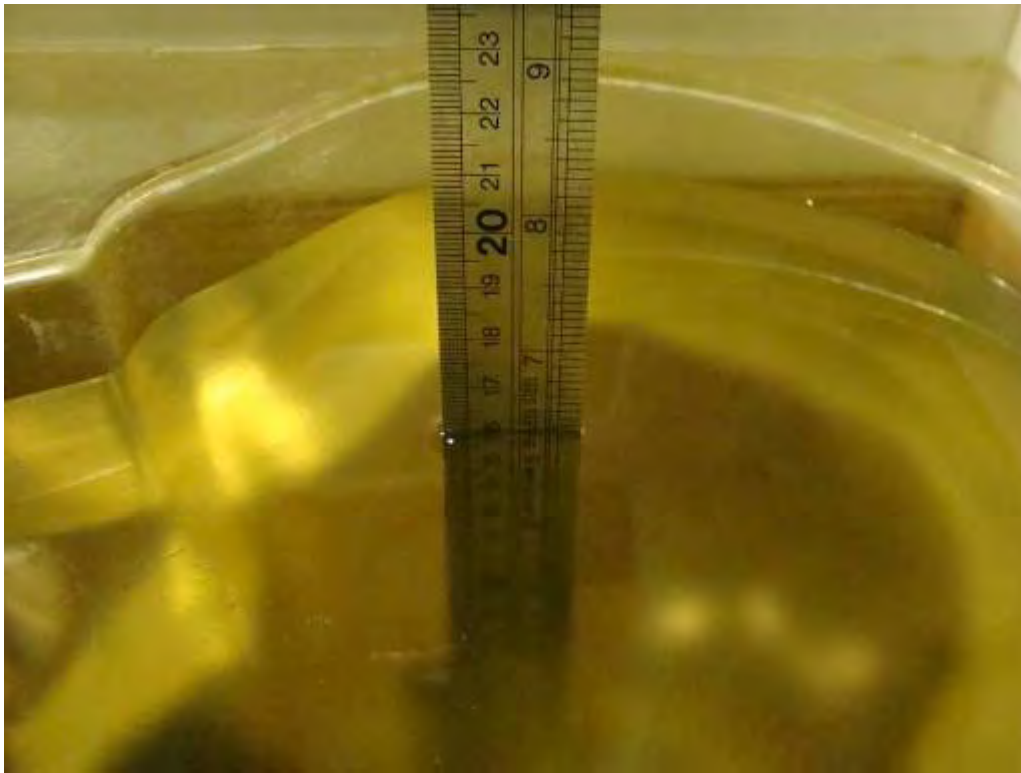
This page has been reviewed for content and attested to by signature within this document.

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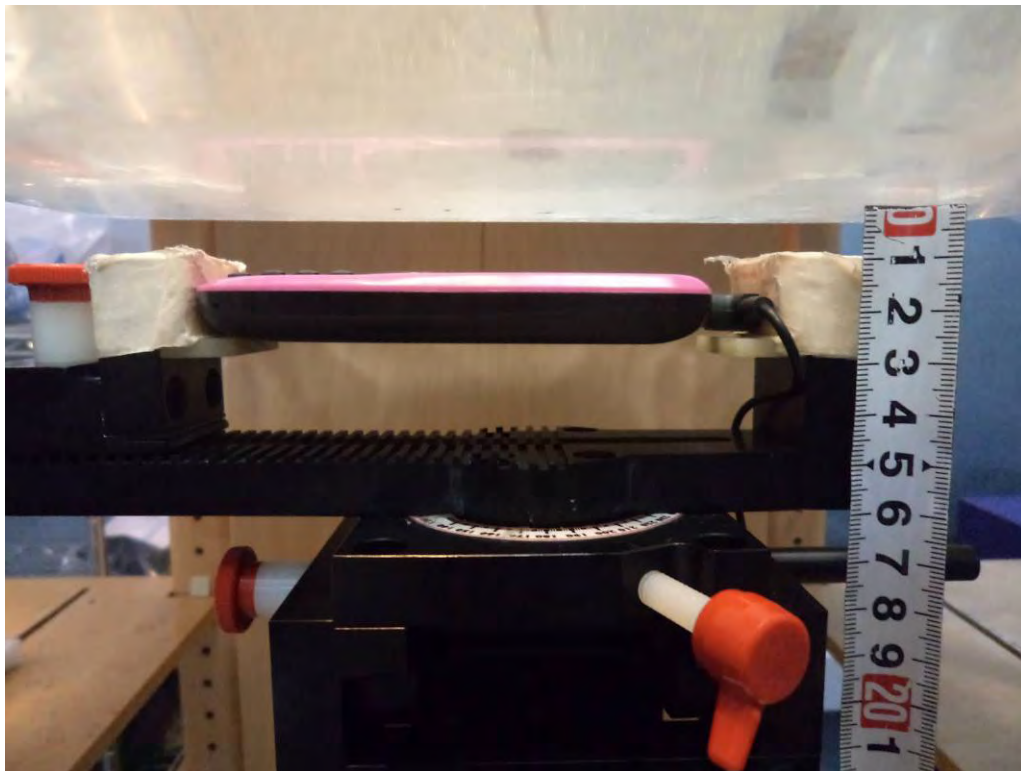
## APPENDIX D EUT TEST POSITION PHOTOS

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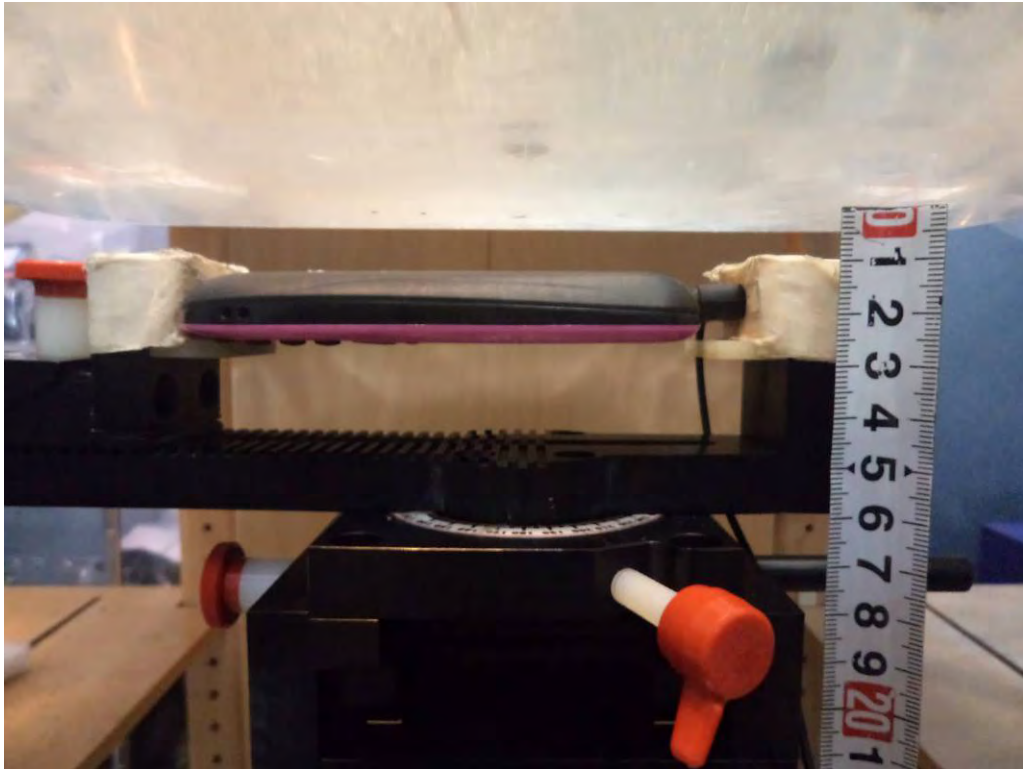
Liquid depth  $\geq 15\text{cm}$



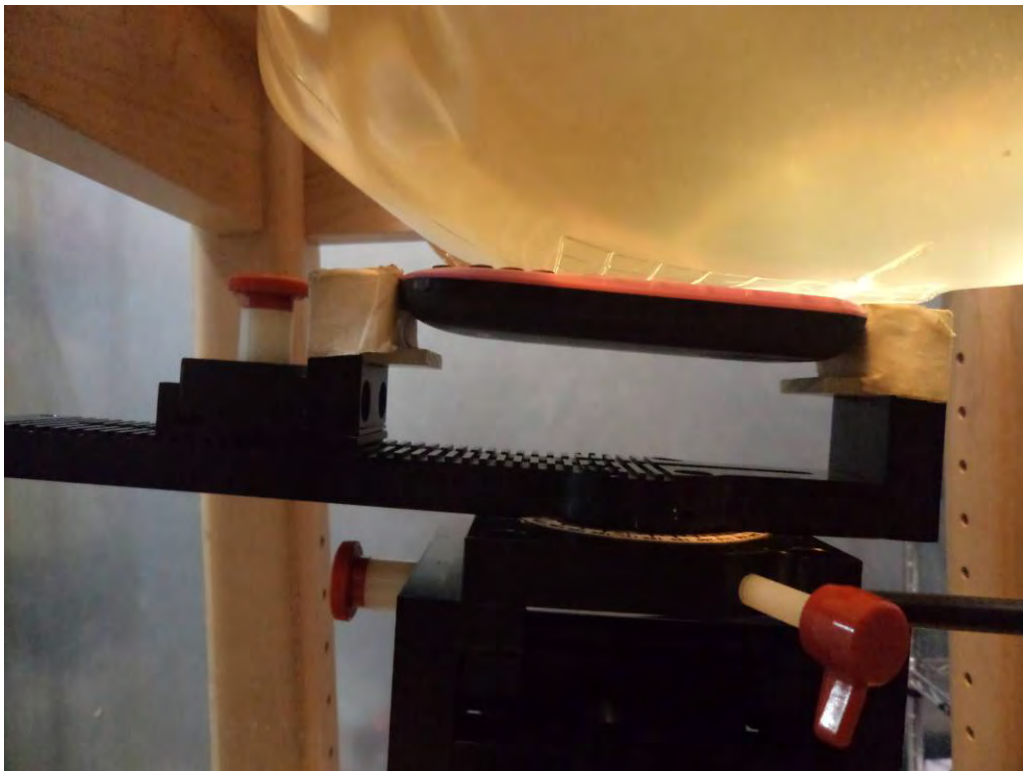
Body-worn Front-Headset Setup Photo



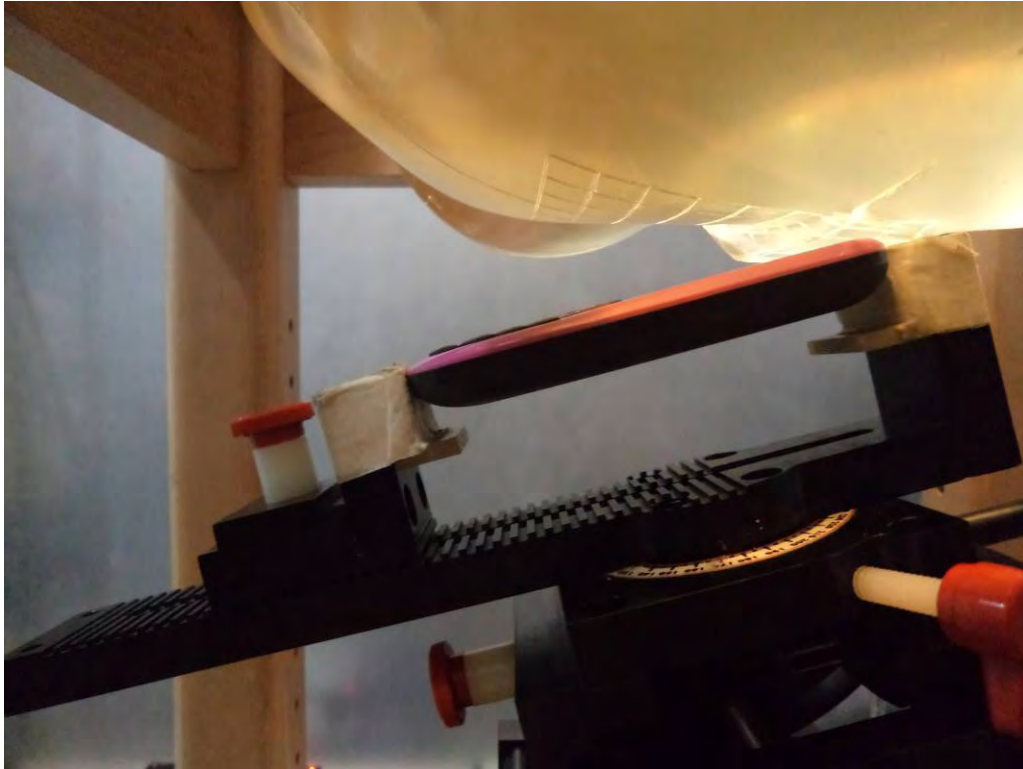
**Body-worn Back-Headset Setup Photo**



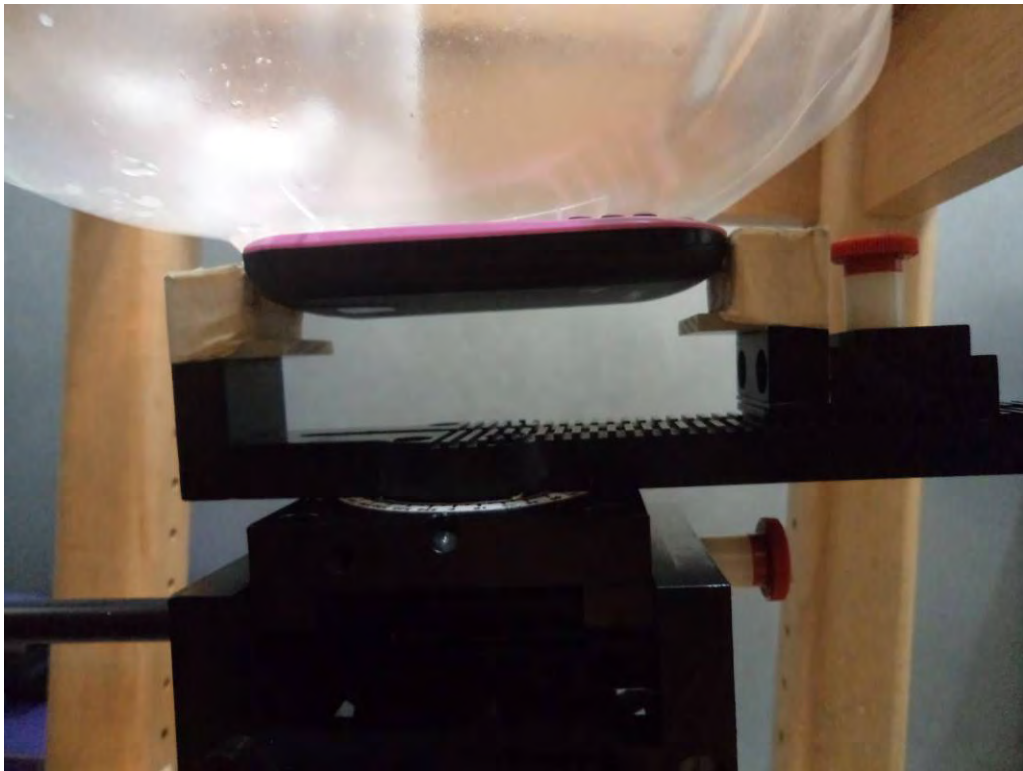
**Left Head Touch Setup Photo**



**Left Head Tilt Setup Photo**

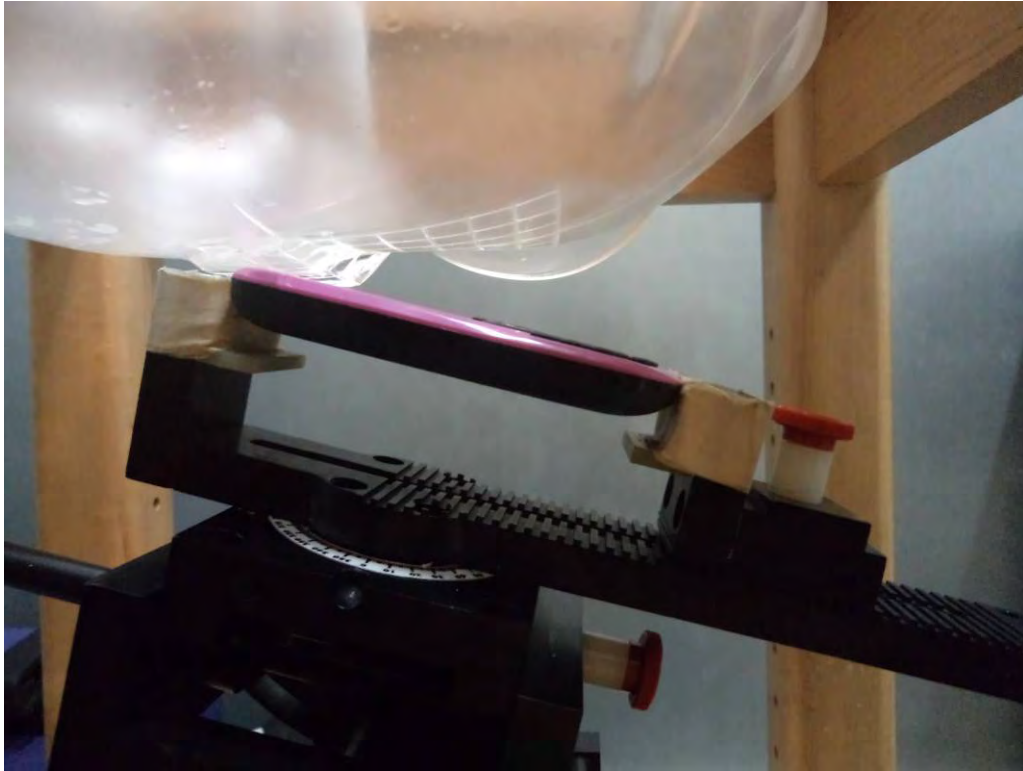


**Right Head Touch Setup Photo**





**Right Head Tilt Setup Photo**



## APPENDIX E EUT PHOTOS

**EUT – Front View**



**EUT – Back View**



**EUT –Left View**



**EUT – Right View**



**EUT – Top View**



**EUT – Bottom View**



**EUT – Uncovered View**



## APPENDIX F INFORMATIVE REFERENCES

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