



# SAR EVALUATION REPORT

For

## UNISTAR TELECOM CO., LIMITED

7A01, Tianjing Building, Tian'an High-tech Plaza, Futian District, Shenzhen, China

**FCC ID:2AC9P-M3**

<b>Report Type:</b> Original Report	<b>Product Type:</b> 3G Smartphone
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<b>Report Number:</b> <u>RDG141226004-20</u>	
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**Note:** This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

Attestation of Test Results		
EUT Information	Company Name	UNISTAR TELECOM CO.,LIMITED
	EUT Description	3G Smartphone
	FCC ID	2AC9P-M3
	Model Number	Main tested model: M3 Adding model: M3U, M3BS, M3CA, X55,UTTA X55, UNISTAR X55,L55
	Test Date	2014-12-29
Frequency	Max. SAR Level(s) Reported	Limit(W/Kg)
GSM 850	0.391 W/kg 1g Head SAR 0.840 W/kg 1g Body SAR	1.6
PCS 1900	0.379 W/kg 1g Head SAR 1.233 W/kg 1g Body SAR	
WCDMA850	0.098 W/kg 1g Head SAR 0.204 W/kg 1g Body SAR	
WCDMA1900	0.217 W/kg 1g Head SAR 0.776 W/kg 1g Body SAR	
Simultaneous	0.755 W/kg 1g Head SAR 1.420 W/kg 1g Body SAR	
Applicable Standards	ANSI / IEEE C95.1 : 2005 IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fileds,3 kHz to 300 GHz.	1.6
	ANSI / IEEE C95.3 : 2002 IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to SuchFields,100 kHz—300 GHz.	
	IEEE1528:2013 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	
	KDB procedures KDB447498 D01 General RF Exposure Guidance v05r02. KDB 648474 D04 Handset SAR v01r02. KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03 KDB 865664 D02 RF Exposure Reporting v01r01 KDB 941225 D01 3G SAR Procedures v03 KDB 941225 D06 Hotspot Mode v02	
	<b>Note:</b> This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures.	
<b>The results and statements contained in this report pertain only to the device(s) evaluated.</b>		

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**DOCUMENT REVISION HISTORY**

Revision Number	Report Number	Description of Revision	Date of Revision
0	RDG141226004-20	Original Report	2015-01-06

## EUT DESCRIPTION

This report has been prepared on behalf of UNISTAR TELECOM CO., LIMITED and their product, FCC ID: 2AC9P-M3, Model: M3 or the EUT (Equipment under Test) as referred to in the rest of this report.

**\*Note:**

1. This series products model: M3, M3U, M3BS, M3CA, X55, UTTA X55, UNISTAR X55 and L55, we select model: M3 to test, there is no electrical change has been made to the equipment, please refer to the product similarity letter.
2. The device is capable of personal hotspot mode. Wi-Fi Hotspot mode permits the device to share its cellular data connection with other 2.4 GHz Wi-Fi enabled devices (channels 1 - 13).

## Technical Specification

<b>Product Type</b>	Portable
<b>Exposure Category:</b>	Population / Uncontrolled
<b>Antenna Type(s):</b>	Internal Antenna
<b>Body-Worn Accessories:</b>	Headset
<b>Face-Head Accessories:</b>	None
<b>Multi-slot Class:</b>	Class12
<b>Operation Mode :</b>	GSM Voice, EGPRS/GPRS Data, WCDMA, Wi-Fi and Bluetooth
<b>Frequency Band:</b>	GSM 850 : 824-849 MHz(TX) ; 869-894 MHz(RX) PCS 1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) WCDMA850: 824-849 MHz(TX) ; 869-894 MHz(RX) WCDMA1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) WiFi: 2412MHz-2472MHz Bluetooth : 2402MHz-2480MHz
<b>Conducted RF Power:</b>	GSM 850 : 32.06 dBm PCS 1900: 29.49 dBm WCDMA 850: 22.12 dBm WCDMA 1900: 22.32 dBm WiFi: 9.36 dBm Bluetooth: 3.15dBm
<b>Dimensions (L*W*H):</b>	154mm (L) × 79 mm (W) × 11 mm (H)
<b>Power Source:</b>	3.7 V <sub>DC</sub> Rechargeable Battery
<b>Normal Operation:</b>	Head and Body-worn

## REFERENCE, STANDARDS, AND GUIDELINES

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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.

## FACILITIES

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

## DESCRIPTION OF TEST SYSTEM

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

### ALSAS-10U System Description

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

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

### Applications

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

### Area Scans

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

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

### Zoom Scan (Cube Scan Averaging)

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

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

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



## ALSAS-10U Interpolation and Extrapolation Uncertainty

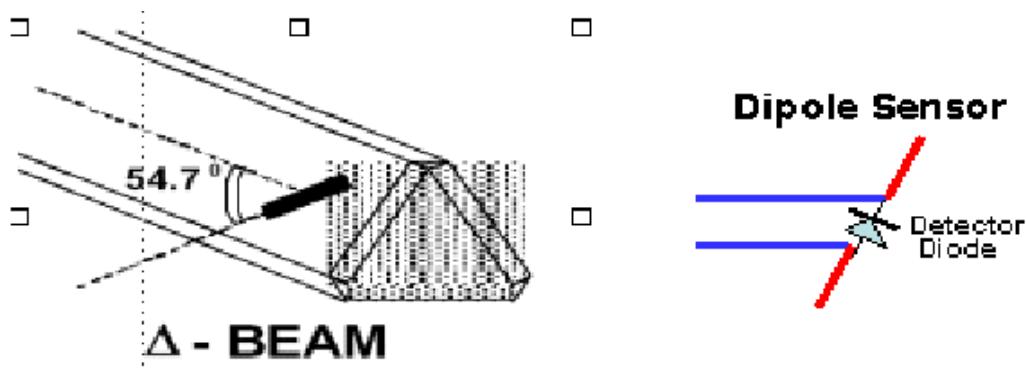
The overall uncertainty for the methodology and algorithms used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

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

### 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 $\mu$ V/(V/m) <sup>2</sup> to 0.85 $\mu$ V/(V/m) <sup>2</sup>
<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 $\mu$ 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 aid of 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.

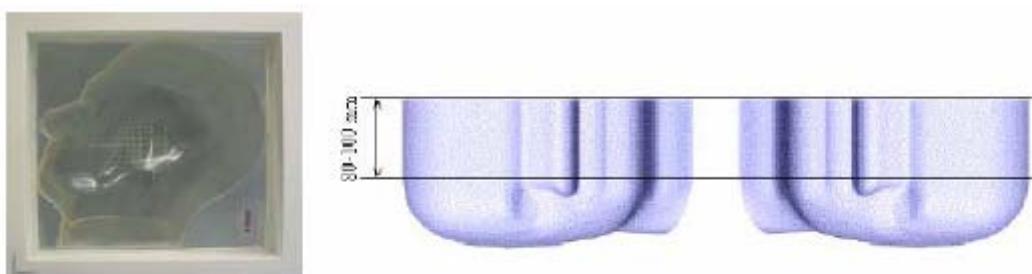


## Phantom Types

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 one frequency for both left and right head experiments in one measurement.



## Tissue Dielectric Parameters for Head and Body Phantoms

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

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

## Recommended Tissue Dielectric Parameters for Head and Body

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

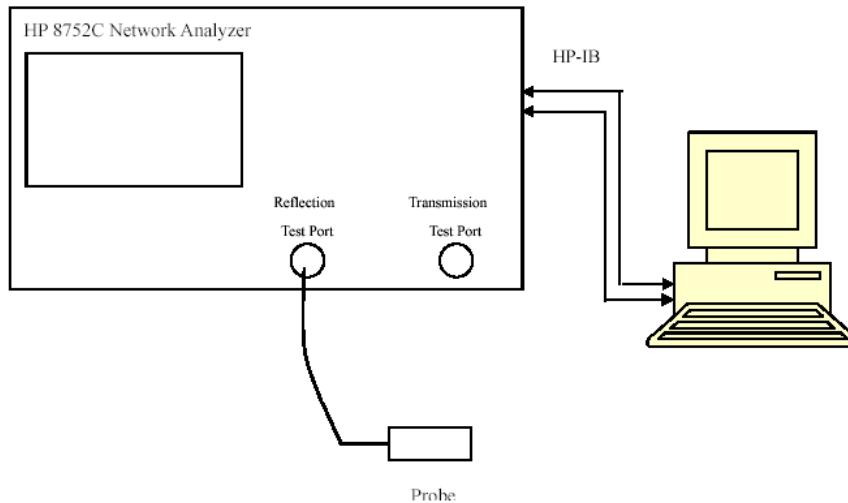
## EQUIPMENT LIST AND CALIBRATION

### Equipments List & Calibration Information

Equipment	Model	Calibration Date	S/N
CRS F3 robot	ALS-F3	N/A	RAF0805352
CRS F3 Software	ALS-F3-SW	N/A	N/A
CRS C500C controller	ALS-C500	N/A	RCF0805379
Probe mounting device & Boundary Detection Sensor System	ALS-PMDPS-3	N/A	120-00270
Universal Work Station	ALS-UWS	N/A	100-00157
Data Acquisition Package	ALS-DAQ-PAQ-3	2014-10-14	110-00212
Miniature E-Field Probe	ALS-E-020	2014-10-14	500-00283
Dipole, 835MHz	ALS-D-835-S-2	2014-10-08	180-00558
Dipole, 1900MHz	ALS-D-1900-S-2	2014-10-09	210-00710
Dipole Spacer	ALS-DS-U	N/A	250-00907
Device holder/Positioner	ALS-H-E-SET-2	N/A	170-00510
Left ear SAM phantom	ALS-P-SAM-L	N/A	130-00311
Right ear SAM phantom	ALS-P-SAM-R	N/A	140-00359
UniPhantom	ALS-P-UP-1	N/A	150-00413
Simulated Tissue 835 MHz Head	ALS-TS-835-H	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-TS-835-B	Each Time	270-02101
Simulated Tissue 1900 MHz Head	ALS-TS-1900-H	Each Time	295-01103
Simulated Tissue 1900 MHz Body	ALS-TS-1900-B	Each Time	296-02102
Directional couple	DC6180A	N/A	0325849
Power Amplifier	5S1G4	N/A	71377
Dielectric probe kit	HP85070B	2014-06-13	N/A
Attenuator	3dB	2014-05-08	5402
Network analyzer	8752C	2014-06-03	3410A02356
Synthesized Sweeper	HP 8341B	2014-06-03	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	2013-11-23	106891
EMI Test Receiver	ESCI	2014-06-13	101746

# SAR MEASUREMENT SYSTEM VERIFICATION

## Liquid Verification



Liquid Verification Setup Block Diagram

## Liquid Verification Results

Frequency	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)	$\Delta\epsilon_r$	$\Delta\sigma$ (S/m)	
824.2	Head	41.46	0.91	41.50	0.90	-0.096	1.111	$\pm 5$
	Body	54.83	0.95	55.20	0.97	-0.670	-2.062	$\pm 5$
826.4	Head	41.35	0.91	41.50	0.90	-0.361	1.111	$\pm 5$
	Body	54.85	0.96	55.20	0.97	-0.634	-1.031	$\pm 5$
836.6	Head	41.42	0.92	41.50	0.90	-0.193	2.222	$\pm 5$
	Body	54.91	0.97	55.20	0.97	-0.525	0.000	$\pm 5$
846.6	Head	41.27	0.93	41.50	0.90	-0.554	3.333	$\pm 5$
	Body	54.97	0.98	55.20	0.97	-0.417	1.031	$\pm 5$
848.8	Head	41.19	0.94	41.50	0.90	-0.747	4.444	$\pm 5$
	Body	54.99	0.99	55.20	0.97	-0.380	2.062	$\pm 5$
1850.2	Head	40.09	1.41	40.00	1.40	0.225	0.714	$\pm 5$
	Body	53.46	1.50	53.30	1.52	0.300	-1.316	$\pm 5$
1852.4	Head	40.09	1.41	40.00	1.40	0.225	0.714	$\pm 5$
	Body	53.42	1.49	53.30	1.52	0.225	-1.974	$\pm 5$
1880.0	Head	40.10	1.44	40.00	1.40	0.250	2.857	$\pm 5$
	Body	53.22	1.53	53.30	1.52	-0.150	0.658	$\pm 5$
1907.6	Head	40.10	1.45	40.00	1.40	0.250	3.571	$\pm 5$
	Body	53.18	1.56	53.30	1.52	-0.225	2.632	$\pm 5$
1909.8	Head	40.11	1.45	40.00	1.40	0.275	3.571	$\pm 5$
	Body	53.29	1.55	53.30	1.52	-0.019	1.974	$\pm 5$

\*Liquid Verification was performed on 2014-12-29.

Please refer to the following tables.

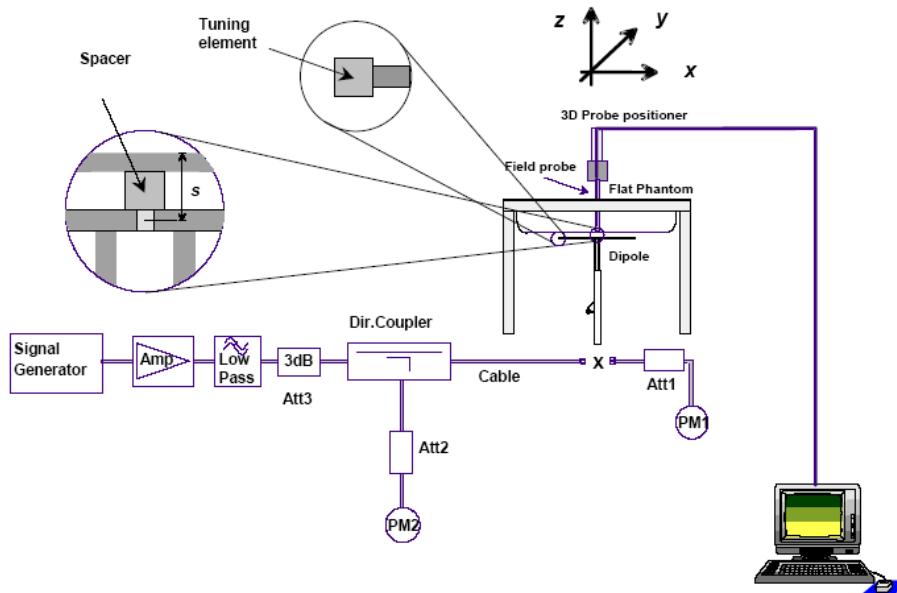
835 MHz Head				835 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
824.0	41.4626	19.7716		824.0	54.8332	20.6852
824.5	41.4316	19.7721		824.5	54.8363	20.5847
825.0	41.4150	19.7727		825.0	54.8394	20.5972
825.5	41.3098	19.7732		825.5	54.8426	20.6097
826.0	41.3282	19.7738		826.0	54.8457	20.7447
826.5	41.3501	19.7743		826.5	54.8489	20.8085
827.0	41.3266	19.7749		827.0	54.8520	20.7230
827.5	41.3739	19.7754		827.5	54.8551	20.6011
828.0	41.3935	19.7760		828.0	54.8583	20.6357
828.5	41.3999	19.7765		828.5	54.8614	20.5931
829.0	41.4508	19.7771		829.0	54.8645	20.6972
829.5	41.3993	19.7776		829.5	54.8677	20.6401
830.0	41.4357	19.7782		830.0	54.8708	20.5180
830.5	41.3957	19.7788		830.5	54.8740	20.5824
831.0	41.3687	19.7793		831.0	54.8771	20.5675
831.5	41.3883	19.7799		831.5	54.8802	20.7750
832.0	41.3501	19.7804		832.0	54.8834	20.7526
832.5	41.3249	19.7810		832.5	54.8865	20.5293
833.0	41.3655	19.7815		833.0	54.8897	20.4627
833.5	41.3969	19.7821		833.5	54.8928	20.5742
834.0	41.3943	19.7826		834.0	54.8959	20.7260
834.5	41.3929	19.7832		834.5	54.8991	20.6190
835.0	41.4177	19.7837		835.0	54.9022	20.5624
835.5	41.4187	19.7846		835.5	54.9053	20.8101
836.0	41.4223	19.7855		836.0	54.9085	20.8171
836.5	41.4073	19.7863		836.5	54.9116	20.6749
837.0	41.3941	19.7872		837.0	54.9148	20.5020
837.5	41.3884	19.7880		837.5	54.9179	20.5382
838.0	41.4115	19.7889		838.0	54.9210	20.8225
838.5	41.3701	19.7897		838.5	54.9242	20.8377
839.0	41.3600	19.7906		839.0	54.9273	20.7597
839.5	41.3625	19.7914		839.5	54.9304	20.6947
840.0	41.3735	19.7923		840.0	54.9336	20.7618
840.5	41.3629	19.7932		840.5	54.9367	20.8072
841.0	41.3462	19.7940		841.0	54.9399	20.7623
841.5	41.3756	19.7949		841.5	54.9430	20.6990
842.0	41.3773	19.7957		842.0	54.9461	20.8749
842.5	41.3810	19.7966		842.5	54.9493	20.8434
843.0	41.3751	19.7874		843.0	54.9524	20.8038
843.5	41.2988	19.7882		843.5	54.9555	20.7593
844.0	41.3750	19.7891		844.0	54.9587	20.7770
844.5	41.3293	19.7900		844.5	54.9618	20.8029
845.0	41.2554	19.7908		845.0	54.9650	20.7123
845.5	41.2707	19.7917		845.5	54.9681	20.6587
846.0	41.2252	19.8126		846.0	54.9712	20.8317
846.5	41.2662	19.8135		846.5	54.9744	20.8931
847.0	41.2464	19.8143		847.0	54.9775	20.8419
847.5	41.2496	19.8152		847.5	54.9807	20.7622
848.0	41.2232	19.8160		848.0	54.9838	20.8524
848.5	41.2278	19.8169		848.5	54.9869	20.9305
849.0	41.1881	19.8177		849.0	54.9901	20.9307

1900 MHz Head				1900 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1850.0	40.0911	13.7454		1850.0	53.4647	14.5346
1851.2	40.0933	13.7154		1851.2	53.3966	14.4920
1852.4	40.0935	13.6827		1852.4	53.4154	14.4931
1853.6	40.0938	13.7061		1853.6	53.3920	14.4694
1854.8	40.0940	13.7000		1854.8	53.2949	14.4888
1856.0	40.0943	13.6241		1856.0	53.3979	14.5253
1857.2	40.0945	13.7640		1857.2	53.3910	14.5513
1858.4	40.0948	13.6602		1858.4	53.3731	14.4725
1859.6	40.0950	13.7141		1859.6	53.3547	14.4668
1860.8	40.0953	13.7154		1860.8	53.2505	14.5196
1862.0	40.0955	13.7320		1862.0	53.2782	14.3468
1863.2	40.0958	13.7544		1863.2	53.2242	14.3596
1864.4	40.0960	13.7894		1864.4	53.2589	14.3767
1865.6	40.0963	13.7840		1865.6	53.2654	14.3477
1866.8	40.0965	13.7728		1866.8	53.3404	14.3383
1868.0	40.0968	13.7913		1868.0	53.4089	14.3544
1869.2	40.0970	13.8521		1869.2	53.4179	14.3768
1870.4	40.0973	13.8448		1870.4	53.3314	14.4283
1871.6	40.0975	13.8187		1871.6	53.2738	14.4290
1872.8	40.0978	13.8488		1872.8	53.3122	14.4580
1874.0	40.0980	13.7914		1874.0	53.2387	14.4663
1875.2	40.0983	13.8255		1875.2	53.3019	14.5295
1876.4	40.0985	13.8235		1876.4	53.2050	14.4523
1877.6	40.0988	13.8880		1877.6	53.3073	14.5323
1878.8	40.0990	13.7836		1878.8	53.3350	14.6642
1880.0	40.0993	13.7288		1880.0	53.2174	14.6831
1881.2	40.0995	13.7775		1881.2	53.1756	14.6802
1882.4	40.0998	13.8001		1882.4	53.2712	14.6515
1883.6	40.1000	13.7689		1883.6	53.2367	14.6076
1884.8	40.1003	13.7695		1884.8	53.2615	14.6303
1886.0	40.1005	13.7688		1886.0	53.2968	14.5625
1887.2	40.1008	13.7640		1887.2	53.2775	14.5387
1888.4	40.1010	13.7590		1888.4	53.3673	14.5730
1889.6	40.1013	13.7543		1889.6	53.2978	14.5776
1890.8	40.1015	13.7494		1890.8	53.3435	14.6344
1892.0	40.1018	13.7446		1892.0	53.3314	14.4306
1893.2	40.1020	13.7397		1893.2	53.3039	14.3915
1894.4	40.1023	13.7349		1894.4	53.2765	14.4406
1895.6	40.1025	13.7300		1895.6	53.2694	14.7744
1896.8	40.1027	13.7252		1896.8	53.2593	14.7725
1898.0	40.1030	13.7203		1898.0	53.2596	14.7531
1899.2	40.1032	13.7155		1899.2	53.3366	14.7535
1900.4	40.1035	13.7106		1900.4	53.3015	14.6522
1901.6	40.1037	13.7058		1901.6	53.3050	14.7415
1902.8	40.1040	13.7009		1902.8	53.2741	14.7015
1904.0	40.1042	13.6961		1904.0	53.3558	14.6704
1905.2	40.1045	13.6912		1905.2	53.2676	14.6389
1906.4	40.1048	13.6864		1906.4	53.2575	14.5638
1907.6	40.1050	13.6816		1907.6	53.1832	14.6806
1908.8	40.1052	13.6767		1908.8	53.2674	14.6160
1910.0	40.1055	13.6719		1910.0	53.2940	14.5797

## System Accuracy Verification

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

### System Verification Setup Block Diagram



### Probe and dipole antenna List and Detail

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
APREL	Probe	ALS-E-020	500-00283	2014-10-14	2015-10-13
APREL	Dipole antenna(835MHz)	ALS-D-835-S-2	180-00558	2014-10-08	2017-10-07
APREL	Dipole antenna(1900MHz)	ALS-D-1900-S-2	210-00710	2014-10-09	2017-10-08

### System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2014-12-29	835	Head	1g-SAR	9.633	9.773	-1.433	$\pm 10$
		Body	1g-SAR	9.935	9.736	2.044	$\pm 10$
	1900	Head	1g-SAR	41.266	39.481	4.521	$\pm 10$
		Body	1g-SAR	40.860	39.715	2.883	$\pm 10$

\*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 : 9.512 W/kg  
Power Drift-Finish : 9.411 W/kg  
Power Drift (%) : -1.089

## Phantom Data

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

## Tissue Data

Type : Head  
Serial No. : 270-01002  
Frequency : 835.0 MHz  
Last Calib. Date : 29-Dec-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 41.42 F/m  
Sigma : 0.92 S/m  
Density : 1000.00 kg/cu. m

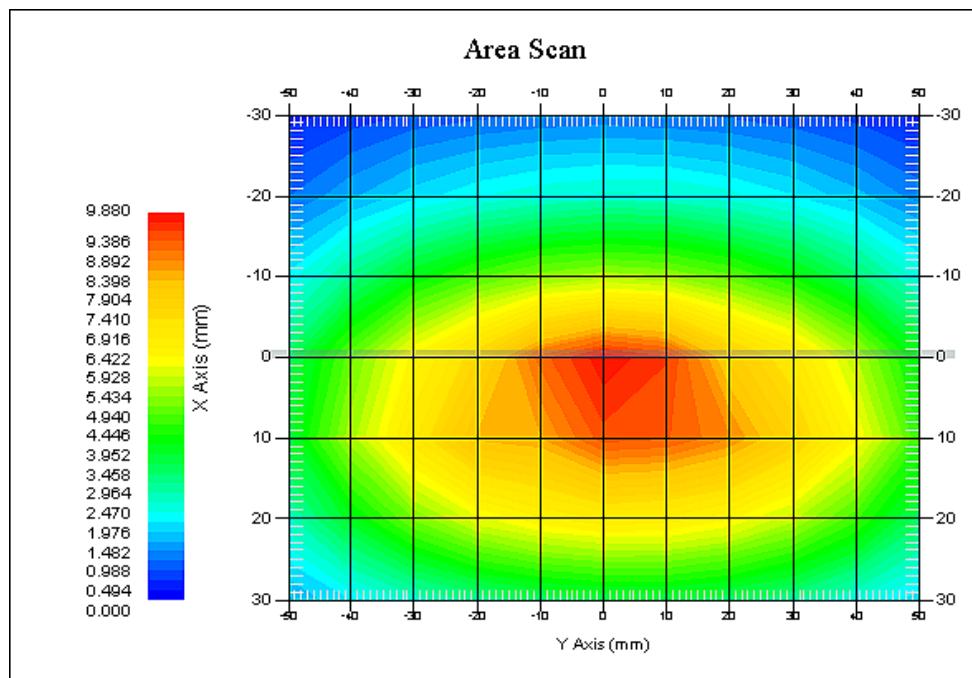
## Probe Data

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

## Measurement Data

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

1 gram SAR value : 9.633 W/kg  
10 gram SAR value : 6.320 W/kg  
Area Scan Peak SAR : 9.868 W/kg  
Zoom Scan Peak SAR : 14.850 W/kg



### 835 MHz System Validation with Head Tissue

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

## Product Data

Device Name : Dipole 835 MHz  
Serial No. : 180-00558  
Type : Dipole  
Model : ALS-D-835-S-2  
Frequency Band : 835  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 9.915 W/kg  
Power Drift-Finish : 10.128 W/kg  
Power Drift (%) : 2.337

## Phantom Data

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

## Tissue Data

Type : Body  
Serial No. : 270-02101  
Frequency : 835.0 MHz  
Last Calib. Date : 29-Dec-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 54.90 RH%  
Epsilon : 53.79 F/m  
Sigma : 0.95 S/m  
Density : 1000.00 kg/cu. m

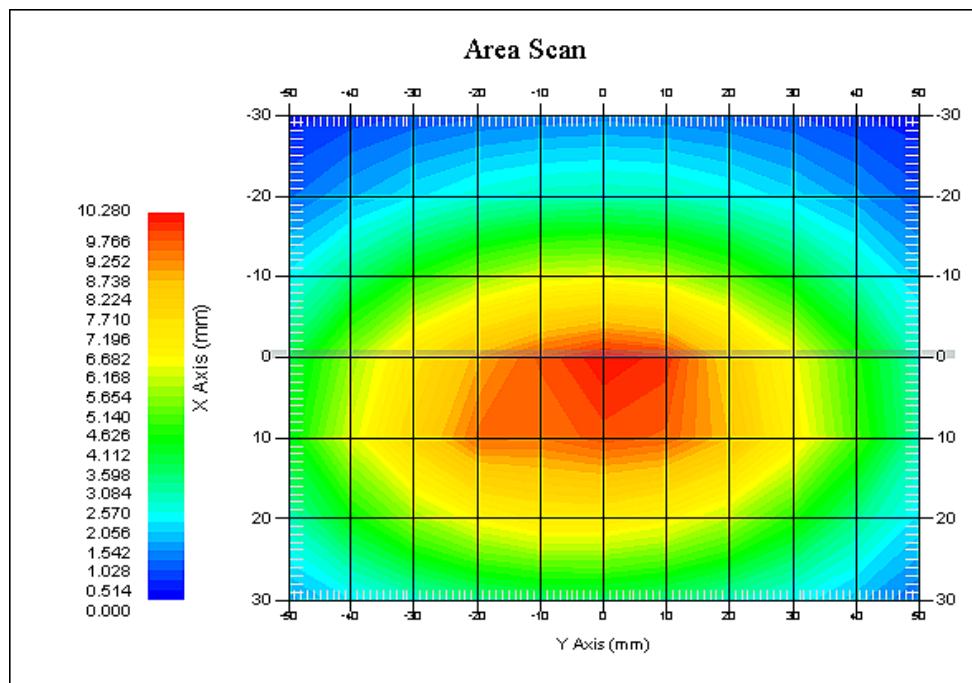
## Probe Data

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

## Measurement Data

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

1 gram SAR value : 9.935 W/kg  
10 gram SAR value : 6.432 W/kg  
Area Scan Peak SAR : 10.280 W/kg  
Zoom Scan Peak SAR : 16.857 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 : 40.926 W/kg  
Power Drift-Finish : 40.186 W/kg  
Power Drift (%) : -1.769

**Phantom Data**

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

**Tissue Data**

Type : Head  
Serial No. : 295-01103  
Frequency : 1900.00 MHz  
Last Calib. Date : 29-Dec-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 40.10 F/m  
Sigma : 1.45 S/m  
Density : 1000.00 kg/cu. M

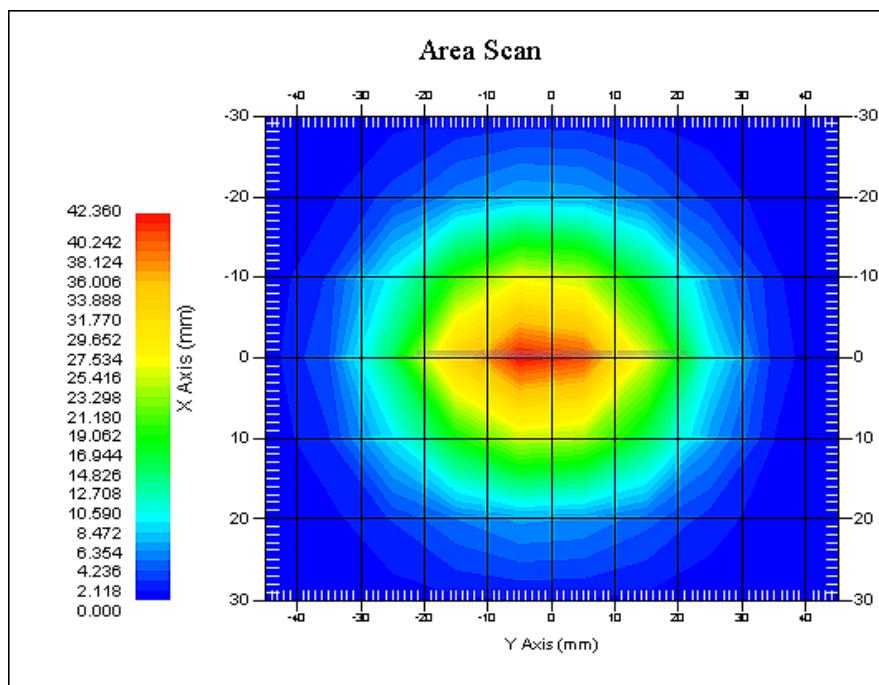
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.8  
Probe Sensitivity : 1.20 1.20 1.20 μV/(V/m)2  
Compression Point : 95.00 mV  
Offset : 1.56 mm

**Measurement Data**

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

1 gram SAR value : 41.266 W/kg  
10 gram SAR value : 21.936 W/kg  
Area Scan Peak SAR : 42.349 W/kg  
Zoom Scan Peak SAR : 68.127 W/kg



### 1900 MHz System Validation with Head Tissue

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

Device Name : Dipole 1900MHz  
Serial No. : 210-00710  
Type : Dipole  
Model : ALS-D-1900-S-2  
Frequency Band : 1900  
Max. Transmit Pwr : 1 W  
Drift Time : 3 min(s)  
Power Drift-Start : 24.403 W/kg  
Power Drift-Finish : 24.012 W/kg  
Power Drift (%) : -1.743

**Phantom Data**

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

**Tissue Data**

Type : Body  
Serial No. : 295-02102  
Frequency : 1900.00 MHz  
Last Calib. Date : 29-Dec-2014  
Temperature : 20.00 °C  
Ambient Temp. : 21.00 °C  
Humidity : 56.00 RH%  
Epsilon : 53.30 F/m  
Sigma : 1.55 S/m  
Density : 1000.00 kg/cu. m

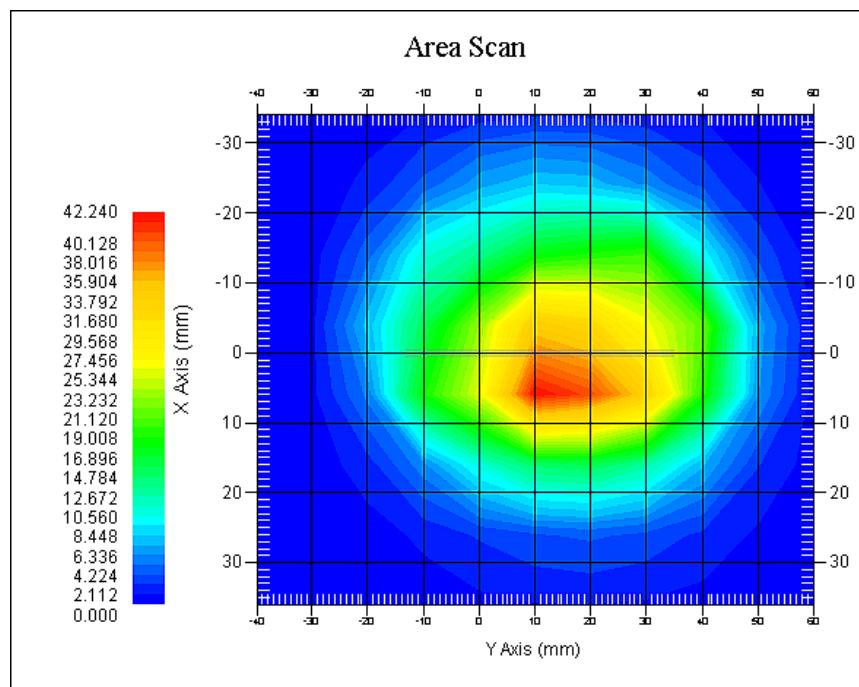
**Probe Data**

Name : E-Field  
Model : E-020  
Type : E-Field Triangle  
Serial No. : 500-00283  
Last Calib. Date : 14-Oct-2014  
Frequency Band : 1900  
Duty Cycle Factor : 1  
Conversion Factor : 4.5  
Probe Sensitivity : 1.20 1.20 1.20 μV/(V/m)2  
Compression Point : 95.00 mV  
Offset : 1.56 mm

**Measurement Data**

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

1 gram SAR value : 40.860 W/kg  
10 gram SAR value : 21.505 W/kg  
Area Scan Peak SAR : 42.240 W/kg  
Zoom Scan Peak SAR : 75.887 W/kg



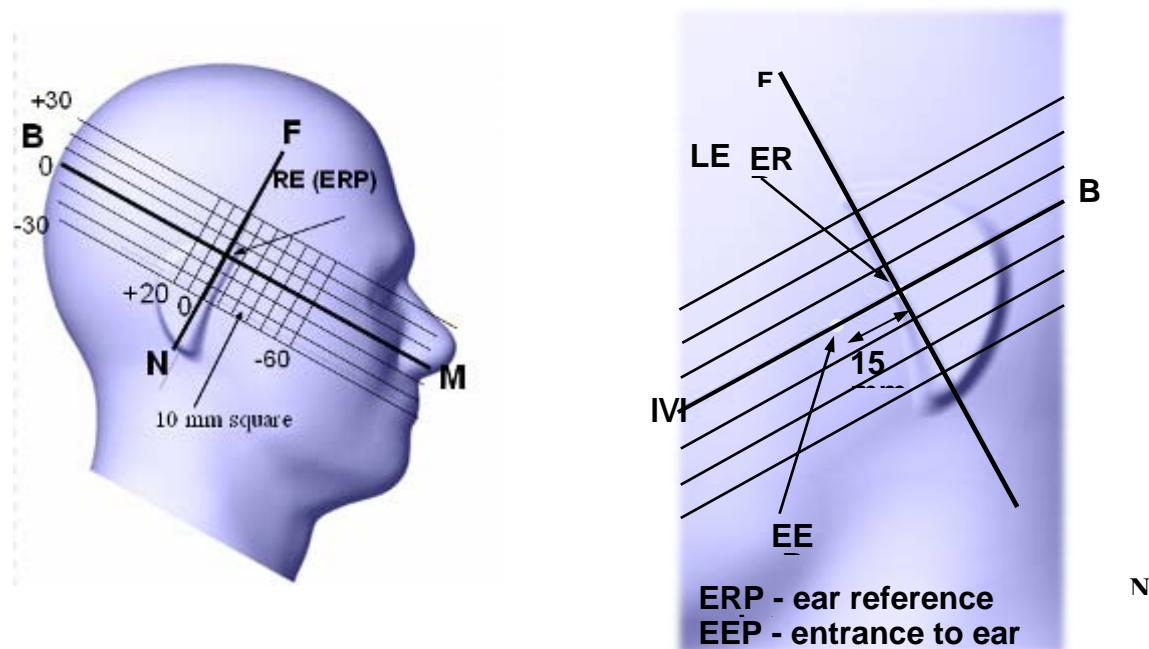
### 1900 MHz System Validation with Body Tissue

## EUT TEST STRATEGY AND METHODOLOGY

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

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

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



## Cheek/Touch Position

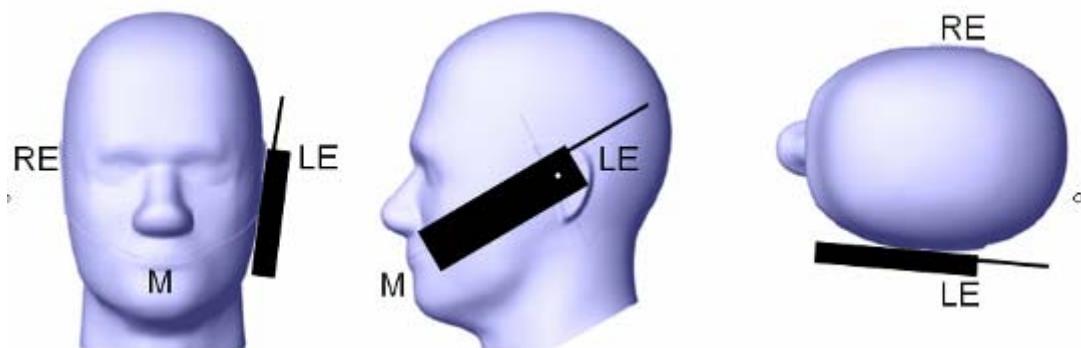
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

This test position is established:

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

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

### Cheek /Touch Position



## Ear/Tilt Position

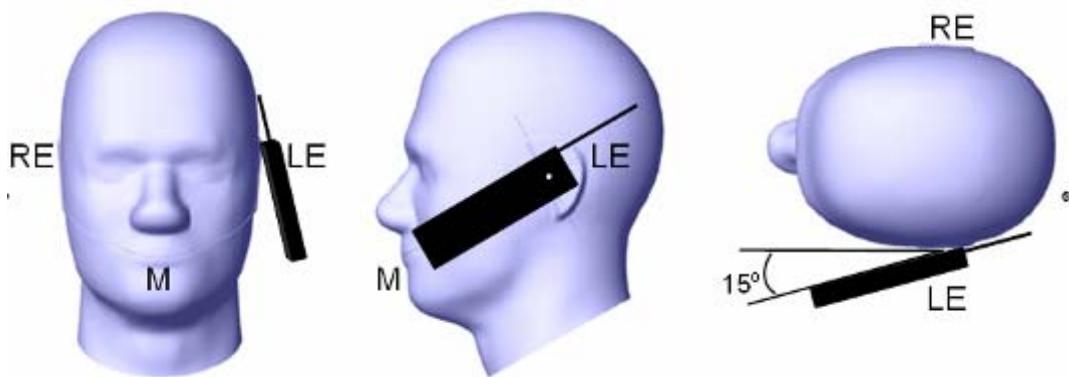
With the handset aligned in the “Cheek/Touch Position”:

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

2) (otherwise) The handset should be moved (translated) away from the cheek perpendicular to the line passes through both “ear reference points” (note: one of these ear reference points may not physically exist on a split head model) for approximate 2-3 cm. While it is in this position, the device handset is tilted away from the mouth with respect to the “test device reference point” until the inside angle between the vertical centerline on the front surface of the phone and the horizontal line passing through the ear reference point is by 15°. 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, Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s). If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

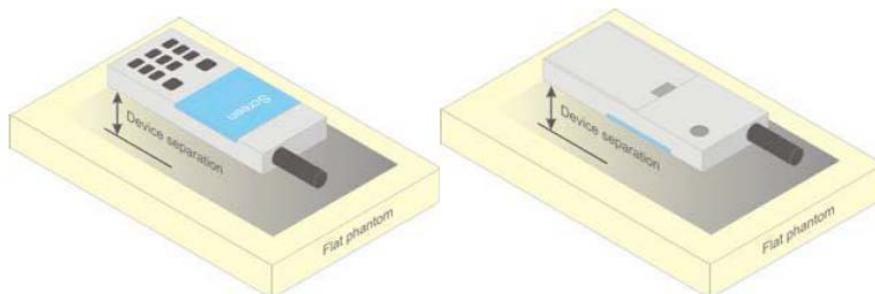
#### Ear /Tilt 15° Position



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

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

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



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

## SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

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

Step 3: Around this point, a volume of 35 mm x 35 mm x 35 mm was assessed by measuring 7x 7 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

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

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

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

## Test methodology

KDB447498 D01 General RF Exposure Guidance v05r02.

KDB 648474 D04 Handset SAR v01r02.

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03

KDB 865664 D02 RF Exposure Reporting v01r01

KDB 941225 D01 3G SAR Procedures v03

KDB 941225 D06 Hotspot Mode v02

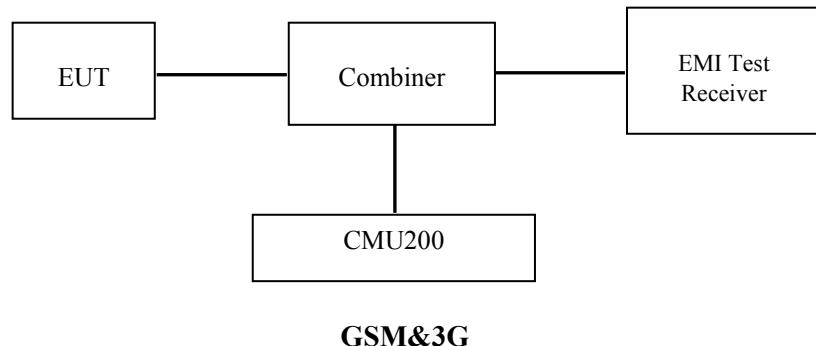
## CONDUCTED OUTPUT POWER MEASUREMENT

## Provision Applicable

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

## Test Procedure

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



### Maximum Output Power among production units

Max Target Power for Production Unit (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	32.10	32.10	32.10
GPRS 1 slot	31.60	31.60	31.60
GPRS 2 slot	30.70	30.70	30.70
GPRS 3 slot	29.00	29.00	29.00
GPRS 4 slot	27.90	27.90	27.90
EGPRS 1 slot	27.00	27.00	27.00
EGPRS 2 slot	25.50	25.50	25.50
EGPRS 3 slot	23.20	23.20	23.20
EGPRS 4 slot	21.00	21.00	21.00
PCS 1900	29.50	29.50	29.50
GPRS 1 slot	29.00	29.00	29.00
GPRS 2 slot	28.20	28.20	28.20
GPRS 3 slot	27.00	27.00	27.00
GPRS 4 slot	25.70	25.70	25.70
EGPRS 1 slot	25.60	25.60	25.60
EGPRS 2 slot	24.50	24.50	24.50
EGPRS 3 slot	22.00	22.00	22.00
EGPRS 4 slot	21.00	21.00	21.00
WCDMA850	22.20	22.20	22.20

WCDMA1900	22.40	22.40	22.40
Wi-Fi	9.40	9.40	9.40
Bluetooth	3.20	3.20	3.20

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

Band	Frequency (MHz)	Conducted Output Power	
		Meas. Power (dBm)	Meas. Power (W)
GSM 850	824.2	31.66	1.466
	836.6	31.75	1.496
	848.8	<b>32.06</b>	1.607
PCS 1900	1850.2	<b>29.49</b>	0.889
	1880.0	29.35	0.861
	1909.8	29.42	0.875

**GPRS:**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	30.84	30.33	28.36	27.41
	190	836.6	31.24	30.41	28.63	27.58
	251	848.8	31.53	30.70	28.94	27.89
PCS 1900	512	1850.2	28.96	28.15	26.93	25.65
	661	1880.0	28.78	28.01	26.74	25.48
	810	1909.8	28.84	28.07	26.82	25.51

**EGPRS:**

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	26.57	25.32	22.84	21.74
	190	836.6	26.73	25.36	23.16	21.68
	251	848.8	26.58	25.25	22.85	21.64
PCS 1900	512	1850.2	25.69	24.35	21.83	20.81
	661	1880.0	25.23	23.87	21.62	20.35
	810	1909.8	24.66	23.31	20.47	20.28

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

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

### The time based average power for GPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	21.84	24.33	24.11	24.41
	190	836.6	22.24	24.41	24.38	24.58
	251	848.8	22.53	24.70	24.69	<b>24.89</b>
PCS 1900	512	1850.2	19.96	22.15	<b>22.68</b>	22.65
	661	1880.0	19.78	22.01	22.49	22.48
	810	1909.8	19.84	22.07	22.57	22.51

### The time based average power for EGPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	17.57	19.32	18.59	18.74
	190	836.6	17.73	19.36	18.91	18.68
	251	848.8	17.58	19.25	18.6	18.64
PCS 1900	512	1850.2	16.69	18.35	17.58	17.81
	661	1880.0	16.23	17.87	17.37	17.35
	810	1909.8	15.66	17.31	16.22	17.28

#### Note:

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

**WCDMA-Release 99:**

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

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

**WCDMA HSDPA**

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

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

## WCDMA HSUPA

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

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

**Results (12.2kbps RMC)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power	
			(dBm)	(Watt)
WCDMA 850	826.4	4132	<b>22.12</b>	0.163
	836.6	4183	22.05	0.160
	846.6	4233	22.11	0.163
WCDMA 1900	1852.4	9262	<b>22.32</b>	0.171
	1880.0	9400	22.11	0.163
	1907.6	9538	21.81	0.152

**Results (HSDPA)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)			
			Subset 1	Subset 2	Subset 3	Subset 4
WCDMA 850	826.4	4132	21.24	21.24	21.19	21.20
	836.6	4183	21.13	21.10	21.13	21.10
	846.6	4233	21.16	21.11	21.12	21.16
WCDMA 1900	1852.4	9262	21.48	21.44	21.42	21.51
	1880.0	9400	21.24	21.22	21.26	21.19
	1907.6	9538	20.94	20.96	20.90	20.91

**Results (HSUPA)**

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)				
			Subset 1	Subset 2	Subset 3	Subset 4	Subset 5
WCDMA 850	826.4	4132	21.25	21.28	21.19	21.27	21.25
	836.6	4183	21.12	21.14	21.14	21.06	21.12
	846.6	4233	21.14	21.11	21.10	21.12	21.17
WCDMA 1900	1852.4	9262	21.46	21.45	21.47	21.44	21.45
	1880.0	9400	21.25	21.24	21.23	21.20	21.22
	1907.6	9538	20.95	20.93	20.94	20.98	20.91

**Note:**

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model 1.
2. KDB 941225 D01-Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than  $\frac{1}{4}$  dB higher than measured without HSDPA using 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.
3. KDB 941225 D01-Body SAR is not required for HSUPA when the maximum average output of each RF channel with HSUPA active is less than  $\frac{1}{4}$  dB higher than measured without HSUPA using 12.2kbps RMC and the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.

**Bluetooth**

<b>Mode</b>	<b>Channel frequency (MHz)</b>	<b>Conducted Output Power</b>	
		<b>(dBm)</b>	<b>(mw)</b>
BDR(GFSK)	(Low)2402	9.32	8.551
	(Middle)2441	9.24	8.395
	(High)2480	9.24	8.395
EDR(4-DQPSK)	(Low)2402	9.19	8.299
	(Middle)2441	9.28	8.472
	(High)2480	9.28	8.472
EDR-8DPSK	(Low)2402	9.16	8.241
	(Middle)2441	9.18	8.279
	(High)2480	9.14	8.204
BLE	(Low)2402	9.21	8.337
	(Middle)2440	<b>9.36</b>	8.630
	(High)2480	9.12	8.166

**Wi-Fi**

<b>Band</b>	<b>Frequency (MHz)</b>	<b>Conducted Output Power</b>	
		<b>(dBm)</b>	<b>(mw)</b>
802.11b	2412	<b>3.15</b>	2.065
	2442	2.70	1.862
	2472	2.05	1.603
802.11g	2412	2.48	1.770
	2442	2.04	1.600
	2472	1.38	1.374
802.11n HT20	2412	2.36	1.722
	2442	1.90	1.549
	2472	1.29	1.346
802.11n HT40	2422	-5.94	0.255
	2442	-6.55	0.221
	2462	-6.95	0.202

**Note:**

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

## SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

### SAR Test Data

#### Environmental Conditions

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

Testing was performed by Wilson Chen on 2014-12-29

#### GSM 850:

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	824.2	GSM	-2.358	31.66	32.10	1.107	0.338	0.374	/
	836.6	GSM	-1.765	31.75	32.10	1.084	0.361	<b>0.391</b>	<b>1#</b>
	848.8	GSM	0.433	32.06	32.10	1.009	0.352	0.355	/
Left Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-1.588	31.75	32.10	1.084	0.173	0.188	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	1.728	31.75	32.10	1.084	0.348	0.377	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	2.572	31.75	32.10	1.084	0.156	0.169	/
	848.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-1.550	31.75	32.10	1.084	0.502	0.544	/
	848.8	GSM	/	/	/	/	/	/	/

#### Note:

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

**PCS Band:**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1850.2	GSM	1.382	29.49	29.50	1.002	0.342	0.343	/
	1880.0	GSM	-2.135	29.35	29.50	1.035	0.366	<b>0.379</b>	2#
	1909.8	GSM	-3.705	29.42	29.50	1.019	0.349	0.355	/
Left Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-2.308	29.35	29.50	1.035	0.155	0.160	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	4.550	29.35	29.50	1.035	0.362	0.375	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	1.177	29.35	29.50	1.035	0.147	0.152	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-3.507	29.35	29.50	1.035	0.535	0.554	/
	1909.8	GSM	/	/	/	/	/	/	/

**Note:**

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

**WCDMA 850**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	826.4	WCDMA 850	1.633	22.12	22.20	1.019	0.093	0.095	/
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Left Head Tilt	826.4	WCDMA 850	-2.820	22.12	22.20	1.019	0.042	0.043	/
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Cheek	826.4	WCDMA 850	2.495	22.12	22.20	1.019	0.096	<b>0.098</b>	3#
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Tilt	826.4	WCDMA 850	0.766	22.12	22.20	1.019	0.038	0.039	/
	836.6	WCDMA 850	/	/	/	/	/	/	/
	846.6	WCDMA 850	/	/	/	/	/	/	/

**WCDMA1900**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1852.4	WCDMA1900	2.937	22.32	22.40	1.019	0.213	<b>0.217</b>	4#
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Left Head Tilt	1852.4	WCDMA1900	-1.658	22.32	22.40	1.019	0.095	0.097	/
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Cheek	1852.4	WCDMA1900	-2.650	22.32	22.40	1.019	0.204	0.208	/
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Tilt	1852.4	WCDMA1900	-1.709	22.32	22.40	1.019	0.103	0.105	/
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/

**Note:**

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

## Mobile Hot-Spot Test Result

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

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

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			Plot
						Scaled Factor	Meas. SAR	Scaled SAR	
Body-Back (10mm)	824.2	GPRS	-1.408	27.41	27.90	1.119	0.655	0.733	/
	836.6	GPRS	-0.616	27.58	27.90	1.076	0.780	<b>0.840</b>	<b>5#</b>
	848.8	GPRS	-2.174	27.89	27.90	1.002	0.808	0.810	/
Body-Right (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	1.308	27.89	27.90	1.002	0.521	0.522	/
Body-Bottom (10mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	3.806	27.89	27.90	1.002	0.485	0.486	/

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

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			Plot
						Scaled Factor	Meas. SAR	Scaled SAR	
Body-Back (10mm)	1850.2	GPRS	-2.625	26.93	27.00	1.016	0.866	0.880	/
	1880.0	GPRS	1.284	26.74	27.00	1.062	0.902	0.958	/
	1909.8	GPRS	1.568	26.82	27.00	1.042	0.878	0.915	/
Body-Right (10mm)	1850.2	GPRS	-2.542	26.93	27.00	1.016	0.286	0.291	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Bottom (10mm)	1850.2	GPRS	0.866	26.93	27.00	1.016	0.976	0.992	/
	1880.0	GPRS	1.352	26.74	27.00	1.062	1.050	1.115	/
	1909.8	GPRS	1.089	26.82	27.00	1.042	1.183	<b>1.233</b>	<b>6#</b>

**Hot Spot-WCDMA850**

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	826.4	WCDMA850	-3.404	22.12	22.20	1.019	0.200	<b>0.204</b>	7#
	836.6	WCDMA850	/	/	/	/	/	/	
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Right (10mm)	826.4	WCDMA850	-1.650	22.12	22.20	1.019	0.085	0.087	
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Bottom (10mm)	826.4	WCDMA850	-1.428	22.12	22.20	1.019	0.033	0.034	
	836.6	WCDMA850	/	/	/	/	/	/	/
	846.6	WCDMA850	/	/	/	/	/	/	/

**Hot Spot-WCDMA1900**

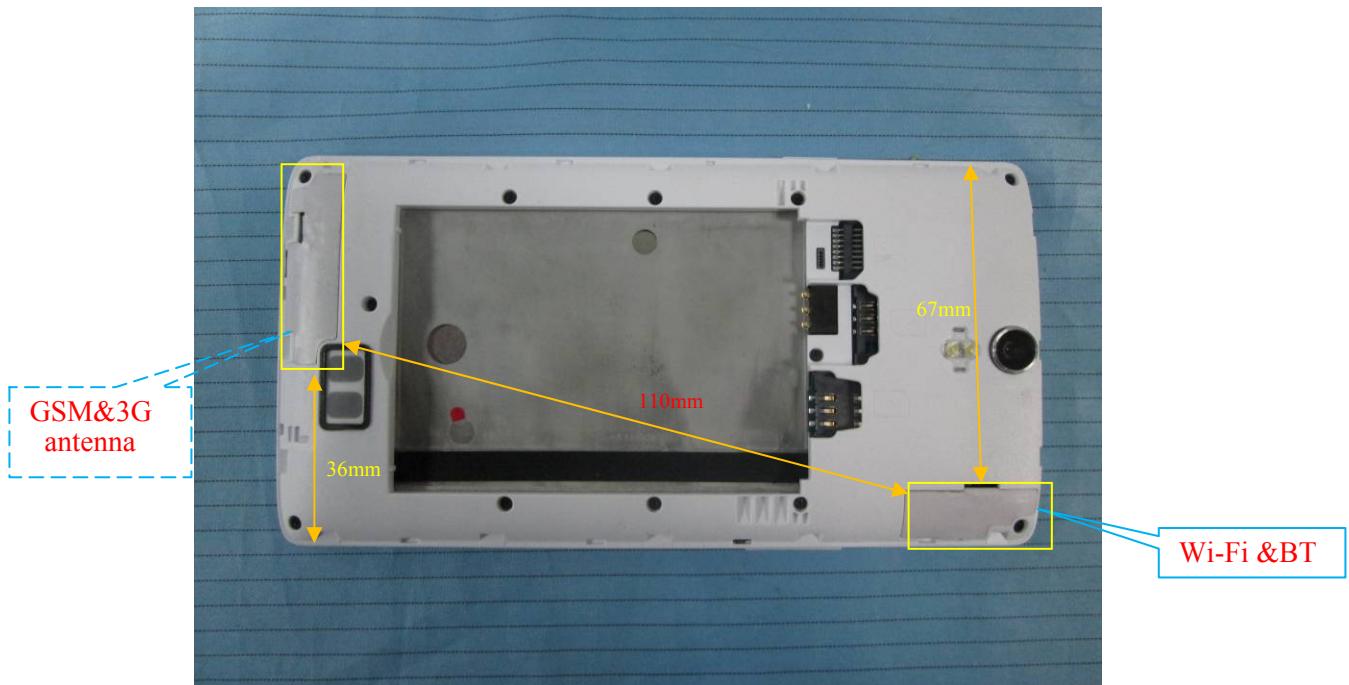
EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	FCC 1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1852.4	WCDMA1900	1.990	22.32	22.40	1.019	0.509	0.518	/
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Right (10mm)	1852.4	WCDMA1900	-2.308	22.32	22.40	1.019	0.167	0.170	/
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Bottom (10mm)	1852.4	WCDMA1900	0.726	22.32	22.40	1.019	0.762	<b>0.776</b>	8#
	1880.0	WCDMA1900	/	/	/	/	/	/	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/

**Note:**

1. When the 1-g SAR is  $\leq 0.8\text{W/Kg}$ , testing for other channels are optional.
2. For GPRS mode: the Multi-slot Classes of EUT is Class12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.
2. For WCDMA mode: the default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model.
3. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

## SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

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



### Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	✗	✗	0
GSM + Bluetooth	✓	✗	110
GSM + Wi-Fi	✓	✗	110
GPRS + WCDMA	✗	✗	0
GPRS + Bluetooth	✓	✗	110
GPRS + Wi-Fi	✓	✓	110
WCDMA + Bluetooth	✓	✗	110
WCDMA + Wi-Fi	✓	✓	110

### Standalone SAR test exclusion considerations

Head Position:

Mode	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GSM850	23.10	204.17	0	37.65	3.0	No
PCS1900	20.50	112.20	0	30.93	3.0	No
WCDMSA850	22.20	165.96	0	30.60	3.0	No
WCDMSA1900	22.40	173.78	0	47.91	3.0	No
Wi-Fi	9.40	8.71	0	2.73	3.0	Yes
Bluetooth	3.20	2.09	0	0.65	3.0	Yes

Body Position:

Mode	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GPRS850	24.90	309.03	10.00	28.49	3.0	No
GPRS1900	22.80	190.55	10.00	26.26	3.0	No
WCDMSA850	22.20	165.96	10.00	15.30	3.0	No
WCDMSA1900	22.40	173.78	10.00	23.95	3.0	No
Wi-Fi	9.40	8.71	10.00	1.36	3.0	Yes
Bluetooth	3.20	2.09	10.00	0.33	3.0	Yes

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

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

1.  $f(\text{GHz})$  is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test Exclusion.

#### Standalone SAR estimation:

Mode	Frequency (GHz)	Distance (mm)	P <sub>avg</sub> (dBm)	P <sub>avg</sub> (mW)	Estimated 1-g (W/kg)
Wi-Fi Head	2.45	0	9.40	8.71	0.364
Wi-Fi Body	2.45	10	9.40	8.71	0.187
BT Head	2.45	0	3.20	2.09	0.086
BT Body	2.45	10	3.20	2.09	0.043

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

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

W/kg for *test separation distances*  $\leq 50$  mm;

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

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

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

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	BT	< 1.6W/kg
GSM850	Left Head Cheek	0.391	0.086	0.477
	Left Head Tile	0.188	0.086	0.274
	Right Head Cheek	0.377	0.086	0.463
	Right Head Tilt	0.169	0.086	0.255
	Body-Headset-Back	0.544	0.043	0.587
PCS1900	Left Head Cheek	0.379	0.086	0.465
	Left Head Tile	0.160	0.086	0.246
	Right Head Cheek	0.375	0.086	0.461
	Right Head Tilt	0.152	0.086	0.238
	Body-Headset-Back	0.554	0.043	0.597

**WCDMA with BT:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.095	0.086	0.181
	Left Head Tile	0.043	0.086	0.129
	Right Head Cheek	0.098	0.086	0.184
	Right Head Tilt	0.039	0.086	0.125
WCDMA 1900	Left Head Cheek	0.217	0.086	0.303
	Left Head Tile	0.097	0.086	0.183
	Right Head Cheek	0.208	0.086	0.294
	Right Head Tilt	0.105	0.086	0.191

**GSM with Wi-Fi:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	Wi-Fi	< 1.6W/kg
GSM850	Left Head Cheek	0.391	0.364	0.755
	Left Head Tile	0.188	0.364	0.552
	Right Head Cheek	0.377	0.364	0.741
	Right Head Tilt	0.169	0.364	0.533
	Body-Headset-Back	0.544	0.187	0.731
PCS1900	Left Head Cheek	0.379	0.364	0.743
	Left Head Tile	0.160	0.364	0.524
	Right Head Cheek	0.375	0.364	0.739
	Right Head Tilt	0.152	0.364	0.516
	Body-Headset-Back	0.554	0.187	0.741

**WCDMA with Wi-Fi:**

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	Wi-Fi	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.095	0.364	0.459
	Left Head Tile	0.043	0.364	0.407
	Right Head Cheek	0.098	0.364	0.462
	Right Head Tilt	0.039	0.364	0.403
WCDMA 1900	Left Head Cheek	0.217	0.364	0.581
	Left Head Tile	0.097	0.364	0.461
	Right Head Cheek	0.208	0.364	0.572
	Right Head Tilt	0.105	0.364	0.469

**Conclusion:**

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

**Hotspot:**

Evaluations for Simultaneous SAR, Mobile Hot Spot Positions					
Test Position	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
GPRS 850	0.840	/	0.522	0.185	/
GPRS 1900	0.958	/	0.291	1.233	/
WCDMA850	0.204	/	0.087	0.034	/
WCDMA 1900	0.518	/	0.170	0.776	/
Wi-Fi	0.180	0.180	0.180	0.180	0.180
	Σ 1-g SAR(W/Kg)				
GPRS850 + Wi-Fi	1.020	/	0.709	0.372	/
GPRS1900 + Wi-Fi	1.138	/	0.478	<b>1.420</b>	/
WCDMA850 + Wi-Fi	0.384	/	0.274	0.221	/
WCDMA 1900 + Wi-Fi	0.698	/	0.357	0.963	/

**Note:**

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

**SAR Plots (Summary of the Highest SAR Values)****Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Left Head Cheek (836.6 MHz Middle Channel)****Measurement Data**

Test mode : GSM  
Crest Factor : 8  
Scan Type : Complete  
Area Scan : 10x13x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.002 W/kg  
Power Drift-Finish : 0.002 W/kg  
Power Drift (%) : -1.765

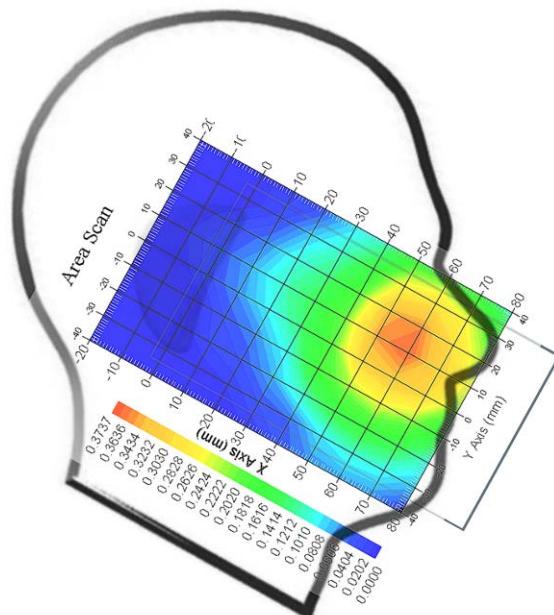
**Tissue Data**

Type : Head  
Frequency : 836.6 MHz  
Epsilon : 41.42 F/m  
Sigma : 0.92 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

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

1 gram SAR value : 0.361 W/kg  
10 gram SAR value : 0.235 W/kg  
Area Scan Peak SAR : 0.368 W/kg  
Zoom Scan Peak SAR : 0.577 W/kg

**Plot 1#**

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

## Measurement Data

Test mode : GSM  
Crest Factor : 8  
Scan Type : Complete  
Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.001 W/kg  
Power Drift-Finish : 0.001 W/kg  
Power Drift (%) : -2.135

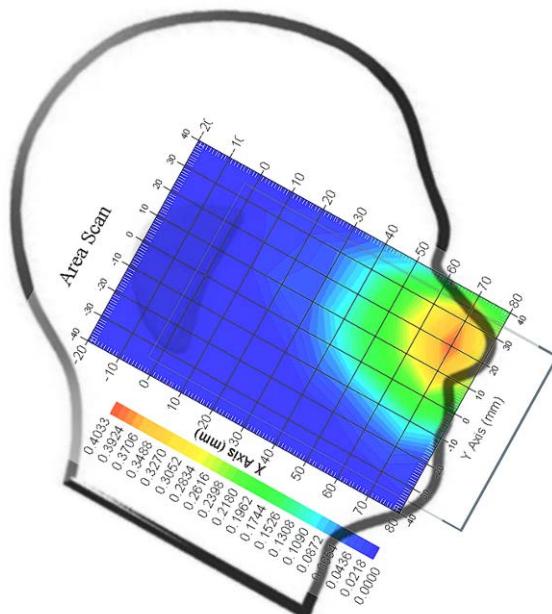
## Tissue Data

Type : Head  
Frequency : 1880 MHz  
Epsilon : 40.10 F/m  
Sigma : 1.44 S/m  
Density : 1000.00 kg/cu. M

## Probe Data

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

1 gram SAR value : 0.366 W/kg  
10 gram SAR value : 0.196 W/kg  
Area Scan Peak SAR : 0.399 W/kg  
Zoom Scan Peak SAR : 0.590 W/kg

**Plot 2#**

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

Test mode : WCDMA850  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.002 W/kg  
Power Drift-Finish : 0.002 W/kg  
Power Drift (%) : 2.495

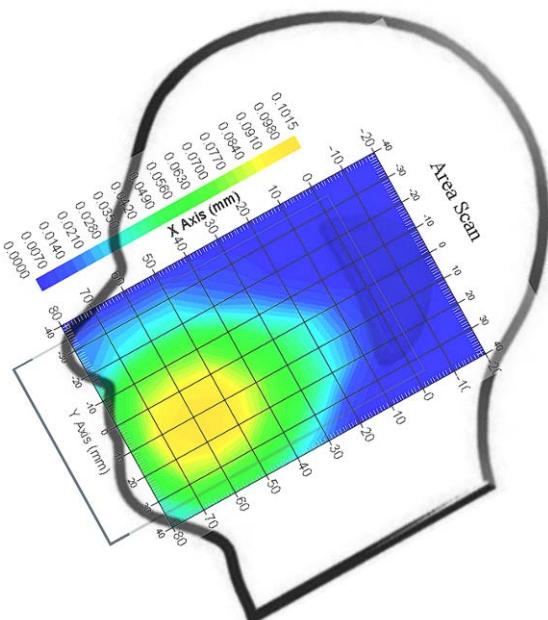
**Tissue Data**

Type : Head  
Frequency : 826.4 MHz  
Epsilon : 41.46 F/m  
Sigma : 0.91 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

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

1 gram SAR value : 0.096 W/kg  
10 gram SAR value : 0.054 W/kg  
Area Scan Peak SAR : 0.101 W/kg  
Zoom Scan Peak SAR : 0.162 W/kg

**Plot 3#**

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

Test mode : WCDMA1900  
 Crest Factor : 1  
 Scan Type : Complete  
 Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.001 W/kg  
 Power Drift-Finish : 0.001 W/kg  
 Power Drift (%) : 2.937

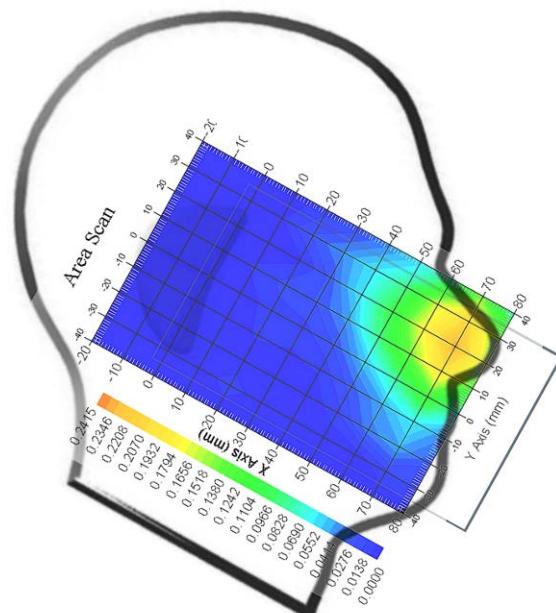
**Tissue Data**

Type : Head  
 Frequency : 1852.4 MHz  
 Epsilon : 40.09 F/m  
 Sigma : 1.41 S/m  
 Density : 1000.00 kg/cu. m

**Probe Data**

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

1 gram SAR value : 0.213 W/kg  
 10 gram SAR value : 0.117 W/kg  
 Area Scan Peak SAR : 0.240 W/kg  
 Zoom Scan Peak SAR : 0.349 W/kg

**Plot 4#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Body-worn-Back (848.8 MHz High Channel)**

## Measurement Data

Test mode : GPRS  
Crest Factor : 2  
Scan Type : Complete  
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.563 W/kg  
Power Drift-Finish : 0.551W/kg  
Power Drift (%) : -2.174

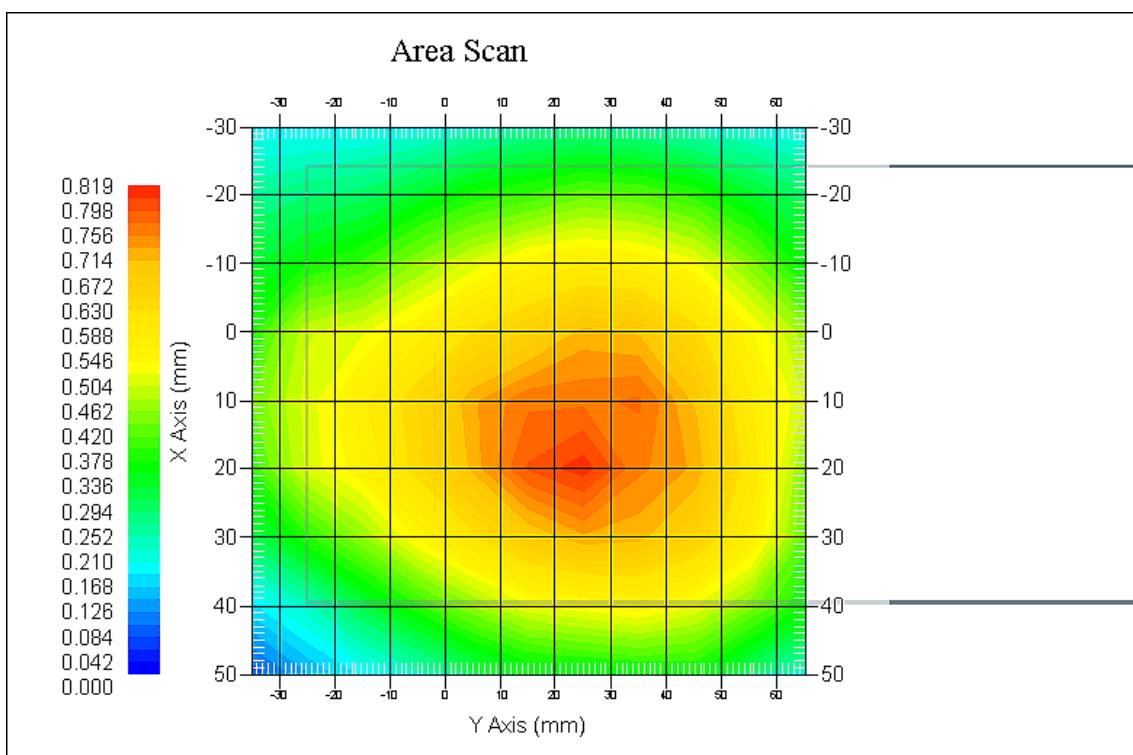
## Tissue Data

Type : Body  
Frequency : 848.8 MHz  
Epsilon : 54.99 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 : 2  
Conversion Factor : 5.9  
Probe Sensitivity : 1.20 1.20 1.20  $\mu$ V/(V/m)2  
Compression Point : 95.00 mV  
Offset : 1.56 mm

1 gram SAR value : 0.808 W/kg  
10 gram SAR value : 0.550 W/kg  
Area Scan Peak SAR : 0.812 W/kg  
Zoom Scan Peak SAR : 1.376 W/kg

**Plot 5#**

**Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)****Body-worn-Bottom (1909.8 MHz High Channel)****Measurement Data**

Test mode : GPRS  
Crest Factor : 2  
Scan Type : Complete  
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 1.029 W/kg  
Power Drift-Finish : 1.132 W/kg  
Power Drift (%) : 1.089

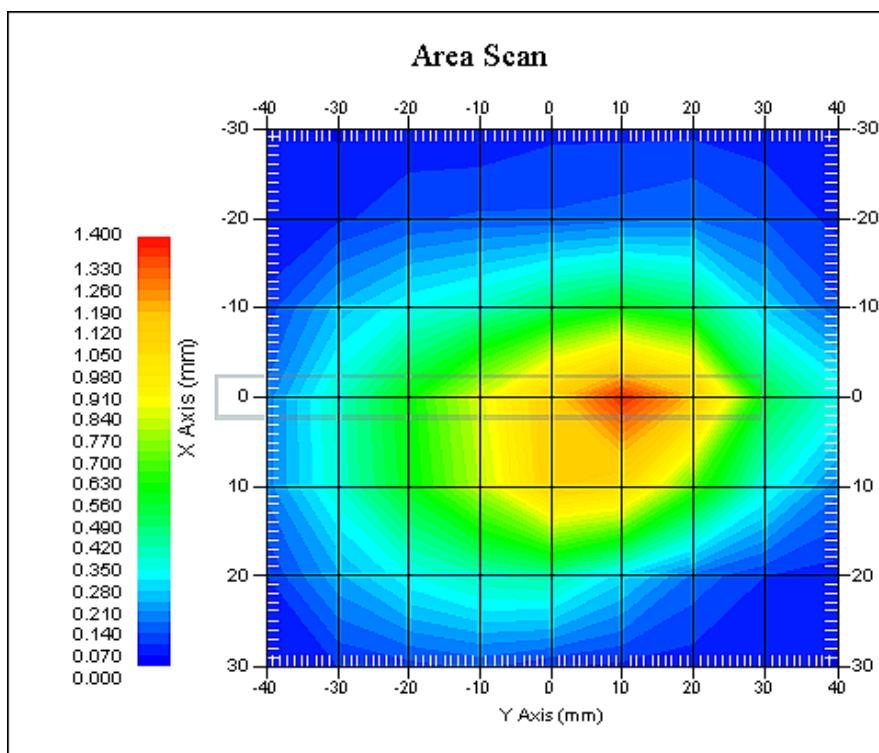
**Tissue Data**

Type : Body  
Frequency : 1909.8 MHz  
Epsilon : 53.29 F/m  
Sigma : 1.55 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

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

1 gram SAR value : 1.183 W/kg  
10 gram SAR value : 0.635 W/kg  
Area Scan Peak SAR : 1.386 W/kg  
Zoom Scan Peak SAR : 1.975 W/kg

**Plot 6#**

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

Test mode : WCDMA850  
Crest Factor : 1  
Scan Type : Complete  
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
Power Drift-Start : 0.159 W/kg  
Power Drift-Finish : 0.154 W/kg  
Power Drift (%) : -3.404

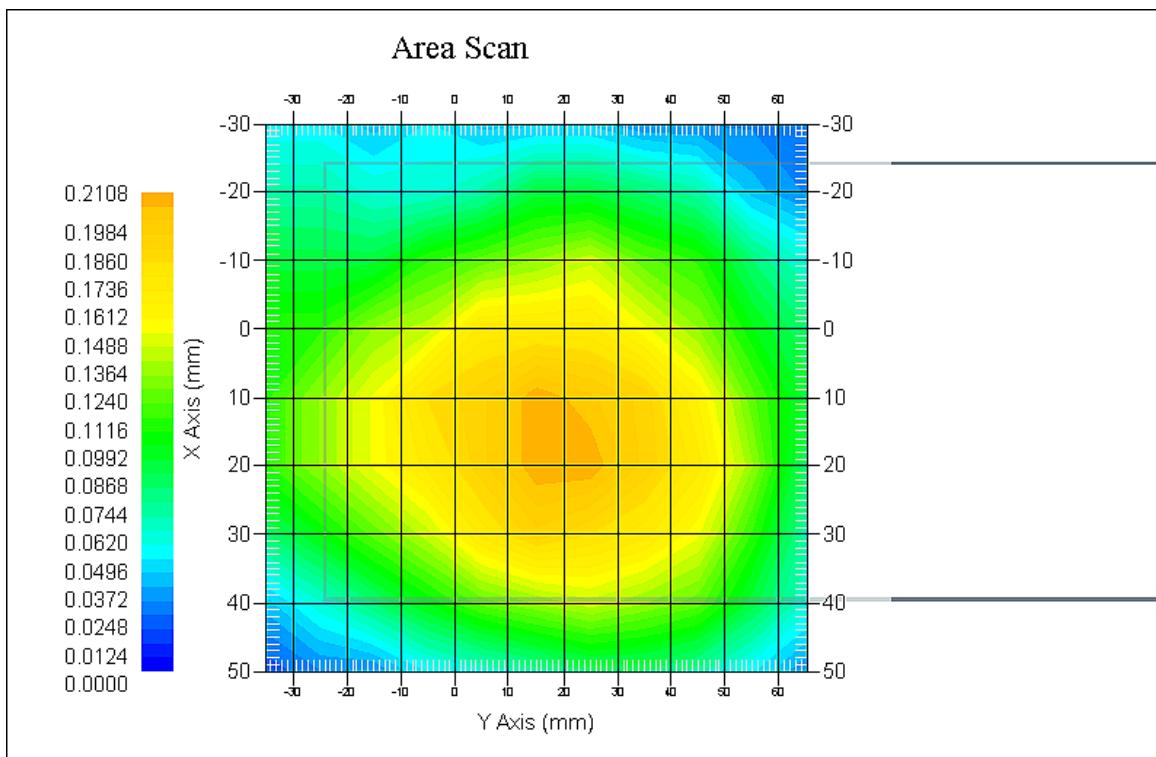
**Tissue Data**

Type : Body  
Frequency : 826.4 MHz  
Epsilon : 54.85 F/m  
Sigma : 0.96 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

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

1 gram SAR value : 0.200 W/kg  
10 gram SAR value : 0.151 W/kg  
Area Scan Peak SAR : 0.207 W/kg  
Zoom Scan Peak SAR : 0.365 W/kg

**Plot 7#**

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

Test mode : WCDMA1900  
 Crest Factor : 1  
 Scan Type : Complete  
 Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm  
 Power Drift-Start : 0.671 W/kg  
 Power Drift-Finish : 0.676 W/kg  
 Power Drift (%) : 0.726

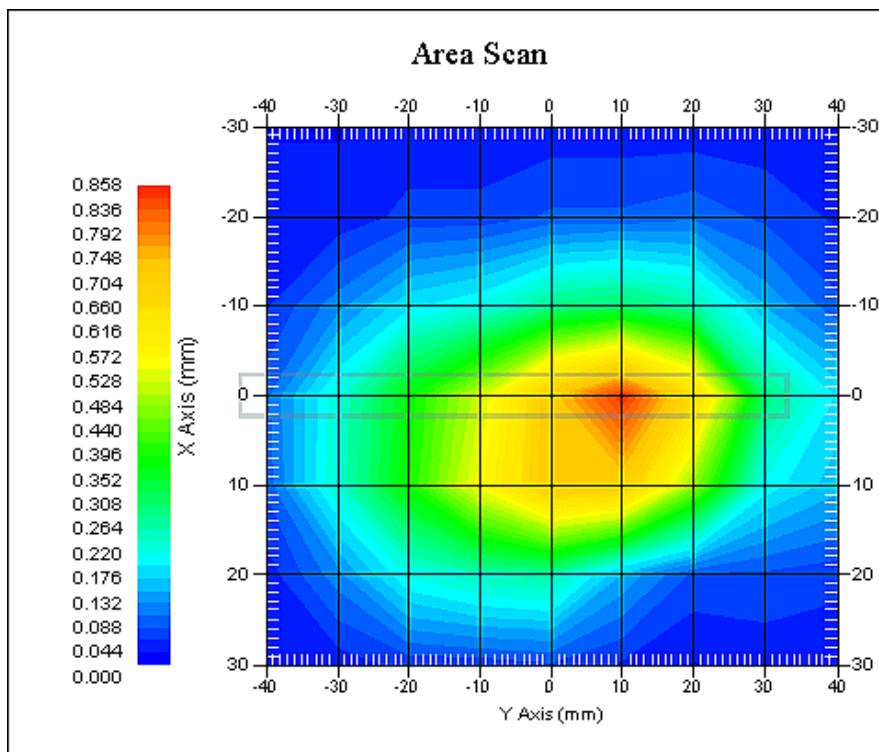
**Tissue Data**

Type : Body  
 Frequency : 1852.4 MHz  
 Epsilon : 53.42 F/m  
 Sigma : 1.49 S/m  
 Density : 1000.00 kg/cu. m

**Probe Data**

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

1 gram SAR value : 0.762 W/kg  
 10 gram SAR value : 0.371 W/kg  
 Area Scan Peak SAR : 0.858 W/kg  
 Zoom Scan Peak SAR : 1.063 W/kg

**Plot 8#**

## APPENDIX A MEASUREMENT UNCERTAINTY

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

### Measurement Uncertainty for 30MHz to 6GHz

SOURCE OF UNCERTAINTY	TOLERANCE VALUE	PROBABILITY DISTRIBUTION	DIVISOR	$C_i^1 (1-G)$	$C_i^1 (10^{-G})$	STANDARD UNCERTAINTY (1-G) %	STANDARD UNCERTAINTY (10-G) %
<b>MEASUREMENT SYSTEM</b>							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)/2$	$(1-cp)/2$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	2.1	rectangular	$\sqrt{3}$	1	1	1.21	1.21
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	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
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
Restriction							
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	1.0	normal	1	1	1	1.0	1.0
Device Holder Uncertainty	1.63	normal	1	1	1	1.63	1.63
Drift of Output Power	4.312	rectangular	$\sqrt{3}$	1	1	3.61	3.61
Phantom and Setup							
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.)	0.369	normal	1	0.7	0.5	0.259	0.185
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	2.062	normal	1	0.6	0.5	1.237	1.031
Combined Uncertainty		RSS				9.165	8.973
Combined Uncertainty (coverage factor=2)		Normal(k=2)				18.33	17.95

**APPENDIX B – PROBE CALIBRATION CERTIFICATES****NCL CALIBRATION LABORATORIES****Calibration File No.: PC-1598****Task No: BACL-5778****C E R T I F I C A T E   O F   C A L I B R A T I O N**

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

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-5745Calibrated: 14<sup>th</sup> October 2014  
Released on: 14<sup>th</sup> October 2014

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

Released By:

Art Brennan, Quality Manager

**NCL CALIBRATION LABORATORIES**Suite 102, 303 Terry Fox Dr,  
OTTAWA, ONTARIO  
CANADA K2K 3J1Division of APREL Lab.  
TEL: (613) 435-8300  
FAX: (613) 435-8306

## **NCL Calibration Laboratories**

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Division of APREL Inc.

### **Introduction**

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

### **Calibration Method**

Probes are calibrated using the following methods.

<800 MHz

TEM Cell for sensitivity in air

Standard phantom using temperature transfer method for sensitivity in tissue

>800 MHz

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**

- o IEEE Standard 1528:2013  
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- o 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
- o IEC 62209-2:2010  
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)
- o TP-D01-032-E020-V2 E-Field probe calibration procedure
- o D22-012-Tissue dielectric tissue calibration procedure
- o D28-002-Dipole procedure for validation of SAR system using a dipole
- o IEEE 1309 Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

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Page 2 of 10

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

**NCL Calibration Laboratories**

Division of APREL Inc.

**Conditions**

Probe 500-00283 was a recalibration.

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

**Primary Measurement Standards**

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

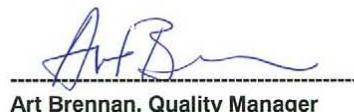
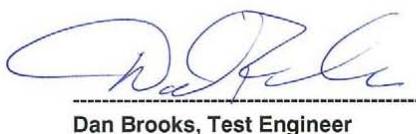
**Secondary Measurement Standards**

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

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

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

  
-----  
Art Brennan, Quality Manager  
-----  
Dan Brooks, Test Engineer

Page 3 of 10

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**

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

\*Resistive to recommended tissue recipes per IEEE-1528

**Sensitivity in Air**

**Channel X:** 1.2  $\mu$ V/(V/m)<sup>2</sup>  
**Channel Y:** 1.2  $\mu$ V/(V/m)<sup>2</sup>  
**Channel Z:** 1.2  $\mu$ V/(V/m)<sup>2</sup>

**Diode Compression Point:** 95 mV

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

**NCL Calibration Laboratories**

Division of APREL Inc.

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

Frequency	Tissue Type	Measured Epsilon	Measured Sigma	Standard Uncertainty (%)	Calibration Frequency Range (MHz)	Conversion Factor
450 H	Head	43.59	0.86	3.5	±50	5.7
450 B	Body	56.74	0.94	3.5	±50	5.8
750 H	Head	42.98	0.92	3.5	±50	6.0
750 B	Body	43.05	0.93	3.5	±50	5.5
835 H	Head	43.42	0.94	3.5	±50	5.9
835 B	Body	55.77	1.01	3.5	±50	5.9
900 H	Head	41.87	1.06	3.5	±50	6.0
900 B	Body	55.62	1.05	3.5	±50	5.9
1450 H	Head	X	X	X	X	X
1450 B	Body	X	X	X	X	X
1500 H	Head	X	X	X	X	X
1500 B	Body	X	X	X	X	X
1640 H	Head	X	X	X	X	X
1640 B	Body	X	X	X	X	X
1750 H	Head	38.23	1.38	3.5	±75	5.4
1750 B	Body	52.86	1.54	3.5	±75	5.3
1800 H	Head	X	X	X	X	X
1800 B	Body	X	X	X	X	X
1900 H	Head	40.20	1.38	3.5	±75	4.8
1900 B	Body	52.63	1.46	3.5	±75	4.5
2000 H	Head	X	X	X	X	X
2000 B	Body	X	X	X	X	X
2100 H	Head	X	X	X	X	X
2100 B	Body	X	X	X	X	X
2300 H	Head	X	X	X	X	X
2300 B	Body	X	X	X	X	X
2450 H	Head	37.26	1.84	3.5	±75	4.9
2450 B	Body	53.61	1.9	3.5	±75	4.3
3000 H	Head	X	X	X	X	X
3000 B	Body	X	X	X	X	X
3600 H	Head	37.49	3.16	3.5	±100	4.5
3600 B	Body	49.94	3.86	3.5	±100	4.0
5250 H	Head	35.51	4.78	3.5	±100	3.0
5250 B	Body	47.54	5.11	3.5	±100	2.8
5600 H	Head	36.05	5.15	3.5	±100	2.8
5600 B	Body	46.49	5.72	3.5	±100	2.2
5800 H	Head	45.99	6.01	3.5	±100	3.2
5800 B	Body	35.6	5.37	3.5	±100	2.5

**NCL Calibration Laboratories**

Division of APREL Inc.

**Boundary Effect:**

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

**Spatial Resolution:**

The spatial resolution uncertainty is less than 1.5% for 4.9mm diameter probe.  
The spatial resolution uncertainty is less than 1.0% for 2.5mm diameter probe.

**DAQ-PAQ Contribution**

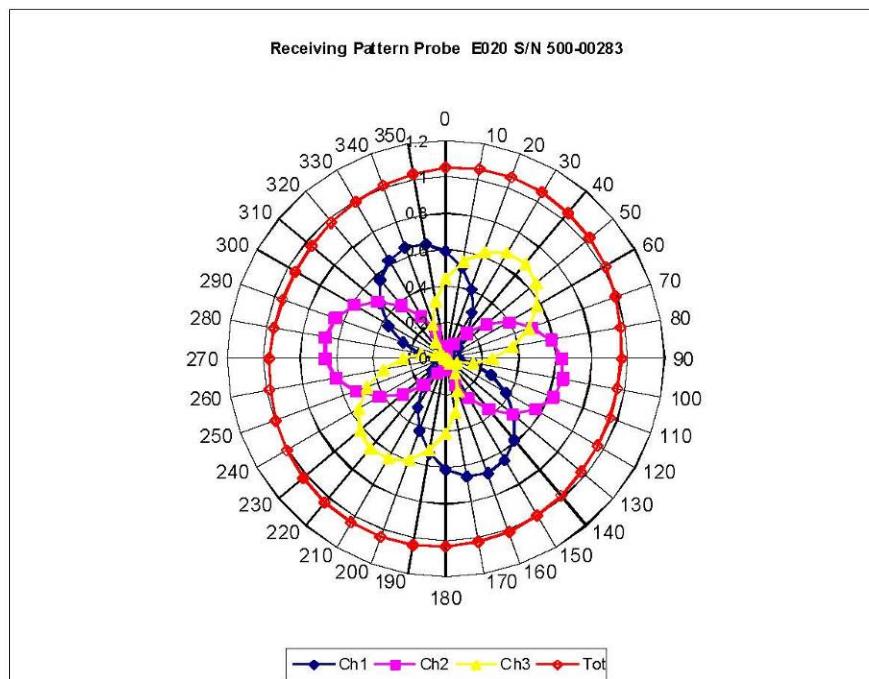
To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of  $5\text{ M}\Omega$ .

**Probe Calibration Uncertainty**

Uncertainty component	Tolerance ( $\pm$ %)	Probability distribution	Divisor	Standard uncertainty ( $\pm$ %)
Incident or forward power	2.5	R	$\sqrt{3}$	1.44
Reflected power	2	R	$\sqrt{3}$	1.15
Liquid conductivity measurement	1	R	$\sqrt{3}$	0.58
Liquid permittivity measurement	1	R	$\sqrt{3}$	0.58
Liquid conductivity deviation	1.5	R	$\sqrt{3}$	0.87
Liquid permittivity deviation	1.5	R	$\sqrt{3}$	0.87
Frequency deviation	2.25	R	$\sqrt{3}$	1.30
Field homogeneity	2.5	R	$\sqrt{3}$	1.44
Field-probe positioning	2.5	R	$\sqrt{3}$	1.44
Field-probe linearity	1.55	R	$\sqrt{3}$	0.89
<b>Combined standard uncertainty</b>		RSS		<b>3.50</b>

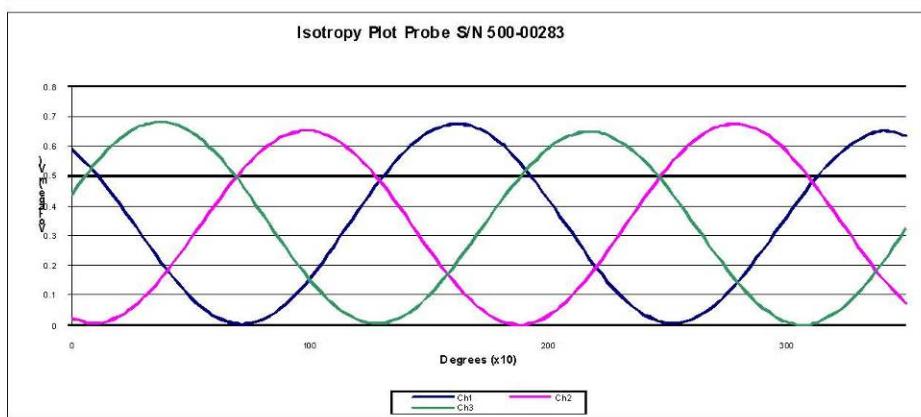
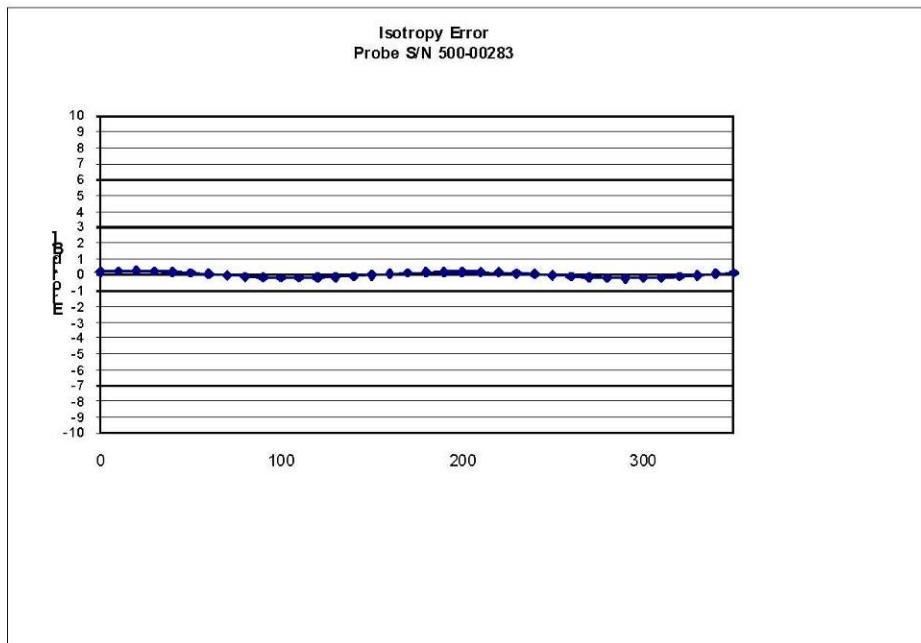
**NCL Calibration Laboratories**

Division of APREL Inc.

**Receiving Pattern Air**

**NCL Calibration Laboratories**

Division of APREL Inc.

**Isotropy Error Air****Isotropicity Tissue:**

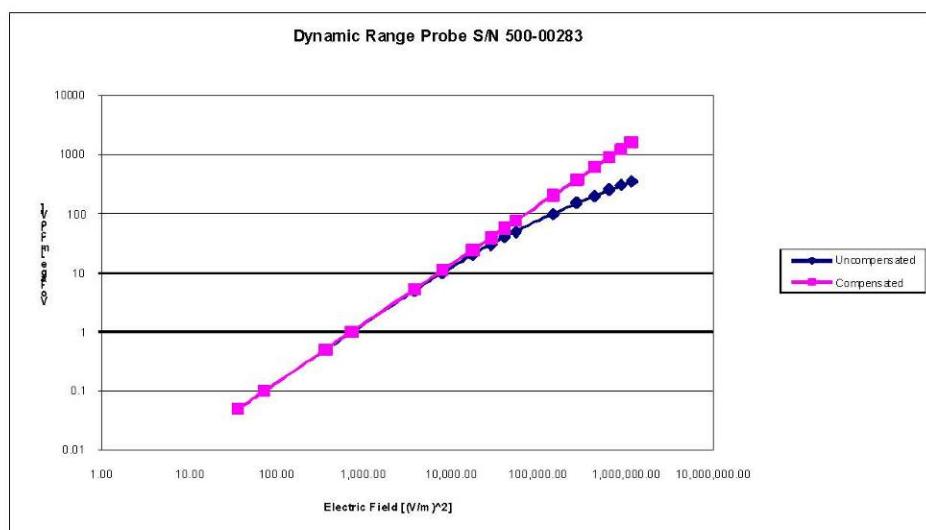
0.10 dB

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

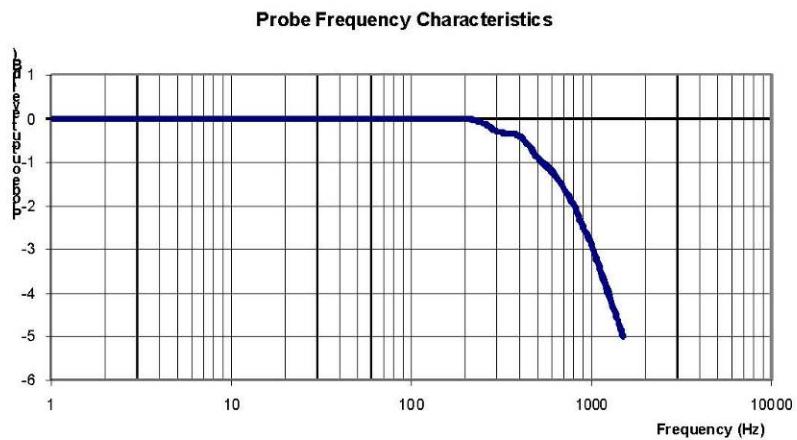
**NCL Calibration Laboratories**

Division of APREL Inc.

**Dynamic Range**

**NCL Calibration Laboratories**

Division of APREL Inc.

**Video Bandwidth**

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

**Test Equipment**

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

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

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

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

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

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

Validation Dipole(Head and Body)

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

Customer: Bay Area Compliance Laboratory (China)

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

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

Released By:



Art Brennan, Quality Manager

**NCL CALIBRATION LABORATORIES**

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

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

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conditions**

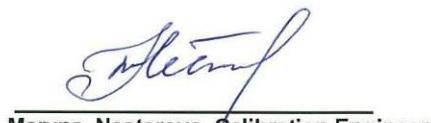
Dipole 180-00558 was received with a damaged connection for a re-calibration.

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

**Attestation**

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

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

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

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

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