SAR EVALUATION REPORT

For

ONE DIAMOND ELECTRONICS INC.

1450 Frazee Road, Suite 303, San Diego, CA 92108, United States

FCC ID: 2ADWUPMID704GK

Report Type:	Product Type:
Original Report	Tablet PC

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Report Number:	RSZ141117019-20
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Attestation of Test Results			
EUT Information	**Company Name**	One Diamond Electronics Inc.	
	EUT Description	Tablet PC	
	FCC ID	2ADWUPMID704GK	
	Model Number	PMID704GK	
	Test Date	2014-11-13	
Frequency	**Max. SAR Level(s) Reported**		**Limit(W/Kg)**
GSM 850	0.507 W/kg 1g Head SAR 0.486 W/kg 1g Body SAR		**1. 6**
PCS 1900	0.592 W/kg 1g Head SAR 1.230 W/kg 1g Body SAR		
WCDMA850	0.327 W/kg 1g Head SAR 0.355 W/kg 1g Body SAR		
WCDMA1900	0.468 W/kg 1g Head SAR 1.152 W/kg 1g Body SAR		
Wi-Fi	0.191 W/kg 1g Head SAR 0.356 W/kg 1g Body SAR		
Simultaneous	0.783 W/kg 1g Head SAR 1.586 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.		
	ANSI / IEEE C95.3 : 2002 IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to SuchFields,100 kHz—300 GHz.		
	IEEE1528:2013 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques		
	KDB procedures KDB 447498 D01 Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies. KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets KDB 865664 D01SAR Measurement Requirements for 100 MHz to 6 GHz KDB 616217 D04 SAR for laptop and tablets v01r01 KDB 941225 D01 SAR Measurement Procedures for 3G Devices-CDMA 2000/EV-Do WCDMA/HSDPA/HSUPA KDB 941225 D06 SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities. KDB 248227 D01 SAR Measurement for 802 11 a b g v01r02		

Note: This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures.

The results and statements contained in this report pertain only to the device(s) evaluated.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RSZ141117019-20	Original Report	2014-11-29

EUT DESCRIPTION

This report has been prepared on behalf of ONE DIAMOND ELECTRONICS INC. and their product, FCC ID: 2ADWUPMID704GK , Model: PMID704GK or the EUT (Equipment under Test) as referred to in the rest of this report.

Technical Specification

Product Type	Portable
Exposure Category:	Population / Uncontrolled
Antenna Type(s):	Internal Antenna
Body-Worn Accessories:	Headset
Face-Head Accessories:	None
Multi-slot Class:	Class12
Operation Mode :	GSM Voice, GPRS Data, WCDMA, Wi-Fi and Bluetooth
Frequency Band:	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) Wi-Fi: 2412MHz-2472MHz Bluetooth : 2402MHz-2480MHz
Conducted RF Power:	GSM 850 : 32.57 dBm PCS 1900: 28.47 dBm WCDMA 850: 21.66 dBm WCDMA 1900: 22.64 dBm WiFi: 13.15 dBm Bluetooth: 1.70dBm
Dimensions (L*W*H):	188.5 mm (L) × 108.5 mm (W) × 9.5 mm (H) Overall diagonal dimension:215mm
Power Source:	3.7 V_{DC} Rechargeable Battery
Normal Operation:	Head and Body-worn

Note: the overall diagonal dimension of the EUT is 210mm＞200mm, so test procedures in KDB616217 should be applicable.

REFERENCE, STANDARDS, AND GUILDELINES

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 10mm2 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/m3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm,with the side length of the 10 g cube 21,5mm.

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

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

ALSAS-10U Interpolation and Extrapolation Uncertainty

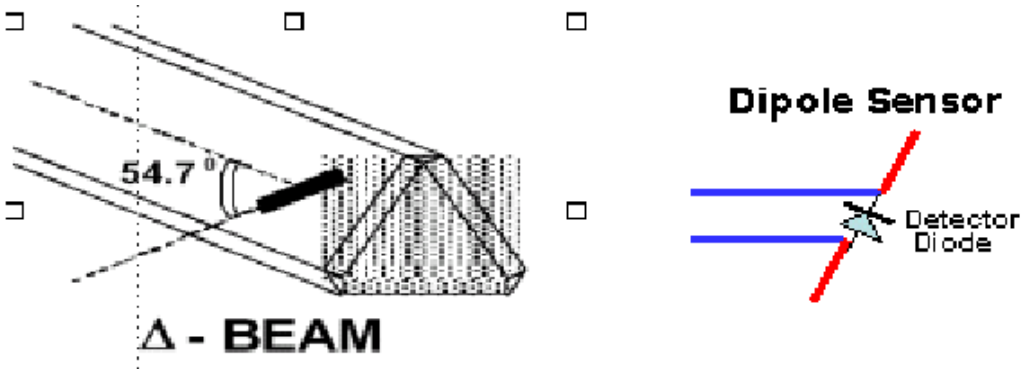
The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

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

Isotropic E-Field Probe

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

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



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

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

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

Isotropic E-Field Probe Specification

Calibration Method	Frequency Dependent Below 1 GHz Calibration in air performed in a TEM Cell Above 1 GHz Calibration in air performed in waveguide
Sensitivity	0.70 μV/(V/m)^2 to 0.85 μV/(V/m)^2
Dynamic Range	0.0005 W/kg to 100 W/kg
Isotropic Response	Better than 0.1 dB
Diode Compression Point (DCP)	Calibration for Specific Frequency
Probe Tip Diameter	< 2.9 mm
Sensor Offset	1.56 (+/- 0.02 mm)
Probe Length	289 mm
Video Bandwidth	@ 500 Hz: 1 dB @ 1.02 kHz: 3 dB
Boundary Effect	Less than 2.1% for distance greater than 0.58 mm
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

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 5μV 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.

ADC	12 Bit
Amplifier Range	20 mV to 200 mV and 150 mV to 800 mV
Field Integration	Local Co-Processor utilizing proprietary integration algorithms
Number of Input Channels	4 in total 3 dedicated and 1 spare
Communication	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.

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

ALSAS Universal Workstation

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

Universal Device Positioner

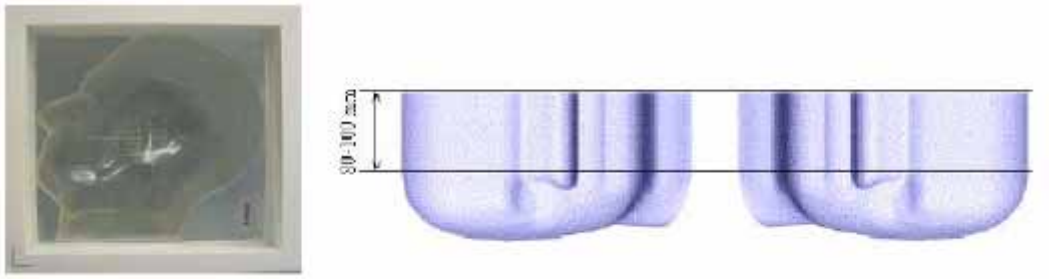
The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales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

Phantom Types

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

APREL SAM Phantoms

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



APREL Laboratories Universal Phantom

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

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

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

Tissue Dielectric Parameters for Head and Body Phantoms

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

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

Recommended Tissue Dielectric Parameters for Head and Body

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	σ (S/m)	εr	σ (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

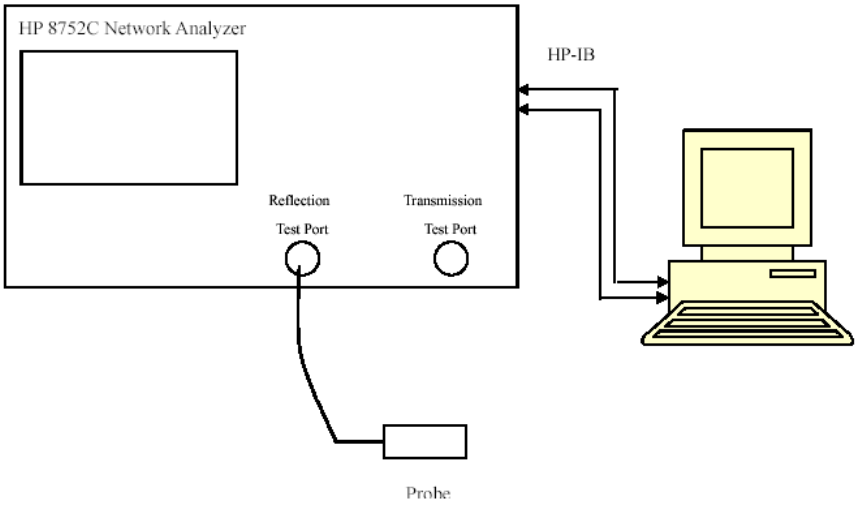
EQUIPMENT LIST AND CALIBRATION

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, 2450MHz	ALS-D-2450-S-2	2014-10-08	220-00758
Dipole Spacer	ALS-DS-U	N/A	250-00907
Device holder/Positioner	ALS-H-E-SET-2	N/A	170-00510
Left ear SAM phantom	ALS-P-SAM-L	N/A	130-00311
Right ear SAM phantom	ALS-P-SAM-R	N/A	140-00359
UniPhantom	ALS-P-UP-1	N/A	150-00413
Simulated Tissue 835 MHz Head	ALS-TS-835-H	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-TS-835-B	Each Time	270-02101
Simulated Tissue 1900 MHz Head	ALS-TS-1900-H	Each Time	295-01103
Simulated Tissue 1900 MHz Body	ALS-TS-1900-B	Each Time	295-02102
Simulated Tissue 2450 MHz Head	ALS-TS-2450-H	Each Time	290-01108
Simulated Tissue 2450 MHz Body	ALS-TS-2450-B	Each Time	290-01109
Directional couple	DC6180A	N/A	0325849
Power Amplifier	5S1G4	N/A	71377
Dielectric probe kit	HP85070B	2014-06-13	N/A
Attenuator	3dB	2014-05-08	5402
Network analyzer	8752C	2014-06-03	3410A02356
Synthesized Sweeper	HP 8341B	2014-06-03	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	2013-11-23	106891
EMI Test Receiver	ESCI	2014-06-13	101746

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

Frequency	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε_r	σ (S/m)	ε_r	σ (S/m)	$\Delta\varepsilon_r$	$\Delta\sigma$ (S/m)	
824.2	Head	41.15	0.90	41.50	0.90	-0.843	0.000	±5
	Body	53.92	0.94	55.20	0.97	-2.319	-3.093	±5
826.4	Head	41.18	0.90	41.50	0.90	-0.771	0.000	±5
	Body	53.89	0.94	55.20	0.97	-2.373	-3.093	±5
836.6	Head	41.18	0.91	41.50	0.90	-0.771	1.111	±5
	Body	53.88	0.95	55.20	0.97	-2.391	-2.062	±5
846.6	Head	41.18	0.91	41.50	0.90	-0.771	1.111	±5
	Body	53.88	0.97	55.20	0.97	-2.391	0.000	±5
848.8	Head	41.08	0.91	41.50	0.90	-1.012	1.111	±5
	Body	53.85	0.97	55.20	0.97	-2.446	0.000	±5
1850.2	Head	39.80	1.37	40.00	1.40	-0.500	-2.143	±5
	Body	52.17	1.46	53.30	1.52	-2.120	-3.947	±5
1852.4	Head	39.70	1.36	40.00	1.40	-0.750	-2.857	±5
	Body	51.97	1.46	53.30	1.52	-2.495	-3.947	±5
1880.0	Head	39.75	1.39	40.00	1.40	-0.625	-0.714	±5
	Body	51.97	1.49	53.30	1.52	-2.495	-1.974	±5
1907.6	Head	39.64	1.41	40.00	1.40	-0.900	0.714	±5
	Body	51.91	1.50	53.30	1.52	-2.608	-1.316	±5
1909.8	Head	39.65	1.41	40.00	1.40	-0.875	0.714	±5
	Body	51.92	1.51	53.30	1.52	-2.589	-0.658	±5
2412	Head	39.51	1.81	39.20	1.80	0.791	0.556	±5
	Body	52.85	1.96	52.70	1.95	0.285	0.513	±5
2437	Head	39.64	1.82	39.20	1.80	1.122	1.111	±5
	Body	52.80	2.00	52.70	1.95	0.190	2.564	±5
2462	Head	39.76	1.85	39.20	1.80	1.429	2.778	±5
	Body	52.86	1.93	52.70	1.95	0.304	-1.026	±5
2472	Head	39.70	1.85	39.20	1.80	1.276	2.778	±5
	Body	52.87	2.02	52.70	1.95	0.323	3.590	±5

**Liquid Verification was performed on 2014-11-13.*

Please refer to the following tables.

835 MHz Head				835 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
824.0	41.1455	19.6078		824.0	53.9150	20.4416
824.5	41.1977	19.6081		824.5	53.9766	20.3718
825.0	41.0850	19.6076		825.0	53.8676	20.4409
825.5	41.1134	19.6523		825.5	53.9873	20.4203
826.0	41.0231	19.6604		826.0	53.8659	20.4579
826.5	41.1812	19.6562		826.5	53.8877	20.4376
827.0	41.0798	19.6229		827.0	53.9886	20.3818
827.5	41.0610	19.6198		827.5	54.0167	20.4275
828.0	41.1628	19.6958		828.0	53.8759	20.4147
828.5	41.1278	19.6419		828.5	53.9840	20.3520
829.0	41.1547	19.6062		829.0	53.8710	20.3932
829.5	41.0979	19.7049		829.5	53.9148	20.4300
830.0	41.1575	19.5920		830.0	53.8826	20.4435
830.5	41.1269	19.6257		830.5	53.8707	20.4902
831.0	41.1071	19.6010		831.0	53.9086	20.4520
831.5	41.0376	19.6062		831.5	53.9850	20.4538
832.0	41.1073	19.7095		832.0	53.9887	20.4930
832.5	41.1297	19.6134		832.5	53.9826	20.4112
833.0	41.1077	19.5929		833.0	53.8822	20.4727
833.5	41.1327	19.6375		833.5	53.9696	20.4406
834.0	41.1459	19.5947		834.0	53.9063	20.4386
834.5	41.1604	19.6095		834.5	53.9385	20.4123
835.0	41.1237	19.6649		835.0	53.9829	20.3658
835.5	41.0847	19.6223		835.5	53.9503	20.4664
836.0	41.1481	19.6771		836.0	53.8861	20.3957
836.5	41.1804	19.6104		836.5	53.8810	20.4174
837.0	41.1547	19.5835		837.0	53.9174	20.4779
837.5	41.1053	19.5855		837.5	53.9332	20.4082
838.0	41.1864	19.5968		838.0	53.9483	20.4470
838.5	41.0945	19.6342		838.5	53.9476	20.4440
839.0	41.1350	19.5778		839.0	53.9337	20.4453
839.5	41.1085	19.5305		839.5	53.9949	20.4733
840.0	41.0942	19.3934		840.0	53.9507	20.4624
840.5	41.2008	19.3862		840.5	53.8959	20.4767
841.0	41.1540	19.3573		841.0	53.9239	20.3775
841.5	41.1324	19.3358		841.5	53.9463	20.4694
842.0	41.1099	19.3376		842.0	53.9785	20.3719
842.5	41.1630	19.3905		842.5	53.9197	20.4314
843.0	41.1646	19.3833		843.0	53.9262	20.3923
843.5	41.1407	19.2736		843.5	53.8481	20.4115
844.0	41.1227	19.3010		844.0	53.9375	20.4580
844.5	41.0844	19.2883		844.5	54.0278	20.4748
845.0	41.1632	19.3428		845.0	53.9415	20.3805
845.5	41.2192	19.3568		845.5	53.9087	20.3881
846.0	41.1080	19.3569		846.0	53.8886	20.3686
846.5	41.1779	19.3937		846.5	53.8758	20.5235
847.0	41.1488	19.3066		847.0	53.8758	20.4886
847.5	41.1363	19.3749		847.5	53.9201	20.4569
848.0	41.1432	19.3509		848.0	53.9497	20.4534
848.5	41.0819	19.2933		848.5	53.9238	20.4449
849.0	41.0829	19.2601		849.0	53.8452	20.5127

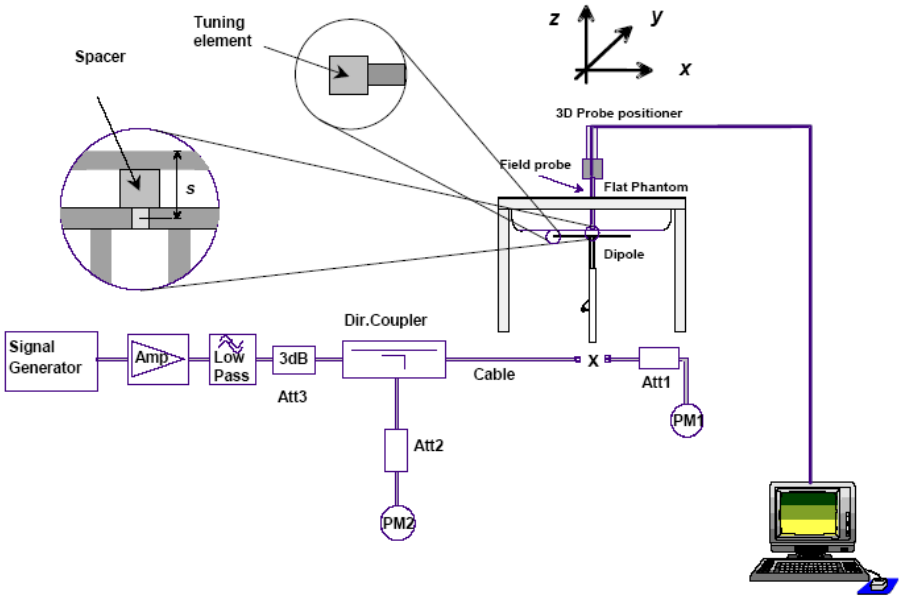
1900 MHz Head				1900 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1850.0	39.7976	13.3265		1850.0	52.1719	14.2125
1851.2	39.7389	13.2146		1851.2	52.0803	14.0850
1852.4	39.6984	13.2109		1852.4	51.9725	14.1702
1853.6	39.7529	13.2752		1853.6	51.9292	14.1590
1854.8	39.6956	13.2634		1854.8	51.9197	14.2372
1856.0	39.7486	13.3180		1856.0	52.1223	14.1388
1857.2	39.7689	13.1980		1857.2	51.9689	14.2377
1858.4	39.8162	13.1674		1858.4	52.1028	14.1124
1859.6	39.6721	13.2727		1859.6	51.9294	14.1662
1860.8	39.7995	13.1972		1860.8	51.9366	14.2307
1862.0	39.7630	13.3031		1862.0	52.1036	14.1995
1863.2	39.7259	13.2998		1863.2	52.1920	14.2230
1864.4	39.6511	13.2314		1864.4	52.0327	14.1372
1865.6	39.6044	13.1687		1865.6	52.1064	14.1934
1866.8	39.6858	13.3033		1866.8	52.1871	14.1761
1868.0	39.7391	13.2982		1868.0	51.9298	14.1511
1869.2	39.8032	13.2743		1869.2	51.8373	14.1329
1870.4	39.6156	13.2034		1870.4	51.8968	14.1579
1871.6	39.7197	13.2304		1871.6	52.0658	14.2618
1872.8	39.7290	13.2735		1872.8	52.1642	14.1629
1874.0	39.7755	13.3040		1874.0	52.2297	14.1147
1875.2	39.7892	13.3744		1875.2	52.0301	14.1565
1876.4	39.6392	13.3499		1876.4	52.0876	14.2026
1877.6	39.6673	13.2318		1877.6	52.1597	14.1658
1878.8	39.6841	13.3416		1878.8	52.1225	14.1585
1880.0	39.7460	13.2645		1880.0	51.9682	14.2179
1881.2	39.7952	13.2818		1881.2	51.8487	14.1695
1882.4	39.7398	13.2316		1882.4	52.0376	14.2076
1883.6	39.7187	13.1831		1883.6	51.9786	14.0906
1884.8	39.8417	13.1493		1884.8	52.0448	14.1949
1886.0	39.6613	13.1856		1886.0	52.1427	14.1394
1887.2	39.6493	13.2828		1887.2	52.0553	14.1930
1888.4	39.7682	13.3556		1888.4	52.0051	14.2368
1889.6	39.7729	13.3050		1889.6	52.0660	14.1281
1890.8	39.8196	13.3416		1890.8	51.9331	14.1091
1892.0	39.6539	13.3426		1892.0	51.8789	14.2781
1893.2	39.7160	13.2217		1893.2	51.9116	14.2465
1894.4	39.6684	13.1521		1894.4	52.0350	14.1885
1895.6	39.8341	13.3211		1895.6	52.0879	14.2100
1896.8	39.8377	13.1859		1896.8	52.0527	14.1092
1898.0	39.6285	13.1645		1898.0	52.1661	14.2208
1899.2	39.7644	13.2834		1899.2	52.2121	14.1462
1900.4	39.7517	13.3628		1900.4	52.2353	14.2170
1901.6	39.8121	13.2184		1901.6	52.1084	14.1246
1902.8	39.7585	13.2448		1902.8	52.1235	14.3096
1904.0	39.6571	13.2109		1904.0	52.0111	14.1257
1905.2	39.6661	13.3074		1905.2	52.1360	14.1023
1906.4	39.7825	13.1897		1906.4	52.1128	14.2903
1907.6	39.6373	13.2852		1907.6	51.9126	14.1189
1908.8	39.8076	13.1991		1908.8	52.1895	14.1550
1910.0	39.6542	13.2981		1910.0	51.9240	14.2308

2450 MHz Head				2450 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
2412.0	39.5115	13.5081		2412	52.8361	14.3409
2413.0	39.6823	13.5265		2413	52.8877	14.3369
2414.0	39.5368	13.5853		2414	52.8820	14.3701
2415.0	39.5976	13.2834		2415	52.8387	14.0772
2416.0	39.9149	13.4642		2416	52.8093	15.0458
2417.0	39.9955	13.2995		2417	52.8126	14.3120
2418.0	39.5645	13.4976		2418	52.8913	14.5980
2419.0	39.4575	13.3898		2419	52.8904	14.2904
2420.0	39.4816	13.5840		2420	52.8552	14.9863
2421.0	39.9152	13.4295		2421	52.8111	14.3339
2422.0	39.8302	13.5763		2422	52.8447	14.5034
2423.0	39.7212	13.4401		2423	52.8217	14.3115
2424.0	39.7015	13.4354		2424	52.8807	15.0543
2425.0	39.7842	13.3558		2425	52.8591	14.4900
2426.0	39.5135	13.5747		2426	52.8283	14.4283
2427.0	39.7038	13.3485		2427	52.8682	14.9303
2428.0	39.7481	13.5960		2428	52.8713	14.1179
2429.0	39.5544	13.5916		2429	52.7943	14.0421
2430.0	39.7947	13.4050		2430	52.8478	14.1208
2431.0	39.9633	13.3383		2431	52.8884	14.0635
2432.0	39.5860	13.5598		2432	52.8098	14.1412
2433.0	39.6041	13.4999		2433	52.8646	15.1135
2434.0	39.4678	13.3332		2434	52.8856	14.2927
2435.0	39.8281	13.5593		2435	52.8649	14.4107
2436.0	39.9057	13.3195		2436	52.8658	14.4399
2437.0	39.6409	13.4416		2437	52.8923	14.0347
2438.0	39.6333	13.5724		2438	52.8068	14.2542
2439.0	39.9803	13.2851		2439	52.8561	14.7192
2440.0	39.5023	13.5792		2440	52.8502	14.9047
2441.0	39.5240	13.2781		2441	52.7967	14.7027
2442.0	39.7905	13.2729		2442	52.8703	14.5964
2443.0	39.6769	13.3870		2443	52.8064	14.8912
2444.0	39.6790	13.4085		2444	52.8777	14.3777
2445.0	39.5586	13.5515		2445	52.8542	15.1089
2446.0	39.9197	13.5642		2446	52.8566	14.8057
2447.0	39.8010	13.5369		2447	52.8095	15.0658
2448.0	39.8965	13.4569		2448	52.8288	14.5480
2449.0	39.8612	13.2997		2449	52.8573	14.3641
2450.0	39.5324	13.4190		2450	52.7991	14.3906
2451.0	39.4612	13.2808		2451	52.8161	15.1057
2452.0	39.5418	13.4067		2452	52.8457	14.5759
2453.0	39.8315	13.3904		2453	52.8066	14.7926
2454.0	39.6191	13.5556		2454	52.8430	15.0130
2455.0	39.7786	13.5821		2455	52.8331	15.0318
2456.0	39.9346	13.4519		2456	52.8139	14.5865
2457.0	39.5731	13.5554		2457	52.8018	14.4041
2458.0	39.7666	13.4860		2458	52.8636	14.6737
2459.0	39.5104	13.5068		2459	52.8843	14.7263
2460.0	39.6595	13.4769		2460	52.8686	14.8058
2461.0	39.8781	13.3062		2461	52.8848	14.0142
2462.0	39.7614	13.5254		2462	52.8886	14.0752
2463.0	39.7373	13.5302		2464	52.8564	14.1895
2464.0	39.9067	13.4426		2466	52.8469	14.0311
2466.0	39.4978	13.4804		2468	52.8290	13.8682
2468.0	39.8933	13.3487		2470	52.8329	14.1376
2470.0	39.8643	13.4672		2472	52.8725	14.7104

System Accuracy Verification

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

System Verification Setup Block Diagram



Probe and dipole antenna List and Detail

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
APREL	Probe	ALS-E-020	500-00283	2014-10-14	2015-10-13
APREL	Dipole antenna(850MHz)	ALS-D-835-S-2	180-00558	2014-10-08	2017-10-07
APREL	Dipole antenna(1900MHz)	ALS-D-1900-S-2	210-00710	2014-10-09	2017-10-08
APREL	Dipole antenna(2450MHz)	ALS-D-2450-S-2	220-00758	2014-10-09	2017-10-08

System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2014-11-13	835	Head	1g	10.135	9.773	3.704	±10
		Body	1g	9.899	9.736	1.674	±10
	1900	Head	1g	40.127	39.481	1.636	±10
		Body	1g	40.231	39.715	1.299	±10
	2450	Head	1g	55.936	54.916	1.857	±10
		Body	1g	53.859	52.418	2.749	±10

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

SAR SYSTEM VALIDATION DATA

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

System Performance Check 835 MHz Head Liquid

Dipole 835 MHz; Type: ALS-D-835-S-2; S/N: 180-00558

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

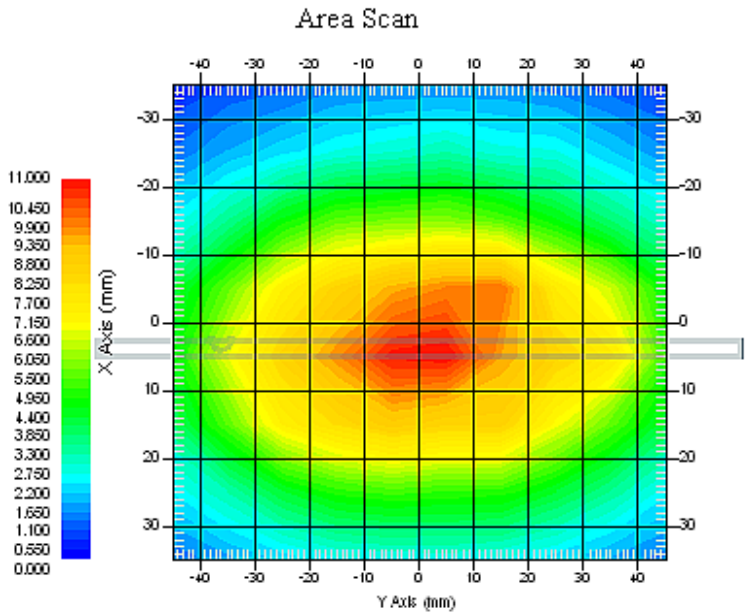
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default
Phantom Data

Tissue Data
Type : Head
Serial No. : 270-01002
Frequency : 835.0 MHz
Last Calib. Date : 13-Nov-2014
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 41.08 F/m
Sigma : 0.92 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 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 : 10.135 W/kg
10 gram SAR value : 6.955 W/kg
Area Scan Peak SAR : 10.985 W/kg
Zoom Scan Peak SAR : 16.327 W/kg



835 MHz System Validation with Head Tissue

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

System Performance Check 835 MHz Body Liquid

Dipole 835 MHz; Type: ALS-D-835-S-2; S/N: 180-00558

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

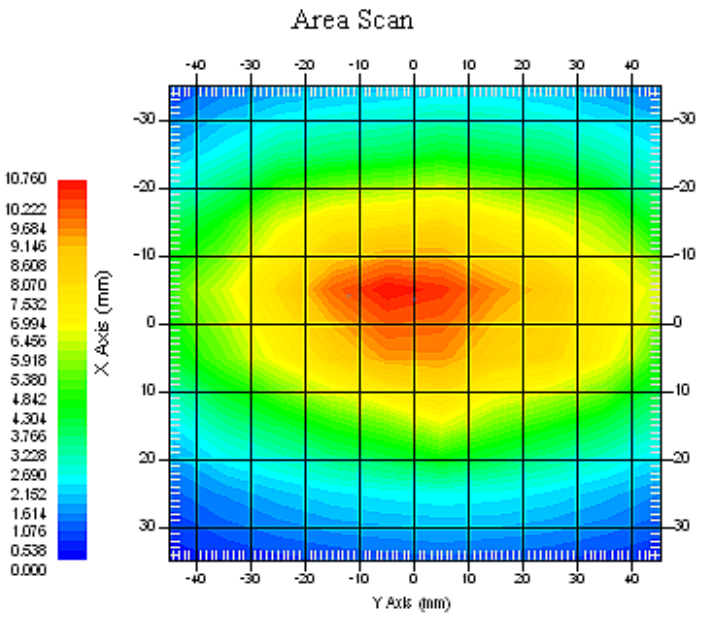
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default
Phantom Data

Tissue Data
Type : Body
Serial No. : 270-02101
Frequency : 835.0 MHz
Last Calib. Date : 13-Nov-2014
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 53.91 F/m
Sigma : 0.96 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 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 : 9.899 W/kg
10 gram SAR value : 6.592 W/kg
Area Scan Peak SAR : 10.751 W/kg
Zoom Scan Peak SAR : 15.858 W/kg



835 MHz System Validation with Body Tissue

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

System Performance Check 1900 MHz Head Liquid

Dipole 1900 MHz; Type: ALS-D-1900-S-2; S/N: 210-00710

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

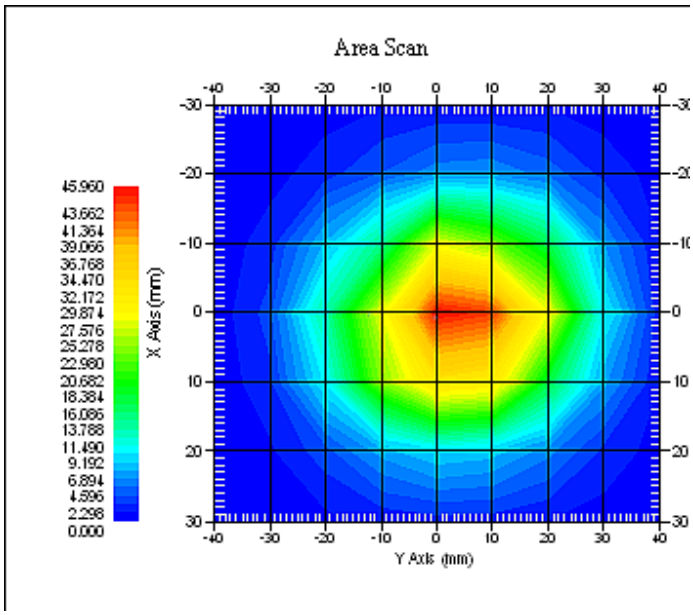
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Head
Serial No. : 295-01103
Frequency : 1900.00 MHz
Last Calib. Date : 13-Nov-2014
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 39.68 F/m
Sigma : 1.42 S/m
Density : 1000.00 kg/cu. M

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 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 : 40.127 W/kg
10 gram SAR value : 21.531 W/kg
Area Scan Peak SAR : 45.957 W/kg
Zoom Scan Peak SAR : 79.857 W/kg



1900 MHz System Validation with Head Tissue

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

System Performance Check 1900 MHz Body Liquid

Dipole 1900 MHz; Type: ALS-D-1900-S-2; S/N: 210-00710

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

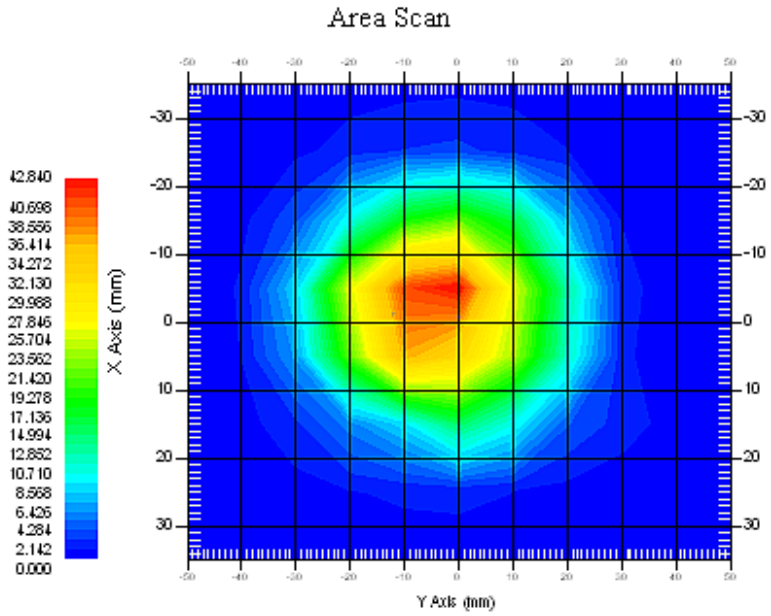
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Body
Serial No. : 295-02102
Frequency : 1900.00 MHz
Last Calib. Date : 13-Nov-2014
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 52.13 F/m
Sigma : 1.51 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 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 : 40.231 W/kg
10 gram SAR value : 21.315 W/kg
Area Scan Peak SAR : 42.837 W/kg
Zoom Scan Peak SAR : 79.852 W/kg



1900 MHz System Validation with Body Tissue

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

System Performance Check 2450 MHz Head Liquid

Dipole 2450 MHz; Type: ALS-D-2450-S-2; S/N: 220-00758

Product Data
Device Name : Dipole 2450MHz
Serial No. : 220-00758
Type : Dipole
Model : ALS-D-2450-S-2
Frequency Band : 2450 MHz
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 51.528 W/kg
Power Drift-Finish : 52.051 W/kg
Power Drift (%) : 0.859

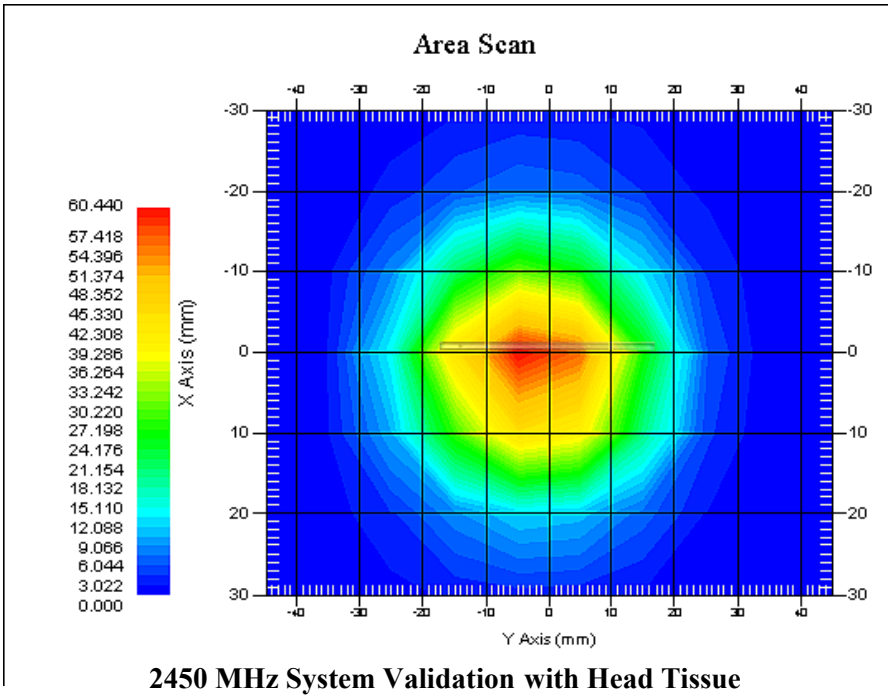
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Head
Serial No. : 290-01109
Frequency : 2450.0 MHz
Last Calib. Date : 13-Nov-2014
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 50.00 RH%
Epsilon : 39.53 F/m
Sigma : 1.83 S/m
Density : 1000.00 kg/cu. M

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 14-Oct-2014
Frequency Band : 2450 MHz
Duty Cycle Factor : 1
Conversion Factor : 4.3
Probe Sensitivity : 1.20 1.20 1.20 $\mu V/(V/m)^2$
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 : 55.936 W/kg
10 gram SAR value : 24.028 W/kg
Area Scan Peak SAR : 60.437 W/kg
Zoom Scan Peak SAR : 95.484 W/kg



2450 MHz System Validation with Head Tissue

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

System Performance Check 2450 MHz Body Liquid

Dipole 2450 MHz; Type: ALS-D-2450-S-2; S/N: 220-00758

Product Data
Device Name : Dipole 2450MHz
Serial No. : 220-00758
Type : Dipole
Model : ALS-D-2450-S-2
Frequency Band : 2450 MHz
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 55.124 W/kg
Power Drift-Finish : 54.032 W/kg
Power Drift (%) : -1.745

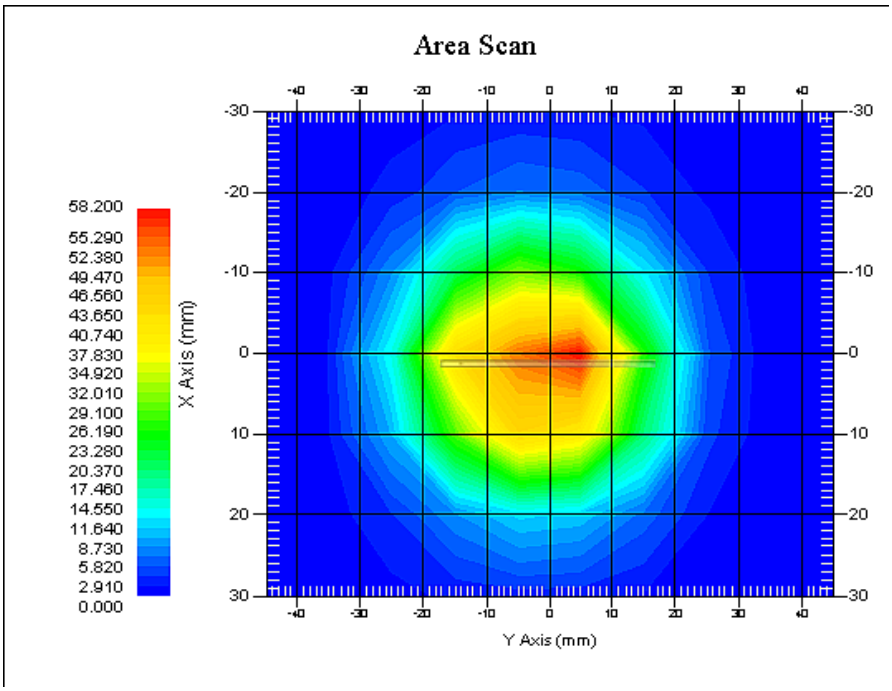
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : BODY
Serial No. : 290-01109
Frequency : 2450.0 MHz
Last Calib. Date : 13-Nov-2014
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 50.00 RH%
Epsilon : 52.86 F/m
Sigma : 1.96 S/m
Density : 1000.00 kg/cu. M

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 14-Oct-2014
Frequency Band : 2450 MHz
Duty Cycle Factor : 1
Conversion Factor : 4.3
Probe Sensitivity : 1.20 1.20 1.20 $\mu V/(V/m)^2$
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 : 8x9x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 53.859 W/kg
10 gram SAR value : 23.745 W/kg
Area Scan Peak SAR : 58.193 W/kg
Zoom Scan Peak SAR : 89.548 W/kg



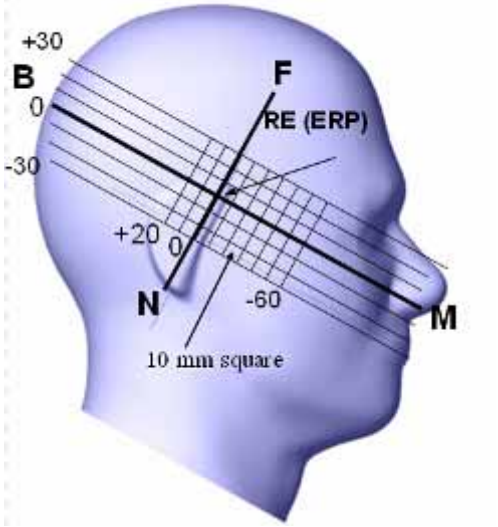
2450 MHz System Validation with Body Tissue

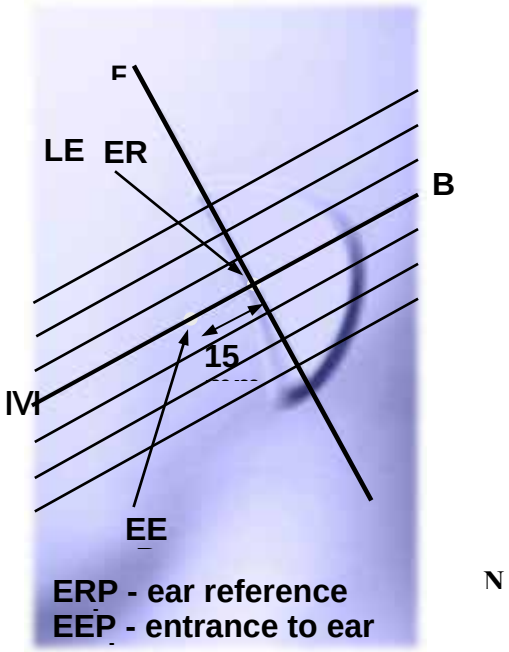
EUT TEST STRATEGY AND METHODOLOGY

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

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

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





Cheek/Touch Position

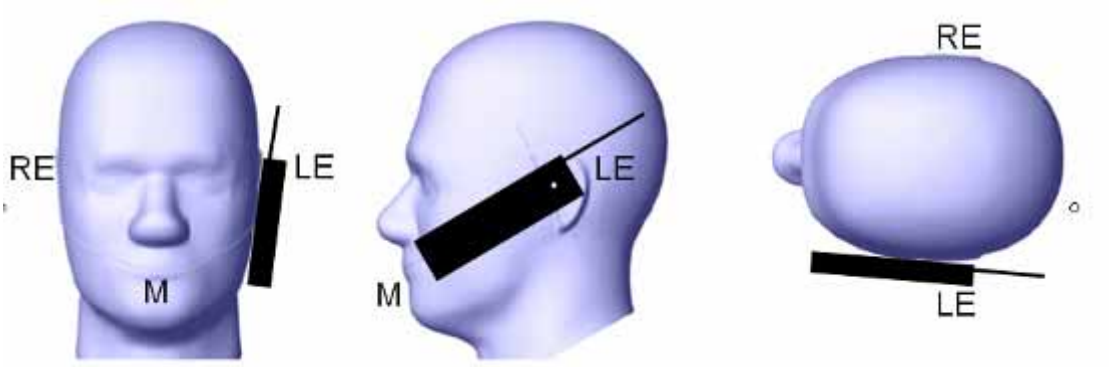
The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

This test position is established:

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

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

Cheek /Touch Position



Ear/Tilt Position

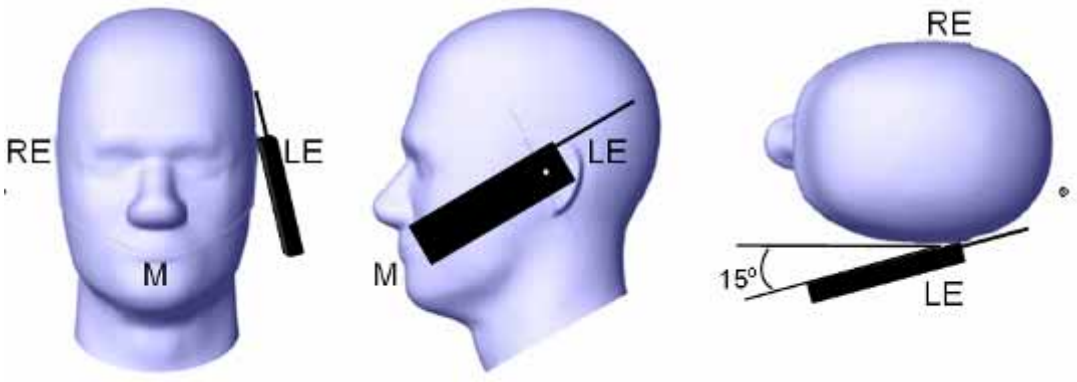
With the handset aligned in the "Cheek/Touch Position":

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

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

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

Ear /Tilt 15° Position



Test positions for body-worn and other configurations

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

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

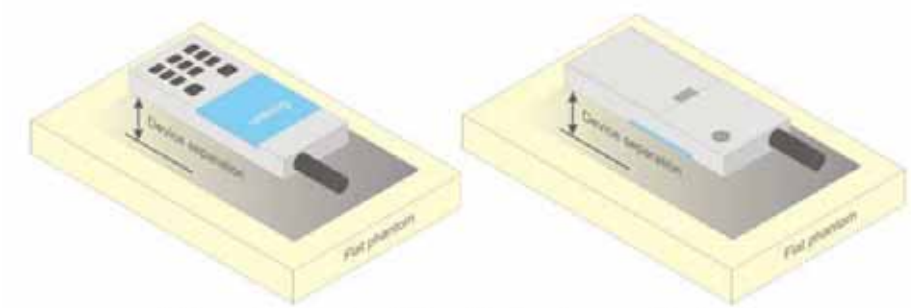


Figure 5 – Test positions for body-worn devices

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

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

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

1) The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the “Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

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

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

Test methodology

KDB 447498 D01.
KDB 648474 D04
KDB 865664 D01
KDB 941225 D01
KDB 941225 D06

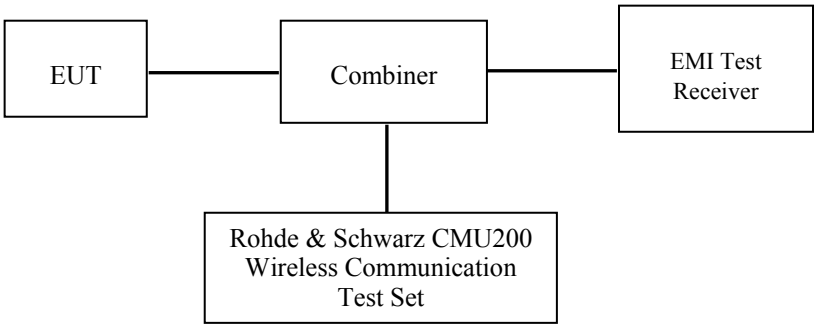
CONDUCTED OUTPUT POWER MEASUREMENT

Provision Applicable

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

Test Procedure

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



GSM&3G

Maximum Output Power among production units

Max Target Power for Production Unit (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	32.60	32.60	32.60
GPRS 1 slot	32.60	32.60	32.60
GPRS 2 slot	32.00	32.00	32.00
GPRS 3 slot	30.20	30.20	30.20
GPRS 4 slot	29.20	29.20	29.20
PCS 1900	28.50	28.50	28.50
GPRS 1 slot	28.50	28.50	28.50
GPRS 2 slot	27.70	27.70	27.70
GPRS 3 slot	25.80	25.80	25.80
GPRS 4 slot	24.80	24.80	24.80
WCDMA850	21.70	21.70	21.70
WCDMA1900	22.70	22.70	22.70
Wi-Fi	13.20	13.20	13.20
Bluetooth	1.70	1.70	1.70

Test Results:

GSM:

Band	Frequency (MHz)	Conducted Output Power	
		Meas. Power (dBm)	Meas. Power (W)
GSM 850	824.2	32.49	1.774
	836.6	32.51	1.782
	848.8	**32.57**	1.807
PCS 1900	1850.2	**28.47**	0.703
	1880.0	28.36	0.685
	1909.8	28.32	0.679

GPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	32.44	31.79	30.15	29.14
	190	836.6	32.49	31.88	30.19	29.13
	251	848.8	32.53	31.92	30.19	29.12
PCS 1900	512	1850.2	28.40	27.62	25.72	24.71
	661	1880.0	28.31	27.54	25.66	24.64
	810	1909.8	28.33	27.56	25.71	24.68

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

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

The time based average power for GPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	23.44	25.79	25.90	**26.14**
	190	836.6	23.49	25.88	25.94	26.13
	251	848.8	23.53	25.92	25.94	26.12
PCS 1900	512	1850.2	19.40	21.62	21.47	**21.71**
	661	1880.0	19.31	21.54	21.41	21.64
	810	1909.8	19.33	21.56	21.46	21.68

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

WCDMA-Release 99:

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

WCDMA General Settings	**Loopback Mode**	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc /βd	8/15

WCDMA HSDPA

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subset	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/ βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR(dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	D_{CQI}	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs= βhs/βc	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				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/ βd	11/15	6/15	15/9	2/15	-
	βhs	22/15	12/15	30/15	4/15	5/15
	CM(dB)	1.0	3.0	2.0	3.0	1.0
	MPR(dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
	Ahs= βhs/ βc	30/15				
HSUPA Specific Settings	DE-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_FCIs	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27	

Results (12.2kbps RMC)

Band	Frequency (MHz)	Channel NO.	Conducted Output Power	
			(dBm)	(Watt)
WCDMA 850	826.4	4132	21.37	0.137
	836.6	4183	**21.66**	0.147
	846.6	4233	21.61	0.145
WCDMA 1900	1852.4	9262	22.60	0.182
	1880.0	9400	**22.64**	0.184
	1907.6	9538	22.27	0.169

Results (HSDPA)

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)			
			Subset 1	Subset 2	Subset 3	Subset 4
WCDMA 850	826.4	4132	21.36	21.24	21.17	21.11
	836.6	4183	21.62	21.54	21.46	21.34
	846.6	4233	21.55	21.45	21.38	21.26
WCDMA 1900	1852.4	9262	21.56	21.47	21.35	21.22
	1880.0	9400	21.51	21.44	21.36	21.24
	1907.6	9538	21.25	21.17	21.12	21.03

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	21.17	21.13	21.07	20.98	20.89
	836.6	4183	21.42	21.35	21.27	21.19	21.05
	846.6	4233	21.15	21.09	20.96	20.88	20.67
WCDMA 1900	1852.4	9262	21.54	21.45	21.37	21.24	21.06
	1880.0	9400	21.53	21.42	21.36	21.21	21.12
	1907.6	9538	21.18	21.13	21.07	20.95	20.83

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model 1.
2. KDB 941225 D01-Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than measured without HSDPA using 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.
3. KDB 941225 D01-Body SAR is not required for HSUPA when the maximum average output of each RF channel with HSUPA active is less than ¼ dB higher than measured without HSUPA using 12.2kbps RMC and the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.

Bluetooth

Mode	Channel frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
BDR(GFSK)	(Low)2402	0.26	1.062
	(Middle)2441	1.55	1.429
	(High)2480	**1.70**	1.479
EDR(4-DQPSK)	(Low)2402	-0.22	0.951
	(Middle)2441	1.03	1.268
	(High)2480	1.29	1.346
EDR-8DPSK	(Low)2402	0.02	1.005
	(Middle)2441	1.23	1.327
	(High)2480	1.47	1.403
BLE	(Low)2402	-7.87	0.163
	(Middle)2440	-6.75	0.211
	(High)2480	-6.28	0.236

WiFi

Band	Frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
802.11b	2412	12.00	15.849
	2437	12.79	19.011
	2462	13.15	**20.654**
	2472	13.14	20.606
802.11g	2412	9.33	8.570
	2437	9.90	9.772
	2462	10.29	10.691
	2472	10.46	11.117
802.11n HT20	2412	5.22	3.327
	2437	5.86	3.855
	2462	6.35	4.315
	2472	6.44	4.406
802.11n HT40	2422	5.44	3.499
	2437	5.69	3.707
	2452	6.30	4.266

Note:

1. The output power was tested under data rate 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n HT20, 13.5Mbps for 802.11n HT40.
2. 248227-SAR is not required for 802.11g/802.11n channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

SAR Test Data

Environmental Conditions

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

Testing was performed by Wilson Chen on 2014-11-13

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	-2.218	32.49	32.60	1.026	0.486	0.499	/
	836.6	GSM	1.574	32.51	32.60	1.021	0.497	**0.507**	**1#**
	848.8	GSM	0.548	32.57	32.60	1.007	0.500	0.504	/
Left Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	1.065	32.51	32.60	1.021	0.325	0.332	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	2.184	32.51	32.60	1.021	0.469	0.479	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-2.157	32.51	32.60	1.021	0.331	0.338	/
	848.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (0mm)	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	0.847	32.51	32.60	1.021	0.342	0.349	/
	848.8	GSM	/	/	/	/	/	/	/
Body-Back (0mm)	824.2	GPRS	1.241	29.14	29.20	1.014	0.479	**0.486**	**2#**
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	/	/	/	/	/	/	/
Body-Right (0mm)	824.2	GPRS	0.125	29.14	29.20	1.014	0.029	0.029	
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	/	/	/	/	/	/	/
Body-Top (0mm)	824.2	GPRS	-2.318	29.14	29.20	1.014	0.074	0.075	
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	/	/	/	/	/	/	/

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	/	/	/	/	/	/	/
	1880.0	GSM	1.054	28.36	28.50	1.033	0.539	0.557	/
	1909.8	GSM	/	/	/	/	/	/	/
Left Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-3.265	28.36	28.50	1.033	0.402	0.415	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	1850.2	GSM	0.187	28.47	28.50	1.007	0.579	0.583	/
	1880.0	GSM	-1.673	28.36	28.50	1.033	0.573	**0.592**	**3#**
	1909.8	GSM	2.184	28.32	28.50	1.042	0.551	0.574	/
Right Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	0.618	28.36	28.50	1.033	0.398	0.411	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (0mm)	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	2.639	28.36	28.50	1.033	0.759	0.784	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back (0mm)	1850.2	GPRS	-2.618	24.71	24.80	1.021	1.205	**1.230**	**4#**
	1880.0	GPRS	-1.268	24.64	24.80	1.038	1.106	1.148	/
	1909.8	GPRS	0.895	24.68	24.80	1.028	1.087	1.117	/
Body-Right (0mm)	1850.2	GPRS	1.526	24.71	24.80	1.021	0.326	0.333	
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Top (0mm)	1850.2	GPRS	2.367	24.71	24.80	1.021	0.736	0.751	
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	/	/	/	/	/	/	/

Note:
1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. The EUT transmit and receive through the same GSM antenna while testing SAR.
3. The Multi-slot Classes of EUT is Class12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.
4. 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.
5. When the maximum output power variation across the required test channels is > ½ 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							/
	836.6	WCDMA 850	1.795	21.66	21.70	1.009	0.324	**0.327**	**5#**
	846.6	WCDMA 850	/	/	/	/	/	/	/
Left Head Tilt	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	-2.284	21.66	21.70	1.009	0.200	0.202	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Cheek	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	0.935	21.66	21.70	1.009	0.316	0.319	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Tilt	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	1.825	21.66	21.70	1.009	0.207	0.209	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Body-Back (0mm)	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	1.503	21.66	21.70	1.009	0.352	**0.355**	**6#**
	846.6	WCDMA 850	/	/	/	/	/	/	/
Body-Right (0mm)	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	3.154	21.66	21.70	1.009	0.012	0.012	
	846.6	WCDMA 850	/	/	/	/	/	/	/
Body-Top (0mm)	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	-2.944	21.66	21.70	1.009	0.049	0.049	
	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	/	/	/	/	/	/	/
	1880.0	WCDMA1900	1.026	22.64	22.70	1.014	0.438	0.444	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Left Head Tilt	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	0.154	22.64	22.70	1.014	0.324	0.329	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Cheek	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-2.845	22.64	22.70	1.014	0.462	**0.468**	**7#**
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Tilt	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	3.654	22.64	22.70	1.014	0.311	0.315	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Back (0mm)	1852.4	WCDMA1900	-2.256	22.60	22.70	1.023	1.025	1.049	/
	1880.0	WCDMA1900	1.859	22.64	22.70	1.014	1.136	**1.152**	**8#**
	1907.6	WCDMA1900	0.528	22.27	22.70	1.104	0.974	1.075	/
Body-Right (0mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-2.598	22.64	22.70	1.014	0.219	0.222	
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Top (0mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-1.008	22.64	22.70	1.014	0.598	0.606	
	1907.6	WCDMA1900	/	/	/	/	/	/	/

Note:
1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model.

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

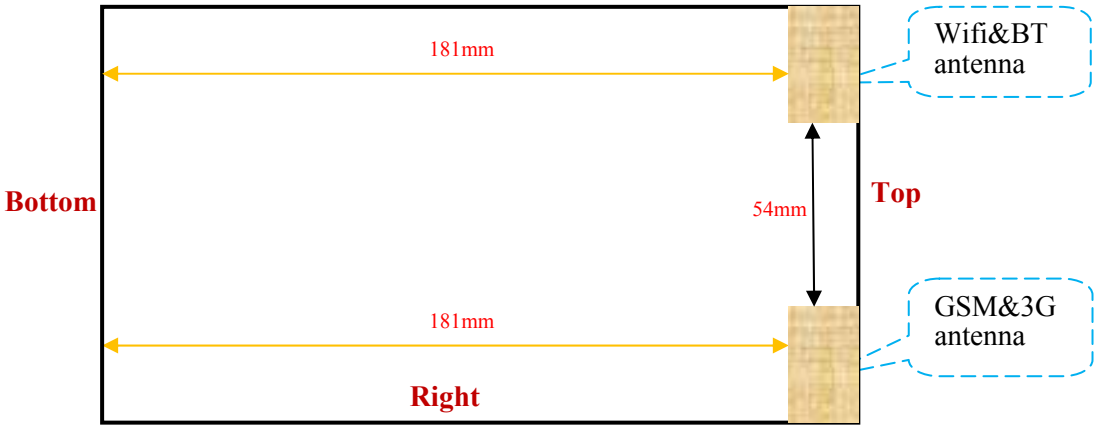
Wi-Fi (802.11b):

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	2412	802.11b	/	/	/	/	/	/	/
	2437	802.11b	/	/	/	/	/	/	/
	2462	802.11b	-2.842	13.15	13.20	1.012	0.175	0.177	/
Left Head Tilt	2412	802.11b	/	/	/	/	/	/	/
	2437	802.11b	/	/	/	/	/	/	/
	2462	802.11b	2.195	13.15	13.20	1.012	0.124	0.125	/
Right Head Cheek	2412	802.11b	/	/	/	/	/	/	/
	2437	802.11b	/	/	/	/	/	/	/
	2462	802.11b	-2.987	13.15	13.20	1.012	0.189	**0.191**	**9#**
Right Head Tilt	2412	802.11b	/	/	/	/	/	/	/
	2437	802.11b	/	/	/	/	/	/	/
	2462	802.11b	0.725	13.15	13.20	1.012	0.117	0.118	/
Body-Back (0mm)	2412	802.11b	/	/	/	/	/	/	/
	2437	802.11b	/	/	/	/	/	/	/
	2462	802.11b	-0.418	13.15	13.20	1.012	0.352	**0.356**	**10#**
Body-Left (0mm)	2412	802.11b	/	/	/	/	/	/	/
	2437	802.11b	/	/	/	/	/	/	/
	2462	802.11b	0.859	13.15	13.20	1.012	0.041	0.041	
Body-Top (0mm)	2412	802.11b	/	/	/	/	/	/	/
	2437	802.11b	/	/	/	/	/	/	/
	2462	802.11b	1.325	13.15	13.20	1.012	0.159	0.161	

Note:
1 .When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.
3. KDB248227-SAR is not required for 802.11g/802.11n channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

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



Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	×	×	0
GSM + Bluetooth	√	×	54
GSM + WiFi	√	×	54
GPRS + WCDMA	×	×	0
GPRS + Bluetooth	√	×	0
GPRS + WiFi	√	√	54
WCDMA + Bluetooth	√	×	54
WCDMA + WiFI	√	√	54

Standalone SAR test exclusion considerations

Head Position:

Mode	Frequency (MHz)	P_{avg} (dBm)	P_{avg} (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GSM850	850	23.60	229.09	0	42.24	3.0	No
PCS1900	1900	19.50	89.13	0	24.57	3.0	No
WCDMSA850	850	21.70	147.91	0	27.27	3.0	No
WCDMSA1900	1900	22.70	186.21	0	51.33	3.0	No
Wi-Fi	2450	12.20	16.60	0	5.20	3.0	No
Bluetooth	2450	1.70	1.48	0	**0.46**	3.0	Yes

Body Position:

Mode	Frequency (MHz)	P_{avg} (dBm)	P_{avg} (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
GPRS850	850	26.20	416.87	0	76.87	3.0	No
GPRS1900	1900	21.80	151.36	0	41.73	3.0	No
WCDMSA850	850	21.70	147.91	0	27.27	3.0	No
WCDMSA1900	1900	22.70	186.21	0	51.33	3.0	No
WiFi	2450	12.20	16.60	0	5.20	3.0	No
Bluetooth	2450	1.70	1.48	0	**0.46**	3.0	Yes

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(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_{avg} (dBm)	P_{avg} (mW)	Estimated $_{1-g}$ (W/kg)
BT Head	2.45	0	1.70	1.48	0.061
BT Body	2.45	0	1.70	1.48	0.061

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:
[(*max. power of channel, including* ***tune-up tolerance****, mW*)/(*min. test separation distance,mm*)]·[√f(GHz)/*x*] W/kg for *test separation distances* ≤ 50 mm;
where *x* = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion

Simultaneous SAR test exclusion considerations:

GSM with BT:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	BT	< 1.6W/kg
GSM850	Left Head Cheek	0.507	0.061	0.568
	Left Head Tile	0.332	0.061	0.393
	Right Head Cheek	0.479	0.061	0.540
	Right Head Tilt	0.338	0.061	0.399
	Body-Back	0.486	0.061	0.547
	Body-Top	0.075	0.061	0.136
PCS1900	Left Head Cheek	0.557	0.061	0.618
	Left Head Tile	0.415	0.061	0.476
	Right Head Cheek	0.592	0.061	0.653
	Right Head Tilt	0.411	0.061	0.472
	Body-Back	1.230	0.061	1.291
	Body-Top`	0.751	0.061	0.812

WCDMA with BT:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.327	0.061	0.388
	Left Head Tile	0.202	0.061	0.263
	Right Head Cheek	0.319	0.061	0.380
	Right Head Tilt	0.209	0.061	0.270
	Body-Back	0.355	0.061	0.416
	Body-Top	0.049	0.061	0.110
WCDMA 1900	Left Head Cheek	0.444	0.061	0.505
	Left Head Tile	0.329	0.061	0.390
	Right Head Cheek	0.468	0.061	0.529
	Right Head Tilt	0.315	0.061	0.376
	Body-Back	1.152	0.061	1.213
	Body-Top`	0.606	0.061	0.667

GSM with WiFi:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	BT	< 1.6W/kg
GSM850	Left Head Cheek	0.507	0.177	0.684
	Left Head Tile	0.332	0.125	0.457
	Right Head Cheek	0.479	0.191	0.670
	Right Head Tilt	0.338	0.118	0.456
	Body-Back	0.486	0.356	0.842
	Body-Top	0.075	0.161	0.236
PCS1900	Left Head Cheek	0.557	0.177	0.734
	Left Head Tile	0.415	0.125	0.540
	Right Head Cheek	0.592	0.191	**0.783**
	Right Head Tilt	0.411	0.118	0.529
	Body-Back	1.230	0.356	**1.586**
	Body-Top`	0.751	0.161	0.912

WCDMA with Wi-Fi:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.327	0.177	0.504
	Left Head Tile	0.202	0.125	0.327
	Right Head Cheek	0.319	0.191	0.510
	Right Head Tilt	0.209	0.118	0.327
	Body-Back	0.355	0.356	0.711
	Body-Top	0.049	0.161	0.210
WCDMA 1900	Left Head Cheek	0.444	0.177	0.621
	Left Head Tile	0.329	0.125	0.454
	Right Head Cheek	0.468	0.191	0.659
	Right Head Tilt	0.315	0.118	0.433
	Body-Back	1.152	0.356	1.508
	Body-Top`	0.606	0.161	0.767

Conclusion:

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

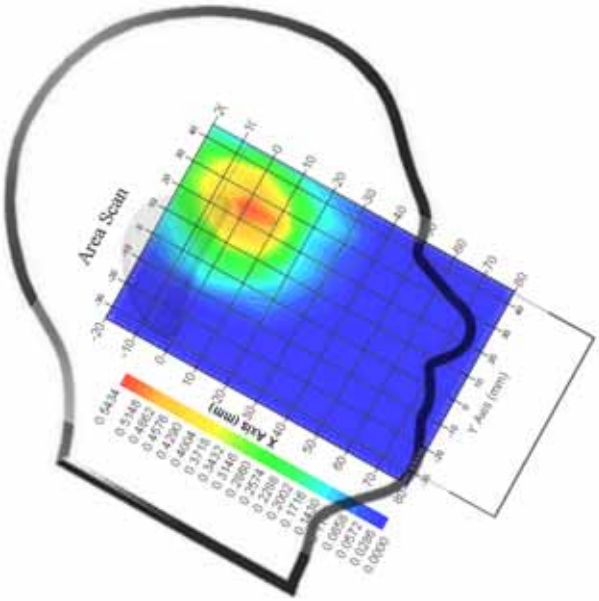
SAR Plots (Summary of the Highest SAR Values)

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

Left Head Cheek (836.6 MHz Middle Channel)

Measurement Data	
Test mode	: GSM
Crest Factor	: 8
Scan Type	: Complete
Area Scan	: 11x8x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan	: 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start	: 0.295 W/kg
Power Drift-Finish	: 0.300 W/kg
Power Drift (%)	: 1.574
Tissue Data	
Type	: Head
Frequency	: 836.6 MHz
Epsilon	: 41.18 F/m
Sigma	: 0.91 S/m
Density	: 1000.00 kg/cu. m
Probe Data	
Serial No.	: 500-00283
Frequency Band	: 835
Duty Cycle Factor	: 8
Conversion Factor	: 5.9
Probe Sensitivity	: 1.20 1.20 1.20 µV/(V/m)2
Compression Point	: 95.00 mV
Offset	: 1.56 mm
1 gram SAR value	: 0.497 W/kg
10 gram SAR value	: 0.249 W/kg
Area Scan Peak SAR	: 0.543 W/kg
Zoom Scan Peak SAR	: 0.917 W/kg

Plot 1#



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

Body-worn-Back (824.2 MHz Low Channel)

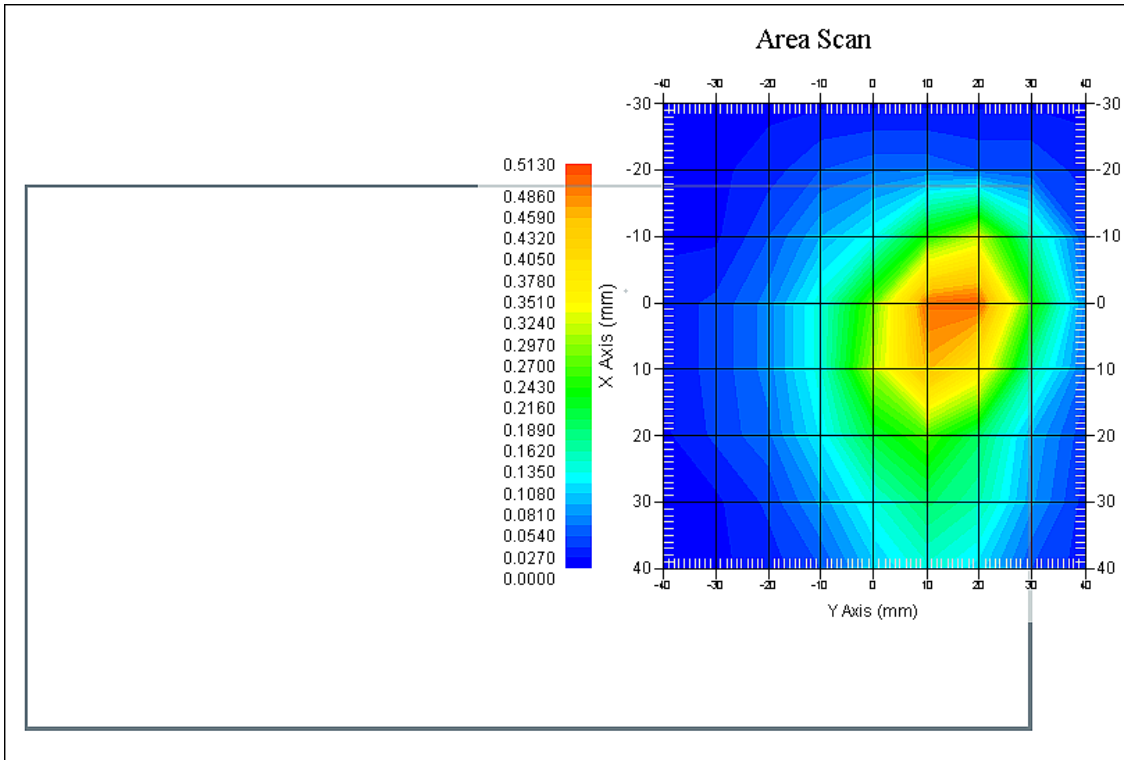
Measurement Data
Test mode : GPRS
Crest Factor : 2
Scan Type： : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.374 W/kg
Power Drift-Finish : 0.370 W/kg
Power Drift (%) : 1.241

Tissue Data
Type : Body
Frequency : 824.2 MHz
Epsilon : 53.92 F/m
Sigma : 0.94 S/m
Density : 1000.00 kg/cu. m

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

1 gram SAR value : 0.479 W/kg
10 gram SAR value : 0.234 W/kg
Area Scan Peak SAR : 0.513 W/kg
Zoom Scan Peak SAR : 0.891 W/kg

Plot 2#



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

Right Head Cheek(1880MHz Middle Channel)

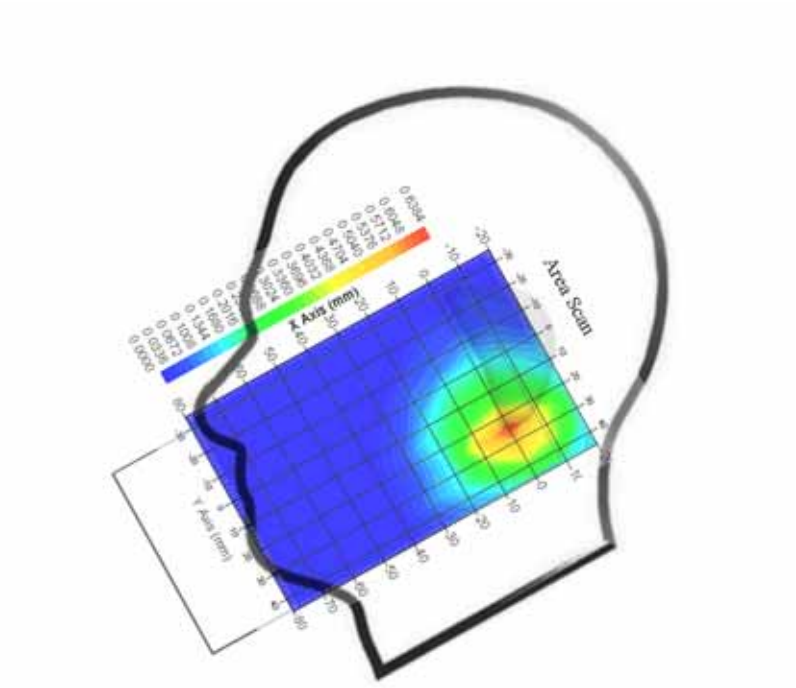
Measurement Data
Test mode : GSM
Crest Factor : 8
Scan Type : Complete
Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.152 W/kg
Power Drift-Finish : 0.150 W/kg
Power Drift (%) : -1.673

Tissue Data
Type : Head
Frequency : 1880 MHz
Epsilon : 39.75 F/m
Sigma : 1.39 S/m
Density : 1000.00 kg/cu. M

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

1 gram SAR value : 0.573 W/kg
10 gram SAR value : 0.287 W/kg
Area Scan Peak SAR : 0.631 W/kg
Zoom Scan Peak SAR : 0.994 W/kg

Plot 3#



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

Body-worn-Back (1850.2MHz Low Channel)

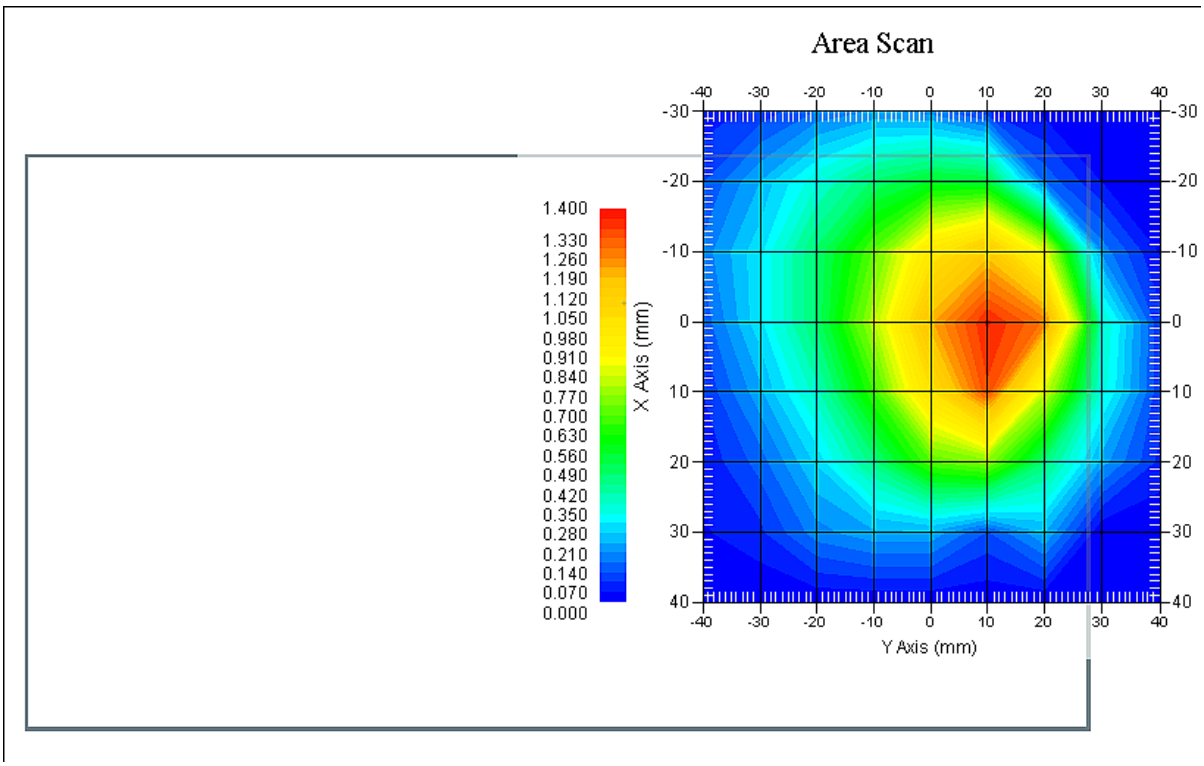
Measurement Data
Test mode : GPRS
Crest Factor : 2
Scan Type : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.742 W/kg
Power Drift-Finish : 0.724 W/kg
Power Drift (%) : -2.618

Tissue Data
Type : Body
Frequency : 1850.2 MHz
Epsilon : 52.17 F/m
Sigma : 1.46 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 1900
Duty Cycle Factor : 2
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

1 gram SAR value : 1.205 W/kg
10 gram SAR value : 0.648 W/kg
Area Scan Peak SAR : 1.387 W/kg
Zoom Scan Peak SAR : 2.105 W/kg

Plot 4#



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

WCDMA850; Left Head Cheek (836.6 MHz Middle Channel)

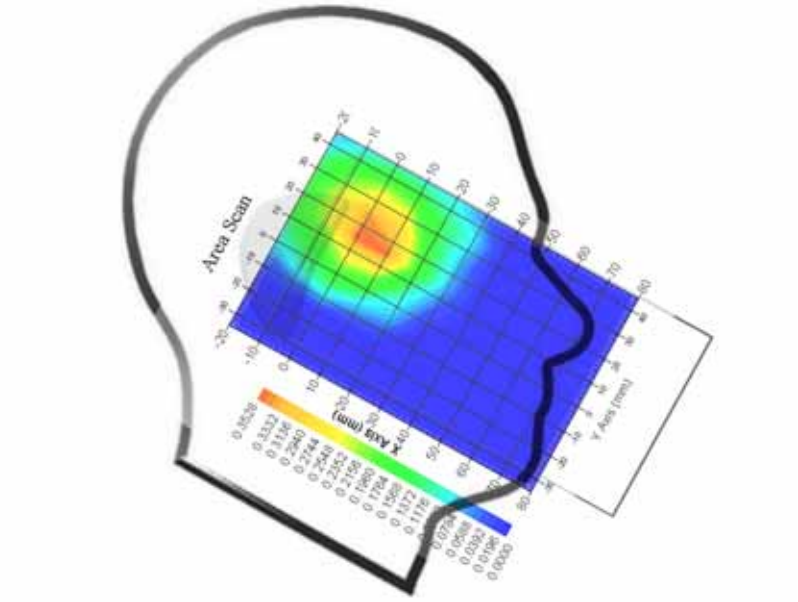
Measurement Data
Test mode : WCDMA850
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.138 W/kg
Power Drift-Finish : 0.140 W/kg
Power Drift (%) : 1.795

Tissue Data
Type : Head
Frequency : 836.6 MHz
Epsilon : 41.18 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 µV/(V/m)2
Compression Point : 95.00 mV
Offset : 1.56 mm

1 gram SAR value : 0.324 W/kg
10 gram SAR value : 0.178 W/kg
Area Scan Peak SAR : 0.353 W/kg
Zoom Scan Peak SAR : 0.529 W/kg

Plot 5#



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

WCDMA850; Body-Worn-Back (836.6 MHz Middle Channel)

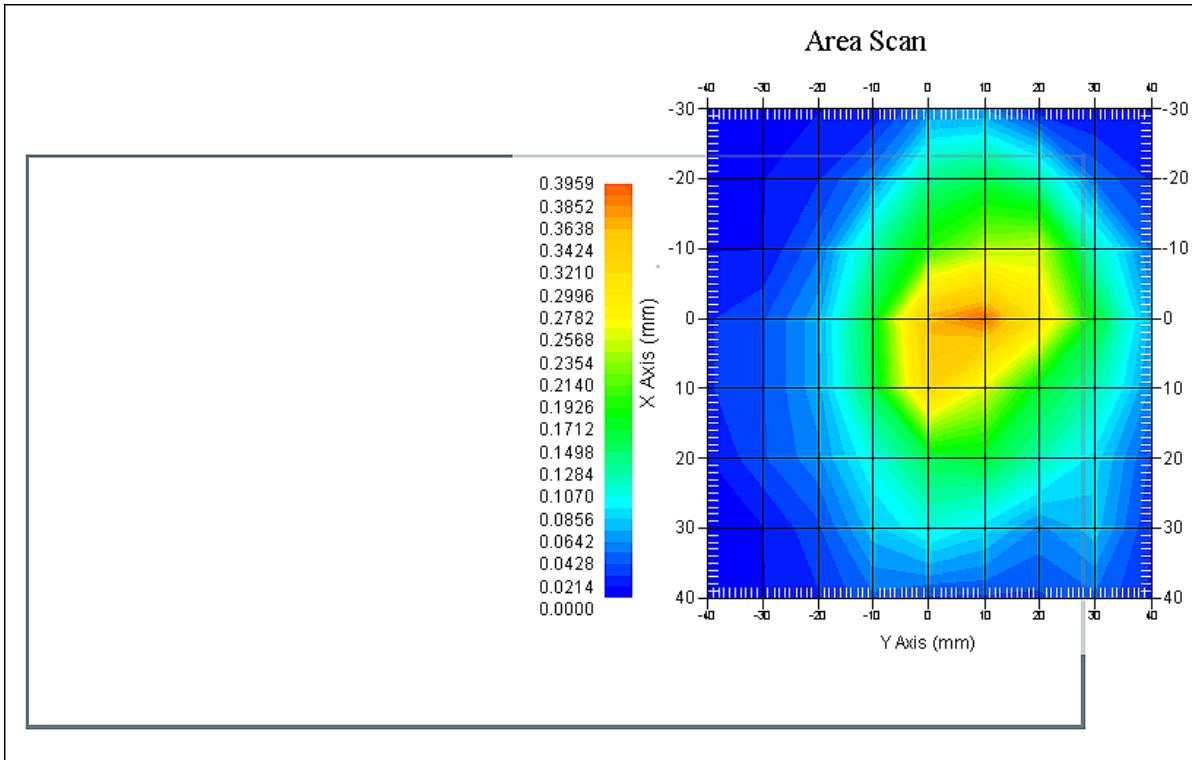
Measurement Data
Test mode : WCDMA850
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.199 W/kg
Power Drift-Finish : 0.202 W/kg
Power Drift (%) : 1.503

Tissue Data
Type : Body
Frequency : 836.6 MHz
Epsilon : 53.88 F/m
Sigma : 0.95 S/m
Density : 1000.00 kg/cu. m

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

1 gram SAR value : 0.352 W/kg
10 gram SAR value : 0.177 W/kg
Area Scan Peak SAR : 0.396 W/kg
Zoom Scan Peak SAR : 0.615 W/kg

Plot 6#



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

WCDMA1900; Right Head Cheek (1880 MHz Middle Channel)

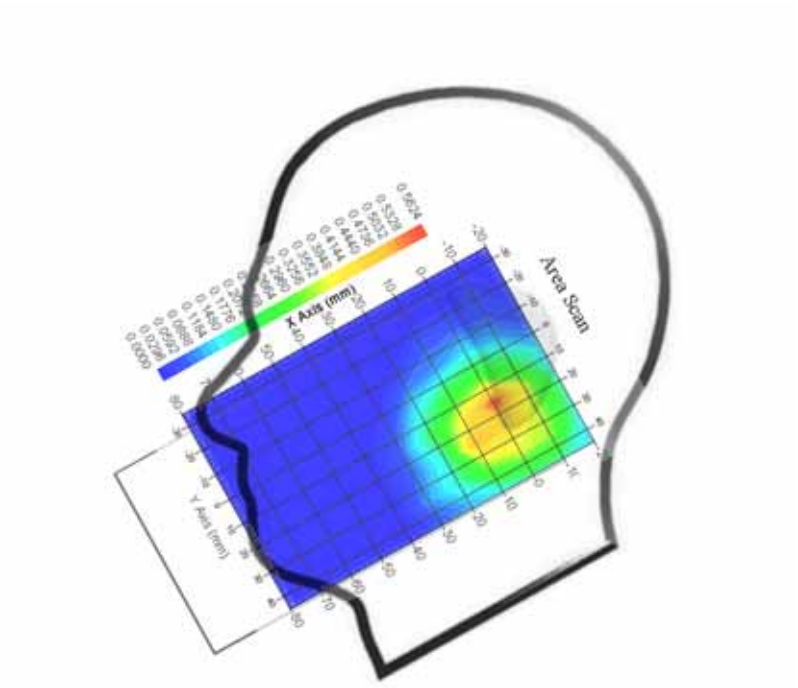
Measurement Data
Test mode : WCDMA1900
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.175 W/kg
Power Drift-Finish : 0.180 W/kg
Power Drift (%) : -2.845

Tissue Data
Type : Head
Frequency : 1880 MHz
Epsilon : 39.75 F/m
Sigma : 1.39 S/m
Density : 1000.00 kg/cu. m

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

1 gram SAR value : 0.462 W/kg
10 gram SAR value : 0.284 W/kg
Area Scan Peak SAR : 0.562 W/kg
Zoom Scan Peak SAR : 0.829 W/kg

Plot 7#



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

WCDMA1900; Body-Worn-Back (1880 MHz Middle Channel)

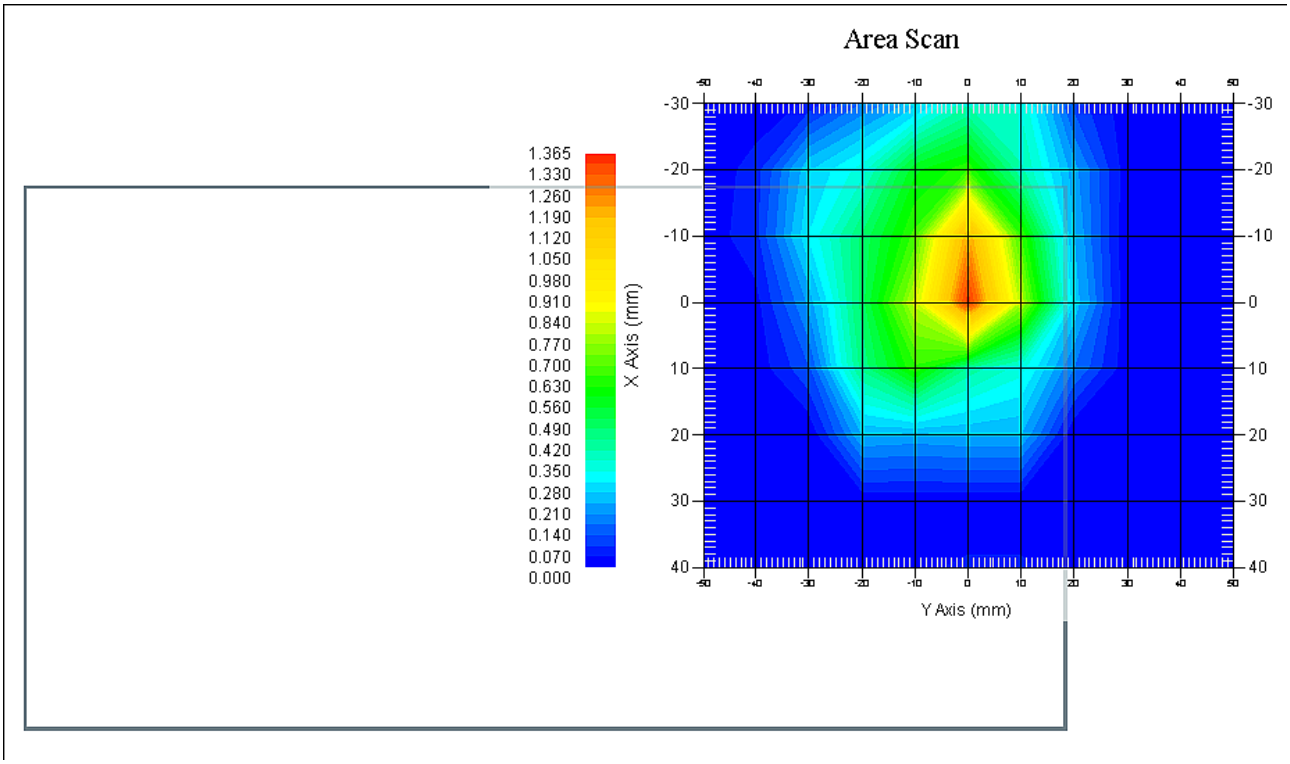
Measurement Data
Test mode : WCDMA1900
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.625 W/kg
Power Drift-Finish : 0.637 W/kg
Power Drift (%) : 1.859

Tissue Data
Type : Body
Frequency : 1880 MHz
Epsilon : 51.97 F/m
Sigma : 1.46 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 1900
Duty Cycle Factor : 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

1 gram SAR value : 1.136 W/kg
10 gram SAR value : 0.577 W/kg
Area Scan Peak SAR : 1.349 W/kg
Zoom Scan Peak SAR : 1.926 W/kg

Plot 8#



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

802.11b; Right Head Cheek (2462 MHz Channel 11)

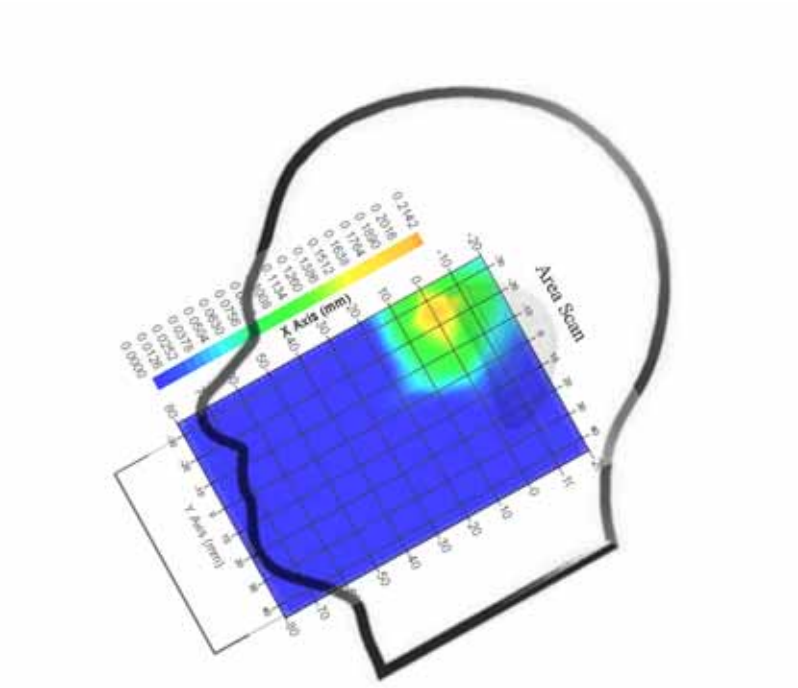
Measurement Data
Test mode : 802.11b
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.102 W/kg
Power Drift-Finish : 0.099 W/kg
Power Drift (%) : -2.987

Tissue Data
Type : Head
Frequency : 2462 MHz
Epsilon : 39.76 F/m
Sigma : 1.85 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 2450
Duty Cycle Factor : 1
Conversion Factor : 4.9
Probe Sensitivity : 1.20 1.20 1.20 µV/(V/m)2
Compression Point : 95.00 mV
Offset : 1.56 mm

1 gram SAR value : 0.189 W/kg
10 gram SAR value : 0.091 W/kg
Area Scan Peak SAR : 0.214 W/kg
Zoom Scan Peak SAR : 0.358 W/kg

Plot 9#



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

802.11b; Body-Worn-Back (2462MHz, Channel 11)

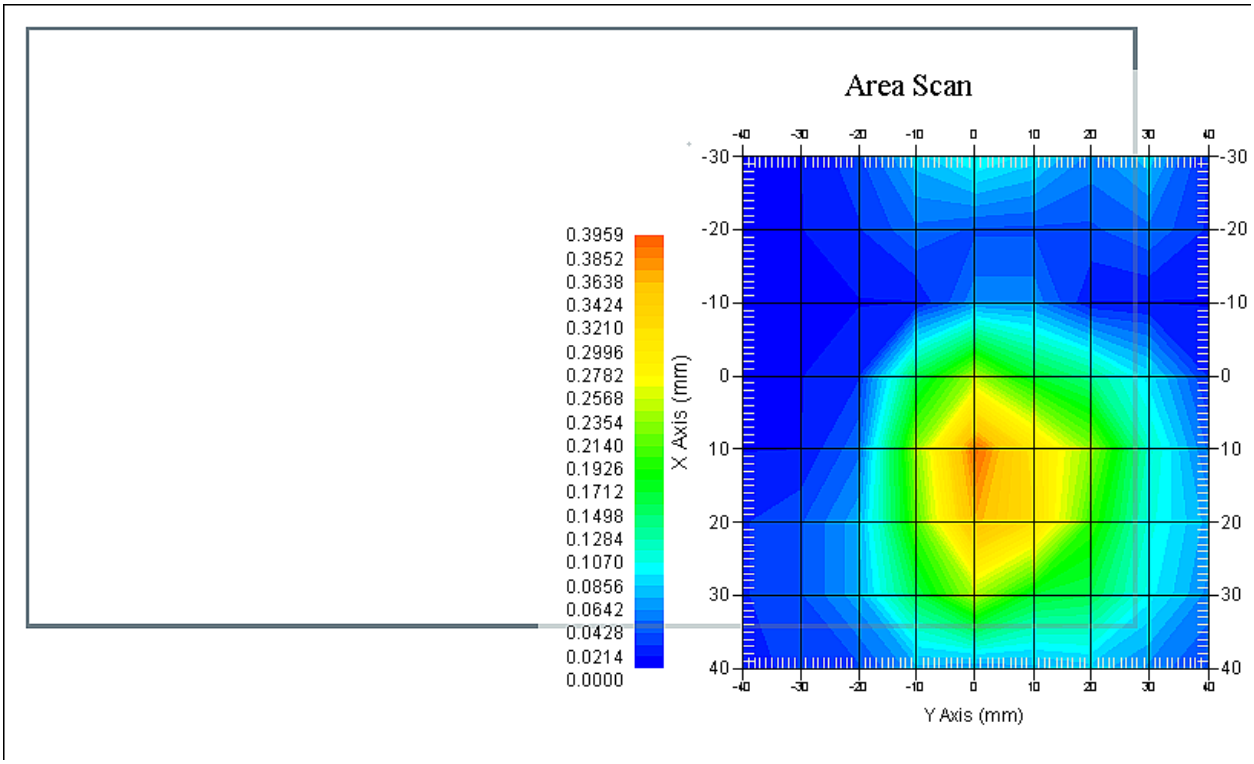
Measurement Data
Crest Factor : 1
Scan Type : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.085 W/kg
Power Drift-Finish : 0.085 W/kg
Power Drift (%) : -0.418

Tissue Data
Type : Body
Frequency : 2462 MHz
Epsilon : 52.86 F/m
Sigma : 1.93 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 2450 MHz
Duty Cycle Factor : 1
Conversion Factor : 4.3
Probe Sensitivity : 1.20 1.20 1.20 µV/(V/m)2
Compression Point : 95.00 mV
Offset : 1.56 mm

1 gram SAR value : 0.352 W/kg
10 gram SAR value : 0.188 W/kg
Area Scan Peak SAR : 0.396 W/kg
Zoom Scan Peak SAR : 0.591 W/kg

Plot 10#



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) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1\text{-cp})^{1/2}$	$(1\text{-cp})^{1}_{/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition -Noise	0.6	rectangular	$\sqrt{3}$	1	1	0.3	0.3
RF Ambient Condition - Reflections	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech. Restrictions	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
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	2.3	normal	1	1	1	2.3	2.3
Device Holder Uncertainty	6.215	normal	1	1	1	6.215	6.215
Drift of Output Power	4.627	rectangular	$\sqrt{3}$	1	1	2.67	2.67
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.)	1.938	normal	1	0.7	0.5	1.36	0.97
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	3.093	normal	1	0.6	0.5	1.86	1.55
Combined Uncertainty		RSS				10.78	10.55
Expanded uncertainty (coverage factor=2)		Normal(k=2)				21.56	21.10

APPENDIX B – PROBE CALIBRATION CERTIFICATES

NCL CALIBRATION LABORATORIES

Calibration File No.: PC-1598

Task No: BACL-5778

CERTIFICATE OF CALIBRATION

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

Equipment: Miniature Isotropic RF Probe
Record of Calibration
Head and Body
Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 500-00283

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

Calibrated: 14th October 2014
Released on: 14th October 2014

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

Released By: _____

Art Brennan, Quality Manager

NCL CALIBRATION LABORATORIES

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

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

NCL Calibration Laboratories

Division of APREL Inc.

Introduction

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

- 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
- EN 62209-1:2006
  Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models. instrumentation, and procedures - Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- IEC 62209-2:2010
  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)
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

NCL Calibration Laboratories
Division of APREL Inc.

Conditions

Probe 500-00283 was a recalibration.

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

Primary Measurement Standards

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

Secondary Measurement Standards

Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

Attestation

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

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

Art Brennan, Quality Manager

Dan Brooks, Test Engineer

Page 3 of 10
This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories
Division of APREL Inc.

Probe Summary

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 μV/(V/m)²
Channel Y:	1.2 μV/(V/m)²
Channel Z:	1.2 μV/(V/m)²

Diode Compression Point:	95 mV

Page 4 of 10
This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories
Division of APREL Inc.

Calibration for Tissue (Head H, Body B)

Frequency	Tissue Type	Measured Epsilon	Measured Sigma	Standard Uncertainty (%)	Calibration Frequency Range (MHz)	Conversion Factor
450 H	Head	43.59	0.86	3.5	±50	5.7
450 B	Body	56.74	0.94	3.5	±50	5.8
750 H	Head	42.98	0.92	3.5	±50	6.0
750 B	Body	43.05	0.93	3.5	±50	5.5
835 H	Head	43.42	0.94	3.5	±50	5.9
835 B	Body	55.77	1.01	3.5	±50	5.9
900 H	Head	41.87	1.06	3.5	±50	6.0
900 B	Body	55.62	1.05	3.5	±50	5.9
1450 H	Head	X	X	X	X	X
1450 B	Body	X	X	X	X	X
1500 H	Head	X	X	X	X	X
1500 B	Body	X	X	X	X	X
1640 H	Head	X	X	X	X	X
1640 B	Body	X	X	X	X	X
1750 H	Head	38.23	1.38	3.5	±75	5.4
1750 B	Body	52.86	1.54	3.5	±75	5.3
1800 H	Head	X	X	X	X	X
1800 B	Body	X	X	X	X	X
1900 H	Head	40.20	1.38	3.5	±75	4.8
1900 B	Body	52.63	1.46	3.5	±75	4.5
2000 H	Head	X	X	X	X	X
2000 B	Body	X	X	X	X	X
2100 H	Head	X	X	X	X	X
2100 B	Body	X	X	X	X	X
2300 H	Head	X	X	X	X	X
2300 B	Body	X	X	X	X	X
2450 H	Head	37.26	1.84	3.5	±75	4.9
2450B	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

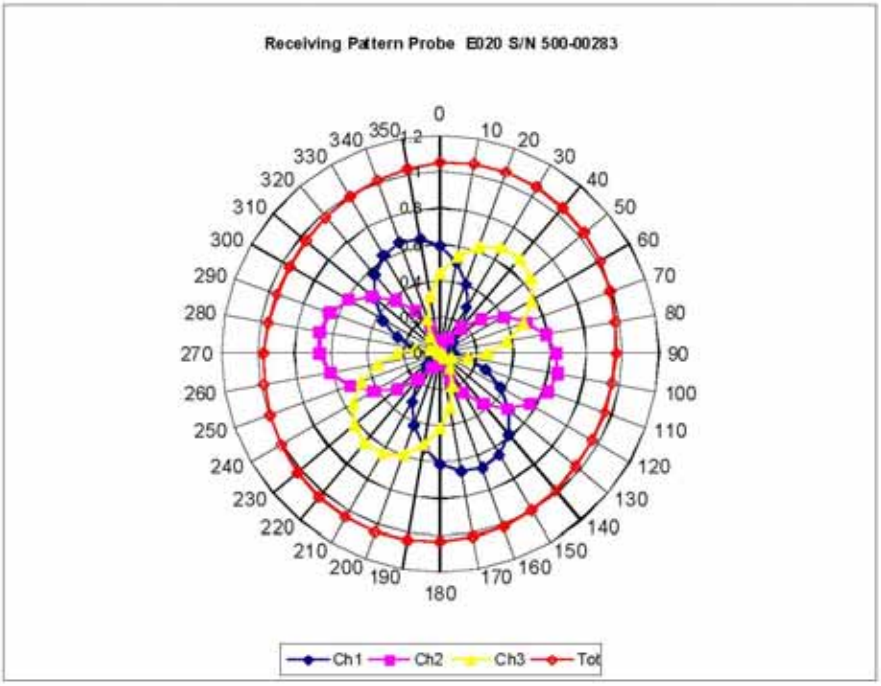
To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Probe Calibration Uncertainty

Uncertainty component	Tolerance (± %)	Probability distribution	Divisor	Standard uncertainty (± %)
Incident or forward power	2.5	R	√3	1.44
Reflected power	2	R	√3	1.15
Liquid conductivity measurement	1	R	√3	0.58
Liquid permittivity measurement	1	R	√3	0.58
Liquid conductivity deviation	1.5	R	√3	0.87
Liquid permittivity deviation	1.5	R	√3	0.87
Frequency deviation	2.25	R	√3	1.30
Field homogeneity	2.5	R	√3	1.44
Field-probe positioning	2.5	R	√3	1.44
Field-probe linearity	1.55	R	√3	0.89
Combined standard uncertainty		RSS		**3.50**

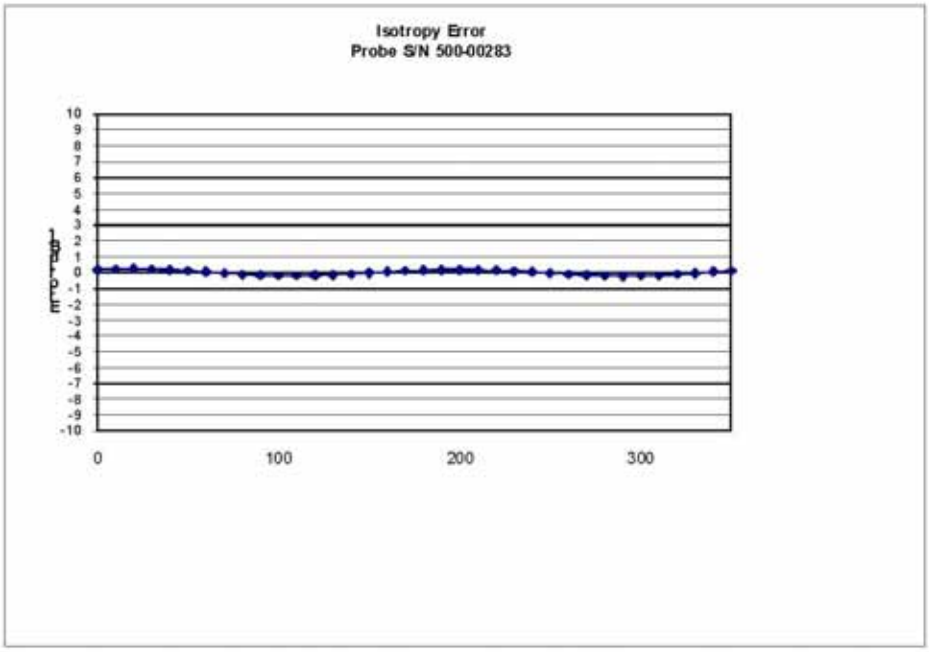
NCL Calibration Laboratories
Division of APREL Inc.

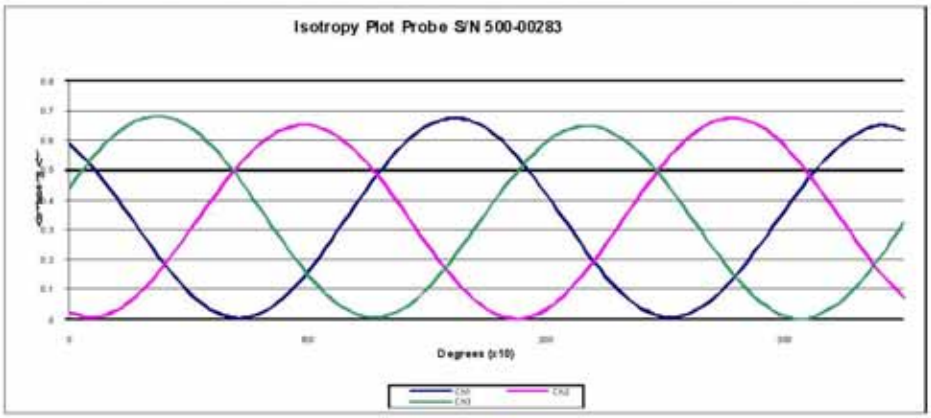
Receiving Pattern Air



NCL Calibration Laboratories
Division of APREL Inc.

Isotropy Error Air

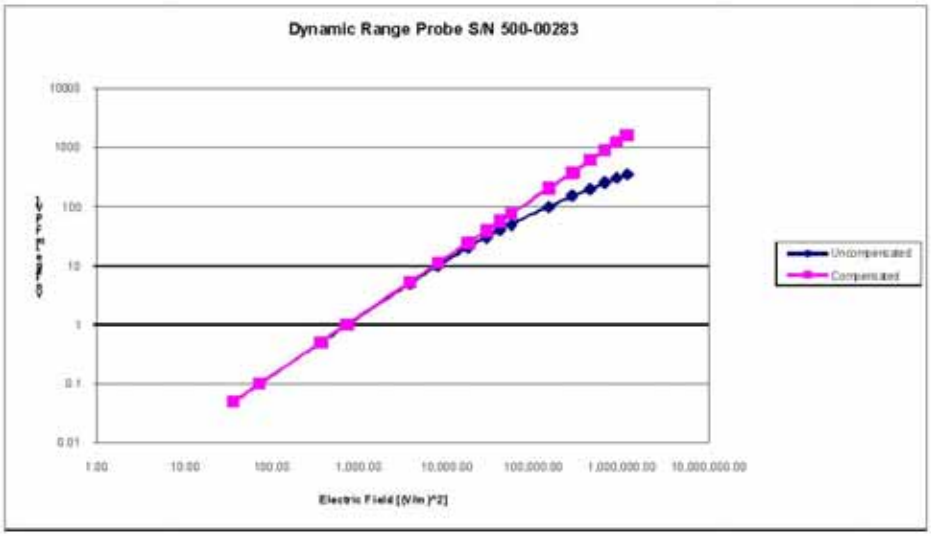




Isotropicity Tissue: 0.10 dB

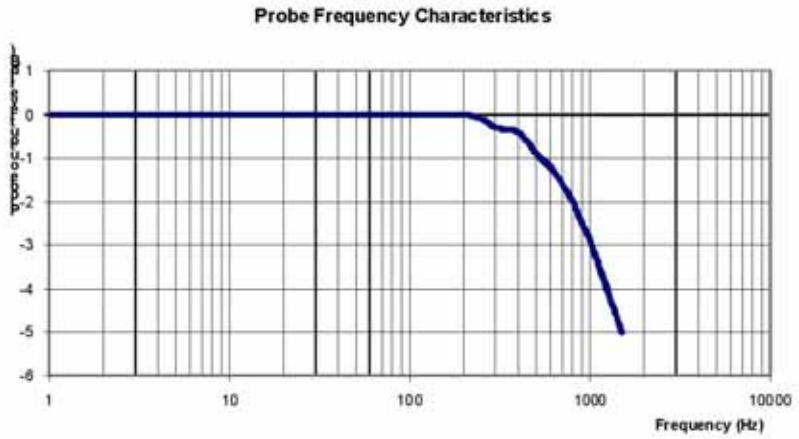
NCL Calibration Laboratories
Division of APREL Inc.

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.

APPENDIX C DIPOLE CALIBRATION CERTIFICATES

NCL CALIBRATION LABORATORIES

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

CERTIFICATE OF CALIBRATION

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

Validation Dipole(Head and Body)

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

Customer: Bay Area Compliance Laboratory (China)

Calibrated: 8th October 2014
Released on: 8th October 2014

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

Released By: _____
Art Brennan, Quality Manager

NCL CALIBRATION LABORATORIES
Suite 102, 303 Terry Fox Dr. Kanata, ONTARIO CANADA K2K 3J1
Division of APREL Lab. TEL: (613) 435-8300 FAX: (613)435-8306

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

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

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

Attestation

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

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

Art Brennan, Quality Manager

Maryna Nesterova Calibration Engineer

Primary Measurement Standards

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

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

NCL Calibration Laboratories
Division of APREL Laboratories.

Calibration Results Summary

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

Mechanical Dimensions

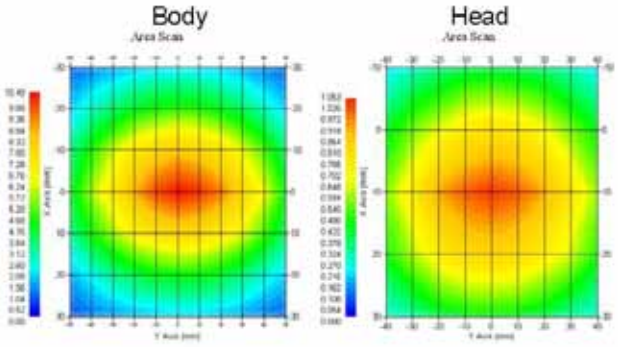
Length: 162.2 mm
Height: 89.4 mm

Electrical Specification

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

System Validation Results

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



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

NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 180-00558. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

References

- SSI-TP-018-ALSAS Dipole Calibration Procedure
- SSI-TP-016 Tissue Calibration Procedure
- IEEE 1528:2013 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques"
- IEC-62209-1:2006 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
  Part 1: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"
- IEC-62209-2:2010 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
  Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"
- D28-002 Procedure for validation of SAR system using a dipole

Conditions

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

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

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

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

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

NCL Calibration Laboratories
Division of APREL Laboratories.

Dipole Calibration Results

Mechanical Verification

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

Electrical Verification

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

Tissue Validation

	Dielectric constant, ε_r	Conductivity, σ [S/m]
Head Tissue 835MHz	43.42	0.94
Body Tissue 835MHz	55.77	1.01

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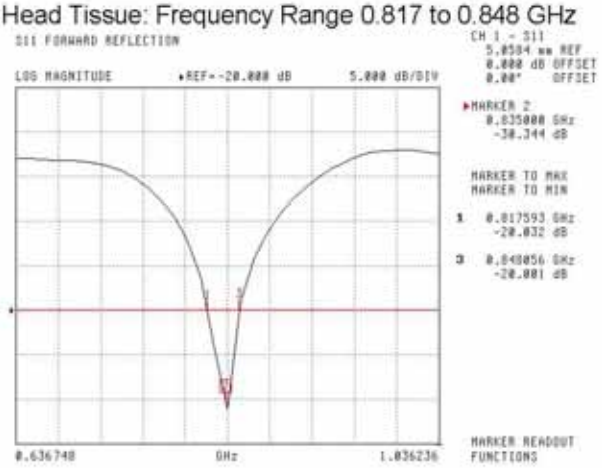
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

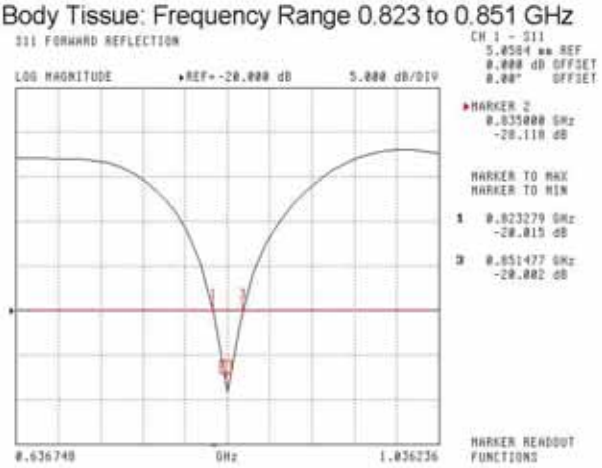
The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

Head Tissue: Frequency Range 0.817 to 0.848 GHz



Body Tissue: Frequency Range 0.823 to 0.851 GHz



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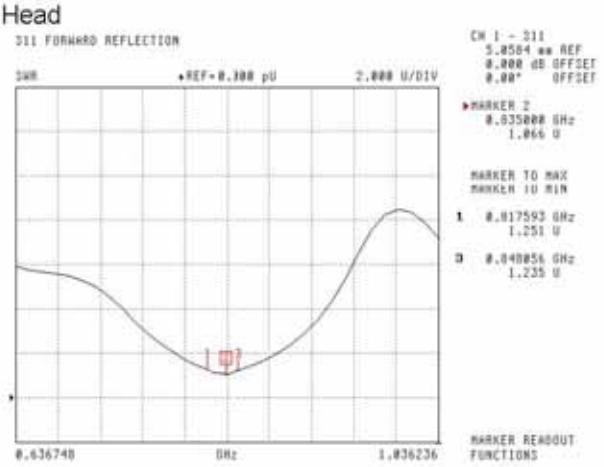
This page has been reviewed for content and attested to by signature within this document.

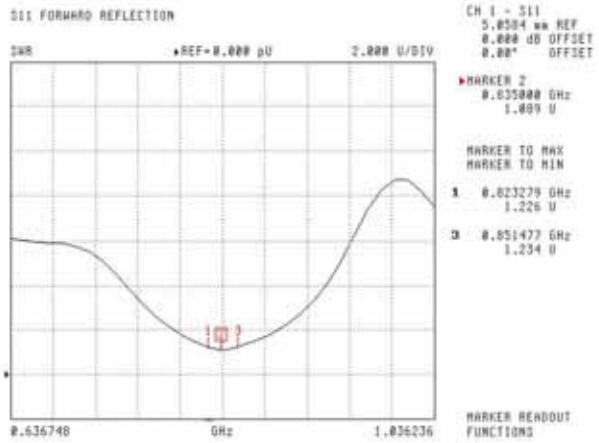
NCL Calibration Laboratories
Division of APREL Laboratories.

SWR

Head



Body



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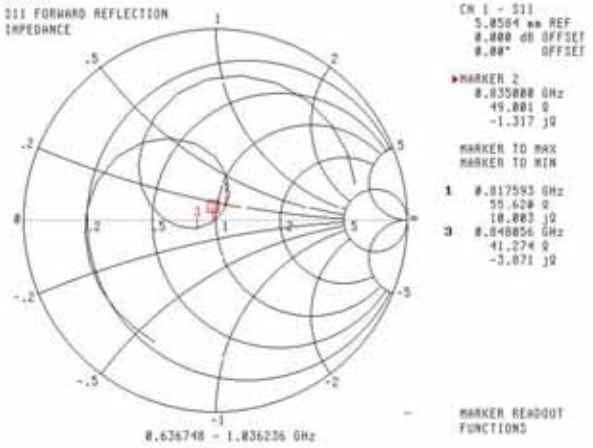
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



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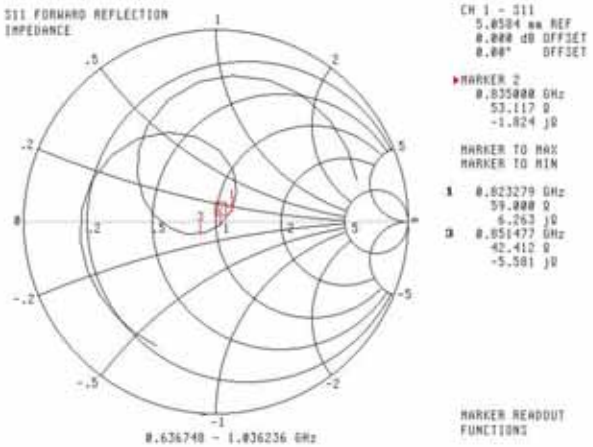

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This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Test Equipment

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

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

NCL CALIBRATION LABORATORIES

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

CERTIFICATE OF CALIBRATION

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

Validation Dipole (Head & Body)

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

Customer: Bay Area Compliance Laboratory (China)

Calibrated: 9th October, 2014
Released on: 9th 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 210-00710 was received in good condition and was a re-calibration.

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

Attestation

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

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

Art Brennan, Quality Manager

Maryna Nesterova Calibration Engineer

Primary Measurement Standards

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

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

NCL Calibration Laboratories
Division of APREL Laboratories.

Calibration Results Summary

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

Mechanical Dimensions

Length: 67.1 mm
Height: 38.9 mm

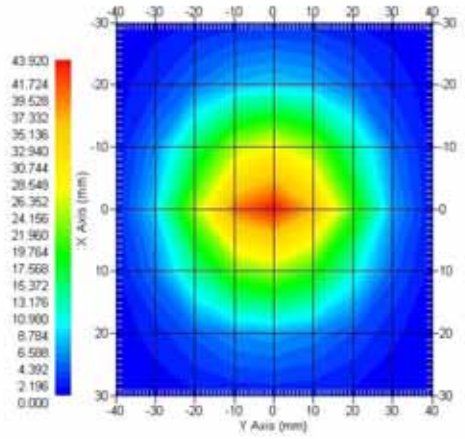
Electrical Specification

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

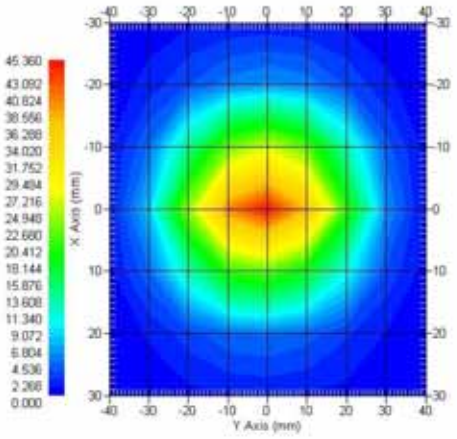
System Validation Results

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

Head
Area Scan



Body
Area Scan



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

NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 210-00710. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

References

- SSI-TP-018-ALSAS Dipole Calibration Procedure
- SSI-TP-016 Tissue Calibration Procedure
- IEEE 1528:2013 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques"
- IEC-62209-1:2006 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
  Part 1: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"
- IEC-62209-2:2010 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
  Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"
- D28-002 Procedure for validation of SAR system using a dipole

Conditions

Dipole 210-00710 was a recalibration.

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

Dipole Calibration uncertainty

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

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

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

NCL Calibration Laboratories
Division of APREL Laboratories.

Dipole Calibration Results

Mechanical Verification

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

Electrical Validation

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

Tissue Validation

	Dielectric constant, ε_r	Conductivity, σ [S/m]
Head Tissue 1900MHz	40.20	1.38
Body Tissue 1900MHz	52.63	1.46

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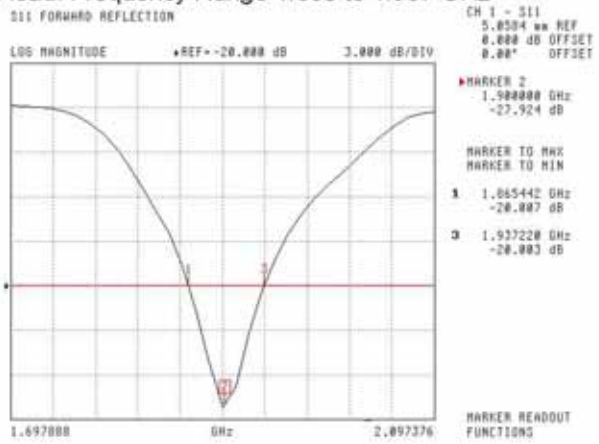
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

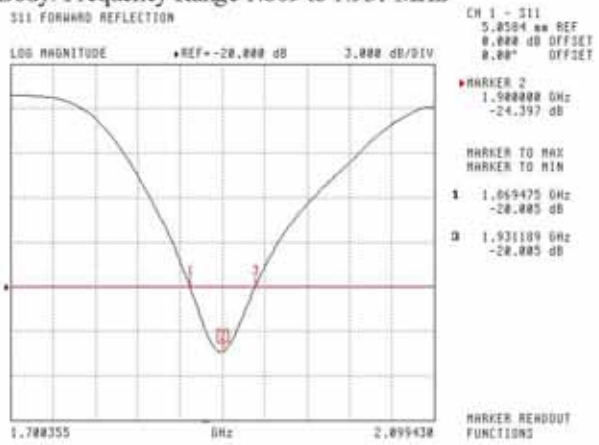
The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

Head: Frequency Range 1.865 to 1.937 GHz



Body: Frequency Range 1.869 to 1.931 MHz



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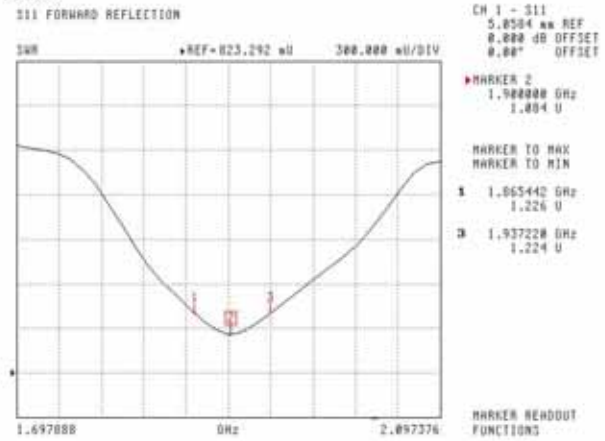
This page has been reviewed for content and attested to by signature within this document.

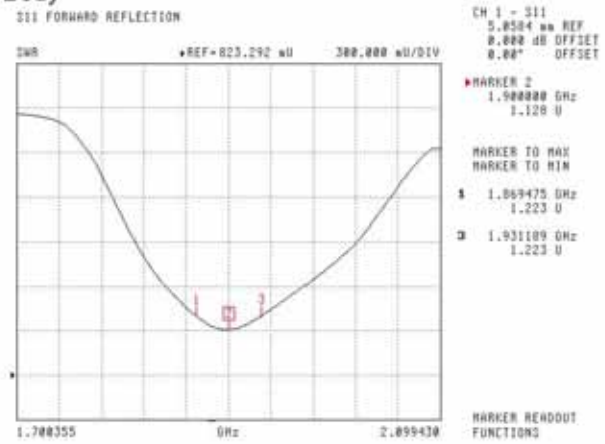
NCL Calibration Laboratories
Division of APREL Laboratories.

SWR

Head



Body



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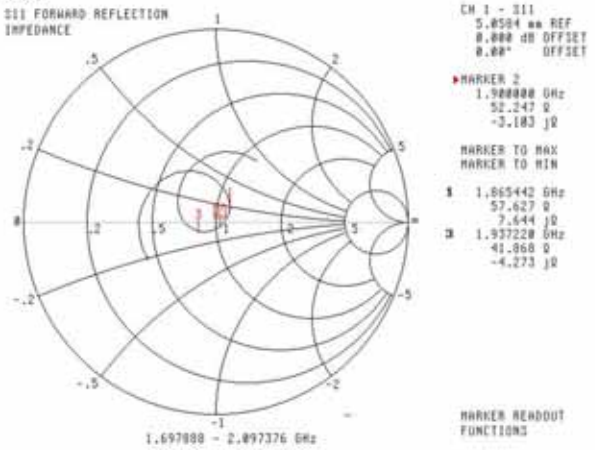
This page has been reviewed for content and attested to by signature within this document.

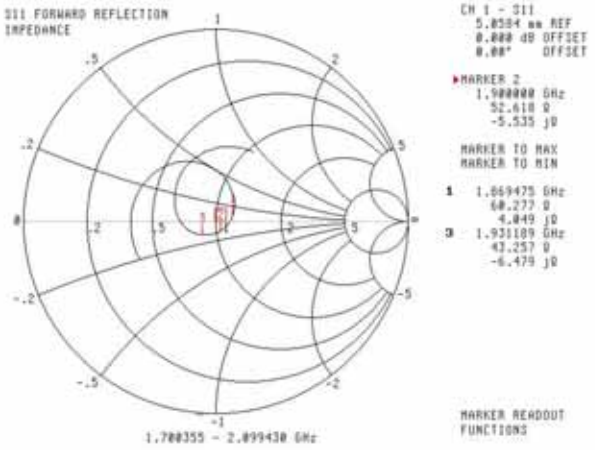
NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



Body



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

NCL Calibration Laboratories
Division of APREL Laboratories.

Test Equipment

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

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

NCL CALIBRATION LABORATORIES

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

CERTIFICATE OF CALIBRATION

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

Validation Dipole (Head & Body)

Manufacturer: APREL Laboratories
Part number: ALS-D-2450-S-2
Frequency: 2450 MHz
Serial No: 220-00758

Customer: Bay Area Compliance Laboratory

Calibrated: 9th October, 2014
Released on: 9th 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

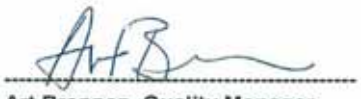
Dipole 220-00758 was received in good condition and was a re-calibration.

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

Attestation

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

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



Art Brennan, Quality Manager

Maryna Nesterova Calibration Engineer

Primary Measurement Standards

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

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

NCL Calibration Laboratories
Division of APREL Laboratories.

Calibration Results Summary

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

Mechanical Dimensions

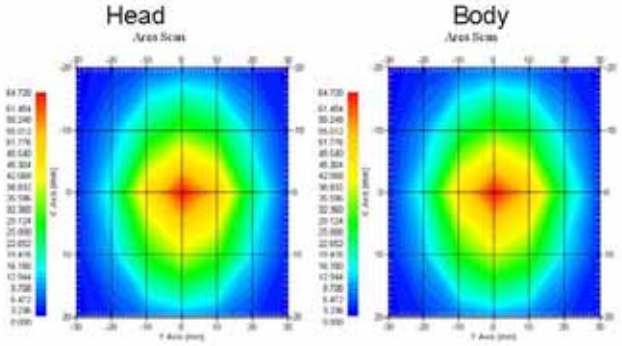
Length: 52.4 mm
Height: 30.3 mm

Electrical Specification

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

System Validation Results

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



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

NCL Calibration Laboratories
Division of APREL Laboratories.

Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 220-00758. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

- SSI-TP-018-ALSAS Dipole Calibration Procedure
- SSI-TP-016 Tissue Calibration Procedure
- IEEE 1528:2013 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques"
- IEC-62209-1:2006 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
  Part 1: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"
- IEC-62209-2:2010 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
  Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"
- D28-002 Procedure for validation of SAR system using a dipole

Conditions

Dipole 220-00758 was a re-calibration.

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

Dipole Calibration uncertainty

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

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

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

NCL Calibration Laboratories
Division of APREL Laboratories.

Dipole Calibration Results

Mechanical Verification

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

Electrical Specification

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

Tissue Validation

	Dielectric constant, ε_r	Conductivity, σ [S/m]
Head Tissue 2450MHz	37.26	1.84
Body Tissue 2450MHz	53.61	1.90

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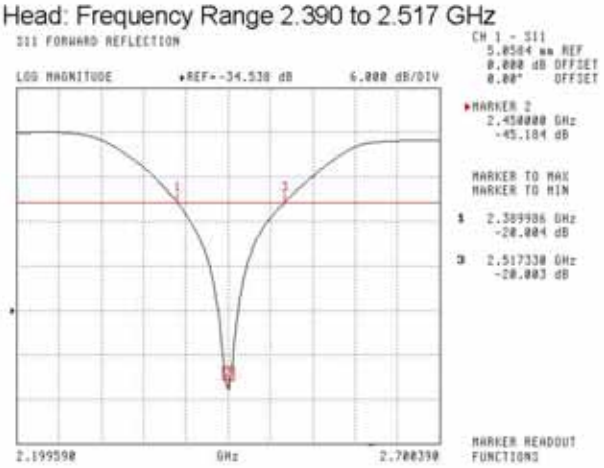
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

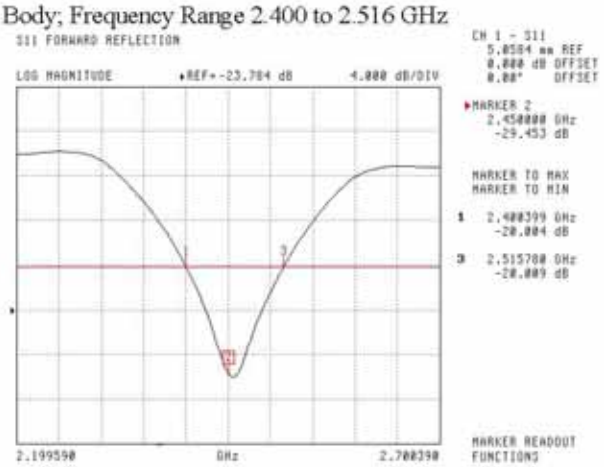
The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

Head: Frequency Range 2.390 to 2.517 GHz



Body; Frequency Range 2.400 to 2.516 GHz



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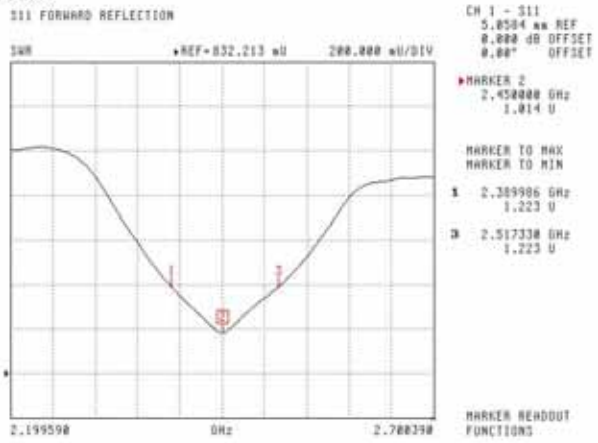
This page has been reviewed for content and attested to by signature within this document.

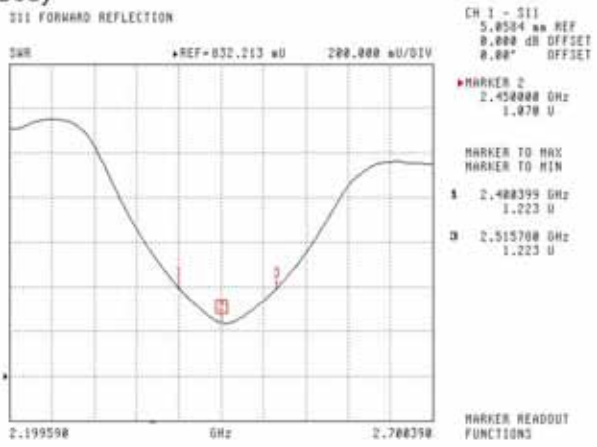
NCL Calibration Laboratories
Division of APREL Laboratories.

SWR

Head



Body



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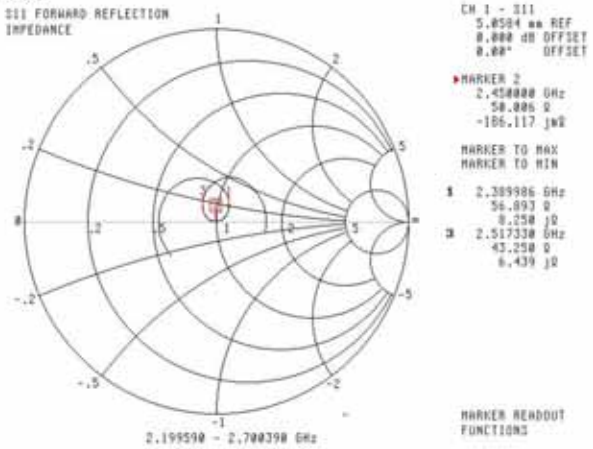
This page has been reviewed for content and attested to by signature within this document.

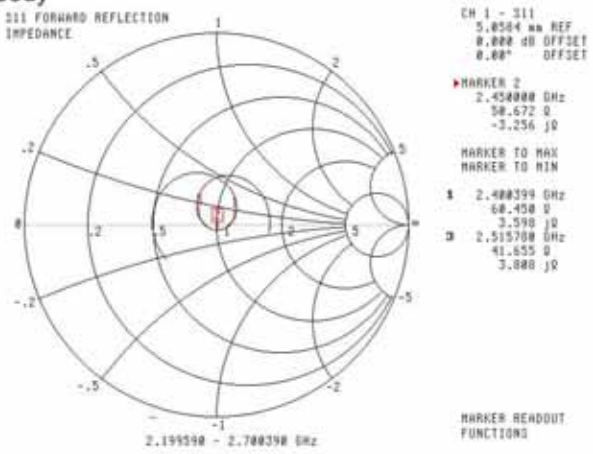
NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



Body



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

NCL Calibration Laboratories
Division of APREL Laboratories.

Test Equipment

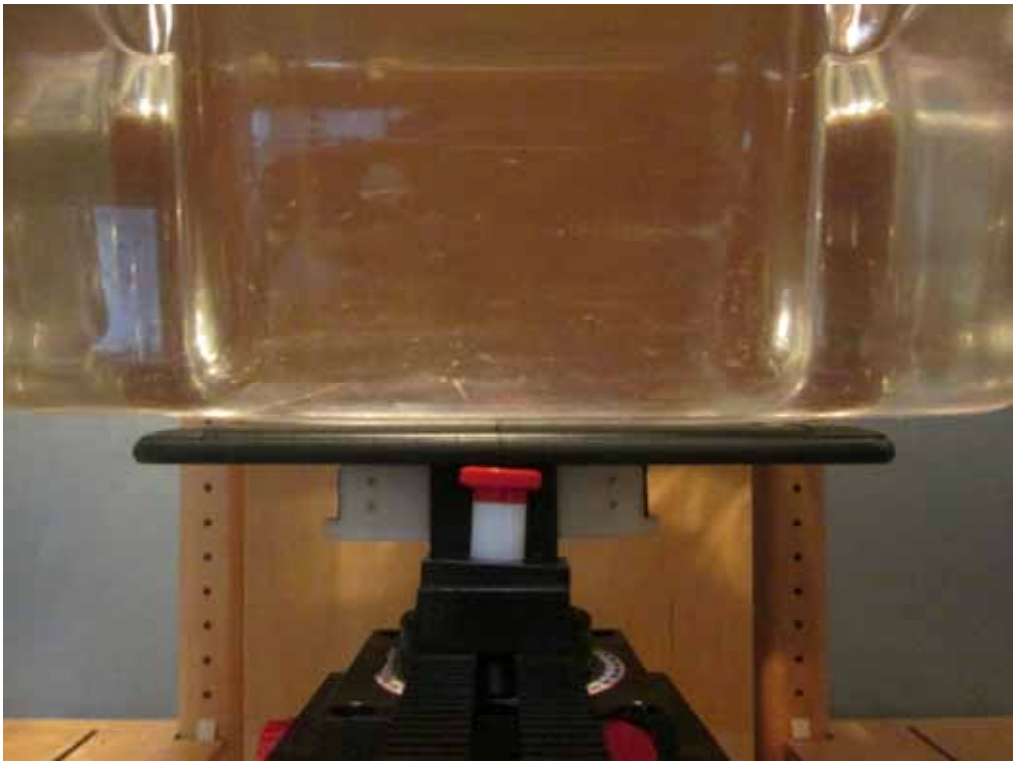
The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2014.

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

APPENDIX D EUT TEST POSITION PHOTOS

Liquid depth ≥ 15cm

Body-worn Back Setup Photo (0mm)

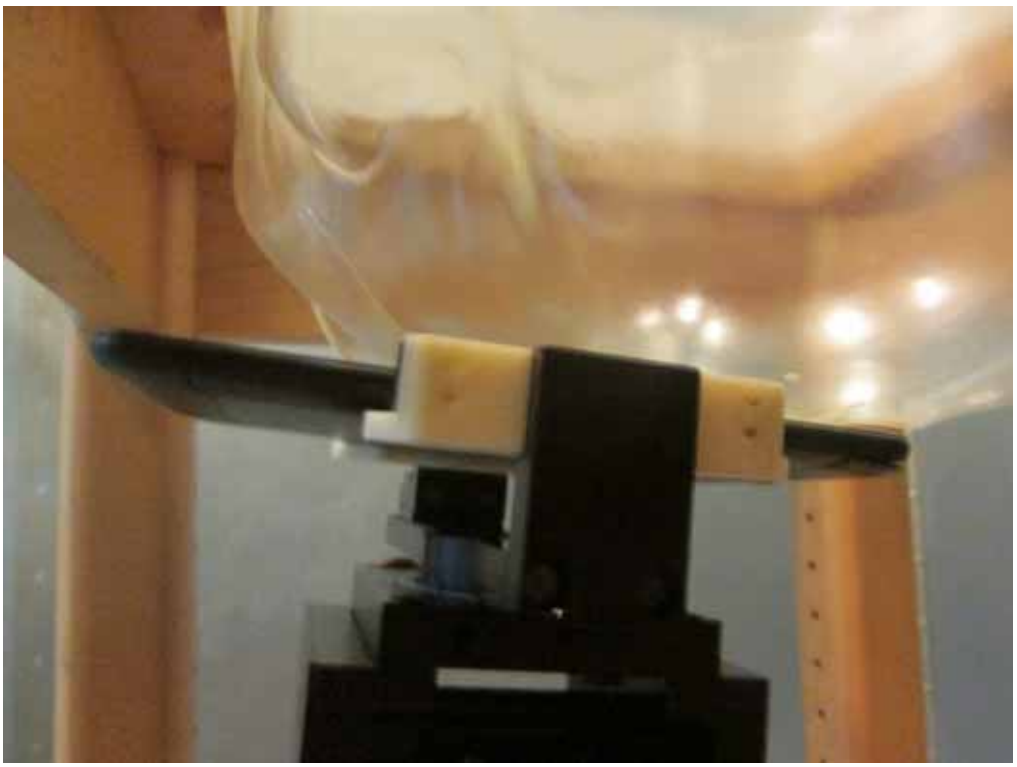


Body-worn Left Setup Photo (0mm)

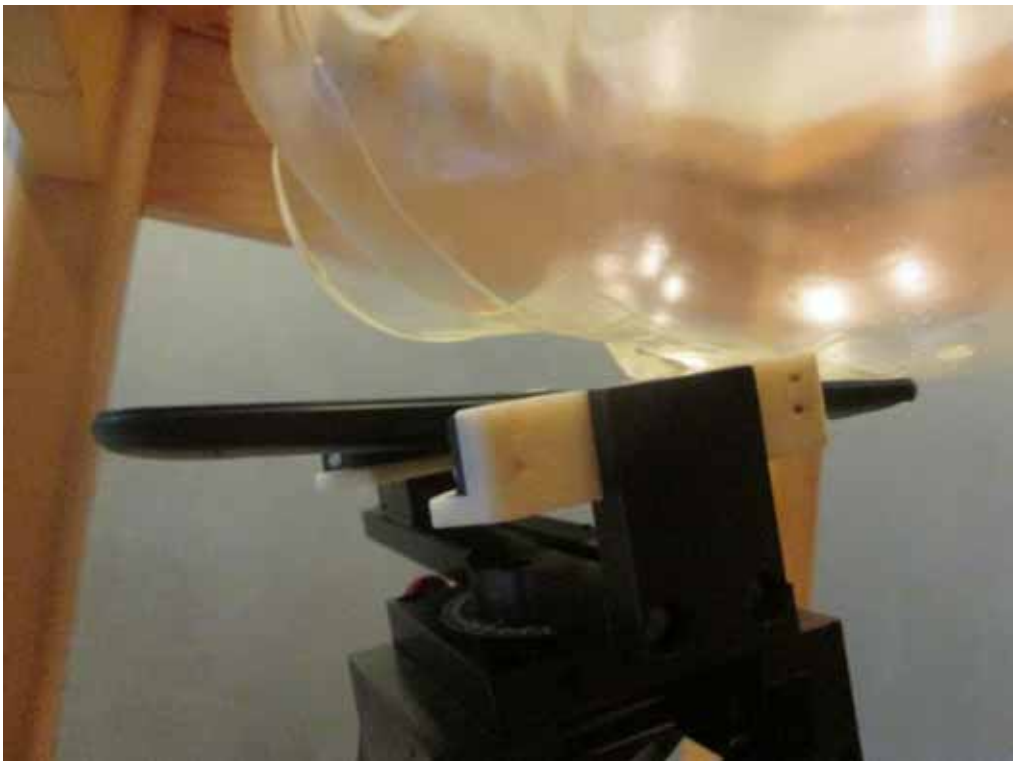
Body-worn Right Setup Photo (0mm)

Body-worn Top Setup Photo (0mm)

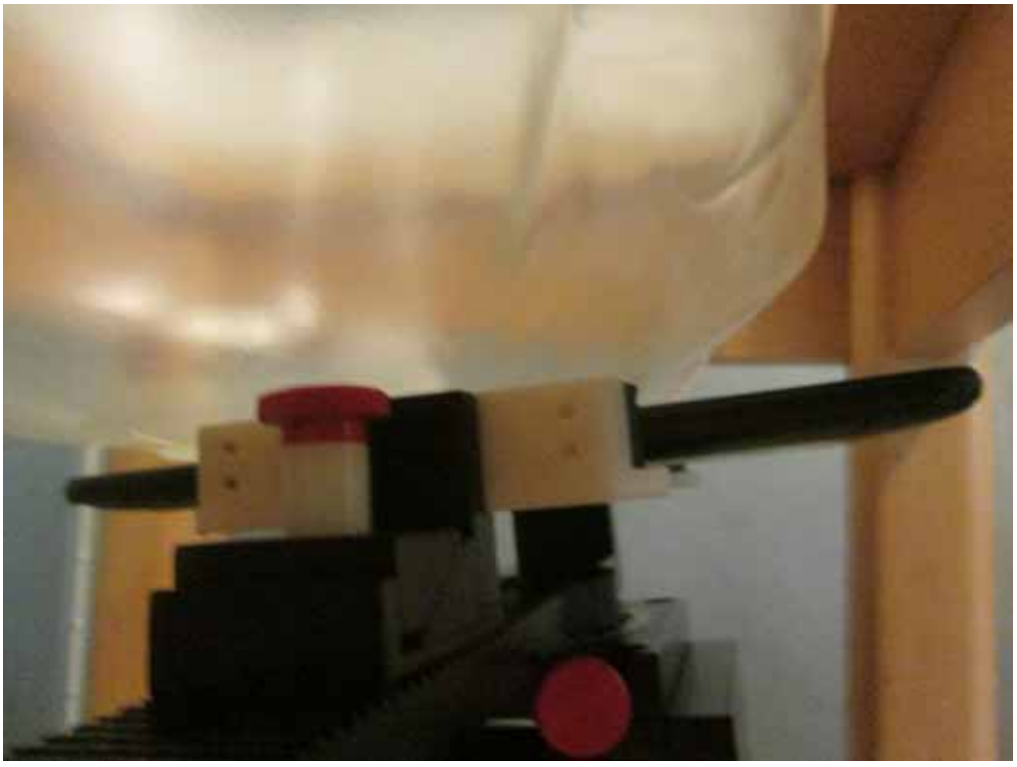
Left Head Touch Setup Photo



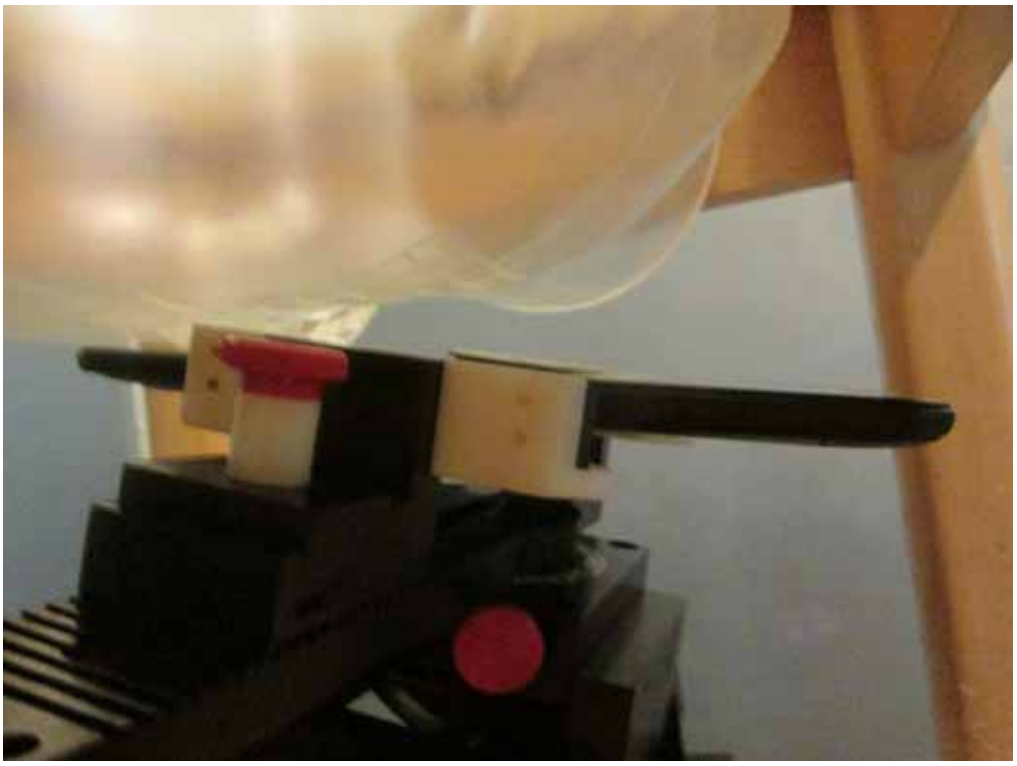
Left Head Tilt Setup Photo



Right Head Touch Setup Photo



Right Head Tilt Setup Photo



APPENDIX E EUT PHOTOS

EUT – Front View

EUT – Back View

EUT –Left Side View

EUT – Right Side View

EUT – Top View

EUT – Bottom View

EUT – Uncover View

APPENDIX F INFORMATIVE REFERENCES

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