SAR EVALUATION REPORT

For

DOPPIO MOBILE INTERNATIONAL LIMITED

ROOM 1708,17/F HART AVENUE PLAZA,5-9 HART AVENUE TSIM SHA TSUI,KOWLOON, Hong Kong

FCC ID: N2GDPF450

Report Type:	**Product Type:**
Original Report	BIOS

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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

Attestation of Test Results		
EUT Information	Company Name	DOPPIO MOBILE INTERNATIONAL LIMITED
	EUT Description	Mobile phone
	Product name	BIOS
	FCC ID	N2GDPF450
	Model Number	DPF450
	Test Date	2015-05-05

Frequency	Max. SAR Level(s) Reported	Limit(W/Kg)
GSM 850	1.151 W/kg 1g Head SAR 0.968 W/kg 1g Body SAR	1. 6
PCS 1900	1.156 W/kg 1g Head SAR 0.930 W/kg 1g Body SAR	
WCDMA850	0.248 W/kg 1g Head SAR 0.175 W/kg 1g Body SAR	
WCDMA1900	0.256 W/kg 1g Head SAR 0.200 W/kg 1g Body SAR	
Wi-Fi(802.11b)	0.321 W/kg 1g Head SAR 0.139 W/kg 1g Body SAR	
Simultaneous	1.477 W/kg 1g Head SAR 1.107 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 KDB447498 D01 General RF Exposure Guidance v05r02. KDB 648474 D04 Handset SAR v01r02. KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03 KDB 865664 D02 RF Exposure Reporting v01r01 KDB 941225 D01 3G SAR Procedures v03 KDB 941225 D06 Hotspot Mode v02

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

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

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY **5**
EUT DESCRIPTION **6**
TECHNICAL SPECIFICATION 6
REFERENCE, STANDARDS, AND GUILDELINES **7**
SAR LIMITS 8
FACILITIES **9**
DESCRIPTION OF TEST SYSTEM **10**
EQUIPMENT LIST AND CALIBRATION **17**
EQUIPMENTS LIST & CALIBRATION INFORMATION 17
SAR MEASUREMENT SYSTEM VERIFICATION **18**
LIQUID VERIFICATION 18
SYSTEM ACCURACY VERIFICATION 23
SAR SYSTEM VALIDATION DATA 24
EUT TEST STRATEGY AND METHODOLOGY **36**
TEST POSITIONS FOR DEVICE OPERATING NEXT TO A PERSON'S EAR 36
CHEEK/TOUCH POSITION 37
EAR/TILT POSITION 37
TEST POSITIONS FOR BODY-WORN AND OTHER CONFIGURATIONS 38
SAR EVALUATION PROCEDURE 39
TEST METHODOLOGY 39
CONDUCTED OUTPUT POWER MEASUREMENT **40**
PROVISION APPLICABLE 40
TEST PROCEDURE 40
MAXIMUM OUTPUT POWER AMONG PRODUCTION UNITS 40
TEST RESULTS: 41
SAR MEASUREMENT RESULTS **47**
SAR TEST DATA 47
SAR SIMULTANEOUS TRANSMISSION DESCRIPTION **54**
SAR PLOTS (SUMMARY OF THE HIGHEST SAR VALUES) 58
APPENDIX A MEASUREMENT UNCERTAINTY **68**
APPENDIX B – PROBE CALIBRATION CERTIFICATES **69**
APPENDIX C DIPOLE CALIBRATION CERTIFICATES **79**
APPENDIX D EUT TEST POSITION PHOTOS **106**
LIQUID DEPTH ≥ 15CM 106
BODY-WORN BACK SETUP PHOTO (10MM) 106
BODY-WORN LEFT SETUP PHOTO (10MM) 107
BODY-WORN RIGHT SETUP PHOTO (10MM) 107
BODY-WORN TOP SETUP PHOTO (10MM) 108
LEFT HEAD TOUCH SETUP PHOTO 108
LEFT HEAD TILT SETUP PHOTO 109
RIGHT HEAD TOUCH SETUP PHOTO 109
RIGHT HEAD TILT SETUP PHOTO 110
APPENDIX E EUT PHOTOS **111**
EUT – FRONT VIEW 111
EUT – BACK VIEW 111
EUT –LEFT SIDE VIEW 112

EUT – RIGHT SIDE VIEW 112
EUT – TOP VIEW 113
EUT – BOTTOM VIEW 113
EUT – UNCOVER VIEW 114

APPENDIX F INFORMATIVE REFERENCES 115

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RDG150430002-20	Original Report	2015-05-08

EUT DESCRIPTION

This report has been prepared on behalf of DOPPIO MOBILE INTERNATIONAL LIMITED and their product, FCC ID: N2GDPF450, Model: DPF450 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/EGPRS 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(802.11b/g/n20): 2412MHz-2462MHz Wi-Fi(802.11n40): 2422MHz-2452MHz Bluetooth : 2402MHz-2480MHz
Conducted RF Power:	GSM 850 : 32.70 dBm PCS 1900: 29.70 dBm WCDMA 850: 23.02 dBm WCDMA 1900: 22.51 dBm Wi-Fi(802.11b/g/n20): 15.65 dBm Wi-Fi(802.11n40): 9.95 dBm Bluetooth:5.71 dBm
Dimensions (L*W*H):	118 mm (L) × 62 mm (W) × 11 mm (H)
Power Source:	3.7 V_{DC} Rechargeable Battery
Normal Operation:	Head and Body-worn

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

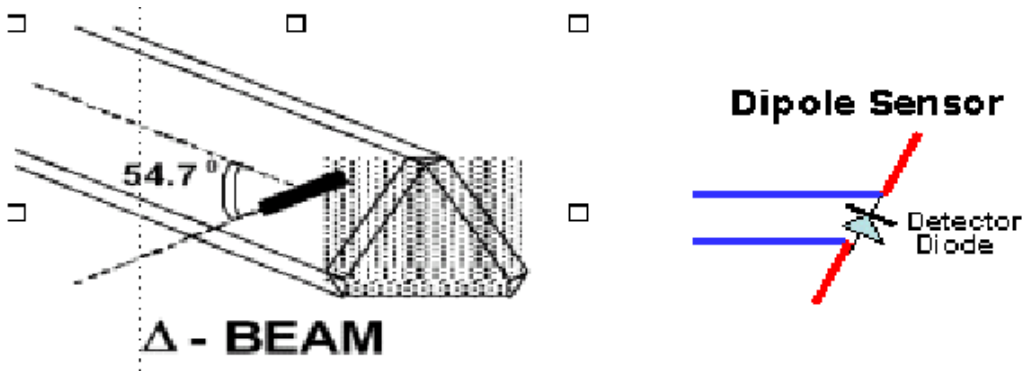
The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

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

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

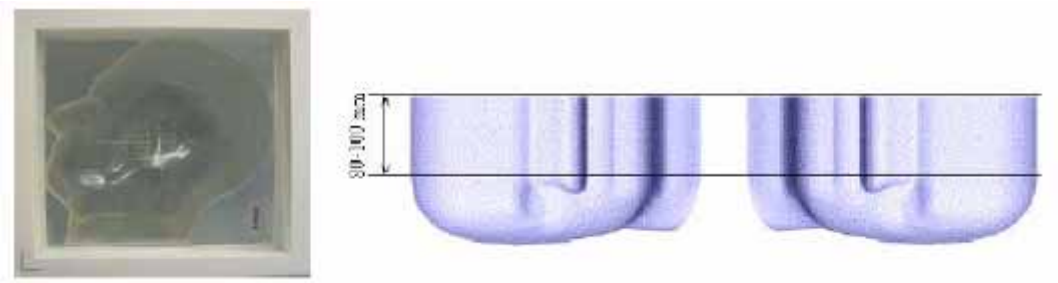
The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales 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	O' (S/m)	εr	O' (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

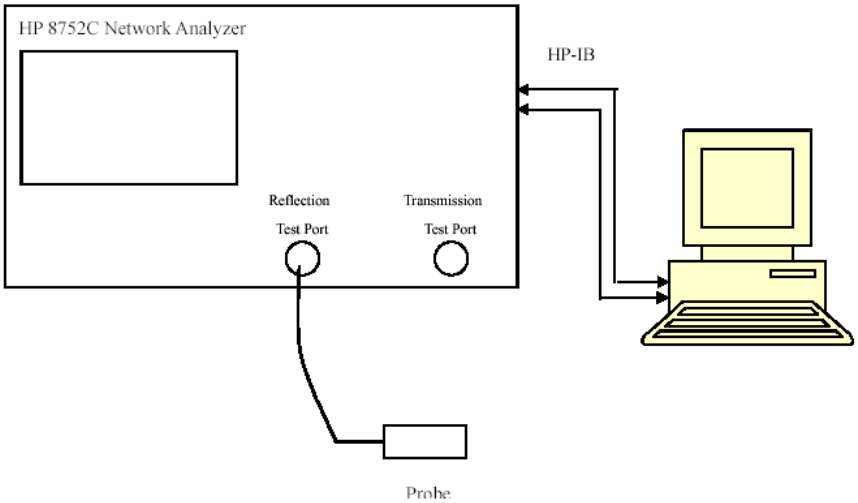
EQUIPMENT LIST AND CALIBRATION

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	2014-10-09	220-00758
Dipole Spacer	ALS-DS-U	N/A	250-00907
Device holder/Positioner	ALS-H-E-SET-2	N/A	170-00510
Left ear SAM phantom	ALS-P-SAM-L	N/A	130-00311
Right ear SAM phantom	ALS-P-SAM-R	N/A	140-00359
UniPhantom	ALS-P-UP-1	N/A	150-00413
Simulated Tissue 835 MHz Head	ALS-TS-835-H	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-TS-835-B	Each Time	270-02101
Simulated Tissue 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	2014-11-23	106891
EMI Test Receiver	ESCI	2014-06-13	101746

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

Frequency	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε_r	σ (S/m)	ε_r	σ (S/m)	$\Delta\varepsilon_r$	Δσ (S/m)	
824.2	Head	41.00	0.90	41.50	0.90	-1.205	0.000	±5
	Body	53.77	0.95	55.20	0.97	-2.591	-2.062	±5
826.4	Head	41.05	0.91	41.50	0.90	-1.084	1.111	±5
	Body	53.84	0.95	55.20	0.97	-2.464	-2.062	±5
836.6	Head	41.07	0.92	41.50	0.90	-1.036	2.222	±5
	Body	53.77	0.96	55.20	0.97	-2.591	-1.031	±5
846.6	Head	41.02	0.91	41.50	0.90	-1.157	1.111	±5
	Body	53.87	0.97	55.20	0.97	-2.409	0.000	±5
848.8	Head	41.00	0.92	41.50	0.90	-1.205	2.222	±5
	Body	53.80	0.98	55.20	0.97	-2.536	1.031	±5
1850.2	Head	39.66	1.36	40.00	1.40	-0.850	-2.857	±5
	Body	51.97	1.49	53.30	1.52	-2.495	-1.974	±5
1852.4	Head	39.69	1.37	40.00	1.40	-0.775	-2.143	±5
	Body	52.01	1.49	53.30	1.52	-2.420	-1.974	±5
1880.0	Head	39.55	1.39	40.00	1.40	-1.125	-0.714	±5
	Body	52.07	1.52	53.30	1.52	-2.308	0.000	±5
1907.6	Head	39.65	1.41	40.00	1.40	-0.875	0.714	±5
	Body	52.08	1.54	53.30	1.52	-2.289	1.316	±5
1909.8	Head	39.65	1.42	40.00	1.40	-0.875	1.429	±5
	Body	51.81	1.53	53.30	1.52	-2.795	0.658	±5
2412	Head	39.61	1.79	39.20	1.80	1.046	-0.556	±5
	Body	52.88	1.94	52.70	1.95	0.342	-0.513	±5
2437	Head	39.69	1.84	39.20	1.80	1.250	2.222	±5
	Body	52.86	1.91	52.70	1.95	0.304	-2.051	±5
2462	Head	39.98	1.86	39.20	1.80	1.990	3.333	±5
	Body	52.81	2.03	52.70	1.95	0.209	4.103	±5

**Liquid Verification was performed on 2015-05-05.*

Please refer to the following tables.

835 MHz Head				835 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
824.0	41.0013	19.6694		824.0	53.7705	20.6849
824.5	41.0318	19.6811		824.5	53.7801	20.6861
825.0	41.0848	19.7015		825.0	53.8157	20.6228
825.5	41.1051	19.7092		825.5	53.8430	20.6389
826.0	41.0695	19.7009		826.0	53.8357	20.6155
826.5	41.0522	19.7064		826.5	53.8447	20.6996
827.0	41.0041	19.7384		827.0	53.8486	20.6133
827.5	41.0689	19.6853		827.5	53.8468	20.6388
828.0	41.0100	19.7071		828.0	53.8221	20.6688
828.5	41.0266	19.7005		828.5	53.7979	20.6944
829.0	41.0370	19.7470		829.0	53.8200	20.6521
829.5	40.9978	19.6787		829.5	53.7982	20.6325
830.0	41.0552	19.7139		830.0	53.7824	20.6505
830.5	41.0353	19.7440		830.5	53.8081	20.7081
831.0	41.0456	19.7689		831.0	53.7723	20.6144
831.5	41.0112	19.7197		831.5	53.7650	20.6401
832.0	41.0886	19.6790		832.0	53.8362	20.6646
832.5	41.0256	19.6928		832.5	53.8207	20.6354
833.0	41.0550	19.7183		833.0	53.7761	20.6286
833.5	41.0832	19.6673		833.5	53.7932	20.6373
834.0	41.0106	19.7371		834.0	53.7828	20.7001
834.5	41.0449	19.7640		834.5	53.7856	20.7002
835.0	40.9967	19.7074		835.0	53.8556	20.6211
835.5	41.0714	19.7458		835.5	53.7743	20.6613
836.0	41.0107	19.7398		836.0	53.7913	20.6548
836.5	41.0977	19.7395		836.5	53.8499	20.6953
837.0	41.0492	19.7072		837.0	53.7740	20.6278
837.5	41.0648	19.7029		837.5	53.7782	20.6169
838.0	41.0238	19.6942		838.0	53.8689	20.6997
838.5	41.0707	19.7141		838.5	53.8191	20.6827
839.0	41.0790	19.7026		839.0	53.7715	20.6489
839.5	41.0238	19.7140		839.5	53.8000	20.6636
840.0	41.0333	19.4234		840.0	53.7806	20.7036
840.5	41.0013	19.3652		840.5	53.7700	20.6839
841.0	41.0822	19.3722		841.0	53.7677	20.6261
841.5	41.0948	19.4623		841.5	53.8681	20.6962
842.0	41.0901	19.4604		842.0	53.8527	20.6817
842.5	41.0624	19.3898		842.5	53.8641	20.7094
843.0	41.0296	19.4307		843.0	53.7797	20.6129
843.5	40.9998	19.4112		843.5	53.8397	20.6237
844.0	41.0098	19.4665		844.0	53.8191	20.6994
844.5	41.0340	19.4633		844.5	53.7913	20.6579
845.0	41.0377	19.4584		845.0	53.8199	20.6959
845.5	41.0884	19.4337		845.5	53.8106	20.6598
846.0	41.0584	19.4352		846.0	53.8487	20.6571
846.5	41.0155	19.4084		846.5	53.8731	20.6766
847.0	41.0289	19.4694		847.0	53.7919	20.6284
847.5	40.9987	19.3671		847.5	53.8618	20.6409
848.0	41.0349	19.3727		848.0	53.7996	20.6693
848.5	41.0603	19.4638		848.5	53.7958	20.6818
849.0	40.9970	19.4029		849.0	53.7958	20.7013

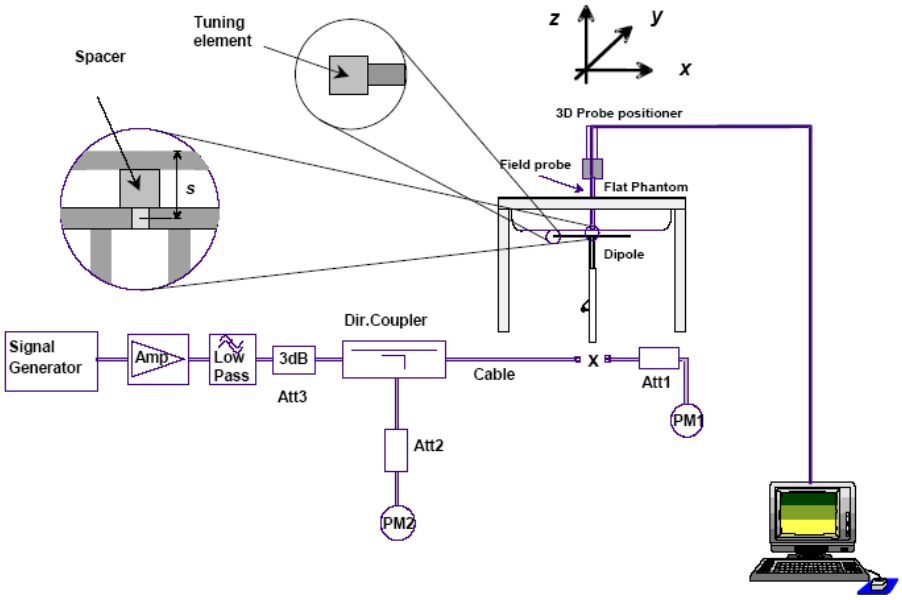
1900 MHz Head				1900 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1850.0	39.6617	13.2606		1850.0	51.9740	14.4993
1851.2	39.6385	13.2423		1851.2	52.0735	14.5583
1852.4	39.6941	13.3384		1852.4	52.0091	14.4588
1853.6	39.5834	13.2799		1853.6	52.0551	14.4562
1854.8	39.6374	13.3021		1854.8	52.0890	14.5049
1856.0	39.7127	13.3466		1856.0	51.9851	14.5262
1857.2	39.7358	13.3445		1857.2	52.0549	14.5036
1858.4	39.5635	13.3515		1858.4	51.8371	14.5794
1859.6	39.5608	13.3297		1859.6	52.0332	14.5417
1860.8	39.7384	13.2579		1860.8	51.8703	14.5030
1862.0	39.5494	13.2640		1862.0	52.0525	14.5596
1863.2	39.5566	13.3256		1863.2	51.9240	14.4565
1864.4	39.6363	13.2644		1864.4	51.7673	14.5549
1865.6	39.6289	13.4203		1865.6	51.8689	14.4423
1866.8	39.5829	13.3311		1866.8	51.9535	14.5510
1868.0	39.7187	13.2572		1868.0	52.0947	14.5795
1869.2	39.6095	13.4117		1869.2	51.9445	14.5714
1870.4	39.6714	13.2954		1870.4	51.7349	14.5425
1871.6	39.6194	13.4283		1871.6	51.7886	14.4830
1872.8	39.7295	13.4042		1872.8	52.0279	14.5507
1874.0	39.6034	13.2992		1874.0	51.8791	14.4379
1875.2	39.5961	13.3337		1875.2	52.0700	14.4310
1876.4	39.6892	13.2680		1876.4	51.9601	14.5423
1877.6	39.7223	13.3642		1877.6	51.9800	14.4285
1878.8	39.6976	13.4337		1878.8	51.8190	14.4823
1880.0	39.5522	13.3016		1880.0	52.0731	14.4939
1881.2	39.7354	13.3656		1881.2	52.0101	14.4853
1882.4	39.6906	13.4351		1882.4	52.0451	14.5125
1883.6	39.5489	13.3872		1883.6	51.8293	14.4327
1884.8	39.7150	13.3523		1884.8	51.8939	14.5048
1886.0	39.5461	13.2858		1886.0	51.7966	14.5078
1887.2	39.5966	13.2969		1887.2	51.9454	14.4554
1888.4	39.5478	13.3860		1888.4	51.7997	14.5734
1889.6	39.6155	13.3600		1889.6	52.0142	14.4683
1890.8	39.5568	13.4332		1890.8	51.9660	14.5579
1892.0	39.6252	13.2690		1892.0	51.7418	14.4866
1893.2	39.7119	13.3209		1893.2	51.9580	14.4206
1894.4	39.5478	13.3330		1894.4	51.9490	14.5017
1895.6	39.6200	13.2739		1895.6	51.7885	14.5188
1896.8	39.6238	13.3029		1896.8	51.8179	14.4683
1898.0	39.5799	13.3902		1898.0	51.9495	14.4266
1899.2	39.5860	13.3694		1899.2	51.9494	14.5106
1900.4	39.5708	13.3276		1900.4	51.9387	14.4215
1901.6	39.7142	13.2975		1901.6	51.9646	14.4825
1902.8	39.7183	13.2999		1902.8	51.7899	14.4388
1904.0	39.7186	13.2972		1904.0	51.9945	14.5457
1905.2	39.6710	13.3221		1905.2	51.9752	14.4456
1906.4	39.7429	13.2820		1906.4	51.8198	14.4173
1907.6	39.6512	13.3032		1907.6	52.0772	14.4879
1908.8	39.5653	13.2597		1908.8	52.0647	14.4215
1910.0	39.6506	13.4078		1910.0	51.8136	14.4251

2450 MHz Head				2450 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
2410.0	39.9360	13.5063		2410.0	52.8528	14.4906
2411.0	39.5244	13.5880		2411.0	52.8824	14.9546
2412.0	39.6051	13.3162		2412.0	52.8766	14.0126
2413.0	39.7804	13.5734		2413.0	52.8344	15.0650
2414.0	39.8071	13.3438		2414.0	52.8127	14.7934
2415.0	39.4867	13.5072		2415.0	52.8884	14.5755
2416.0	39.9381	13.5591		2416.0	52.8020	14.9889
2417.0	39.9004	13.3110		2417.0	52.8609	14.6804
2418.0	39.7466	13.4332		2418.0	52.8420	14.3474
2419.0	39.9491	13.5119		2419.0	52.8604	14.1034
2420.0	39.5521	13.3264		2420.0	52.7969	13.9584
2421.0	39.9379	13.2908		2421.0	52.7936	14.4640
2422.0	39.7720	13.4491		2422.0	52.8719	14.4627
2423.0	39.9618	13.4487		2423.0	52.8317	15.0274
2424.0	39.9366	13.2768		2424.0	52.8193	14.5033
2425.0	39.9426	13.4918		2425.0	52.7968	14.3629
2426.0	39.7713	13.4533		2426.0	52.8467	14.9678
2427.0	39.8477	13.3132		2427.0	52.8832	15.1215
2428.0	39.9609	13.5963		2428.0	52.8722	14.0931
2429.0	39.8921	13.3509		2429.0	52.8091	14.7520
2430.0	39.5543	13.3893		2430.0	52.8255	15.1372
2431.0	39.6828	13.2785		2431.0	52.8655	14.7603
2432.0	39.7715	13.3030		2432.0	52.8254	14.2264
2433.0	39.8152	13.3575		2433.0	52.8651	14.0861
2434.0	39.8299	13.4340		2434.0	52.8606	14.5649
2435.0	39.9948	13.4848		2435.0	52.8587	14.2002
2436.0	39.6094	13.3716		2436.0	52.8816	14.6950
2437.0	39.6898	13.5957		2437.0	52.8640	14.1065
2438.0	39.8568	13.5017		2438.0	52.8695	14.4924
2440.0	39.6881	13.4723		2440.0	52.8156	14.8047
2441.0	39.8211	13.5912		2441.0	52.8464	14.5574
2442.0	39.8383	13.5789		2442.0	52.8389	14.9220
2443.0	39.5458	13.3185		2443.0	52.8528	14.4284
2444.0	39.8008	13.4907		2444.0	52.8452	14.4448
2445.0	39.7012	13.4702		2445.0	52.8442	14.5109
2446.0	39.7596	13.2811		2446.0	52.8418	15.1046
2447.0	39.5784	13.4211		2447.0	52.8050	15.1162
2448.0	39.7658	13.5449		2448.0	52.8041	14.7948
2449.0	39.9278	13.4383		2449.0	52.8075	15.1314
2450.0	39.5821	13.5688		2450.0	52.8498	14.6079
2451.0	39.7064	13.5967		2451.0	52.8242	14.8373
2452.0	39.5570	13.3186		2452.0	52.8154	14.8049
2453.0	39.7142	13.5146		2453.0	52.8066	14.5295
2454.0	39.5726	13.3564		2454.0	52.8158	14.9249
2455.0	39.5703	13.5068		2455.0	52.8762	14.7748
2456.0	39.8241	13.3683		2456.0	52.8070	14.4576
2457.0	39.9902	13.4608		2457.0	52.8741	14.9452
2458.0	39.7071	13.5477		2458.0	52.8687	15.0703
2459.0	39.8469	13.3701		2459.0	52.8741	14.2097
2460.0	39.8709	13.5996		2460.0	52.8182	15.1418
2461.0	39.6822	13.3338		2461.0	52.8907	14.1209
2462.0	39.9797	13.5610		2462.0	52.8100	14.8423

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(835MHz)	ALS-D-835-S-2	180-00558	2014-10-08	2017-10-07
APREL	Dipole antenna(1900MHz)	ALS-D-1900-S-2	210-00710	2014-10-09	2017-10-08
APREL	Dipole antenna(2450MHz)	ALS-D-2450-S-2	220-00758	2014-10-09	2017-10-08

System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2015-05-05	835	Head	1g	9.630	9.773	-1.463	±10
		Body	1g	10.276	9.736	5.546	±10
	1900	Head	1g	39.556	39.481	0.190	±10
		Body	1g	38.877	39.715	-2.110	±10
	2450	Head	1g	50.365	54.916	-8.287	±10
		Body	1g	51.966	52.418	-0.862	±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 : 9.638 W/kg
Power Drift-Finish : 9.727 W/kg
Power Drift (%) : 0.921

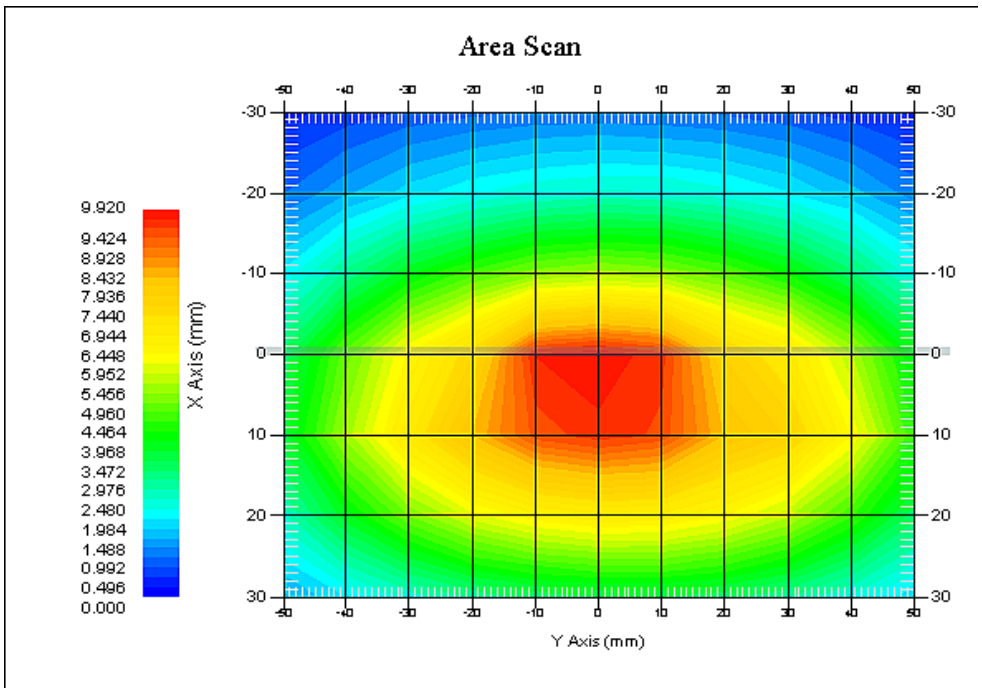
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default
Phantom Data

Tissue Data
Type : Head
Serial No. : 270-01002
Frequency : 835.0 MHz
Last Calib. Date : 05-May-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 41.00 F/m
Sigma : 0.91 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 14-Oct-2014
Frequency Band : 835
Duty Cycle Factor : 1
Conversion Factor : 5.9
Probe Sensitivity : 1.20 1.20 1.20 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 : 9.630 W/kg
10 gram SAR value : 6.382 W/kg
Area Scan Peak SAR : 9.836 W/kg
Zoom Scan Peak SAR : 16.362 W/kg



835 MHz System Validation with Head Tissue

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

System Performance Check 835 MHz Body Liquid

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

Product Data
Device Name : Dipole 835 MHz
Serial No. : 180-00558
Type : Dipole
Model : ALS-D-835-S-2
Frequency Band : 835
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 10.355 W/kg
Power Drift-Finish : 10.521 W/kg
Power Drift (%) : 1.679

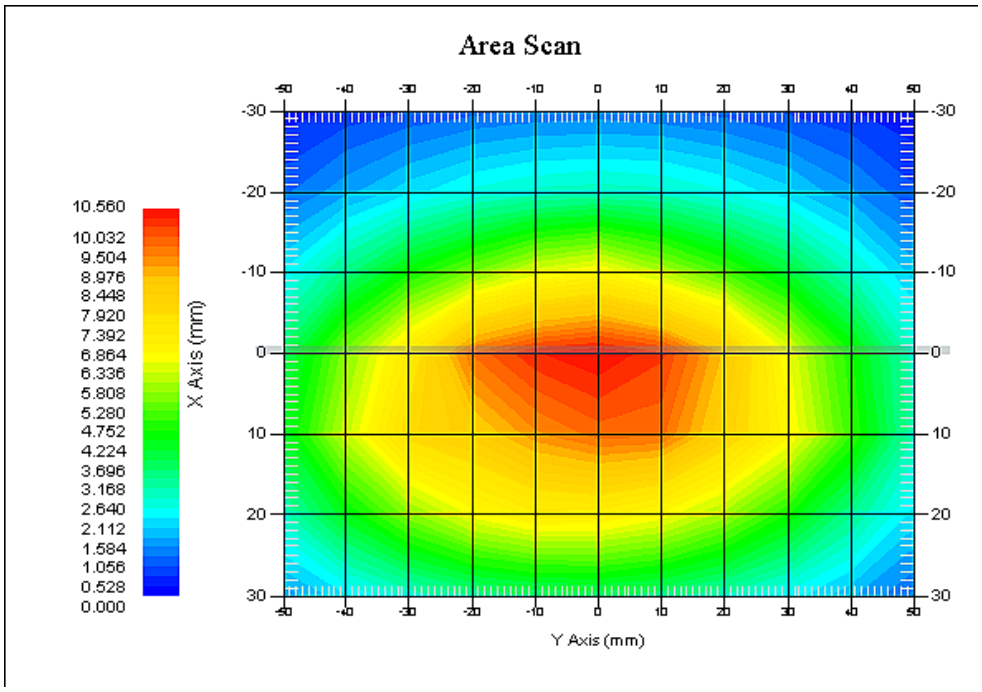
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default
Phantom Data

Tissue Data
Type : Body
Serial No. : 270-02101
Frequency : 835.0 MHz
Last Calib. Date : 05-May-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 53.86 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 : 10.276 W/kg
10 gram SAR value : 6.362 W/kg
Area Scan Peak SAR : 10.520 W/kg
Zoom Scan Peak SAR : 17.598 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 : 37.862 W/kg
Power Drift-Finish : 37.331 W/kg
Power Drift (%) : -1.316

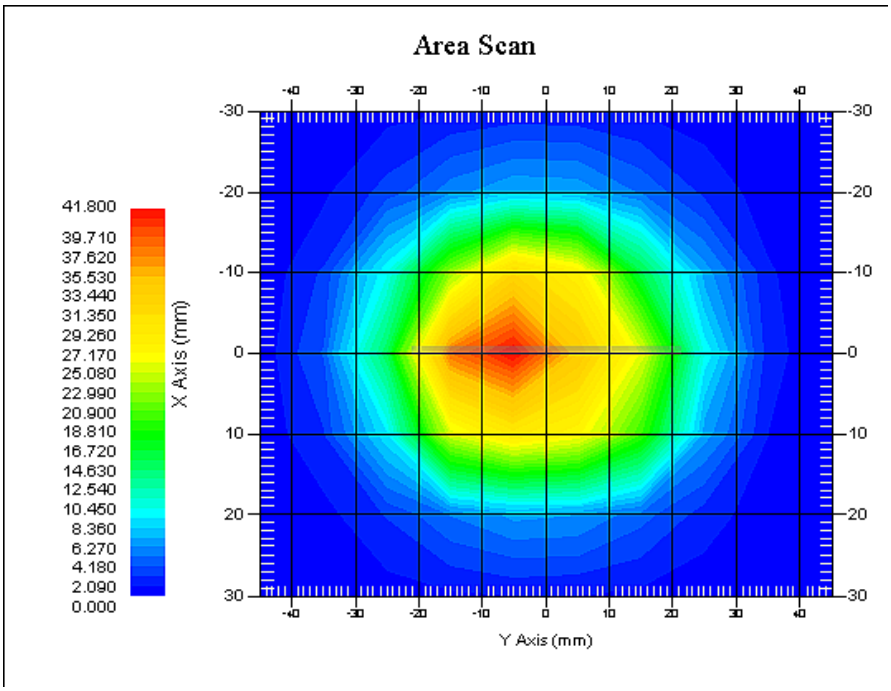
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Head
Serial No. : 295-01103
Frequency : 1900.00 MHz
Last Calib. Date : 05-May-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 39.58 F/m
Sigma : 1.41 S/m
Density : 1000.00 kg/cu. M

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 14-Oct-2014
Frequency Band : 1900
Duty Cycle Factor : 1
Conversion Factor : 4.8
Probe Sensitivity : 1.20 1.20 1.20 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 : 39.556 W/kg
10 gram SAR value : 20.868 W/kg
Area Scan Peak SAR : 41.755 W/kg
Zoom Scan Peak SAR : 71.527 W/kg



1900 MHz System Validation with Head Tissue

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

System Performance Check 1900 MHz Body Liquid

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

Product Data
Device Name : Dipole 1900MHz
Serial No. : 210-00710
Type : Dipole
Model : ALS-D-1900-S-2
Frequency Band : 1900
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 38.436 W/kg
Power Drift-Finish : 38.899 W/kg
Power Drift (%) : 1.185

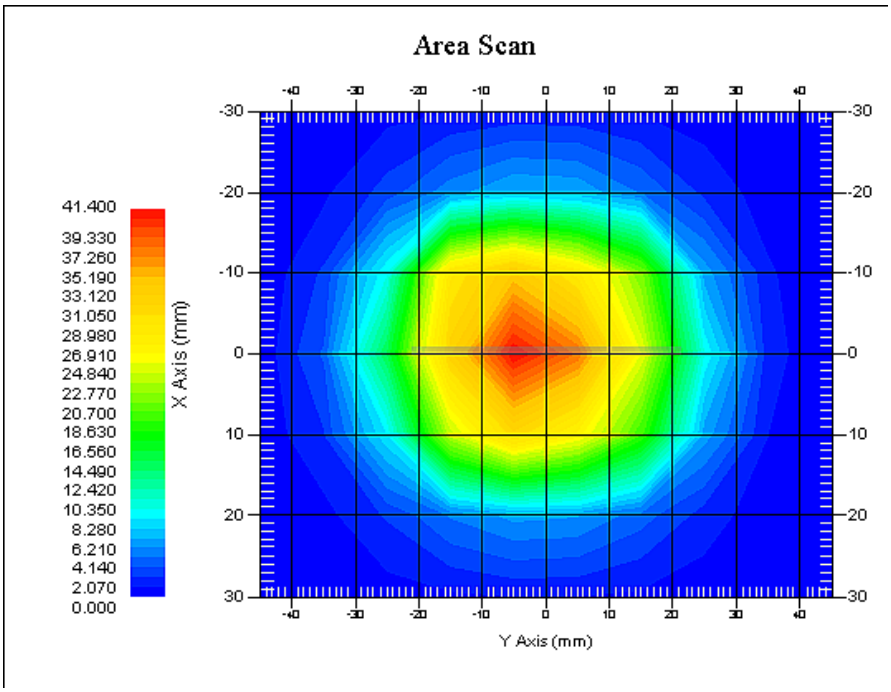
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Body
Serial No. : 295-02102
Frequency : 1900.00 MHz
Last Calib. Date : 05-May-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 51.93 F/m
Sigma : 1.53 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : E-Field
Model : E-020
Type : E-Field Triangle
Serial No. : 500-00283
Last Calib. Date : 14-Oct-2014
Frequency Band : 1900
Duty Cycle Factor : 1
Conversion Factor : 4.5
Probe Sensitivity : 1.20 1.20 1.20 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 : 38.877 W/kg
10 gram SAR value : 20.333 W/kg
Area Scan Peak SAR : 41.360 W/kg
Zoom Scan Peak SAR : 70.802 W/kg



1900 MHz System Validation with Body Tissue

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

System Performance Check 2450 MHz Head Liquid

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

Product Data
Device Name : Dipole 2450MHz
Serial No. : 220-00758
Type : Dipole
Model : ALS-D-2450-S-2
Frequency Band : 2450 MHz
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 50.374 W/kg
Power Drift-Finish : 49.769 W/kg
Power Drift (%) : -1.236

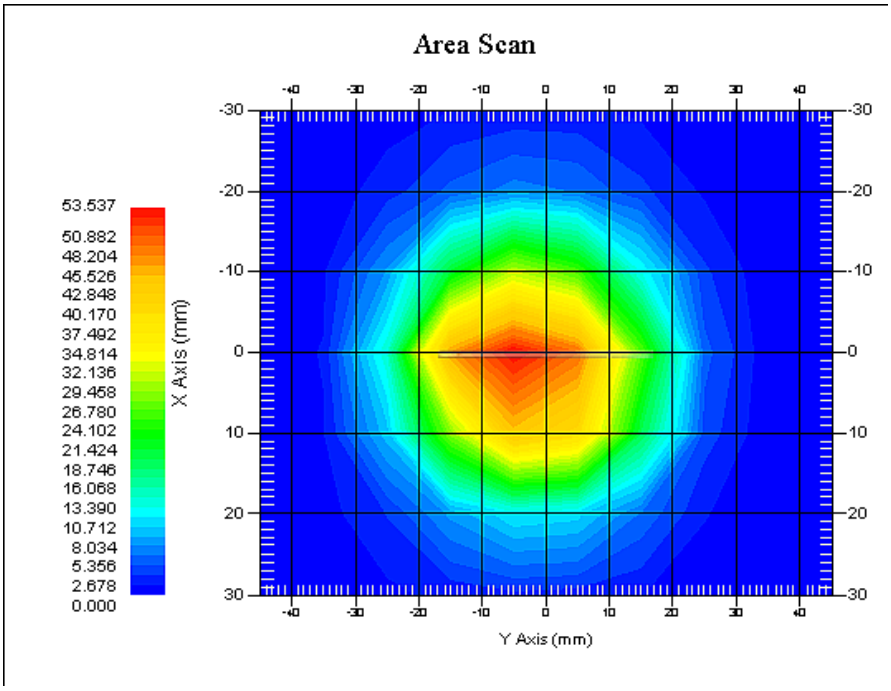
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Head
Serial No. : 290-01109
Frequency : 2450.0 MHz
Last Calib. Date : 05-May-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 50.00 RH%
Epsilon : 39.58 F/m
Sigma : 1.85 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 : 50.365 W/kg
10 gram SAR value : 23.618 W/kg
Area Scan Peak SAR : 53.425 W/kg
Zoom Scan Peak SAR : 87.689 W/kg



2450 MHz System Validation with Head Tissue

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

System Performance Check 2450 MHz Body Liquid

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

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

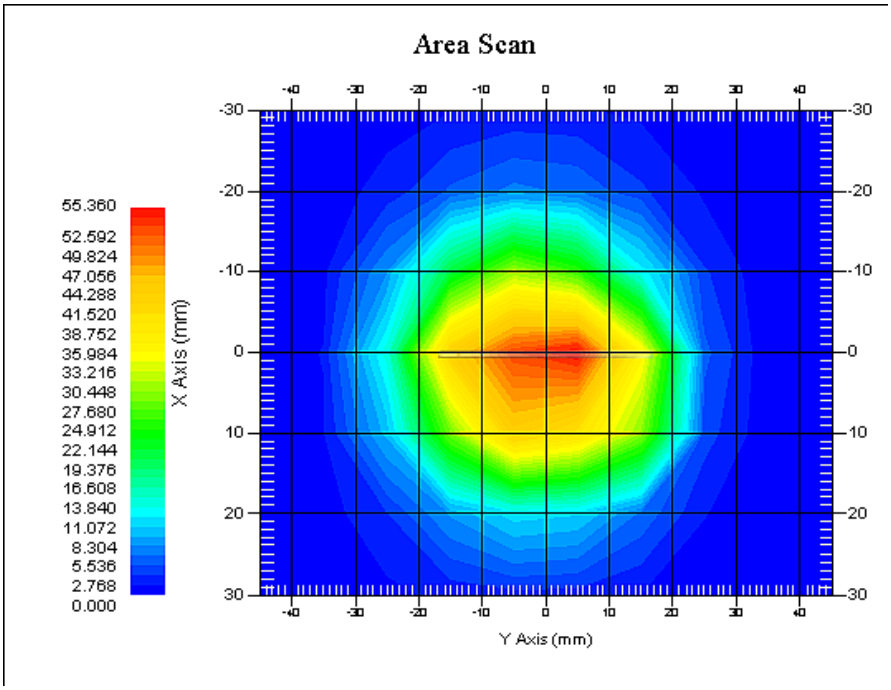
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : BODY
Serial No. : 290-01109
Frequency : 2450.0 MHz
Last Calib. Date : 05-May-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 50.00 RH%
Epsilon : 52.85 F/m
Sigma : 1.99 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 : 51.966 W/kg
10 gram SAR value : 23.519 W/kg
Area Scan Peak SAR : 55.255 W/kg
Zoom Scan Peak SAR : 90.396 W/kg



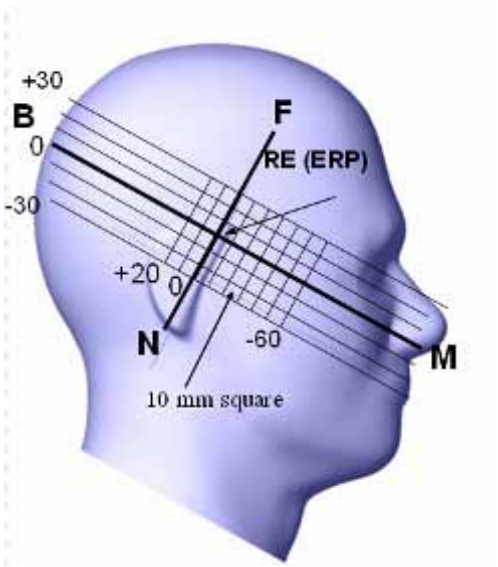
2450 MHz System Validation with Body Tissue

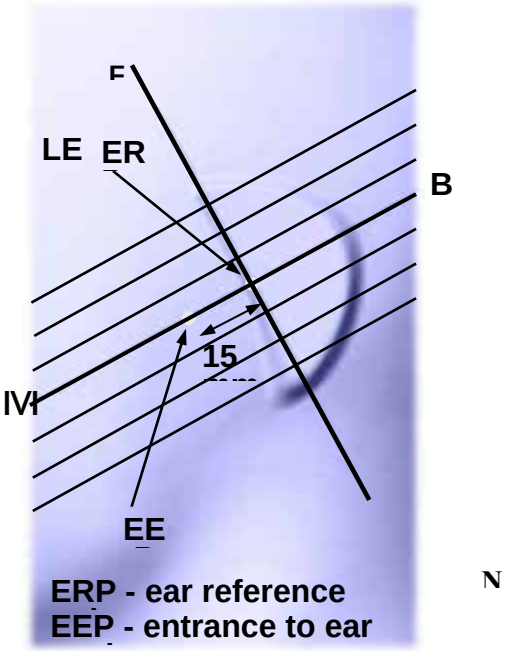
EUT TEST STRATEGY AND METHODOLOGY

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

This category includes most wireless handsets with fixed, retractable or internal antennas located toward the top half of the device, with or without a foldout, sliding or similar keypad cover. The handset should have its earpiece located within the upper 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

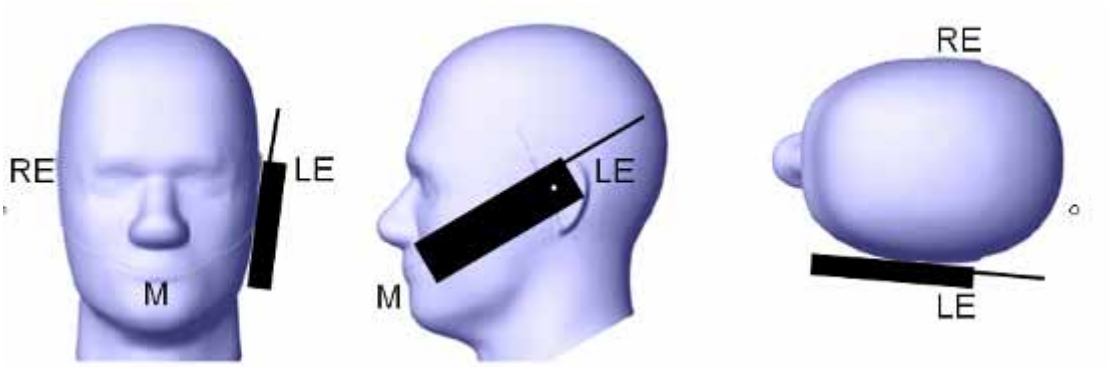
The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

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

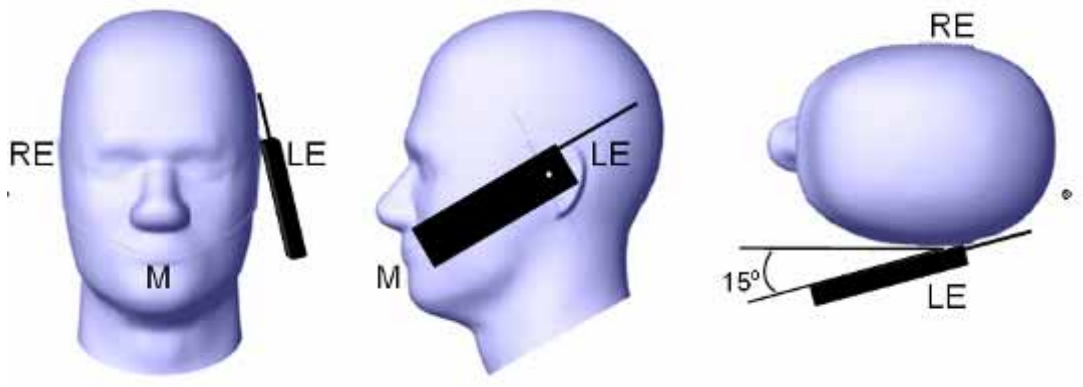
With the handset aligned in the "Cheek/Touch Position":

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, Tilt/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s). If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

Ear /Tilt 15° Position



Test positions for body-worn and other configurations

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

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

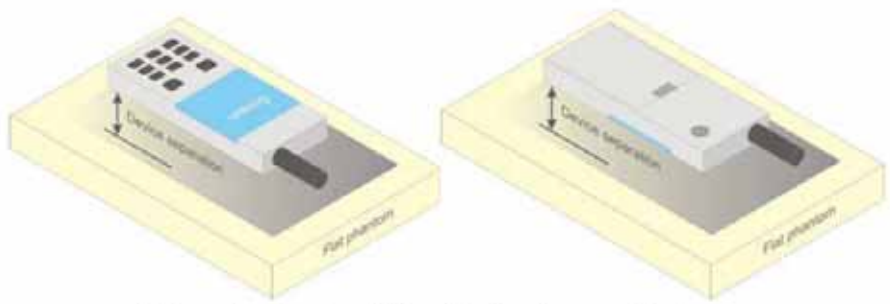


Figure 5 – Test positions for body-worn devices

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

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

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

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

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

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

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

Test methodology

KDB447498 D01 General RF Exposure Guidance v05r02.
KDB 648474 D04 Handset SAR v01r02.
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
KDB 865664 D02 RF Exposure Reporting v01r01
KDB 941225 D01 3G SAR Procedures v03
KDB 941225 D06 Hotspot Mode v02

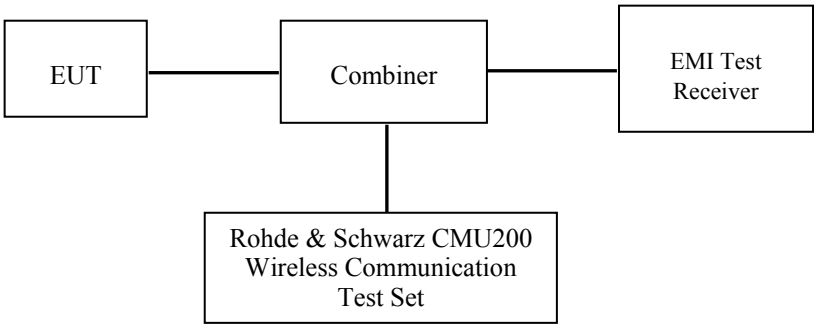
CONDUCTED OUTPUT POWER MEASUREMENT

Provision Applicable

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

Test Procedure

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



GSM&3G

Maximum Output Power among production units

Max Target Power for Production Unit (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	32.80	32.80	32.80
GPRS 1 slot	32.60	32.60	32.60
GPRS 2 slot	31.80	31.80	31.80
GPRS 3 slot	30.00	30.00	30.00
GPRS 4 slot	29.00	29.00	29.00
EGPRS 1 slot	25.70	25.70	25.70
EGPRS 2 slot	23.90	23.90	23.90
EGPRS 3 slot	21.60	21.60	21.60
EGPRS 4 slot	20.30	20.30	20.30
PCS 1900	29.80	29.80	29.80
GPRS 1 slot	29.70	29.70	29.70
GPRS 2 slot	28.90	28.90	28.90
GPRS 3 slot	27.10	27.10	27.10
GPRS 4 slot	26.20	26.20	26.20
EGPRS 1 slot	23.60	23.60	23.60
EGPRS 2 slot	22.40	22.40	22.40
EGPRS 3 slot	19.80	19.80	19.80
EGPRS 4 slot	18.50	18.50	18.50
WCDMA850	23.10	23.10	23.10
WCDMA1900	22.60	22.60	22.60
Wi-Fi	15.70	15.70	15.70
Bluetooth	5.80	5.80	5.80

Test Results:

GSM:

Band	Frequency (MHz)	Conducted Output Power	
		Meas. Power (dBm)	Meas. Power (W)
GSM 850	824.2	**32.70**	1.862
	836.6	32.60	1.820
	848.8	32.60	1.820
PCS 1900	1850.2	**29.70**	0.933
	1880.0	29.50	0.891
	1909.8	29.50	0.891

GPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	32.55	31.75	29.96	28.94
	190	836.6	32.47	31.71	29.91	28.88
	251	848.8	32.47	31.75	29.94	28.92
PCS 1900	512	1850.2	29.68	28.89	26.97	25.94
	661	1880.0	29.53	28.75	26.89	25.88
	810	1909.8	29.47	28.86	27.07	26.15

EGPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	25.61	23.87	21.51	20.22
	190	836.6	25.03	23.58	21.29	20.13
	251	848.8	24.81	23.42	21.08	20.17
PCS 1900	512	1850.2	23.51	22.31	19.72	18.41
	661	1880.0	23.26	21.98	19.51	18.02
	810	1909.8	22.91	21.52	19.09	17.61

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	23.55	25.75	25.71	**25.94**
	190	836.6	23.47	25.71	25.66	25.88
	251	848.8	23.47	25.75	25.69	25.92
PCS 1900	512	1850.2	20.68	22.89	22.72	22.94
	661	1880.0	20.53	22.75	22.64	22.88
	810	1909.8	20.47	22.86	22.82	**23.15**

The time based average power for EGPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	16.61	**17.87**	17.26	17.22
	190	836.6	16.03	17.58	17.04	17.13
	251	848.8	15.81	17.42	16.83	17.17
PCS 1900	512	1850.2	14.51	**16.31**	15.47	15.41
	661	1880.0	14.26	15.98	15.26	15.02
	810	1909.8	13.91	15.52	14.84	14.61

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

WCDMA-Release 99:

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

WCDMA General Settings	**Loopback Mode**	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	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_FCls	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	22.81	0.191
	836.6	4183	**23.02**	0.200
	846.6	4233	22.67	0.185
WCDMA 1900	1852.4	9262	22.47	0.177
	1880.0	9400	**22.51**	0.178
	1907.6	9538	22.21	0.166

Results (HSDPA)

Band	Frequency (MHz)	Channel NO.	Conducted Output Power (dBm)			
			Subset 1	Subset 2	Subset 3	Subset 4
WCDMA 850	826.4	4132	21.77	21.76	21.74	21.78
	836.6	4183	21.82	21.78	21.80	21.83
	846.6	4233	21.62	21.64	21.57	21.59
WCDMA 1900	1852.4	9262	21.49	21.54	21.47	21.52
	1880.0	9400	21.54	21.50	21.57	21.55
	1907.6	9538	21.23	21.21	21.27	21.24

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	21.79	21.52	21.41	21.44	21.53
	836.6	4183	21.84	21.81	21.86	21.87	21.91
	846.6	4233	21.66	21.70	21.64	21.69	21.63
WCDMA 1900	1852.4	8562	21.47	21.44	21.46	21.49	21.51
	1880.0	8662	21.53	21.52	21.57	21.50	21.56
	1907.6	8763	21.08	21.06	21.09	21.00	21.03

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	4.95	3.126
	(Middle)2441	5.49	3.540
	(High)2480	**5.71**	3.724
EDR(4-DQPSK)	(Low)2402	4.32	2.704
	(Middle)2441	4.76	2.992
	(High)2480	4.96	3.133
EDR-8DPSK	(Low)2402	4.40	2.754
	(Middle)2441	4.86	3.062
	(High)2480	5.09	3.228
BT4.0	(Low)2402	-2.38	0.578
	(Middle)2440	-2.33	0.585
	(High)2480	-2.32	0.586

Wi-Fi

Band	Frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
802.11b	2412	**15.65**	36.728
	2437	15.22	33.266
	2462	15.50	35.481
802.11g	2412	13.19	20.845
	2437	13.56	22.699
	2462	13.49	22.336
802.11n HT20	2412	9.30	8.511
	2437	9.75	9.441
	2462	9.74	9.419
802.11n HT40	2422	9.95	9.886
	2437	9.86	9.683
	2452	9.32	8.551

Note:

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

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

SAR Test Data

Environmental Conditions

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

Testing was performed by Terry XiaHou on 2015-05-05

GSM 850:

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	824.2	GSM	1.358	32.70	32.80	1.023	1.125	**1.151**	**1#**
	836.6	GSM	-1.130	32.60	32.80	1.047	0.966	1.011	/
	848.8	GSM	-1.466	32.60	32.80	1.047	0.911	0.954	/
Left Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	1.375	32.60	32.80	1.047	0.760	0.796	/
	848.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	824.2	GSM	-2.054	32.70	32.80	1.023	0.974	0.996	/
	836.6	GSM	1.545	32.60	32.80	1.047	0.915	0.958	/
	848.8	GSM	1.147	32.60	32.80	1.047	0.863	0.904	/
Right Head Tilt	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	-2.269	32.60	32.80	1.047	0.738	0.773	/
	848.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	824.2	GSM	/	/	/	/	/	/	/
	836.6	GSM	0.775	32.60	32.80	1.047	0.692	0.725	/
	848.8	GSM	/	/	/	/	/	/	/

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

PCS Band:

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1850.2	GSM	-0.823	29.70	29.80	1.023	0.976	0.999	/
	1880.0	GSM	-0.571	29.50	29.80	1.072	0.935	1.002	/
	1909.8	GSM	-2.336	29.50	29.80	1.072	1.079	**1.156**	**2#**
Left Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	2.842	29.50	29.80	1.072	0.716	0.767	/
	1909.8	GSM	/	/	/	/	/	/	/
Right Head Cheek	1850.2	GSM	-2.058	29.70	29.80	1.023	0.912	0.933	/
	1880.0	GSM	-2.994	29.50	29.80	1.072	0.821	0.880	/
	1909.8	GSM	1.636	29.50	29.80	1.072	0.963	1.032	/
Right Head Tilt	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-1.650	29.50	29.80	1.072	0.727	0.779	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back-Headset (10mm)	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	1.683	29.50	29.80	1.072	0.612	0.656	/
	1909.8	GSM	/	/	/	/	/	/	/

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. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.
4. When the maximum output power variation across the required test channels is > 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)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	0.975	23.02	23.10	1.019	0.225	0.229	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Left Head Tilt	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	-3.138	23.02	23.10	1.019	0.167	0.170	/
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Cheek	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	1.873	23.02	23.10	1.019	0.243	**0.248**	**3#**
	846.6	WCDMA 850	/	/	/	/	/	/	/
Right Head Tilt	826.4	WCDMA 850	/	/	/	/	/	/	/
	836.6	WCDMA 850	2.820	23.02	23.10	1.019	0.181	0.184	/
	846.6	WCDMA 850	/	/	/	/	/	/	/

WCDMA1900

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-1.122	22.51	22.60	1.021	0.230	0.235	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Left Head Tilt	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-3.479	22.51	22.60	1.021	0.167	0.170	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Cheek	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-1.402	22.51	22.60	1.021	0.251	**0.256**	**4#**
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Right Head Tilt	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	1.772	22.51	22.60	1.021	0.179	0.183	/
	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)	Power Drift (%)	Meas. Avg. Power (dBm)	Max. Rated Avg. Power (dBm)	1 g SAR Value (W/Kg)			
					Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	2412	-1.685	15.65	15.70	1.012	0.317	**0.321**	**5#**
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/
Left Head Tilt	2412	2.170	15.65	15.70	1.012	0.236	0.239	/
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/
Right Head Cheek	2412	1.177	15.65	15.70	1.012	0.293	0.296	/
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/
Right Head Tilt	2412	1.627	15.65	15.70	1.012	0.227	0.230	/
	2437	/	/	/	/	/	/	/
	2462	/	/	/	/	/	/	/

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 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

Mobile Hot-Spot Test Result

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

Hot spot-GPRS (Frequency Band: 835)

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	824.2	GPRS	1.201	28.94	29.00	1.014	0.739	0.749	/
	836.6	GPRS	-0.916	28.88	29.00	1.028	0.787	0.809	/
	848.8	GPRS	1.416	28.92	29.00	1.019	0.950	**0.968**	**6#**
Body-Left (10mm)	824.2	GPRS	-3.115	28.94	29.00	1.014	0.812	0.823	
	836.6	GPRS	-2.092	28.88	29.00	1.028	0.838	0.861	/
	848.8	GPRS	1.561	28.92	29.00	1.019	0.701	0.714	/
Body-Top (10mm)	824.2	GPRS	1.225	28.94	29.00	1.014	0.427	0.433	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	/	/	/	/	/	/	/

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

Hot spot-GPRS (Frequency Band: 1900)

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1850.2	GPRS	-2.033	25.94	26.20	1.062	0.876	**0.930**	**7#**
	1880.0	GPRS	0.989	25.88	26.20	1.076	0.831	0.895	/
	1909.8	GPRS	-1.798	26.15	26.20	1.012	0.856	0.866	/
Body-Left (10mm)	1850.2	GPRS	/	/	/	/	/	/	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	-0.926	26.15	26.20	1.012	0.226	0.229	
Body-Top (10mm)	1850.2	GPRS	/	/	/	/	/	/	/
	1880.0	GPRS	/	/	/	/	/	/	/
	1909.8	GPRS	1.789	26.15	26.20	1.012	0.305	0.309	

Note:
1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. The EUT is a Capability Class B mobile phone which can be attached to both GPRS and GSM services.
3. The Multi-slot Classes of EUT is Class12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.
4. The EUT transmit and receive through the same GSM antenna while testing SAR.
5. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

Hot Spot-WCDMA850

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	826.4	WCDMA850	/	/	/	/	/	/	/
	836.6	WCDMA850	-0.776	23.02	23.10	1.019	0.172	0.175	**8#**
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Left (10mm)	826.4	WCDMA850	/	/	/	/	/	/	/
	836.6	WCDMA850	-0.818	23.02	23.10	1.019	0.165	0.168	/
	846.6	WCDMA850	/	/	/	/	/	/	/
Body-Top (10mm)	826.4	WCDMA850	/	/	/	/	/	/	/
	836.6	WCDMA850	-2.723	23.02	23.10	1.019	0.063	0.064	/
	846.6	WCDMA850	/	/	/	/	/	/	/

Hot Spot-WCDMA1900

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	1.350	22.51	22.60	1.021	0.196	**0.200**	**9#**
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Left (10mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	-2.057	22.51	22.60	1.021	0.106	0.108	/
	1907.6	WCDMA1900	/	/	/	/	/	/	/
Body-Top (10mm)	1852.4	WCDMA1900	/	/	/	/	/	/	/
	1880.0	WCDMA1900	2.122	22.51	22.60	1.021	0.193	0.197	/
	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.
5. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

Wi-Fi 802.11b (2412-2462MHz)

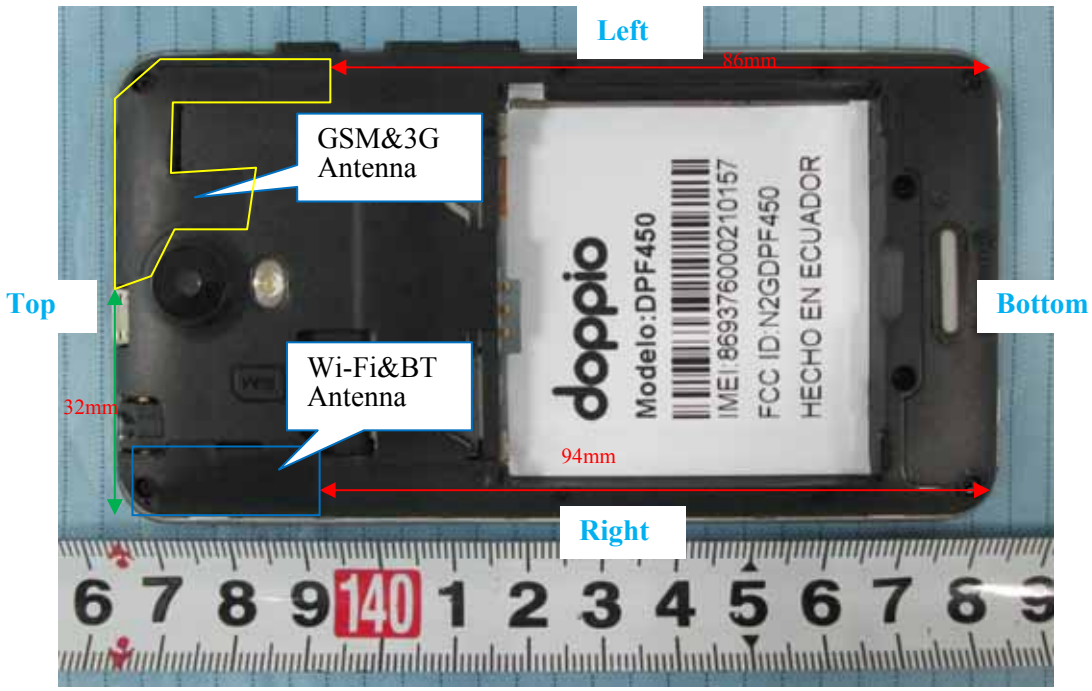
EUT Position	Frequency (MHz)		Power Drift (%)	Meas. Avg. Power (dBm)	Max. Rated Avg. Power (dBm)	1 g SAR Value (W/Kg)			
	Channel	MHz				Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-worn-Back (10mm)	1	2412	-2.341	15.65	15.70	1.012	0.137	**0.139**	**10#**
	6	2437	/	/	/	/	/	/	/
	11	2462	/	/	/	/	/	/	/
Body-worn-Right (10mm)	1	2412	2.365	15.65	15.70	1.012	0.071	0.072	/
	6	2437	/	/	/	/	/	/	/
	11	2462	/	/	/	/	/	/	/
Body-worn-Top (10mm)	1	2412	1.974	15.65	15.70	1.012	0.115	0.116	/
	6	2437	/	/	/	/	/	/	/
	11	2462	/	/	/	/	/	/	/

Note:

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

SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

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



Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	×	×	0
GSM + Bluetooth	√	×	21
GSM + Wi-Fi	√	×	21
GPRS + WCDMA	×	×	0
GPRS + Bluetooth	√	×	0
GPRS + Wi-Fi	√	√	21
WCDMA + Bluetooth	√	×	21
WCDMA + Wi-Fi	√	√	21

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	23.80	239.88	0	44.2	3.0	No
PCS1900	1900	20.80	120.23	0	33.1	3.0	No
WCDMA850	850	23.10	204.17	0	37.6	3.0	No
WCDMA1900	1900	22.60	181.97	0	50.2	3.0	No
Wi-Fi	2450	15.70	37.15	0	11.6	3.0	No
Bluetooth	2450	5.80	3.80	0	**1.2**	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	26.00	398.11	10.00	36.7	3.0	No
GPRS1900	1900	23.20	208.93	10.00	28.8	3.0	No
WCDMA850	850	23.10	204.17	10.00	18.8	3.0	No
WCDMA1900	1900	22.60	181.97	10.00	25.1	3.0	No
Wi-Fi	2450	15.70	37.15	10.00	5.8	3.0	No
Bluetooth	2450	5.80	3.80	10.00	**0.6**	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	5.80	3.80	0.159
BT Body	2.45	10	5.80	3.80	0.080

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	1.151	0.159	1.310
	Left Head Tilt	0.796	0.159	0.955
	Right Head Cheek	0.996	0.159	1.155
	Right Head Tilt	0.773	0.159	0.932
	Body–Headset-Back	0.725	0.080	0.805
PCS1900	Left Head Cheek	1.156	0.159	1.315
	Left Head Tilt	0.767	0.159	0.926
	Right Head Cheek	1.032	0.159	1.191
	Right Head Tilt	0.779	0.159	0.938
	Body–Headset-Back	0.656	0.080	0.736

WCDMA with BT:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.229	0.159	0.388
	Left Head Tilt	0.170	0.159	0.329
	Right Head Cheek	0.248	0.159	0.407
	Right Head Tilt	0.184	0.159	0.343
WCDMA 1900	Left Head Cheek	0.235	0.159	0.394
	Left Head Tilt	0.170	0.159	0.329
	Right Head Cheek	0.256	0.159	0.415
	Right Head Tilt	0.183	0.159	0.342

GSM with Wi-Fi:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	Wi-Fi	< 1.6W/kg
GSM850	Left Head Cheek	1.151	0.321	1.472
	Left Head Tilt	0.796	0.239	1.035
	Right Head Cheek	0.996	0.296	1.292
	Right Head Tilt	0.773	0.230	1.003
	Body–Headset-Back	0.725	0.139	0.864
PCS1900	Left Head Cheek	1.156	0.321	**1.477**
	Left Head Tilt	0.767	0.239	1.006
	Right Head Cheek	1.032	0.296	1.328
	Right Head Tilt	0.779	0.230	1.009
	Body–Headset-Back	0.656	0.139	0.795

WCDMA with Wi-Fi:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	Wi-Fi	< 1.6W/kg
WCDMA 850	Left Head Cheek	0.229	0.321	0.550
	Left Head Tilt	0.170	0.239	0.409
	Right Head Cheek	0.248	0.296	0.544
	Right Head Tilt	0.184	0.230	0.414
WCDMA 1900	Left Head Cheek	0.235	0.321	0.556
	Left Head Tilt	0.170	0.239	0.409
	Right Head Cheek	0.256	0.296	0.552
	Right Head Tilt	0.183	0.230	0.413

Evaluations for Simultaneous SAR, BT+GSM/3G					
Test Position	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
GPRS 850	0.968	0.861	/	/	0.433
GPRS 1900	0.930	0.229	/	/	0.309
WCDMA850	0.175	0.168	/	/	0.064
WCDMA1900	0.200	0.108	/	/	0.197
BT	0.080	0.080	0.080	0.080	0.080
	∑ 1-g SAR(W/Kg)				
GPRS850 + BT	1.048	0.941	/	/	0.513
GPRS1900 + BT	1.010	0.309	/	/	0.389
WCDMA850 + BT	0.255	0.248	/	/	0.144
WCDMA1900 + BT	0.280	0.188	/	/	0.277
Evaluations for Simultaneous SAR, Mobile Hot Spot Positions					
Test Position	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
GPRS 850	0.968	0.861	/	/	0.433
GPRS 1900	0.930	0.229	/	/	0.309
WCDMA850	0.175	0.168	/	/	0.064
WCDMA 1900	0.200	0.108	/	/	0.197
Wi-Fi	0.139	/	0.072	/	0.116
	∑ 1-g SAR(W/Kg)				
GPRS850 + Wi-Fi	**1.107**	/	0.459	/	0.549
GPRS1900 + Wi-Fi	1.069	/	0.162	/	0.425
WCDMA850 + Wi-Fi	0.299	/	0.176	/	0.180
WCDMA 1900 +Wi-Fi	0.339	/	0.135	/	0.313

Note:

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

SAR Plots (Summary of the Highest SAR Values)

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

Left Head Cheek (824.2 MHz Low Channel)

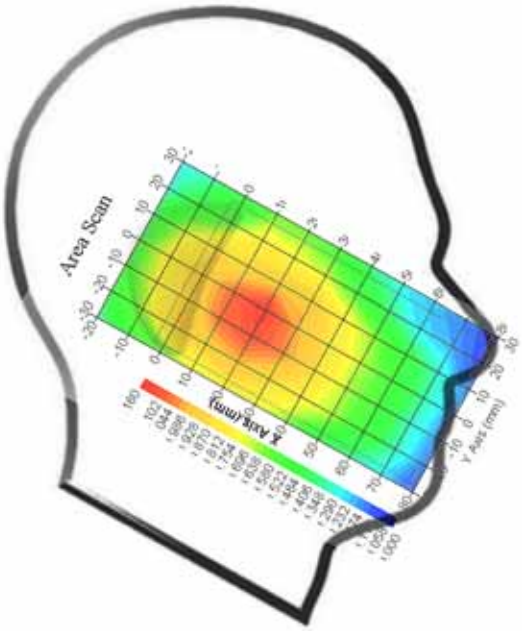
Measurement Data
Test mode : GSM
Crest Factor : 8
Scan Type : Complete
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.913 W/kg
Power Drift-Finish : 0.925 W/kg
Power Drift (%) : 1.358

Tissue Data
Type : Head
Frequency : 824.2 MHz
Epsilon : 41.00 F/m
Sigma : 0.90 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 : 1.125 W/kg
10 gram SAR value : 0.892 W/kg
Area Scan Peak SAR : 1.143 W/kg
Zoom Scan Peak SAR : 1.837 W/kg

Plot 1#



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

Left Head Cheek(1909.8MHz High Channel)

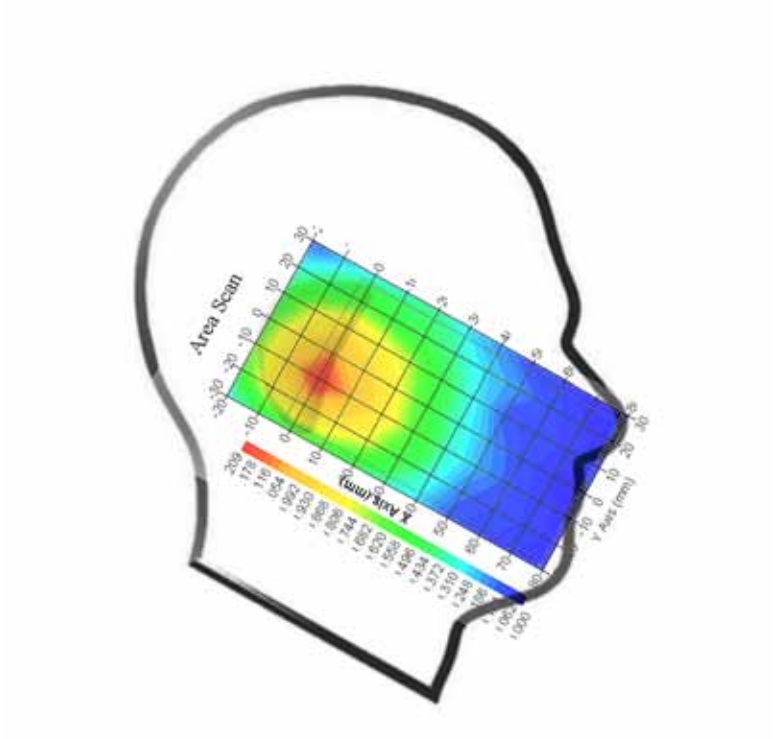
Measurement Data
Test mode : GSM
Crest Factor : 8
Scan Type : Complete
Area Scan : 11x8x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 1.063 W/kg
Power Drift-Finish : 1.037W/kg
Power Drift (%) : -2.336

Tissue Data
Type : Head
Frequency : 1909.8 MHz
Epsilon : 39.65 F/m
Sigma : 1.42 S/m
Density : 1000.00 kg/cu. M

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

1 gram SAR value : 1.079 W/kg
10 gram SAR value : 0.839 W/kg
Area Scan Peak SAR : 1.191 W/kg
Zoom Scan Peak SAR : 1.711 W/kg

Plot 2#



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

WCDMA850; Right Head Cheek (836.6 MHz Middle Channel)

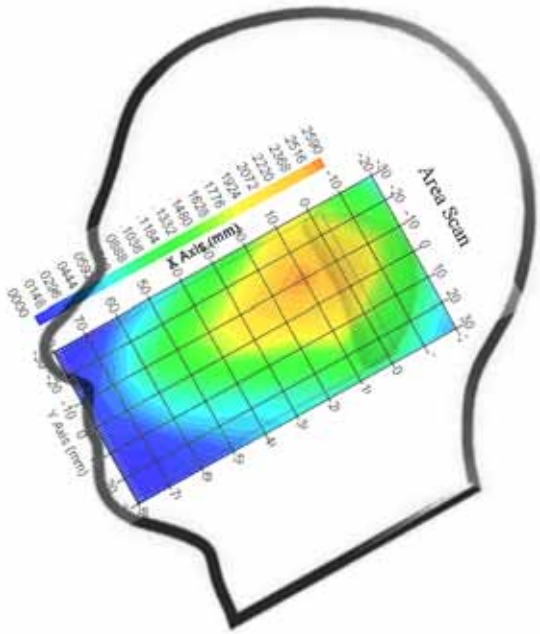
Measurement Data
Test mode : WCDMA850
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.218 W/kg
Power Drift-Finish : 0.222 W/kg
Power Drift (%) : 1.873

Tissue Data
Type : Head
Frequency : 836.6 MHz
Epsilon : 41.07 F/m
Sigma : 0.92 S/m
Density : 1000.00 kg/cu. m

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

1 gram SAR value : 0.243 W/kg
10 gram SAR value : 0.162 W/kg
Area Scan Peak SAR : 0.255 W/kg
Zoom Scan Peak SAR : 0.415 W/kg

Plot 3#



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

WCDMA1900; Right Head Cheek (1880 MHz Middle Channel)

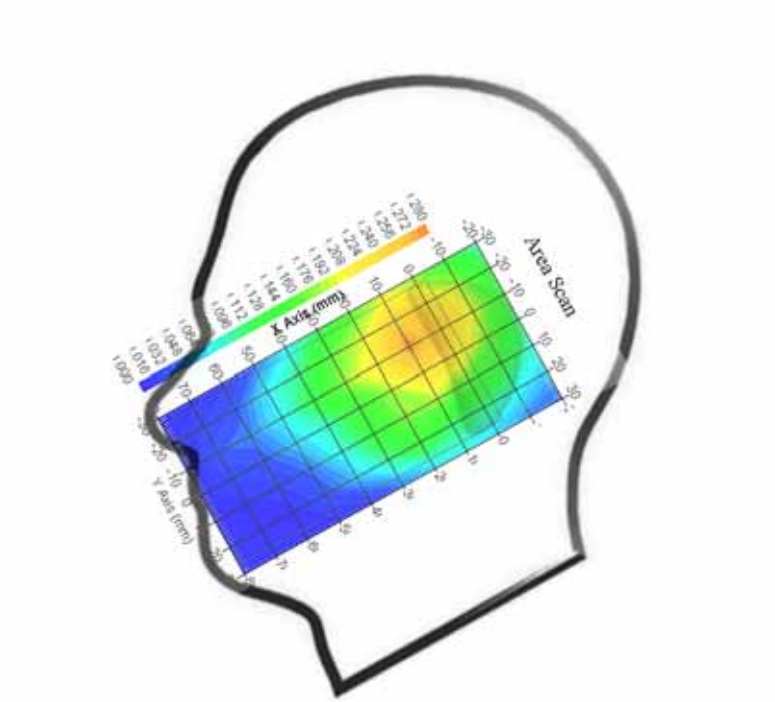
Measurement Data
Test mode : WCDMA1900
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.213 W/kg
Power Drift-Finish : 0.210 W/kg
Power Drift (%) : -1.402

Tissue Data
Type : Head
Frequency : 1880 MHz
Epsilon : 39.55 F/m
Sigma : 1.39 S/m
Density : 1000.00 kg/cu. m

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

1 gram SAR value : 0.251 W/kg
10 gram SAR value : 0.155 W/kg
Area Scan Peak SAR : 0.277 W/kg
Zoom Scan Peak SAR : 0.410 W/kg

Plot 4#



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

802.11b; Left Head Cheek (2412 MHz Channel 1)

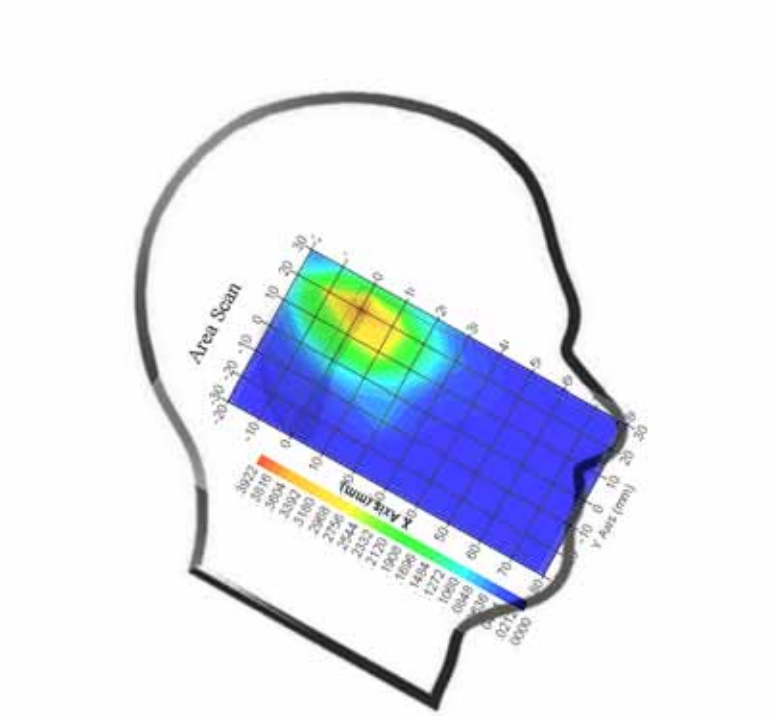
Measurement Data
Test mode : 802.11b
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.122 W/kg
Power Drift-Finish : 0.120 W/kg
Power Drift (%) : -1.685

Tissue Data
Type : Head
Frequency : 2412 MHz
Epsilon : 39.61 F/m
Sigma : 1.79 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 : 0.317 W/kg
10 gram SAR value : 0.123 W/kg
Area Scan Peak SAR : 0.390 W/kg
Zoom Scan Peak SAR : 0.515 W/kg

Plot 5#



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

Body-worn-Back (848.8 MHz High Channel)

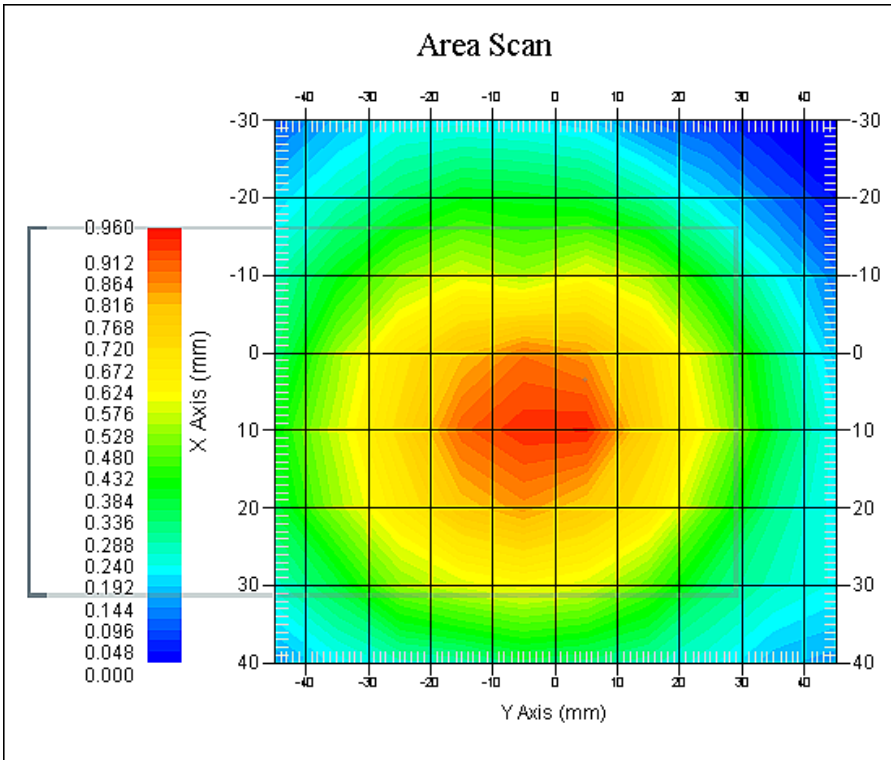
Measurement Data
Test mode : GPRS
Crest Factor : 2
Scan Type： : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.853 W/kg
Power Drift-Finish : 0.865 W/kg
Power Drift (%) : 1.416

Tissue Data
Type : Body
Frequency : 848.8 MHz
Epsilon : 53.80 F/m
Sigma : 0.98 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 : 0.950 W/kg
10 gram SAR value : 0.760 W/kg
Area Scan Peak SAR : 0.955 W/kg
Zoom Scan Peak SAR : 1.532 W/kg

Plot 6#



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

Body-worn-Back (1850.2MHz Low Channel)

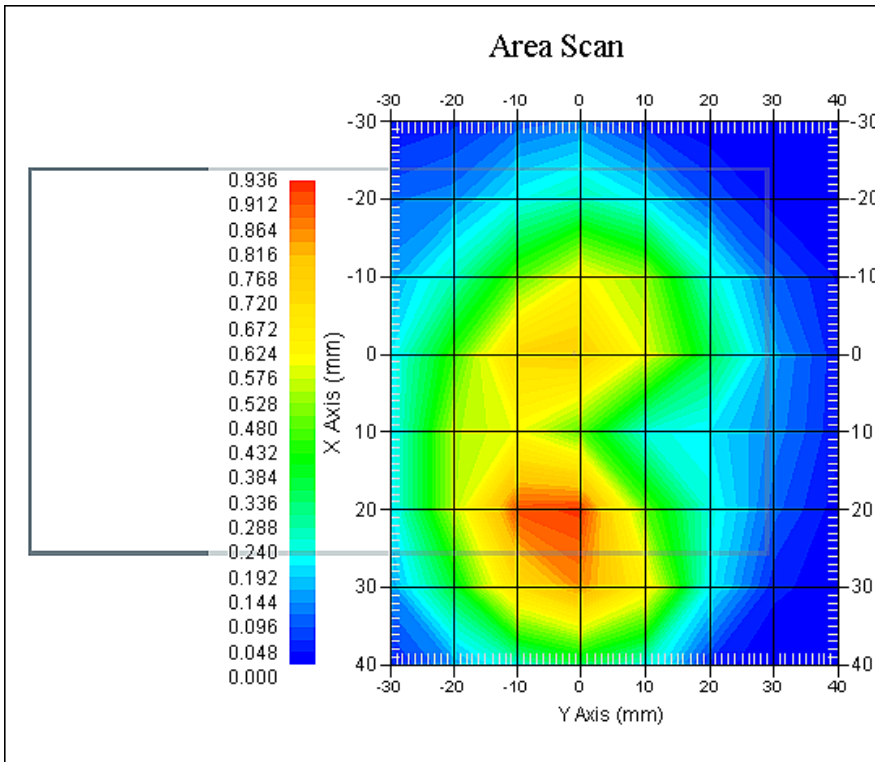
Measurement Data
Test mode : GPRS
Crest Factor : 2
Scan Type : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.676 W/kg
Power Drift-Finish : 0.662 W/kg
Power Drift (%) : -2.033

Tissue Data
Type : Body
Frequency : 1850.2 MHz
Epsilon : 51.97 F/m
Sigma : 1.49 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 1900
Duty Cycle Factor : 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 : 0.876 W/kg
10 gram SAR value : 0.491 W/kg
Area Scan Peak SAR : 0.932 W/kg
Zoom Scan Peak SAR : 1.300 W/kg

Plot 7#



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

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

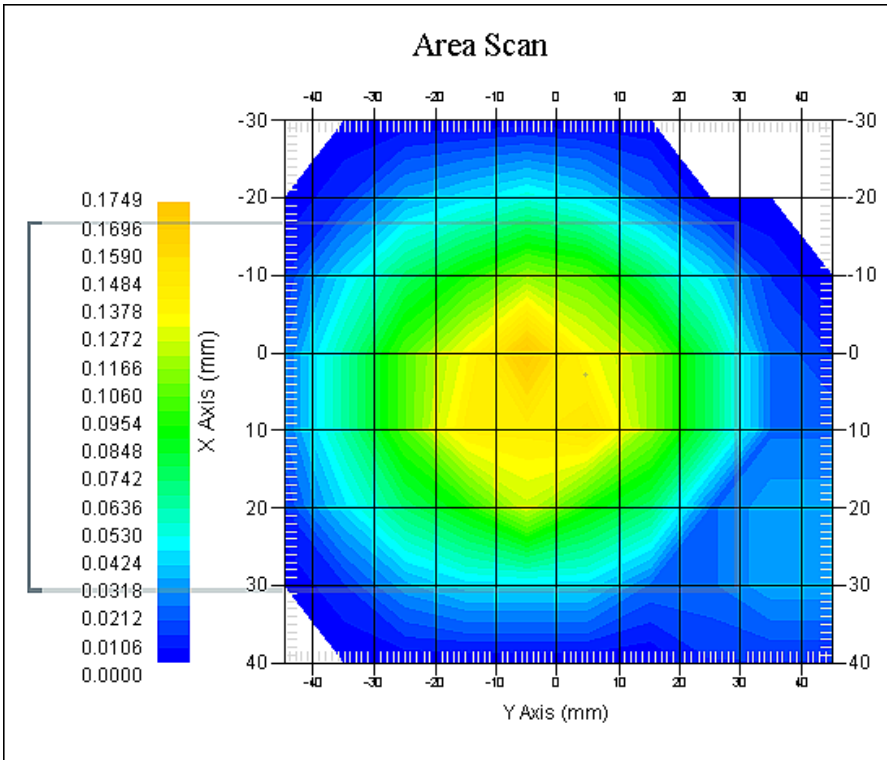
Measurement Data
Test mode : WCDMA850
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.165 W/kg
Power Drift-Finish : 0.164 W/kg
Power Drift (%) : -0.776

Tissue Data
Type : Body
Frequency : 836.6 MHz
Epsilon : 53.77 F/m
Sigma : 0.96 S/m
Density : 1000.00 kg/cu. m

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

1 gram SAR value : 0.172 W/kg
10 gram SAR value : 0.119 W/kg
Area Scan Peak SAR : 0.175 W/kg
Zoom Scan Peak SAR : 0.306 W/kg

Plot 8#



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

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

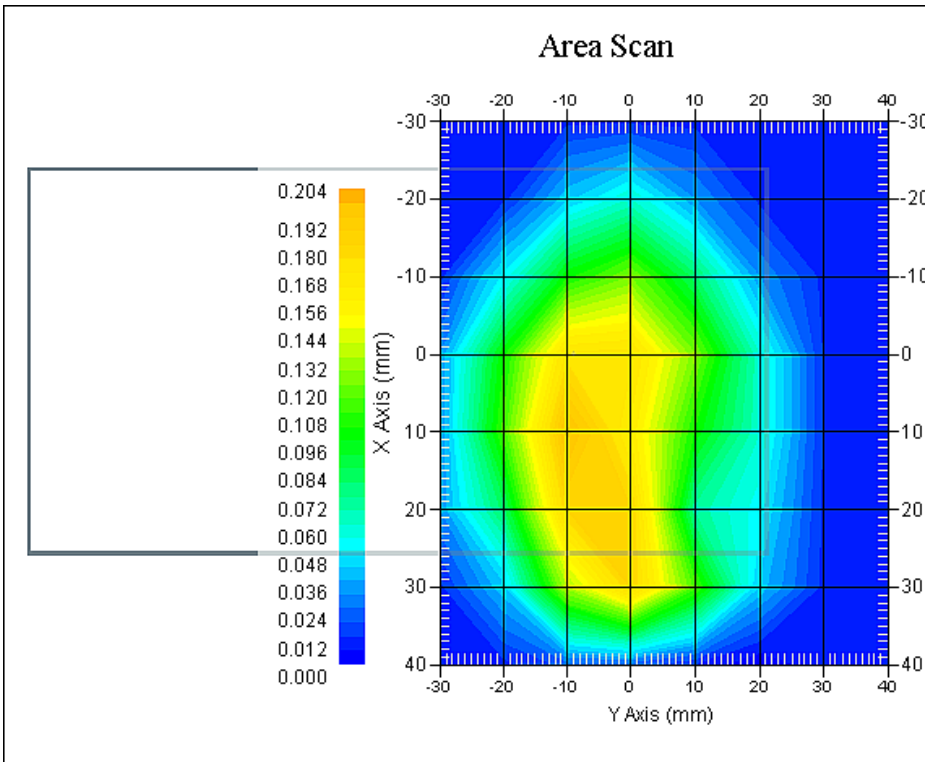
Measurement Data
Test mode : WCDMA1900
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.153 W/kg
Power Drift-Finish : 0.155 W/kg
Power Drift (%) : 1.350

Tissue Data
Type : Body
Frequency : 1880 MHz
Epsilon : 52.07 F/m
Sigma : 1.52 S/m
Density : 1000.00 kg/cu. m

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

1 gram SAR value : 0.196 W/kg
10 gram SAR value : 0.107 W/kg
Area Scan Peak SAR : 0.203 W/kg
Zoom Scan Peak SAR : 0.287 W/kg

Plot 9#



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

802.11b; Body-Worn-Back (2412MHz, Channel 1)

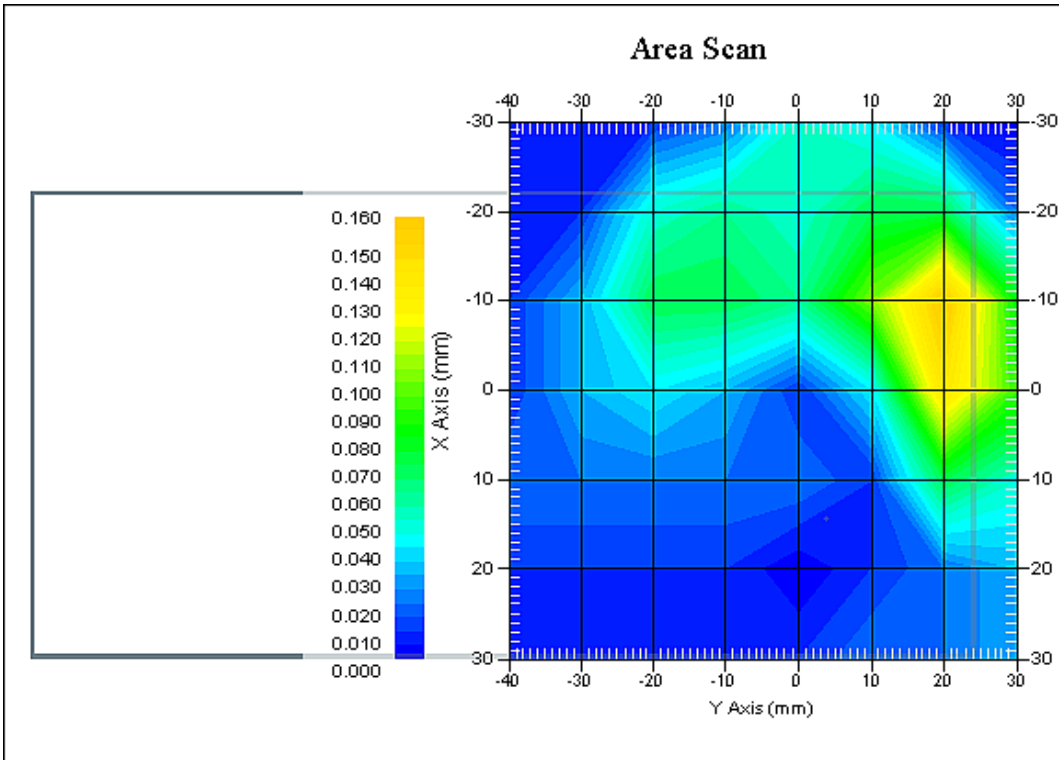
Measurement Data
Crest Factor : 1
Scan Type : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.020 W/kg
Power Drift-Finish : 0.020 W/kg
Power Drift (%) : -2.341

Tissue Data
Type : Body
Frequency : 2412 MHz
Epsilon : 52.88 F/m
Sigma : 1.94 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 : 0.137 W/kg
10 gram SAR value : 0.072 W/kg
Area Scan Peak SAR : 0.160 W/kg
Zoom Scan Peak SAR : 0.211 W/kg

Plot 10#



APPENDIX A MEASUREMENT UNCERTAINTY

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

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	c_i^1 (1-g)	c_i^1 (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition -Noise	0.6	rectangular	$\sqrt{3}$	1	1	0.3	0.3
RF Ambient Condition - Reflections	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech. Restrictions	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
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 related							
Test sample positioning	2.0	normal	1	1	1	2.0	2.0
Test Sample Positioning	2.3	normal	1	1	1	2.3	2.3
Device Holder Uncertainty	4.0	normal	1	1	1	6.215	6.215
Drift of Output Power	5.0	rectangular	$\sqrt{3}$	1	1	2.67	2.67
Phantom and Setup							
Phantom Uncertainty	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
SAR correction in permittivity and conductivity	1.2	normal	1	1	0.85	1.2	1.0
Liquid conductivity measurement	5.0	normal	1	0.78	0.71	3.9	3.6
Liquid permittivity measurement	5.0	normal	1	0.25	0.29	1.3	1.5
conductivity—temperature	1.1	rectangular	$\sqrt{3}$	0.78	0.71	0.5	0.5
permittivity—temperature	1.3	rectangular	$\sqrt{3}$	0.23	0.23	0.2	0.2
Combined Uncertainty		RSS				10.78	10.55
Expanded uncertainty (coverage factor=2)		Normal(k=2)				21.56	21.10

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.

<1000MHz
TEM Cell for sensitivity in air
Standard phantom using temperature transfer method for sensitivity in tissue

>1000MHz
Waveguide* method to determine sensitivity in air and tissue
*Waveguide is numerically (simulation) assessed to determine the field distribution and power

The boundary effect for the probe is assessed using a standard flat phantom where the probe output is compared against a numerically simulated series of data points

References

- IEEE Standard 1528
  IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- EN 62209-1
  Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models. instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- IEC 62209-2
  Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

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

NCL Calibration Laboratories
Division of APREL Inc.

Conditions

Probe 500-00283 was a recalibration.

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

Primary Measurement Standards

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

Secondary Measurement Standards

Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

Attestation

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

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

Art Brennan, Quality Manager

Dan Brooks, Test Engineer

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

NCL Calibration Laboratories
Division of APREL Inc.

Probe Summary

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

Page 5 of 10
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NCL Calibration Laboratories
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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.

Page 6 of 10
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NCL Calibration Laboratories
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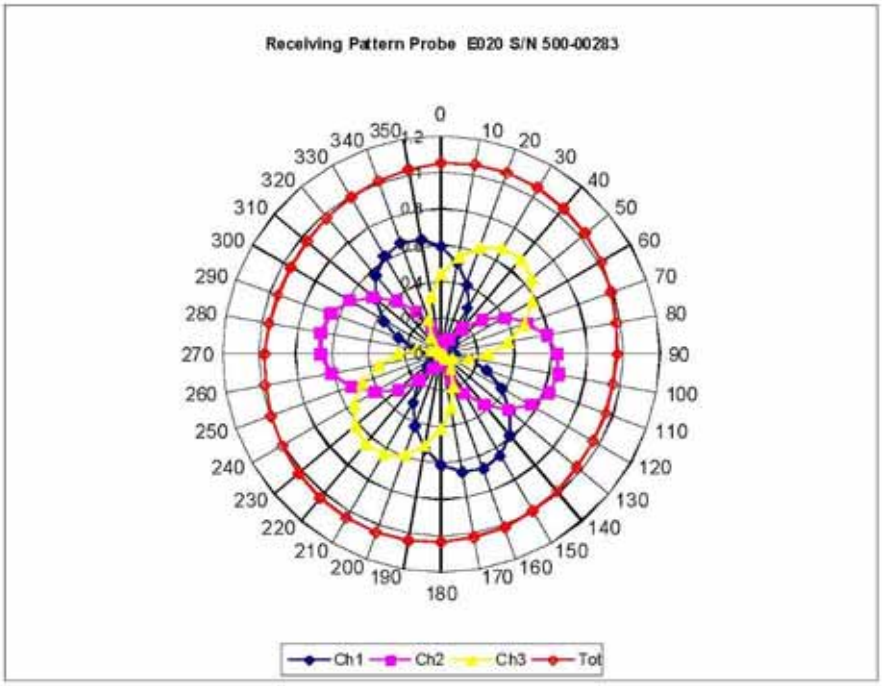
Receiving Pattern Air



Page 7 of 10
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NCL Calibration Laboratories
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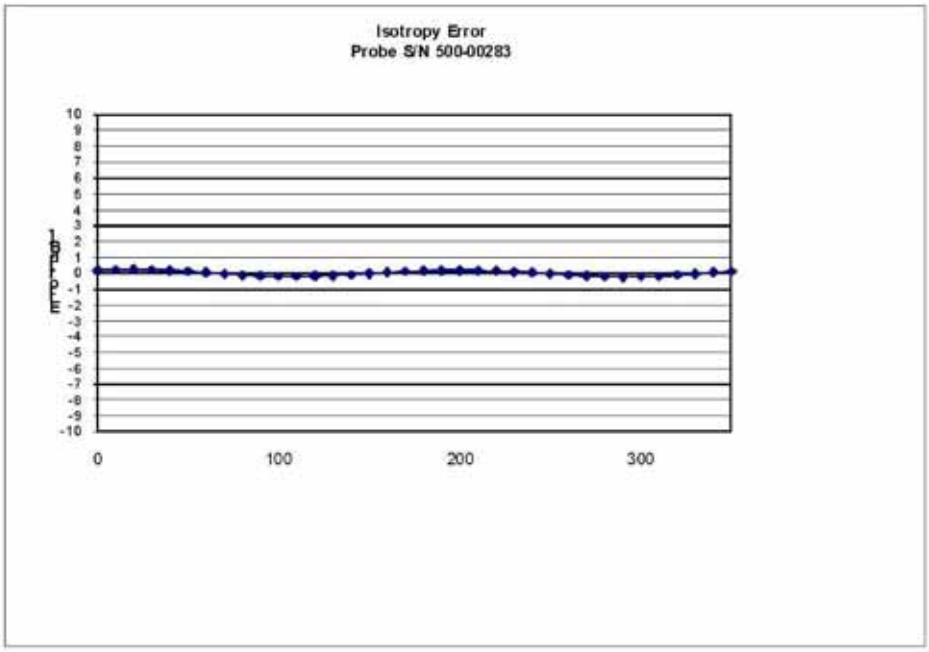
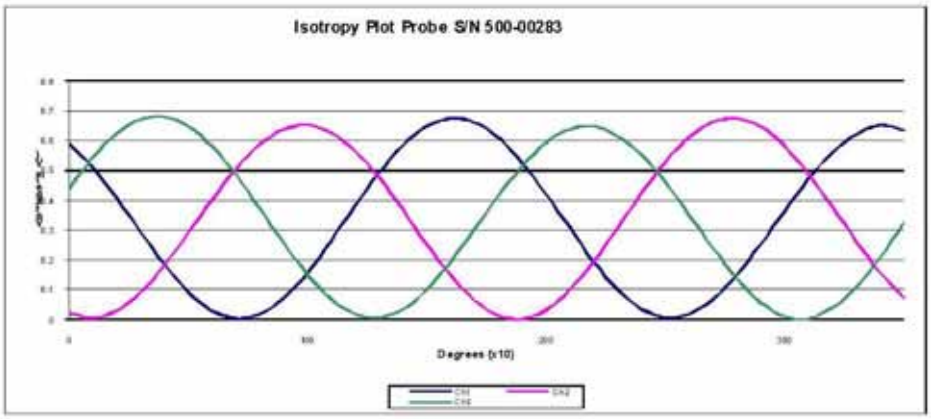
Isotropy Error Air





Isotropicity Tissue: 0.10 dB

Page 8 of 10
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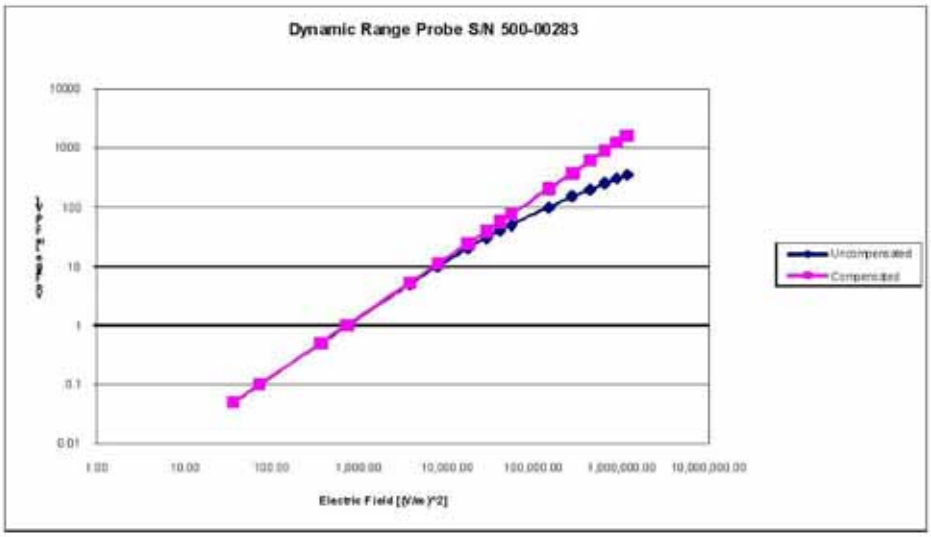
Division of APREL Inc.

Dynamic Range



Page 9 of 10
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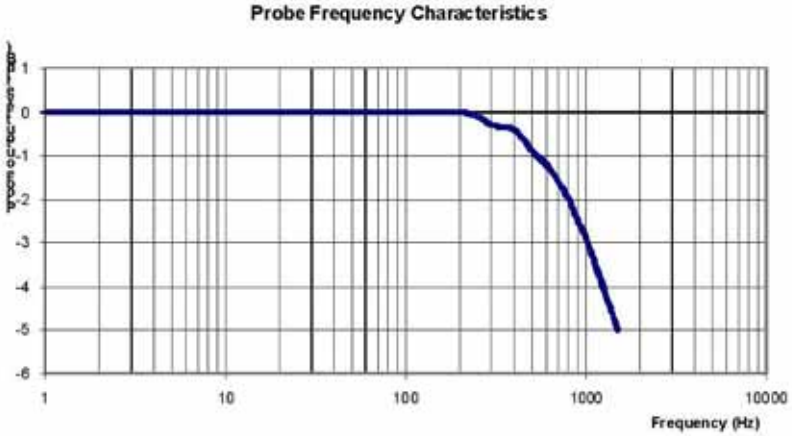
NCL Calibration Laboratories
Division of APREL Inc.

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.

Page 10 of 10
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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

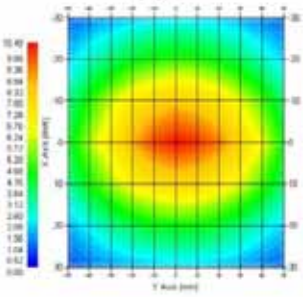
Electrical Specification

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

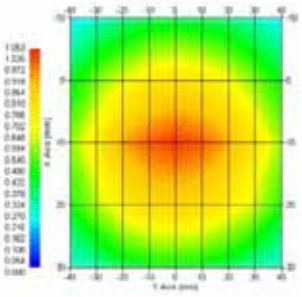
System Validation Results

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

Body



Head



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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

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

Conditions

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

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

Dipole Calibration uncertainty

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

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

4

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

5

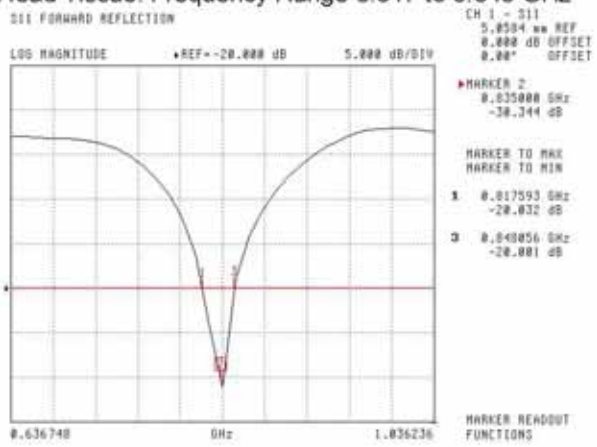
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

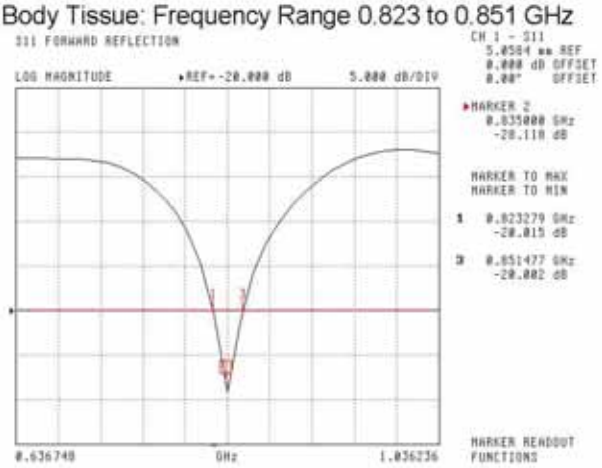
The Following Graphs are the results as displayed on the Vector Network Analyzer.

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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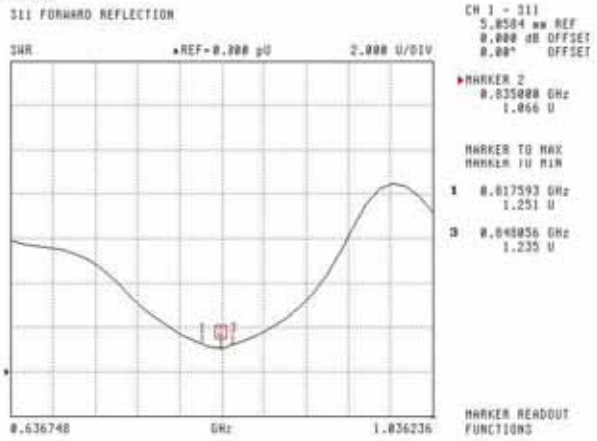
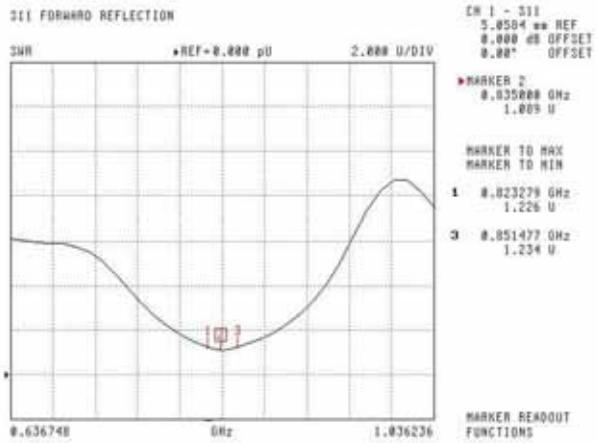
NCL Calibration Laboratories
Division of APREL Laboratories.

SWR

Head



Body



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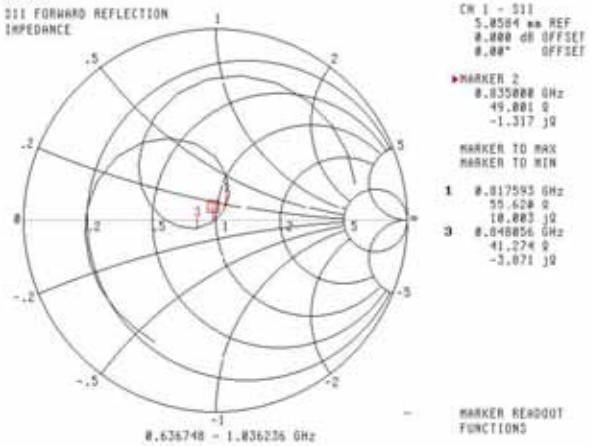
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



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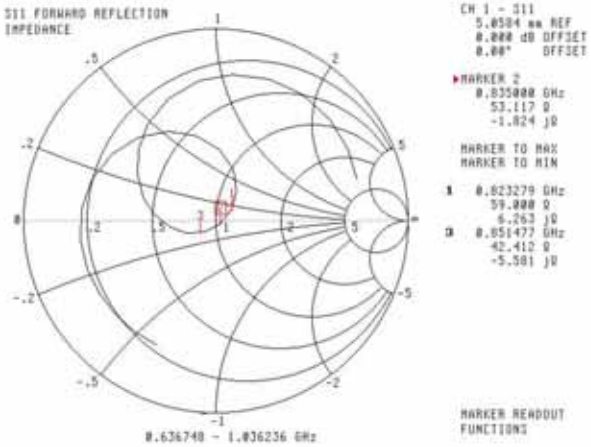

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This page has been reviewed for content and attested to by signature within this document.

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

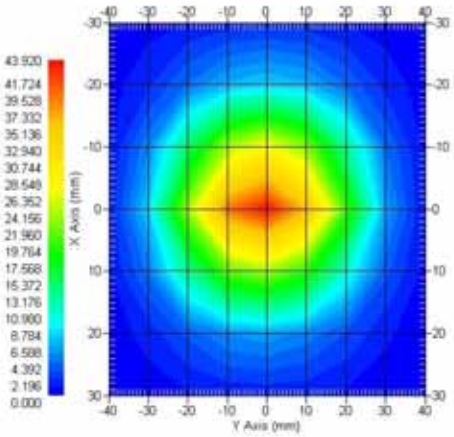
Electrical Specification

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

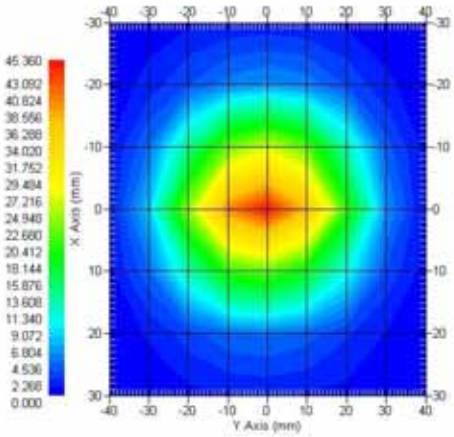
System Validation Results

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

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

Conditions

Dipole 210-00710 was a recalibration.

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

Dipole Calibration uncertainty

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

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

4

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

5

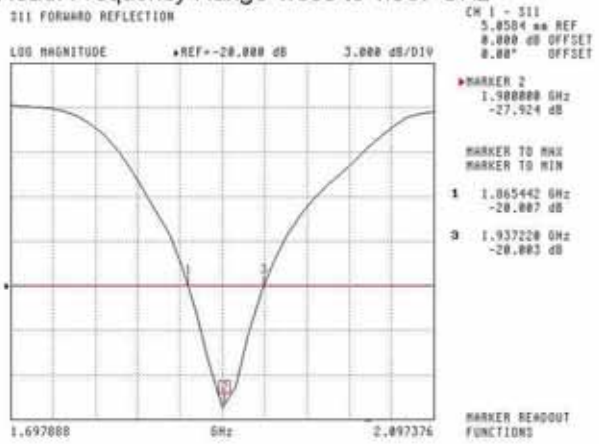
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

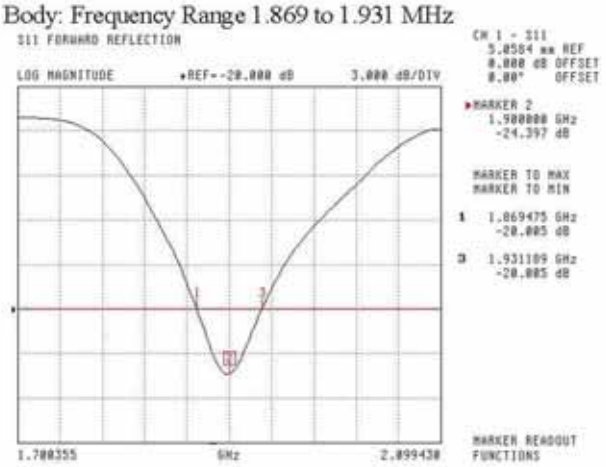
The Following Graphs are the results as displayed on the Vector Network Analyzer.

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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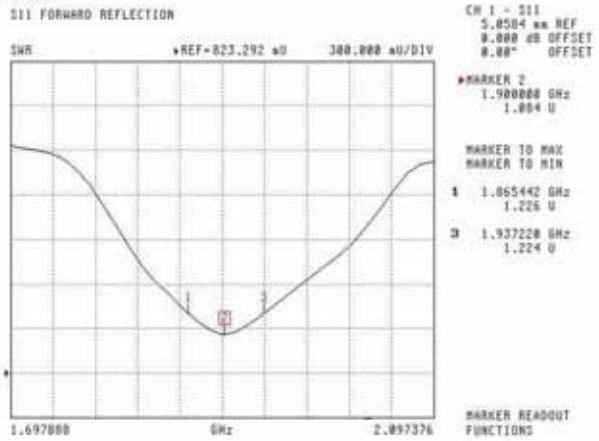
NCL Calibration Laboratories
Division of APREL Laboratories.

SWR

Head



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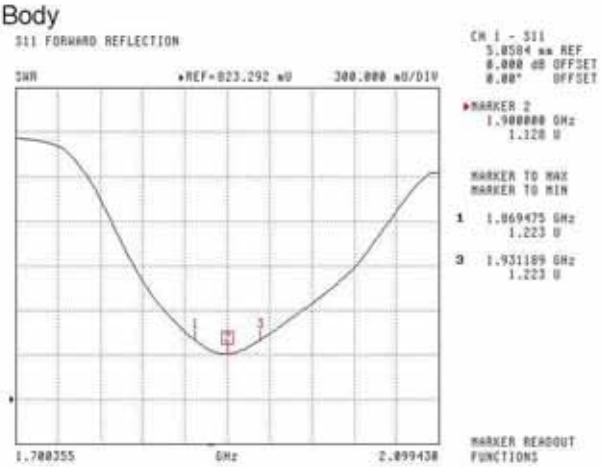

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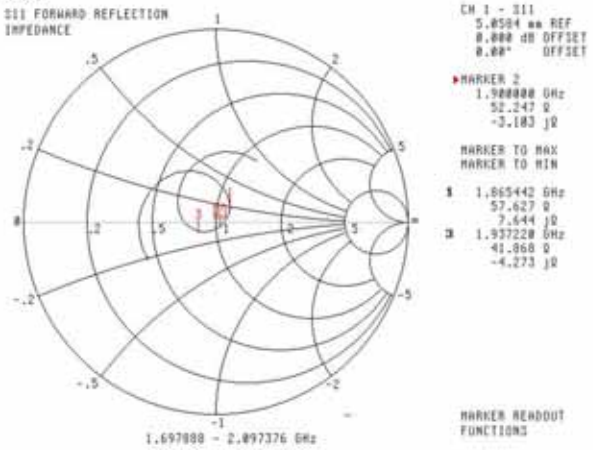
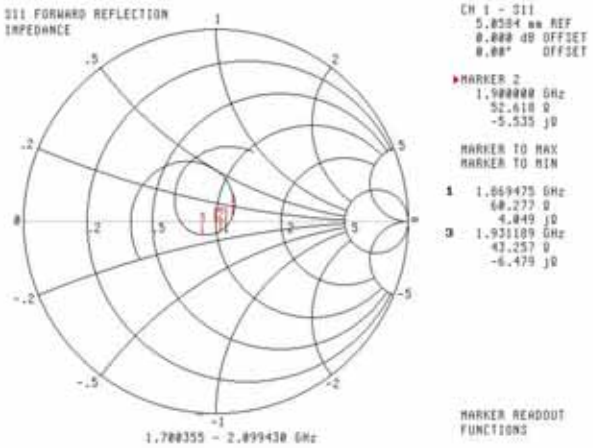
NCL Calibration Laboratories
Division of APREL Laboratories.

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

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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

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Calibration Results Summary

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

Mechanical Dimensions

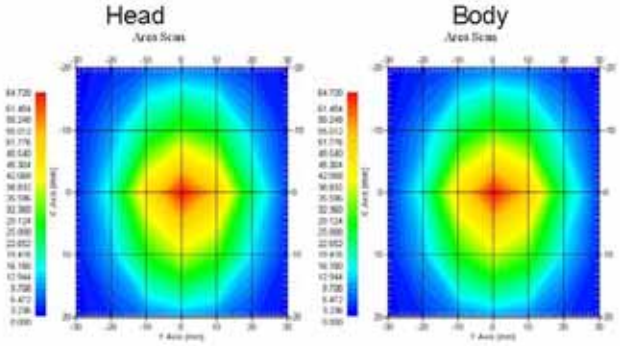
Length: 52.4 mm
Height: 30.3 mm

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



3

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Introduction

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

References

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

Conditions

Dipole 220-00758 was a re-calibration.

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

Dipole Calibration uncertainty

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

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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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

5

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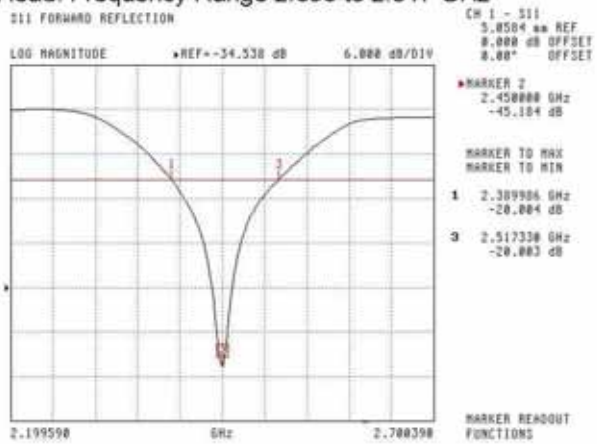
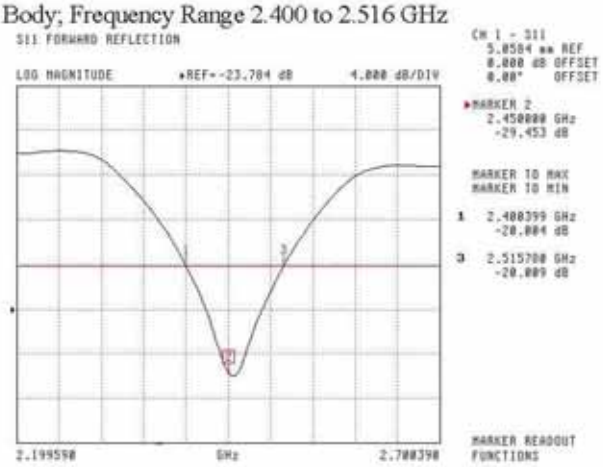
The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

Head: Frequency Range 2.390 to 2.517 GHz



Body; Frequency Range 2.400 to 2.516 GHz



6

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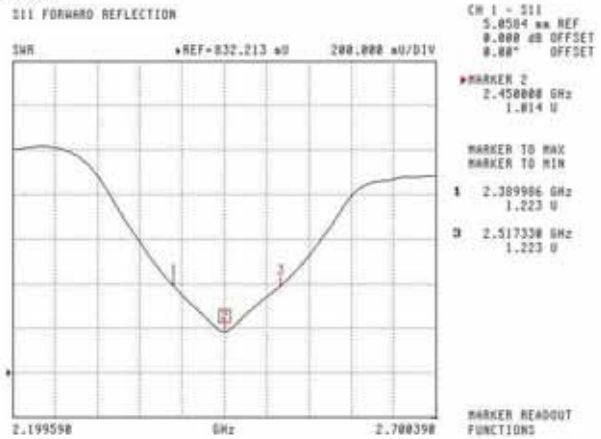
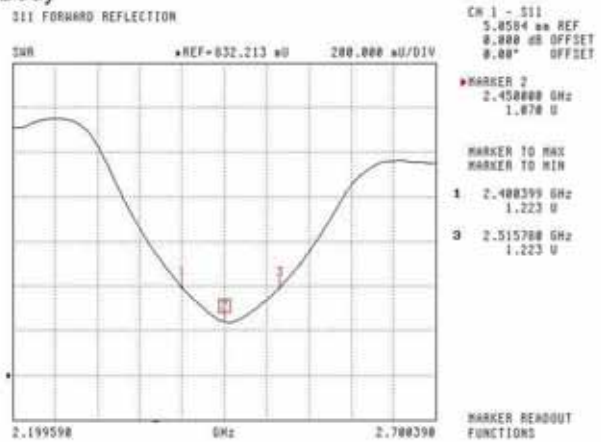
SWR

Head



Body



7

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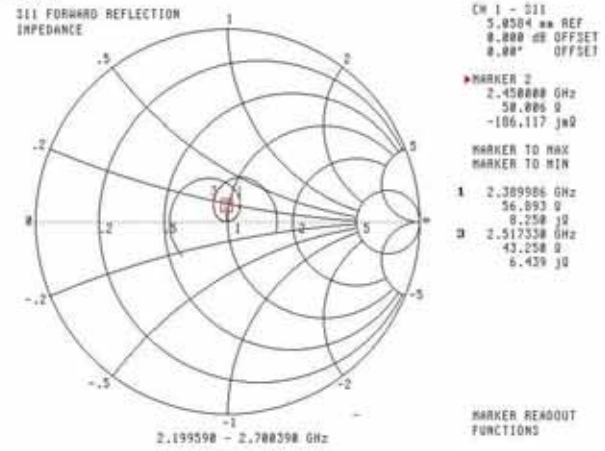
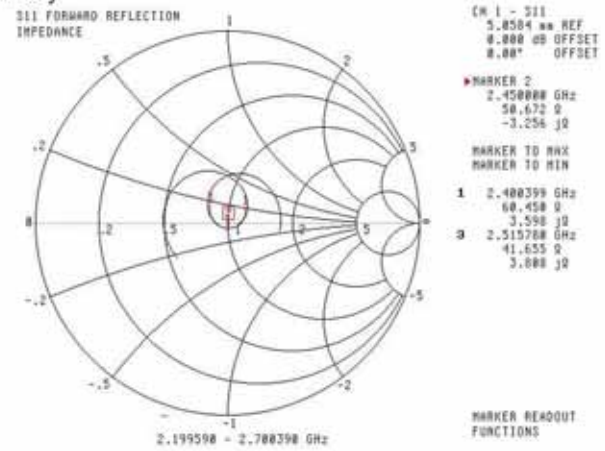
Smith Chart Dipole Impedance

Head



Body



8

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Test Equipment

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

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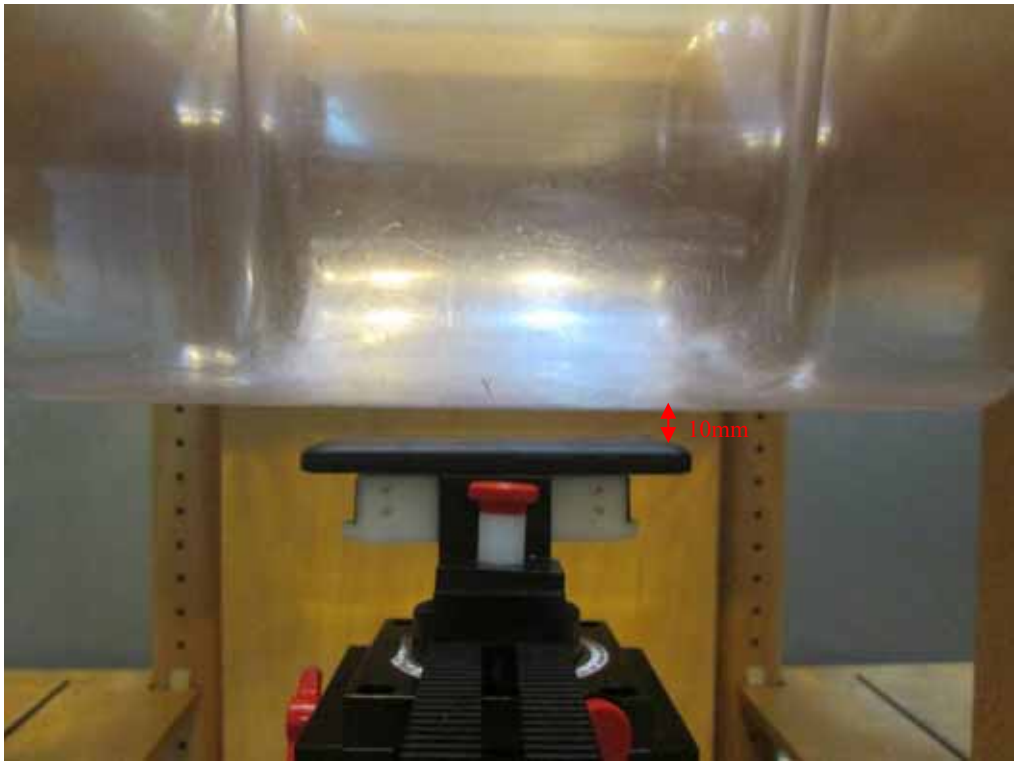
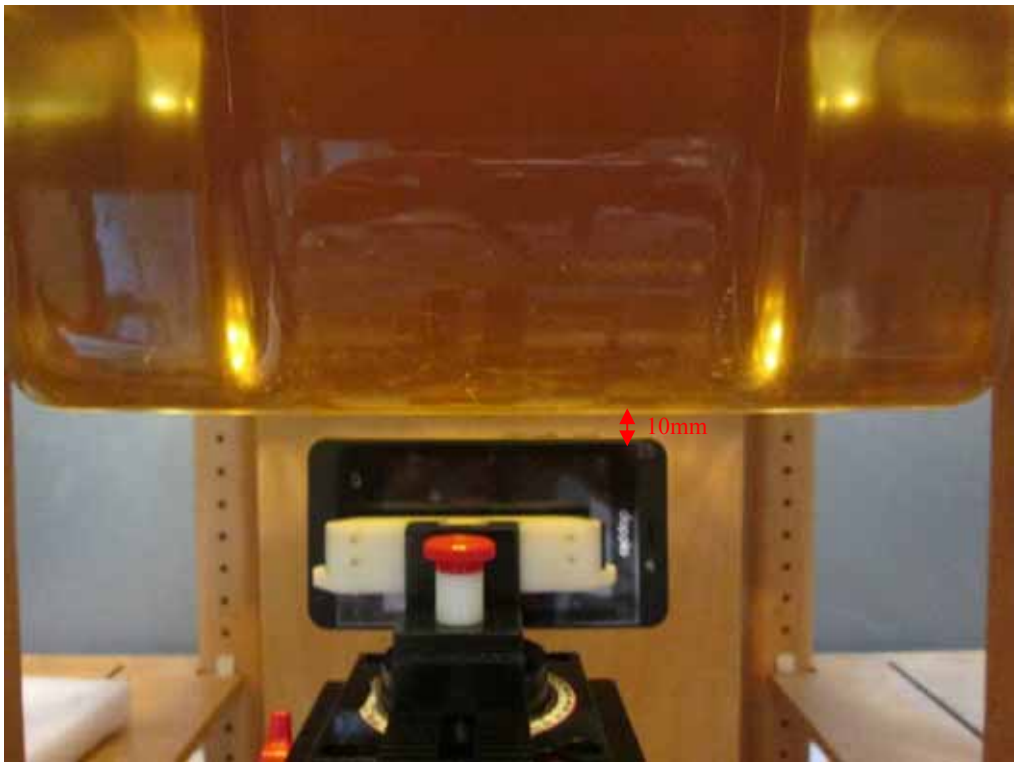
APPENDIX D EUT TEST POSITION PHOTOS

Liquid depth ≥ 15cm

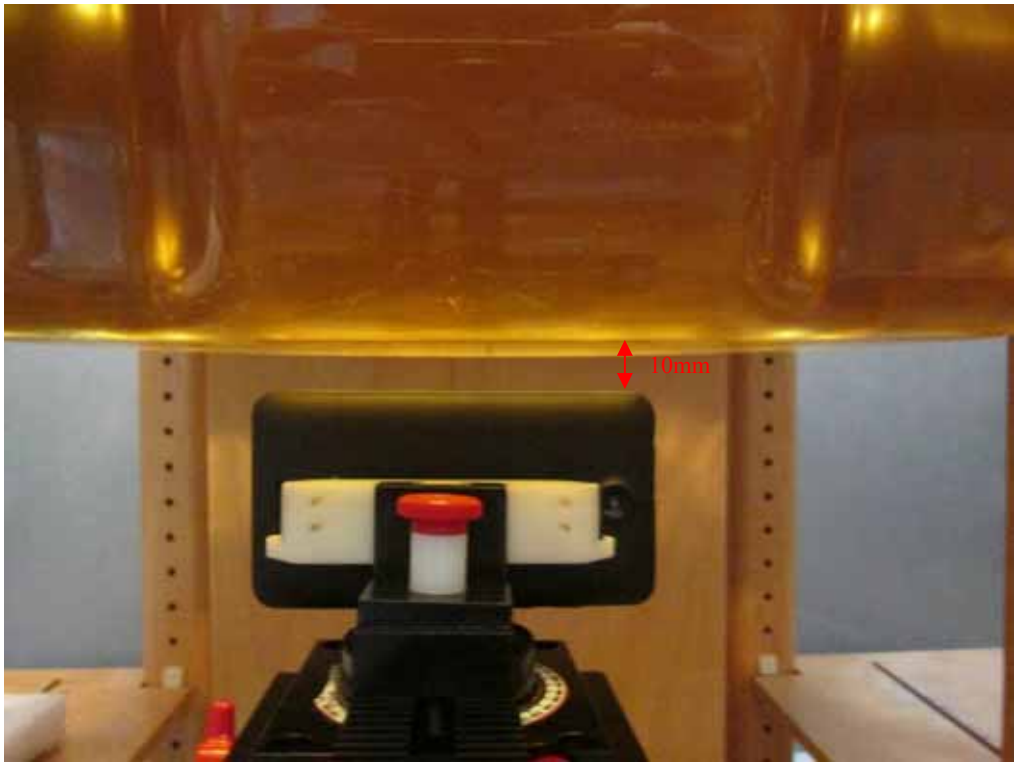
Body-worn Back Setup Photo (10mm)



Body-worn Left Setup Photo (10mm)

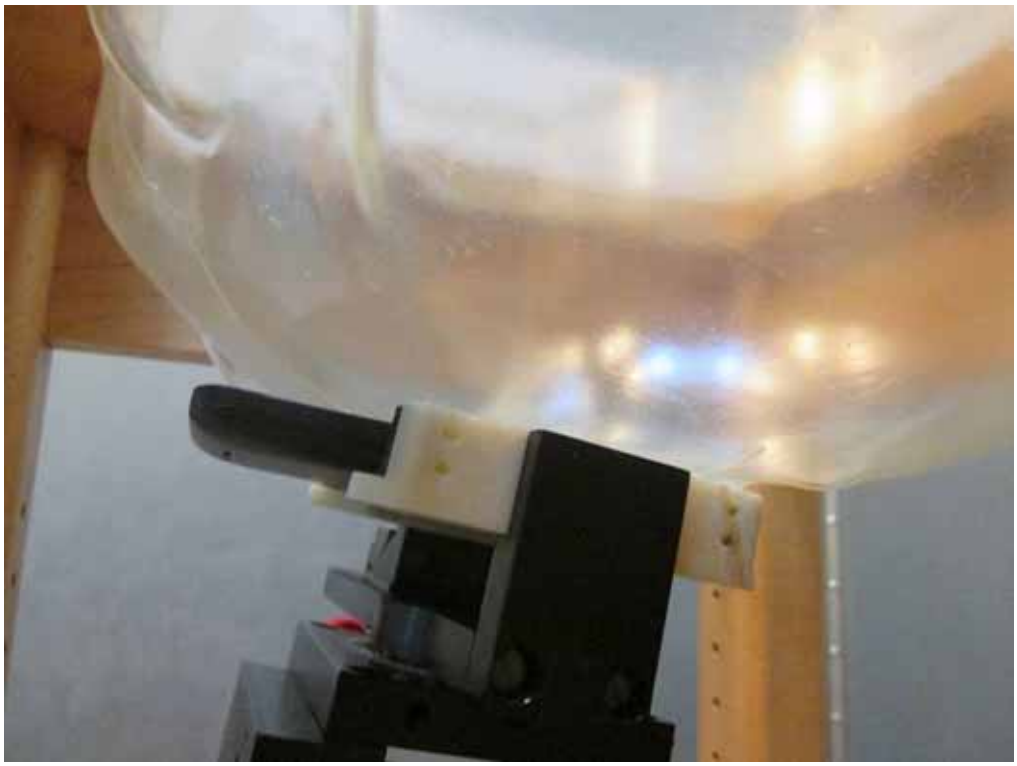


Body-worn Right Setup Photo (10mm)

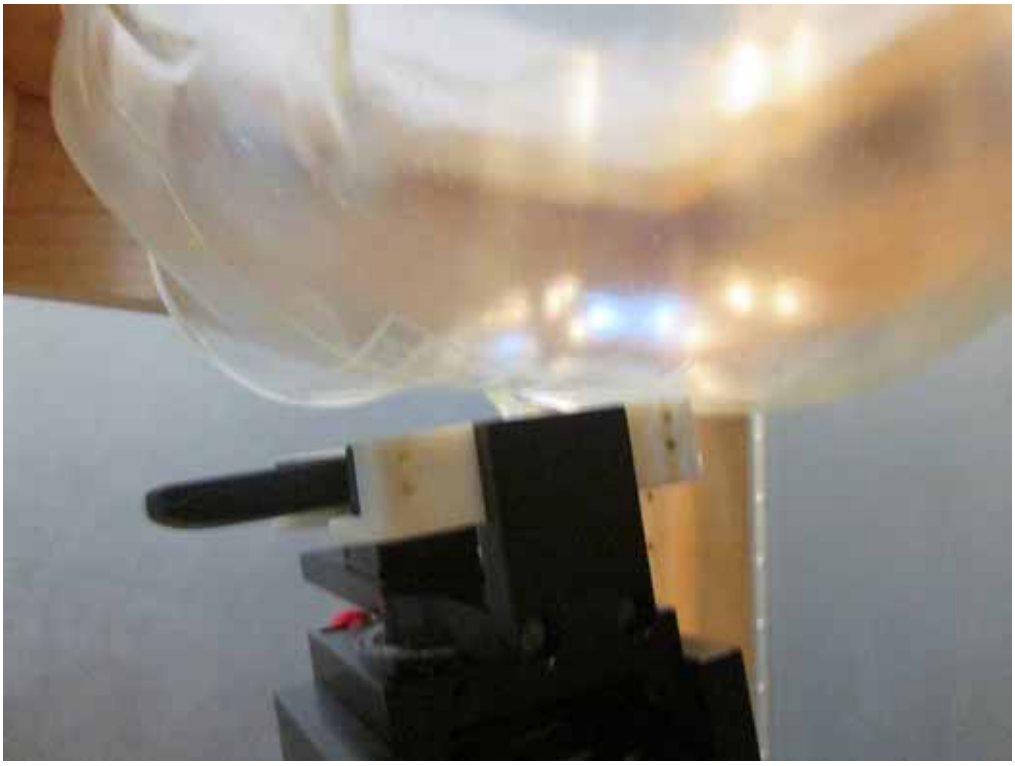


Body-worn Top Setup Photo (10mm)

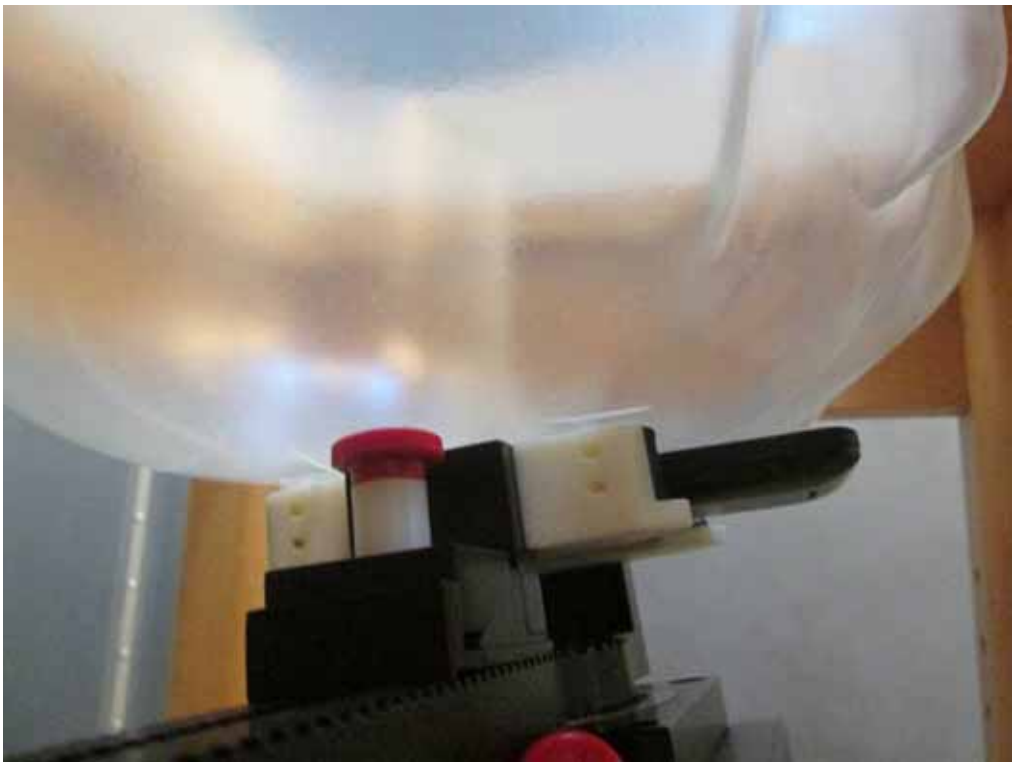
Left Head Touch Setup Photo



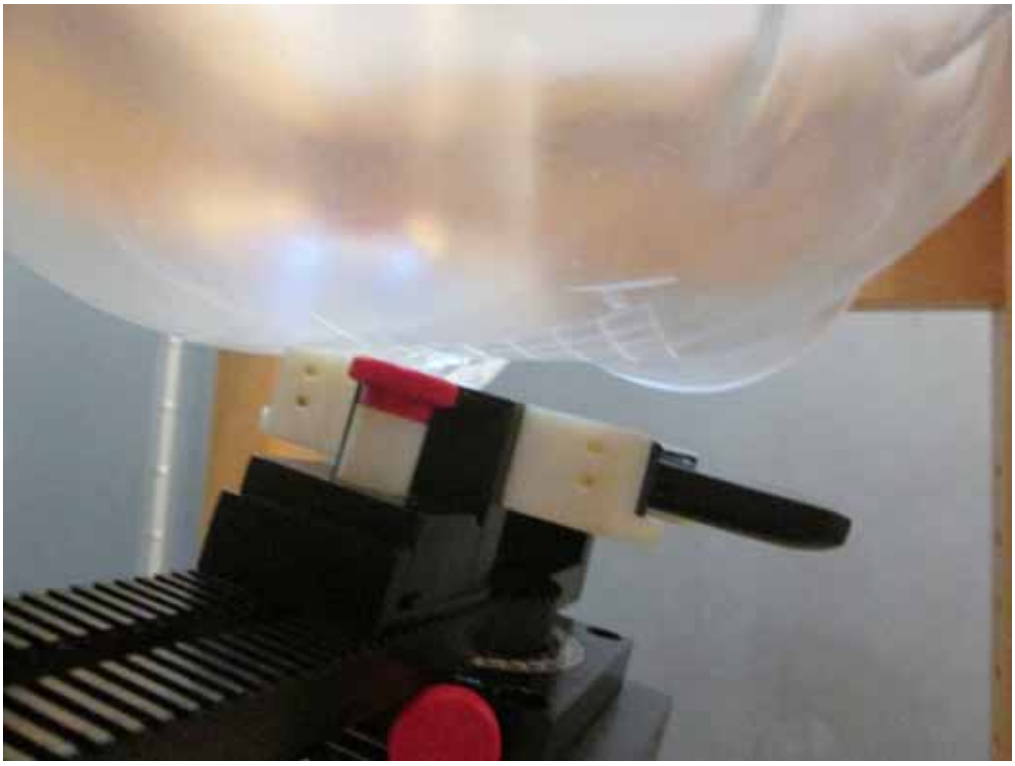
Left Head Tilt Setup Photo



Right Head Touch Setup Photo



Right Head Tilt Setup Photo



APPENDIX E EUT PHOTOS

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

[1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, O_ce of Engineering & Technology, Washington, DC, 1997.

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, \Automated E-_eld scanning system for dosimetricPage 115 of 115
assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105{113, Jan. 1996.

[4] Niels Kuster, Ralph K.astle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.

[5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

[6] ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM _ 97, Dubrovnik, October 15{17, 1997, pp. 120-24.

[8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172-175.

[9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard K. uhn, and Niels Kuster, \The depen-dence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1865-1873, Oct. 1996.

[10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.

[11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[12] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992.Dosimetric Evaluation of Sample device, month 1998 9

[13] NIS81 NAMAS, \The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10.

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