



NVLAP LAB CODE 200707-0



SAR EVALUATION REPORT

For

MACKARL ENTERPRISES INC.

16960 Gale Ave., City of Industry,

CA 91745, USA

FCC ID: NK63123X

Report Type: Original Report	Product Type: DECT6.0 Cordless Phone
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Report Number: RSZ09100903-SAR	
Report Date: 2009-11-11	
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* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "*".

Summary of Test Results

Rule Part(s):	CFR 47 §2.1093
Test Procedure(s):	FCC OET Bulletin 65C IEEE 1528-2003
Device Type:	Portable device
Exposure Category	Population/Uncontrolled
Modulation:	GFSK
TX Frequency Range:	1928.448-1921.536 MHz
Maximum Conducted Power Tested:	18.10 dBm
Antenna Type(s):	Internal Antenna
Face-Head Accessories:	None
Max. SAR Level(s) Measured:	0.021W/Kg 1g Head Tissue

This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C and IEEE 1528-2003.

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



EUT Photo

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REFERENCE, STANDARDS AND GUIDELINES

FCC:

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

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

CE:

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by the EN50360 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 1 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).

EUT DESCRIPTION

This Bay Area Compliance Laboratories Corp. test report has been prepared on behalf of MACKARL ENTERPRISES INC. and their product, FCC ID: NK63123X or the EUT (Equipment Under Test) as referred to in the rest of this report.

***Note:** The series products, Model: 3123X (Where X: can be 0 (extra HS), 1 (Single HS), 2 (Two HS), 3 (Three HS) - Version), we select 31231 to test, there is no electrical change has been made to the equipment, which was explained in the Appendix J Product Similar Declaration Letter

Technical Specification

Item	Content
Modulation	GFSK
Frequency Band	1921.536-1928.448 MHz
Dimensions (L*W*H)	155mm (L)×46 mm (W)× 20mm (H)
Weight	100g
Power Source	2.4 VDC / 500 mAh Rechargeable Battery
Normal Operation	Head

EUT Photo



*Model: 31231
Please refer to Appendix H*

FACILITIES AND ACCREDITATION

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect data is located at

6/F, the 3rd Phase of WanLi Industrial Building,
Shi Hua Road, Fu Tian Free Trade Zone,
Shenzhen, Guangdong, P.R. of China

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



NVLAP LAB CODE 200707-0

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

DESCRIPTION OF TEST SYSTEM

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



ALSAS-10U System Description

ALSAS-10-U is fully compliant with the technical and scientific requirements of IEEE 1528, IEC 62209, CENELEC, ARIB, ACA, and the Federal Communications Commission. The system comprises of a six axes articulated robot which utilizes a dedicated controller. ALSAS-10U uses the latest methodologies. And FDTD modeling to provide a platform which is repeatable with minimum uncertainty.

Applications

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

Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 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

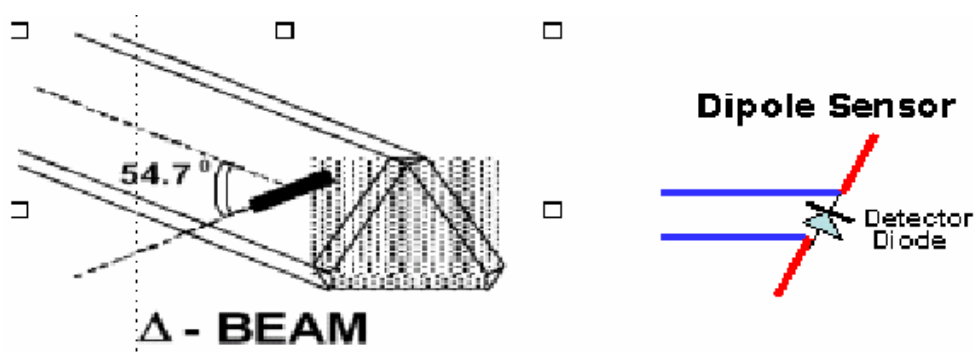
The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

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

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 in Air	Frequency Dependent Below 2 GHz Calibration in air performed in a TEM Cell Above 2 GHz Calibration in air performed in waveguide
Sensitivity	$0.70 \mu\text{V}/(\text{V}/\text{m})^2$ to $0.85 \mu\text{V}/(\text{V}/\text{m})^2$
Dynamic Range	0.0005 W/kg to 100 W/kg
Isotropic Response	Better than 0.2 dB
Diode Compression Point (DCP)	Calibration for Specific Frequency
Probe Tip Radius	< 5 mm
Sensor Offset	1.56 (+/- 0.02 mm)
Probe Length	290 mm
Video Bandwidth	@ 500 Hz: 1 dB @ 1.02 kHz: 3 dB
Boundary Effect	Less than 2% for distance greater than 2.4 mm
Spatial Resolution	Diameter less than 5 mm Compliant with Standards

Boundary Detection Unit and Probe Mounting Device

ALSAS-10U incorporates a boundary detection unit with a sensitivity of 0.05mm for detecting all types of surfaces. The robust design allows for detection during probe tilt (probe normalize) exercises, and utilizes a second stage emergency stop. The signal electronics are fed directly into the robot controller for high accuracy surface detection in lateral and axial detection modes (X, Y, & Z).

The probe is mounted directly onto the Boundary Detection unit for accurate tooling and displacement calculations controlled by the robot kinematics. The probe is connect to an isolated probe interconnect where the output stage of the probe is fed directly into the amplifier stage of the Daq-Paq.

Daq-Paq (Analog to Digital Electronics)

ALSAS-10U incorporates a fully calibrated Daq-Paq (analog to digital conversion system) which has a 4 channel input stage, sent via a 2 stage auto-set amplifier module. The input signal is amplified accordingly so as to offer a dynamic range from 5 μV 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.

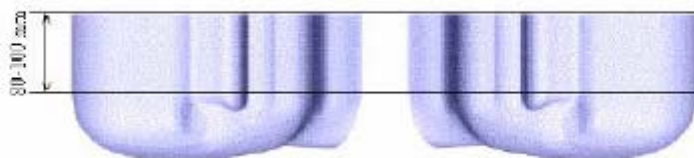


Phantom Types

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

IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

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

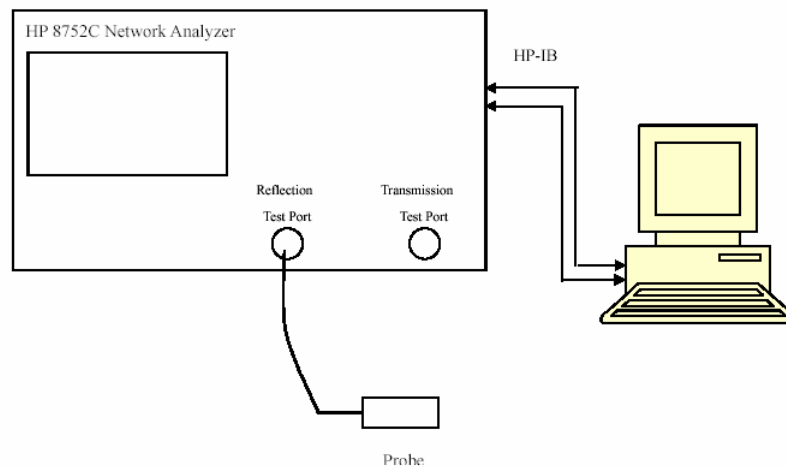
EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Info

Equipment	Model	Calibration Due 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	N/A	110-00212
Miniature E-Field Probe	ALS-E-020	2010-09-05	273
Dipole, 835MHz	ALS-D-835-S-2	2010-09-01	180-00558
Dipole, 1900MHz	ALS-D-1900-S-2	2010-09-01	210-00710
Dipole Spacer	ALS-DS-U	N/A	250-00907
R&S, universal Digital Communication Tester	CMD60	2010-09-26	1100.0008.02
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-T-835-1-H	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-T-835-1-B	Each Time	270-02101
Simulated Tissue 1900 MHz Head	ALS-T-1900-1-H	Each Time	295-01103
Simulated Tissue 1900 MHz Body	ALS-T-1900-1-B	Each Time	295-02102
Signal Generator	HP8341B	2009-11-06	2624A00116
Power Amplifier	5S1G4	N/A	71377
Spectrum Analyzer	FSEM30	2010-07-08	849720/019

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

Frequency (MHz)	Liquid Type	Liquid Parameter		Result
		ϵ_r	σ (S/m)	
1900	Head	39.38	1.44	In Tolerance
1900	Body	53.29	1.58	In Tolerance

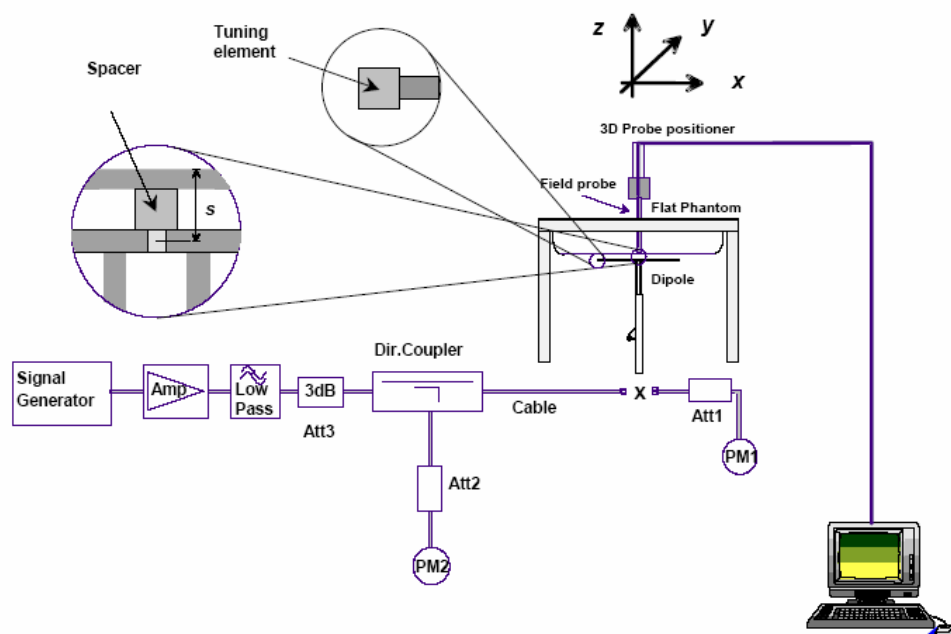
Please refer to the following tables.

1900 MHz Head				1900 MHz Body		
Frequency	e'	e''		Frequency	e'	e''
1921536000	39.532131	13.375729		1921536000	53.321859	14.557703
1921674240	39.499723	13.394913		1921674240	53.317276	14.557276
1921812480	39.518713	13.400145		1921812480	53.338443	14.581392
1921950720	39.468882	13.391188		1921950720	53.297603	14.573233
1922088960	39.445811	13.386570		1922088960	53.317792	14.579820
1922227200	39.479390	13.400720		1922227200	53.325236	14.572279
1922365440	39.479299	13.384883		1922365440	53.312857	14.575240
1922503680	39.456787	13.409964		1922503680	53.315462	14.586664
1922641920	39.443499	13.387340		1922641920	53.338685	14.572162
1922780160	39.454477	13.379565		1922780160	53.338095	14.571853
1922918400	39.439835	13.426709		1922918400	53.303836	14.627591
1923056640	39.414990	13.414328		1923056640	53.327682	14.638076
1923194880	39.417089	13.444995		1923194880	53.337700	14.657507
1923333120	39.400904	13.451185		1923333120	53.269173	14.630641
1923471360	39.409763	13.444715		1923471360	53.312140	14.645771
1923609600	39.412726	13.447929		1923609600	53.317675	14.639937
1923747840	39.403336	13.464838		1923747840	53.335816	14.651943
1923886080	39.397970	13.464268		1923886080	53.324552	14.635627
1924024320	39.415464	13.476284		1924024320	53.339424	14.635872
1924162560	39.400459	13.469825		1924162560	53.315992	14.674667
1924300800	39.414429	13.457124		1924300800	53.318579	14.649350
1924439040	39.391490	13.485533		1924439040	53.316763	14.679485
1924577280	39.378949	13.492444		1924577280	53.291873	14.668259
1924715520	39.387909	13.509752		1924715520	53.329240	14.680936
1924853760	39.411066	13.521119		1924853760	53.335478	14.703753
1924992000	39.378177	13.505060		1924992000	53.293439	14.733924
1925130240	39.405619	13.513661		1925130240	53.312186	14.734164
1925268480	39.433517	13.504081		1925268480	53.328018	14.715144
1925406720	39.421765	13.540390		1925406720	53.321745	14.720033
1925544960	39.440531	13.530519		1925544960	53.321598	14.715587
1925683200	39.424443	13.545684		1925683200	53.300548	14.708324
1925821440	39.427524	13.548693		1925821440	53.300630	14.744026
1925959680	39.451136	13.541699		1925959680	53.282908	14.748386
1926097920	39.445321	13.568259		1926097920	53.353844	14.737294
1926236160	39.447847	13.565634		1926236160	53.320815	14.744893
1926374400	39.467572	13.575955		1926374400	53.314456	14.753458
1926512640	39.451781	13.581991		1926512640	53.329804	14.745735
1926650880	39.436952	13.608254		1926650880	53.272139	14.750341
1926789120	39.476553	13.635692		1926789120	53.301356	14.777456
1926927360	39.447499	13.611429		1926927360	53.289146	14.791547
1927065600	39.474001	13.599448		1927065600	53.284882	14.798246
1927203840	39.482808	13.634527		1927203840	53.284611	14.801279
1927342080	39.500790	13.627946		1927342080	53.299297	14.812507
1927480320	39.496108	13.641799		1927480320	53.258218	14.787281
1927618560	39.495999	13.634824		1927618560	53.258598	14.775013
1927756800	39.495911	13.627846		1927756800	53.230492	14.811216
1927895040	39.495491	13.638947		1927895040	53.242096	14.803212
1928033280	39.501137	13.622336		1928033280	53.245041	14.825341
1928171520	39.499555	13.622276		1928171520	53.242055	14.801574
1928309760	39.486831	13.623402		1928309760	53.224374	14.817171
1928448000	39.485974	13.661532		1928448000	53.199072	14.832476

System Accuracy Verification

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

System Verification Setup Block Diagram



System Accuracy Check Results

Frequency (MHz)	1 g SAR (W/Kg)	10 g SAR (W/Kg)	Result
1900	40.195	20.616	In Tolerance

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

IEEE P1528 recommended reference value for Head Tissue

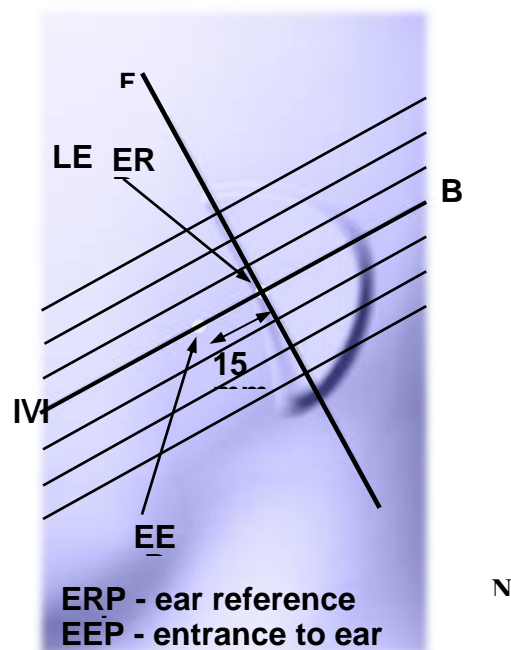
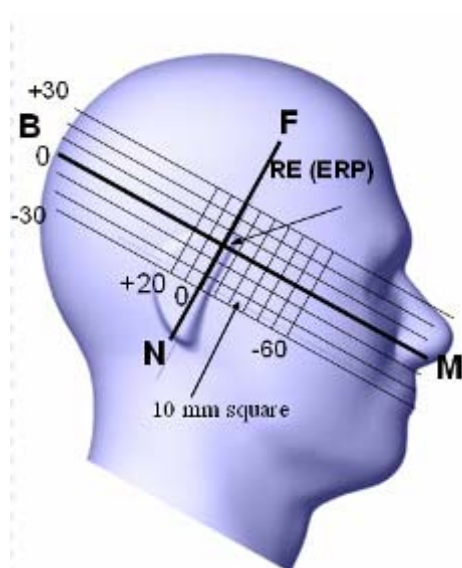
Frequency (MHz)	1 g SAR (W/Kg)	10 g SAR (W/Kg)	Local SAR at surface (above feed point)	Local SAR at surface ($v=2\text{cm}$ offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	14.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

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

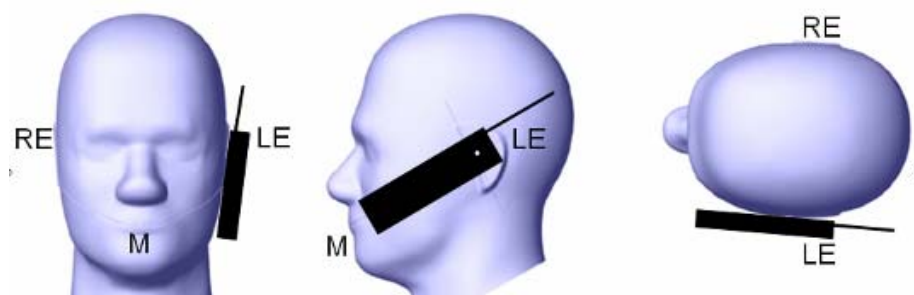
The device is brought toward the mouth of the head phantom by pivoting against the “ear reference point” or along the “N-F” line for the SCC-34/SC-2 head phantom.

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.

Check /Touch Position



Ear/Tilt Position

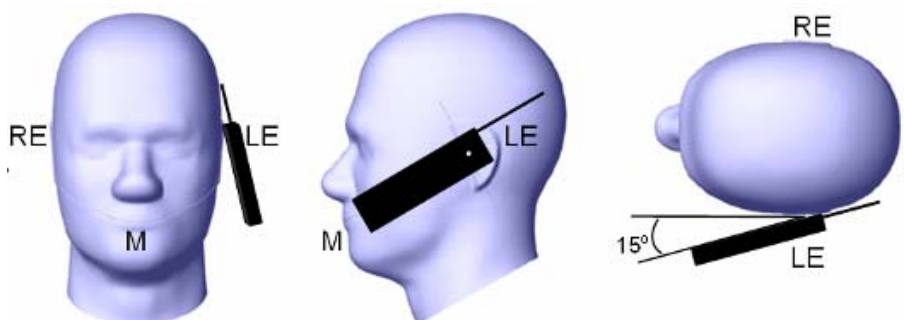
With the handset aligned in the “Cheek/Touch Position”:

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

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

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

Ear /Tilt 15° Position



Test positions for body-worn and other configurations

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

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

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or EUT and the horizontal grid spacing was 15 mm x 15 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 30 mm x 30 mm x 21 mm was assessed by measuring 5 x 5 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.

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device, could be found in Appendix E.

SAR Test Data

Environmental Conditions

Temperature:	24° C
Relative Humidity:	50%
ATM Pressure:	1003 mbar

* Testing was performed by Eric Zhang on 2009-10-19.

EUT Position	Frequency (MHz)	Test Type	Antenna Type	Liquid	Phantom	Accessories	1g SAR Value (W/Kg)	FCC Limit (W/Kg)	Ref. Plot #
Left Head Cheek	1928.448	Head	Integral	Head	Left Head	-	0.021	1.6	1
Left Head Tilt	1928.448	Head	Integral	Head	Left Head	-	0.019	1.6	2
Right Head Cheek	1928.448	Head	Integral	Head	Right Head	-	0.020	1.6	3
Right Head Tilt	1928.448	Head	Integral	Head	Right Head	-	0.014	1.6	4

APPENDIX A – MEASUREMENT UNCERTAINTY

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

Exposure Assessment Measurement Uncertainty

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	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	3.2	rectangular	$\sqrt{3}$	1	1	1.8	1.8
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	0.0	normal	1	0.7	0.5	0.0	0.0
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid Permittivity(meas.)	0.0	normal	1	0.6	0.5	0.0	0.0
Combined Uncertainty		RSS				9.4	9.2
Combined Uncertainty (coverage factor=2)		Normal(k=2)				18.8	18.5

APPENDIX B – PROBE CALIBRATION CERTIFICATES

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1015

Client.: BACL

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 1900 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 273

Calibration in Head Tissue

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: BACB-E field probe-cal-5476

Calibrated: 7th September 2009
Released on: 9th September 2009

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

Released By: **NCL CALIBRATION LABORATORIES**

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

NCL Calibration Laboratories

Division of APREL Laboratories.

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 273.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe 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"
SSI-TP-011 Tissue Calibration Procedure

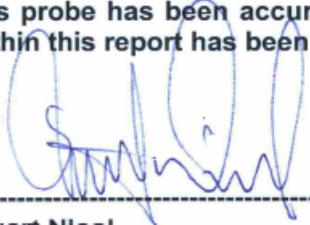
Conditions

Probe 273 was a re-calibration.

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

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

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



Stuart Nicol

Jesse Hones

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 Laboratories.

Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	273
Frequency:	1900 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Y:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Z:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point:	95 mV

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

NCL Calibration Laboratories

Division of APREL Laboratories.

Sensitivity in Head Tissue Measured**Frequency:** 1900 MHz**Epsilon:** 38.50 (+/-5%) **Sigma:** 1.40 S/m (+/-5%)**ConvF****Channel X:** 5.25**Channel Y:** 5.25**Channel Z:** 5.25

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

Boundary Effect:

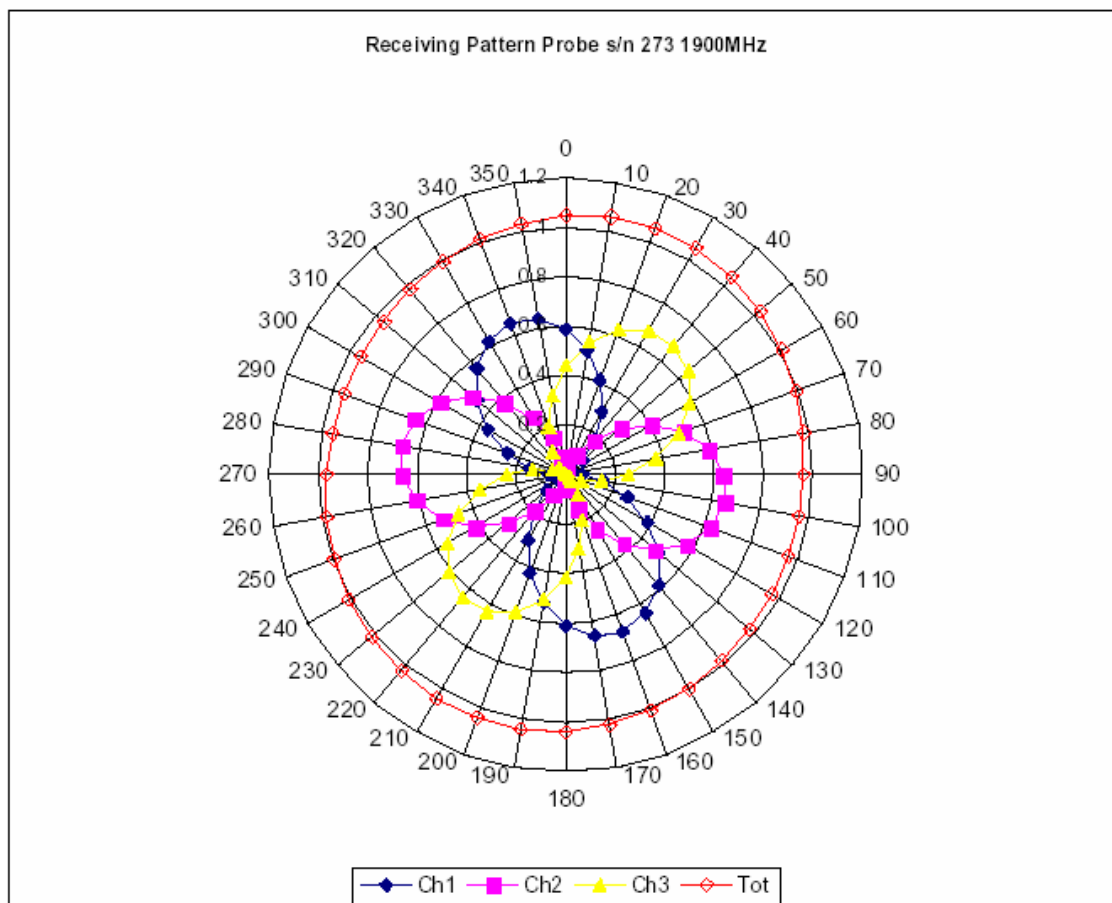
Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

Spatial Resolution:

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

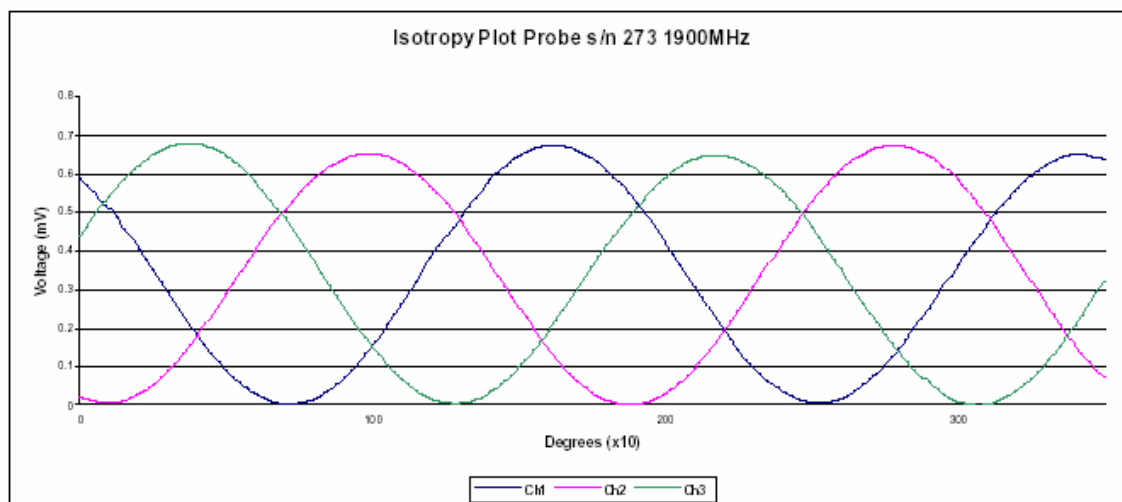
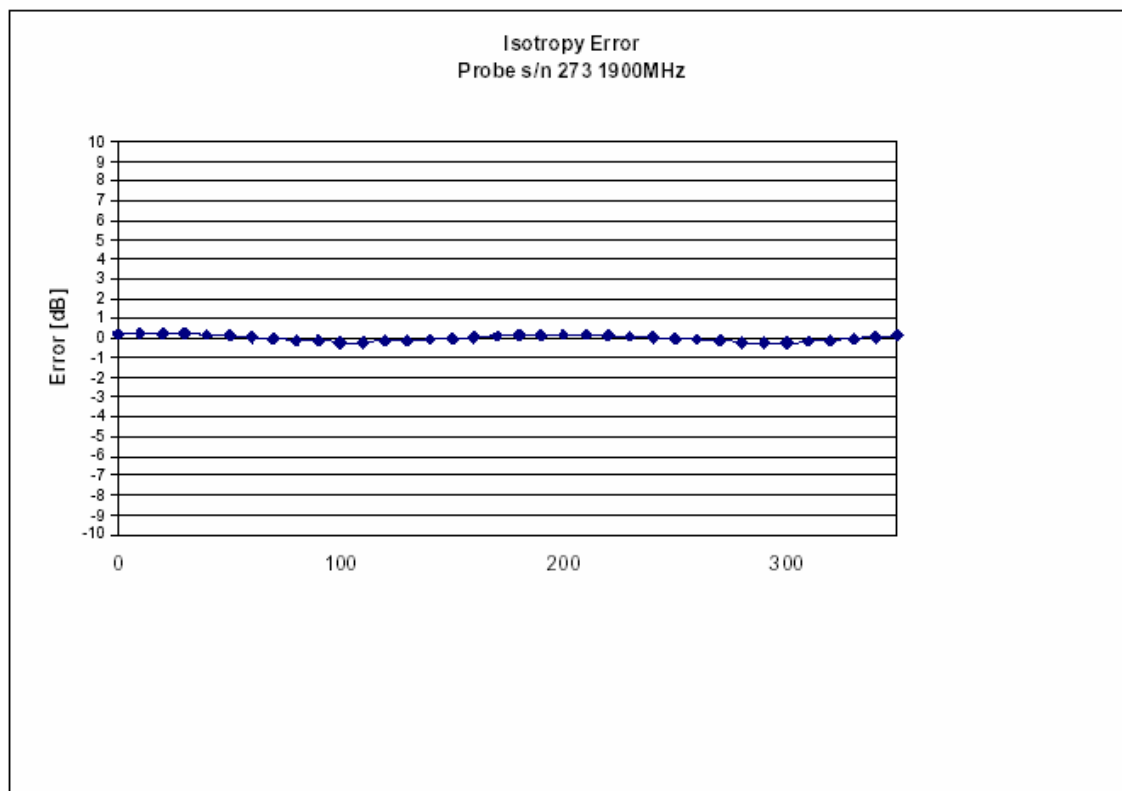
NCL Calibration Laboratories

Division of APREL Laboratories.

Receiving Pattern 1900 MHz (Air)

NCL Calibration Laboratories

Division of APREL Laboratories.

Isotropy Error 1900 MHz (Air)**Isotropy in Tissue:**

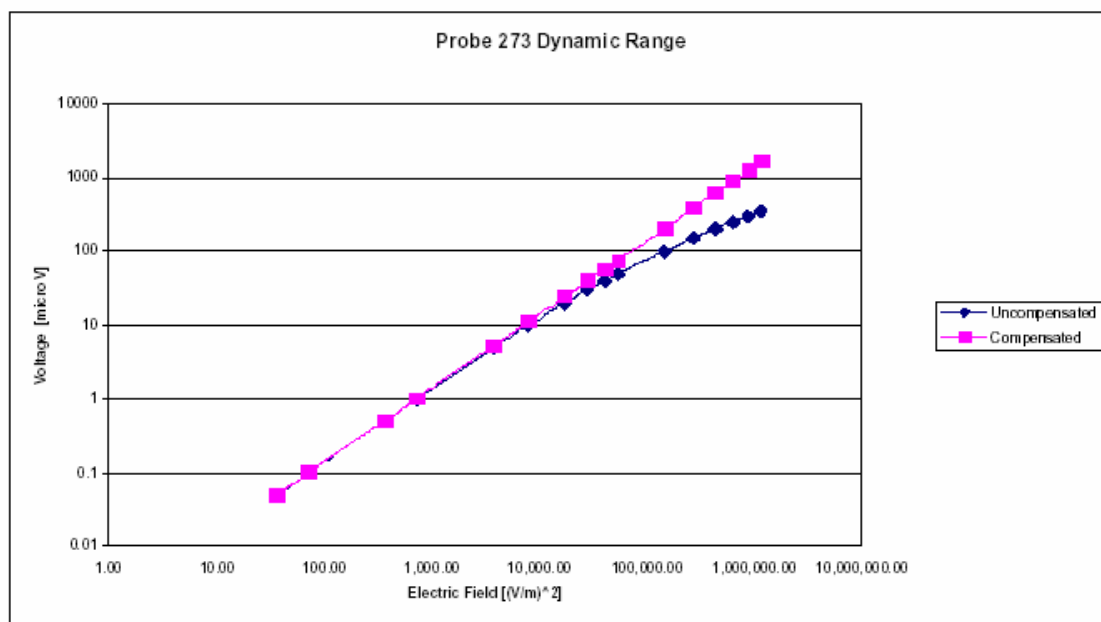
0.10 dB

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

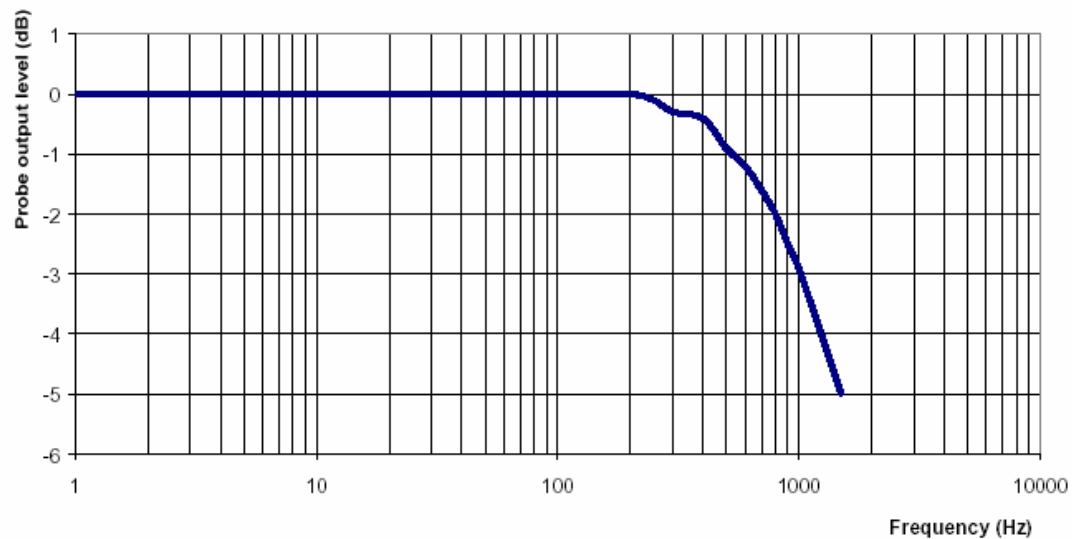
NCL Calibration Laboratories

Division of APREL Laboratories.

Dynamic Range

NCL Calibration Laboratories

Division of APREL Laboratories.

Video Bandwidth**Probe Frequency Characteristics**

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

NCL Calibration Laboratories

Division of APREL Laboratories.

Conversion Factor Uncertainty Assessment**Frequency:** 1900MHz**Epsilon:** 38.50 (+/-5%)**Sigma:** 1.40 S/m (+/-5%)**ConvF****Channel X:** 5.25 7%(K=2)**Channel Y:** 5.25 7%(K=2)**Channel Z:** 5.25 7%(K=2)

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

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

Page 9 of 10

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

NCL Calibration Laboratories

Division of APREL Laboratories.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2009.

Page 10 of 10

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

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1016

Client.: BACL

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 1900 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 273

Calibration in Body Tissue

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: BACB-E field probe-cal-5476

Calibrated: 7th September 2009
Released on: 9th September 2009

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

Released By: _____

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
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Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

NCL Calibration Laboratories

Division of APREL Laboratories.

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 273.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe 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"
SSI-TP-011 Tissue Calibration Procedure

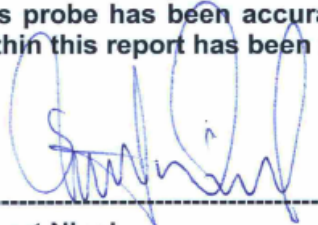
Conditions

Probe 273 was a re-calibration.

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

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

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



Stuart Nicol

Jesse Hones

NCL Calibration Laboratories

Division of APREL Laboratories.

Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	273
Frequency:	1900 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X:	1.2 $\mu\text{V}/(\text{V}/\text{m})^2$
Channel Y:	1.2 $\mu\text{V}/(\text{V}/\text{m})^2$
Channel Z:	1.2 $\mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point:	95 mV

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 Laboratories.

Sensitivity in Body Tissue Measured**Frequency:** 1900 MHz**Epsilon:** 53.05 (+/-5%) **Sigma:** 1.58 S/m (+/-5%)**ConvF****Channel X:** 5.15**Channel Y:** 5.15**Channel Z:** 5.15

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

Boundary Effect:

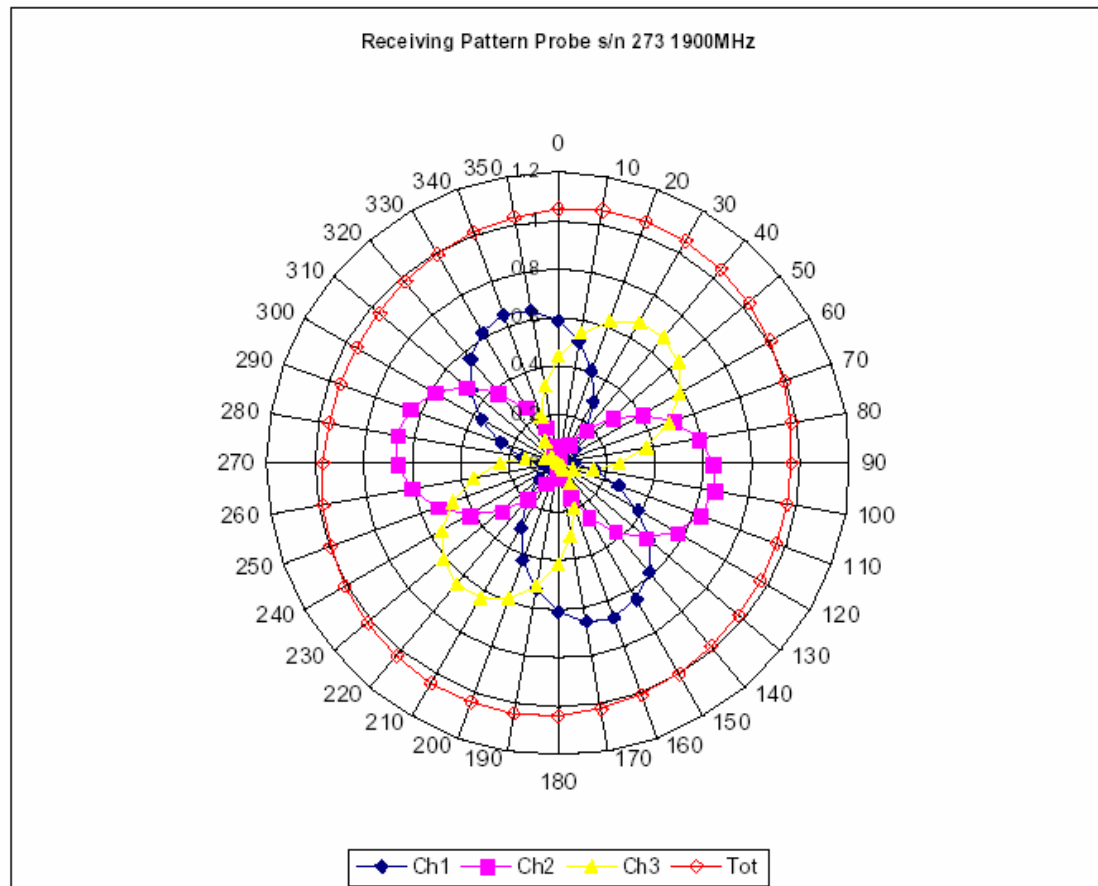
Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

Spatial Resolution:

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

NCL Calibration Laboratories

Division of APREL Laboratories.

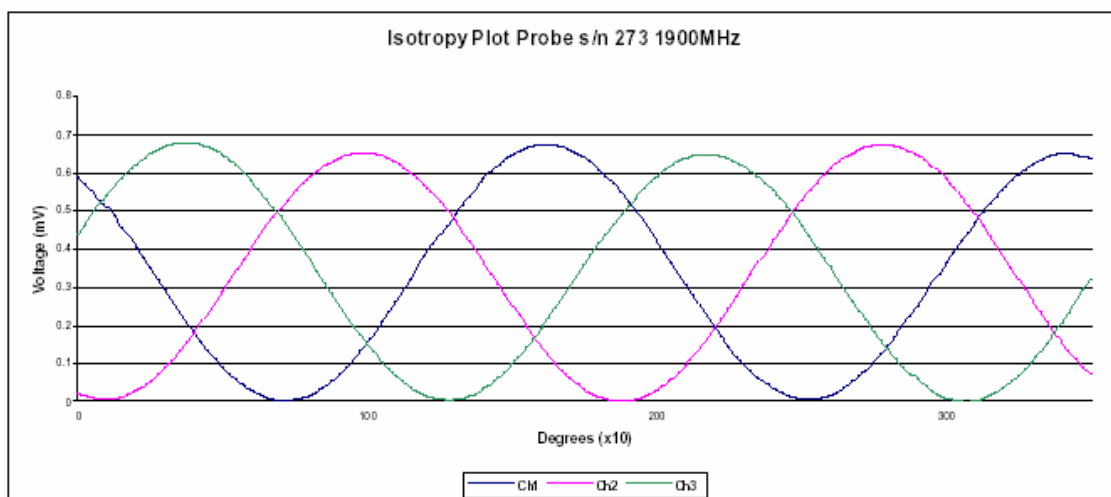
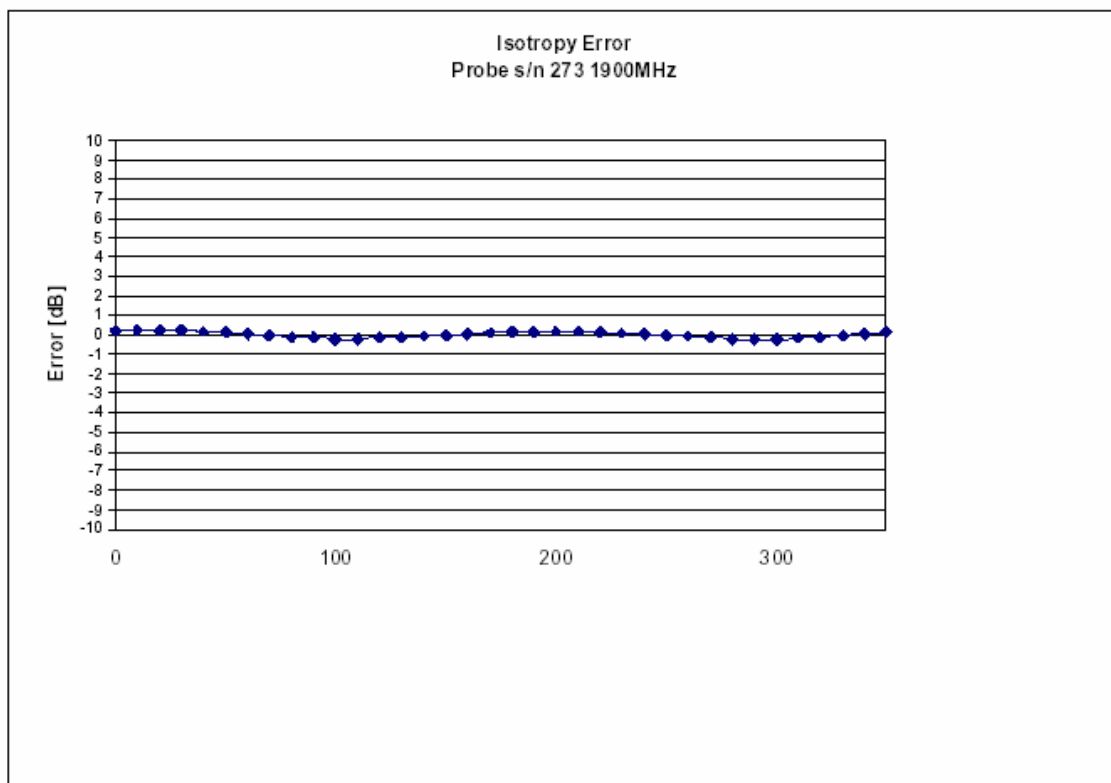
Receiving Pattern 1900 MHz (Air)

Page 5 of 10

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

NCL Calibration Laboratories

Division of APREL Laboratories.

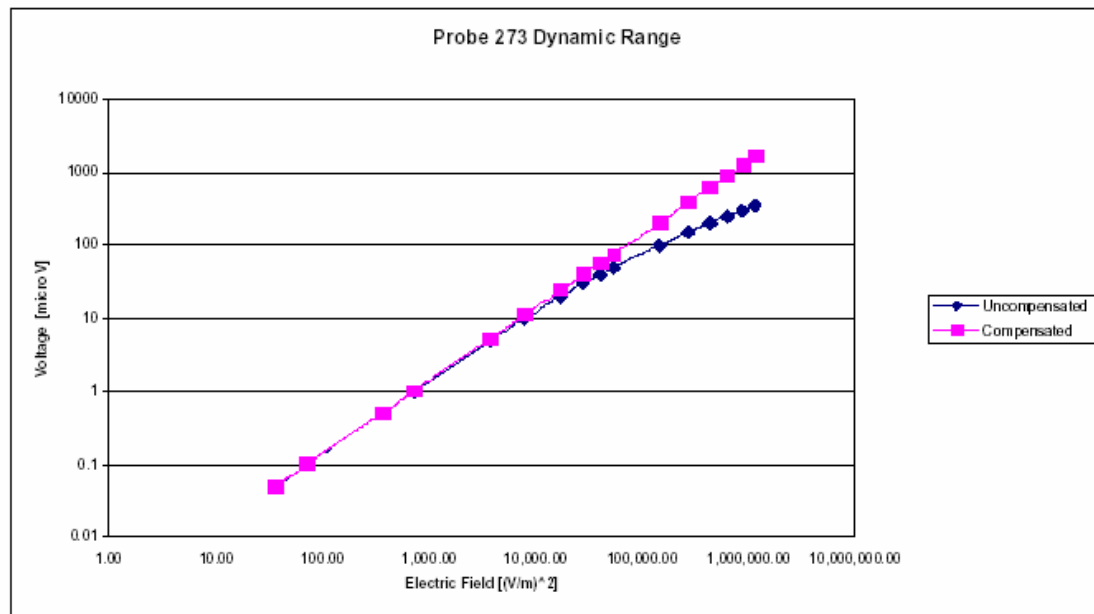
Isotropy Error 1900 MHz (Air)**Isotropy in Tissue:****0.10 dB**

Page 6 of 10

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

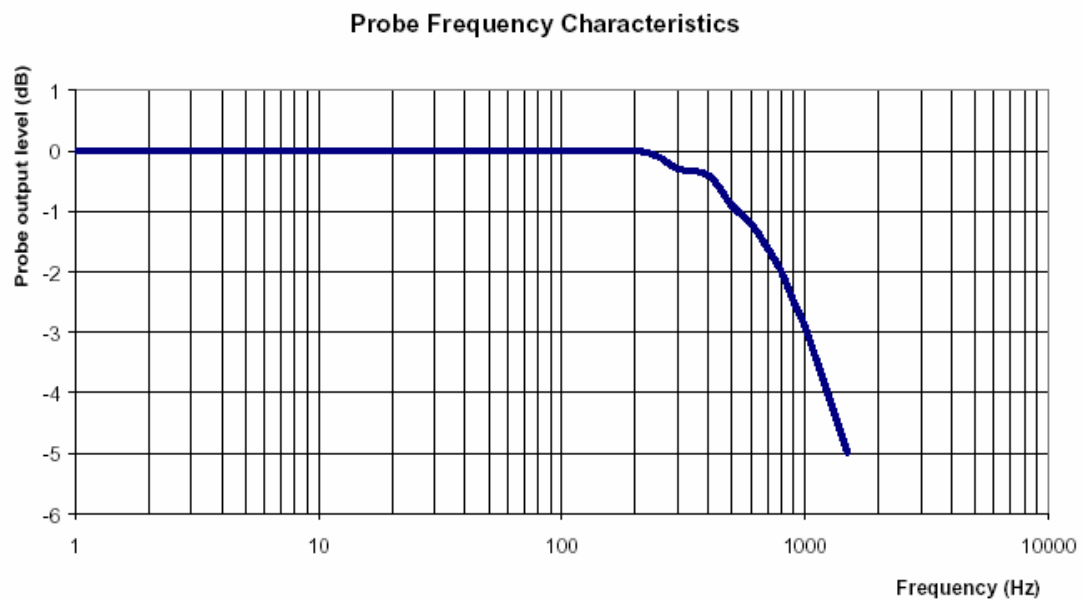
NCL Calibration Laboratories

Division of APREL Laboratories.

Dynamic Range

NCL Calibration Laboratories

Division of APREL Laboratories.

Video Bandwidth

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

NCL Calibration Laboratories

Division of APREL Laboratories.

Conversion Factor Uncertainty Assessment**Frequency:** 1900MHz**Epsilon:** 53.05 (+/-5%) **Sigma:** 1.58 S/m (+/-5%)**ConvF****Channel X:** 5.15 7%(K=2)**Channel Y:** 5.15 7%(K=2)**Channel Z:** 5.15 7%(K=2)

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

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

Page 9 of 10

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

NCL Calibration Laboratories

Division of APREL Laboratories.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2009.

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

APPENDIX C – DIPOLE CALIBRATION CERTIFICATES

NCL CALIBRATION LABORATORIES

Calibration File No: DC-920
Project Number: BACL-ALSAS10U-5323

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

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

Customer: Bay Area Compliance Laboratory

Calibrated: 1st September 2008
Released on: 1st September 2008

This Calibration Certificate is incomplete unless accompanied with the Calibration Results Summary

Released By: _____

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4162

NCL Calibration Laboratories

Division of APREL Laboratories.

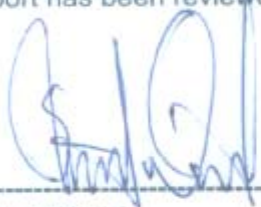
Conditions

Dipole 210-00710 was new and taken from stock prior to calibration.

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

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

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



Stuart Nicol



C. Teodorian

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

NCL Calibration Laboratories

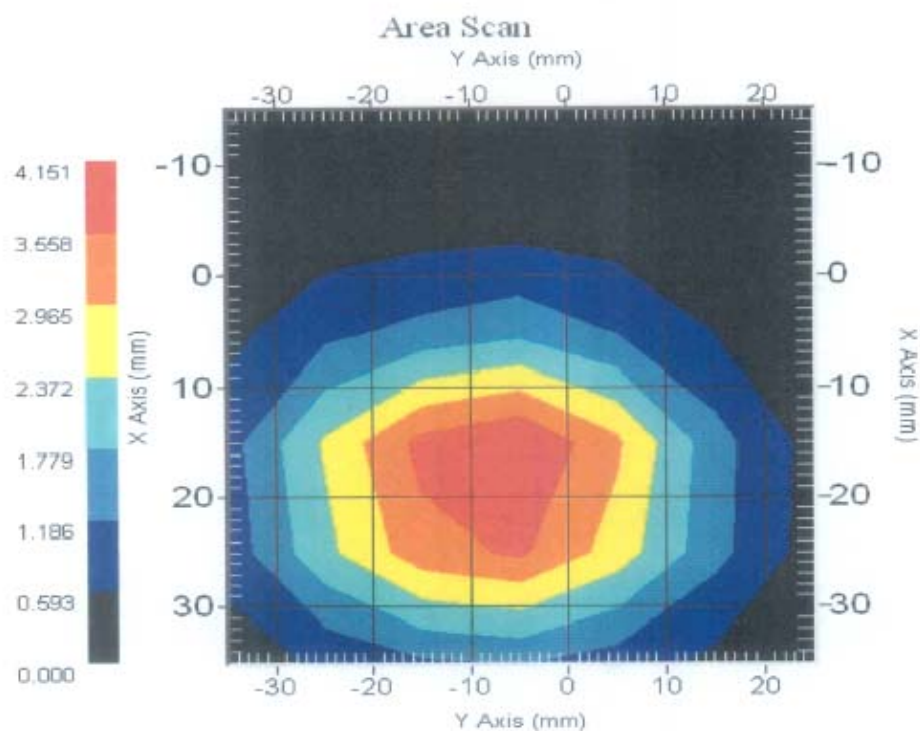
Division of APREL Laboratories.

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****SWR:** 1.059 U**Return Loss:** -30.831 dB**Impedance:** 50.914 Ω **System Validation Results**

Frequency	1 Gram	10 Gram	Peak
1900 MHz	38.7	20.5	69.7



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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 210-00710. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

References

SSI-TP-018-ALSAS Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

Conditions

Dipole 210-00710 was new taken from stock.

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

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Dipole Calibration Results**Mechanical Verification**

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

Tissue Validation

Head Tissue 1900 MHz	Measured
Dielectric constant, ϵ_r	40.03
Conductivity, σ [S/m]	1.38

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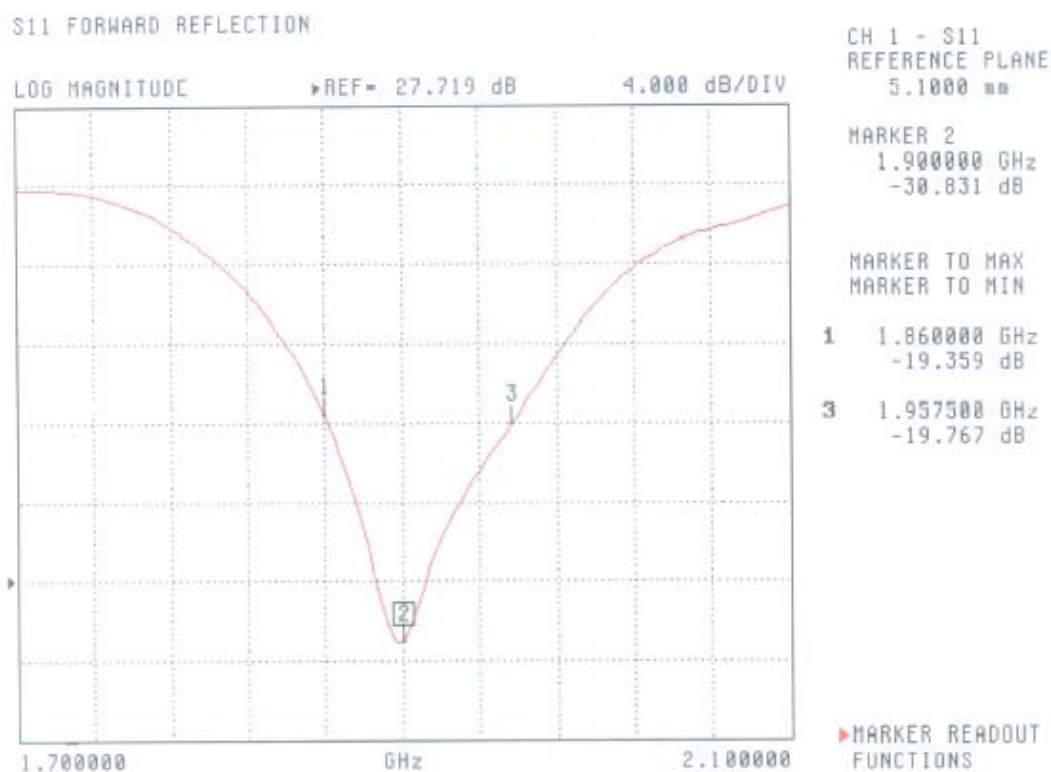
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Electrical Calibration

Test	Result
S11 R/L	-30.831 dB
SWR	1.059 U
Impedance	50.914 Ω

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

S11 Parameter Return Loss

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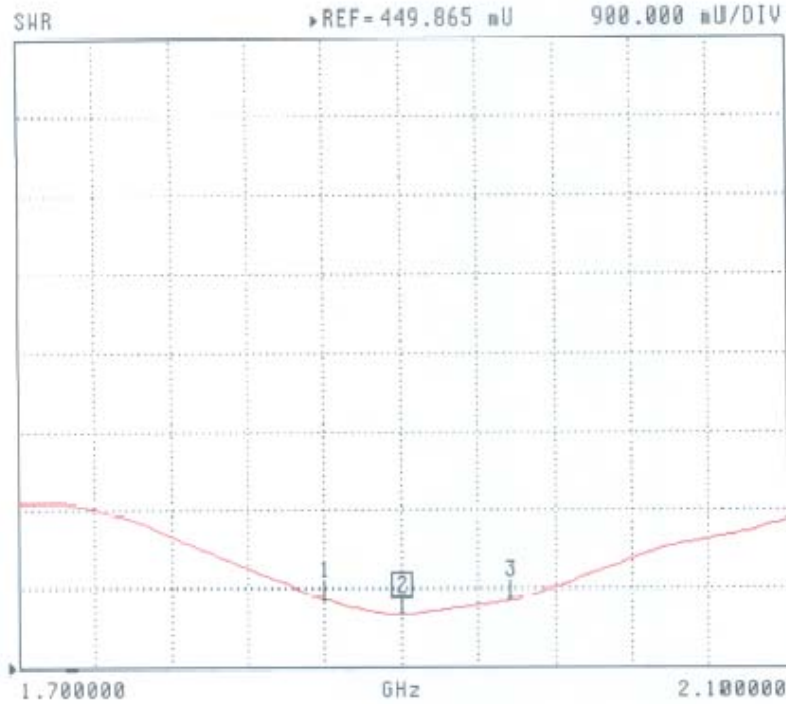
6

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SWR

S11 FORWARD REFLECTION

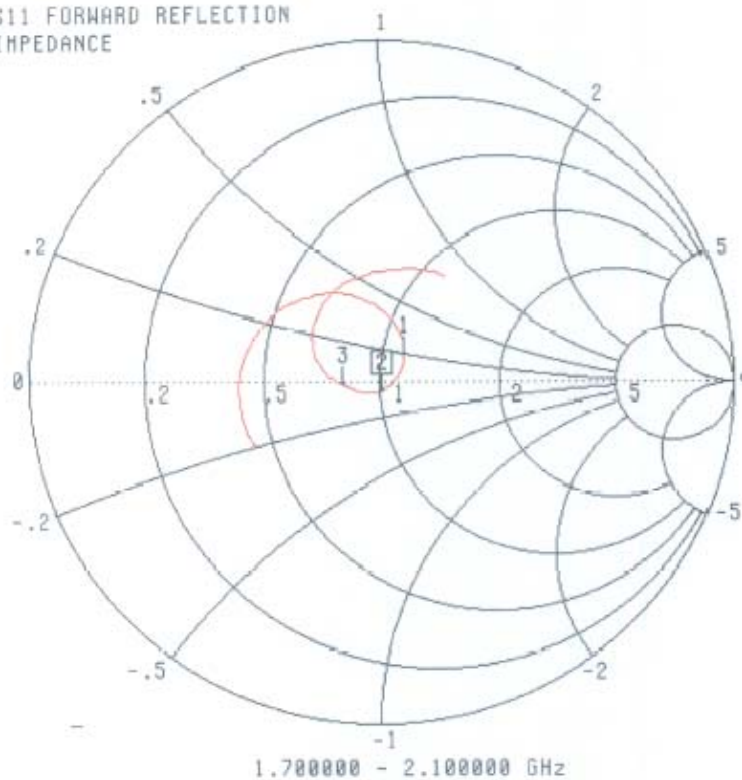
CH 1 - S11
REFERENCE PLANE
5.1000 mmMARKER 2
1.900000 GHz
1.059 UMARKER TO MAX
MARKER TO MIN1 1.860000 GHz
1.241 U3 1.957500 GHz
1.229 U▶ MARKER READOUT
FUNCTIONS

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Smith Chart Dipole ImpedanceS11 FORWARD REFLECTION
IMPEDANCECH 1 - S11
REFERENCE PLANE
5.1000 mmMARKER 2
1.900000 GHz
50.914 Ω
-2.753 j Ω MARKER TO MAX
MARKER TO MIN

1	1.860000 GHz
	57.324 Ω
	8.989 j Ω
3	1.957500 GHz
	40.725 Ω
	-916.404 j Ω

▶ MARKER READOUT
FUNCTIONS

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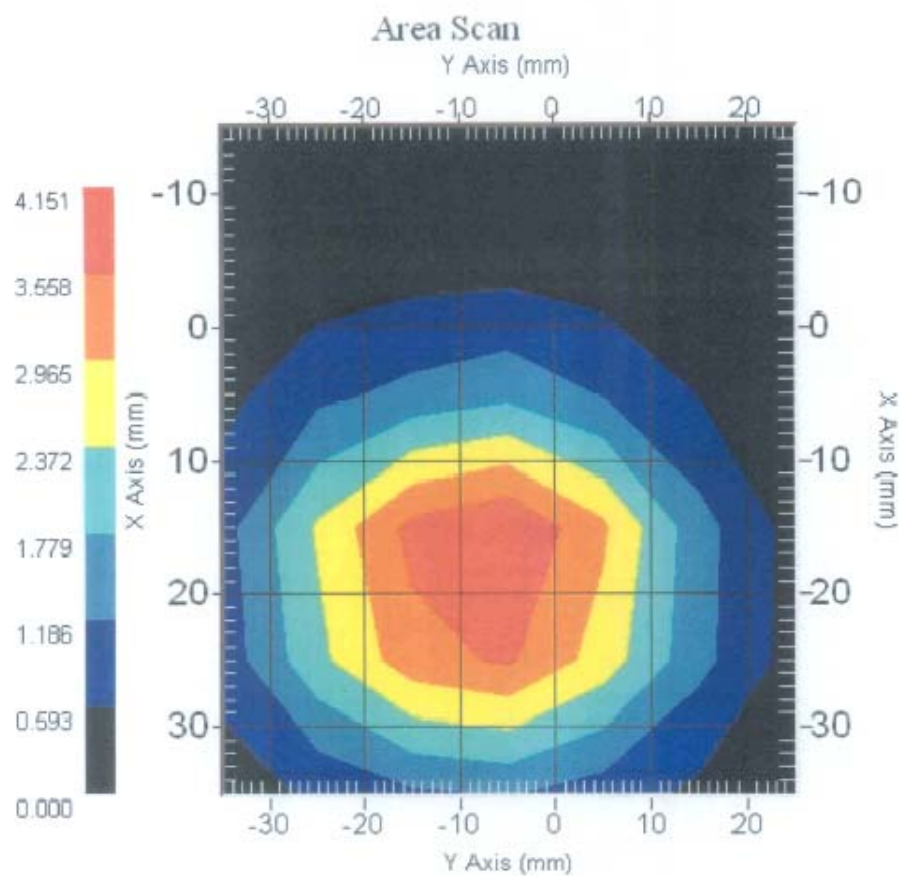
8

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System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
1900 MHz	38.7	20.5	69.7



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NCL Calibration Laboratories

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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 2007.

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APPENDIX D – SAR SYSTEM VALIDATION DATA

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

System Performance Check 1900 MHz Head Tissue

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 : 1900.00 MHz
 Max. Transmit Pwr : 1 W
 Drift Time : 3 min(s)
 Power Drift-Start : 39.335 W/kg
 Power Drift-Finish : 39.191 W/kg
 Power Drift (%) : -0.367

Phantom Data

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

Tissue Data

Type : HEAD
 Serial No. : 295-01103
 Frequency : 1900.00 MHz
 Last Calib. Date : 16-Oct-2009
 Temperature : 20.00 °C
 Ambient Temp. : 20.00 °C
 Humidity : 56.00 RH%
 Epsilon : 39.38 F/m
 Sigma : 1.44 S/m
 Density : 1000.00 kg/cu. m

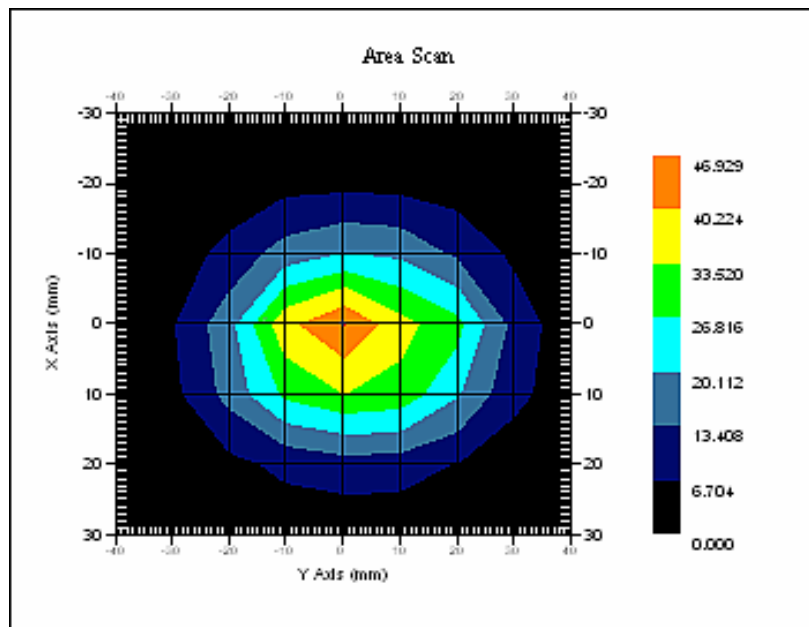
Probe Data

Name : E-Field
 Model : E-020
 Type : E-Field Triangle
 Serial No. : 273
 Last Calib. Date : 07-Sep-2009
 Frequency : 1900.00 MHz
 Duty Cycle Factor : 1
 Conversion Factor : 5.25
 Probe Sensitivity : 1.20 1.20 1.20 $\mu\text{V}/(\text{V/m})^2$
 Compression Point : 95.00 mV
 Offset : 1.56 mm

Measurement Data

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

1 gram SAR value : 40.195 W/kg
10 gram SAR value : 20.616 W/kg
Area Scan Peak SAR : 46.929 W/kg
Zoom Scan Peak SAR : 74.466 W/kg



1900 MHz System Validation

APPENDIX E – EUT SCAN RESULTS

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

Left Head Cheek (1900 MHz High Channel)

Measurement Data

Test mode : DECT
Crest Factor : 12
Scan Type: : Complete
Area Scan : 11x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.014 W/kg
Power Drift-Finish : 0.014 W/kg
Power Drift (%) : 1.082

Tissue Data

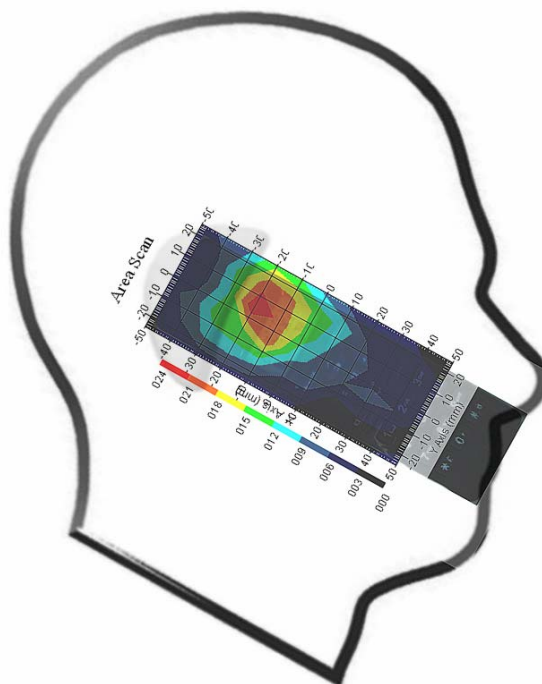
Type : HEAD
Frequency : 1900.00 MHz
Epsilon : 39.38 F/m
Sigma : 1.44 S/m
Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 273
Frequency : 1900.00 MHz
Duty Cycle Factor : 12
Conversion Factor : 5.25
Probe Sensitivity : 1.20 1.20 1.20 $\mu\text{V}/(\text{V/m})^2$
Compression Point : 95.00 mV
Offset : 1.56 mm

1 gram SAR value : 0.021 W/kg
10 gram SAR value : 0.013 W/kg
Area Scan Peak SAR : 0.024 W/kg
Zoom Scan Peak SAR : 0.030 W/kg

Plot 1#



Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**Left Head Tilt (1900 MHz High Channel)****Measurement Data**

Test mode : DECT
Crest Factor : 12
Scan Type: : Complete
Area Scan : 11x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.014 W/kg
Power Drift-Finish : 0.014 W/kg
Power Drift (%) : -2.644

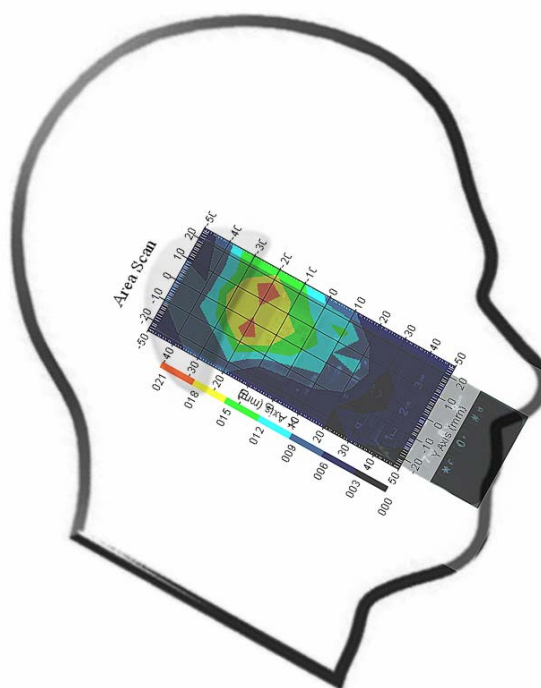
Tissue Data

Type : HEAD
Frequency : 1900.00 MHz
Epsilon : 39.38 F/m
Sigma : 1.44 S/m
Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 273
Frequency : 1900.00 MHz
Duty Cycle Factor : 12
Conversion Factor : 5.25
Probe Sensitivity : 1.20 1.20 1.20 $\mu\text{V}/(\text{V/m})^2$
Compression Point : 95.00 mV
Offset : 1.56 mm

1 gram SAR value : 0.019 W/kg
10 gram SAR value : 0.011 W/kg
Area Scan Peak SAR : 0.021 W/kg
Zoom Scan Peak SAR : 0.030 W/kg

Plot 2#

Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**Right Head Cheek (1900 MHz High Channel)****Measurement Data**

Test mode : DECT
Crest Factor : 12
Scan Type: : Complete
Area Scan : 11x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.016 W/kg
Power Drift-Finish : 0.016 W/kg
Power Drift (%) : 2.243

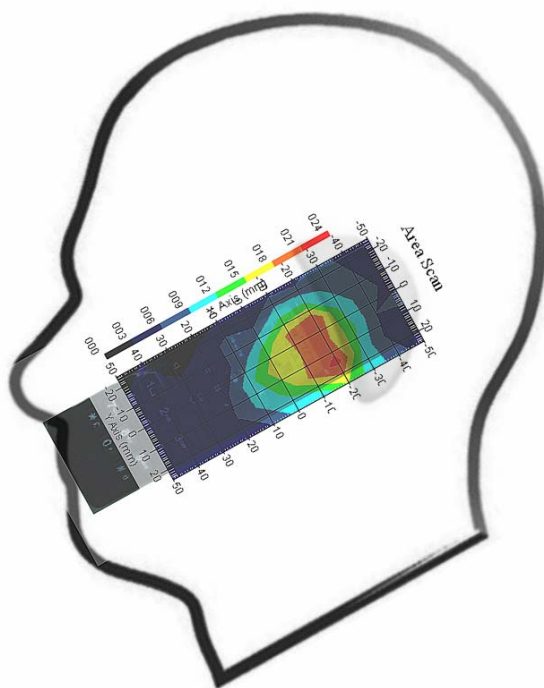
Tissue Data

Type : HEAD
Frequency : 1900.00 MHz
Epsilon : 39.38 F/m
Sigma : 1.44 S/m
Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 273
Frequency : 1900.00 MHz
Duty Cycle Factor : 12
Conversion Factor : 5.25
Probe Sensitivity : 1.20 1.20 1.20 $\mu\text{V}/(\text{V/m})^2$
Compression Point : 95.00 mV
Offset : 1.56 mm

1 gram SAR value : 0.020 W/kg
10 gram SAR value : 0.011 W/kg
Area Scan Peak SAR : 0.022 W/kg
Zoom Scan Peak SAR : 0.030 W/kg

Plot 3#

Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)**Right Head Tilt (1900 MHz High Channel)**

Measurement Data

Test mode : DECT
Crest Factor : 12
Scan Type: : Complete
Area Scan : 11x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.015 W/kg
Power Drift-Finish : 0.015 W/kg
Power Drift (%) : 3.429

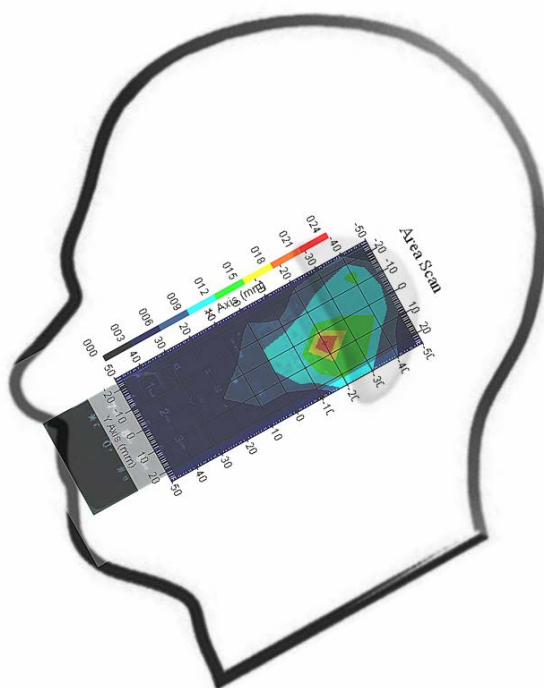
Tissue Data

Type : HEAD
Frequency : 1900.00 MHz
Epsilon : 39.38 F/m
Sigma : 1.44 S/m
Density : 1000.00 kg/cu. m

Probe Data

Serial No. : 273
Frequency : 1900.00 MHz
Duty Cycle Factor : 12
Conversion Factor : 5.25
Probe Sensitivity : 1.20 1.20 1.20 $\mu\text{V}/(\text{V/m})^2$
Compression Point : 95.00 mV
Offset : 1.56 mm

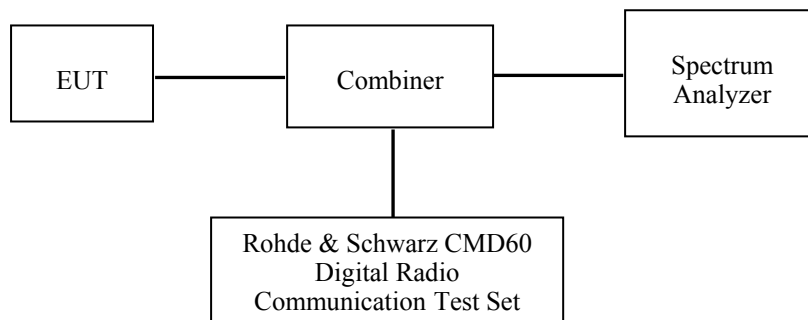
1 gram SAR value : 0.014 W/kg
10 gram SAR value : 0.010 W/kg
Area Scan Peak SAR : 0.022 W/kg
Zoom Scan Peak SAR : 0.024 W/kg

Plot 4#

APPENDIX F – CONDUCTED OUTPUT POWER MEASUREMENT

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.



Test Equipment List and Details

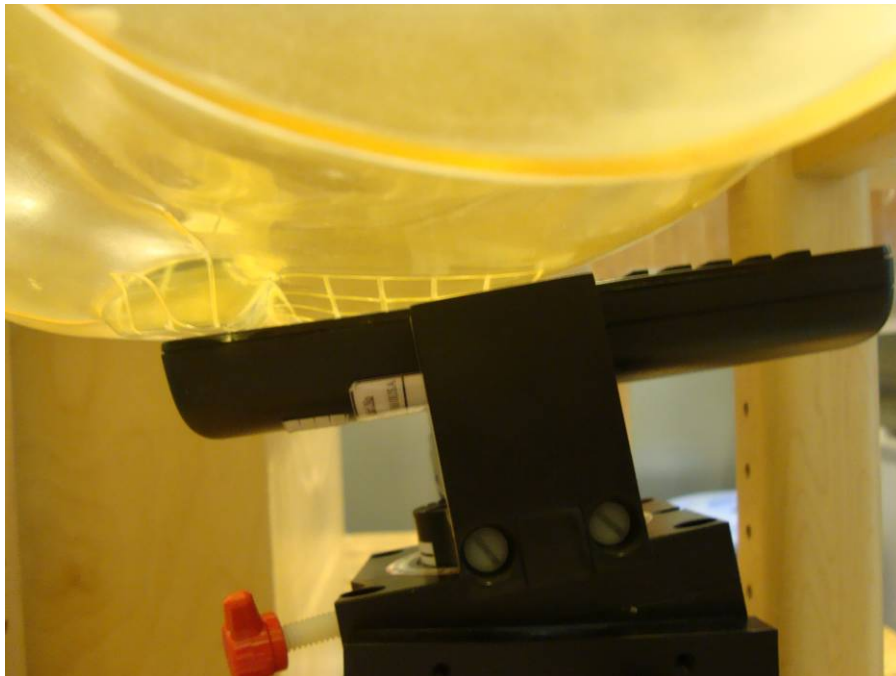
Manufacturer	Equipment Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Communication Tester	CMD60	1050.9008.60	2009-09-26
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2009-07-08

Test Results

Channel No.	Frequency (MHz)	Conducted Output Power	
		(dBm)	(mWatt)
4	1921.536	17.92	61.94
2	1924.992	18.03	63.53
0	1928.448	18.10	64.57

APPENDIX G – EUT TEST POSITION PHOTOS

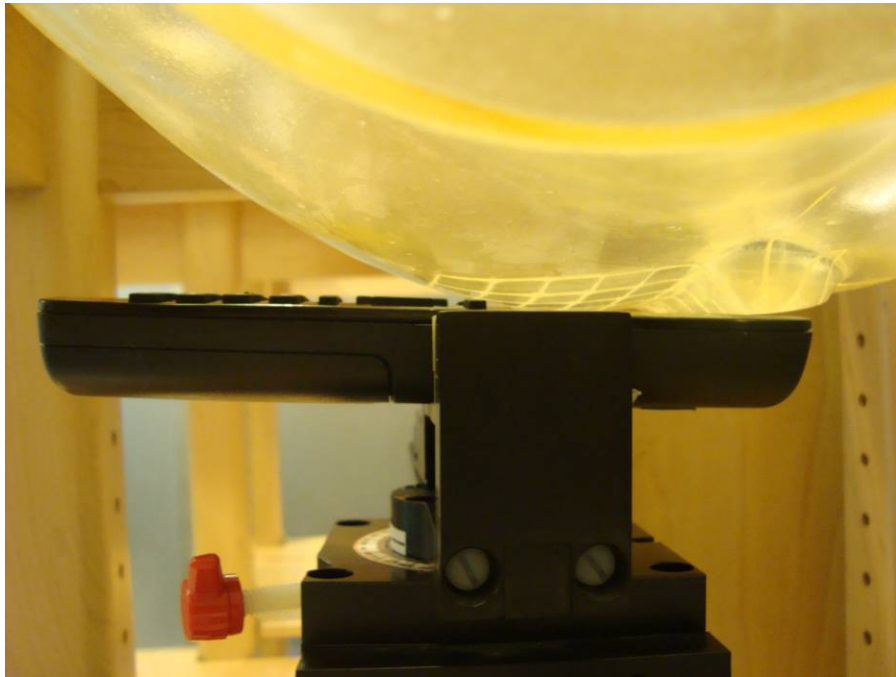
Left Head Touch Setup Photo



Left Head Tilt Setup Photo



Right Head Touch Setup Photo



Right Head Tilt Setup Photo



APPENDIX H – EUT PHOTOS

EUT - Top View



EUT - Bottom View



EUT- Uncovered View



EUT – Top Side View



APPENDIX I - INFORMATIVE REFERENCES

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- [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, Office of Engineering & Technology, Washington, DC, 1997.
- [3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105-113, Jan. 1996.
- [4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with known precision", IEEE Transactions on Communications, vol. E80-B, no. 5, pp. 645-652, May 1997.
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- [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.
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- [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 Recipes 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 uncertainty 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.

APPENDIX J - PRODUCT SIMILAR DECLARATION LETTER

**MACKARL ENTERPRISES, INC.**

16960 Gale Avenue, City of Industry, CA 91745 Tel (626) 912-2166 Fax (626) 912-2258

Product Similarity Declaration

To Whom It May Concern;

We, MACKARL ENTERPRISES INC., hereby declare that our DECT 6.0 Cordless Phone, Model Number: 3123X (Where X: can be 0 (extra HS), 1 (Single HS), 2 (Two HS), 3 (Three HS) - Version), it means that – 31230 (one handset, one charger unit) can be added to any of the other model series i.e. 31231, 31232, 31233;

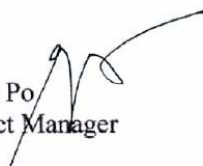
31231 (one handset, one base) can be expanded by adding 31230;
31233 (three handsets, one base) can be expanded by adding 31230;
31232 (two handsets, one base) can be expanded by adding 31230;

So 31230, 31233, 31232 are electrically identical with the Model Number: 31231 that was certified by BACL, they are named differently and have different quantity of handset due to marketing purposes and only for FCC Part 68 test, we add one receiver to the product, no other change are made to them.

Please contact me if you have any question.

Sincerely Yours;

Alvin Po
Project Manager



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