

SAR Test Report

Product Name: GSM Mobile Phone

Model No: U-140-2

FCC ID: OLEU140

Applicant : PARKTEL FZE

Address : WARE HOUSE NO: FF01,ROUND ABOUT NO:
05,JEBEL ALI FREEZONE DUBAI U.A.E



Prepared : IAC Compliance Laboratory

Address : No.789 Pu Xing Road,Shanghai,PRC

Date of Test : 2013.04.17

Test Report Certification

Test Date : 2013.04.17

Report No. : 130418001SAR-FCC

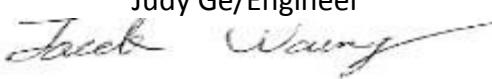
Product Name : GSM Mobile Phone
Applicant : PARKTEL FZE
Address : WARE HOUSE NO: FF01,ROUND ABOUT NO:
05,JEBEL ALI FREEZONE DUBAI U.A.E
Manufacturer : PROFIT HARVEST CORPORATION LIMITED
Model No. : U-140-2
Serial Model No : U-140-1
Standard : FCC 47 CFR Part2 (2.1093)
IEEE C95.1-1999
IEEE 1528-2003
FCC OET Bulletin 65 supplement C

Test Result : Complied

The Test Results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of IAC Compliance Lab.

Documented By : 
Judy Ge/Engineer

Tested By : 
Jack Wang/Engineer

Approved By : 
Jeff Huang/Director of Operations

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1. GENERAL INFORMATION

1.1. Applicant

Company Name: PARKTEL FZE

Address: WARE HOUSE NO: FF01,ROUND ABOUT NO: 05,JEBEL ALI FREEZONE DUBAI U.A.E

1.2. Manufacturer

Company Name: PROFIT HARVEST CORPORATION LIMITED

Address: FLAT/RM 506C 5/F INNOCENTRE 72 TAT CHEE AVENUE KOWLOON TONG KL

1.3. Test Environment

Ambient conditions in the laboratory:

| Items | Required | Actual |
|-----------------|----------|--------|
| Temperature(°C) | 15~30 | 21.4 |
| Humidity(%RH) | 30~70 | 46 |

1.4. EUT Description

| | | | |
|--------------------|---|--------------|---|
| Device type | Portable Device | | |
| EUT Stage | Production unit | | |
| Antenna Type | Inner PIFA antenna | | |
| Operation Model(s) | GSM850/1900 | | |
| Tx Frequency | 824.2-848.8,1850.2-1909.8MHz | | |
| HW Version | SP11D_MB_V2.0 | | |
| SW Version | JSP11DP0220_GST_SP11D_S330_PARKTEL_M10_3232_MF_V02_20130320_stone | | |
| Accessories | Brand:unnecto™ | Model:BU-140 | Rated Voltage:3.7V Capacity:600mAh |
| | Brand:unnecto™ | Model:CU-140 | Input AC:100-240V 50/60Hz 0.15A Output DC:5V/500mAh |

2. SAR Measurement System

2.1. 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 order to provide a platform which is repeatable with minimum uncertainty.

2.1.1. 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 is available up to 6 GHz in simulated tissue.



2.1.2. 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.

2.1.3. 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 1g or 10g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000kg/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 1g cube is 10mm, with the side length of the 10g cube 21.5mm.

When the cube intersects with the surFront of the phantom, it is oriented so that 3 vertices touch the surFront of the shell or the center of a Front is tangent to the surFront.

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.

2.1.4. 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:

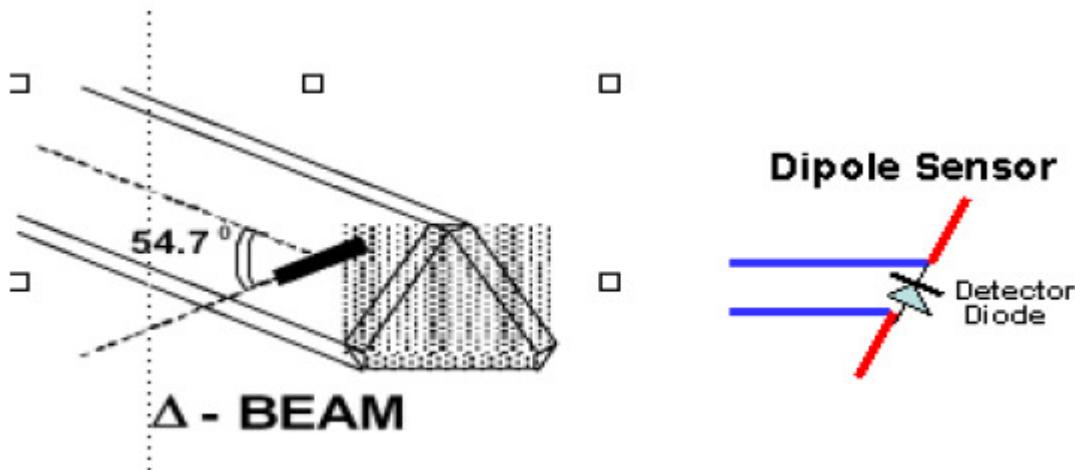
$$f_3(x, y, z) = A \frac{a^2}{\frac{a^2}{4} + x'^2 + y'^2} \cdot \left(e^{-\frac{2z}{a}} + \frac{a^2}{2(a + 2z)^2} \right)$$

2.2. Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropic, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change. A number of methods is used for calibrating probes, and these are outlined in the table below:

| Calibration Frequency | Air Calibration | Tissue Calibration |
|-----------------------|-----------------|--------------------|
| 900MHz | TEM Cell | Temperature |
| 1800MHz | TEM Cell | Temperature |

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 surFront (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 surFront.

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.

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

2.2.1. Isotropic E-Field Probe Specification

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

Probe model no: ALS-E-020, S/N:500-00273

2.3. 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 surFronts. The robust design allows for detecting during probe tilt (probe normalize) exercises, and utilizes a second stage emergency sTop. The signal electronics are directly into the robot controller for high accuracy surFront 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 connected to an isolated probe interconnect where the output stage of the probe is fed directly into the amplifier stage of the Daq-Paq.

2.4. Daq-Paq (Analog to Digital Electronics)

ALSAS-10U incorporates a fully calibrated Daq-Paq (analog to digital conversion system) which has a 4 channel input stage, sent via a 2 stage auto-set amplifier module. The input signal is amplified accordingly so as to offer a dynamic range from $5 \mu V$ to 800mV. Integration of the fields measured is carried out at board level utilizing a Co-Processor which then sends the measured fields down into the main computational module in digitized form via a RS232 communications port. Probe linearity and duty cycle compensation is carried out within the main Daq-Paq module.

| | |
|--------------------------|---|
| ADC | 12 Bit |
| Amplifier Range | 20mV to 200mV and 150mV to 800mV |
| 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 |

2.5. Axis Articulated Robot

ALSAS-10U utilizes a six 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 envelop. 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 | 0.05mm |
| Controller Type | Single phase Pentium based C500C |
| Robot Reach | 710mm |
| Communication | RS232 and LAN compatible |

2.6. ALSAS Universal Workstation

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

2.7. 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 movements for head SAR analysis. Overall uncertainty for measurements has 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.

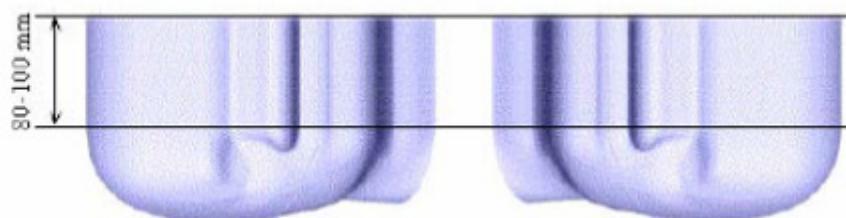


2.8. Phantom Types

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

2.8.1. 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.



2.8.2. 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.



3. Tissue Simulating Liquid

3.1. The composition of the tissue simulating liquid

| INGREDIENT (% Weight) | 850MHz | 1900MHz | 850MHz | 1900MHz |
|--------------------------|--------|---------|--------|---------|
| | Head | Head | Body | Body |
| Water | 40.45% | 54.9% | 45.0% | 70.17% |
| Salt | 1.45% | 0.18% | 52.4% | 0.39% |
| Sugar | 57.6% | 0% | 1.4% | 0% |
| HEC | 0.4% | 0% | 1.0% | 0% |
| Preventol | 0.1% | 0% | 0.1% | 0% |
| DGBE | 0% | 44.92% | 0% | 29.44% |

3.2. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to SAR evaluation using APREL Dielectric Probe Kit and Agilent E5071B Vector Network Analyzer.

| Head Tissue Simulate Measurement | | | | |
|----------------------------------|------------------|-----------------------|----------------|------------------|
| Frequency (MHz) | Description | Dielectric Parameters | | Tissue Temp.(°C) |
| | | ϵ_r | σ (s/m) | |
| 835MHz | Reference result | 41.5 | 0.90 | NA |
| | +/-5% window | 39.425to43.575 | 0.855to0.945 | |
| | 17-Apr-13 | 40.37 | 0.93 | |
| 1900MHz | Reference result | 40.0 | 1.40 | NA |
| | +/-5% window | 38to42 | 1.33 to 1.47 | |
| | 17-Apr-13 | 41.55 | 1.42 | |

| Body Tissue Simulate Measurement | | | | |
|----------------------------------|------------------|-----------------------|----------------|------------------|
| Frequency (MHz) | Description | Dielectric Parameters | | Tissue Temp.(°C) |
| | | ϵ_r | σ (s/m) | |
| 835MHz | Reference result | 55.2 | 0.97 | NA |
| | +/-5% window | 52.44to57.96 | 0.922to1.019 | |
| | 17-Apr-13 | 53.32 | 0.96 | 20.7 |
| 1900MHz | Reference result | 53.3 | 1.52 | NA |
| | +/-5% window | 50.635to55.965 | 1.444to1.596 | |
| | 17-Apr-13 | 52.93 | 1.51 | 20.7 |

3.3. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in PP1528 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 P1428 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.

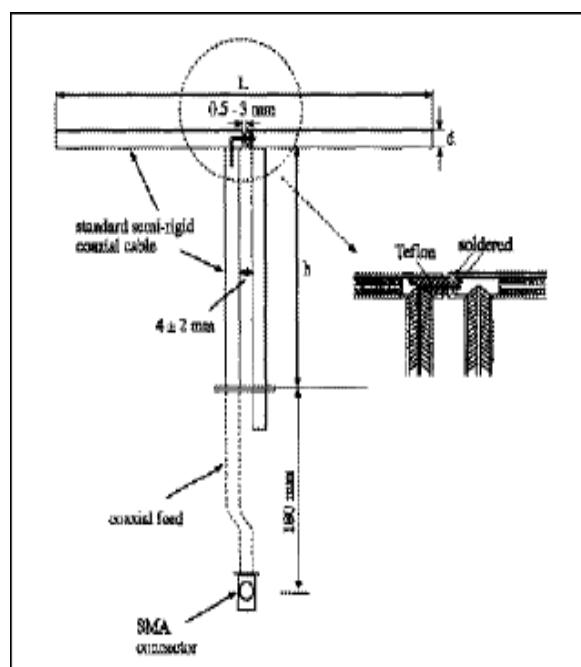
| Target Frequency (MHz) | Head | | Body | |
|---------------------------|--------------|----------------|--------------|----------------|
| | ϵ_r | σ (S/m) | ϵ_r | σ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.90 | 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 |

(ϵ_r =relative permittivity, σ =conductivity and $\rho = 1000 \text{ kg/m}^3$)

4. SAR Measurement Procedure

4.1. SAR System Validation

4.1.1. Validation Dipoles



The dipoles used are based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE and FCC Supplement C. The table below provides details for the mechanical and electrical specifications for the dipoles.

| Frequency | L(mm) | h(mm) | d(mm) |
|-----------|-------|-------|-------|
| 835MHz | 161 | 89.8 | 3.6 |
| 1900MHz | 67.1 | 38.9 | 3.6 |

4.1.2. Validation Result

Head System Performance Check at 835MHZ&1900MHz

Validation Kit: ASL-D-835-S-2

| Frequency(MHz) | Description | SAR(W/kg) 1g | SAR(W/kg) 10g | Tissue Temp.(°C) |
|----------------|------------------|--------------|---------------|------------------|
| 835MHz | Reference result | 9.590 | 6.003 | N/A |
| | +/-5%window | 9.110to10.07 | 5.702to6.303 | |
| | 17-Apr-13(1W) | 9.498 | 5.877 | |

Validation Kit: ASL-D-1900-S-2

| Frequency(MHz) | Description | SAR(W/kg) 1g | SAR(W/kg) 10g | Tissue Temp.(°C) |
|----------------|------------------|----------------|----------------|------------------|
| 1900MHz | Reference result | 39.378 | 19.668 | N/A |
| | +/-5%window | 37.418to41.356 | 18.685to20.651 | |
| | 17-Apr-13(1W) | 38.694 | 19.256 | |

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

Body System Performance Check at 835MHZ&1900MHz

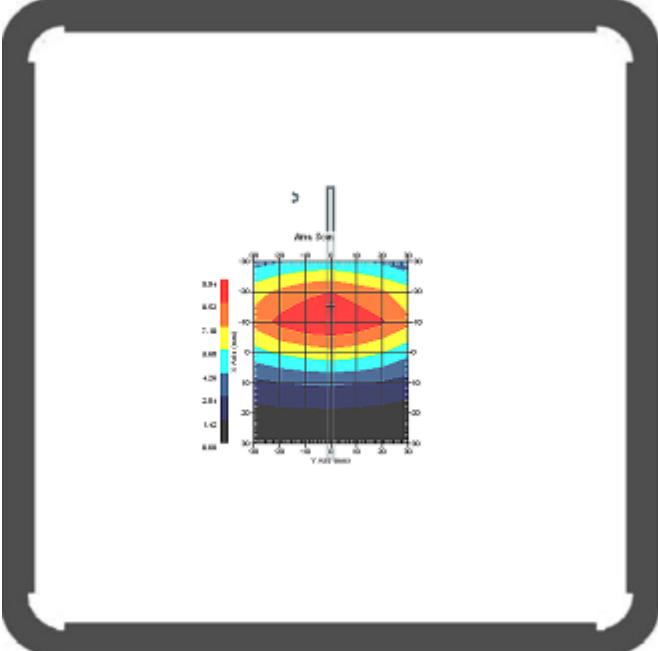
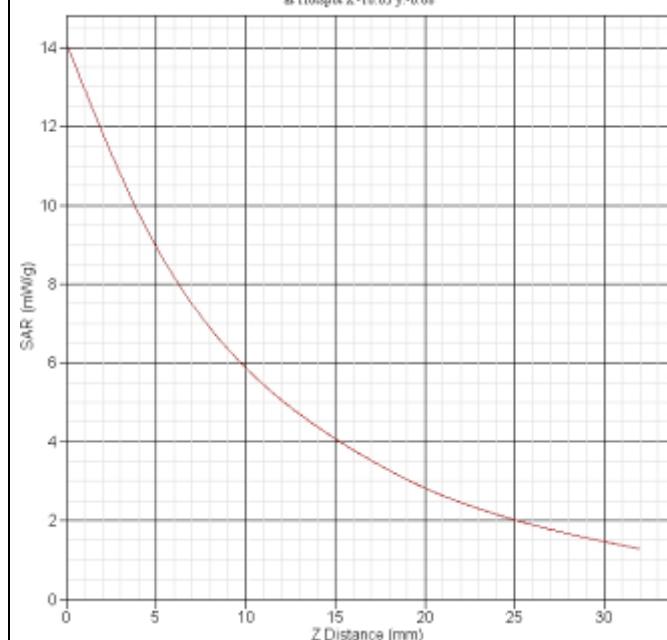
Validation Kit: ASL-D-835-S-2

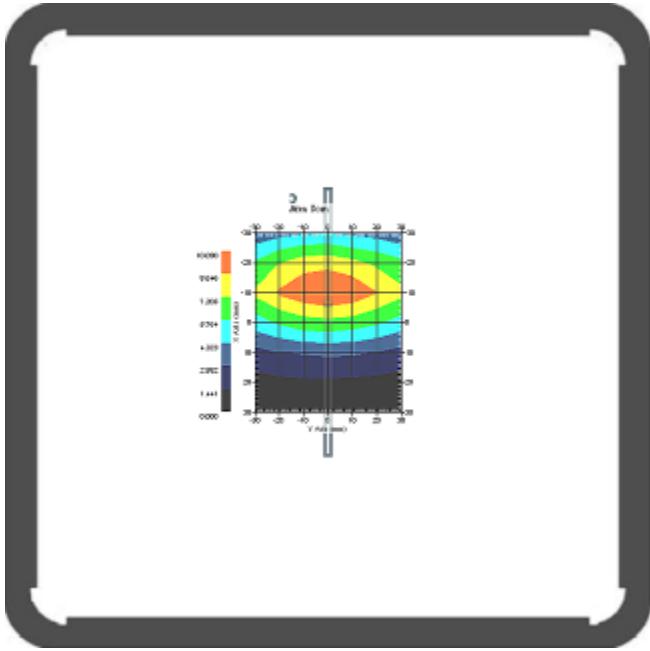
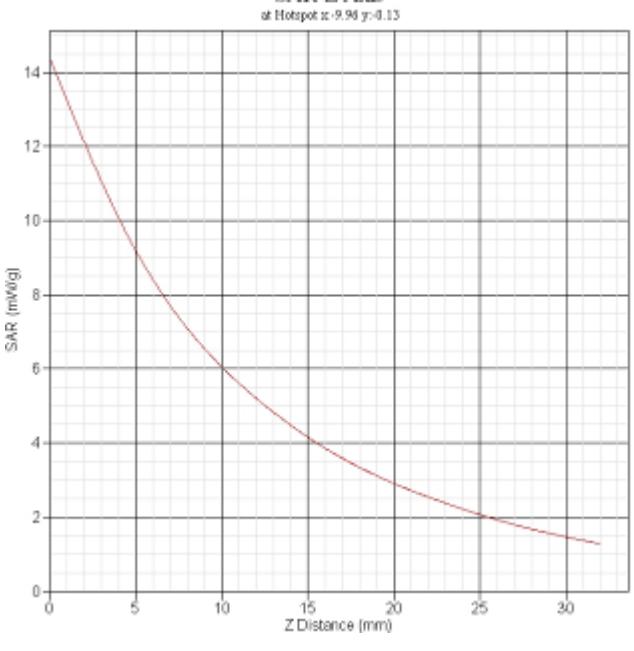
| Frequency(MHz) | Description | SAR(W/kg) 1g | SAR(W/kg) 10g | Tissue Temp.(°C) |
|----------------|------------------|--------------|---------------|------------------|
| 835MHz | Reference result | 9.981 | 6.006 | N/A |
| | +/-5%window | 9.482to10.48 | 5.706to6.306 | |
| | 17-Apr-13(1W) | 9.559 | 5.883 | |

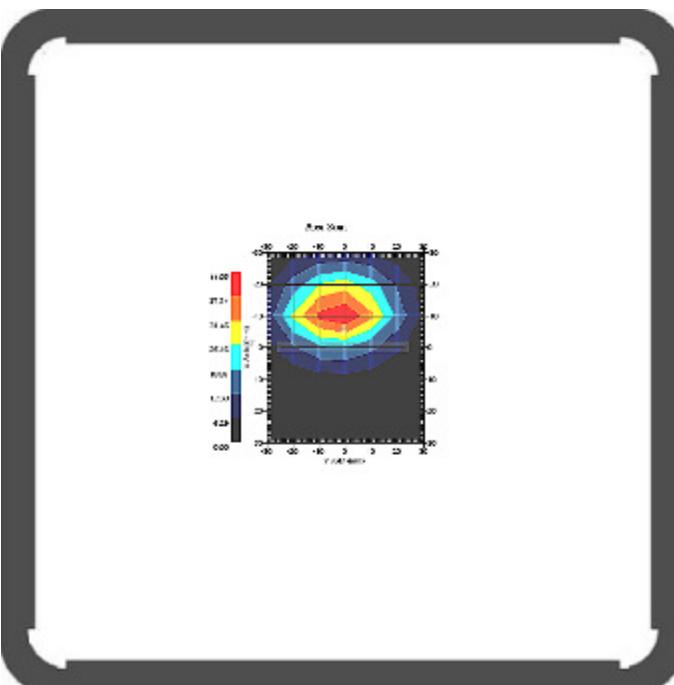
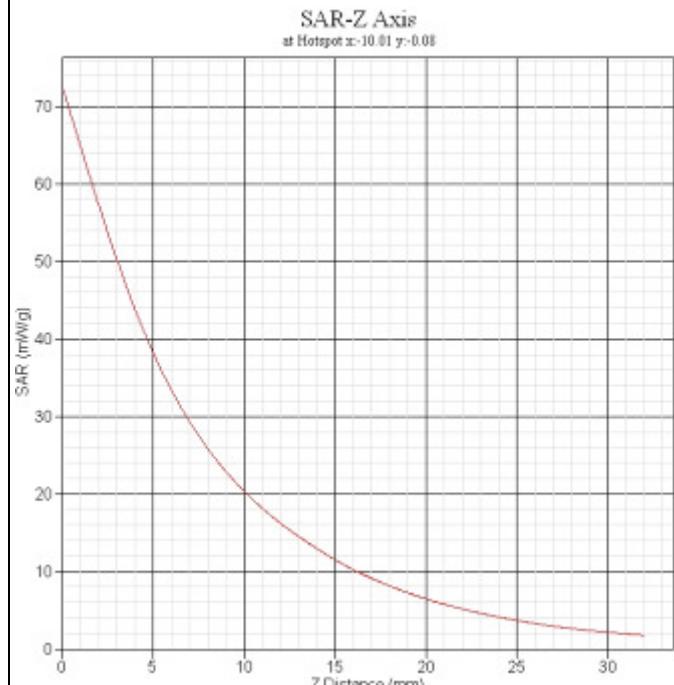
Validation Kit: ASL-D-1900-S-2

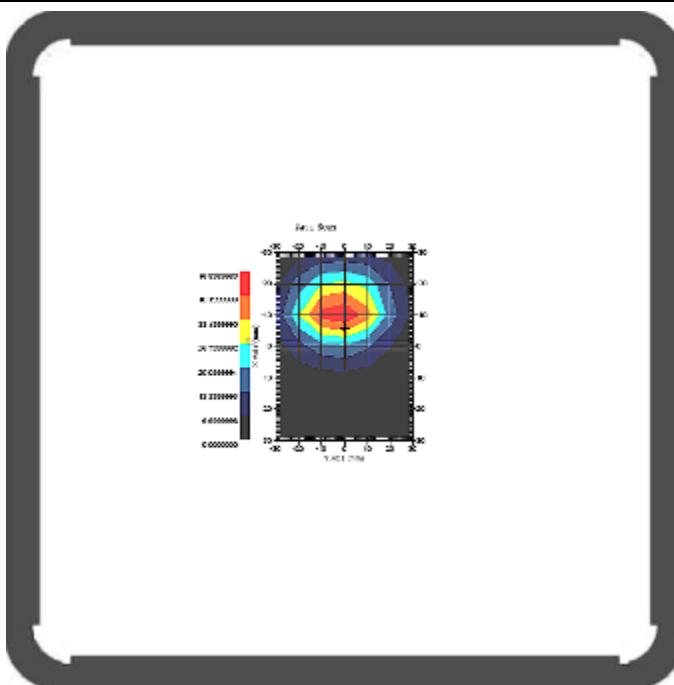
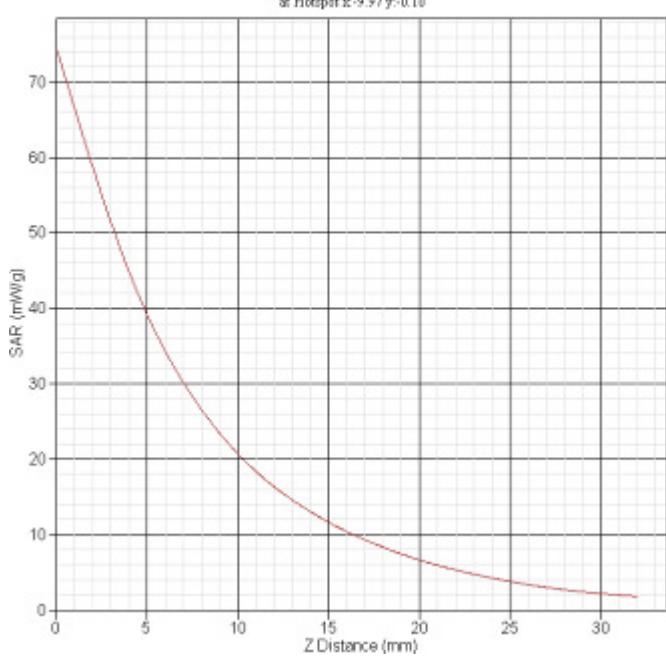
| Frequency(MHz) | Description | SAR(W/kg) 1g | SAR(W/kg) 10g | Tissue Temp.(°C) |
|----------------|------------------|----------------|----------------|------------------|
| 1900MHz | Reference result | 39.654 | 19.668 | N/A |
| | +/-5%window | 37.671to41.637 | 18.685to20.651 | |
| | 17-Apr-13(1W) | 39.649 | 19.731 | |

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

| | |
|--|---|
| Frequency(MHz) | 835 |
| Relative permittivity(real part) | 40.37 |
| Conductivity(S/m) | 0.93 |
| Variation(%) | 0.532 |
| Duty Cycle Factor | 1 |
| Crest factor | 1 |
| Conversion Factor | 6.5 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  | <p style="text-align: center;">SAR-Z Axis at Hotspot x=10.03 y=0.08</p>  |
| SAR 1g(W/kg) | 9.498 |
| SAR 10g(W/kg) | 5.877 |

| Frequency(MHz) | 835 | | | | | | | | | | | | | | | | |
|--|--|-----------------|------------|---|------|---|-----|----|-----|----|-----|----|-----|----|-----|----|-----|
| Relative permittivity(real part) | 53.32 | | | | | | | | | | | | | | | | |
| Conductivity(S/m) | 0.96 | | | | | | | | | | | | | | | | |
| Variation(%) | -0.531 | | | | | | | | | | | | | | | | |
| Duty Cycle Factor | 1 | | | | | | | | | | | | | | | | |
| Crest factor | 1 | | | | | | | | | | | | | | | | |
| Conversion Factor | 6.4 | | | | | | | | | | | | | | | | |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 | | | | | | | | | | | | | | | | |
| Data | 2013-04-17 | | | | | | | | | | | | | | | | |
|  | <p style="text-align: center;">SAR-Z Axis at Hotspot x: 9.98 y: 0.13</p>  <table border="1"> <caption>Data points estimated from the SAR-Z Axis graph</caption> <thead> <tr> <th>Z Distance (mm)</th> <th>SAR (mW/g)</th> </tr> </thead> <tbody> <tr><td>0</td><td>14.0</td></tr> <tr><td>5</td><td>9.0</td></tr> <tr><td>10</td><td>5.5</td></tr> <tr><td>15</td><td>4.0</td></tr> <tr><td>20</td><td>2.5</td></tr> <tr><td>25</td><td>2.0</td></tr> <tr><td>30</td><td>1.5</td></tr> </tbody> </table> | Z Distance (mm) | SAR (mW/g) | 0 | 14.0 | 5 | 9.0 | 10 | 5.5 | 15 | 4.0 | 20 | 2.5 | 25 | 2.0 | 30 | 1.5 |
| Z Distance (mm) | SAR (mW/g) | | | | | | | | | | | | | | | | |
| 0 | 14.0 | | | | | | | | | | | | | | | | |
| 5 | 9.0 | | | | | | | | | | | | | | | | |
| 10 | 5.5 | | | | | | | | | | | | | | | | |
| 15 | 4.0 | | | | | | | | | | | | | | | | |
| 20 | 2.5 | | | | | | | | | | | | | | | | |
| 25 | 2.0 | | | | | | | | | | | | | | | | |
| 30 | 1.5 | | | | | | | | | | | | | | | | |
| SAR 1g(W/kg) | 9.559 | | | | | | | | | | | | | | | | |
| SAR 10g(W/kg) | 5.883 | | | | | | | | | | | | | | | | |

| | |
|---|-------------------------------|
| Frequency(MHz) | 1900 |
| Relative permittivity(real part) | 41.55 |
| Conductivity(S/m) | 1.42 |
| Variation(%) | 0.268 |
| Duty Cycle Factor | 1 |
| Crest factor | 1 |
| Conversion Factor | 5.7 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  | |
|  | |
| SAR 1g(W/kg) | 38.694 |
| SAR 10g(W/kg) | 19.256 |

| | |
|--|--|
| Frequency(MHz) | 1900 |
| Relative permittivity(real part) | 52.93 |
| Conductivity(S/m) | 1.51 |
| Variation(%) | -0.156 |
| Duty Cycle Factor | 1 |
| Crest factor | 1 |
| Conversion Factor | 5.4 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  | <p style="text-align: center;">SAR-Z Axis at Hotspot x:-9.97 y:-0.10</p>  |
| SAR 1g(W/kg) | 39.649 |
| SAR 10g(W/kg) | 19.731 |

4.2. Arrangement Assessment Setup

4.2.1. Test Positions of Device Relative to Head

This specifies exactly two test positions for the handset against the head phantom, the “cheek” position and the “tilted” position. The handset should be tested in both positions on the left and right sides of the SAM phantom. If the handset construction is such that it cannot be positioned using the handset positioning procedures described in 4.2.2.1 and 4.2.2.2 to represent normal use conditions (e.g. asymmetric handset), alternative alignment procedures should be considered with details provided in the test report.

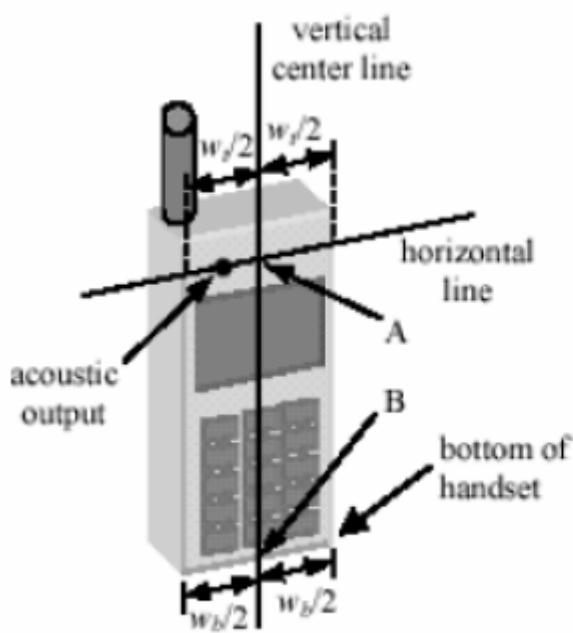


Figure 4.1a Internal Case

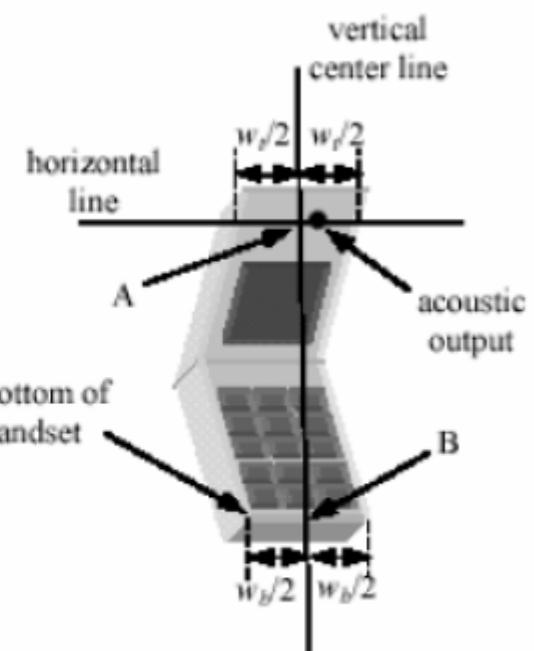


Figure 4.1b Clam Shell

4.2.2.1. Definition of the “Cheek” Position

The “cheek” position is defined as follows:

- Ready the handset for talk operation, if necessary. For example, for hand sets with a cover piece, open the cover. (If the handset can also be used with the cover closed both configurations must be tested.)
- Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width w_t of the handset at the level of the acoustic output (point A on Figures 4.1 a and 4.1 b), and the midpoint of the width w_b of the back of the handset through the center of the acoustic output (see Figure 4.1 a). The

two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front Front of the handset (see Figure 4.1 b), especially for clamshell handsets, handsets with flip pieces, and other irregularly-shaped handsets.

- c. Position the handset close to the surFront of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see 4.2), such that the plan defined by the vertical center line and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
- d. Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the pinna.
- e. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).
- f. Rotate the handset around the vertical centerline until the handset (horizontal line) is symmetrical with respect to the line NF.

While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the handset contact with the pinna, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the pinna (cheek). See Figure 4.2 the physical angles of rotation should be noted.

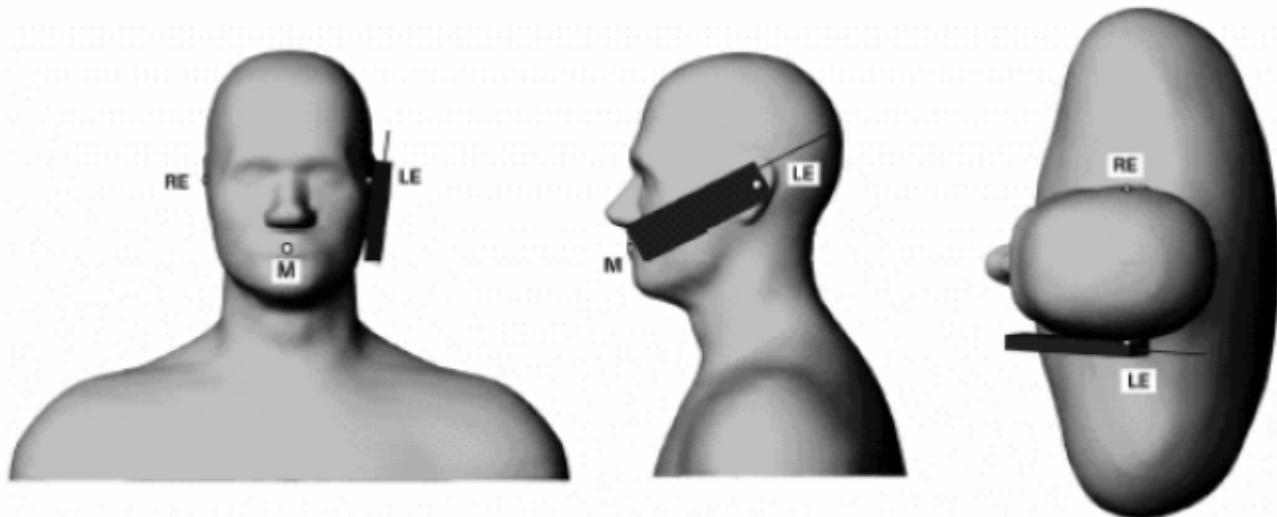


Figure 4.2 – Phone position 1, “cheek” or “touch” position.

4.2.1.2 Definition of the “Tilted” Position

The “tilted” position is defined as follows:

- a. Repeat steps (a) – (g) of 4.2.1.1 to place the device in the “cheek position”.
- b. While maintaining the orientation of the handset move the handset away from the pinna along the line passing through RE and LE in order to enable a rotation of the

handset by 15 degrees.

- c. Rotate the handset around the horizontal line by 15 degrees.
- d. While maintaining the orientation of the handset, move the handset towards the phantom on a line passing through RE and LE until any part of the handset touches the ear. The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna (e.g. the antenna with the Back of the phantom head), the angle of the handset should be reduced. In this case, the tilted position is obtained if any part of the handset is in contact with the pinna as well as a second part of the handset is contact with the phantom (e.g. the antenna with Back of the head).

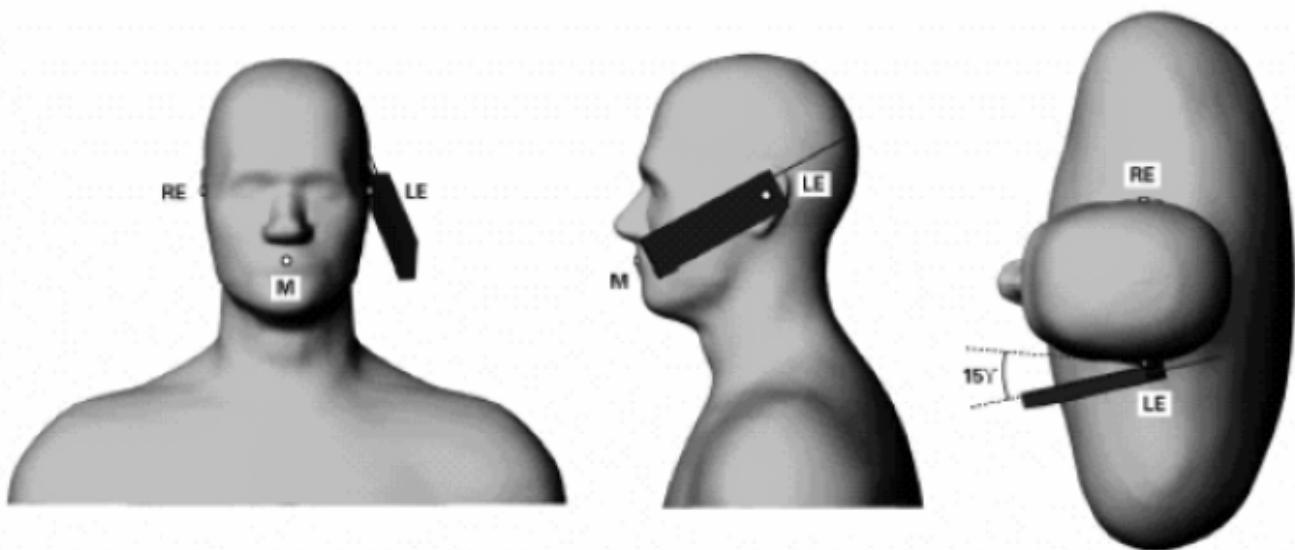


Figure 4.3 – Phone position 2, “tilted” position.

4.2.2. Test Positions for body-worn

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. 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 distance may be used, but not exceed 2.5cm.

4.3. SAR Measurement Procedure

The ALSAS-10U calculates SAR using the following equation,

$$SAR = \frac{\sigma |E|^2}{\rho}$$

σ :represents the simulated tissue conductivity

ρ :represents the tissue density

The EUT is set to transmit at the required power in line with product specification, at each frequency relating to the LOW, MID, and HIGH channel settings.

Pre-scans are made on the device to establish the location for the transmitting antenna, using a large area scan in either air or tissue simulation fluid.

The EUT is placed against the Universal Phantom where the maximum area scan dimensions are large than the physical size of the resonating antenna. When the scan size is not large enough to cover the peak SAR distribution, it is modified by either extending the area scan size in both the X and Y directions, or the device is shifted within the predefined area.

The area scan is then run to establish the peak SAR location (interpolated resolution set at 1 mm²) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at 1 mm³).

5. SAR Exposure Limits

SAR assessments have been made in line with the requirements of IEEE C95.1-1999, IEEE 1528-2003 , FCC OET Bulletin 65 supplement C.

| Type Exposure (W/kg) | Uncontrolled Environment Limit |
|---|--------------------------------|
| Spatial Peak SAR (10g cube tissue for head and trunk) | 1.60 W/kg |
| Spatial Average SAR (whole body) | 0.08 W/kg |
| Spatial Peak SAR (10g for limb) | 4.00 W/kg |

6. Test Equipment List

| Instrument | Manufacture | Model No. | Serial No. | Last Calibration |
|--|---------------|----------------|------------|------------------|
| Universal Work Station | Aprel | ALS-UWS | 100-00154 | NCR |
| Data Acquisition Package | Aprel | ALS-DAQ-PAQ-3 | 110-00215 | NCR |
| Probe Mounting Device and Boundary Detection Sensor System | Aprel | ALS-PMDPS-3 | 120-00265 | NCR |
| Miniature E-Field Probe | Aprel | ALS-E-020 | 500-00273 | Oct.01,2012 |
| Left ear SAM Phantom | Aprel | ALS-P-SAM-L | 130-00312 | NCR |
| Right ear SAM Phantom | Aprel | ALS-P-SAM-R | 140-00362 | NCR |
| Universal SAM Phantom | Aprel | ALS-P-SU-1 | 150-00410 | NCR |
| Reference Validation Dipole 850MHz | Aprel | ALS-D-835-S-2 | 180-00556 | May.19,2011 |
| Reference Validation Dipole 1900MHz | Aprel | ALS-D-1900-S-2 | 210-00707 | May.16,2011 |
| Dielectric Probe Kit | Aprel | ALS-PR-DIEL | 260-00955 | NCR |
| Device Holder 2.0 | Aprel | ALS-H-E-SET-2 | 170-00506 | NCR |
| SAR software | Aprel | ALS-SAR-AL-10 | Ver.2.3.8 | NCR |
| CRS C500C Controller | Thermo | ALS-C500 | RCF0504291 | NCR |
| CRS F3 Robot | Aprel | ALS-F3-SW | N/A | NCR |
| Power Amplifier | Mini-Circuit | ZHL- 42 | 040306 | Jul.17,2012 |
| Directional Coupler | Agilent | 778D-012 | 51011 | Jul.17,2012 |
| Universal Radio Communication Tester | Agilent | E5515C | 104845 | Mar.1,2013 |
| Vector Network | Agilent | E5071B | MY4230146 | Jul.19,2012 |
| Signal Generator | Agilent | E8257D | N/A | Dec.10,2012 |
| Power Meter | Rohde&Schwarz | NRP | N/A | Dec.10,2012 |

Note: All equipment upon which need to be calibrated are with calibration period of 1 year, except validation dipole antenna of every 3 years.

7. Measurement Uncertainty

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 | 0.6 | rectangular | $\sqrt{3}$ | 1 | 1 | 0.3 | 0.3 |
| 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.) | 2.4 | normal | 1 | 0.6 | 0.5 | 1.4 | 1.2 |
| Combined Uncertainty | | RSS | | | | 9.3 | 9.2 |
| Combined Uncertainty (coverage factor=2) | | Normal(k=2) | | | | 18.7 | 18.3 |

8. SAR Test Results

8.1. Conducted Power(Unit:dBm)

| Band | GSM850 | | | GSM1900 | | |
|----------------|--------|-------|-------|---------|--------|--------|
| Channel | 128 | 190 | 251 | 512 | 661 | 810 |
| Frequency(MHz) | 824.2 | 836.6 | 848.8 | 1850.2 | 1900.0 | 1909.8 |
| GSM | 32.14 | 32.23 | 32.18 | 29.74 | 29.69 | 29.53 |
| GPRS (1UP) | 32.13 | 32.22 | 32.16 | 29.73 | 29.66 | 29.52 |
| GPRS (2UP) | 31.47 | 31.64 | 31.53 | 28.65 | 28.58 | 28.47 |

8.2. SAR Test Results Summary

8.2.1 Test results for Head SAR Test

| Band | Position | Channel | Measured Power(dBm) | Tune-up Power(dBm) | SAR 1g (W/kg) | Scale factor | Scaled SAR 1g(W/kg) |
|---------|----------|---------|---------------------|--------------------|---------------|--------------|---------------------|
| GSM850 | LC | 190 | 32.23 | 33 | 0.177 | 1.194 | 0.211 |
| | LT | 190 | 32.23 | 33 | 0.152 | 1.194 | 0.181 |
| | RC | 190 | 32.23 | 33 | 0.206 | 1.194 | 0.246 |
| | RT | 190 | 32.23 | 33 | 0.148 | 1.194 | 0.177 |
| GSM1900 | LC | 512 | 29.74 | 30 | 0.464 | 1.062 | 0.493 |
| | LT | 512 | 29.74 | 30 | 0.126 | 1.062 | 0.134 |
| | RC | 512 | 29.74 | 30 | 0.399 | 1.062 | 0.424 |
| | RT | 512 | 29.74 | 30 | 0.140 | 1.062 | 0.149 |

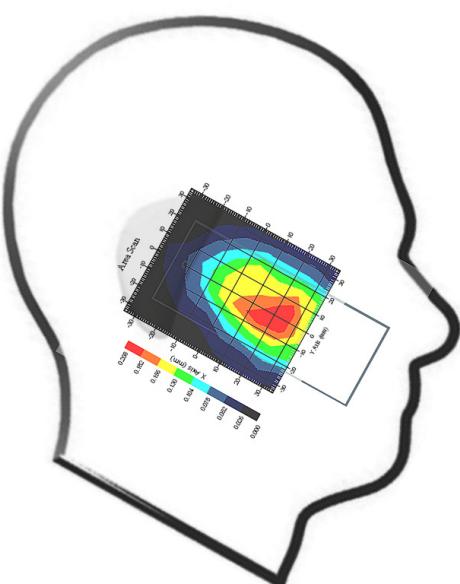
8.2.2 Test results for Body-worn SAR Test

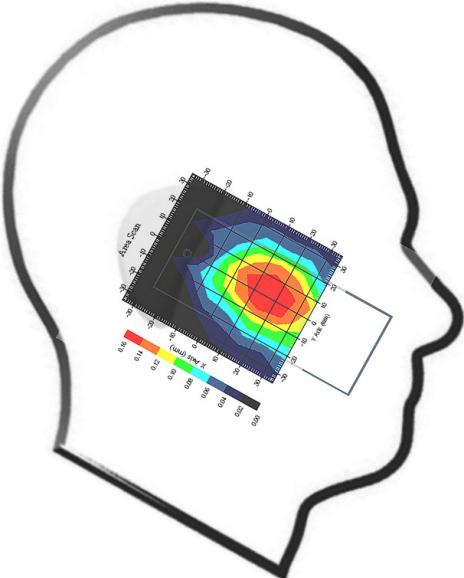
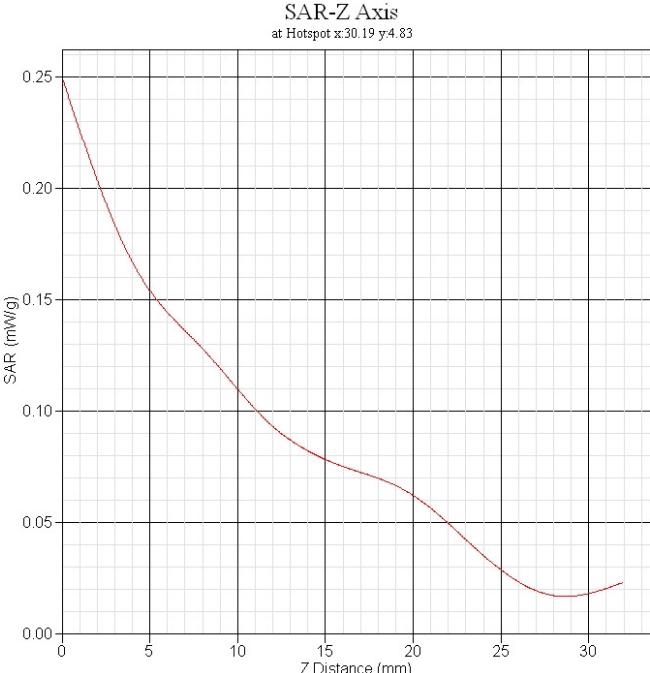
| Band | Position | CH | Measured Power(dBm) | Tune-up Power(dBm) | SAR 1g (W/kg) | Scale factor | Scaled SAR 1g(W/kg) |
|---------|----------|-----|---------------------|--------------------|---------------|--------------|---------------------|
| GSM850 | Front | 190 | 31.64 | 33 | 0.272 | 1.368 | 0.372 |
| | Back | 190 | 31.64 | 33 | 0.402 | 1.368 | 0.550 |
| GSM1900 | Front | 512 | 28.65 | 30 | 0.166 | 1.365 | 0.227 |
| | Back | 512 | 28.65 | 30 | 0.269 | 1.365 | 0.367 |

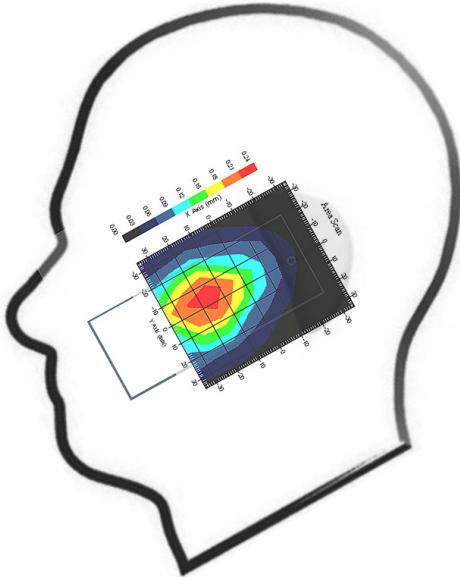
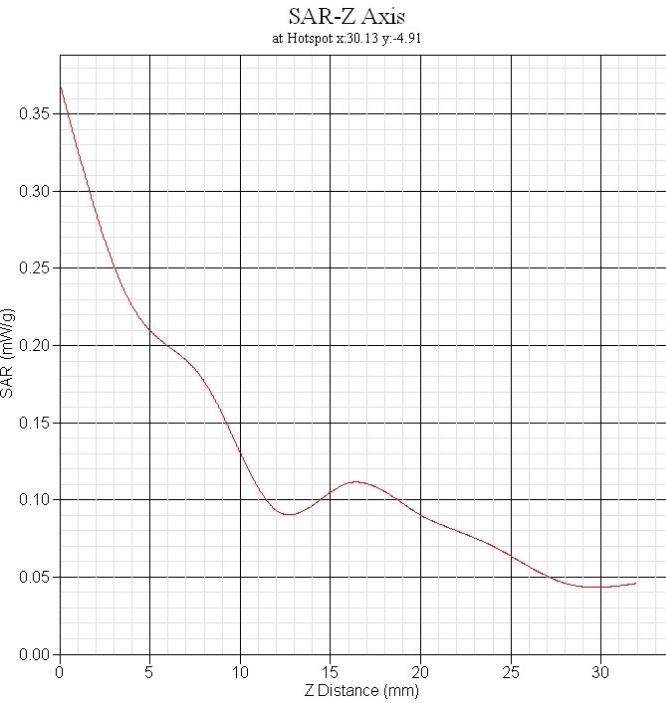
Note :

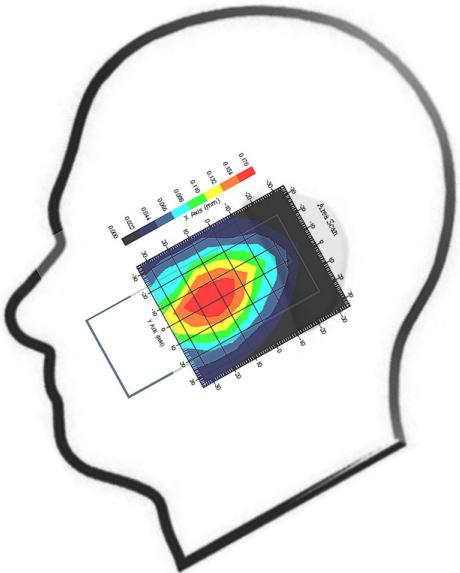
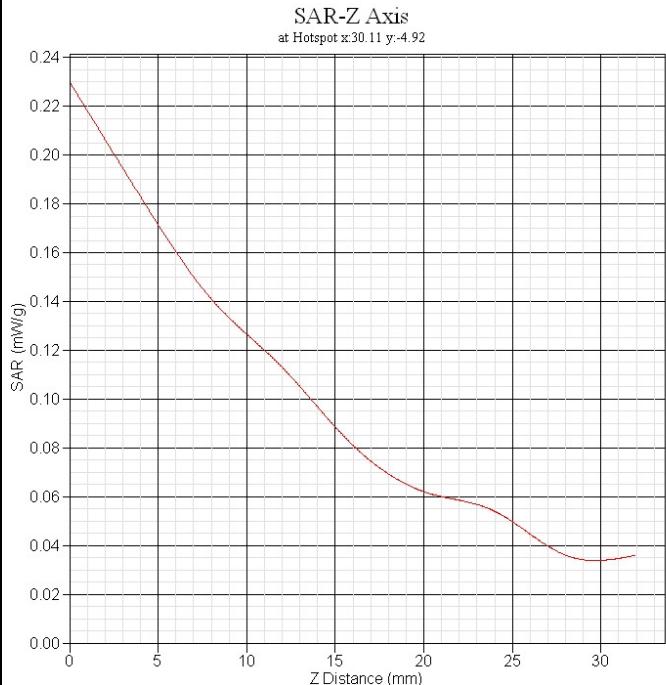
1. Per KDB 865664 D01v01, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8\text{W/kg}$
2. Per KDB 447498D01v05, for each exposure position, if the highest output channel $< 0.8\text{W/kg}$, other channels SAR testing are not necessary.
3. Per KDB 865664 D01v01, if the deviation among the repeated measurement is $\leq 20\%$ and the measured SAR $< 1.45\text{W/kg}$, only one repeated measurement is required.
4. The deviation is the difference in percentage between original and repeated measured SAR.
5. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

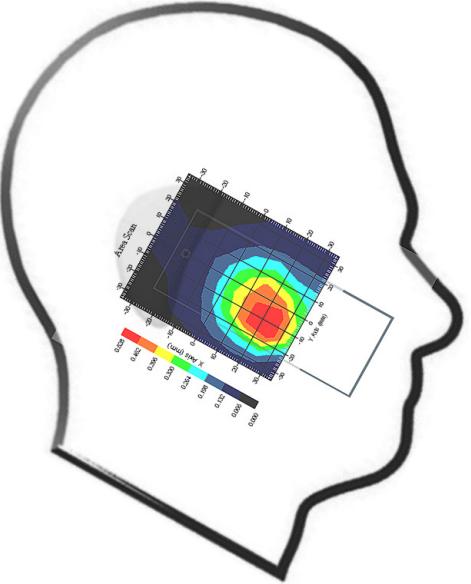
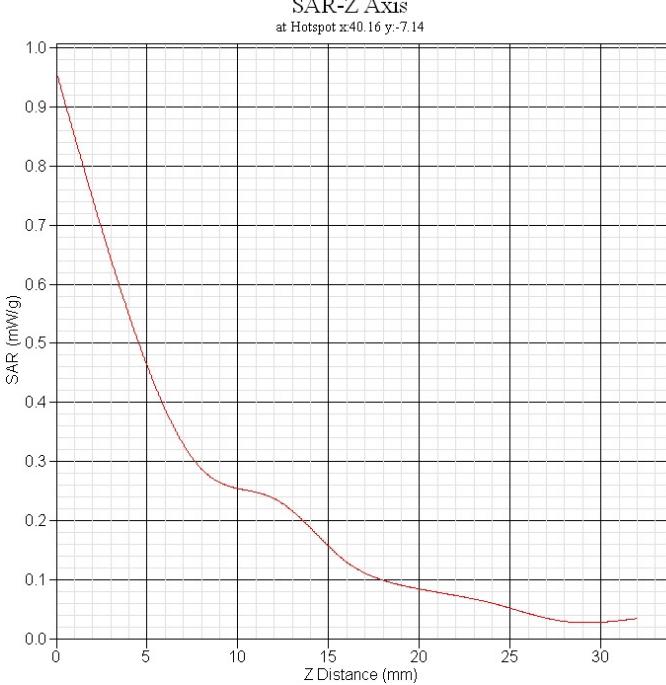
8.3. SAR Measurement Data

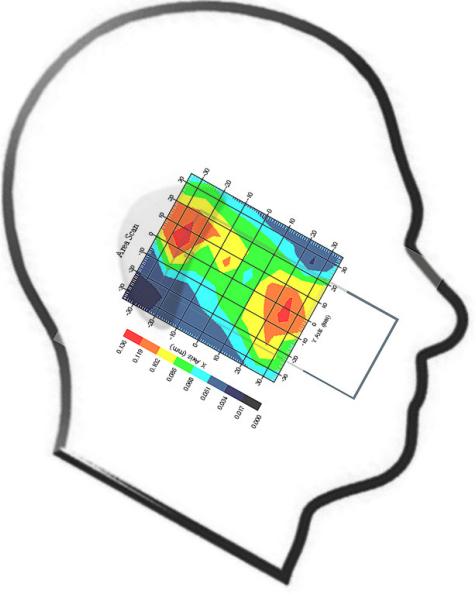
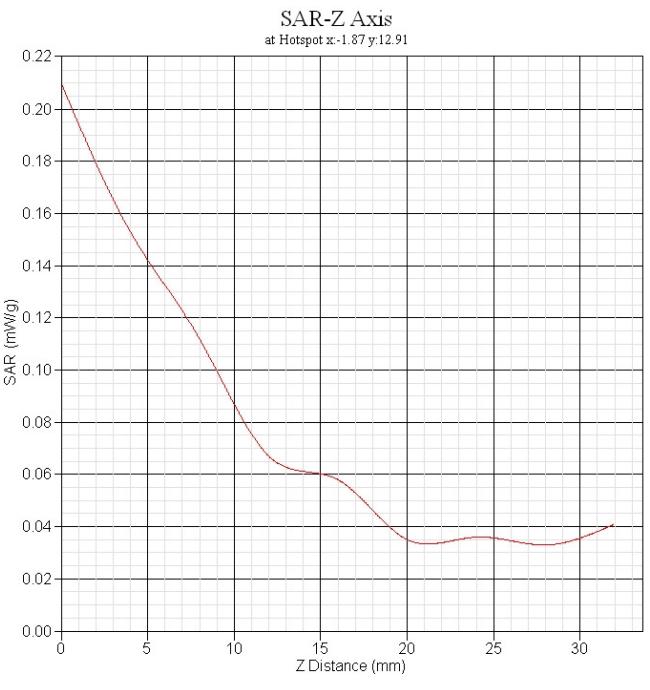
| GSM850 left cheek ch190 | |
|--|---|
| Frequency(MHz) | 836.6 |
| Relative permittivity(real part) | 40.37 |
| Conductivity(S/m) | 0.93 |
| Variation(%) | -1.103 |
| Duty Cycle Factor | 8 |
| Crest factor | 8 |
| 4Conversion Factor | 6.5 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m) ² |
| Data | 2013-04-17 |
|  | |
| SAR 1g(W/kg) | 0.177 |
| SAR 10g(W/kg) | 0.111 |

| GSM850 left tilt ch190 | |
|---|-------------------------------|
| Frequency(MHz) | 836.6 |
| Relative permittivity(real part) | 40.37 |
| Conductivity(S/m) | 0.93 |
| Variation(%) | 1.300 |
| Duty Cycle Factor | 8 |
| Crest factor | 8 |
| Conversion Factor | 6.5 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  | |
|  | |
| SAR 1g(W/kg) | 0.152 |
| SAR 10g(W/kg) | 0.098 |

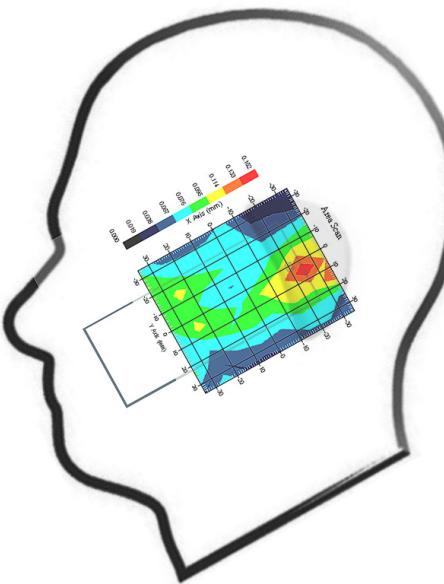
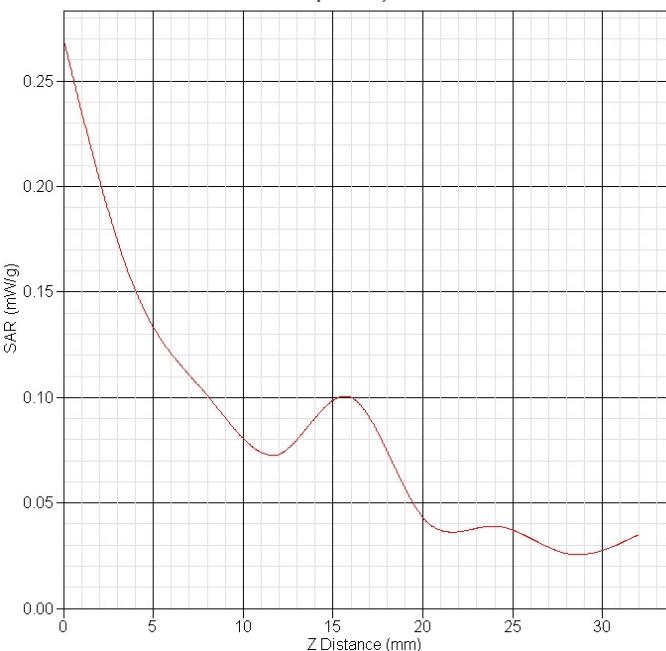
| GSM850 Right cheek ch190 | |
|--|-------------------------------|
| Frequency(MHz) | 836.6 |
| Relative permittivity(real part) | 40.37 |
| Conductivity(S/m) | 0.93 |
| Variation(%) | 3.821 |
| Duty Cycle Factor | 8 |
| Crest factor | 8 |
| Conversion Factor | 6.5 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|   | |
| SAR 1g(W/kg) | 0.206 |
| SAR 10g(W/kg) | 0.123 |

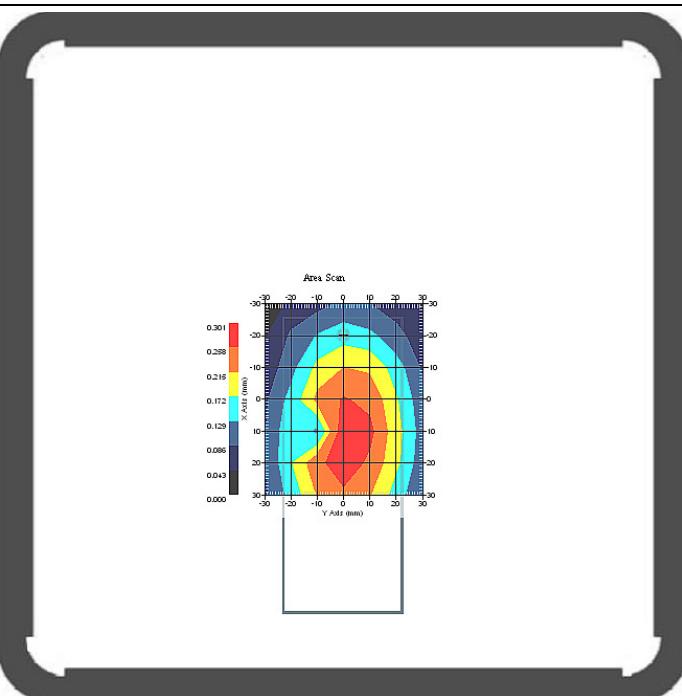
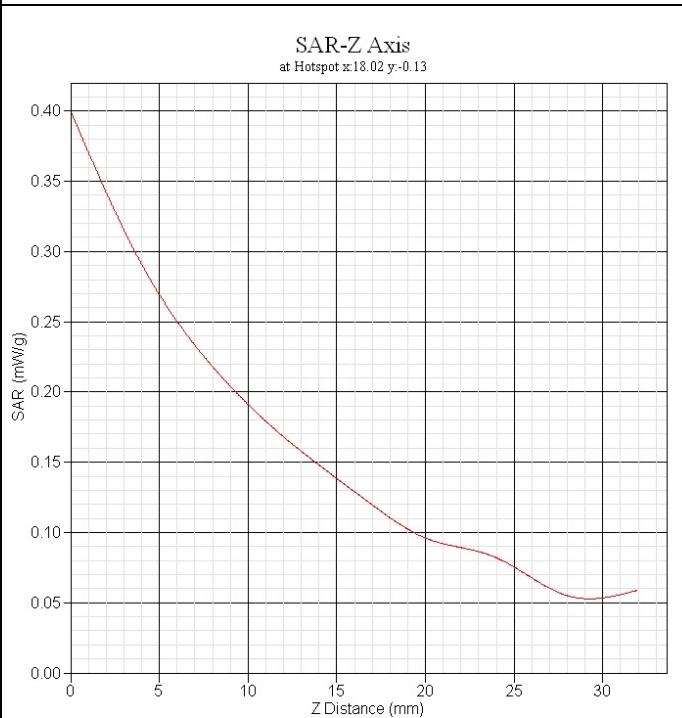
| GSM850 Right tilt CH190 | |
|---|-------------------------------|
| Frequency(MHz) | 836.6 |
| Relative permittivity(real part) | 40.37 |
| Conductivity(S/m) | 0.93 |
| Variation(%) | -2.537 |
| Duty Cycle Factor | 8 |
| Crest factor | 8 |
| Conversion Factor | 6.5 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  | |
|  | |
| SAR 1g(W/kg) | 0.148 |
| SAR 10g(W/kg) | 0.097 |

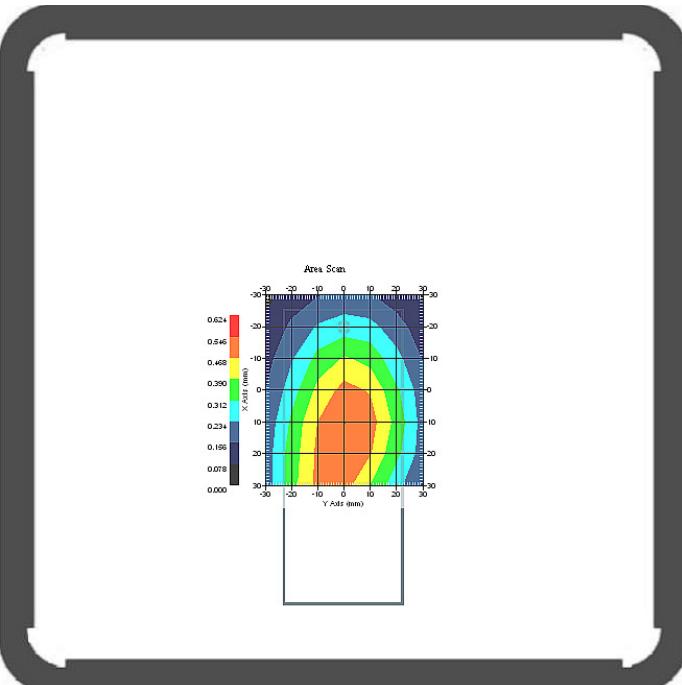
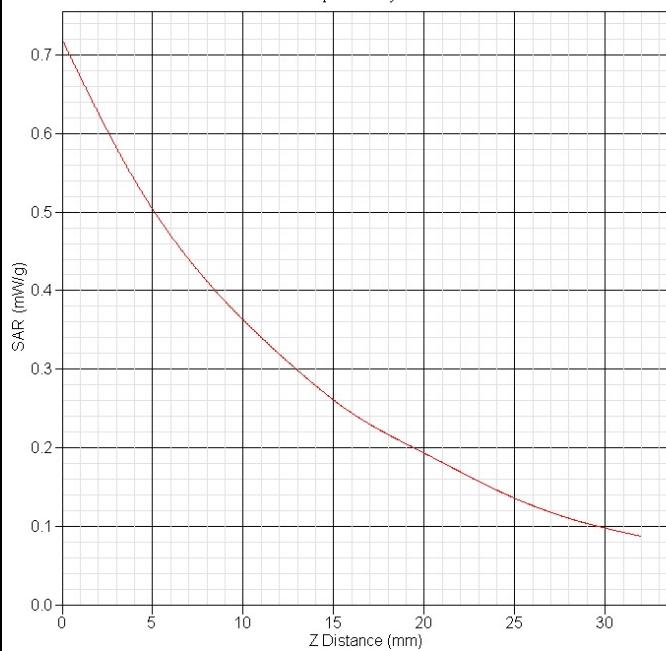
| GSM1900 Left cheek CH512 | |
|---|-------------------------------|
| Frequency(MHz) | 1850.2 |
| Relative permittivity(real part) | 41.55 |
| Conductivity(S/m) | 1.42 |
| Variation(%) | -3.147 |
| Duty Cycle Factor | 8 |
| Crest factor | 8 |
| Conversion Factor | 5.7 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  | |
|  | |
| SAR 1g(W/kg) | 0.464 |
| SAR 10g(W/kg) | 0.233 |

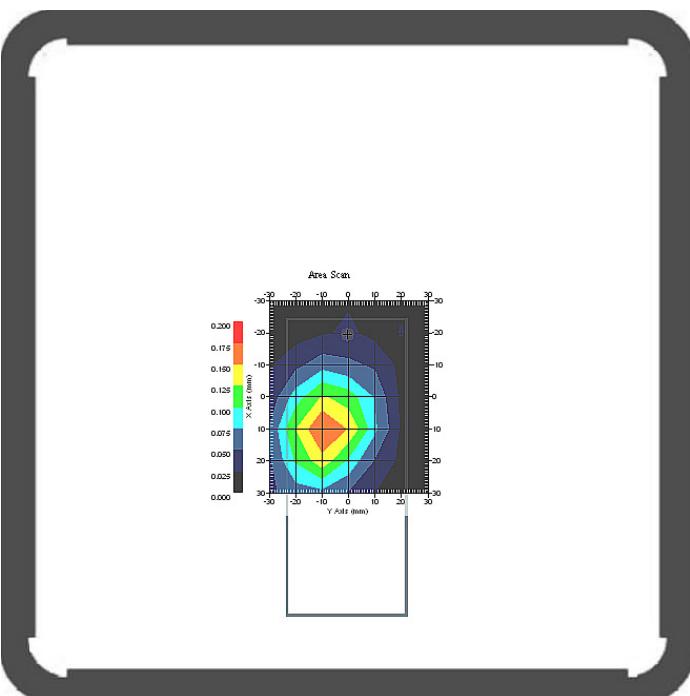
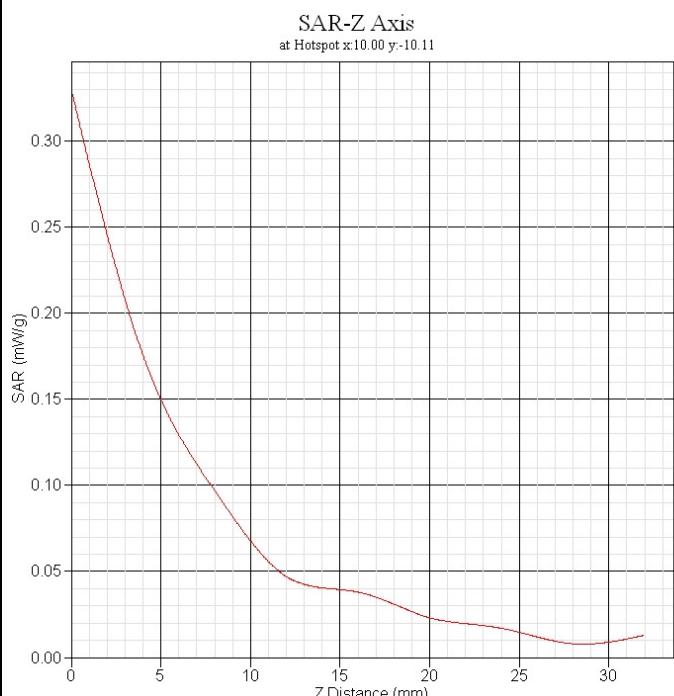
| GSM1900 Left tilt CH512 | |
|--|-------------------------------|
| Frequency(MHz) | 1850.2 |
| Relative permittivity(real part) | 41.55 |
| Conductivity(S/m) | 1.42 |
| Variation(%) | 1.625 |
| Duty Cycle Factor | 8 |
| Crest factor | 8 |
| Conversion Factor | 5.7 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  <p>A head silhouette containing a 3D SAR distribution map. The map shows power density in mW/g across the head's internal structures. A color scale from 0.00 to 0.15 is provided. The map is labeled with 'Abs. SAR' and 'V.Avg. (mW/g)'.</p>  <p>A line graph titled 'SAR-Z Axis at Hotspot x:-1.87 y:12.91'. The y-axis is 'SAR (mW/g)' ranging from 0.00 to 0.22. The x-axis is 'Z Distance (mm)' ranging from 0 to 30. The curve starts at approximately 0.21 mW/g at 0 mm and decreases rapidly, reaching a minimum of about 0.03 mW/g at 22 mm, then slightly increasing to 0.04 mW/g at 32 mm.</p> | |
| SAR 1g(W/kg) | 0.126 |
| SAR 10g(W/kg) | 0.074 |

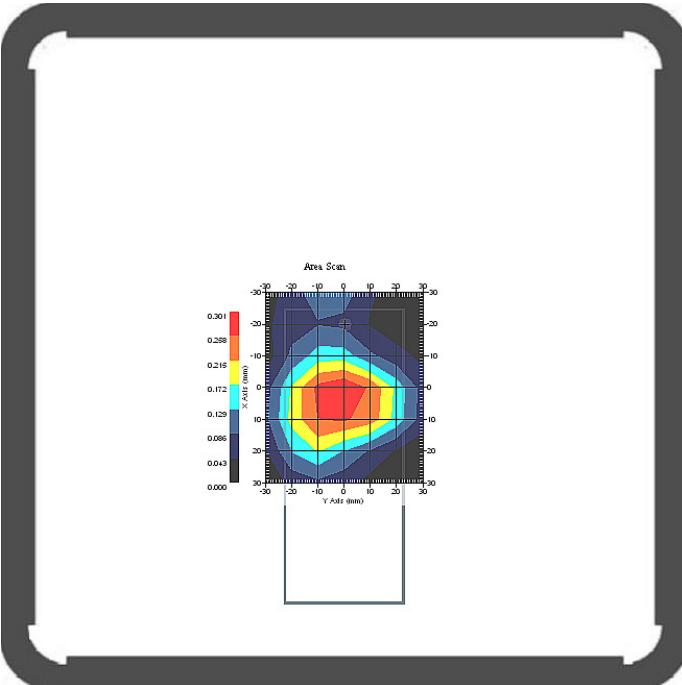
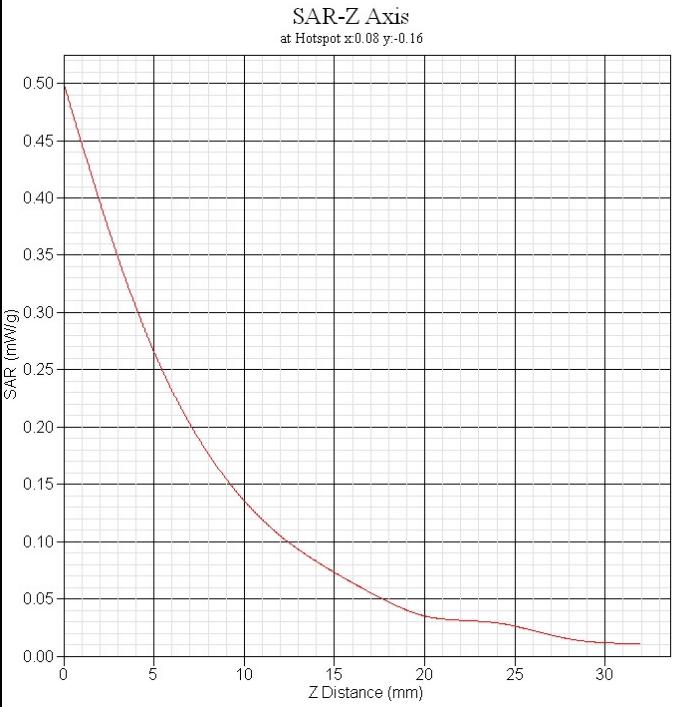
| GSM1900 Right cheek CH512 | |
|----------------------------------|-------------------------------|
| Frequency(MHz) | 1850.2 |
| Relative permittivity(real part) | 41.55 |
| Conductivity(S/m) | 1.42 |
| Variation(%) | -0.484 |
| Duty Cycle Factor | 8 |
| Crest factor | 8 |
| Conversion Factor | 5.7 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
| | |
| | |
| SAR 1g(W/kg) | 0.399 |
| SAR 10g(W/kg) | 0.224 |

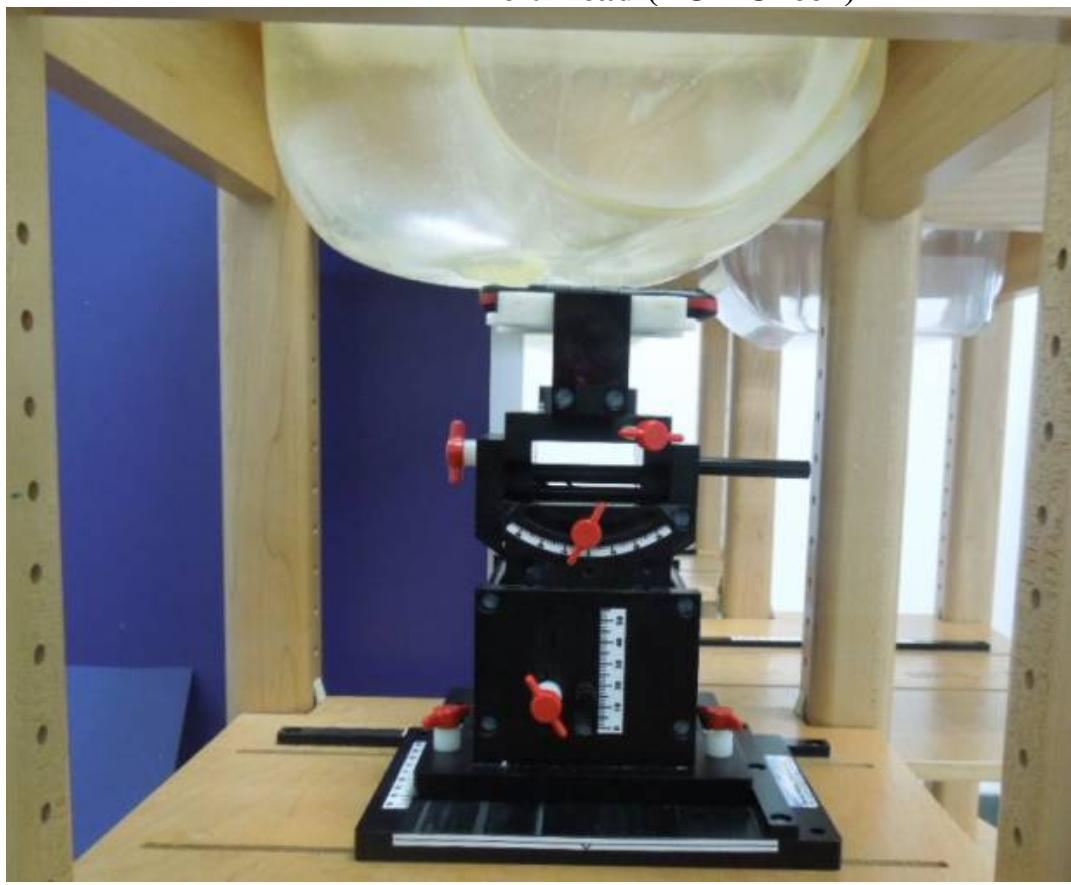
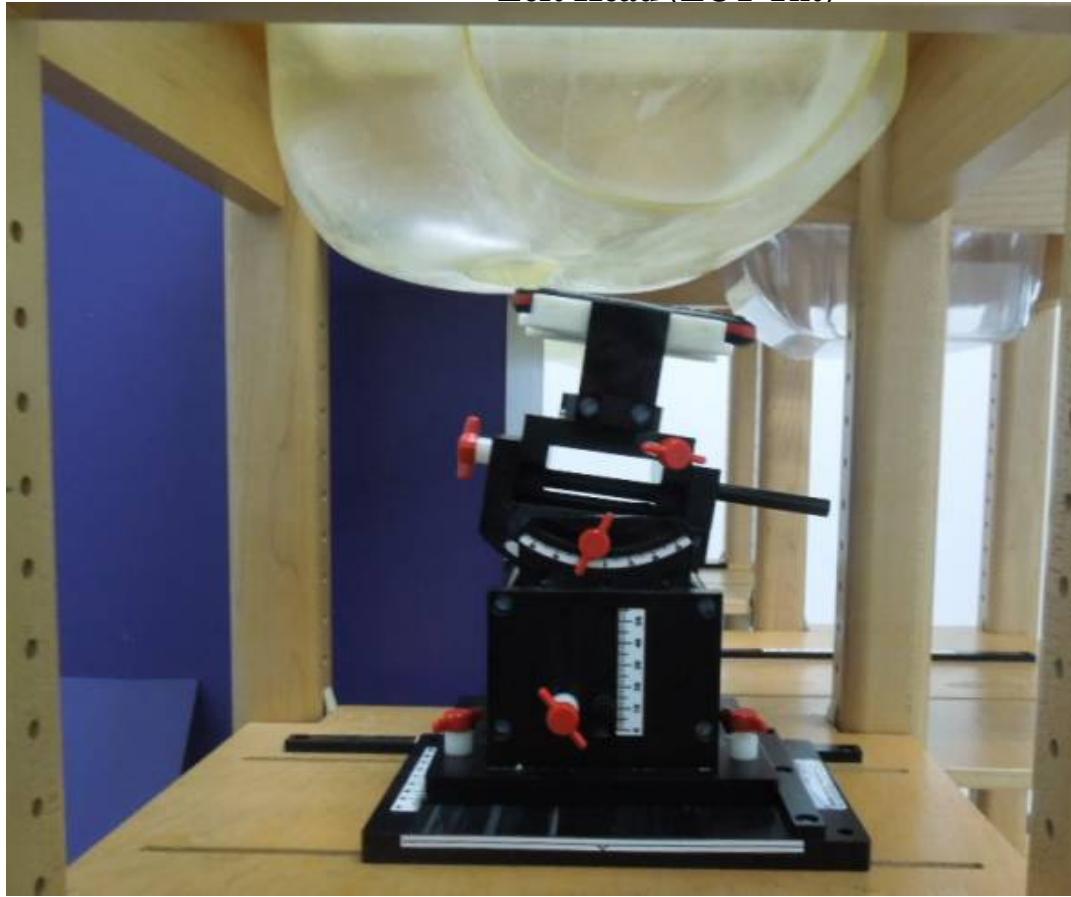
| GSM1900 Right tilt CH512 | | | | | | | | | | | | | | | | | | | |
|--|-------------------------------|-----------------|------------|---|------|---|------|---|------|----|------|----|------|----|------|----|------|----|------|
| Frequency(MHz) | 1850.2 | | | | | | | | | | | | | | | | | | |
| Relative permittivity(real part) | 41.55 | | | | | | | | | | | | | | | | | | |
| Conductivity(S/m) | 1.42 | | | | | | | | | | | | | | | | | | |
| Variation(%) | -3.892 | | | | | | | | | | | | | | | | | | |
| Duty Cycle Factor | 8 | | | | | | | | | | | | | | | | | | |
| Crest factor | 8 | | | | | | | | | | | | | | | | | | |
| Conversion Factor | 5.7 | | | | | | | | | | | | | | | | | | |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 | | | | | | | | | | | | | | | | | | |
| Data | 2013-04-17 | | | | | | | | | | | | | | | | | | |
|  <p>SAR-Z Axis at Hotspot x:-9.93 y:13.03</p>  <table border="1"> <caption>SAR-Z Axis Data (Estimated from Graph)</caption> <thead> <tr> <th>Z Distance (mm)</th> <th>SAR (mW/g)</th> </tr> </thead> <tbody> <tr><td>0</td><td>0.26</td></tr> <tr><td>2</td><td>0.22</td></tr> <tr><td>5</td><td>0.14</td></tr> <tr><td>10</td><td>0.08</td></tr> <tr><td>15</td><td>0.10</td></tr> <tr><td>20</td><td>0.04</td></tr> <tr><td>25</td><td>0.03</td></tr> <tr><td>30</td><td>0.04</td></tr> </tbody> </table> | | Z Distance (mm) | SAR (mW/g) | 0 | 0.26 | 2 | 0.22 | 5 | 0.14 | 10 | 0.08 | 15 | 0.10 | 20 | 0.04 | 25 | 0.03 | 30 | 0.04 |
| Z Distance (mm) | SAR (mW/g) | | | | | | | | | | | | | | | | | | |
| 0 | 0.26 | | | | | | | | | | | | | | | | | | |
| 2 | 0.22 | | | | | | | | | | | | | | | | | | |
| 5 | 0.14 | | | | | | | | | | | | | | | | | | |
| 10 | 0.08 | | | | | | | | | | | | | | | | | | |
| 15 | 0.10 | | | | | | | | | | | | | | | | | | |
| 20 | 0.04 | | | | | | | | | | | | | | | | | | |
| 25 | 0.03 | | | | | | | | | | | | | | | | | | |
| 30 | 0.04 | | | | | | | | | | | | | | | | | | |
| SAR 1g(W/kg) | 0.140 | | | | | | | | | | | | | | | | | | |
| SAR 10g(W/kg) | 0.081 | | | | | | | | | | | | | | | | | | |

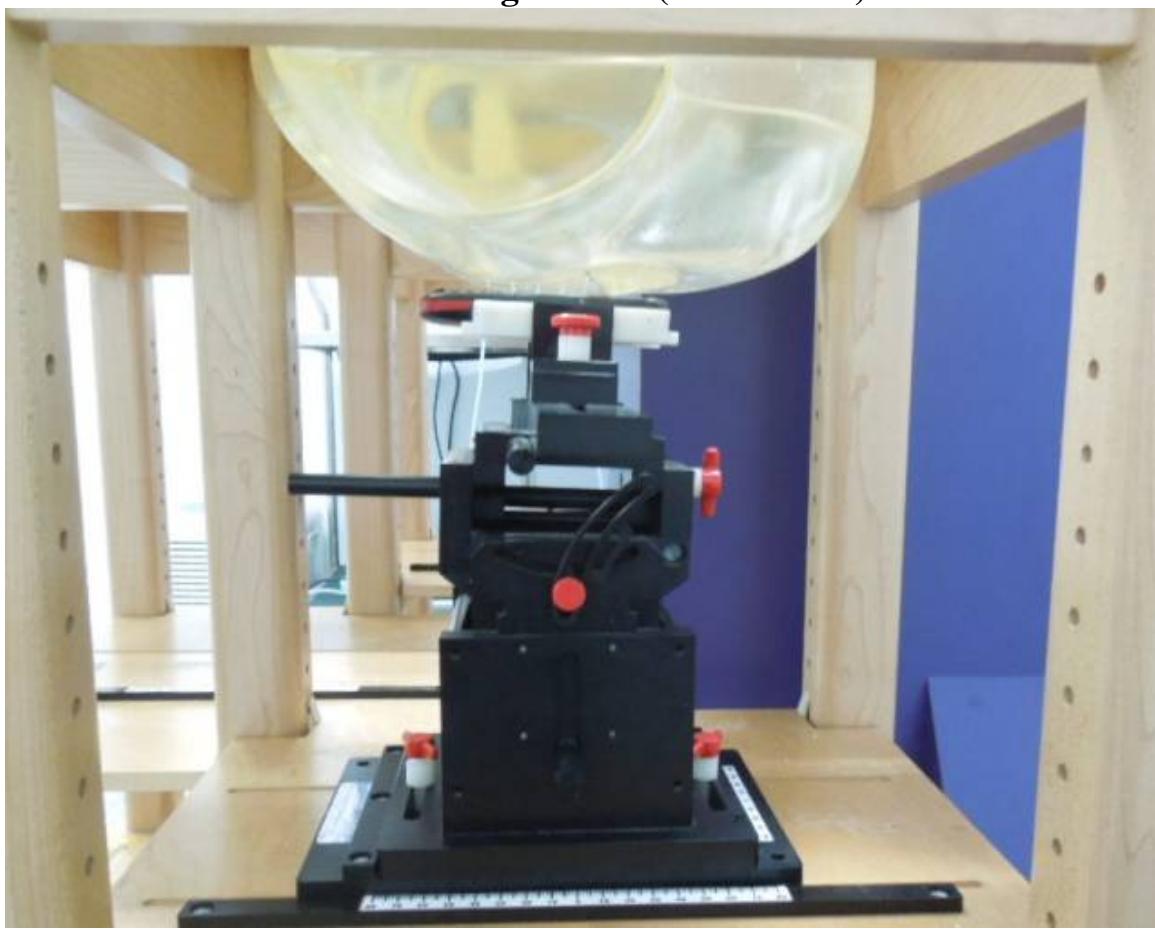
| GPRS850 body Front CH190 | |
|--|---|
| Frequency(MHz) | 836.6 |
| Relative permittivity(real part) | 53.32 |
| Conductivity(S/m) | 0.96 |
| Variation(%) | 0.816 |
| Duty Cycle Factor | 4 |
| Crest factor | 4 |
| Conversion Factor | 6.4 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  |  |
| SAR 1g(W/kg) | 0.272 |
| SAR 10g(W/kg) | 0.180 |

| GPRS850 body Back CH190 | |
|--|---|
| Frequency(MHz) | 836.6 |
| Relative permittivity(real part) | 53.32 |
| Conductivity(S/m) | 0.96 |
| Variation(%) | -0.570 |
| Duty Cycle Factor | 4 |
| Crest factor | 4 |
| Conversion Factor | 6.4 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  | <p style="text-align: center;">SAR-Z Axis at Hotspot x:10.06 y:0.16</p>  |
| SAR 1g(W/kg) | 0.402 |
| SAR 10g(W/kg) | 0.281 |

| GPRS1900 body Front CH512 | |
|---|---|
| Frequency(MHz) | 1850.2 |
| Relative permittivity(real part) | 52.93 |
| Conductivity(S/m) | 1.51 |
| Variation(%) | -1.722 |
| Duty Cycle Factor | 4 |
| Crest factor | 4 |
| Conversion Factor | 5.4 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  |  |
| SAR 1g(W/kg) | 0.166 |
| SAR 10g(W/kg) | 0.082 |

| GPRS1900 body Back CH512 | |
|--|---|
| Frequency(MHz) | 1850.2 |
| Relative permittivity(real part) | 52.93 |
| Conductivity(S/m) | 1.51 |
| Variation(%) | 0.809 |
| Duty Cycle Factor | 4 |
| Crest factor | 4 |
| Conversion Factor | 5.4 |
| Probe Sensitivity | 1.20 1.20 1.20 μ V/(V/m)2 |
| Data | 2013-04-17 |
|  |  |
| SAR 1g(W/kg) | 0.269 |
| SAR 10g(W/kg) | 0.132 |

SAR Test Photographs**Left Head (EUT Cheek)****Left Head (EUT Tilt)**

Right Head (EUT Cheek)**Right Head (EUT Tilt)**

Body Back (1.5cm)**Body Front (1.5cm)**

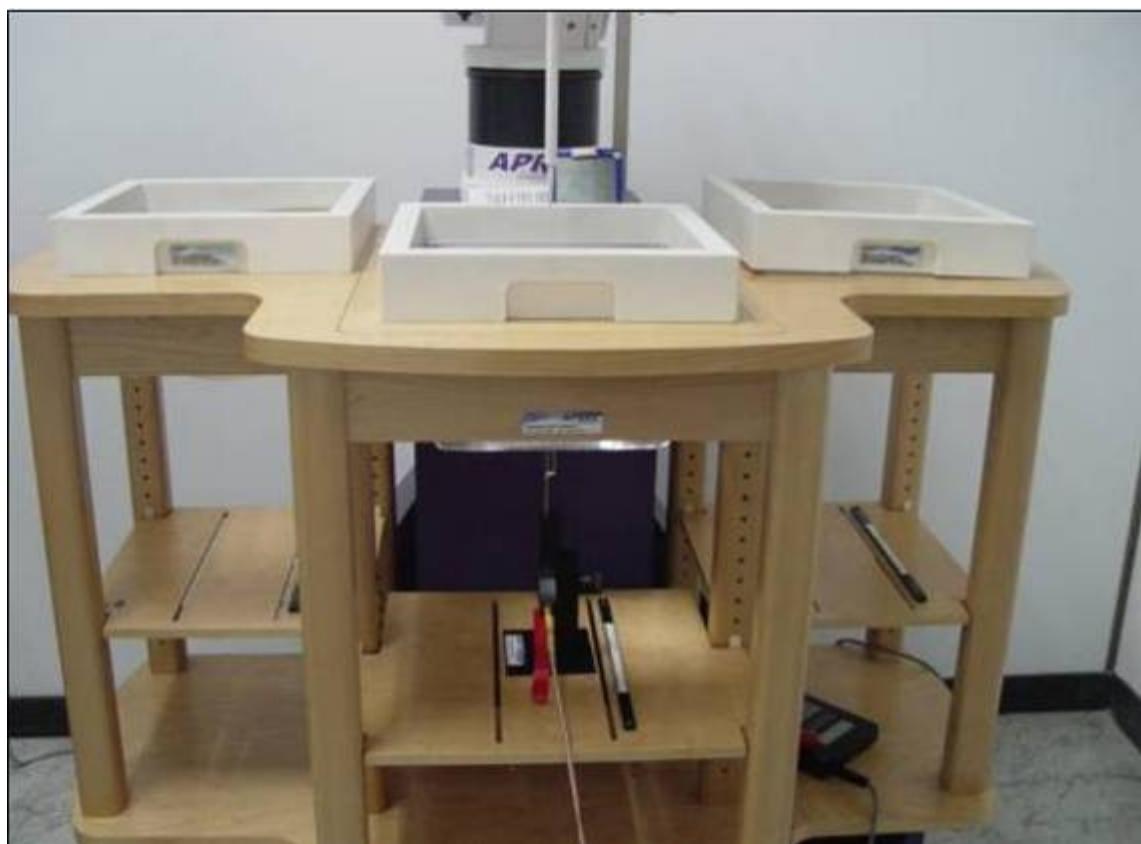
Validation

Photo of Liquid Height for Head SAR

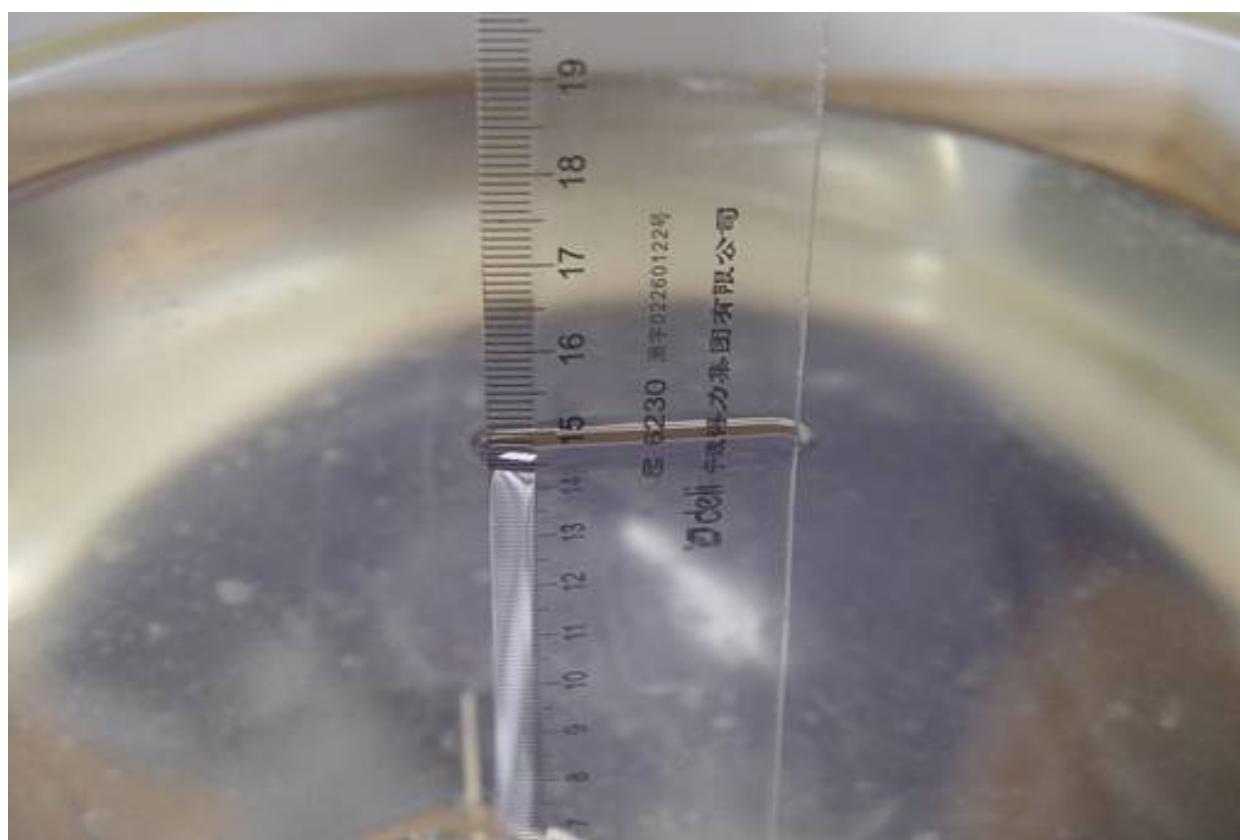
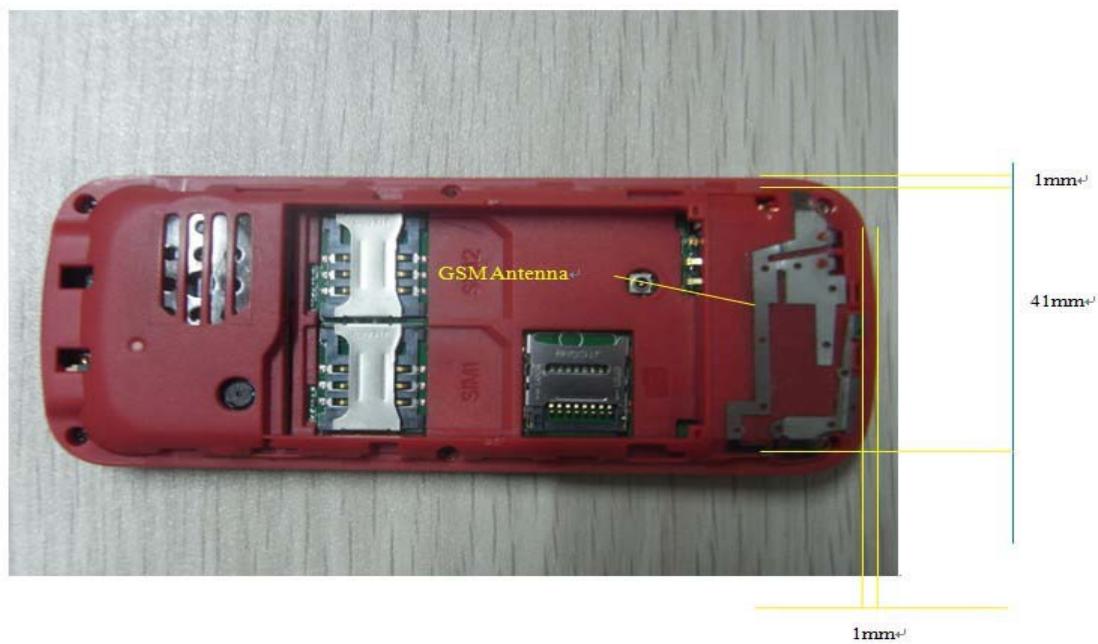


Photo of Liquid Height for Body SAR**EUT**



NCL CALIBRATION LABORATORIES**Calibration File No.: PC 1432****Client.: IAC****C E R T I F I C A T E O F C A L I B R A T I O N**

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

Equipment: Miniature Isotropic RF Probe

Record of Calibration

Head and Body

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 500-00273

Calibration Procedure: D01-032-E020-V2, D22-012-Tissue, D28-002-Dipole
Project No: ISL-E020-5695**Calibrated:** 1st October 2012
Released on: 5th October 2012

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

Released By:



Art Brennan, Quality Manager

NCL CALIBRATION LABORATORIES303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1Division of APREL
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

- o IEEE Standard 1528 (2003) including Amendment 1
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- o EN 62209-1 (2006)
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models. Instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- o IEC 62209-2 Ed. 1.0 (2010-03)
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- o TP-D01-032-E020-V2 E-Field probe calibration procedure
- o D22-012-Tissue dielectric tissue calibration procedure
- o D28-002-Dipole procedure for validation of SAR system using a dipole
- o IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Page 2 of 10

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

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

Probe 500-00273 was a recalibration.

"The probe was received in good working order, although at 1900MHz the uncertainty was higher than our standard (see note")

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

Primary Measurement Standards

| Instrument | Serial Number | Cal due date |
|----------------------------------|---------------|----------------|
| Power meter Anritsu MA2408A | 90025437 | Nov.5, 2012 |
| Power Sensor Anritsu MA2481D | 103555 | Nov 5 2012 |
| Attenuator HP 8495A (70dB) | 1944A10711 | Sept. 13, 2013 |
| Network Analyzer Anritsu MT8801C | MB11855 | Feb. 7, 2013 |

Secondary Measurement Standards

Signal Generator Agilent E4438C -506 MY55182336 June 6, 2013

Attestation

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

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



Art Brennan, Quality Manager



Dan Brooks, Test Engineer

NCL Calibration Laboratories
Division of APREL Inc.

Probe Summary

Probe Type: E-Field Probe E020
Serial Number: 500-00273
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 μ V/(V/m)²
Channel Y: 1.2 μ V/(V/m)²
Channel Z: 1.2 μ V/(V/m)²

Diode Compression Point: 95 mV

NCL Calibration Laboratories

Division of APREL Inc.

Calibration for Tissue (Head H, Body B)

| Frequency | Tissue Type | Measured Epsilon | Measured Sigma | Calibration Uncertainty | Tolerance Uncertainty for 5%* | Conversion Factor |
|-----------|-------------|------------------|----------------|-------------------------|-------------------------------|-------------------|
| 450 H | Head | X | X | X | X | X |
| 450 B | Body | X | X | X | X | X |
| 750 H | Head | X | X | X | X | X |
| 750 B | Body | X | X | X | X | X |
| 850 H | Head | 42.86 | 0.95 | 3.5 | 3.4 | 6.5 |
| 850 B | Body | 53.71 | 1.04 | 3.5 | 3.4 | 6.4 |
| 900 H | Head | 41.5 | 0.99 | 3.5 | 3.4 | 6.1 |
| 900 B | Body | 53.25 | 1.04 | 3.5 | 3.4 | 6.3 |
| 1450 H | Head | X | X | X | X | X |
| 1450 B | Body | X | X | X | X | X |
| 1500 H | Head | X | X | X | X | X |
| 1500 B | Body | X | X | X | X | X |
| 1640 H | Head | X | X | X | X | X |
| 1640 B | Body | X | X | X | X | X |
| 1750 H | Head | X | X | X | X | X |
| 1750 B | Body | X | X | X | X | X |
| 1800 H | Head | 36.85 | 1.35 | 3.5 | 2.7 | 5.5 |
| 1800 B | Body | 52.38 | 1.5 | 3.5 | 2.7 | 5.4 |
| 1900 H | Head | 38.21 | 1.46 | 3.5 | 2.7 | 5.7 |
| 1900 B | Body | 52.1 | 1.59 | 3.5 | 2.7 | 5.4 |
| 2000 H | Head | X | X | X | X | X |
| 2000 B | Body | X | X | X | X | X |
| 2100 H | Head | 39.8 | 1.49 | 3.5 | 2.9 | 5.0 |
| 2100 B | Body | 53.0 | 1.58 | 3.5 | 2.9 | 4.9 |
| 2300 H | Head | X | X | X | X | X |
| 2300 B | Body | X | X | X | X | X |
| 2450 H | Head | 38.2 | 1.84 | 3.5 | 3.5 | 4.65 |
| 2450 B | Body | 50.63 | 1.99 | 3.5 | 3.5 | 4.4 |
| 2600 H | Head | X | X | X | X | X |
| 2600 B | Body | X | X | X | X | X |
| 3000 H | Head | X | X | X | X | X |
| 3000 B | Body | X | X | X | X | X |
| 3600 H | Head | X | X | X | X | X |
| 3600 B | Body | X | X | X | X | X |
| 5200 H | Head | X | X | X | X | X |
| 5200 B | Body | X | X | X | X | X |
| 5600 H | Head | X | X | X | X | X |
| 5600 B | Body | X | X | X | X | X |
| 5800 H | Head | X | X | X | X | X |
| 5800 B | Body | X | X | X | X | X |

NCL Calibration Laboratories
Division of APREL Inc.

Boundary Effect:

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

Spatial Resolution:

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

DAQ-PAQ Contribution

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

Boundary Effect:

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

NOTES:

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

**1800MHz Head was evaluated at close to the 10% allowable deviation; the deviation has now been normalized to within 2%.

***1800MHz Body was evaluated at close to the 10% allowable deviation; the deviation has now been normalized to within 2%.

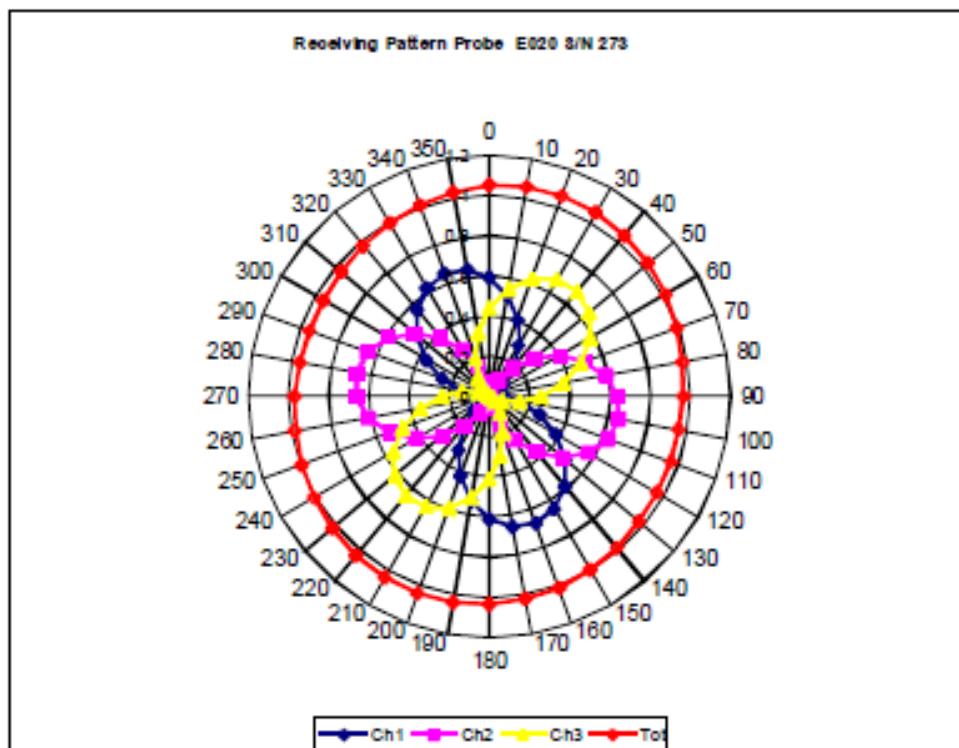
****1900MHz Body was evaluated at close to the 10% allowable deviation; the deviation has now been normalized to within 2%.

*****2450MHz Head was evaluated at close to the 10% allowable deviation; the deviation has now been normalized to within 2%.

*****2450MHz Body was evaluated at close to the 10% allowable deviation; the deviation has now been normalized to within 2%.

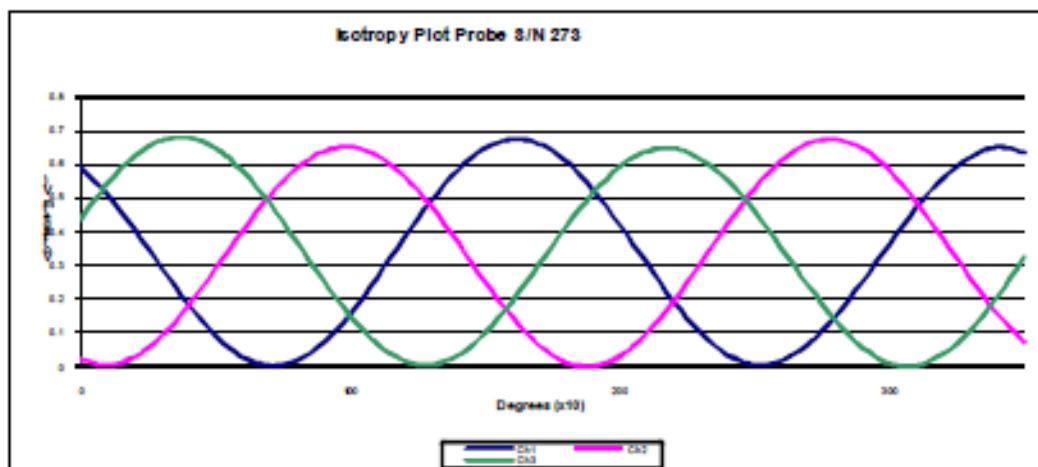
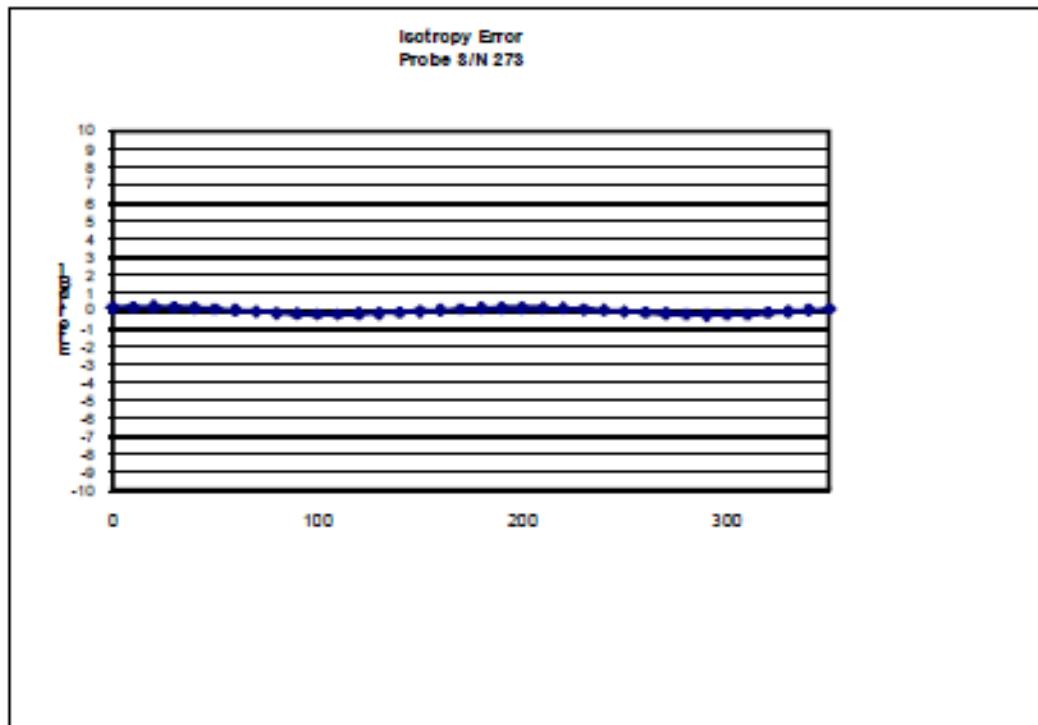
NCL Calibration Laboratories
Division of APREL Inc.

Receiving Pattern Air



NCL Calibration Laboratories
Division of APREL Inc.

Isotropy Error Air



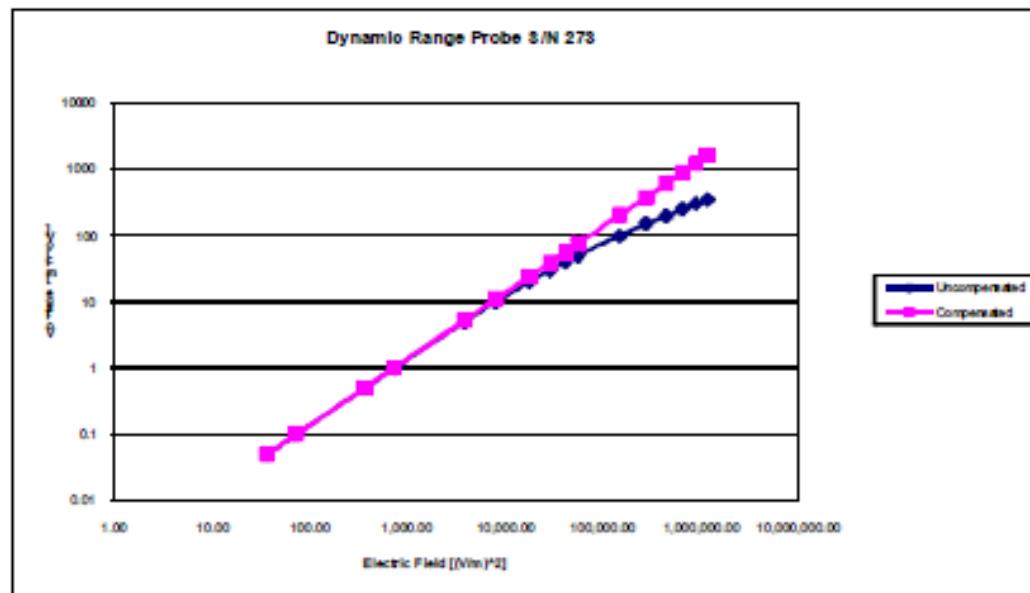
Isotropicity Tissue: 0.10 dB

Page 8 of 10

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

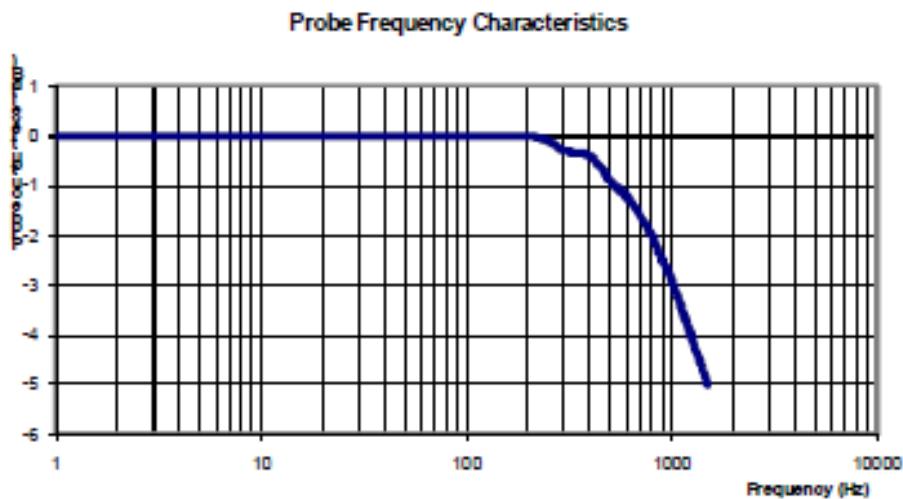
NCL Calibration Laboratories
Division of APREL Inc.

Dynamic Range



NCL Calibration Laboratories
Division of APREL Inc.

Video Bandwidth



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

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\INCL\Calibration Equipment\Instrument List May 2012.

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: DC-1217/18
Project Number: SGL-IAC-DC-5582-93

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

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

Validation Dipole
835MHz Head & Body

Manufacturer: APREL Laboratories

Part number: ALS-D-835-S-2

Frequency: 835MHz

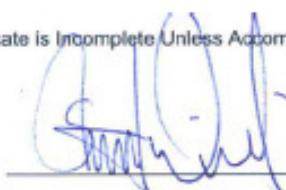
Serial No: 180-00556

Customer: IAC

Calibrated: 17th May 2011
Released on: 27th May 2011

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

Released By:

**NCL CALIBRATION LABORATORIES**

303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1

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

NCL Calibration Laboratories
Division of APREL Inc.

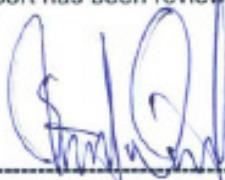
Conditions

Dipole 180-00556 was a re-calibration.

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

Dipoles are calibrated on the ALSAS-10U with a feed power normalized to 1Watt.

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



Stuart Nicol



C. Teodorian

Primary Measurement Standards

| Instrument | Serial Number | Cal due date |
|----------------------------------|---------------|----------------|
| Power meter Anritsu MA2408A | 90025437 | Nov.4, 2010 |
| Power Sensor Anritsu MA2481D | 103555 | Nov 4, 2010 |
| Attenuator HP 8495A (70dB) | 1944A10711 | Sept. 14, 2010 |
| Network Analyzer Anritsu MT8801C | MB11855 | Feb. 8, 2011 |

Secondary Measurement Standards

Signal Generator Agilent E4438C -506 MY55182336 June 7, 2011

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

NCL Calibration Laboratories

Division of APREL Inc.

Calibration Results Summary

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

Mechanical Dimensions

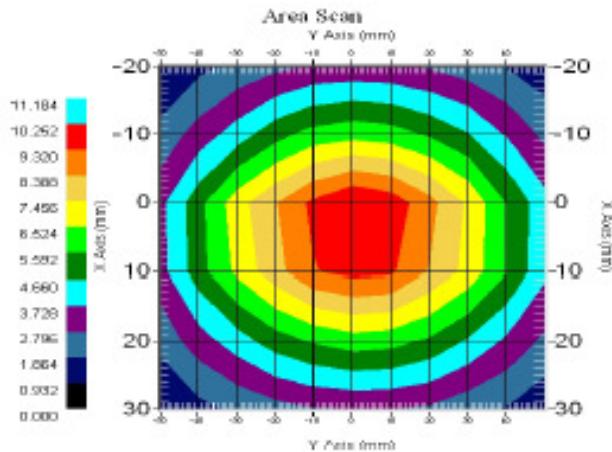
Length: 161.0 mm
Height: 89.8 mm

Electrical Specification 835MHz

| Tissue Type | Return Loss: | Impedance: | SWR: |
|-------------|--------------|------------|--------|
| Head | -26.655 | 51.666 | 1.102U |
| Body | -22.106 | 57.482 | 1.177U |

System Validation Results

| Tissue | Frequency | 1 Gram | 10 Gram | Peak |
|--------|-----------|--------|---------|--------|
| Head | 835 MHz | 9.590 | 6.003 | 15.013 |
| Body | 835 MHz | 9.981 | 6.006 | 15.013 |

835MHz

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

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NCL Calibration Laboratories

Division of APREL Inc.

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 190-00606. 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-030 130 MHz to 26 GHz E-Field Probe Serial Number 215.

References

- o IEEE Standard 1528 (2003) including Amendment 1
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- o EN 62209-1 (2006)
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- o IEC 62209-2 Ed. 1.0 (2010-03)
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- o TP-D01-032-E020-V2 E-Field probe calibration procedure
- o D22-012-Tissue dielectric tissue calibration procedure
- o D28-002-Dipole procedure for validation of SAR system using a dipole
- o IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions

Dipole 190-00606 was a re-calibration.

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

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

4

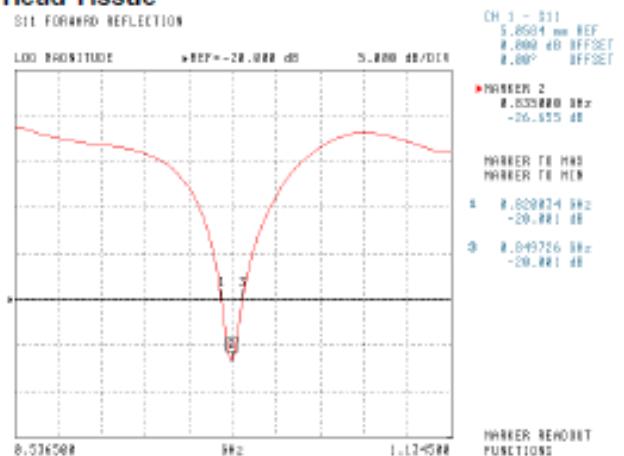
NCL Calibration Laboratories
Division of APREL Inc.

Electrical Calibration

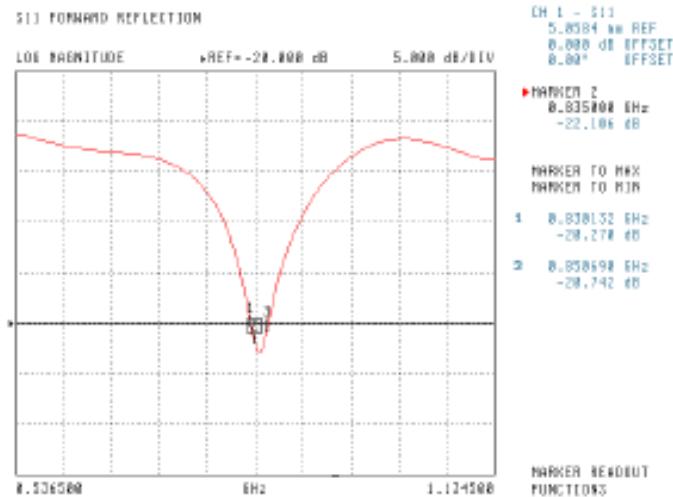
Electrical Specification 835MHz

| Tissue Type | Measured Epsilon | Measured Sigma |
|-------------|------------------|----------------|
| Head | 41.09 | 0.89 |
| Body | 53.15 | 0.95 |

Head Tissue



Body Tissue



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

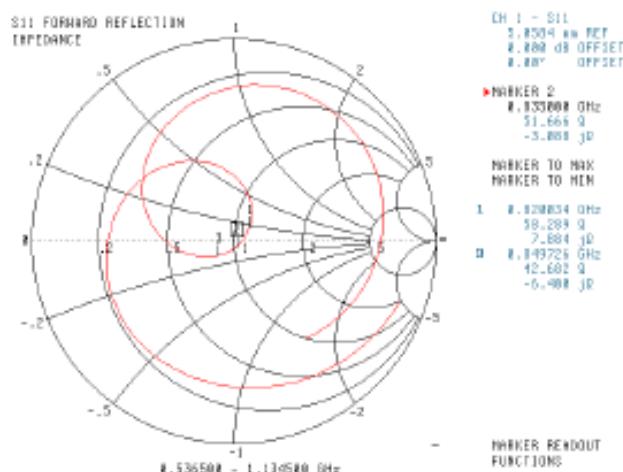
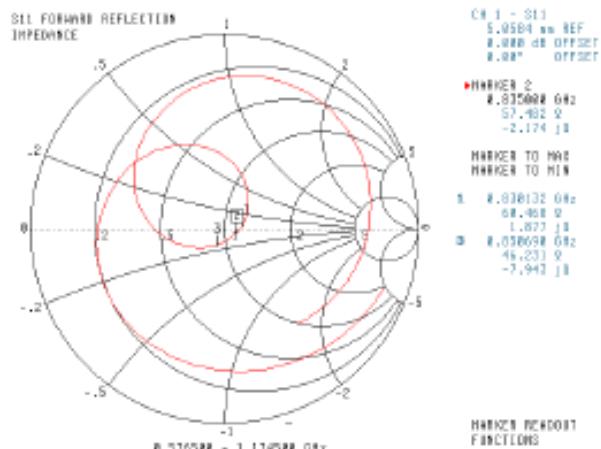
5

NCL Calibration Laboratories

Division of APREL Inc.

**Electrical Specification 835MHz
Impedance**

| Tissue Type | Measured Epsilon | Measured Sigma |
|-------------|------------------|----------------|
| Head | 41.09 | 0.89 |
| Body | 53.15 | 0.95 |

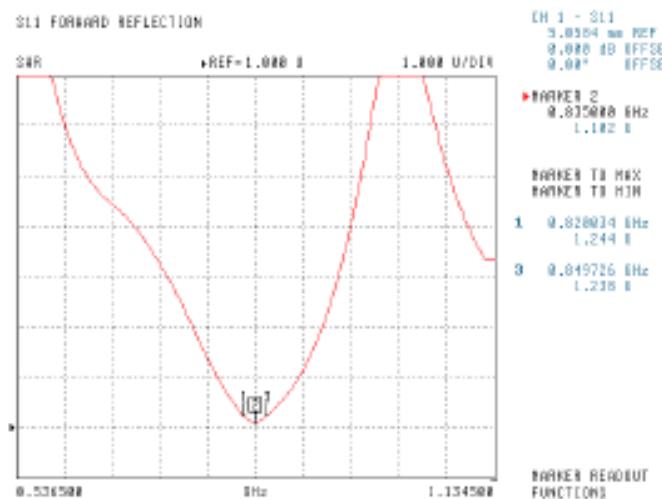
Head Tissue**Body Tissue**

NCL Calibration Laboratories
Division of APREL Inc.

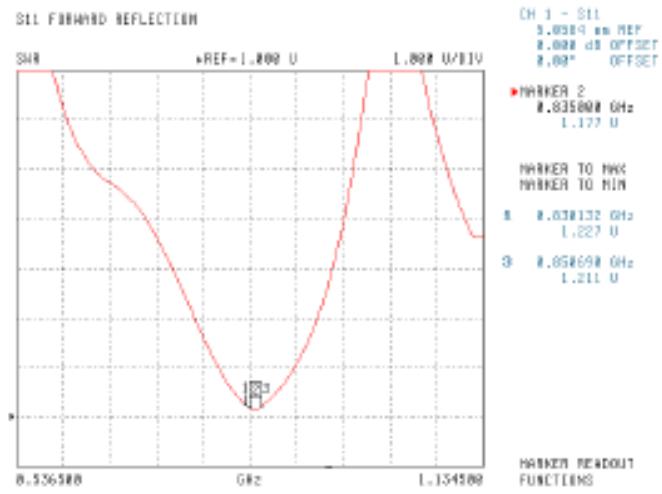
Electrical Specification 835MHz
Standing Wave Ratio

| Tissue Type | Measured Epsilon | Measured Sigma |
|-------------|------------------|----------------|
| Head | 41.09 | 0.89 |
| Body | 53.15 | 0.95 |

Head Tissue



Body Tissue



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

7

NCL Calibration Laboratories
Division of APREL Inc.

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 2011.

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

8

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1224/5
Project Number: SGL-IAC-DC-5582-93

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

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

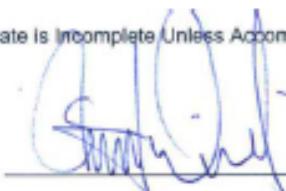
Validation Dipole
1900MHz Head & Body

Manufacturer: APREL Laboratories
Part number: ALS-D-1900-S-2
Frequency: 1900MHz
Serial No: 210-00707

Customer: IAC

Calibrated: 16th May 2011
Released on: 27th May 2011

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

Released By: 

NCL CALIBRATION LABORATORIES

303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1

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

NCL Calibration Laboratories
Division of APREL Inc.

Conditions

Dipole 210-00707 was a new dipole taken from stock.

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

Dipoles are calibrated on the ALSAS-10U with a feed power normalized to 1Watt.

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



Stuart Nicol



C. Teodorian

Primary Measurement Standards

| Instrument | Serial Number | Cal due date |
|----------------------------------|---------------|----------------|
| Power meter Anritsu MA2408A | 190025437 | Nov.4, 2010 |
| Power Sensor Anritsu MA2481D | 103555 | Nov 4, 2010 |
| Attenuator HP 8495A (70dB) | 1944A10711 | Sept. 14, 2010 |
| Network Analyzer Anritsu MT8801C | MB11855 | Feb. 8, 2011 |

Secondary Measurement Standards

Signal Generator Agilent E4438C -506 MY55182336 June 7, 2011

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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

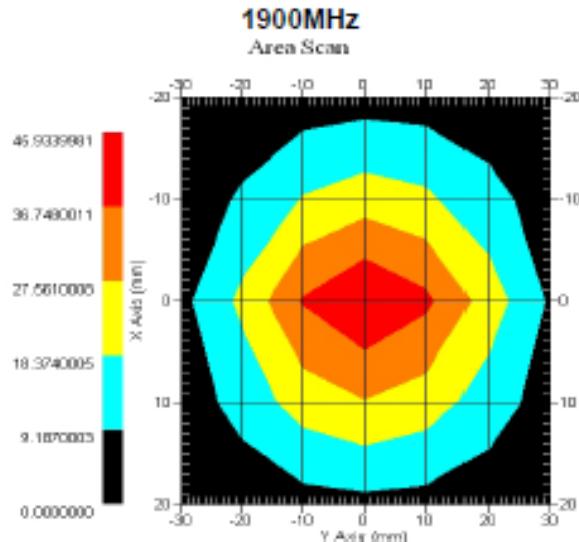
Length: 67.1 mm
Height: 38.9 mm

Electrical Specification 1900MHz

| Tissue Type | Return Loss: | Impedance: | SWR: |
|-------------|--------------|------------|--------|
| Head | -31.943 | 51.262 | 1.055U |
| Body | -25.099 | 57.750 | 1.119U |

System Validation Results

| Tissue | Frequency | 1 Gram | 10 Gram | Peak |
|--------|-----------|--------|---------|--------|
| Head | 1900 MHz | 39.378 | 19.668 | 77.268 |
| Body | 1900 MHz | 39.654 | 19.668 | 77.268 |



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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 200-00657. 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-030 130 MHz to 26 GHz E-Field Probe Serial Number 215.

References

- o IEEE Standard 1528 (2003) including Amendment 1
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- o EN 62209-1 (2006)
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- o IEC 62209-2 Ed. 1.0 (2010-03)
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- o TP-D01-032-E020-V2 E-Field probe calibration procedure
- o D22-012-Tissue dielectric tissue calibration procedure
- o D28-002-Dipole procedure for validation of SAR system using a dipole
- o IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions

Dipole 200-00657 was a re-calibration.

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

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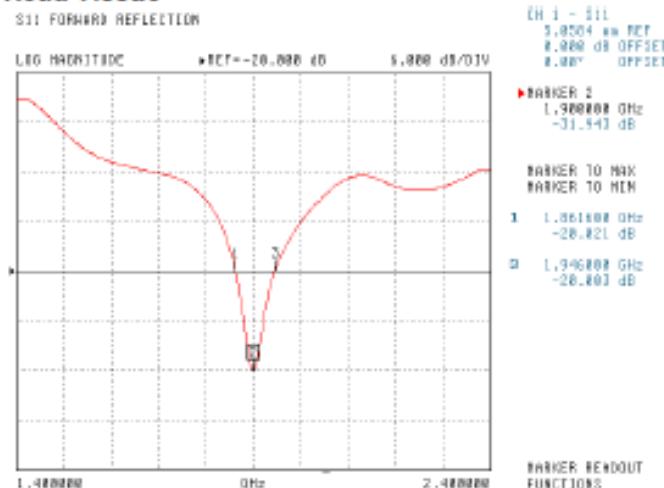
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Electrical Calibration

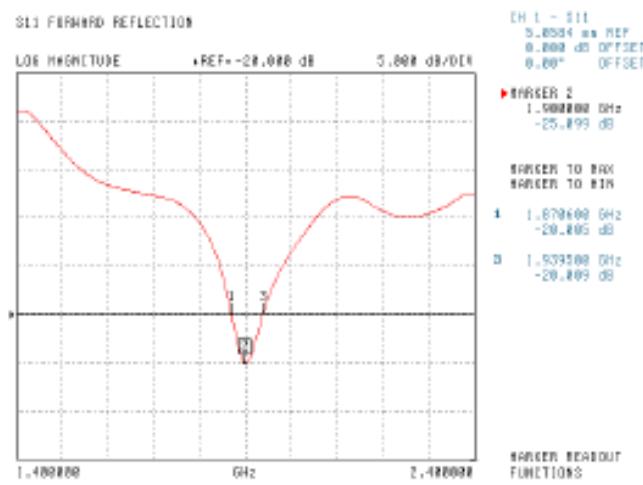
Electrical Specification 1900MHz

| Tissue Type | Measured Epsilon | Measured Sigma |
|-------------|------------------|----------------|
| Head | 38.12 | 1.41 |
| Body | 51.52 | 1.57 |

Head Tissue



Body Tissue



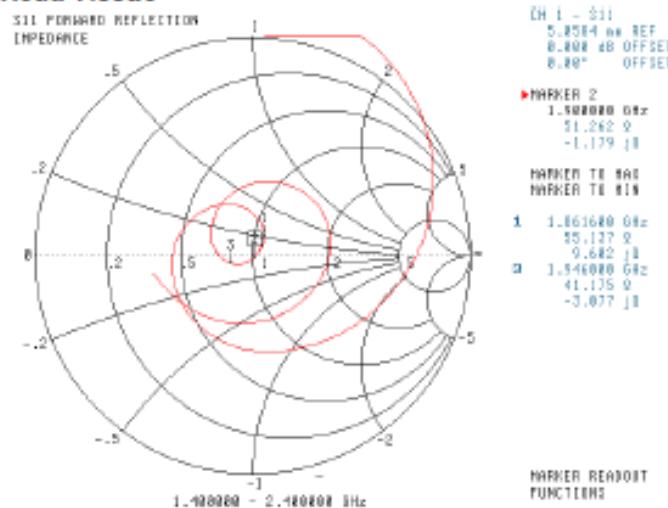
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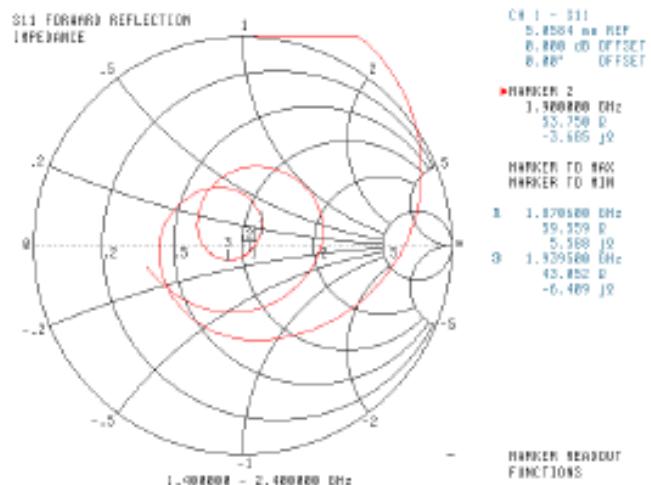
Electrical Specification 1900MHz
Impedance

| Tissue Type | Measured Epsilon | Measured Sigma |
|-------------|------------------|----------------|
| Head | 38.12 | 1.41 |
| Body | 51.52 | 1.57 |

Head Tissue



Body Tissue



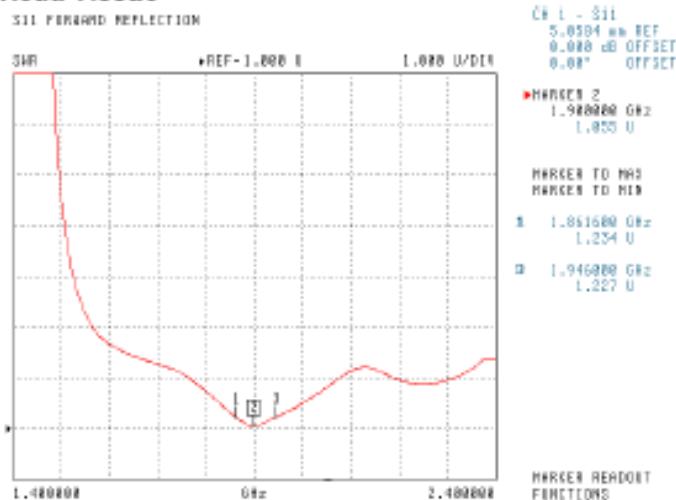
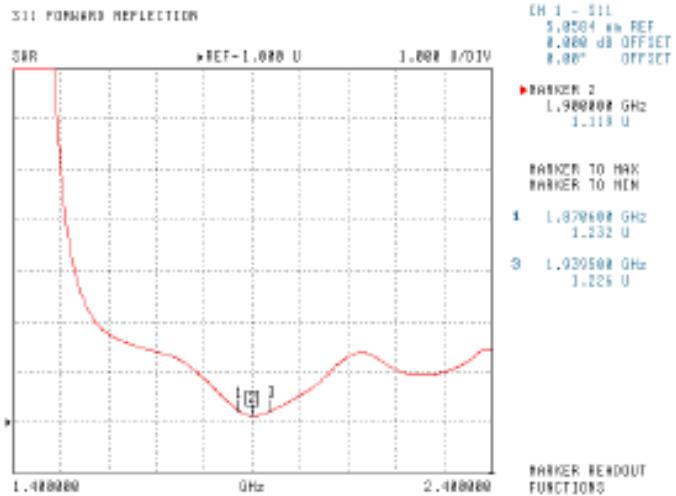
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**Electrical Specification 1900MHz
Standing Wave Ratio**

| Tissue Type | Measured Epsilon | Measured Sigma |
|-------------|------------------|----------------|
| Head | 38.12 | 1.41 |
| Body | 51.52 | 1.57 |

Head Tissue**Body Tissue**

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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 2011.

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