CLASS TWO PERMISSIVE CHANGE SAR REPORT FOR HEAD

Subject: **Specific Absorption Rate (SAR) FCC Report**

Product: **Cellular Telephone**

Model: **Audiovox Mp3 Phone**

Client: **Standard Telecom (Airlynx)**

Address: **C/O 926 Kwangyang 2-Dong,**
Dongan-Ku,
Anyang-City,
Kyunggi-Do
Korea 431-062

Project #: **ALXB-NXC 3200 Modified-3671**

Prepared by APREL Laboratories
51 SpectrumWay
Nepean, Ontario
K2R 1E6

Approved by _____ Date: 29 March 2001
Stuart Nicol
Director Product Development, Dosimetric R&D

Submitted by _____ Date: March 29, 2001
JaySarkar
Technical Director of Standards & Certification

Released by _____ Date: March 29/01
Dr. Jacek J. Wojcik, P. Eng.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

FCC ID: MBUNXC-3200
Applicant: Standard Telecom
Equipment: Cellular Telephone
Model: Audiovox Mp3 Phone
Standard: FCC 96 –326, Guidelines for Evaluating the Environmental Effects of Radio-Frequency Radiation

ENGINEERING SUMMARY

This report contains the results of the engineering evaluation performed on the Audiovox (Airlynx) Mp3 phone. The measurements were carried out in accordance with FCC 96-326. The Device Under Investigation (DUI) was evaluated for its maximum power level 27 dBm in AMPS mode and 25 dBm in CDMA mode. The client will supply a letter of confirmation as to the true conducted power level for the product tested.

The DUI was tested at the low, middle and high channels for the AMPS & CDMA frequency range. The maximum 1g SAR (1.29 W/kg) was found to coincide with the peak performance RF output power of channel 383 middle (836.4 MHz) for the keyboard side of the device in AMPS mode. (The hot spot is located on the center just below the view screen). Test data and graphs are presented in this report.

The device was evaluated at channel 383 (836.4 MHz) in CDMA mode as this coincided with the conservative measured SAR value for AMPS. It was found that the conservative value for CDMA mode at the above frequency was lower than the measured AMPS value.

The manufacturer had an engineer present during all the testing for the device listed. The engineer from Airlynx activated the device prior to testing which enabled the DUI to transmit at the maximum required power. The device was then measured for the Tx power using an Anritsu spectrum analyzer to ensure that the device was transmitting, and then again at the end of the process to prove that the device had not stopped during the test process. The Tx power was recorded and where appropriate documented within this report.

Based on the test results and on how the device will be marketed and used, it is certified that the product meets the requirements as set forth in the above specifications as part of a part two permissive change, for RF exposure environment.

(The results presented in this report relate only to the sample tested.)

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Table of Contents

TABLES AND FIGURES

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

1. INTRODUCTION

Tests were conducted to determine the Specific Absorption Rate (SAR) for a sample Audiovox Mp3 mobile telephone in support of a class two permissive change. These tests were conducted at APREL Laboratories' facility located at 51 Spectrum Way, Nepean, Ontario, Canada. A view of the SAR measurement setup can be seen in Appendix A Figure 1. This report describes the results obtained.

2. APPLICABLE DOCUMENTS

The following documents are applicable to the work performed:

1) FCC 96-326, Guidelines for Evaluating the Environmental Effects of Radio-Frequency Radiation

2) ANSI/IEEE C95.1-1999, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.

3) ANSI/IEEE C95.3-1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

4) OET Bulletin 65 (Edition 97-01) Supplement C (Edition 97-01), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields".

3. DEVICE UNDER INVESTIGATION

- Audiovox Mp3 Phone, s/n 7D022EA3 , received by APREL on Mar 2, 2001 .

The Audiovox Mp3 Phone will be called DUI (Device Under Investigation) in the following test report.

The manufacturer's original submission documentation contains all the necessary drawings and applicable design details.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

4. TEST EQUIPMENT

- APREL Triangular Dosimetric Probe Model E-009, s/n 115, Asset # 301420
- CRS Robotics A255 articulated robot arm, s/n RA2750, Asset # 301335
- CRS Robotics C500 robotic system controller, s/n RC584, Asset # 301334
- Anritsu Spectrum Analyser, Asset # 301436
- Universal Head and Arm Simulator (phantom shell thickness 3mm)
- Tissue Recipe and Calibration Requirements, APREL procedure SSI/DRB-TP-D01-033

5. TEST METHODOLOGY

1. The test methodology utilised in the certification of the DUI complies with the requirements of FCC 96-326 and ANSI/IEEE C95.3-1992.

2. The E-field is measured with a small isotropic probe (output voltage proportional to E^2).

3. The probe is moved precisely from one point to the next using the robot (10 mm increments for wide area scanning, 5 mm increments for zoom scanning, and 2.5 mm increments for the final depth profile measurement).

4. The probe travels in the homogeneous liquid simulating human tissue. Appendix A contains information about the properties of the simulated tissue used for these measurements.

5. The liquid is contained in a manikin simulating a portion of the human body with an overall shell thickness of 3 mm.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

6. The DUI is positioned with the surface under investigation against the phantom touching the spacer at the receiver end of the DUI giving a total maximum distance (which includes the phantom thickness and spacer) of 6mm.

7. All tests were performed with the highest power available from the sample DUI under transmit conditions.

   More detailed descriptions of the test method are given in Section 6 when appropriate.

6. TEST RESULTS

6.1. TRANSMITTER CHARACTERISTICS

The battery-powered DUI will consume energy from its batteries, which may affect the DUI's transmission characteristics. In order to gage this effect the output of the transmitter is sampled before and after each SAR run. In the case of this DUI, the Tx power was sampled throughout the test process. The following table shows the RF power sampled before and after each of the five sets of data used for the worst case SAR in this report.

Scan		**Power Readings (dBm)**		**D**
Type	**Height (mm)**	**Before**	**After**	**(dB)**
Area	2.5	27	27.2	0.2
Zoom	2.5	27	27.3	0.3
Zoom	7.5	27	27.2	0.2
Zoom	12.5	27	27	0.0
Depth	2.5 – 22.5	27	26.5	0.5

Table 1. Sampled RF Power

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

6.2. SAR MEASUREMENTS

1) RF exposure is expressed as a Specific Absorption Rate (SAR). SAR is calculated from the E-field, measured in a grid of test points as shown in Appendix A Figure 1. SAR is expressed as RF power per kilogram of mass, averaged in 10 grams of tissue for the extremities and 1 gram of tissue elsewhere.

2) The DUI was put into test mode for the SAR measurements by entering specific code(s) which were used to control the channel and maximum operating power via the DUI keypad. Airlynx had an engineer on site that executed this operation. The output power was then measured using the Anritsu spectrum analyzer before and after each test and the values were recorded.

3) Figure 5 in Appendix A shows the contour plot of the SAR measurement for the DUI at channel 383 (836.4 MHz). It also shows an overlay of the DUI's outlines, superimposed onto the contour plot

   A different presentation of the same data is shown in Appendix A Figure 6. This is a surface plot, where the measured SAR values provide the vertical dimension, which is useful as a visualisation aid.

4) Wide area scans were performed for the low, middle and high channels of the DUI. The DUI was operating at maximum output power (27 dBm AMPS and 25 dB CDMA). The DUI was placed next to the phantom in the generic touch position. The maximum distance was 6mm at the spacer (including the phantom shell thickness) decreasing to 3mm at the microphone. The duty cycle was regulated by the DUI as per the AMPS/CDMA specifications.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

TYPE OF EXPOSURE	DUI side	Battery Type	Mode	Antenna Position	Device distance to phantom (mm)	Channel			Peak Local SAR (W/kg
						L/M/H	#	Freq. (MHz)	
Head	Keyboard up	Extended	AMPS	In	3	Middle	383	836.4	1.34
	Keyboard up	Extended	AMPS	Out	3	Middle	383	836.4	1.06
	Keyboard up	***Standard***	***AMPS***	***In***	***3***	***Middle***	***383***	***836.4***	***1.21***
	Keyboard up	Extended	AMPS	In	3	Low	991	824.04	1.10
	Keyboard up	Extended	AMPS	Out	3	Low	991	824.04	0.82
	Keyboard up	Extended	AMPS	In	3	High	799	848.97	0.94
	Keyboard up	Extended	AMPS	Out	3	High	799	848.97	0.89
	Keyboard up	Extended	CDMA	In	3	Middle	383	836.49	0.94
	Keyboard up	Extended	CDMA	Out	3	Middle	383	836.49	0.95
	Keyboard up	Extended	CDMA	In	3	Low	101	824.64	0.92
	Keyboard up	Extended	CDMA	Out	3	Low	101	824.64	0.87
	Keyboard up	Extended	CDMA	In	3	High	779	848.39	1.03
	Keyboard up	Extended	CDMA	Out	3	High	779	848.39	0.75

Table 2. SAR Measurements

7. USER'S HEAD EXPOSURE

1) Due to the above data all the subsequent testing for user's head exposure was performed on channel 383 (836.4 MHz), in AMPS mode, with the extended battery, with the keyboard of the DUI facing up at a maximum distance of 6mm at the spacer and minimum distance of 3 mm at the lower end of the DUI. This relates to the position and frequency found to provide the maximum measured SAR value. The DUT was fully evaluated on the CDMA mode (table 2) and it was found that the maximum measured SAR peak was less than the value measured in AMPS mode.

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

2) Channel 383 (836.4 MHz) was also explored on a refined 5 mm grid in three dimensions. The SAR value averaged over 1 gram was determined from these measurements by averaging the 27 points (3x3x3) comprising a 1 cm cube. The maximum SAR value measured averaged over 1 gram was determined from these measurements to be 0.972 W/kg.

3) To extrapolate the maximum SAR value averaged over 1 gram to the inner surface of the phantom a series of measurements were made at five (x,y) co-ordinates within the refined grid as a function of depth, with 2.5 mm spacing. The average exponential coefficient was determined to be (-0.0586± 0.0007) / mm.

4) The distance from the probe tip to the inner surface of the phantom for the lowest point is 2.5 mm. The distance from the probe tip to the tip of the measuring dipole within the APREL Triangular Dosimetric Probe Model E-009 is 2.3 mm. The total extrapolation distance is 4.8 mm, the sum of these two.

Applying the exponential coefficient over the 4.8 mm to the maximum SAR value averaged over 1 gram that was determined previously, we obtain the **maximum SAR value at the surface averaged over 1 gram**, 1.29 W/kg.

Figure 1. Device Under Investigation

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

CONCLUSIONS

The maximum Specific Absorption Rate (SAR) averaged over 1 gram, determined at 836.4 MHz (channel 383) of the Audiovox Mp3 telephone, is 1.29 W/kg. The overall margin of uncertainty for this measurement is ±12.4% (Appendix B). The SAR limit given in the FCC 96-326 Safety Guideline is 1.6 W/kg for head exposure for the general population.

Tested by _____ Date MAR. 29, 2001

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

APPENDIX A. Measurement Setup, Tissue Properties and SAR Graphs

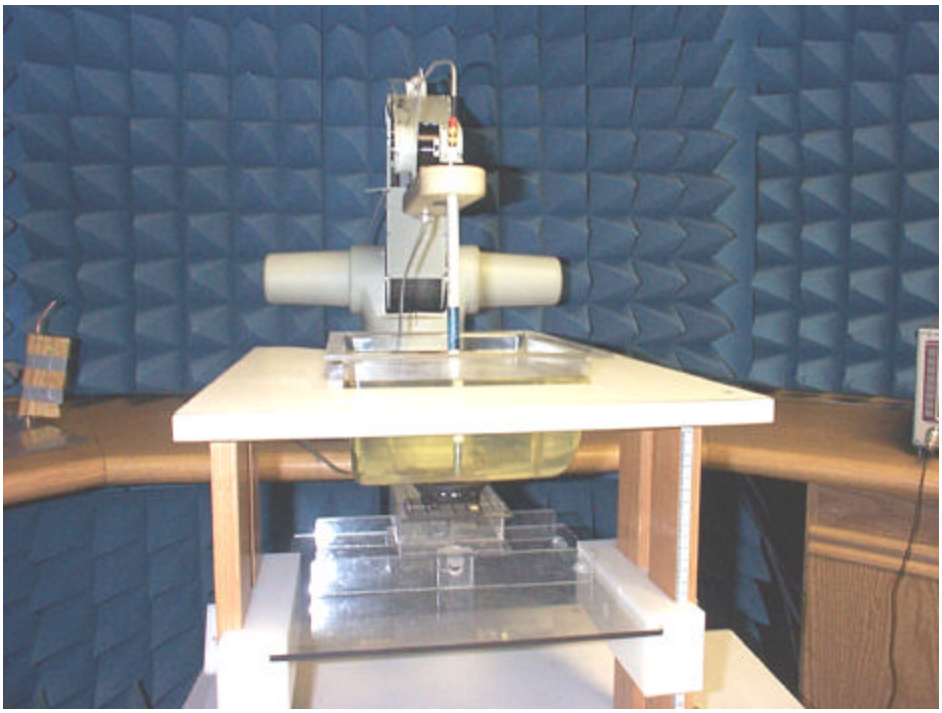

Figure 2. Setup

Figure 3. DUI at 3mm Spacer

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Figure 4. Top View of DUI With Grid

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

Simulated Tissue Material and Calibration Technique

The mixture used was based on that presented SSI/DRB-TP-D01-033, "Tissue Recipe and Calibration Requirements". The density used to determine SAR from the measurements was the recommended 1030 kg/m^3 found in Appendix C of Supplement C to OET Bulletin 65, Edition 97-01).

Dielectric parameters of the simulated tissue material were determined using a Hewlett Packard 8510 Network Analyser, a Hewlett Packard 809B Slotted Line Carriage, and an APREL SLP-001 Slotted Line Probe.

	APREL	OET 65 Supplement	Δ (%) (OET)
Dielectric constant, ε_r	41.70	46.09	9.52 %
Conductivity, σ [S/m]	0.94	0.74	21.28 %
Tissue Conversion Factor, γ	9.0	-	-

Table 3. Dielectric Properties of the Simulated Head Tissue at 835 MHz

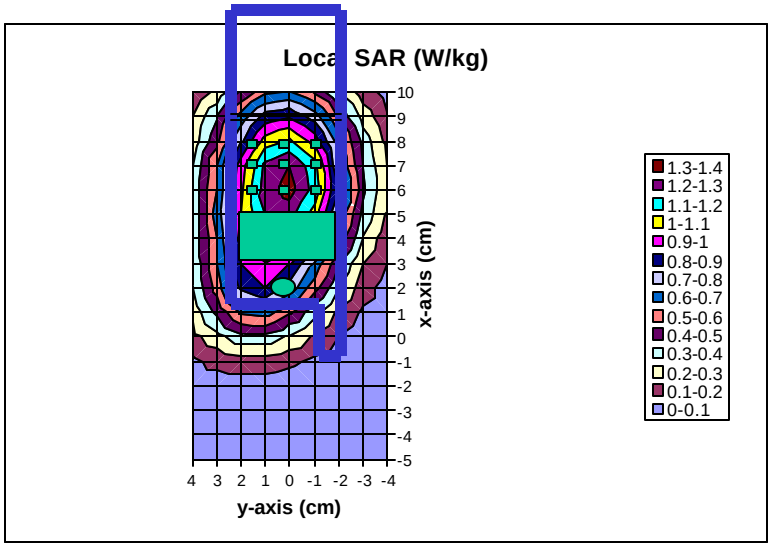

Figure 5. Contour Plot of Area Scan 2.5mm Above Phantom Surface

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

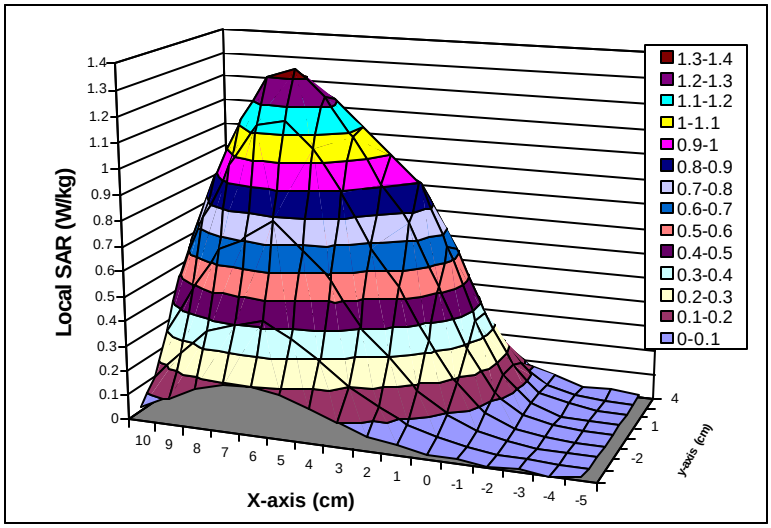

Figure 6. Surface Plot of the Area Scan 2.5mm Above Phantom Surface

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

APPENDIX B. Uncertainty Budget

Uncertainties Contributing to the Overall Uncertainty			
Type of Uncertainty	**Specific to**	**Uncertainty**	
Power variation due to battery condition	Phone	5.9%	
Extrapolation due to curve fit of SAR Vs depth	Phone	2.5%	
Extrapolation due to depth measurement	Setup	2.9%	
Conductivity	Setup	6.0%	
Density	Setup	2.6%	
Tissue enhancement factor	Setup	7.0%	
Voltage measurement	Setup	0.4%	
Probe sensitivity factor	Setup	3.5%	
		12.4%	**RSS**

Table 4. Uncertainty Budget

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com
Tel. (613) 820-2730
Fax (613) 820 4161

APPENDIX C. Validation Scan on a Flat Phantom

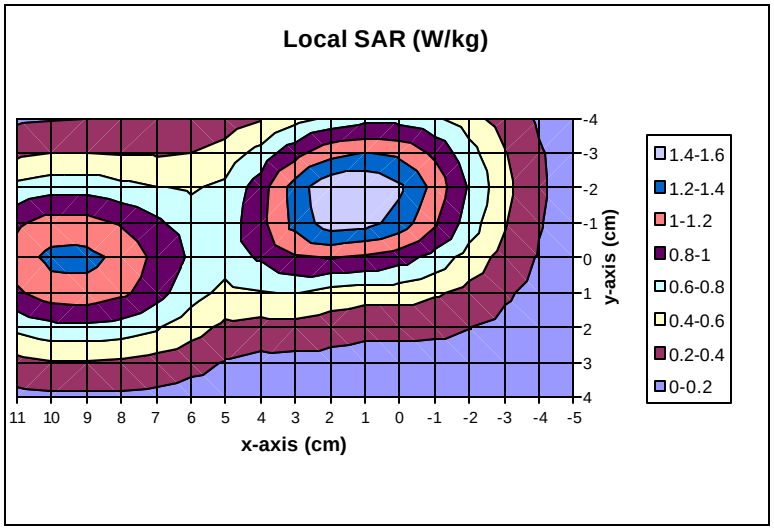

Figure 7. Contour Plot of Reference Area Scan 2.5mm Above Phantom

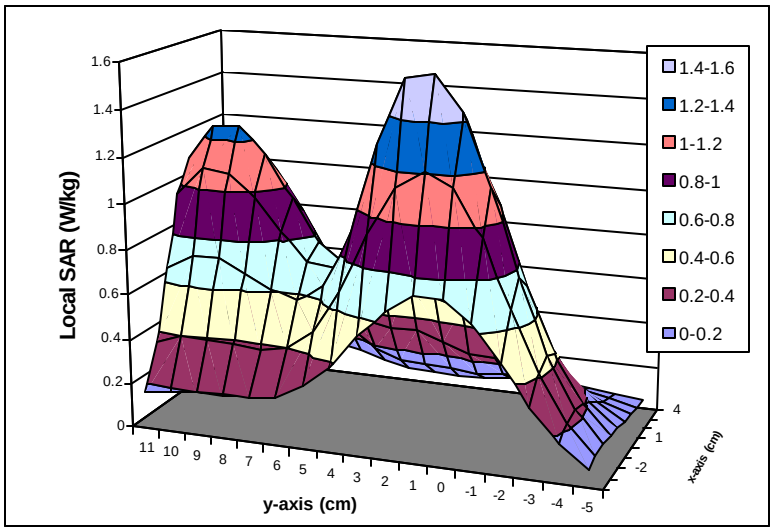

Figure 8. Surface Plot of Reference Area Scan 2.5mm Above Phantom

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161

APPENDIX D. Probe Calibration

NCL CALIBRATION LABORATORIES

Calibration File No.: 301420

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

Manufacturer: APREL Laboratories/IDX Robotics Inc
Model No.: E-009
Serial No.: 115

Customer: APREL
Asset No.:301420

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

Cal. Date: 9 November, 2000 Cal. Due Date: 8 November, 2001
Remarks: None

Calibrated By: _____

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
FAX: (613) 820-4161

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

51 Spectrum Way
Nepean, Ontario, K2R 1E6
e-mail: info@aprel.com

Tel. (613) 820-2730
Fax (613) 820 4161