























$$\left\{ e^{-jk[(h+\frac{L}{2})\cos(\theta)]} + e^{-jk[(h-\frac{L}{2})\cos(\theta)]} \right\} \quad (14)$$

$$S_{12} = -\frac{I_0 \cos(\frac{k_0 L}{2})}{2rk(\cos(\theta)+1)} e^{-jk[r-h\cos(\theta)]} e^{-jk[h\cos(\theta)]} \quad (15)$$

$$S_{13} = \frac{I_0}{2rk(-\cos(\theta)+1)} e^{-jk[r-h\cos(\theta)]} \quad (16)$$

$$\left\{ e^{-jk[(h+\frac{L}{2})\cos(\theta)]} + e^{-jk[(h-\frac{L}{2})\cos(\theta)]} \right\} \\ S_{14} = -\frac{I_0 \cos(\frac{k_0 L}{2})}{2rk(-\cos(\theta)+1)} e^{-jk[r-h\cos(\theta)]} e^{-jk[h\cos(\theta)]} \quad (17)$$

$$S_{21} = \frac{I_0}{2r_1 k(\cos(\theta_1)+1)} e^{-jk[r_1+h\cos(\theta_1)]}$$

$$\left\{ e^{jk[(h+\frac{L}{2})\cos(\theta_1)]} + e^{jk[(h-\frac{L}{2})\cos(\theta_1)]} \right\} \quad (18)$$

$$S_{22} = -\frac{I_0 \cos(\frac{k_0 L}{2})}{2r_1 k(\cos(\theta_1)+1)} e^{-jk[r_1+h\cos(\theta_1)]} e^{jk[h\cos(\theta_1)]} \quad (19)$$

$$S_{23} = \frac{I_0}{2r_1 k(-\cos(\theta_1)+1)} e^{-jk[r_1+h\cos(\theta_1)]}$$

$$\left\{ e^{jk[(h+\frac{L}{2})\cos(\theta_1)]} + e^{jk[(h-\frac{L}{2})\cos(\theta_1)]} \right\} \quad (20)$$

$$S_{24} = -\frac{I_0 \cos(\frac{k_0 L}{2})}{2r_1 k(-\cos(\theta_1)+1)} e^{-jk[r_1+h\cos(\theta_1)]} e^{jk[h\cos(\theta_1)]} \quad (21)$$

## APPENDIX B

Whole body averaged SAR for cylindrical body model:

$$SAR_{WB} = \frac{1}{V} \int_V SAR dV \quad (1)$$

where

$$SAR_{WB} = \frac{\sigma k^2}{4\rho L a^4 \pi^3 (\sigma^2 + \omega^2 \varepsilon^2)} \frac{1}{|J_1(j^{-1/2} k \zeta)|^2} \int_0^a |J_0(j^{-1/2} k \zeta)|^2 d\zeta \int_0^L |I_z(z)|^2 dz \quad (2)$$

$$\frac{\sigma k^2}{4\rho L a^4 \pi^3 (\sigma^2 + \omega^2 \varepsilon^2)} \frac{1}{|J_1(j^{-1/2} k a)|^2} = C \quad (3)$$

$$\int_0^a |J_0(j^{-1/2} k \zeta)|^2 d\zeta = I_1 \quad (4)$$

$$\int_0^L |I_z(z)|^2 dz = I_2 \quad (5)$$

$$SAR_{WB} = C I_1 I_2 \quad (6)$$

Since current distribution in cylindrical human body model depends of Bessel function, axial current should have a form similar to (7), where:

$$I(z) = C_1 \cos \gamma z + C_2 \sin \gamma z \quad (7)$$

$$\gamma^2 = k^2 \left( 1 - \frac{j4\pi Z_c(\zeta)}{k Z_c \Psi_{dR}} \right) \quad (8)$$

where  $k$  is the free space wave number,  $Z_c = 120\pi$  is the free space impedance and  $Z_c(\zeta)$  is the HF region, the impedance per unit length is given by

$$k = \omega \sqrt{\mu_0 \varepsilon_0} \quad (9)$$

$$Z_c(\zeta) = \frac{k}{2\pi\sigma} \frac{J_0(j^{-1/2} k \zeta)}{J_1(j^{-1/2} k a)} \quad (10)$$

$$\Psi_{dR} = c \sin \gamma (h - |z|) \int_{-h}^h \sin \gamma (h - |z'|) \left[ \frac{\cos kR}{R} - \frac{\cos kR_h}{Rh} \right] dz' \quad (11)$$



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