APPENDIX 4-1
Power Emitted from Targets with Constant Radiometric Quantities

1. Equation 4-13: If M is constant:

$$\Phi = \int d\Phi = \int d\Phi \frac{dA_{SEND}}{dA_{SEND}} = \int\limits_{SURFACE} \frac{d\Phi}{dA_{SEND}} dA_{SEND} = \int\limits_{SURFACE} M\, dA_{SEND}$$

$$= M \int\limits_{SURFACE} dA_{SEND} = M\, A_{SEND}$$

2. Equation 4-14: If I is constant:

$$\Phi = \int d\Phi = \int d\Phi \frac{d\Omega_{SEND}}{d\Omega_{SEND}} = \int\limits_{SPHERE} \frac{d\Phi}{d\Omega_{SEND}} d\Omega_{SEND} = \int\limits_{SPHERE} I\, d\Omega_{SEND}$$

$$= I \int\limits_{SPHERE} d\Omega_{SEND} = 4\pi I$$

3. Equation 4-15: If L is constant:

$$\Phi = \int d\Phi = \int d\Phi \frac{dA_{SEND} \cos\theta\, d\Omega}{dA_{SEND} \cos\theta\, d\Omega} = \iint\limits_{\substack{SURFACE \\ HEMISPHERE}} \frac{d\Phi}{dA_{SEND} \cos\theta\, d\Omega} dA_{SEND} \cos\theta\, d\Omega$$

$$= \iint\limits_{\substack{SURFACE \\ HEMISPHERE}} L\, dA_{SEND} \cos\theta\, d\Omega = L \iint\limits_{\substack{SURFACE \\ HEMISPHERE}} dA_{SEND} \cos\theta\, d\Omega$$

$$= L \int\limits_{SURFACE} dA_{SEND} \int\limits_{HEMISPHERE} \cos\theta\, d\Omega = L\, A_{SEND} \int\limits_{HEMISPHERE} \cos\theta \sin\theta\, d\theta\, d\varphi$$

$$= L\, A_{SEND} \int_0^{\pi/2} \cos\theta \sin\theta\, d\theta \int_0^{2\pi} d\varphi = L\, A_{SEND} \left[\frac{-\cos^2\theta}{2} \right]_0^{\pi/2} \left[\varphi \right]_0^{2\pi}$$

$$= L\, A_{SEND} \left[\frac{-\cos^2 \pi/2}{2} - \frac{-\cos^2 0}{2} \right] \left[2\pi - 0 \right] = L\, A_{SEND} \left[\frac{1}{2} \right] \left[2\pi \right] = L\, A_{SEND}\, \pi = \pi\, L\, A_{SEND}$$

(Notice the final answer has a factor of π rather than a factor of 2π as might be expected.)