BER of a multiple antenna wireless system with L antennas,

$$BER = \left(\frac{1-\lambda}{2}\right)^{L} \sum_{l=0}^{L-1} {}^{L+l-1}C_{l} \left(\frac{1+\lambda}{2}\right)^{l}$$

$$\lambda = \sqrt{\frac{SNR}{2+SNR}}$$

Develop an approximation for BER in a multiple antenna wireless system

$$\frac{1-\lambda}{2} = \frac{1}{2}(1-\lambda)$$

$$= \frac{1}{2}\left(1 - \sqrt{\frac{SNR}{2+SNR}}\right)$$

$$= \frac{1}{2}\left(1 - \sqrt{\frac{1}{1+\frac{2}{SNR}}}\right)$$

$$= \frac{1}{2}\left(1 - \left(1+\frac{2}{SNR}\right)^{-\frac{1}{2}}\right)$$

if $x \approx 0$

$(1+x)^{-\frac{1}{2}} \approx 1 - \frac{1}{2}x$

$$\approx \frac{1}{2}\left(1 - \left(1 - \frac{1}{2}\cdot\frac{2}{SNR}\right)\right)$$

$$= \frac{1}{2}\cdot\frac{1}{SNR} = \frac{1}{2\cdot SNR}$$

$$\frac{1+\lambda}{2} = \frac{1}{2}\left(1+\sqrt{\frac{SNR}{2+SNR}}\right)$$

$$= \frac{1}{2}\left(1+\sqrt{\frac{1}{1+\frac{2}{SNR}}}\right)$$

$$= \frac{1}{2}\left(1+\left(1+\frac{2}{SNR}\right)^{-1/2}\right)$$

$$\approx \frac{1}{2}\left(1+\left(1-\frac{1}{2}\cdot\frac{2}{SNR}\right)\right)$$

$$= \frac{1}{2}\left(2 - \frac{1}{SNR}\right)$$

$\frac{1}{SNR} \approx 0$ at high SNR

$$\approx \frac{1}{2} \times 2 = 1$$

Therefore, at high SNR

$$\frac{1-\lambda}{2} \approx \frac{1}{2 \cdot SNR}$$

$$\frac{1+\lambda}{2} \approx 1$$

$$BER = \left(\frac{1-\lambda}{2}\right)^L \sum_{l=0}^{L-1} {}^{L+l-1}C_l \left(\frac{1+\lambda}{2}\right)^l$$

at high SNR

$$\approx \left(\frac{1}{2 \cdot SNR}\right)^L \sum_{l=0}^{L-1} {}^{L+l-1}C_l \cdot 1$$

$$\approx \left(\frac{1}{2\,SNR}\right)^L \sum_{l=0}^{L-1} {}^{L+l-1}C_l$$

$$= {}^{2L-1}C_L \cdot \left(\frac{1}{2 \cdot SNR}\right)^L$$

At high SNR, BER of wireless communication system with L antennas,

$$\text{Approx BER} = {}^{2L-1}C_{L} \cdot \left(\frac{1}{2\,SNR}\right)^{L}$$

For $L = 2$

Approx BER

$$= {}^{2L-1}C_{L} \cdot \left(\frac{1}{2\,SNR}\right)^{L}$$

$$= {}^{3}C_{2} \cdot \left(\frac{1}{2\,SNR}\right)^{2}$$

$$= 3 \cdot \frac{1}{4} \cdot \frac{1}{SNR^2} = \frac{3}{4} \cdot \frac{1}{SNR^2}$$

Approx BER for $L = 2$