$T = H_{LOS}H_{LOS}^H$, and $\text{tr}_j(T)$ is the $j^{th}$ elementary symmetric function of $T$ (see [29] and [30]). Special case number 2 (Corollary 2) in [29] is the case of a Ricean channel with rank 1 $H_{LOS}$

$$R(H) = E[I_H] \leq \log_2 \left[ 1 + \sum_{p=1}^{K} \sum_{j=0}^{p} \left( \frac{\rho b^2}{N_T} (K_p KL)^j \times (L - p + 1)(p-j) \right) \right]$$

(5)

2) One Dimensional Multihop Relaying System: Consider the one dimensional linear MH system shown in Fig. 1, in which a base station (BS) wishes to transmit data to the mobile station (MS) at the cell edge via a number of relay stations (RSs). The cell radius, $r$, is divided into $n_{\text{hops}}$ hops, whose distances are $r_{k_{n_{\text{hops}}}}$, $k = 1, 2, ..., n_{\text{hops}}$. To simplify calculations for the one dimensional case only, we often use equally spaced relays so that $r_{k_{n_{\text{hops}}}} = r/n_{\text{hops}}$, $k = 1, 2, ..., n_{\text{hops}}$. In a MH MIMO system, Fig. 2, there are $n_{\text{hops}}$ channel matrices, $H_{k_{n_{\text{hops}}}}$, $k = 1, 2, ..., n_{\text{hops}}$. Hop $k$ has $N_{T, k}$ transmit antennas and $N_{R, k}$ receive antennas.

For each hop, $k$, we have the channel matrix

$$H_{k_{n_{\text{hops}}}} = \gamma_{k_{n_{\text{hops}}}} \cdot \left[ \sqrt{\frac{K_{r, k_{n_{\text{hops}}}}}{1 + K_{r, k_{n_{\text{hops}}}}}} H_{LOS, k}^{n_{\text{hops}}} + \sqrt{\frac{1}{1 + K_{r, k_{n_{\text{hops}}}}}} H_{NLOS, k}^{n_{\text{hops}}} \right]$$

(6)

where $\gamma_{k_{n_{\text{hops}}}} = \gamma(r_{k_{n_{\text{hops}}}})$ and $K_{r, k_{n_{\text{hops}}}} = K_{r}(r_{k_{n_{\text{hops}}}})$ are area-averaged path gain and Rice factor for the $k^{th}$ hop, respectively. The path loss model used is based on the Okumura-Hata and Walfish-Ikegami models for urban macrocell and microcell environments, as these are widely adopted by COST231, 3GPP [22], 802.16 [31] and other standards bodies. Since a benefit of MH relaying is the ability to relay around obstacles, we use a dual slope model,