Supplementary Appendix S3

1 MONOTONIC INCREASE OF SINR AS FUNCTION OF CONDUCTED POWER GAIN

Let us rewrite Eq. (S3) of Supplementary Appendix S1 as below

$$\mathrm{SINR}_k = \frac{G_{RF} S_{k0}}{G_{RF} I_{k0} + N_k}, \tag{S1}$$

where $S_{k0} = |\mathbf{H}_{k:}\mathbf{W}_{:k}|^2 > 0$, $I_{k0} = \sum_{k' \neq k}^{K} |\mathbf{H}_{k:}\mathbf{W}_{:k'}|^2 \geq 0$ and $N_k > 0$. Because G_{RF} and $\mathbf{W}$ are independent, G_{RF} is also independent of S_{k0} and I_{k0}. The derivative of SINR_k of G_{RF} is

$$\frac{\mathrm{dSINR}_k}{\mathrm{d}G_{RF}} = \frac{S_{k0} N_k}{(G_{RF} I_{k0} + N_k)^2}, \tag{S2}$$

which is always greater than zero. Therefore SINR_k is an increasing function of G_{RF}. It is worth noting that in the case when $G_{RF} I_{k0} \gg N_k$ then SINR_k S1 becomes independent of G_{RF}. This may happen in the ideal noise-free conditions, but also in more practical conditions when either $G_{RF} \gg N_k / I_{k0}$ or $I_{k0} \gg N_k / G_{RF}$.