# Supplementary Appendix S2

## 1 DERIVATION OF THE CONDUCTED TRANSMIT POWER

The power of linearly precoded transmit signal $p_m$ is

$$\begin{aligned} \mathrm{E}\left\{|p_m|^2\right\} &= \mathrm{E}\left\{|\mathbf{W}_{m:}\mathbf{x}|^2\right\} \\ &= \mathrm{E}\left\{\mathbf{W}_{m:}\mathbf{x}\mathbf{x}^\dagger\mathbf{W}_{m:}^\dagger\right\} \\ &= \mathbf{W}_{m:}\mathrm{E}\left\{\mathbf{x}\mathbf{x}^\dagger\right\}\mathbf{W}_{m:}^\dagger \\ &= \mathbf{W}_{m:}\mathbf{I}_K\mathbf{W}_{m:}^\dagger \\ &= \|\mathbf{W}_{m:}\|^2 . \end{aligned} \tag{S1}$$

$\mathrm{E}\left\{|s_m|^2\right\}$ can be written as (see Fig. 1 in the paper)

$$\mathrm{E}\left\{|s_m|^2\right\} = G_{RF}\mathrm{E}\left\{|p_m|^2\right\} = G_{RF}\|\mathbf{W}_{m:}\|^2 . \tag{S2}$$

The sum of all the power of linearly precoded transmit signals can be computed as

$$\begin{aligned} \sum_{m=1}^{M}\mathrm{E}\left\{|p_m|^2\right\} &= \sum_{m=1}^{M}\|\mathbf{W}_{m:}\|^2 \\ &= \|\mathbf{W}\|_F \\ &= 1, \end{aligned} \tag{S3}$$

which is due to the normalization of the precoding matrix $\mathbf{W}$. Therefore it can be shown that the total conducted transmit power is

$$\sum_{m=1}^{M}\mathrm{E}\left\{|s_m|^2\right\} = G_{RF}. \tag{S4}$$