

3GPP TSG-RAN WG1#80

R1-150557

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SOURCE: ERICSSON

TITLE: CHANNEL RECIPROcity
MODELLING FOR FDD

AGENDA ITEM: 7.2.4.1

DOCUMENT FOR: DISCUSSION AND
DECISION

BACKGROUND

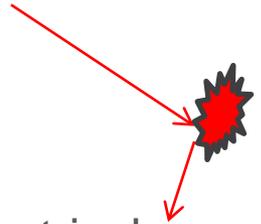


- › For evaluations utilizing channel reciprocity, particularly for FDD, there is a need to align the modeling assumptions among companies
 - The purpose of this contribution is to propose such model for agreement
 - The model is to be used for 2DAA evaluations
 - › An agreed model can be captured in TR 36.897

MODEL MOTIVATION



- › The channel differences in Uplink vs. Downlink are due to several factors:
 - A phase shift due to the length of the traveled path d_r of the ray: $e^{\frac{j2\pi d_r}{\lambda}}$
 - A frequency dependent Reflection / Diffraction / Scattering of the radio wave
 - › Each polarization experiences a phase shift and magnitude scaling
 - › Depends on the scattering properties of the reflector
- › These factors are not explicitly modeled in TR 36.873 by using geometrical channel models (instead random values are drawn in the depolarization matrix model of \mathbf{M} shown below).
 - independent realizations of random variables in the depolarization matrix \mathbf{M} can be drawn for the different carrier frequencies



$$\mathbf{M} = \begin{bmatrix} \exp(j\Phi_{n,m}^{\theta\theta}) & \sqrt{\kappa_{n,m}^{-1}} \exp(j\Phi_{n,m}^{\theta\phi}) \\ \sqrt{\kappa_{n,m}^{-1}} \exp(j\Phi_{n,m}^{\phi\theta}) & \exp(j\Phi_{n,m}^{\phi\phi}) \end{bmatrix}$$

MODEL PROPOSAL



Model assumptions:

- The duplex distance $f_{DL} - f_{UL}$ is larger than the channel coherence bandwidth
- The cluster (sub)-ray arrival and departure directions $\theta_{ZOA}, \theta_{ZOD}, \phi_{AOA}, \phi_{AOD}$ are equal in UL & DL.
- The delays and relative powers of the clusters are assumed to be equal in UL & DL.
- The XPRs κ are assumed to be equal in UL & DL.
- New path loss factors are calculated for UL channel.
- Phase changes between antenna elements and Doppler shift are different in UL & DL and thus modified according to carrier frequency wavelength λ
- Independent random initial phases $\Phi^{\theta\theta}, \Phi^{\theta\phi}, \Phi^{\phi\theta}, \Phi^{\phi\phi}$ are drawn for UL & DL channel.

$$H_{u,s,n}(t) = \sqrt{P_n/M} \sum_{m=1}^M \begin{bmatrix} F_{rx,u,\theta}(\theta_{n,m,ZOA}, \phi_{n,m,AOA}) \\ F_{rx,u,\phi}(\theta_{n,m,ZOA}, \phi_{n,m,AOA}) \end{bmatrix}^T \underbrace{\begin{bmatrix} \exp(j\Phi_{n,m}^{\theta\theta}) & \sqrt{\kappa_{n,m}^{-1}} \exp(j\Phi_{n,m}^{\theta\phi}) \\ \sqrt{\kappa_{n,m}^{-1}} \exp(j\Phi_{n,m}^{\phi\theta}) & \exp(j\Phi_{n,m}^{\phi\phi}) \end{bmatrix}}_{\triangleq \mathbf{M}} \begin{bmatrix} F_{tx,s,\theta}(\theta_{n,m,ZOD}, \phi_{n,m,AOD}) \\ F_{tx,s,\phi}(\theta_{n,m,ZOD}, \phi_{n,m,AOD}) \end{bmatrix} \exp(j2\pi\lambda_0^{-1}(\hat{r}_{rx,n,m}^T \bar{d}_{rx,u})) \exp(j2\pi\lambda_0^{-1}(\hat{r}_{tx,n,m}^T \bar{d}_{tx,s})) \exp(j2\pi\nu_{n,m}t)$$

CONCLUSION



- › **Proposal:** Agree on the modeling on slide 4 and capture this in TR 36.897.



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