Influence of the Environment on the Cross-sector Compatibility in Wireless Access System

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Abstract— This paper is devoted the evaluation of power permeation to MS from BS that is in neighbouring sector. The basis for the analysis is the power azimuth spectrum (PAS) that describes the angle distribution of the signal power at the input of receiver. The results of the numerous measurements show that with the increase of the environment urbanization degree, the angular dispersion of the received signal is increased. From among the many models, the von Mises model is used as PAS. Influence of the environment differentiation on PAS is taken into account by the adaptive selection of van Mises parameter. Obtained results provide the opportunity to evaluate of the multipath environment influence on the cross-sector compatibility in wireless system.

1. INTRODUCTION

Multipath of the wave propagation is the phenomenon that plays a dominant role in formation of internal disturbances in radio systems. This phenomenon significantly limits the possibilities of signal transmission in wireless systems. To increase the capacity of access system, the spatial sectorisation of areas that are supported by the access base station (BS), is used.The multipath phenomenon that occurs in urban area, is the cause of the signal power permeation to neighbouring sectors. It is reason the occurrence of additional disturbances in access neighbouring sectors. This phenomenon is especially important in the case of mobile object (mobile station MS) location near the border of neighbouring sectors. In wireless access systems, the effect of the phenomenon is important for the implementation handover procedure.

This paper is devoted the evaluation of power permeation to MS from BS that is in neighbouring sector. The basis for the analysis is power azimuth spectrum (PAS) that describes the angle distribution of signal power at the input of the receiver. For different types of environments, these characteristics are differentiated. The results of the numerous measurements show that with the increase of the environment urbanization degree, the angular dispersion of the received signal is increased. From among the many models, the von Mises function is used as PAS model. Influence of the environment differentiation on PAS is taken into account by the adaptive selection of van Mises parameter. The model validation is made on the basis of the results that are obtained for five measurement scenarios taken from open literature. As criterion of model validation, the least square error (LSE) minimization is used. The characteristic that shows the functional relationship of permeation power and location angle of MS with respect to BS of neighbouring sector is the analysis result presented in the paper. The obtained characteristic is the basis for the evaluation of the disturbance power level that originates from the neighbouring sectors of the wireless access system.

2. EVALUATION OF ENVIRONMENT ON POWER SCATTERING

In our paper, we analysis influence of multipath propagation on power scattering of received signal. In cellular systems, the sector antennas are used. In Fig. 1, the power patter of sector antenna is presented.

Presented pattern is a base for numerical calculation of the interference power at receiver that is located in neighbouring sector. For scattering power, von Mises model is used. In [1, 2], the description of this model is included. In our analysis, we evaluate level of the interference power for five different propagation scenarios. The differentiation degree of environments is described by different values of rms angle spread. In Figs. 2–6, the graphs of interference power for different propagation environment are presented. Details of measurement scenarios are described in [3–6].

From graphs result that with increasing scattering propagation environments increasing the level of interference power coming from the neighboring sectors. For each propagation scenarios, the results of numerical calculations are presented in Table 1. The article connected with the topic of this article are [7–21].

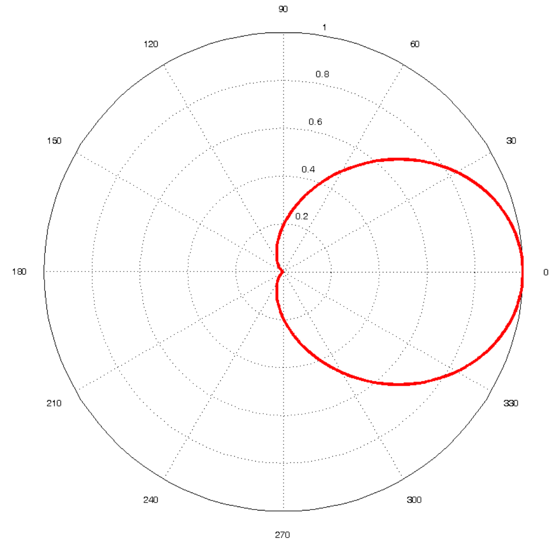

Figure 1: Power pattern of sector antenna.

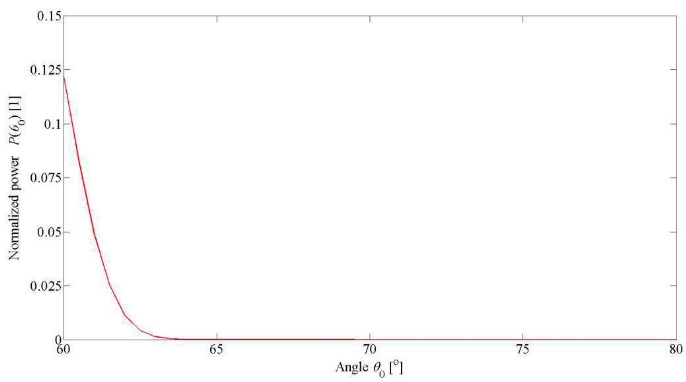

Figure 2: Interference power for Scenario 1 (RA-Bristol [3]).

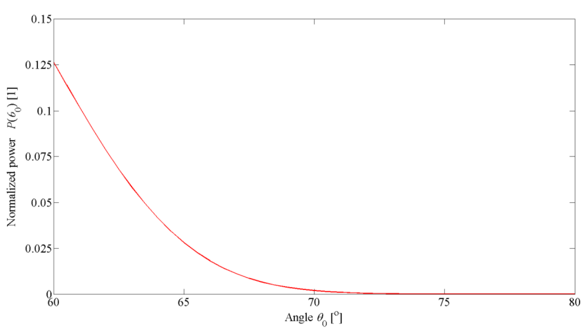

Figure 3: Interference power for Scenario 2 (TU-Aarhus [4]).

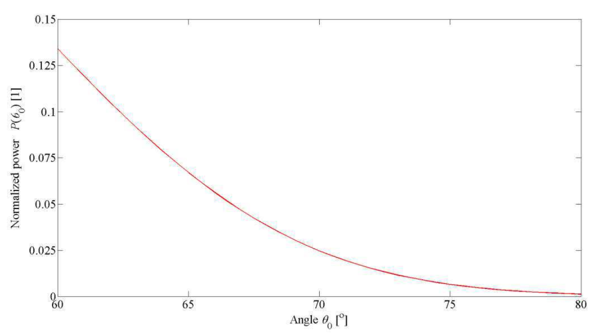

Figure 4: Interference power for Scenario 3 (TU-Stockholm [4]).

Table 1: Normalized interference power for varied propagation scenarios.

	Sc1	Sc2	Sc3	Sc4	Sc5
κ [1]	2398.4	192.5	56.0	106.1	90.9
P_Σ [°]	0.2971	0.8904	1.6718	1.1982	1.2969

where: κ — optimum value of von Mises model parameter,
P_Σ — normalized interference power.

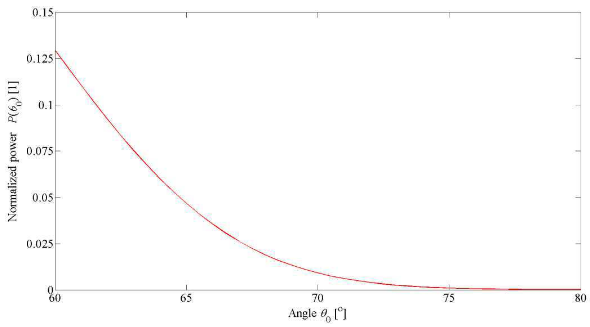

Figure 5: Interference power for Scenario 4 (TU-Aalborg [5]).

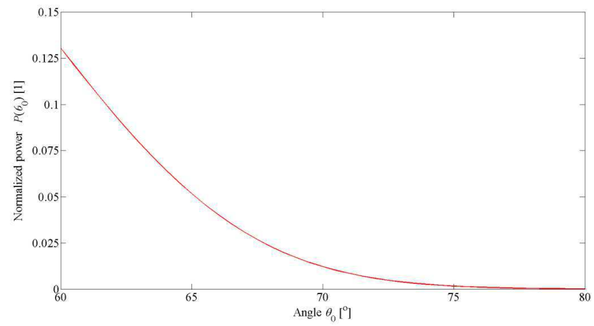

Figure 6: Interference power for Scenario 4 (TU-Aalborg [6]).

3. CONCLUSIONS

In this paper, the evaluation of the interference power from multipath propagation is presented. Obtained results show that with increasing scattering propagation environments increasing the level of interference power coming from the neighboring sectors. As PAS model the von Mises model is used. Obtained results provide the opportunity to evaluate of the multipath environment influence on the cross-sector compatibility in wireless system.

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