Project	**IEEE 802.16 Broadband Wireless Access Working Group**
Title	**CS to CS Boundary pfd Simulations at 3.5 GHz**
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Re:	Coexistence pfd Simulation Estimates in Support of 802.16a System Design
Abstract	This document examines CS to pfd requirements at 3.5 GHz. It identifies the distance limits for which coordination may be required between system operators. The conclusions are specific to the system model selected. Other system model parameters may modify the distance coordination requirements.
Purpose	This document is provided for consideration and inclusion in the amended Coexistence Practice Document for PMP systems operating below 11 GHz (P802.16.2a).
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Release	
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CS to CS Boundary pfd Simulations at 3.5 GHz

1.0 Introduction

In operational scenarios where one, or both operators, deploy as a TDD mode of transmission, a CS to CS interference coupling mechanism is created. In such cases, both operators can be viewed as either the interference source or as the victim. This contribution examines these interference couplings

As in [1], the victim inbound link is assumed to be 16-QAM and the outbound interference link is assumed to be 64-QAM. Assumed simulation transmission parameters remain as in [1] and the critical pfd level for I/N = -6 dB remains at -125 dBW/m^2/MHz.

2.0 Simulation Model and Methodology

Figure 1 illustrates the system model. The alignment of interference and victim sectors is again assumed to be uncoordinated, hence to develop a simulation estimate, both sectors are independently spun in 5 degree increments.

As both interference and victim antennas are now wide beam width - 90 degree sectored, we would expect a much greater probability for worst case couplings. This assumption is confirmed in the following.

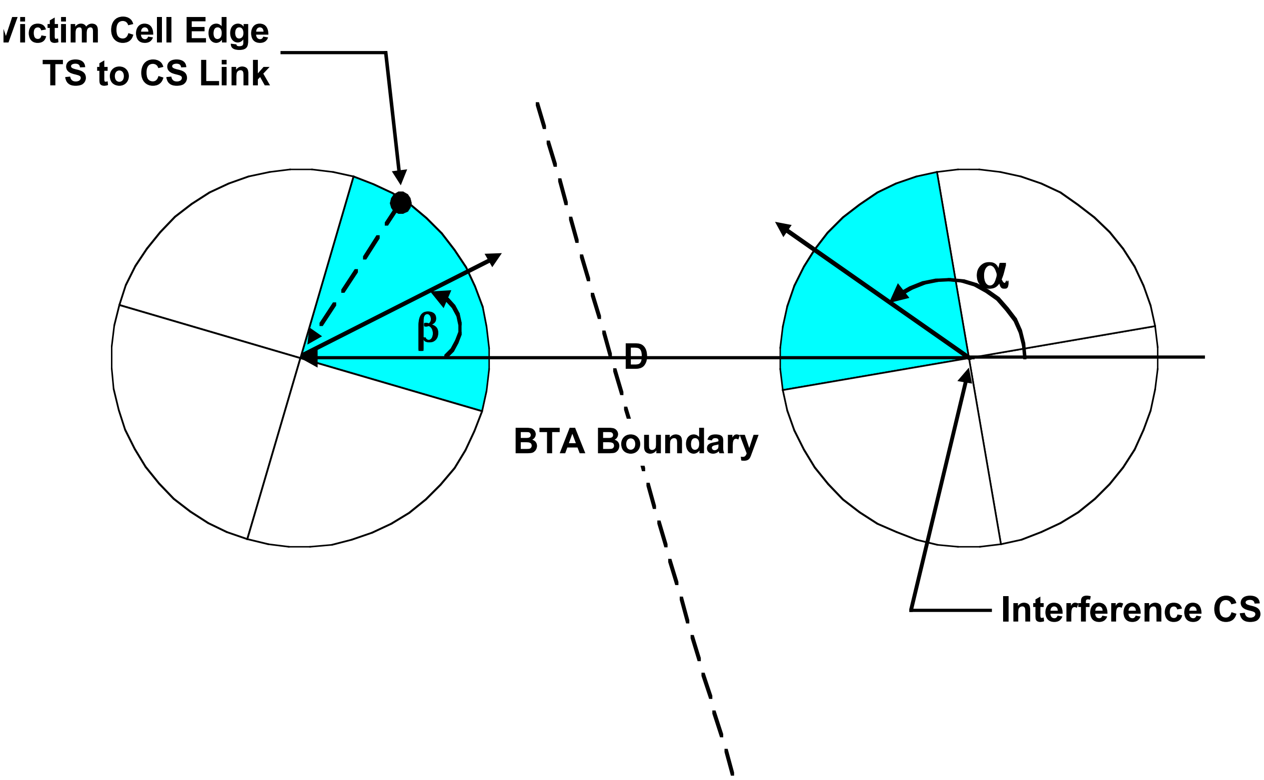

Figure 1. Simulation Model

3.0 Simulation Results

Figure 2 illustrates the case when all interference vectors are assumed to be LOS. As anticipated, the simulation results illustrate that the probability of interference couplings would be unmanageable unless operator coordination is employed and mitigation techniques are applied. However, this is an extreme case and somewhat unlikely, as it does not account for excess path loss or diffraction loss at the horizon.

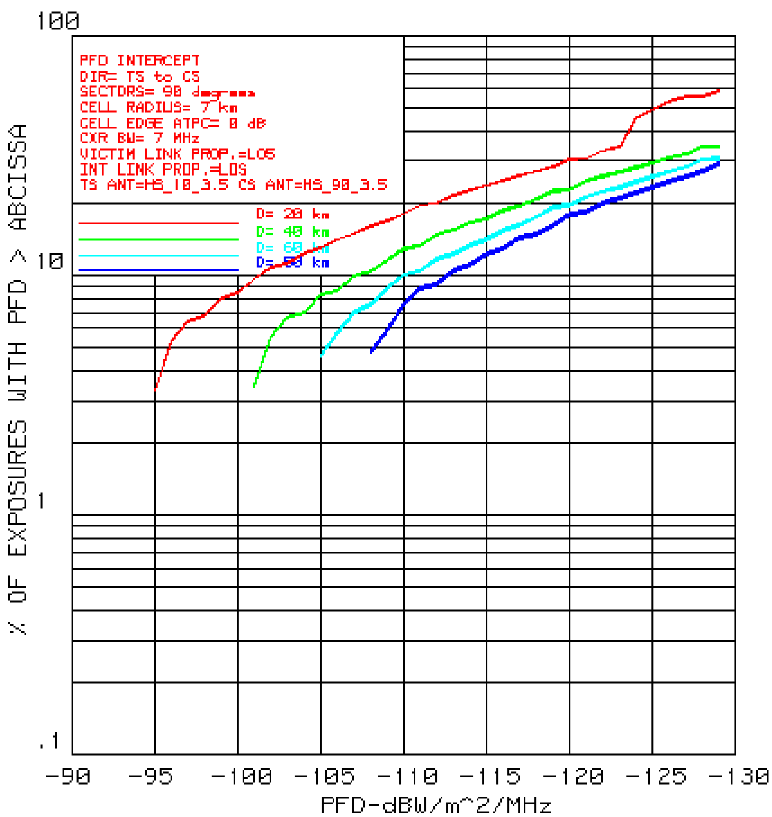

Figure 2 CDF Simulation Estimates for LOS Interference Vectors

Figure 3 illustrates the simulation results when all interference vectors are LOS up to 7 km but experience a path loss exponent of 4 beyond 7 km. Under these conditions, exposures at the critical pfd level are reduced to less than 6% for Di = 60 km and are of no significance for Di = 80 km.

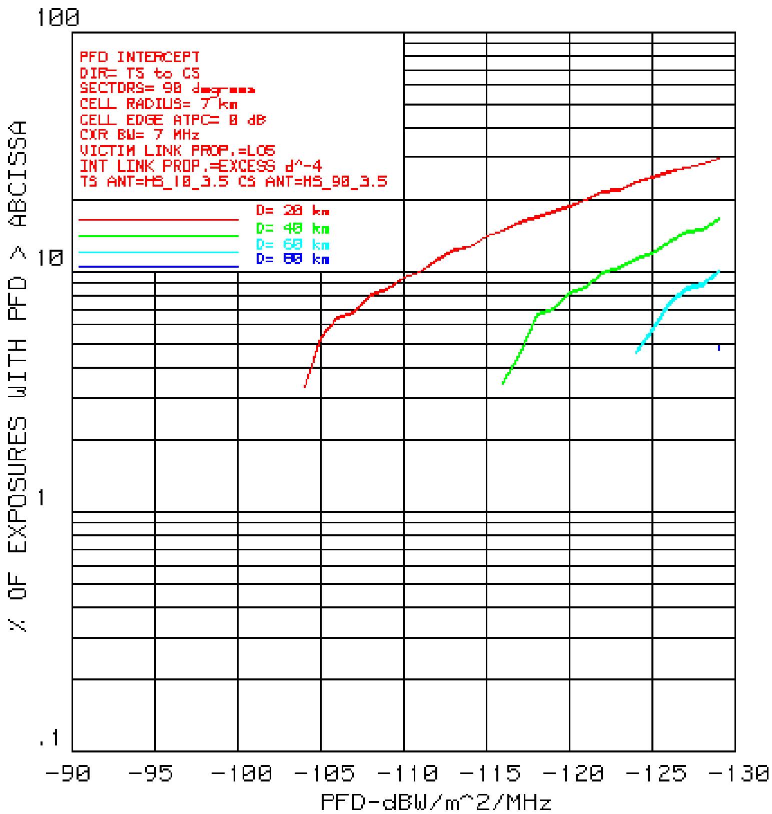

Figure 3. CDF Simulation Estimates for Interference Vectors with Excess Path Loss

Figures 4 - 6 examine the couplings from a different perspective, these being the inclusion of expected diffraction loss beyond the horizon. For these examples, LOS interference vectors are assumed, however the diffraction loss from a smooth spherical earth [2] is added to the LOS interference loss. The expected diffraction loss is a function of the CS to CS separation distance D and the relative elevations of the two CS antennas. These represent an endless number of combinations. Hence, Figures 4 to 6 examine a very reduced subset of combinations. For the interference distances previously examined, we consider only CS elevations of 30/30, 60/60 and 90/90 m. Table 1 summarizes the diffraction loss to be expected from these combinations.

CS Antenna Relative Elevations (m)	**CS Separation Distance D (km)**			
	20	**40**	**60**	**80**
30/30	**0**	**8**	**35**	**61**
60/60	**0**	**0**	**8**	**35**
90/90	**0**	**0**	**0**	**15**

Table 1. Expected Smooth Spherical Earth Diffraction Loss as a Function of CS Separation Distance D and Relative CS Antenna Elevation

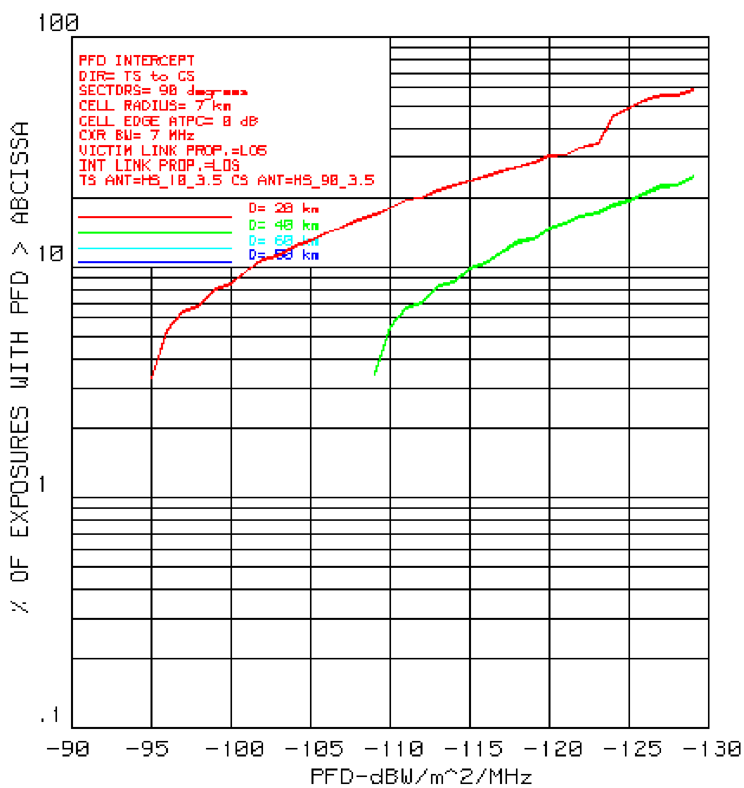

Figure 4. CDF Simulation Estimates for LOS Interference Vectors and CS Antennas at 30 m

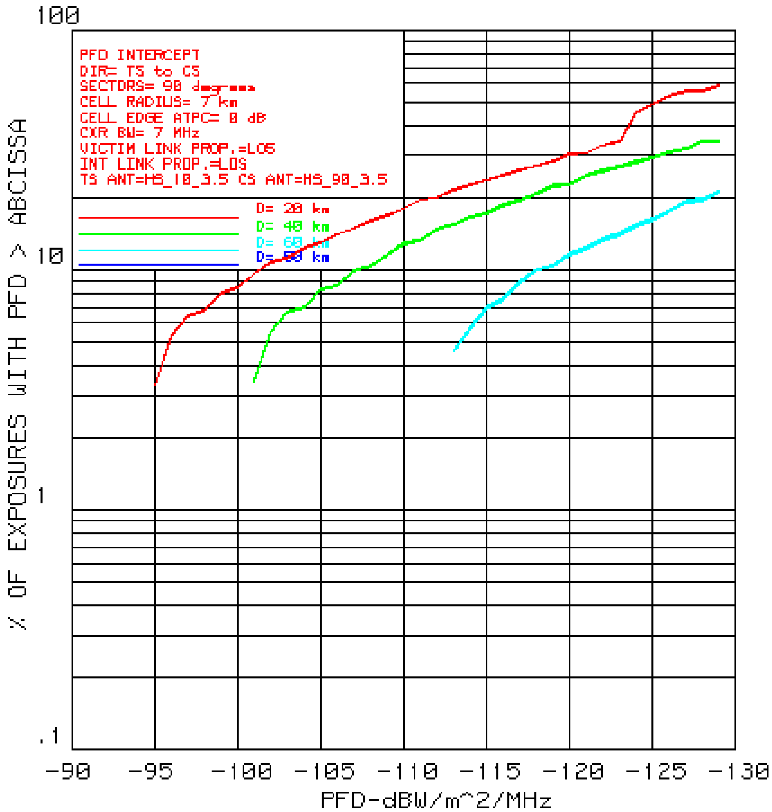

Figure 5. CDF Simulation Estimates for LOS Interference Vectors and CS Antennas at 60 m

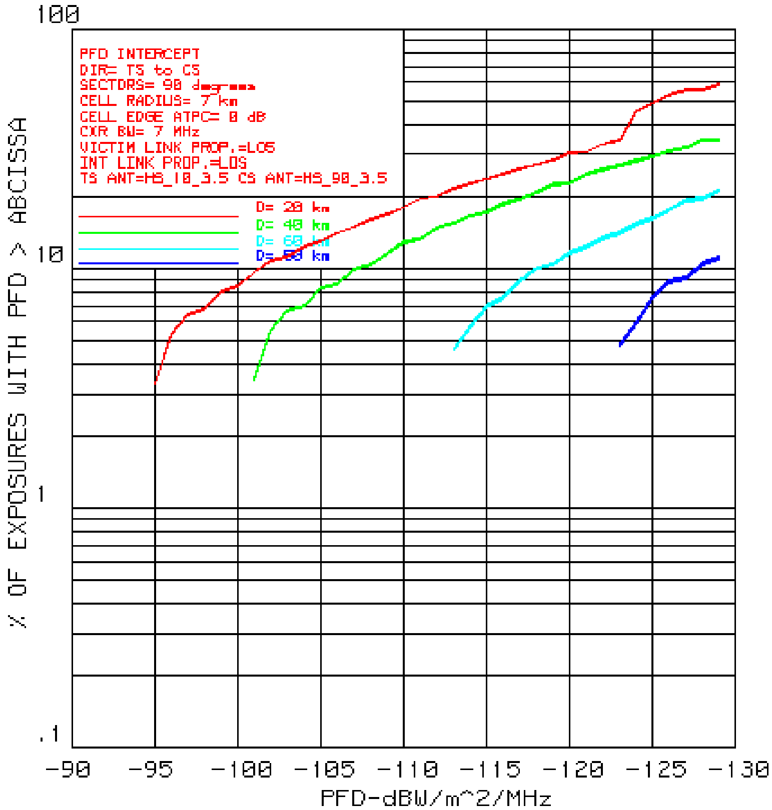

Figure 6. CDF Simulation Estimates for LOS Interference Vectors and CS Antennas at 90 m

Unless we can realistically assume that most interference vectors experience excess path loss, the simulations associated with Figures 4 - 6 indicate that the coordination distance is very much influenced by the amount of diffraction loss associated with distance separation D and relative CS antenna elevations. Referenced to what are probably "quite high" CS antenna elevations, it would appear that we are not on safe ground unless a coordination distance of D = 80 km is assumed.

4.0 References

[1] Outbound Boundary pfd Simulations at 3.5 GHz

[2] Propagation by Diffraction, CCIR, Report 715 -2