

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	CS to CS and CS to TS Boundary pfd Estimates at 10.5 GHz	
Date Submitted	2002-06-03	
Source(s)	G. Jack Garrison Harris Corp 3 Hotel de Ville Dollard-des-Ormeaux, Quebec H9B3G4	Voice: (604) 524-6980 Fax: (604) 524-6980
Re:	Coexistence pfd Simulation Estimates in Support of TGa System Design	
Abstract	This document examines CS to CS and CS to TS pfd levels at 10.5 GHz. It identifies the distance limits for which coordination may be required between system operators.	
Purpose	This document is provided to TG2a for consideration and inclusion in the amended Coexistence Practice Document for PMP systems operating below 11 GHz.	
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.	
Patent Policy and Procedures	<p>The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures (Version 1.0) <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, if there is technical justification in the opinion of the standards-developing committee and provided the IEEE receives assurance from the patent holder that it will license applicants under reasonable terms and conditions for the purpose of implementing the standard."</p> <p>Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:r.b.marks@ieee.org> as early as possible, in written or electronic form, of any patents (granted or under application) that may cover technology that is under consideration by or has been approved by IEEE 802.16. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.</p>	

CS to CS and CS to TS Boundary pfd Estimates at 10.5 GHz

1.0 Introduction

In a companion paper [1], pfd boundary simulation estimates were developed for the inbound TS to CS case. This document summarizes results for the two other major interference mechanisms, these being CS to CS and CS to TS couplings.

2.0 Limiting pfd Considerations

Using "representative" system and equipment parameters detailed in [1], prior link budget estimates have indicated that 10.5 GHz links should be able to support 16-QAM outbound and 4-QAM inbound. These link budgets apply for LOS transmission and a 7 km path link. Hence, for the CS to CS interference link, the victim link is a 4-QAM inbound link. Comparably, for a CS to TS interference link, the victim link is an outbound 16-QAM link.

Limiting pfd levels that correspond to an $I/N = -6$ dB are given in Table 1. The limiting pfd levels differ for the two cases. This is a result of the different threshold requirements and the different receive antenna gains specific to the link models.

Interference Link	CS to CS	CS to TS
Victim Link	TS to CS	CS to TS
Victim Link Modulation	4-QAM	16-QAM
$(C/N)_{\text{threshold}}$	12 dB	18 dB
pfd_sig_threshold	-99.1 dBW/m ² /MHz	-102.1 dBW/m ² /MHz
$(C/I)_{1 \text{ dB threshold impairment}} (I/N = -6 \text{ dB})$	18 dB	24 dB
pfd_int_1 dB (I/N = -6 dB)	-117.1 dBW/m ² /MHz	-126.1 dBW/m ² /MHz

Table 1 C/N, C/I and pfd Relationships

3.0 Simulation Methodology, Results and Discussion

3.1 CS to CS

Figure 1 illustrates the simulation system model. The figure illustrates an uncoordinated alignment of interference and victim co-channel sectors, but one for which both sectors illuminate each other within their primary sector beam width. An inbound victim link is also illustrated. It is placed at cell edge. Distance proportional ATPC would place all victim links at the same received signal level. Thus, it is necessary to consider one such link with reference to critical pfd levels.

The interference separation distance D_1 is simply D , the distance between the two CS locations. For any one interference estimate, angles β and θ set the antenna RPE discrimination of the sectors.

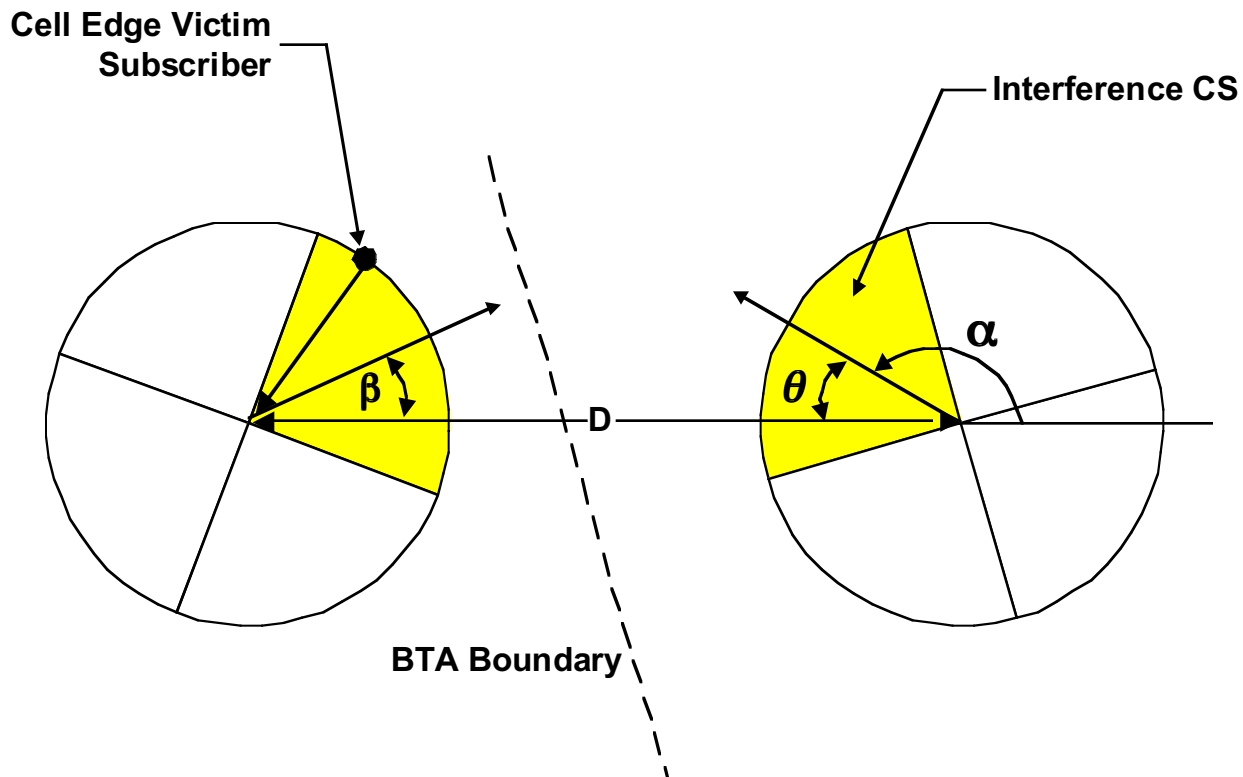


Figure 1 CS to CS Simulation Model

Figures 2 and 3 illustrate the simulation results. Figure 2 illustrates the case all interference links are assumed to be LOS. Figure 3 examines the case where the interference path loss exponent is set to 2 (LOS) up to 7 km and is set to 4 beyond this distance.

For the LOS case of Figure 2, it is evident that there is a high probability of pfd exposures (approximately 20%) that exceed the objective of $-117 \text{ dBW/m}^2/\text{MHz}$. If excess loss interference vectors can be assumed as per Figure 3, then a coordination distance of 40 km would appear adequate. However, there is no guarantee that this latter case will apply. Thus, one must assume that a horizon distance of 80 km should be set for operator coordination.

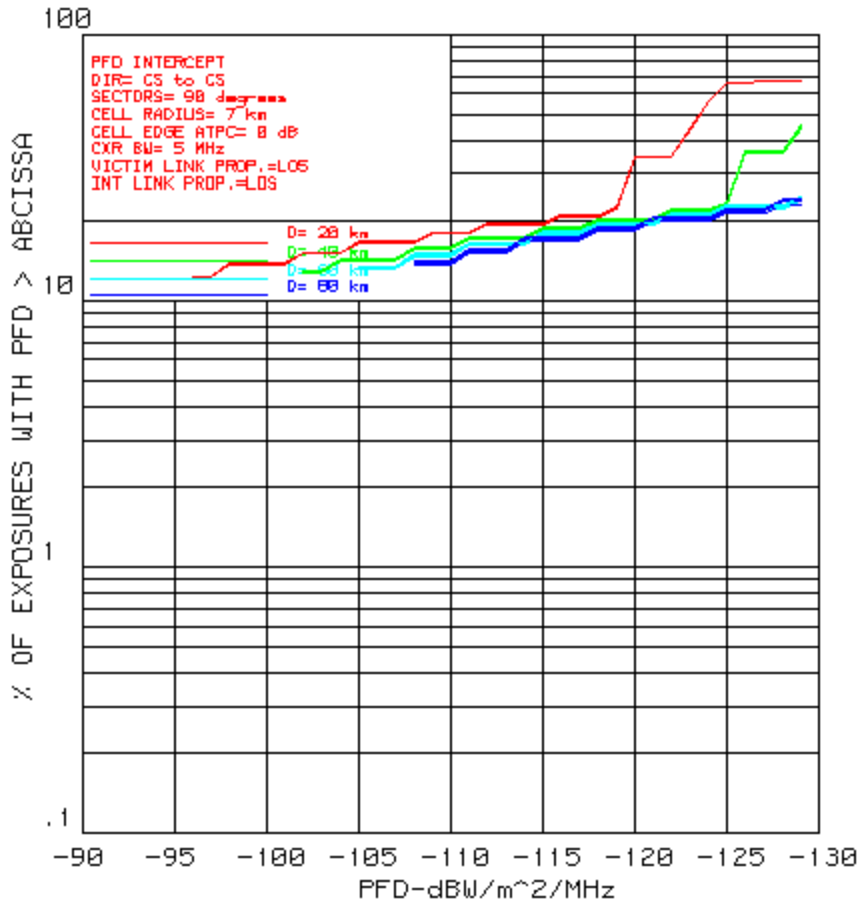


Figure 2. CS to CS pfd Simulation Estimates for LOS Interference Vectors.

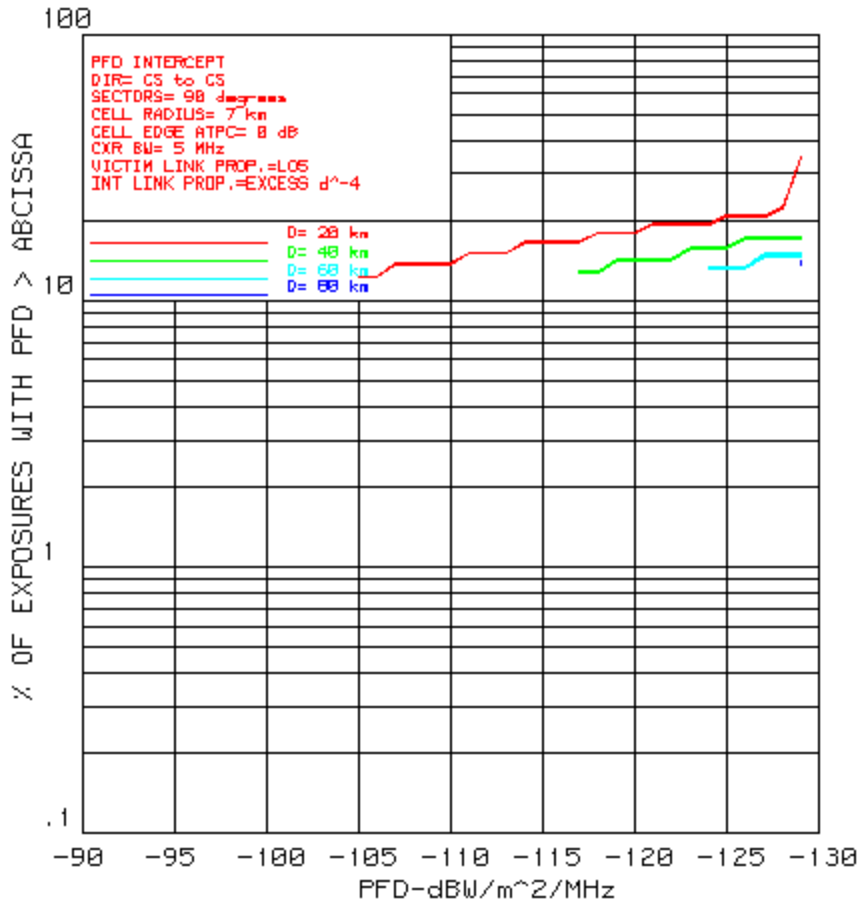


Figure 3. CS to CS pfd Simulation Estimates for Excess Loss Interference Vectors.

3.2 CS to TS

Figure 4 illustrates the simulation model for the CS to TS case. In this case the victim link is now 16-QAM. The antenna RPE discrimination angles are now set by θ and ψ . The interference estimates now benefit from the reduced beam width of the TS antenna. However, the interference pfd objective has now increased to -126 dBW/m²/MHz. As with the other 10.5 GHz cases, this cannot be assured unless the coordination distance is set to be a horizon limit of 80 km.

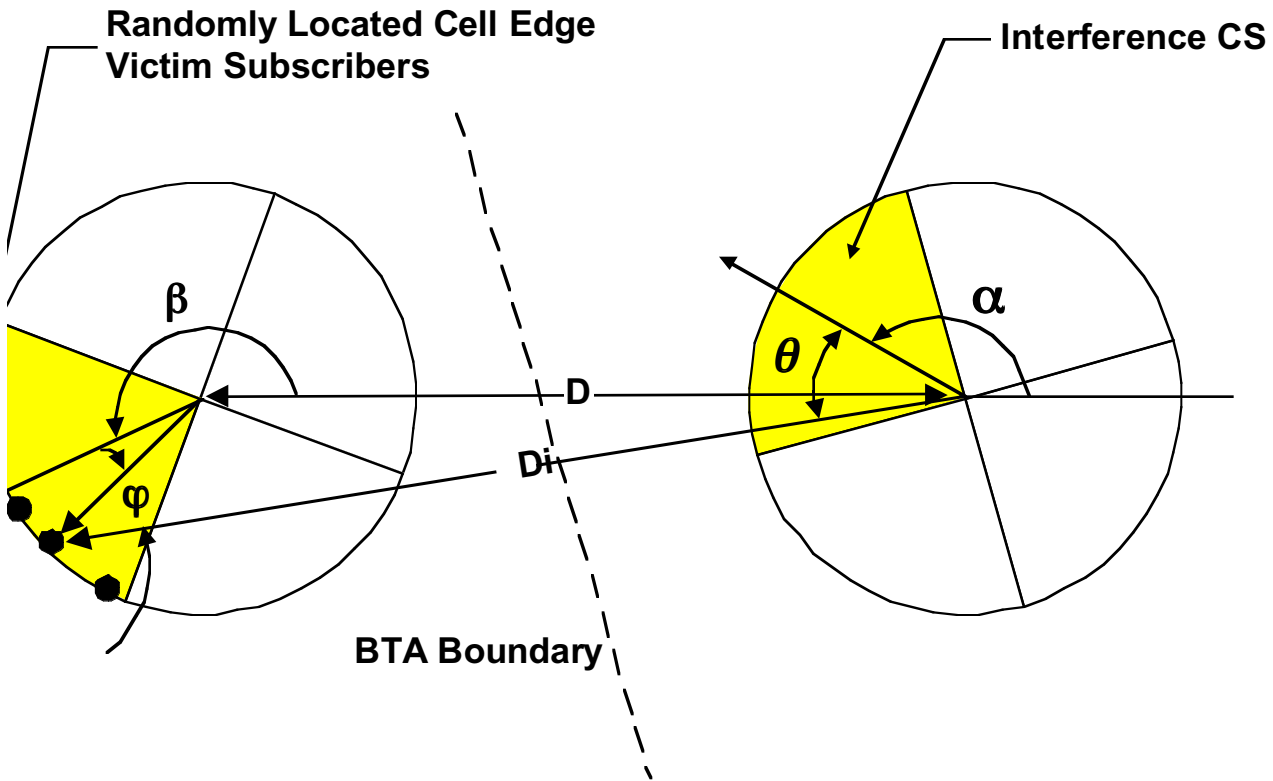


Figure 4 CS to TS Simulation Model

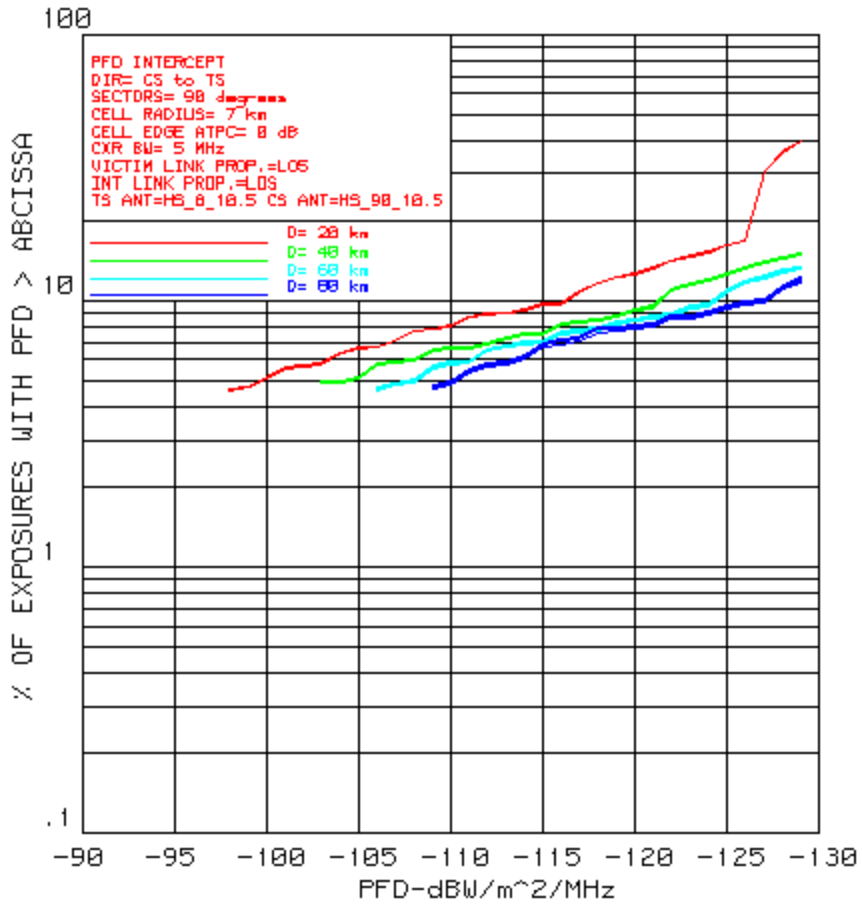


Figure 5. CS to TS pfd Simulation Estimates for LOS Interference Vectors.

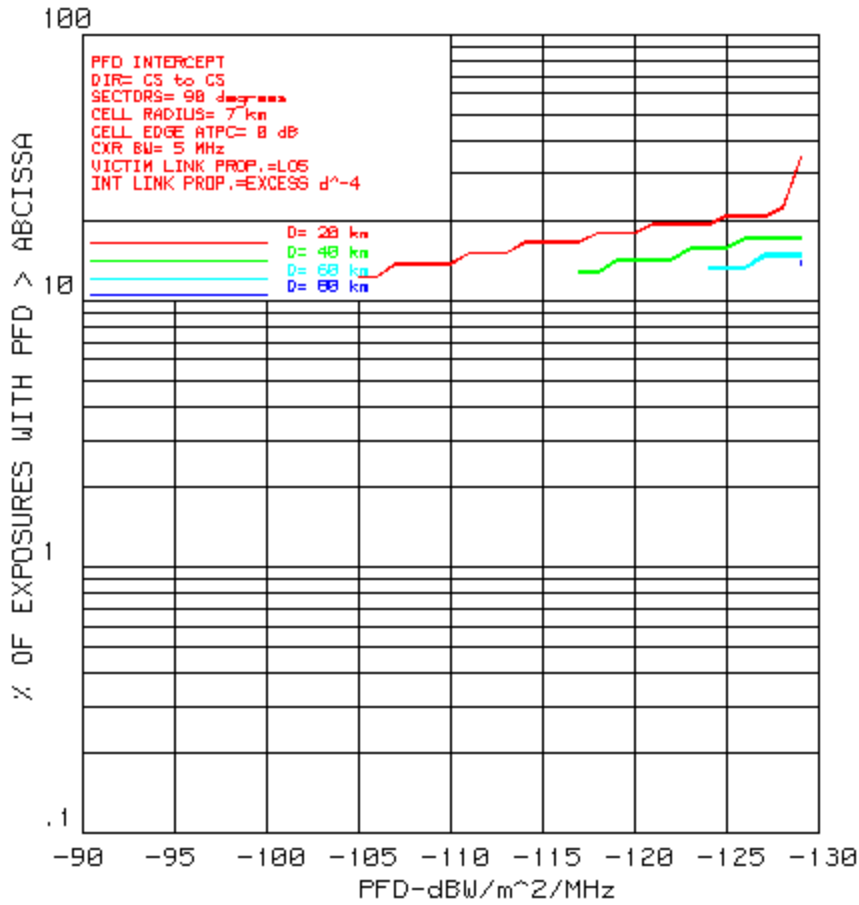


Figure 6. CS to TS pfd Simulation Estimates for Excess Loss Interference Vectors.

4.0 References

[1] Coexistence Co-Channel Boundary pfd Simulations at 10.5 GHz (Inbound), C802.16.2a-02/01r1.