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| 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** |
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| 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 |  |
| Release |  |
| Patent Policy and Procedures |  |

# 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 |
| $(C/N)_{threshold}$ | 12 dB | 18 dB |
| pfd_sig_threshold | -99.1 dBW/m$^2$/MHz | -102.1 dBW/m$^2$/MHz |
| $(C/I)_{1\ dB\ threshold\ impairment}$ (I/N = -6 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 $D_I$ is simply D, the distance between the two CS locations. For any one interference estimate, angles $\beta$ and $\theta$ set the antenna RPE discrimination of the sectors.

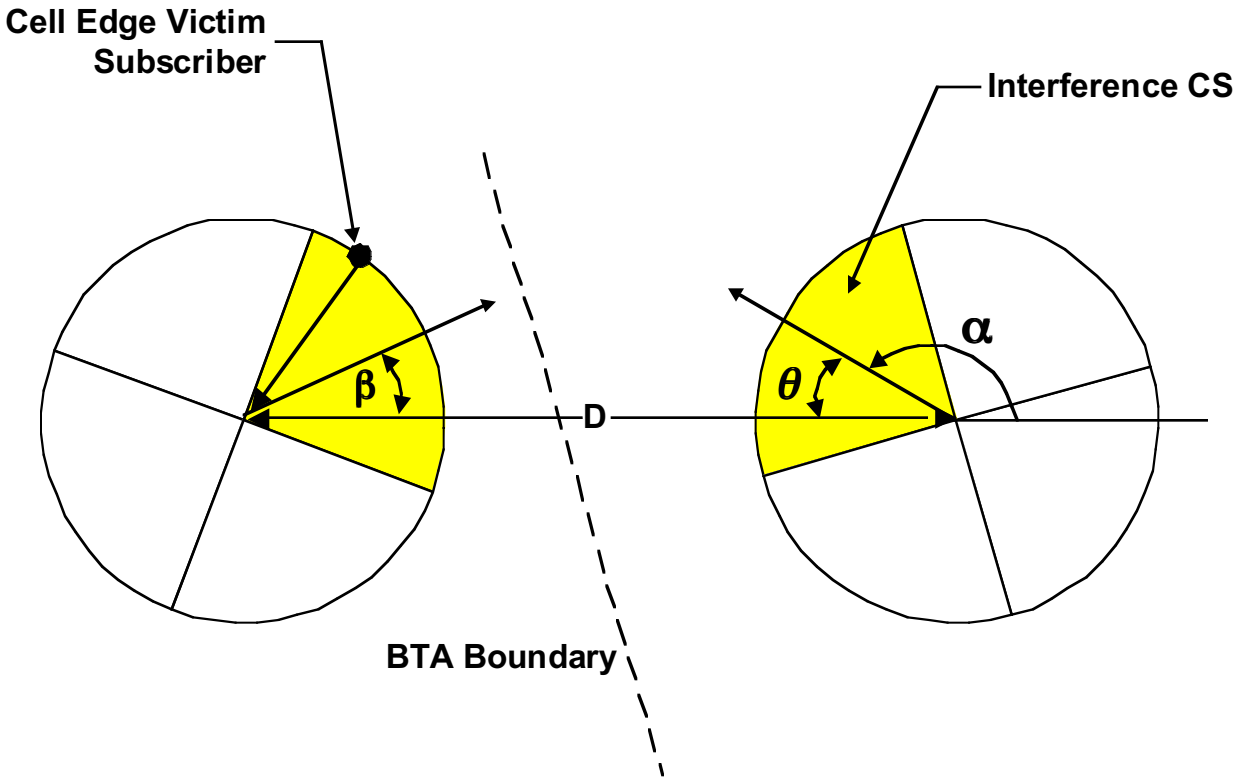


Figure 1 CS to CS Simulation Model

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 dBW/m$^2$/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.

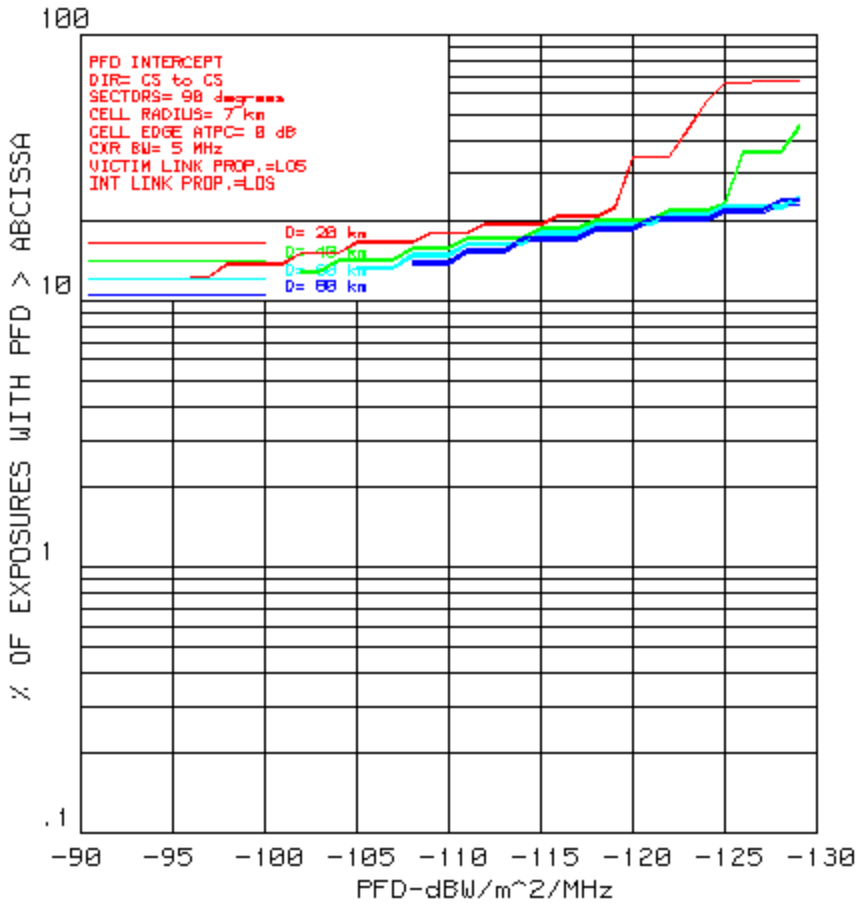


Figure 2. CS to CS pfd Simulation Estimates for LOS Interference Vectors.

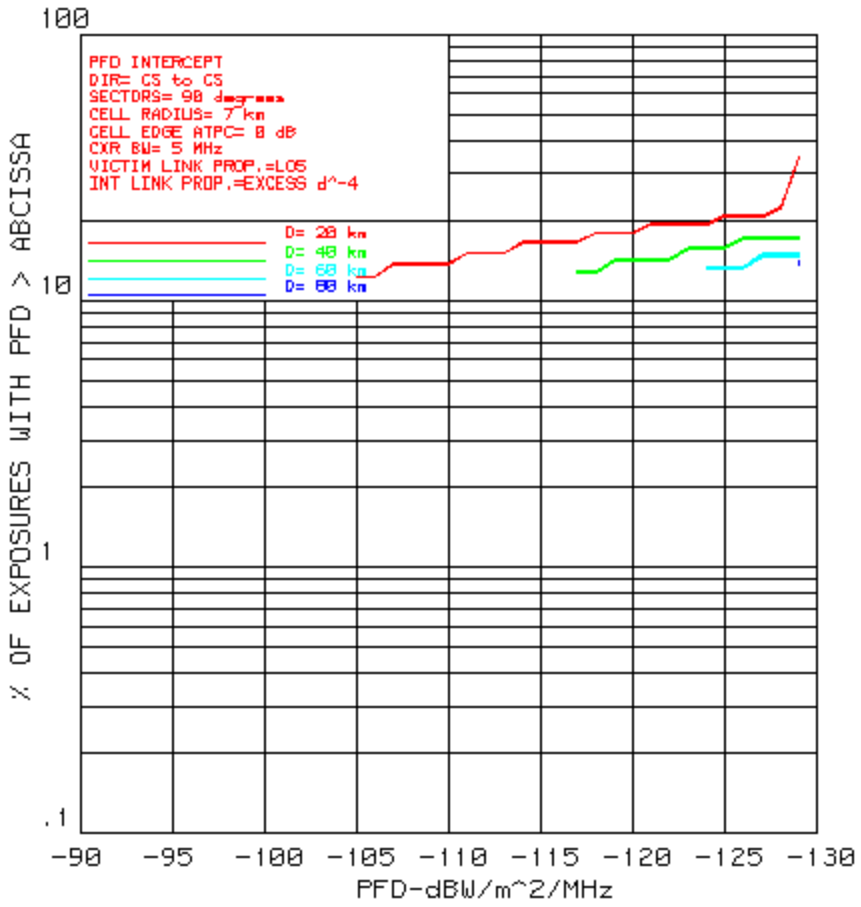


Figure 3. CS to CS pfd Simulation Estimates for Excess Loss Interference Vectors.

## 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 $\theta$ and $\psi$ . 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/m$^2$/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.

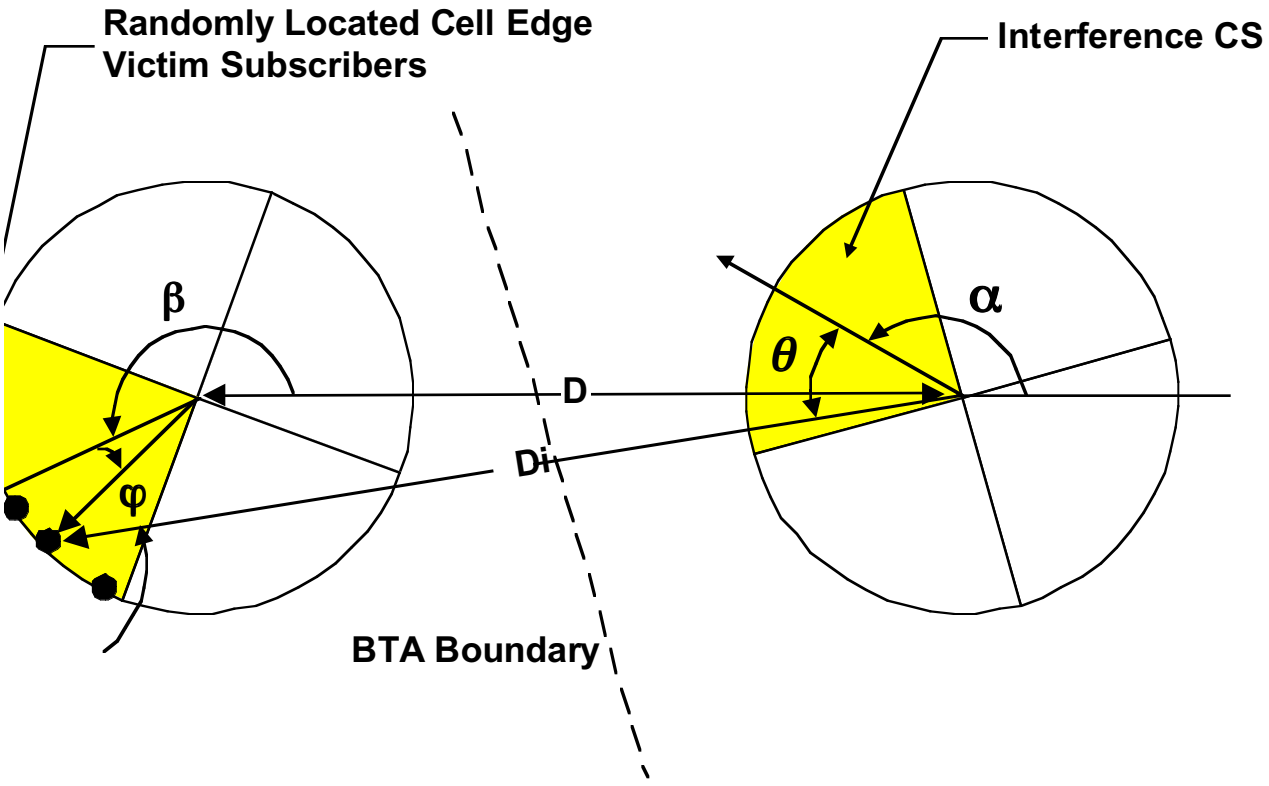


Figure 4 CS to TS Simulation Model

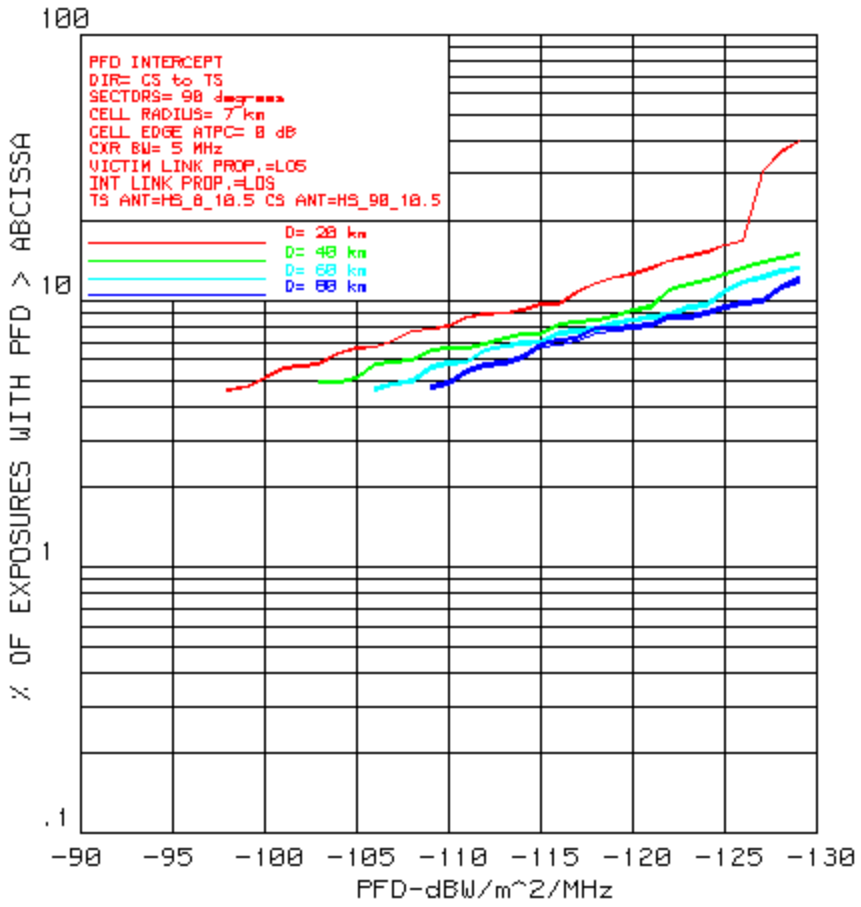


Figure 5. CS to TS pfd Simulation Estimates for LOS Interference Vectors.

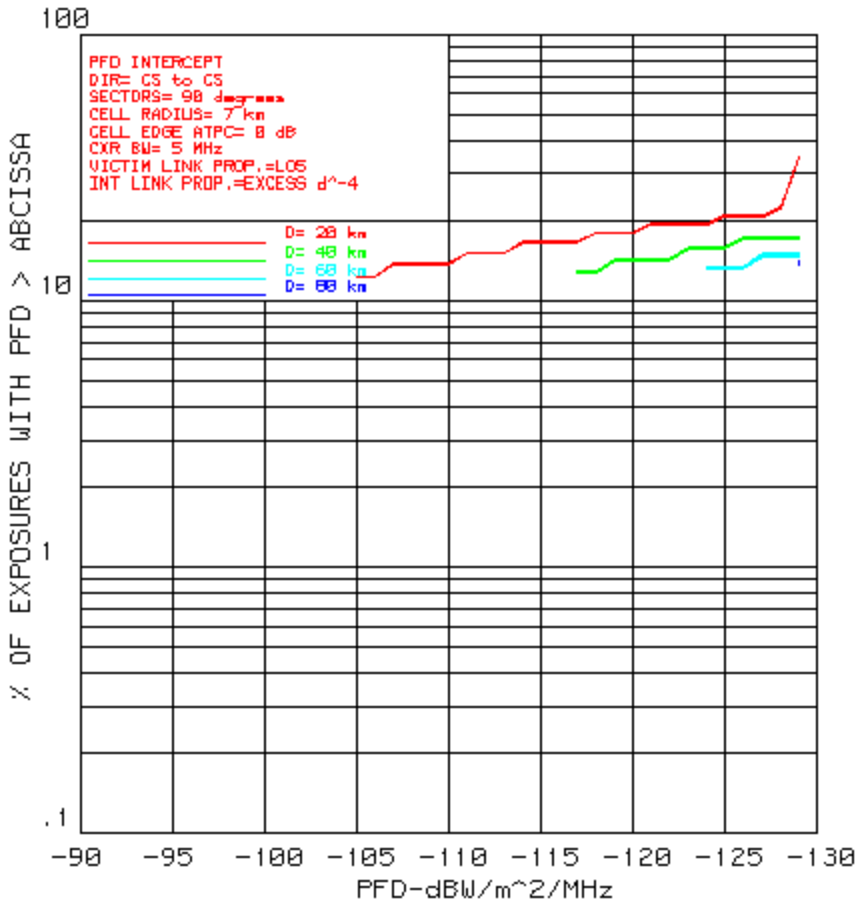


Figure 6. CS to TS pfd Simulation Estimates for Excess Loss Interference Vectors.

## 4.0 References

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