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Re:	This is a response to the chairman of the coexistence task group's oral call for contributions at the July 99 meeting for input to the document outline in paper 80216cc-99/11.
Abstract	This document provides baseline text for section 3.1.1.4 (Power control range, including rain effects).
Purpose	802.16.2 is asked to consider this text for adoption in the coexistence practice.
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Release	The contributor acknowledges and accepts that this contribution may be made publicly available by 802.16.

Power Control Assumptions for Coexistence Modelling

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Introduction

This contribution provides text for section 3.1.1.4 of the coexistence practice outline (reference paper 802.16cc-99/11).

Power Control Range

Downstream

BWA systems generally do not employ adaptive transmit power control (ATPC) in the downstream direction. The downstream channel is generally a shared signal, which is broadcast to all subscribers in the sector. Consequently, as some subscribers may be located close to the hub, while others may be located at the cell edge, it is not possible to use ATPC to track out range differences of near and far subscribers. Further, the use of variable power levels in the downstream direction to track out rain fades to the most distant subscribers can result in large differences in transmitted power levels from nearby sectors re-using the same channel at the hub, which degrades intra-system C/I (carrier-to-interference) ratios under differential rain fade conditions.

Interference analysis according to this coexistence practice therefore assumes that hubs always transmit at full power under all conditions.

Upstream

In comparison to the downstream problem, BWA systems generally *do* employ ATPC in the upstream direction. ATPC is required to equalize near/far and differential rain fading effects so that the received powers at the hub from multiple subscribers arrive at almost the same power level. An equal received power level is desirable for three reasons:

- For TDMA systems, equal power allows burst receivers to more easily recover successive signals from different subscribers
- For FDMA systems, equal power minimizes the required adjacent-channel rejection of the hub receiver and minimizes the required adjacent-channel spurious emission suppression required of the upstream transmitters.
- For systems which employ intensive frequency re-use, such that the same upstream channel is spatially re-used at the same hub in another sector, equal received power minimizes the required hub antenna out-of-sector rejection required to ensure adequate C/I.

Interference analysis according to this coexistence practice therefore assumes that subscriber stations employ ATPC.

Degree of Upstream ATPC

A subscriber station at the cell edge, whose range is limited by the upstream link budget, will produce a received power level of threshold (i.e. the minimum power which results in a threshold BER) while transmitting at full power into the worst-case rain fade.

BWA systems using upstream ATPC generally attempt to set all received signal levels several dB above the minimum receiver threshold under clear-sky conditions. This provides:

- Better than threshold BER most of the time; and
- Margin for imperfect power control loops, imprecise power measurements etc.

Under worst-case rain conditions, the signal from a subscriber at the edge of the cell will fall to threshold, while those near the hub will hardly change; thus, the C/I for adjacent channels may fall from 0 dB to the negative of the number of dB above threshold to which the nominal level is set. So as not to stress the C/I performance of the hub receiver, the nominal level cannot be set too much above threshold then.

It will therefore be assumed that the upstream received power level under clear-sky conditions will be set 5 dB above threshold.

Assume that under worst-case rain fade conditions, a subscriber station transmits the full power Pmax defined in this practice in section 3.1.1.2 (the value is TBD).

This means that if the worst case rain fade depth is F dB, the power transmitted by the subscriber station at the cell edge under clear-sky conditions is therefore Pmax - (F-5) dB. The ATPC turn-down of power is F-5 dB.

BWA systems are generally designed with a fade margin of at least 20 dB, regardless of rain region. In low rain regions, where the degree of rain fading per km is slight, the cell size is generally increased so that the the total rain fade is at least 20 dB. Although the rain fade margin may be higher than 20 dB, for purposes of modelling interference caused by BWA subscriber stations, we are concerned not with the large fade margins that will result at higher carrier frequencies and in high rain regions, but with small turn fade margins which do not result in much decrease of upstream power.

It will therefore be assumed that the upstream fade margin is 20 dB, hence the ATPC turn-down from full subscriber power under clear-sky conditions will be assumed to be 15 dB. Under slight fading conditions, the degree of ATPC turn-down from full subscriber power will be assumed to be equal to the degree of rain attenuation experienced by a path equal to the nominal cell radius.