Fixed WiMAX Profit Maximisation with Energy Saving through Relay Sleep Modes and Cell Zooming

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Abstract:

In Fixed WiMAX, the cost/revenue optimisation function for radio and network planning incorporates the cost of building and maintaining the infrastructure and the impact of the available resources on revenues. Supported throughput typically decreases with larger cells due to the implied greater average distance of users from the base station, although the use of subchannelisation can keep throughput steady with a larger cell radius. The use of sectored base stations facilitates selection of higher order modulation and coding schemes in the cell and can improve throughput; however, sectored equipment is more expensive. Fortuitously, using Relay Stations (RSs) ca n reduce the deployment cost of such systems. In such a context, if RSs are put into sleep mode during the night and at weekends when they are not necessary, important energy savings can be achieved. With relays, only the consideration of tri-sectored Base Station (BS) antennas with ¬K=3 (at the cost of extra channels, where 9 channels corresponds to a bandwidth of 31.5MHz) obtains values of system throughput comparable to those without using relays. This is due to the more favourable frame format that is employed under the use of tri-sectored BS antennas.
This paper shows that the application of cell zooming in conjunction with relays going into sleep mode at times of low load achieves a notable power saving, corresponding to 10% saving in operation and maintenance cost on average. Moreover, as it is assumed that the DL sub-frame format cannot be changed to a more favourable one, economic performance is better when RSs are deployed. It is however important to highlight t hat in the absence of RSs, economic performance is still reasonable (for tri-sectored and omnidirectional BSs, 700-800% and 400-450% profit, respectively), compared with the case where RSs are deployed (~1000% and ~900% profit, respectively).