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Title	Text proposal for interference management of cooperative small base-stations in hierarchical networks	
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Re:	Call for contributions for the 802.16 PPC	
Abstract	It proposes interference management of cooperative small base-stations in Hierarchical Networks Study Report.	
Purpose	For discussion	
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TEXT PROPOSAL FOR INTERFERENCE MANAGEMENT OF COOPERATIVE SMALL BASE-STATIONS IN HIERARCHICAL NETWORKS

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Introduction

This contribution suggests interference management for cooperative small base-stations in C802.16ppc-11/0004r1, where wireless back-haul is adopted to easily deploy the cooperative small base-stations including micro, pico, and femto BSs. The proposed text is described in the usage model section and Figure 2 is modified accordingly.

Proposed text change

Adopt the following remedies in IEEE 802.16ppc-11/0004r1.

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[Remedy #1: Replace Figure 2, and modify the texts as indicated.]

2 Usage Models

2.1 Single Radio Access Technology

2.1.1 Multi-tier Networks

Multi-tier networks refer to a hierarchical or overlay deployments of cells which may have increasingly base stations of smaller sizes: macro base station, micro base station, pico base station, femto base station, and relay base station (Figure 2). The hierarchy shown in Figure 2 is not strict and is mainly illustrative of the increasingly smaller cell sizes that may be included as part of a multi-tier deployment. For example, in a given deployment, a 2 tier hierarchical relationship may exist between a Macro and both pico and/or a femto cells, with the pico and femto cells comprising the same tier in the hierarchy. Typical deployment would consist of the tiers operating on the same radio access technology (RAT). Femto and relay are included as a part of the IEEE 802.16m specification [3]. Coordination techniques between devices and between cells across the multiple tiers and among cooperating small BSs are important aspects of multi-tier network design to achieve cell capacity enhancements and interference mitigation techniques across tiers are also critical to achieving the user throughput enhancements. However, it is not fully enabled in IEEE 802.16m because multiple types of base stations (including Macro, Pico, Femto, Relay) will be deployed in multi-tier networks and this will cause more complicated interference among tiers. Therefore enhanced interference mitigation and coordination techniques are needed with the enhanced channel measurement, downlink signaling, and uplink feedback schemes, etc. In

particular, multi-tier deployments affect the areal capacity (bps/Hz/square meters) of the system due to the deployment of significantly more cells in a given area. The highest tier macro cells are still needed to provide broader coverage and seamless mobility.

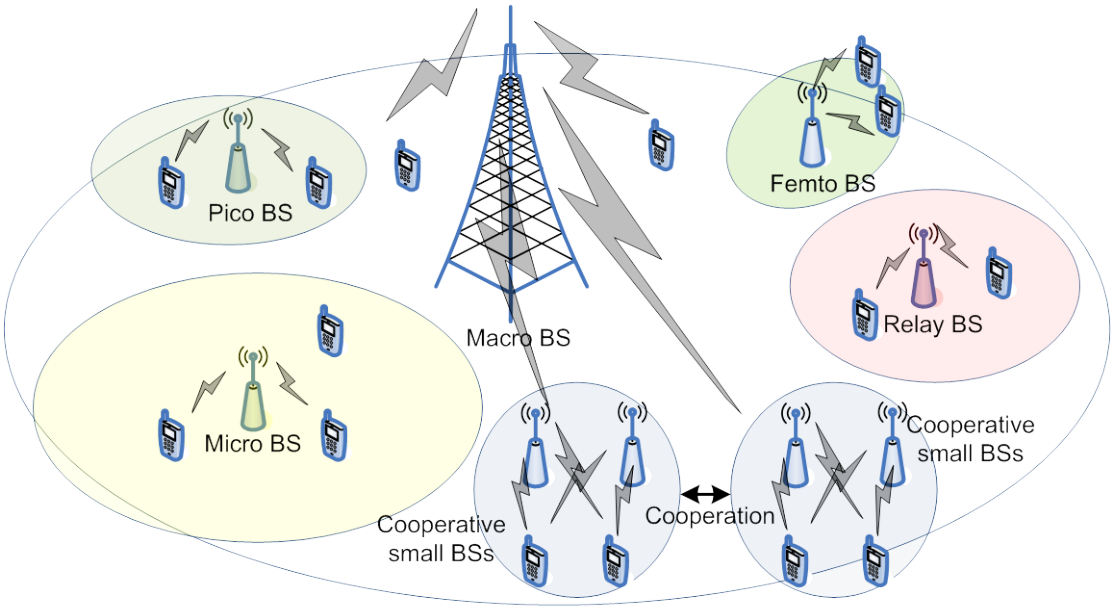

Figure 1: An example of Single RAT Hierarchical (Multi-tier) Architecture Framework

2.1.1.1 Multi-Tier Deployment Scenarios

As indicated, small base stations may be used in a hierarchical network deployment. The type and location of these base stations will play a significant role in determining the cost and performance of multi-tier deployments. For example, indoor femto cell deployments can utilize the existing back-haul thereby significantly lowering the cost of such deployments. With outdoor pico-cellular deployments, the operator will need to provide back-haul capability and manage more critical spectrum reuse challenges. Especially, the wireless back-haul can be used to reduce CAPEX/OPEX between macro BS and small BSs, and to ease the deployment of small BSs. As mentioned in section 1 and shown in Figure 2, a group of small BSs cooperates to increase the system coverage and capacity. To efficiently form and manage a cluster of cooperative small BSs, the interference management among cooperative small BSs is of high importance. Other deployment models cover indoor enterprise or outdoor campus deployments that may impose different manageability a
nd reliability requirements. Multi-tier deployments across this range of scenarios are not fully addressed by the IEEE 802.16m standard.

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4.1.1.3 Advanced Interference Management for Multiple Carrier Deployment

Control/data channel interference shall be mitigated to enable multiple carrier multi-tier deployment, where the cells are deployed on multiple available carriers. Large cells and small cells can be deployed over a distinct set of carriers to avoid interference across the tier of large cells and the tier of small cells. Large and small cells can also be deployed over the same set of carriers or having carriers overlapped, where resource (carrier, power,

time, space, etc.) allocation can be made, to avoid or mitigate the interference across tiers. Enhanced interference management schemes can be used for managing interference among cooperating small BSs. Examples of such schemes are joint scheduling and coordinated beamforming.

Carrier Aggregation (CA) shall be supported with the considerations interference mitigation or avoidance across tiers. This will account for the overlaying macrocell, overlaid pico and femto cells (including CSG cells). Multi-carrier system may work together with SON algorithms.

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