Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>
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Re:	Response to "Call for Comments on Draft 802.16m Evaluation Methodology Document"
Abstract	This document proposes some amendments to C80216m-07_080r1 to evaluate the system with distributed antennas.
Purpose	For discussion and approval by TGm.
Notice	
Release	
Patent Policy and Procedures	

Amendments to Draft IEEE 802.16m Evaluation Methodology Document

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Introduction

Relaying is viewed as a key feature for the next generation wireless systems by WINNER[1] and IEEE 802.16J, due to its advantages, such as extending the coverage area of one Base Station (BS), increasing the capacity of one BS, and covering dead spots. Another important reason for using relaying in the next generation system is its cost efficiency and flexibility in deployment.

However, the increase in capacity of cellular system by using relaying is not enough to meet the capacity requirement in hot spots or some high user density areas. To further improve capacity, it is necessary to build more complex network deployment than using Relay Stations (RS). We recommend that it should be feasible to connect BS and its RSs by fibers or other high speed lines in high user density areas. Moreover, it is also feasible to jointly transmit and receive by the adjacent BSs. For simplicity's sake, the RS connecting with BS by high speed lines is called Node A (N.A) in this text, and the proposed system is called Distributed Nodes Cellular Systems (DNCS).

In fact, DNCS is extension of distributed antenna systems (DAS), which have been widely implemented in state-of-the art cellular communication systems to cover dead spots. Recent academic studies have shown that in addition to coverage improvements, DAS can also have potential advantages such as reduced power and increased system capacity in a single/multiple cell environment[2-4]. The results show that DAS reduces other-cell interference in a multicell environment and hence significantly improves capacity (by about 2x), with particularly large improvements for users near cell boundaries.

With the development of Radio over Fiber (RoF), it is practical and affordable to build DNCS in hot spots.

System description of DNCS

In DNCS, all the processing modules in one cell are centralized at a location (central unit) and are connected with distributed nodes (Node A). Each distributed node may be mounted one or more antennas and is physically connected with a home base station via dedicated wires, fiber optics, or an exclusive RF link. A general cell of DNCS is showed in Fig. 1, where the cell is covered by its home BS and there are several distributed N.A to assist the BS to improve the system performance.

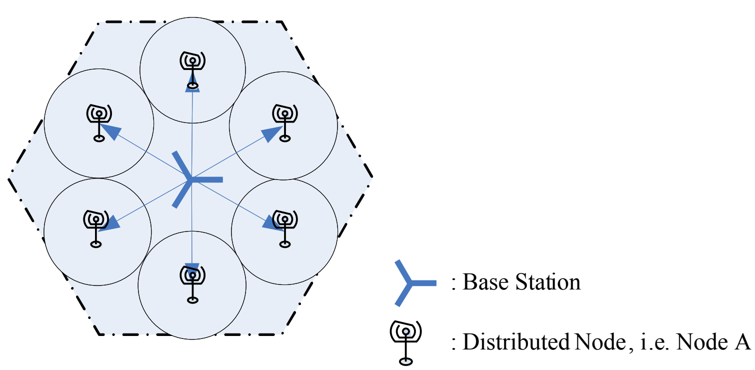

Fig. 1. A general cell deployment of DNCS

In DNCS, the following features should be highlighted.

1) To keep the backward compatibility with the 3rd generation systems and WiMAX systems, the DNCS BS may be designed just as same as the conventional BS in RF modules and high-level protocols, and deployed according to the same methodology, which means that it is possible to use the same procedure such as broadcast, measurement, and handover procedures in DNCS and conventional cellular systems. The main difference of DNCS BS and the conventional BS lies in signal transmitting and receiving.

2) N.A acts as a remote RF end and may be mounted one or more antennas. To allow for cost efficient and flexible deployment solutions, N.A may operate at a lower-power and be mounted at a lower-height position, compared with the conventional BS. In DNCS, there is at least one N.A in each sector.

3) The main purpose of using N.A is to boost the practical throughput of each cell in high user density areas. Therefore, DNCS can be alone employed to set up wireless network as showed in Fig. 2, and can also be combined with traditional cells to set up wireless network as showed in Fig.3.

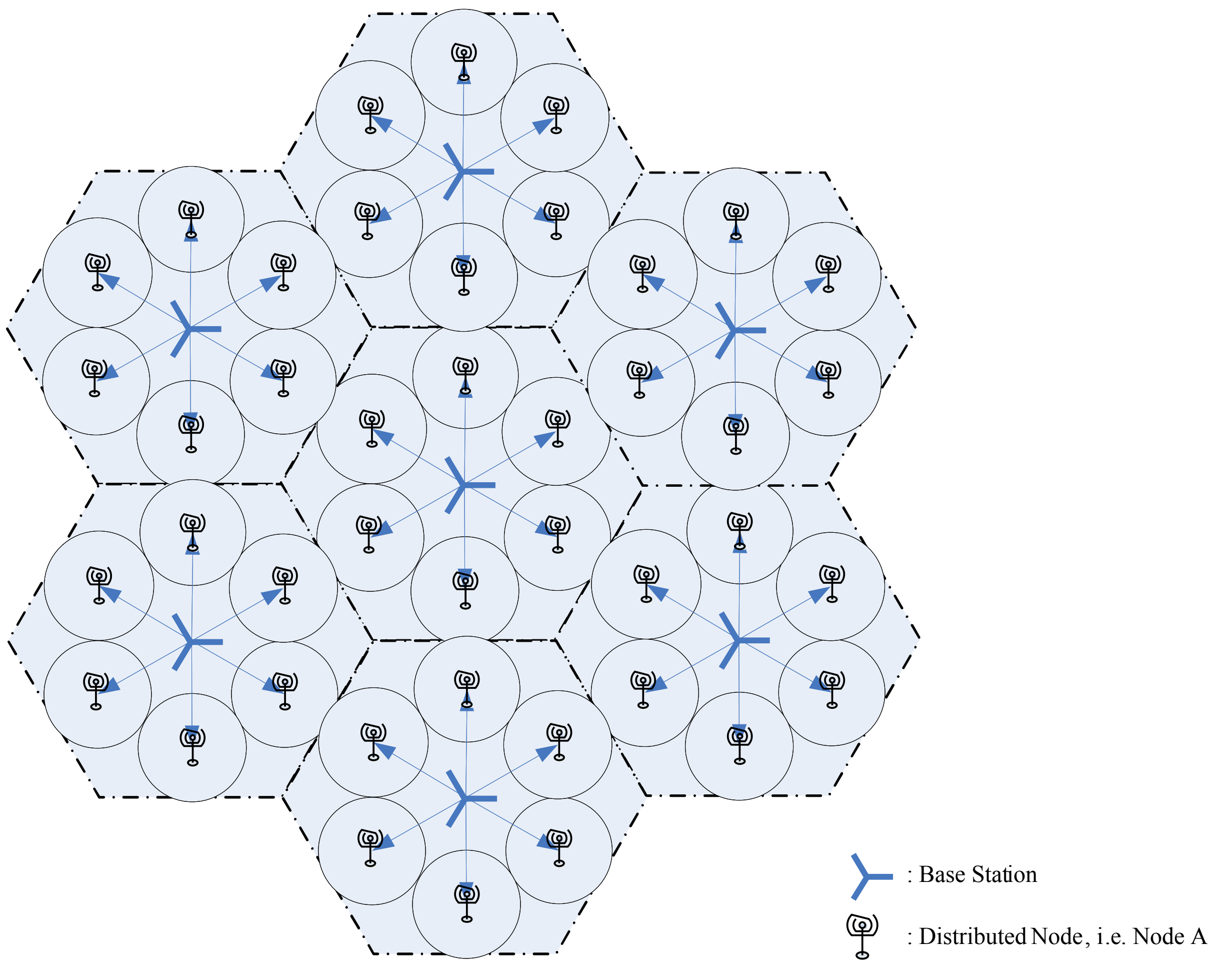

Figure 2: An example of only 1-tier wireless network using pure DNCS

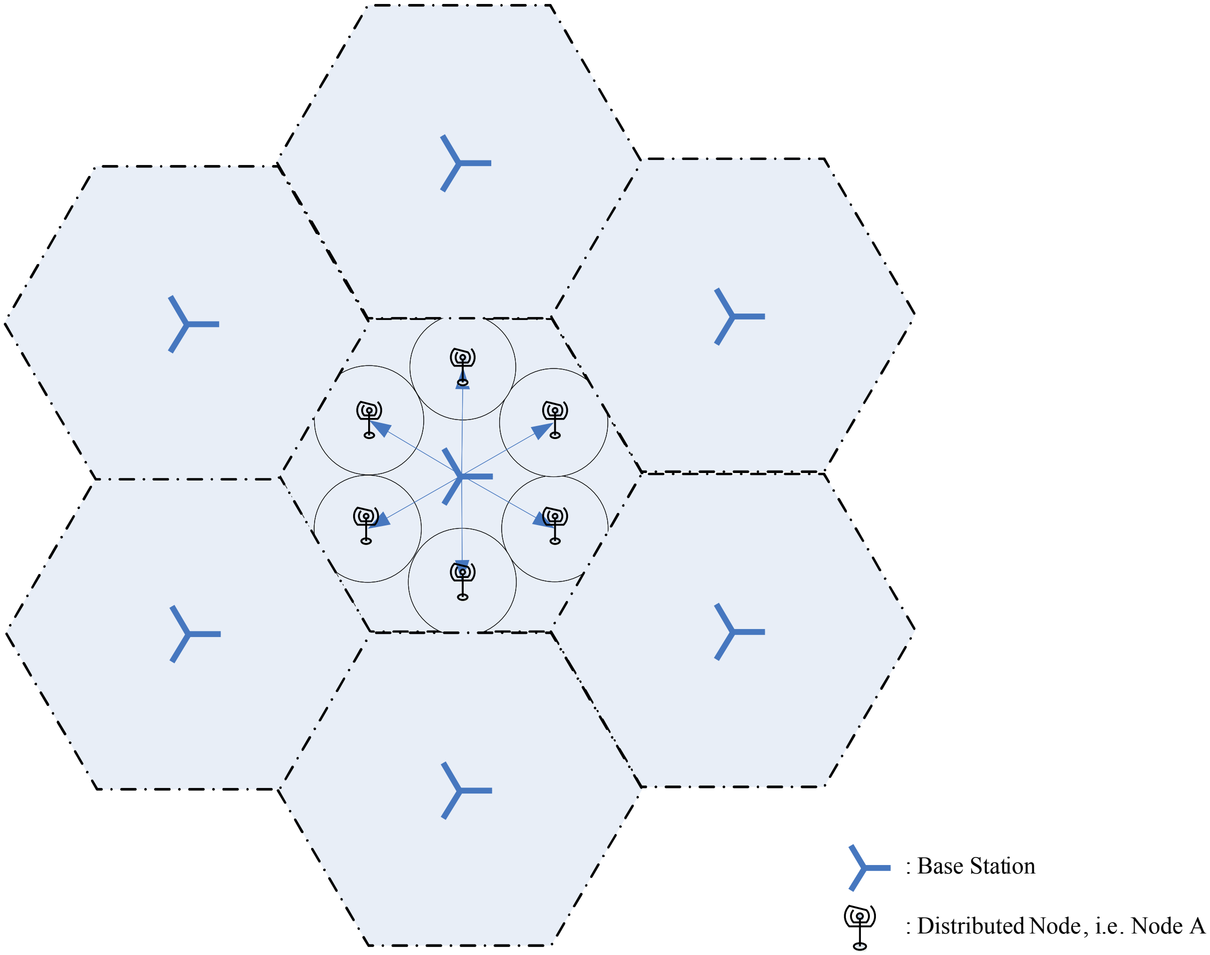

Figure 3: An example of only 1-tier wireless network combining traditional cells with DNCS

Specific Text change[5]

[Insert some new Abbreviations in “IEEE C802 16m-07/080r1”]

DNCS Distributed Node Cellular Systems

Node A Remote RF modules mounted with one or more antennas and connected with a home base station via dedicated wires Node A

N.A Node A

In order to evaluate the impact of DNCS, Node A equipment model is needed. Therefore, a new clause namded “Node A equipment model” is added after subsection 2.4.3.

[Add a new sub-clause 2.4.3 in “IEEE C802 16m-07/080r1”]

Section 2.4.4 Node A Equipment Model

Parameter	Description	Value Range
$PI_{N.A}$	Node A power amplifier 1dB compression point	TBD[27-51 dBm]
$PAR_{N.A}$	Peak-to-average backoff at BS	TBD[9-11 dB]
$P_{N.A}$	Max transmit power per	TBD[27-51 dBm TBD 33dBm@5MHz bandwidth TBD 36dBm@10MHz bandwidth

		39dBm@20MHz bandwidth and similarly scalable for other bandwidths]
$H_{N.A}$	Node A height	TBD[10-50m(18m)]
$G_{N.A}$	Gain	TBD[9dBi]
$\theta_{N.A}$	3dB beamwidth	TBD[$\theta_{N.A}$ 180]
G_{FB}	Front-to-back power ratio	TBD[0dB]
M_{TX}	Number of transmit antennas	TBD[1,2,3,4]
M_{RX}	Number of receive antennas	TBD[1,2,3,4]
$d_{N.A}$	Node A antenna spacing(ref: ULA)	TBD[$\lambda/2, \lambda, 2\lambda, 4\lambda$
$\rho_{N.A}$	Node A antenna correlation	TBD[0.5]
$NF_{N.A}$	Noise Figure(transmit & receive)	TBD[5-7dB(6dB)]
$HW_{N.A}$	Hardware loss(calbe implementation, etc.)	TBD[2dB]

[Replace the Table 4.2.2-1 in "IEEE C802 16m-07/080r1" by the following Table]

Channel Scenario	Urban Macro-Cellular
AS at BS	σ_{AS} 15
Per-path AS at BS (Fixed)	2
AS at MS	$\sigma_{AS,MS}$ 68
Per-path AS at MS (Fixed)	35
AS at Node A	$\sigma_{AS,N.A}$ 50
Per-path AS at Node A (Fixed)	25
AoDs	As specified in Table 4.2.2-2
AoAs	As specified in Table 4.2.2-2

Table 4.2.2-1 ITU Profiles Spatial Extension Parameters

References

[1] IST-2003-507581 WINNER II D3.5.1, "Relaying concepts and supporting actions in the context of CGs", October 2006. https://www.ist-winner.org/

[2] Lin Dai, Shidong Zhou, Yan Yao, "Capacity analysis in CDMA distributed antenna systems", Wireless Communications, IEEE Transactions on, Volume 4, Issue 6, Nov. 2005 Page(s):2613 - 2620

[3] Wan Choi, Jeffrey G. Andrews, "Downlink performance and capacity of distributed antenna systems in a multicell environment", Wireless Communications, IEEE Transactions on, Volume 6, Issue 1, Jan. 2007 Page(s):69 - 73

[4] Shidong Zhou, Ming Zhao, Xibin Xu, Jing Wang, Yan Yao, "Distributed wireless communication system: a new architecture for future public wireless access", Communications Magazine, IEEE, Volume 41, Issue 3, March 2003 Page(s):108 - 113

[5] IEEE C802 16m-07/080r1, "Draft 802.16m Evaluation Methodology Document" April, 2007