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Source(s)	Yang-Han Lee, Yih-Guang Jan, Ming-Hsueh Chuang, Hsien-Wei Tseng, Po-Jung Lin, Ting-Chien Wang	yhlee@ee.tku.edu.tw
	Tamkang University (TKU)	
	Kanchei (Ken) Loa, Chih-Wei Su, Yung-Ting Lee, Hua-Chiang Yin, Youn-Tai Lee	loa@nmi.iii.org.tw
	Institute for Information Industry (III)	
	Shiann-Tsong Sheu	stsheu@ce.ncu.edu.tw
	National Central University (NCU)	

Re:	IEEE 802.16m-08/024: Call for Contributions on Project 802.16m System Description Document (SDD). Target topic: “Interference Mitigation”.
Abstract	This contribution proposes for Pilot Design for Interference Mitigation
Purpose	To be discussed and adopted by TGm for the 802.16m SDD.
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Pilot Design for Interference Mitigation in IEEE 802.16m

Yang-Han Lee, Yih-Guang Jan, Ming-Hsueh Chuang, Hsien-Wei Tseng, Po-Jung Lin, Ting-Chien Wang
Tamkang University (TKU)

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Institute for Information Industry (III)

Shiann-Tsong Sheu
National Central University (NCU)

1. Introduction

In wireless transmission it incurs various kinds of interference such as the MS-MS, MS-BS and BS-BS. When MS moves the distance between the MS and the BS changes, the interference level between the MS and BS changes accordingly and the MS receiving signal level will also change. We will analyze the interference level and discuss the interference environment in this contribution, and through the Interference Mitigation to introduce proper pilot patterns for the MS/BS so as to reduce the interference effect on the system performance.

Consider in a BS it consists of three sectors and the neighborhood of three BSs can be considered as the neighborhood of three sectors with each sector belonging to a BS as shown in Fig. 1.

With an MS in a sector we will simulate its interference level by using different pilot patterns that is contributed from other two sectors in other two BSs as shown in Fig. 2. We will simulate by using different pilot patterns to observe its possibility of reducing the interference levels.

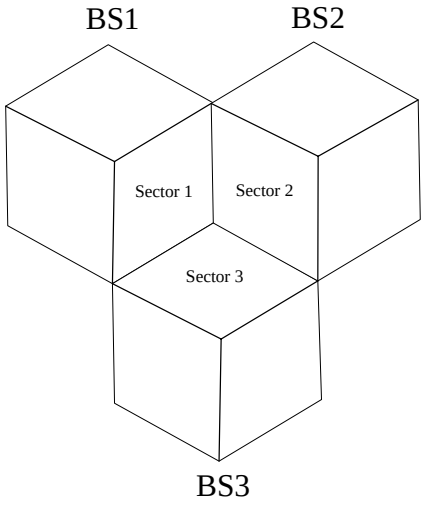

Fig. 1 Three Neighboring Sectors Comprising from Three Neighboring BSs

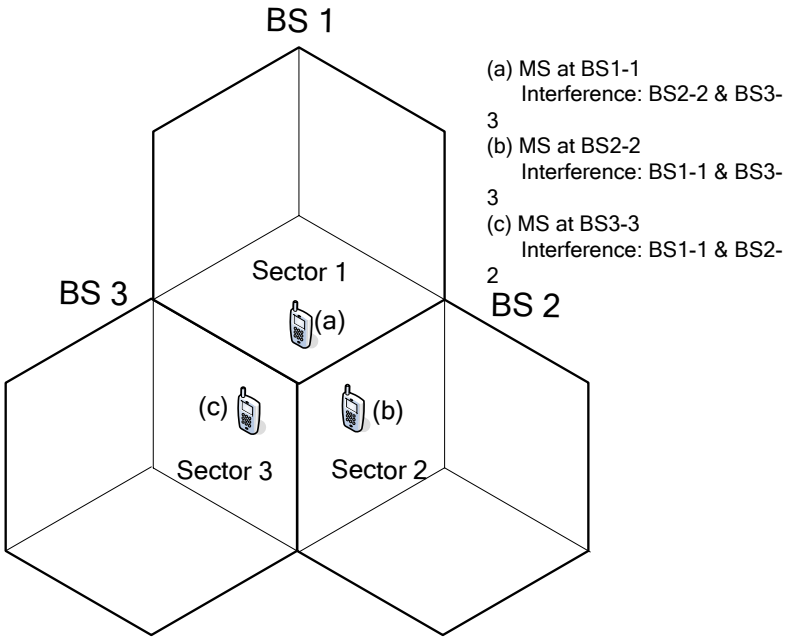

Fig. 2 When an MS in a Sector Central Area its Interference Sources Coming from the Two Sectors of other Two BSs

2. Interference Cases

Several Interference Environments are introduced in the sequel.

Case 1: MS is in Stationary

As shown in Fig. 3 is a stationary MS it stays in a fixed location of a BS, its neighboring two sectors are the interfering sources.

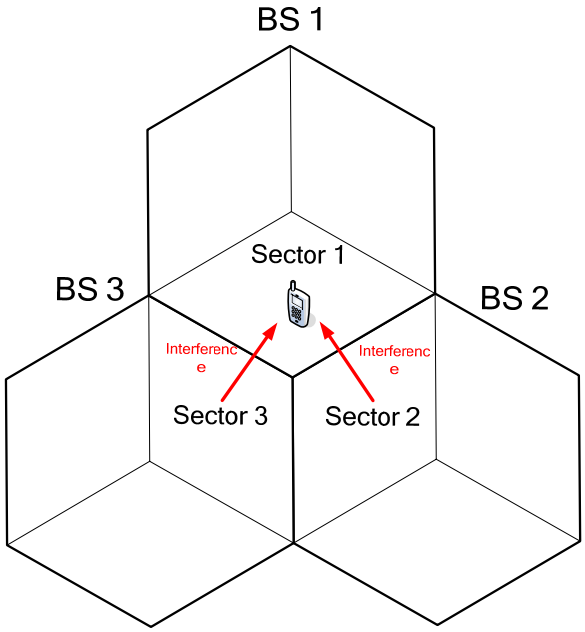

Fig.3 Neighboring BSs Sectors are the Interfering Sources

Case 2: Mobility 1

When an MS moves from one BS Sector to another BS Sector its distances between the MS and the BS Sector changes and consequently its interference level changes during the MS moves. As shown in Fig. 4 is an

MS moving from Sector 1 of BS1 (BS1-1) to Sector 3 of BS3 (BS3-3), the interference level coming from BS3-3 increases when its distance with MS decreases. By proper use of pilot patterns we can reduce the interference level resulting from BS3-3.

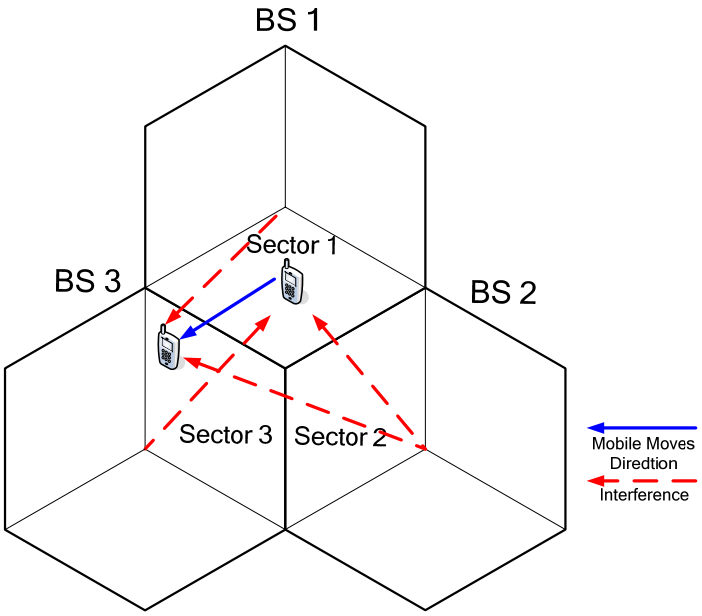

Fig. 4 An MS Moves from Sector 1 of BS1 (BS1-1) to Sector 3 of BS3 (BS3-3).

Case 3: Mobility 2

It is the same interference environment as in Case 2 but the moving path of the MS is along the cell edge as shown in Fig. 5. The MS in BS1-1 moves along the cell edges of BS2 and BS3, the interference levels coming from BS2 and BS3 are correspondingly increased. If same pilot patterns are used by all BSs, as shown in Table 1, it will have the same interference levels as shown in Table 2 during the distance changing between the MS and BSs when the MS moves.

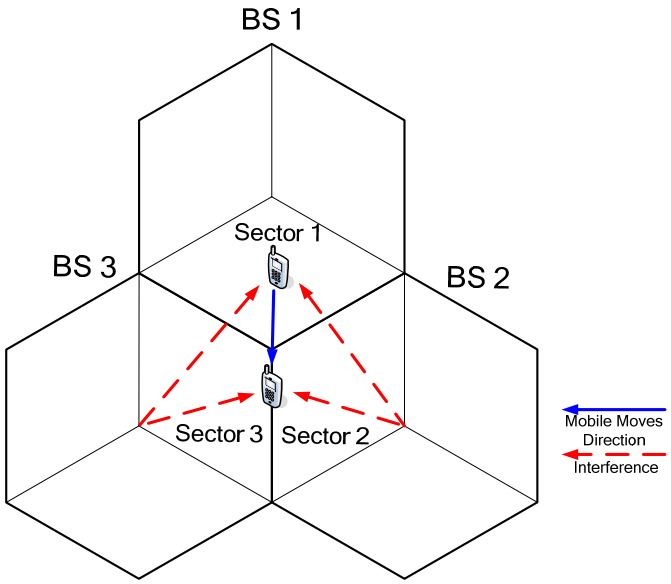

Fig. 5 MS Moves from BS1-1 along Cell Edges of BS2 and BS3

Table 1 Original Pilot Patterns for Every BS Sectors

BS1-1	BS2-2	BS3-3	Interference Weihgt BS1-1 & BS2-2	Interference Weihgt BS1-1 & BS3-3	Interference Weihgt BS2-2 & BS3-3
			1	1	1
			1	1	1
			1	1	1
			1	1	1

Table 2 Pilot Patterns and Their Resulting Signal Strengths between the MS and Various BSs Sectors

BS1-1	BS2-2	BS3-3	Sensitivity (dBm) MS: BS1-1 Interference: BS2-2 & BS3-3	Sensitivity (dBm) MS: BS2-2 Interference: BS1-1 & BS3-3	Sensitivity (dBm) MS: BS3-3 Interference: BS1-1 & BS2-2
			-128.2400	-128.2400	-128.2400
			-128.2400	-128.2400	-128.2400
			-128.2400	-128.2400	-128.2400
			-128.2400	-128.2400	-128.2400

3. Interference Mitigation

Based on the Interference Mitigation consideration we propose proper pilot patterns for various interference environments to reduce the interference effect on the system performance.

When an MS is in stationary and stays in a BS its interference is coming from other two BSs, the pilot patterns for various sectors are designed as shown in Table 3. The pilot patterns between two BSs are orthogonal to each to reduce its interference down to the minimum level while maintaining the possible interference level from other BS is as small as possible. As shown in Table 4 is its resulting interference level with the pilot patterns designed and proposed, its interference level is tremendously lower comparing with the results obtained from the original pilot patterns. This structure of pilot patterns is suitable for the case when the

MS is stationary in a BS and the other close BS will contribute the maximal interferences, therefore if we select two orthogonal pilot patterns between these two BSs and select the pilot pattern for the other BS the resulting interference levels will be minimized.

Table 3 In Stationary the Selected Pilot Patterns for Various BSs Sectors and Their Weighting Factors

BS1-1	BS2-2	BS3-3	Interference Weihgt BS1-1 & BS2-2	Interference Weihgt BS1-1 & BS3-3	Interference Weihgt BS2-2 & BS3-3
			0.5	0	0.5
			0.5	0	0.5
			0.5	0	0.5
			0.5	0	0.5

Table 4 In Stationary, the Pilot Patterns and the Resulting Signal Strengths between the MS and Various BSs

BS1-1	BS2-2	BS3-3	Sensitivity (dBm) MS: BS1-1 Interference: BS2-2 & BS3-3	Sensitivity (dBm) MS: BS2-2 Interference: BS1-1 & BS3-3	Sensitivity (dBm) MS: BS3-3 Interference: BS1-1 & BS2-2
			-134.2606	-131.2503	-134.2606
			-134.2606	-131.2503	-134.2606
			-134.2606	-131.2503	-134.2606
			-134.2606	-131.2503	-134.2606

4. Conclusion

From the simulation results no matter the MS is stationary or moves it is evident that the resulting interference levels by using our designed pilot patterns are lower than that generating from the original pilot patterns.

Text Proposal for the 'Interference Mitigation'

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XX.X Pilot Design for Interference Mitigation

The pilot pattern among neighbor 802.16m cells may be coordinated in order to mitigate interference at cell edge. Fig. X illustrates the concept of pilot pattern coordination, where three coordinated pilot patterns are applied to a cluster of three neighboring sectors BS1-1, BS2-2, and BS3-3. When an MS is in stationary or mobility, the pilot patterns assigned to its serving BS and its two neighboring BSs are shown in Table X.1:

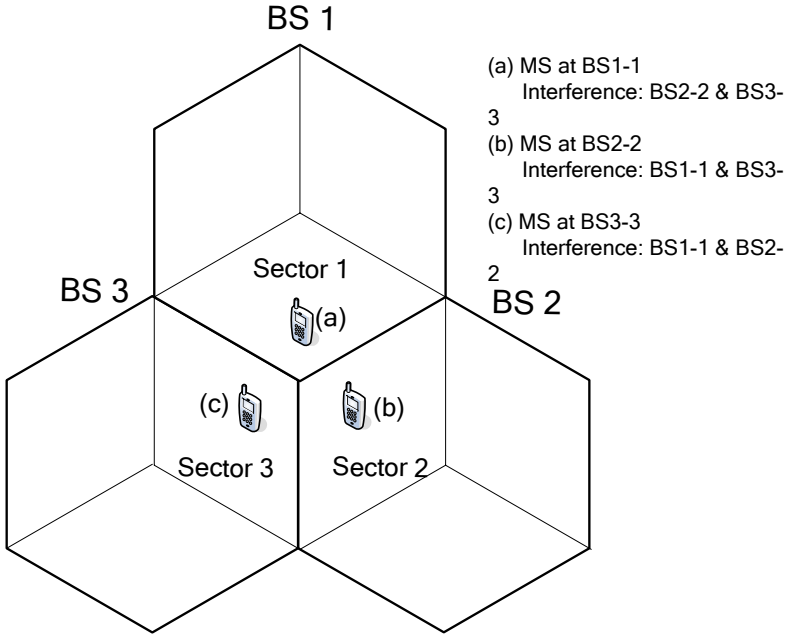

Fig. x When an MS in a sector central area its interference sources coming from the two sectors of other two BSs

Table X.1 Pilot patterns assigned for BSs when the MS is in stationary or mobility

BS1-1 (BS1's Sector 1)	BS2-2 (BS2's Sector 2)	BS3-3 (BS3's Sector 3)	Sensitivity (dBm) MS: BS1-1 Interference: BS2-2 & BS3-3	Sensitivity (dBm) MS: BS2-2 Interference: BS1-1 & BS3-3	Sensitivity (dBm) MS: BS3-3 Interference: BS1-1 & BS2-2
			-134.2606	-131.2503	-134.2606
			-134.2606	-131.2503	-134.2606
			-134.2606	-131.2503	-134.2606
			-134.2606	-131.2503	-134.2606

==========*End of Proposed Text*==========