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Re:	P802.16m/D1 Femto 15.4.x
Abstract	This contribution provides a scheme allowing multi-carrier operation for Femtocell ABS**.**
Purpose	For discussion and approval by IEEE 802.16m TG
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Proposed Text for the IEEE 802.16m/D1: Multi-carrier Operation for Femtocell ABS

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1 Introduction

This contribution proposes a scheme that allows multi-carrier operation for Femtocell ABS without increasing interference to macro/micro cells.

2 Multi-carrier Operation

2.1 Multi-carrier Operation for Femtocell ABS

Multi-carrier operation may be supported by Femtocell ABS as depicted in Fig.1. All operational principles for multi-carrier operation also apply to a system involving Femtocell ABS unless explicitly stated otherwise. In this way, Femtocell ABS can assign a secondary carrier to an MS in addition to a primary carrier.

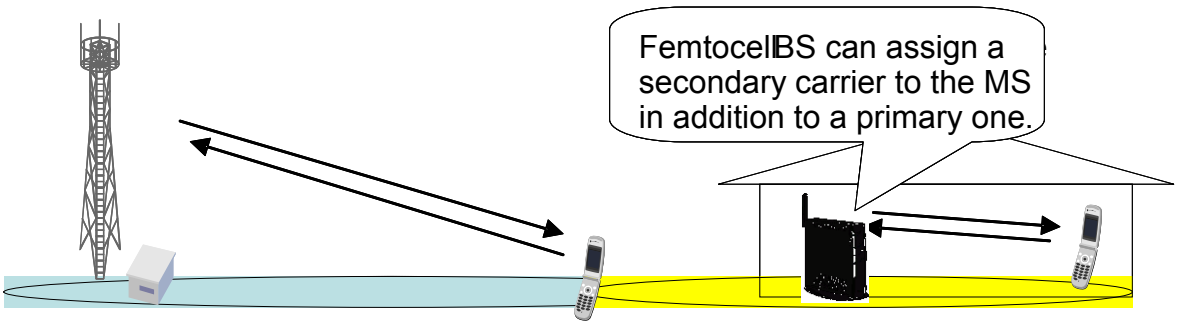

Fig.1 Illustration of the concept of multi-carrier operation for Femtocell ABS.

2.2 Interference in Multi-carrier Operation for Femtocells

If the secondary carrier of Femtocell ABS happens to be the same carrier as the one used by macro/micro cell, the interference from Femtocell to macro/micro cell will subsequently increase. An illustration of this scenario is demonstrated in Fig. 2 below.

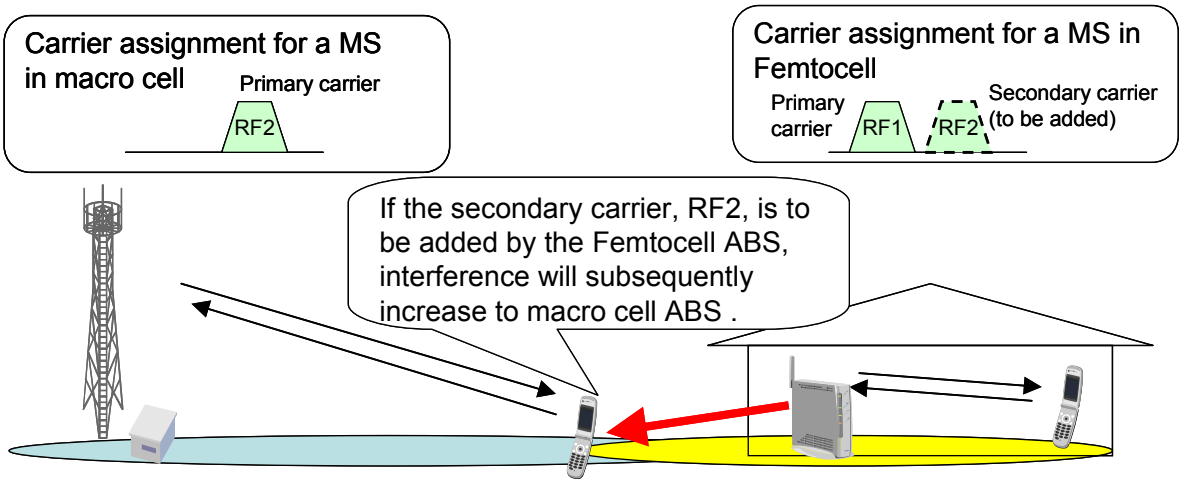

Fig.2 Illustration of the scenario of interference increase in multi-carrier operation for Femtocell ABS.

2.3 Proposed Scheme for Interference Mitigation in Multi-carrier Operation

In order to enable the necessary interference avoidance or interference mitigation schemes, the Femtocell ABS shall be capable to scan the signals transmitted from neighbor ABSs and measures the signal strength. Based on these measurements, the Femtocell ABS selects a primary carrier which has a minimum interference impact on macro/micro MSs. In this case the macro MSs will receive little interference from the Femtocell ABS even if they move closer to the Femtocell ABS.

In case of multi-carrier operation for Femtocell ABS, Femtocell ABS should also consider interference avoidance or interference mitigation when assigning the secondary carrier.

According to the secondary carrier management, macro ABS decides the activation or deactivation of secondary carrier(s) based on load condition of carriers and may transmit the list of active carriers to the AMS.

Transmit power for each carrier of the macro ABS may be used as the load condition. If the interference from Femtocell ABS to macro MS becomes large, the transmit power increase of the macro ABS will not help. Subsequently if the load condition for a carrier exceeds certain threshold, the macro ABS requests a deactivation of the secondary carrier and transmits the decision to Femtocell ABS as shown in Fig.3 below. The Femtocell ABSs can receive the deactivation information at an initial setting or during an unavailable interval in the low duty operation mode. The Femtocell ABSs will in this case avoid using this carrier as the secondary carrier.

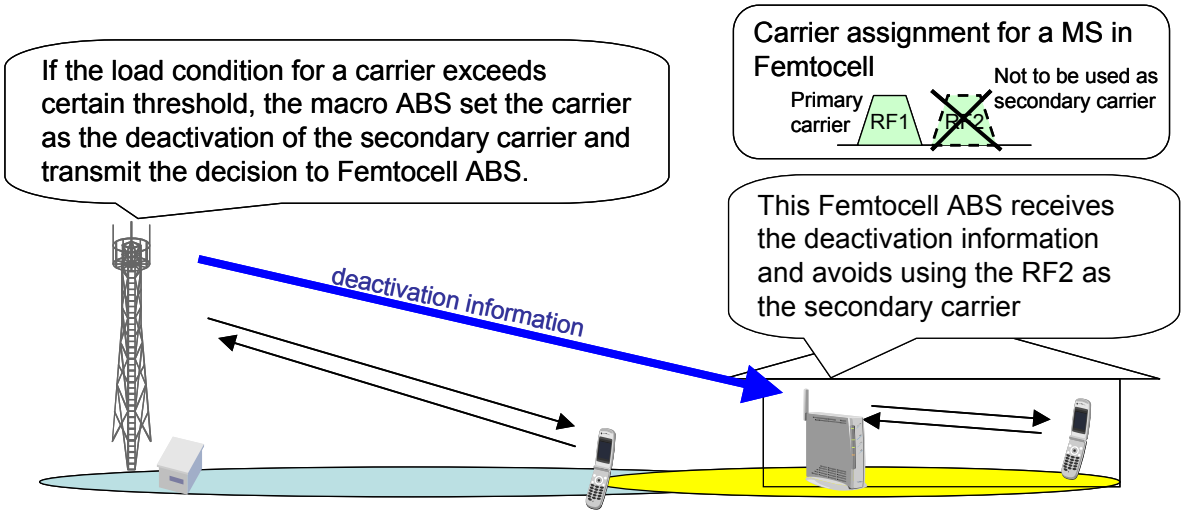

Fig.3 Proposed Scheme for interference mitigation in multi-carrier operation.

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15.4.x Multi-carrier Operation (Related to Sec. 15.16 in SDD)

Multi-carrier operation may be supported by Femtocell ABS. All operational principles for multi-carrier operation also apply to a system involving Femtocell ABS unless explicitly stated otherwise. Femtocell ABS may assign a secondary carrier to an AMS in addition to a primary carrier.

In order to enable the interference avoidance or interference mitigation schemes, the Femtocell ABS shall be capable to scan the signals transmitted from neighbor ABSs and measure the signal strength. The Femtocell ABS selects a primary carrier which has a minimum interference impact on macro/micro MSs based on the measurement.

According to the secondary carrier management, macro ABS decides the activation or deactivation of secondary carrier(s) based on load condition of carriers and may transmit the list of active carriers to the AMS. If the load condition for a carrier exceeds certain threshold, the macro ABS requests a deactivation of the secondary carrier and transmits the decision to Femtocell ABS. The Femtocell ABSs can receive the deactivation information at an initial setting or during an unavailable interval in low duty operation mode. The Femtocell ABSs shall in this case avoid using this carrier as a secondary carrier.

The carrier activation/deactivation request from the macro ABS to the Femto ABS may be transmitted using a load indicator Information Element “LD-indicator” field in S-SFH SP3. This Information Element may be implemented through a 1 bit indicator such that when “LD_indicator” is set to 1 the load is High while 0 value is used to indicate “Not High Load”

The above mentioned load indicator is controlled by a resource utilisation protocol and by adopting a pre-defined thresholds, the protocol triggers the appropriate changes in the load indicator based on resource utilisation or used power. The load indicator changes would, like other IEs within S-SFH, trigger a broadcast of the S-SFH. Alternatively the activation and deactivation request may be communicated with Femto ABS over the direct link or backhaul.

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