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Title	**Closed-loop Downlink Power Control for Femtocell BS in IEEE 802.16m Amendment**
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Re:	802.16m Amendment Working Document Call for contributions on "Support for Femtocell BS"
Abstract	This contribution proposes the power control scheme for Femtocell BS**.**
Purpose	For discussion and approval by IEEE 802.16m TG
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Closed-loop Downlink Power Control for Femtocell BS in IEEE 802.16m Amendment

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1   Introduction

In order to facilitate the power control in the femtocell, the SDD [1] defines in Section 15.12: "DL closed-loop power control shall be supported by Femtocell BS in order to reduce interference to the surrounding macro BS or neighbor Femtocell BSs."

This contribution proposes the closed-loop downlink power control procedure and related message format for femtocell BS.

2   Proposed new text in the 802.16 Amendment Working Document (IEEE 802.16m-09/0010r2)

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15.X Support for Femtocell BS

15.X.Y Closed-loop Downlink Power Control

The proposed closed-loop downlink power control scheme is as follows:

(1) The femtocell BS can request one or multiple AMSs to report measurement metrics for interference and received signal density from the ABS for specified RF spectrum resources via the downlink control channel.

(2) MSs measure and record metrics for interference and the received signal density from the BSs for each requested RF spectrum resources. These metrics can be measured by preambles and control channel.

(3) The MS reports these metrics to the serving BS via the uplink control channel. The reported value of metrics should consider the effect of their historical values. The weighted average value may be used.

(4) The BS allocates power, modulation and coding scheme, and subchannel according to QoS, loading, received metric's value, interference limitation, service type, etc. This kind of allocation is user based. Cooperation between multiple BSs, including femtocell BSs, Macrocell BSs, and Picocell BSs, may exist during the resource allocation procedure. The aim of cooperation of multiple BSs is to decrease the effect of co-channel interference.

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15.2.5 AAI MAC Management Message

15.2.5.X AAI-Femto-DLPC-REQ message (ABS requests measurement metrics on interference and received signal strength information)

The AAI-Femto-DLPC-REQ message shall be transmitted by a BS to request one or multiple MSs to report measurement metrics for interference and received signal density from the ABS for specified RF spectrum resources. The message shall be transmitted via the downlink control channel. The format of AAI-Femto-DLPC-REQ messages is shown in Table X1.

Table X1 AAI-Femto-DLPC-REQ message format

Syntax	Size (bits)	Note
AAI-Femto-DLPC-REQ _message_format() {		
Management message type	8	[TBD]
TLV encoded information	Variable	TLV-specific
}		

The following parameter shall be included in the AAI-Femto-DLPC-REQ message:
      Set of target RF spectrum (See Table Z3)
      Measurement metric type (See Table Z4)
If it is transmitted as a broadcast message, the following parameter shall be included:
      Set of target AMSs (See Section Table Z5)

15.2.5.Y AAI-Femto-DLPC-RSP message (AMS reports measurement metrics on interference and received signal strength information)

The AAI-Femto-DLPC-RSP message shall be transmitted by an MS to report the measured metrics on interference and received signal strength information to the serving BS that requests measurement metrics. The format of AAI- Femto-DLPC-RSP messages is shown in Table 2.

Table Y1 AAI-Femto-DLPC-RSP message format

Syntax	Size (bits)	Note
AAI- Femto-DLPC-RSP_message_format() {		
Management message type	8	[TBD]
TLV encoded information	Variable	TLV-specific
}		

The following parameters shall be included in the AAI-Femto-DLPC-RSP message:
      Measurement metric type (See Table Z4)
      Measurement metric values (See Table Z5)

15.3.Z AAI-Femto-DLPC-REQ/RSP management message encoding:

Table Z1 AAI-Femto-DLPC-REQ /RSP management message encodings

Type	Parameters
…	
[TBD]	Set of target AMSs
[TBD]	Set of target RF spectrum
[TBD]	Measurement metric types
[TBD]	Measurement metric values
...	

Table Z2 Set of target AMSs

Type	Length	Value	Scope
[TBD]	Variable	[# of AMSs in the list (each with ## bits); List of AMS IDs]	AAI- Femto-DLPC -REQ

Table Z3 Set of target RF spectrums resource

Type	Length	Value	Scope
[TBD]	Variable	[# of RF spectrum resources in the list; {Preamble ID of B1; # of RF spectrum resources for Preamble ID of B1; {List of required RF spectrum resources of preamble ID for B1}; ... {Preamble ID of Bn; # of RF spectrum resources for Preamble ID of Bn; {List of required RF spectrum resources of preamble ID for Bn};]	AAI- Femto-DLPC -REQ

Table Z4 Measurement metric types:

Type	Length	Value	Scope
[TBD]	8	[TBD] [Example: 0: CNR 1: CINR, 2: RSSI, … 3-255: reserved]	AAI- Femto-DLPC -REQ, AAI- Femto-DLPC -RSP

Table Z5 Measurement metric values:

Type	Length	Value	Scope
[TBD]	Variable	[TBD]	AAI- Femto-

| | | [Example:
{#of measured BS (preamble)},
{Preamble ID of B1}; { metric values on the required RF spectrum resources of B1 (According to AAI- Femto-DLPC –REQ message)};

...
{ Preamble ID of Bn}; { metric values on the required RF spectrum resources Bn};
] | DLPC -RSP |

---End of the Text---

3   References

[1] IEEE 80216m-08/003r9a "IEEE 802.16m System Description Document", 31 May 2009.