Considerations on DL power control in closed user group femtocell BS

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Keiichi Nakatsugawa, Masato Okuda, Yanling Lu, Luciano Sarperi   E-mail:

Fujitsu   Nakatsugawa@jp.fujitsu.com

    *<http://standards.ieee.org/faqs/affiliationFAQ.html>

Venue:

    IEEE 802.16m-08/040"Call for Contributions on Project 802.16m System Description Document (SDD)", in response to the following topics: "TGm SDD: Femtocells", MAC related

Base Contribution:

    N/A

Purpose:

    to be discussed and adopted by TGm for the 802.16m SDD

Notice:

Release:

Patent Policy:

Closed user group Femtocell BS

- SRD specifies requirement for a femtocell BS (fBS) to provide access to closed user group (CUG).
    - 9.5 Support for Femtocells

        "A Femtocell is a low power BS, typically installed by a subscriber in his/her home or SOHO to provide access to closed or open group of users as configured by the subscriber and/or the access provider."

- In CUG operation, the CUG members may be managed by fBS.
    - In such case, non-user MS (both 16m and legacy) may perform NW entry but it's denied.

Closed user group

MS1(**user**)

Member List:
MS1
MS2

WiMAX Operator Network

Internet

MS2(**user**)

DSL modem

fBS

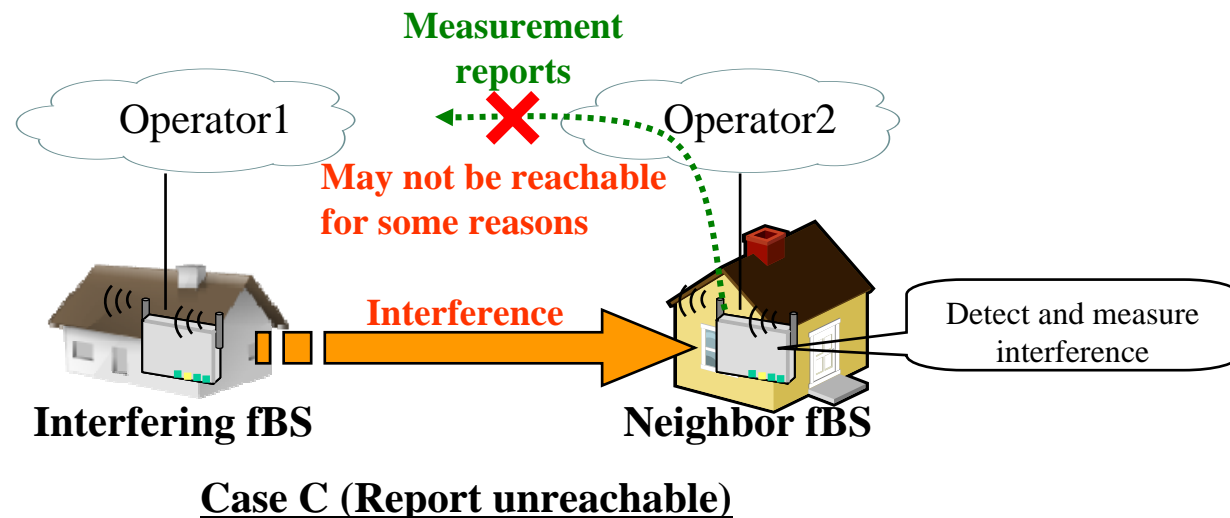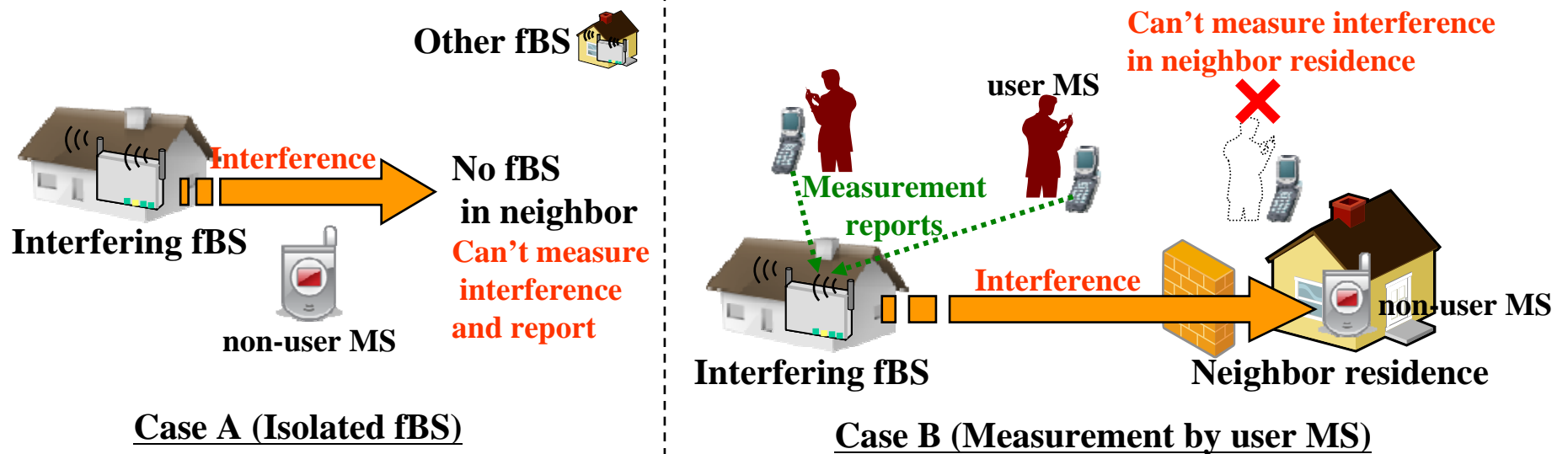**MS3(non-user)**

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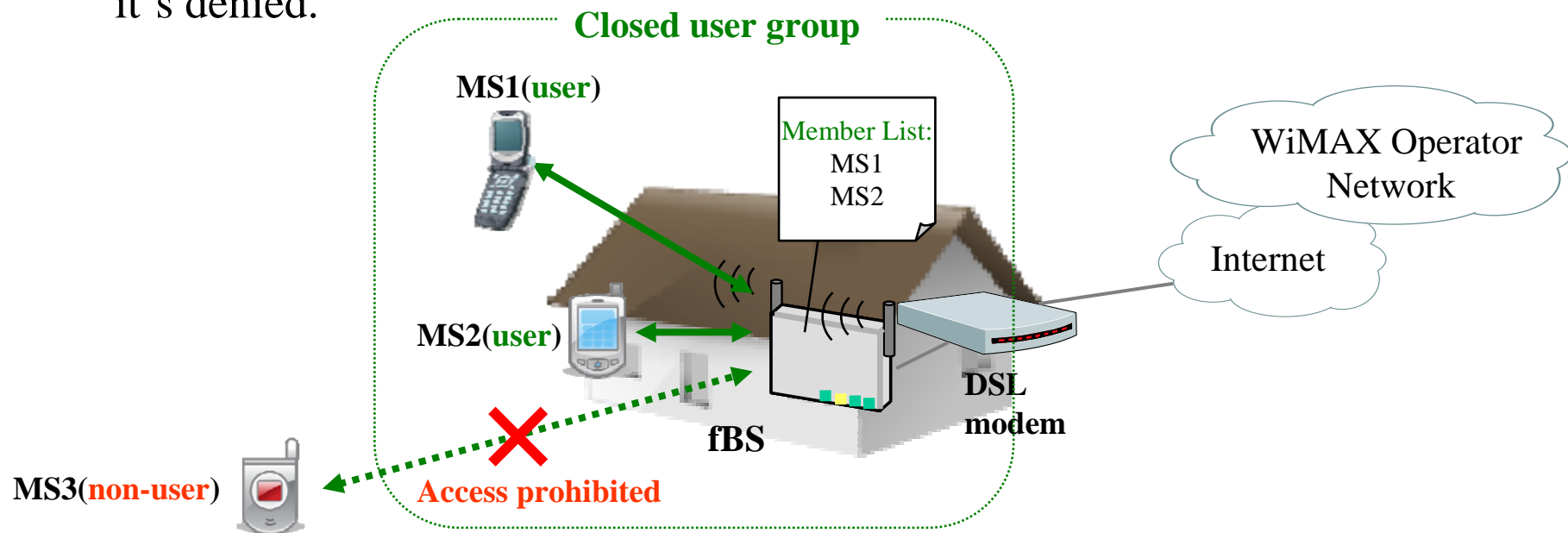
Interference mitigation for CUG fBS(1)

- fBS is a low power BS, however, the radio signals will reach the out of user's residence. (esp. dense deployment case)
  - The interference degrades performance and causes undesirable NW entry from non-user MS.

- SRD specifies requirement for interference detection and mitigation.
  - 9.5 Support for Femtocells

    "The air interface should support over the air measurements by BS or MS for interference detection and mitigation between femto-cell and microcells or among femtocells."

- In some situations, over the air measurements and its reports can not be available or practical. (See next slide)

  A. The interfering fBS is isolated, none of neighbor fBS can measure.

    Or, other fBS may barely detect the signal and return good measurement result.

  B. The interfering fBS make its user MS measurement. The user MS has to go out side of the residence and move around.

    However, the user MS can't measure interference inside the neighbor's residence.

  C. Neighbor fBS can measure interference, but for some reasons (ex. different operators), the interfering fBS may not be able to obtain measurement report.

Interference mitigation for CUG fBS(2)

- Possible cases for over the air measurements:

Other fBS

Interference

Interfering fBS

non-user MS

No fBS in neighbor

Can't measure interference and report

Case A (Isolated fBS)

Can't measure interference in neighbor residence

user MS

Measurement reports

Interfering fBS

Interference

non-user MS

Neighbor residence

Case B (Measurement by user MS)

Measurement reports

Operator1

Operator2

May not be reachable for some reasons

Interfering fBS

Interference

Neighbor fBS

Detect and measure interference

Case C (Report unreachable)

DL power control in CUG fBS(1)

- In addition to a typical interference mitigation using over the air measurements, DL power control in fBS should also support complementary interference mitigation without over the air measurements.

- Based on the statistics of NW entry denials from non-user MS, fBS recognizes itself as an interfering source and adjust DL Tx power.

Management System

Operator NW

2b

Internet

macro BS
coverage area

1 **2a**

non-user MS

fBS(CUG)

3

macro BS

fBS coverage area: **before control** / **after control**
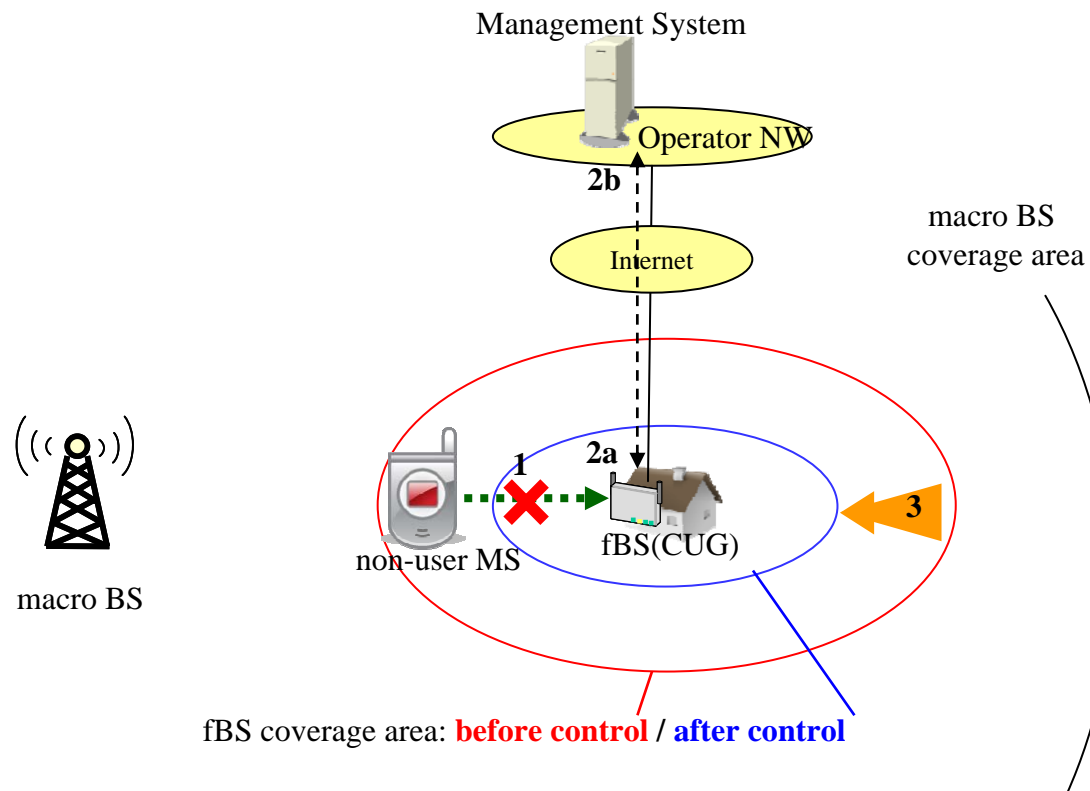
DL power control in CUG fBS(2)

Example of DL power control procedure (previous slide):

- step1

    When fBS DL transmission power is strong, some non-user of CUG attempts network entry, but it's denied.

- step2

    The fBS counts such a denial and calculates the frequency of repetitious denial (ex. x times/hour, y times/day). If the frequency exceeds a threshold, the fBS recognizes itself as an interfering source. Then it performs either step2a or 2b:

  step2a

    The fBS determines a new DL transmission power (lower) autonomously.

  step2b

    The fBS reports to management system (ex. Num/frequency of denials). Network operator determines optimal DL transmission power, then instructs it to the fBS.

- step3

    The fBS changes its DL transmission power. The coverage area of the fBS becomes smaller. After that, non-user of closed group will select macro BS.

- After step3, when DL transmission power is still strong, step 1-3 may happen repeatedly.

- And when DL transmission power becomes too weak, RSSI or CINR of user MS successfully connected to the fBS becomes worse inside the residence, the fBS may oppositely gain DL transmission power a little. By repetition of these up and down, DL transmission power will converge to an optimal level.

Proposed Text

[Insert the following new subclause to the section 17 (Support for Femtocell)]

----------------------------------- Start of the Text -------------------------------------

17 Support for femtocell

17.x Transmission power control in femtocell

Femtocell BS supporting closed user group shall deny network entry to the MS users not subscribed to the closed group, calculates the frequency of such denials, and may report it further to the network. To prevent such an undesirable network entry, based on the frequency of the network entry denials, the femtocell BS shall change transmission power autonomously or under the network management system.

----------------------------------- End of the Text -------------------------------------