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| Re: | A response to a Call for Technical Proposal, http://wirelessman.org/relay/docs/80216j-06_027.pdf | |
| Abstract | In this contribution, we propose relay grouping to better serving the mobiles and to maintain good broadcast channel quality that allows frequency reuse amongst relay groups. | |
| Purpose | To incorporate the proposed text into the P802.16j Baseline Document (IEEE 802.16j-06/026) | |
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Relay Grouping and PUSC Segment Selection for FCH/MAP Transmission

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1. Introduction

During the initial network entry, a RS first selects a station (either a MMR-BS or another RS) as its serving station. Secondly, a RS can select or is configured by its serving station a segment for transmitting FCH and MAPs. A RS may either use the same segment as or different segment from that of its serving station.

When a RS uses the same segment as that of the MMRBS (the RS does not have its own identity from a MS point of view), the system operation may be simpler, but the frequency reuse gain is not optimized. When a RS selects or is assigned a dedicated preamble sequence, this RS has its identity and can transmit its own FCH and MAPs. The benefit of the latter case is the potential gain from frequency reuse, compared to the first case. The issue of the latter case may result in higher co-channel interference on FCH/MAP transmission for certain scenarios.

In this contribution, we propose a method called RS grouping (refer to Figure 1):

- > RSs are grouped based on the segments selected (or assigned)
- > All RSs in the same group shall transmit the identical preamble, FCH and MAP. Such a group can be viewed as a Virtual Station by a MS
- > A group leader is defined as a station that is responsible for managing FCH and MAP. If a group includes MMR-BS, the MMR-BS is the leader of the group.
- > Different groups transmit different preambles, the same or different FCH and MAP from that of the associated MMR-BS
- > A MMR-BS serves one or more RS groups
- > A MS can identify its favorite access point at RS group level

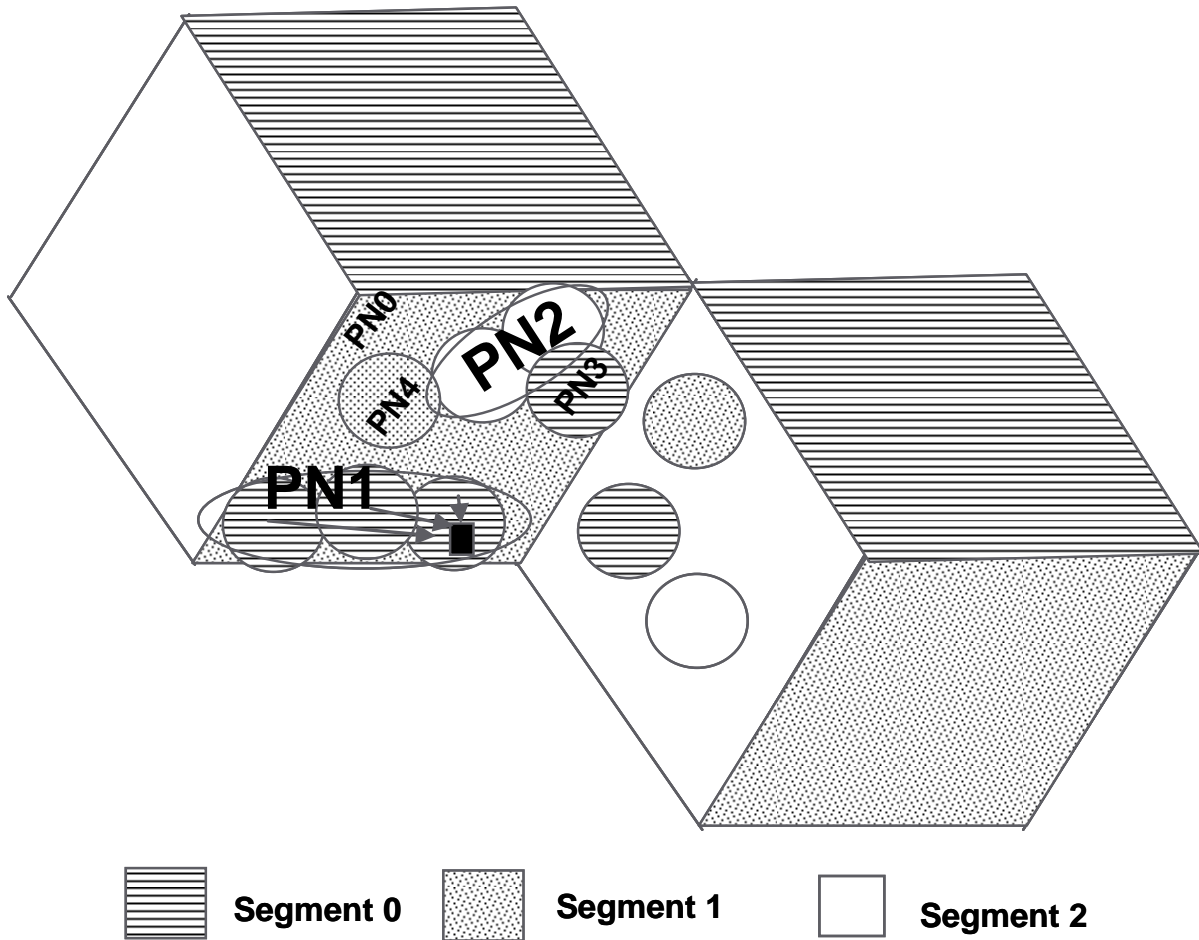


Figure 1: RS grouping

A relay, at network entry, can either create a new group, i.e., it selects or is assigned a dedicated preamble sequence index (implying the segment) or joins an existing group. The RS can perform the measurement of radio environment and then report to MMR-BS regarding the preferred preamble sequence index (implying the segment). The MMR-BS replies by either confirming the preamble sequence index selected by the RS or assigning a different one, and at the same time, providing the corresponding RS group ID.

If a RS is creating a new group, the RS becomes the group leader and shall manage its own FCH and MAP message. Otherwise, the RS shall obtain FCH/MAP message to be transmitted to MS(s), which is identical to FCH/MAP message transmitted by the corresponding group leader

2. FCH/MAP Interference Evaluation

2.1 Parameters and assumptions

- 19 Umbrella macro cells (2Km cell to cell separation)
- Tri-sector cell with cell site wrap around
- Random drop relay locations
- Number of relays per sector: 15 relays
- Carrier frequency: 2.5 GHz
- Beam Tx power is 20 watts. Relay Tx power is 600mW or 3W
- Antenna gain: base = 15 dBi; relay = -1 dBi
- Antenna pattern: base (3dB width) = 70 degrees (20 dB front to back ratio); relay = Omni
- Noise figure: 9 dB for base, relay and MS
- Thermal noise: -174 dBm/Hz
- CIR Limit: 30 dB
- Same pathloss model for base to relay, base to MS, relay to relay and relay to MS
- Shadowing: 10 dB standard deviation; 0.5 correlation
- Minimum distance: 35 m for base to relay & base to MS; No minimum between relay to relay & relay to MS
- Average CIR curves plotted are as observed by MS on the best segment reception.

2.2 Scenarios

Scenario 1 (No RS Grouping):

Each RS selects a PUSC segment which is different from the segment of its associated MMR-BS

- Each RS measures the combined segment power of the remaining two segments from all cells/sectors including its own sector

- RS selects the segment with the lower combined power

Scenario 2 (Simple RS Grouping):

Each RS group assigns a PUSC segment which is different from the segment of its associated MMR-BS

- Each RS measures the combined segment power of the remaining two segments from external cells/sectors only
- RS report the segment with the lower combined power
- All RSs that report the same segment are assigned to the same RS group by MMR-BS

2.3 Results

For individual relay case with no RS grouping, as shown in Figure 2, a degraded average FCH/MAP CIR statistics at MS are observed. However, with RS grouping, there is no degradation on average CIR statistics. In fact, it provides additional improvements in the low CIR region.

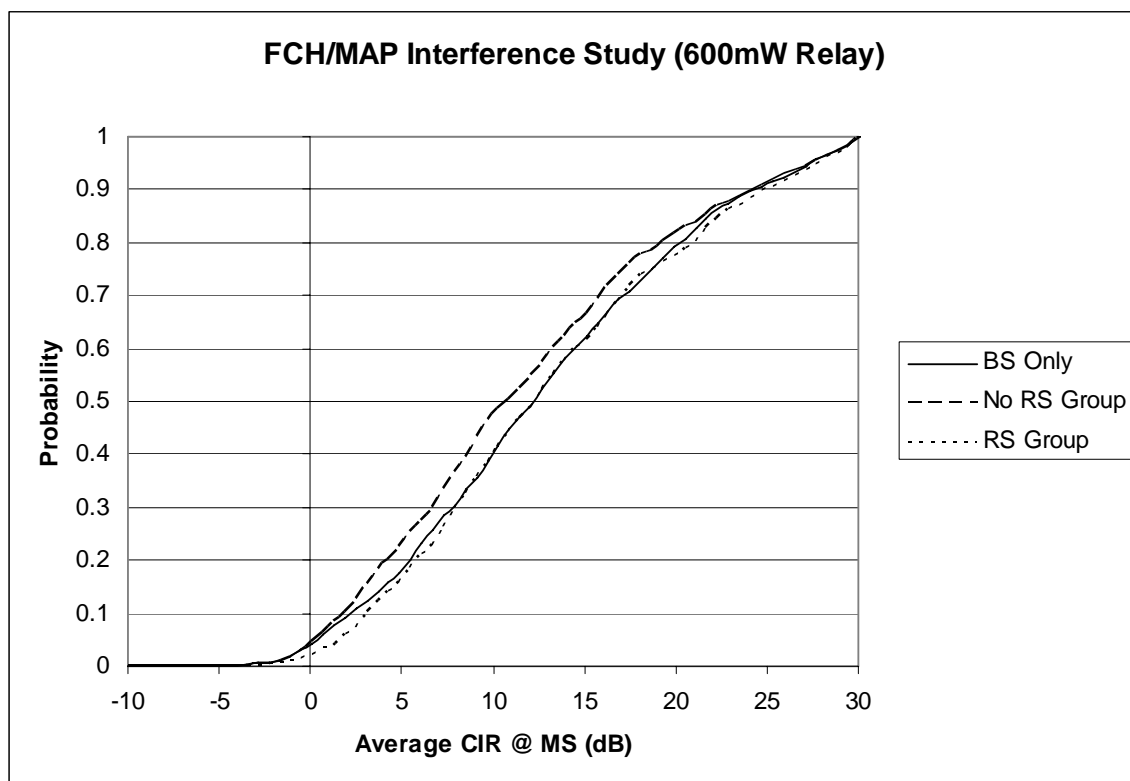


Figure 2: FCH/MAP Interference Study (600mW Relay)

For higher power relay and with no RS grouping, the results from Figure 3 indicate a further degradation in the average CIR statistics. On the other hand, with RS grouping, an improvement in slightly shifting the curve to higher CIR is observed.

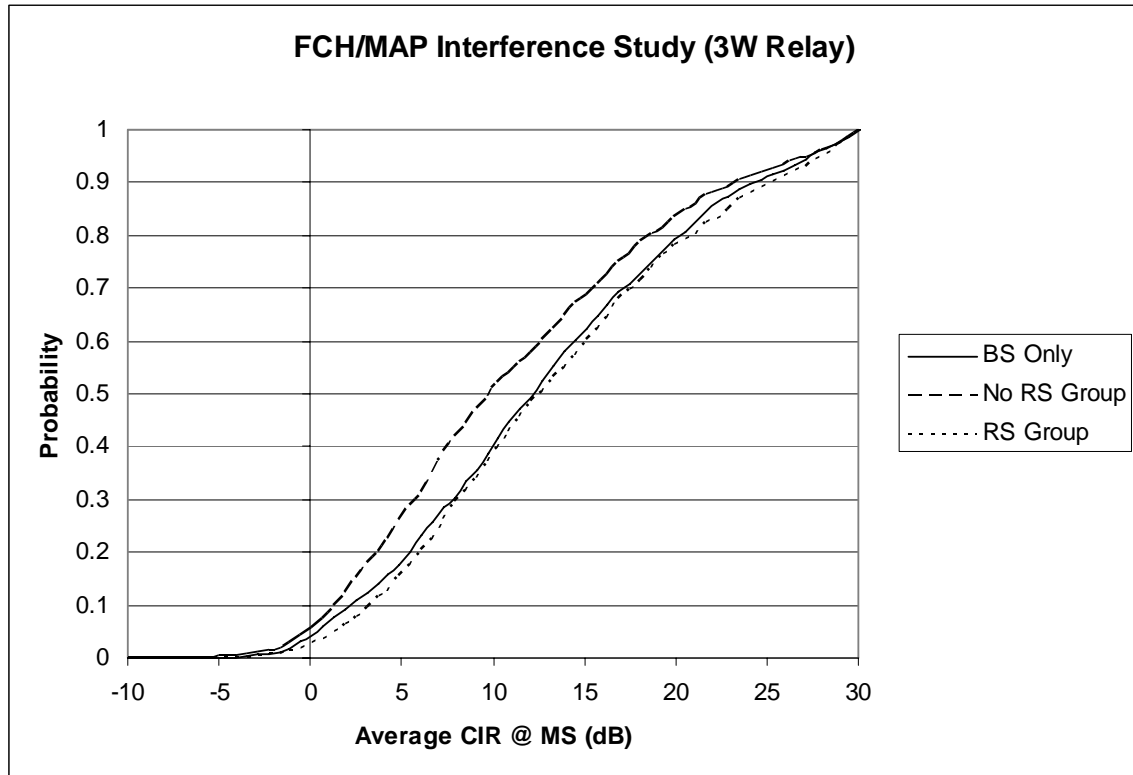


Figure 3: FCH/MAP Interference Study (3W Relay)

2.4 Evaluation Summary

In this study on RS grouping and PUSC segment selection:

- There is no degradation in average FCH/MAP CIR received at MS. In fact, there is a slight improvement especially at the lower CIR region. Without RS grouping, the CIR degraded.
- Frequency reuse is possible amongst the RS groups as each group can transmit different FCH/MAP and potentially enable higher capacity in the relaying network.

3. Proposed text change

3.1 RS grouping procedure

[Add the following section]

6.3.9.16 Network entry and initialization

6.3.9.16.1 RS network entry and initialization

6.3.9.16.1.1 RS grouping

RS grouping method includes the following characteristics:

- RSs are grouped based on the segments selected (or assigned)
- Each group is identified as RS group ID (RS Group ID)
- All RSs in the same group shall transmit the identical preamble, FCH and MAP. Such a group can be viewed as a virtual Station by a MS
- A group leader is defined as a station which is responsible for managing FCH and MAP. If a group includes MMRBS, the MMRBS is the leader of this group.
- Different groups transmit different preamble, same or different FCH and MAP from that of the associated MMRBS
- A MMRBS covers one or more RS groups
- A MS can identify its favorite access point at RS group level

A relay, at network entry, can either create a new group, i.e., it selects or is assigned a dedicated preamble index (implying the segment) or joins an existing group. The RS can perform measurement of radio environment and then report to MMRBS regarding the preferred preamble index (implying the segment) using a MAC management message. The MMRBS replies by either confirming the preamble selected by the RS or assigning a different one, and at the same time, providing the corresponding RS group ID using a MAC management message.

3.2 MAC management message to enable the RS grouping operation

3.2.1 Reuse REG-REQ/RSP

REG_REQ/RES is modified to include preamble index TLV.

[Insert the following text to the end of section 6.3.2.3.7 in Page 56]

The REG-REQ may include the following TLV:

Preamble selection

This TLV is used by a RS to indicate the preamble index to MMRBS.

[Insert the following text to the end of section 6.3.2.3.8 in Page 58]

The REG-RSP may include the following TLV:

Preamble selection

This TLV is used by a MMRBS to indicate the preamble assignment to a RS.

[Add one type in Table 369a in page 685 of IEEE std 802,16e-2005]

| Type | Parameter |
|------|---------------------------|
| 45 | <u>Preamble selection</u> |

[Add a new section 11.7.27 as described]

11.7.27 Preamble selection

This field in REG-REQ message is used by a RS to report suggested preamble index to a MMRBS for the purpose of selection of a preamble (implying the segment) to be used by the RS after it assumes a RS function.

This field in REG-RSP message is used by a MMRBS to indicate to a RS regarding the preamble assigned.

| Type | Length | Value | Scope |
|------|----------|-------------------------|--------------------|
| 45 | <u>1</u> | <u>A preamble index</u> | <u>REG-REQ/RSP</u> |

3.2.2 Use RS_Config-REQ/RSP message

[Add two new section 6.3.2.3.62 and 6.3.2.3.63 as described]

6.3.2.3.62 RS configuration request message

This message may be transmitted by a RS to request some physical layer operation parameters. A RS may use this message to report information to facilitate the determination of a MMR-BS on configuration of RS operation parameters.

Table XXX. RS Config-REQ message format.

| Syntax | Size | Notes |
|--|---------------|--|
| <u>RS Config-REQ format {</u> | | |
| <u>Management message type = 67</u> | <u>8 bits</u> | |
| <u>Configuration para type</u> | <u>8 bits</u> | <u>b0 = 1: preamble configuration is included;</u> <u>b1 – b7: reserved</u> |
| <u>If (b0 of Configured para type == 1) {</u> | <u>8 bits</u> | |
| <u>Preamble_index }</u> | <u>7 bits</u> | <u>Preamble_index</u> |
| <u>}</u> | | |

Configuration para type

The first bit is used as preamble index indicator to indicate the preamble_index field appearance in this message

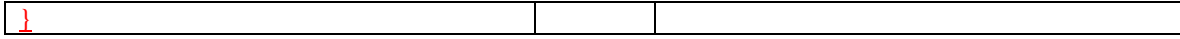
Preamble index

This field is used to indicate the preamble index

6.3.2.3.63 MMR-BS configuration response message

This message may be transmitted by a MMR-BS for the purpose of RS configuration. A MMR-BS may use this message to set operation parameters for a RS. MMR-BS may transmit this message as a response to RS_Config-REQ or as an unsolicited message.

| Syntax | Size | Notes |
|--|---------------|--|
| <u>RS Config-RSP format {</u> | | |
| <u>Management message type = 68</u> | <u>8 bits</u> | |
| <u>Configured para type</u> | <u>8 bits</u> | <u>b0 = 1: preamble configuration is included;</u> <u>b1 – b7: reserved</u> |
| <u>If (b0 of Configured para type == 1) {</u> | <u>8 bits</u> | |
| <u>Preamble_index }</u> | <u>7 bits</u> | <u>Preamble_index</u> |



Configuration para type

The first bit is used as preamble index indicator to indicate the preamble_index field appearance in this message

Preamble index

This field is used to indicate the preamble index