A Recommendation on PMP Mode Compatible Frame Structure

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This is a response to IEEE 802.16mmr-05/001(call for contributions: IEEE 802.16’s Study Group on Mobile Multi-hop Relay) to present a compatible frame structure.

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Purpose

- To propose a frame structure that is compatible to the TDD mode with no relaying
  - BS/RS and RS/MS use the same frequency, i.e., homogeneous relaying.

- From the BS viewpoint, an RS behaves the same as an SS. The transmission/reception burst is controlled by the BS.

- From the MS viewpoint, an RS just performs coverage extension and is transparent to MSs.
Scenario

BS

RS1

MS1

MS2

RS2

BM (base station to mobile station)

BR (base station to relay station)

RB (relay station to base station)

MB (mobile station to base station)

RM (relay station to mobile station)

RM (mobile station to relay station)

Multi-hop relay

Two-hop relay
Frame Structure for Multi-hop Relay

TDD Frame Structure

DL sub-frame

UL sub-frame

P  F  C  H
DL burst #1  BR/BM  RM  C  MR  RB/MB

(DL-MAP,
UL-MAP,...)

DL sub-frame

UL sub-frame

P  MAP  Data burst  C  Data burst

BR/BM  RM

MR  RB/MB

C  contention area
FCH  frame control header
P  preamble

BM  base station to mobile station
BR  base station to relay station
MB  mobile station to base station
MR  mobile station to relay station
RB  relay station to base station
RM  relay station to mobile station
Simplified Frame Structure for Two-hop

- **C**: contention area
- **FCH**: frame control header
- **P**: preamble
- **BM**: base station to mobile station
- **BR**: base station to relay station
- **MB**: mobile station to base station
- **MR**: mobile station to relay station
- **RB**: relay station to base station
- **RM**: relay station to mobile station

- **If there is no need to provide MAP at RS, the frequency domain can be further partitioned for BS/MS and RS/MS at the same time.**
- **Otherwise, the coexistence of BS/MS and RS/MS at the same time will reduce the flexibility to enable multihop relay capability.**
Example of Two Hop Relaying

**DL sub-frame**

<table>
<thead>
<tr>
<th>P</th>
<th>FCH</th>
<th>MAP</th>
<th>RS (CID a)</th>
<th>MS1 (CID 1)</th>
<th>MS2 (CID 2)</th>
<th>...</th>
<th>C</th>
<th>MS1 (CID 3)</th>
<th>MS2 (CID 4)</th>
<th>...</th>
<th>RS (CID b)</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**UL sub-frame**

<table>
<thead>
<tr>
<th>CID a</th>
<th>RSE</th>
<th>MS1 PDU</th>
<th>MS2 PDU</th>
<th>CID b</th>
<th>MS1 PDU</th>
<th>MS2 PDU</th>
</tr>
</thead>
</table>

**Relay Station DL PDU**

**Relay Station UL PDU**

RSE relay service element
Relay Service Element (RSE)

- RSE is the control PDU for an RS to know the following info
  - The downlink relaying service CIDs and their DL burst profiles of the MSs served by the RS.
  - The uplink relaying service CIDs and their UL burst profiles of the MSs served by the RS.
  - For last page example, RES consists of
    - Burst profile for CID 1
    - Burst profile for CID 2
    - Burst profile for CID 3
    - Burst profile for CID 4