IEEE P802.22
Wireless RANs

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| MAC Frame Modification |
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Abstract

MAC Frame Modifications are added in this document.

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1. 802.22b OFDMA Frame Forwarding in a Relay Network
	1. 802.22b Network



Example of a 802.22b Network

* 1. Possible Connections

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|  | A-BS | C-A-CPE 1 | C-A-CPE 2 | D-A-CPE 1 | D-A-CPE 2 | S-CPE 1 | S-CPE 2 | S-CPE 3 | S-CPE 4 | S-CPE 5 | S-CPE 6 | S-CPE 7 | S-CPE 8 | S-CPE 9 | S-CPE 10 |
| A-BS |  | AZ | AZ | AZ | AZ | AZ | AZ | AZ | AZ | AZ | AZ |  |  |  |  |
| C-A-CPE 1 |  |  |  |  |  |  |  | CRZ | CRZ |  |  |  |  |  |  |
| C-A-CPE 2 |  |  |  |  |  |  |  |  |  | CRZ | CRZ |  |  |  |  |
| D-A-CPE 1 |  |  |  |  |  |  |  |  |  |  |  | DRZ | DRZ |  |  |
| D-A-CPE 2 |  |  |  |  |  |  |  |  |  |  |  |  |  | DRZ | DRZ |

* 1. Downstream MAP Construction for downstream

DS-MAP

 --- DS-MAP IE [0] :: DIUC (62) :: Extended DIUC Code (0x01)

 --- Multi-Zone Configuration IE ()

 ---- Number of Zone (4)

 ---- Zone Index (0) :: Zone Mode (0) :: Access Zone :: OFDMA symbol offset :: zone duration

 ---- Zone Index (1) :: Zone Mode (1) :: Centralized Relay Zone :: OFDMA symbol offset :: zone duration

 ---- Zone Index (2) :: Zone Mode (2) :: Distributed Relay Zone :: OFDMA symbol offset :: zone duration

 ---- Zone Index (3) :: Zone Mode (2) :: Distributed Relay Zone :: OFDMA symbol offset :: zone duration

 --- DS-MAP IE [1]:: DIUC (62):: Extended DIUC Code (0x02)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (S-CPE 1)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (Off)

 --- Relay Node (Null)

* Relay mode (1bit) and Relay node (13bits) are newly added on AZDS-MAP IE. Relay mode is a indication whether the burst allocated in AZDS-MAP is relayed or not. Relay node is a centralized scheduling A-CPE’s SID when relay mode is set. When relay mode is set, the burst allocated in AZDS-MAP shall be transmitted to the centralized scheduling A-CPE, then shall be relayed to the target S-CPE.
* S-CPE 1 is directly connected to A-BS, then relay mode is off.

 --- DS-MAP IE [2] :: DIUC (62):: Extended DIUC Code (0x02)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (S-CPE 2)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (Off)

 --- Relay Node (Null)

* S-CPE 2 is directly connected to A-BS, then relay mode is off.

 --- DS-MAP IE [3] :: DIUC (62):: Extended DIUC Code (0x02)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (S-CPE 3)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (Off)

 --- Relay Node (Null)

* S-CPE 3 is connected to A-BS throught centralized scheduling A-CPE 1. There are two choices for downstream, which is a direct transmission from A-BS to S-CPE or is a relay transmission through the centralized scheduling A-CPE
* Relay mode is off, then downstream is transmitted to S-CPE directly.

 --- DS-MAP IE [4] :: DIUC (62):: Extended DIUC Code (0x02)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (S-CPE 4)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (Off)

 --- Relay Node (Null)

* S-CPE 4 is connected to A-BS throught centralized scheduling A-CPE 1. There are two choices for downstream, which is a direct transmission from A-BS to S-CPE or is a relay transmission through the centralized scheduling A-CPE
* Relay mode is off, then downstream is transmitted to S-CPE directly.

 --- DS-MAP IE [5] :: DIUC (62):: Extended DIUC Code (0x02)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (S-CPE 5)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (On)

 --- Relay Node (Centralized Scheduling A-CPE 2’s SID)

* S-CPE 5 is connected to A-BS throught centralized scheduling A-CPE 2. There are two choices for downstream, which is a direct transmission from A-BS to S-CPE or is a relay transmission through the centralized scheduling A-CPE
* Relay mode is set, then downstream is transmitted to S-CPE through the centralized scheduling A-CPE indicated in Relay node. If S-CPE receives downstream in AZ, it can ignore received downstream

 --- DS-MAP IE [6] :: DIUC (62):: Extended DIUC Code (0x03)

 --- CRZDS-MAP IE

 --- Zone Index (1)

 --- DIUC

 --- SID (S-CPE 5)

 --- CRZ Start Offset (y slots)

 --- Length (x slots)

 --- Boosting

* For relay burst transmission, the slot allocation in centralized relay zone (CRZ) is defined in CRZDS-MAP. Centralized scheduling A-CPE shall transmit the received burst in AZ to S-CPE through the allocated CRZ.

 --- DS-MAP IE [7] :: DIUC (62):: Extended DIUC Code (0x02)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (S-CPE 6)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (On)

 --- Relay Node (Centralized Scheduling A-CPE 2’s SID)

* S-CPE 6 is connected to A-BS throught centralized scheduling A-CPE 2. There are two choices for downstream, which is a direct transmission from A-BS to S-CPE or is a relay transmission through the centralized scheduling A-CPE
* Relay mode is set, then downstream is transmitted to S-CPE through the centralized scheduling A-CPE indicated in Relay node.

 --- DS-MAP IE [8] :: DIUC (62):: Extended DIUC Code (0x03)

 --- CRZDS-MAP IE

 --- Zone Index (1)

 --- DIUC

 --- SID (S-CPE 6)

 --- CRZ Start Offset (x+y slots)

 --- Length (x slots)

 --- Boosting

* For relay burst transmission, the slot allocation in centralized relay zone (CRZ) is defined in CRZDS-MAP. Centralized scheduling A-CPE shall transmit the received burst in AZ to S-CPE through the allocated CRZ.

 --- DS-MAP IE [9] :: DIUC (62):: Extended DIUC Code (0x04)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (Null or Distributed Scheduling A-CPE 1’s SID)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (On/Off)

 --- Relay Node (Distributed Scheduling A-CPE 1’s SID)

* S-CPE 7 is connected to A-BS throught distributed scheduling A-CPE 1. S-CPE7 is managed by the distbuted scheduling A-CPE, then all downstream bursts from A-BS shall be transmitted to the distributed scheduling A-CPE
* For relay burst transmission on distributes scheduling A-CPE, the distributed scheduling A-CPE shall transmit DS-MAP including the downstream slot allocation to S-CPE as same as A-BS.

 --- DS-MAP IE [10] :: DIUC (62):: Extended DIUC Code (0x04)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (Null or Distributed Scheduling A-CPE 1’s SID)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (On/Off)

 --- Relay Node (Distributed Scheduling A-CPE 1’s SID)

 --- DS-MAP IE [11] :: DIUC (62):: Extended DIUC Code (0x04)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (Null or Distributed Scheduling A-CPE 2’s SID)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (On/Off)

 --- Relay Node (Distributed Scheduling A-CPE 2’s SID)

 --- DS-MAP IE [12] :: DIUC (62):: Extended DIUC Code (0x04)

 --- AZDS-MAP IE

 --- Zone Index (0)

 --- DIUC

 --- SID (Null or Distributed Scheduling A-CPE 2’s SID)

 --- Length (x slots)

 --- Boosting

 --- Relay Mode (On/Off)

 --- Relay Node (Distributed Scheduling A-CPE 2’s SID)



* 1. Downstream Frame Modifications
* DS-MAP message is transmitted by only BS, A-BS and Distributed Scheduling A-CPE.
* DS-MAP IE [] can be defined by AZDS-MAP IE, CRZDS-MAP IE and DRZDS-GRA-IE from DIUC value, then AZDS-MAP IE, CRZDS-MAP IE, DRZDS-MAP IE and DRZDS-GRA-IE defined in DS-MAP IE[] are duplicated. Then, remove them from DS-MAP message.

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| * **DS-MAP message format**
 |
| **Syntax** | **Size** | **Note** |
| DS-MAP\_Message\_Format() { |  |  |
| Management Message Type = 1 | 8 bits |  |
| DCD Count | 8 bits | Matches the value of the configuration change count of the DCD, which describes the downstream burst profiles that apply to this map. |
| If (transmitted by BS or A-BS or distributed scheduling A-CPE) { |  |  |
| Begin PHY Specific Section { |  |  |
| Number of IEs: n | 12 bits | Number of IEs in the downstream map |
| for (*i* = 1; *i*=< n; i++) { |  | PHY specific (7.7.2.1) |
| DS-MAP\_IE() | Variable |  |
| } |  |  |
| } |  |  |
| } |  |  |
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| If(!byte\_boundary) |  |  |
| Padding bits | 0-7 bits |  |
| } |  |  |

* DRZDS-MAP IE is considered to use DS-MAP Information in DRZ, thus DRZDS-MAP IE is the duplication of DS-MAP IE. Then remove it.

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| **Table 28a** **- Extended DIUC IE Type** |
| **Extended DIUC** | **Usage** |
| 0x00 | DS-MAP Dummy Extended IE |
| 0x01 | DS Multi-Zone Configuration IE |
| 0x02 | AZDS-MAP IE |
| 0x03 | CRZDS-MAP IE |
| 0x04 |  |
| 0x05 | DS-MAP GRA IE |
| 0x05-0xFF | Reserved |

* DS Multi-Zone Configuration IE is only defined in Multi-Zone Configuration, then any MAP IE is not necessary in this IE.
* Zone Index indicates what kind of zone is used.
* AZ is dedicated in A-BS.
* CRZ can be used by multiple centralized scheduling A-CPEs, however DRZ is dedicated by one distributed scheduling A-CPE.

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| **Table F1 - DS Multi-Zone Configuration IE format** |
| **Syntax** | **Size** | **Notes** |
| DS Multi-Zone Configuration\_IE() { |  |  |
| Multi-Zone Configuration{ |  |  |
| Number of zones | 8 bits | Number of zones including access and relay zones. Number of zones (0) is not available of DS. Number of zone (1) shall be access zone.  |
| For(i=1; i =< Number of zones; i++){ |  |  |
| Zone Index | 8 bits | Increase the index from 0 to Number of Zones-1 |
| Zone Mode | 2 bits | 0: access zone1: centralized relay zone2: distributed relay zone |
| Used Segment Bitmap | 4 bits | Bit 1: Segment 0Bit 2: Segment 1Bit 3: Segment 2Bit 4: ReservedSegmentation is only used in distributed relay zone |
| } |  |  |
| } |  |  |
| for(Zone index=0; Zone index < Number of zones; Zone index++){ |  |  |
| OFDMA symbol offset | 7 bits | The zone starts at the OFDMA symbol offset, counted after the preamble of the frame |
| Zone duration | 5 bits | The zone ends after the zone duration starting from the OFDMA symbol offset. The unit of duration is an OFDMA symbol |
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| if (Zone mode == 2) { |  | Distributed Relay Zone (DRZ) mode |
| SID | 13 bits | SID of distributed scheduling R-CPE |
| } |  |  |
| } |  |  |
| } |  |  |

* Zone Index indicates whether the current slot is allocated for AZ, CRZ or DRZ.
* When A-BS may transmit a downstream burst to a S-CPE, there are two choices. One is direct transmission to S-CPE, and another is a relay transmission through the centralized scheduling A-CPE. For a direct transmission, SID is a final destination of S-CPE, and then no relay A-CPE is necessary. But, for a relay transmission, at first A-BS sends the burst to the centralized scheduling A-CPE.In this case, relay mode is “on” and set to relay node of a relay node ID (a centralized scheduling A-CPE). A centralized scheduling A-CPE relays the received burst to S-CPE indicated in SID.

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| **Table G1 - AZDS-MAP IE** |
| **Syntax** | **Size** | **Notes** |
| AZDS-MAP\_IE(){ |  |  |
| Zone Index | 8 bits | See Table F1 |
| DIUC | 6bits | 7.7.2.1.1 |
|  if (DIUC == 12) |  |  |
|  Extended DIUC Value | 6 bits | See Table 27a |
| SID | 13 bits | Station ID of CPE or multicast group. |
| Length | 12 bits | Number of OFDM slots linearly allocated to the DSburst specified by this IE. |
| Boosting | 3 bits | 111: +9 dB110: +6 dB101: +3 dB100: 0 dB, normal (not boosted)011: –3 dB010: –6 dB001: –9 dB000: –12 dB |
| Relay Mode | 1 bit | 0: No relay1: Relay mode on |
| Relay Node | 13 bits | Centralized Scheduling A-CPE’s SID when relay mode is set 1 |
| } |  |  |

* Zone Index indicates whether the current slot is allocated for AZ, CRZ or DRZ.
* A centralized scheduling A-CPE relays the received burst to S-CPE indicated in SID.

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| **Table H1 - CRZDS-MAP IE** |
| **Syntax** | **Size** | **Notes** |
| CRZDS-MAP\_IE(){ |  |  |
| Zone Index | 8 bits | See Table F1 |
| DIUC | 6bits | 7.7.2.1.1 |
|  if (DIUC == 12) |  |  |
|  Extended DIUC Value | 6 bits | See  |
| SID | 13 bits | Station ID of CPE or multicast group. |
| CRZ Start Offset | 12 bits | Number of OFDMA slots counted after the centralized relay zone mode start |
| Length | 12 bits | Number of OFDM slots linearly allocated to the CRZDS burst specified by this IE. |
| Boosting | 3 bits | 111: +9 dB110: +6 dB101: +3 dB100: 0 dB, normal (not boosted)011: –3 dB010: –6 dB001: –9 dB000: –12 dB |
| } |  |  |

* DRZDS-MAP IE is duplication of DS-MAP IE.

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