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Re:  This is a response to Call for Technical Proposals regarding IEEE Project P802.16j.
Abstract  The document contains technical proposals for IEEE P802.16j that would provide a Data Relay of RS using additional MAP_IE().
Purpose  The document is submitted for review by 802.16 Working Group members.
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MAP-based Data Relay for Transparent RS

Sungcheol Chang, Juhee Kim and Chulsik Yoon
ETRI

1. Introduction
All the radio resources are allocated by the BS and resource allocation information is broadcasted to all the MSs in IEEE 802.16 specifications. The MAP messages describe all the resource allocations in both downlink and uplink. The MS receives the MAP message in the symbols followed by the preamble and gets information about allocated resources to the MS. The PHY burst in the allocated resource consists of MAC PDUs.

DL-MAP_IE() and UL-MAP_IE() describe the allocations in downlink and uplink, respectively. The MAP messages describe the radio resources as symbols and subchannels in 2D expression. Within the rectangular resource the allocations is done in frequency-first order in downlink. HARQ DL-MAP_IE() in downlink uses this two-step description of the allocations. The uplink resources are allocated in time-first order. HARQ UL-MAP_IE() consists of bursts. There are sub-bursts in the burst in both HARQ DL-MAP_IE() and HARQ UL-MAP_IE().

![Figure 1 MAP IEs and allocations.](image)

Legacy MAP IEs in the IEEE 802.16 specifications are designed only for the MS that is a terminator in downlink and a originator in uplink. The RS requires new MAP IEs having information about both the allocation for receiving and the allocation for sending.

2. Proposed Solution
MR-BS and Transparent RSs within a cell use one MAP in a frame and all the transparent RSs can receive the MAP. (Note: This characteristics is independent of adapting signal regeneration function like repeaters which have been available in the cellular systems.) If the radio resource is managed only by the MR-BS within the cell, the allocated information shall be delivered to the RSs so that the RSs can generate related signals in the pointed resources. This proposal is based on the MAP messages for delivering the resource-allocated information to the RSs.

This contribution introduces new Relay IEs in the MAP messages. The BS informs the RSs of the allocated resource. The RS receives Relay IEs that consists of Rx resource description, RS identifiers, and Tx resource description. The resource description may be either MAP IE index or the resources specified by 2D-expression or 1D-expression. The MAP IE index just indicates the index of the MAP IE that has the resource description. Generally the Relay IE has the resource for RS’s receiving and the MAP IE index identifying the MAP IE of the resource for RS’s transmitting. Also the Relay IE has the RS identifiers that notify the
involved RSs. The involved RSs shall receive the data in the Rx resource and buffer it until transmitting. The involved RSs receive the MAP IE pointed by Tx MAP IE index and transmit the data in the Tx resource. Multiple RSs can transmit the same data to other RS or the MS in a Tx resource allocation. These Relay IEs have an instance of the specification of cooperative RSs.

DL-Relay_IE() and HARQ DL-Relay_IE() are introduced in downlink and UL-Relay_IE() and HARQ UL-Relay_IE() are introduced in uplink. DL-Relay_IE() and UL-Relay_IE() have information about one hop operation of one allocation. HARQ DL-Relay_IE() and HARQ UL-Relay_IE() has information about one hop operation of multiple sub-bursts in multiple bursts. Those MAP IEs are based on MAP IEs including DL-MAP_IE(), UL-MAP_IE(), HARQ DL-MAP_IE(), and HARQ UL-MAP_IE(). Newly added MAP IEs describe the relay operations with similar allocation styles. Figure 3 shows a downlink example that the RSs use DL-Relay_IE() and the MS uses legacy DL-MAP_IE(). The first DL-Relay_IE() forces RS1 to relay the data. RS1 and RS2 shall relay the same data at the same time so that the MS receives the data with more good quality. The MS uses the legacy DL-MAP_IE(). Because one MAP describes one hop operation, the various configurations are possible. This example shows four possibilities from Time Example A to Time Example D the MMR-BS. The MMR-BS can select the resource allocation with various options.

![Diagram](image)

**Figure 2** Relaying downlink data using relay MAP, DL-Relay_IE().

Figure 4 shows an uplink example that the MS uses legacy UL-MAP_IE() and the RSs use UL-Relay_IE(). The MS send the data in the uplink allocation of UL-MAP_IE(). In the same frame UL-Relay_IE() shall exist. This UL-Relay_IE() forces RS2 and RS3 to receive the signal from MS and send it. The last UL-Relay_IE() has information that the RS1 sends the data. Because one MAP describes one hop operation, the various configurations are possible. This example shows four possibilities from Time Example A to Time Example D. The MMR-BS can select the resource allocation with various options.

HARQ DL-Relay_IE() and HARQ UL-Relay_IE() are designed with the same concept of describing RS’s one hop operation. As
legacy HARQ DL-MAP_IE() and HARQ UL-MAP_IE() have sub-bursts of bursts in an information element, HARQ DL-Relay_IE() and HARQ UL-Relay_IE() have descriptions of sub-bursts of bursts in an information element.

This contribution introduces the MAP IE index that points the MAP IE(). Generally MAP IE() may not be completed by itself but also related to other information. The index method uses just linking information and all the other MAP information is described in the pointed MAP information. This index method reduces the cost of describing the same information.

![Diagram of relay uplink data using relay MAP, UL-Relay_IE().](image)

**Figure 3** Relaying uplink data using relay MAP, UL-Relay_IE().

### Text Proposals

[Insert the text after 6.3.7.7:]

#### 6.3.7.7.1 Relaying data burst

Exchanging data between the MS and the MMR-BS is based on the resource allocation and its notification to two communication entities. The MMR-BS allocates the radio resources and broadcasts allocation information to corresponding entities. The allocation resource information described in the MAP message is sent by the MMR-BS to all the RSs and MSs within cell coverage. The RS shall get information about the allocation in which it may receive the relayed data. The RS holds the received data in a few frames and transmits the data in the allocation.
The allocation information of RS in downlink is the form of DL-Relay IE() and HARQ DL-Relay IE(). For the uplink UL-Relay IE() and HARQ UL-Relay IE() are added. Commonly the relay information about both the burst in either DL-MAP IE() or UL-MAP IE() and the sub-burst in either HARQ DL-MAP IE() or HARQ UL-MAP IE(), consists of three parts: the allocation for receiving, RS identifiers, and the allocation for sending. The allocation may be either the allocated resource description or the pointer of related MAP information element. The allocation for sending may be in the same frame that the allocation for receiving is. Also the allocation for sending may be in a few frames later. The DL-MAP IE() is the last information element in the downlink and the UL-MAP IE() is the first information element in the uplink when a relay path between the MMR-BS and the MS is established.

In the view of receiving the signal, RSs sending the same data increase the received signal strength in the receiver. If the BS allocates an allocation, RSs in the selected path should send the same data so that the receiver can get the received signal at a time. The sending RS can adjust its transmitting power level according to the amount specified by the MAP message.

8.4.5.3.28 DL-Relay IE()

The DL-Relay IE() consists of downlink allocation part for receiving, RS identifiers, and downlink allocation part for transmitting. The RSs receive the data from the downlink allocations and relay the data in the downlink allocations for transmission. The downlink allocation for the transmission of the RS may be in same downlink sub-frame or a few downlink sub-frames later. The legacy DL-MAP IE() sent to the MS is the last in a relaying path from the MMR-BS to the MS.

Table bbb- DL-Relay_IE() format

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIUC</td>
<td>4 bits</td>
<td>15</td>
</tr>
<tr>
<td>DL_extended-2_IE()</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended-2 DIUC</td>
</tr>
<tr>
<td></td>
<td>4 bits</td>
<td>? (B-D, F)</td>
</tr>
<tr>
<td>Length</td>
<td>8 bits</td>
<td></td>
</tr>
<tr>
<td>Rx OFDMA Symbol offset</td>
<td>8 bits</td>
<td></td>
</tr>
<tr>
<td>Rx Subchannel offset</td>
<td>6 bits</td>
<td></td>
</tr>
<tr>
<td>Rx Boosting</td>
<td>3 bits</td>
<td>000: Normal (not boosted); 001: 6dB; 010: -6dB; 011: +9dB; 100: +3dB; 101: -3dB; 110: -9dB; 111: -12dB</td>
</tr>
<tr>
<td>Rx No. OFDMA Symbols</td>
<td>7 bits</td>
<td></td>
</tr>
<tr>
<td>Rx No. Subchannels</td>
<td>6 bits</td>
<td></td>
</tr>
<tr>
<td>Rx Repetition Coding Indication</td>
<td>2 bits</td>
<td>0b00 – No repetition coding; 0b01 – Repetition coding of 2 used; 0b10 – Repetition coding of 4 used; 0b11 – Repetition coding of 6 used</td>
</tr>
<tr>
<td>Rx DIUC</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>N_RS_RxTx</td>
<td>2 bits</td>
<td>The number of Relay Station</td>
</tr>
<tr>
<td>Field</td>
<td>Length</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Reserved</em></td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>For (n=0; n&lt;N_RS_RxTx; n++) {}</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>RxTx RS ID</em></td>
<td>16 bits</td>
<td>Basic CID</td>
</tr>
<tr>
<td><em>Tx Boosting Adjustment</em></td>
<td>4 bits</td>
<td>Signed value in units of 0.5 dB units</td>
</tr>
<tr>
<td><em>Tx DL-MAP_IE frame offset</em></td>
<td>2 bits</td>
<td></td>
</tr>
</tbody>
</table>
| _Tx DL-MAP_IE Sub-MAP offset_    | 2 bits | 0b00: default MAP  
0b01-0b11: Sub-MAP offset                                              |
| _Tx DL-MAP_IE offset_            | 4 bits |                                                                                  |
| _Padding_                         | variable| Number of bits required to align to byte length. Shall be set to zero.            |

**Rx OFDMA Symbol offset**
The offset of OFDMA symbol in which the burst starts.

**Rx Subchannel offset**
The lowest index OFDMA subchannel used for carrying the burst, starting from subchannel 0.

**Rx Boosting**
Power boost applied to the data subcarriers of the burst.

**Rx No. OFDMA Symbol**
The number of OFDMA symbols for the allocation.

**Rx No. Subchannel**
The number of Subchannels for the allocation.

**Rx Repetition Coding Indication**
Indicates the repetition code used inside the allocated burst.

**Rx DIUC**
DIUC used for the burst

**N_RS_RxTx**
The number of RSs that receive the data in the allocations for receiving and transmit it in the allocations for sending.

**RxTx RS ID**
Indicates the RS that receives the data in the allocations for receiving and transmit it in the allocations for sending.

**Tx Boosting Adjustment**
The RS specified by “Rx RS ID” sends the data in the downlink allocation that is identified by “Tx DL-MAP_IE frame offset”, “Tx DL-MAP_IE Sub-MAP offset”, and “Tx DL-MAP_IE offset”. When the RS transmits the signal, power boosting is applied to the allocated data subcarriers.

**Tx DL-MAP_IE frame offset**
Indicates the frame offset, in which the allocated resource for the transmission is. The frame is starting from this frame.

**Tx DL-MAP_IE Sub-MAP offset**
Indicates the Sub-MAP offset in the frame specified by “Tx DL-MAP IE frame offset”, in which the allocated resource for the transmission of RSs is.

Tx DL-MAP IE offset
Indicates the DL-MAP IE() in Sub-MAP specified by “Tx DL-MAP IE sub-MAP offset”, in which the allocated resource for the transmission of RSs is.

8.4.5.3.29 HARQ DL-Relay_IE()

The HARQ DL-Relay IE() may include several bursts. Each burst consists of downlink allocation part for receiving, RS identifiers, and downlink allocation part for transmitting. The RSs receive the data from the downlink allocations and relay the data in the downlink allocation for transmission. The slots are allocated in a frequency-first order. Downlink allocation for the transmission of the RS may be in same downlink sub-frame or a few downlink sub-frames later. The legacy DL-MAP IE() sent to the MS is the last in a relaying path from the MMR-BS to the MS.

Table ccc- HARQ DL-Relay_IE() format

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIUC</td>
<td>4 bits</td>
<td>15</td>
</tr>
<tr>
<td>DL_extended-2 IE()</td>
<td>-</td>
<td>? (B-D, F)</td>
</tr>
<tr>
<td>_ Extended-2 DIUC</td>
<td>4 bits</td>
<td>? (B-D, F)</td>
</tr>
<tr>
<td>_ Length</td>
<td>8 bits</td>
<td></td>
</tr>
<tr>
<td>_ N_Burst</td>
<td>4 bits</td>
<td>The number of bursts in the frame</td>
</tr>
<tr>
<td>For (i=0; i&lt;N_Burst; i++) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_ Rx Boosting</td>
<td>3 bits</td>
<td>000: Normal (not boosted); 001: 6dB; 010: -6dB; 011: +9dB; 100:-3dB; 101:-9dB; 110:-12dB</td>
</tr>
<tr>
<td>_ Rx Region_ID use indicator</td>
<td>1 bit</td>
<td>0: not use Region_ID; 1: use Region_ID</td>
</tr>
<tr>
<td>_ If (Rx Region_ID use indicator == 0) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_ _ Rx OFDMA Symbol offset</td>
<td>8 bits</td>
<td></td>
</tr>
<tr>
<td>_ _ Rx Subchannel offset</td>
<td>7 bits</td>
<td></td>
</tr>
<tr>
<td>_ _ Rx No. OFDMA Symbols</td>
<td>7 bits</td>
<td></td>
</tr>
<tr>
<td>_ _ Rx No. Subchannels</td>
<td>7 bits</td>
<td></td>
</tr>
<tr>
<td>_ _ Reserved</td>
<td>3 bits</td>
<td></td>
</tr>
<tr>
<td>_ _ } else {}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_ _ _ Rx Region_ID</td>
<td>8 bits</td>
<td>Index to the DL region defined in DL region definition TLV in DCD</td>
</tr>
<tr>
<td>_ _ }</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_ N_Sub-Burst</td>
<td>4 bits</td>
<td>The number of sub bursts in the 2D region</td>
</tr>
<tr>
<td>_ For (j=0; j&lt;N_Sub-Burst; j++) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>Size</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **Rx Sub-Burst Mode**                     | 2 bits| 0b00 – DIUC  
0b10 – \( N_{EP}, N_{SCCH} \)  
0b01 – The same Sub-Burst Mode as the previous Sub-Burst  
0b11 – No operation |
| **Reserved**                              | 2 bits|                                                                             |
| If (Rx Sub-Burst Mode == 0b00) {         |      |                                                                             |
| **Rx Duration**                           | 10 bits| In units of OFDMA slots                                                     |
| **Rx DIUC**                               | 4 bits|                                                                             |
| **Rx Repetition Coding Indication**       | 2 bits| 0b00 – No repetition coding  
0b01 – Repetition coding of 2 used  
0b10 – Repetition coding of 4 used  
0b11 – Repetition coding of 6 used |
| } else if (Rx Sub-Burst Mode == 0b10) {   |      |                                                                             |
| **Rx N_{EP}**                             | 4 bits|                                                                             |
| **Rx N_{SCCH}**                           | 4 bits|                                                                             |
| } else {                                  |      |                                                                             |
| **Rx Duration**                           | 10 bits| In units of OFDMA slots                                                     |
| **Reserved**                              | 6 bits| Shall be set to zero                                                         |
| }                                         |      |                                                                             |
| If (Rx Sub-Burst Mode != 0b11) {         |      |                                                                             |
| **N_{RSRX}**                              | 2 bits|                                                                             |
| **Reserved**                              | 2 bits|                                                                             |
| For (n=0; n<N_{RSRX}; n++) {              |      |                                                                             |
| **RxTx RS ID**                            | 16 bits| Basic CID                                                                  |
| **Tx Boosting Adjustment**                | 4 bits| Signed value in units of 0.5 dB units                                       |
| }                                         |      |                                                                             |
| **Tx DL-MAP_IE frame offset**             | 2 bits|                                                                             |
| **Tx DL-MAP_IE Sub-MAP offset**           | 2 bits| 0b00: default MAP  
0b01-0b11: Sub-MAP offset |
| **Tx DL-MAP_IE offset**                   | 4 bits|                                                                             |
| **Tx DL-MAP_IE burst offset**             | 2 bits|                                                                             |
| **Tx DL-MAP_IE sub-burst offset**         | 4 bits|                                                                             |
| }                                         |      |                                                                             |
| Padding                                   | variable| Number of bits required to align to byte length, shall be set to zero      |
N_Burst
The number of Bursts.

Rx Boosting
Power boost applied to the data subcarriers of the burst.

Rx Region_ID use indicator
Indicates the way that the region is describes. If 0, the region is specified by the starting point, OFDMA Symbol offset and Subchannel offset, and sizes, No. OFDMA Symbol and No. Subchannel. If 1, Region_ID identifies the region that is specified in the DCD message.

Rx OFDMA Symbol offset
The offset of OFDMA symbol in which the burst starts, measured from beginning of the designated transmission uplink frame.

Rx Subchannel offset
The lowest index OFDMA subchannel used for carrying the burst, starting from subchannel 0.

Rx No. OFDMA Symbol
The number of OFDMA symbols for the region.

Rx No. Subchannel
The number of Subchannels for the region.

N_Sub-Burst
The number of Sub-Bursts in a Burst.

Rx Sub-Burst Mode
0b00: DIUC style.
0b10: N_EP/N_SCH style.
0b01: The same Sub-Burst Mode as the previous Sub-Burst.
0b11: No operation in the allocation.

Rx Duration
Indicates the duration, in units of OFDMA slots, of the allocation.

Rx DIUC
DIUC used for the sub-burst

Rx Repetition Coding Indication
Indicates the repetition code used inside the allocated burst.

Rx N_EP/Rx N_SCH

N_RS_RxTx
The number of RSs that receives the data in the allocated resource.

RxTx RS ID
Indicates the RS that receives the data in the allocated resource.

Tx Boosting Adjustment
The RS specified by “Rx RS ID” sends the data in the downlink allocation that is identified by “Tx DL-MAP_IE frame
offset”, “Tx DL-MAP_IE Sub-MAP offset”, “Tx DL-MAP_IE offset”, “Tx DL-MAP_IE burst offset”, and “Tx DL-MAP_IE sub-burst offset”. When the RS transmits the signal, power boosting is applied to the allocated data subcarriers.

**Tx DL-MAP_IE frame offset**
Indicates the frame offset, in which the allocated resource for the transmission is. The frame is counted from this frame.

**Tx DL-MAP_IE Sub-MAP offset**
Indicates the Sub-MAP offset in the frame specified by “Tx DL-MAP_IE frame offset”, in which the allocated resource for the transmission of RSs is.

**Tx DL-MAP_IE offset**
Indicates the DL-MAP_IE() in Sub-MAP specified by “Tx DL-MAP_IE sub-MAP offset”, in which the allocated resource for the transmission of RSs is.

**Tx DL-MAP_IE burst offset**
Indicates the burst offset in DL-MAP_IE() specified by “Tx DL-MAP_IE offset”, in which the allocated resource for the transmission of RSs is.

**Tx DL-MAP_IE sub-burst offset**
Indicates the sub-burst offset in the burst offset specified by “Tx DL-MAP_IE burst offset”, in which the allocated resource for the transmission of RSs is.

[Insert the text after 8.4.5.4.28:]

### 8.4.5.4.30 UL-Relay_IE()

The UL-Relay_IE() consists of uplink allocation part for receiving, RS identifiers, and uplink allocation part for transmitting. The RSs receive the data from the uplink allocations and relay the data in the uplink allocation for transmission. The slots are allocated in a time-first order. The uplink allocation for the transmission of the RS may be in same uplink sub-frame or a few uplink sub-frames later. The legacy UL-MAP_IE() sent to the MS is the first in a relaying path from the MS to the MMR-BS.

<table>
<thead>
<tr>
<th>Table ddd- UL-Relay_IE() format</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Syntax</strong></td>
</tr>
<tr>
<td>CID</td>
</tr>
<tr>
<td>UIUC</td>
</tr>
<tr>
<td>DL_extended-2_IE()</td>
</tr>
<tr>
<td>__ Extended-2 DIUC</td>
</tr>
<tr>
<td>__ Length</td>
</tr>
</tbody>
</table>
| __ Relay control | 4 bits | Bit #0: Rx resource allocation  
| | | Bit #1: Relay information  
| | | Bit #2-#3: Reserved |
| __ If(Rx resource allocation == 1) | | |
| | Rx UIUC | 4 bits | |
| | Rx Duration | 10 bits | In units of OFDMA Slots |
| | Rx Repetition Coding Indication | 2 bits | 0b00 – No repetition coding |

[Insert the text after 8.4.5.4.30:]

## 8.4.5.4.31 UL-Relay_IE() format

The UL-Relay_IE() consists of uplink allocation part for receiving, RS identifiers, and uplink allocation part for transmitting. The RSs receive the data from the uplink allocations and relay the data in the uplink allocation for transmission. The slots are allocated in a time-first order. The uplink allocation for the transmission of the RS may be in same uplink sub-frame or a few uplink sub-frames later. The legacy UL-MAP_IE() sent to the MS is the first in a relaying path from the MS to the MMR-BS.
<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx UL-MAP_IE Sub-MAP offset</td>
<td>2 bits</td>
<td>0b00: default MAP 0b01-0b11: Sub-MAP offset</td>
</tr>
<tr>
<td>Rx UL-MAP_IE offset</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>Relay information == 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N_RS_RxTx</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>For (n=0; n&lt;N_RS_RxTx; n++)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RxTx RS ID</td>
<td>16 bits</td>
<td>Basic CID. If Relay information == 1, the first CID in this IE() is the first RS_ID.</td>
</tr>
<tr>
<td>Tx Boosting Adjustment</td>
<td>4 bits</td>
<td>Signed value in units of 0.5 dB units</td>
</tr>
<tr>
<td>Tx UL-MAP_IE frame offset</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>Tx UL-MAP_IE Sub-MAP offset</td>
<td>2 bits</td>
<td>0b00: default MAP 0b01-0b11: Sub-MAP offset</td>
</tr>
<tr>
<td>Tx UL-MAP_IE offset</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>Padding</td>
<td>variable</td>
<td>Number of bits required to align to byte length. Shall be set to zero.</td>
</tr>
</tbody>
</table>

**Relay control**

- Bit #0: “Rx resource allocation”. If 1, the allocated resource is described, otherwise the MAP pointer that indicates the MAP of the resource allocation is described.
- Bit #1: Relay information. If 1, the relay information about RS and its resource for transmission is.
- Bit #2-#3: Reserved

**Rx Duration**

Indicates the duration, in units of OFDMA slots, of the allocation.

**Rx UIUC**

UIUC used for the sub-burst.

**Rx Repetition Coding Indication**

Indicates the repetition code used inside the allocated burst.

**Rx UL-MAP_IE Sub-MAP offset**
Indicates the Sub-MAP offset, in which the allocated resource for the receipt is. The Sub-MAP is in this UL sub-frame.

**Rx UL-MAP IE offset**

Indicates the burst offset in Sub-MAP specified by “Rx UL-MAP IE sub-MAP offset”, in which the allocated resource for the receipt is.

**N_RS_RxTx**

The number of RSs that receive the data in the allocated resource.

**RxTx RS ID**

Indicates the RS that receives the data in the allocated resource.

**Tx Boosting Adjustment**

The RS specified by “Rx RS ID” sends the data in the uplink allocation that is identified by “Tx UL-MAP IE frame offset”, “Tx UL-MAP IE Sub-MAP offset”, “Tx UL-MAP IE offset”, “Tx UL-MAP IE burst offset”, and “Tx UL-MAP IE sub-burst offset”. When the RS transmits the signal, power boosting is applied to the allocated data subcarriers.

**Tx UL-MAP IE frame offset**

Indicates the frame offset, in which the allocated resource for the transmission is. The frame is counted from this frame.

**Tx UL-MAP IE Sub-MAP offset**

Indicates the Sub-MAP offset in the frame specified by “Tx UL-MAP IE frame offset”, in which the allocated resource for the transmission of RSs is. The Sub-MAP is in this UL sub-frame.

**Tx UL-MAP IE offset**

Indicates the UL-MAP_IE() in Sub-MAP specified by “Tx UL-MAP IE sub-MAP offset”, in which the allocated resource for the transmission of RSs is.

**Tx UL-MAP IE burst offset**

Indicates the burst offset in UL-MAP_IE() specified by “Tx UL-MAP IE offset”, in which the allocated resource for the transmission of RSs is.

**Tx UL-MAP IE sub-burst offset**

Indicates the sub-burst offset in the burst offset specified by “Tx UL-MAP IE burst offset”, in which the allocated resource for the transmission of RSs is.

### 8.4.5.4.31 HARQ UL-Relay IE()

The HARQ UL-Relay IE() may include several bursts that is starting with either the starting symbol and subchannel or the global slot index. The allocation indexed by the global slot shall follow the last allocation. The slots are allocated in a time-first order. The uplink allocation for the sub-burst in the burst is pointed by parameters: Sub-MAP offset, UL-MAP IE offset, burst offset, and sub-burst offset. The RSs receive the data from the uplink allocations and relay the data in the uplink allocations for transmission. The uplink allocation for the transmission of the RS is done in same uplink sub-frame or a few uplink sub-frames later. The legacy UL-MAP_IE() sent to the MS is the first in a relaying path from the MS to the MMR-BS.

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CID</td>
<td>16 bits</td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>Length</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>UIUC</td>
<td>4 bits</td>
<td>11</td>
</tr>
<tr>
<td>DL_extended-2_IE() {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_Extended-2_DIUC</td>
<td>4 bits</td>
<td>? (9-D)</td>
</tr>
<tr>
<td>_Length</td>
<td>8 bits</td>
<td></td>
</tr>
<tr>
<td>_N_Burst</td>
<td>2 bits</td>
<td>The number of bursts</td>
</tr>
<tr>
<td>_Reserved</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>For (i=0; i&lt;N_Burst; i++) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_Rx Allocation Start Indication</td>
<td>1 bit</td>
<td>0: No allocation start information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: Allocation start information follows</td>
</tr>
<tr>
<td>If (Rx Allocation Start Indication == 1) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_Rx OFDMA Symbol offset</td>
<td>8 bits</td>
<td>This value indicates start Symbol offset of subsequent sub-bursts in this IE()</td>
</tr>
<tr>
<td>_Rx Subchannel offset</td>
<td>7 bits</td>
<td>This value indicates start Subchannel offset of subsequent sub-bursts in this IE()</td>
</tr>
<tr>
<td>} else {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_Reserved</td>
<td>3 bits</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_N_Sub-Burst</td>
<td>4 bits</td>
<td>The number of bursts in this zone</td>
</tr>
<tr>
<td>For (j=0; j&lt;N_Sub-Burst; j++) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_Relay control</td>
<td>4 bits</td>
<td>Bit #0: Rx resource allocation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit #1: Relay information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit #2-#3: Reserved</td>
</tr>
<tr>
<td>If (Rx resource allocation == 1) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_Rx Sub-Burst Mode</td>
<td>2 bits</td>
<td>0b00 – UIUC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b10 – N_{EP}, N_{SCH}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b01 – The same Sub-Burst Mode as the previous Sub-Burst</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b11 – No operation</td>
</tr>
<tr>
<td>} else if (Sub-Burst Mode == 0b10) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_Rx Duration</td>
<td>10 bits</td>
<td>In units of OFDMA slots</td>
</tr>
<tr>
<td>_Rx UIUC</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>_Rx Repetition Coding Indication</td>
<td>2 bits</td>
<td>0b00 – No repetition coding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b01 – Repetition coding of 2 used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b10 – Repetition coding of 4 used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b11 – Repetition coding of 6 used</td>
</tr>
<tr>
<td>} else if (Sub-Burst Mode == 0b10) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Rx N</em>{EP}</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>Length</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Rx N_{RS_{RxTx}}</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>} else {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rx Duration</td>
<td>10 bits</td>
<td>In units of OFDMA slots</td>
</tr>
<tr>
<td>Reserved</td>
<td>6 bits</td>
<td>Shall be set to zero</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rx UL-MAP_IE Sub-MAP offset</td>
<td>2 bits</td>
<td>0b00: default MAP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b01-0b11: Sub-MAP offset</td>
</tr>
<tr>
<td>Rx UL-MAP_IE offset</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>Rx UL-MAP_IE burst offset</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>Rx UL-MAP_IE sub-burst offset</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If (Relay information == 1) {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N_{RS_{RxTx}}</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>For (n=0; n&lt;N_{RS_{RxTx}}; n++)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RxTx RS ID</td>
<td>16 bits</td>
<td>Basic CID</td>
</tr>
<tr>
<td>Tx Boosting Adjustment</td>
<td>4 bits</td>
<td>Signed value in units of 0.5 dB units</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tx UL-MAP_IE frame offset</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>Tx UL-MAP_IE Sub-MAP offset</td>
<td>2 bits</td>
<td>0b00: default MAP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0b01-0b11: Sub-MAP offset</td>
</tr>
<tr>
<td>Tx UL-MAP_IE offset</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>Tx UL-MAP_IE burst offset</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>Tx UL-MAP_IE sub-burst offset</td>
<td>4 bits</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Padding</td>
<td>variable</td>
<td>Number of bits required to align to byte length. Shall be set to zero.</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**N_{Burst}**

The number of Bursts.

**Rx Allocation Start Indication**

When Allocation Start Indication is 1, the HARQ UL Relay IE() includes the starting symbol and subchannel of the allocation. Allocations made without an Allocation Start Indication, shall be based on the global slot index, each of these allocations shall follow the last allocation which did not contain Allocation Start indication.

**Rx OFDMA Symbol offset**


The offset of OFDMA symbol in which the burst starts, measured from beginning of the designated transmission uplink frame.

**Rx Subchannel offset**

The lowest index OFDMA subchannel used for carrying the burst, starting from subchannel 0.

**N Sub-Burst**

The number of Sub-Bursts in a Burst.

**Relay control**

Bit #0: “Rx resource allocation”. If 1, the allocated resource is described, otherwise the MAP pointer that indicates the MAP of the resource allocation is described.

Bit #1: Relay information. If 1, the relay information about RS and its resource for transmission is.

Bit #2-#3: Reserved

**Rx Sub-Burst Mode**

0b00: UIUC style.

0b10: NEP/N_sCH style.

0b01: The same Sub-Burst Mode as the previous Sub-Burst.

0b11: No operation in the allocation.

**Rx Duration**

Indicates the duration, in units of OFDMA slots, of the allocation.

**Rx UIUC**

UIUC used for the sub-burst

**Rx Repetition Coding Indication**

Indicates the repetition code used inside the allocated burst.

**Rx NEP/Rx N_sCH**

**Rx UL-MAP_IE Sub-MAP offset**

Indicates the Sub-MAP offset, in which the allocated resource for the receipt is. The Sub-MAP is in this UL sub-frame.

**Rx UL-MAP_IE offset**

Indicates the UL-MAP_IE() in Sub-MAP specified by “Rx UL-MAP_IE sub-MAP offset”, in which the allocated resource for the receipt is.

**Rx UL-MAP_IE burst offset**

Indicates the burst offset in UL-MAP_IE() specified by “Rx UL-MAP_IE offset”, in which the allocated resource for the receipt is.

**Rx UL-MAP_IE sub-burst offset**

Indicates the sub-burst offset in the burst offset specified by “Rx UL-MAP_IE burst offset”, in which the allocated resource for the receipt is.

**N_RS_RxTx**

The number of RSs that receives the data in the allocated resource.

**RxTx RS ID**

Indicates the RS that receives the data in the allocated resource.

**Tx Boosting Adjustment**
The RS specified by “Rx RS ID” sends the data in the uplink allocation that is identified by “Tx UL-MAP IE frame offset”, “Tx UL-MAP IE Sub-MAP offset”, “Tx UL-MAP IE offset”, “Tx UL-MAP IE burst offset”, and “Tx UL-MAP IE sub-burst offset”. When the RS transmits the signal, power boosting is applied to the allocated data subcarriers.

**Tx UL-MAP IE frame offset**
 Indicates the frame offset, in which the allocated resource for the transmission is. The frame is counted from this frame.

**Tx UL-MAP IE Sub-MAP offset**
 Indicates the Sub-MAP offset in the frame specified by “Tx UL-MAP IE frame offset”, in which the allocated resource for the transmission of RSs is. The Sub-MAP is in this UL sub-frame.

**Tx UL-MAP IE offset**
 Indicates the UL-MAP IE() in Sub-MAP specified by “Tx UL-MAP IE sub-MAP offset”, in which the allocated resource for the transmission of RSs is.

**Tx UL-MAP IE burst offset**
 Indicates the burst offset in UL-MAP IE() specified by “Tx UL-MAP IE offset”, in which the allocated resource for the transmission of RSs is.

**Tx UL-MAP IE sub-burst offset**
 Indicates the sub-burst offset in the burst offset specified by “Tx UL-MAP IE burst offset”, in which the allocated resource for the transmission of RSs is.