# Group Resource Allocation for 802.16m

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Venue:

IEEE 802.16m-09/0012, “Call for Contributions on Project 802.16m Amendment Working Document (AWD) Content”.

Target topic: “Group resource allocation”

Base Contribution:

None

Purpose:

The contribution proposes text for group resource allocation to be included in the 802.16m amendment.

# Group Resource Allocation for IEEE 802.16m

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# Outline

- **Goal and scope of this presentation**
  - Outline overall features of Group Resource Allocation(GRA)
  - Propose text for GRA operation

- **Issue to be resolved in this contribution**
  - Control information for affiliation/de-affiliation
  - Group configuration(Group supportable MCS set, Packet size set)
  - Indication of transmit format for group users (MCS, Packet format)

# Group Affiliation

- **Required message fields for group affiliation**
  - Assumption: This information is sent through either MAC management message or user-specific unicast IE.

| Message Type | Bit Size | Description | Comment |
|---|---|---|---|
| Group ID | [4 or 5] | Group ID | |
| MCS Set | [3] | Supportable MCS set in the group | Select one MCS set among predefined [8] sets. |
| Packet Size Set | [2] | Supportable Packet size set in the group | Select one packet size among [4] candidates configured in additional broadcast information. |
| User bitmap position | [5] | Position of user within group's bitmap | |
| [Initial ACID] | [TBD] | Start of ACID | Reserve a range of ACID for group resource allocation. |
| [N_ACID] | [TBD] | # of ACID used for group allocation | |

# Group De-affiliation

- **De-affiliation message is located in GRA A-MAP IE.**
  - Require to indicate user bitmap position of de-affiliating MS.
  - Error handling of de-affiliating message is TBD.
    - ➢ Miss-reception of de-affiliating message will result in unexpected trouble.
    - ➢ Need to
    - ➢ Group resource allocation may be released upon receiving consecutive NACKs.

# Group Configuration Info.: MCS set

- **A group supports multi-MCS levels**
  - Each group selects one set among several predefined candidate sets.
  - Group supportable MCS set is indicated when MS affiliating to a group.

- **Decision points**
  - Benefit if we make the supportable set is configurable?
  - Need several candidates of MCS set?

  ➔Refer to appendix 1 for detailed analysis.

- **Our view**
  - Predefining at most 7~8(number is TBD) candidates of MCS set is enough to cover most of cases.
  - Configuration of MCS set may not be necessary.

**Candidates of MCS set**

| MCS TYPE = 000 | |
|---|---|
| QPSK | 31/256 |
| QPSK | 47/256 |
| QPSK | 70/256 |
| QPSK | 98/256 |
| QPSK | 131/256 |
| QPSK | 166/256 |
| QPSK | 199/256 |
| 16QAM | 123/256 |
| 16QAM | 149/256 |
| 16QAM | 176/256 |
| 16QAM | 204/256 |
| 16QAM | 229/256 |
| 64QAM | 173/256 |
| 64QAM | 196/256 |
| 64QAM | 218/256 |
| 64QAM | 234/256 |

| MCS TYPE = 001 | |
|---|---|
| QPSK | 31/256 |
| QPSK | 47/256 |
| QPSK | 70/256 |
| QPSK | 98/256 |
| QPSK | 131/256 |
| QPSK | 166/256 |
| QPSK | 199/256 |
| 16QAM | 123/256 |

| MCS TYPE = 010 | |
|---|---|
| 16QAM | 149/256 |
| 16QAM | 176/256 |
| 16QAM | 204/256 |
| 16QAM | 229/256 |
| 64QAM | 173/256 |
| 64QAM | 196/256 |
| 64QAM | 218/256 |
| 64QAM | 234/256 |

| MCS TYPE = 011 | |
|---|---|
| QPSK | 31/256 |
| QPSK | 47/256 |
| QPSK | 70/256 |
| QPSK | 98/256 |

| MCS TYPE = 100 | |
|---|---|
| QPSK | 131/256 |
| QPSK | 166/256 |
| QPSK | 199/256 |
| 16QAM | 123/256 |

| MCS TYPE = 101 | |
|---|---|
| 16QAM | 149/256 |
| 16QAM | 176/256 |
| 16QAM | 204/256 |
| 16QAM | 229/256 |

| MCS TYPE = 110 | |
|---|---|
| 64QAM | 173/256 |
| 64QAM | 196/256 |
| 64QAM | 218/256 |
| 64QAM | 234/256 |

# Group Configuration Info.: Packet Size Set

- **A group supports multi-packet size**
  - Each group selects one set among several configured candidate sets.
  - Candidate sets are configured and indicated through additional broadcast information.
  - Group supportable Packet size set is indicated when MS affiliated to a group.

- **Necessity of supporting multi-packet size**

  ➔Refer to appendix 2 for detailed analysis.
  - To group various codec users.
  - To group various applications.
  - To group various length VoIP packet.

- **Necessity of configuring candidate sets**
  - To give full flexibility of utilizing GRA.
  - To open the anticipated utilization for any new applications such as HD-VoIP.

**Ex) Packet size sets**

| Packet size Type=00 | |
|---|---|
| No_packet size=4 | |
| packet size | 20 |
| packet size | 30 |
| packet size | 40 |
| packet size | 50 |

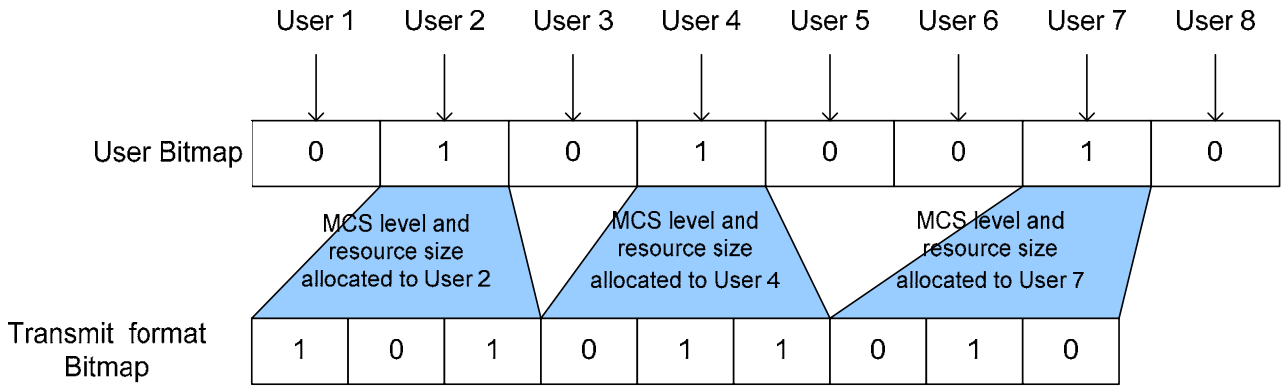
| Packet size Type=01 | |
|---|---|
| No_packet size=4 | |
| packet size | 100 |
| packet size | 200 |
| packet size | 300 |
| packet size | 400 |

| Packet size Type=02 | |
|---|---|
| No_packet size=4 | |
| packet size | 10 |
| packet size | 50 |
| packet size | 100 |
| packet size | 150 |

| Packet size Type=03 | |
|---|---|
| No_packet size=4 | |
| packet size | 10 |
| packet size | 20 |
| packet size | 100 |
| packet size | 150 |

# Resource Assignment in Group

- **User bitmap**
  - Indicate users who are granted group resource.
- **Transmit format bitmap**
  - Indicate MCS/Resource size for each granted user.
  - Bitmap bit size is dependent on group supportable MCS set and packet size set.



# Text Proposal to 802.16m AWD

***Insert the following text into new section 15.2.x***

**15.2.x Group resource allocation**

**15.2.x.1 Group affiliation**

**15.2.x.2 Group de-affiliation**

**15.2.x.3 Group configuration**

**15.2.x.3 Group assignment indication**

# Appendix 1. Analysis for Multiple MCS set

# Performance Analysis for MCS Set

- **Examine the impact of MCS types on control overhead and power consumption: Trade-off between large size and small size**
  - Large size MCS set (Comparing to small size)
    - ➢ Traded Pros: Avoid unnecessary grouping (Reduce overhead)
    - ➢ Traded Cons: Increase bitmap size for indicating MCS level, Excessive power consumption for robust transmission
- **Considering MCS set types**

**MCS TYPE 1**

| | |
|---|---|
| QPSK | 31/256 |
| QPSK | 47/256 |
| QPSK | 70/256 |
| QPSK | 98/256 |
| QPSK | 131/256 |
| QPSK | 166/256 |
| QPSK | 199/256 |
| 16QAM | 123/256 |
| 16QAM | 149/256 |
| 16QAM | 176/256 |
| 16QAM | 204/256 |
| 16QAM | 229/256 |
| 64QAM | 173/256 |
| 64QAM | 196/256 |
| 64QAM | 218/256 |
| 64QAM | 234/256 |

**MCS TYPE 2**

| | |
|---|---|
| QPSK | 31/256 |
| QPSK | 47/256 |
| QPSK | 70/256 |
| QPSK | 98/256 |
| QPSK | 131/256 |
| QPSK | 166/256 |
| QPSK | 199/256 |
| 16QAM | 123/256 |

| | |
|---|---|
| 16QAM | 149/256 |
| 16QAM | 176/256 |
| 16QAM | 204/256 |
| 16QAM | 229/256 |
| 64QAM | 173/256 |
| 64QAM | 196/256 |
| 64QAM | 218/256 |
| 64QAM | 234/256 |

**MCS TYPE 3**

| | |
|---|---|
| QPSK | 31/256 |
| QPSK | 47/256 |
| QPSK | 70/256 |
| QPSK | 98/256 |
| QPSK | 131/256 |

| | |
|---|---|
| QPSK | 166/256 |
| QPSK | 199/256 |
| 16QAM | 123/256 |
| 16QAM | 149/256 |
| 16QAM | 176/256 |

| | |
|---|---|
| 16QAM | 204/256 |
| 16QAM | 229/256 |
| 64QAM | 173/256 |
| 64QAM | 196/256 |
| 64QAM | 218/256 |
| 64QAM | 234/256 |

**MCS TYPE 4**

| | |
|---|---|
| QPSK | 31/256 |
| QPSK | 47/256 |
| QPSK | 70/256 |
| QPSK | 98/256 |

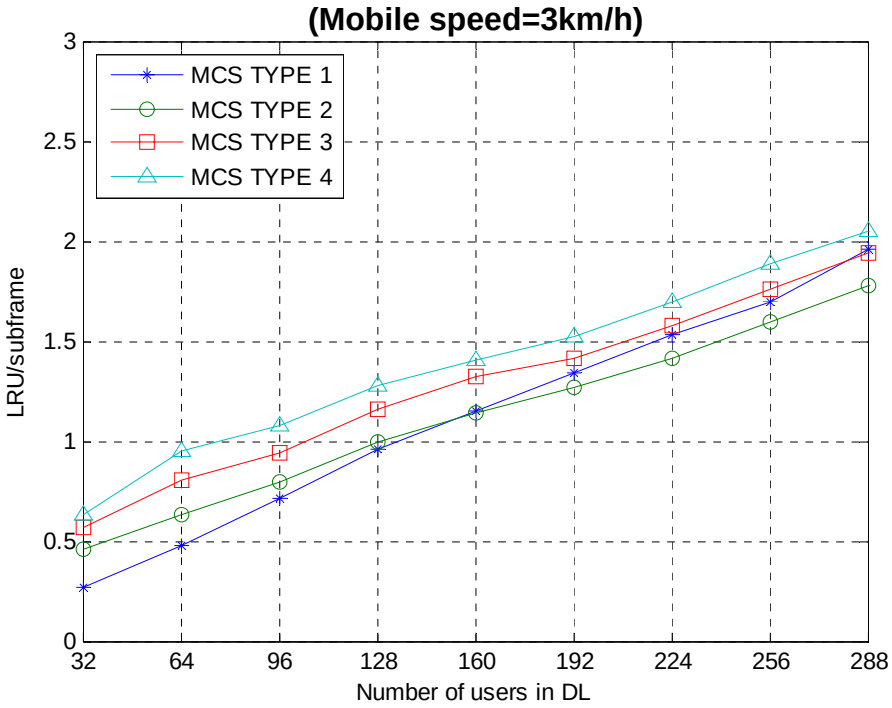
| | |
|---|---|
| QPSK | 131/256 |
| QPSK | 166/256 |
| QPSK | 199/256 |
| 16QAM | 123/256 |

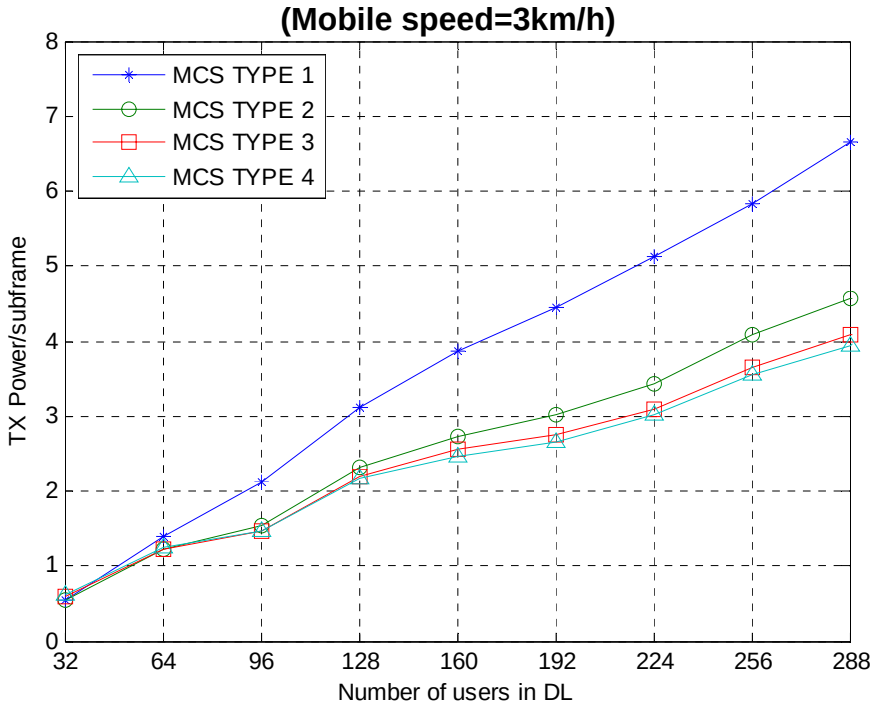
| | |
|---|---|
| 16QAM | 149/256 |
| 16QAM | 176/256 |
| 16QAM | 204/256 |
| 16QAM | 229/256 |

| | |
|---|---|
| 64QAM | 173/256 |
| 64QAM | 196/256 |
| 64QAM | 218/256 |
| 64QAM | 234/256 |

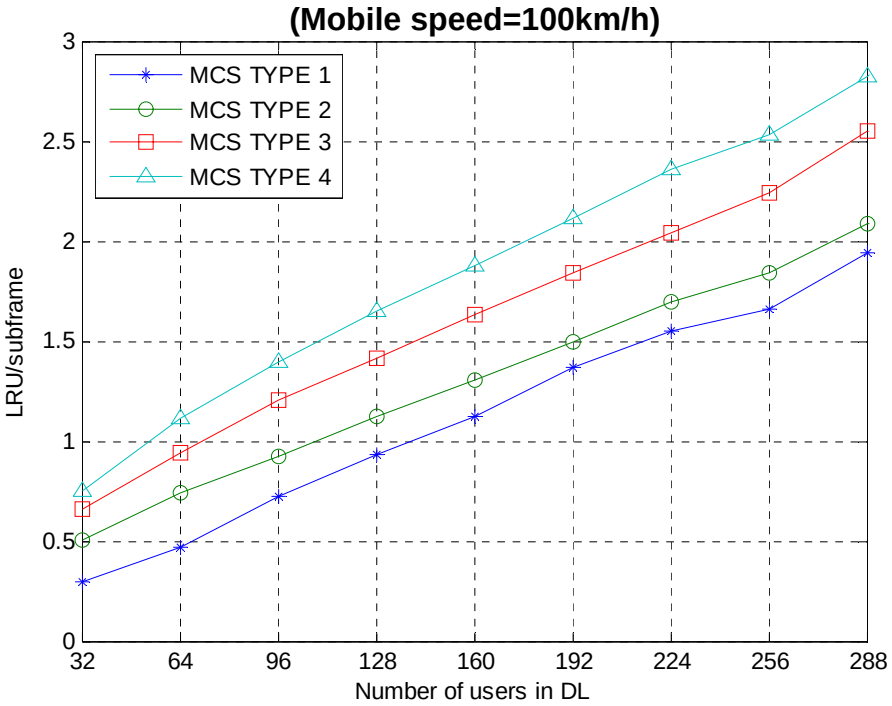
# Performance Analysis for MCS Set (Cont'd)

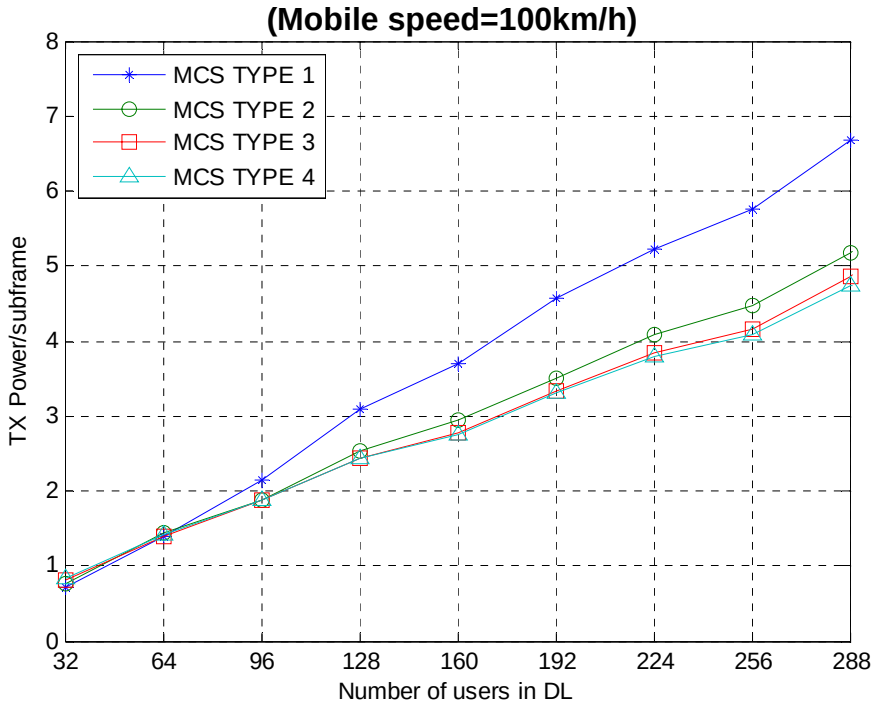
- **Observation**
  - Large size MCS set: Need for avoiding unnecessary grouping or changing group.
  - Small size MCS set: Need for saving transmit power/overhead.



# Performance Analysis for MCS Set (Cont'd)




- **Simulation assumptions**
  - VoIP codec=AMR (40bytes)
  - DL:UL=4:4, GRA MAP IE transmission period=20msec
  - GRA MAP IE is boosted to QPSK1/2.
  - When group is changed due to link adaptation, affiliation and de-affiliation message are inserted.

# Appendix 2. Analysis for Packet Size Set

# Multiple Packet Size Support(Cont'd)

- **Assumptions**
  - **GRA1**: supporting single packet size in a group
    - Require multiple GRA MAP IE for supporting multiple packet sizes
  - **GRA2**: supporting multiple packet size in a group
    - Require single GRA MAP IE for supporting multiple packet sizes
  - # of packet : Total number of required packet size in system.
- **Observation**
  - GRA2 scheme considerably reduces overhead in DL.