

Multiplexing Downlink Resource Unit for 802.16m

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE C802.16m-08/187r2

Date Submitted:

2008-03-10

Source:

Junsung Lim, Chiwoo Lim, Jeongho Park, Jaeweon Cho,
Hokyu Choi, Heewon Kang, DS Park
Samsung Electronics Co., Ltd.
416 Maetan-3, Suwon, 443-770, Korea

Voice: +82-31-279-7467

E-mail: junsung.lim@samsung.com

Venue:

IEEE 802.16m-08/005, "Call for Contributions on Project 802.16m System Description Document (SDD)".
Target topic: "Downlink Physical Resource Allocation Unit".

Base Contribution:

None

Purpose:

To be discussed and adopted by TGM for the 802.16m SDD

Notice:

This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.

Release:

The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

Patent Policy:

The contributor is familiar with the IEEE-SA Patent Policy and Procedures:

<<http://standards.ieee.org/guides/bylaws/sect6-7.html#6>> and <<http://standards.ieee.org/guides/opman/sect6.html#6.3>>.

Further information is located at <<http://standards.ieee.org/board/pat/pat-material.html>> and <<http://standards.ieee.org/board/pat>>.

Multiplexing Downlink Resource Unit for IEEE 802.16m

*Junsung Lim, Chiwoo Lim, Jeongho Park, Jaeweon Cho,
Hokyu Choi, Heewon Kang, DS Park*

Samsung Electronics Co., Ltd.

About This Contribution

▪ Goal and scope of this presentation

- Propose a multiplexing between diversity(PUSC) and band selection(band AMC) resource unit in a sub-frame for 16m.

▪ Issue to be resolved in this contribution

- Multiplexing: FDM vs TDM
- Two options in FDM mode
 - Opt 1: Distribution of diversity resource excluding subbands used for band selection
 - Opt 2: Distribution of diversity resource over the entire bandwidth, while unused resources in a subband are used for band selection.

▪ Proposed working assumption

⇒ **FDM**

(with distribution of diversity resources excluding subbands used for band selection)

DL Resource Unit

- **DL resource unit can be composed of**
 - Band selection(band AMC-like) resource unit to achieve frequency selective multi-user diversity where users are coordinated to a portion of bandwidth in favorable characteristics.
 - Diversity(PUSC-like) resource unit offers the advantage of frequency diversity when scheduling can not track the instantaneous fading variation.

- **Considerations of multiplexing between band selection and diversity resource unit (FDM vs TDM)**
 - Scheduler flexibility
 - Reliable transmission
 - Performance

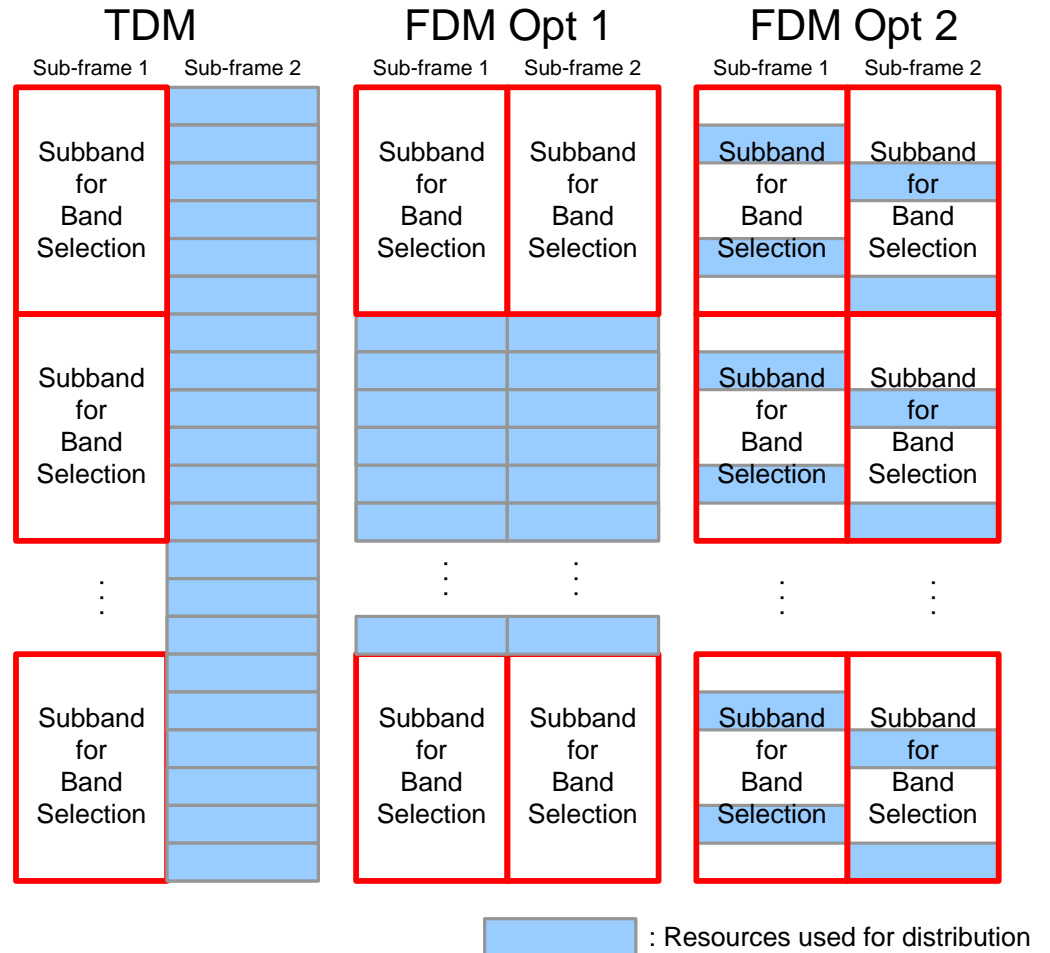
Data Multiplexing

- **TDM**

- Only band selection or diversity within a sub-frame

- **FDM**

- Opt 1
→ Distribution of diversity resource excluding subbands used for band selection.
- Opt2
→ Distribution of diversity resource over the entire bandwidth, while unused resources in a subband are used for band selection.



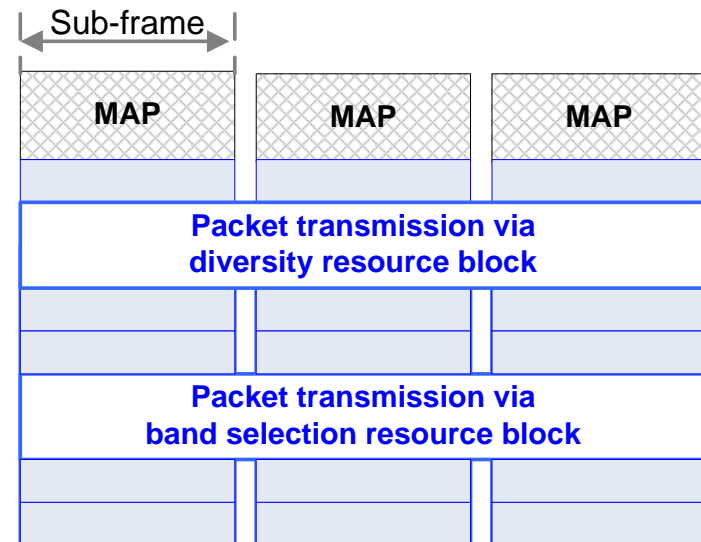
FDM vs TDM Multiplexing

▪ Scheduling flexibility

- FDM provides various MUX ratios of diversity and band selection
 - Granularity on multiplex ratio: sub-frame for TDM, subband for FDM
- FDM is ease of supporting a long TTI
 - Assignment of a favorable subband for band selection (or logical subchannel for diversity) can be hold over multiple sub-frames.

▪ Reliable transmission

- Diversity mechanism is required for MAP/small packet transmission.
- Band selection in TDM mode can't employ diversity resource unit.



FDM vs TDM Multiplexing (Cont'd)

- **Diversity/Scheduling gain**

- FDM may moderate the benefit of diversity or frequency selective scheduling.

Consideration		FDM	TDM
Scheduling flexibility	Multiplex ratio	Flexible Granularity: Subband	Less flexible Granularity: sub-frame
	Support long TTI	Favorable	Unfavorable
Reliability on transmitting MAP/Small packet		Good (achieve diversity gain via diversity resource unit)	Bad (No diversity gain for sub-frame with band selection resource unit)
Diversity/Scheduling gain		Moderate	Fully achievable



❖ **Preference : FDM**

FDM Multiplexing

▪ Two options

- Opt 1: Distribution of diversity resource excluding subbands used for band selection
- Opt 2: Distribution of diversity resource over the entire bandwidth, while unused resources in a subband are used for band selection.

Type	Impact on diversity	Impact on band selection
FDM opt 1	Mildly bad : Limited set of resource is used for diversity → Moderate diversity gain : HARQ ReTX compensates this deficit.	Good : Full benefit from frequency scheduling
FDM opt 2	Good : Full benefit from distribution over entire bandwidth	Bad : Less frequency selective scheduling gain

- **Preference : FDM opt 1 if the moderation is not severe.**

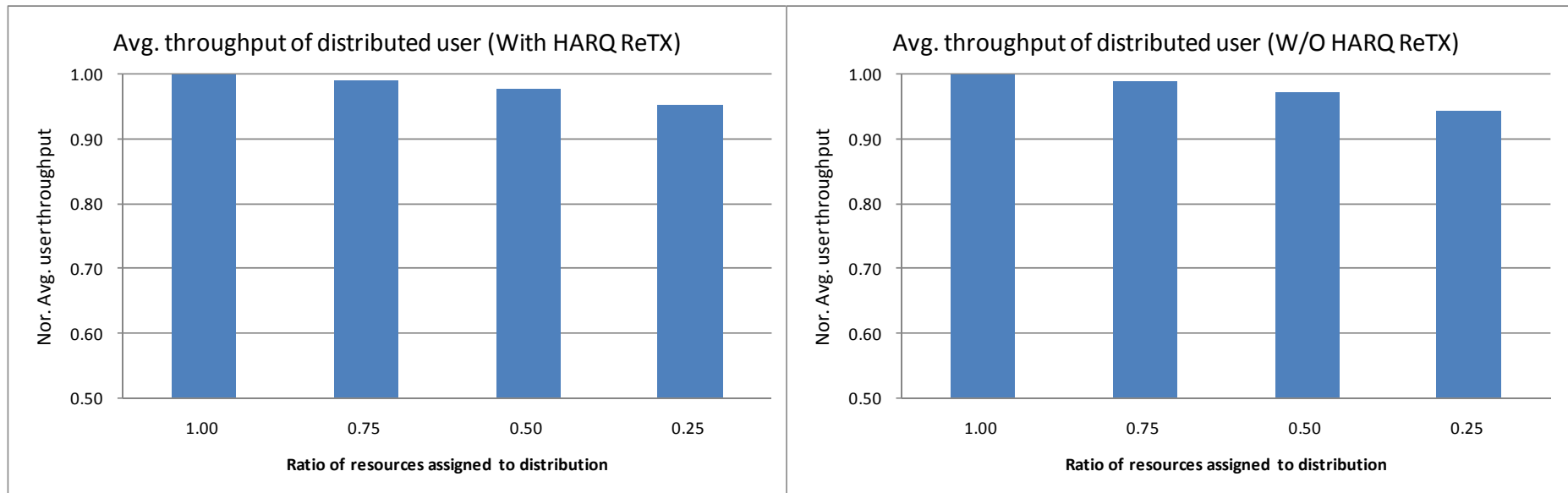
System Level Evaluation for FDM Opt 1

- **Objective**

- To examine performance of diversity user when a limited set is used for diversity.

- **Performance metric**

- Average user throughput of distributed user normalized by throughput of a case that all subcarriers are used for diversity.



Diversity loss due to FDM MUX is about 2~3% when half of resources are used for diversity.

Conclusions/Proposal

▪ **Conclusions**

- FDM benefits from
 - Better granularity on multiplexing
 - Support of long TTI
 - Reliable transmission for MAP and small packet

▪ **We propose**

- FDM data multiplexing between band selection and diversity resource unit.
- Type of FDM : Distribution of diversity resource excluding subbands used for band selection (FDM opt 1).

Text Proposal to 802.16m SDD

Insert the following text into Physical Layer clause (Chapter 11 in [IEEE 802.16m-08/003])

11.x Data multiplexing

The multiplexing between band selection and diversity resource unit is done in FDM manner within one sub-frame. Whole frequency band is divided into multiple subbands. A number of subbands can be devoted to band selection, while others are used for diversity.

Appendix. System-level Simulation

▪ Considerations

- Total number of users: 12
- Mobile speed : Ped-B 30Km

▪ Resource allocation

- # of partition: 12 (1 partition = 72 subcarriers)
- Scheduler: RR
- Multiplexing type: FDM option 1
- Distribution for diversity user
 - Equidistant distribution among resources left over after band selection scheduling.

▪ HARQ type

- Synchronous HARQ/CC
- 5ms latency for HARQ retransmission

▪ Antenna configuration

- SIMO

