

# System Level Performance Evaluation on Transmission Format of USCCH in IEEE 802.16m

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IEEE 802.16m-08/024, "Call for Comments and Contributions on Project 802.16m System Description Document (SDD)".

Target topic: "DL Control Structure".

Base Contribution:

None

Purpose:

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

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# **System Level Performance Evaluation on Transmission Format of USCCH in IEEE 802.16m**

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# About This Contribution

- Proposal on Text Modification

802.16m  
-08/003r3

~~The transmission format (joint/separate) for user-specific control information is FFS.~~

*Separate*

For user-specific control information, multiple information elements are coded separately.

Based on System Level Performance Evaluation



This contribution gives the reason why we should adopt Separate Coding

# Joint vs. Separate

Performance Metrics		Separate Coding	*Joint Coding	Note
Signaling Bit Overhead	CID	<ul style="list-style-type: none"> <li>Possible to eliminate CID overhead</li> </ul>	<ul style="list-style-type: none"> <li>Per assignment message</li> </ul>	<ul style="list-style-type: none"> <li>Separate: CRC masked by CID, scrambling using CID, etc</li> </ul>
	CRC	<ul style="list-style-type: none"> <li>Per assignment message</li> </ul>	<ul style="list-style-type: none"> <li>One CRC</li> </ul>	
Coding gain (Length)		<ul style="list-style-type: none"> <li>Smaller</li> </ul>	<ul style="list-style-type: none"> <li>Larger</li> </ul>	
Link adaptation gain		<ul style="list-style-type: none"> <li>Larger</li> </ul>	<ul style="list-style-type: none"> <li>Smaller</li> </ul>	
Packing Efficiency		<ul style="list-style-type: none"> <li>Lower</li> </ul>	<ul style="list-style-type: none"> <li>Higher</li> </ul>	



All metrics are finally expressed as **MAP OVERHEAD**

**System Level Performance Evaluation**



***SEPARATE CODING*** has more gain than ***Joint coding*** (next slide)

\*Joint coding: all assignment messages are combined together and encoded

# System Level Performance Evaluation

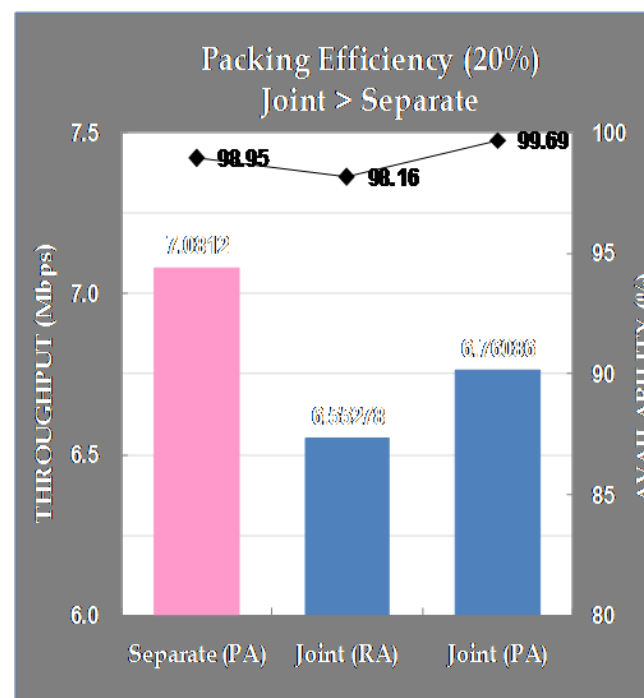
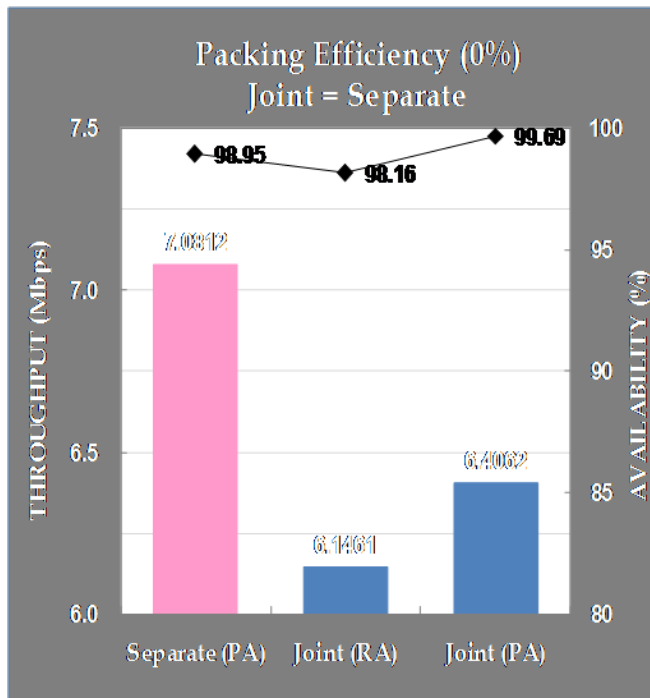
## Joint vs. Separate

### Separate >> Joint

- Link adaptation gain is larger than coding gain + packing efficiency

Item	Condition
Coding Gain	Reflected
Packing Efficiency	Assumption: Joint is 0% or 20% higher than Separate
Link Adaptation	Power or Rate (MCS)

- PA: Power adaptation, RA: Rate adaptation
- Availability (%) = 100 – MAP outage



Transmission Format	MAP Overhead (%)	
	PE 0 %	PE 20 %
Separate (PA)	13.4	13.4
Joint (RA)	24.9	19.9
Joint (PA)	21.7	17.3

# Sub-MAP

Short period  
(small  $n$ )

Scheduling Interval  
(Every  $n$  sub-frames)

Long period  
(large  $n \geq 4$ )

Small number of scheduled users



User grouping is difficult



high indication OH + high link adaptation gain

or

low indication OH + small link adaptation gain



***SEPARATE CODING*** has more gain than Sub-MAP

***Even Joint coding can have better performance than Sub-MAP***

(next slide)

Separate coding  $\approx$  Sub-MAP

?



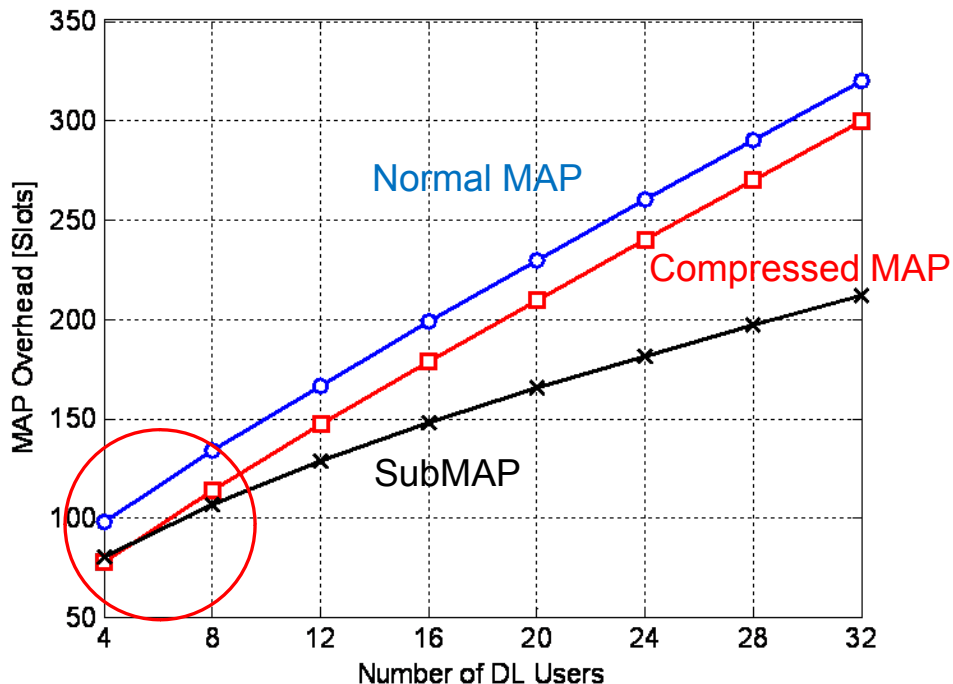
**CANNOT** satisfy latency  
requirement in SRD

# Overhead Analysis

## Joint vs. Sub-MAP

### Simulation Condition

- Based on 16e system
- System level user distribution + Link level performance
- Non-HARQ burst : HARQ burst = 1 : 1, Number of users DL : UL = 1 : 1
- Maximum 3 sub-MAP user groups



*When the number of users is small, Sub-MAP yields **worse or similar** performance compared to joint coding*

↑  
Link adaptation gain <  
Indication overhead

We expect the number of scheduled MSs per a sub-frame is around 3~4

# Summary

- **Criteria: Sector Throughput (Overhead)**
    - Joint coding < **Separate coding**
      - Link adaptation gain > coding gain + packing efficiency
    - Sub-MAP-style joint coding  $\approx$  joint coding < **Separate coding**
      - When scheduling Interval is short (small  $n$ )
      - Small user-grouping gain in sub-MAP
- ▶ **SEPARATE CODING** is better than Joint coding (including Sub-MAP) in respect to **SECTOR THROUGHPUT**



# Annex: System Level Simulation (1)

## ▪ Major Assumptions

- Subframe-based structure
  - [IEEE C802.16m-08/062r1]
- Only assignment block in MAP region
  - 48 bits (including CRC) per assignment block
- 2-D MAP region
- FDM
- Link adaptation
  - Separate: per user, Joint: based on worst user

## ▪ Performance Metrics

- **Sector Throughput** with satisfying MAP outage requirement
- **MAP Outage** requirement: Distribution of user whose BLER is larger than  $1\% < 3\%$  of total users

# Annex: System Level Simulation (2)

## ■ Simulation Environments/Assumptions

Index	Value
Deployment Scenario	EMD baseline [IEEE 802.16m-07/037r2 ]
MCS for MAP	QPSK, 1/2
HARQ	Synchronous (No assignment message for retransmission)
Scheduler	Proportional fairness
# of Users per Sector	10
# of Scheduled Users	3 per sub-frame (6 for both DL and UL)
MAP Error Effects	Resource loss for MAX retransmission
Antenna Configuration	SIMO 1x2
Channel Model	Mixed (Ped B-3kmph-60%, Veh A-30kmph-30%, Veh A-120kmph-10%)
Channel Estimation	Real channel estimation (Equal impairment for both TDM and FDM)
Other Simulation Assumptions	EMD baseline