

Transmission Format for Unicast Service Control Channels in IEEE 802.16m

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IEEE C80216m-08/297, "Call for Comments on DL Control Rapportuer Group Contribution".

Target topic: "Unicast Service Control Channels".

Base Contribution:

None

Purpose:

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

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Transmission Format

- 4 Options

<p><i>Option 1: Jointly coded/Fixed MCS</i></p> <p>[Multiple unicast service control information elements are coded jointly to form a control block and the same MCS is used for each coded control block that is transmitted.]</p>	<p><i>Option 2: Jointly coded/Variable MCS</i></p> <p>[Multiple unicast service control information elements are coded jointly to form a control block and a different MCS can be used for each coded control block that is transmitted.]</p>
<p><i>Option 3: Separately coded/Fixed MCS</i></p> <p>[Multiple unicast service control information elements are coded separately and the same MCS is used for each control information element that is transmitted.]</p>	<p><i>Option 4: Separately coded/Variable MCS</i></p> <p>[Multiple unicast service control information elements are coded separately and a different MCS can be used for each control information element that is transmitted.]</p>

Keep option 3 and Delete option 1 and option 2.

Option 4 is FFS.

→ This contribution gives the reason why we should adopt separate coding

Coding - Joint vs. Separate

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

All metrics are finally expressed as MAP OVERHEAD

Full System
Level
Performance
Evaluation



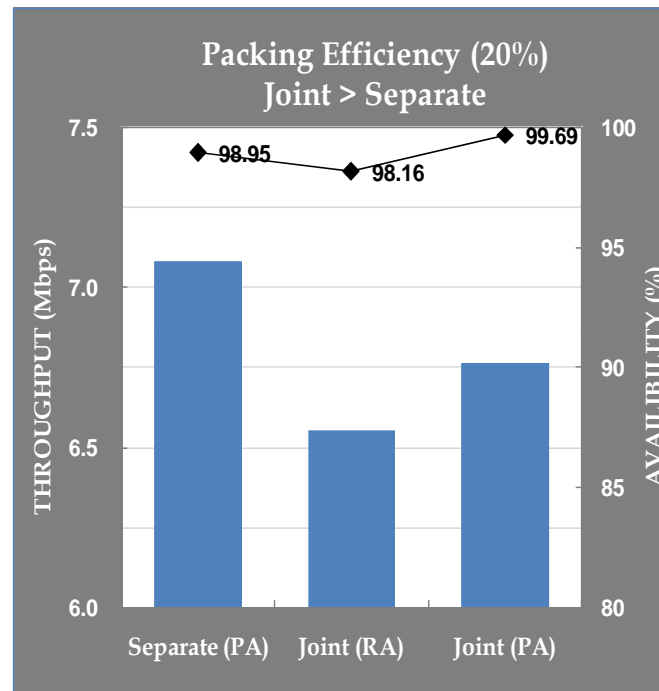
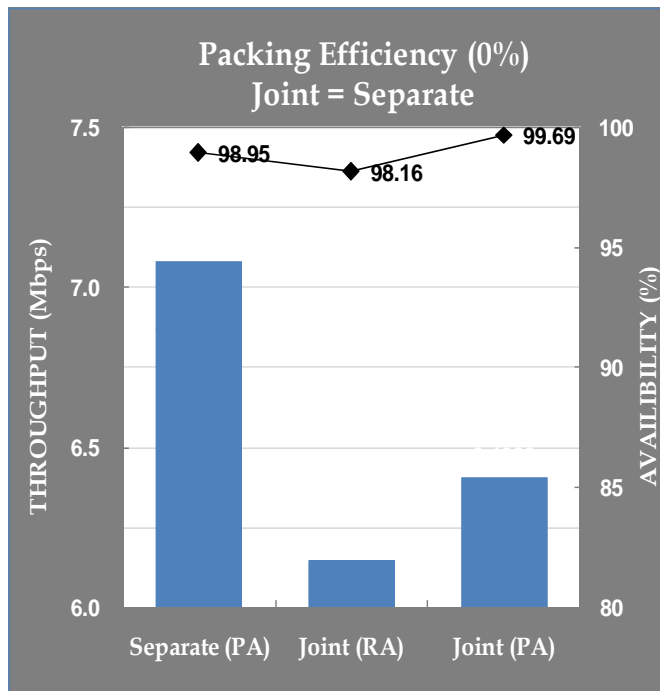
Separate coding has more gain than Joint coding

System Level Performance Evaluation

Separate >> Joint

- Link adaptation gain is larger than coding gain + packing efficiency
- MAP is transmitted every subframe
- PA: Power adaptation, RA: Rate adaptation

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



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

Separate Coding vs. Sub-MAP

Performance Metrics		Separate Coding	Sub-MAP	Joint Coding
Signaling Bit Overhead	CID	▪ Possible to eliminate CID overhead	▪ Per assignment message	▪ Per assignment message
	CRC	▪ Per assignment message	▪ Per sub-MAP	▪ One CRC
Coding gain (Length)		▪ Smaller	▪ Medium	▪ Larger
Link adaptation gain		▪ Larger	▪ Medium	▪ Smaller
Packing Efficiency		▪ Lower	▪ Medium	▪ Higher
Indication OH (header)		▪ Lower	▪ Higher	▪ Lower

Short period
(small n)

Scheduling Interval
(Every n subframes)

*Long period
(large n)

Small number of scheduled users



User grouping is difficult



Separate coding style with high indication OH

or Joint coding style with low indication OH (small link adaptation gain)



Separate coding has more gain than Sub-MAP

Separate coding \approx Sub-MAP
?

*Can satisfy latency requirement in SRD?

Summary

▪ Metric: Sector Throughput

- Separate coding > Joint coding
 - Link adaptation gain > coding gain + packing efficiency
- Separate coding > SubMAP-style joint coding
 - When scheduling Interval is short (small n)
 - Small user grouping gain in SubMAP
- Long scheduling interval (large n)
 - Data Latency problem

▶ **Separate coding is better than Joint coding with 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 subframe (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