

Antenna Selection for Mobile Station

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None

Purpose:

Propose to adopt the mobile station antenna selection technique described herein into IEEE 802.16m SDD.

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Antenna Selection for Mobile Station

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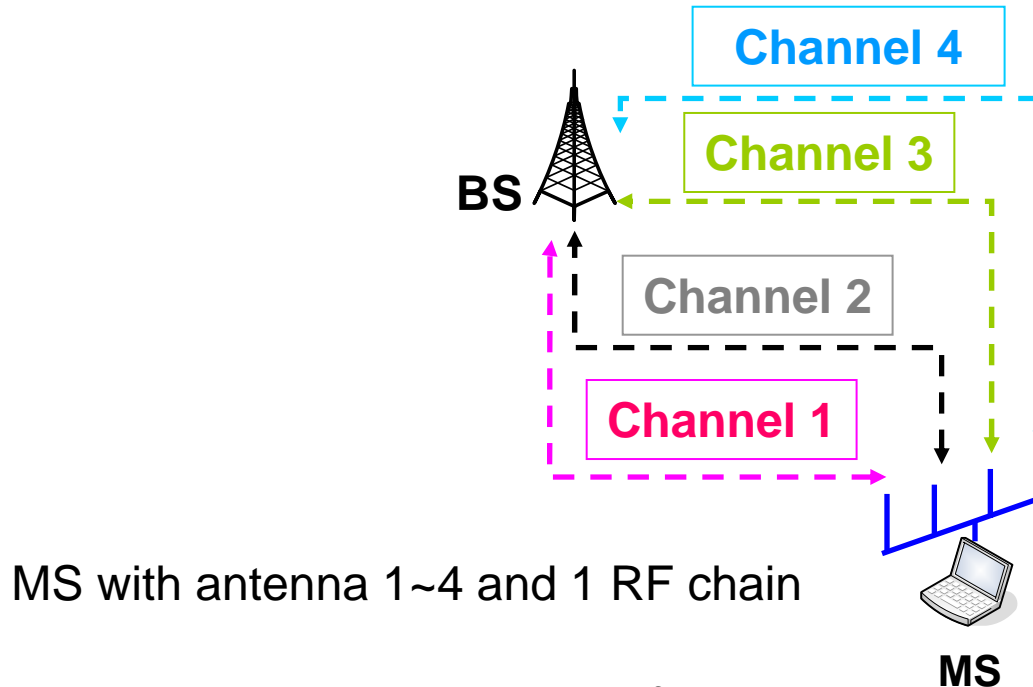
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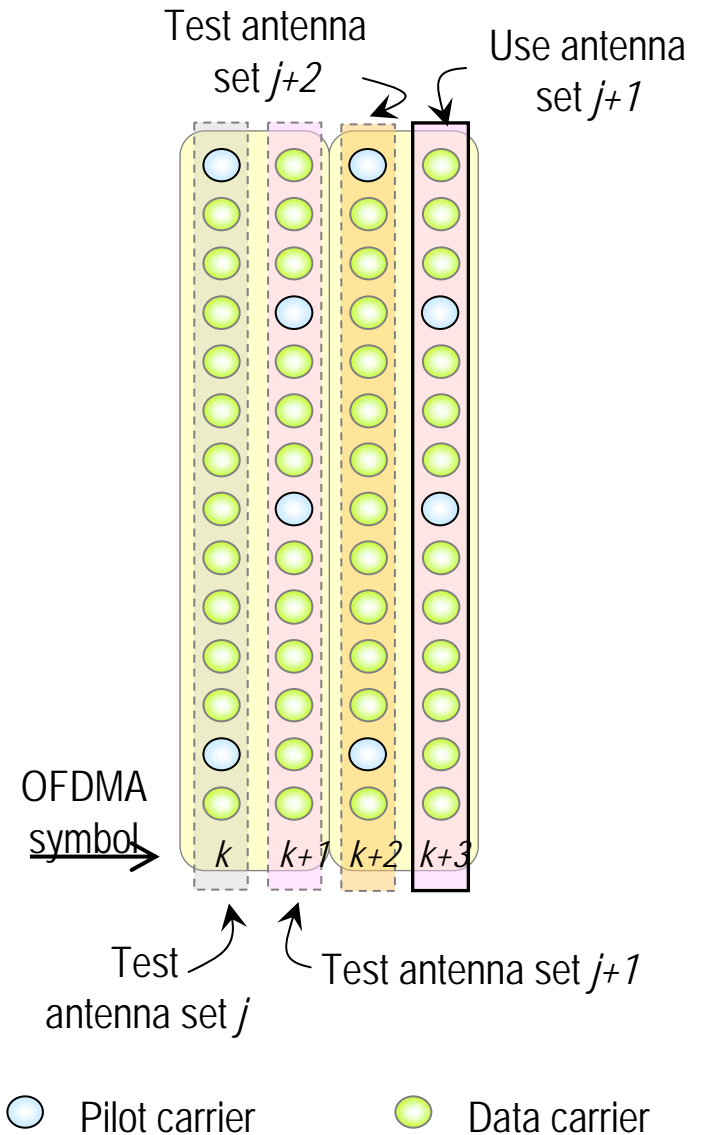
Motivations

- MIMO system will be mandatory
- For antennas, channel 1~4 is time variant with different gains!
- Less RF chains than antennas will be available at MS (e.g., laptop, etc.) due to cost constraint.
- MS Antenna Selection will be used in other 4G standards (LTE, 11n)
- **Requires only minor changes in standard, but gives large performance improvement**



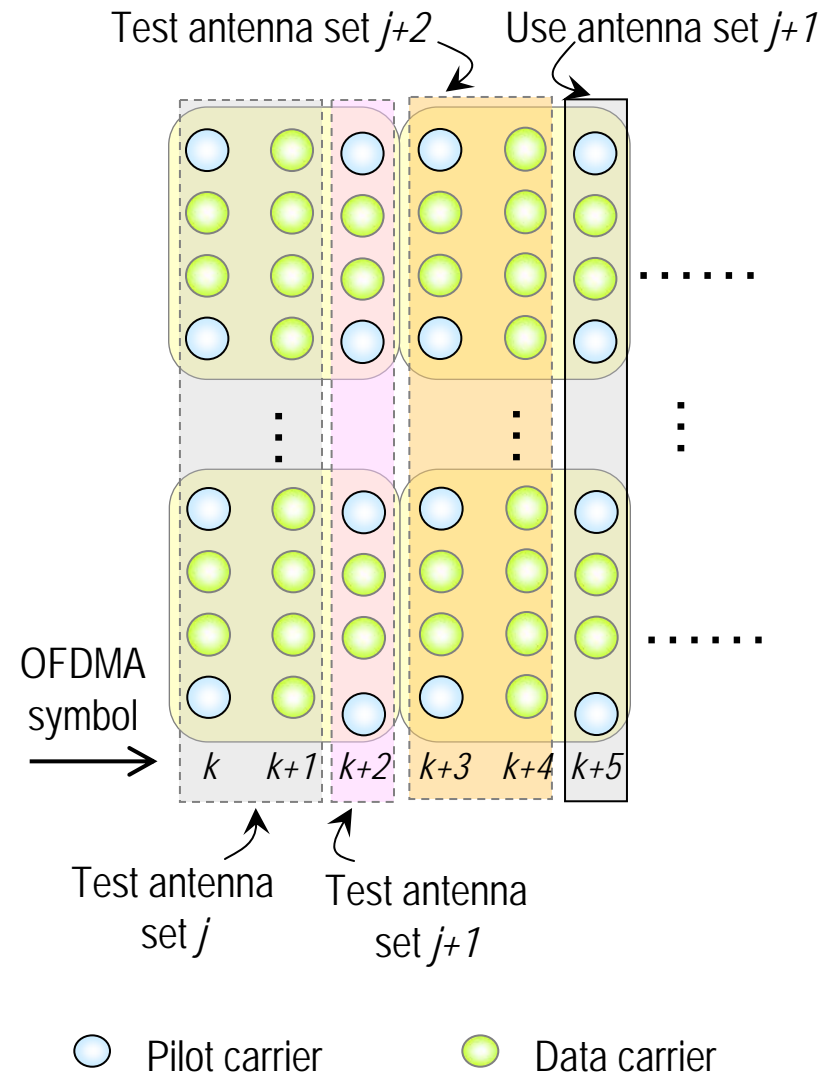
Receive Antenna Selection

- **Requires no standard change**
- Downlink receive antenna selection at mobile station
- Permutation
 - Partially used subcarrier (PUSC)
- Receiver tests antennas and selects the best one(s)



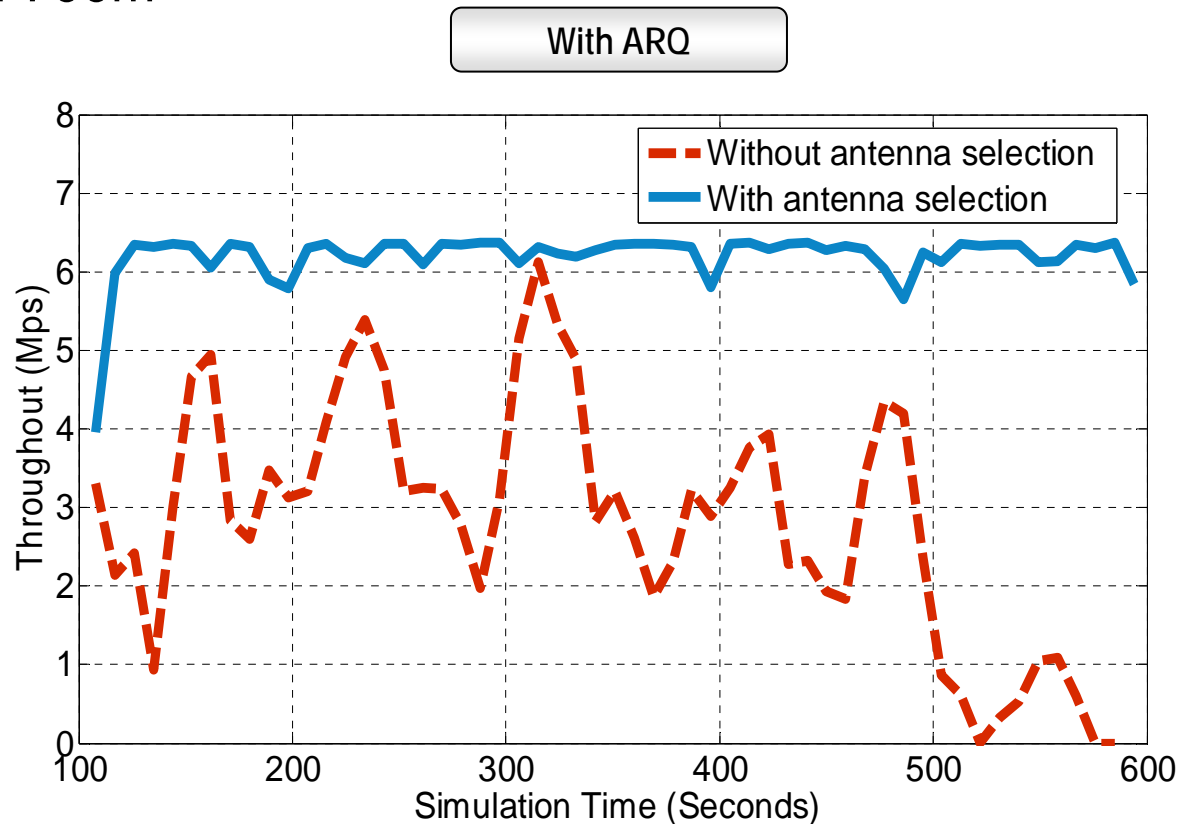
Transmit Antenna Selection

- *MS and BS agree on sequence in which antennas are trained*
- Uplink transmit antenna selection at mobile station
- MS transmits test signals from different antennas; BS feeds back which ones to use
- Antennas can also be selected based on reciprocity
- Permutation
 - Partially used subcarrier (PUSC)



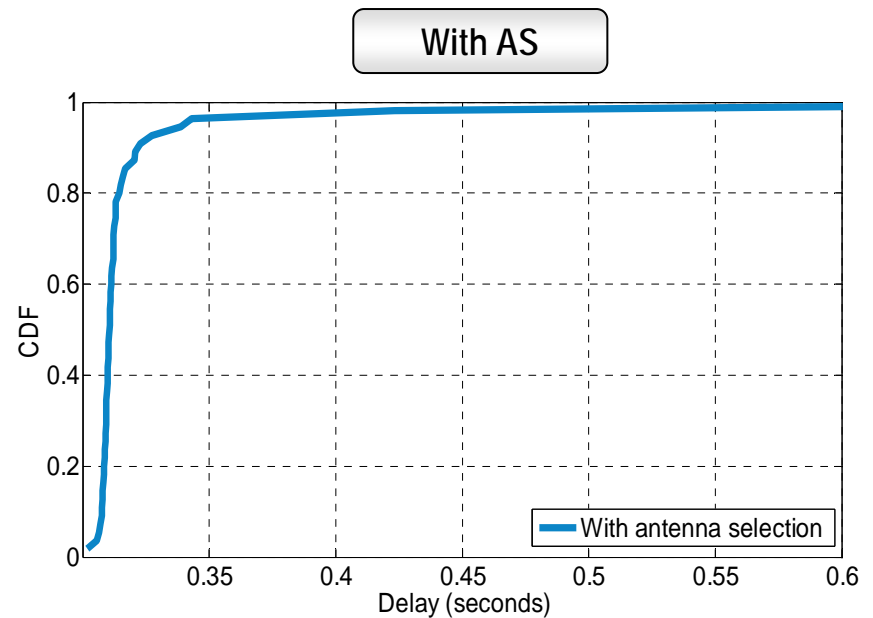
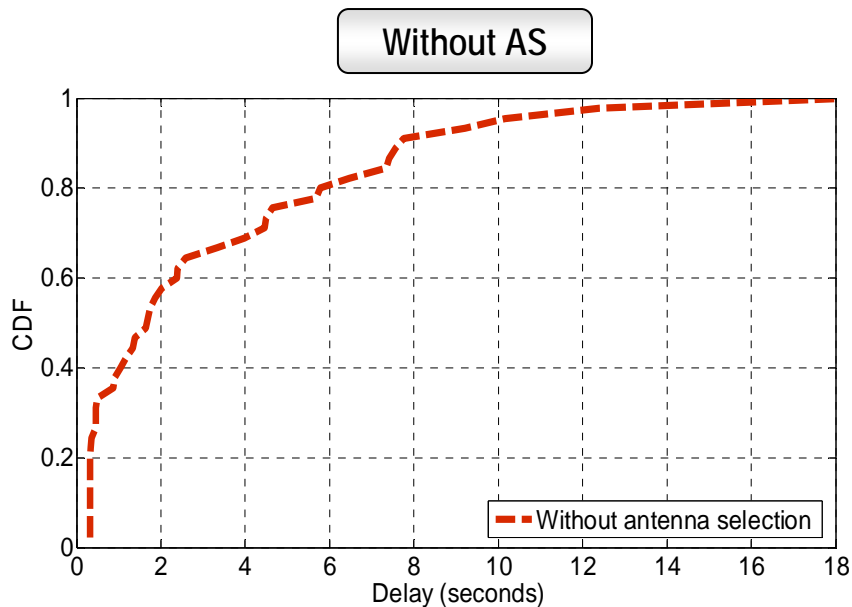
AS Increases Instantaneous Throughput

- **AS increases instantaneous throughput**
- AMC: 64QAM, $\frac{1}{2}$ coding rate
- 5 ms frame size
- Uplink traffic only
- Distance: 700m



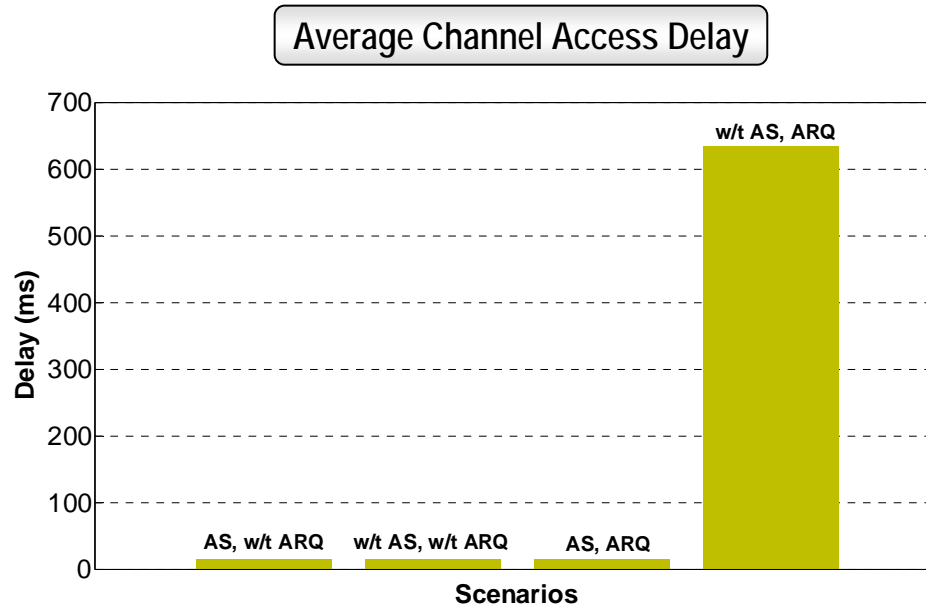
AS Reduces Delay

- *AS reduces retransmission, and thus lowers delay*
- AMC: 64QAM, $\frac{1}{2}$ coding rate
- 5 ms frame size
- Uplink traffic only
- ARQ
- Distance: 700m



AS Reduces Delay

- Average Channel Access Delay

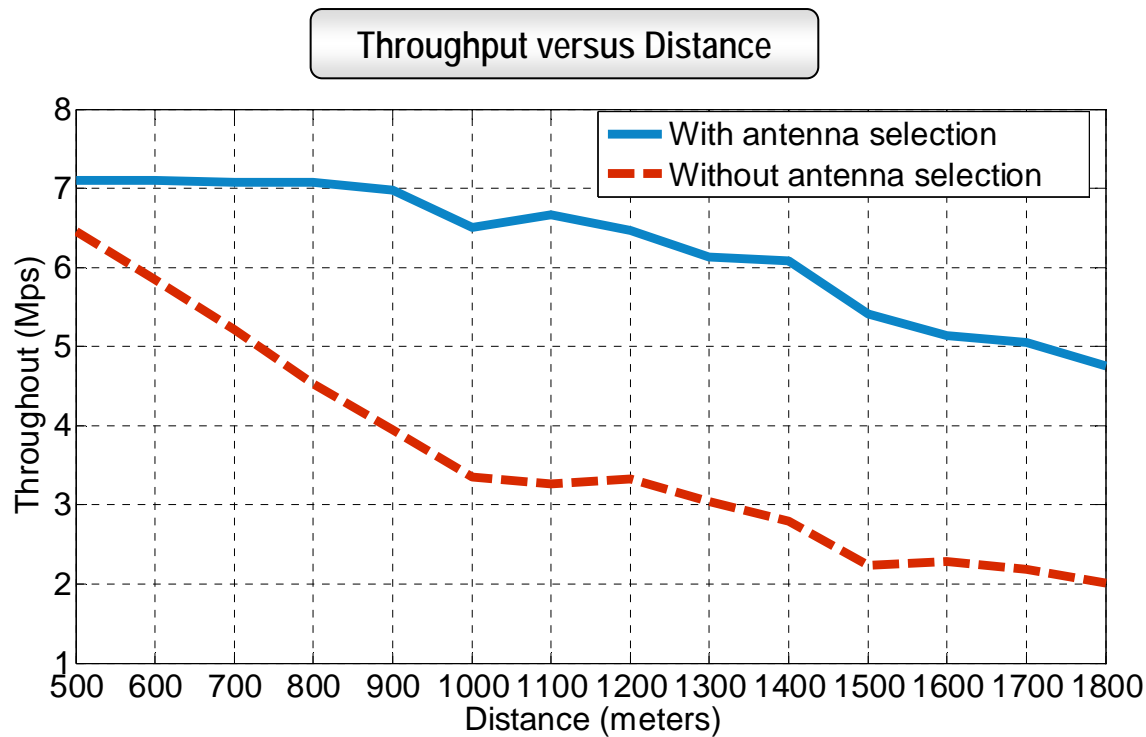


Delay	ARQ	
	Antenna Selection	w/t AS, w/t ARQ
	AS, w/t ARQ	AS, ARQ

Diagram illustrating the relationship between Antenna Selection and ARQ. The table shows four scenarios: w/t AS, w/t ARQ (yellow), AS, w/t ARQ (orange), w/t AS, ARQ (green), and AS, ARQ (blue). Red arrows indicate that the delay for w/t AS, ARQ is higher than for w/t AS, w/t ARQ, and that AS, ARQ is higher than AS, w/t ARQ. A grey oval highlights the ARQ scenarios, and a blue oval highlights the AS scenarios.

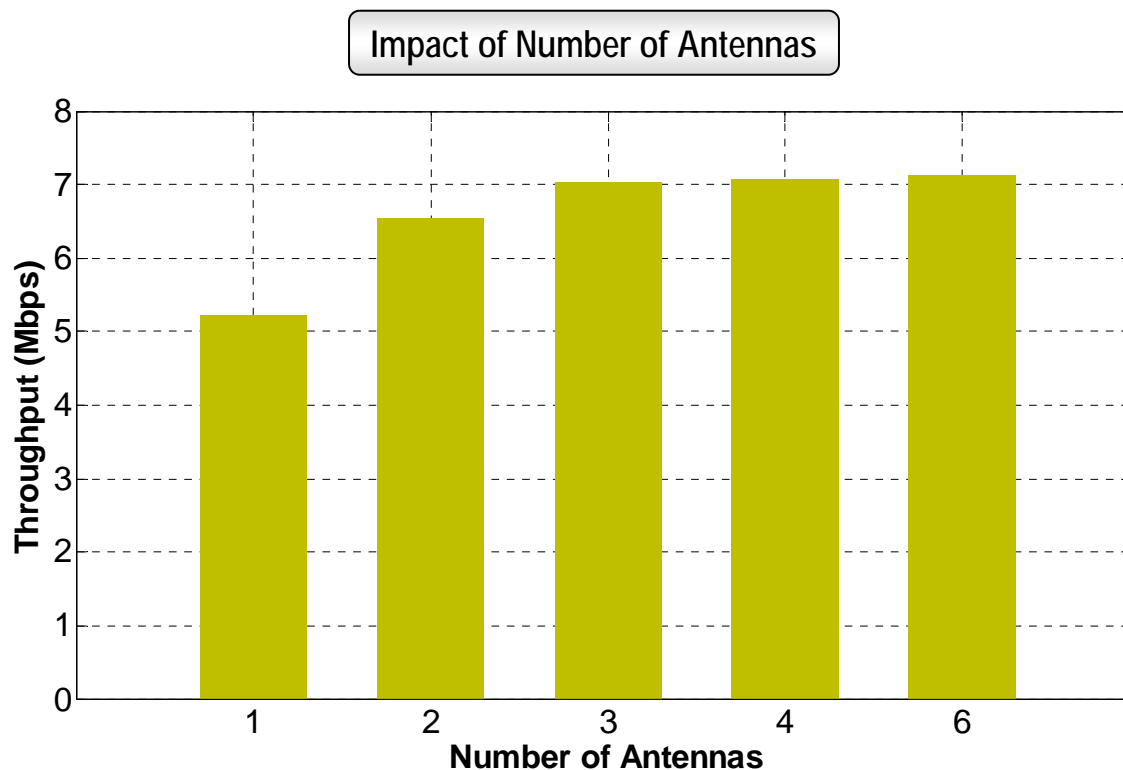
Throughput versus Distance

- Fixed AMC: 64QAM, $\frac{1}{2}$ coding rate
- 5 ms frame size
- Uplink traffic only
- Without ARQ



Throughput versus Number of Antennas

- BS and MS Distance: 700m
- Number of Antenna: {1, 2, 3, 4, 6}
- Without ARQ



Conclusions

- Antenna selection at MS improves performance
- Easily implemented with current handset technology
- Requires only minimal changes in standard
- Improvement of throughput by up to 30%, decrease in latency by order of magnitude