Antenna Selection for Mobile Station

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Purpose:

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

Antenna Selection for Mobile Station

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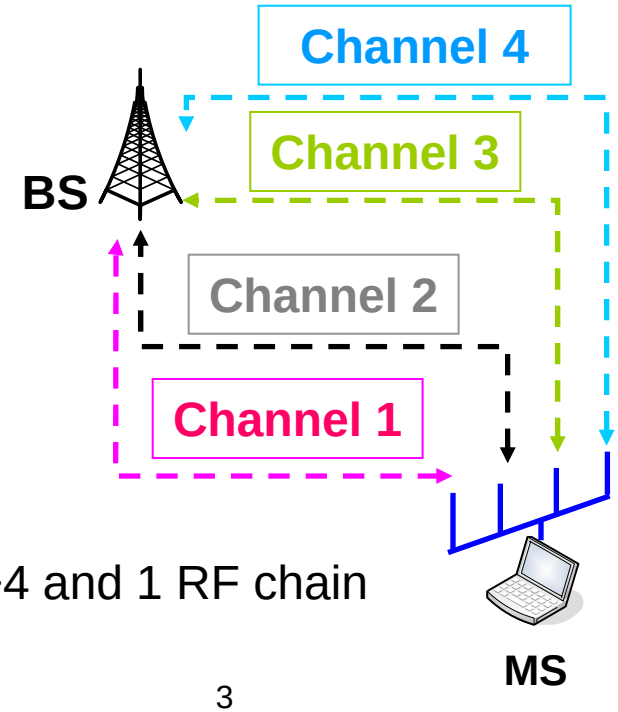
Motivations

- 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**



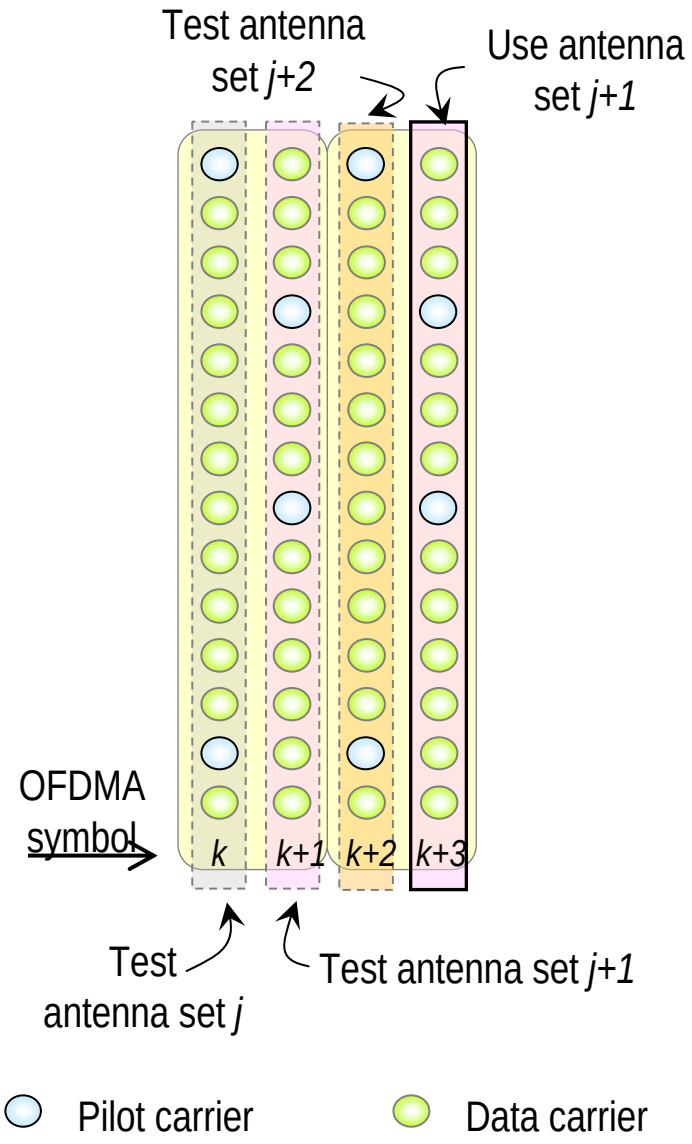
MS with antenna 1~4 and 1 RF chain

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)

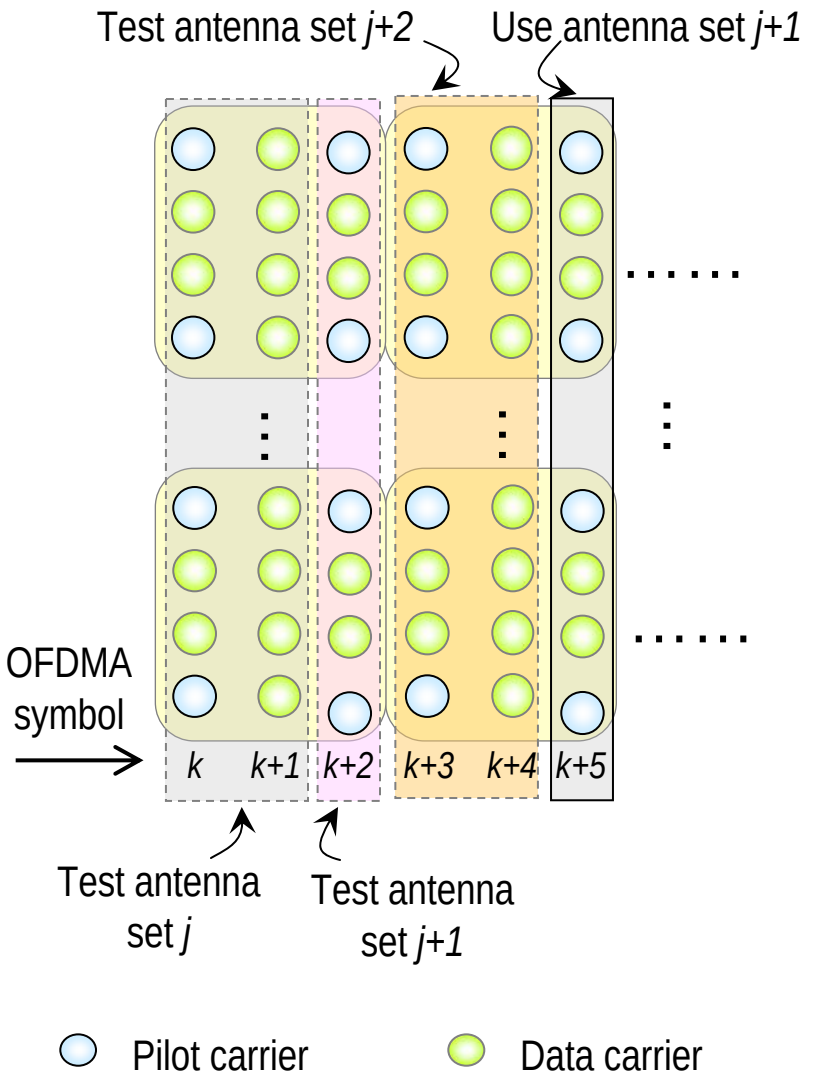


Transmit Antenna Selection

- ***MS and BS agree on sequence in which antennas are trained***

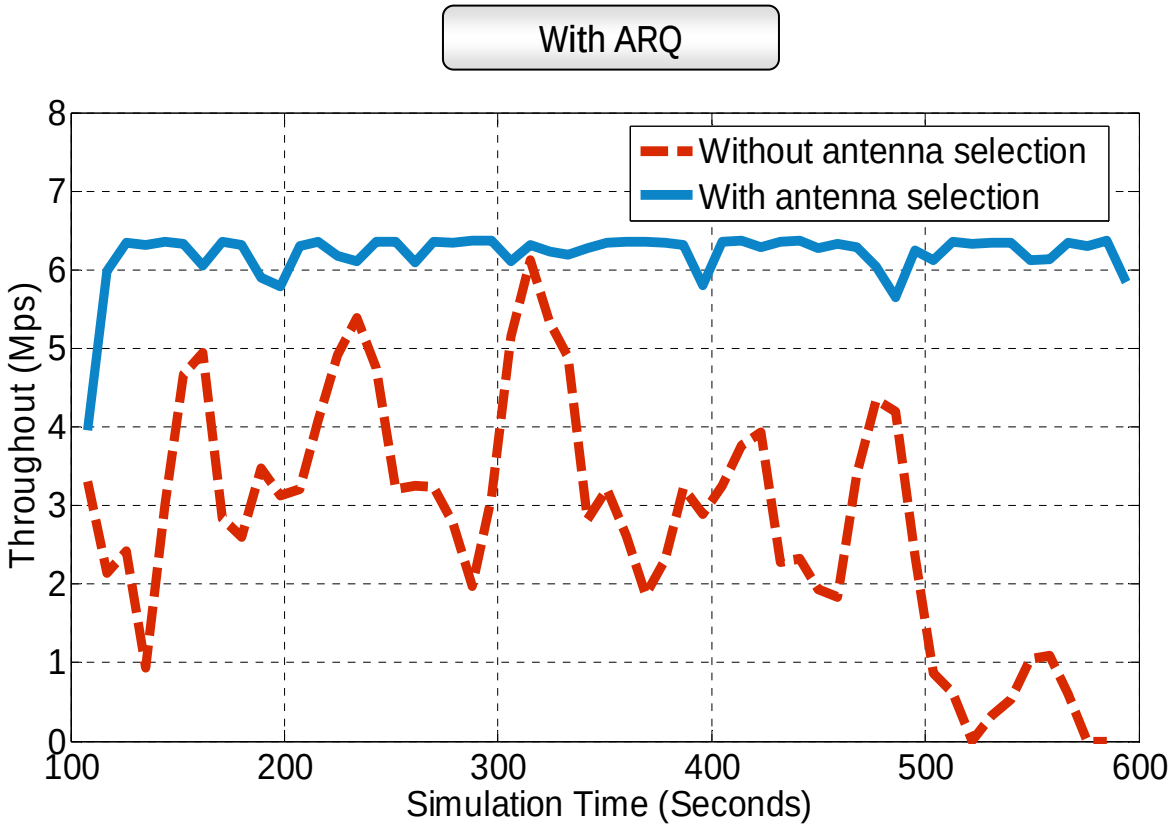
- Uplink transmit antenna selection at mobile station
- MS transmits test signals from different antennas; BS feeds back which ones to use
- Antennas can also be selected based on reciprocity

- Permutation
  - Partially used subcarrier (PUSC)



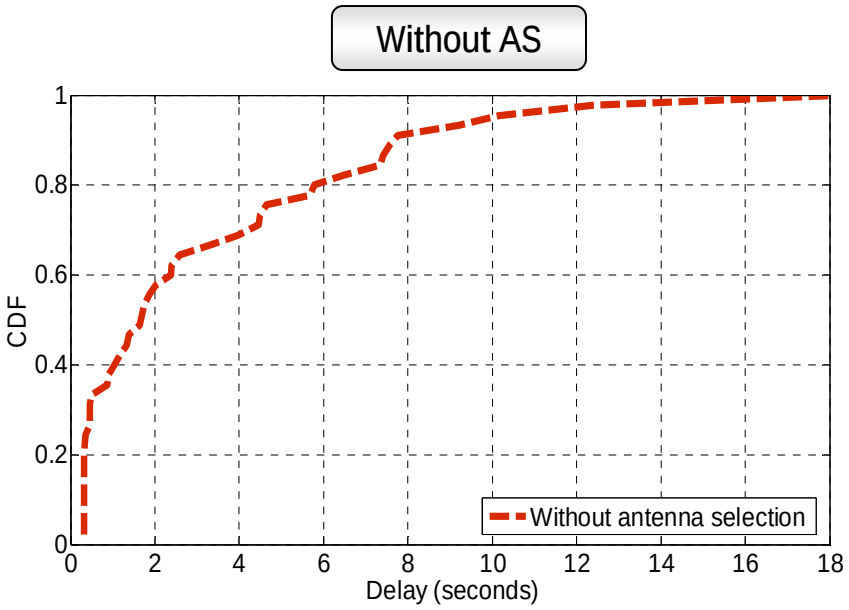
AS Increases Instantaneous Throughput

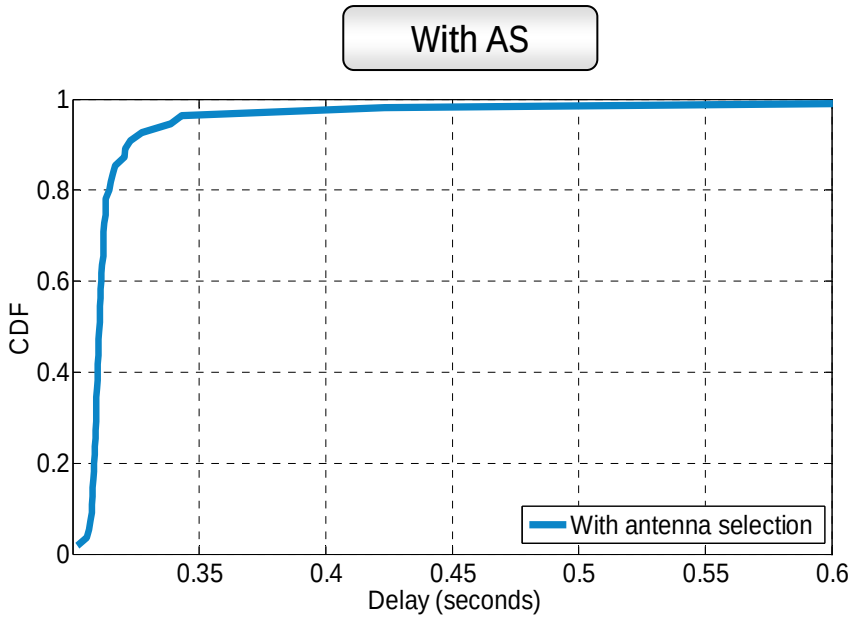
- ***AS increases instantaneous throughput***
- AMC: 64QAM, ½ coding rate
- 5 ms frame size
- Uplink traffic only
- Distance: 700m



AS Reduces Delay

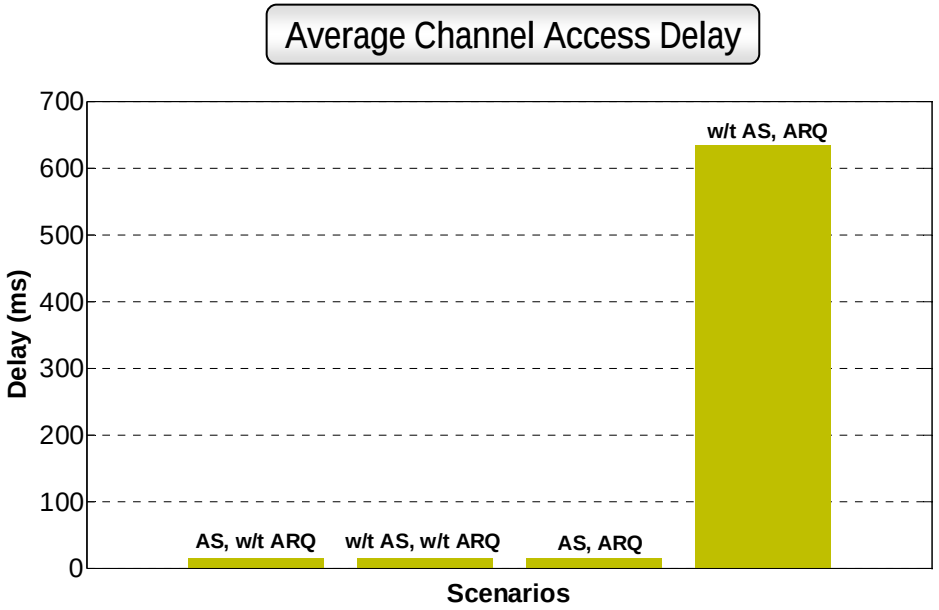
- ***AS reduces retransmission, and thus lowers delay***
- AMC: 64QAM, ½ coding rate
- 5 ms frame size
- Uplink traffic only
- ARQ
- Distance: 700m





AS Reduces Delay

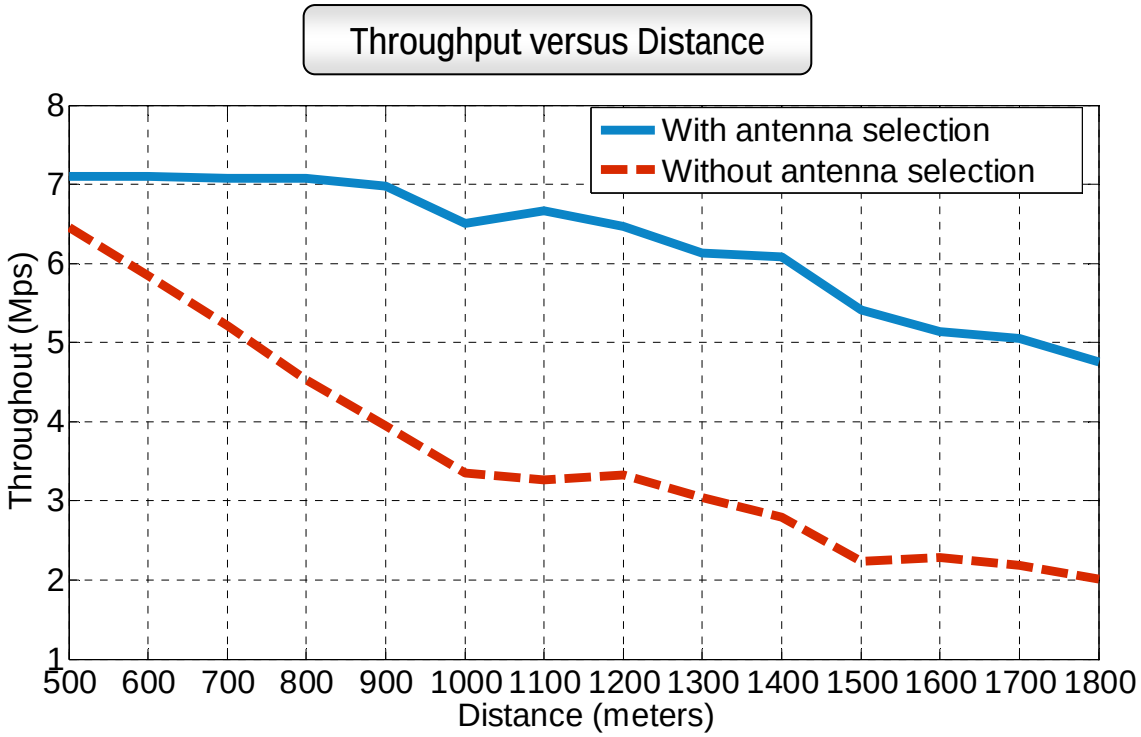
- Average Channel Access Delay



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

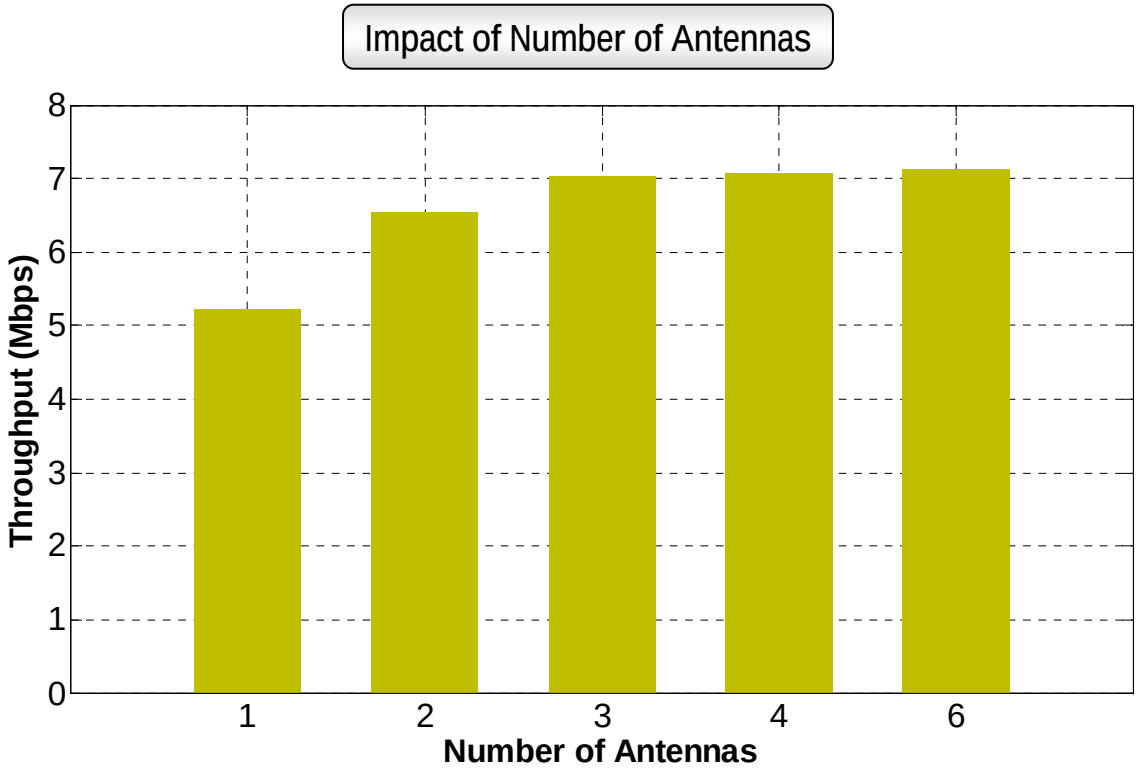
Throughput versus Distance

- Fixed AMC: 64QAM, ½ 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