Uplink Sounding for Antenna Selection at Mobile Station

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Purpose:

To adopt the scheme of using uplink sounding to facilitate antenna selection at mobile station proposed herein into IEEE 802.16m system description document (SDD).

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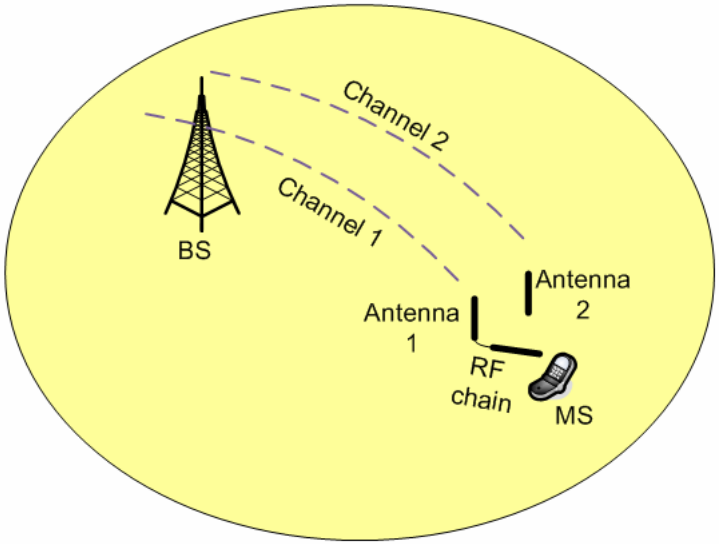
Antenna Selection at Mobile Station

- Antenna selection is a technique in which only a subset of available antenna elements is used for the transmission/reception of data
  - The subset can change according to channel conditions and interference situation.
  - Antenna selection can effectively reduce hardware complexity/cost, while retaining most of the benefits of large antenna arrays (e.g., diversity).

- Proper channel estimation is needed for antenna selection



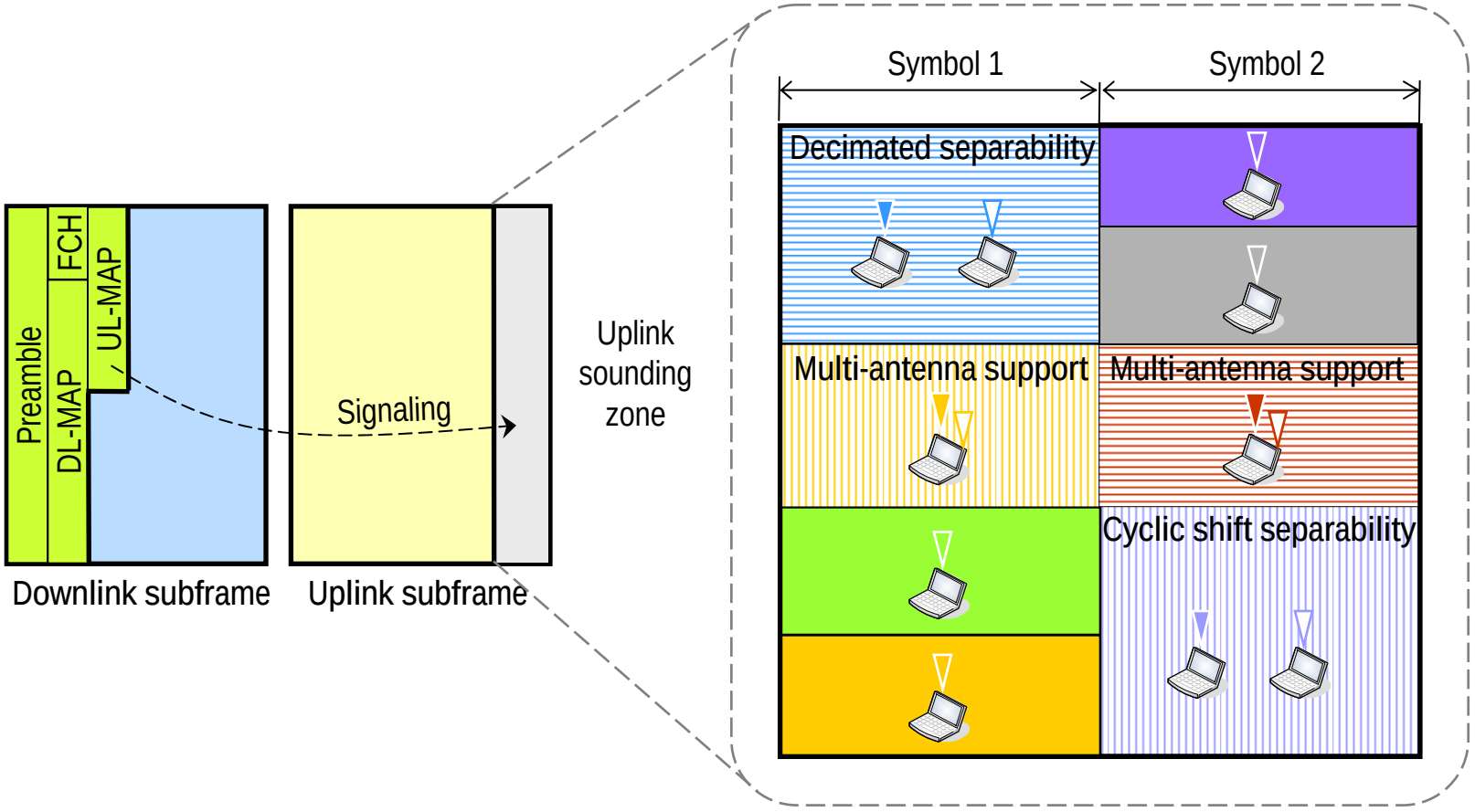
Legacy Uplink Sounding

- Signaling
  - UL-MAP_IE (UIUC = 13)
  - PAPR_Reduction_and_Safety_Sounding_Zone_Allocation_IE()
  - UL_Sounding_Command_IE()

- Non-distributed subcarrier allocation (Type A)
  - MS multiplexing
    - Decimated separatability
    - Cyclic shift separatability
  - Multiple antenna can be supported in the legacy uplink sounding
    - But only when the number of antenna is equal to the number of RF chains
    - Not for antenna selection
  - Mandatory in current WiMAX Forum Profile

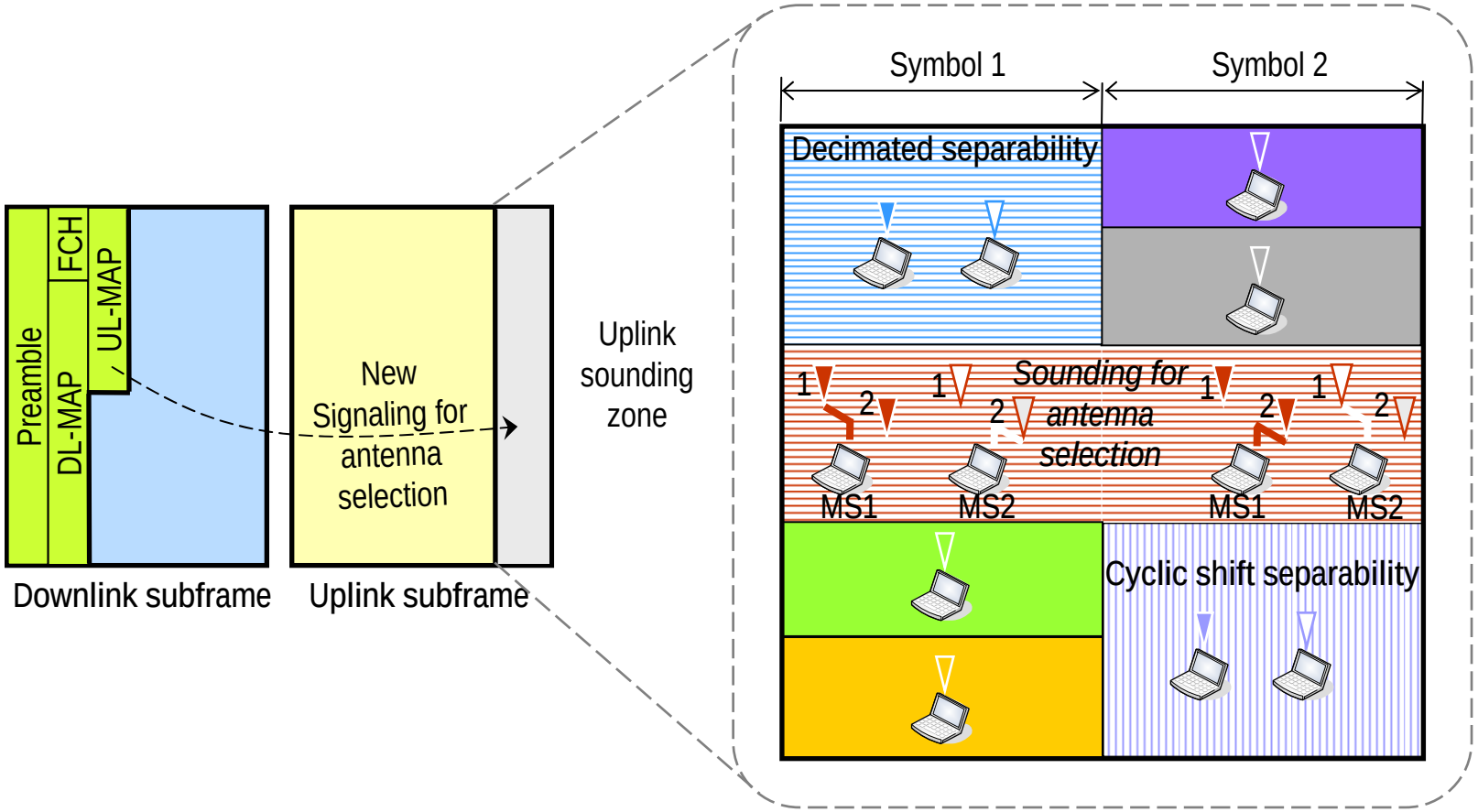
- Distributed subcarrier allocation (Type B)
  - No MS multiplexing
  - No support to multiple antenna
  - Optional in current WiMAX Forum Profile

Legacy Uplink Sounding: Illustration



Uplink Sounding for Antenna Selection

- Uplink sounding can be used to support antenna selection
- UL_Sounding_Command_IE only needs to be slightly updated (i.e., insertion of a new field) to enable this feature
  - The entire legacy uplink sounding mechanism is completely reused
  - All the benefits of uplink sounding thus are fully inherited



Proposed Change

- The “Multi-antenna flag” and the newly introduced “Number of AS sounding symbols” field are used together to signal the uplink sounding for antenna selection.

Syntax	Size (bit)	Notes
UL_Sounding_Command_IE() {	-	-
Extended-2 UIUC	4	UL_Sounding_Command_IE() = 0x04
…	…	…
Power boost	1	0 = no power boost 1 = power boost
Multi-antenna flag	1	0 = MS sounds first antenna only 1 = MS sounds all antenna
…	…	…
Periodicity	3	0b000 = Single command, not periodic, or ter-minate periodicity. Otherwise, repeat sound-ing once per r frames, where r = 2(n–1), where n is the decimal equivalent of the periodicity field.
Number of AS sounding symbols	*3*	*Number of OFDMA symbols immediately following the UL sounding symbol in this sounding zone that will be used for the sounding for uplink antenna selection*
…	…	…
}		

Conclusions

- Uplink sounding mechanism can be effectively used for antenna selection

- Only very minor change to UL_Sounding_Command_IE() would be needed to enable this feature.