

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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Uplink Sounding for Antenna Selection at Mobile Station

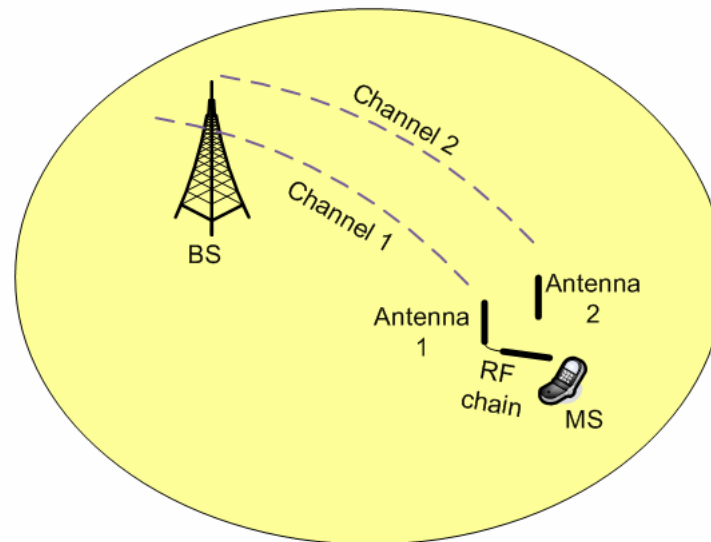
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Antenna Selection at Mobile Station

- 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



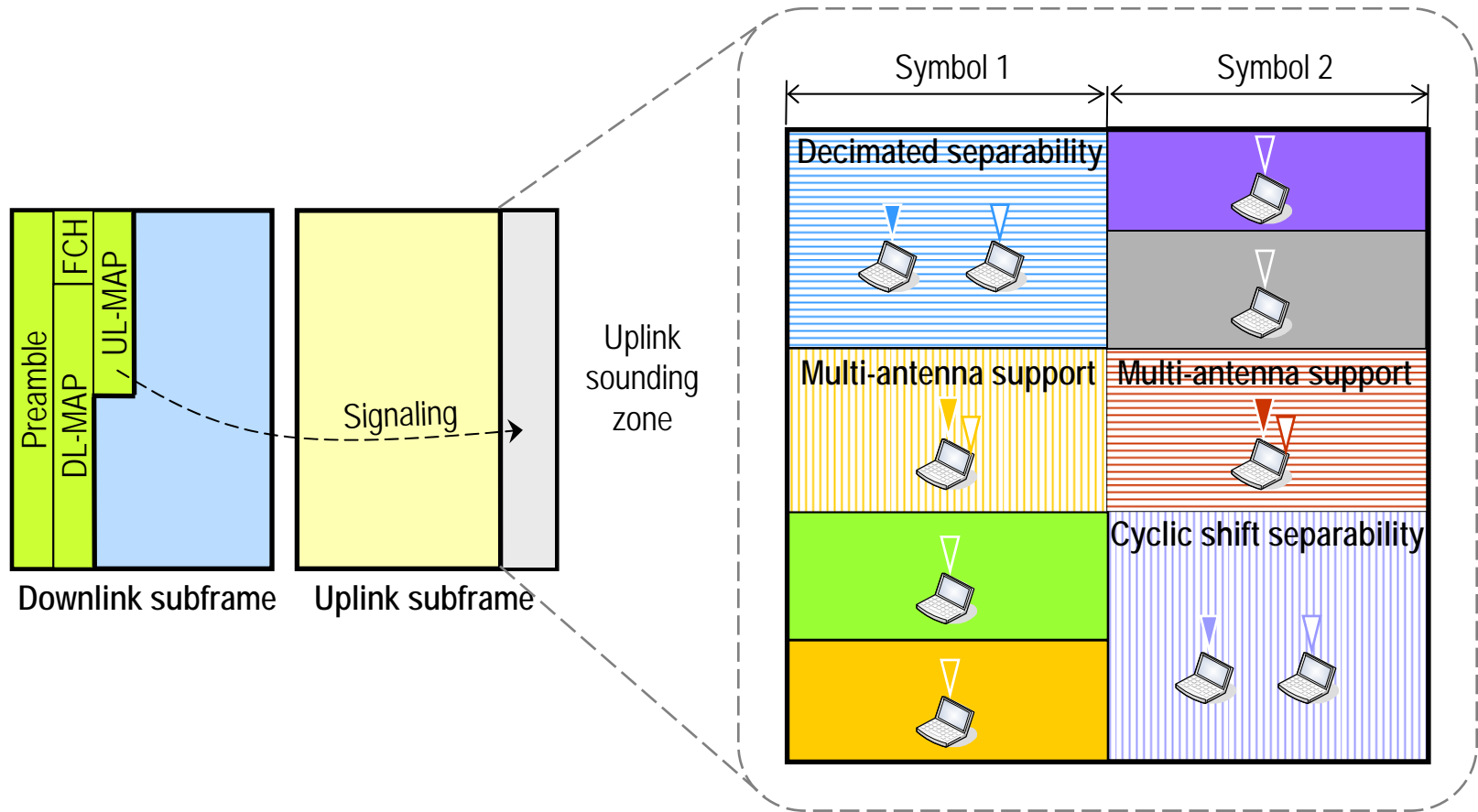
Legacy Uplink Sounding

- 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 separability
 - Cyclic shift separability
 - 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

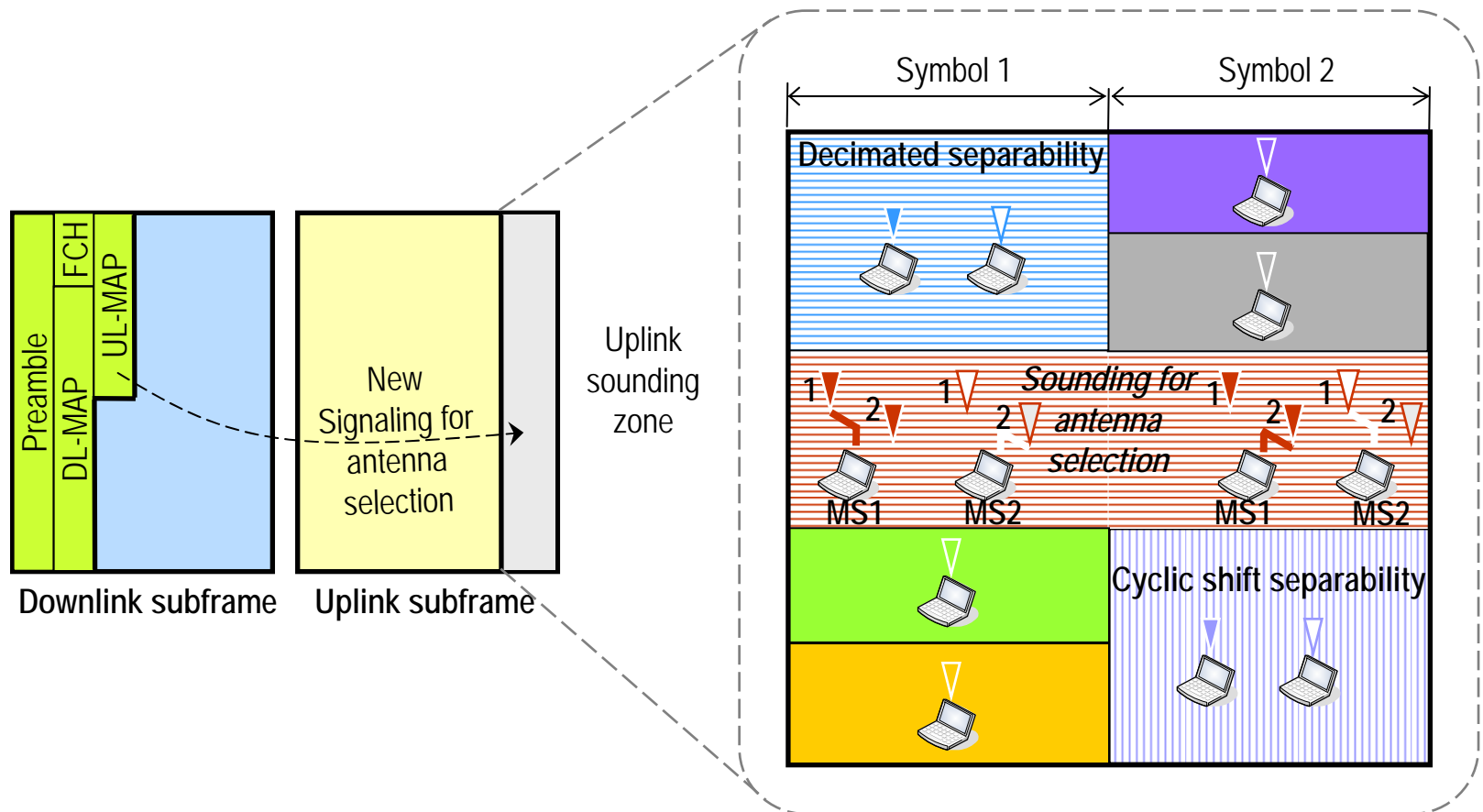
- Distributed subcarrier allocation (Type B)
 - No MS multiplexing
 - No support to multiple antenna
 - Optional in current WiMAX Forum Profile

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 terminate periodicity. Otherwise, repeat sounding once per r frames, where $r = 2(n-1)$, where n is the decimal equivalent of the periodicity field.
<u>Number of AS sounding symbols</u>	<u>3</u>	<u>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</u>
...
}		

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.