

BW Field in HE-MU Format

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Overview

- Non-Contiguous Channel bonding was adopted by 11ax [1].
- The bandwidth field in HE-SIG-A of a HE MU format has 3 bits to signal the corresponding puncturing modes in the preamble [2].
 - Excluding the 4 basic BW modes (20/40/80/160(80+80)), 4 additional modes may be indicated by BW field.

On the Name “Non-Contiguous Channel Bonding”

- The name “bonding” is not very accurate, because we are not doing carrier aggregation but actually digitally puncturing tones.
 - There will be non-negligible spectral leakage in the continuous frequency points in the punctured 20MHz channels that is not in the exact subcarrier locations.
- With or without this “bonding”, the spectral mask should be identical as defined for the full BW (20/40/80/160(80+80) masks).
- Proposals:
 - Change the term “Non-contiguous channel bonding” to “channel puncturing”.
 - The BW field in HE-SIG-A of HE-MU format indicates “preamble puncturing”.

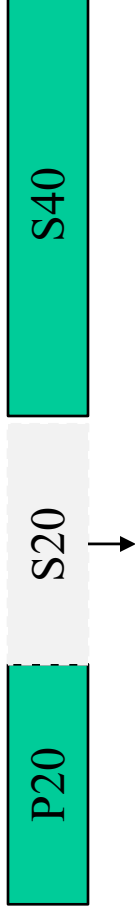
Criteria for Preamble Puncturing—1

- Preamble puncturing happens only for 80MHz and 160MHz, therefore in the primary 80MHz without puncturing, there are two 20MHz subchannels carrying the HE-SIG-B content channels 1 and 2 respectively.
- For receiver implementation simplicity (i.e. to reduce the SIGB decoding variations), it is desirable to have at least one instance of the 1st SIG-B content channel and one instance of the 2nd SIG-B content channel being present in primary 80 MHz.

Criteria for Preamble Puncturing—2

- The following puncturing mode for 80MHz are possible:

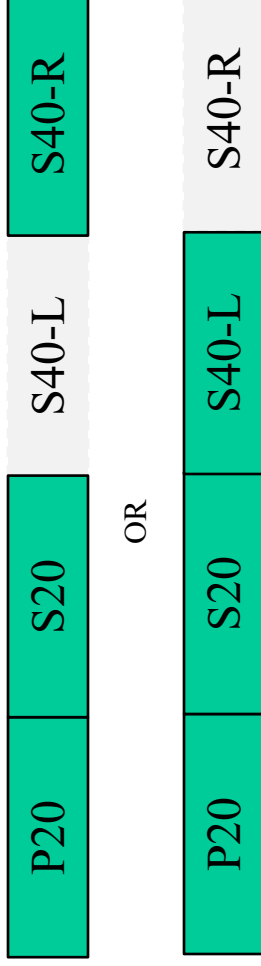
Preamble Puncturing
Mode 1:



In 11ac, S20 CCA busy leads to 20MHz Tx, ~3x Throughput over 11ac

Receiver is able to decode SIGB-C1 and SIGB-C2 from the known puncturing landscape

Preamble Puncturing
Mode 2:



Receiver is able to decode SIGB-C1 and SIGB-C2 from P40

Criteria for Preamble Puncturing—3

- The following puncturing mode for 160MHz (or 80+80MHz) are possible:

Preamble Puncturing

Mode 3:



In 11ac, S20 CCA busy leads to 20MHz Tx, up to ~7x Throughput of 11ac!

Receiver is able to decode SIGB-C1 and SIGB-C2 from the known puncturing landscape

Preamble Puncturing

Mode 4:



OR



OR



In 11ac, S40 CCA busy leads to 40MHz Tx, up to ~3.5x Throughput of 11ac!

Receiver is able to decode SIGB-C1 and SIGB-C2 from the P40.

Puncturing may happen in S80, but not need to be signaled by SIGA, because typically SIGB decoding won't use S80.

Proposals

- Propose to limit preamble puncturing in P80 only to the above mentioned 4 modes.
 - SIGB content channels 1 and 2 are both present in primary 80MHz, therefore **no need to change the current SIGB encoding structure and content** (“[1 2 1 2]” structure).
- Capability: propose to define 4-bit capability on these 4 additional CB modes.
- In the above mentioned preamble puncturing modes 2 and 4, SIGB RU allocation may further signal which 20MHz sub-channel the in secondary 40MHz is punctured
- In the above mentioned preamble puncturing modes 3 and 4, SIGB RU allocation may further signal which 20MHz sub-channel the in secondary 80MHz is punctured
- Spectral Mask: propose no spectral mask change with channel puncturing.
 - i.e. in channel puncturing modes, the transmitted waveforms only need to conform to the original 80MHz or 160MHz masks.

Straw Poll 1

- Do you agree with the following definition of the BW field in HE-SIG-A of HE_MU format?
 - The 3-bit BW field in HE-SIG-A of HE-MU format is defined as:
 - 0: Full 20MHz
 - 1: Full 40MHz
 - 2: Full 80MHz
 - 3: Full 160/80+80 MHz
 - 4: 80MHz with Preamble Puncturing: in the preamble, only the secondary 20MHz is punctured
 - 5: 80MHz with Preamble Puncturing: in the preamble, only one of the two 20MHz subchannels in secondary 40MHz is punctured
 - 6: 160/80+80MHz with Preamble Puncturing: in the primary 80MHz of the preamble, only the secondary 20MHz is punctured.
 - 7: 160/80+80MHz with Preamble Puncturing: in the primary 80MHz of the preamble, the primary 40MHz is present
 - **Furthermore:**
 - In Mode 5, HE-SIG-B RU allocation may signal which 20MHz sub-channel the in secondary 40MHz is punctured
 - In Mode 6 and Mode 7, HE-SIG-B RU allocation may signal additional puncturing in secondary 80MHz.
 - In Mode 7, HE-SIG-B RU allocation may signal additional puncturing in secondary 40MHz.
 - Modes 4~7 are optional for STA to receive, each with a capability bit
 - In the Preamble Puncturing modes (Modes 4~7), the spectral mask is the same as those defined for the total bandwidth.
 - Regardless of Preamble Puncturing modes, the structure of HE-SIG-B is the same, i.e. the HE-SIG-B structure is solely dependent on the total BW

Straw Poll 2

- Do you agree to adopt the spec text changes as shown in doc 11/16-0899r0 (reflects the content of SP1)?

References

- [1] 11-16-0059-01-00ax-non-contiguous-channel-bonding-in-11ax
- [2] 11-16-0635-02-00ax-bw-indication-for-non-contiguous-channel-bonding