

HE-SIG-B Signaling Discussions

Date: 2016-03-14

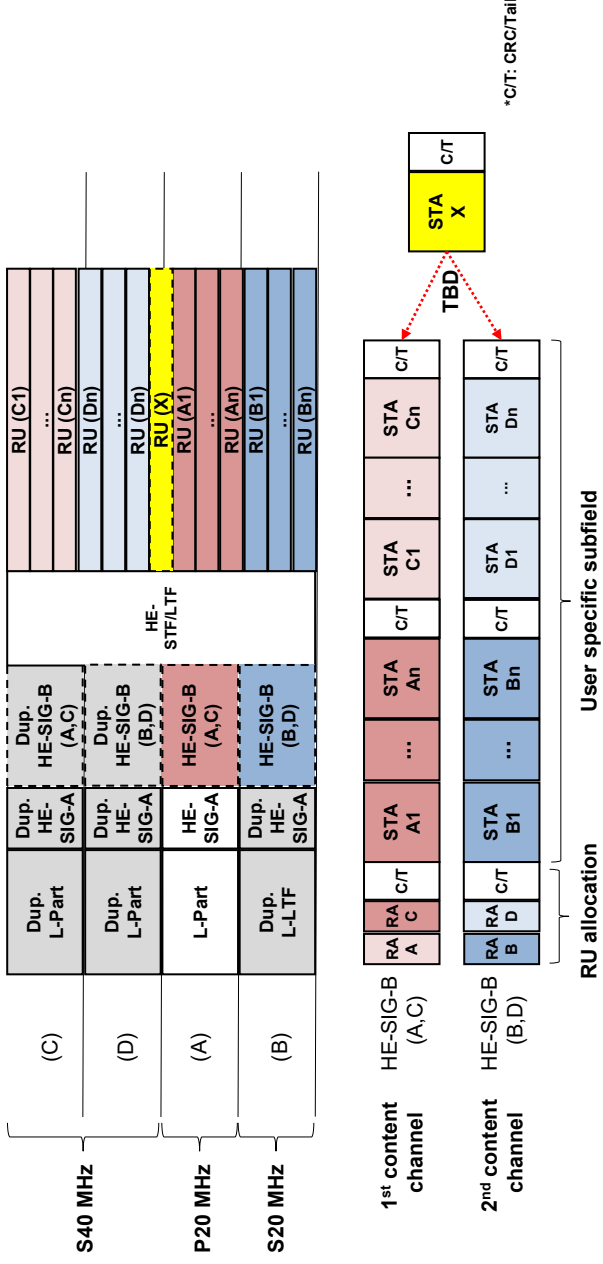
Authors:

Name	Affiliations	Address	Phone	email
John (Ju-Hyung) Son	WILUS	48 Mabang-ro, Seocho-gu, Seoul, Korea	+82-2-552-0110	john.son@wilusgroup.com
Geonjung Ko				greg.ko@wilusgroup.com
Minseok Noh				minseok.noh@wilusgroup.com
Jin Sam Kwak				jinsam.kwak@wilusgroup.com

Introduction

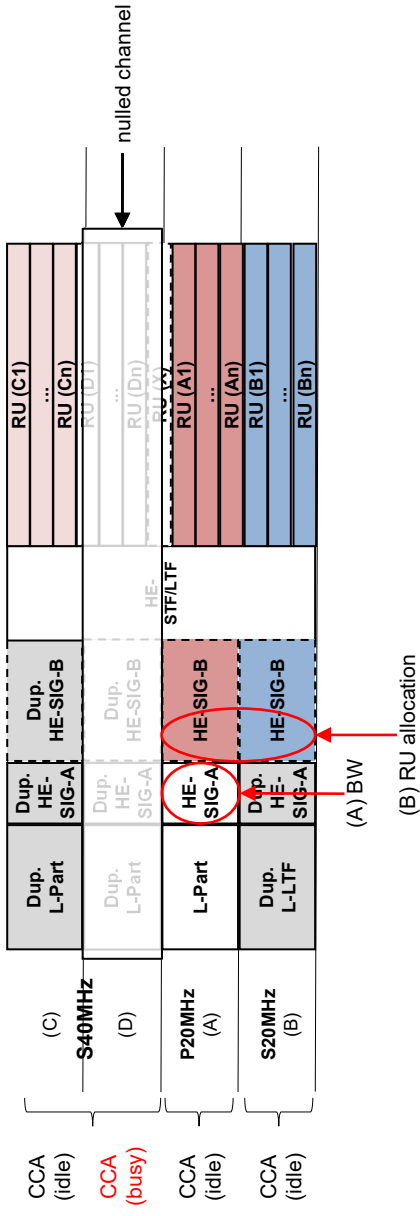
- In HE MU PPDU, HE-SIG-B field delivers multi user signaling information [1].
- Also, TGax adopted non-contiguous channel bonding [2][3]
 - *The non-contiguous channel bonding will be supported in 802.11ax by:*
 - *Transmitting using OFDMA PPDU format by nulling the tones of one or more secondary channels in 80 MHz and 160 (80+80) MHz;*
 - *Modes for non-contiguous channel bonding are TBD;*
 - *Non-contiguous channels within primary or secondary 80 MHz only exists at AP side.*
- **In this submission, we discuss HE-SIG-B signaling details for the non-contiguous channel bonding**

Recap: HE-SIG-B



- **Two HE-SIG-B content channels are parallel-decoded at receiving STAs**
- **RU allocation subfield signals RU arrangements in frequency domain and the number of User specific subfields**
- **Signaling for the center 26 RU in 80MHz is TBD**

Signaling of non-contiguous channel-bonding

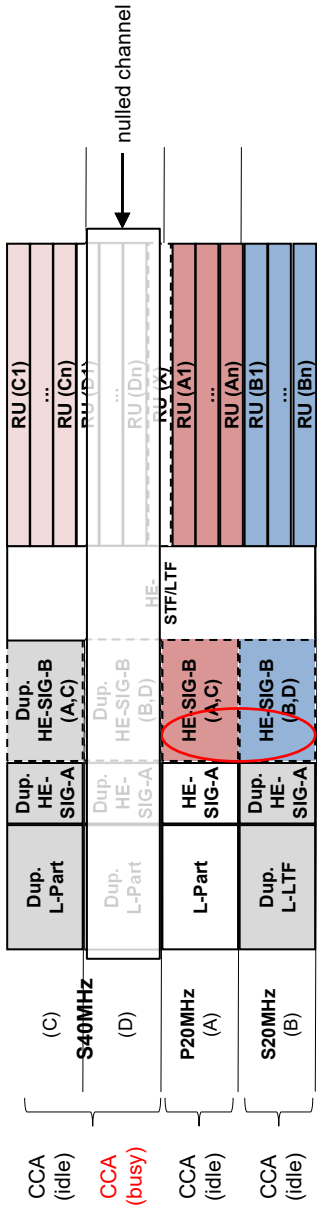


- For DL OFDMA PPDU, tones of one or more secondary channels in 80MHz and 160(80+80) MHz can be nulled [2][3]
- AP can signal non-contiguous channel based PPDU constructions by
 - (A) Using SIG-A's BW subfield
 - (B) Using SIG-B's RU allocation subfield

Signaling of non-contiguous channel-bonding

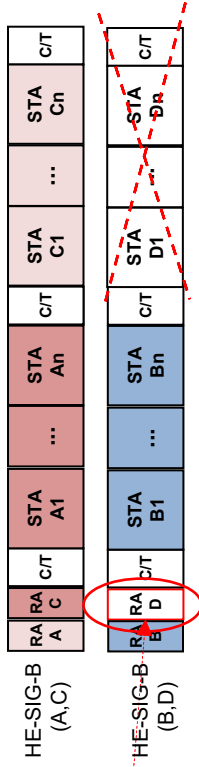
- **(A) Using SIG-A's BW subfield**
 - In SU PPDU, SIG-A's BW subfield signals 20/40/80/160(80+80) MHz bandwidths only
 - In MU PPDU, SIG-A's BW subfield is TBD that may accommodate more bandwidth options than in SU case
 - 11ax may extend SIG-A's BW subfield in DL MU to explicitly signal multiple TBD non-contiguous bandwidth options (e.g. P20+S40)
 - According to [2], BW subfield may require 3~7 bits according to channel bonding rules

Signaling of non-contiguous channel-bonding



RU allocation

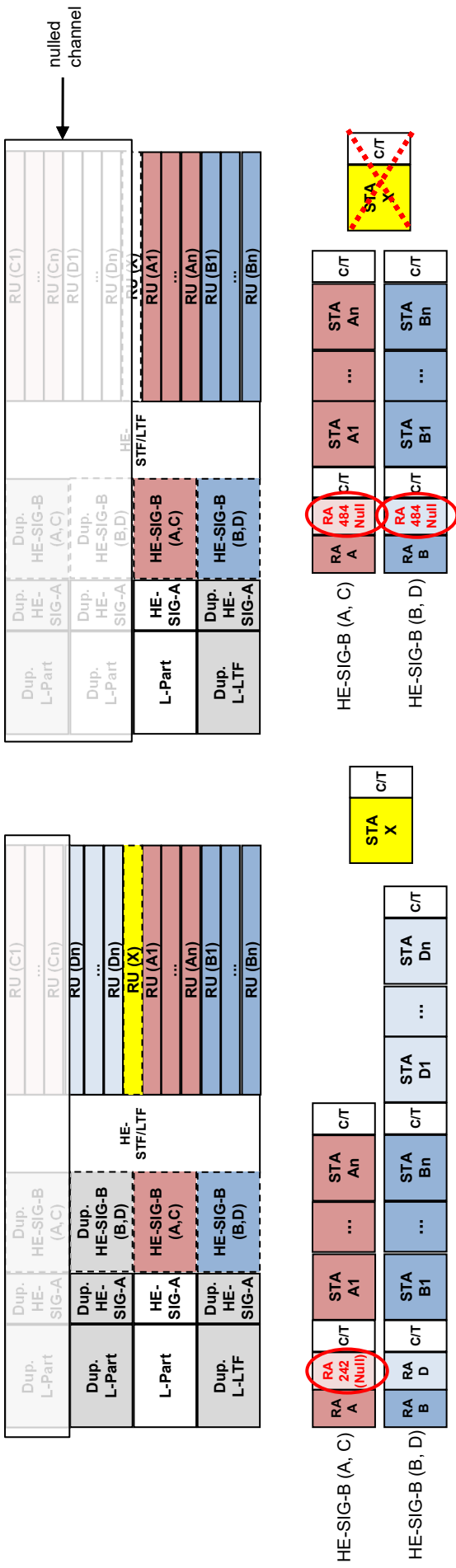
indices	#1	#2	#3	#4	#5	#6	#7	#8	#9	# of Entries
...										...
TBD					242 Null					1
TBD					484 Null					1
TBD					996 Null					1
...										...



• (B) Using SIG-B's RU allocation subfield

- Add additional Null RU indices to the current RU allocation definition (currently there are many TBD index ranges)
- RU allocation subfield signals "242/484/996 Null" to indicate nulled secondary channels
- No user specific subfields are sent corresponding to the Null RUs
- No additional signaling overheads on SIG-A/B bit fields compared to the current design
- The Null RU indices can be reused in MU-MIMO signaling load balancing scenarios [4]

Signaling of non-contiguous channel-bonding



- In 80MHz OFDMA there is the center 26 RU, and its signaling within HE-SIG-B content channels is TBD (e.g. 1st or 2nd, fixed or dynamic)
- In non-contiguous channel PPDU, when a secondary channel adjacent to the center 26 RU is nulled, the center 26 RU also may be nulled
- The proposed option (B) signaling can explicitly identify the existence of the center 26 RU even with the decoding failure of one SIG-B content channel

Signaling of non-contiguous channel-bonding

- **HE-SIG-B transmission in secondary 20MHz**
 - With option (B), SIG-A's BW subfield signals only 20/40/80/160(80+80) MHz BW
 - Thus receiving STAs do not know the nulled secondary channels before SIG-B
 - Therefore, 1/2 SIG-B content channels should be transmitted at least for Primary 40MHz to signal nulled secondary channels (unless there is no RUs to be signaled by 2nd SIG-B content channel)
 - Possible ways
 - Limit non-contiguous channel bonding rule to always occupy P40
 - Transmit preamble parts even in nulled secondary channels (at least in S20)

Conclusions

- **In this submission, we discussed signaling for non-contiguous channel-based PPDU**
- **We propose 11ax to consider signaling of non-contiguous channel bonding by**
 - (A) Using SIG-A's BW subfield
 - Early signaling of non-contiguous PPDU BWs
 - Limited remaining bit spaces in SIG-A may limit the number of BW options that can be signaled
 - (B) Using SIG-B's RU allocation subfields
 - Flexible signaling capabilities (many TBD indices)
 - Parallel SIG-B contents channel design may limit flexibilities of non-contiguous channel bonding rule
- TGax needs further discussions on signaling by using one or both subfields.

References

- [1] 11-15/0132r15, Spec Framework Doc
- [2] 11-16/0045r1, Flexible Wider Bandwidth Transmission
- [3] 11-16/0059r1, Non-contiguous Channel Bonding in 11ax
- [4] 11-16/0039r1, RU Allocation in SIG-B

Straw poll

- **Do you agree to add the following text into 11ax SFD?**
 - **3.1 General**
 - *The non-contiguous channel bonding will be supported in 802.11ax by:*
 - *Transmitting using OFDMA PPDU format by nulling the tones of one or more secondary channels in 80 MHz and 160 (80+80) MHz;*
 - *Modes for non-contiguous channel bonding are TBD;*
 - *Non-contiguous channels within primary or secondary 80 MHz only exists at AP side.*
 - Signaling for non-contiguous channel bonding is contained in BW subfield of HE-SIG-A and/or RU allocation subfield in the common block of HE-SIG-B. Details are TBD.
- Y/N/A