IEEE P802.11
Wireless LANs

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| PHY capability “HE MU PPDU *NHE-LTF* Rx” proposal |
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Abstract: This document contains proposed text changes to add a new subfield “HE MU PPDU Rx Max *NHE-LTF* ” in PHY capabilities information field in D6.1.

Discussions:

In 27.3.11.10 HE-LTF, it states that “HE MU PPDU with a single RU, the number of HE-LTF symbol, *NHE-LTF,* is a function of the total number of space-time streams *NSTS,total*”. The maximum number of HE-LTF symbol, *NHE-LTF,* that a non-AP STA is capable of receiving in a DL full bandwidth MU-MIMO transmission, can be claimed by two PHY capability subfields, Beamformee STS <= 80MHz and Beamformee STS > 80MHz (indicates the maximum total number of space-time streams over all the users that can be sent in a DL MU-MIMO transmission on an RU that includes that STA, where RU might or might not span the entire PPDU bandwidth). For example, if Beamformee STS <= 80MHz is set to 3, then the maximum number of HE-LTF symbol sent in a DL full bandwidth MU-MIMO transmission to that STA is limited to 4.

It further states that “In an HE MU PPDU with more than one RU, *NHE-LTF,* may take a value 1, 2, 4, 6 or 8 that is greater than or equal to the maximum value of the initial number of HE-LTF symbols for each RU, where the initial number of HE-LTF symbols is calculated as a function of *NSTS,r,total*”. This statement assumes that the maximum number of HE-LTF symbol, *NHE-LTF,* that a non-AP STA is capable of receiving is 8 in an HE MU PPDU with more than one RU. This assumption may cause some interop issues since there is no spec text clearly states that non-AP STA is mandatory to receive up to 8 HE-LTF symbols in an HE MU PPDU with more than one RU, e.g., some non-AP STAs only support to receive up to 4 HE-LTF symbols in a DL transmission. We propose to add a PHY capability subfield “HE MU PPDU Rx Max *NHE-LTF*” to avoid the interop issue. Depending on the maximum number of HE-LTF symbols that the STA is capable of receiving in an HE MU PPDU, AP can schedule STAs accordingly in an HE MU PPDU with more than one RU. For example, if *NSTS,r,total* for one RU is greater than 4, then AP shall not schedule a STA, which is only capable of receiving up to 4 HE-LTF symbols in an HE MU PPDU, in the same OFDMA transmission. On the other hand, if AP decides to transmit more HE-LTF symbols than the maximum value of the initial number of HE-LTF symbols for each RU, then AP needs to make sure that all scheduled STAs are capable of receiving the number of HE-LTF symbols it intends to transmit.

Due to concern that reusing a reserved bit for this new capability may affect 11ax non-AP STAs already deployed in the fields, encoding of the new capability bits ensures no changes are needed for STAs whose *NHE-LTF* support matches Beamformee STS support. Value 0 (reserved bit value) indicates Max Rx *NHE-LTF* support = *NHE-LTF*(Beamformee STS+1), and value 1 indicates Max Rx *NHE-LTF* support = 8.

* On P191L28-L33 : Please change to the following text

B78 B79 B80 B81 B87

HE MU PPDU with more than one RU Rx Max *NHE-LTF*

Reserved

Nominal
Packet

Padding

 Bits: 2 1 7

* On P199L45 : Please add following text to the end of Table 9-321b

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| **Subfield** | **Definition** | **Encoding** |
| HE MU PPDU with more than one RU Rx Max *NHE-LTF*  | Indicates the maximum number of HE-LTF symbols, *NHE-LTF*, that the STA is capable of receiving in an HE MU PPDU with more than one RU. | For a non-AP STA:Set to 0 if the number of HE-LTF symbols, *NHE-LTF*, that the STA is capable of receiving in an HE MU PPDU equals *NHE-LTF*(Beamformee STS+1), where *NHE-LTF*(Beamformee STS+1) is calculated as a function of Beamformee STS+1 based on Table 21-13(Number of VHT-LTFs required for different numbers of space-time streams) in 21.3.8.3.5.Note— For PPDU bandwith less than or equal to 80MHz, use value defined in Beamformee STS <=80MHz, for PPDU bandwidth greater than 80MHz, use value defined in Beamformee STS > 80MHz. Set to 1 if the maximum number of HE-LTF symbols, *NHE-LTF*, that the STA is capable of receiving in an HE MU PPDU is 8.Reserved for an AP. |

On P476L44 : Please add following text to the Part describing a non-AP STA mandatory features

— Reception of an HE MU PPDU consisting of a single RU spanning the entire PPDU bandwidth and

utilizing MU-MIMO (DL MU-MIMO). The maximum number of spatial streams per user the non-

AP STA can receive in the DL MU-MIMO transmission shall be equal to the minimum of 4 and the

maximum number of spatial streams supported for reception of HE SU PPDUs. The non-AP STA

shall be able to receive its intended spatial streams in a DL MU-MIMO transmission with a total

number of spatial streams across all users of at least 4.

— Reception of an HE MU PPDU with up to 4 HE-LTF symbols, where the RU allocated to the non-AP STA does not span the entire PPDU bandwidth.

— Responding with the requested beamforming feedback in an HE sounding procedure with the maximum

number of space-time streams in the HE sounding NDP that the non-AP STA can respond to

being at least 4.

On P477L44 : Please add following text to the Part describing a non-AP STA optional features

— MU-MIMO reception on an RU in an HE MU PPDU where the RU does not span the entire PPDU

bandwidth (DL MU-MIMO within OFDMA). The maximum number of spatial streams per user in

the DL MU-MIMO within OFDMA transmission that the non-AP STA can receive shall be a minimum

of 4 and the maximum number of spatial streams supported for reception of HE SU PPDUs.

The total number of spatial streams (across all users) in the DL MU-MIMO within OFDMA transmission

that the non-AP STA can receive shall be at least 4.

— Reception of an HE MU PPDU with up to 8 HE-LTF symbols, where the RU allocated to the non-AP STA does not span the entire PPDU bandwidth.

— MU-MIMO transmission on an RU in an HE TB PPDU where the RU spans the entire PPDU bandwidth

(UL MU-MIMO). If supported, then the non-AP HE STA shall support transmitting UL MUMIMO

where the total space-time streams summed across all users is less than or equal to 8.

On P597L7 : Please add following text to the end of the first paragraph

In an HE MU PPDU with more than one RU, *NHE-LTF* may take a value 1, 2, 4, 6 or 8 that is greater than or equal to the maximum value of the initial number of HE-LTF symbols for each RU, where the initial number of HE-LTF symbols is calculated as a function of *NSTS,r,total* (where *r* is the index of the RU) based on Table 21-13

(Number of VHT-LTFs required for different numbers of space-time streams) in 21.3.8.3.5 (VHT-LTF definition)

with *NVHT-LTF* replaced by *NHE-LTF*.(#24314, #24315, #24317)

NOTE—AP may use non-AP STA “HE MU PPDU Rx Max *NHE-LTF*” information in OFDMA scheduling, and assigning *NHE-LTF* for OFDMA transmission. In an HE MU PPDU with more than one RU, AP might not allocate any RU to a non-AP STA if *NHE-LTF* of the transmission is greater than the value that non-AP STA is capabling of receiving.