IEEE P802.11
Wireless LANs

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| Comment resolution for CIDs on 11-1-3-10 dual beacon operation  |
| Date: 2017-03-24 |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D1.0 with the following CIDs (15):

* 3054, 3055, 5165, 5797, 5905, 6554, 6556, 6560, 7961, 7977, 7978, 9334, 9561, 9696, 9868,

Revisions:

* Rev 0: Initial version of the document.

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

**CIDs: 5165, 6556, 9334, 9696**

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| **CID** | **Comment** | **Proposed Change** | **Resolution** |
| 5165 | We had dual-beacon in 11n with STBC. No one implemented it. Why are we introducing yet another dual-beacon? Delete this to reduce complexity in the spec. | as in comment  | Rejected –See discussion below. But we agree to add the text to clarify the need for HE Beacon. |
| 6556 | There's something odd about this idea of dual beacons. Superficlally, the idea is attractive: the extended range SU modes (purportedly) extend range, so it's natural to think of some way of conveying beacon information to the new, extended range. But there are many modes that extend range beyond 6 Mb/s: LDPC, DCM, STBC, TxBF, as well as HE\_EXT\_SU, with all permissible combinations (many optional). If the principle is that every mode has a corresponding beacon, then we have a nightmare of beacon proliferation. If instead the principle is that we have a common beacon understandable by all, why, we have that already with the good old 6 Mb/s normal beacon. The text in the current draft has the feel of a half-worked out add-on. It would be better to do this properly or not at all. Incidentally there is not one word about extended range in the PAR or CSD, so this is tangential to the entire project. (A side note: it might be preferable to remove all issues pertaining to extended range and multiple beacons to a new project, which could consider all issues in depth, including future extensibility when we add Further ER, Further Still ER, and so on, as we will inevitably do in the future.) | Delete this sentence and all references to dual beacons in the draft. | Rejected –See discussion 1 below. But we agree to add the text to clarify the need for HE Beacon. |
| 9334 | When the AP transmits beacons in an HE\_EXT\_SU PHY format, it uses the dual beacon mechanism. However, the dual beacon mechanism is deprecated in the baseline (see Table 9-168 and subclause 11.1.3.2 in 802.11-2016). There is no need to reintroduce this again.Just allowing the beacons to be transmitted in an HE\_EXT\_SU PHY format is enough. | Add in subclause 10.7.5.3 a condition to allow beacon frames and group addressed frames to be transmitted in an HE\_EXT\_SU PHY format if the BSSBasicRateSet, the Basic HT-MCS Set, and the basic VHT-MCS and NSS set are all empty and only the Basic HE MCS And NSS Set is not empty.Delete subclause 11.1.3.10, delete the definition of high efficient (HE) dual beacon from subclause 3.2, replace the Dual Beacon subfield in the HE Operation Parameters field to reserved and delete the description of the Dual Beacon subfield in subclause 9.4.2.219. | Revised – Agree the comment in principle. See discussion below. Propososed resolutions:1. Move the subclause 11.1.3.10 to 27.16.x
2. Keep HE Beacon definition in 3.2 and modify the definition.
3. Change the “Dual Beacon” subfield in HE Operation Parameter to “HE Beacon”. See CID#9562 and #9563
4. Add subclause 10.7.5.x Rate selection for HE Beacon frames
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| 9696 | Remove 11.1.3.10 because there is no evidence of the coverage improvement through the Beacon frame transmitted in an HE extended range SU PPDU.Please provide a simulation result of the Beacon transmission in an HE extended range SU PPDU.If it is proven, the rate selection rule of the Beacon transmission in an HE extended range SU PPDU shall be added.Insert a new subclause in 10.7.5 (Rate selection for Data and Management frames) for a rate selection of an HE extended range Beacon frame. | As per comment. | Revised – See discussion below.Proposed resolution:Add subclause 10.7.5.x Rate selection for HE Beacon frames |

**Discussion:**

STBC beacon defined in IEEE802.11-2012 intends to improve coverage of BSS. However, in the current WLAN deployment, the coverage is not limited by DL transimission. Instead, the coverage limitation is caused by the UL transmission, i.e. the STA can see the beacon of BSS, but the AP could not receive the transmission from STA at the edge of cell. This is because the transmit power of STA is a few dB lower than the transmit power of AP in most cases of deployment.

In 802.11ax PAR, it requires to support the use case of outdoor deployment and improve robustness transmission in outdoor propagation environments. 802.11ax simulation scenario [11-14-0980-16] defines the simulation and evalution cases for outdoor in the case 4 and 4a with coverage of inter-AP space 130m. The contribution [11-14-0801] simulated transmission robustness at different CP lengths, and concludes that short CP length does not secure the robustness for outdoor cases, The longer CP is needed to improve the rubustness of transmission in the outdoor deployment case.

802.11ax introduces OFDMA PHY to improve transmission efficiency and robustness, including for outdoor deployment cases. The UL transmission could gain about up to 10dB. This could change the coverage restriction from UL limited to DL limited in the typical deployment if HE AP still uses legacy PHY format to carry beacon frame. Even an HE STA could be able to benefit from OFDMA for its UL transmission, but it would be difficult for an HE STA to associate with an HE AP if the HE STA could not see the beacon transmitted from the HE AP.

In addition, if the HE AP still uses non-HT PPDU format to carry beacon frame, it could not take the advance of OFDMA, such as using longer CP for improving signal robustment in outdoor scenario.

Therefore the HE beacon transmission is needed.

**Proposed Resolution:**

We agree with comments for clarifying the text to avoid the confusion. The proposed resolution as follows

1. Change the “dual beacon” to “HE Beacon” as it is carried in the HE\_EXT\_SU PPDU format.
2. Add explanation for the reason of introducing HE Beacon.
3. Move the clause of 11.1.3.10 to 27.16.x to follow the new style of 802.11ax specification structure.
4. Keep the HE Beacon definition in 3.2 and change the definition from “HE dual beacon” to “HE Beacon” to avoid the confusion.
5. Add the rate selection for HE Beacon in the Clause of 10.7.5.x
6. Change the “Dual Beacon” subfield in HE Operation Parameter to “HE Beacon”. Refer CID #9562 and #9563.
7. Add subclause 10.7.5.x Rate selection for HE Beacon frames

**CIDs: 6554, 6560, 9868**

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| **CID** | **Comment** | **Proposed Change** | **Resolution** |
| 6554 | Inconsistent usage of defined terms: here we have "beacon frames", whereas everywhere else in the drfat, including several places in the same section, we have "Beacon frames". | Change "beacon frames" to "Beacon frames". | Acceped  |
| 6560 | Inconsistent use of defined term: here we have "HE EXT\_SU", whereas everywhere else in the draft we have "HE\_EXT\_SU". | Change "HE EXT\_SU" to "HE\_EXT\_SU". | Acceped  |
| 9868 | When Beacon frames are transmitted in two PHY formats, it says one of the format shall be non-HE format. However, as baseline spec. says the beacon frame to be carried in non-HE (duplicate) format, it shall be non-HT format instead of non-HE format. | As in the comment.  | Revised –As “dual beacon” is changed to HE Beacon, the correspond ing text is removed accordingly. See CID #7977, #7978 #9561 |

**CIDs: 7977, 7978, 9561**

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| **CID** | **Comment** | **Proposed Change** | **Resoluiton** |
| 7977 | "The Beacon frame transmitted in non-HE PPDU format has TBTT at the TSF value 0." is unclear | Change to "Time 0 is defined to be a TBTT for the Beacon frame transmitted in non-HE PPDU format (see 11.1.3.2)." | Revised – See discussion below.Proposed resolution: delete the text related HE Beacon transmission timing to legacy Beacon. |
| 7978 | "The Beacon frame transmitted in HE extended range SU PPDU has TBTT at the TSF value 0 plus the TBTT offset which value is a half of the value of the Beacon Interval field of the Beacon frame sent in non-HE format." is unclear | Change to "The TBTT for the Beacon frame transmitted in HE extended range SU PPDU format shall be offset by half of abeacon interval from the TBTT of the Beacon frame transmitted in non-HE PPDU format." | Revised – See discussion below.Proposed resolution: delete the text related HE Beacon transmission timing to legacy Beacon. |
| 9561 | Using a half value of Beacon Interval of legacy beacon frames as offset of HE beacon may not be flexisible in deployment. Suggest to add HE Beacon Offset in the HE Operation element, or remove this restriction. | as in the comment | Revised – See discussion below.Proposed resolution: delete the text related HE Beacon transmission timing to legacy Beacon transmission. |

**Discussion:**

Those comments are related to HE Beacon transmission timing vs legacy Beacon transmission timing.

Agree with those comments in prinple and there is a need to clarify the text.

As a HE Beacon transmission is controlled by HE AP when there is a need to improve Beacon transmission reliability in HE BSS coverage, it may not be necessary to bundle HE Beacon transmission with the legacy Beacon (in non-HT PHY format) together. Therefore HE AP can schedule an HE Beacon transmission as normal, and it is not necessary to restrict the time of HE Beacon transmission aligning with legacy Beacon’s transmission. However an HE AP shall not schedule transmissions of HE Beacon and legacy Beacon at same time.

**Proposed Resolution:**

Remove the sentences indicated, and add the restriction of not sending HE Beacon and legacy Beacon at same time.

**CIDs: 3055, 5797, 5905, 7961, 7979**

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| **CID** | **Comment** | **Proposed Change** | **Resolution** |
| 3055 | Only HE STAs can understand an HE Beacon in Extended PPDU format. Such beacon need not carry information that is relevant to non-HE/legacy STAs. This will help reduce the size of HE Beacon. | Add a sentence which implies that an HE beacon may not include fields/IEs that apply only to legacy STAs. | accepted |
| 5797 | Need detail description of different element sets may be included in beacons in non-HE and HE\_EXT\_SU PPDUs formats. If they are carrying different set of elements, then in order to avoid any ambiguity, need to list out which elements may differ, and the reasons behind them. | Please add detail description | Revised –See discussion and proposed resolution below. |
| 5905 | Rather than stating different elements may be carried, it should be specified what are identical elements and contents that must be carried in both types of Beacon frames. | As suggested. | Revised –See discussion and proposed resolution below. |
| 7961 | For dual beacons to work w.r.t. both non-HE STAs and distant HE STAs, group-addressed traffic needs to be sent twice, once after each of the beacon types | After "When Beacon frames aretransmitted in two PHY formats, the HE AP shall transmit Beacon frames in non-HE format and in HE\_EXT\_SU format." add "The HE AP shall transmit buffered non-GCR-SP group addressed BUs twice, once immediately after each of these Beacon frames, when they are DTIM Beacons frames (see 11.2.3.4)."Also add a bit to HE Operation to indicate which kind of beacon it is (cf. STBC Beacon in 802.11-2016 page 953) | Revised –As “dual beacon” is changed to “HE Beacon”, the proposed text is revised: “The HE AP shall transmit buffered non-GCR-SP group addressed BUs, immediately after HE Beacon frames, when they are DTIM Beacons frames” |
| 7979 | "The non-HE format and HE EXT\_SU PPDU format Beacon frames may contain different set of elements." is far too loose. | Change to "Except for the setting of the TIM field and TSF field, all other fields inside the Beacon frame transmitted in HE extended range SU PPDU format shall be identical to the Beacon frame transmitted in non-HE PPDU format." At 141.41 delete "as indicated in the Beacon frame transmitted in non-HE PPDUformat" and change "Beacon interval" to "beacon interval". At 141.48 delete "as indicated in the Beacon frame transmitted in the HE extended range SU PPDU." | Revised –See discussion below.Proposed resolution: delete the text related to Beacon content. |

**Discussion:**

Those comments are related to the content of HE Beacon and legacy Beacon.

Agree with comments in principle and there is a need to clarify the content of HE Beacon and legacy Beacon.

In general, the Beacon frame should carry the enough information about BSS for STAs to associate with an AP and other information like DTIM. The AP could include the information in the non-HT format that would be able to use by both legacy and HE STAs. As the legacy STAs would not be able to detect the HE Beacon, the HE AP can only include in the HE beacon the information for HE STAs only.

As the content in Beacon frame is controlled by the AP through configuration and scheduling, there is no need to specify the content in the Beacon frame in the spec. The related text should be removed from the spec.

In order to provide flexibity for HE STA to receive a legacy Beacon or HE Beacon when HE AP transmits Beacons in both non-HT and HE\_ER\_SU formats, an HE AP can include an indication in HE Operation Parameter IE to indicate the availability of legacy Beacon or HE Beacon.

**Proposed Resolution:**

1. Delete the sentence related to the content of Beacon frame
2. Add a restriction of not including the content or IE that apply for legacy STAs only for the HE Beacon frame.
3. Add "The HE AP shall transmit buffered non-GCR-SP group addressed BUs”

**TGax Editor: *Move the subclause 11.1.3.10 to subcause 27.16, and change the subclauses below as follows:***

**~~11.1.3.10~~ 27.16.x HE Beacon generation in an HE BSS**

An HE Beacon is a Beacon frame carried in HE PPDU format to provide additional link budget of downlink transmission to compensate the link budget imbalance between downlink and uplink due to introduction of UL OFDMA transmission [#5165, #6556].

An HE AP may transmit HE Beacon frames and group addressed traffic in HE\_EXT\_SU PHY formats to ensure the BSS discoverability and BSS operating parameter distribution for the entire coverage area of HE BSS. An HE AP may use larger CP length of HE\_EXT\_SU PPDU to further improve the transmission reliability of HE Beacon [#6554, #5165, #6556, #9334].

The HE AP shall set the HE Beacon subfield to 1 in the HE Operation elements to indicate availability of HE Beacon, and not schedule transmissions of HE Beacon at the time of legacy Beacon transmission. The HE AP shall transmit buffered non-GCR-SP group addressed BUs, immediately after HE Beacon frames, when they are DTIM Beacons frames (see 11.2.3.4) [#7961]. Otherwise, the HE AP shall set the field of HE Operation element to 0.

An HE AP follows the rate selection rule defined in 10.7.5.x Rate selection for HE Beacon frames. [#9696, #9334]

An HE Beacon frame may not include fields/IEs that apply only to legacy STAs [#3055]

 [#7978]

 [ #7977.#7979, #9561]

~~The non-HE format and HE EXT\_SU PPDU format Beacon frames may contain different set of elements~~[#5797, #5905]

**TGax Editor: *Add the subclauses below as follows:***

**10.7.5.x Rate selection for HE Beacon frames[#9696, #9334]**

If the BSSBasicRateSet parameter, the Basic HT-MCS Set field of the HT Operation parameter of the MLME-START.request primitive or Basic HT-MCS Set field of the HT Operation parameter of the SelectedBSS parameter of the MLME-JOIN.request primitive, and the basic VHT-MCS and NSS set is all empty, but Basic HE MCS and NSS Set is not empty, the frame shall be transmitted in a HE\_EXT\_SU PPDU using one of the <HE-MCS. NSS> tuples included in the basic HE-MCS and NSS set. The additional rate selection restriction for HE PPDU is defined in the clause 27.15.4.3.

**TGax Editor: *Change the subclauses below as follows:***

**3.2 Definitions specific to IEEE 802.11 [#9334]**

**high efficient (HE) beacon:** A BSS transmits beacons in HE\_EXT\_SU PHY format to enable BSS discoverability and BSS operating parameters distribution in the whole BSS coverage.