IEEE P802.11  
Wireless LANs

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| **Resolutions for Comments related to Extended Range Beacon** |
| **Date:** 2017-04-06 |

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Abstract

This submission proposes resolutions for the following CIDs related to TGax extended range Beacon (**24 CIDs**):

* 6228, 6556, 9696,
* 4708, 6223, 6917, 6918,
* 7997, 9562, 9563,
* 5393,
* 5391,
* 3055, 5797, 5905, 7961, 7978, 7979, 9334,
* 5392, 9415,
* 6179, 7042, 5390,

# Discussion

* HE ER SU PPDU Beacon

The baseline spec has the following:

**“10.7.5.1 Rate selection for non-STBC Beacon and non-STBC PSMP frames**

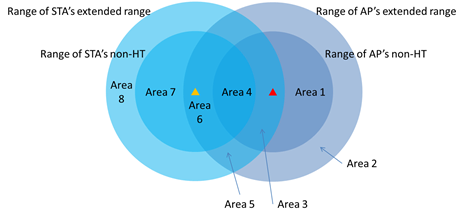
If the BSSBasicRateSet parameter is not empty, a non-STBC PSMP frame or a non-STBC Beacon frame shall be transmitted in a non-HT PPDU using one of the rates included in the BSSBasicRateSet parameter.

If the BSSBasicRateSet parameter is empty, the frame shall be transmitted in a non-HT PPDU using one of the mandatory PHY rates.”

With this, up to now, a Beacon frame other than sent in STBC is always sent in non-HT PPDU for operation in the legacy band. Based on this basic rule, we can assume that all the STAs associated with the AP are within the coverage of non-HT PPDU frames from the AP. As all the STAs other than only supporting DSSS can receive and decode the non-HT PPDU, which means the STAs can set NAV by frames transmitted in non-HT PPDU, the AP can use non-HT PPDU to achieve robust protection.

With the adoption of HE ER SU PPDU Beacon, the above assumption will be denied.

If some of the HE non-AP STAs have the same power with the AP, with a Beacon sent in HE ER SU PPDU, there will be HE STAs associated with the AP in the area where non-HT PPDUs don’t reach but only HE ER SU PPDUs sent by the AP reach the STAs.



Even with the use of the PPDU format switch from HE ER SU PPDU to non-HT PPDU, such HE STAs (in Area 2 above) won’t be protected. Note that the PPDU format switch is only effective to protect STAs in the area where non-HT PPDUs reach.

In order to protect such HE STAs and legacy STAs, we have to think of a mechanism such as the dual CTS protection. However, the dual CTS protection is *deprecated* in the baseline and *we should avoid going another round for discussion on protection*.

*Banning Beacons sent in HE ER SU PPDU is the most straight forward way.*

There may be argument that UL-OFDMA will extend the range of HE STAs and there is a need of such Beacon.

But all the frames sent from such HE STAs need to be in UL-OFDMA and triggered by the AP. In other words, such HE STAs need to always rely on UL-OFDMA to get connected with the AP. Such operation is shaky and not realistic. And there is the above protection problem.

When there is power imbalance between non-AP STAs and APs, which applies to most of the cases, there will be almost no effect on extending the range of the BSS through Beacons sent in HE ER SU PPDU. Frames sent from such STAs in the area covered only by HE ER SU PPDU Beacon cannot reach the AP, even when the Beacon is sent in HE ER SU PPDU anyway.

The suggestion will be to ban Beacons sent in HE ER SU PPDU.

By doing so, there is no need to define HE dual beacon mode.

* HE Dual Beacon

Firstly, we already had dual beacon in the baseline, but it is deprecated. STBC Beacon was introduced at that time for the same reason, which is to extend the BSS range. We should consider the reason why it is deprecated, in order to not step on the same rut.

The same protection problem as above existed for STBC Beacon and dual CTS protection was introduced. The protection problem is one reason.

When there is some kind of change for the BSS, such as channel change or quiet time, a Beacon frame is used to notify the change. Such change will be based on TBTT. With dual beacon, the reference point for the change will be affected. This is another reason.

Furthermore, repeating management information and group addressed data in HE ER SU PPDU will consume the wireless resource and it will not be an efficient system.

Banning the HE ER SU PPDU Beacon will be the simplest solution.

# Proposed Change: Ban HE ER SU PPDU Beacon

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.***

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| **CID** | **Commenter** | **PP.LL** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 6228 | John Coffey | 6.50 | 3.2 | The entire HE dual beacon mode purportedly enables increased BSS coverage. In dense deployments this will reduce spatial reuse, and thus will run counter to the main aims of the project. It serves to clutter up an already bloated draft amendment. | Delete the definition of HE dual beacon and all references to it in the draft. | Approve.  (See the instruction to the editor in doc. 11-17/0576r1.) |
| 6556 | John Coffey | 141.43 | 11.1.3.10 | 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. | Revised.  Agree in principal.  See proposed change in doc. 11-17/0576r1. |
| 9696 | Yongho Seok | 141.32 | 11.1.3.10 | 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.  Agree in principal.  See proposed change in doc. 11-17/0576r1. |
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| Related Comments in Subclause 3.2 | | | | | | |
| 4708 | Alfred Asterjadhi | 6.50 | 3.2 | Some issues with this definition: 1) Replace first occurrence of "BSS" with "basic service set (BSS)", replace "PHY modes", with "physical layer (PHY) protocol data unit (PPDU)", replace "efficient" with "efficiency", replace "HE extended range PHY" with "HE extended range single user (ER SU) PPDU", replace "HE\_EXT\_SU PHY format" with "HE ER SU PPDU", and replace "non-HE" with "non-HT". Also "in the whole BSS coverage" is arguable. Even when the AP does not use ER SU PPDUs for Beacons the legacy beacon covers the "whole BSS". It is a matter of perspective. Perhaps better to say, expanding the BSS coverage or something like that. | As in comment. | Revised.  See proposed change in doc. 11-17/0576r1. |
| 6223 | John Coffey | 6.50 | 3.2 | The definition of an HE dual beacon starts with an action: "A BSS transmits beacons in two PHY modes ...". This is very unclear. The BSS shall transmit beacons in two PHY modes? Or the BSS may transmit beacons in two PHY modes? And either way, what is this doing in a definitions section? | Rewrite the definition so that it defines the term purportedly being defined. In particular, if or when a BSS uses HE dual beacons, are both beacons "HE dual beacons", or is only the one transmitted in HE\_EXT\_SU PY format a dual beacon? Or is it the case that neither is, and instead the BSS is in "HE dual beacon mode"? And isn't it normally the case that beacons are transmitted by an "AP", not a BSS? Clarify. | Revised.  See proposed change in doc. 11-17/0576r1. |
| 6917 | Joseph Levy | 6.50 | 3.2 | The definition of high efficient dual beacon is a bit odd as it is not really a beacon but an operating mode that allow for the transmission of both a non-HE formatted | rewrite the definition of the HE Dual Beacon to be for the HE Dual Beacon Mode. | Revised.  See proposed change in doc. 11-17/0576r1. |
| 6918 | Joseph Levy | 6.50 | 3.2 | The term: high efficient dual beacon, HE dual beacon, or high efficient (HE) dual beacon does not appear in this amendment anywhere accept the in definitions | Either add the term to some clauses in the amendment or delete the definition. | Revised.  See proposed change in doc. 11-17/0576r1. |
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| Related Comments in Subclause 9.4.2.219 | | | | | | |
| 7997 | Massinissa Lalam | 92.36 | 9.4.2.219 | It seems to me that the Dual Beacon subfield does not "indicate" the TBTT offset of the Beacon frame in HE extended range SU PPDU format. This offset is fixed and defined in subclause 11.1.3.10. | Delete the sentence "The Dual Beacon subfield also indicates the TBTT offset of Beacon frame in HE extended range SU PPDU in 11.1.3.10 (Beacon generation in an HE BSS)." Add the sentence "The TBTT offset of Beacon frame in HE extended range SU PPDU is defined in 11.1.3.10 (Beacon generation in an HE BSS)." after "The subfield is set to 1 if the HE AP transmits beacons in an HE extended range SU PPDU and a non-HE PPDU.". | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 9562 | Yonggang Fang | 91.00 | 9.4.2.219 | In order to improve the deployment flexibility, it may require to independently control legacy beacon and HE beacon transmission. Increase the size Dual Beacon field to 2 bits | as in the comment | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 9563 | Yonggang Fang | 92.30 | 9.4.2.219 | Modify the definition of Dual Beacon field. | 00: Legacy Beacon only,  01: HE beacon only,  10: L+HE beacon with duplicated system info.  11: L+HE with non-duplicated system info | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
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| Related Comments in Subclause 9.4.2.220 | | | | | | |
| 5393 | Geonjung Ko | 93.14 | 9.4.2.220 | When an AP uses the Dual Beacon, a non-AP STA that receives RAPS elements from both Beacon frames of two PPDU formats would initialize its OBO counter twice. Then the STA may have less probability to access the random access RU than a STA that receives one Beacon frame. | When an AP uses the Dual Beacon, the RAPS element should be included only in one format of Beacon frame between two formats of Beacon frames. | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
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| Related Comments in Subclause 9.4.2.222 | | | | | | |
| 5391 | Geonjung Ko | 95.24 | 9.4.2.222 | When an AP uses the Dual Beacon, even if the STA receives any Beacon frame between Beacon frames of two PPDU formats, all STAs in the BSS shall start to use the BSS Color at the same time. e.g. at the TBTT of non-HE format Beacon frame. Need a clarification on a setting of the Color Switch Countdown field. | When an AP uses the Dual Beacon, a value of 0 indicates that the switch occurs at the current TBTT if the element is carried in a non-HE format Beacon frame or at the next TBTT of a non-HE format Beacon frame if the element is not carried in a nonHE format Beacon frame. | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
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| Related Comments in Subclause 11.1.3.10 | | | | | | |
| 3055 | Abhishek Patil | 141.00 | 11.1.3.10 | 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. | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 5797 | Huizhao Wang | 141.50 | 11.1.3.10 | 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.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 5905 | James Yee | 141.50 | 11.1.3.10 | 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.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 7961 | Mark RISON | 141.37 | 11.1.3.10 | 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 are  transmitted 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.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 7978 | Mark RISON | 141.44 | 11.1.3.10 | "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 a  beacon interval from the TBTT of the Beacon frame transmitted in non-HE PPDU format." | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 7979 | Mark RISON | 141.50 | 11.1.3.10 | "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 PPDU  format" 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.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 9334 | Tomoko Adachi | 141.30 | 11.1.3.10 | 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.  See proposed change in doc. 11-17/0576r1. |
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| Related Comments in Subclause 27.5.2.6.2 | | | | | | |
| 5392 | Geonjung Ko | 173.31 | 27.5.2.6.2 | When an AP uses the Dual Beacon, a non-AP STA that receives RAPS elements from both Beacon frames of two PPDU formats would initialize its OBO counter twice. Then the STA may have less probability to access the random access RU than a STA that receives one Beacon frame. | When an AP uses the Dual Beacon, the STA should use the RAPS element from one format of Beacon frame. | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 9415 | Woojin Ahn | 173.31 | 27.5.2.6.2 | A STA might receive both normal Beacon and Dual Beacon. If both of the two beacons included RAPS elements, the STA might reset its OBO and OCW twice. | If a STA receives a normal Beacon and a Dual beacon including RAPS elements, it shall initialize its OBO and OCW only for the normal Beacon | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
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| Related Comments in Subclause 27.16.2 | | | | | | |
| 6179 | Jin-Sam Kwak | 206.39 | 27.16.2 | In case that an AP uses the Dual Beacon, all of STAs associated with the AP should identify the same BSS Color change TBTT. | Please define the BSS Color change TBTT to be the same to all of STAs in a BSS when the BSS uses the Dual Beacon. | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 7042 | Ju-Hyung Son | 206.39 | 27.16.2 | When Dual Beacon is used, two kinds of Beacon frames have TBTTs respectively. Please specify BSS color change sequence when Dual Beacon is used. | As per comment. | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
| 5390 | Geonjung Ko | 206.39 | 27.16.2 | We need a clarification on what is BSS Color change TBTT when the HE extended range SU PPDU format Beacon is used. When the Dual Beacon is used, two kinds of Beacon frames have different TBTTs. | Even if the STA receives any Beacon frame between Beacon frames of two PPDU formats, all STAs in the BSS shall start to use the BSS Color at the same time. e.g. at the TBTT of non-HE format Beacon frame. | Revised.  The Dual Beacon mechanism is deleted.  See proposed change in doc. 11-17/0576r1. |
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TGax editor: Remove the definition of high efficient (HE) dual beacon in subclause 3.2 from TGax D1.1. (#6228, #4708, #6223, #6917, #6918)

TGax editor: Remove subclause 11.1.3.10 from TGax D1.1. (#6556, #9696, #3055, #5797, #5905, #7961, #7978, #7979, #9334)

TGax editor: Change B31in Figure 9-589cr of TGax D1.1 from “Dual Beacon” to “reserved” (#7997, #9562, #9563)

TGax editor: Delete the paragraph starting from “The Dual Beacon subfield indicates whether the HE AP transmits beacons using two PHY formats, …” in subclause 9.4.2.219 in TGax D1.1. (#7997, #9562, #9563)