IEEE P802.11
Wireless LANs

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| CR for OPS |
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Abstract

This document provides CR for CIDs: 20016, 20037, 21447, 20070

1. **Introduction**

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. The introduction and the explanation of the proposed changes are 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** | **Clause Number(C)** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 20016 | Abhishek Patil | 9.4.2.5 | 142.32 | Clause 9.4.2.5 is empty. Since these are new rules which are applicable only when the meaning of TIM bitmap is overloaded for OPS feature, it should be in it's own subclause | Create a new sub-clause after 9.4.2.5.5 and move this content under the new clause | Revised – agree with the commenter. Create a new subclause to describe the encoding of the TIM element when it is used for OPS. Apply the changes marked with CID 20016 as proposed in doc 19/0415r0. |
| 20037 | Abhishek Patil | 11.2.3.17 | 279.53 | What does 'current' beacon mean? Broadcast TIM frame has a different interval than TBTTs and therefore, the term 'present beacon' is ambiguous. | Replace '... and is present in the current Beacon frame.' with '... and will be carried in Beacon frame transmitted at the next TBTT'. | Revised – there does not seem to be relevant distinction between inclusion and insertion. Replace the term insertion by the term inclusion, that is well defined. Apply the changes marked with CID20037 as proposed in doc 19/0415r0. |
| 21447 | Tomoko Adachi | 26.14.3.1 | 416.43 | The mode names, unscheduled and scheduled, should be changed to such as non-periodic and periodic, as the unscheduled mode provides scheduling information. Change the names throughout the draft. | As in comment. | Revised – agree with the commenter. Change the name of the 2 modes as suggested. Apply the changes marked as 21447 in doc 19/0415r0. |
| 20070 | Abhishek Patil | 26.14.3.2 | 416.64 | FILS Discovery frame and OPS frames carry the same information for OPS STAs (OPS element / TIM element). Therefore, an must send only one of them if the timing aligns. Remove the recommendation and make it a mandatory requirement | Replace 'should' with 'shall' on P416L64 and P417L21 | Reject – According to the spec, it is possible that the FILS DF is transmitted in an HE MU PPDU and be received only by unassociated STAs. In such case, even if the timing is aligned, the OPS frame could be used instead of the FILS DF. The “should” helps to cover for this case.Or Revised – replace should with shall, and define a new STA\_ID\_LIST value (2044) that indicates that it is a broadcast RU for both associated and unassociated RUs.. |

1. **Proposed changes**

***TGax editor: Change the following section 9.4.2.5 TIM element as described below (#20016, #21447)***

* TIM element

(18/1497r2)Insert the following at the end of the subclause:

The encoding of the TIM element when used for opportunistic power save (see 26.14.3 (Opportunistic power save)) is described in subclause 9.4.2.5.6 (TIM element for Opportunistic power save).

Define a new subclause 9.4.2.5.6 TIM element for Opportunistic power save

9.4.2.5.6 TIM element for Opportunistic power save

If(#15215) included in an OPS frame or a FILS Discovery frame by an OPS AP for non-periodic opportunistic power save (see 26.14.3 (Opportunistic power save)), the following apply:

* The DTIM Count field is reserved
* The DTIM Period field is reserved
* Bit *N* in the traffic indication virtual bitmap that corresponds to an OPS STA with AID *N* is determined as follows:
* Bit *N* in the traffic indication virtual bitmap is set to(#15216) 0 if the OPS AP does not intend to transmit to the OPS STA including to trigger the OPS STA for an UL MU transmission during the OPS period.(#15877, #17027)
* Otherwise, bit *N* in the traffic indication virtual bitmap for the OPS STA is set to(#15217) 1.
* Bit *N* in the traffic indication virtual bitmap that corresponds to an non-OPS STA with AID *N* is determined as follows:
* Bit *N* in the traffic indication virtual bitmap is set to(#15218) 1 to indicate that AP has buffered frames for the STA and set to 0 otherwise.

If included in a TIM frame or a FILS Discovery frame by an OPS AP for periodic opportunistic power save (see 26.14.3 (Opportunistic power save)), the following apply:

* The DTIM Count field is reserved
* The DTIM Period field is reserved
* Bit *N* in the traffic indication virtual bitmap that corresponds to an OPS STA with AID *N* is determined as follows:
* Bit *N* in the traffic indication virtual bitmap is set to 0 if the OPS AP does not intend to transmit to the OPS STA including to trigger the OPS STA for an UL MU transmission during the TWT SP and before the next TWT SP.
* Otherwise, bit *N* in the traffic indication virtual bitmap for the OPS STA is set to 1.
* Bit *N* in the traffic indication virtual bitmap that corresponds to an non-OPS STA with AID *N* is determined as follows:
* Bit *N* in the traffic indication virtual bitmap is set to 1 to indicate that AP has buffered frames for the STA and set to 0 otherwise.(#15877, #15878)

***TGax editor: Change the following section 11.2.3.17 TIM Broadcast as described below (#20037)***

* TIM Broadcast

[…]

The AP shall increase the value (modulo 256) of the Check Beacon field in the next transmitted TIM frame(s) when a critical update occurs to any of the elements inside the Beacon frame. The following events shall classify as a critical update:

* Inclusion of a Channel Switch Announcement element
* Inclusion of an Extended Channel Switch Announcement element
* Modification of the EDCA parameters element
* Inclusion of a Quiet element
* Modification of the DSSS Parameter Set
* Modification of the CF Parameter Set element
* Modification of the HT Operation element
* Inclusion of a Wide Bandwidth Channel Switch element
* Inclusion of a Channel Switch Wrapper element
* Inclusion of an Operating Mode Notification element
* Inclusion of a Quiet Channel element
* Modification of the VHT Operation element
* Modification of the HE Operation element
* Inclusion of a Broadcast TWT element
* Inclusion of the BSS Color Change Announcement element
* Modification of the MU EDCA Parameter Set element
* Modification of the Spatial Reuse Parameter Set element(#15059)

NOTE—Modification of an element means that at least one value of a field in the element is changed. Inclusion of an element means that the element is included in a Beacon frame.

***TGax editor: Change the following section 26.14.3 Opportunistic power save as described below (#21447)***

* Opportunistic power save
* General

An OPS STA is a non-AP HE STA that sets the OPS Support subfield in the HE MAC Capabilities Information field of the HE Capabilities element to 1.

An OPS AP is an AP HE STA that sets the OPS Support subfield in the HE MAC Capabilities Information field in HE Capabilities element to 1.

Opportunistic power save mechanism has the objective to allow OPS STAs that are in active mode to be unavailable and to allow OPS STAs that are in PS mode to be in doze state(#15845) to save power for a defined period. The opportunistic power save mechanism has two modes: non-periodic and periodic.(18/1497r2)

In the non-periodic mode, an OPS AP sends an OPS frame or a FILS discovery frame at any time to provide the scheduling information for all OPS STAs for the OPS period that follows the transmission of the OPS frame or FILS discovery frame. Based on this information, the OPS STAs that are in active mode may be unavailable(18/1497r2) during the OPS period and the OPS STAs that are in PS mode may be in doze state during the OPS period.(#15845)

In the periodic mode, an OPS AP splits a beacon interval into several periodic broadcast TWT SPs and provides, at the beginning of each SP, the scheduling information for all OPS STAs. Based on this information, the OPS STAs that are in active mode may be unavailable(18/1497r2) until the next TWT SP and the OPS STAs that are in PS mode may be in doze state until the next TWT SP.(#15845)

* AP operation for opportunistic power save

To enable non-periodic opportunistic power save, an OPS AP shall schedule for transmission an OPS frame or a FILS Discovery frame with the RA field set to the broadcast address that includes a TIM element (see 9.4.2.5 (TIM element)) and an OPS element (see 9.4.2.251 (OPS element)). The AP should transmit a FILS Discovery frame instead of an OPS frame if the target transmission time closely aligns with the transmission time of a FILS Discovery frame. The OPS Duration field in the OPS element shall be set to(#15171) the duration of the OPS period that immediately follows the transmission of the OPS frame or FILS Discovery frame. The TIM element is encoded specifically as defined in 9.4.2.5 (TIM element) in order to provide the information of which STAs are (#17026)not scheduled during the OPS period. If the OPS AP sets the bit corresponding to an OPS STA in the traffic indication virtual bitmap field carried by the Partial Virtual Bitmap of the TIM element of the OPS frame or FILS Discovery frame to 0, the AP should send neither individually addressed frames to the STA nor Trigger frames that solicit an HE TB PPDU from the STA during the OPS period.(#15172, #16470)

To enable periodic opportunistic power save, an OPS AP shall include a TWT element in beacons to set a periodic Broadcast TWT SP with the following information:

* The Broadcast TWT Recommendation field(18/1497r2) set to 3
* The Broadcast TWT ID subfield is set to 0

At the beginning of these periodic TWT SPs with the Broadcast TWT Recommendation field set to 3, the AP shall schedule for transmission a TIM frame or a FILS Discovery frame with the RA field set to the broadcast address that includes a TIM element (see 9.4.2.5 (TIM element)). The FILS Discovery frame may include an OPS element. The AP should transmit a FILS Discovery frame instead of a TIM frame if the TWT SP start time closely(#15170) aligns with the transmission time of a FILS Discovery frame. If the OPS AP also operates with TIM Broadcast and uses TIM frames for Opportunistic power save mechanism, the OPS AP should align the transmission time of a TIM frame for TIM Broadcast, with the start time of the broadcast TWT SP with the Broadcast TWT Recommendation field set to 3. If the OPS AP sets the bit corresponding to an OPS STA in the traffic indication virtual bitmap carried in the Partial Virtual Bitmap field of the TIM element of the TIM frame or FILS Discovery frame to 0, the AP should send neither individually addressed frames to the STA nor Trigger frames that solicits HE TB PPDU from the STA during the TWT SP and until the next TWT SP with the Broadcast TWT Recommendation field set to 3.(18/1497r2)

* STA operation for opportunistic power save

With non-periodic opportunistic power save, if an OPS STA with AID *N* that is in the awake state receives a TIM element and an OPS element in an OPS frame or a FILS Discovery frame from the associated OPS AP, then the STA may be unavailable if the STA is in active mode or may be in doze state if the STA is in PS mode(#15845) until the end of the OPS period indicated in the OPS element, if the bit N in the traffic indication virtual bitmap carried in the Partial Virtual Bitmap field of the current TIM element is set to 0, unless other conditions not related to operation with the OPS AP require the STA to be in the awake state. At the end of the OPS period, the STA shall be in the awake state, unless determined otherwise by other power save protocols.(18/1497r2)

With periodic opportunistic power save, if an OPS STA with AID *N* that is in the awake state receives from the OPS AP with which it associated a TIM element with bit *N* of the traffic indication virtual bitmap field equal to 0 in a TIM frame or FILS Discovery frame within a broadcast TWT SP with the Broadcast TWT Recommendation field set to 3, then the STA may be unavailable if the STA is in active mode or may be in doze state if the STA is in PS mode during the TWT SP and until the next TWT SP with the Broadcast TWT Recommendation field set to 3, unless other conditions not related to operation with the OPS AP require the STA to be in the awake state.(18/1497r2)(#15845)

(#15167)An OPS STA shall not operate with TIM broadcast procedure if its associated AP is an OPS AP.(18/1497r2)

***TGax editor: Change the following section 26.8.3 Broadcast TWT operation as described below (#21447)***

* Broadcast TWT operation
* General

A TWT scheduling AP is an HE AP with dot11TWTOptionActivated equal to true that sets the Broadcast TWT Support field of the HE Capabilities element it transmits to 1 and that follows the rules in 26.8.3.2 (Rules for TWT scheduling AP), 26.14.2 (Power save with UORA and TWT), and those for periodic OPS defined(#15840) in 26.14.3 (Opportunistic power save).

[…]

A TWT scheduled STA follows the schedule provided by the TWT scheduling AP as described in 26.8.3.3 (Rules for TWT scheduled STA), 26.14.2 (Power save with UORA and TWT), and for periodic OPS as described in(#15841) 26.14.3 (Opportunistic power save). A TWT scheduled STA can negotiate the wake TBTT and wake interval for Beacon frames it intends to receive as described in 26.8.6 (Negotiation of wake TBTT and wake interval) or can join a particular broadcast TWT as described below.