### IEEE P802.11Wireless LANs

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| 11ba D2.0 MAC Comment Resolution for Wake up Operation |
| Date: 2019-03-10 |
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Abstract

This submission proposes resolutions for comments of TGba Draft D2.0 with the following CIDs:

2054, 2749, 2172, 2611, 2226, 2235, 2236, 2143, 2160, 2163, 2173, 2686, 2783, 2174, 2227, 2689

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Revised based on the discussion during the presentation.

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 TGba D2.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGba D2.0 Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

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

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| **CID** | **Commenter** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 2054 | Alfred Asterjadhi | 74.00 | 30.8.1 | Need to add a reference here to specify for which BSS the BU delivery is available (transnmitter vs nontransmitter BSS). Similarly, for the bss parameter update mentioned in the paragraph below. | As in comment. | Revised –Agree in principle with the commenter. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2054 |
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| 2749 | Xiaofei Wang | 74.00 | 30.8.1 | grammer: change "where one of the identifiers" to ", one of which" | as in comment. | Revised – Agree in principle with the commenter. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2749 |
| 2172 | Jeongki Kim | 74.00 | 30.8.1 | A broadcast WUR Wake-up frame can be sent using a nontransmitter ID as well as transmitter ID. | Change the related text as follow: "The WUR AP may transmit a broadcast WUR wake-up frame (see 30.4.2 (Transmitter ID) and 30.4.5 (Nontransmitter ID)) with the Group Addressed BU subfield of the Misc subfield set to 1 to indicate that group addressed BU(s) are available for all the associated WUR non-AP STA(s)" | Revised – Agree in principle with the commenter. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2172 |
| 2611 | Rojan Chitrakar | 74.00 | 30.8.1 | broadcast wake-up frames may also carry nonTransmitter ID, so nonTransmitter ID should also be referred. | Add reference to 30.4.5 (Nontransmitter ID) | Revised – Agree in principle with the commenter. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2611 |
| 2226 | Joseph Levy | 73.00 | 30.8 | The WUR AP sends a WUR Wake-up frame to a WUR non-AP STA to wake it up and have the STA send it a frame indicating that the STA is now in active mode. Please clarify this section so that it is clear what the result of the transmission of a wake up frame is, and what happens if the desired result is not received. | Clarify the wake-up procedure, as per the comment. | Rejected – The operation is described in 30.8.2 WUR AP Operation and 30.8.3 WUR non-AP STA Operation. As for the recovery method, it is described as the following.*The methods by which a WUR AP determines the exact value of the timeout interval and determines the number of retries after the transmission of individually addressed WUR Wake-up frame fails are implementation specific and out of scope of this standard.* |
| 2235 | kaiying Lv | 75.00 | 30.8.2 | "When a traffic filtering agreement is established for a WUR non-AP STA in WUR mode and Bit 1 of the TFS Action Code field is set to 1, then the WUR AP should transmit a WUR Wake-up frame to the WUR non-AP STA when the WUR AP receives an individually addressed BU destined to the WUR non-AP STA that matches the traffic filter set". Add the condition that only when the WUR non-AP STA in WUR mode is in doze state. | please clarify it. | Revised – Agree in principle with the commenter. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2235 |
| 2236 | kaiying Lv | 75.00 | 30.8.2 | When the Bit 1 of the TFS Action Code field is set to 0, the AP does not not send TFS Notify frame to the requesting STA. For WUR AP , it shall not transmit a WUR Wake-up frame to the WUR non-AP STA when the WUR AP receives an individually addressed BU destined to the WUR non-AP STA that matches the traffic filter set. | Change "should not" to "shall not" | Rejected –Wake-up frame desin on top of TFS Action code is designed as an optional and recommended feature for AP rather than mandatory feature.  |
| 2143 | James Lepp | 74.00 | 30.8.2 | "WUR AP that generates a VL WUR Wake-up frame with one or more STA Info fields shall order the STA Info fields in the Frame Body field so that the WUR IDs appear in increasing order." While logically this is great, would it be more efficient to have the WUR IDs in decreasing order? | "WUR AP that generates a VL WUR Wake-up frame with one or more STA Info fields shall order the STA Info fields in the Frame Body field so that the WUR IDs appear in decreasing order." | Rejected –Increasing order or decreasing order does not change the benefits of early termination of reception.  |
| 2160 | Jarkko Kneckt | 74.00 | 30.8.2 | "Individually addressed BU(s) are delivered at specific times, which are provided along with the agreed PS operation." | This sentence is unclear. Where are these times provided? Why individually addressed frames transmission is related to wake up radio? | Rejected –The sentence is about the behaviors of delivering individual addressed buffered BUs after the wake-up frame is transmitted, which is the reason why it is described in 11ba spec. As for the specific time, an example is that if Ps-Poll operaton is used, then AP delivers individual addressed BU after receiving a Ps-Poll frame.  |
| 2163 | Jeongki Kim | 75.00 | 30.8.2 | Is there a specific AP's operation after the successful Wake-up transmission? If no, why not merging two sentences to one sentence only with normative text. | Merge two sentences into one sentence as below:"If the WUR AP does not receive any transmission from the WUR non-AP STA within the timeout interval, the WUR AP may retransmit the WUR Wake-up frame to the WUR non-AP STA." | Rejected – We do need to describe the successful event so that the failed event is also defined, which is used in the following sentence.*The methods by which a WUR AP determines the exact value of the timeout interval and determines the number of retries after the transmission of individually addressed WUR Wake-up frame fails are implementation specific and out of scope of this standard.* |
| 2173 | Jeongki Kim | 74.00 | 30.8.2 | VL WUR Wake-up frame will be sent for indicating two or more STAs. FL WUR Wake-up frame is sent for indicating only one STA. | Change the related text as follow: "A WUR AP that generates a VL WUR Wake-up frame with two or more STA Info fields shall order..." | Rejected – Agree that it is not efficient for the AP to put only one STA Info field. However, it is up to the AP to decide what is the best option for implementation specific reason as long as STA can receive it. Since there is no interoperability issue, we do not make change.  |
| 2685 | Woojin Ahn | 74.00 | 30.8.2 | It is not clear whether AP could only include WUR ID of a WUR STA identified by the WUR Group ID in the ID field or any WUR ID. | Please clarify | Revised –Agree in principle with the commenter that we should clarify that any WUR ID is included in the frame body as shown in Figure 9-988f—STA Info field format.TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2685 |
| 2686 | Woojin Ahn | 75.00 | 30.8.2 | Whenever a STA enters awake state from doze state, NAV sychronization is required. Unless the WUR AP considers NAVSyncDelay of the recipient of a Wake-up frame in the timeout interval, it might cause a status mismatch problem. | Since the NAVSyncDelay is a implementation specific value, It is necessary for WUR AP to advertise a recommended NAVSyncDelay value for its WUR service | Rejected – The group agrees that the method to determine the exact value of timeout interval is implementation specific. Since NAVSyncDelay is not mandatory, recommending NAVSyncDelay does not solve the problem.*The methods by which a WUR AP determines the exact value of the timeout interval and determines the number of retries after the transmission of individually addressed WUR Wake-up frame fails are implementation specific and out of scope of this standard.* |
| 2783 | Yongho Seok | 75.00 | 30.8.2 | "A WUR AP that sends a WUR Wake-up frame to the WUR non-AP STA(s) may send a Trigger Frame to solicit response frames from one or more WUR non-AP STAs that support the reception of the Trigger frame."Any frame can be used for soliciting response frames from a WUR non-AP STA.For example, in addition to a Trigger frame, a WUR AP may send a QoS Null frame to a WUR non-AP STA. | Please remove the cited text or generalize the text for allowing other frames. | Revised – Agree in principle with the commenter. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2783 |
| 2174 | Jeongki Kim | 76.00 | 30.8.3 | WUR non-AP STA sends a response frame to the associated WUR AP after receiving a WUR Wake-up frame with ID field set to the WUR ID that identifies the WUR non-AP STA. Then, how about the WUR Group ID or VL WUR Wake-up frame with its WUR ID in Frame body field? Both cases are also the methods for indicating individually addressed BUs. For both cases, should the WUR AP send the individually addressed BU to WUR STAs without receiving any response frame from the WUR STAs. Sending individually addressed BUs without any confirmation of STA's wake-up may result in unnecessary resource wastage. Don't we need to define any operation for both cases? | Define the specific operation of WUR STA/AP after receiving WUR Wake-up frame with Group ID or frame body containing its WUR ID? | Revised – Agree in principle with the commenter. We think that the STA needs to follow the existing PS operation to communicate with the AP. As a result, the sentence is not really needed. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2174 |
| 2227 | Joseph Levy | 76.00 | 30.8.3 | Requiring the WUR non-AP STA to follow existing operation of PS operation, instead of simply requiring the STA to send a frame notifying the AP that it is awake is overly complicated and unnecessary. Clarify the STA behavior such that when it receives a wake-up frame it does just that wakes up and notifies the AP that it is awake. | Clarify the wake-up procedure, as per the comment. | Revised – Agree in principle with the commenter. We think that the STA needs to follow the existing PS operation to communicate with the AP. As a result, the sentence is not really needed. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2227 |
| 2689 | Woojin Ahn | 76.00 | 30.8.3 | If a WUR non-AP STA using U-APSD does not set all ACs delivery-enabled, it may not know whether it should transmit PS-poll or U-APSD trigger frame after wake-up, resulting in fail to receive buffered BUs properly. | Add a recommendataion or a note that a WUR non-AP STA should set all ACs delivery-enabled before in enters WUR Mode. | Revised – Agree in principle with the commenter. TGba editor to make the changes shown in 11-19/0442r1 under all headings that include CID 2689 |
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**Discussion:** *None.*

**Propose:** Revised for CID 2054, 2749, 2172, 2611, 2235, 2783, 2689, 2227, 2714 per discussion and editing instructions in 11-19/0442r1.

***TGba editor: Change 30.8 Wake-up Operation as follows:***

* Wake-up Operation
* General

An WUR AP may send a WUR Wake-up frame to an associated WUR non-AP STA as described in 30.7.4 (WUR AP operation) to notify the WUR non-AP STA that the WUR AP intends to have operation with the WUR non-AP STA as described in 30.8.2 (WUR AP Operation) and 30.8.3 (WUR non-AP STA Operation). (#866)

A WUR AP shall not send a WUR Wake-up frame to associated WUR non-AP STA(s) with data rate that is not supported by the WUR non-AP STA(s). (#829)

If the WUR AP and the WUR non-AP STA support traffic filtering service (TFS) as specified in 11.22.12 (TFS Procedures), then the WUR AP and the WUR non-AP STA may reuse existing traffic filter sets to control the WUR Wake-up frame transmission as described in 30.8.2 (WUR AP Operation).

The WUR AP may transmit a WUR Wake-up frame to an associated WUR non-AP STA to indicate that individually addressed BU(s) are available for the non-AP STA. The WUR Wake-up frame shall satisfy any of the conditions below:

* The ID field of the WUR Wake-up frame contains a WUR ID that identifies the WUR non-AP STA.
* The ID field of the WUR Wake-up frame contains a WUR group ID that identifies a group of WUR non-AP STAs that include the WUR non-AP STA.
* The WUR Wake-up frame has a list of identifiers in the Frame Body field, and one of the identifiers identifies the WUR non-AP STA (see 9.10.3.2 (WUR Wake-up frame format)).(#2749)

(#866, #130, #417, #732)

The WUR AP may transmit a broadcast WUR wake-up frame (see 30.4.2 (Transmitter ID) and 30.4.5 (Nontransmitter ID)) with the Group Addressed BU subfield of the Misc subfield set to 1 to indicate that group addressed BU(s) of the WUR AP (see 11.2.3.4 (TIM types)) are available for all the associated WUR non-AP STA(s). (#2054, #2172, #2611)(#1186, #733, #866, #132)

The WUR AP may transmit a broadcast WUR Wake-up frame to associated WUR non-AP STA(s) to indicate that a critical update to the BSS parameters of the WUR AP(#2054) has occurred for the associated WUR non-AP STA (see 30.8.2 (WUR AP Operation)). The critical update is indicated in the Counter subfield of the Type Dependent Control field. (#866, #1246, #37, #1135)

* WUR AP Operation

A WUR AP that transmits a WUR Wake-up frame to a WUR non-AP STA that indicates the availability of individually addressed BU(s) shall follow the existing operation, which is any PS operation that the WUR AP and the WUR non-AP STA has agreed to use (e.g., baseline active mode and PS mode change, U-APSD, TWT, etc.), to deliver individually addressed BU(s) to the WUR non-AP STA. Individually addressed BU(s) are delivered at specific times, which are provided along with the agreed PS operation. (#332)

When the WUR AP schedules a transmission that is not a WUR PPDU to the WUR non-AP STA, the WUR AP shall ensure that either of the conditions below is met:

* The transition delay indicated by the WUR non-AP STA in the WUR Capabilities elements following the most recent transmitted WUR Wake-up frame intended to the WUR non-AP STA has expired.
* The WUR non-AP STA has indicated that it is in the awake state by transmitting a frame to the WUR AP.(#133)

NOTE—The frames scheduled by the WUR AP to be delivered are not limited to individually addressed BU(s) only.

A WUR AP that generates a VL WUR Wake-up frame with one or more STA Info fields shall order the STA Info fields in the Frame Body field so that the WUR IDs appear in increasing order. The WUR AP shall not include the WUR ID of a WUR non-AP STA that does not support reception of VL WUR frames. (see 9.4.2.290 (WUR Capabilities element)).(#722)

A WUR AP that transmits a broadcast WUR Wake-up frame to a WUR non-AP STA that indicates the availability of group addressed BU(s) shall follow existing operation, which is any PS operation that the WUR AP and the WUR non-AP STA has agreed to use (e.g., DTIM, FMS, etc.), to deliver group addressed BU(s) to the WUR non-AP STA. Group addressed BU(s) are delivered at specific times, which are provided along with the agreed PS operation. (#1186)

When the WUR AP schedules a transmission of group addressed BU(s) to the WUR non-AP STA(s), the WUR AP shall ensure that the following condition is met:

* The maximum transition delay following the most recently transmitted WUR Wake-up frame indicating buffered group addressed BU(s) has expired. The maximum transition delay is defined as the maximum value of the transition delay values in the WUR Capabilities elements indicated by all the WUR non-AP STAs that are not in the awake state, have negotiated WUR power management service with the WUR AP, and are in WUR mode.

(#891, #735)

A WUR AP that sends a WUR Wake-up frame to the WUR non-AP STA(s) may send a frame (for example, a Trigger Frame) to solicit response frames from one or more WUR non-AP STAs that support the reception of the frame. (#2783)(#136)

When a traffic filtering agreement is established for a WUR non-AP STA in WUR mode, the WUR non-AP STA is in doze state, and Bit 1 of the TFS Action Code field is set to 1, then the WUR AP should transmit a WUR Wake-up frame to the WUR non-AP STA when the WUR AP receives an individually addressed BU destined to the WUR non-AP STA that matches the traffic filter set. (#2235)

When a traffic filtering agreement is established for a WUR non-AP STA in WUR mode, the WUR non-AP STA is in doze state, and Bit 1 of the TFS Action Code field is set to 0, then the WUR AP should not transmit a WUR Wake-up frame to the WUR non-AP STA when the WUR AP receives an individually addressed BU destined to the WUR non-AP STA that matches the traffic filter set. (#2235)

A WUR AP shall maintain a BSS Parameter Update Counter. The WUR AP shall increase the value of the BSS Parameter Update Counter when a critical update occurs to any of the elements inside the Beacon frame. The following events shall be classified as a critical update:

* Inclusion of a Channel Switch announce element
* Inclusion of an Extended Channel Switch announce element
* Inclusion of a Wide Bandwidth Channel Switch element
* Inclusion of an Operating Mode Notification element
* Modification of the EDCA parameters
* Modification of the HT Operation element
* Modification of the VHT Operation element
* Modification of the HE Operation element
* Modification of the DSSS Parameter Set
* Inclusion of a Channel Switch Wrapper element

(#141, #137, #170)

The WUR AP shall include the current value of the BSS Parameter Update Counter in the WUR Parameter field in the WUR Operation element. The WUR AP shall include a WUR Operation element in the WUR Mode Setup frames if the Counter value in the WUR Operation element has been recently updated. (#138)

The WUR AP shall include the current value of the BSS Parameter Update Counter in the Counter subfield of the Type Dependent Control field in all transmitted broadcast WUR Wake-up frames. (#736)

A WUR AP may classify other changes in the Beacon frame as critical updates, which may include those that are described in 11.2.3.15 (TIM Broadcast).

After a WUR AP sends a WUR Wake-up frame with the ID field set to a WUR ID that identifies a WUR non-AP STA, the WUR AP waits for a timeout interval that is larger than the transition delay indicated by the WUR non-AP STA in the WUR Capabilities elements:

* If the WUR AP receives any transmission from the WUR non-AP STA within the timeout interval, then the WUR Wake-up frame transmission is successful.
* Otherwise, the WUR Wake-up frame transmission fails, and the WUR AP may retransmit the WUR Wake-up frame to the WUR non-AP STA.

(#737, #130)

The methods by which a WUR AP determines the exact value of the timeout interval and determines the number of retries after the transmission of individually addressed WUR Wake-up frame fails are implementation specific and out of scope of this standard. (#139)

* WUR non-AP STA Operation

A WUR non-AP STA that receives a WUR Wake-up frame addressed to itself with an indication of individually addressed BU(s) (see 30.8.1 (General)) shall follow existing operation, which is any PS operation the associated WUR AP and the WUR the non-AP STA has agreed to use (e.g., baseline PM change, U-APSD, TWT, etc.), to retrieve individually addressed BU(s) and follow the wake up timing information (e.g., the next service period) that is provided along with the agreed PS operation. In this case, the STA may be in the doze state until the time indicated by the wake up timing information (e.g., the next service period) that is provided along with the agreed PS operation.(#437, #738, #465)

NOTE 1—For example, rule b), c), and d) in 11.2.3.7 (Receive operation for STAs in PS mode) describes one operation for a WUR non-AP STA to retrieve individually addressed BU(s) using PS-Poll or U-APSD.

NOTE 2 – To use both Ps-Poll or U-APSD, the STA can set all ACs are delivery-enabled as defined in 11.2.3.7 (Receive operation for STAs in PS mode).(#2689)

A WUR non-AP STA that receives a WUR Wake-up frame with an indication of buffered group addressed BU(s) (see 30.8.1 (General)) shall follow existing operation, which is any PS operation that the WUR AP and the WUR non-AP STA has agreed to use (e.g., DTIM, FMS, etc.) to receive group addressed BU(s) and follow the wake up timing information (e.g., the next DTIM TBTT) that is provided along with the agreed PS operation. In this case, the WUR non-AP STA may be in the doze state until the time indicated by the wake up timing information (e.g., the next DTIM TBTT) that is provided along with the agreed PS operation.(#438, #739)

NOTE—For example, rule e) in 11.2.3.7 (Receive operation for STAs in PS mode) describes one operation for a WUR non-AP STA to receive group addressed frame.

A WUR non-AP STA shall maintain a BSS Parameter Update Counter. The WUR non-AP STA shall update the value of its BSS Parameter Update Counter to the value of the Counter subfield contained in the latest WUR Operation element received from the WUR AP with which it is associated. A WUR non-AP STA that receives the Counter subfield of the Type Dependent Control field in a broadcast WUR Wake-up frame that contains a value that is different from the value of its BSS Parameter Update Counter shall follow the procedure defined in 11.2.3.15 (TIM Broadcast) to attempt to receive the Beacon information. (#141, #1147, #740)

(#2174, #2227)