### IEEE P802.11 Wireless LANs

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| 11ba D6.0 Comment Resolution for WUR Wake-up Operation Part I | | | | |
| Date: 2020-05-21 | | | | |
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Abstract

This submission proposes resolutions for comments of TGba Draft D6.0 with the following CIDs:

7012, 7014, 7036, 7039, 7057, 7113, 7085, 7086, 7087

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Revision based on the discussion in the teleconference call.

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 D6.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGba D6.0 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** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 7012 | 122.30 | 29.9.4 | In the clause 29.9.3 WUR AP operation, it indicates  "After a WUR AP sends a WUR Wake-up frame with the ID field equal 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."  However, in the clause 29.9.4 WUR non-AP STA operation, there is no corresponding description for the WUR STA to transmit any PPDU within the timeout interval. Please add this missing description for WUR non-AP STA. | A WUR non-AP STA that receives a WUR Wake-up frame addressed to it with an indication of individually addressed BU(s) (see 29.9.1 (General)) shall follow existing operation, which is any PS operation the associated WUR AP and the WUR non-AP STA has agreed to use (e.g., power management mode 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. The WUR non-AP STA shall send a frame to the WUR AP within the timeout interval. ..... | Revised –  The timeout interval is not indicated from the WUR AP to the WUR non-AP STA. As a result, a WUR non-AP STA will not know the exact time to follow the “shall” reqirement.  Even if we have a WUR AP indicate this information, a WUR non-AP STA may need to go through channel access, and the transmission be later the timeout interval. However, as long as the transmission is before the next time that the WUR AP retransmits, the WUR non-AP STA can still retrieve the individual addressed BU(s).  Finally, we add a note to explain that AP might need to consider other factors like wake up timing to better determine the exact timeout interval value. Further, we revise the description to clarify that WUR non-AP STA shall follow existing PS operation to schedule transmission to indicate WUR AP the WUR non-AP STA is in awake state so we do not need additional normative behaviour.  TGba editor to make the changes shown in 11-20/0802r1 under all headings that include CID 7012. |
| 7014 | 122.43 | 29.9.4 | After an WUR non-AP STA wakes up and completes its communication with WUR AP, it may enter the doze mode after the inactivity timer expires. This needs to be specified in specification. | NOTE 4 - The waked-up WUR non-AP STA may enter the doze mode after it completes its communication with the WUR AP and the inactivity timer expires. | Rejected –  The commenter is not clear about the referenced “inactivity timer”. Search “inactivity timer” in 11ba D6.0 does not return any result. Search “inactivity timer” in revmd D3.3 returns results for   * Inactivity timer for block ack setup * Inactivity timer for TS admission * Inactivity timer for multicast diagnostic request   None of above is related to enter doze state.  We also note that in 29.9.4, we specify that WUR non-AP STA follows existing PS operation, which includes going back to doze state, and existing PS operation is already described in 11.2 (Power management) and 26.8 (TWT operation). |
| 7036 | 120.47 | 29.9.3 | There should be a way for the WUR AP to confirm if the WUR non-AP STA is awake. | Add the following sentence after the NOTE in pp.ll 120.50:   "In order to confirm if the above second condition is met, the WUR AP may transmit a WUR Wake-up frame." | Revised –  The following sentence is referece by the commenter. Although the second bullet says a WUR non-AP STA transmits a frame to a WUR AP to indicate awake state. The sentence does not exclude the possibility for a WUR AP to send Trigger frame and solicit transmission.  *If the WUR AP schedules a transmission that is not a WUR PPDU to the WUR non-AP STA, the WUR AP shall verify 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 (see 11.2.1 (General)) by transmitting a frame to the WUR AP.*  The possibility for a WUR AP to send Trigger frame or any other frame to solicit response is described in the following.  *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.*  We think the commenter just wants to add description to explain why a WUR non-AP STA will do this. We simply add a note to refer to 29.9.4 that a WUR non-AP STA can indicate a WUR AP that it is in awake state after the WUR non-AP STA receives a WUR wake-up frame as described in 29.9.4.  TGba editor to make the changes shown in 11-20/0802r1 under all headings that include CID 7036. |
| 7039 | 120.31 | 29.9.3 | What does "shall follow the existing operation" mean? This sentence does not make sense. | Change "shall follow the existing operation" to "shall follow a power save operation, as defined in clauses x.y". Clause x.y then refers to the clauses where: active mode, PS mode change, U-APSD, TWT are defined. | Revised –  Agree in principle with the commenter. We add the reference.  TGba editor to make the changes shown in 11-20/0802r1 under all headings that include CID 7039. |
| 7057 | 122.27 | 29.9.4 | It states that the WUR non-AP STA comes out of WUR state and potentially into the doze state until the next service period (of any existing PS operation). I argue this is not possible for all existing power management modes because the timing kept while in WUR Duty cycle isn't enough for the STA to keep timing of the "main radio" periodicity. Need to clarify that depending on the PS operation there are significant requirements on the STA to keep the main radio PS timers in addition to the WUR beacon period timers throughout all the doze and WUR Doze states. In some cases it may be advisable to use poll-based PS modes in conjunction with WUR to maximize power saving. |  | Rejected –  We note that WUR Beacon provides TSF information to update the TSF information of the WUR non-AP STA. As a result, a WUR non-AP STA can keep track the TSF information. See 29.6.3 Maintaining TSF timer synchronization with WUR Beacon frame.  We also note that synchronizing with WUR Beacon is a mandatory feature as described in 4.3.15b Wake-up radio (WUR) AP and WUR non-AP STA.  *A WUR non-AP STA has the following mandatory main features:*  *…*  *— Synchronization using WUR Beacon frame.* |
| 7113 | 119.1 | 29.9.1 | "If a WUR AP and an associated WUR non-AP STA support traffic filtering service (TFS) ... then the WUR AP and the WUR non-AP STA may reuse existing traffic filter sets to control the WUR Wake-up frame transmission …"    Huh? So, if I have a TFS filter that would control how a WUR Wake-up frame is buffered or filtered, then the AP applies that filter? That is, the WUR Wake-up frame could be buffered (or dropped)? Then how does the non-AP STA get notified that the WUR Wake-up frame is buffered, by sending another WUR Wake-up frame? Something here doesn't make sense. | Delete this paragraph. There is nothing special about TFS operation over any other "legacy power save" feature, that needs special attention. However, it is important to note that the WUR Wake-up frame itself is not buffered, dropped, filtered, etc. in any way, due to any legacy power save features. So, add to the end of the first paragraph of 29.9.3, "A WUR AP shall not apply any existing power save operation with respect to WUR frames. WUR frames are delivered according to the negotiated WUR power management service." | Rejected –  We cite the exact description in 29.9.3 WUR AP operation about TFS below. We explain that traffic filtering is about control the traffic notification, and depending on whether a traffic is filtered or not, the WUR AP may decide whether to notify WUR non-AP STA about the traffic or not using WUR wake up frame.  *If a traffic filtering agreement is established for a WUR non-AP STA in WUR mode, the WUR non-AP STA is in doze state (see 11.2.1 (General)), and Bit 1 of the TFS Action Code field is equal to 1, then the WUR AP should transmit a WUR Wake-up frame to the WUR non-AP STA if the WUR AP receives an individually addressed BU destined to the WUR non-AP STA that matches the traffic filter set.*  *If a traffic filtering agreement is established for a WUR non-AP STA in WUR mode, the WUR non-AP STA is in doze state (see 11.2.1 (General)), and Bit 1 of the TFS Action Code field is equal to 0, then the WUR AP should not transmit a WUR Wake-up frame to the WUR non-AP STA if the WUR AP receives an individually addressed BU destined to the WUR non-AP STA that matches the traffic filter set.*  We note that this aligns the operation in 9.4.2.79 TFS Request element for AP to send TFS notify frame.  *Setting this field to 1 indicates the STA is to be sent a TFS Notify frame upon the first frame matching to the traffic filter set or the first frame match after the AP receives a Notify Response frame containing the corresponding TFS ID. Set ting this field to 0 indicates the AP does not send TFS Notify frame to the requesting STA.* |
| 7085 | 119.55 | 29.9.1 | While a WUR AP may send a WUR Wake-up frame or a WUR Short Wake-up Frame to an associated WUR non-AP STA, it is critical that these transmission may only be made when the WUR non-AP STA is scheduled to be in WUR awake state. | Clarify that a WUR AP may only send WUR Wake-up frames to an associated WUR non-AP STA when that STA is scheduled to be in WUR awake state. | Rejected –  We note that the baseline does not have a “shall” statement that the AP can only send frames when the non-AP STA is in awake state. For example, RTS/CTS exchange can be used to check if non-AP STA is alive or not.  However, we agree that AP in general shall schedule wake-up frame to notify individual addressed BUs in WUR service period. This is already described in 29.8.3 WUR power management operation for a WUR AP, and we simply add a reference.  *The WUR AP shall schedule for transmission a WUR Wake-up frame or a WUR Short Wake-up frame for the WUR non-AP STA during a WUR duty cycle service period that is negotiated with the WUR non-AP STA to notify the WUR non-AP STA that the WUR AP intends to have operation with the WUR non-AP STA as described in 29.9.3 (WUR AP operation) and 29.9.4 (WUR non-AP STA operation)*  Finally, we note that the following sentence in 29.9.1 alreay reference 29.8.3.  *A WUR AP may send a WUR Wake-up frame or a WUR Short Wake-up frame (see 29.9.2 (WUR Short Wake-up frame operation)) to an associated WUR non-AP STA as described in 29.9 (Wake-up operation) and 29.8.3 (WUR power management operation for a WUR AP) to notify the WUR non-AP STA that the WUR AP intends to have operation with the WUR non-AP STA as described in 29.9.3 (WUR AP operation) and 29.9.4 (WUR non-AP STA operation).* |
| 7086 | 119.55 | 29.9.1 | The current WUR AP operation description describes WUR AP behavior when a PS mode is also defined for the WUR non-AP STA. This is very confusing and unnecessary. It would be much simpler if the WUR power save mode, was a mode that the WUR AP used to simply wake the WUR non-AP STA. The behavior of the WUR non-AP STA after it is woken should be described else where. | Clarify that how a WUR AP wakes a WUR non-AP STA in WUR power save mode. Remove all the unnecessary description on how PS mode and WUR mode interact. Leave the PS mode behavior description to the PS clauses. | Rejected –  We note that in 29.9.1, there is no texts mentioning PS mode or WUR power save mode or WUR mode. |
| 7087 | 122.66 | 29.9.4 | Clarify that a WUR non-AP STA that receives a WUR Wake-up frame addressed to it will leave WUR power save mode and transition back to WUR mode and at this point will either be in awake or doze state based on the STAs PS mode or alternatively will transition to awake mode. Which would seem to be the state the WUR that is woken up should move to. | Clarify the behavior of the WUR non-AP STA when it receives a WUR Wake-up frame. Clarify that it wakes up. This does not have to be complicated. | Revised –  Agree in principle with the commenter. We add the reference to clarify how STA wakes based on existing PS operation.  TGba editor to make the changes shown in 11-20/0802r1 under all headings that include CID 7087. |

**Discussion:** *None.*

***TGba editor: Change 29.9.3 WUR AP operation as follows (track change on):***

**29.9.3 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 PS operation defined in 11.2 (Power management) and 26.8 (TWT operation), which is any PS operation that the WUR AP and the WUR non-AP STA has agreed to use (e.g., active mode and PS mode change, U-APSD, TWT, etc.), to deliver individually addressed BU(s) to the WUR non-AP STA and follow the timing information (e.g., the next service period) that is provided along with the agreed PS operation.(#7012, #7039)

NOTE—As described in 29.3 (Channel access), a WUR AP can transmit multiple WUR Wake-up frames in a TXOP  
(see 10.24.2.8 (Multiple frame transmission in an EDCA TXOP)).

If the WUR AP schedules a transmission that is not a WUR PPDU to the WUR non-AP STA, the WUR AP  
shall verify 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 (see 11.2.1 (General)) by transmitting a frame to the WUR AP.

NOTE 1 —The frames scheduled by the WUR AP to be delivered are not limited to individually addressed BU(s)

NOTE 2—The WUR non-AP STA indicates that it is in the awake state by transmitting a frame to the WUR AP and following the existing PS operation after receiving a WUR Wake-up frame addressed to it with an indication of individually addressed BU(s) (see 29.9.4 WUR non-AP STA operation).(#7036)

(…existing texts…)

After a WUR AP sends a WUR Wake-up frame with the ID field equal 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.

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.

NOTE – The WUR AP might take into account the wake up timing information (e.g., the next service period) that is provided along with the agreed PS operation to determine the value of the timeout interval.(#7012)

(…existing texts…)

***TGba editor: Change 29.9.4 WUR non-AP STA operation as follows (track change on):***

**29.9.4 WUR non-AP STA operation**

A WUR non-AP STA that receives a WUR Wake-up frame addressed to it with an indication of individually addressed BU(s) (see 29.9.1 (General)) shall follow existing PS operation defined in 11.2 (Power management) and 26.8 (TWT operation), which is any PS operation the associated WUR AP and the WUR non-AP STA has agreed to use (e.g., power management mode change, UAPSD, 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 WUR non-AP STA may be in the doze state (see 11.2.1 (General)) 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. (#7039, #7087, #7012)

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.

(…existing texts…)