### IEEE P802.11 Wireless LANs

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| 11ba D5.0 Comment Resolution for Wake-up Operation | | | | |
| Date: 2019-12-26 | | | | |
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Abstract

This submission proposes resolutions for comments of TGba Draft D5.0 with the following CIDs:

5001, 5002, 5003, 5004, 5013, 5005, 5008

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 D5.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGba D5.0 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** |
| 5001 | Joseph Levy | 116.50 | 29.9.1 | Why does the specification not require an WUR AP to send a WUR Wake-up frame to a WUR non-AP STA for which the WUR AP has individually addressed BU(s) or according to TFS? | There should be a requirement on the WUR AP to send a WUR Wake-up frame when the received individually addressed BU(s) meet a specific criteria. As the WUR non-AP STA should be aware of the nominal expected delay of individually addressed BU(s) are when it in the WUR mode. | Revised –  The following sentence are related to the requirement asked by the commenter. We revise the sentence to provide necessary reference in 29.9.1.  ***29.8.3 WUR power management operation for a WUR AP***  *The WUR AP shall schedule for transmission a WUR 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) if the WUR non-AP STA is in the doze state (see 11.2.1 (General)). The WUR Wake-up frame classifies as a keep-alive WUR frame for a WUR non-AP STA that has requested the transmission of keep-alive WUR frames during WUR mode setup.*  ***29.9.3 WUR AP operation***  *If a traffic filtering agreement is established for a WUR non-AP STA in WUR mode, the WUR non-APSTA 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.*  TGba editor to make the changes shown in 11-19/2166r1 under all headings that include CID 5001. |
| 5002 | Joseph Levy | 119.35 | 29.9.2 | The specification should state when a WUR AP is required to send a WUR Short Wake-up frame. | Specify when a WUR-AP should send a WUR Short Wake-up frame. | Revised –  The following sentence are related to the requirement asked by the commenter. We revise the sentence to add the missing short wake-up frame.  ***29.8.3 WUR power management operation for a WUR AP***  *The WUR AP shall schedule for transmission a WUR 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) if the WUR non-AP STA is in the doze state (see 11.2.1 (General)). The WUR Wake-up frame classifies as a keep-alive WUR frame for a WUR non-AP STA that has requested the transmission of keep-alive WUR frames during WUR mode setup.*  TGba editor to make the changes shown in 11-19/2166r1 under all headings that include CID 5002. |
| 5003 | Joseph Levy | 120.25 | 29.9.3 | The specification should state when a WUR AP is required to send a WUR Wake-up frame. | Specify when a WUR-AP should send a WUR Wake-up frame. | Revised –  The following sentence are related to the requirement asked by the commenter. We revise the sentence to provide necessary reference in 29.9.1.  ***29.8.3 WUR power management operation for a WUR AP***  *The WUR AP shall schedule for transmission a WUR 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) if the WUR non-AP STA is in the doze state (see 11.2.1 (General)). The WUR Wake-up frame classifies as a keep-alive WUR frame for a WUR non-AP STA that has requested the transmission of keep-alive WUR frames during WUR mode setup.*  ***29.9.3 WUR AP operation***  *If a traffic filtering agreement is established for a WUR non-AP STA in WUR mode, the WUR non-APSTA 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.*  TGba editor to make the changes shown in 11-19/2166r1 under all headings that include CID 5003. |
| 5004 | Joseph Levy | 120.23 | 29.9.3 | WUR AP operation does not clearly state that when WUR mode is active the WUR AP will buffer frames for the WUR non-AP STA and will suspend PS transmissions intended for the WUR non-AP STA until the WUR AP has sent a WUR Wake-up frame to the WUR non-AP STA and the WUR non-AP STA has either indicated it is awake or transition delay time has expired. | Clearly specify expected WUR AP behavior regarding PS transmissions when WUR mode is active. | Revised –  If a WUR non-AP STA is in Active mode, then AP can still transmit frame without any restriction like today.  However, it is true that we may want to note that WUR AP still buffer traffic if the STA is in PS mode. We add a note to clarify this point.  Finally, the following sentence describes that the existing servive period is suspended.  *The existing negotiated service periods between the WUR AP and the WUR non-AP STA for the WUR non-AP STA’s schedule are suspended, i.e., the WUR non-AP STA is not required to be in the awake state (see 11.2.1 (General)) during the existing negotiated service period:*  TGba editor to make the changes shown in 11-19/2166r1 under all headings that include CID 5004. |
| 5013 | Mark Hamilton | 120.37 | 29.9.3 | Because 29.9.4 says that the non-AP STA can stay in doze until the next expected service period, the AP needs to wait the transition delay, plus, then wait for the next expected service period. | Add "and the next service period interval has arrived" to the end of this bullet. Same thing (to first sentence in the bullet) in the bullet at top of page 121. | Revised –  Agree in principle with the commenter. The requirement is captured in the following two sentences.  *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.*  *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.*  We revise accordingly based on the texts in 29.9.4 WUR non-AP STA operation to provide better connection. We also revise the wording “baseline”, which is not a appropriate term when 11ba rolls into the next major revison of 802.11.  TGba editor to make the changes shown in 11-19/2166r1 under all headings that include CID 5013. |
| 5005 | Joseph Levy | 122.19 | 29.9.4 | The requirement that a WUR non-AP STA "shall follow existing operation, which is any PS operation the associated WUR AP and the WRU non-AP STA has agreed to use" is not very clear nor does it specify WUR non-AP STA operation. | Clearly specify that a WUR non-AP STA that receives a WUR wake-up frame should change power management mode from WUR power management mode (e.g. a WUR awake and WUR doze scheduled behavior) to a PS mode (e.g. a awake and doze schedule consistent with the agreed PS mode). More precisely the WUR non-AP STA should be aware that the WUR AP that transmitted the received WRU wake-up frame will be transmit PPDUs intended for the WUR non-AP STA in the manner of the agreed PS mode after the AP STA has either indicated it is awake or transition delay time has expired. | Revised –  We note that A WUR non-AP STA can be in WUR mode and PS mode. The only difference is that certain operation in PS mode like service period is suspended, and WUR AP shall follow those timing information to deliver traffic when a wake-up frame is sent.  We revise accordingly based on the texts in 29.9.4 WUR non-AP STA operation to provide better connection with 29.9.3.  TGba editor to make the changes shown in 11-19/2166r1 under all headings that include CID 5005. |
| 5008 | Joseph Levy |  |  | "WUR mode seems to be defined to be two things: a. The mode in which a WUR AP will buffer frames for the WUR non-AP STA until the non-AP STA can "wake-up" and the WUR AP "wakes-up" the non-AP STA by send the WUR non-AP STA a WUR wakeup PPDU and then waiting for the WUR non-AP STA to "wake-up". b. The mode in which a WRU AP and a WUR non-AP STA have completed the exchange of frames to configure the WUR mode. The mode in which WUR mode is configured but not necessarily active. The WUR mode is not active unless the WUR non-AP STA is in doze state (or more accurately the WUR AP is aware that the WUR non-AP STA is scheduled to be in "doze" state. | Clarify what is meant by WUR mode and depending on the definition clarify states as defined in the comment. | Revised –  We note that WUR AP still buffer traffic if the STA is in PS mode and send the traffic in designated time as defined today. We add a note to clarify this point.  The definition of WUR mode based on b is described in 29.8. The commenter refers a term WUR mode active. We think that the commenter refers to the time that a WUR AP can send WUR frame based on WUR duty cycle operation as described in 29.7. The timing to send non-WUR PPDU after the WUR PPDU is revised to align with the design that existing power save protocols can be used.  TGba editor to make the changes shown in 11-19/2166r1 under all headings that include CID 5008. |

**Discussion:** *None.*

***TGba editor: Change 29.8.3 WUR power management operation for a WUR AP as follows (track change on):***

* WUR power management operation for a WUR AP

For each WUR non-AP STA that requests WUR power management service from an associated WUR AP, the WUR AP shall maintain a WUR status that indicates whether the WUR non-AP STA is in WUR mode or WUR mode suspend.

If a WUR non-AP STA is in WUR mode, then:

* The negotiated WUR parameters between the WUR AP and the WUR non-AP STA are maintained by the WUR AP.
* The WUR AP shall schedule for transmission a WUR Wake-up frame or a WUR Short Wake-up frame (#5002) 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) if the WUR non-AP STA is in the doze state (see 11.2.1 (General)). The WUR Wake-up frame classifies as a keep-alive WUR frame for a WUR non-AP STA that has requested the transmission of keep-alive WUR frames during WUR mode setup.
* The WUR AP shall schedule for transmission a WUR Beacon frame during a WUR duty cycle service period that is negotiated with the WUR non-AP STA as a keep-alive WUR frame if the WUR AP does not schedule for transmission a WUR Wake-up frame for the WUR non-AP STA during that WUR duty cycle service period and the WUR non-AP STA has requested the transmission of keep-alive WUR frames during a successful WUR mode setup (see 29.8.2 (WUR mode setup)).
* The existing negotiated service periods between the WUR AP and the WUR non-AP STA for the WUR non-AP STA’s schedule are suspended, i.e., the WUR non-AP STA is not required to be in the awake state (see 11.2.1 (General)) during the existing negotiated service period:
* After the WUR AP transmits a WUR Wake-up frame addressed to the WUR non-AP STA with an indication of individually addressed buffered BU(s), the WUR AP expects that the WUR non-AP STA is in the awake state (see 11.2.1 (General)) at the earliest service period, which has end time larger than the received time of the frame plus the transition delay indicated by the WUR non-AP STA in the WUR Capabilities elements, following the existing PS operation (e.g., individual TWT) agreed between the WUR AP and the WUR non-AP STA.
* The parameters of the negotiated service period for the WUR non-AP STA’s schedule between the WUR AP and the WUR non-AP STA are maintained by the WUR AP.
* The WUR AP shall follow the wake-up operation defined in 29.9 (Wake-up operation).

NOTE 1—The WUR non-AP STA might not wake up at the exact start time of the earliestThe WUR non-AP STA might not wake up at the exact start time of the earliest service period.

NOTE 2—A WUR AP can generate keep-alive WUR frames, which are WUR beacon frames, in the WUR primary channel, and a WUR AP cannot generate keep-alive WUR frames, which are WUR beacon frames, in a WUR channel that is not the WUR primary channel. Hence, the AP can assign these WUR non-AP STAs in the WUR primary channel to enable generation of the keep-alive WUR frames, and the AP cannot assign these WUR non-AP STAs in a WUR channel that is not the WUR primary channel to enable the keep-alive operation.

NOTE 3 – If the WUR non-AP STA is in power save mode, then the WUR AP still buffer individually addressed BUs (see 11.2.3.1 (General)) as described in 29.1 (Introduction) and deliver them in designated time as described in 29.9.3 (WUR AP operation) and 29.9.4 (WUR non-AP STA operation). (#5004, #5008)

If a WUR non-AP STA is in WUR mode suspend, then:

* The negotiated WUR parameters between the WUR AP and the WUR non-AP STA are maintained by the WUR AP.

NOTE—The WUR non-AP STA might not wake up at the exact start time of the earliestA WUR non-AP STA in WUR mode suspend does not need to follow the WUR duty cycle service period agreed between the WUR AP and the WUR non-AP STA.

* General

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)(#5001, #5003) 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).

(…existing texts)

* 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., (#5013)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.(#5013, #5005, #5008).

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

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 9.4.2.289 (WUR Capabilities element)).

NOTE—Inclusion of the STA Info fields in a VL WUR Wake-up frame in increasing order allows a WUR STA to stop processing the WUR frame once the STA locates a User Info field that contains the WUR ID of the STA or a WUR ID that is greater than the WUR ID of the STA.

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 and follow the timing information (e.g., the next DTIM TBTT) that is provided along with the agreed PS operation.(#5013, #5005, #5008)

(…existing texts)

**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 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(#5013) 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 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.

(…existing texts)