802.11ba Draft Specification

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| Spec Text for Channel Access, Duty Cycle Operation, and WUR Mode |
| Date: 2018-03-04 |
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Abstract

This submission contains spec text to be incorporated in P802.11ba D0.2 related to revision of WUR Mode neogitation and these motions:

1. [Assigned D0.2] The period of the WUR duty cycle as shown below is a multiple of a basic unit. The basic unit is indicated by the AP. The on duration in each period for WUR duty cycle as shown below is larger than or equal to a minimum wake-up duration. The minimum wake-up duration is indicated by the AP.



1. [Assigned D0.2] AP decides the starting point for one WUR duty cycle schedule. How to indicate the starting point is TBD.
2. [Assigned D0.2] Use EDCA to send wake-up frames:
* The EDCA parameter set for wake-up frames is TBD.
1. [Assigned D0.2] An AP reuses existing 4 ACs and corresponding EDCA parameters to transmit WUR frame:
* Note that WUR frame includes unicast wake-up frame, multicast wake-up frame, and WUR Beacon.
1. [Assigned D0.2] An AP may use any AC for sending a multicast wake-up frame. An AP may use any AC for sending a WUR Beacon.
2. [Assigned D0.2] An AP may use any AC for sending a unicast wake-up frame to a STA if the AP does not have pending buffered frame to the STA.
3. [Assigned D0.2] After an AP sends a WUR frame using EDCAF of a particular AC, the AP shall not update CW and retry count of the AC. After identifying failure for a unicast wake-up frame that is sent using EDCAF of a particular AC, AP shall not update CW and retry count of the AC.

**Reference slide deck(s):**

[1] 11-17-0651-01 Indication for WUR Duty Cycle

[2] 11-17-0354-02 Initial thoughts on MAC procedures

[3] 11-17-0652-01 Consideration of EDCA for WUR Signal

Revision History:

* Rev 0: Initial version of the document
* Rev 1: Postpone the texts relating to piggying back WUR Setup in (Re)Association requeust/response based on the comment from Jarkko. Have editorial revision based on the comment from Alfred.

***Editing instructions formatted like this are intended to be copied into the TGba 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 or insert 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.***

**TGba Editor: *Instruction: Modify Table 9-27 as the following:***

* Management frames
* Beacon frame format

TGba Editor: Instruction: Insert the following rows into Table 9-27 (Beacon frame body) maintaining row order:

|  |
| --- |
| * Beacon frame body
 |
| **Order** | **Information** | **Notes** |
| <Last-2> | WUR Capabilities | The WUR Capabilities element is present when dot11WUROptionImplemented is true; otherwise it is not present. |
| <Last-1> | WUR Operation | The WUR Operation element is present when dot11WUROptionImplemented is true; otherwise it is not present. |

* Association Request frame format

TGba Editor: Instruction: Insert the following new row into Table 9-29 (Association Request frame body):

|  |
| --- |
| * Association Request frame body
 |
| **Order** | **Information** | **Notes** |
| <Last-1> | WUR Capabilities | The WUR Capabilities element is present when dot11WUROptionImplemented is true; otherwise it is not present. |

* Association Response frame format

TGba Editor: Instruction: Insert the following rows into Table 9-30 (Association Response frame body) as follows maintaining numeric order:

|  |
| --- |
| * Association Response frame body
 |
| **Order** | **Information** | **Notes** |
| <Last-2> | WUR Capabilities | The WUR Capabilities element is present when dot11WUROptionImplemented is true; otherwise it is not present. |
| <Last-1> | WUR Operation | The WUR Operation element is present when dot11WUROptionImplemented is true; otherwise it is not present. |

* Reassociation Request frame format

TGba Editor: Instruction: Insert the following row in Table 9-31 (Reassociation Request frame body):

|  |
| --- |
| * Reassociation Request frame body
 |
| **Order** | **Information** | **Notes** |
| <Last-1> | WUR Capabilities | The WUR Capabilities element is present when dot11WUROptionImplemented is true; otherwise it is not present. |

* Reassociation Response frame format

TGba Editor: Instruction: Insert the following rows into Table 9-32 (Reassociation Response frame body) as follows maintaining numeric order:

|  |
| --- |
| * Reassociation Response frame body
 |
| **Order** | **Information** | **Notes** |
| <Last-2> | WUR Capabilities | The WUR Capabilities element is present when dot11WUROptionImplemented is true; otherwise it is not present. |
| <Last-1> | WUR Operation | The WUR Operation element is present when dot11WUROptionImplemented is true; otherwise it is not present. |

* Probe Request frame format

TGba Editor: Instruction: Insert the following new row into Table 9-33 (Probe Request frame body):

|  |
| --- |
| * Probe Request frame body
 |
| **Order** | **Information** | **Notes** |
| <Last-1> | WUR Capabilities | The WUR Capabilities element is present when dot11WUROptionImplemented is true; otherwise it is not present. |

* Probe Response frame format

TGba Editor: Instruction: Insert the following new rows into Table 9-34 (Probe Response frame body):

|  |
| --- |
| * Probe Response frame body
 |
| **Order** | **Information** | **Notes** |
| <Last-2> | WUR Capabilities | The WUR Capabilities element is present when dot11WUROptionImplemented is true; otherwise it is not present. |
| <Last-1> | WUR Operation | The WUR Operation element is present when dot11WUROptionImplemented is true; otherwise it is not present. |

**TGba Editor: *Instruction: Modify Table 9-77 as the following:***

* Elements
* General

***Insert the following new rows into Table 9-77 (Element IDs) (header row shown for convenience):***

|  |  |
| --- | --- |
| * Element IDs
 |  |
| **Element** | **Element ID** | **Element ID Extension**  | **Extensible** | **Fragmentable** |
| WUR Capabilities | 255 | <ANA> | Yes | No |
| WUR Operation | 255 | <ANA> | Yes | No |
| WUR Mode | 255 | <ANA> | Yes | No |

**TGba Editor: *Instruction: Modify 9.4.2.262 WUR Mode element as the following:***

***(…existing texts …)***

The subfields of the WUR Parameters field sent from WUR AP are defined in Table 9-262c (Subfields of WUR Parameters field from WUR AP).

|  |
| --- |
| * Subfields of WUR Parameters field from WUR AP
 |
| **Subfield** | **Definition** | **Encoding** |
| WUR ID | A WUR identifier that uniquely identifies the WUR STA within the BSS of the AP  | An WUR identifier provided by the AP. |
| ~~WUR Operating Class~~ | ~~Indicates the operating class in use for transmission of WUR frame from the WUR AP to the WUR non-AP STA~~ | ~~The size and encoding is the same as the definition of Operating Class in 9.4.1.22 (Operating Class and Channel field)~~ |
| ~~WUR Channel~~ | ~~Indicates the channel in use for transmission of WUR frame from the WUR AP to the WUR non-AP STA~~ | ~~The size and encoding is the same as the definition of Channel field in 9.4.1.22 (Operating Class and Channel field)~~ |
| Duty cycle information | TBD | TBD |
| ~~WUR Beacon Period~~ | ~~Indicates the period of WUR Beacon frame~~ | ~~Detail is TBD.~~ |

The subfields of the WUR Parameters field sent from WUR non-AP STA are defined in Table 9-262d (Subfields of the WUR Parameters field from WUR non-AP STA).

|  |
| --- |
| * Subfields of the WUR Parameters field from WUR non-AP STA
 |
| **Subfield** | **Definition** | **Encoding** |
| O~~N~~n Duration | Indicates the preferred On ~~d~~Duration that the WURx of the WUR non-AP STA will be in WURx awake state ~~in the~~ for each WUR duty cycle ~~mode~~schedule (see 31.4 (WUR Duty Cycle Operation)) | Detail is TBD. |
| Duty Cycle Period | Indicates the preferred ~~interval~~ elapsed time between the start times ~~starting points~~ of two~~the~~ successive ~~ON Durations in~~ ~~the~~ WUR duty cycle schedules ~~mode~~ with units indicated by the Duty Cycle Period Units field in the most recently received WUR Operation element from the associated WUR AP (see 31.4 (WUR Duty Cycle Operation)) | Detail is TBD. |

**TGba Editor: *Instruction: Insert 9.4.2.264 WUR Operation element as the following:***

9.4.2.264 WUR Operation element

The WUR Operation element contains the set of parameters necessary to support the WUR operation. The format of the WUR Operation element is defined in Figure 9-589c (WUR Operation element format).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Element ID** | **Length** | **Element ID Extension** | **Minimum Wake-up Duration** | **Duty Cycle Period Units**  | **WUR Operating Class** | **WUR Channel** | **WUR Beacon Period** |
| Octets: | 1 | 1 | 1 | TBD | TBD | 1 | 1 | TBD |

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General).

The Minimum Wake-up Duration field indicates the minimum on duration of the WUR duty cycle operation (see 31.4 (WUR Duty Cycle Operation)). The encoding of the Minimum Wake-up Duration field is TBD.

The Duty Cycle Period Units field indicates the basic unit of the period of the WUR dutcy cycle operation (see 31.4 WUR Duty Cycle Operation). The encoding of the Duty Cycle Period Units field is TBD.

 The WUR Operating Class field indicates the operating class in use for transmission of WUR frame from the WUR AP to the WUR non-AP STA. The encoding is the same as the definition of Operating Class field in 9.4.1.22 (Operating Class and Channel field)

The WUR Channel field indicates the channel in use for transmission of WUR frame from the WUR AP to the WUR non-AP STA. The encoding is the same as the definition of Channel field in 9.4.1.22 (Operating Class and Channel field).

The WUR Beacon period field indicates the period of WUR Beacon frame.

**TGba Editor: *Instruction: Insert texts to 31.2 Channel Access as the following:***

* 1. Channel Access

A WUR AP that intends to transmit a WUR frame shall contend for the medium as defined in 10.22.2 HCF contention based channel access (EDCA) except that:

* The WUR AP may use any AC for sending a WUR Beacon frame, a WUR Discovery frame, or a WUR Vendor Specific frame.
* The WUR AP may use any AC for sending a WUR Wake-up frame that is addressed to more than one WUR non-AP STA.
* The WUR AP may use any AC for sending a WUR Wake up frame that is addressed to one WUR non-AP STA when the WUR AP does not have pending buffered BU(s) for the WUR non-AP STA.
* The WUR AP that sent a WUR frame using the EDCAF of a particular AC shall not update the CW and the retry counters for that AC independently of whether the WUR frame was successfully received by the intended recipient.

**TGba Editor: *Instruction: Insert texts to 31.4 WUR Duty Cycle Operation as the following:***

* 1. WUR~~x~~ Duty Cycle Operation

WUR duty cycle operation reduces the required amount of time that a WUR non-AP STA utilizing WUR Mode needs to be in WURx awake state after the PCR component of the WUR non-AP STA enters doze state (see 31.5 (Power management with WUR)) and allows WUR AP to manage WUR activity in the BSS by scheduling WUR non-AP STA to receive WUR frame at different times.

WUR duty cycle operation is determined by three parameters: starting point, on duration, and duty cycle period as shown in Figure x. On duration determines the time that a WUR non-AP STA is in WURx awake state for each WUR duty cycle schedule. Duty cycle period determines the elapased time between the start times of two successive WUR duty cycle schedules. Starting point is the start time of one WUR duty cycle schedule and is decided by the WUR AP. How to indicate the starting point is TBD.



Figure x

WUR AP indicates the set of parameters necessary to support the WUR duty cycle operation in WUR Operation element.

WUR non-AP STA communicates WUR duty cycle information to the associated WUR AP through WUR Mode Setup as described in 31.5.1 (WUR Mode Setup).

WUR non-AP STA indicates preferred on duration in the On Duration subfield of the WUR Parameters field in the WUR Mode element. WUR non-AP STA shall indicate a value of preferred on duration that is larger than or equal to the value indicated by the Minimum Wake-up Duration field in the most recently received WUR Operation element from the associated WUR AP.

WUR non-AP STA indicates preferred duty cycle period in the Duty Cycle Period subfield of the WUR Parameters field in the WUR Mode element with units indicated by the Duty Cycle Period Units field in the most recently received WUR Operation element from the associated WUR AP.