### IEEE P802.11 Wireless LANs

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| 11ba D2.0 MAC Comment Resolution for WUR Beacon and Synchronization Part I | | | | |
| Date: 2019-03-10 | | | | |
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Abstract

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

2208, 2409, 2410, 2431, 2432, 2468, 2523, 2129, 2268, 2233, 2413, 2209, 2210, 2212, 2738, 2262, 2819, 2269, 2604, 2605, 2261, 2722, 2723, 2724, 2425, 2035, 2725

Revisions:

* Rev 0: Initial version of the document.

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** |
| 2208 | Joseph Levy | 65.00 | 30.5.1 | Since it is clearly stated that a WUR STA is a non-HT, HT, VHT, or HE STA, well really a WUR AP is and a WUR non-AP STA is why is it necessary to state that it has any specific TSF timer accuracy? The statement that the STA meet the requirements for a non-DMG STA means nothing, at best this should be a note. But I don't see need for one. | Delete: "A WUR STA's TSF timer follows the TSF timer accuracy requirement defined in 11.1.3.9 (TSF timer accuracy) for a non-DMG STA. NOTE--A non-DMB STA's timer is accurate to within +/-100 ppm." | Revised –  Agree in principle with the commenter. The purpose of the sentence is to clarify that there is no further change for the TSF timer accuracy for WUR STA based on the new WUR Beacon transmission. We put the description to a note and put it in the appropriate location.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2208 |
| 2409 | Mark RISON | 65.00 | 30.5.1 | My understanding of the (bad) new amendment style is that everything in "legacy" subclauses applies unless explicitly countermanded by the amendment subclauses (otherwise we'd have no end of "xyz is the same as in the legacy subclause" statements | Delete the first para of the referenced subclause | Revised –  Agree in principle with the commenter. The purpose of the sentence is to clarify that there is no further change for the TSF timer accuracy for WUR STA based on the new WUR Beacon transmission. We put the description to a note and put it in the appropriate location.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2409 |
| 2410 | Mark RISON | 65.00 | 30.5.1 | There is no such thing as a "non-DMB STA" | Delete the NOTE of the referenced subclause | Revised –  Agree in principle with the commenter. The purpose of the sentence is to clarify that there is no further change for the TSF timer accuracy for WUR STA based on the new WUR Beacon transmission. We put the description to a note and put it in the appropriate location.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2410 |
| 2431 | Ming Gan | 65.00 | 30.5.1 | WUR STA may use different timer from the STA. However, TSF timer accuracy requirement defined in 11.1.3.9 is for main radio. | "Follow" may not be exact. Change it to some other word | Revised –  Agree in principle with the commenter. In Jan IEEE meeting, the group agrees to put reception of WUR PPDU as a capability and not mentioning main radio or specific receiver. We put the description to a note and put it in the appropriate location.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2431 |
| 2432 | Ming Gan | 65.00 | 30.5.2 | Typo on non-DMB | Change it non-DMG | Revised –  Agree in principle with the commenter. The purpose of the sentence is to clarify that there is no further change for the TSF timer accuracy for WUR STA based on the new WUR Beacon transmission. We put the description to a note and put it in the appropriate location.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2432 |
| 2468 | Minyoung Park | 66.00 | 30.5.2 | "except" is missing in the following sentence "...according to the medium access rules specified in Clause 10 when any one of the following conditions is met:". The original text in D1.0 was as follows: "...according to the medium access rules specified in Clause 10 except that one of the following conditions is met:" | Change the sentence by inserting "except" back in the text as follows "...according to the medium access rules specified in Clause 10 except when any one of the following conditions is met:" | Revised –  Agree in principle with the commenter.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2468 |
| 2523 | Po-Kai Huang | 66.00 | 30.5.2 | There is a missing "except" for the condition. | change "specified in Clause 10 when any one of the following conditions is met:" to change "specified in Clause 10 except when any one of the following conditions is met:" | Revised –  Agree in principle with the commenter.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2523 |
| 2129 | Hanseul Hong | 66.00 | 30.5.2 | When those condition is met, WUR AP does not have to send a WUR Beacon frame | As in the comment | Revised –  Agree in principle with the commenter. There is missing “except” in the sentence. We revise the sentence to fix this.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2129 |
| 2268 | Li-Hsiang Sun | 66.00 | 30.5.2 | "At each TWBTT, the WUR AP shall schedule a WUR Beacon frame on the WUR primary channel indicated by the WUR Operating Class and WUR Channel subfields in the WUR Operation element as the next frame for transmission according to the medium access rules specified in Clause 10 when any one of the following conditions is met:" This does not seem correct. The following conditions are the cases that there is no need for a WUR beacon frame | change 'when' to except | Revised –  Agree in principle with the commenter. There is missing “except” in the sentence. We revise the sentence to fix this.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2268 |
| 2233 | kaiying Lv | 66.00 | 30.5.2 | The last sentence of this paragraph describe the conditions that WUR Beacon does not need to be transmitted. | Change "according to the medium access rules specifiedin Clause 10 when any one of the following conditions is met" to "according to the medium access rules specifiedin Clause 10 except any one of the following conditions is met" | Revised –  Agree in principle with the commenter. There is missing “except” in the sentence. We revise the sentence to fix this.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2233 |
| 2413 | Mark RISON | 66.00 | 30.5.2 | I don't understand the rules for when to tx a WUR beacon. Why is tx of a WUR beacon not needed if there is at least one WUR non-AP STA in PS mode? | Delete from "when any one of the following conditions is met: " and the following three bullets (leave a full stop at the end) | Revised –  Agree in principle with the commenter. There is missing “except” in the sentence. We revise the sentence to fix this.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2413 |
| 2209 | Joseph Levy | 65.00 | 30.5.1 | What the WUR non-AP STA expects is not something that should be specified. | Delete: "A WUR non-AP STA that is in WUR mode expects to receive WUR Beacon frames every dot11WURBeaconPeriod." | Rejected –  We note that in the based line, similar sentence is used for various Beacon frames.  *STAs expect to receive Beacon frames at a nominal rate. In a non-DMG infrastructure BSS, the interval between* *Beacon frames is defined by dot11BeaconPeriod. In a DMG infrastructure BSS, the STAs expect to receive* *at least one DMG Beacon frame every dot11BeaconPeriod × dot11MaxLostBeacons TUs. In a PBSS, STAs* *expect to receive at least one DMG Beacon frame or one Announce frame every dot11BeaconPeriod ×* *dot11MaxLostBeacons TUs.* |
| 2210 | Joseph Levy | 66.00 | 30.5.2 | How does a WUR AP define the timing by transmitting WUR Beacon frames? It is true the WUR AP defines the WUR beacon period and the Offset of TWBTT. It is also true that the WUR AP broadcasts the WUR beacon. But it doesn't really define the timing, it only is providing a synchronization transmission. It is up to the WUR non-AP STA to use these transmissions to maintain synchronization. The specification should state what the synchronization requirements are for the non-AP STA, but it need not specify how the non-AP STA maintains synchronization. | Clarify what the WUR AP broadcasts and when it broadcasts. Also specify what the timing synchronization requirements on the WUR non-AP STA are. | Rejected –  We note that in the based line, similar sentence is used to describe that timing is defined by transmitting Beacon frames.  *If the AP is a non-S1G AP, it shall define the timing for the entire BSS by transmitting Beacon frames according to dot11BeaconPeriod. (11ah)If the AP is an S1G AP, it shall define the timing for the entire BSS by transmitting S1G Beacon frames according to dot11BeaconPeriod.*  For WUR AP, the transmission of WUR Beacon is already clearly defined in 30.5.2. For WUR non-AP STA, we only describe the timer accuracy with a note. |
| 2212 | Joseph Levy | 66.00 | 30.5.3 | There needs to be a statement that a WUR non-AP STA may use received WUR beacons to maintain synchronization. There also needs to be a requirement on the accuracy of synchronization that the WUR non-AP STA must maintain. Also it would be helpful to note that this synchronization requirement is only applicable when the WUR non-AP STA is in WUR Awake or WUR Doze state. If a WUR non-AP STA is simply in non-WUR PS mode or active state current existing 802.11 synchronization requirements apply. | Please provide the context for WUR synchronization and when the STA need use it. e.g. when the STA is in the WUR awake or doze state. Also it is not necessary to explain how to use the WUR beacon information to maintain synchronization. All that need to be specified is what information is broadcast by the AP and what the synchronization requirement is for the non-AP STA. | Rejected –  We note that due to the reason that partial TSF is include in the WUR Beacon, there is a need to describe the procedure based on the partial TSF. In the baseline, similar behaviour is defined in S1G Beacon because partial TSF is also used in S1G Beacon. Please see 11.1.3.10 Maintaining synchronization using S1G Beacon frames. |
| 2738 | Xiaofei Wang | 62.00 | 11 | Changes are needed in clause 11 to discuss maintaining synchronization using WUR beacons | Changes are needed in clause 11 to discuss maintaining synchronization using WUR beacons | Rejected –  The new amendment style initiates by editor group suggests to put new amendment in a separate clause. |
| 2262 | Lei Wang | 65.00 | 30.5.1 | Few questions about the WUR Beacon frame, e.g., 1) Is it possible for dot11WURBeaconPeriod less than or equal to dot11BeaconPeriod? If no, then should it be specified clearly in the spec? If yes, then please explain how WUR achieve its power saving purpose? 2) If WUR Beacon frame is transmitted as the main data radio primary channel, then which Beacon frame has priority if the Regular Beacon and the WUR beacon happen to be due at the same time? | Please answer the questions listed in this comment and add clarificatin text in the spec as needed. | Revised –  Agree in principle with the commenter.  We answer the question from the commenter as follows.  For question 1, the answer is that the AP can set dot11WURBeaconPeriod to any value. Set a WUR Beacon period too small will increase the system overhead. Set a WUR Beacon period too large will increase the potential TSF drifting for WUR non-AP STA. The tradeoff is a implemenetation specific consideration and does not affect the interoperability.  For question 2, WUR AP has the capability to set TWBTT offset to make sure that TWBTT does not overlap with TBTT. However, agree that we may need to clarify that when TWBTT overlap with TBTT, then TBTT has the priority.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2262 |
| 2819 | Yunsong Yang | 66.00 | 30.5.1 | Regarding "the start of the data symbol containing the first bit", a bit in a WUR frame isn't contained in a traditional data symbol, but in 2 or 4 MC-OOK symbols. Need to use the right terminology and make it clear which MC-OOK symbol (among the 2 or 4) is used for marking "the start". | Change the cited text to "the start of the first MC-OOK symbol containing the first bit". | Accepted - |
| 2269 | Li-Hsiang Sun | 67.00 | 30.5.3 | (modulo 2^12): is it applied to 2^11 or (AT+/-2^11)?  It seems neither way is correct: A) modulo is only applied to 2^11: there is no need to have (modulo 2^12)  B) modulo is applied to (AT+/-2^11): this is incorrect as well, For example bullet (1): AT=2^11+10, LT[5:16]=2^11+20, then (AT+2^11)%2^12=10, This means LT[5:16]>AT and LS[5:16]>(AT+2^11)%2^12=10 is satisfied, bullet 1 says local TSF[17:63] needs to be incremented However, in this case, TSF[17:63] does not need to be incremented  For example bullet (2): AT=2^11-10, LT[5:16]=2^11-20, then (AT-2^11)%2^12=2^12-10, This means LT[5:16]<AT and LS[5:16]<(AT-2^11)%2^12=2^12-10 is satisfied, bullet 2 says local TSF[17:63] needs to be decremented However, in this case, TSF[17:63] does not need to be decremented | remove (modulo 2^12) in bullet 1 and 2 | Rejected –  We note that the two examples mentioned by the commenter does not satisfy the assumptions of the conditons, that is the most significant bit (MSB) of the adjusted value of the received partial TSF timestamp needs to be not equal to the bit 16 of the local TSF timer. |
| 2604 | Rojan Chitrakar | 65.00 | 30.5.1 | It will be helpful to add a Note regarding non-AP STAs associated to a nontransmitted BSSID. | Add a Note: NOTE--WUR non-AP STAs associated to a nontransmitted BSSID are expected to receive WUR Beacons frames sent with the transmitter ID. | Revised –  Agree in principle with the commenter. We revise the sentence to clarify various cases under multiple BSSID implementation.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2604 |
| 2605 | Rojan Chitrakar | 66.00 | 30.5.2 | This statement should be expanded to include WUR APs corresponding to nontransmitted BSSID when dot11MultiBSSIDImplemented is true. | Change to: There are no WUR non-AP STAs associated with the WUR AP when dot11MultiBSSIDImplemented is false, or there are no WUR non-AP STAs associated with the WUR AP corresponding to the transmitted BSSID or WUR APs corresponding to the nontransmitted BSSID when dot11MultiBSSIDImplemented is true. | Revised –  Agree in principle with the commenter.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2605 |
| 2261 | Lei Huang | 44.00 | 9.4.2.291 | It is better to rename the "WUR Channel subfield" to the "WUR Primary Channel subfield". | change "The WUR Channel subfield indicates a channel number, which is interpreted in the context of the indicated operating class as defined in Annex E in use for transmission of a WUR Beacon frames from the WUR AP to the WUR non-AP STA." to "The WUR Primary Channel subfield indicates a channel number for the WUR primary channel, which is interpreted in the context of the indicated operating class as defined in Annex E. | Revised –  Agree in principle with the commenter. We change WUR Primary channel to WUR Beacon channel across the Draft and change the name to WUR Beacon Operating class and WUR Beacon channel.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2261 |
| 2722 | Xiaofei Wang | 44.00 | 9.4.2.291 | WUR Operation Class seems to indicate the operation class for the Wur primary channel. It should be so described, instead of using a long description using "WUR beacon frames". | as in comment. | Revised –  Agree in principle with the commenter. We change WUR Primary channel to WUR Beacon channel across the Draft and change the name to WUR Beacon Operating class and WUR Beacon channel.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2722 |
| 2723 | Xiaofei Wang | 44.00 | 9.4.2.291 | WUR Channel seems to indicate the channel number for the WUR primary channel. It should be so described, instead of using a long description using "WUR beacon frames". | as in comment. | Revised –  Agree in principle with the commenter. We change WUR Primary channel to WUR Beacon channel across the Draft and change the name to WUR Beacon Operating class and WUR Beacon channel.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2723 |
| 2724 | Xiaofei Wang | 43.00 | 9.4.2.291 | The name "WUR channel" should be "WUR Primary Channel" since the WUR channel field describes the WUR primary channel. | as in comment. | Revised –  Agree in principle with the commenter. We change WUR Primary channel to WUR Beacon channel across the Draft and change the name to WUR Beacon Operating class and WUR Beacon channel.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2724 |
| 2425 | Ming Gan | 44.00 | 9.4.2.291 | The meaning of Offset of TWBTT is not clear, is there any relationship between offset and the smallest TSF time in units of TU? | Clarify it | Revised –  Agree in principle with the commenter.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2425 |
| 2035 | Alfred Asterjadhi | 44.00 | 9.4.2.291 | What is the smallest TSF time? Please clarify. | As in comment. | Revised –  Agree in principle with the commenter.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2035 |
| 2725 | Xiaofei Wang | 44.00 | 9.4.2.291 | It is unclear what the reference point is for Offset of TWBTT. Is it referenced to TBTT or transmission of the current frame? Please clarify. | please clarify | Revised –  Agree in principle with the commenter.  TGax editor to make the changes shown in 11-19/0383r0 under all headings that include CID 2725 |

**Discussion:** *None.*

**Propose:** Revised for CID 2208, 2410, 2431, 2432, 2468, 2523, 2129, 2233, 2413, 2212, 2262, 2819, 2268, 2409, 2604, 2605, 2261, 2722, 2723, 2724, 2425, 2035, 2725 per discussion and editing instructions in 11-19/0383r0.

***TGba editor: Change 30.5 Maintaining synchronization as follows***

* Maintaining synchronization
* General

(#2208, #2410, #2431, #2432, #2409)A WUR non-AP STA that is in WUR mode expects to receive WUR Beacon frames every dot11WURBeaconPeriod.

NOTE - A WUR STA’s TSF timer has the same TSF timer accuracy requirement, which is accurate to within ±100 ppm, defined in 11.1.3.9 (TSF timer accuracy) for a non-DMG STA.(#104) (#2208, #2410, #2431, #2432, #2409)(#104)

A WUR AP sending a WUR Beacon frame shall set the Type Dependent Control field of the WUR Beacon frame to the TSF timer [5:16] of the WUR AP’s TSF timer at the time that the start of the first MC-OOK (#2819) symbol containing the first bit of the Type Dependent Control field is transmitted by the PHY plus the WUR AP’s delays through its local PHY from the MAC-PHY interface to its interface with the WM.(#1180, #1181, #626)

* WUR Beacon generation

The WUR AP shall define the timing for WUR by WUR Beacon frames according to dot11WURBeaconPeriod and the Offset of TWBTT subfield of the WUR Operation element sent by itself. This defines a series of TWBTTs exactly dot11WURBeaconPeriod TUs apart. At each TWBTT, the WUR AP if dot11MultiBSSIDImplemented is false or the WUR AP with BSSID equal to transmitted BSSID in a multiple BSSID set(#2604) shall schedule a WUR Beacon frame on the WUR primary channel indicated by the WUR Operating Class and WUR Channel subfields in the WUR Operation element except when any one of the following conditions is met: (#2468, #2523, #2129, #2233, #2413, #2268, #2262)

* There are no WUR non-AP STAs associated with the WUR AP if dot11MultiBSSIDImplemented is false. (#2605)
* There are no WUR non-AP STAs associated with any WUR APs in the multiple BSSID set if dot11MultiBSSIDImplemented is true. (#2605)
* The WUR AP does not provide WUR power management service to any associated WUR non-AP STA (see 30.7 (WUR power management procedure)).
* All the associated WUR non-AP STAs are in Active mode.(#569, #105, #627, #498, #106, #595)

NOTE—To achieve this requirement of scheduling a WUR Beacon frame, the WUR AP suspends any pending transmissions until the WUR Beacon frame has been transmitted. (#596, #528)

If the WUR AP schedules a WUR Beacon frame, the WUR Beacon frame shall be the next frame for transmission according to the medium access rules specified in Clause 10 unless a Beacon frame is scheduled for transmission as defined in 11.1.3.2 (Beacon generation in non-DMG infrastructure networks) in which case the Beacon frame has higher priority for transmission.(#2262)

A WUR AP shall indicate the WUR beacon period in the WUR Operation element sent by itself. A WUR non-AP STA shall adopt that WUR beacon period when joining the BSS, i.e., the WUR non-AP STA shall set the dot11WURBeaconPeriod to the value of the WUR Beacon Period subfield of the received WUR Operation element. (#107)

NOTE—Though the transmission of a WUR Beacon frame might be delayed because of CSMA deferrals, subsequent WUR Beacon frames are scheduled at the undelayed nominal WUR beacon period. (#886)

If dot11MultiBSSIDImplemented is false, a WUR AP shall transmit a WUR Beacon frame with data rate that is supported by all WUR non-AP STAs that have requested WUR power management service (see 30.7 (WUR power management procedure)). (#2604)

If dot11MultiBSSIDImplemented is true, the WUR AP with BSSID equal to the transmitted BSSID in a multiple BSSID set shall transmit a WUR Beacon frame with data rate that is supported by all WUR non-AP STAs that have requested WUR power management service to any members in the multiple BSSID set (see 30.7 (WUR power management procedure)). (#2604)

(#830)

* Maintaining TSF Timer Synchronization with WUR Beacon frame(#108)

Upon receiving a WUR Beacon frame with a valid FCS and transmitter ID that matches the transmitter ID of the WUR AP to which the WUR non-AP STA is associated, a WUR non-AP STA shall update its TSF timer according to the algorithm described below.

The received partial TSF timestamp, obtained from the Type Dependent Control field of the WUR Beacon frame, is adjusted to consider the WUR non-AP STA’s delay as shown below:

* Create a temporary timestamp by concatenating the received partial TSF timestamp with 5 bits containing an implementation specific value that represents the assumed value of bit position 0 to 4 of temporary timestamp.
* Add an amount equal to the receiving STA’s delay through its local PHY components plus the time since the first bit of the Partial TSF field was received at the MAC/PHY interface to the temporary timestamp.
* The adjusted value of the received partial TSF timestamp is set as the value of bit position 5 to 16 of the temporary timestamp.

(#46, #47, #48, #109)

If the most significant bit (MSB) of the adjusted value of the received partial TSF timestamp is not equal to the bit 16 of the local TSF timer, then the value of bits 17 to 63 of the local TSF timer shall be adjusted to account for roll over as follows:

* The value shall be increased by one unit (modulo 247) if LT[5:16] > AT and LT[5:16] > (AT+ 211 (modulo 212)).
* The value shall be decreased by one unit (modulo 247) if LT[5:16] < AT and LT[5:16] < (AT – 211 (modulo 212)).

where AT is the adjusted value of the received partial TSF timestamp and LT[5:16] is the value of bits 5 to 16 of the local TSF timer.

(#49, #167, #168, #45)

The bits 5 to 16 of the STA’s local TSF timer shall be set to the adjusted value of the received partial TSF timestamp.

***TGba editor:Change “WUR Primary Channel”(not case sensitive) to “WUR Beacon channel” across the spec***

(#2261, #2722, #2723, #2724) (#71)

***TGba editor:Change “WUR Channel” field to “WUR Beacon Channel” field across the spec.*** (#2261, #2722, #2723, #2724) (#71)

***TGba editor:Change “WUR Operating class” field to “WUR Beacon Operating class” field across the spec.*** (#2261, #2722, #2723, #2724) (#71)

***TGba editor: Change 9.4.2.291 as follows***

* 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 9-772d (WUR Operation element format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | WUR Operation Parameters | WUR Parameters |
| Octets: | 1 | 1 | 1 | 9 | 1 |
| * WUR Operation element format | | | | | |

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

The format of the WUR Parameters field is defined in 9-772e (WUR Operation Parameters).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Minimum Wake-up Duration | Duty Cycle Period Units | WUR Beacon Operating Class | WUR Beacon Channel | WUR Beacon Period | Offset of **Offset of Target Wake-up radio Beacon Transmission Time (TWBTT)**TWBTT |
| Octets: | 1 | 2 | 1 | 1 | 2 | 2 |

(#2261, #2722, #2723, #2724) (#71)

* WUR Operation Parameters

The Minimum Wake-up Duration subfield indicates the minimum on duration of the WUR duty cycle operation (see 30.6 (WUR duty cycle operation)) in units of 256 µs.

The Duty Cycle Period Units subfield indicates the basic unit of the period of the WUR duty cycle operation (see 30.6 (WUR duty cycle operation)). The unit of the Duty Cycle Period Units subfield is 4 µs.

The granularity of the Duty Cycle Period Units field is 4 . (#73)

The WUR Beacon Operating Class subfield indicates the operating class values as defined in Annex E in use for transmission of a WUR Beacon frames from the WUR AP to the WUR non-AP STA. The operating class is interpreted in the context of the country specified in the Beacon frame. The encoding is the same as the definition of Operating Class field in 9.4.1.22 (Operating Class and Channel field). (#2261, #2722, #2723, #2724) (#71)

(#818, #843)

The WUR Beacon Channel subfield indicates a channel number, which is interpreted in the context of the indicated operating class as defined in Annex E in use for transmission of a WUR Beacon frames 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). (#2261, #2722, #2723, #2724) (#71)

(#818, #843)

The WUR Beacon Period subfield represents the number of time units (TUs) between consecutive target WUR beacon transmission times (TWBTTs) (see 30.5.2 (WUR Beacon generation)). (#1163)

The Offset of TWBTT subfield indicates the time difference between the TWBTT with the smallest TSF time in units of TU and TSF 0.(see 30.5.2 (WUR Beacon generation)). (#2425, #2035, #2725) (#75, #1163)

The format of the WUR Parameters field is defined in Figure 9-772f (WUR Parameters field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0          B3 | B4 | B5                    B7 |
|  | Counter | Common IPN | Reserved |
| Bits: | 4 | 1 | 3 |
| * WUR Parameters field format | | | |

The Counter subfield indicates the current value of the Counter subfield included in the broadcast WUR Wake-up frames (see 30.4.2 (Transmitter ID)).(#1184)

The Common IPN subfield indicates if a common IPN is used for all protected WUR frames generated within the BSS. The Common IPN subfield is set to 1 to indicate that the IPN is common for all protected WUR frames and set to 0 to indicate that the IPN is separate for protected WUR frames addressed to different receivers (see 30.9.3 (Generation and construction of IPN for WUR frames)).(#714)