### IEEE P802.11Wireless LANs

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| 11ba D1.0 MAC Comment Resolution for WUR Beacon and Synchronization |
| Date: 2018-11-11 |
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Abstract

This submission proposes resolutions for comments of TGba Draft D1.0 with the following CIDs:

104, 333, 497, 624, 404, 625, 626, 1180, 1181, 105, 403, 106, 107, 360, 421, ~~423,~~ 498, 528, 569, 593, 594, 595, 596, 627, 805, 830, 864, 886, 1127, 1128, 1129, 45, 46, 47, 48, 49, 108, 109, 460, 589, 167, 168

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Revision based on the discussion during the presentation. Remove CID 423 for further consideration.

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 D1.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGba D1.0 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** |
| 104 | Alfred Asterjadhi | 50.65 | 31.4.1 | Double normative. There is already a shall in the baseline. Replace "shall be" with "is". | As in comment. | Revised – Agree in principle with the commenter. We revise the sentence to say that the WUR STA follows the TSF requeiment in the baseline. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 104. |
| 333 | Ihtisham Khalid | 50.65 | 31.4.1 | Only abbreviation is used for "ppm" | please mention full form when it is used for the first time in text. | Rejected – PPM is defined in the baseline 802.11 spec and has been spell out in the baseline 802.11 spec.  |
| 497 | Joseph Levy | 50.65 | 31.4.1 | There is no reason to respecify the TSF timer accuracy - it is already specified in 11.1.3.9 | Delete the STA's TSF timer accuracy requirement. If desired a note referencing section 11.1.3.9 can be provided, but it should not be respecified. | Revised – Agree in principle with the commenter. We revise the sentence to say that the WUR STA follows the TSF requeiment in the baseline. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 104. |
| 624 | Mark RISON | 50.65 | 31.4.1 | Do not duplicate information | Delete "A STA's TSF timer shall be accurate to within +/-100 ppm (See 11.1.3.9 (TSF timer accuracy))." at the cited location | Revised – Agree in principle with the commenter. We revise the sentence to say that the WUR STA follows the TSF requeiment in the baseline. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 104. |
| 404 | James Lepp | 51.02 | 31.4.1 | Both dot11BeaconPeriod and dot11WURBeaconPeriod are defined as 32 bit unsigned integers in units of TUs. I am expecting the WUR beacon period to be at least an order of magnitude longer than the PCR beacon period but this currently isn't mentioned in the specification. | Add a sentence to the second paragraph of 31.4.1 stating that the dot11WURBeaconPeriod should be about 10x longer than the dot11BeaconPeriod. | Rejected – Like Beacon frame, we leave the decision of choosing dot11WURBeaconPeriod to the implementer.  |
| 625 | Mark RISON | 51.01 | 31.4.1 | "A non-AP STA that is in WUR mode expects to receive WUR Beacon frames everydot11WURBeaconPeriod." -- does not seem to have any actual relevance | Delete | Rejected – We note that in baseline, we have the following sentence for non-DMG.*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.* |
| 626 | Mark RISON | 51.06 | 31.4.1 | " the data symbol, containing thefirst bit of TD Control field, " -- spurious commas and missing article | Change to "the data symbol containing thefirst bit of the TD Control field" | Accepted – |
| 1180 | yujin noh | 51.06 | 31.4.1 | the transmitting STA is a bit confusing. Claify it. For example, the AP's TSF timer.... | as in comment | Accepted – |
| 1181 | yujin noh | 51.07 | 31.4.1 | the transmitting STA is a bit confusing. Claify it. For example, the AP's TSF timer ..... | as in comment | Accepted – |
| 105 | Alfred Asterjadhi | 51.20 | 31.4.2 | Except that one of" to be replaced with "except when one of? | As in comment. | Accepted – |
| 403 | James Lepp | 51.19 | 31.4.2 | editorial: that --> when | fix word, or reword sentence | Revised –Agree in principle with the commenter. We revise with “when”.TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 105. |
| 106 | Alfred Asterjadhi | 51.25 | 31.4.2 | "All the PCR components of the associated WUR STAs" to be replaced with "The PCR of all WUR STAs that are in WUR mode". Also make this a positive statement. | As in comment. | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 106. |
| 107 | Alfred Asterjadhi | 51.33 | 31.4.2 | Please replace "The WUR beacon period is included in the WUR Operation element sent by AP, and a non-AP STA with WURx" with "A WUR AP shall indicate the WUR beacon period in the WUR Operation elements it transmits. A WUR STA that is in WUR mode". Also in the note "undelayed nominal WUR beacon interval" to be replaced with "undelayed nominal TWBTT". | As in comment. | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 107. |
| 360 | James Lepp | 51.17 | 31.4.2 | Why does TWBTTs have the "s" at the end? | TWBTT | Rejected – The context is the following, which refers to a series of TWBTTs.*This defines a series of TWBTTs* |
| 421 | James Lepp | 51.11 | 31.4.2 | WUR Beacon operation and WUR Duty Cycle operation seem to be completely asynchronous and have no relationship. If this is true, mention it somewhere. Most traditional PCR power save modes are cycled around the beacon period. |  | Rejected – The starting time of WUR duty cycle and the unit of duty cycle period can be decided by the AP. As a result, AP can manage to put WUR duty cycle repeating around the WUR Beacon period. However, we do not add this retriction and leave the exact design choices to the implementers. Note that TWT also does not restrict SP to always be cycled around the beacon period.  |
| ~~423~~ | ~~James Lepp~~ | ~~51.11~~ | ~~31.4.2~~ | ~~Since you're going through all the trouble to send a second set of Beacons in the WURx encoding just to maintain TSF timer synchronization have you considered just including paging information in the WUR Beacon (for example a "WUR DTIM"). How would a WUR Beacon DTIM scheme compare to the proposed duty cycle operation as far as power saving performance and airtime usage?~~ | ~~Commenter to provide submission. Essentially give the WUR Beacon Frame a Frame Body field containing a bitmap of AIDs (or other identifier) to wake up.~~ | ~~Rejected –~~ ~~Support of frame body is optional for WUR non-AP STA. As a result, adding TIM bitmap in the framebody will not work for all WUR non-AP STAs.~~ ~~Given that the data rate of WUR is much smallers than the data rate of PCR, the typical TIM design will greatly increase the overhead of WUR Beacon, which most of the people prefer to keep it short.~~  |
| 498 | Joseph Levy | 51.11 | 31.4.2 | WUR Beacon generation text is not clear. It is not clear when a WUR Beacons are transmitted or when they should be received by WURx or that the timing of WURx's will use the timing of the WUR Beacons to set the timing of the WURx awake and doze periods. | Align the WUR Beacon text with that inn 11.1.3.2, and make it clear that these beacons are used to align the WURx timing. Also the statement that allow the WUR Beacon to not be sent should be stated in such terms. "WUR Beacons are not transmitted when: There are no "WUR non-AP STAs associated with the AP" and there are no "WUR non-AP STAs with WUR configured in PS mode". | Revised – Agree in principle with the commenter. Note that generation of WUR Beacon is defined in 31.4.2 and follows the description in 11.1.3.2 (Beacon generation in non-DMG infrastructure networks). A non-AP STA updates its TSF timer upon reception of WUR Beacon frame as described in 31.4.3. We only revise the condition that allows AP not to transmit WUR Beacon as suggested by the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 498. |
| 528 | Lei Huang | 51.29 | 31.4.2 | "the WUR beacon" should be changed to "the WUR Beacon frame" | as per comment | Accepted –  |
| 569 | Li-Hsiang Sun | 51.15 | 31.4.2 | TWBTT is not entirely determined by the dot11WURBeaconPeriod. It is determined with the offset relative to TSF=0, in addition to the period. | Change the 2nd sentence to "dot11WURBeaconPeriod and The Offset of Target Wake-up radio Beacon Transmission Time (TWBTT) field of WUR operation element defines a series of TWBTT ..." | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 569. |
| 593 | Mark Hamilton | 51.23 | 31.4.2 | What does "provide WUR service" mean? Does this mean no associated non-AP WUR STA has negotiated WUR mode? If so, say that. If something else, clarify what. | Clarify the second bullet in 31.4.2, per the comment. | Revised – Agree in principle with the commenter. We change the wording to WUR power management service, which the definition is provided in 31.6. Reference are also provided. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 498. |
| 594 | Mark Hamilton | 51.15 | 31.4.2 | What does "exactly" mean? |  | Rejected –We note that the same description is used by the baseline to describe TBTT. “exactly” are used to emphasize the accuracy.*This defines a series of TBTTsexactly dot11BeaconPeriod TUs apart.* |
| 595 | Mark Hamilton | 51.25 | 31.4.2 | The AP needs to transmit WUR Beacons unless all associated non-AP WUR STAs are \_active\_, not just awake. (Awake is a very transitory condition, not useful for turning on/off beaconing.) |  | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 595. |
| 596 | Mark Hamilton | 51.29 | 31.4.2 | Which "requiremnnt"? What does "suspend any pending transmissions" mean? Why is this informative (a NOTE)? |  | Revised –Agree in principle with the commenter. We note that similar note are provided in the baseline. We only revise the note to clarify the requirement. NOTE 1(Ed)—To achieve this requirement, the AP suspends any pending transmissions until the beacon has beentransmitted.TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 596. |
| 627 | Mark RISON | 51.19 | 31.4.2 | "except that one of the following conditions is met" seems wrong; also not clear if has to be just one |  | Revised – Agree in principle with the commenter. We replace “that” with “when.” We also add “any” in front of “one.”TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 627. |
| 805 | Peter Ecclesine | 51.22 | 31.4.2 | Grammer: There is zero WUR non-AP STA | There is no WUR non-AP STA ... | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 498. |
| 830 | Po-Kai Huang | 51.11 | 31.4.2 | Since high data rate is not supported by all the non-AP STA, WUR Beacon may be transmitted with a data rate not supported by all WUR STAs. | Add a rule that WUR Beacon shall be transmitted with a data rate that is supported by all WUR STAs in WUR mode and doze state. | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 830. |
| 864 | Pooya Monajemi | 51.22 | 31.4.2 | WUR beacon can be suppressed if all WUR non-AP STAs are in the doze part of thier duty cycle | Modify the third item toFor all associated WUR non-AP STAs, either the PCR component is in awake state or the WUR duty cycle schedule is in the doze part. | Rejected – WUR non-AP STAs may do self wake-up of WURx to receive WUR Beacon frame.  |
| 886 | Rojan Chitrakar | 51.39 | 31.4.2 | WUR beacon interval is not defined | Either add definition of WUR beacon interval or change to WUR beacon period. Alternatively, change the sentence to:..., subsequent WUR Beacon frames are still scheduled at TWBTTs. | Revised – Agree in principle with the commenter. We replace “interval” with “period.”TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 886. |
| 1127 | Xiaofei Wang | 51.17 | 31.4.2 | Transmitting WUR beacons concurrently over all WUR channels is more beneficial. This will allow STAs that are allocated to other channels from switching channels to receive WUR beacons. | allow an option to have a WUR AP transmitting WUR beacons over all WUR channels | Rejected – Legacy Beacon frame is not allowed to be transmitted concurrently over different 20 MHz channels. There are several reasons.  |
| 1128 | Xiaofei Wang | 51.19 | 31.4.2. | "except that" should be "except when" | as in comment | Accepted - |
| 1129 | Xiaofei Wang | 51.22 | 31.4.2 | change "zero WUR non-AP STA" to "no WUR non-AP STA" | as in comment | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 498. |
| 45 | Albert Petrick | 52.10 | 31.4.3 | Missing period |  | Accepted - |
| 46 | Albert Petrick | 51.58 | 31.4.3 | Missing period |  | Accepted - |
| 47 | Albert Petrick | 51.62 | 31.4.3 | Missing period |  | Accepted - |
| 48 | Albert Petrick | 51.65 | 31.4.3 | Missing period |  | Accepted - |
| 49 | Albert Petrick | 52.02 | 31.4.3 | Grammar |  | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 49. |
| 108 | Alfred Asterjadhi | 51.45 | 31.4.3 | Please replace" TSF Timer Update with" with "Maintaining synchronization with". | As in comment. | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 108. |
| 109 | Alfred Asterjadhi | 51.45 | 31.4.3 | This subclause would read better if the field names are used consistently and the names of the internal variables as well. E.g., temporal versus temporary and so on. Also it may be better to have a figure showing the format of the TSF timer/LT and/or AT with bit positions and MSB/LSB indications. The same figure would be used for 31.8.3.1 and 31.8.3.2. | As in comment. | Revised – Agree in principle with the commenter. TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 109. |
| 460 | John Buffington | 51.55 | 31.4.3 TSF Timer Update with WUR Beacon | "implementation specific value" needs to be defined. | The specification refers to an "implementation specific value" which should be defined, or at minimum given a reference that identifies a reasonable set of values. | Rejected –Implementation specific value means that the value is chosen based on whatever consideration of the implementers.  |
| 589 | Mark Hamilton | 51.47 | 31.4.3 | Presumably, a non-AP STA only updates its TSF timer based on the WUR Beacon if the STA is in WUR mode, the WURx is active/awake, and the PCR is in PS Mode. Even then, there is a potential that the PCR could be awake for the normal Beacon, since there is no requirement that the PCR shall not receive Beacons while the WURx is receiving WUR Beacons. The interaction of these two machines needs to be clarified. | Qualify the statement at the start of 31.4.3, with any rules for when the STA will perform such an update upon receiving a WUR Beacon, if it also is receiving/has recently received a normal Beacon on the PCR. | Rejected –When the PCR is in awake state, it is implementation specific if the WURx can still receive WUR PPDU. Note that to allow this operation, certain interface cancellation technique is required, which is out of scope of this standard.  |
| 167 | Bin Tian | 52.05 | 31.4 | "if LT[5:16] > AT and LT[5:16] > AT + 2^11" : need to double check these conditions. If LT[5:16] is unsigned, can the two equations be combined into one? | as in the comment | Revised – Agree in principle with the commenter. We emphasize that AT+2^11 goes through modulo 2^12 operations. As a result, both inequalities are needed.TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 167. |
| 168 | Bin Tian | 52.07 | 31.4 | if LT[5:16] < AT and LT[5:16] < AT - 2^11: need to double check these conditions. If LT[5:16] is unsigned, can the two equations be combined into one? | as in the comment | Revised – Agree in principle with the commenter. We emphasize that AT-2^11 goes through modulo 2^12 operations. As a result, both inequalities are needed.TGba editor, please make changes as shown in doc 11-18/1875r1 under all headings that include CID 168. |

**Discussion:** *None.*

**Propose:** Revised for CID 104, 626, 1180, 1181, 105, 106, 107, 528, 498, 569, 595, 596, 830, 627, 886, 45, 46, 47, 48, 49, 108, 109, 167, 168 per discussion and editing instructions in 11-18/1875r1.

***TGax editor: Change 31.4 Maintaining synchronization to IEEE 802.11 as follows: (Track change on)***

* Maintaining synchronization
* General

A 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-DMG STA’s TSF timer is accurate to within ±100 ppm.(#104)

A non-AP STA that is in WUR mode expects to receive WUR Beacon frames every dot11WURBeaconPeriod.

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

* WUR Beacon generation

The AP shall define the timing for WUR by transmitting WUR Beacon frames according to dot11WURBeaconPeriod and the Offset of TWBTT field of the WUR Operation element sent by itself(#569). This defines a series of TWBTTs exactly dot11WURBeaconPeriod TUs apart. At each TWBTT, the AP shall schedule a WUR Beacon frame on the WUR primary channel indicated by the WUR Operating Class and WUR Channel fields in the WUR Operation element as the next frame for transmission according to the medium access rules specified in Clause 10 except when(#105) any(#627) one of the following conditions is met:

* There are no WUR non-AP STAs(#498) associated with the AP
* AP does not provide WUR power management service to any associated WUR non-AP STA (see 31.6 (WUR power management procedure)) (#498)
* The PCR components of all(#106) the associated WUR non-AP STAs are in Active mode.(#595)

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

An AP shall indicate the WUR beacon period in the WUR Operation element sent by itself.

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

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).

An 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 31.6 (WUR power management procedure)).(#830)

* Maintaining TSF Timer Synchronziationwith WUR Beacon frame(#108)

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

The received partial TSF timestamp, obtained from the TD Control field of the WUR Beacon frame, is adjusted to consider the WUR 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(#109) timestamp.(#46)
* 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(#109).(#47)
* The adjusted value of the received partial TSF timestamp is set as the value of bit position 5 to 16 of the temporary(#109) timestamp.(#48)

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,(#49) 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))(#167)
* The value shall be decreased by one unit (modulo 247) if LT[5:16] < AT and LT[5:16] < (AT – 211(modulo 212))(#168)

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.(#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.