**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) – TG4k |
| Title | Comments about HWSL in Sponsor Ballot and Proposed Resolutions |
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| Re: | [] |
| Abstract | Suggestion of Sponsor Ballot Comments Resolution for the HWSL |
| Purpose | Draft standard development |
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***CID 23***

**Comment:**

“In Figure 34sb, what is the access mode of the 2nd to Nth HWSL wakeup frames? When a channel is acquired through CSMA-CA, how long can the channel be left idle before channel acquisition is lost and another CSMA-CA is required? If the gap between frames is large, shouldn't another CSMA-CA be required? Listening for a frame from the endpoint device is not the same as CCA. CCA needs to be performed in conjunction to "listening for frame."”

**Proposed Change:**

“If the channel access was gained through CSMA-CA, then a CCA must be completed prior to transmitting each remaining HWSL Wakeup frames of the wakeup sequence.”

**Explanation:**

What is the access mode of the 2nd to Nth HWSL wakeup frames?

The 2nd to Nth HWSL wakeup frames will be send by unslotted Aloha.

***CID 24***

**Comment:**

“In Figure 34sb, other devices may complete the CCA portion of a CSMA-CA during the gaps periods, thus gaining access to the channel and interrupting the wakeup sequence. What happens in this case? Wouldn't this cause a termination of the wakeup sequence?”

**Proposed Change:**

“If another device gains access to the channel during the gap periods, this would cause a termination of the wakeup sequence, which would have to be restarted with a CSMA-CA channel access.”

**Explanation:**

1. for the characteristic of 4k network, data transmission is not very busy, the probability of other device get access to the channel during the gaps of wakeup sequence is small;
2. during the gap of wakeup sequence, the coordinator will check:
3. if the received frame is data frame;
4. if the received frame is from the corresponding device.

so other transmission will not cause a termination of the wakeup sequence.

***CID 25***

**Comment:**

“In Figure 34sb, *macHWSLMaxInterval* is referenced. Is this the definition for *macHWSLMaxInterval*? It is not defined elsewhere? Is this supposed to be *macHWSLMaxPeriod*?”

**Proposed Change:**

“Define *macHWSLMaxInterval* or change Figure 34sb to indicate *macHWSLMaxPeriod* instead of *macHWSLMaxInterval*.”

**Explanation:**

Accept,

*macHWSLMaxInterval* is the same with *macHWSLMaxPeriod*, there is an mistake in figure 34sb, will modify it.

***CID 27***

**Comment:**

“Is *macHWSLMaxInterval* constrained to occur within a single CAP or can it span multipe superframes? Is GTS allocation allowed when *macHWSLEnabled* is TRUE?”

**Proposed Change:**

“Add clarification”

**Explanation:**

Accept, add clarification:

“HWSL mode is supported in nonbeacon-enabled network.”

***CID 28***

**Comment:**

“How long is the endpoint device required to "sample" for a frame. Are all endpoint devices expected to sample for a period that spans the maximum gap between HWSL Wakeup Frames? If so, doesn't that require excessive on time and higher duty cycle by the endpoint devices?”

**Proposed Change:**

“Clarify the requirements for how long the endpoint must sample for a frame.”

**Explanation:**

Accept,

1. add description and modify this paragraph:

“An endpoint device performs a channel sample every macHWSLPeriod time, the interval of sample is *macHWSLSampleInterval*.”

1. add definition of *macHWSLSampleInterval* in Table 52j in 6.4.3.7.

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| --- | --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** | **Default** |
| *macHWSLSampleInterval* | Integer | transmission time of one wakeup frame ~ 65535 | Sample Interval of endpoint for wakeup frame. | transmission time of one wakeup frame |

***CID 29***

**Comment:**

“What is the IFS and turnaround requirement between the HWSL Wakeup frame and the Data Request Frame for the endpoint device? LIFS? *aTurnaroundTime*? *macDataWaitDuration*?”

**Proposed Change:**

“Add requirement if not already defined elsewhere.”

**Explanation:**

The interval between the HWSL Wakeup frame and the Data Request frame for the endpoint device is at least “LIFS + *aUnitBackoffPerio*d”.

***CID 30***

**Comment:**

“*macDataWaitDuration* is not defined.”

**Proposed Change:**

“define *macDataWaitDuration*”

**Explanation:**

AIP, change all “*macDataWaitDuration*” to “*macMaxFrameTotalWaitTime*”, which is defined in 15.4.

***CID 31***

**Comment:**

“Figure 34sc, - shows End Point 1 twice. The second endpoint should be End Point 2.”

**Proposed Change:**

“Change the second endpoint should be End Point 2”

**Explanation:**

Accept, will change the second endpoint name to “End Point 2” in figure 34sc.

***CID 80***

**Comment:**

“Has someone actually done the cost-benefit analysis of listening between each wakeup frame and waiting for a data request? Why not just send the wakeup frames back to back? By listening between each wakeup frame, you increase the delay between wakeup frames, the cost of a channel sample, and ultimately the overall duty-cycle of the sleeping device. In effect, HWSL reduces communication latency by increasing the overall duty-cycle, something you could have done by simply decreasing the period between channel samples. For broadcast communication, any latency reduction is dependent on the number of devices - for larger networks, there does not seem to be any benefit over CSL. It seems like all the same benefits can be achieved with appropriately configured CSL.”

**Proposed Change:**

“Remove normative text; consider adding text in the informative annex applying the existing mechanisms to the LECIM use case.”

**Explanation:**

1. Why we need to listen for data request between each wakeup frame?
2. when coordinator received enough data request from the corresponding endpoints, it can stop the sending of wakeup sequence, can reduce the occupy of channel.
3. for unicast wakeup, as the coordinator received the data request, it can stop the sending of wakeup sequence, then send the unicast frame, reduce the communication latency.
4. for larger networks, there does not seem to be any benefit over CSL.
5. for larger networks, CSL need to send back to back wakeup sequence to overall the duty-cycle of all devices, for such a long time, the channel is occupied. In many applications or region restrict, it’s not available.
6. It seems like all the benefits can be achieved with appropriately configured CSL.
7. HWSL is the joint and improved mechanism of CSL and RIT, seems can’t be configured CSL.

***CID 91***

**Comment:**

“In Figure 34sb, first receiving period of end point should be before the first wakeup sequence.”

**Proposed Change:**

“Update the Figure to show that end points first receiving period is before the first wakeup sequence.”

**Explanation:**

Accept, will modify this figure.

***CID 129***

**Comment:**

“Since the wakeup frame includes the remaining time until the broadcast data frame transmission, is it really necessary to have each endpoint device send a data request command? suppose that the coordinator is trying to make sure all the endpoint devices are listening before sending the data frame, but what is they are not all listening? Will the coordinator still send the broadcast data frame (the text does not address this situation)? In other words, what happens when *macHWSLMaxPeriod* expires? Will the data frame be sent anyway or will the process of sending wakeup frames be repeated or will the coordinator give up?”

**Proposed Change:**

“If the result is that the coordinator will go ahead and send the data frame even if one (or more) of the endpoints does not send a data request command, then I don't see the need of sending the data request commands. In any case, explain what happens when the macHWSLMaxPeriod expires.”

**Explanation:**

1. Is it necessary to have each endpoint device send a data request command?

Yes, it’s necessary, after received data frames from all the endpoint devices, the coordinator and stop sending wakeup sequence, although there may still have remaining time, the coordinator will not occupy the channel.

1. As *macHWSLMaxPeriod* is bigger than the sample interval (*macHWSLPeriod*) of endpoint device, the wakeup sequence will wake up all the endpoints.

Add sentences: “if the coordinator don’t receive enough data request commands, but the sending of wakeup sequence has finished, the coordinator will still send the broadcast data frame after wakeup sequence.” at the last paragraph before 5.1.11.4.

***CID 235***

**Comment:**

“The figure does not show a random backoff for Aloha in the figure.”

**Proposed Change:**

“The easiest is to delete the figure and note in the text that the purpose of this mode is to allow the end point to sleep.”

**Explanation:**

It seems hard to illustrate a random backoff, the figure just want to show the interactive of normal data transmission between coordinator and endpoint, with the complement of description in 5.1.11.3.2 is enough.

the normal data transmission mode here is to allow the endpoint to sleep, as well as supply the way to transmit data from coordinator to endpoint.

***CID 237***

**Comment:**

“Improper use of "may", this is an ability not a requirement.”

**Proposed Change:**

“Change "may" to be "can" or even better, delete the sentence "HWSL may enhance ... is set to TRUE."”

**Explanation:**

1. Change “may” to be “can”.

Accept.

1. Delete the sentence “HWSL may enhance… is set to TRUE”.

HWSL is optional, so need PIB to set enabled or disabled this mode.

***CID 238***

**Comment:**

“It is not clear that HWSL provides any measurable advantage over the flexible power saving modes that are already in 15.4k. Instead, this adds complexity to the standard without a commensurate technical benefit.”

**Proposed Change:**

“Delete HWSL protocols and associated frame formats from the draft.”

**Explanation:**

1. to achieve the power saving in 4k, we can use the normal data transmission mode mentioned in 5.1.11.3.2.
2. as we use the mechanism like this, the latency of the data transmit from coordinator can’t be guaranteed, if the endpoint keep sleep all the time. (the endpoint will only wakeup when it has frame to send.)
* we need provide wakeup mechanism to guarantee the latency of data transmission from coordinator.
* we also want to:
1. reduce the channel occupy of wakeup sequence;
2. support broadcast wakeup
* so we proposed HWSL to concentrate the advantages of CSL and RIT.

***CID 239***

**Comment:**

“This paragraph does not add any useful technical information. Furthermore, HWSL does not reduce latency, although it might provide a very small benefit in power savings.”

**Proposed Change:**

“Delete the paragraph "As described ... may be placed into HWSL mode."”

**Explanation:**

1. for power saving, we use normal data transmission mode described in 5.1.11.3.2;
2. for the optional mechanism HWSL, aim to provide latency guarantee mechanism for data transmission from coordinator to endpoint, as endpoint always in sleep mode.

***CID 240***

**Comment:**

“"It is assumed ..." You can't assume anything, either the coordinator is required to be able to do it or you can't assume that it is the case.”

**Proposed Change:**

“If this behavior is required, then it is a shall be capable, otherwise delete the sentence.”

**Explanation:**

Accept, delete this sentence.

***CID 241***

**Comment:**

“The coordinator has no way to know that a specific frame is an "emergency frame", hence you can't require it to do anything special.”

**Proposed Change:**

“Best option: Delete HWSL protocols and associated frame formats from the draft. Next best option: Delete "If the cordinator ... HWSL wakeup frames."”

**Explanation:**

whether a specific frame is an “emergency frame” is decided by higher layer, we just provide mechanism in MAC layer to support the transmission requirements of emergency frames, for each frame, whether to use HWSL mechanism, is decided by higher layer, not by MAC layer.

As in 15.4, whether the frame is time guaranteed, whether the frame will be transmitted in CFP, is also decided by the higher layer, not MAC.

***CID 242***

**Comment:**

“This paragraph does not have any meaningful normative text. The one "may" is already allowed in the standard, so there is no reason to say this.”

**Proposed Change:**

“Delete the paragraph "An endpoint device ... channel sample time." or just delete HWSL in its entirety.”

**Explanation:**

For the normal mode, the endpoint will not perform channel sample periodically, so the description is necessary.

***CID 243***

**Comment:**

“This paragraph is an excellent example of how the HWSL defined in this subclause is a mess. The device always checks the destination address and discards frames that aren't addressed to it. Why does it tell the higher layer that it "may" suspend channel sampling. The higher layer doesn't care, it expects the MAC to act autonomously. Finally, the last statement is not true, the device has to gain access to the channel before it can send the data request frame. Futhermore, the device can't possibly immediately respond to the coordinator's HWSL frame if it only hears the last one.”

**Proposed Change:**

“Delete HWSL protocols and associated frame formats from the draft.”

**Explanation:**

Accept, change this paragraph to:

“If the endpoint device received corresponding unicast wakeup frame from the coordinator, it shall suspend periodic channel sampling, then send a data request frame by unslotted aloha to the coordinator, and wait for a period *macDataWaitDuration* for an incoming unicast data from the coordinator.”

***CID 244***

**Comment:**

“The unicast transmission procedure is already defined. This list of steps repeats text that is already in the draft. The only difference is that it sends a frame repeatedly. Why does the coordinator wake up a device if it doesn't have a frame? That isn't low latency or low power, it is just silly.”

**Proposed Change:**

“Delete HWSL protocols and associated frame formats from the draft.”

**Explanation:**

Accept, delete the paragraph of line 8~24, page 19.

***CID 247***

**Comment:**

“The HWSL process would be much faster, lower power and lower latency if the Coordinator simply sent the frame that it wants the target to receive multiple times rather than sending the HWSL wakeup frame, get a data request command and then send the frame.”

**Proposed Change:**

“Delete HWSL protocols and associated frame formats from the draft.”

**Explanation:**

For three consideration:

1. frame the coordinator wants to send may be much longer than the wakeup frame, so maybe the overhead is bigger;
2. without data request, some repeated transmission may be wasted;
3. if the frame is broadcast, without waiting data request, to ensure all the endpoint can receive the frame, the multiply time need to be a big number, then increase the occupy the channel.