**IEEE P802.15**

**Wireless Personal Area Networks**

|  |  |
| --- | --- |
| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | **Text proposal for contention-free relay-assisted 15.4w** |
| Date Submitted | [07 September, 2018] |
| Source | [Jin-Taek Lim, Youngnam Han][KAIST] [Kunmin Yeo][ETRI][717, N1 Bldg., 291, Daehak-ro, Yuseong-gu, Daejeon, Republic of Korea] | Voice: [+82-10-4736-8940]E-mail: [jtyim@kaist.ac.kr] |
| Re: | [P802-15-18-0147-00-004w-call-for-proposals.docx(08-Mar-2018)] |
| Abstract | [This is a proposal for single-hop contention-free relay-assisted 15.4w to release the energy consumption of devices without harming the system performance like connectivity] |
| Purpose | [Contribution to IEEE 802.15.4w] |
| Notice | This document has been prepared to assist the IEEE P802.15. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein. This work was supported by Institute for Information & communications Technology Promotion (IITP) grant funded by the Korea government (MSIP) (No.2016-0-00209).  |
| Release | The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15. |

The main idea in this proposal is to reduce the transmission energy consumption of RFDs with poor energy by using energy rich FFD as a single hop relay. At this time, the FFD used as relay is energy-rich device, so the transmission and reception with GW only uses a contention-free scheme. In case of the contention access scheme of which the energy consumption is small, retransmissions occur when transmission fails. However, in case of the contention free access scheme, the energy consumption is large, but the probability of transmission failure is small and the transmission delay becomes large in crowded environment. Therefore, considering the application QoS (Quality of Service, mostly on delay bound) of the distributed devices, it is necessary to optimally allocate each of the contention free period (or frequency resource amount) allocated to FFD and the contention access period (or frequency resource amount) allocated to RFD. Optimally dividing value is broadcasted from the GW via beacon. We omit the optimal allocation algorithm for this proposal. However, this value can be derived through a statistical trace of whether the packet of application arrive successfully to the GW after the system operates.

Below is a list of standards that should be modified to implement the idea described above.

***1. Add the following paragraph at the end of 5.5.1:***

**5.5.1 Star network formation**

For the LPWA star topology, a single-hop relay (such as FFD) may be used to to save the energy consumption of RFD.

**FFD**

**RFD**

**GW**

Gateway

FFD
RFD

***3. Revise the paragraphs of 5.1 to the following:***

Two different device types can participate in an IEEE 802.15.4 network: a full-function device (FFD) and a reduced-function device (RFD). An FFD is a device that is capable of serving as a personal area network (PAN) coordinator or a coordinator, as defined in 6.1. In order to perform complex functions, candidates for FFDs can be devices that are generally less restrictive in terms of energy. An outlet-based device or a battery-powered device, such as a smart car, can be a candidate for FFD. An RFD is a device that is not capable of serving as either a PAN coordinator or a coordinator. An RFD is intended for applications that are extremely simple, such as a light switch or a passive infrared sensor; it does not have the need to send large amounts of data and only associates with a single FFD at a time. Consequently, the RFD can be implemented using minimal resources and memory capacity.

***3. Revise the Figure 7.2 of 7.2.1:***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bits: 0-2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10-11 | 12-13 | 14-15 | 16-17 |
| FrameType | SecurityEnabled | FramePending | AR | PAN IDCompression | Reserved | SequenceNumberSuppression | IEPresent | DestinationAddressingmode | FrameVersion | SourceAddressingMode | Delay BoundIndicator |

***3. Add the following paragraph at the end of 7.2.1.\*:***

**7.2.1.10 Delay Bound Indicator**

The Delay Bound Indicator field is an unsigned integer that specifies the class of the application which device uses. According to the class level, the maximum-allowable delay (delay bound) of application is different.

Specific delay bounds of class should be added future investigations.

A summary of the Delay Bound Indicator for each of the frame types is shown in Table.

|  |  |
| --- | --- |
|  | Delay Bound Indicator |
|  | 0b00 | 0b01 | 0b10 | 0b11 |
| Beacon | - | - | - | - |
| Data | Class 1 | Class 2 | Class 3 | Class 4 |
| Acknowledgment | Class 1 | Class 2 | Class 3 | Class 4 |
| MAC Command | Class 1 | Class 2 | Class 3 | Class 4 |
| Reserved | - | - | - | - |
| Multipurpose | - | - | - | - |
| Fragment | - | - | - | - |
| Extended | - | - | - | - |