Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [LB comment resolution related to 5.5.3.1.1 and 5.5.3.1.2]
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Re: [Response to LB comment of TG7]

Abstract: [This document describes LB comment resolution related to 5.5.3.1.1 and 5.5.3.1.2.]

Purpose: [To resolve LB comments related to 5.5.3.1.1 and 5.5.3.1.2]

LB comment resolution related to 5.5.3.1.1 and 5.5.3.1.2

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D1 Draft (5.5.3 and 5.5.4)

5.5.3   Cross Layer Consideration

    5.5.3.1   Flicker Compensation

            5.5.3.1.1 Intra-frame Flicker Compensation

            5.5.3.1.2 Inter-frame Flicker Compensation

    5.5.3.2   Light Dimming

            5.5.3.2.1 VPM Dimming

            5.5.3.2.2 Idle Pattern and Adjustment Time Dimming

            5.5.3.2.3 Analog Dimming

    5.5.3.3   Idle Pattern

    5.5.3.4   Idle Pattern

5.5.4   Flicker Mitigation (Informative)

Current D2 Draft (5.5.3 and 5.5.4)

5.5.3   Flicker compensation and dimming

    5.5.3.1   Flicker Compensation

        5.5.3.1.1 Intra-frame Flicker Compensation

        5.5.3.1.2 Inter-frame Flicker Compensation

    5.5.3.2   Light Dimming

        5.5.3.2.1 VPM Dimming

        5.5.3.2.2 Idle Pattern and Adjustment Time Dimming

        5.5.3.2.3 Amplitude Dimming

    5.5.3.3   Idle Pattern

    ~~5.5.3.4   Idle Pattern~~

5.5.4   Flicker Mitigation (Informative)

Main Issue related to 5.5.3.1.1 and 5.5.3.1.2

- There are 11 technical comments associated with 5.5.3.1.1 and 5.5.3.1.2, but actually most of them belongs to editorial comments.

- 11 CIDs : 79, 80, 81, 87,92, 82, 84, 88, 90, 93, 95d

- The technical editor has rewritten the subclause 5.5.3.1.1 and 5.5.3.1.2 to implement the editorial comments.

- Two discussion issues in 5.5.3.1.1 and 5.5.3.1.2 of the current D2.

5.5.3.1.1 Intra-frame Flicker compensation in D1 and the current D2

- **(D1 draft) The intra-frame flicker compensation can be accomplished by three technologies, which are the use of Manchester or 4B6B run length limiting code or VPM(Variable Pulse Position Modulation) modulation, in this standard. Two methods of them belong to run length limiting code scheme and the other belongs to modulation scheme. The use of Manchester run length limiting code or VPM modulation prevent the intra-frame flicker through the property that the optical signal to which they are applied has the same brightness both in bits "1" and "0", respectively. 4B6B run length limiting code compensates it from the property that the optical signal of 6 bits converted from 4 bits data is converted into 6 bits applied always shows the constant average brightness being independent of data patterns. The details on 4B6B run length limiting code and VPM are described in 6.6.4.1 and Annex F, respectively.**

- **(The current D2 draft) Intra-frame flicker compensation shall be accomplished by the use of one of the following mechanisms: Manchester encoding as specified in 6.6.4.2, 4B6B encoding as specified in 6.6.4.1, or 8B10B encoding as specified in 6.7.3.2.**

Discussion on 5.5.3.1.1

- The current D2 draft (5.5.3.1.1 Intra-frame flicker compensation)
  - "Intra-frame flicker compensation shall be accomplished by the use of one of the following mechanisms: Manchester encoding as specified in 6.6.4.2, 4B6B encoding as specified in 6.6.4.1, or 8B10B encoding as specified in 6.7.3.2."
  - We'd like to recommend that VPPM will be included in 5.5.3.1.1 because it is also an intra-frame flicker compensation technology.

5.5.3.1.2 Inter-frame Flicker compensation in D1 and the current D2

- **(D1 draft)** **The discrepancy of the average brightness between the data transmission time and the idle time is resulted in the inter-frame flicker because the VLC light source may be always "ON" or "OFF" state on the idle time in which no data is transmitted. Therefore, to compensate the inter-frame flicker, the idle pattern whose average brightness is equal to that of data frame is sent between the data frames that has the same duty cycle as the modulated frame but the pulse repetition rate is set lower so as not to cause "in band" modulation domain interference with any VLC modulation. Any types of idle pattern can be used to compensate it when the use of Manchester run length limiting code or VPM is applied to VLC, but the pattern types which are occupied for the idle pattern are employed on the use of 4B6B run length limiting code.**

- **(The current D2 draft)** **The compensation method used for inter-frame flicker shall be the transmission of an idle pattern between data frames whose average brightness is equal to that of the data frames. The idle pattern for PHY 1 OOK devices is not specified and it is allowable to a use a idle pattern symbol rate other than that used for data transmissions to avoid in-band modulation domain interference.**
  [ED NOTE] are the idle patterns for VPM arbitrary or are they specified?

Discussion on 5.5.3.1.2

- The current D2 draft (5.5.3.1.2 Inter-frame flicker compensation)
  - "The compensation method used for inter-frame flicker shall be the transmission of an idle pattern between data frames whose average brightness is equal to that of the data frames. The idle pattern for PHY 1 OOK devices is not specified and it is allowable to a use an idle pattern symbol rate other than that used for data transmissions to avoid in-band modulation domain interference."

  - [ED NOTE] are the idle patterns for VPM arbitrary or are they specified?

  - ETRI's reply : The idle pattern for VPPM is arbitrary. It's O.K. if the idle pattern for VPPM does not belong to preamble patterns.

New Texts in 5.5.3.1.1 and 5.5.3.1.2

- **5.5.3.1.1 Intra-frame flicker compensation**
  Intra-frame flicker compensation can be accomplished by the use of one of the following mechanisms: Manchester encoding as specified in 6.6.4.2, 4B6B encoding as specified in 6.6.4.1, 8B10B encoding as specified in 6.7.3.2 or VPPM as specified in 6.9.6 and Annex F".

- **5.5.3.1.2 Inter-frame flicker compensation**
  The compensation method used for inter-frame flicker can be the transmission of an idle pattern between data frames whose average brightness is equal to that of the data frames. The idle pattern is not specified and it is allowable to a use an idle pattern symbol rate other than that used for data transmissions to avoid in-band modulation domain interference.

CID 79

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
79	**Clint Chaplin**	**5**	**5.5.3.1.1**	**9**	**25**	**"(SY) ""Two methods of them belong to run length limiting code scheme and the other belongs to modulationscheme."""**	**"Two of the methods are used in the run length limited code scheme and the other method is used in the modulation scheme."**

- ## Recommendation/Instruction to editor
  - CID 79 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.1 because the above sentence is not longer in the new text.
  - See slide #10.

CID 80

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
80	Clint Chaplin	5	5.5.3.1.1	9	26	(SY) "The use of Manchester run length limiting code or VPM modulation prevent the intra-frame flicker through the property that the optical signal to which they are applied has the same brightness both in bits "1" and "0", respectively"	"The use of Manchester code or VPM modulation prevent intra-frame flicker through the property that brightness of the optical signal to which they are applied is the same for both encoded "0" and "1" bits"

- **Recommendation/Instruction to editor**
  - CID 80 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.1 because the above sentence is not longer in the new text.
  - See slide #10.

CID 81

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
81	Clint Chaplin	5	5.5.3.1.1	9	28	(SY) "4B6B run length limiting code compensates it from the property that the optical signal of 6 bits converted from 4 bits data is converted into 6 bits applied always shows the constant average brightness being independent of data patterns"	"4B6B run length limited code prevents intra-frame flicker through the property that the encoded 6 bits has the same constant average brightness independent of the unencoded 4 bits"

- ## **Recommendation/Instruction to editor**
  - CID 81 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.1 because the above sentence is not longer in the new text.
  - See slide #10.

CID 87

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
87	Sridhar Rajagopal	5.5.3.1.1		9		why is 4B6B explicitly mentioned?	change 4B6B to RLL

- **Recommendation/Instruction to editor**
  - All of Manchester, 4B6B, 8B10B, and VPPM have been mentioned in the new text of 5.5.3.1.1.
  - See slide #10.
  - CID 87 : Accept.

CID 92

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
92	R. Roberts	5.5.3.1.1		9		modify sentence at line 26	**The use of OOK Manchester run length limiting code or VPM modulation, in conjunction with a sufficiently high optical rate, prevents the intra-frame flicker through the property that the optical signal to which they are applied has the same brightness due to the equal number of both in bits "1" and "0", respectively.**

- ## **Recommendation/Instruction to editor**
  - CID 92 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.1 because the above sentence is not longer in the new text.
  - See slide #10.

CID 82

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
82	Clint Chaplin	5	5.5.3.1.2	9	35	(SY) "The discrepancy of the average brightness between the data transmission time and the idle time is resulted in the inter-frame flicker because the VLC light source may be always "ON" or "OFF" state on the idle time in which no data is transmitted. Therefore, to compensate the inter-frame flicker, the idle pattern whose average brightness is equal to that of data frame is sent between the data frames that has the same duty cycle as the modulated frame but the pulse repetition rate is set lower so as not to cause "in band" modulation domain interference with any VLC modulation. Any types of idle pattern can be used to compensate it when the use of Manchester run length limiting code or VPM is applied to VLC, but the pattern types which are occupied for the idle pattern are employed on the use of 4B6B run length limiting code."	"The discrepancy of the average brightness between the data transmission time and the idle time results in inter-frame flicker because the VLC light source may be always "ON" or "OFF" during the idle time in which no data is transmitted. Therefore, to eliminate inter-frame flicker, an idle pattern whose average brightness is equal to that of the data frame is sent between the data frames. The idle pattern has the same duty cycle as the data frame but the pulse repetition rate is lower so as to not cause "in band" modulation domain interference with any VLC data frame. Any types of idle pattern can be used to eliminate inter-frame flicker when Manchester code or VPM is used in the data frame, but the pattern types which are used for the idle pattern when 4B6B code is used in the data frame are ???." I have no idea what ??? should be.

CID 82 (cont.)

- ## Recommendation/Instruction to editor
  - CID 82 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.2 because the above sentence is not longer in the new text.
  - See slide #10.

CID 84

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
84	**Michael Bahr**	**5**	**5.5.3.1.2**	**9**	**33-42**	**I hardly understand the current text (due to grammar etc.) and it also seems to contain an internal contradiction. Also, the inclusion of a zero pulse-repetition rate, as discussed during the plenary meeting in January 2010, is still not implemented.**	**I suggest that the TG resolves the internal contradiction (4B6B first as an option but, in the last row, as mandatory for all modulation formats). Rewritten text of this Clause will be provided.**

• **Recommendation/Instruction to editor**

- CID 84 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.2 because the text has been rewritten.

- See slide #10.

CID 88

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
88	Sridhar Rajagopal	5.5.3.1.2		9		4B6B code exception	do not use existing codes for visibility patterns for all RLL codes

- ## **Recommendation/Instruction to editor**
  - I cannot exactly make sense of the comment, but 4B6B is not shown in the new text of 5.5.3.1.2 no longer.
  - CID 88 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.2.
  - See slide #10.

CID 90

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
90	James Gilb	5	5.5.3.1.2	9	40	The sentence "Any types of idle ... run length limiting code." repeats information that is better described in Clause 6 and so it should be deleted. This is an overview section, not a detailed description of operation. In addition, the final clause makes no sense.	Delete the sentence "Any types of idle ... run length limiting code."

- **Recommendation/Instruction to editor**
  - CID 90 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.2 because the text has been rewritten and the above sentence is not longer in the new text.
  - See slide #10.

CID 93

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
93	R. Roberts	5.5.3.1.2		9	41	sentence clarification needed	"The sentence phrase at line 41 states …""… but the pattern types which are occupied for the idle pattern are employed on the use of 4B6B run length limiting code"".I suspect what is meant is the patterns used with VPM are specified in the standard. Is this correct? What section number is that?"

• **Recommendation/Instruction to editor**

- CID 93 : Automatically resolved if the resolution committee accept the new text in 5.5.3.1.2 because the text has been rewritten and the above sentence is not longer in the new text.

- See slide #10.

CID 95d

CID	Name	Clause	Subclause	Page	Line	Comment	SuggestedRemedy
95d	James Gilb	5	5.5.3.1.2	9	37	5.5.3.1.2 refers to the idle patterns, yet these are described in other subclauses (5.5.3.2.2, 5.5.3.3 and 5.5.3.4).	Merge the information from 5.5.3.2.2 and 5.5.3.3 into subclause 5.5.3.1.2 (which should just be in 5.5.3.1). Delete 5.5.3.4 as it only repeats information in 5.5.3.2.2.

- **Recommendation/Instruction to editor**
  - CID 95d : Reject the suggested remedy as "Merge the information from 5.5.3.2.2 and 5.5.3.3 into subclause 5.5.3.1.2" because 5.5.3.1.2 mainly describes inter-frame flicker compensation using idle patterns while 5.5.3.2.2 describes light dimming using idle patterns.
  - CID 95d : Accept the suggested remedy as "Delete 5.5.3.4 as it only repeats information in 5.5.3.2.2."
  - See slide #10.

Summary

- 11 CIDs related to 5.5.3.1.1 and 5.5.3.1.2 have been resolved.

- 11 CIDs : 79, 80, 81, 87, 92, 82, 84, 88, 90, 93, 95d