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

Submission Title: [Resolution of comments on Dynamic Data Mode SYNC Length Negotiation]
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Re: [Discussion and resolution of LB213 (4ab D02) comment index #s 117, 621 and 622]

Abstract: [Resolving comments / Fixing issues with the “SYNC length negotiation for HRP-EMDEV dynamic data mode” facility.]

Purpose: [Consider and decide on the handling of overlapping functionality in 4ab features]

Introduction

This submission:

- Gives an overview of the SYNC length negotiation that is described in clause 10.42.2 of P802.15.4ab (draft D02),
- examines the shortcomings of this negotiation as highlighted by submission: 15-24-0620-00-04ab-dynamic-phr-sync-negotiation.pptx,
- and, resolves LB213 comment index #’s 117, 621 and 622 via proposed changes to the draft to clarify the negotiation and address the issues raised.

Comments on P802.15.4ab (draft D02)

This submission addresses comment index #’s 117, 621 and 622

Index	page	clause	line	Comment	Proposed Change
117 (Vinod)	188	10.42.2	11	There are some gaps in Sync length negotiation using TDMS/RDMS exchange. While the transmitter has all the information to determine the outcome of negotiation, there are scenarios where receiver cannot determine the result of negotiation, which could lead to potential interop issues. These are described in detail in DCN 15-24-0620-00-04ab. Potential solutions to address these gaps are also provided, with minimal changes to the spec.	Update the TDMS/RDMS exchanges, based on the proposal presented in DCN 15-24-0620-00-04ab, to fill the gaps. We will provide the CR text to address the gaps.
621 (Billy)	188	10.42.2	11	The points raised in 15-24-0620-00-04ab should be addressed	With reference to the original author and intent of this clause, consider what changes are needed.
622 (Billy)	188	10.42.2	20	"SYNC and SFD it wants" is a little unclear also "SYNC and SFD" are used for the "SYNC and SFD fragment" so it would be good to not says "SYNC and SFD" anywhere else except when talking about the SYNC and SDF fragment.	change to say "and the SYNC length(s) it requires for those modulation rates and the and SFD it requires."

SYNC length negotiation for HRP-EMDEV dynamic data mode

Why did we include this negotiation in 4ab?

- Main reason is that with the advent of the dynamic data mode it was desirable for the receiver select the length of SYNC it requires based on its capabilities and the proposed set of TX data rates. (This was not intended to be a data rate negotiation, but rather a more flexible approach to an early proposal to have just three modes each with a defined SYNC length value and SFD choice and a particular set of data rates).
  - Thus, the sub-clause focuses on

    10.42.2 SYNC length negotiation for HRP-EMDEV dynamic data mode

  - Primarily this is catering for two needs:
    - (a) receivers that want to have the same sync length for all rates
    - (b) receivers capable of having different SYNC length (i.e., shorter SYNC length for higher data rates)
  - But we also included the ability for the receiver to specify the SFD to use

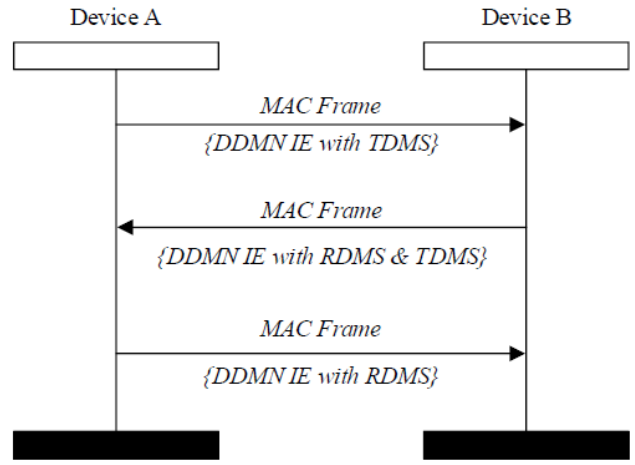
  Note: This SYNC length negotiation is optional. OOB methods can of course also be used, and probably likely in the context of other SDO defining data modes for their own application use cases.

Review of SYNC length negotiation

The general procedure, illustrated in Figure 190, is for one device to indicate the data rates and coding it wishes to use in its transmitter and for the remote device to indicate what it can handle in its receiver, and the SYNC and SFD it wants. For a pair of devices, A and B, wanting to do this negotiation, device A begins by sending a DDMN IE with the Transmitter Data Mode Specifier (TDMS) field. Then in response, Device B may send a DDMN IE with a Receiver Data Mode Specifier (RDMS) field and include a TDMS field covering its transmission needs. Device A then ends the negotiation exchange by sending a final DDMN IE with an RDMS field.

D02 p.88
lines 18-24

- Using the Dynamic Data Mode Negotiation IE, the Transmitter:
  - Advises what TX rates & Coding it wishes to use
- And the Receiver:
  - Says which of these it can do, and selects the SYNC length to use (per data rate) and a single SFD to use for all rates.
  - The intention is that TX is selecting the rates, and RX is selecting the SYNC, so RX cannot exclude any mandatory rates that the TX asks for but only the non-mandatory one, (which was intended to be on the basis that the RX does not support it).



The philosophy of the negotiation

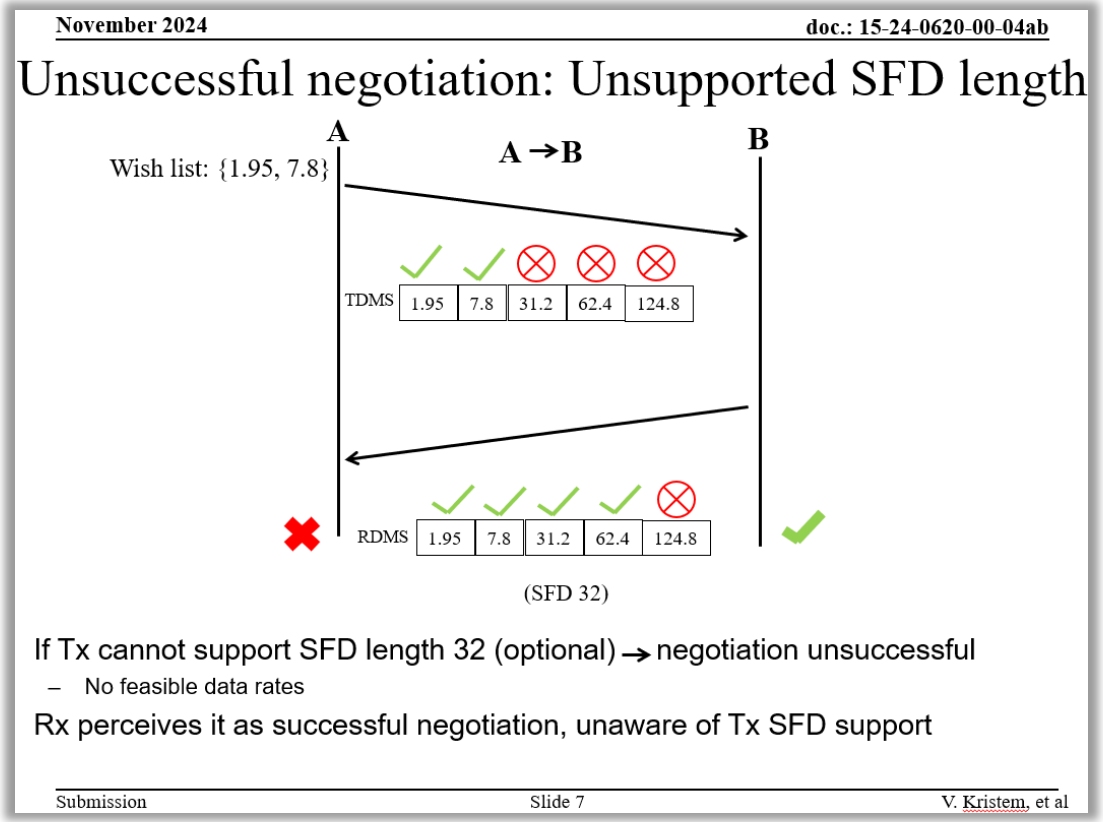
- The general philosophy is based on the assumption that the transmit side knows its application TX traffic needs and can thus propose a set of rates to use.
  - If it supports LDPC on some or all of the proposed rates it may, (or not), as it sees fit, indicate that too.
    - The transmitter is not obliged to use LDPC on rates where it is indicating support, i.e., (if the receiver supports LDPC on a particular data rate), the transmitter when sending at that rate may choose per frame whether to use LDPC or not. (**C1:** Propose to note this in 4ab text)
- The main purpose of the negotiation was for the receiver to say whether it supports any optional rates/codes proposed, and, to select appropriate SYNC length(s) for the rates/codes asked for (that it supports) and to select an SFD.
  - Some receivers may not want multiple SYNC lengths, so would select the same length SYNC for all rates
  - Other receivers may propose different SYNC lengths for different rates.
  - TX can still opt to only use one length, following the (agreed) rules defined on how to choose the SYNC length.
- Given this is “dynamic data mode” the design expectation is/was that several rates would be proposed, i.e., there would always be at least one mandatory rate in the proposed set.
  - **C2:** Propose to make it rule that the set includes at least one mandatory rate, (and recommend at least two).

Issues raised by 15-24-0620

- Submission: 15-24-0620-00-04ab-dynamic-phr-sync-negotiation.pptx raised several issues with the parameter negotiation.
- These issues are examined / discussed on sheets following this one and solutions are proposed

(A) Length 32 SFD

- The point being made here is that if the RX asks for a length 32 SFD, this (being optional) might not be supported by the remote TX.
  - This is a shortcoming. While length 16 SDF may already be sufficiently strong. This length 32 case is not covered.
- We could disallow use of length 32 SFD, but a better solution is…
  - **C3:** Propose to add a mechanism for the TX to indicate that it supports the length 32 SFD, (using one of the reserved bits in the TDMS field) so the RX knows whether it can ask for this or not.

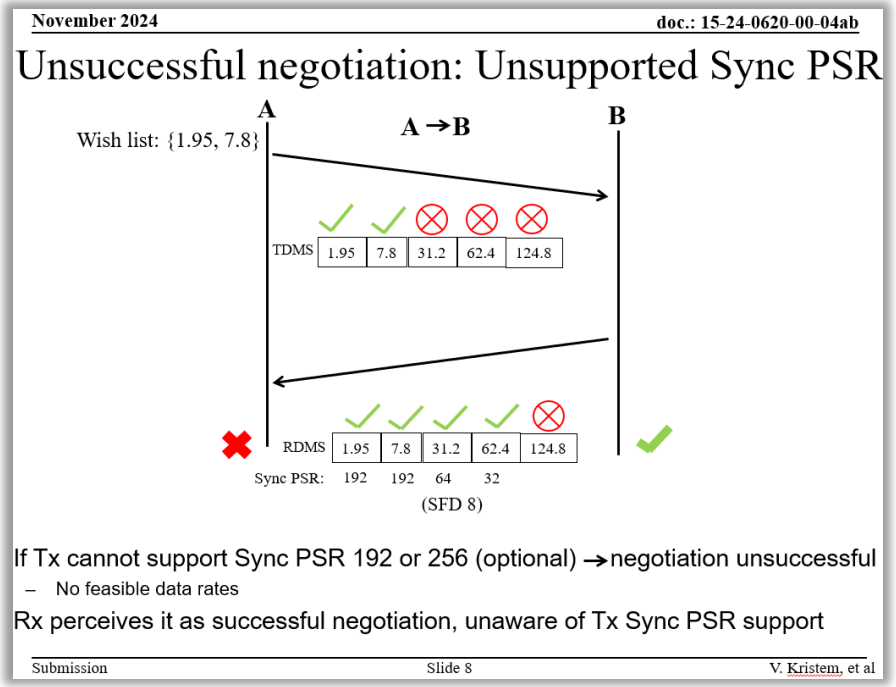


Note: On 24/620r0 slide7, the SYNC and LDPC values for 31.2 and 62.4 Mb/s in RDMS are not relevant since the TDMS indicates it is not planning to these. The choice of SYNC length should only be considering the rates the TX proposes to use.

C4: *Clarify that RDMS should not be considering SYNC length or LDPC for rates not proposed in the TDMS, as these should be ignored when the RDMS is received.*

(B) SYNC of 192 or 256 symbols

- In this example the receiver is selecting a SYNC length of 192 for the two rates that the transmitter has indicated it wants to use.
  - (SYNC lengths for rates TDMS hasn't proposed are meaningless)
- This is a shortcoming, since the text describing the TX SYNC length choice does not properly cover the case of these longer SYNC lengths where there isn't a higher mandatory SYNC length.



Since the RDMS may indicate different SYNC PSR values for different data rates, the specified operation with respect to this is as follows: Subsequent to a TDMS/RDMS exchange, the transmitter shall use those payload data rates and coding methods that the receiver has indicated it can support, and the transmitter shall use the SFD requested by the receiver, and a SYNC length from Table 58 that is no shorter than that requested by the receiver for the selected payload data rate and no longer than the largest SYNC indicated in the Receiver Data Mode Specifier (RDMS) for any data rate, except in the case where the transmitter cannot support sending an optional SYNC length in which case it shall use the next higher mandatory SYNC length.

Possible solutions:

- (a) Make 256 also a mandatory TX length.
- (b) **C5:** At the end of the paragraph, add "or otherwise the highest mandatory length"

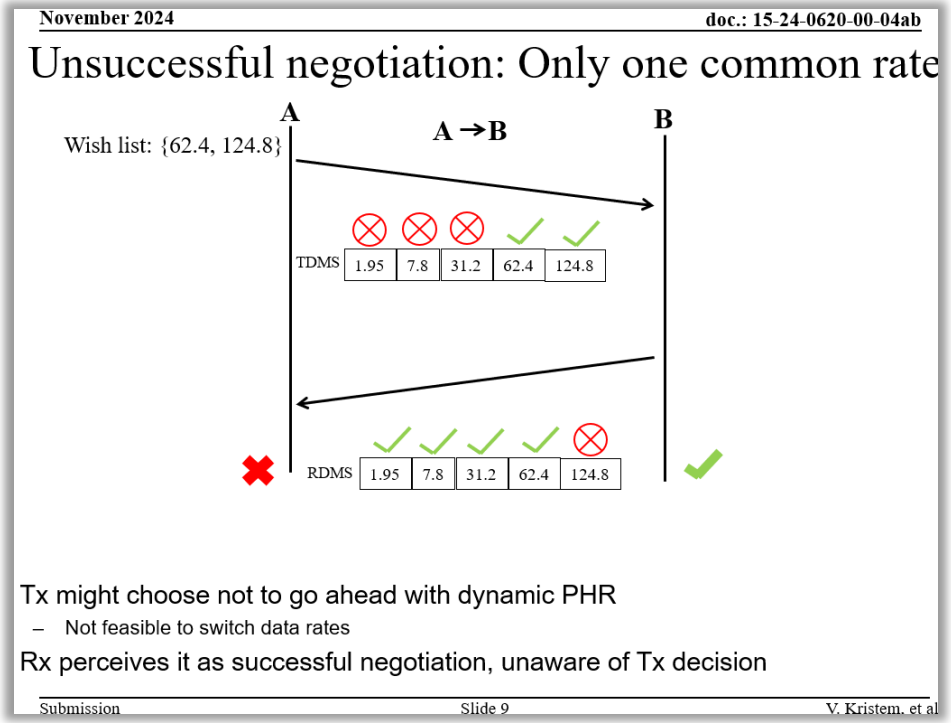
It is expected (b) will be preferred over (a)

Note: on the negotiation image, the RDMS since values for 31.2 and 62.4 are unused the receiver essentially just selecting length 192 sync

(C) One common rate

This is not really an issue…

- There was no design intention for this procedure to be negotiating the non-use the dynamic PHR. The negotiation purpose was selecting an appropriate SYNC Length.
- The assumption is that dynamic PHR is still used by the receiver, which may be also receiving from other devices with overlapping capabilities. The transmitter then should also use dynamic PHR to have its transmissions received by the RX device.
- While there is only one rate is resulting, the negotiation is still considered successful.
  - It serves its purpose of giving the receiver the opportunity to tell the transmitter what SYNC length to use
- Even with one rate, the negotiation also includes LDPC capability
  - If LDPC is supported on both sides, the dynamic PHR can indicate on a per packet basis whether the TX has employed LDPC or not, which it might decide based on frame length.
- The issue here is the assertion that the “TX might choose to not use dynamic PHR”.
  - C6: To resolve this we can state: “Any decision not to use the dynamic PHR, needs to be coordinated between the participating devices. The mechanisms to this are beyond the scope of this standard”.

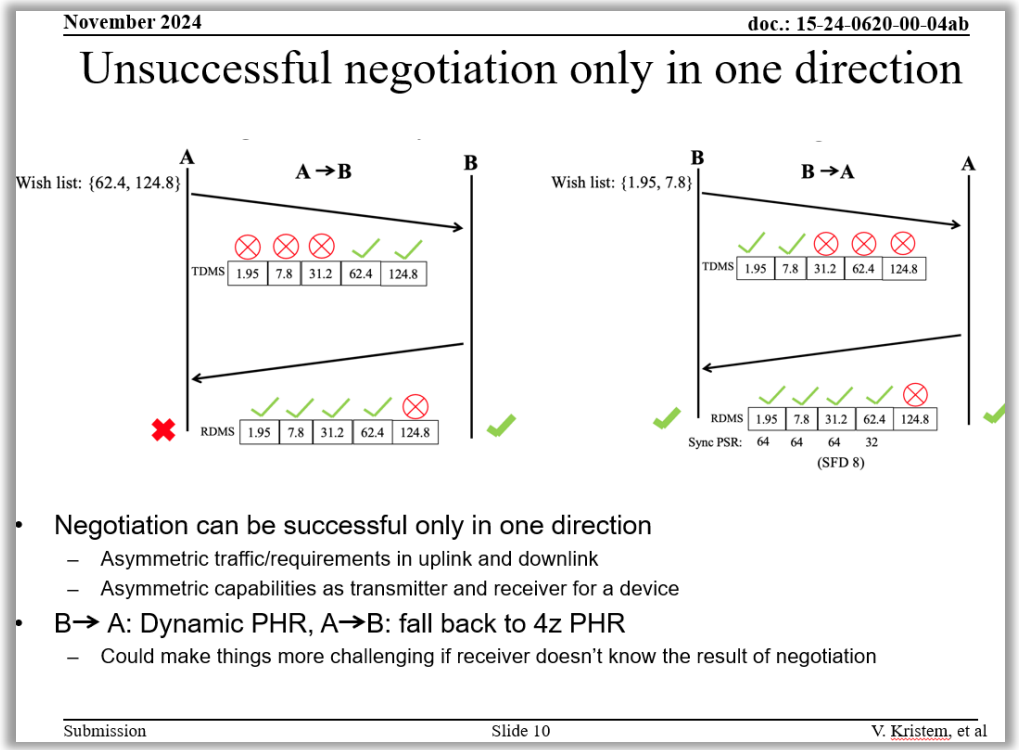


C6: Before this statement we can add: “This negotiation assumes both sides support and will use the dynamic PHR for their communications subsequent to the negotiation.”

(D) Asymmetric ~~failure~~ case

- As per previous sheet, case (C), there is no failure since the use of the dynamic PHR is required
  - There is no fallback to 4z PHR considered as part of this negotiation procedure

- The negotiation has successfully decided:
  - Direction A -> B uses 62.4 Mb/s
  - Direction B to A uses 7.8 Mb/s and 1.95 Mb/s



No additional changes needed

In this scenario Device B having the knowledge that Device A is intending to operate in an environment where the link supports 62.4 Mb/s might logically include 31.2 Mb/s and 62.4 Mb/s in the set of rates in its TDMS field. This indicates a certain asymmetry in the negotiation since B has the TDMS from A before sending its TDMS, as per Figure 190, (reproduced on slide 6 above).

*We don't need to consider this more. The next higher layer can decide who goes first and agree via OOB methods when to engage in this negotiation or any subsequent re-negotiation should the application needs change. We can note this (**C6**).*

Final thoughts before discussing the proposed resolutions…

- When using the (optional) Dynamic PHR it is possible that a device is in communication with more than one device in same or different networks and potentially with different needs and capabilities.
- Any (4ab) compliant PHY supporting the (optional) Dynamic PHR capability, must support the HRP EMDEV mandatory modulation rates, and might support the optional 128.4Mb/s rate and/or the optional LDPC code.
- So, notwithstanding any negotiation with any other individual transmitting devices, when the Dynamic PHR packet format is enabled, the PHY receiver, after detecting SFD and receiving a PHR1, might be expected to progress to receive the PHR2 insofar as it supports the rate/coding and, continue to demodulate/decode the received payload to a point where it can pass it to the MAC layer to allow the MAC to decide whether and how to continue processing the received MAC frame.

Summary of the proposed changes:

1. Clarify, by adding a note, that LDPC can be dynamically selected per TX frame.
2. Clarify that at least one mandatory rate shall be proposed by the transmitter
3. Add a mechanism for TX to indicate it supports the length 32 SFD so the RX knows not to ask for this otherwise.
4. Clarify that RDMS should not be proposing SYNC lengths or LDPC for rates not proposed in the TDMS, and these should be ignored when the RDMS is received
5. Clarify the SYNC length to use when the longest optional lengths are asked for by the receiver but are not supported by the transmitter
6. Clarify this negotiation is only applicable to dynamic data mode where the dynamic PHR is used subsequent to the negotiation, and note the role of the NHL.
7. The change proposed by comment index #662.

Details of change (C1):

- Clarify, by adding a note, that LDPC (when supported) can be dynamically selected per TX frame.

Change: After the description of the LDPC Request field, (D02 p190 before line 3), insert the following new paragraph:

Note that if the receiver supports LDPC on any particular data rate, the transmitter when sending at that rate may choose per frame whether to use LDPC or not.

Details of change (C2):

- Clarify that at least one mandatory rate shall be proposed by the transmitter

Change: At the end of subclause *10.42.2 SYNC length negotiation for HRP-EMDEV dynamic data mode*, (D02 p189 after line 7), insert the following paragraph:

The TDMS field shall include at least one mandatory data rate. It is recommended that at least two mandatory data rates are included.

Details of change (C3) :

- Add a mechanism for TX to indicate that it supports the length 32 SFD so the RX knows not to ask for this otherwise.

Change: Add a new 'SFD32 Support' single bit subfield at the end of the Transmitter Data Modes Specifier field (as shown) and insert the description as a new paragraph, on D02 p190 between lines 2 & 3.

Bits: 0–1	2–3	4-5	6–7	8–9	10–15
TRCS_1p95	TRCS_7p8	TRCS_31p2	TRCS_62p4	TRCS_124p8	reserved

Figure 192—Transmitter Data Modes Specifier field of the DDMN IE

10–14	15
reserved	SFD32 Support

The SFD32 Support field when one indicates that the device transmitter supports the optional length 32 SFD defined in Table 16-11, or when zero that this SFD is not supported so the receiver knows not to ask for it, (i.e., in the RSFDS field of the Receiver Data Modes Specifier field).

Details of change (C4):

- Clarify that RDMS should not be proposing SYNC lengths or LDPC for rates not proposed in the TDMS, and these should be ignored when the RDMS is received.

On D02 p190 change the paragraph starting line 10 and modify first row of Table 58 as shown:

The SYNC Support field encodes whether the corresponding dynamic data rate, if proposed by the remote transmitter, is supported by the device receiver, and if supported what SYNC length is required for it. The permitted values and their meanings are specified in Table 58. The transmit device should ignore RDMS SYNC length values for any rates it did not propose in its TDMS.

Table 58—Sync Support Field values

SYNC Support field value	Meaning
0	~~Data rate not supported or not to be used~~ This data rate is not supported or the TDMS did not propose its use.

Details of change (C5) :

- Clarify the SYNC length to use when the longest optional lengths are asked for by the receiver but are not supported by the transmitter.

Change: At end of the paragraph, ending line 7 p189 of D02, add: “or otherwise the highest mandatory length”, as shown below:

… except in the case where the transmitter cannot support sending an optional SYNC length in which case it shall use the next higher mandatory SYNC length, or otherwise the highest mandatory SYNC length.

Details of change (C6):

- Clarify this negotiation is only applicable to dynamic data mode where the dynamic PHR is used subsequent to the negotiation, and note the role of the NHL.

Change: At the end of the third paragraph of subclause *10.42.2 SYNC length negotiation for HRP-EMDEV dynamic data mode*, (D02 p188, at the end of line 24), insert the following sentences:

> Subsequent to this negotiation, it is assumed that the devices will use the UWB packet format with the PHR defined in 16.2.7.4 and with parameters set following the negotiation as specified here. Any decision to do otherwise would need to be coordinated between the participating devices. The mechanisms to this are beyond the scope of this standard and are left to the higher layer. It is also left to the next higher layer to decide who goes first and when to engage in this negotiation or any subsequent re-negotiation when the application needs change.

Details of change (C7): as proposed by CID #662

Index	page	clause	line	Comment	Proposed Change
622 (Billy)	188	10.42.2	20	"SYNC and SFD it wants" is a little unclear also "SYNC and SFD" are used for the "SYNC and SFD fragment" so it would be good to not says "SYNC and SFD" anywhere else except when talking about the SYNC and SDF fragment.	change to say "and the SYNC length(s) it requires for those modulation rates and the and SFD it requires."

This is essentially editorial since it just using better language as per the commenter's proposed change and not changing the intended meaning. The change is to modify the sentence on D02 p188 lines 18-20 as shown:

The general procedure, illustrated in Figure 190, is for one device to indicate the data rates and coding it wishes to use in its transmitter and for the remote device to indicate what it can handle in its receiver, ~~and the SYNC and SFD it wants~~ and the SYNC length(s) it requires for those modulation rates and the and SFD it requires.

Conclusion

This submission proposed resolutions to the following D02 LB213 comments:

- CID # 117 : Revised.
- CID # 621 : Revised.
- CID # 622 : Accepted.

with the changes as detailed on slide numbers 15 to 21 above.

THE END