

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

Submission Title: [CSM Issues in FH Networks]

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Source: [Daniel Popa, Hartman Van Wyk]

Company [ITRON],

Address [France],

E-Mail:[{ daniel.popa, hartman.vanwyk }@itron.com]

Re: [802.15.4g Comment Resolution for LB59]

Abstract: []

Purpose: [CSM related Comments Resolution for LB59]

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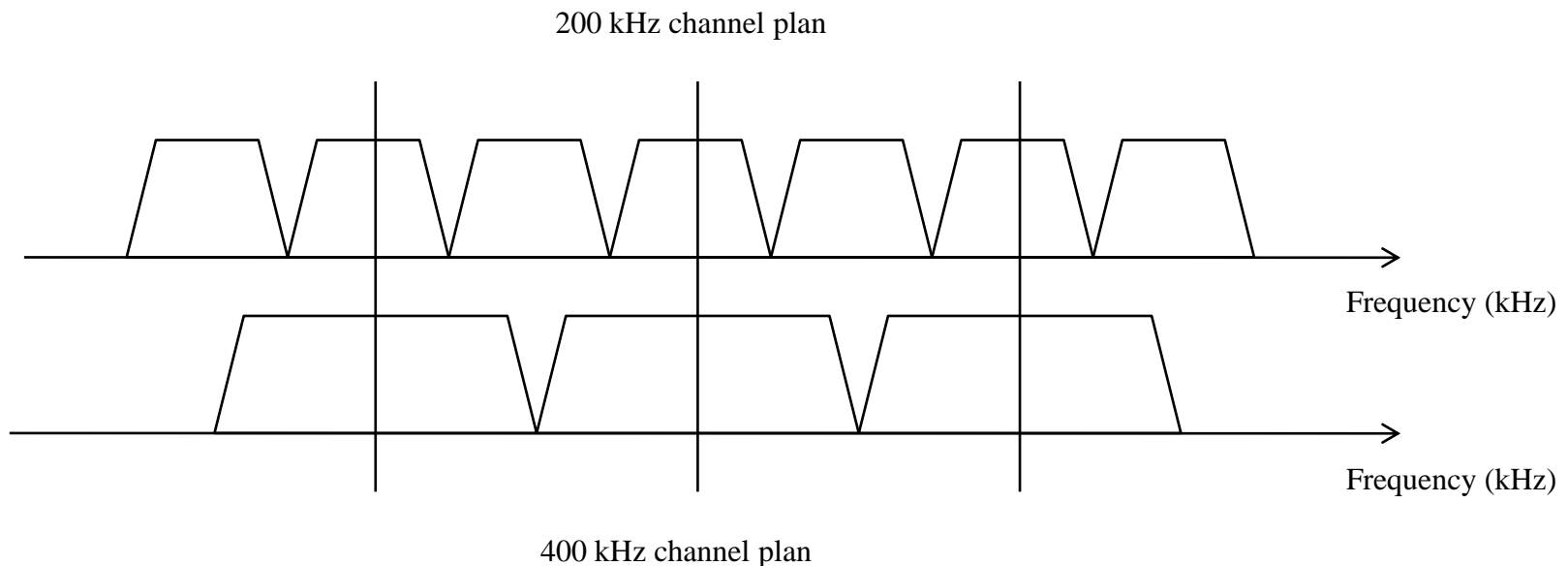
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Outline

- This document builds on DCN 771rev07 and DCN 952rev2
- This document discusses the following topic
 - PIB usage versus CSM channel utilization

Alignment of 200/400 kHz-spacing channels

- The need for channel alignment (w/r/t center frequency) has been recognized
 - 200 kHz channel spacing
 - 400 kHz channel spacing



Issue on the table

- Two opinions emerged during the last calls
 1. to mandate in the (4g) standard the channels to be used for EB/EBR exchange: use only those 200 kHz-spacing channels that align with 400 kHz-spacing channels (aka “odd” 200 kHz –spacing channels)
 2. to use PIB attribute (or NHL to use MAC primitives) to select the channel to be used for EB/EBR exchange: use either only those 200 kHz-spacing channels that align with 400 kHz-spacing channel (aka “odd” 200 kHz-spacing channels) or all 200 kHz-spacing channels
- 1st opinion (1.) has been discussed
 - performance analysis (see DCN 771 rev6) showed its benefits (in terms of probability of successfully exchanging EB/EBR and average waiting time before successfully exchanging EB/EBR)

Issue on the table (cont'd)

- We will explore the 2nd opinion: the use of PIB attribute (or NHL uses MAC primitives) to select the channel to be used for EB/EBR exchange
- Statements
 - EB/EBR uses the CSM => 50 kbps and 200 kHz channel spacing
 - 200 kHz-spacing and 400 kHz-spacing channels are aligned, w/r/t their center frequencies
- Assume device A and B configured by PIB attributes (or by NHL via MAC primitives) to select the channels to be used for EB/EBR exchange
 - PIB attribute has two states: {0, 1}
 - PIB attribute = 0 : use only the “odd” 200 kHz-spacing channels for EB/EBR exchange
 - PIB attribute = 1 : use all 200 kHz-spacing channels for EB/EBR exchange

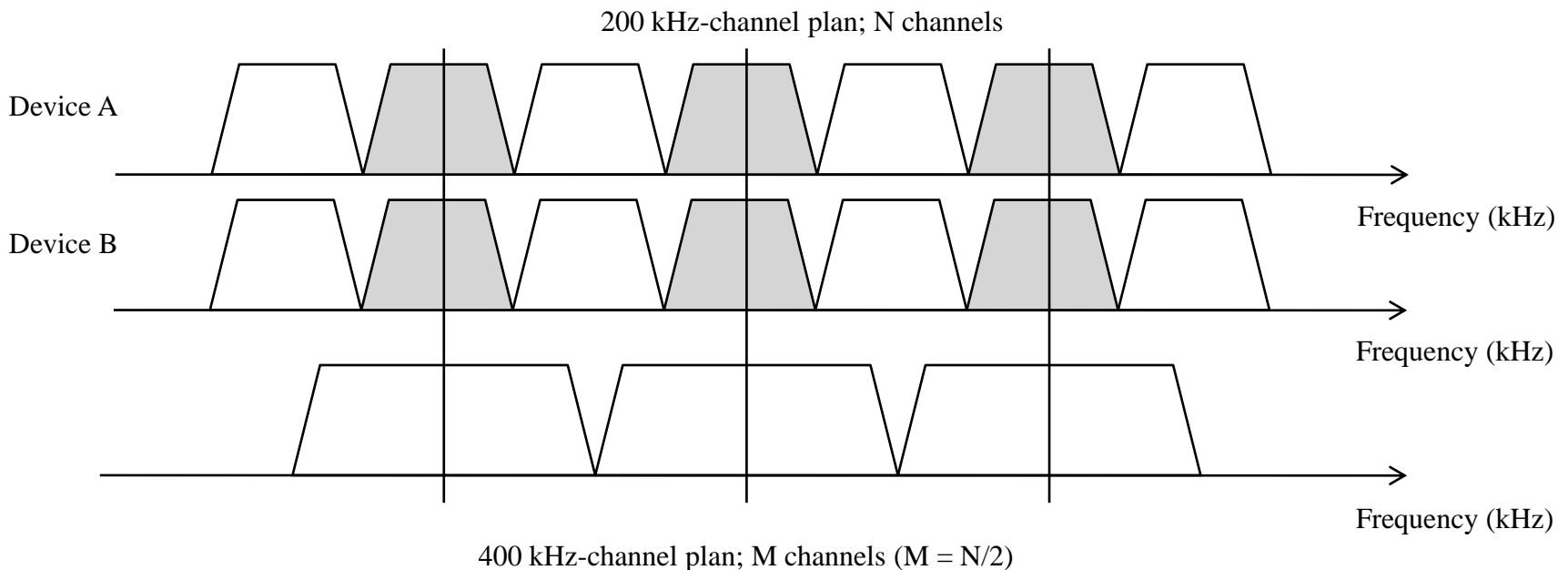
Issue on the table (cont'd)

- Assume device A and B configured by PIB attributes (or by NHL via MAC primitives) to select the channels to be used for EB/EBR exchange
 - PIB attribute has two states: {0, 1} => 4 use cases
 - Case I: Device A has a PIB attribute = 0 and Device B has a PIB attribute = 0
 - Case II: Device A has a PIB attribute = 0 and Device B has a PIB attribute = 1
 - Case III: Device A has a PIB attribute = 1 and Device B has a PIB attribute = 0
 - Case IV: Device A has a PIB attribute = 1 and Device B has a PIB attribute = 1

Issue on the table (cont'd)

- Case I:

- Device A has a PIB attribute = 0 and Device B has a PIB attribute = 0
 - PIB attribute = 0 : use only the “odd” 200 kHz-spacing channels for EB/EBR exchange

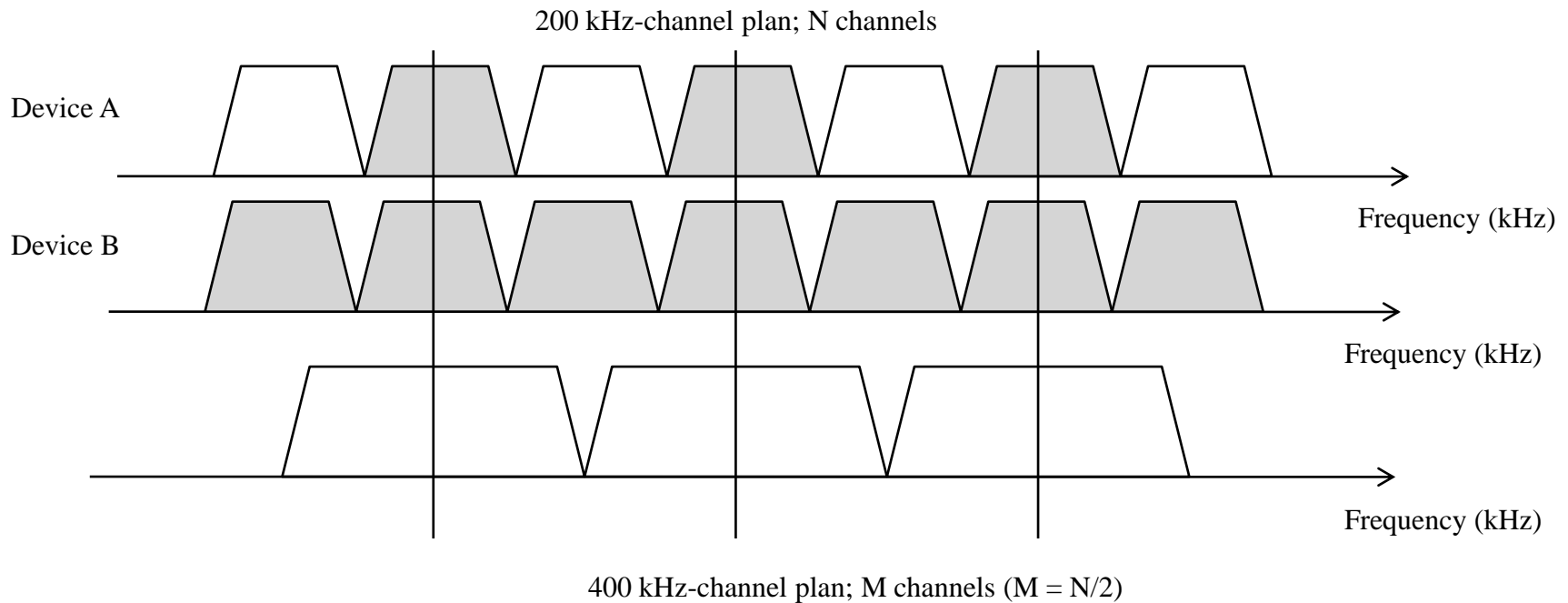


- $P \{ \text{Device A and Device B on the same channel} \} = 1/(N/2) = 1/M$

Issue on the table (cont'd)

- Case II:

- Device A has a PIB attribute = 0 and Device B has a PIB attribute = 1
 - PIB attribute = 0 : use only the “odd” 200 kHz-spacing channels for EB/EBR exchange
 - PIB attribute = 1 : use all the 200 kHz-spacing channels for EB/EBR exchange

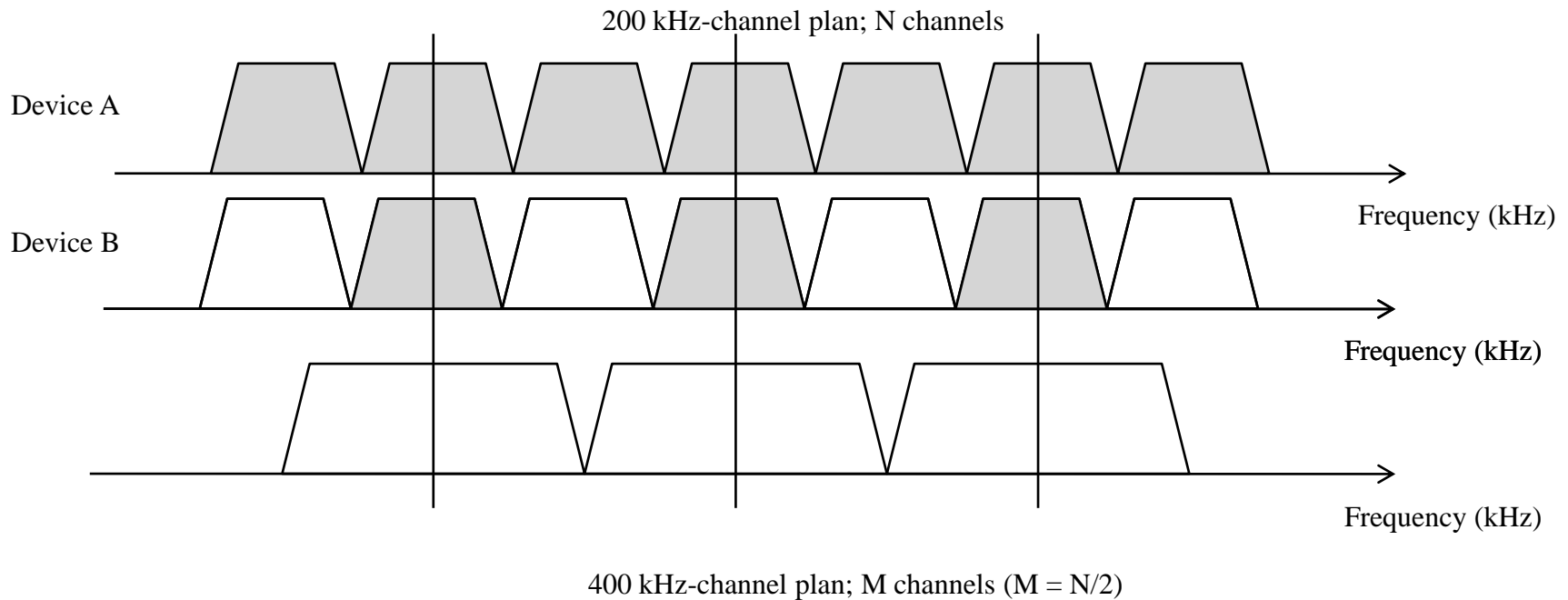


- $P \{ \text{Device A and Device B on the same channel} \} = 1/(2M) = 1/N$

Issue on the table (cont'd)

• Case III:

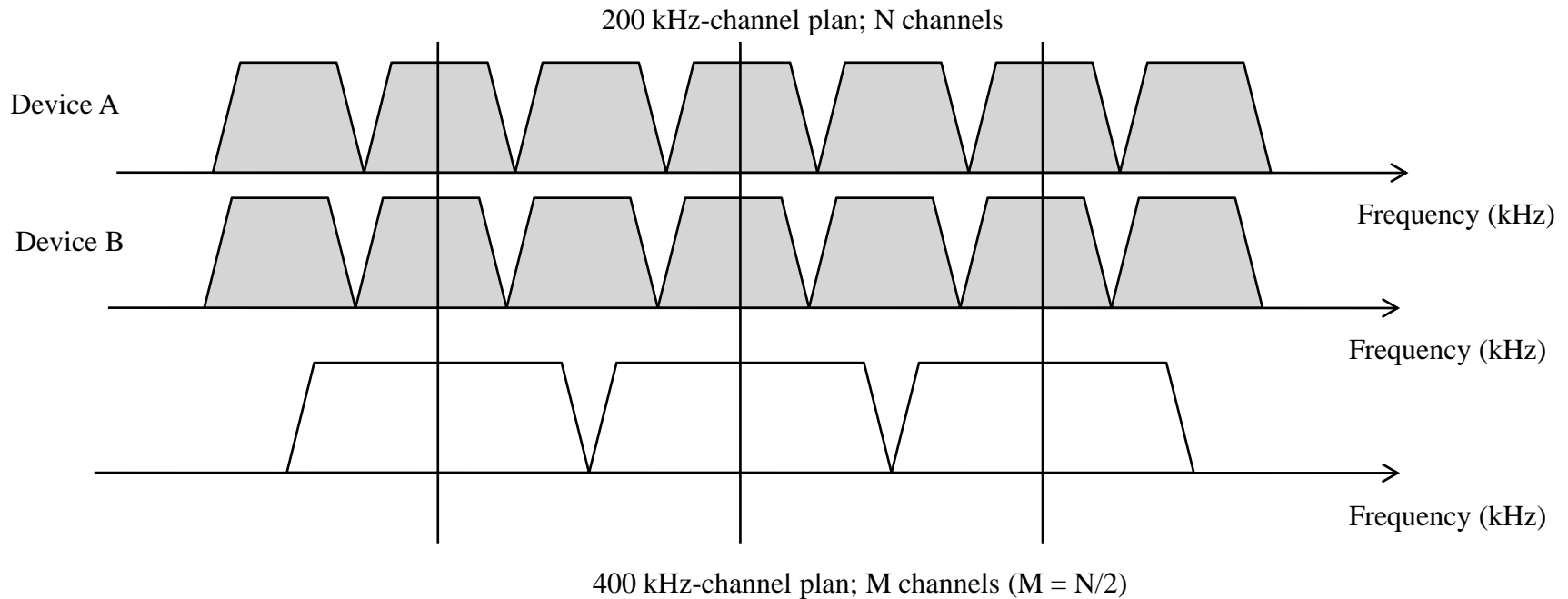
- Device A has a PIB attribute = 1 and Device B has a PIB attribute = 0
 - PIB attribute = 0 : use only the “odd” 200 kHz-spacing channels for EB/EBR exchange
 - PIB attribute = 1 : use all the 200 kHz-spacing channels for EB/EBR exchange



- $P \{ \text{Device A and Device B on the same channel} \} = 1/(2M) = 1/N$

Issue on the table (cont'd)

- Case IV:
 - Device A has a PIB attribute = 1 and Device B has a PIB attribute = 1
 - PIB attribute = 1 : use all the 200 kHz-spacing channels for EB/EBR exchange



- $P \{ \text{Device A and Device B on the same channel} \} = 1/N$

Conclusion

- The use of PIB attributes to deal with CSM channel utilization issue has been explored
- The use of PIB attribute – to deal with CSM channel utilization issue - is not recommended
 - the use of PIB attributes degrades the performance of exchanging EB/EBR, when devices have not the same PIB attribute value
- Mandating, in the standard, the channels to be used for exchanging EB/EBR is facilitating interoperability and, additionally, increase system performance
 - the “best” performance was observed for the case where each device uses the same set of channels to exchange EB/EBR; this case corresponds to each device using only the “odd” 200 kHz-spacing channels.

Thank you for your attention

Questions ?