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

Submission Title: Comment Resolution CID 3060, LB-101

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Abstract: Comment Resolution

Purpose: Comment Resolution for CID 3060 of LB101

CID 3060:

Comment:

Allowing a variable preamble length in 15.4g was a bad compromise that should not be repeated. The response "The optimal preamble length depends the use case. E.g. when battery life is limited by TX power consumption a short preamble is preffered." is incorrect. First, the short preamble would save only a little bit of energy and only if the channel at that moment allows it. Furthermore, requiring an implementation to support a short preamble complicates the design (requiring faster AGC, DC offset removal, etc.) that will require more power in the receiver. Devices typically spend more time receiving rather than transmitting and so making the receiver more difficult and power hungry is a bad idea.

Proposed change:

Set the preamble length to be 4 octets, fixed. 2 is too short and 4 is sufficient.

CID 3060:

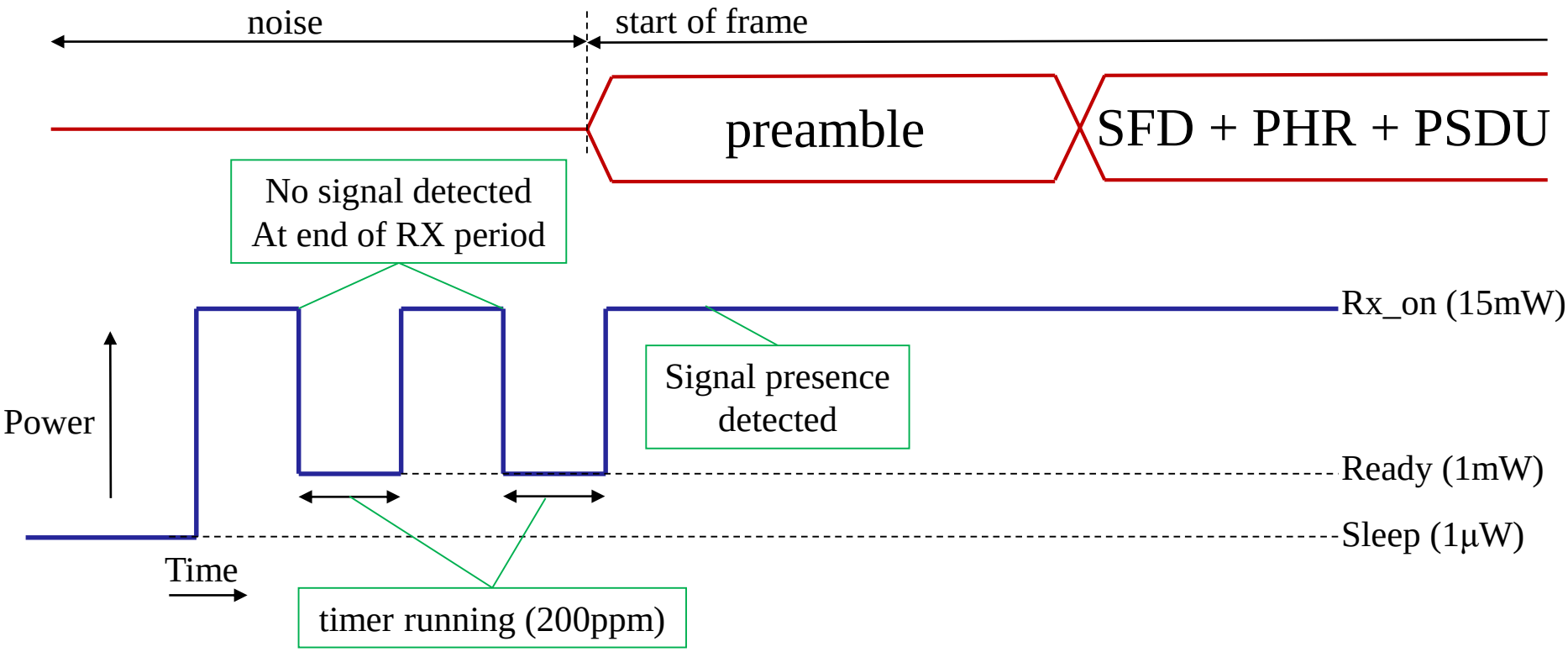
Resolution:

Revised: Have a fixed preamble length: 8 Bytes for beacon frames and 4 Bytes for all other frame types. Remove phyUlpGfskPreambleLength and references from the draft. Replace all text in 31.1.1 with "The preamble field of any beacon frame shall contain 8 multiples of the 8-bit sequence “01010101”. In all other frame types the preamble field shall contain 4 multiples of the 8-bit sequence “01010101”.

Motivation:

- Fixed definition allows for performance optimization
- Longer preamble in beacon allows for receiver duty cycling

Illustration of RX duty cycling:



Shelf label example (1):

A shelf label is monitoring a beacon of a coordinator to check for price updates.

The beacon is transmitted every minute

Other parameters:

- Data rate = 150kbps ; SHR + PHR = 88 bits ; PSDU = 240 Bytes
- Signal detection time = 16 bits (from receiver start to detection of beacon preamble)
- Continuous receive power = 15mW. Low power standby mode power = 1mW (crystal running)
- Low power sleep mode with 200ppm clock running = 1 µW

The low power sleep clock has an accuracy of 200 ppm

The skew over 60 seconds = 12 ms. This means that the receiver needs to be activated 12ms earlier to cope with the skew. Assuming symmetric distribution → On average the receiver is on 12 ms before the preamble arrives.

The total frame length is 2.187 ms. → the majority of the active receive period is spend on searching for a valid preamble.

A longer preamble allows the receiver to be duty cycled without missing the beacon. E.g. 16 bits RX on. Go to a low power mode (Ready) when no signal is found for 24 bits.

A 32 bit preamble reduces the potential of RX duty cycling.

- A minimum number of bits is needs to be received before the presence of signal can be detected

Shelf label example (3):

Average power consumption during preamble search = (15 x 16 + 1 x 24)/40 = 6.6mW

When a 32 bit preamble is used there is no power saving → 15mW

→ Savings are 56%