

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

Submission Title: [A method for supporting communication and interoperability between legacy and standard devices]

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Source: [Daniel Popa*, Hartman Van Wyk*, John Buffington*, Brent Cain*, Robert Mason**, Rodney Hemminger**]

Company [*Itron, **Elster]

Address: [see document 15-09-0490-01-004g]

Voice: [see document 15-09-0490-01-004g]

E-Mail: [see document 15-09-0490-01-004g]

Re: [Amendment to document 15-09-0490-01-004g: *Merged-proposal-for-fhss-to-tg4*]

Abstract: [This document proposes a PHY layer “tag” and method to use it for supporting communication with legacy devices as well as interoperability between multi-vendor devices]

Purpose: [For consideration of inclusion into 802.15.4 PHY draft amendment]

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Objectives

1. Propose an amendment to document number 15-09-0490-01-004g, *Merged-proposal-for-fhss-to-tg4*
2. Propose a method for supporting *any* legacy device
 - ✓ existing and ongoing deployments will not become obsolete
 - ✓ simultaneous (and parallel) operation of *any* system based on legacy and standard devices, respectively
3. Propose a method that opens up for multi-vendor interoperability
4. *Minimize* the impact of legacy device support on the standard and *not encumber* the choice of the “best” technology

Support for legacy devices

- ❑ Upgrade over-the-air the legacy devices affected by 802.15.4g support
 - ✓ only legacy devices that can accommodate radio parameter changes, while keeping (transmission link) communication performance at an acceptable level

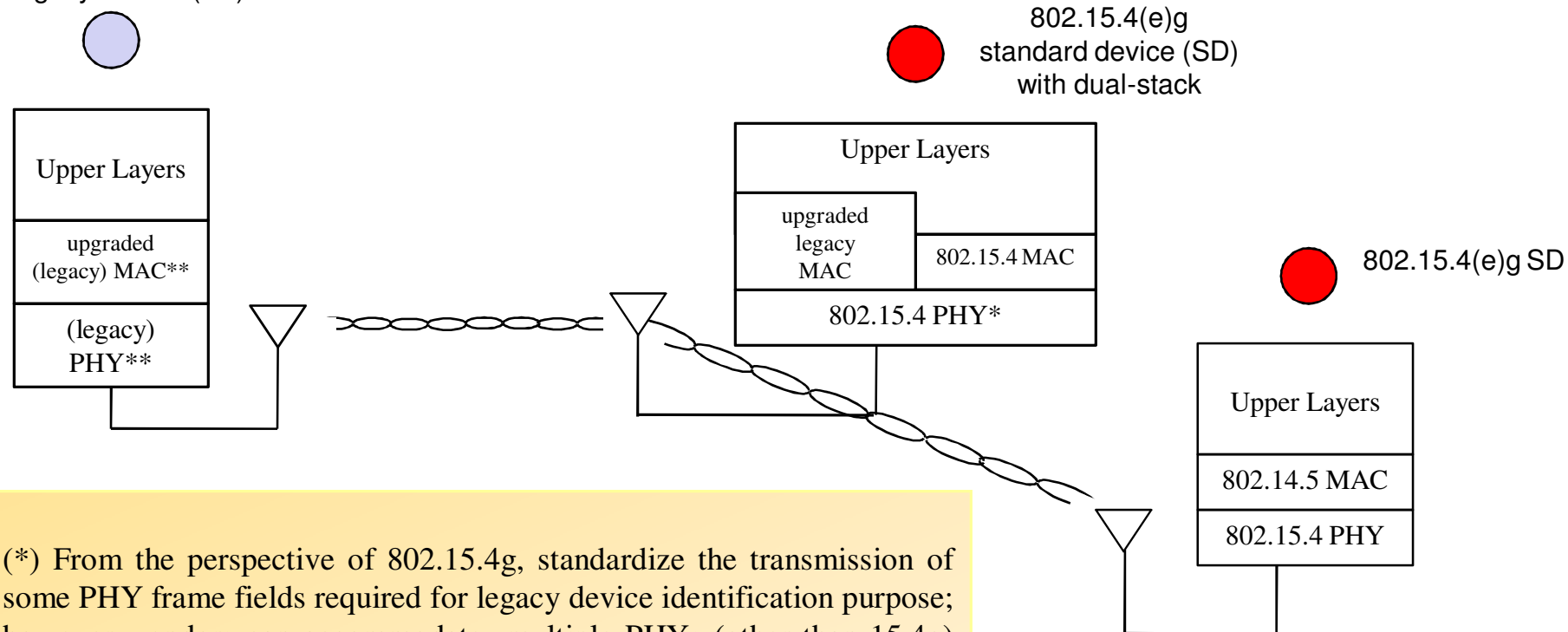
- ❑ Let system implementations deciding if standard devices support or not legacy devices
 - ✓ standard devices can support legacy devices by dual-stacking (proprietary layers and 802.15.4(e)g layers) rather than bridging

- ❑ Make standard PHY able to recognize if legacy devices are present on the field

- ❑ Use standard information for legacy device identification
 - ✓ is modulated with the most common legacy scheme: 2-(G)FSK
 - ✓ has the lowest acceptable and robust data rate of 40 Kbps
 - ✓ respects all PHY & MAC parameters, as will be defined by 802.15.4(e)g: channel spacing, channel bandwidth, etc.

Support for legacy devices (cont'd)

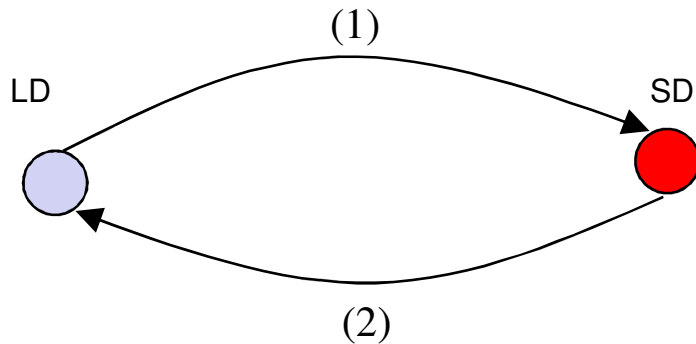
Legacy Device (LD)



(*) From the perspective of 802.15.4g, standardize the transmission of some PHY frame fields required for legacy device identification purpose; however, vendors can accommodate multiple PHYs (other than 15.4g) on such devices, based on their legacy system parameters; for flexibility, this should be a vendor prerogative

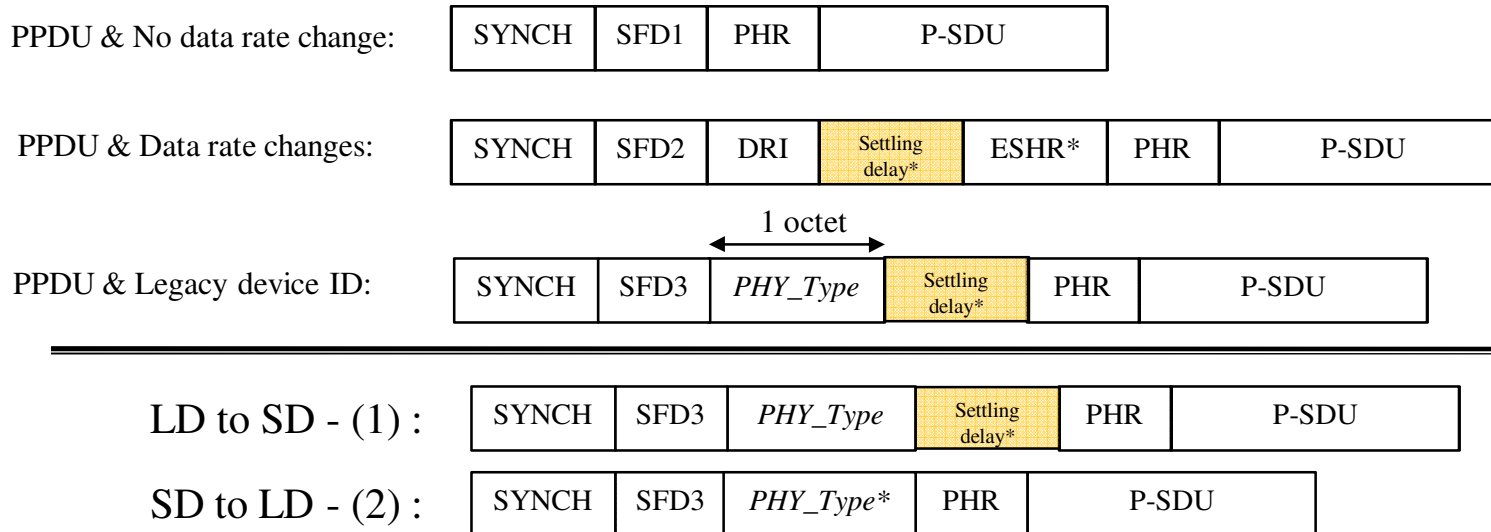
(**) over-the-air upgrade the legacy MAC that will further (re-)configure legacy PHY to deal with radio parameter changes for supporting legacy device identification

Support for legacy devices (cont'd)



- Start of Frame Delimiter (SFD)
 - indicates whether there is a data rate change or not
 - additionally, indicates whether or not there is a legacy device
 - has three standard/defined values :
 - 0xAA52 = no data rate change
 - 0xAA2D = data rate change prior to PHR
 - xxxxxx = legacy device (with no data rate change)

Proposed PPDU structure: see document “15-09-0490-01-004g-merged-proposal-for-fhss-to-tg4” for further details

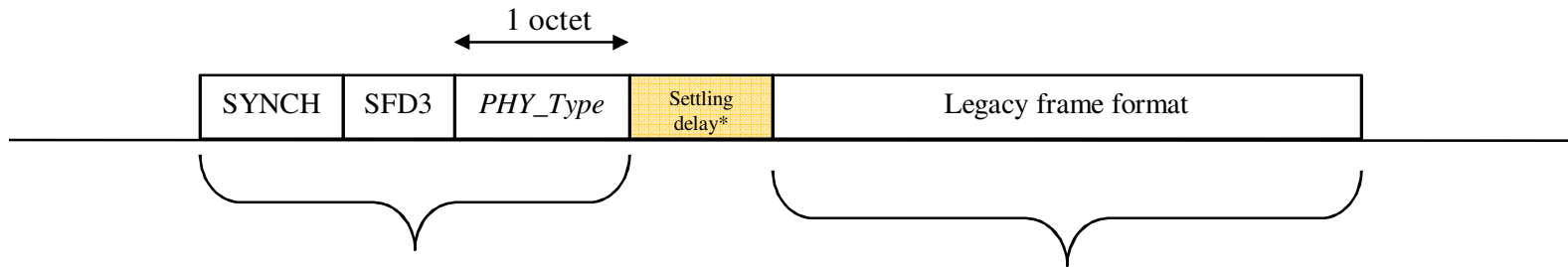


(*) = Designates optional fields

Support for legacy devices (cont'd)

PPDU format supporting legacy devices, modulation, data rate, PHY parameters,...

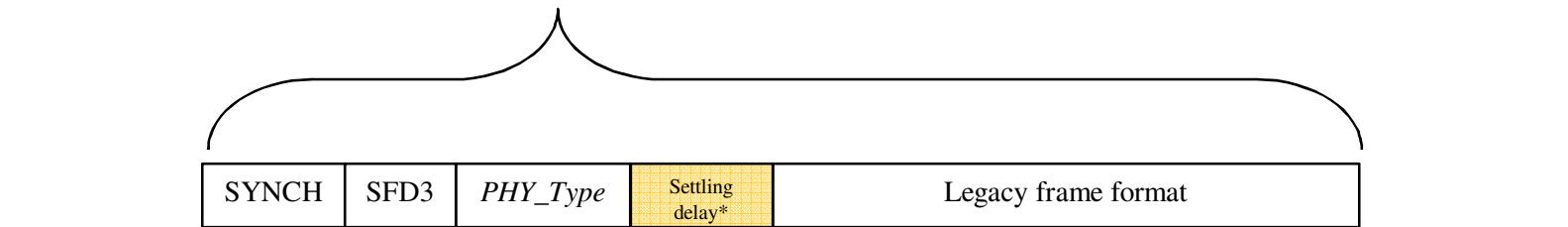
User case A:
"Shim" legacy
PHY upgrade



- most common modulation: 2-(G)FSK
- lowest acceptable and robust data rate : 40 Kbps
- respect all (PHY+MAC) parameters as defined by 802.15.4(e)g, e.g., channel spacing, channel bandwidth

- data sent with respect to a specific legacy PHY
 - legacy PHY to be defined by each vendor but not standardized

User case B:
Full legacy
PHY upgrade



Legacy device identification

- ❑ Per vendor SFD value(s) versus per vendor PHY_Type value(s)
 - ✓ Assign per vendor SFD value(s)
 - SFD sequences MUST have lowest correlation sidelobes as a function of specific SYNCH patterns
 - 2-byte SFD => scarce number of optimum SFD sequences; 3/4-byte SFD word may alleviate aforementioned issue but still SFD sequences/words as a function of SYNCH pattern(s)
 - legacy devices from different vendors with identical SFD => require additional tag for differentiation
 - ✓ Assign per vendor PHY_Type value(s)
 - no constraint related to some other PHY frame field
 - 1-byte *PHY_Type* field => 256 sequences
 - ❑ legacy devices from different vendors get different PHY_Type value

- ❑ Standardize an *unique format* for Legacy device identification:
 - ✓ SYNCH : standard value for all vendors
 - ✓ SFD3 : standard value for all vendors
 - ✓ PHY_Type : a couple of standard values for each vendor

- ❑ Over-the-air “upgrade” legacy PHY Layer to accommodate transmission of the legacy device identification

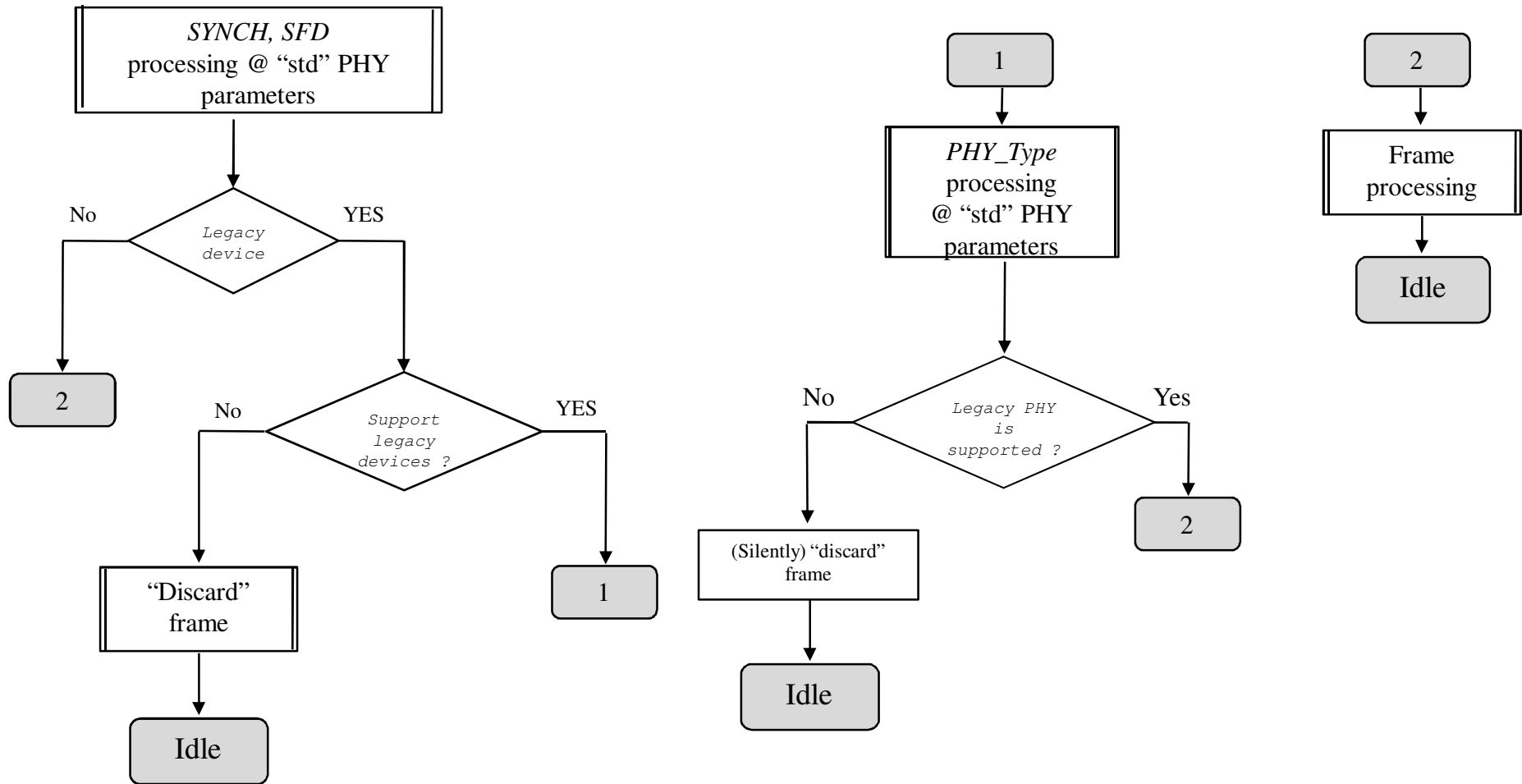
PIB: *PHY_Type* values

- An example of assigning *PHY_Type* values

<i>PHY_Type</i> Value	Vendor	Notice
0-4	A	<ul style="list-style-type: none">• Several PHY types per vendor• No standard: vendor A defines its PHY & PHY parameters
5-9	B	<ul style="list-style-type: none">• Several PHY types per vendor• No standard: vendor B defines its PHY & PHY parameters (can be different from vendor A)
10-14	C	<ul style="list-style-type: none">• Several PHY types per vendor• No standard: vendor C defines its PHY & PHY parameters (can be different from vendor A and B)
15-19	D	<ul style="list-style-type: none">• Several PHY types per vendor• No standard: vendor D defines its PHY & PHY parameters (can be different from vendor A,B and C)
20-24
25-29
...

Support legacy devices with 802.15.4g PHY

802.15.4g devices receiving frames from legacy device



Advantages

1. Minimum impact on standard development
 - ✓ minimum on-air cost, minimum complexity and can be ignored where not necessary
2. Does not require “bridging everywhere” to support legacy devices
 - ✓ where possible just over-the-air upgrade the legacy devices
3. Opens up for multi-vendor interoperability
 - ✓ open platform by stacking up multi-vendor protocols on top of a common PHY (and MAC)
4. Provides extensibility
 - ✓ further versions of the 802.15.4g PHY standard (different modulation) can be supported