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

Submission Title: [Mode Switching Mechanisms and Frame Structure]
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Abstract: The mode switch mechanisms are part of the Channel Page/Generic PHY FSK subgroup. This presentation proposes the format for the mode switch packet for TG4g as well as the mechanisms necessary to support mode switching

Purpose: Presented to the 802.15.4g SUN Task Group for consideration

Background

- In the MR FSK PHY, the first bit of the PHR is a Mode Switch bit
- If the Mode Switch bit is set:
  - It indicates a mode switch frame precedes the normal frame
  - The normal frame is transmitted using a different mode (data rate and/or modulation scheme) from the mode switch frame
- The mode switch header and frame have not yet been defined in the draft text
- This presentation proposes the definition of the mode switch frame and supporting structures

Define PIB Attributes to Support Mode Switching

- *phyModeSwitchParameterEntries*: An array of 4 rows where each row consists of a set of mode switch descriptors
- Mode Switch Descriptors:
  - *settlingDelay*: The settling delay between the mode switch frame and the secondary PPDU transmitted using the new PHY mode. Range = 0 – 255 µsec.
  - *secondaryPreambleLength*: The number of preamble repetitions for the secondary preamble. Range = 0-255 octets.
  - *secondarySFD*: Type = Boolean. True indicates a secondary SFD is transmitted.
- Add a PD-DATA.request parameter to specify the mode switch parameter entry [0-3] used for the current transmission. Valid if PD-DATA.request ModeSwitching = TRUE

PIB Attributes to Support Mode Switching

- Four entries allow different mode switch parameters based on the type of mode switch operation. For example, the four entries could be set as follows:
  - *phyModeSwitchParameterEntries[0]* = FSK → FSK
  - *phyModeSwitchParameterEntries[1]* = FSK → 4-FSK
  - *phyModeSwitchParameterEntries[2]* = FSK → OFDM
  - *phyModeSwitchParameterEntries[3]* = FSK → DSSS

Proposed Mode Switch Packet

- PHR when Mode Switch = 1:

Octets:	variable	2	2			
Bits:	variable	16	1	2	8	5
Field:	Preamble	SFD	Mode Switch = 1	ModeSwitch ParameterEntry	New Mode	ModeSwitch FEC
	SHR		PHR			

  - ModeSwitchParameterEntry: the index of the entry in the *phyModeSwitchParameterEntries* array that defines the mode switch parameters to be used
  - NewMode: Per document #155 rev 0, the new PHY mode

Page	Freq Band	Mod Scheme	Mode
1 bit *	5 bits	2 bits	5 bits

* Selects page 7 or 8

Proposed Mode Switch Packet (2)

- PHR when Mode Switch = 1:

Octets:	variable	2	2			
Bits:	variable	16	1	2	8	5
Field:	Preamble	SFD	Mode Switch = 1	ModeSwitch ParameterEntry	New Mode	ModeSwitch FEC
	SHR		PHR			

  - ModeSwitch FEC: A BCH(15,11) or Hamming(15,11) single error correcting code, plus a parity bit for double error detection.

Mode Switch Mechanism

- When a valid Mode Switch frame is received, the device will change its mode to the new mode defined in the Mode Switch frame
- The settling delay (between the mode change frame and the following frame transmitted with the new mode), the secondary preamble, and the secondary SFD are optional and can be set based on the type of mode change
- The channel number and frequency band are not changed by the mode switch

Channel Alignment to Support Mode Switching

- Channels (as defined by channel center frequencies) align to support mode switching. 915 MHz band shown as an example:

  - FSK – 200/400 kHz channel spacing
  - DSSS – 2 MHz channel spacing
  - OFDM – supports 400 kHz channel spacing

FSK (200 kHz)	FSK (400 kHz)	DSSS	OFDM
902.2			
902.4	902.4		902.4
902.6			
902.8	902.8		902.8
903.0			
903.2	903.2		903.2
903.4			
903.6	903.6		903.6
903.8			
904.0	904.0	904.0	904.0
904.2			
904.4	904.4		904.4
904.6			
904.8	904.8		904.8
905.0			
905.2	905.2		905.2
905.4			
905.6	905.6		905.6
905.8			
906.0	906.0	906.0	906.0
906.2			
906.4	906.4		906.4
906.6			
906.8	906.8		906.8
907.0			
907.2	907.2		907.2
907.4			
907.6	907.6		907.6
907.8			
908.0	908.0	908.0	908.0
908.2			
908.4	908.4		908.4
908.6			
908.8	908.8		908.8
909.0			
909.2	909.2		909.2
909.4			
909.6	909.6		909.6
909.8			
910.0	910.0	910.0	910.0
:	:	:	:
etc	etc	etc	etc

Mode Switch Example

Octets:	variable	2	2			
Bits:	variable	16	1	2	8	5
Field:	Preamble	SFD	Mode Switch = 1	Mode Switch Parameters	New Mode	ModeSwitch FEC
	SHR		PHR			

Settling Delay (0-255 µsec)	New Preamble (0-255 repetitions)	2	2			variable	2 or 4
		16	1	4	11	variable	16 or 32
		Optional SFD	Mode Switch = 0	Other Header	Length	Payload	CRC
			PHR			PSDU	

Preamble and the following PPDU are transmitted using the new mode

Questions?