IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)
Title	Supporting Text for Mode Switch (Switching) Comment Resolutions
Date Submitted	September 2010
Source	[Kuor-Hsin Chang, Bob Mason] Voice: [ ] Fax: [ ] Company [Elster Solutions] E-mail: [kuor-hsin.chang@us.elster.com, robert.t.mason@us.elster.com]
Re:	Mode Switching (Switching) Comment Resolutions for LB51
Abstract	This document proposes resolutions to address comments submitted against letter ballot 51 (TG4g) that are related to PHY mode switching.
Purpose	Propose resolution text for comments submitted against the TG4g letter ballot.
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TG4g (LB 51) Comment Resolution:
This document proposes resolutions for the following TG4g comments:

Proposed changes to the 802.15.4g amendment:

Section 6.2.1.1.1

Add the following parameters to the end of the list:

        ModeSwitch, (change this from ModeSwitching to ModeSwitch)
        NewModeSunPage,
        ModeSwitchParameterEntry

In Table 8 – PD-DATA.request parameters, change the name from ModeSwitching to ModeSwitch and update the descriptions as shown:

Name	Type	Valid Range	Description
ModeSwitch	Boolean	TRUE or FALSE	• A value of TRUE instructs the PHY entity to send a mode switch PPDU first then a following PPDU that contains the PSDU using the associated mode switch parameters. Both PPDUs are transmitted on *phyCurrentChannel*. The mode switch PPDU is transmitted using the PHY mode specified by *phyCurrentSUNPageEntry*. The PPDU containing the PSDU is transmitted using the PHY mode specified by NewModeSunPage. A value of FALSE instructs the PHY to send the PSDU in a single PPDU using the PHY mode specified by *phyCurrentSUNPageEntry* on *phyCurrentChannel.*
NewModeSunPage	Integer	See section 6.1.2.5a.1	The Sun channel page for the PPDU transmitted in the new mode (after the mode switch PPDU). This parameter is only valid if ModeSwitch = TRUE.
ModeSwitchParameterEntry	Integer	0-3	The mode switch parameter entry specifies the index in the *phyModeSwitchParameterEntries* array for the ModeSwitchDescriptor to be used for this PHY mode switch. This parameter is only valid if ModeSwitch = TRUE.

Editor's note: Replace Clause 6.3a.1.4 PHR for mode switch packet with the following text and table.

6.2.1.1.3 Effect on receipt
Change the first paragraph of 6.2.1.1.3 as indicated:

The receipt of the PD-DATA.request primitive by the PHY entity will cause the transmission of the supplied PSDU to be attempted on the channel specified by the TxChannel parameter. Provided the transmitter is enabled (TX_ON state) and the transmit channel specified by the TxChannel parameter is supported, if ModeSwitch is FALSE the PHY will first construct a PPDU, that contains the supplied PSDU, and then attempt to transmit the PPDU. If ModeSwitch is TRUE, the PHY entity will construct a mode switch PPDU and a following PPDU containing PSDU, then attempt to transmit the mode switch PPDU and the following PPDU consecutively, as shown in Figure 00, using TxChannel.
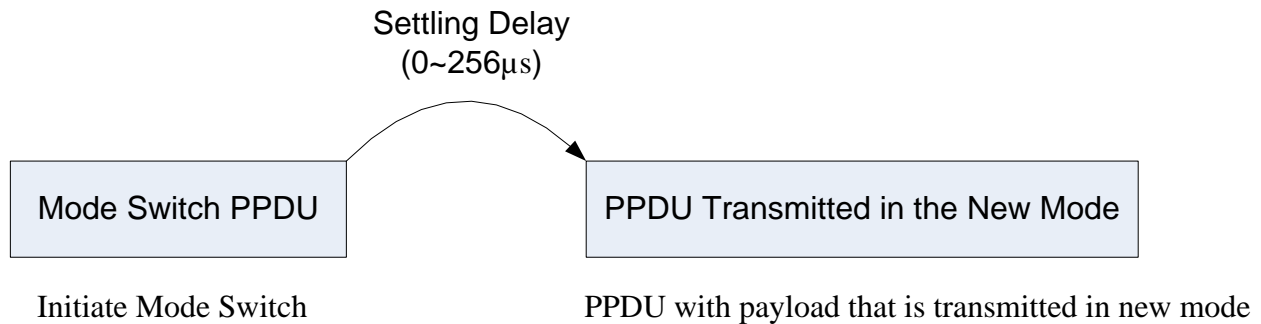
Settling Delay
(0~256μs)

| Mode Switch PPDU | PPDU Transmitted in the New Mode |

Initiate Mode Switch   PPDU with payload that is transmitted in new mode

Figure 00 Transmitting sequence between Mode Switch PPDU and the following PPDU

6.2.1.2.2 When generated
Change the paragraph as indicated:

The PD-DATA.confirm primitive is generated by the PHY entity and issued to its MAC sublayer entity in response to a PD-DATA.request primitive. The PD-DATA.confirm primitive will return a status of either SUCCESS, indicating that the request to transmit was successful, if ModeSwitch is TRUE this means both the mode switch PPDU and the following PPDU were transmitted successfully, or an error code of RX_ON, TRX_OFF, or BUSY_TX, UNSUPPORTED_TX_CHANNEL, UNSUPPORTED_PPDU_FEC, or UNSUPPORTED_MODE_SWITCHING.

6.3a.1.4 PHR for mode switch packet

The format of the PHR is shown in Figure 27d. All multi-bit fields are unsigned integers and shall be processed MSB first.

Bit string index	0	1	2	3	4…10	11…14	15
Bit mapping	MS	M1	M0	FEC	See Figure 27e	$B_3…B_0$	PC
Field name	Mode Switch	Mode Switch Parameter Entry		New Mode FEC	New Mode	Checksum	Parity Check

Figure 27d-Format of the PHR for MR-FSK mode switching

The Mode Switch field (MS) shall be set to one, indicating that a mode switch shall occur. The mode of the next PPDU transmitted shall be as described by the remaining fields contained in the PHR.

The Mode Switch Parameter Entry field (M1–M0) is the index to an entry in the *phyModeSwitchParameterEntries* array (see Table 31) that defines the mode switch parameters (see Table 31b) to be used.

The New Mode FEC field (FEC) specifies whether the packet following the mode switch PPDU is transmitted using FEC. A value of zero indicates that the new mode packet is transmitted without FEC, and a value of one indicates that it is transmitted with FEC. If the new mode packet has an SFD (and, therefore, information controlling whether the PPDU is coded or uncoded) (6.12a.1.3), that SFD shall override this value of the New Mode FEC field.

The New Mode field is formatted as shown in Figure 27e. The Page bit (PAGE) shall be set to zero to indicate channel page 7 or set to one to indicate channel page 8. The Modulation Scheme bits (MOD1–MOD0) indicate the modulation scheme (see Table 4b) when *phyCurrentChannel* equals seven; when *phyCurrentChannel* equals eight, the Modulation Scheme bits are not used. The Mode bits (MD3–MD0) specify the new mode of operation. When the PAGE field is zero (channel page 7), the interpretation of the MODE field (MD3-MD0) is based on the Modulation Scheme.

- If Modulation Scheme equals FSK, the integer value of MD3-MD0 corresponds to the bit position in the Page "Standard Defined PHY Modes" field.
- If Modulation Scheme equals OFDM, the integer value of (MD3-MD0) plus one defines the OFDM Option (1-5) for the new mode.

If Modulation Scheme equals O-QPSK-DSSS or O-QPSK-MDSSS, only one bit in Mode field shall be set, and the set bit corresponds to the bit position in the Rate Modes supported field.

Bit string index	4	5	6	7…10
Bit mapping	PAGE	MOD1	MOD0	MD3…MD0
Subfield name	Page	Modulation Scheme		Mode

Figure 27e-Format of the New Mode field

The Checksum field is the checksum for the BCH(15,11) code (B_3–B_0). The generator polynomial for the BCH code is shown in $G(x) = 1 + x + x^4$ (1)

:

$$G(x) = 1 + x + x^4 \quad (1)$$

The Parity check (PC) field provides error detection for the mode switch PPDU. The value of PC is calculated from Equation (2):

$$PC = MS \oplus M0 \oplus M1 \oplus FEC \oplus PAGE \oplus MOD0 \oplus MOD1 \oplus MD0 \oplus MD1 \oplus MD2 \oplus MD3 \quad (2)$$

where addition is modulo-2 addition (addition over GF(2)). The combination of the BCH(15,11) code and one parity bit allows for the achievement of single error correction and double error detection over the 11 bits of information in the mode switch PPDU.

Table 4b—Modulation scheme representation

Modulation scheme identifier (binary) (b_{21} b_{20})	Description
0 0	FSK/GFSK
0 1	OFDM
1 0	O-QPSK-DSSS
1 1	O-QPSK-MDSSS

Editor's note: Replace Clause 6.12a.3 Mode switch mechanism with the following text and table

6.12a.3 Mode switch mechanism

The mode switch mechanism is optional.

When a valid mode switch packet is received, namely the Mode Switch subfield is set to one, a device that supports mode switching shall change its mode of operation to the new mode defined in the mode switch packet in order to receive the following frame. Once the reception of the following frame is completed, the mode of operation of the receiver goes back to its previous mode.

When changing from the current operating mode to the new mode, a settling delay, secondary preamble and/or secondary SFD may exist. These parameters are elements of a ModeSwitchDescriptor. The value specified in the Mode Switch Parameter Entry field of the PHR (**Error! Reference source not found.**) is the index of the PIB attribute array *phyModeSwitchParameterEntries*, which contains the elements of the ModeSwitchDescriptor (**Error! Reference source not found.**). How the Mode Switch Parameter Entry field maps to *phyModeSwitchParameterEntries* is illustrated in Figure 65ii. The Mode Switch Parameter Entry table is defined by the NHL.

phyMode SwitchParameterEntries[ ]	Mode Switch Operation	ModeSwitchDescriptor		
		Settling Delay	secondary Preamble Length	Secondary SFD
0	FSK->FSK	20	0	FALSE
1	FSK->4FSK	40	0	FALSE
2	FSK->OFDM	160	0	FALSE

| 3 | FSK->O-QPSK-DSSS | 80 | 8 | TRUE |

Figure 65ii Mapping between *phyModeSwitchParameterEntries[]* and ModeSwitchDescriptor

The channel number and frequency band are not changed by the mode switch mechanism. Channel alignment shall be assumed during mode switch operation. An example of channel alignment for SUN PHYs is shown in **Error! Reference source not found.**.

7.1.1.1.1 Semantics of the service primitive

Add the following parameters to the end of the MCPS-DATA.request list:

TxChannel,
PPDUCoding,
FCSLength,
ModeSwitch, (change this from ModeSwitching to ModeSwitch)
NewModeSunPage,
ModeSwitchParameterEntry

In Table 77 – MCPS-DATA.request parameters, add the following parameters to the end of the table:

Name	Type	Valid Range	Description
TxChannel	Integer	0–65535	The channel on which to send the PPDU.
PPDUCoding	Enumeration	0, 1	A value of 0 indicates that the (PHR+PSDU) is uncoded, and a value of 1 indicates that the (PHR+PSDU) is coded as a single block of data.
FCSLength	Enumeration	SHORT_FCS, LONG_FCS	The length of the FCS contained in the PSDU to be transmitted. A value of SHORT_FCS indicates a 16
ModeSwitch	Enumeration	0, 1	A value of 1 instructs the PHY entity to send a mode switch PPDU first then a following PPDU that contains the PSDU using the associated mode switch parameters. Both PPDUs are transmitted on *phyCurrentChannel*. The mode switch PPDU is transmitted using the PHY mode specified by *phyCurrentSUNPageEntry*. The PPDU containing the PSDU is transmitted using the PHY mode specified by NewModeSunPage. A value of 1 instructs the PHY to send the PSDU in a single PPDU using the PHY mode specified by *phyCurrentSUNPageEntry* on *phyCurrentChannel*.
NewModeSunPage	Enumeration	0, 1	The Sun channel page for the PPDU transmitted in the new mode (after the mode switch PPDU).

			A value of 0 indicates the channel page for the new mode is seven. A value of indicates the channel page for the new mode is eight. This parameter is only valid if ModeSwitch = TRUE.
ModeSwitchParameter Entry	Integer	0-3	The mode switch parameter entry specifies the index in the *phyModeSwitchParameterEntries* array for the ModeSwitchDescriptor to be used for this PHY mode switch. This parameter is only valid if ModeSwitch = TRUE.