IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)	
Title	**MAC and Misc. comment resolutions**	
Date Submitted	[22 June, 2006]	
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Re:	[]	
Abstract	[This document is a record of comment resolutions and text for the MAC sublayer and the collection of comments not addressed elsewhere. It includes scan and maximum frame time on air. The comments are from LB34 but also include a few comments unaddressed from LB33.]	
Purpose	[To provide a record of the proposed changes to D2 of the WG recirculation letter ballot as a result of comments received from LB34.]	
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CID 55, 89 -- On the topic of calculating parameters macAckWaitDuration and macMaxFrameTotalWaitTime for the UWB PHY types. This document contains the structured changes based on the content of document 06/276r2 as authored by Ben Rolfe and Zhen Bin.

Proposed Text Changes

7.4.2 MAC PIB attributes

Insert the following after the last paragraph in this subclause:

For the UWB PHY, where there the CCA method is ALOHA, the formula for *macAckWaitDuration* reduces to

macAckWaitDuration = aTurnaroundTime phy + SHRDuration + ceil(6* *phySymbolsPerOctet*);

Where SHRDuration is calculated as shown in sub-clause 6.4.2.1. This form also works for the UWB PHY with optional CCA mode, as explained in 6.4.2.1.

For UWB PHY types, *macMaxBE*, *macMaxCSMABackoffs* amd *m* in {equation 16 - seems wrong} become zero, so the formula reduces to:

macMaxFrameTotalWaitTime = phyMaxFrameDurationUs

where *phyMaxFrameDuationUs* is also given in section 6.4.2.1

Change rows in table Table 23-PHY PIB attributes

Table 1—

Attribute	Identifier	Type	Range	Description
phyMaxFrameDuration†	0x05	Integer	53, 206, 258, 1032	The maximum number of symbols in a frame. For all non-UWB PHY ypes: =phySHRDuration +ceiling([aMaxPHYPacketSize + 1] * phySymbolsPerOctet) For UWB PHY types, see subclause 6.4.2.1
phySHRDuration†	0x06	Integer	3, 7, 10, 40	The duration of the synchronization header (SHR). For non-UWB PHYs types, constant in symbols for the current PHY. For UWB PHY types

6.4.2 PHY PIB attributes

Insert the following subclause:

6.4.2.1 PIB values *phyMaxFrameDuration*, *phySHRDuration* for UWB

For the UWB PHY types, the values for these PIB attributes varies depending upon the UWB PHY operating mode. The symbol duration varies by data rate and is different for preamble symbols and body symbols. Also note that the preamble and PHY header are sent at a different data rate than the body.

$$phyMaxFrameDuration\mu s = T_{preamble} + T_{PHR} + T_{body} + T_{CCApreamble}$$

$$T_{preamble} = [T_{psym\mu s} \bullet (N_{preambleSymbols} + N_{DSym})] \bullet F_{DRpreamble}$$

$$T_{PHR} = N_{PHRsym} \bullet T_{psym\mu s} \bullet F_{DRpreamble}$$

$$T_{body} = \left[T_{dsym\mu s} \bullet \frac{N_{PPDUoctets} \bullet N_{symPerOctet}}{R_{FEC}} \right]$$

$$T_{CCApreamble} = \left[T_{psym\mu s} \bullet 8 \bullet (N_{PHYHDR} + N_{PPDUoctets}) \bullet \frac{T_{dsym}}{4 \bullet T_{dCCAsym}} \right]$$

where

$T_{psym\mu s}$ = Base symbol time, microseconds, for preamble and header, see Table 39c

$T_{dsym\mu s}$ = Payload data rate, microseconds, see Table 39a

$T_{dCCAsym\mu s}$ = default CCA symbol duration, microseconds, see Table 39a

$N_{preambleSymbols}$ = {32, 256, 4096} symbols

N_{DSym} = Number of delimiter symbols= $\begin{pmatrix} 8 \text{ for 100 Kb/s data rate} \\ 1 \text{ for other data rates} \end{pmatrix}$

N_{PHYHDR} = 2

$N_{PPDUoctets}$ = number of octets in PHY protocol data unit (payload)

$N_{symPerOctet}$ = Symbols per octet, uncoded = 16

R_{FEC} = overall FEC rate = 0.44

$F_{DRpreamble}$ = $\begin{pmatrix} 8 \text{ for 100 Kb/s data rate} \\ 1 \text{ for other data rates} \end{pmatrix}$

The values for T_{psym} and T_{dsym} are given in tables 39a and 39c in picoseconds, expressed above as T_{dsymus} and $T_{dsym\mathbf{u}s}$ in microseconds. The value of $T_{\_d\_CCAsym}$ is the nominal data rate of 1Mbps which is listed as follows (from Table 39a), in microseconds.

Table 2—

Channel number	Data symbol duration Tdsym (ns)	Symbol Rate (Mbps)
{0:3, 5,6, 8:10, 12:14}	1025.64	0.98
4, 11	769.23	1.30
7	946.75	1.06
15	755.74	1.32

The PHY parameter SHRDuration is given by the above formula as

SHRDuration = $T_{preamble} + T_{PHR}$

CID ??? Additions to CL3 and CL4

The following address the CSS PHY

Chirp Linear frequency sweep (frequency may either increase or decrease)

CSS Chirp Spread Spectrum

Sub-band Frequency band which can be either lower or upper half of the total occupied band

Sub-chirp Chirp signal with amplitude shaping which occupies one of the two sub-bands

Sub-chirp sequenceSequence of 4 sub-chirps

Chirp symbolOne sub-chirp sequence followed by a time gap

DQPSK Differential Quadrature Phase Shift Keying

CSK Chirp Shift Keying. The phases of subsequent chirps are modulated.

DQCSK Differential Quadrature Chirp Shift Keying. The phases of subsequent chirps are modulated with DQPSK values.

CID 93 - insert the following definition

Solver - The solver is that node in a ranging network that computes relative positions from timestamp reports.

CID 90 - definition of complex channel - the comment requests PRF to be included. Other text would indicate that the complex channel is the channel and code only.

Complex channel - A combination of channel (RF center frequency) and a preamble code.

CID 65

A standard compliant UWB PHY need only support:

- one single band;
- one mandatory center frequency;
- one mandatory data rate;
- one mandatory bandwidth;
- one waveform;
- one chipping rate;
- with no special support for CCA;
- and with no support for FEC when receiving.

The compliant PHY does have to support 2 preamble codes, but using only one mandatory preamble symbol length.