IEEE 802.11
Wireless Access Method and Physical Layer Specifications

Preliminary List of Static Elements for the Common PHY MIB

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Abstract

This document presents a preliminary list of elements that may be appropriate for the MIB used by the 802.11 MAC to obtain the PHY–specific parameters relevant to MAC operation.

1. Introduction

This document was generated for the purpose of surfacing issues and promoting progress toward definition of a common MIB that can describe all PHYs to the degree necessary for the 802.11 MAC to operate over any of these PHYs. This document is **neither** a complete definition of this interface **nor** a carefully constructed proposal. This document was generated as a result of discussions that took place at the MAC/PHY Interface Ad–Hoc meeting on Tuesday, March 8, 1994. The objective of releasing this document to the full 802.11 Working Group is to serve as a starting point to determine:

- Which elements are missing from this list that are required by the 802.11 MAC,
- which elements are present on this list that are unnecessary for use by the 802.11 MAC,
- which elements on this list are necessary, but are improperly defined, and
- what initial values for the necessary elements should be specified for each of the PHYs.

This list is a (mildly edited) aggregation of PHY parameters identified in several sources:

- The Foundation MAC Tutorial (document 94/57),
- Physical Layer Draft Specification for 2.4GHz Frequency Hopping Spread Spectrum Media (document 94/68), and
- MAC/PHY Interface From a DS Standpoint (document 94/61);
- As well as some parameters this author believes to be important based on experience implementing a protocol controller for a wireless MAC similar to the 802.11 Foundation MAC protocol over an RF modem that presents an interface similar to that described in document 94/61.

The PHY MIB will need to contain both static parameters and dynamic parameters. This document only deals with the static parameters, which are listed in Table 1. Entries in this table are defined, where possible, in terms of the description of the PHY service primitives presented in document 94/68. It is recognized that this is not an approved MAC/PHY interface definition, but is the most recent and most precisely–specified such interface available at the present time. Several cases exist where it is not clear that this set of service specifications are sufficient to define some of the necessary parameters, especially in relationship to **time**. A number of questions and areas where this author was uncertain how to interpret document 94/68 and had to make assumptions, are presented in ***sans–serif, bold, italic font***.

TABLE 1
STATIC ELEMENTS OF PHY MIB NEEDED BY MAC

NAME	TYPE	UNITS	USAGE
PHY_TYPE	byte[2]		Codes that identify the type of PHY. The first element indicates the general type of PHY (FH, DS, IR, etc.), while the second element specifies the particular PHY. ***{code values need to be assigned}***
BIT_TIMES	integer[2]	nsec	Times to transmit one bit on the medium at the common and alternate signaling rates. The first element defines the bit time used for all PHY headers. The second element defines the bit time used for the remainder of the PhPDU when the PHY header specifies that the portion of the PhPDU following the PLCP header is at the alternate bit rate. ***{This assumes that there are not more than 2 signaling rates available, and that dynamic switching of signaling rates is possible .}***
MDPU_LENGTH_LIMITS	integer[4]	octets	The minimum and maximum values that may be used for the LENGTH parameter in PHY_DATA.request and PHY_DATA.indicate. Hence, the minimum and maximum numbers of octets in an MPDU. There are two sets of these (max,min) values, because there may be different limits for the common and alternate signaling rates.
FREQ_CHANNELS	integer		Number of MAC–selectable frequency channels available. Set =1 for single–channel PHYs.
CHAN_SWITCH_TIME	integer	µsec	Maximum time to accomplish channel switching. (For the FHSS PHY, this is the time from PHY_FREQHOP.request until PHY_FREQHOP.confirm.) ***{This assumes that it is permissible for MAC to generate a PHY_DATA.request immediately after receiving a PHY_FREQHOP.confirm; or, if no such PHY_DATA.request is issued, that it is possible to get a PHY_CS.indicate (BUSY) as early as one CCA_RESPONSE time after the PHY_FREQHOP.confirm.}***
{other channel switching parameters that might be necessary}	***<tbd>***	***<tbd>***	***{Does there need to be separate time values for channel switching immediately before entering or after leaving TxState and for channel switching immediately before entering or after leaving CsState or RxState?}***

TX_PWR_LEVELS	integer	***(mW?)***	The number of transmit power levels selectable by MAC on a per–frame basis. The permissible range for the TXPWR parameter of PHY_DATA.request is 0 through the value of this entry. ***{Is there any benefit in defining this parameter to be in some power measurement unit, such as mW?}***
RX_SIG_LEVELS	integer[3]		The number of levels available for PHY to report the received signal level and quality on a per–frame basis. The allowable ranges for the signal level (RSSI), signal quality (SQ), and silence level parameters of PHY_DATA.indicate are 0 through the value of the respective element of this entry. For signal level status not available from a particular PHY, the corresponding element value is =0.
MEDIUM_ASSESS_TIME	integer[2]	µsec	The minimum and maximum times from entry into CsState or of an antenna switch at which a change in the state of PHY_CS.indicate can occur, assuming the corresponding change in the state of the medium occurred no later than the start of this measurement interval. ***{If this medium assessment time is different when the change is being sensed after CsState and antenna selection are stable, there may be a need for and additional pair of times, but the overall best and worst cases are likely to be sufficient.}***
CCA_RESPONSE_TIME	integer[2]	µsec	Minimum and maximum times from a detectable change in medium status (while the PHY is in CsState or RxState) until the corresponding PHY_CS.indicate. The detection of these changes in medium status must be based upon receiver energy detection and/or signaling content, not upon decoding and validation of framing information. Any antenna switching and diversity processing needed to assess medium state is included in these values.
CCA_UPDATE_INTV	integer	µsec	Minimum time between changes of PHY_CS.indicate. If the PHY provides updates "continuously" (more frequently than once per microsecond) this value is =0. ***{Are there differences in the CCA update interval and/or CCA sensitivity during frame reception and between frames? If so, these differences probably need to be parameterized and added to the MIB.}***
CCA_THLD_LEVELS	integer	***(dBm?)***	Number of discrete levels to which the MAC can set the CCA threshold. For PHYs with a fixed CCA threshold, this value is =0.

{other medium status parameters that might be necessary}	***<tbd>***	***<tbd>***	***{Does there need to be a set of CCA parameters for more than one type of medium assessment mechanism?}***
PWR_ON_DELAY	integer	µsec	Maximum time from PHY power–on ***{the provision of DC power to PHY?}*** until PHY operational ***{PHY in CsState or standby state?}.***
PWR_OFF_DELAY	integer	µsec	Maximum time from PHY power–off ***{the removal of DC power to PHY?}*** until PHY is fully inactive and PHY power–on may be initiated.
FROM_STBY_DELAY	integer	µsec	Maximum time from MPMD_PWRMGMT.request (ON) until PHY is ready to operate. (For the FHSS PHY "ready to operate" appears to be MPMD_SYNLOCK.indicate(LOCKED).)
TO_STBY_DELAY	integer	µsec	Maximum time from MPMD_PWRMGMT.request (OFF) until PHY is in standby state and a MPMD_PWRMGMT.request (ON) may be issued.
STANDBY_PWR	integer	mW	***(Typical?)*** DC power consumption of PHY while in standby state.
TRANSMIT_PWR	integer	mW	***(Typical?)*** DC power consumption of PHY while in TxState.
RECEIVE_PWR	integer	mW	***(Typical?)*** DC power consumption of PHY while in RxState.
CS_PWR	integer	mW	***(Typical?)*** DC power consumption of PHY while in CsState.
TX_RX_DELAY	integer[2]	µsec	Maximum and minimum times between the point that the PMD ceases placing energy onto the medium at the end of a transmission by a station and the earliest possible occurrence of PHY_RXBUSY.indicate (BUSY) at the same station due to detection of the PLCP header of a subsequent frame. Both the maximum duration and the permissible station–to–station variation in duration of this delay is of relevance to the MAC. ***{Does PHY_TXBUSY.indicate (IDLE) occur when the PMD ceases placing energy onto the medium?}***
RX_TX_DELAY	integer[2]	µsec	Maximum and minimum times between PHY_RXBUSY.indicate (IDLE) at the end of a reception by a station and the earliest time at which the MAC at the same station is permitted to issue a PHY_DATA.request. ***{Does PHY_RXBUSY.indicate (IDLE) occur when the PMD receives the last octet of the PhPDU from the medium?}***

TX_CS_DELAY	integer[2]	µsec	Maximum and minimum times between the point that the PMD ceases placing energy onto the medium at the end of a transmission by a station and the beginning of the interval during which the PHY at the same station is able to begin the "carrier sense" function and therefore able be the start of the CCA_RESPONSE time. ***{Does PHY_TXBUSY.indicate (IDLE) occur when the PMD ceases placing energy onto the medium?}***
RX_CS_DELAY	integer[2]	µsec	Maximum and minimum times between PHY_RXBUSY.indicate (IDLE) at the end of a reception by a station and the beginning of the interval during which the PHY at the same station is able to begin the "carrier sense" function and therefore able be the start of the CCA_RESPONSE time. ***{Does PHY_RXBUSY.indicate (IDLE) occur when the PMD receives the last octet of the PhPDU from the medium?}***
TX_PROP_DELAY	integer[2]	µsec	Maximum and minimum times from the PHY_DATA.request until the first bit of the MPDU is transmitted on the medium. ***{This is not really the "TX modem delay," but is an interval that can be specified with events that are available in document 94/68, which does not provide an octet-oriented data interface between MAC and PHY.}***
RX_PROP_DELAY	integer[2]	µsec	Maximum and minimum times from the receipt of the first bit of an octet from the medium and **<TBD>**. ***{It is unclear which events can be used to define the "RX modem delay" in the model from document 94/68, which does not provide an octet-oriented data interface between MAC and PHY. Perhaps this parameter should be the delay between the receipt of the last bit of the Start Frame Delimiter from the medium and the occurrence of PHY_RXBUSY (BUSY).}***
NUM_ANTENNAS	integer[2]		The number of antennas that can be used for transmission (first element, the maximum value of ANTSEL in a PHY_DATA.request) and for reception (second element, the maximum value of ANTSEL in a PHY_DATA.indicate).

ANT_SWITCH_DELAY	integer	µsec	Maximum time from occurrence of a PHY_DATA.request that specifies a change in the selected antenna until the antenna selection is accomplished by PHY. For PHYs without MAC–selectable antennas, this value is =0. ***{It is unclear whether this parameter is relevant with a MAC/PHY interface of the type defined in document 94/68.}***
{other antenna related parameters that may be necessary}	***<tbd>***	***<tbd>***	***{Considerable discussion has taken place regarding the possibility of beneficial use, within the MAC, of channel state information from each available antenna, not only the antenna selected by the PHY as "best."}***
PLCP_FRAMING_BITS	integer[2]	bits	Number of bits added before and after MPDU for transmission on medium. The first element is the number of bits in the PLCP preamble plus the PLCP header. The second element is the number of bits in the PLCP postamble.
STUFFING_FACTOR	integer[2]	bits	The factor by which the MPDU is expanded, in a non–payload–dependent manner, by the PHY for transmission on the medium. These two elements define a ratio: For each STUFFING_FACTOR[2] bits of the MPDU, the PHY adds STUFFING_FACTOR[1] bits to the PhPDU.