IEEE 802.11
Wireless Access Method and Physical Specification

Title: **Proposed Starting Point for Section 8 Edit**

Date: July 10, 1995

Author: Dean Kawaguchi
Symbol Technologies, Inc.
2145 Hamilton Ave.
San Jose, CA. 95125
Voice: (408)369-2629
FAX: (408)446-4630
email: DeanK@psd.symbol.com

This submission is a proposed starting point for editing Section 8. The most significant change was clearing up the inconsistencies of the PHY_DATA primitive classes, data types, and acceptable combinations. The new text in this submission reflects the vote which accepted the classes as defined by 94/241, which was a joint submission of the FH, DS, and IR PHY editors. In addition, a number of editorial changes has been made to clarify the text without changing the intent of the previous text. A number of technical comments made on this section has not been addressed in this submission. These will hopefully be addressed in the July 95 meeting.

8.   Physical Service Specification

This section specifies the services and interactions provided by the Physical (PHY) layer to the Medium Access Control (MAC) layer.

> a) ~~by Physical layer (PhL) to Medium Access Control (MAC) - MAC being a sublayer of the Data Link Layer (DLL);~~
> b) ~~by PhL to MAC;~~
> c) ~~Other (TBD).~~

8.1. Detailed Service Specifications

All primitives are specified in an exemplary form only. Each service defines the primitive and the required information that shall be passed between the MAC and PHY entities.

8.1.1. ~~Ph-~~PHY_DATA.~~-~~request

This primitive defines the transfer of data from the MAC entity to the PHY~~Ph~~ entity.

~~Ph-~~PHY_DATA.~~-~~request (Class, Data)

Class. This parameter specifies the Ph interface control information component of the Physical Service ~~Ph Interface~~ Data Unit (PSDU~~PhIDU~~). ~~The possible values are:~~

> a) ~~START-OF-ACTIVITY - request transmission of PhPDU (i.e. preamble and Ph headers) prior to Ph user data transmission.~~
> b) ~~DATA - request the transfer of the associated single octet 'Data' parameter.~~
> c) ~~END-OF-DATA-AND-ACTIVITY - request:~~
> d) ~~transmission of the PhPDU terminating the Ph user data transfer immediately following the last Ph data user transfer.~~
> e) ~~cessation of active transmission.~~

Data.   This parameter supplies additional information required to execute the specific primitive. In the case of a ~~Ph-~~PHY_DATA.request with class START-OF-DATA~~ACTIVITY~~, it provides specific values for the interface control parameters associated with a specific PHY~~h~~-Layer type. In the case of a ~~Ph-~~PHY_DATA.request with class DATA, it provides the specific value of the user data to be transmitted.

Acceptable Combinations

> a)   class=Start_of_Data, data=TXVECTOR
>   Starts the transmit state machine. TXVECTOR contains the packet length and   other packet control information which are PHY dependent.

> b)   class=Data, data=DATA
>   One octet of MPDU data

> c)   class=End_of_Data, data=NULL
>   Indicates end of data to transmit.

> d)   class=End_of_Activity, data=NULL
>   Resets the PLCP CS/CCA assessment timers to the state appropriate for the end of a received packet. This is generated by the MAC at the end of a NAV timer. This request is used by some PHY implementations which may synchronize antenna diversity switching with the contention backoff timing. The use of this request in the PHY is optional.

8.1.2. ~~Ph~~ PHY_DATA.~~-~~indication

This primitive defines the transfer of data from the PHY~~h~~ entity to the MAC entity.

~~Ph~~ PHY_DATA.~~-~~indication (Class, Data)

Class. This parameter specifies the PHY~~Ph~~ interface control information component of the Physical Service~~Ph Interface~~ Data Unit (PSDU~~PhIDU~~). ~~The possible values are:~~

a) ~~START-OF-ACTIVITY - indicates reception of an apparent transmission from one or more peer Ph entities.~~
b) ~~DATA - indicates that the associated 'Data' parameter was received as part of a continuous correctly structured reception.~~
c) ~~END-OF-DATA - indicates that the continuous correctly structured reception of Ph user data is concluded with correct reception of PhPDU implying end of data.~~
d) ~~END-OF-ACTIVITY - indicates that the ongoing reception (of an apparent transmission from one or more peer Phs) is concluded, with no further evidence of Ph transmission.~~
e) ~~END-OF-DATA-AND-ACTIVITY - indicates the simultaneous occurrence of the end of Ph user data and activity.~~

Data. This parameter supplies additional information required to execute the specific primitive. In the case of a ~~Ph~~ PHY_DATA.indication with class START-OF-ACTIVITY, START-OF-DATA, END-OF-DATA, or END-OF ACTIVITY ~~or END-OF-DATA-AND-ACTIVITY~~, it provides specific values for the interface control parameters associated with a specific PHY~~h~~-Layer type. In the case of a ~~Ph~~ PHY_DATA.indication with class DATA, it provides the specific value of the user data to be transmitted.

Acceptable Combinations

a)   class=Start_of_Activity, data=NULL
     CS/CCA channel busy

b)   class=Start_of_Data, data=RXVECTOR
     Start of the MPDU portion of a packet following a valid SFD and PLCP Header.
     RXVECTOR contains the packet length and other packet information including RSSI.
     RXVECTOR is PHY dependent.

c)   class=Data, data=DATA

d)   class=End_of_Data, data=RXERROR
     End of a received packet. RXERROR contains the condition of the received   packet
     with states including no_error, header_violation, format_violation, carrier_lost.

e)   class=End_of_Activity, data=NULL
     CS/CCA channel idle

8.1.3. ~~Ph~~ PHY_DATA.~~-~~confirm

This primitive is passed from the PHY~~Ph~~ entity to the MAC entity to convey the results from an associated previous service request. The ~~Ph~~ PHY_DATA.~~-~~confirm provides the critical timing feedback to inhibit the MAC from starting a new transmission before the previous one is completed. The final ~~Ph~~ PHY_DATA. confirm~~ation~~ should not be issued until the PHY~~Ph~~ entity has completed the current transmission. After all PHY_DATA.request(Data, DATA), it indicates the PLCP is ready to receive another byte. After the PHY_DATA.request(End_of_Data, NULL), it indicates that transmission is complete.

Ph-PHY_DATA.-confirm (Status)

Status. This parameter specifies either success or the locally detected reason for inferring failure.

Acceptable Combinations

8.1.4. Others

8.2. Overview of Physical Layer Services

8.2.1. General Description of Service Provided

The interface specification proposed provides the following basic services:

a)   Transfer Physical Service~~Layer Interface~~ Data Units (PSDU~~PhIDUs~~) between the <u>Media Access Control (MAC) layer</u> ~~Data Link Layer (DLL)~~ and the Physical <u>(PHY)</u> Layer ~~(PhL)~~ in a manner consistent with ISO 7498 [3].

b)   This specification is intended to insure interoperability between conformant stations of the same Physical Layer type

c)   The intention is to support a variety of different P<u>HY</u>~~h~~'s, using a common medium independent interface. The current defined P<u>HY</u>~~h~~ types are: Direct Sequence Spread Spectrum (DSSS) in the 2.54 GHz ISM Band, Frequency Hopping Spread Spectrum (FHSS) in the 2.54 GHz ISM Band and baseband IR.

d)   In addition to PS<u>h</u>DU's, information regarding the characteristics of the receive signal and current state of P<u>HY</u>~~h~~ Control Parameter Vector are passed across the <u>PHY-MAC</u>~~Ph-DLL~~ interface on a frame by frame basis. There is also the capability for the adjustment of transmission parameters by the <u>MAC</u>~~Data Link~~ Layer on a frame by frame basis. This is in addition to conventional station management information on a per request basis.

8.2.2. Overview of Interactions

The transmission of normal data between Physical (P<u>HY</u>~~h~~) ~~and~~ <u>Media Access Control</u> ~~Data Link~~ (<u>MAC</u>~~DL~~) <u>layer</u> entities takes place via the Physical Service Access Point (<u>PHY</u>~~Ph~~SAP).

The P<u>HY</u>~~h~~ entity determines the timing of all transmissions. When the MAC entity is ready to transmit a <u>Physical Service</u>~~MAC Protocol~~ Data Unit (<u>PSDU</u>~~MPDU~~), it shall pass the <u>PSDU</u>~~MPDU~~ with the concatenated FCS to the P<u>HY</u>~~h~~ entity using a sequence of ~~Ph-~~<u>PHY</u>_DATA.~~-~~request primitives. This sequence of requests consist of a single ~~Ph-~~<u>PHY</u>_DATA.~~-~~request specifying START-OF-DATA<u>ACTIVITY</u>, followed by n consecutive ~~Ph-~~<u>PHY</u>_DATA.~~-~~requests specifying Data (where n defines the packet size (note 1)), and concluded by a single ~~Ph-~~<u>PHY</u>_DATA.~~-~~request specifying END-OF-DATA-~~AND-ACTIVITY~~. The data parameter of the ~~Ph-~~<u>PHY</u>_DATA.request primitive is used to convey specific values of interface control information parameters when the class of the ~~Ph-~~<u>PHY</u>_DATA.request primitive is START-OF-<u>DATA</u>~~ACTIVITY~~.

The P<u>HY</u>~~h~~ entity signals the process completion of each ~~Ph-~~<u>PHY</u>_DATA.~~-~~request primitive and its readiness to accept a new ~~Ph-~~<u>PHY</u>_DATA.~~-~~request with a ~~Ph-~~<u>PHY_DATA.</u>confirm primitive. A ~~Ph-~~<u>PHY</u>_DATA.~~-~~request should not be issued by the MAC entity until a ~~Ph-~~<u>PHY</u>_DATA.~~-~~confirm corresponding to the previous request has been received from the P<u>HY</u>~~h~~ entity.

The P<u>HY</u>~~h~~ entity reports, using the ~~data~~ <u>PHY-SAP</u> ~~(PhSAP)~~, a received <u>PSDU</u>~~MPDU~~ with a sequence of ~~Ph-~~<u>PHY</u>_DATA.~~-~~indication primitives which shall consist of:~~:~~ <u>a single PHY_DATA.indication specifying START-OF-ACTIVITY indicating that the channel is busy, followed by a PHY_DATA.indication specifying START-OF-DATA and indicating a valid PLCP header has been received, followed by n consecutive PHY_DATA.indications specifying DATA, followed by a single PHY_DATA.indication specifying END-OF-DATA and indicating the end of the received frame. The receive sequence is conditionally concluded by a single PHY_DATA.indication specifying END-OF-ACTIVITY if the clear channel assessment following the received packet indicates that the channel is clear.</u>

Under some channel conditions, the PHY_DATA.indication specifying START-OF-ACTIVITY and indicating that the channel is busy may occur without being followed by the reception of an MSDU. The CCA channel busy indication will remain set until the PHY_DATA.indication specifying END-OF-ACTIVITY is issued by the Physical Layer.

a) ~~a single Ph-DATA indication specifying START-OF-ACTIVITY, followed by consecutive Ph-DATA indications specifying DATA, followed by a single Ph-DATA indication specifying END-OF-DATA, and concluded by a single Ph-DATA indication specifying END-OF-ACTIVITY; or,~~

b) ~~a single Ph-DATA indication specifying START-OF-ACTIVITY, followed by consecutive Ph-DATA indications specifying DATA, followed by a single Ph-DATA indication specifying END-OF-DATA-AND-ACTIVITY; or,~~

c) ~~a single Ph-DATA indication specifying START-OF-ACTIVITY which may be followed by one or more consecutive Ph-DATA indications specifying DATA, and concluded by a single Ph-DATA indication specifying END-OF-ACTIVITY (note: this last sequence is indicative of an incomplete or incorrect reception).~~

The PHY~~h~~ entity may also reports a set of PHY~~h~~ specific parameters using the signal parameter vector (i.e. signal quality, channel used, received signal strength etc.). This reporting is synchronous with the reporting of the data on a frame by frame basis and is implemented through the use of the data parameter of the ~~Ph~~HY_DATA.indication primitive when the class is anything other than DATA. In addition, when requested by the Station Management entity, information on the managed objects will be reported by the PHY~~h~~ entity through the Layer Management Entity Service Access Point (LME-SAP).

8.2.3. Basic Services and Options

The PHY~~PhS~~ shall support the transfer of Physical Service~~MAC Protocol~~ Data Units (PSDU~~MPDU~~). The PHY~~PhS~~ shall support a minimum of one~~single~~ channel. Support of additional channels is optional. If more than one channel is implemented, the MAC will be informed about the number of channels and the channel in use by indication passed across the Layer Management Entity~~Ph~~ Service Access Point (LME-SAP). The MAC will be able to change channels using the LME-SAP~~PhSAP~~.

The PHY~~PhS~~ shall support a minimum of one~~single~~ level of transmit power. Support of additional levels is optional. If more than one level is implemented, the MAC will be informed about the number of levels and the level in use by indication passed across the LME-SAP~~PhSAP~~. The MAC will be able to change transmit power levels using the LME-SAP~~PhSAP~~.

PHY~~h~~ entities shall report the received signal strength as a relative indication~~to one threshold level. Support of additional thresholds is optional. If more than one threshold is implemented, the MAC will be informed about the number of thresholds and the value of the threshold, by using the PhSAP. The MAC will be able to change channels using the PhSAP.~~

PHY~~h~~ entities shall implement a jabber control function.