IEEE P802.11
Wireless Access Method and Physical Layer Specifications

Title: **Changes to the Infrared Baseband PHY in draft IEEE p802.11-93/20b3**

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Abstract:

This document proposes changes to the Infrared Baseband PHY described in section 12 of the current draft IEEE P802.11-93/20b3.

What's Wrong:

1. The Infrared Baseband Phy, Section 12 in the current draft IEEE P802.11-93/20b3 has a receiver FOV definition which is difficult to measure.
2. The Infrared Baseband Phy, Section 12 in the current draft IEEE P802.11-93/20b3 has no Transmit Spectrum mask specification.
3. The Infrared Baseband Phy, Section 12 in the current draft IEEE P802.11-93/20b3 has no figure of the Emitter Radiation Pattern mask.

How To Fix It:

1. Redefine receiver FOV specification.
2. Include Transmit Spectrum mask specification.
3. Include Emitter Radiation Pattern mask figure.

Motions:

Resolved, that the proposed text changes in 11-94/256 be incorporated into the draft standard IEEE p802.11-93/20b3, Section 11 in it's next revision by the editors.

12.1. Introduction

12.1.1. Scope

This document describes the physical layer services provided by the 802.11 wireless LAN MAC for the Baseband Infrared (IR) system. The Baseband IR PHY layer consists of two protocol functions as follows:

1. A physical layer convergence function which adapts the capabilities of the physical medium dependent system into the Physical Layer service. This function is supported by the Physical Layer Convergence Procedure (PLCP) which defines a method of mapping the 802.11 MAC layer Protocol Data Units (MPDU) into a framing format suitable for sending and receiving user data and management information between two or more nodes using the associated physical medium dependent system.
2. A Physical Medium Dependent (PMD) system whose function defines the characteristics of, and method of transmitting and receiving data via wireless media between two or more nodes.

Each physical medium dependent sublayer for the Baseband IR PMD may require the definition of a unique PLCP. If the PMD sublayer already provides the defined Physical Layer services, the physical layer convergence function might be null.

12.1.2. Baseband IR Physical Layer Functions

The Baseband IR physical layer contains three functional entities: the physical medium dependent function, the physical layer convergence function, and the layer management function. Each of these functions is described in detail in the following subsections.

The Baseband IR Physical Layer service is provided to the Media Access Control entity at the node through a Service Access Point (SAP) as described in Section 8, Physical Service Specification. For a visual guide to the relationship of the Baseband IR Physical Layer to the remainder of a system, refer to figure 2-11, Portion of the ISO Basic Reference Model Covered in this Standard.

12.1.2.1. Physical Layer Convergence Procedure Sublayer

In order to allow the 802.11 MAC to operate with minimum dependence on the PMD sublayer, a physical layer convergence sublayer is defined. This function simplifies the physical layer service interface to the 802.11 MAC services. The PHY specific preamble is normally associated with this convergence layer.

12.1.2.2. Physical Medium Dependent Sublayer

The physical medium dependent sublayer provides a clear channel assessment mechanism, transmission mechanism and reception mechanism which are used by the MAC via the PCLP to send or receive data between two or more nodes.

12.1.2.3. Physical Layer Management Entity (LME)

The Physical LME performs management of the local Physical Layer Functions in conjunction with the MAC Management entity.

12.1.3. Definitions

This section defines the terms used in this standard. Words in *italics* indicate terms that are defined elsewhere in the lists of definitions

12.1.4. Acronyms

CRC	=	Cyclic Redundancy Check
FCS	=	Frame Check Sequence
IR	=	Infrared
LME	=	Layer Management Entity
MAC	=	Media Access Control
MPDU	=	MAC Protocol Data Unit
PDU	=	Protocol Data Unit
PHY_SAP	=	Physical Layer Service Access Point
PLCP	=	Physical Layer Convergence Procedure
PMD	=	Physical Medium Dependent
PMD_SAP	=	Physical Medium Dependent Service Access Point
PPM	=	Pulse Position Modulation
SAP	=	Service Access Point

12.1.5. Service Specification Method and Notation

The models represented by figures and state diagrams are intended as the illustrations of functions provided. It is important to distinguish between a model and a real implementation. The models are optimized for simplicity and clarity of presentation, the actual method of implementation is left to the discretion of the 802.11 Baseband IR PHY compliant developer. Conformance to the standard is not dependent on following the model, and an implementation which follows the model closely may not be conformant.

The service of layer or sublayer is a set of capabilities that it offers to a user in the next higher layer (or sublayer). Abstract services are specified here by describing the service primitives and parameters that characterize each service. This definition is independent of any particular implementation. In particular, the PHY_SAP operations are defined and described as instantaneous, however, this may be difficult to achieve in an implementation.

12.2. Baseband IR Physical Layer Convergence Procedure Sublayer

While the Physical Layer Convergence Procedure (PLCP) sublayer and the Physical Medium Dependent (PMD) sublayer are described separately, the separation and distinction between these sublayers is artificial, and is not meant to imply that the implementation must separate these functions. This distinction is made primarily to provide a point of reference from which to describe certain functional components and aspects of the PMD. The functions of the Physical Layer Convergence Procedure can be subsumed by a Physical Medium Dependent sublayer: In this case, the PMD will incorporate the PHY_SAP as it's interface, and will not offer a PMD_SAP.

12.2.1. Introduction

This section provides a convergence procedure in which MPDUs are converted to and from PDUs. During transmission, the MPDU is appended with a PLCP Preamble and PLCP Header to create the PDU. At the receiver, the PLCP Preamble is processed and the internal data fields are processed to aid in demodulation and delivery of the MPDU.

12.2.2. Physical Layer Convergence Procedure Frame Format

Figure 12.2~~3~~.1 shows the format for the PDU including the PLCP Preamble, the PLCP Header and the MPDU. The PLCP Preamble contains the following fields: Synchronization (SYNC) and Start Frame Delimiter (SFD). The PLCP Header contains the following fields: Data Rate (DR), DC Level Adjustment (DCLA), Length (LENGTH) and CRC. Each of these fields will be described in detail in section 12.2.4~~3.3~~.

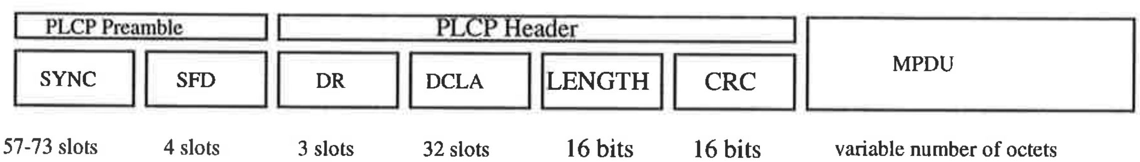

Figure 12.2~~3~~.1. PLCP Frame Format

12.2.3. PLCP Modulation and Rate Change

The PLCP Preamble shall be transmitted using the basic pulse defined in section 12.3.3~~4.8~~.2. The MPDU, LENGTH and CRC fields are transmitted using Pulse Position Modulation (PPM). PPM maps words into symbols: a word with n bits is mapped into one of the $L=2^n$ positions of a symbol (L-PPM). The basic L-PPM time unit is the slot. A slot corresponds to one of the L positions of a symbol and has a 250ns duration. The MPDU, LENGTH and CRC fields are transmitted in one of two bit rates: 1MBPS and 2MBPS. The Data Rate field indicates the data rate which will be used to transmit the MPDU, LENGTH and CRC fields. The 1 MBPS data rate uses 16-PPM (Basic Access Rate) and the 2 MBPS data rate uses 4-PPM (Enhanced Access Rate). The transmitter and receiver will initiate the modulation or demodulation indicated by the DR field starting with the first 4 bits in 16-PPM or 2 bits in 4-PPM of the LENGTH field. The MPDU transmission rate is set by the RATE parameter in PHY_DATA.request primitive specifying START-OF-ACTIVITY. Any conformant Baseband IR PHY shall be capable of receiving at 1 MBPS and 2 MBPS. Transmission at 2 MBPS is optional.

12.2.4. PLCP Field Definitions

In all fields the left most bit is transmitted first.

12.2.4.1. PLCP Synchronization (SYNC)

The SYNC field consists of a sequence of alternated presence and absence of a pulse in consecutive slots. The SYNC field has a minimum length of 57 slots and a maximum length of 73 slots and shall terminate with an empty slot. This field is provided so that the receiver can perform clock recovery (slot synchronization), automatic gain control (optional), signal-to-noise ratio estimation (optional) and diversity selection (optional).

12.2.4.2. PLCP Start Frame Delimiter (SFD)

The SFD field length is 4 slots and consists of the binary sequence `1001`. The SFD field is provided to indicate the start of the PLCP Preamble and to perform bit and symbol synchronization.

12.2.4.3. PLCP Data Rate (DR)

The DR field indicates to the PHY the data rate which will be used for the transmission or reception of the MPDU, LENGTH and CRC fields. The transmitted value is provided by the PHY_DATA.request primitive specifying START_OF_ACTIVITY as described in section 8. The DR field has a length of 3 slots. The Baseband IR PHY currently supports two data rates defined by the following binary words:

1 MBPS:	000
2 MBPS:	001

This field allows for the future introduction of a maximum of 8 different data rates.

12.2.4.4. PLCP DC Level Adjustment (DCLA)

The DCLA field is required to allow the receiver to stabilize the DC level after the SYNC , SFD and DR fields. The length of the DCLA field is 32 slots and consists of the binary words:

1 MBPS:	00000000100000000000000010000000
2 MBPS:	00100010001000100010001000100010

12.2.4.5. PLCP LENGTH

The LENGTH field is an unsigned 16 bit integer which indicates the number of octets to be transmitted in the MPDU. The transmitted value is provided by the PHY_DATA.request primitive specifying START_OF_ACTIVITY as described in section 8. The LSB (least significant bit) shall be transmitted first in time. This field is sent in L-PPM format. This field is protected by the CRC16 Frame Check Sequence described in next section.

12.2.4.6. PLCP CRC

The LENGTH field shall be protected by a CCITT CRC16 FCS (Frame Check Sequence). The CRC16 FCS is the ones compliment of the remainder generated by the module 2 division of the LENGTH field by the polynomial:

$$x^{16}+x^{12}+x^{5}+1$$

The protected bits will be processed in transmit order. This field is sent in L-PPM format. All FCS calculations shall be made prior to L-PPM encoding on transmission and after L-PPM decoding on reception.

12.2.4.7. PLCP Transmit Procedure

All commands issued by the MAC require PHY_DATA.confirm primitives to be issued by the PHY. The PHY_DATA.confirm primitives provide flow control between the MAC and the PHY.

Based on the status of CCA the MAC will assess that the channel is clear. If the channel is clear, transmission of the MPDU is initiated by a PHY_DATA.request specifying START-OF-ACTIVITY with DATA parameters LENGTH and RATE.

The PHY entity will immediately initiate transmission of the PLCP preamble and PLCP header based on the LENGTH and RATE parameters passed in the PHY_DATA.request primitive. Once the PLCP preamble and PLCP header transmission is completed the PHY entity issues a PHY_DATA.indicate specifying END-OF-ACTIVITY. Data is then exchanged between the MAC and the PHY by a series of PHY_DATA.request specifying DATA. At the PHY layer each octet is divided into symbols (2 or 4 bits). Transmission is terminated by the MAC through the primitive PHY_DATA.request specifying END-OF-DATA-AND-ACTIVITY.

12.2.4.8. PLCP Receive Procedure

All commands issued by the MAC require PHY_DATA.confirm primitives to be issued by the PHY. The PHY_DATA.confirm primitives provide flow control between the MAC and the PHY.

Reception is initiated by a PHY_DATA.indicate specifying START_OF_ACTIVITY indicating that the medium is busy. This will occur during the SYNC field of the PLCP preamble. The PHY entity will then begin searching for the SFD field. Once the SFD field is detected the PHY entity will receive the PLCP header. After receiving the DR and DCLA fields the CRC processing is initiated and LENGTH field is received. The change indicated in the DR field is initiated with the first symbol of the LENGTH field. The CRC16 FCS will be processed. If the CRC16 FCS check fails or no match is found for DR field a PHY_DATA.indicate specifying END-OF-ACTIVITY will be issued.

If the PLCP preamble and PLCP header reception is successful, the received MPDU bits are assembled into octets and presented to the MAC using a series of PHY_DATA.indicate specifying DATA. The first PHY_DATA.indicate specifying DATA will include the parameters RATE and LENGTH. The PHY proceeds with MPDU reception. Reception is terminated after the reception of the final bit of the last MPDU octet indicated by the PLCP header LENGTH field. Depending on the CCA status, either a PHY_DATA.indicate specifying END-OF-DATA or a PHY_DATA.indicate specifying END-OF-DATA-AND-ACTIVITY is issued to the MAC.

12.3. Baseband IR Physical Medium Dependent Sublayer

The Baseband IR Physical Medium Dependent Sublayer does not define PMD Service Access Primitives. The mechanism for communications between the PLCP and PMD sublayers, as well as the distinction between these two sublayers, if any, are left to the implementors. In particular, it is possible to design and implement in a conformant way a single sublayer which subsumes the functions of both the PLCP and PMD, presenting only the PHY_SAP.

12.3.1. Introduction

This section describes the PMD functional, electrical, and optical characteristics required for interoperability of implementations conforming to this specification. The relationship of this specification to the entire Baseband IR PHY Layer is shown in figure 12.34.1

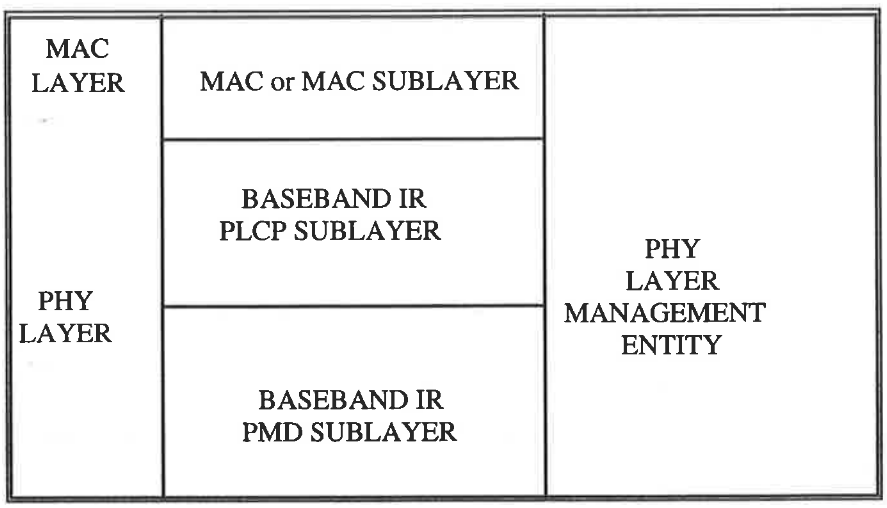

Figure 12.34.1 PMD Layer Reference Model

The Baseband IR Physical Medium Dependent Sublayer provides the actual means by which data is transmitted or received from the media.

12.3.2. PMD Operating Specifications General

The following sections provide general specifications for the Baseband IR Physical Medium Dependent sublayer. These specifications apply to both the receive and transmit functions and general operation of a compliant Baseband IR PHY.

12.3.2.1. Modulation and Channel Data Rates

Two modulation formats and data rates are specified for the Baseband IR PHY: a Basic Access Rate and an Enhanced Access Rate. The Basic Access Rate is based on 1 MBPS 16-PPM modulation. The 16-PPM encoding is specified in Table 12.3.14-6. Each group of 4 data bits is mapped in one of 16-PPM symbols. The Enhanced Access Rate is based on 2 MBPS 4-PPM. The 4-PPM encoding is specified in Table 12.3.24-7. Each group of 2 data bits is mapped into one of 4-PPM symbols.

Data	16-PPM Symbol
0000	1 - 0000000000000001
0001	2 - 0000000000000010
0010	3 - 0000000000000100
0011	4 - 0000000000001000
0100	5 - 0000000000010000
0101	6 - 0000000000100000
0110	7 - 0000000001000000
0111	8 - 0000000010000000
1000	9 - 0000000100000000
1001	10 - 0000001000000000
1010	11 - 0000010000000000
1011	12 - 0000100000000000
1100	13 - 0001000000000000
1101	14 - 0010000000000000
1110	15 - 0100000000000000
1111	16 - 1000000000000000

Table 12.*3.1*.~~6~~ 1 MBPS 16-PPM Basic Rate Mapping Table

Data	4-PPM Symbol
00	1 - 0001
01	2 - 0010
10	3 - 0100
11	4 - 1000

Table 12.*3.2*.~~7~~ 2 MBPS 4-PPM Enhanced Rate Mapping Table

12.3.3. PMD Transmit Specifications

The following sections describe the transmit functions and parameters associated with the Physical Medium Dependent sublayer.

12.3.3.1. Transmitted Peak Optical Power

The peak optical power shall be 2 W ± 20%.

12.3.3.2. Basic Pulse Shape and Parameters

The basic pulse width measured between the 50% amplitude points, shall be 250 ns ± 10 ns. The pulse rise time, measured between the 10% and 90% amplitude points, shall be lower than or equal to 40 ns. The pulse fall time, measured between the 10% and 90% amplitude points, shall be lower than or equal to 40 ns. The pulse jitter, defined as the absolute deviation in time of the ~~a~~ pulse from its correct position, shall be lower than or equal to 10 ns.

12.3.3.3. Emitter Radiation Pattern Mask

The emitter radiation pattern mask is defined in table 12.3.34-8. Position the conformant device in its recommended attitude. Define the conformant device axis as the axis passing through the emitter center and having the direction of the vertical from the floor. The mask represents the irradiance normalised to the average emitted power, as a function of the angle between the conformant device axis and the axis from the emitter center to the test receiver center (declination angle). The distance between emitter and test receiver is 1 meter. The test receiver normal is always aimed at the emitter center. The azimuth angle is a rotation angle on the conformant device axis.

DECLINATION ANGLE	NORMALIZED IRRADIANCE
α ≤£ 60°	> 3.5e-6
$\alpha \leq 22°$	≤ 2.2e-5
$29° < \alpha \leq 43°$	≤ -1.06e-4 + (0.44e-5) α
$43° < \alpha \leq 57°$	≤ -1.15e-4 - (7.1e-7) α
$57° < \alpha \leq 74°$	≤ 2.98e-4 - (3.9e-6) α
$74° < \alpha \leq 90°$	≤ 4.05e-5 - (4.5e-7) α

Table 12.3.34-8 Definition of the Emitter Radiation Pattern Mask

Measurements at the following angles shall be made: declination angles from 0° to 90° in steps of 10°; at each declination angle for azimuth angles of 0°, 4°, 11°, 20° and 31°. A device is judged conformant if for all 10 declination angles the average of the irradiance over the 5 azimuth angles falls within the bounds of the emitter radiation pattern mask for any arbitrarily selected initial azimuth angle.

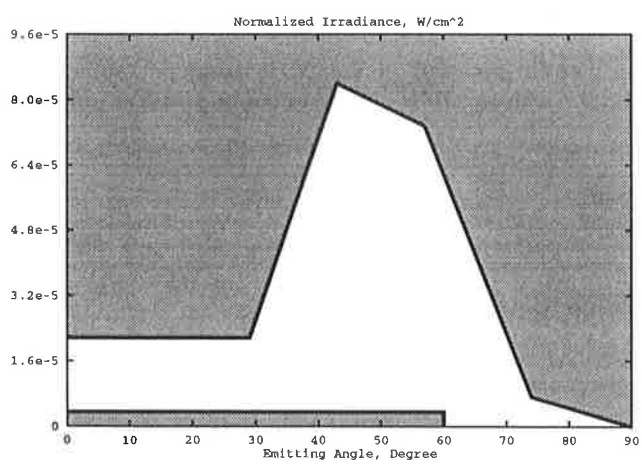

Figure 12.3.2. Emitter radiation pattern mask.

12.3.3.4. Optical Emitter Peak Wavelength

The optical emitter peak wavelength shall be between 850 and 950 nm.

12.3.3.5. *Transmit Spectrum Mask*

Define the transmit spectrum of a transmitter as the Fourier Transform, or equivalent, of a voltage (or current) signal whose amplitude, as a function of time, is proportional to the transmitted optical power.

The transmit spectrum of a conformant transmitter shall be 20 dB bellow its maximum for all frequencies above 15 MHz. The transmit spectrum mask is shown in figure 12.3.3.

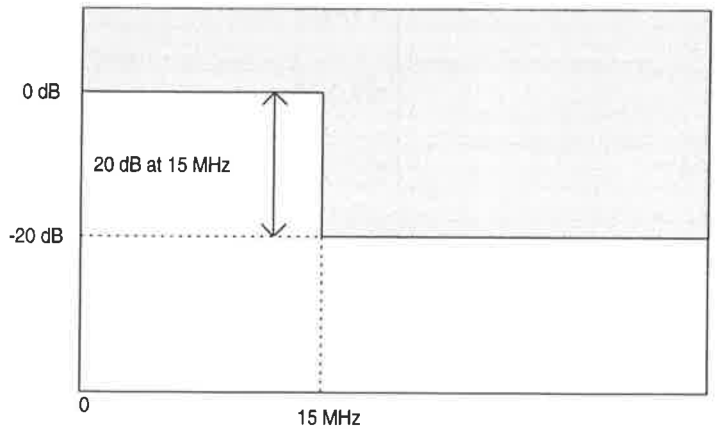

Figure 12.3.3. Transmit spectrum mask.

12.3.3.6. PMD Receiver Specifications

The following sections describe the receive functions and parameters associated with the Physical Medium Dependent sublayer.

12.3.3.7. Receiver Sensitivity

The Receiver Sensitivity defined as the minimum irradiance (in dBm/cm^2) at the photodetector plane required for a FER of $4x10^{-5}$ with an MPDU of 512 octets and with an ambient light level of - 10 dBm/cm^2, shall be:

1 MBPS: - 47 dBm/cm^2
2 MBPS: - 41 dBm/cm^2

12.3.3.8. Receiver Dynamic Range

The receiver dynamic range, defined as the ratio between the maximum and minimum irradiance at the photodetector plane that assures a FER lower than or equal to $4x10^{-5}$ with an MPDU of 512 octets and with an ambient light level of - 10 dBm/cm^2, shall be greater or equal to 30 dB.

12.3.3.9. Receiver Field-of-View (FOV)

Define the receiver axis as the direction of incidence of the optical signal at which the received optical power is maximum.

Define the receiver FOV as twice the angle measured between the receiver axis and the direction of incidence at which the received optical power is equal to 1% of the maximum received optical power. For incident angles smaller than half the FOV, the received optical power should always be higher than 1% of the maximum received power.

The receiver FOV of a conformant receiver shall be greater than or equal to 150°.

~~The receiver FOV defined as twice the angle from the normal of the detector surface to the direction at which no more optical power impinges on the detector shall be greater than or equal to 150°.~~

12.3.4. Clear Channel Assessment, Carrier Detect and Energy Detect Definitions

12.3.4.1. Clear Channel Assessment:

Clear Channel Assessment (CCA) will be asserted "CLEAR" by the PHY when the Carrier Detect Signal (CS) and the Energy Detect Signal (ED) are both false, or when ED has been continuously asserted for a period of time defined by the product of CCA_WATCHDOG_TIMER and CCA_WATCHDOG_COUNT without CS becoming active. When either CS or ED go true, CCA is indicated as "BUSY" to the MAC via the primitive ***PHY_DATA.indicate*** *of class* ***START-OF-ACTIVITY.***

Normally, CCA will be held "BUSY" throughout the period of the PLCP Header. After receiving the last PLCP bit and the first data octet, the PHY will signal ***PHY_DATA.indicate*** *of class* ***DATA*** *with the parameters* ***LENGTH*** *and* ***RATE***. CCA will be held "BUSY" until the number of octets specified in the decoded PLCP Header are received. At that time the PHY will signal ***PHY_DATA.indicate*** *of class* ***END-OF-DATA-AND-ACTIVITY*** or ***PHY_DATA.indicate*** *of class* ***END-OF-DATA*** if CCA remains "BUSY", indicating some form of interference. In the latter case, the PHY will signal ***PHY_DATA.indicate*** *of class* ***END-OF-ACTIVITY*** only when CCA goes "CLEAR".

The transition of CCA from *"BUSY" to "CLEAR"* ~~"CLEAR" to "BUSY"~~ is indicated to the MAC via the primitive ***PHY_DATA.indicate,*** *of class* ***END-OF-DATA-AND-ACTIVITY,*** *or* ***END-OF-ACTIVITY.***

If CS and ED go false before the PHY signals ***PHY_DATA.indicate*** *of class* ***DATA***, CCA is set to "CLEAR" and immediately signaled to the MAC via ***PHY_DATA.indicate*** *of class* ***END-OF-ACTIVITY.*** If CS and ED go false after the PHY has signaled ***PHY_DATA.indicate*** *of class* ***DATA*** implying that the PLCP Header has been properly decoded, then the PHY will not signal a change in state of CCA until the proper interval has passed for the number of bytes indicated by the received PLCP LENGTH. At that time, the PHY will signal ***PHY_DATA.indicate*** *of class* ***END-OF-DATA-AND-ACTIVITY.***

The transition of CCA from "CLEAR" to "BUSY" resets the timer and counter associated with CCA_WATCHDOG_TIMER and CCA_WATCHDOG_COUNT, respectively. CCA_WATCHDOG_TIMER and CCA_WATCHDOG_COUNT are parameters available via MIB table entries and can be read and set via the LME.

Rise and fall times of CCA relative to the OR'ing of the CS and ED signals will be less than 30 nanoseconds. CS and ED are both internal signals to the PHY and are not available directly to the MAC, nor are they defined at any exposed interface.

12.3.4.2. Carrier Detect Signal:

The Carrier Detect Signal (CS) is asserted by the PHY when it detects and locks onto an incoming PLCP Preamble signal. This signal is not directly available to the MAC. Conforming PHY are required to assert this condition within the first 12 microseconds of signal reception, at a signal level of -47 dBm/cm^2 for 1 MBPS operation and -41 dBm/cm^2 for 2 MBPS operation, with less than -10 dBm/cm^2 of background IR.

The Carrier Detect Signal (CS) is de-asserted by the PHY when the receiving conformant device loses carrier lock.

Note that the 12 microseconds specification is somewhat less than the minimum length of PLCP SYNC interval which is ~~28.5 cycles at 2 MHz, or~~ 14.25 usec.

12.3.4.3. Energy Detect:

The Energy Detection Signal (ED) is set true when IR energy variations in the band between 1 Mhz and 10 Mhz exceed -30 dBm/cm^2 .

This signal is not directly available to the MAC.

12.4. PHY Managed Objects

PHY Managed objects have default values, or allowed values which are PHY dependent. This section describes those values, and further specifies whether they are permitted vary from implementation to implementation.

MIB Object	Default Value	Operational Semantics	Operational Behavior
aCCA_Rise_Time	5 usec	Static	Identical for all conformant PHY
aCCA_Fall_Time	1 usec	Static	Identical for all conformant PHY
aRxTx_Turnaround_Time	0 usec	Static	Identical for all conformant PHY
aRx_Propagation_Delay	1.5 usec	Static	Identical for all conformant PHY
aTx_Propagation_Delay	3.5 usec	Static	Identical for all conformant PHY
aPLCP_Time	60 usec 1mbps 40 usec 2mbps	Static	Identical for all conformant PHY
aPHY_SAP_Delay	13.6 usec 1mbps 9.6 usec 2mbps	Static	Identical for all conformant PHY
aCCA_Watchdog_Timer_Max	implementation dependent	Dynamic	A conformant PHY may set this via the LME
aCCA_Watchdog_Count_Max	implementation dependent	Dynamic	A conformant PHY may set this via the LME
aCCA_Watchdog_Timer_Min	22	Static	Identical for all conformant PHY
aCCA_Watchdog_Count_Min	1	Static	Identical for all conformant PHY
aChannel_Transit_Delay	25 nsec	Static	Identical for all conformant PHY
aChannel_Transit_Variance	25 nsec	Static	Identical for all conformant PHY
aMPDU_Maximum	2500 octets	Static	Identical for all conformant PHY
aMPDU_Minimum	0 octets	Static	Identical for all conformant PHY
aMPDU_Current_Maximum	implementation dependent	Dynamic	A conformant PHY may set this via the LME
aSupported_Rx_Rates	implementation dependent	Static	All conformant PHY must include the value 000 (1 Mbps).
aSupported_Rx_Rates	implementation dependent	Static	All conformant PHY must include the values 000 (1 Mbps) and 001 (2 Mbps).
aBSS_Basic_Rate_Set	000, 001	Static	Identical for all conformant PHY

aStation_Basic_Rate	implementation dependent	Dynamic	A conformant PHY may set this via the LME
aExtended_Rate_Set	implementation dependent	Static	Rates not in the BSS_Basic_Rate_Set which are supported by the PHY
aPLCP_Rate	000, 001	Static	The PLCP rate must be a member of the BSS_Basic_Rate_Set, and if the data rate is also a member of the BSS_Basic_Rate_Set, then the PLCP_Rate is the same.
aPreferred_Tx_Rate	implementation dependent	Dynamic	A conformant PHY may set this via the LME,
aPreferred_Rx_Rate	implementation dependent	Dynamic	A conformant PHY may set this via the LME,