IEEE 802.11
Wireless Access Methods and Physical Layer Specifications

Minutes of the Baseband IR PHY Ad-Hoc Group

August 29 - September 1, 1994

San Antonio, Texas

Monday PM, 8/29/94, IR PHY

The meeting was called to order by Roger Samdahl at 10:30 AM on Monday, 8/29/94.

Attendees:	Barry Dobyns	Photonics	dobyns@acm.org
	Rui Valadas	University of Aveiro	RV@zeus.ci.ua.pt
	Roger Samdahl	Photonics	70110.360@compuserve.com
	Hirohisa Wakai	Sharp	wakai@Sharp.CO.JP

It was agreed by consensus that 94/152B1 would not be revised to show further changes in the PLCP Header and SAP interface. Instead, the new paper, 94/182 will incorporate all of the changes specified in 152B2 and new changes resulting from this meeting.

Rui Valadas presented 94/xxx, "Measurements on the Power Spectral Density and Optical Switching Times of 16 PPM", showing that a 1 MBPS baseband PPM system, designed for minimum intersymbol interference, will have frequency components that extend out to 8 or 10 MHz. [Ed: slide one = Stanley DN305, slide two = Hitachi HL8807CL, slide three = Hitachi HE8812SG.] Valadas is concerned that slowing the rise and fall time of transmitted pulses will compromise performance, either by increasing receiver noise or by increasing intersymbol interference. The argument is that a raised cosign pulse in the receiver is optimum and that can only be done with sharp pulses unless the implementor uses high frequency boost.

R. Valadas then presented 94/175, "Response to doc:IEEE 802.11-94/151" which refuted some of the conclusions that had been presented in that paper.

R. Valadas then presented 94/173, "Radiation Pattern Specification for the Baseband IR PHY". This paper addresses the optimum physical or spatial characteristics of the IR output. The analysis leads to a recommended radiation pattern and mask for the IR distribution pattern.

R. Valadas then presented 94/174, "Safety Issues of the Baseband IR PHY". This paper addressed the safety issues related to the use of narrow dispersion angle LED's based on IEC Standard 825-1.

The conversation went back to the conformance testing for the transmitted radiation pattern and how the axis of symmetry should be defined. H. Wakai pointed out that measurements on a PDA type device should be performed with the transmitter positioned in it 'normal' orientation. Samdahl suggested that the vertical room axis be used as the implied axis of symmetry for

measuring the radiation pattern. Dobyns suggested that manufactures should specify the orientation in which their systems are designed to operate. Such orientation should not depend on the test operator being able to determine the internal axis of symmetry of the device.

The issue of access points was also discussed. These assumed stationary devices may be permanently mounted in positions where 360 degrees of radiation are not appropriate.

A motion from R. Valadas regarding the transmitting pattern mask is expected on Tuesday, with modifications for measuring relative to the rooms' vertical axis and possibly with some considerations for access points.

Tuesday AM, 8/30/94, IR PHY

Discussion began with a description of MIB's started by Dobyns. This is a virtual database .

Went on to discuss CCA. The discussion centered on the mechanism suggested by the DS PHY. There is some uncertainty regarding the four 15 msec intervals.

Dobyns made a motion related to the current DS version in 50B3. The motion was temporarily tabled until P. Struhsaker could be enlisted to explain the need for the timer plus counter in the DS context. He did so, and agreed that in the IR case the counter was unnecessary, since its purpose is to allow synchronizing with microwave ovens.

Motion: (B. Dobyns, R. Valadas) That the IR Baseband PHY adopt a Clear Channel Assessment mechanism following 50R3 (10.4.8.4) except using a single watchdog timer instead of the counter and watchdog. The watchdog timer will have a default value of 22 Msec and a minimum value of 22 Msec. The watchdog timer value will reside as a get/set PHY MIB value. Passed 4-0-0, unanimously.

We still need to define energy detection and carrier sense mechanisms. Samdahl will attempt to define a threshold for energy detection and a definition of carrier sense during the afternoon, for presentation to the group tomorrow.

Motion: (R. Valadas, B. Dobyns)That the Baseband IR PHY adopt the emitter radiation pattern defined or specified in document 94/173 except that the measurement axis of symmetry is defined to be vertical (relative to the floor) with the unit operating in its normal attitude. Passed 4-0-0, unanimously.

Samdahl agreed to get information relating to the maximum packet length for IRDA packets and also to provide definitions for carrier sense, energy detect, and the MIB terms listed below.

Dobyns presented a list of limited MIB values that needs to be defined:

- CCA rise time -> GET
- CCA fall time -> GET
- Rx-Tx turnaround time -> GET

- Tx-Rx turnaround time -> GET
- Rx propagation delay -> GET
- Tx propagation delay -> GET
- CCA watchdog timer value -> SET and GET
- CCA watchdog count -> SET and GET
- Channel transit delay -> GET
- Channel transit variance -> GET
- Supported Rx rates -> GET
- Supported Tx rates -> GET
- Preferred Rx rate -> GET
- Preferred Tx rate -> GET

Tuesday PM, 8/30/94, IR PHY

The ad-hoc group worked separately to complete several missing sections of 94/182.

Wednesday AM, 8/31/94, IR PHY

Discussions continued on the MIB parameters with an attempt to define real numbers:

The contentious issues are CCA rise and fall time, and Tx - Rx turnaround time. We also discovered some difficulty in defining Tx and Rx propagation delay.

CCA rise and fall time are difficult because we don't have a working proposal for an Energy Detection device that can provide accurate detection and that provides rapid attack and decay. The basic operation of CCA was settled on Tuesday by adopting a modified version of the one proposed by the Direct Sequence PHY ad-hoc group. After much discussion the chair decided to postpone further work in this area and to go on with other MIB parameter decisions.

Tx-Rx turnaround triggered a discussion about how AGC functions will operate in a reference design. Between a transmit cycle and a receive cycle (or between receipt of a strong packet and receipt of a weak packet) the receiver must be allowed to reach an equilibrium position from which it is able to drive to the correct AGC to match the signal level of the next pack to be received. Presumably, this AGC acquisition takes place during the early part of the SYNC field provided in the PLCP Preamble. It is possible that a design will not require any particular equilibrium state to exist before the next packet arrives. It is also possible that AGC acquisition can occur during the SYNC field regardless of its initial condition. After discussion, we agreed that a suitable compromise was 10 usec, noting that some designs may require no Tx-Rx delay at all.

Notwithstanding these issues, the following values and definitions were agreed to, but no motion was presented:

Definitions of primitive Baseband IR PHY parameters for inclusion into MIB tables:

Where appropriate, values are shown for [(1 MbPS)/(2 MbPS)]

CCA rise time -> GET [5 usec]

Time (in nsec) from the disappearance of a transmission in the medium to the assertion of CCA "Clear". The decay time of the CCA detector should be included.

CCA fall time -> GET [1 usec]

Time (in nsec) from the appearance of a transmission in the medium to the assertion of CCA "Busy". The attack time of the CCA detector should be included.

Rx-Tx turnaround time -> GET [0 usec]

Minimum time (in nsec) between the delivery of the last octet of a received frame (to the MAC) and the earliest possible transmission of a new packet. This does not include any recovery time required by the receiver.

Tx-Rx turnaround time -> GET [10 usec]

Minimum time (in nsec) between the transmission of the last symbol of an outgoing frame and the recovery of the receiver to within 3 dB of its nominal gain and noise performance parameters.

Rx propagation delay -> GET[1.5 usec/1.5 usec]

This is the electronic delay through the receiver.

Tx propagation delay -> GET [3.5 usec/3.5 usec]

This is just the electronic delays incurred propagating signals through the transmitter. It does not include the actual transmission time for the octet

PHY_DATA.request (DATA) to PHY_DATA.indicate(DATA) -> GET [13.6 usec/9.6 usec]

Includes propagation delays, channel delays, and parallel-serial-parallel conversion of information [9.5 usec/5.5 usec].

CCA watchdog timer value -> SET and GET [22 msec]

The product of the watchdog timer value and the watchdog count (below) must be set to match the length of the maximum length foreign packet that is to be allowed time to operate. Default value of 22 msec allows time for 802.11 type maximal length packets. For Baseband IR, the default value of the timer is set to 22 msec and the count (below) is

set to one.

CCA watchdog count -> SET and GET [1]

Number of repetitions of the watchdog time to allow to expire before asserting Clear Channel in spite of interfering signals. For baseband IR, set to one.

Channel transit delay -> GET [25 nsec]

Antenna to antenna signal trasit time measured in nsec.

Channel transit variance -> GET [25 nsec]

Expected variance in the channel trasit time, measured in nsec.

Supported Rx rates -> GET [1 and 2 MbPS]

Reception rates that are allowed by this transceiver. Both 1 and 2 MbPS rates must be available in any conformant device under the PHY definition.

Supported Tx rates -> GET [1 MbPS or (1 MbPS and 2 MbPS)]

Transmission rates allowed and supported by this transceiver. The PHY requires that at least 1 MbPS must be available with 2 MbPS being an option.

Preferred Rx rate -> GET [1 or 2 MbPS]

The reception rate favored by this transceiver, chosen from among the supported Rx rates.

Preferred Tx rate -> GET [1 or 2 MbPS]

The transmission rate favored by this transceiver, chosen from among the supported Tx rates.

Thursday AM, 9/1/94, IR PHY

Motion: (Dobyns, Wakai) Resolved, that the proposed text changes in 11-94/0182 be incorporated into the draft standard IEEE p802.11-93/20b2, Sections 7 and Section 11 in it's next revision by the editors.

Passed: Unanimously, 4-0-0

Issues for November:

Need a better form of the Energy Detect function.

Editorial changes including a radiation pattern picture.

Review definitions and clarify to improve the chances of developing a workable conformance test.

We will define a spectral mask for inclusion in the standard.

Wakai offered some additional information about competing standards. The EIAJ in Japan has parsed out the IR band as follows:

Band 1.	33 KHz - 40 KHz	Low speed remote control systems (TV's etc.)
Band 2.	45 KHz - 1 MHz	Analog voice transmission
Band 3.	1 MHz - 2 MHz	Bi-directional remote control systems (Sega?)
Band 4.	2 MHz - 6 MHz	High quality analog and digital voice transmission
Band 5.	6 MHz - 30 MHz	Video transmission

Wakai believes that these are the same bands as will be specified by IEC when there standard is issued.

The meeting was adjourned.