Title: **IEEE802.11 DS-PHY**
Minimal Accessible Interface for Conformance Testing

Al Petrick, John Fakatselis, Carl Andren
Harris Semiconductor
P.O. Box 883
Melbourne, Florida 32901-0883
Tel: 407-729-4944
Fax: 407-724-7886
email:apetrick@ccmail.mis.semi.harris.com

Abstract:

This paper describes a strawman list of signals which make up an interface that can be instrumental for performing the tests required to prove the physical layer level specifications. The selection of these signals were carefully chosen, to enable facilities performing such tests, common ground for configuring test equipment to conduct tests applicable to the direct sequence physical layer. They consist of signals emitting RF energy over the medium, and those associated at the interface between the PHY and MAC layers, with timing criticality.
The purpose of this paper is to provide insight of how one manufacturer may elect to provide access to such signals for acquiring performance data from a test bed used in conformance testing. This paper has no intention recommending the requirements for an exposed interface.

Introduction:
Conformance testing for the 802.11 should not be overlooked, since it is one of the basic foundations and claims, "Interoperability". Conformance testing is an important vehicle for gathering information about a product developed by two different manufacturers of the same 802.11 platform. Conformance testing of such products should be kept at minimum, thus gather information about ones product, proving compliance to specifications in the 802.11 draft to insure interoperability at both the medium and network level. Test facilities basically have two options for gather data; 1) setup hardware test bed configurations illustrated in the March 96 submission document 96/97, 2) generate automated tests at the MAC and network management layer by which the majority of the tests could be conducted. In this paper we've chosen to address option 1.

DS-PHY Unit Under Test

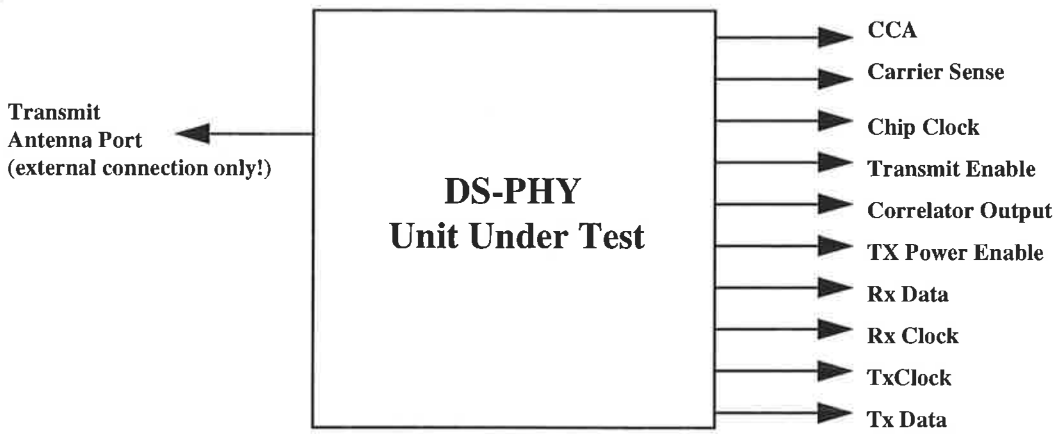

Exhibit A Accessible Interface for Conformance Testing

Accessible Interface Signals

The following is a minimal list of accessible exposed signals necessary to conduct performance data using the test bed model illustrated in the March 1996 submission document 96/97.

Transmit Antenna Port: The external antenna port if provided can be used to conduct any tests associated with radiating RF energy over the medium. This includes tests associated with the following: transmit RF power, transmit spectral mask, transmit modulation accuracy, carrier suppression, transmit power ramp up and ramp down timing.

CCA: Clear channel Assessment (CCA), can be instrumental in verifying a number of defined PHY specifications. This includes Tx and Rx turnaround times, as well as, the CCA algorithm itself which comes with critical time constants. The CCA is generated on the PHY layer and it is asserted upon detection of signals. This is the first PHY signal confirming the detection of a valid signal and thus it can be used to measure the Rx related timing specifications. This is the most practical signal to cover testing of timing measures of the CCA algorithm itself. Other possible ways will be indirect involving probably the MAC.

Carrier Sense: Carrier sense provides a means to indicate that PN code lock is established.
This is the indicator that a valid signal has been detected by the receiver. This signal can be used for timing measurements related with receiver detection and turnaround. This signal can be used for some of the tests that CCA is utilized as described above. It is a good alternative to CCA for some of the receive timing specifications especially if the chosen CCA algorithm option prohibits reliable measurement of such timing. An example can be a CCA based on the energy detection option. This option will react to any energy in the channel including on energy from non DS 802.11 signals. This might make it more difficult to measure timing that defines detection of valid waveforms only. In this case Carrier Sense is probably a better signal to be utilized.

Tx Chip Clock: Accessible to measure clock accuracy specifications. In addition, this signal can be instrumental to perform modulation accuracy tests used in conjunction with the Tx data.

Transmit Enable: Accessible to indicate the start of transmission of data over the medium. This signal in conjunction with CCA and/or Carrier Sense can be instrumental in determining conformance of turn around times between Rx and Tx operations.

Correlator output: This output can be useful for proof of processing gain (PG) compliance by FCC rules. There are various other ways of measuring processing gain without the observation of the PN correlator outputs. This is though the most direct measure of processing gain.

TX Power Enable: Accessible to be used as a trigger in order to measure the ramp up and ramp down timing of the RF radiated energy at the antenna.

RxData: Accessible to monitor the demodulated data packet. The demodulated data can be used to verify any measurements based on BER or FER. These BER/FER measurements are the classical way of measuring receiver performance to test specifications such as sensitivity, adjacent channel rejection, and receiver performance under carrier/clock offsets. If the data is not directly accessible it then has to be interpreted indirectly more than likely through the MAC.

RxClock: Accessible to be used in conjunction with the RxData.

TxClock: Accessible to be used in conjuction with TxData.

TxData: Accessible to be used to provide an input to the DS-PHY for inputing data such as pseudo-random data patterns for verification of transmit spectrum mask and FCC regulations as governed by part 15.247.

This set of signals can be sufficient to test the DS-PHY specifications. This is just an example. There are other potential ways to verify a design based on individual implementations.

Conclusions

As part of the conformance testing process, we believe that it is very important to provide insight on presenting options to properly test future products which support 802.11. This paper does not suggest though that this is the only way to test for compliance.