1. Toning Proposal for P1394b connectivity management

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1.1 Introduction

A form of toning is required in P1394b in order to maintain the connection status of an AC coupled port.

An important criterion is that the toning should be very low power, as the main time that such toning is required is during the time that a port is suspended.

Other requirements are:-

Must be capable of transmission through an optical transceiver (assumed cut-off frequency of 100 MHz, full swing PECL inputs);

Must be capable of transmission over POF and UTP (maximum frequencies of the order of 100-200 MHz).

Must be capable of overcoming the start-up latencies of an optical transciever (of the order of 500 microseconds);

Must be capable of detecting the transition from physical connection to physical disconnection or vice-versa in human-scale real-time (typically 50 milliseconds);

1.2 Proposal

The proposal is based on the open-loop transmission/reception of a regular tone. Reception of a tone indicates a connection, lack of a tone indicates no connection.

The proposal is to transmit a “tone” every 34.133 milliseconds (122.88/2**23), i.e. approx 30 tones a second. The tone comprises a signal of frequency 122.88 MHz (S800 transmission rate / 4), and has a duration of 533.333 microseconds (2**17 clocks of a 122.88 MHz clock). Note, for EMC reasons on UTP, it may be necessary to use a signal of half this frequency, and it needs to be verified that this can pass through an optical transciever suffiecntly well to provide a signal detect at the far end. Note, previous proposals based on a “loose” clock are not considered further, as it seems that there is no significant power saving by using such a clock in place of a crystal oscillator. Note, the transmitters are active for 1/256 of the time, and will not be consuming power otherwise.

A signal detect circuit is used to detect that a valid signal is received. This is latched, and the latch sampled at appropriate intervals. The latch is reset after each sampling, i.e. the latch indicates that a valid tone has been received since the last time a sample was taken.

If the port is disconnected or suspended, the latch is sampled at the same interval as the toning interval.If the port is suspended, the far end signals a resume by changing to a continuous transmission (actually of IDLE characters for synchronisation). In this case, if the port detects a signal, it samples again after an interval of 2* TONE_DURATION. If it detects a signal, then it starts a resume. (NB this needs some tightening up, as there are some buggy corner cases, but two samples will fix it).

The specification of the signal detect circuit is adopted (with minor modifications) from Gigabit Ethernet (Note, this will have to be included in the electrical section):-

1.3 PMD signal detect function

(Note, needs adapting to P1394b)

The PMD Signal Detect function shall report to the PMD service interface, using the message PMD_SIGNAL.indicate(SIGNAL_DETECT) which is signaled continuously. PMD_SIGNAL.indicate is intended to be an indicator of signal presence. SIGNAL_DETECT shall be set to OK when the PMD circuitry receives a valid electrical signal. SIGNAL_DETECT shall be set to FAIL when the received electrical amplitude is below 200 mV (p-p). Examples of a FAIL condition are when the link is unplugged or the transmitter to which it is attached is turned off. Under all other conditions, the state of SIGNAL_DETECT is unspecified.

Under all valid operating conditions there shall be no false positive OK indications. Though unspecified, this implies that there must be adequate margin between the SIGNAL_DETECT trip point and the inherent noise level of the PMD due to cross talk, power supply noise, etc. Under all valid operating conditions, an incoming signal at or above the minimum receive threshold (400 mV p-p) shall not indicate FAIL. Though unspecified, this implies that there must be adequate margin between the SIGNAL_DETECT trip point and the receiver minimum differential sensitivity.

Response time requirements are not specified.

It is expected that SIGNAL_DETECT may chatter at some input level. It is expected that the PMD service interface will be designed to handle this.

Table 1-1—SIGNAL_DETECT value definition

Receive conditions	SIGNAL_DETECT value
V*input* Receiver < 200 mV pk-pk[a]	FAIL
Other conditions Examples 1) Receiving neither a tone nor a non-8B/10B encoded data stream 2) Other end of the link undergoing power-on-reset (POR) transients 3) 200 mV (p-p) < V *input* Receiver < Minimum differential sensitivity 4) One of the differential lines is open	Unspecified
Receiving a tone or encoded 8B/10B characters[b] AND Minimum differential sensitivity < V *input* Receiver <Maximum differential input[c]	OK

[a.] This implies that the link is open, or the transmitter on the other end of the link is OFF (see Table 39-2 for definition of OFF transmitter). 200 mV (p-p) assumes a combination of worst case NEXT (120mV (p-p)) plus OFF transmitter noise due to ground and power supply noise (70mV(p-p)) plus a 10 mV(p-p) margin.

[b.] This implies the transmitter on the other end of the link must be receiving encoded 8B/10B characters from the port or is toning, and is functioning normally.

[c.] This implies that the transmitter on the other end of the link is operating within specifications and the link is within specifications

