Title: Changed Transformer Noise Tolerance in Manchester Mode in AS8202NF

Subject: Protocol Bug Fix

Related Revision: Firmware V2.00 and later

Description:

AN130 describes a bug in the receiver that can prevent a node from correctly integrating into a cluster. In addition, if a cluster uses the Manchester encoding and if transformer couplers are used to DC-decouple the shared bus from the node, a certain amount at the beginning of the preamble can be distorted. This distortion is not handled properly by an AS8202NF with protocol versions up to 1.02. AN134 describes a solution to this problem of noise preceding the preamble for the synchronous state while this document describes a solution for the asynchronous state. Protocol version 2.00 can handle both states correctly.

The new protocol requires one additional MEDL parameter. The parameter controls the timeout that has to expire when the start of a frame is detected at the receiver. After the timeout the receiver is reset to start receiving the frame correctly. The MEDL parameter is called 'Asynchronous Preamble Cut-off' and is to be chosen according to the following rules. Note that the term 'microtick' refers to one internal clock period of the AS8202NF.

1. The detection of a start-of-activity on on TTP channel is delayed by a fixed amount of microticks due to a delay in the receiver circuit. The detection is further delayed by a variable amount of microticks due to the state polling of the protocol firmware (jitter).
2. After this delay an internal timer is set to the 'Asynchronous Premable Cut-off' MEDL parameter.
3. When the timeout is expired, the receiver is reset. Detection of timeout expiration is delayed by a variable amount of microticks due to the state polling of the protocol firmware (jitter).
4. After the receiver is reset, the preamble on the media has to be settled down, and the transmitter has to be set up to transmit additional correct preamble bits for the receiver to synchronize on. There is a lower bound for the number of preamble bits, but no upper bound.
5. Note that all the jitter has no impact on the synchronization to the frame which is done with microtick granularity, the jitter only requires enough preamble bits to be sent by the transmitter.

The following formulas use some terms to know:

- n_{APC} The 'Asynchronous Preamble Cut-Off' MEDL parameter in microticks (clock cycles)
- f_{BIT} The TTP bus transmission bitrate in Bit per second
- f_{CLK} The clock rate of the AS8202NF in Hz
- n_{RECJIT} The jitter of the activity detection in the firmware in microticks (clock cycles)
- $t_{DISTORT}$ The maximum time for which the start of the received frame is distorted at the receiver from any transmitter, in seconds
- $n_{PREAMBLE}$ The number of preamble bits sent preceding the SOF (start of frame) pattern
- n_{PREREC} The number of preamble bits the receiver requires for correct synchronization preceding the SOF (start of frame) pattern

$$n_{APC} > f_{CLK} \cdot t_{DISTORT}$$

$$n_{PREAMBLE} > n_{PREREC} + \frac{f_{BIT}}{f_{CLK}} \cdot \left(2 \cdot n_{RECJIT} + n_{APC}\right)$$

with $n_{PREAMBLE}$ dividable by 2

For firmware release 2.00 the following values apply to the constants:

- n_{RECJIT} = 104
- n_{PREREC} = 2

As an example, for a typical setup with f_{CLK}=40 MHz, f_{BIT}=5 MBit/s, $t_{DISTORT}$= 600 ns, the following values can be used: n_{APC}=25, $n_{PREAMBLE}$=32

As a second example, a setup with f_{CLK}=40 MHz, f_{BIT}=2 MBit/s, $t_{DISTORT}$= 1000 ns requires the following values: n_{APC}=41, $n_{PREAMBLE}$=26

Note that the preamble dibit value stored in the MEDL is half of the preamble bit count.