TND340/D
Rev. 2, MAY – 2008

ON Semiconductor®

AMIS–49200 Fieldbus MAU Reference Board

FF–830 Test Results

May, 2008 – Rev. 2
Publication Order Number:
TND340/D

AMIS-49200 Fieldbus MAU Reference Board

Physical Layer Conformance Testing
FF-830 Test Results
December 19, 2007

Notes:

1. The FF-830 specification (from Fieldbus Foundation) is not available from ON Semiconductor to customers. Please contact the Fieldbus Foundation at www.fieldbus.org to obtain the latest test specifications.
2. Custom testing services are not provided by ON Semiconductor.

1.0 Scope

This document contains the relevant results of the FOUNDATION™ Fieldbus Physical Layer Conformance testing performed on the AMIS-49200 Fieldbus MAU Reference Board (Rev 1.0). For a detailed explanation of each test describing its purpose and set-up refer to FF-830.

2.0 References

FF-830	Fieldbus Foundation Specification 31.25kbit/s Physical Layer Conformance Test – Rev. 1.50

3.0 Definitions, Acronyms and Abbreviations

DUT	Device Under Test
FIC	Field Interface Card
ICS	Implementation Conformance Statement
MAU	Medium Attachment Unit
MDS	Medium Dependent Sublayer
PN	Probe Node
PR	Probe Response

4.0 Device Set-up

All tests were run at room temperature.

Device:
AMIS-49200 FF Reference Board

Test Equipment Used:

- Tektronix THS730A 2-channel isolated oscilloscope
- KEPCO - Variable Power Supply, all tests run at 24V unless otherwise stated
- Discrete board for non-Fieldbus power supply with two terminators
    - L = 5mH, 18 AWG, 1.3 ohm air core inductor (Jantzen)
    - RL = 50 ohms ± 1%
    - Two terminators each consisting of:
        - R = 50 ohms ± 1 ohm (Qty = 2)
        - C = 2uF 400V crosscap (Qty = 2) (Jantzen)
- Fieldbus message source device
- HP33120A – arbitrary waveform generator
- Waveform generation interface – a custom Fieldbus physical interface circuit card functions as the interface between the arbitrary waveform generator and the Fieldbus test network

5.0 Test Summary

Table 1: Test Summary

Test ID #	Test	Test Notes	Test Status
1.1	Valid ID of DUT	See Annex E of FF-830	*See note below
1.2	Static conformance review		*See note below
1.3	ICS self-consistency		*See note below
1.4	Consistency between DUT and ICS		*See note below
2.1	Signal and power connections		*See note below
2.2	Receive signal polarity		*See note below
2.3	Transmitted signal polarity		*See note below
3.1	Output amplitude		Pass
3.2	Output amplitude with one terminator		*See note below
3.3	Signal bias		Pass
3.4	Output signal distortion		Pass
4.1	Bit rate		*See note below
4.2	Bit time		*See note below
4.3	Rise and fall times		Pass
4.4	Slew rate		Pass
4.5	Jitter		*See note below
4.6	Transmit enable time		*See note below
4.7	Quiescent DVC output		*See note below
5.1	Maximum rate of current change		*See note below
5.2	Maximum current		*See note below
6.1	Receiver sensitivity		Pass
6.2	Receiver noise rejection		Pass
7.1	Operating voltage		*See note below
7.2	Withstand voltage		*See note below
7.3	Ripple sensitivity		*See note below
8.1	Common mode broadband interference		*See note below
8.2	Common mode power frequency		*See note below
9.1	Input impedance		Pass
9.2	Unbalanced capacitance		*See note below

*Note: Accuracy of test requires entire node electronics to be present, including the host microprocessor and associated memory, Fieldbus link controller and associated support circuitry. Test is to be performed by customer.

Test results for room temperature on tests run indicate the physical layer DOES conform to all specifications put forth by the Fieldbus Foundation.

6.0 Test Results

6.1 Test Group 1 – Static Conformance Review

These tests are not applicable. Tests to be performed by customer.

6.2 Test Group 2 – Basic Interconnection Tests

These tests are not applicable. Tests to be performed by customer.

6.3 Test Group 3 – Transmit Levels

6.3.1. Test ID's: 3.1 Output Amplitude, 3.3 Signal Bias, and 3.4 Output Signal Distortion

Test results: PASS

Tests were set-up per diagram in “Test Group 3” of FF-830.

Power Supply = 24V

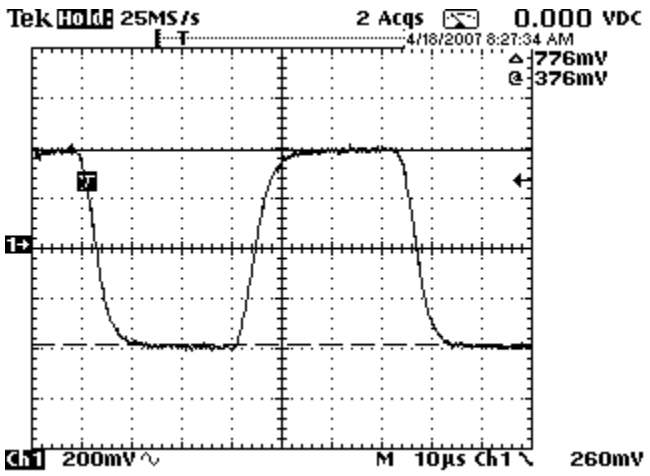


Table 2: Test Case 3.1

Test Case 3.1 Output Amplitude Clause 223.1a			
		Power Supply = 24V	
Step	Action-Behavior	Measured or Calculated Data (mV)	Verdict
3.1.2	Transmit PN and capture DUT response		
3.1.3	Measure maximum positive peak level of response waveform	380	
	Measure minimum positive trough level of response waveform	372	
	Calculate positive mid-voltage (‘mid-voltage peak to trough’)	376	
3.1.4	Measure maximum negative peak level of response waveform	-408	
	Measure minimum negative trough level of response waveform	-392	
	Calculate negative mid-voltage (‘mid-voltage peak to trough’)	-400	
3.1.5	Calculate output amplitude from negative to positive mid-voltage	776	
	If amplitude is between 0.75V and 1.0V peak-to-peak Pass, otherwise Fail		Pass
3.3.5	Calculate | positive mid-voltage | – | negative mid-voltage |	24	
	If absolute difference does not exceed ± 50mV peak Pass, otherwise Fail		Pass
	Calculate 10% of peak-to-peak	77.6	
	Calculate 10% point	-322.4	
	Calculate 90% point	298.4	
	Set cursors to 10% and 90% points on the waveform for reference		
3.4.3	Check each response waveform rise from 10-90% peak-to-peak		
	If no negative going transitions in 10-90% pk-pk range Pass, otherwise Fail		Pass
3.4.4	Check each response waveform fall from 90-10% peak-to-peak		
	If no positive going transitions in 90-10% pk-pk range Pass, otherwise Fail		Pass
3.4.5	Check each response waveform region above 90% peak-to-peak		
	If no variation >= ± 10% pk-pk including all distortions Pass, otherwise Fail		Pass
3.4.6	Check each response waveform region below 10% peak-to-peak		
	If no variation >= ± 10% pk-pk test including all distortions Pass, otherwise Fail		Pass

6.3.2. Test ID: 3.2 Output Amplitude One Trunk Terminator Removed

6.4 This test is not applicable. Test to be performed by customer.Test Group 4 – Transmit Timing and Quiescent Output

6.4.1. Test ID's: 4.1 Bit Rate, 4.2 Bit Time

These tests are not applicable. Tests to be performed by customer.

6.4.2. Test ID's: 4.3 Rise and Fall Times, 4.4 Slew Rate

Test results: PASS

6.4.2.1. Test ID 4.3 Rise and Fall Times

Positive mid-voltage = $\frac{Positive\,Peak - Positive\,Trough}{2} + Positive\,Trough$

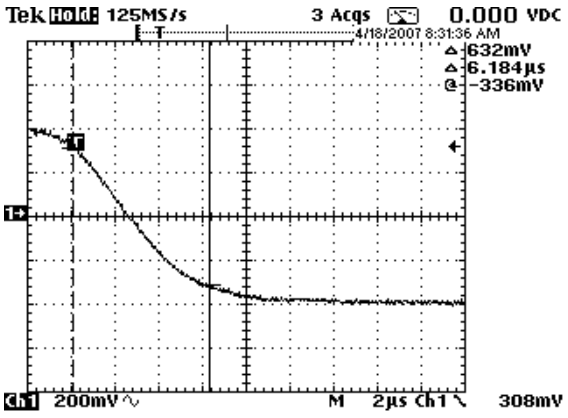
Positive mid-voltage = $\frac{380\,mV - 372\,mV}{2} + 372\,mV = 376\,mV$

Negative mid-voltage = $\frac{Negative\,Peak - Negative\,Trough}{2} + Negative\,Trough$

Negative mid-voltage = $\frac{-408\,mV - (-392\,mV)}{2} - 392\,mV = -400\,mV$

Peak-to-peak voltage = | Positive mid-voltage | + | Negative mid-voltage |
Peak-to-peak voltage = |376mV| + |-400mV| = 776mV
10 % of peak-to-peak = 0.1 * 776mV = 77.6mV
10 % point = negative mid-voltage + 10% of peak-to-peak = -400mV + 77.6mV = -322.4mV
90 % point = positive mid-voltage – 10% of peak-to-peak = 376mV –77.6mV = 298.4mV

Fall Time
6.184us



Rise Time
6.824us

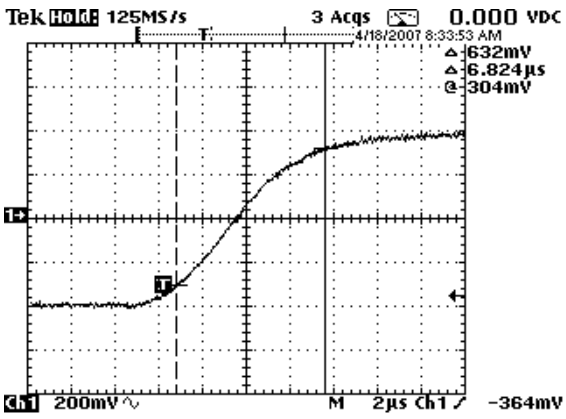


Table 3: Test Case 4.3

Test Case 4.3 Rise and Fall Times Clause 22.3.3a		
Step	**Action-Behavior**	**Verdict**
4.3.1	Set-up for group 4 with supply set for 24V ± 0.1V d.c. at DUT	
4.3.2	Transmit PN and capture DUT response (or use response from 4.2)	
4.3.3.	Measure sample response waveform fall from 90-10% peak (it is suggested to use the bit cycle selected for Test Case 4.2)	
	If time does not exceed 8µs for 90-10% peak-to-peak Pass, otherwise Fail	Pass
4.3.4	Measure sample response waveform rise from 90-10% peak	
	If time does not exceed 8µs for 10-90% peak-to-peak Pass, otherwise Fail	Pass

6.4.2.2. Test ID 4.4 Slew Rate

Slew Rate = $\frac{Volts}{Time}$

Requirement: $\frac{Volts}{Time} \leq \frac{0.2\ \mathrm{V}}{1uS}$

90% - 10% Range
.165V/uS

10% - 90% Range
.150V/uS

Table 4: Test Case 4.4

Test Case 4.4 Slew Rate Clause 22.3.3b		
Step	**Action-Behavior**	**Verdict**
4.4.1	Set-up for group 4 with supply set for 24V ± 0.1V d.c. at DUT	
4.4.2	Transmit PN and capture DUT response (or use response from 4.3)	
4.4.3.	Measure each response waveform fall from 90-10% peak-peak	
	Calculate maximum slew rate between each pair of sample points	
	If slew rate <= 0.2V per µs at any point in range 10% to 90% Pass, otherwise Fail	Pass
	Measure each response waveform rise from 10-90% peak-peak	
	Calculate maximum slew rate between each pair of sample points	
	If slew rate <= 0.2V per µs at any point in range 10% to 90% Pass, otherwise Fail	Pass

6.4.3. Test ID's: 4.5 Jitter, 4.6 Transmit Enable time, 4.7 Quiescent Transmitter Output

These tests are not applicable. Tests to be performed by customer.

6.5 Test Group 5 – Special Tests for Bus-Powered Devices

These tests are not applicable. Tests to be performed by customer.

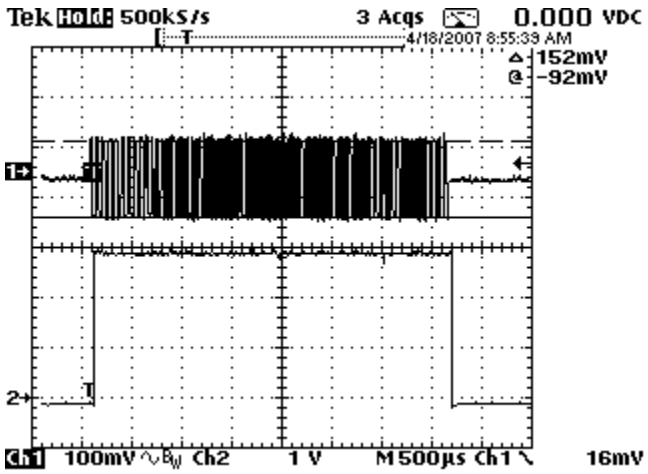
6.6 Test Group 6 – Receive Characteristics Plus Transmit Disable Time

6.6.1. Test ID's 6.1 Receive Sensitivity, 6.2 Receiver Noise Rejection

Test results: PASS

6.6.1.1. Test ID 6.1 Receive Sensitivity

- Trigger on the response from DUT
- Established communication with the device
- Reduced the amplitude of the waveform generator until it is at 155mVpp
- Verified that communication remained intact for several minutes and RXA remains active



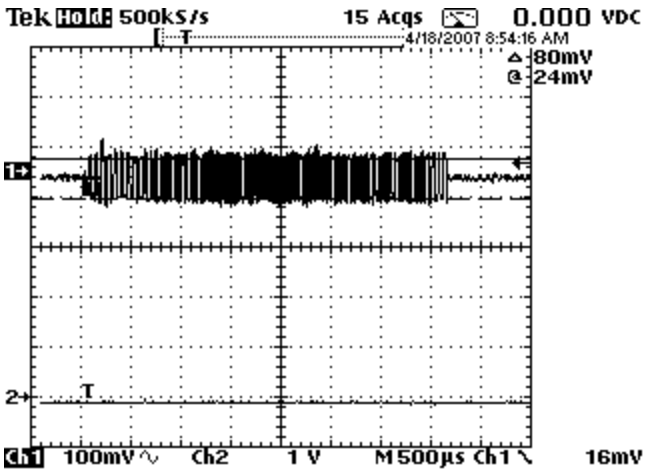
Channel one is PN in at 155mV
Channel two is RXA going active

Table 5: Test Case 6.1

Test Case 6.1 Receiver Sensitivity Part of Clause 22.4.2		
Step	**Action-Behavior**	**Verdict**
6.1.1	Set-up for group 6, supply set for 24V ± 0.1V D.C. at DUT	
6.1.2	Set waveform generator for 155mV ± 5mV pk-pk at DUT	
6.1.3	Transmit PN, capture response from DUT and examine	
	PR length	
	Preamble	
	Start delimiter	
	End delimiter	
	Frame control	
	If valid PR as defined for test group 2 Pass, otherwise Fail	Pass

6.6.1.2. Test ID 6.2 Receiver Noise Rejection

- Trigger on the RxA pin
- Established communication with the device
- Reduced the amplitude of the waveform generator until it is at 70mVpp
- Verified that communication fails and RxA remains inactive



Channel one is PN in at 70mVpp
Channel two is RXA staying active

Table 6: Test Case 6.2

Test Case 6.2 Receiver Noise Rejection Part of Clause 22.4.2		
Step	**Action-Behavior**	**Verdict**
6.2.1	Set-up for group 6, supply set for 24V ± 0.1V D.C. at DUT	
6.2.2	Set waveform generator for 70mV ± 5mV pk-pk at DUT	
6.2.3	Transmit PN, capture response from DUT	
	If no response, neither valid nor invalid waveform, Pass	Pass

6.7 Test Group 7 – Network Power Distribution

These tests are not applicable. Tests to be performed by customer.

6.8 Test Group 8 – Interference Sensitivity

These tests are not applicable. Tests to be performed by customer.

6.9 Test Group 9 – Input Circuit Parameter Measurement

6.9.1. Test ID 9.1 Input Impedance

Test Result: PASS

- Set-up according to Annex B for bus-powered devices
- Spec. impedance ≥ 3kΩ DUT
- Results: Powered but idle at 9V

Supply (v)	Frequency in (kHz)	Vz (Vp-p)	Rs (ohms)	Vrs (mVp-p)	Z = (Rs/Vrs) * Vz (ohms)
9	7.8	0.3535	100.4	0.733	48419
9	15.625	0.3542	100.4	0.766	46425
9	31.25	0.3533	100.4	1.707	20780
9	39	0.3537	100.4	2.151	16509

6.9.2. Test ID 9.2 Unbalanced Capacitance

This test is not applicable. Test to be performed by customer.

7.0 Release/Revision Record

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Approved by:	Paul Pulley, Product Manager, AMI Semiconductor
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Date:	May, 2008
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