DeviceNet™ - ODVA Conformance Test Results

Test Information	
Scheduled Test Date	**2014.10.16**
Composite Test (CT) Revision	**CT25**
ODVA File Number	**11350.01**
Test Type	**Single Product**

Vendor Information	
Vendor Name (from vid.dat)	Acrel Co., Ltd.

Device Information

Device Information from Identity Object Instance* 1

For multiple identity object instances, additional Device Information tables are inserted into the report.

Identity Object	Attribute	Value			
Attribute 1	Vendor ID (decimal)	**1340**			
Attribute 2	Device Type (hex)	**0x0c**			
Not an Attribute	Device Profile Name	**Communications Adapter**			
Attribute 4	Product Revision (decimal)	Major Rev	**1**	Minor rev	**001**
Identity Object	**Attribute**	**Value for Device 1**		**Value for Device 2**	
Attribute 3	Product Code (decimal)	**1**			
Attribute 7	Product Name	**ANET-D100**			

*For multiple instances, additional Device Information tables should be inserted into the report.

TSP Information	
TSP Location	ODAV TSP - Shanghai China
Engineer Initials or Name	LMH
Completion Date	2014.10.16
Test Result	**Pass**
All advisories, warnings, and failures are summarized and described in Table 1 below.	

DeviceNet™ - ODVA Conformance Test Results

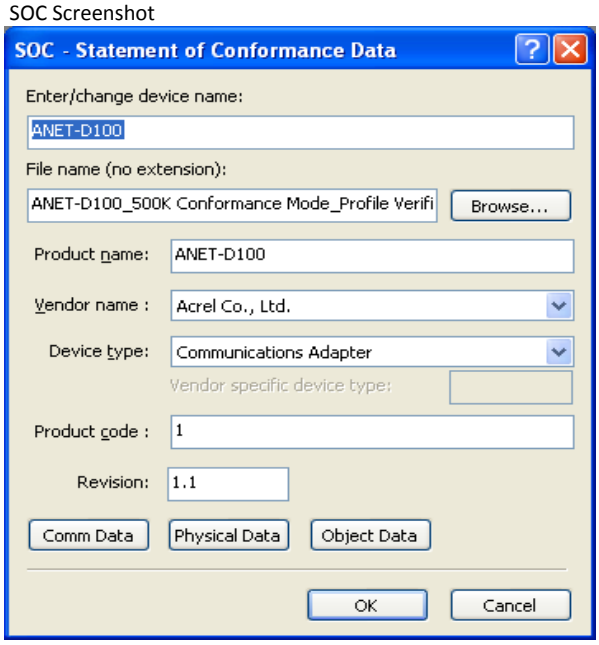
Table 1 Conformance Failures and Advisories

NOTE: **Advisories** indicate recommendations, W**arnings** indicate behavior that may be required to be changed before subsequent tests as indicated in Warning description, and F**ailures** must be resolved to pass

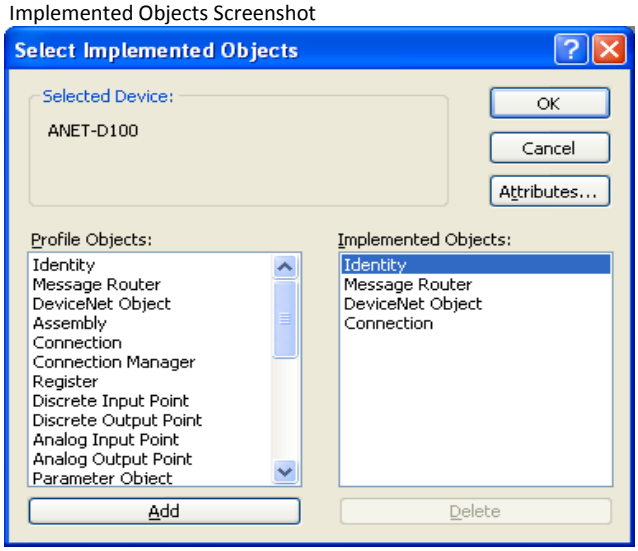
Index	Test Item	Advisories and Failures: Observed DUT Behavior	Required Behavior & Specification Reference
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

DeviceNet™ Device Under Test

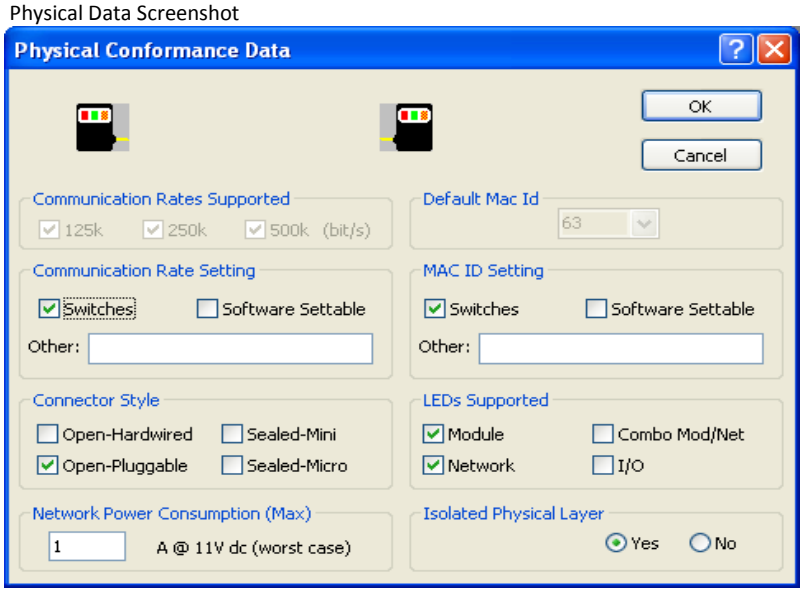
SOC Screenshot



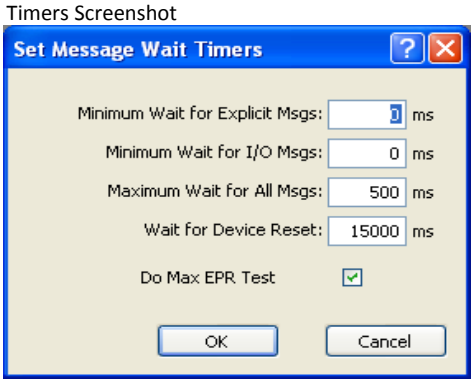
Implemented Objects Screenshot



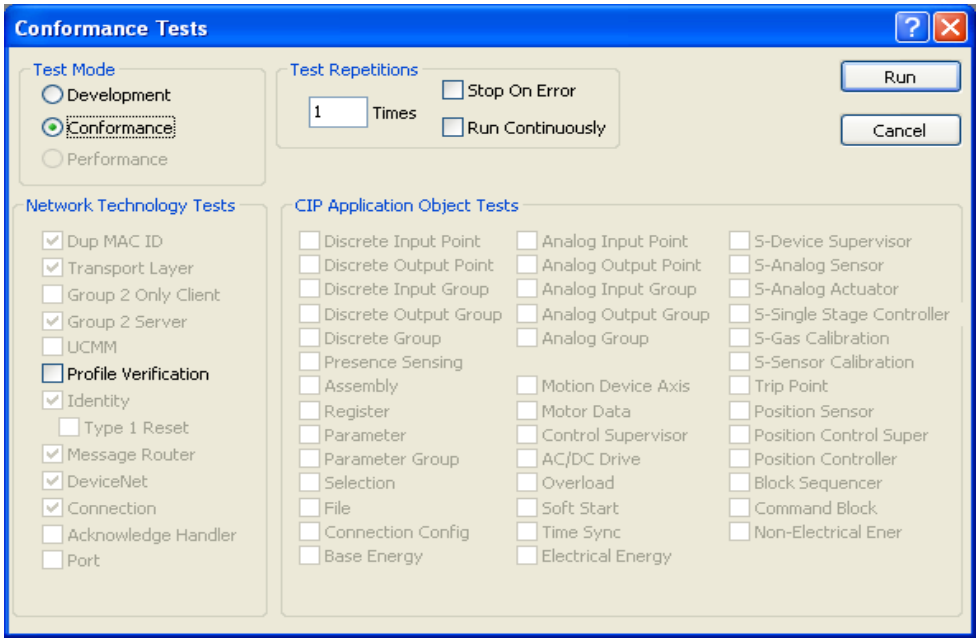
Physical Data Screenshot



Timers Screenshot



Conformance Test Screenshot



DeviceNet™ Physical Layer Test Setup

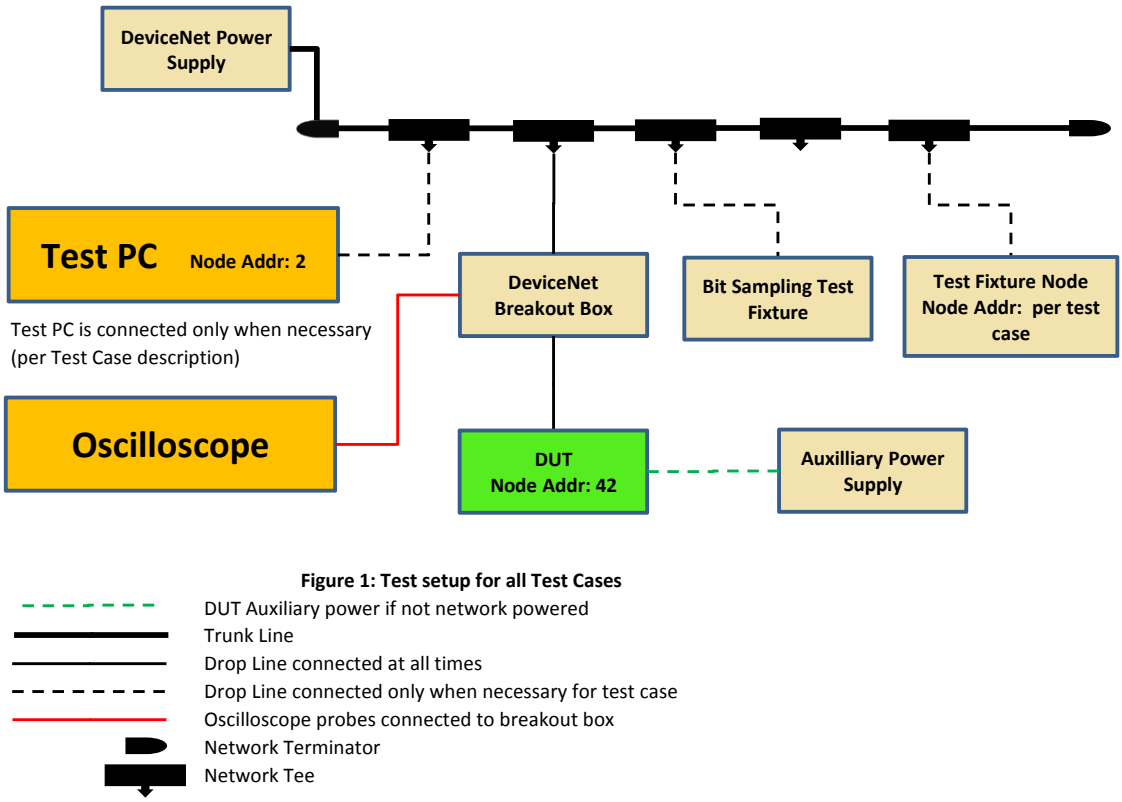


Figure 1: Test setup for all Test Cases

DUT Auxiliary power if not network powered
Trunk Line
Drop Line connected at all times
Drop Line connected only when necessary for test case
Oscilloscope probes connected to breakout box
Network Terminator
Network Tee

DeviceNet™ Conformance Composite Test Results *CT25*

DUT Name:	ANET-D100

1.0 Protocol Test Results Table

Baud Rate	SOC File (*.stc)	Log File (*.log)	Wait for Explicit (*) ms	Wait for all, ms	Result
500K	ANET-D100	Identity + Type1_Reset	0	500	Pass
500K		DeviceNetObj + Switches_and_LED	0	500	Pass
500K		Conformance + Profile (no Sw or LED)	0	500	Pass
250K		Conformance (no Sw or LED)	0	500	Pass
125K		Conformance (no Sw or LED)	0	500	Pass

(*) Wait for Explicit cannot exceed 10 ms for a passing result

2.0 Physical Layer Test (Enter Test Data in Blue Cells)

2.1 to 2.6 - Overall Results (from section "DUT 1 - Indicators and Switches Tests")

Test Name	Result
2.1 DeviceNet Connector Presence and Type	Pass
2.2 Indicators V3 Ch 9-2	Pass
2.3 Module Status LED Operation V3 Ch 9-2 and Ch 5-4	Pass
2.4 Module/Network Status (MNS) Indicator Operation	N/A
2.5 Network Status Indicator Operation	Pass
2.6 Network Behavior and Device Operation (all devices)	Pass
2.7 Switches V3 Ch 9-2	Pass

2.7 Isolation

2.7 Configure a high potential isolation (Hi-Pot) test instrument for 500 VDC, 1 ma maximum current with a 5 second ramp time and 30 second test duration. Configure a network connector with V+, V-, CAN-H and CAN-L shorted together. There is no connection to the network drain conductor. Connect the positive lead of the test instrument to the network conductors and the negative lead to the conductor indicated in the test steps below. Apply the isolation potential. Reverse the positive and negative leads and repeat. The maximum allowable isolation current is 1 ma.

Results test or of Vendor Supplied HIPOT Data	Maximum Current @ +500 VDC, ma	Maximum Current @ -500 VDC, ma	Result
DUT network conductors (not drain) to DUT earth conductor	0.02	0.02	**Pass**
DUT network (not incl drain) to DUT aux power conductors	0.02	0.02	**Pass**
DUT network (not drain) to DUT field wiring conductors	0.02	0.02	**Pass**

2.8 Impedance

2.8 Measure the resistance at the DUT network connector (no cable attached) between the CAN-H and CAN-L pins with the DUT unpowered. Measure the capacitance between the same two pins using a BK Precision LCR/ESR meter or similar vector impedance measuring device with a resolution of 1 pf or less.

2.8.1 Resistance and Capacitance: CAN-H to CAN-L

Parameter	Limit	Measured (kΩ & pF)	Result
CAN_H to CAN_L Resistance	20K ohm, minimum	50.4	Pass
CAN_H to CAN_L Capacitance (Unpowered OR Faulted and Powered - per DeviceNet circuitry implementation)	24 pf, maximum	11.2	Pass

2.9 Power

2.8.1 Physical Layer Power Sequence Verification

Auxiliary Powered DUT only	Result
Device communicates when network power is reapplied	Pass

2.9.2 Minimum Operating Voltage

Minimum Operating Voltage	Result
Device starts and operates for 1 minute at a network voltage of 11 VDC	Pass

2.9.3 Network Current Consumption: Advisory only Use a DVM to measure the current flowing into the DUT network connector V+ pin while the DUT is producing Dup Mac Check messages as the only node on the network at 500K.

V+ Device Voltage, V	DUT Network Current, A	DUT Network Power, W	DUT Connector Current Rating, A	Power Supply Type	Advisory Result
11.0	**0.03**	**0.33**	**8**	**Linear**	Pass
17.0	**0.03**	**0.51**			
25.0	**0.03**	**0.75**			

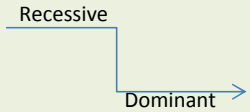
2.9.4 Inrush Current: Advisory only Use the DeviceNet Breakout Box (or a 0.1 ohm metal film resistor) and a digital oscilloscope to measure the peak inrush current when the DUT is connected to the network power. The DeviceNet Breakout Box provides a network power-up rise time of approximately 100 ns. Warning if inrush > 6A for > 1ms, else Pass.

Network Voltage, V	Inrush Current max, Amp	Inrush Current Duration, ms	Advisory Result
25	**0**	**0**	Pass

2.9.5 Power-up / Power-down CAN Dominant

2.9.5 Configure DUT for 125K baud, address 42 and attach to DeviceNet breakout box. Remove all other devices from the network. If the DUT uses auxiliary power, turn on the auxiliary power. Cycle the network power on then off 5 times with approximately 5 seconds between power events while monitoring the network with an oscilloscope adjusted to trigger on DUT produced CAN dominants that are greater than 100 us in duration. If the the DUT uses auxiliary power, repeat while leaving the network power on and cycle the auxiliary power 5 times as described above. If CAN dominants are observed, enter the width of the dominant signal and the delay from the power event to the begining of the dominant.

CAN Transceiver Data Out



DUT Power Event	Delay to CAN Dominant ms	CAN Dominant Duration, Pass if Duration < 1.5 ms	Result
Network Power-up		0	Pass
Network Power-down		0	Pass
Aux Power-up		0	Pass
Aux Power-down		0	Pass

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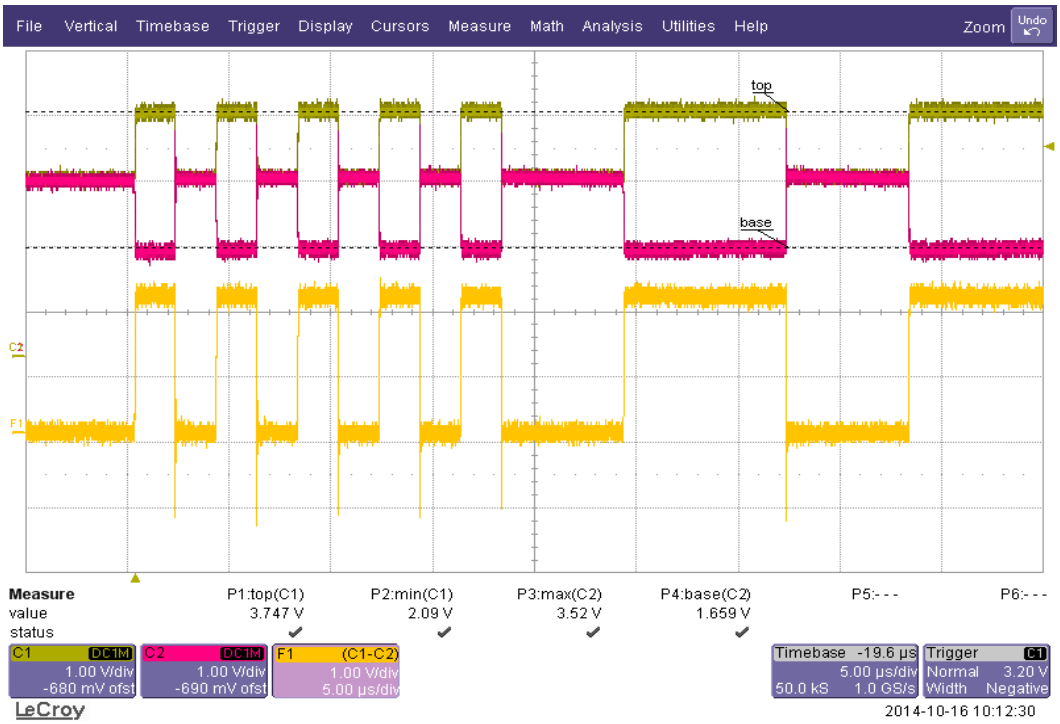
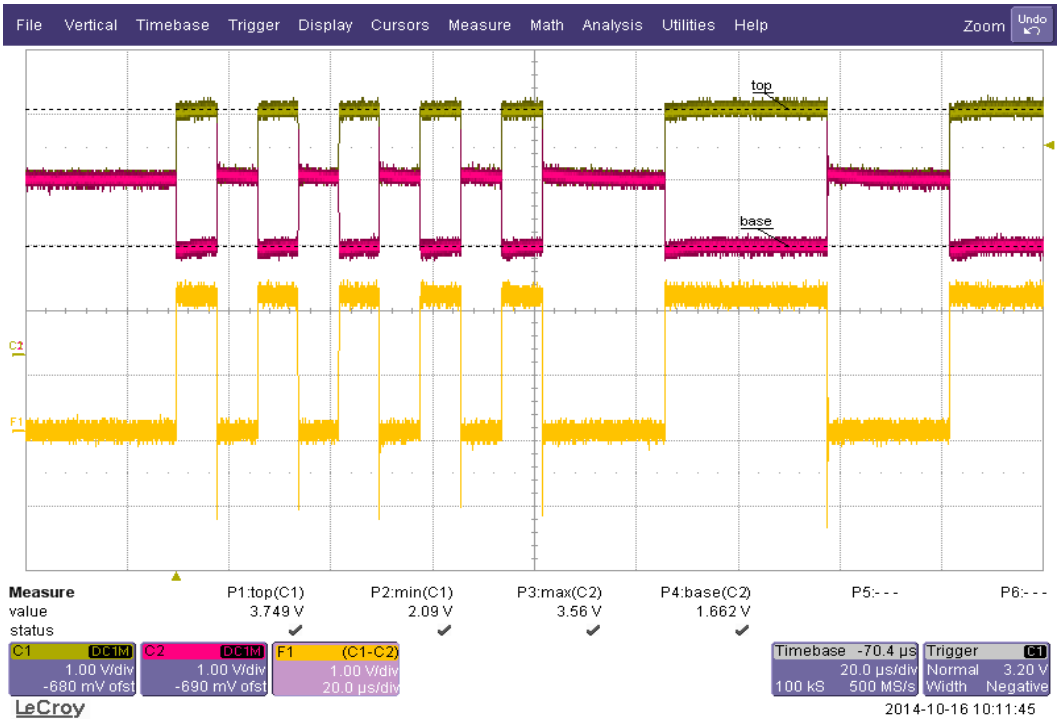
2.10 CAN Voltage Levels

2.10.1 Can-H and CAN-L Recessive Voltage Levels: Measure CAN-H, CAN-L with respect to V- with DVM at DUT with DUT in Communication Fault state					
Measured value, volts				**Pass/Fail Criteria**	**Result**
Tests		@25V	@11V		
Recessive level on CAN_H	V	2.69	2.70	2.25V<Pass<3.6V 2.25V<Warning<2.7V 3.1V<Warning<3.6V	Pass
Recessive level on CAN_L	V	2.69	2.70	2.25V<Pass<3.6V 2.25V<Warning<2.7V 3.1V<Warning<3.6V	Pass
Recessive level Differential (CAN_H – CAN_L)	mV	0.00	0.00	-500mV<Pass<+50mV	Pass





2.10.2 Can-H and CAN-L Dominant Voltage Levels: Configure DUT for node address 42 and attach to empty network. Capture CAN signals and paste above. Enter Dominant CAN-H and CAN-L signal levels below.					
Measured value, volts				**Pass/Fail Criteria**	**Result**
Tests		@25V	@11V		
Dominant level on CAN_H	V	3.75	3.74	3.0V<Pass<5.1V	Pass
				3.0V<Warning<3.5V	
				4.5V<Warning<5.1V	
Dominant level on CAN_L	V	1.66	1.66	0.75V<Pass<2.85V	Pass
				0.75V<Warning<1.25V	
				2.25V<Warning<2.85V	

2.10.3 Can-H and CAN-L Differential Voltage Level

Measured value, volts				**Pass/Fail**	**Result**
Tests		@25V	@11V		
Dominant level Differential (CAN_H – CAN_L)	V	2.09	2.08	1.5V<Pass<3.0V	Pass

2.11 CAN Timing (DUT Set to Mac Id 42)

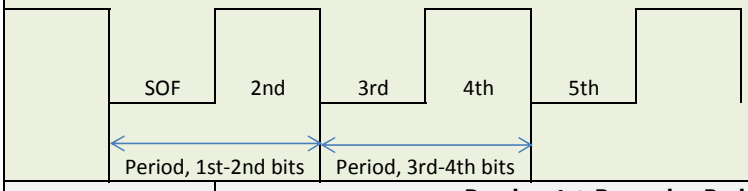
The following CAN Timing tests are a critical component of the physical layer tests. The DeviceNet tolerance on the bit time is 1000 ppm = 0.1%. At 500K 0.1% of 2000 us = 2 ns. Perform all measurements to a resolution of 1 ns or less.

DUT setup:

- **Set DUT Mac Id = 42 for all CAN timing measurements**
- **Use Bit Sample Point test fixture for all bit timing measurements.**
- **Period = (dominant bit time + recessive bit time), us**
- **Exclude the start of frame bit from the 3rd-4th Bit Period measurement**

2.11.1 (Dominant + Recessive) Period with and without Start of Frame (SOF) bit

Measure the periods as shown below to within +/- 1 ns. Hint - make all the indicated measurements in 2.11.1 - 2.11.4 first at 500K, then 250K, and finally at 125K. The Pass/Fail Result is automatically calculated from the measurement data entered.



Baud Rate (Kbps)	Dominant + Recessive Period, us				Result
	1st-2nd Bits incl SOF bit	3rd-4th Bits w/out SOF bit	Minimum w/out SOF bit	Maximum w/out SOF bit	
500	4.000	4.000	3.996	4.004	Pass
250	7.999	7.999	7.992	8.008	Pass
125	15.999	15.998	15.984	16.016	Pass

2.11.2 Dominant - Recessive Bit Asymmetry (Not Including SOF Bit)

Baud Rate	Dominant minus Recessive Bit Width, ns					Result
	Dominant Width	Recessive Width	Bit Asymmetry	Requirement		
Kbps	us	us	ns	Min	Max	
500	1.980	2.018	-38	-100	100	**Pass**

2.11.3 Jitter Between SOF Leading Edge and Next Recessive to Dominant Edge

Baud Rate (Kbps)	Jitter between Dominant Edges, ns p-p				Result
	Measured	Minimum	Advisory	Maximum	
500	1.6	0	4	20	Pass

2.11.4 Bit Sample Point

Baud Rate (Kbps)	Bit Sample Point, % Bit time, 80% Minimum				Sample Point Result
	Maximum Dominant Width, us	Compensated Dominant Width, us	Computed Propagation Delay, ns	Computed Bit Sample Point %	
500	3.445	3.444	201	82.3%	Pass
250	7.119	7.119		83.0%	Pass
125	14.440	14.439		83.0%	Pass

2.11.5 Phy Propagation Delay

Baud Rate (Kbps)	Phy Propagation Delay, ns				Prop Delay Result
	Delay, ns		Minimum, ns	Maximum, ns	
N/A	201		0	312	Pass

2.12 Device Mis-wiring

2.12 Disconnect all power sources from DUT. Connect DUT network connector to test fixture that provides access to all network connector conductors. Adjust a DC power supply to **18.0 VDC** and set current limit to approximately 1 amp. Connect power supply to each possible pair of DUT network conductors starting with (+18, 0) connected to (V+, V-). Move +18V connection from V+ to CAN-H, then to Drain, and then to CAN-L. Repeat for 0V connected to CAN-L, etc. Maintain each connection for 15 seconds. If the measured current is greater than 10 ma, maintain the connection for 1 minute.

1	No connection except (V+,V-) = (+18,0) causes more than 20 ma to flow	Pass
2	No obvious damage during or after mis-wiring	Pass
3	CAN_L to CAN_H input resistance is >= 20K ohms	Pass
4	Device powers up and communicates on network	Pass

3.0 EDS File Syntax and Minimum Content Test

3.1 Record the EDS file name and open the product EDS file with EZ-EDS. Record the EDS file revision from the File (1st) section of the EZ-EDS display.

3.1 EDS File Syntax Utility	**EZ-EDS Revision:**	**3.9**
EDS File Name	anet-d100.eds	
EDS File Revision	1.1	

3.2 Open EDS file and navigate to the [Device] section information. Open the Conformance Test Software logfile and navigate to the Identity object test section. Compare EDS section to Identity information in the DUT, Enter comparison result below.

3.2 EDS File Minimum Content			**Result**
ProdType (must match Identity Object Attribute 2)	ProdType =	12.0	Pass
ProdCode (must match Identity Object Attribute 3)	ProdCode =	1.0	Pass
MajRev (must match Identity Object Attribute 4, byte 0)	MajRev =	1.0	Pass
EZ-EDS Result - Minimum Content			Pass
3.3 EDS File Connection Entries			**Result**
All connections defined: Keyword - Path and Sizes			Pass

EDS File Advisories:

4.0 Interoperability Conformance Test Revision C6

All tests described below are performed with the ODVA Interoperability Test Fixture

Test Information: Master devices used for the interoperability test

Interoperability Master Device; P=Primary Master, A=Alternate Master	
Allen-Bradley 1756-DNB/A (F/W Revision 10.005)	P
Omron CJ1W-DRM21 (Revision 1.01)	A

Test Information: Manager tools used for the interoperability test

Interoperability Manager Tool; P=Primary Tool, A=Alternate Tool	
RSNetWorx for DeviceNet	P
Omron DeviceNet Configurator (Revision 2.21)	A

4.1 EDS File Interoperability Test

Install the vendor supplied EDS file into the configuration manager tool and configure the DUT for use on the ODVA Interoperability Test Fixture. Note: Some DUT's and EDS files do not support or allow I/O configurations other than the original configuration installed in the DUT. Advisory if additional I/O assemblies are described in the EDS file but are not supported by the DUT.

4.1.1 Install the vendor supplied EDS file into the configuration manager tool

4.1.1 Requirement	**Result**
Pass if able to install EDS file into the configuration manager, else Warning	Pass

4.1.2 Use configuration manager to configure the DUT to use the I/O Assembly with the largest produced/consumed connection sizes referenced in the EDS file, up to 64 bytes.

Producing Assy Instance	Produced size, bytes	Consuming Assy Instance	Consumed Size, Bytes
Poll	2	Poll	2

4.1.2 Requirement	**Result**
Pass if able to configure DUT connection, else Advisory	**Pass**

4.1.3 Configure the Primary Master scan list for the selected I/O configuration(s).
Example: Poll + COS + BS. Note: cannot configure for COS and Cyclic together.

Poll (Produced/Consumed) bytes	BS (Produced/Consumed) bytes	COS (Produced/Consumed) bytes	Cyclic (Produced/Consumed) bytes
2/2			

4.1.3 Requirement	**Result**
Pass if able to configure and connect Scanner for all supported DUT connections, Fail if not able to connect scanner to any DUT supported connection, else Advisory.	**Pass**

4.2 Power Cycle Test

Perform either 4.2.1.1 or 4.2.1.2 as appropriate. Place the Master keyswitch in Run mode. Start with all power off. Turn on each power supply in the sequence indicated at 2 to 4 second intervals. Verify that after turning on all power supplies in each test, all of the connections, including DUT, are established within one minute and the network returns to the "Operational" state as indicated by a Green stack light after pressing the Network Fault Reset button. Fail if DUT fails to connect after any power sequence.

4.2.1 Power Supply Sequence

4.2.1.1 For a DUT with an Auxiliary Power Input

Test #	Power Supply Turn ON Sequence – Primary Master – performed twice				Result
	1	2	3	4	
1	Network	Master	DUT	Aux Pwd Dev	Pass
2	Network	DUT	Aux Pwd Dev	Master	Pass
1	Network	DUT	Master	Aux Pwd Dev	Pass
2	Network	Aux Pwd Dev	DUT	Master	Pass
3	DUT	Master	Network	Aux Pwd Dev	Pass
4	DUT	Aux Pwd Dev	Network	Master	Pass
7	DUT	Master	Aux Pwd Dev	Network	Pass

4.2.1.2 For a Network Powered DUT

Test #	Power Supply Turn ON Sequence – Primary Master – performed twice				Result
	1	2	3	4	
1	Network	Master	Aux Pwd Dev	N/A	N/A
2	Network	Aux Pwd Dev	Master	N/A	N/A
3	Master	Network	Aux Pwd Dev	N/A	N/A
4	Aux Pwd Dev	Network	Master	N/A	N/A
7	Master	Aux Pwd Dev	Network	N/A	N/A

4.2.2 Power On/Off

Place the Master keyswitch in Run mode. Cycle a power source off-on as indicated. Verify that after turning on the indicated power source in each test, all of the connections, including DUT, are established within 90 seconds and the network returns to the "Operational" state of a Green stack light after pressing the Network Fault Reset button. Fail if DUT fails to connect within 90 seconds after any power cycle or if DUT produces CAN dominant that exceeds 1.5 ms. (Observe DUT dominant with current probe on DUT CAN data lines. Trigger on dominant > 1ms.)

Test #	Performed 5 times - DUT must connect to network within 90 sec each cycle	Result
1	Master Power Off/On (5 times)	Pass
2	Network Power Off/On (5 times)	Pass
3	DUT Aux Power Off/On (5 times) Perform for DUT that uses Auxiliary power, else N/A.	Pass

4.3 Device Disconnect-Reconnect Test

Place the Master keyswitch in Run mode. Cycle a network connection off-on as indicated. Verify that after reconnecting the indicated device in each test, all of the connections, including DUT, are established within 90 seconds and the network returns to the "Operational" state of a Green light after pressing the Network Fault Reset button. Fail if DUT fails to connect withing 90 seconds after any network disconnect-reconnect cycle or if DUT produces CAN dominant that exceeds 1.5 ms. (Observe DUT dominant during DUT reconnect with current probe on DUT CAN data lines. Trigger on dominant > 1ms.)

Test #	Performed 5 times - DUT must connect to network within 90 sec each cycle	Result
7.3.1	Master Disconnect-Reconnect with time out (disconnected for > 10 sec)	Pass
7.3.2	Master Disconnect-Reconnect without time out (disconnected for < 10 sec)	Pass
7.3.3	DUT Disconnect-Reconnect (disconnected for > 10 sec)	Pass

4.4 Network Aerobic Test

4.4.1 Master Idle Who Test Run all tests with the Master keyswitch in Idle mode. Press the Network Fault Reset button and verify that the network is in "Operational" state and Green stack light is on.
1- Scan the network with the network configuration tool (RSNetworx, etc.). Verify that the tool identifies all nodes. Pass if all nodes identified, Advisory if one node other than the DUT is not identified. Failure if tool is unable to communicate with the DUT.
2- Select the DUT icon in the scan results list and upload the DUT parameters (if any are supported). N/A if no parameters, Pass if parameters upload without errors, else Warning.
3- Attempt to modify and download one unlocked parameter. Pass if successful, N/A if no parameters or no unlocked parameters, else Advisory.
4- Verify that all nodes remain connected as evidenced by Green stack light and Green MOD/NET LED on Master.

Step #	Master in IDLE Mode – Perform test sequence twice within 5 minutes	Result
1	Master Idle mode: Successful network "who"	Pass
2	Master Idle mode: Upload DUT parameters (N/A if DUT EDS file does not include PARAMS)	Pass
3	Master Idle mode: Modify 1 or more DUT parameters (N/A if DUT EDS file does not include PARAMS or if all parameters are locked) - Advisory only	Pass
4	Verify network remains in "Operational State" all nodes remain connected.	Pass

4.4.2 Master Active Who Test Run all tests with the Master keyswitch in Run mode. Press the Network Fault Reset button and verify that the network is in "Operational" state and Green stack light is on.
1- Scan the network with the network configuration tool (RSNetworx, etc.). Verify that the tool identifies all nodes. Pass if all nodes identified, Advisory if one node other than the DUT is not identified. Failure if tool is unable to communicate with the DUT.
2- Select the DUT icon in the scan results list and upload the DUT parameters (if any are supported). N/A if no parameters, Pass if parameters upload without errors, else Warning.
3- Attempt to modify and download one unlocked parameter. Pass if successful, N/A if no parameters or no unlocked parameters, else Advisory.
4- Verify that all nodes remain connected as evidenced by Green stack light and Green MOD/NET LED on Master.

Step #	Master in RUN Mode – Perform test sequence twice	Result
1	Master RUN mode: Successful network "who"	Pass
2	Master RUN mode: Upload DUT parameters (N/A if DUT EDS file does not include PARAMS)	Pass
3	Master RUN mode: Modify 1 or more DUT parameters (N/A if DUT EDS file does not include PARAMS or if all parameters are locked) - Advisory only	Pass
4	Verify network remains in "Operational State" all nodes remain connected and Interop Test Fixture Status light = Green	Pass

4.4.2 Master Active Test Run test with the Master keyswitch in Run mode. Press the Network Fault Reset button and verify that the network is in "Operational" state and Green stack light is on. Switch the NetMeter off then on, set the selector switch to 2, Bus Errors, and press the left hand button 3 times to display total bus errors (shoud be 0 at begining of test). Let the test run undisturbed for approximately 90 minutes until the Blue stack light is on. Record the state of the network (Operational if Green stack light is on) and the total Bus errors indicated on NetMeter during the 90 minute test. Pass if Green stack light remains on, Fail if Red stack light is on. Pass if Bus errors <= 9, Advisory if <= 90, else Warning.

Step #	Primary Master – Run time >= 1.5 hours		Result
1	With Master in the Run state, network remains in the "Operational State" for 1.5 hours		Pass
	Bus errors during Master Active Test: Pass if <= 10, Advisory if <= 100	0	Pass

DUT 1 - Indicator and Switches Tests and Report CT25

DUT Name:	ANET-D100

2.1 DeviceNet Connector Presence and Type

2.1 Visually examine the DUT for the DeviceNet network connector.

2.1 Requirement	Result
Connector matches SOC (stc file) and Connector Profile from [V3 Ch 8-3.12]	Pass
Connector type is male. N/A if connection type is hard-wired.	Pass
Connector pins are gold colored. N/A if connection type is hard-wired.	Pass
If the connection type is hard-wired (no connector), connections shall have clearly marked terminals. N/A if connection type is not hard-wired.	N/A

2.2 Indicators V3 Ch 9-2

2.2 Compare the indicators 'LED Supported' on the Physical Conformance Data page of the stc file with the indicators present in the DUT.

2.2 Requirement	Specified in SOC	Present in DUT	Result
Module Status	Yes	Yes	Pass
Combined Module/Network Status	No	No	Pass
Network Status	Yes	Yes	Pass

2.3 Module Status LED Operation V3 Ch 9-2 and Ch 5-4

2.3 The Module Status indicator tests are N/A if a Module Status indicator is not specified in SOC and is not present in DUT. Else, prepare a DeviceNet Physical Layer Test Network (network) per the Figure 1 of the Physical Layer Test Setup diagram before proceeding.

Indicator Label and Colors

2.3.1 Visually examine the DUT for a Module Status Indicator.

Requirement	Result
An indicator is labeled “Module Status”, "MOD Status", "MOD", or “MS”. The labels may be upper or lower case.	Pass
The Module Status indicator is a Red/Green bicolor LED or a Red LED and a Green LED in very close proximity.	Pass

Indicator Power-up Behavior

2.3.2 Power-up the DUT while observing the Module Status indicator behavior.

Requirement	Result
The indicator flashes green for 0.25 sec. then red for 0.25 sec during power-up self test.	Pass
The indicator is green or is flashing green after completion of power-up self test.	Pass

Node Address and Data Rate Switch Change Behavior

2.3.3 This test is N/A if the DUT does not support Node Address switches. Else, configure the network with at least one device other than the DUT. Configure the DUT for the network data rate but at a node address that is different from that of the other network device. Connect the DUT to the network and power the network. Once the DUT begins to flash the Network Status LED green, change the DUT node address switches to a different value than the device is currently on line at.

Requirement	Result
The DUT must automatically reset when the node address switch is changed or the Module Status LED must flash Red when the Node Address switch setting is valid (0 – 63) and does not match the on-line address.	Pass

2.3.4 This test is N/A if DUT does not support Data Rate switches. Else, configure the network with at least one device other than the DUT. Configure the DUT for the network data rate but at a node address that is different from that of the other network device. Connect the DUT to the network and power the network. Once the DUT begins to flash the Network Status LED green, change the DUT data rate switch to a different value than the device is currently on line at.	
Requirement	**Result**
Module Status LED must flash Red when the Data Rate switch setting is valid (0 – 2) and does not match the on-line data rate.	Pass
2.3.5 Recall all Module Status LED states during the test items in 2.3	
Requirement	**Result**
The permissible indicator states observed during test sequence 2.3 are off, flashing green, green, flashing red, red, flashing red-green. The red and green LED's are never on at the same time.	Pass

2.4 Combined Module/Network Status (MNS) Indicator Operation

2.4 The Combined Module/Network Status indicator tests are N/A if a Module/Network indicator is not specified in SOC and is not present in DUT. Else, prepare a DeviceNet Physical Layer Test Network (network) per the Figure 1 of the Physical Layer Test Setup diagram before proceeding.

2.5 Network Status Indicator Operation if no Combined Module/Network Status Indicator is present. (See 2.4 above for Combined Module/Network Status LED operation)

2.5 The Network Status indicator tests are N/A if a Module/Network indicator is not specified in SOC and is not present in DUT. Else, prepare a DeviceNet Physical Layer Test Network (network) per the Figure 1 of the Physical Layer Test Setup diagram.

Indicator Label and Colors

2.5.1 Visually examine the DUT for a Network Status Indicator.	
Requirement	**Result**
The Network Status indicator is labeled “Network Status”, "Net Status", "Net", or “NS”. The labels may be upper or lower case.	Pass
The Network Status indicator is a Red/Green bicolor LED or a Red LED and a Green LED in very close proximity.	Pass

Indicator Power-up Behavior

2.5.2 Leave the network unpowered and connect the DUT as the only node on the network.	
2.5.2a Turn on the network power while observing the NS indicator.	
2.5.2b If the DUT requires Auxiliary power, connect a source of Auxiliary power to the DUT and observe indicator.	
The indicator flashes green for 0.25 sec. then red for 0.25 sec during power-up self test.	Pass
The indicator is off after completion of power-up self test.	Pass

Occupied Network Behavior

2.5.3 Configure the network for 500K with at least one device other than the DUT. Configure the DUT for a data rate of 500K but at a node address that is different than that of the other network device. Connect the DUT to the network and power the network.	
Requirement	**Result**
The Network Status indicator flashes green after self test when DUT is a node on an occupied network and DUT MAC ID is unique.	Pass
2.5.4 Run DNetCT in the Developer mode and select only the DeviceNet object test. When the test asks if you wish to perform the Network Status Indicator test, answer YES.	
Requirement	**Result**
The DUT must pass the DNetCT Network Status Indicator tests.	Pass

2.6 Network Behavior and Device Operation (all devices)

Recessive Bus Error Behavior

2.6.1 Configure the DUT for node address 42 and data rate 500K. Connect the DUT as the only node on the network and power the DUT and the network. Attach a configuration tool to the network and scan the network at 500K. Use the configuration tool to send a Get Attribute Single request to the DUT for the DeviceNet BOI attribute (0E 03 01 03). If the DUT supports this attribute and the value is not 0, send a Set Attribute Single request to set the attribute value to 0 (10 03 01 03 00). **Disconnect the configuration tool and cycle the network power.** If the DUT is autobaud only, momentarily connect a second node configured for 500K and a node address that is different from the DUT. Remove this second node after it has produced one acknowledged Duplicate MAC ID Check (Dup Mac) message and before it produces a second Dup Mac message one second later.

Requirement	Result
The DUT must produce a continuous stream of DUP Mac messages as the only node on the network.	Pass

2.6.2 While the DUT is producing Dup Mac messages, force the network to a recessive state by applying a short circuit between the network CAN-H and CAN-L conductors for approximately 5 seconds. Remove the short circuit.

Requirement	Result
The DUT must stop sending Dup Mac messages and leave the network in a recessive state (CAN-H = CAN-L = approximately 2.5 volts > V-). If the DUT supports a Network Status LED or MNS LED, the LED must be red.	Pass

2.6.3 While the DUT is in the Communication Fault State (bus-off), attach a configuration tool to the network and scan the network at 500K.

Requirement	Result
The DUT must not respond to the network scan. It must remain bus-off. If the DUT supports a Network Status LED or MNS LED, the LED must remain red.	Pass

Dominant Bus Error Behavior

2.6.4a Disconnect the configuration tool from the network and cycle **only** the network power. If the DUT also uses a source of auxiliary power, do **not** cycle the auxiliary power to the DUT.

2.6.4b Perform this step for Autobaud devices only: If the DUT is autobaud only, momentarily connect a second node configured for 500K and a node address that is different from the DUT. Remove this second node after it has produced one acknowledged Duplicate MAC ID Check (Dup Mac) message and before it produces a second Dup Mac message one second later.

2.6.4c Observe the network traffic on the oscilloscope.

Requirement	Result
The DUT produces a continuous stream of DUP Mac messages as the only node on the network.	Pass

2.6.5 While the DUT is producing Dup Mac messages, force the network to a dominant state by applying a source of (+4.5V, 0V) between the network CAN-H and CAN-L conductors for approximately 5 seconds. Remove the dominant source.
Test Note: It may be necessary to repeat this step more than once to obtain the result required below. If after 5 attempts, the DUT does not become bus-off, test Resuts 2.5.8 and 2.5.9 are marked as Advisory.

Requirement	Result
The DUT must stop sending Dup Mac messages and leave the network in a recessive state (CAN-H = CAN-L = approximately 2.5 volts > V-). If the DUT supports a Network Status LED or MNS LED, the LED must remain red.	Pass

2.6.6 This test is marked as Advisory if the requirement in test step 2.6.5 above cannot be achieved. While the DUT is in the Communication Fault State (bus-off), attach a configuration tool to the network and scan the network at 500K.

Requirement	Result
The DUT must not respond to the network scan. It must remain bus-off. If the DUT supports a Network Status LED or MNS LED, the LED must remain red.	Pass

2.6.7a Disconnect the configuration tool from the network and cycle only the network power. If the DUT also uses a source of auxiliary power, do not cycle the auxiliary power to the DUT.

2.6.7b Autobaud devices only: If the DUT is autobaud only, momentarily connect a second node configured for 500K and a node address that is different from the DUT. Remove this second node after it has produced one acknowledged Duplicate MAC ID Check (Dup Mac) message and before it produces a second Dup Mac message one second later.	
2.6.7c Observe the network traffic on the oscilloscope.	
Requirement	**Result**
The DUT produces a continuous stream of DUP Mac messages.	Pass

Occupied Node Address Behavior

2.6.8 Disconnect the DUT from the network. Configure a reference node for node address 42 and data rate 500K. Attach the reference node and the Test PC to the network and power the network. Attach a configuration tool to the network and scan the network at 500K. Make sure that the configuration tool discovers the reference node at address 42. Configure the DUT for the same node address 42 and data rate 500K. Connect the DUT to the network and power the DUT. Wait approximately 5 seconds and disconnect the reference node. Use the configuration tool to scan the network at 500K.	
Requirement	**Result**
The DUT must not respond to the network scan. It must remain bus-off. If the DUT supports a Network Status LED or MNS LED, the LED must remain red.	Pass

Node Address Change Behavior

2.6.9 Set the DUT node address to Mac Id 42, data rate to 500K baud, attach DUT to network and power DUT and network. Attach a configuration tool to the network and scan the network at 500K. Verify DUT communicates with configuration tool at 500K baud. While the DUT remains on-line and connected, change the node address to 43. Do NOT cycle the DUT or network power. Verify that the DUT exhibits one of the two following behaviors: a) the DUT remains connected at Mac Id 42 and continues to communicate with the configuration tool, -OR- b) the DUT stops communicating at Mac Id 42 and begins sending Duplicate Mac Id Check messages at Mac Id 43. Cycle the network power. If the DUT also uses a source of auxiliary power, it may be necessary to cycle the DUT auxiliary power. Attach a configuration tool to the network and scan the network at 500K baud. Verify DUT communicates with configuration tool at Mac Id 43, 500K baud.	
Requirement	**Result**
When the node address configuration is changed the DUT must either a) remain connected at the original Mac Id until the network (and optionally, the DUT auxiliary power) is cycled -OR- b) the DUT may close all existing connection and begin sending Dup Mac Check messages at the new node address.	Pass

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Data Rate Change Behavior

2.6.10 Set the DUT data rate to 500K baud, attach DUT to network and power DUT and network.
Attach a configuration tool to the network and scan the network at 500K.
Verify DUT communicates with configuration tool at 500K baud.
While the DUT remains on-line and connected, change the DUT Data Rate to 250K using the DUT Data Rate switch or DUT configuration tool as appropriate. Do NOT cycle the DUT or network power.
Verify that the DUT remains connected at 500K and continues to communicate with the network configuration tool.
Cycle the network power. If the DUT also uses a source of auxiliary power, it may be necessary to cycle the DUT auxiliary power.
Observe the DUT Dup Mac messages on the network.
Attach a configuration tool to the network and scan the network at 250K baud.
Verify DUT communicates with configuration tool at 250K baud.

Requirement				**Result**
Network Data Rate, K Baud	**DUT Data Rate Setting**	**Network Power Cycle (or Aux Power Cycle)**	**Data Rate on Network, K Baud**	
500	2	No	500	Pass
500	1	No	500	Pass
250	1	Yes	250	Pass

2.7 Switches V3 Ch 9-2

2.7.1 Compare the switches supported on the Physical Conformance Data page of the stc file with the switches present in the DUT.

Switch Requirements	Specified in SOC	Present in DUT	Result
Node Address Switch	Yes	Yes	Pass
Data Rate Switch	Yes	Yes	Pass

2.7.2 Node Address Switch

2.7.2 The Node Address switch tests are N/A if a Node Address switch is not specified in SOC and is not present in DUT.

2.7.2.1 Visually examine the DUT for a Node Address switch.

Requirements	Result
The Node Address switches are labeled “Node Address”, "Address", or “NA”. The labels may be upper or lower case.	Pass
The most significant digit switch is set to the left or top of the product and determined by the orientation of the switch label.	Pass
If the Node Address switch is rotary, thumb-wheel, or push-wheel, the switch must be labeled in decimal format.	N/A

2.7.2.2 Run DNetCT in the Developer mode and select only the DeviceNet object test. When the test asks if you wish to perform the Node Address Switch test, answer YES.

Requirement	Result
The DUT must pass the DNetCT Node Address Switch test	Pass

Invalid Node Address Switch Setting Behavior

2.7.2.3a This test step result is N/A if the DUT does not support Node Address switches, if the Node Address switches cannot be set to a value > 63, or if the DUT supports the Set Attribute Single service request for DeviceNet instance attribute 01, Mac Id (attribute required to be Non-Volatile). Turn off the power to the network. Set the DUT Node Address switches to value 85 (0x45). If the node address switches cannot be set to the value specified, choose any address > 63.

2.7.2.3b Verify that the DUT is conected to the network, and turn on the network power.

2.7.2.3c Observe the network traffic on the oscilloscope.

2.7.2.3d Scan the network at 500K.

Requirement	Result
There must be no network activity on the network.	Pass
The DUT must not respond to the network scan. It must remain bus-off. If the DUT supports a Network Status LED or MNS LED, the LED must remain red.	Pass

2.7.3 Data Rate Switch

2.7.3 The Data Rate switch tests are N/A if a Data Rate switch is not specified in SOC and is not present in DUT.

2.7.3.1 Visually examine the DUT for a Data Rate switch.

Requirement	Result
The Data Rate switch is labeled “Data Rate”, "Rate", or “DR”. The labels may be upper or lower case.	Pass
The most significant digit switch is set to the left or top of the product and determined by the orientation of the switch label.	Pass
The switch must be encoded as follows: (Switch setting : Data Rate) of (0 : 125K), (1 : 250K), (2 : 500K)	Pass

2.7.3.2 For each Requirement case below:
Turn off the network power and stop the configuration tool, if running.
Set the Data Rate switch to the setting indicated.
Connect the DUT as the only node on the network and power the DUT and the network.
Observe the DUT Dup Mac messages on the network.
Attach a configuration tool to the network and scan the network at the indicated data rate.
Use the configuration tool to send a Get Attribute Single request to the DUT for the DeviceNet Baud Rate Switch Value attribute (0E 03 01 09). Enter "N/A" for attribute 3-1-9 value if the switch cannot be changed while the DUT is on-line and connected, for example if the DUT must be powered off and physically disassembled to access the switch.
Repeat for each Data Rate switch setting indicated.

Requirement	

Config Tool Data Rate, K Baud	Data Rate Switch Setting	Data Rate switch value in Attribute 3-1-9	Data Rate on Network, K Baud	Result
125	0	0	125	Pass
250	1	1	250	Pass
500	2	2	500	Pass

2.7.3.3 This test step result is N/A if the Data Rate switches cannot be set to a value > 2 or if the DUT does NOT support the Set Attribute Single service request for DeviceNet instance attribute 02, Baud Rate.
Set the DUT Data Rate switch to 1, attach DUT to network and power DUT and network.
Attach a configuration tool to the network and scan the network at 250K.
Verify DUT communicates with configuration tool at 250K baud.
Set the Data Rate switch to 3 (DIP swich) or 9 (Rotary switch). Do NOT cycle the DUT or network power.
Verify that the DUT remains connected at 250K and continues to communicate with the configuration tool.
Cycle the network power. If the DUT also uses a source of auxiliary power, it may be necessary to cycle the DUT auxiliary power.
Observe the DUT Dup Mac messages on the network.
Attach a configuration tool to the network and scan the network 250K.
Verify DUT communicates with configuration tool at 250K baud.
Use the configuration tool to send a Get Attribute Single request to the DUT for the DeviceNet Baud Rate Switch Value attribute (0E 03 01 09). Enter "N/A" for attribute 3-1-9 value if the switch cannot be changed while the DUT is on-line and connected, for example if the DUT must be powered off and physically disassembled to access the switch.

Requirement				Result
Config Tool Data Rate, K Baud	**Data Rate Switch Setting: Use 3 for DIP, 9 for Rotary SW.**	**Data Rate switch value in Attribute 3-1-9**	**Data Rate on Network, K Baud**	
250	1	1	250	Pass

Invalid Data Rate Switch Setting Behavior

2.7.3.4a This test step result is N/A if the DUT does not support Data Rate switches, if the Data Rate switches cannot be set to a value > 2, if the DUT supports Autobaud operation for Data Rate switch value >2, or if the DUT supports the Set Attribute Single service request for DeviceNet instance attribute 02, Baud Rate.
Turn off the power to the network. Set the DUT Data Rate switches to value 3.

2.7.3.4b Verify that the DUT is conected to the network, and turn on the network power.

2.7.3.4c Observe the network traffic on the oscilloscope.

2.7.3.4d Scan the network at 500K.

Requirement	Result
There must be no network activity on the network.	Pass
The DUT must not respond to the network scan. It must remain bus-off. If the DUT supports a Network Status LED or MNS LED, the LED must remain red.	Pass