ETHERNET COMMUNICATION SYSTEM TESTING

Project Name: _____

This test procedure outlines the tests required to measure and prove the Ethernet network performance. The Department will select the test locations to be tested based upon the network. Each test location will consist of two switch nodes. Submit request for test locations to RE 45 days prior to test. Perform all tests using approved network testing equipment. At least 30 days prior to this test, submit to RE for approval catalog cuts for testing equipment, list of software and network protocols to be used to perform the test. Testing equipment must be compliant with RFC, and IEEE standards.

Testing Equipment Device #1:

_____

Manufacturer/Model No.:

_____

Testing Equipment Device #2:

_____

Manufacturer/Model No.:

_____

Software_____

Approved Testing Locations:

Test Site # 1 - Location A to Location B:

A) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

B) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

Test Site # 2 - Location C to Location D:

C) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

D) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

Test Site # 3 - Location E to Location F:

E) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

F) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

Test Site # 4 - Location G to Location H:

G) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

H) Node Name_____ ROUTE_____ MP_____ Direction (NB,SB…)_____
IP Address:_____ Test Device IP Address_____

Additional sites to be added as required in order to complete the project intent.

Complete one set of test forms for each Test Site.

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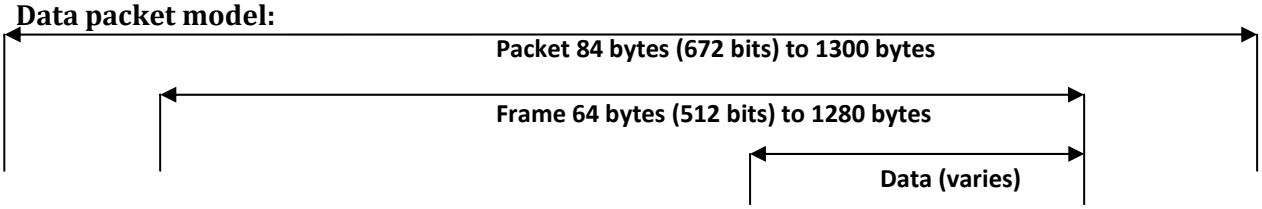
Data packet model:



Pre-amble	MAC Destination address	MAC Source address	Ethernet Type or length	Frame check sequence	Payload (data)	Inter Packet Gap
8 bytes	6 bytes	6 bytes	2 bytes	4 bytes	46 to 1262 bytes	12 bytes

1: THROUGHPUT

Perform throughput testing in accordance with the procedures listed in RFC 2544 for 10Mbps and 100Mbps, and 1Gbps when gigabit ports and/or SFP modules are specified or provided Upon error, use the "half doubling method" to find the maximum throughput value. See below table for minimum frames per second.

Comments:	**PASS** / **FAIL**

10 Mbps

Test Frame Size (bytes)	Total Packet Size (bits)	Testing Rate Bits/sec		Frame Throughput bits/sec		This value incorporates a 1% loss of the number of frames transmitted in Frames Per Second*	
		Minimum	Actual	Minimum	Actual	Minimum	Actual
64	672	9899232		7544272		14731	
128	1184	9898240		8560640		8360	
256	2208	9898464		9181184		4483	
512	4256	9895200		9523200		2325	
1024	8352	9897120		9707520		1185	
1280	10400	9890400		9738240		951	

***For example, at frame size of 64 bytes the maximum fps value is 14880. A 1% loss yields 14731 fps.**

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100 Mbps							
Test Frame Size (bytes)	**Total Packet Size (bits)**	**Testing Rate Bits/sec**		**Frame Throughput bits/sec**		**This value incorporates a 1% loss of the number of frames transmitted in Frames Per Second***	
		Minimum	**Actual**	**Minimum**	**Actual**	**Minimum**	**Actual**
64	672	98999040		75427840		147320	
128	1184	98998976		85620736		83614	
256	2208	98997888		91824128		44836	
512	4256	98998816		95277056		23261	
1024	8352	98996256		97099776		11853	
1280	10400	98904000		97484800		9510	

1000 Mbps							
Test Frame Size (bytes)	**Total Packet Size (bits)**	**Testing Rate Bits/sec**		**Frame Throughput bits/sec**		**This value incorporates a 1% loss of the number of frames transmitted in Frames Per Second***	
		Minimum	**Actual**	**Minimum**	**Actual**	**Minimum**	**Actual**
64	672	999999840		754285593		1473214	
128	1184	999999296		856215552		836148	
256	2208	999998784		918259712		448369	
512	4256	999998272		952778752		232612	
1024	8352	999993312		971022336		118533	
1280	10400	999991200		974755840		95191	

2: LATENCY

Perform latency testing in accordance with the procedures listed in RFC 2544 to determine the minimum time transmit and receive a given frame.

Comments:	**PASS** **FAIL**

100 Mbps **Repeat 20 times**				
Test Frame Size (bytes)	**Total Packet Size (bits)**	**Latency Time – Round Trip Required Value = ≤10ms Round trip**		
		Minimum	**Average**	**Maximum**
64	672			
128	1184			
256	2208			
512	4256			
1024	8352			
1280	10400			

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3: JITTER

Determine the difference between the forwarding delay of two consecutive received packets belonging to the same stream. Send evenly spaced data at a constant rate using fixed length packets. Use true real-time jitter measurement method for this test.	
Comments:	**PASS** **FAIL**

100 Mbps **Required Value = ≤ 1ms**

Test Frame Size (bytes)	Total Packet Size (bits)	No. of Frames Sent	No. of Frames Lost (%)	Jitter	Pass	Fail
64	672					
128	1184					
256	2208					
512	4256					
1024	8352					
1280	10400					

4: BACK TO BACK TEST

Perform back-to-back frame testing in accordance with the procedures listed in RFC 1242 to determine the maximum number of frame that the device can transmit and receive without frame loss (%).	
Comments:	**PASS** **FAIL**

100 Mbps **Required Value** = No frames lost (0.00%)

Test Frame Size (bytes)	Total Packet Size (bits)	Number of Frames Sent in 2 seconds	Number of Frames Lost	Pass	Fail
64	672				
128	1184				
256	2208				
512	4256				
1024	8352				
1280	10400				

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5: SYSTEM RECOVERY

At a frame size of 512 bytes, set testing rate to 100Mbps and verify that no frames are dropped for a period of 60 seconds. Gradually increase the rate until frames are lost. Drop the rate back to 100Mbps and verify the frame failures drop to 0.00%. **The Minimum frame per second represents a 1% loss of the number of frames transmitted.**

Comments:	**PASS** **FAIL**

Test Frame Size (bytes)	**Total Packet Size (bits)**	**Testing Rate Bits/sec**		**Frame Throughput bits/sec**		**Frames per second**	
		Minimum	**Actual**	**Minimum**	**Actual**	**Minimum**	**Actual**
512	4256	10886848		104800256		Induced Failure	
512	4256	98998816		95277056		23261	

6: RESET

Press the reset button on the switch and perform the throughput test at 100Mbps for a frame size of 512 bytes. **The Minimum frame per second represents a 1% loss of the number of frames transmitted.**

Comments:	**PASS** **FAIL**

Test Frame Size (bytes)	**Total Packet Size (bits)**	**Testing Rate Bits/sec**		**Frame Throughput bits/sec**		**Frames per second**	
		Minimum	**Actual**	**Minimum**	**Actual**	**Minimum**	**Actual**
512	4256	98998816		95277056		23261	

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TEST RESULTS

NUMBER OF TEST SITES #: _____

Test Site # 1 **PASS**_____ **FAIL**_____**COMMENT**_____

Test Site # 2 **PASS**_____ **FAIL**_____**COMMENT**_____

Test Site # 3 **PASS**_____ **FAIL**_____**COMMENT**_____

Test Site # 4 **PASS**_____ **FAIL**_____**COMMENT**_____

Test Site # 5 **PASS**_____ **FAIL**_____**COMMENT**_____

Corrective Action Work Items:

1. _____
2. _____
3. _____
4. _____
5. _____

We agree that testing of the Ethernet Communication System has been performed and that the information above accurately represent the results of the test.

Contractor Name: _____
Contractor Representative Name: _____
Signature and Date: _____

ITS Inspector: _____
Signature and Date: _____

Corrective Action Work Items:

Work Items	ITS Inspector Signature	Date
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____