



REPORT OF PERFORMANCE

08-1357

OBJECT	PowerTrans Ethernet Switch Rackmount Gigabit Ethernet Switch for Power Substations		
TYPE	PT-7728 and PT-7828	SERIAL No.	see heading 1
	Rated Voltage 110 – 240 VAC or 125 – 250VDC Absolute maximum 264 VAC or 300 VDC Absolute minimum 85 VAC or 88 VDC		
MANUFACTURER	MOXA Inc. F4, No. 135, Lane 235, Pao-Chiao Rd. Shing-Tien City, Taipei, TAIWAN		
CLIENT	MOXA Inc. F4, No. 135, Lane 235, Pao-Chiao Rd. Shing-Tien City, Taipei, TAIWAN		
TESTED BY	KEMA HIGH-VOLTAGE LABORATORY Arnhem, the Netherlands		
DATES OF TESTS	November 2007 up to July 2008		
TEST PROGRAMME	The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Report, has been subjected to the series of proving tests in accordance with the following: <ul style="list-style-type: none">- IEC 61850-3 (2002-01) for EMC immunity, climatic and mechanical conditions;- IEEE 1613 (2003) for EMC immunity, climatic conditions;- IEC 61000-6-2 (1999-01) for EMC immunity for industrial environments;- IEC 61000-6-4 (2006-07) for EMC emission for industrial environments;- IEC/TS 61000-6-5 (2001-07) for EMC immunity in substation environment; (see Table of Contents, page 2).		
SUMMARY AND CONCLUSION	The tests were passed.		

This Report of Performance applies only to the object tested. The responsibility for conformity of any object having the same designations with that tested rests with the Manufacturer.

This report consists of 45 pages in total.

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KEMA Nederland B.V.

P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 15 August 2008

SUMMARY

By the order of MOXA, located in Shing-Tien City, Taipei, TAIWAN, EMC immunity, EMC emission, climatic and mechanical tests were performed on Ethernet Switch type PT-7728 for use in substation and industrial environments.

Manufacturer	MOXA Inc., TAIWAN
Type	PT-7728
Software version	V1.0 & V1.2
Build date	12-05-2007, 08-15-2007, 03-01-2008

The PowerTrans Ethernet Switch PT-7728 is tested for use in HV substations and connections to HV equipment according IEC 61850, IEEE 1613 class 2 and IEC/TS 61000-6-5 for electromagnetic immunity, IEC 60255-5 and IEEE 1613 for insulation coordination, IEC 61850-3 and IEEE 1613 for climatic and mechanical conditions. Additionally the PT-7728 device is tested for compliance with IEC 61000-6-2 and IEC 61000-6-4 for EMC immunity and emission for use in industrial environments.

A test program according IEC 61850-3, IEEE 1613, IEC 61000-6-2 and IEC 61000-6-4 is performed on Ethernet Switch model PT-7728. The tests were passed. Moxa declares that the hardware of Ethernet Switch model PT-7828 are exactly the same as Ethernet Switch model PT-7728. The PT-7828 supports Layer 3 routing protocol and model PT-7728 only supports Layer 2 routing protocol. Ethernet Switch model PT-7828 were not subjected to any test.

The following tests are performed with positive test results on the PowerTrans Ethernet Switch PT-7728

Test program according to IEC 61850-3

Communication networks and systems in substations – Part 3: General requirements

Climatic environmental conditions					
test description	IEC 61850-3 reference	test reference	requirement	test standard	ports
low air temperature for use	5.2	IEC 60870-2-2 table 1	class C3 (3K7), -40°C	IEEE 1613 IEC 60068-2-1 IEC 60721-3-3	F
high air temperature for use	5.2	IEC 60870-2-2	other, +85°C class Dt1	IEEE 1613 IEC 60068-2-2 IEC 60721-3-3	F
low air temperature for storage and transportation	5.2	IEC 60870-2-2 table 2	class Ct2 (2K4), -40°C	IEEE 1613 IEC 60068-2-1 IEC 60721-3-3	F
high air temperature for storage and transportation	5.2	IEC 60870-2-2 table 2	class Dt1 (2K5), +85°	IEEE 1613 IEC 60068-2-2 IEC 60721-3-3	F
humidity separate communication equipment / dampheat	5.3	IEC 60870-2-2 table 1	class C1 (3K5), 95%	IEC 60870-2-2 IEC 60068-2-30 IEC 60721-3-3	F

Mechanical Environmental Conditions					
test description	IEC 61850-3 reference	test reference	requirement	test standard	ports
stationary vibration	5.5	IEC 60870-2-2 table 3	class C _m (3M6, 4M6)	IEC 60068-2-6 IEC 60721-3-3	F
shock	5.5	IEC 60870-2-2 table 3	class C _m (3M6, 4M6)	IEC 60068-2-27 IEC 60721-3-3	F
free fall	5.5	IEC 60870-2-2	class C _m (3M6, 4M6)	IEC 60721-3-3	F
static load	5.5	IEC 60870-2-2	class C _m	IEC 60721-3-3	F

Electromagnetic compatibility (EMC)					
test description	IEC 61850-3 reference	test reference	requirement	test standard	ports
induced disturbances by RF-fields	5.7.1.1	-	0,15 – 80 MHz AM 80% 1 kHz 10 V (unmodulated)	IEC 61000-4-6 IEEE C37.90.2	A, B, C, E
surges	5.7.1.2	-	4 kV CM 2 kV DM	IEC/TS 61000-6-5 IEC 61000-4-5	A, B, C, E
100 kHz oscillatory waves	5.7.1.3	-	2,5 kV CM 1,25 kV DM	IEC 61000-4-12 IEC 61000-4-18 IEEE C37.90.1	A, B, C, E
1 MHz oscillatory waves	5.7.1.3	-	2,5 kV CM 1,25 kV DM	IEC 61000-4-12 IEC 61000-4-18 IEEE C37.90.1	A, B, C, E
fast transient	5.7.1.4	-	4 kV CM	IEC 61000-4-4 IEC/TS 61000-6-5 IEEE C37.90.1 IEEE 1613	A, B, C, E
EM-fields	5.7.2	-	0,08 – 1 GHz AM 80% 1 kHz 10 V/m (unmodulated)	IEC 61000-4-3 IEEE C37.90.2	F
induced CM voltages	5.7.3	-	level 4 30 V cont., 300 V 1 s	IEC 61000-4-16	A, B, C, E
1 MHz damped oscillatory magnetic field	5.7.3	-	30 A/m	IEC 61000-4-10	F
100 kHz damped oscillatory magnetic field	5.7.3	-	30 A/m	IEC 61000-4-10	F
PF magnetic field	5.7.3	-	100 A/m continuous 1000 A/m 1 s to 3 s	IEC 61000-4-8	F
radiated emission	5.8	-	class A	CISPR22 FCC part 15	F
power supply variations, dips and interruptions	6	IEC 60870-2-1	1)	IEC 61000-4-11 IEC 61000-4-29	A
1) tolerances AC supply, class AC3 (+15% to -20%) dips 40% during 10/12 cycles tolerances DC supply, class DC3 (+15% to -20%) dips 70% during 25/30 cycles interruptions 10 ms for DC supply dips 80% during 250/300 cycles 20 ms for AC supply					

Ports

- A Main power supply input
- B 10/100Base Tx electrical Ethernet port
- C Digital input & output ports
- D RS232 console port
- E Functional earth port
- F Housing

Test program according to IEEE 1613

IEEE Standard Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations

Climatic environmental conditions					
test description	IEEE 1613 reference	test reference	requirement	test standard	ports
low air temperature for use	4.1.1	IEEE 1613 clause 4.1.1	a, -40°C	IEEE 1613 clause 4.1.1	A, B, C, E, F
high air temperature for use	4.1.1	IEEE 1613 clause 4.1.1	other +85°C	IEEE 1613 clause 4.1.1	A, B, C, E, F
low air temperature for storage and transportation	4.1.2	IEEE 1613 clause 4.1.2	b, -40°C	IEEE 1613 clause 4.1.2	F
high air temperature for storage and transportation	4.1.2	IEEE 1613 clause 4.1.2	a, +85°C	IEEE 1613 clause 4.1.2	F
humidity separate communication equipment / dampheat	4.1.3	IEEE 1613 clause 4.1.3	95% during 96 hours	IEEE 1613 clause 4.1.3	A, B, C, E, F

Power inputs					
test description	IEEE 1613 reference	test reference	requirement	test standard	ports
power supply variations	5	IEEE 1613 clause 5.1	1)	IEEE 1613 clause 5.1	A
1) tolerances DC supply ripple on DC supply tolerances AC supply 24 V; 0,8 Ur - Umax = 28V 5% in range 0,8 Un – Umax 120 V; 85% = 102 V 48 V; 0,8 Ur - Umax = 56V AC supply 240 V; 110% = 264 V 250 V; 0,8 Ur - Umax = 280V 0,85 – 1,10 Ur					

Insulation					
test description	IEEE 1613 reference	test reference	requirement	test standard	ports
dielectric power frequency test	6.2	IEEE 1613 clause 6.2	2,0 kVrms if Ur > 50 V to 250 V	IEEE 1613 clause 6.2 IEC 60255-5 IEEE C 37.90	A, B, C, E
impulse voltage test	6.3	IEEE 1613 clause 6.3	5,0 kV	IEEE 1613 clause 6.3 IEC 60255-5 IEEE C 37.90	A, B, C, E

Electromagnetic compatibility (EMC)					
test description	IEEE 1613 reference	test reference	requirement	test standard	ports
1 MHz oscillatory waves	7	IEEE 1613 clause 7	2,5 kV CM 2,5 kV DM	IEEE C37.90.1	A, B, C, E
fast transient	7	IEEE 1613 clause 7	4 kV CM	IEEE C37.90.1	A, B, C, E
RF susceptibility	8	IEEE 1613 clause 8	0,08 – 1 GHz AM 80% 1 kHz 20 V/m (unmodulated) 35 Vp/m (modulated)	IEEE C37.90.2	F
electrostatic discharges	9	IEEE 1613 clause 9	8 kV contact, 15 kV air	IEEE C37.90.3	F

Mechanical Environmental Conditions					
test description	IEEE 1613 reference	test reference	requirement	test standard	ports
stationary vibration	10	IEEE 1613 10, table 14	V.S.3, < 30 mm/s	IEEE C37.1 / IEEE 1613 10, table 14	F
free fall	10	IEEE 1613 10, table 15	height of fall 250 mm	IEEE 1613 10, table 15	F

Ports

- A Main power supply input
- B 10/100Base Tx electrical Ethernet port
- C Digital input & output ports
- D RS232 console port
- E Functional earth port
- F Housing

Test program according IEC 61000-6-2

Electromagnetic compatibility (EMC) - Part 6-2: Generic standards – Immunity for industrial environments

test description	requirement	test standard	ports
PF magnetic field	100 A/m continuous 1000 A/m 1 s to 3 s	IEC 61000-4-8	F
EM-fields	0,08 – 1 GHz AM 80% 1 kHz 10 V/m (unmodulated)	IEC 61000-4-3	F
electrostatic discharges	8 kV contact, 15 kV air	IEC 61000-4-2	F
induced disturbances by RF-fields	0,15 – 80 MHz AM 80% 1 kHz 10 V (unmodulated)	IEC 61000-4-6	A, B, C, E
fast transients	4 kV CM	IEC 61000-4-4	A, B, C, E
surges	4 kV CM 2 kV DM	IEC 61000-4-5	A, B, C, E
power supply variations, dips and interruptions	Interruptions 20 ms for AC supply dips 40% during 10/12 cycles 70% during 25/30 cycles 80% during 250/300 cycles	IEC 61000-4-11	A

Ports

- A Main power supply input
- B 10/100Base Tx electrical Ethernet port
- C Digital input & output ports
- D RS232 console port
- E Functional earth port
- F Housing

Test program according IEC 61000-6-4

Electromagnetic compatibility (EMC) - Part 6-4: Generic standards – Emission standard for industrial environments

test description	requirement	test standard	ports
conducted emission	30 MHz – 230 MHz, 30 dB(μ V/m) quasi peak, measured at 30 m 230 MHz – 1000 MHz, 37 dB(μ V/m) quasi peak, measured at 30 m	CISPR11	A
radiated emission	0,15 MHz – 0,5 MHz, 79 dB(μ V/m) quasi peak, 66 dB(μ V/m) average 0,5 MHz – 5 MHz, 73 dB(μ V/m) quasi peak, 60 dB(μ V/m) average 5 MHz – 30 MHz, 73 dB(μ V/m) quasi peak, 60 dB(μ V/m) average	CISPR11	F

Ports

- A Main power supply input
- B 10/100Base Tx electrical Ethernet port
- C Digital input & output ports
- D RS232 console port
- E Functional earth port
- F Housing

The report of performance is based on tests performed on five specimen of the product as referred above, performed by KEMA. The test results show that the specimen meets the requirements as listed above.

This document does not imply that KEMA has certified or approved any products other than the specimen tested. The manufacturer's production facility has not been assessed.