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**IBM® GDPS® and Server Time Protocol (STP) Application Qualification support for the Adtran FSP 3000 Dense Wavelength Division Multiplexer (DWDM) Platform running software releases 22.5.2 / 22.5.3 and 5.5.1 / 5.5.2**

International Business Machines Corporation and Adtran Inc. have successfully completed application qualification testing of the Adtran FSP 3000 Dense Wavelength Division Multiplexer (DWDM) Platform running software releases 22.5.2 / 22.5.3 and 5.5.1 / 5.5.2 for the following IBM Z®, Parallel Sysplex® and Geographically Dispersed Parallel Sysplex™(GDPS), IBM z16™ Model A01 (z16 A01), IBM z16™ Model A02 (z16 A02), IBM z16™ Rack Mount (z16 Rack Mount), IBM z15® Model T01 (z15 T01), IBM z15® Model T02 (z15 T02), IBM z14® (z14), IBM z14 Model ZR1 (z14 ZR1) environments:

- GDPS / Peer-to-Peer Remote Copy (PPRC) (Metro Mirror) using the following protocols:
  - High Performance FICON for IBM Z (zHPF®) & FICON for Storage Access
  - FCP for disk mirroring
  - 10G RoCE based Coupling Express® Long Reach (10G CE LR) or 1x InfiniBand (1x IFB)<sup>5</sup> for exchanging Server Time Protocol (STP) messages to provide synchronization of servers
- GDPS / Extended Remote Copy (XRC) (z/OS Global Mirror) using zHPF & FICON for asynchronous remote copy
- 10/25GbE RoCE Express<sup>2</sup> feature (Remote Direct Memory Access over Converged Ethernet) using Shared Memory Communications – Remote Direct Memory Access (SMC-R)

Distances for the protocols supported for these GDPS applications are defined in the Qualification Results Summary below.

**Qualification Results Summary:**

The Adtran FSP 3000 Dense Wavelength Division Multiplexer (DWDM) Platform running software releases 22.5.2 / 22.5.3 and 5.5.1 / 5.5.2 met IBM Qualification criteria for protocols listed in the table below.

<b>Adtran FSP 3000 Dense Wavelength Division Multiplexer (DWDM) Platform running software release 22.5.2 and 22.5.3</b>				
<b>Module</b>	<b>Description</b>	<b>Model</b>	<b>Protocols Supported</b>	<b>Supported Distance</b>
5TCE <sup>1, A</sup>	5-port 10G TDM module: 2:1 5G InfiniBand (1x IFB DDR) 3:1 4G FCP/ISL 1:1 8G FCP/ISL 1:1 10G ISL 1:1 10GbE	5TCE-PCTN-10GU+10G-xx#Dy (FWP 161.0.6)	1x IFB 5 Gbps (DDR), 4,8 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE	135km
5TCE-AES <sup>1, A</sup>	5-port 10G TDM module with AES 256 Encryption: 2:1 5G InfiniBand (1x IFB DDR) 3:1 4G FCP/ISL 1:1 8G FCP/ISL 1:1 10G ISL 1:1 10GbE	5TCE-PCTN-10GU+AES10G-xx#Dy (FWP 202.1.1)	1x IFB 5 Gbps (DDR), 4,8 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE	135km
5TCE-PCN <sup>1, A</sup>	5-port 10G TDM module with pluggable network: 2:1 5G InfiniBand (1x IFB DDR) 3:1 4G FCP/ISL 1:1 8G FCP/ISL 1:1 10G ISL 1:1 10GbE	5TCE-PCN-10GU+10G (FWP 192.0.2)	1x IFB 5 Gbps (DDR), 4,8 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE	135km

5TCE-PCN-AES <sup>1, A</sup>	5-port 10G TDM module with pluggable network interface and AES 256 Encryption: 2:1 5G InfiniBand (1x IFB DDR) 3:1 4G FCP/ISL 1:1 8G FCP/ISL 1:1 10G ISL 1:1 10GbE	5TCE-PCN-10GU+AES10G (FWP 202.1.2)	1x IFB 5 Gbps (DDR), 4,8 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE	135km
5WCA <sup>1, R</sup>	5-port 16G Transponder Module: 5:5 5G InfiniBand (1x IFB DDR) 5:5 8G FCP/ISL 5:5 16G FCP/ISL 5:5 10G CE LR 5:5 10GbE	5WCA-PCN-16GU (FWP 225.1.3)	1x IFB 5 Gbps (DDR), 10G CE LR, 8,16 Gbps FCP <sup>1</sup> /ISL, 10GbE <sup>R</sup>	110km
6WCA <sup>1, RR</sup>	6-port Transponder Module: 6:6 4G FCP/ISL 6:6 8G FCP/ISL 6:6 16G FCP/ISL 6:6 10G CE LR 6:6 10GbE 6:6 25GbE	6WCA-PCN-28GU (FWP 225.2.2)	10G CE LR, 4,8,16 Gbps FCP <sup>1</sup> /ISL, 10,25 GbE <sup>RR</sup>	135km
10TCE-100G-16G <sup>1, R, A</sup>	10-port 16G TDM Module with either coherent 100G or 4x28G line side modules: 10:1 or 10:4 5G InfiniBand (1x IFB DDR) 10:1 or 10:4 8G FCP/ISL 8:1 or 8:4 10G ISL 7:1 or 7:4 16G FCP/ISL 10:1 or 10:4 10G CE LR 10:1 or 10:4 10GbE	10TCE-PCN-16GU+100G (FWP 221.0.8)	1x IFB 5 Gbps (DDR), 10G CE LR, 8,16 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE <sup>R</sup>	135km
10TCE-100G AES-16G <sup>1, R, A</sup>	10-port 16G TDM Module with AES 256 Encryption with coherent 100G or 4x28G line side modules: 10:1 or 10:4 5G InfiniBand (1x IFB DDR) 10:1 or 10:4 8G FCP/ISL 8:1 or 8:4 10G ISL 7:1 or 7:4 16G FCP/ISL 10:1 or 10:4 10G CE LR 10:1 or 10:4 10GbE	10TCE-PCN-16GU+AES100G (FWP 211.1.10)	1x IFB 5 Gbps (DDR), 10G CE LR, 8,16 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE <sup>R</sup>	135km
10TCE-100G AES-16G-BSI <sup>1, R, A</sup>	BSI Compliant 10-port 16G TDM Module with AES 256 Encryption with coherent 100G or 4x28G line side modules: 10:1 or 10:4 5G InfiniBand (1x IFB DDR) 10:1 or 10:4 8G FCP/ISL 8:1 or 8:4 10G ISL 7:1 or 7:4 16G FCP/ISL 10:1 or 10:4 10G CE LR 10:1 or 10:4 10GbE	10TCE-PCN-16GU+AES100G-BSI (FWP 225.5.7)	1x IFB 5 Gbps (DDR), 10G CE LR, 8,16 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE <sup>R</sup>	135km

10TCE-PCN-16GU-AES-100G-F <sup>1, R, A</sup>	10-port 16G TDM Module with pluggable network interface and AES 256 Encryption with coherent 100G or 4x28G line side modules: 10:1 or 10:4 5G InfiniBand (1x IFB DDR) 10:1 or 10:4 8G FCP/ISL 8:1 or 8:4 10G ISL 7:1 or 7:4 16G FCP/ISL 10:1 or 10:4 10G CE LR 10:1 or 10:4 10GbE	10TCE-PCN-16GU+AES100G-F (FWP 191.4.1)	1x IFB 5 Gbps (DDR), 10G CE LR, 8,16 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE <sup>R</sup>	135km
9TCE-PCN-10GU-10G <sup>1, R, A</sup>	Quad 8/10G Transponder module: 4:1 2G FCP/ISL 2:1 4G FCP/ISL 4:4 8G FCP/ISL 4:4 10G CE LR 4:4 10GbE	9TCE-PCN-10GU+10G (FWP 225.0.2)	2,4,8 Gbps FCP <sup>1</sup> /ISL 10G CE LR, 10GbE <sup>R</sup>	135km
9TCE-PCN-10GU-AES10G <sup>1, R, A</sup>	Quad 8/10G Transponder module with AES 256 Encryption: 4:1 2G FCP/ISL 2:1 4G FCP/ISL 4:4 8G FCP/ISL 4:4 10G CE LR 4:4 10GbE	9TCE-PCN-10GU+AES10G (FWP 215.3.2)	2,4,8 Gbps FCP <sup>1</sup> /ISL 10G CE LR, 10GbE <sup>R</sup>	135km
9TCE-PCN-10GU-AES10G-F <sup>1, R</sup>	Quad 8/10G Transponder module with AES 256 Encryption: 4:4 8G FCP/ISL 4:4 10G CE LR 4:4 10GbE	9TCE-PCN-10GU+AES10G-F (FWP 191.4.8)	8 Gbps FCP <sup>1</sup> /ISL 10G CE LR, 10GbE <sup>R</sup>	135km
9TCE-PCN-10GU-AES10G-G <sup>1, R</sup>	Quad 8/10G Transponder module with AES 256 Encryption: 4:4 8G FCP/ISL 4:4 10G CE LR 4:4 10GbE	9TCE-PCN-10GU+AES10G-G (FWP 211.11.9)	8 Gbps FCP <sup>1</sup> /ISL 10G CE LR, 10GbE <sup>R</sup>	135km
4TCC-PCN-32GU-AES100G	3-port 32G Muxponder with AES 256 Encryption: 3:1 32G ISL	4TCC-PCN-32GU+AES100G (FWP 215.1.7)	32 Gbps ISL	135km
4TCC-PCN-32GU-AES100G-G	3-port 32G Muxponder with AES 256 Encryption: 3:1 32G ISL	4TCC-PCN-32GU+AES100G-G (FWP 211.18.7)	32 Gbps ISL	135km
4TCA-PCN <sup>1</sup>	4-port 4G TDM module: 2:2 4G FCP/ISL	4TCA-PCN-4GU+4G (FWP 163.0.32)	4 Gbps FCP <sup>1</sup> /ISL	135km

2WCA <sup>1, R</sup>	Dual 10G Transponder Module: 2:2 4G FCP/ISL 2:2 8G FCP/ISL 2:2 10G ISL 2:2 10GbE	2WCA-PCN-10G (FWP 161.0.1)	4,8 Gbps FCP <sup>1</sup> /ISL, 10 Gbps ISL, 10GbE <sup>R</sup>	135km
OPPM <sup>3,4</sup>	Fiber Protection Switch	OPPM (FWP 201.0.0)	All Protocols (including 10G CE LR and 1x IFB)	135km
RSM <sup>3</sup>	Fiber Protection Switch	RSM-OLM#1630 (FWP 3.2.0)	All Protocols (including 10G CE LR and 1x IFB)	80km
Y-Cable Protection <sup>3,6</sup>	Y-Cable protection using redundant DWDM client cards	1PM/SM 1PM/MM 2PM/SM 2PM/MM Y-CABLE/SM Y-CABLE/MM	All Protocols (including 10G CE LR and 1x IFB)	135km
DCG-M DCG50-M	Managed DCM using Chirped Fiber Bragg Gratings (CFG)	DCG-M/060/SSMF DCG-M/080/SSMF DCG-M/100/SSMF DCG50-M/020/SMFF DCG50-M/040/SMFF DCG50-M/060/SSMF DCG50-M/080/SSMF DCG50-M/100/SSMF	All Protocols (including 10G CE LR and 1x IFB)	N/A

<b>Adtran FSP 3000CC Dense Wavelength Division Multiplexer (DWDM) Platform running software release 22.5.2 and 22.5.3</b>				
<b>Module</b>	<b>Description</b>	<b>Model</b>	<b>Protocols Supported</b>	<b>Supported Distance</b>
MA-2C5LT <sup>1, R</sup> with MP-2B4CT	Client and Line Side card pair:  Client card – 5 QSFP client ports, each 4x28Gbps, 2 QSFP Network ports, each 4x28Gbps  Line card – 4 QSFP client ports, each 4x28Gbps, 2 fixed Network ports, each 200Gbps  Card pair supports: 20 x 8G ISL 12 x 16G ISL 6 x 32G ISL 20 x 10GbE 6 x 25GbE	MA-2C5LT (FWP 60.5.1, 60.5.2) MP-2B4CT (FWP 60.5.1, 60.5.2)	8,16,32Gbps ISL, 10GbE <sup>R</sup> , 25 GbE	135km

<p>MA-2C2C3LT-A<sup>1,R</sup> with MP-2B4CT</p>	<p>Client and Line Side card pair:</p> <p>Client card – 5 QSFP client ports, each 4x28Gbps, 2 QSFP Network ports, each 4x28Gbps and AES 256 Encryption</p> <p>Line card – 4 QSFP client ports, each 4x28Gbps, 2 fixed Network ports, each 200Gbps</p> <p>Card pair supports: 20 x 8G ISL 12 x 16G ISL 6 x 32G ISL 20 x 10GbE 6 x 25GbE</p>	<p>MA-2C2C3LT-A (FWP 60.5.1, 60.5.2) MP-2B4CT (FWP 60.5.1, 60.5.2)</p>	<p>8,16,32Gbps ISL, 10GbE<sup>R</sup>,25 GbE</p>	<p>135km</p>
<p>MA-B2C3LT-A<sup>1,R</sup></p>	<p>5 QSFP client ports, each 4x28Gbps, 1 CFP2 Network port, 224 Gbps and AES 256 Encryption</p> <p>20 x 8G ISL 12 x 16G ISL 6 x 32G ISL 20 x 10GbE 6 x 25GbE</p>	<p>MA-B2C3LT-A (FWP 60.5.1, 60.5.2)</p>	<p>8,16,32Gbps ISL, 10GbE<sup>R</sup>,25 GbE</p>	<p>135km</p>
<p>MA-B5LT<sup>1,R</sup></p>	<p>5 QSFP client ports, each 4x28Gbps, 1 CFP2 Network port 224 Gbps:</p> <p>20 x 8G ISL 12 x 16G ISL 6 x 32G ISL 20 x 10GbE 6 x 25GbE</p>	<p>MA-B5LT (FWP 60.5.1, 60.5.2)</p>	<p>8,16,32Gbps ISL, 10GbE<sup>R</sup>,25 GbE,</p>	<p>135km</p>
<p>SF-D19DCT<sup>1,R</sup></p>	<p>Multiprotocol multiplexer with 19 (SFP, QSFP) client ports and 1 CFP2 Network port, 448Gbps</p> <p>7 x 64G ISL 12 x 32G ISL 14 x 16G ISL 2 x 10G CE LR 2 x 10GbE</p>	<p>SF-D19DCT (FWP 60.5.2)</p>	<p>16,32,64Gbps ISL, 10G CE LR, 10GbE<sup>R</sup></p>	<p>135km</p>
<p>SF-D19DCT-A<sup>1,R</sup></p>	<p>Multiprotocol multiplexer with 19 (SFP, QSFP) client ports and 1 CFP2 Network port, 448Gbps and AES 256 Encryption</p> <p>7 x 64G ISL 12 x 32G ISL 14 x 16G ISL 2 x 10G CE LR 2 x 10GbE</p>	<p>SF-D19DCT-A (FWP 60.5.1, 60.5.2)</p>	<p>16,32,64Gbps ISL, 10G CE LR, 10GbE<sup>R</sup></p>	<p>135km</p>

<b>Adtran FSP 3000C Dense Wavelength Division Multiplexer (DWDM) Platform running software release 5.5.1 and 5.5.2</b>				
<b>Module</b>	<b>Description</b>	<b>Model</b>	<b>Protocols Supported</b>	<b>Supported Distance</b>
MA-B2C3LT-A <sup>1, R, A</sup>	5 QSFP client ports, each 4x28Gbps, 1 CFP2 Network port, 224 Gbps and AES 256 Encryption  20 x 8G ISL 12 x 16G ISL 6 x 32G ISL 20 x 10GbE 6 x 25GbE	MA-B2C3LT-A (FWP 60.5.1, 60.5.2)	8,16,32Gbps ISL, 10GbE <sup>R</sup> ,25 GbE	135km
MA-B5LT <sup>1, R, A</sup>	5 QSFP client ports, each 4x28Gbps, 1 CFP2 Network port 224 Gbps:  20 x 8G ISL 12 x 16G ISL 6 x 32G ISL 20 x 10GbE 6 x 25GbE	MA-B5LT (FWP 60.5.1, 60.5.2)	8,16,32Gbps ISL, 10GbE <sup>R</sup> ,25 GbE,	135km
SF-D19DCT <sup>1,R</sup>	Multiprotocol multiplexer with 19 (SFP, QSFP) client ports and 1 CFP2 Network port, 448Gbps  7 x 64G ISL 12 x 32G ISL 14 x 16G ISL 2 x 10G CE LR 2 x 10GbE	SF-D19DCT (FWP 60.5.2)	16,32,64Gbps ISL, 10G CE LR, 10GbE <sup>R</sup>	135km
SF-D19DCT-A <sup>1,R</sup>	Multiprotocol multiplexer with 19 (SFP, QSFP) client ports and 1 CFP2 Network port, 448Gbps and AES 256 Encryption  7 x 64G ISL 12 x 32G ISL 14 x 16G ISL 2 x 10G CE LR 2 x 10GbE	SF-D19DCT-A (FWP 60.5.1, 60.5.2)	16,32,64Gbps ISL, 10G CE LR, 10GbE <sup>R</sup>	135km
OPPM-F <sup>3,4</sup>	Fiber Protection Switch	OPPM-F (FWP 60.5.1, 60.5.2)	All Protocols (including 10G CE LR)	135km

<sup>1</sup> The FSP 3000, 3000CC and 3000C do not perform link data rate auto-negotiation. Therefore, use of these platforms for FCP requires cascaded Directors/switches to set the link data rate.

<sup>2</sup> DWDM client modules that support 10GbE RoCE Express for SMC-R are noted in the table above with <sup>R</sup>. DWDM client modules that support both 10GbE RoCE Express for SMC-R and 25GbE RoCE Express for SMC-R are noted in the table above with <sup>RR</sup>.

<sup>3</sup> The OPPM, RSM, OPPM-F, or protection schemes cannot be used alone; they must be used in conjunction with client layer protection to ensure cross site connectivity is not lost during a switchover.

<sup>4</sup> To ensure bi-directional protection switching, at least one module pair in the system must support an APS channel. DWDM client modules that support APS are noted in the table above with <sup>A</sup>. The OPPM or OPPM-F must be configured for channel card trigger in conjunction with APS.

<sup>5</sup> PS-IFB is not supported on the z16 A01, z16 A02, z16 Rack Mount, z15 T01, z15 T02, or z14 ZR1.

<sup>6</sup> Y-cable/power splitter protection is only supported for use with the 5TCE card variants.

**GDPS Application Limitations:**

- IBM GDPS support is limited to DWDM product applications which utilize point-to-point fixed dark fiber network interconnect between Parallel Sysplexes.
- DWDM end-to-end networks, including DWDM components, transport elements and dark fiber links, must not exceed the equivalent of 900 meters differential delay between transmit and receive paths used for GDPS links for Server Time Protocol (STP) message passing (which includes 10G CE LR and 1x IFB links).
- Fiber-based dispersion compensation units that have not been qualified by IBM are not supported for STP applications.
- Redundant DWDM platforms, utilizing two site-to-site fiber pairs over diverse routes, are recommended for fiber trunk protection of links used for STP message passing (10G CE LR and 1x IFB). STP links should connect using different trunk switching modules to ensure that a fiber trunk protection event does not interrupt all timing links simultaneously.

Results achieved were in a test environment under laboratory conditions. IBM does not make any representations or warranties regarding Adtran products. Adtran retains sole responsibility for its products, the performance of such products and all claims relating to such products, including without limitation its products' compliance with product specifications, industry standards and safety and other regulatory requirements.

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