MEMORANDUM FOR THE RECORD

April 22, 2016

To: Jim Moody E.E. PE
PPD-E Manager

From: Dale G. Pickering E.E. MS
PPD-E PQ Engineer

Cc: Rhea Roberson E.E. PE
PPD-E Managing Director

Re: EMC^2, Data Center I.T. Storage Equipment Manufacturer EDC-W Testimony

The FedEx EDC-W Enterprise Data Center is the crown jewel of the FedEx Corporations; thirteen *(13)* Operating Companies *(Op-Cos)* and is the "I.T. glue that hold the entire corporation together" *(quoted by Mr. Rob Carter, CEO of FedEx Services I.T. Op-Co)*. During the EDC-W's Construction, between 2007 - 2015, the EDC-W's LEED qualifications and Tier 4 Facilities infrastructure was rated among the top 3% of all Data Centers in the world! Successful Semi-Conductor Manufacturing Power Quality Design modifications to the EDC-W's Construction resulted in a very productive and clean data center environment of its new "VE" Server Application. Many of the traditional I.T. Equipment operational problems;

- "Latency,"
- "Lock Ups,"
- "Data Language Corruption,"
- "Electronic I.C. Degradation/Failures,"
- "Electronic to Light Translator component Failures,"
- "Critical PC Circuit Board Degradation/Failures,"
- "White Space Power Distribution System voltage drop weakening" and
- "I.T. Equipment AC to DC Power Supply Degradation/Failures"

have been mitigated and even eliminated!

Periodically, I.T. Equipment Manufacturer's newly-released models perform less than their Test Bench units claims and when pressured, the manufacturers typically blames the Data Center environment within which their equipment is operating for these short falls. However, such professionally conducted "Environmental Studies" of the EDC-W return a resounding "Clean Bill of Health" for the Mechanical Cooling, Copper & Fiber Network, and Electrical Power Quality Systems within and without of the EDC-W!

Recently, FedEx Services suffered a massive, untimely and costly customer inconvenience of one Vendor's weaknesses and failures within their newly installed massive Storage Equipment. After such an environmental investigation proved that FedEx was not at fault, but an excellent Data Center White Space to operate within! Vendor attempts to correct its failures proved unacceptable. As a result, an "Emergency Corrective Action Plan" to inject massive Storage Equipment from another Vendor became an incredibly fast moving solution. All of the FedEx Services' Memphis "Storage Team" flew to the

EDC-W and required their alternate Vendor's National Sales Team and Technical Engineers to brainstorm technical solutions and purchase Storage Solutions, during their sequestered five *(5)* day Teamwork. Out of this return to basics planning, a remarkable EMC² environmental "testimony" resounded throughout the site.

Justin Burns, EMC² Field Engineer and FedEx imbedded "EDC-W DCM Vendor Contracted Tech. Rep." questioned the remarkably clean Power Quality found within the "EDC-W's White Space." As the FedEx Express WHQ assigned Properties Project Development Engineering E.E. to the EDC-W, I explained all of the mitigation techniques that we used to improve this Data Center, from the curb's Utility 12kV Service Entrances *(2 each)* to the point-of-use 208V connection to every piece of I.T. Equipment with in the EDC-W. During this conversation, we discussed the topic of internally generated electrical and electronic "Transients/Spikes," that flow to and from the I.T. Equipment themselves and how these harmful, destructive Transients affect both the powered I.T. Hardware/Firmware and their sensitive "VE" Application's Data Manufacturing language process. Unexplainable hardware failures and hidden inconsistent language/data "Script Replacements and Script Losses!" In answer to Justin's query, I explained our pro-active PQ application of a third *(3rd)* and final application of Filtered, Sine wave Tracking "Total Protection Solutions" *(TPS)* "Low Profile," SPD/TVSS Unit's close, direct attachment to every Remote Power Panel (RPP) Branch Panel's main vertical bus bars. These world class, Lifetime Warranted TVSS Units sense high speed, high frequency AC/DC "Transients" that are riding parasitically upon the building's 208V, 60 Cycle full wave form and clips then off the Sine Wave and "Shunts" *(removes, carries away safely)* all "Transients" to the Building Grounding System *(electric trash can/garbage disposal).* Only leave a 1 to 2 volt shadow of their former selves, with little or no further harmful energy, once contained within them *(Transients)*! Thereby, we are eliminating these harmful degradations to all TVSS protected EDC-W I.T. hardware and to their data manufacturing language stream!

Surprisingly, Justin reported that during the past weeks joint meeting at the EDC-W, his National EMC² colleagues could not understand why their I.T. Equipment Product Line operated so much differently, better in this FedEx Enterprise Data Canter, than the hundreds of other Data Centers that they deal with and have to trouble shoot their own hardware, firmware, and their client's Application Software failures! "Now I can tell them why … it the "TPS" TVSS Unit attached in the Branch Panels next to our equipment's power feeds!" Justin declared that at the EDC-W, "…we do not have intermittent Power Supply failures, PC Board damage, I.C./Chip losses, discreet component failures, Storage Drive issues (fragmentation, scattered data, data retrieval losses, etc.)! Everything here is operating smoothly and way beyond their expected 'Life Cycle Expectancy' and routine PM replacement…! In those other Data Centers, we are always having to pre-replace PC Boards, I.C. Chips, Drives and Power Supplies… which we've never had to do here… wow… and it makes such sense of all that you have sensibly described and then the "TPS" Sine Wave Tracking TVSS… That makes so much sense and at an incredible low investment cost, compared to all the high tech parts that we normally would have to replace elsewhere, and sometimes within warranty, at our own expense … not to mention all of the lost time of production and labor costs while we Factory Reps have to drive or fly in like firefighters to fix it… what common sense this makes to me now and I can hardly wait to tell all my EMC² National Team… You should explain this to our Regional Sales Managers and Technical Engineers Staff… they will be blown away!"

So I knew that some of the I.T. Equipment within the EDC-W were powered from larger Power Distribution Units (PDUs) and from their inboard Branch Panels, that we had not yet retrofitted them with this Standardized "TPS" Low Profile, Filtering, Sine Wave Tracking SPD/TVSS Units. In our honest communication and attempts at drilling down to the "Root Cause Analysis," I knew that we have some twenty (20) other EMC² Cabinets located across the White Space's floor in a group that are attached to PDUs, without any "TPS" TVSS Units installed yet. I asked Justin, "Say …you know those twenty (20) EMC² Symphony Cabinets over there?" He answered, "Yes." I responded, "Do you have the same

wonderful track record with that isolated cluster over there?" Justin did not hesitate and said "NO…wait…I have had some rare Power Supply Battery issues, in that I have had to prematurely replace some Batteries and Power Supplies before their standard three (3) year operation PM cycle…but that is all… why do you ask?" I responded, "Well … in fairness I must tell you that we are not perfect and there are some PDUs that we could not yet shutdown on weekends and retrofit them with Branch Panel TVSS Units." Justin interrupted with excitement and asked "Are they not on the same TVSS Protection?" I shook my head, no. Justine yelled, "Oh my G_ _, that's it… real world test results that the "TPS" TVSS Units make THE difference in good/with or poor/without "TPS" TVSS installations and are THE factor that is saving our equipment above all of those hundreds of Data Centers …WOW, what a finding, this is amazing! I feel so honored to working here at FedEx, I learn so much every day, and you guys are simply the best out there! Thank you for taking the time to reveal all of this useable technology to me.. wow!"

Personally, it was rewarding to talk to Justin and see his field response to hundreds of Data Centers that I could never look within and compare our/my PQ Philosophies and "Best Practices" to theirs. Partnering with "TPS" is one of the best investigations and acceptable applications that I have made in my twenty-two (22) years of "High Tech Industry" Power Quality Electrical Engineering mitigation solution products in my "Tool Box!"

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Attachments – N/A