



HEMP/ IEMI Threats: Specifics on How to Protect Critical Infrastructure Systems with Specialized Shielding



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Abstract

This webinar will focus on how high altitude electromagnetic pulse (HEMP) and intentional electromagnetic interference (IEMI) pose a serious threat to the operation of critical infrastructure systems – utilities, transportation, communication, etc. – which are dependent on susceptible electronic circuitry. Damage can be mitigated or eliminated with specialized shielding and point-of-entry systems incorporated in facility and equipment design. Specific examples will be provided including a recent EMP shield installation for the control center for a large public utility company. The challenge to accommodate numerous entry points for MEP and HVAC requirements while maintaining shield integrity and pulse protection will be discussed

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Terminology

Electromagnetic Pulse (EMP)

- An umbrella term identifying damaging two forms of high power electromagnetic signals

High-altitude Electromagnetic Pulse (HEMP)

- Damaging electromagnetic signals (>50,000 volts/meter) emitted from a nuclear detonation in outer space at any altitude above 18 miles (30 km)

- Note: No damaging near field or radiation effects

Intentional Electromagnetic Interference (IEMI)

- Disruptive and data altering electromagnetic signals caused by the malicious use of electromagnetic weapons (non-detonation, within targeted footprints)

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EMP Threat

Electronic equipment and apparatus could be destroyed.

- Every device that relies on integrated circuits for operation could be immediately disabled or destroyed.
- Unlike a cyber-attack where “fingerprints” can often be found for forensic analysis, an IEMI attacker will not leave any information behind.
- An EMP shutdown of electronics is so rapid that the log files in computers will not record the event.

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EMP Threat

How much EMP is needed to destroy your data equipment?

- Volts per meter (V/m) are the standard units of electric field strength used to determine electromagnetic immunity in products and equipment.
- *Most electronic equipment can survive a pulse of 10 Volts per meter.*
- *An EMP would create a pulse higher than 10,000 V/m.*

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EMP Threat

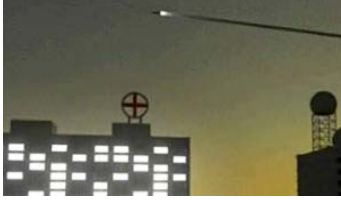
Harmonized Immunity Standards

- IT Equipment - 10 Volts/meter
- Medical Equipment – 10 Volts/meter
- Network Telephone Equipment – 10 Volts/meter
- Aircraft- (HIRF) 7,200 Volts/meter
- Automobiles – 100 Volts/meter
- Military Equipment – 200 Volts/meter

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EMP Threat

Counter-electronics High-powered Advanced Missile Project



CHAMP (by Boeing)



EMP Threat



IEMI "Truck Mounted" Weapons



EMP Threat



IEMI "Suitcase" Weapons



EMP Threat

System Type	EMP/E3 or GMD Vulnerability	EMP/E1 Vulnerability	RF Weapon Vulnerability	3 – High 2 – Medium 1 – Low 0 – No
Grid Power Transmission/Distribution	3	3	1	
Electric Power Grid Electronic Control, Monitor Systems	1*	4	4	
Long Haul Comm, Data Lines Repeater Systems	3	3	3	
Data Center Equipment Rooms	1*	3	3	
SCADA, Process Control Systems	1*	3	3	
Vehicles, Ships, Aircraft Electronics	0	2	3	
Hand-held Electronics	0	2	3	



Specifications & Legislation

- US military established MIL-STD 188-125-1 and -2 to describe the threat environment, test methods and minimum protection requirements for HEMP.
- Time-urgent command, control, communications, computer, and intelligence (C4I) functions.
- To keep expenditures in check, Utility, Commercial and Industrial organizations reference MIL-STD 188-125 but consider applying it in a slightly modified form by scaling the protection efforts down and using alternate certified materials and components.



Specifications & Legislation

State of Maine:

- H.P 106-L.D. 131
- Directing The Public Utilities Commission To Examine Measures To Mitigate The Effects Of Geomagnetic Disturbances and Electromagnetic Pulse On The State's Transmission System
- June 10, 2013
- First in the Nation
- Report submitted January 20, 2014
<http://www.maine.gov/tools/whatsnew/attach.php?id=612759&an=1>



Specifications & Legislation

U.S. Congress:

- H.R.3410
- To Amend The Homeland Security Act of 2002 To Secure Critical Infrastructure Against Electromagnetic Pulses, And For Other Purposes
- October 30, 2013
- Referred to the Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies



Potential Applications

TIER 1 Data Centers

- Small Businesses
- 99.671% Uptime
- 28.8 Hours Downtime Per Year
- No Redundancy

TIER 2 Data Centers

- Medium-size Businesses
- 99.749% Uptime
- 22 Hours Downtime Per Year
- Partial Redundancy in Power and Cooling

Based upon proprietary rating system of The Uptime Institute four-tier ranking system as a benchmark for determining the reliability of a data center.



Potential Applications

TIER 3 Data Centers

- Large Businesses
- 99.982% Uptime
- 1.6 Hours Downtime Per Year
- N+1 Fault Tolerant
- 72 Hour Power Outage Protection

TIER 4 Data Centers

- Enterprise Corporations
- 99.995% Uptime
- 2.4 Minutes Downtime Per Year
- 2N+1 Fully Redundant
- 96 Hour Power Outage Protection

Based upon proprietary rating system of The Uptime Institute four-tier ranking system as a benchmark for determining the reliability of a data center.



MITIGATION and PROTECTION

- **Determine the "mission" of the facility (New or Existing)**
 - Does it need to be up and running 100% of the time?
 - What outage is acceptable and for how long
 - What equipment can be sacrificed?
- **Determine the extent of critical long lead equipment**

Servers	Generators	Fire Protection
Storage	Power Distribution	Intrusion Protection
HVAC	Communications	Transportation
UPS	Network Switches	Water



MITIGATION and PROTECTION

(Red Edge™) PROTECTION LEVEL 1 (Survival of Data and Equipment)

EMP Protected Environment

- With EMP protected enclosures and treated points of entry, your data and processing equipment will survive. Although the power, cooling, and utilities in an unprotected host facility may not be immediately available, your equipment will remain safe. And, when power, cooling and utilities are restored, your data equipment will be fully operable.



MITIGATION and PROTECTION



(Red Edge™) PROTECTION LEVEL 1 (Survival of Data and Equipment)



MITIGATION and PROTECTION

(Red Edge™) PROTECTION LEVEL 2 (Survival & Continuous Operations of Data & Equipment)

Independent Power and Utilities

- If an EMP event occurs, your data and processing equipment will continuously operate with a fully independent and protected power and utility source. This unit may be located inside your suite or outside the existing data center facility. Your data processing and communication will not be interrupted.



MITIGATION and PROTECTION



(Red Edge™) PROTECTION LEVEL 2 (Survival & Continuous Operations of Data & Equipment)



System Design



Welded



Modular

Shielded Enclosures Types



System Design



RF-Tight Doors



System Design



- Two rows of beryllium copper finger-stock around the perimeter of RCM receiver
- Easy to retrofit with standard modular and welded shielded enclosure
- Heavy-duty cam latch strikes for three-point latching, guided by precision machined latch bar guides
- Precision machined aluminum hinges with six thrust bearings for sag-free mounting and smooth operation




System Design



Power and Signal Line Filters



System Design **REDEGE**
PULSE PROTECTION



Waveguide Air Vents Waveguide Pipe Penetrations

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PULSE PROTECTION



Installation of a Protection System

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EMP Protected Mechanical Room

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System Design **REDEGE**
PULSE PROTECTION



Interlocked Double Door Vestibule

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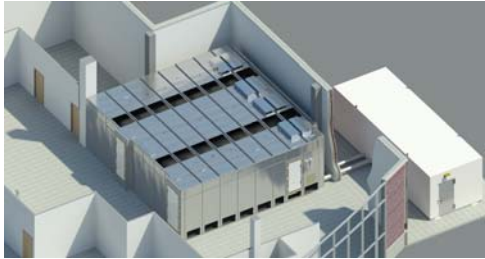
System Design



Prefabricated Mobile Shelters

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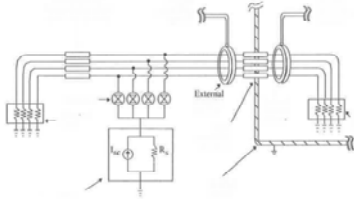
System Design



Prefabricated Mobile Shelters

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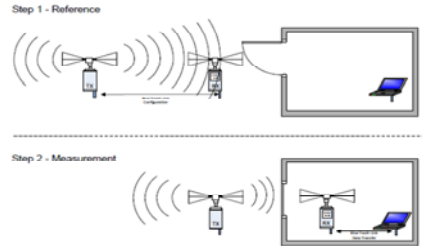
Verification Testing



Pulse Current Injection (PCI) Testing



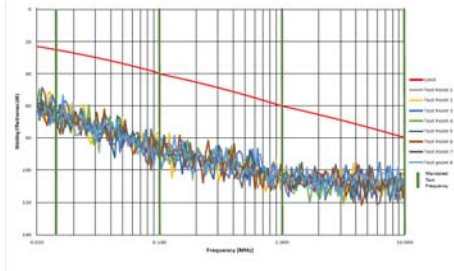
Verification Testing



Shielding Effectiveness (SE) Testing



Verification Testing



Typical Test Results



CONCLUSIONS

- Critical Infrastructure facilities that support life and our way of living for Computer/Business/Distribution/Communication/Manufacturing systems have become a significant part of our modern critical infrastructure system for survival
- Both narrowband and wideband EMP waveforms can be produced by non-lethal weapons using modern technology
- Modern electronics are extremely vulnerable EMP waveforms
- Protection measures are available, but many businesses are not aware of the threat and/or not willing to invest the time or money
- There is a prevailing "It Can't Happen" attitude



**Thank You For
Attending This Webinar
Questions?**

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