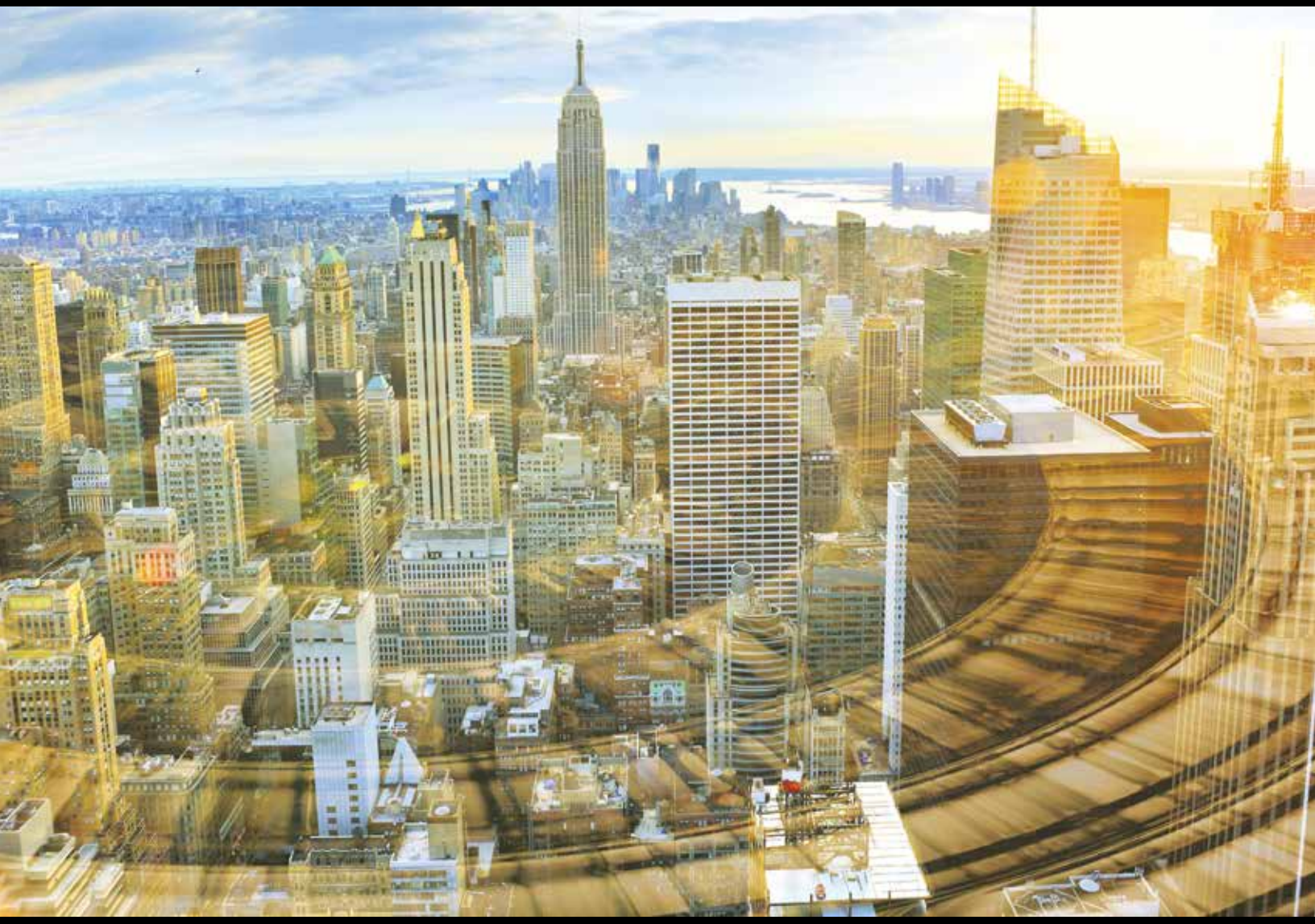
TRANSTECTOR



Mission Critical Communications

High-Altitude Electromagnetic Pulse (HEMP) Solutions for Civil Infrastructure

HEMP TESTED

an INFINITE company

Prepare. Protect. Persevere.
HEMP Tested Surge Protection

The most feared Electromagnetic pulse, or EMP, is a chain reaction created by a high-altitude nuclear explosion. The range and extent of damage this type of destructive pulse would cause to the critical networks within our civil infrastructure is being evaluated globally by governments, business leaders and military agencies.

As experts in highly specialized EMP/HEMP filter technology, top defense contractors have relied on Transtector design experience and patented technology to meet the requirements set by military standards for EMP-EMI mitigation. This proven technology and tested product mix is now being expanded to support commercial network operators as they plan HEMP network threat assessments.

HEMP™ TESTED

What Is HEMP?

Greatly simplified, HEMP refers to a potential nuclear explosion detonated high above our planet's surface. The higher the altitude, the greater the area potentially impacted on earth. HEMP measurements focus on three pulses: E1 in nanoseconds, E2 in microseconds (similar to lightning), and E3—a longer phase potentially lasting minutes on grid systems, similar to a solar flare.

The Potential Impact of HEMP

The sheer energy associated with a HEMP event is likely staggering. The "coupling" nature of the EMP phases (E1, E2 and E3), with the transmission of RF/data lines impacted multiply the transient energy strength and network damage. In short, power grids, communications networks and other physical infrastructure are vulnerable.

The Civil Infrastructure's Standard

The growth of nuclear powers and terrorism around the globe have elevated the HEMP threat.

Recognizing the need for a standard that can be applied to civilian life, the U.S. Department of Homeland Security released the Electromagnetic Pulse (EMP) Protection and Restoration Guidelines for Equipment and Facilities. This unclassified document introduces the EMP protection zone concept, which allows system operators to select and implement adequate protection to ensure system recovery after exposure to a potentially catastrophic HEMP event.

Department of Homeland Security Recommended EMP Protection Levels for Equipment and Facilities

LOW COST

LEVEL 1

Use procedures and low cost best practices to mitigate EMP effects. Unplug power and data line into spare backup equipment. Turn off equipment that cannot be unplugged and that is not immediately needed for mission support. Store one week of food, water and critical supplies for personnel. Wrap spare electronics with aluminum foil or put in Faraday containers. Have back up power that is not connected to the grid (generators, solar panels, etc.) with one week of on-site fuel (such as propane/diesel). Use GETS, WPS, 7 TSP services; join SHARES if applicable.

HOURS

LEVEL 2

In addition to Level 1, use EMP rated surge protection devices (SPDs) on power cords, antenna and data cables and have EMP protected back-up power. Use SPDs (one nanosecond or better response time) to protect critical equipment. Use true line/double-conversation uninterruptible power supplies (UPS). Use fiber optic cables (with no metal); otherwise use shielded cables and ferrite/SPDs. Shielded racks/rooms and/or facilities may be more cost effective than hardening numerous cables. Use EMP protected HF radio voice/email if need longhaul nets. Suppress EMP fires.

MINUTES

LEVEL 3

In addition to Level 2, use civil EMP protection standards (such as IEC SC 77C). Use EMP shielded racks/rooms and/or facilities to protect critical computers, data centers, phone switches, industrial and substation controls and other electronics. Shielding should be 30-80 dB of protection thru 10 GHz. Use SPDs to protect equipment outside of shielded areas. Can use single-door EMP-safe entryways. Use ITU and IEC EMP standards for design guidance and testing. Have 30 days of back-up power with on-site fuel (or via assured service agreement with EMP resilient refuelers). Use EMP protected HF radio and satellite voice/data nets for long-range links to support missions.

SECONDS

LEVEL 4

Use Military EMP Standards (MIL-STD-188-125-1 and MIL-HDBK-423), and 80+ dB hardening thru 10 GHz. Use EMP/RFW shielding in rooms, racks, and/or buildings to protect critical equipment. Use EMP SPDs to protect equipment outside of shielded area. Use EMP protected double-door entryways. Have 30± days of supplies and EMP protected back-up power (including on-site fuel) for critical systems. Do not rely on commercial Internet, telephone, satellite, or radio nets that are not EMP protected for communications. Use EMP protected fiber, satellite, and radio links.

EMP Effects

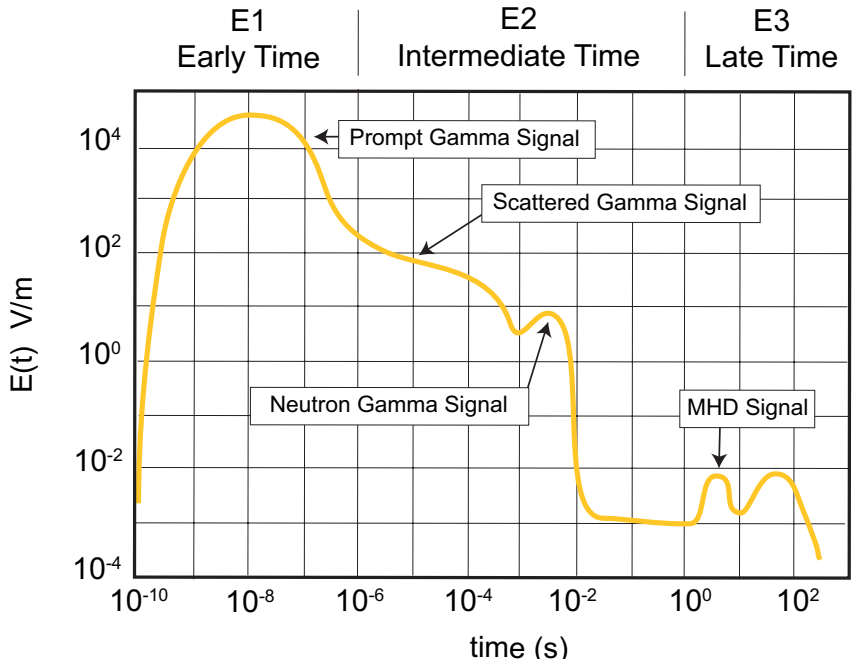
Wavelength and Device Impacts

While the EMP effects of a high-altitude nuclear detonation vary based on the yield, altitude and orientation of the weapon, the resulting pulse components of a classic HEMP event are categorized into three time domain regimes that include:

- **Early Time (E1)** – this is the shortest wavelength, and attaches most effectively to small electrical systems. The very fast rise time of this pulse impacts electronics such as cell phones, computers and engine controls.

- **Intermediate Time (E2)** – this wavelength is very similar to lightning and attaches effectively to wiring in commercial and residential facilities. The gamma signal found in the E2 pulse would impact electronics, telecommunications and control systems.

- **Late Time (E3)** – this wavelength is similar to a geomagnetic disturbance or solar storm and has a long relative time duration that is considered a pseudo-DC signal, capable of coupling to large portions of the power grid and causing hotspots in critical transformers.



Source: Nuclear Electromagnetic Pulse and Post EMP Commission Issues, Bronius Cikotas

Due to these substantially different time domain characteristics and associated wavelengths, each of the staged events couples or attaches to systems of different physical and technical characteristics.

Areas of Protection–Partners in HEMP

Transtector Systems partners with RF technology expert PolyPhaser to engineer HEMP-tested products, systems and solutions designed to address the pulse protection requirements of a comprehensive range of essential applications.

- Land and mobile communications networks
- Utility networks and grids
- TV/radio broadcasting facilities
- Process control in banking/finance
- Road/rail signaling systems
- Transport/communications infrastructure
- Field military forces and support facilities
- Backup power and energy storage systems
- Internet of Things (IoT) platforms

Site Protection

When evaluating networks to determine requirements for total site protection it is important to consider three key components:

1. **EMP Surge Protection -** Selecting the right technology for each application is key to creating an effective HEMP site protection plan.
2. **Site Audit -** These onsite reviews identify deficiencies in each network that, left unchecked, will compromise the integrity of the electrical environment and performance. Site audits available through Transtector are unique to each location and include power, grounding, bonding, and transient overvoltage protection.
3. **Grounding -** The complete and proper installation of a single point grounding application from PolyPhaser is imperative for system integrity.

Application	Network Component	HEMP Tested Surge Protection Required	Site Audit
Satellite Communications	Lightning/EMP for Ground-Based Cables	AC, DC, Data, RF	√
Telecommunications	Radio, RRH, AC/DC Power, RF Feeds, Small Cells	AC, DC, Data, RF	√
First Responders	Field-Deployable Broadband	AC, DC, Data, RF	√
Utilities	Sensors, SCADA, Substations, GPS, Telecommunications	AC, DC, Data, RF	√
Rail Transportation	Signal, Switches, Track Circuit, Radio, PTC	AC, DC, Data, RF	√

HEMP Tested Surge Protection Solutions

Many of today's communication networks are vulnerable to a HEMP threat. There is no substitute for experience, technology and reliability when scoping out HEMP surge protection requirements across different network topologies and applications. To meet this growing technology demand, Transtector Systems and PolyPhaser have introduced HEMP Tested products and site audits for AC, DC, Data and RF applications. Tested to stringent Military Standard 188-125, these products are engineered to protect against HEMP (High-Altitude Electromagnetic Pulse) events.

AC EMP Surge Protection

TRANSTECTOR

APEX IMAX HT Series

Wide range of AC EMP surge protectors engineered for 120/208, 120/240 and 120 Vac applications

- Outdoor EMI shielded enclosure
- Form C remote alarm contacts
- Low VPL at high induced surge current
- UL 1449 4th Edition
- Enclosure UL50 Type 4
- EMP protection level 1, 2, 3

Part Number	Product Name	Frequency Range	Phases	Mounting	Technology	E1 20/500ns per MIL-STD-188-125	E2 1.5/3-5000us per MIL-STD-188-125	Max Lightning Discharge Current
HT-AO-IMAX-120Y	APEX IMAX HT 120Y	50 to 400 Hz	3 Wye	Panel Mount	Hybrid (Silicon + MOV)	5 kA	250 A	160 kA
HT-AO-IMAX-120T	APEX IMAX HT 120T	50 to 400 Hz	Split Phase	Panel Mount	Hybrid (Silicon + MOV)	5 kA	250 A	160 kA
HT-AI-IMAX-120S	APEX IMAX HT 120S Module	50 to 400 Hz	Single Phase	Replacement Module	Silicon (SASD)	5 kA	250 A	10 kA

TRANSTECTOR

E3PA Series

AC EMP surge protectors tested to extreme SREMP environment

- Military grade
- Fail-safe fusing
- Cabinet options with continuous protection to downstream equipment available
- EMP protection level 1, 2, 3

Part Number	Product Name	Frequency Range	Phases	Mounting	Technology	E1 20/500ns per MIL-STD-188-125	E2 1.5/3-5000us per MIL-STD-188-125	Max Lightning Discharge Current
HT-AI-E3PA-120S	E3PA HT 120S	50 to 400 Hz	Single Phase	Panel Mount	Silicon (SASD)	5 kA	250 A	50 kA
HT-AI-E3PA-120Y	E3PA HT 120Y	50 to 400 Hz	3 Wye	Wall Mount	Hybrid (Silicon + MOV)	5 kA	250 A	50 kA

DC EMP Surge Protection

TRANSTECTOR

DCPM HT Series
Wide range of DC EMP surge protectors available for 12, 24, 28 and 48 Vdc applications

- Continuous protection to downstream equipment
- Military grade options
- Field serviceable
- EMP protection level 1, 2, 3

Part Number	Product Name	Application	Nominal Voltage	Nominal Current Rating	Mounting	Technology	E1 20/500ns per MIL-STD-188-125	E2 1.5/3-5000us per MIL-STD-188-125	Max Lightning Discharge Current
HT-DI-DCPM-48D	DCPM HT 48D	12, 24, 28, 48 Vdc	48 Vdc	120 A	DIN Rail	Fail-Short MOV	5 kA	250 A	60 kA
HT-DO-E3PM-283	E3PM HT S30	12, 24, 28 Vdc	28 Vdc	30 A	Bulkhead	Silicon (SASD)	5 kA	250 A	5 kA
HT-DO-E3PM-2810	E3PM HT S100	12, 24, 28 Vdc	28 Vdc	100 A	Bulkhead	Silicon (SASD)	5 kA	250 A	5 kA

Network Signal EMP Surge Protection

TRANSTECTOR

ALPU HT and E3PM HT Series
Rugged, compact and lightweight dataline EMP surge protection

- Continuous protection to downstream equipment
- Military grade options
- Field serviceable
- Rugged construction ideal for outdoor applications
- Silicon (SASD) technology
- EMP protection level 1, 2, 3

Part Number	Product Name	Application	Nominal Voltage	Data Rate	Connectors	Mounting	Enclosure	E1 20/500ns per MIL-STD-188-125	E2 1.5/3-5000us per MILSTD-188-125
HT-NO-ALPU-GBEP	ALPU HT GBEPOE	GbE, GbE PoE, GbE PoE+, GbE PoE++	Up to 90 Vdc	1000 Mb/s	RJ45 Cat5e shielded	Panel Mount	Metal NEMA 3R	5 kA	50A
HT-NO-E3PM-GBE	E3PM HT GbE	GbE	3.3 V	1000 Mb/s	Military grade D38999/20WB35SN	Bulkhead	6061-T6 Machined Aluminum	5 kA	25 A
HT-NO-E3PM-GPST	E3PM HT GPST	GbE	5 V	1 pulse (1 Hz)	Isolated BNC	Bulkhead	6061-T6 Machined Aluminum	5 kA	25 A

RF EMP Surge Protection

PolyPhaser

TSX HT Series
Outdoor rated RF Coaxial EMP surge protector for 698 MHz to 2.7 GHz frequency

- Bulkhead mount, minimizing product footprint
- Line/load bidirectional surge protection
- Low let-through energy
- Tri-plated brass housing
- Installation kit included
- RoHS, CE, IEC 60950-1AS
- EMP protection level 1, 2, 3, 4

Part Number	Product Name	Application	Surge	Protected	PIM Spec	Technology	E1 20/500ns per MIL-STD-188-125	Type
HT-RO-TSX-BNFF	TSX HT NFF	Cellular, LTE, Data Collection	Female N	Female N	<-155dBc (-112 dBm), 2.x20W input	High Pass Filter	5 kA	DC Short
HT-RO-TSX-BNFM	TSX HT NFM	Cellular, LTE, Data Collection	Female N	Male N	<-155dBc (-112 dBm), 2.x20W input	High Pass Filter	5 kA	DC Short
HT-RO-TSX-BDFF	TSX HT DFF	Cellular, LTE, Data Collection	Female DIN	Female DIN	<-155dBc (-112 dBm), 2.x20W input	High Pass Filter	5 kA	DC Short
HT-RO-TSX-BDFM	TSX HT DFM	Cellular, LTE, Data Collection	Female DIN	Male DIN	<-155dBc (-112 dBm), 2.x20W input	High Pass Filter	5 kA	DC Short
HT-RO-TSX-DCDFF	TSX HT DCDFF	GPS, Cellular, Telemetry, AISG	Female DIN	Female DIN	<-155dBc (-112 dBm), 2.x20W input	High Pass Filter	5 kA	DC Pass
HT-RO-TSX-DCDFM	TSX HT DCDFM	GPS, Cellular, Telemetry, AISG	Female DIN	Male DIN	<-155dBc (-112 dBm), 2.x20W input	High Pass Filter	5 kA	DC Pass

PolyPhaser

E3PM HT Series
DC Pass broadband coaxial protector engineered for Land Mobile Radio applications

- Flange or bulkhead mounting options
- Low throughput energy
- N-Type connectors
- Aluminum and tri-plated brass options
- DFARS hardware kit included
- RoHS, Buy American Act
- EMP protection level 1, 2, 3, 4

Part Number	Product Name	Application	Surge	Protected	Frequency	Technology	E1 20/500ns per MIL-STD-188-125	Type
HT-RI-E3PM-BNFM	E3PM HT NFM	LMR	Female N	Female N	10 MHz to 700 MHz	GDT	5 kA	DC Block
HT-RO-E3PM-DCP	E3PM HT DCNFF	LMR, GPS	Female N	Female N	800 MHz to 2.5 GHz	Staged SASD, MOV, GDT	5 kA	DC Pass

Custom Solutions–E3 Mitigation Expertise and Innovation

Transtector provides a complete systems approach for the protection of communication networks and critical electronics from lightning and power anomalies. Our unique expertise in filter technologies enables us to provide a comprehensive portfolio of electromagnetic environmental effect (E3) hardening solutions including custom designs to fit your specific EMP - EMI protection needs. For more than a decade, top defense contractors have relied on Transtector Systems design experience and high performance filter technology to meet the requirements set by military standards. We have the proven capabilities to protect civil infrastructure communications, satellite and electrical power systems from all major power quality threats including:

- EMI (electromagnetic interference)
- EMP (electromagnetic pulse)
- HEMP (high-altitude electromagnetic pulse)
- SREMP (surface-radiated electromagnetic pulse)
- NEMP (nuclear electromagnetic pulse)
- SGEMP (system-generated electromagnetic pulse)
- HPM (high-powered microwave)
- TEMPEST
- Geomagnetic storms
- Internally generated transients
- Power grid anomalies
- Lightning induced transients

To obtain additional information on how to scope a custom EMP protection solution for your network, schedule a site visit, or arrange for a consultation contact us a +1.208.635.6400.

TRANSTECTOR

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