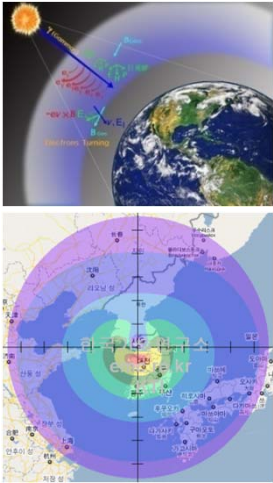


HEMP / HPEM TOTAL ENGINEERING & CONSTRUCTIONS

From the theoretical simulation to the acceptance test



KTI developed HEMP simulation tools

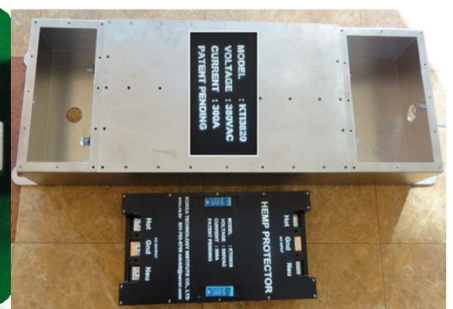
Perfect design ability for the HEMP hardening

Various experience based during 25 years

Patent listed for HEMP hardening facilities

Full line up for HEMP parts and facilities

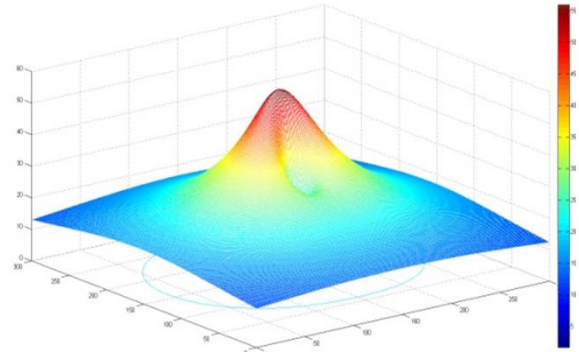
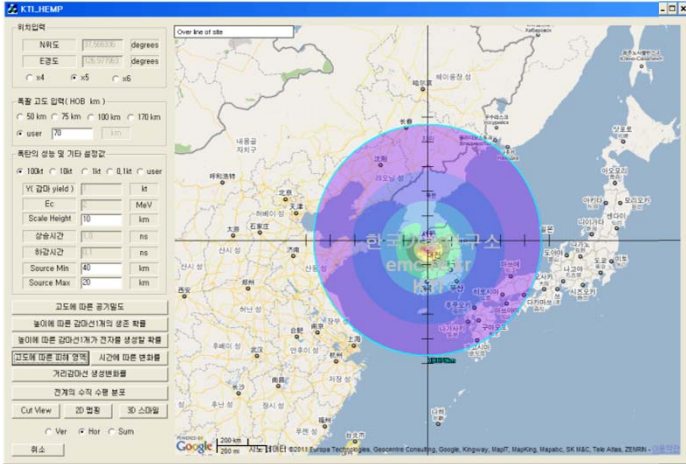
ISO 17925 test lab for EMC & RF



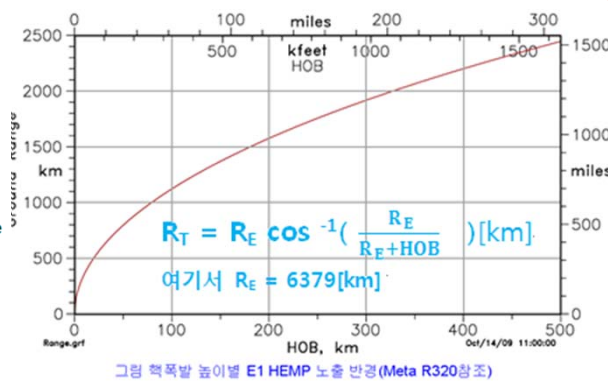
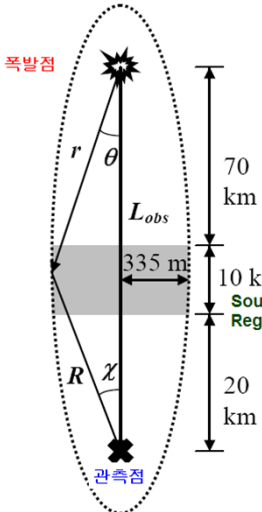
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KTI developed HEMP simulation tools

KTI HEMP CODE

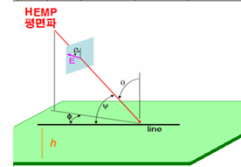


- 핵폭탄 탄두별, 고도별, 위경도별, 지자기 입사각도별 고고도 핵 전자기파 발생량 예측
- 전력선, 통신선의 전주간 거리, 높이, 입사각도별 핵 전자기파 유도량 예측
- 토양의 유전율, 도전율에 따라 전선의 매설 깊이 별 핵 전자기파에 의한 유도량 예측
- HEMP방호실 구조 설계를 위한 차폐도 예측 프로그램
- HEMP 방호용 전원필터 최적설계 프로그램 및 HEMP 전원필터 직접개발 생산, 공인인증
- 과전압 보호소자/10ns 미만 transient surge 최적설계 알고리즘 및 다단 보호회로 개발 특허
- Multilayer soils 및 암반 지하구조물의 차폐도 예측 프로그램



유한-전력선의 입사각도별-HEMP-유도량

입사각도	유한-전선-	전력 트랜스-중단-	단락회로-					
Φ	Ψ	I_p [kA]	V_p [kV]	Tr [kV/ns]	I_p [kA]	V_p [kV]	Tr [kV/ns]	I_p [kA]
0°	60°	2.2	950	13.8	2.75	1700	8.5	4.1
30°	60°	2.53	945	36.4	3.9	1640	12.0	4.6
30°	90°	2.0	760	19.6	3.0	1000	8.0	3.55
90°	90°	1.85	0.0	0.0	1.57	525	4.5	1.87
90°	90°	0.75	0.0	0.0	0.70	190	1.72	0.75
30°	60°	1.65	700	10.0	2.25	1320	5.8	3.0
30°	90°	1.23	540	34.6	2.2	590	6.0	2.35
0°	60°	10.0	4850	28.2	9.7	9000	32.8	19.5

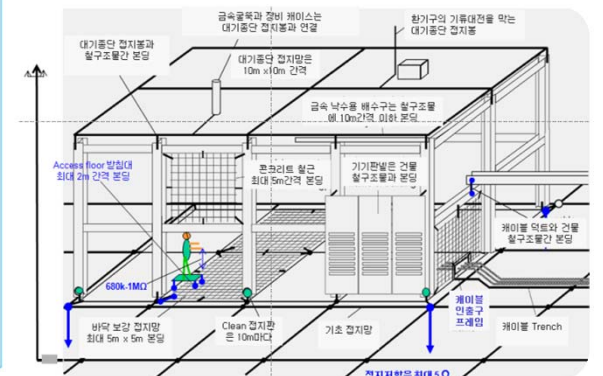
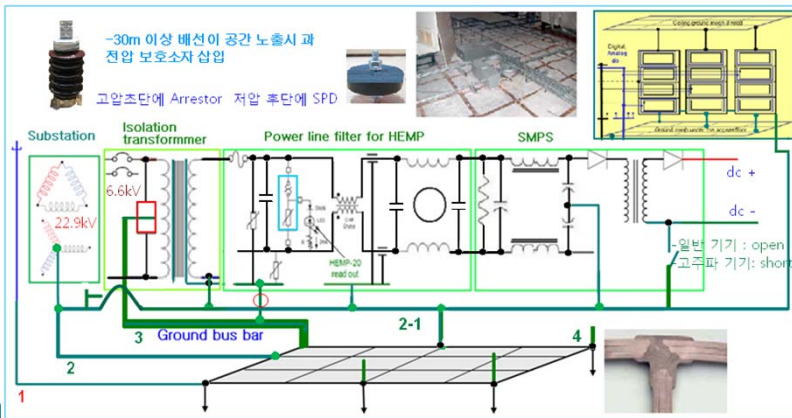
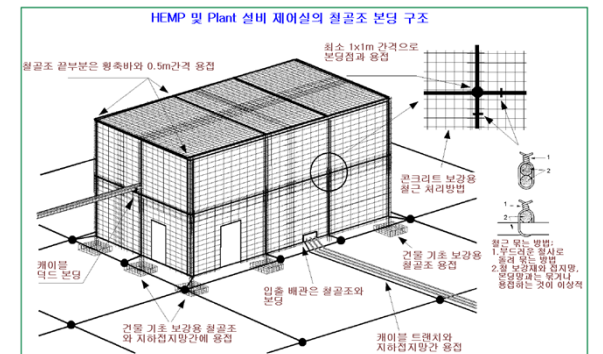
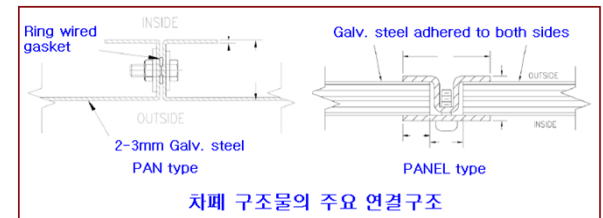
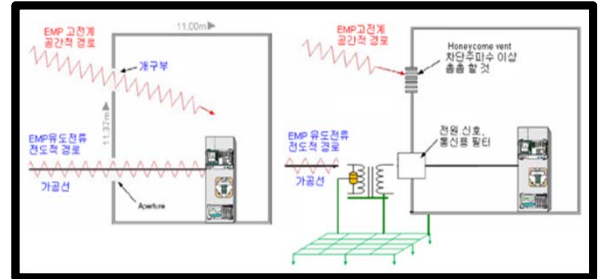


-가공 전선의 높이: 10m
 -전선의 굵기: 5mm
 -전선 저항률: 1.72×10^{-4} [cm-ohm]
 -점고유전: IN 246



HEMP shelter drawing, design and audit

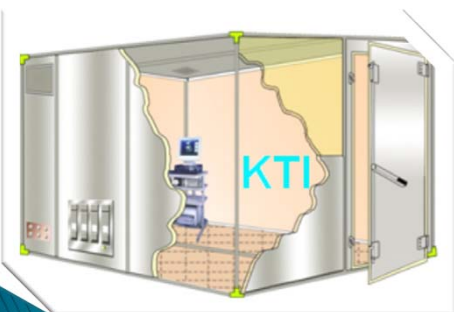
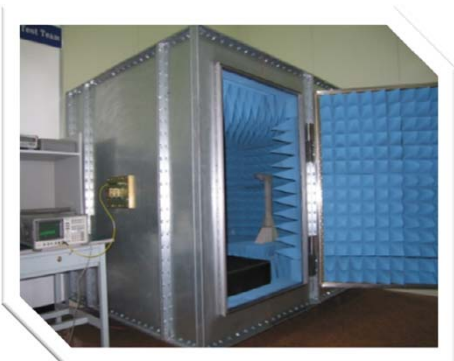
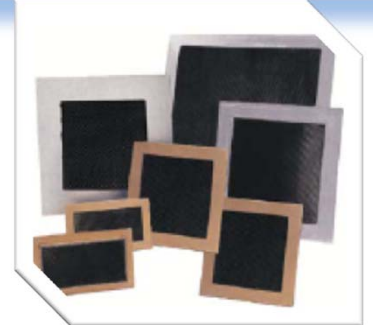
- 1,000건 이상의 EMC 분야 엔지니어링 25년 경험
- 세계최고의 HEMP 접지구조 최적설계 능력
(미국의 벡털, 프랑스 알스톰, 영국의 York emc 등 이 당소의 기술력 극찬)
- 세계최고 수준의 과전압 보호회로 최적 설계 능력
- 충분한 경험과 이론을 바탕으로 최적의 HEMP 방호용 전원, 통신, 신호 계통설계 능력
- 자체 개발한 다양한 HEMP 시뮬레이션 S/W
- Short pulse, Intermediate pulse, charge line pulse 및 CW시험에 완벽하게 합격 될 수 있는 방호 구조물 및 부품품 설계와 시공
- 결과를 책임지는 완벽한 설계 및 정확한 물량산출
- EMC 분야 25년, 공인시험, 교정기관
- 정보통신 부문 엔지니어링 사업자 등록업체



정통 장인/KTI가 시공하면 차원이 다릅니다

HEMP hardening shelter construction [I]

- 삼성전자 수원, 한국기기유화, 기계연구원, 한국과학기술원, 해양대학교, 자동차 부품연구원, 오토닉스, KTI, 연합정밀 등 다양한 차폐시설의 충분한 시공실적
- Door, honeycomb, HEMP power line filter 등 자체제작 및 개발. 각종 센서 광변환기 및 광 케이블화,
- 다양한 HEMP시뮬레이션 S/W 보유
- 충분한 이론과 25년 경험을 바탕으로 시공
- 성능검사에 합격할 수 있도록 완벽한 시공
- 다양한 방식의 방호실 시공경험, 용접, 판넬, 팬 타입
- 다양한 자체 성능 시험검사 설비 보유



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HEMP hardening shelter construction [II]



KTI가 시공한 유사 EMP 방호시설

- Pan type , 파형강판 방호시설
- Modular type
- Welding type
- Reverberation chamber
- GTEM based pan type

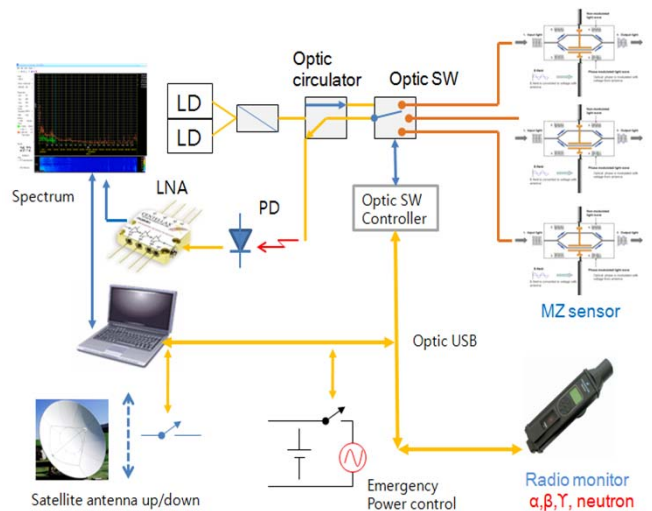
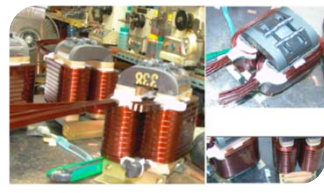
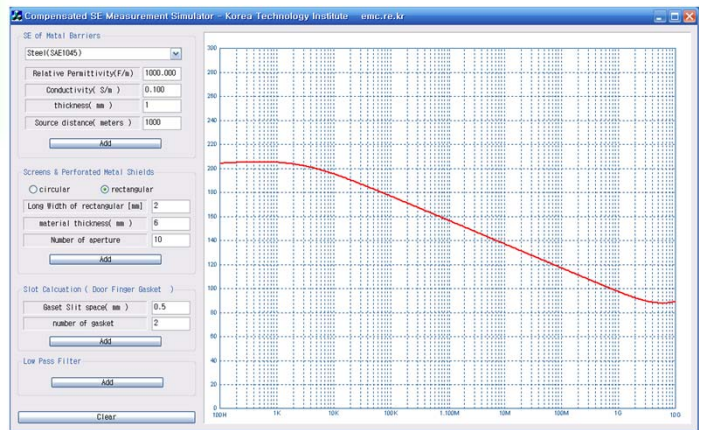
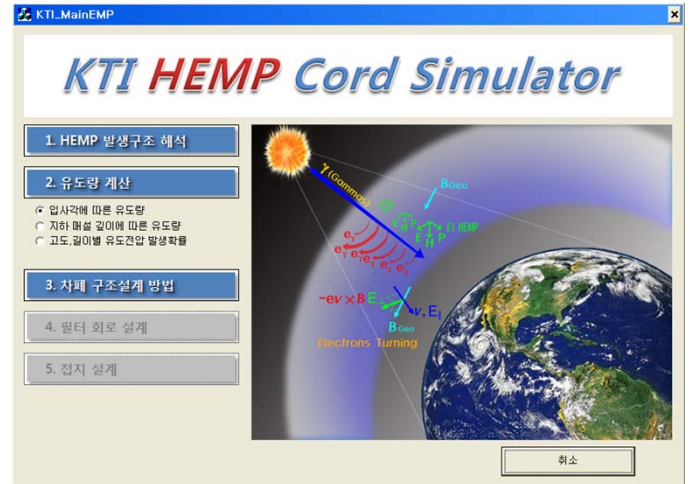


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KTI는 외국제품보다 성능이 우수한 제품만을 개발합니다

KTI developed products & S/W

1. HEMP simulation 프로그램
(핵탄두 크기, 고도, 지자기 입사각, 위경도
가공선의 높이, 길이, 매설깊이에 따른 유도량)
2. HEMP 차폐실 최적 설계용 프로그램
3. HEMP 전원 필터 최적 설계용 프로그램
4. CW immersion test 시스템 및 프로그램
5. RS 105 HEMP Simulator
6. HEMP monitoring system
7. HEMP/HPEM 전용 전원/신호용 필터
8. HEMP/HPEM 전용 관통형 컨덴서
9. Multilayer soils, 암반 차폐도 예측 프로그램



MIL-STD-188-125-1 CONTINUOUS WAVE(CW) IMMERSION

Monitoring Configuration

Measurement

- Electric free-field(XYZ)
- Magnetic free-field(XYZ)
- Surface current(XY)
- Current meas. (20 locations)

Field strength selection

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Equipment

RF Source moving Rack

Signal Generator

Low Amp1 High Amp2

Power Meter

Monopole BI-log Ant

Reference Field Sensor

MZ sensor A MZ sensor B

Receiver

Numbers of Sensor Selection

F/O Current (10 / 20) Channel

F/O Surface Current (2 / 3) Channel

F/O Free-Field (4 / 5) Channel

EXIT



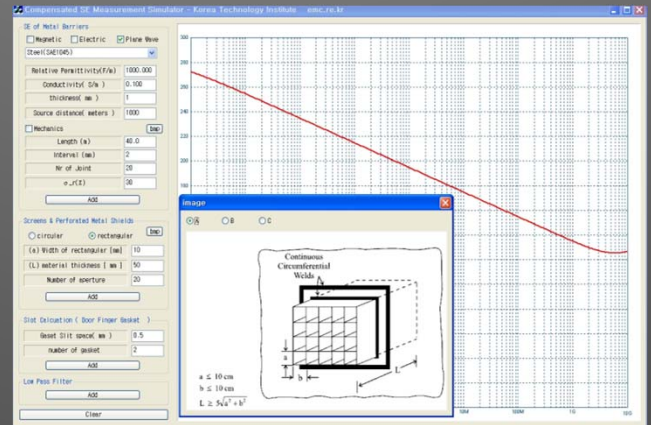
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S/W tools for HEMP Optimization Design

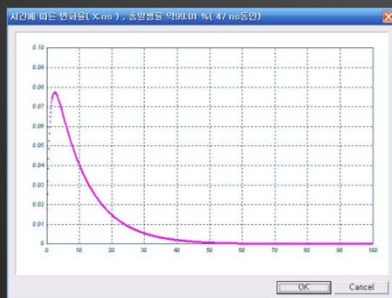
Developed by KTI



탄두,고도, 위경도 별 smile diagram

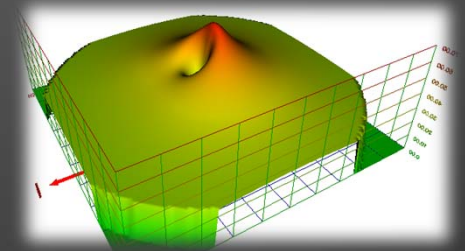


차폐도 계산

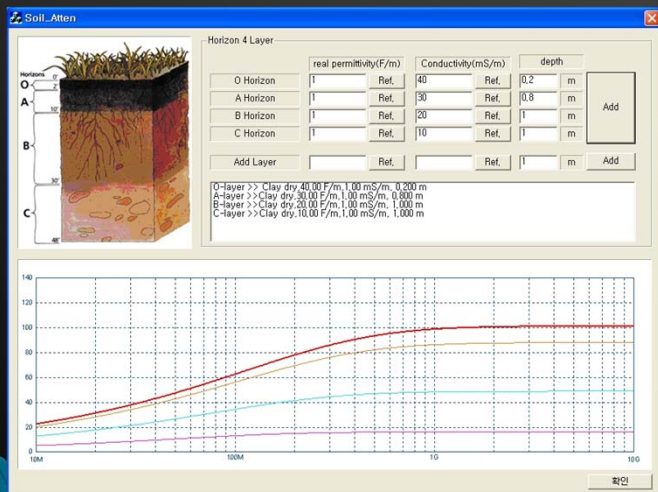


HEMP 시간 확률

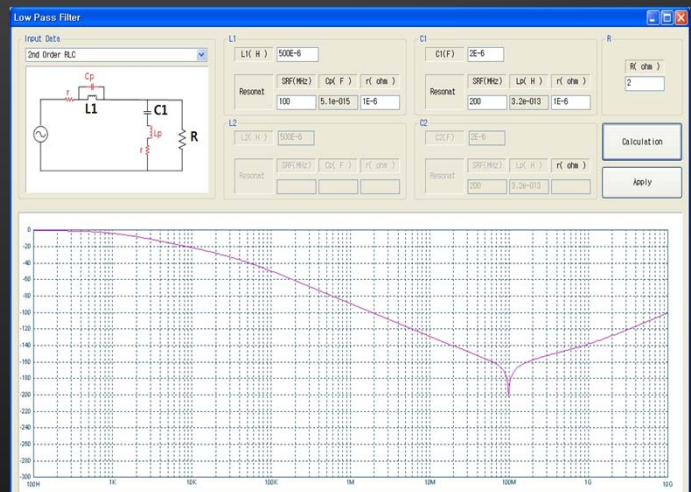
Here, we are
KTI



HEMP 3D view



다중 지하구조물의 차폐도 연산



HEMP 필터 최적설계

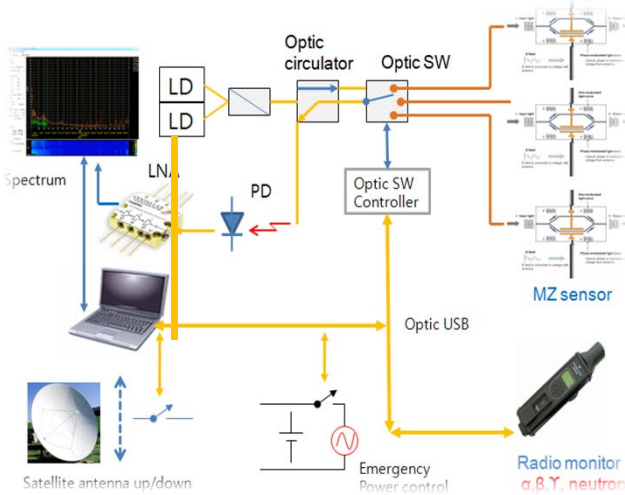


Never seen, never before

HEMP, HPEM direction finder

Model: HEMP SEN 25

Functional specifications



Model, HEMP SEN-25

- HEMP E1, E2 검출 기능
- Long pulse/ E3 대책기능/ 주 전원 고속 절체 기능
- HEMP 방호시설 성능유지 정보 Data logging
- 고 에너지 전자파/HPEM 검출, 분석, 판단 및 대응기능
- Jamming 신호 검출, 분석, 판단 및 대응기능
- 낙뢰와 HEMP 구분 기능
- 과전압 보호소자 손상 여부 판단기능(검출단자 있을 때)
- HEMP방호시설 전원 상태감시 및 응급조치 기능
- HEMP시설 종합망 관리 기능
- 핵 폭발시 응급조치 절차서 내장
- Visual C++ S/W control, Visual graphic MMC
- HEMP/HPEM 완벽한 자기 방호능력
- 누설전류 감시기능(선택사양)

HPEM, HEMP 방향탐지 기능

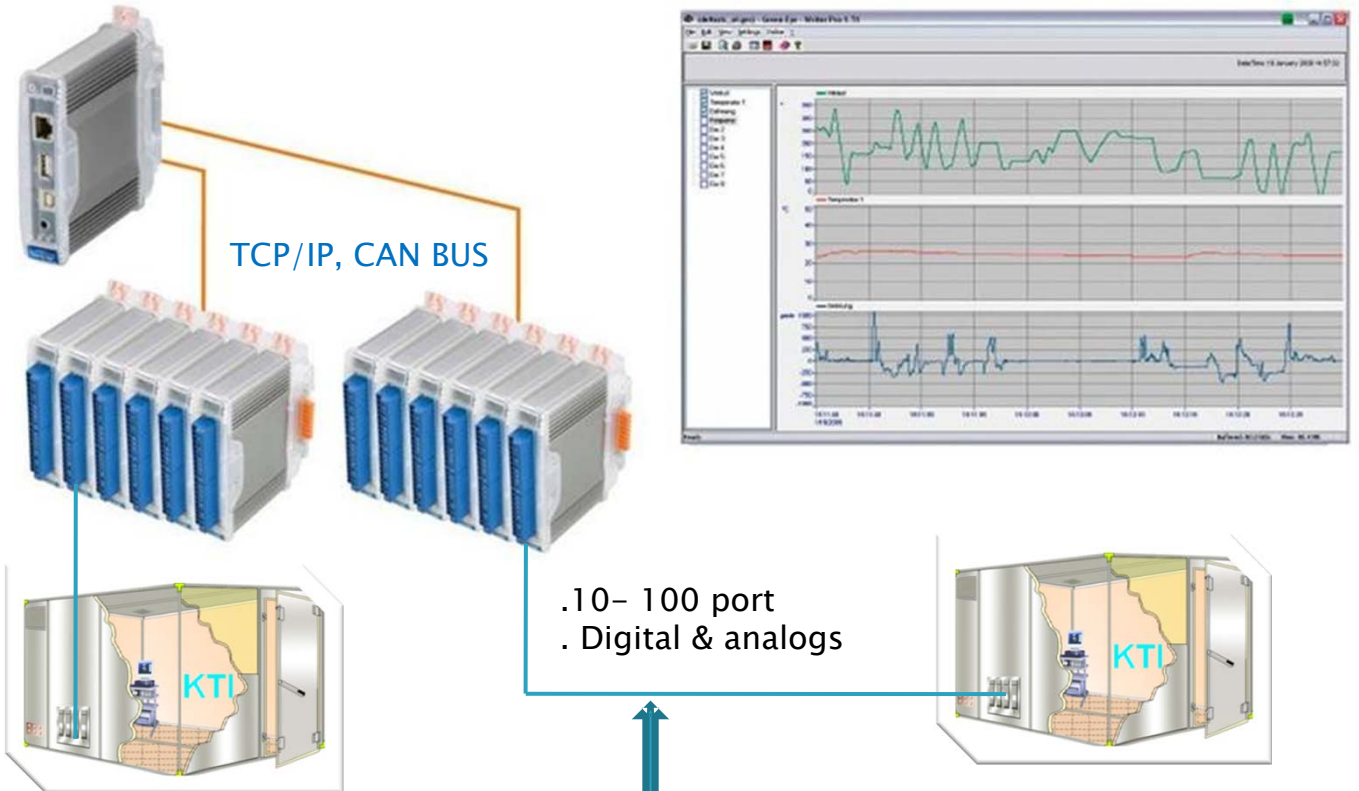
- ▶ HEMP 폭발위치 및 좌표, 탄두크기, 입사각 검출 능력
- ▶ 검출특성 : ns(10^{-9} sec)
- ▶ 검출방식 : 무전원 MZ형 광센서 및 광 케이블 채택
- ▶ 검출 주파수 범위 : 200MHz(옵션 300 kHz) - 10GHz
- ▶ 신호전송방식 : 광밀도 변도 및 차동비교
- ▶ 수신감도 : 0.5V/m-MV/m
- ▶ 수신축 방향 : X,Y,Z 3축 동시 측정기능
- ▶ 수신 전송로 에너지 전송특성 : No phase delay, reflections and attenuation on the transmission
- ▶ 전계 수신 및 전송방식 : Full optical field sensors and optical fiber transmission lines
- ▶ 온도 및 환경영향 : No influence on the temperature and extra interference
- ▶ 경량 전계 검출 센서 / Light weight of the external field sensors with cables
- ▶ 수신 안테나 위치 변경 불필요/ No needs to change the antennas position
- ▶ HEMP, HPEM, 낙뢰 구분 능력/HEMP, HPEM, Lightning detections and classified functions
- ▶ HEMP/HPEM발생시 긴급조치 및 전력 감시 기능/ Emergency control functions for high voltage protectors and power monitoring.
- ▶ 수신 전계량 연산 및 전송기능/ Calculation function of the transmitter power



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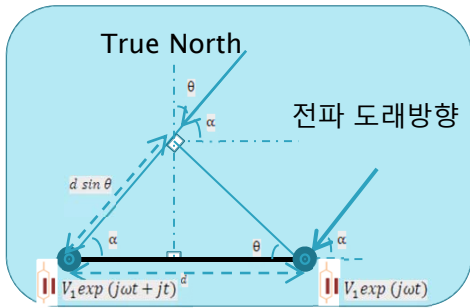
Never seen, never before on the world. Patent pending

HEMP shelter monitoring system, Model, HEMP SEN-25

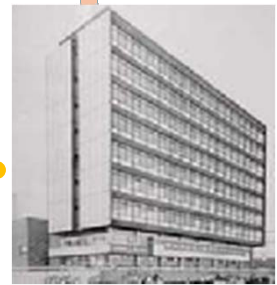
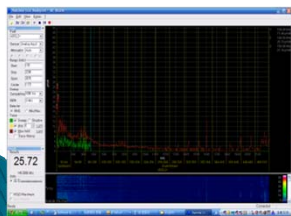


System A : 과전압 회로/소자
E3 Long pulse 대책기능

System B : 전파 방향 탐지기
HEMP, HPEM 방향탐지



- .Frequency band 1 : 200MHz-10GHz for HPEM
- .Frequency band 2 : 300kHz-6.5GHz for HEMP
- .Field sensitivity : 0.5V/m- 1MV/m
- .Isotropy: +/- 0.5dB
- .Full optic sensor and fiber



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World top class products

CW immersion and SE test system

MIL-STD-188-125-1 CONTINUOUS WAVE(CW) IMMERSION

Monitoring Configuration

Measurement

- Electric free-field(XYZ)
- Magnetic free-field(XYZ)
- Surface current(XY)
- Current meas. (20 locations)

Field strength selection

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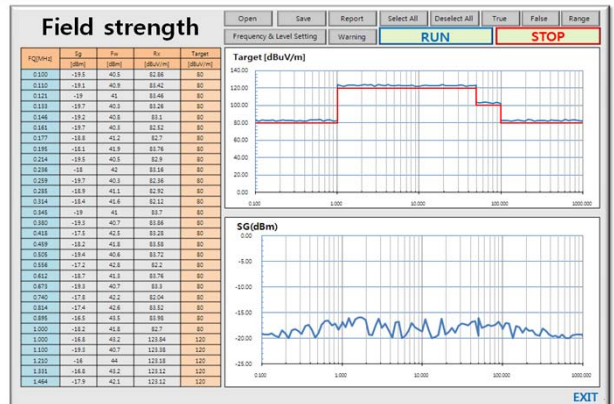
Equipment

RF Source moving Rack
 Signal Generator
 Low Amp1 High Amp2
 Power Meter
 Monopole Bi-log Ant.

Reference Field Sensor
 MZ sensor A MZ sensor B
 Receiver

Numbers of Sensor Selection
 F/O Current (10 / 20) Channel
 F/O Surface Current (2 / 3) Channel
 F/O Free-Field (4 / 5) Channel

EXIT



RF sources

- Frequency band : 100kHz- 1GHz
- Field strength : 0.5 V/m-10V/m or higher(User option)
- Amplifier output :250W(100kHz-200MHz), 250W(200MHz-1GHz) or higher
- Output control : optical RS 232
- Control S/W : KTI RS 2010
- Antenna : 100kHz- 30MHz / E- field generator, 30MHz- 1GHz: Bilog antenna

Reference optical E field sensor

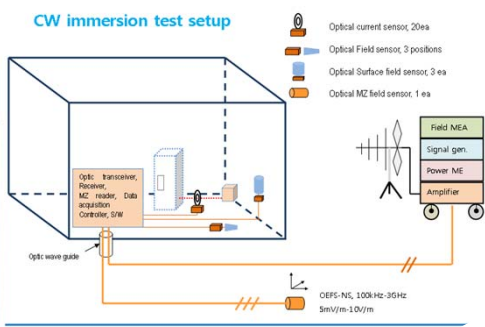
- MZ type orthogonal 5mV/m-10V/m with controller and calibrated
- ### D-dot, B-dot, I-dot, Current sensor, Integrator, Balun and Twinax cable assembly
- Fully meet the IEC 61000-4-33 sensor requirements and calibration
 - B & D-dot sensor : 1103,1115 & 1119,1140
 - I-dot sensor : 1120
 - Current sensor : 1131,1134,1135,1136
 - Integrator : 1310,1315
 - Balun :1300
 - Twinax cable assembly
 - Surface current density sensor : 1107



Remark

- Fully meet the DS 59-118 and IEC 61000-4-33 sensor requirement with the calibration
- Oscilloscope, Optical camera, D/A converter, Optical link, shielded fixtures and controller with S/W are additionally required.

CW immersion test setup



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smart

HEMP Power Line Filter with protector

KTI newly developed the intelligent power line filter with HEMP protector which could fully satisfied the MIL STD 188-125-1/2 based on the 25 years expert.

Main features(patent pending)

- 250 Vac to 380 Vac(35A-400A)
- *ns* high speed response time and high reliability
- Automatic monitoring function of the high voltage protector circuit
- Complies with IEC 950, UL 94-V0 insulating material used
- Extremely lowest residual HEMP current
- Easy to replacement for safety, component evaluation and replace **modular type protector**(IEC 61643-1 (2/98))
- Short circuit protection of the varistor.
- Ground functionally separated and/or one body style advanced design
- MTBF : Minimum 3 years



MIL STD 188 - 125 Certified

Electrical characteristics

- Test voltage : EN 133200 Y2 5,000V 2 second(Prior to fitting HEMP protectors)
- Insulation Resistance : higher than 100Mohm(Prior to fitting discharge resistor)
- Temperature : -25 to +50
- Leakage current : 1- 5A at 250vac, 60Hz
- Peak surge current : higher than 100kA tested by intermediated pulse 1.5/3,000 μ s
Gas arrester + varistor multi stage combination protector, **patent pending**



PCI Test Setup

Selection guidance of the HEMP/HPEM power line filter

- Check on the varistor fails: fire, circuit open, short and quality degradation.
- Fully meet the class II, IEC61643-1 and EN 133200 Y2
- Display and monitoring function for the varistor failure

Nominal insertion loss on the frequency domain

Tested on the 50 Ω load						
Frequency	10kHz	100kHz	1MHz	10MHz	100MHz	1GHz
Insertion loss	25dB	55dB	90dB	100dB	100dB	100dB

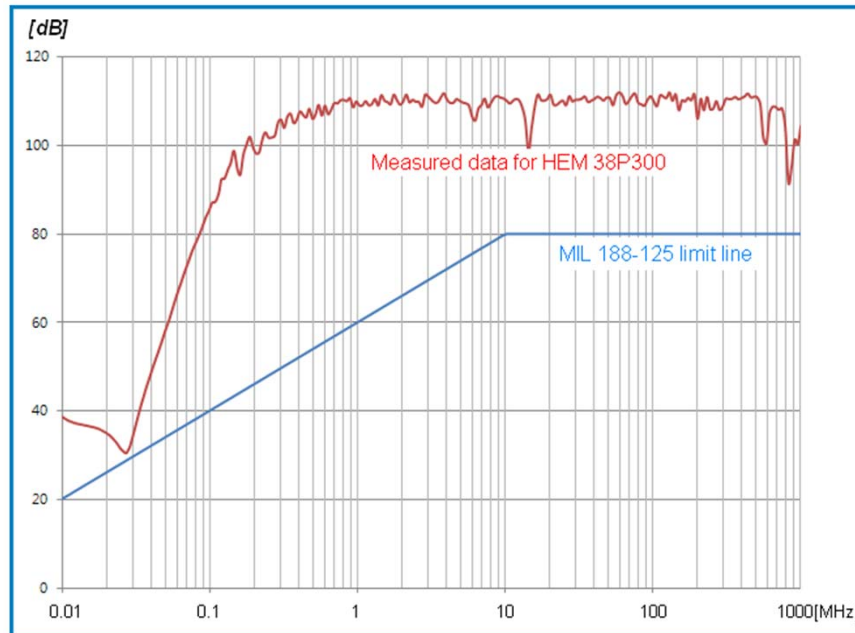
* Actual test data listed on next page

Transient current limit performance on the MIL STD 188-125-1/1

Tested on the MIL STD 188-125-1/2 acceptance test, 20/500ns							
Injected pulse current [A]	250	500	1,000	2,000	2,500	5,000	
Residual current limit on requirement	10A	10A	10A	10A	10A	10A	
Typical throughput residual current	1A	1A	1A	2A	3A	4A	

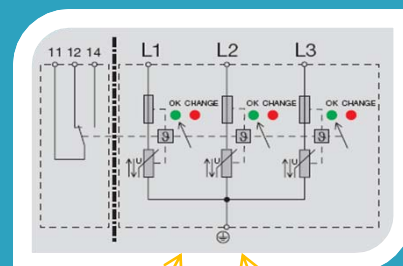
Patent pending

Typical insertion loss at 50Ω load tested by MIL STD 220C



Intelligent HEMP /HPEM protector specifications

	Primary protector	2nd protector
IEC 61643-A		Class I, II
Intermediate pulse worst test 1.5/3,000 , 250A. 50 times repeated test	Working well without damage 100kA	No degradation
Rated leakage current at 8/20us		20kA
Max. leakage current at 8/20us		70kA
Response time	few μs	10 ns
Back up fuse, max.	None	125A
Protection level Up(typ.)	1kV +/-20%	1.3kV
MTBF at 1.5/3,000us, 250A	Minimum 3 years at 20 times lightning per year	
Monitoring contact	None	Press in/out
Visual indicator	None	Green: ok Red : replace



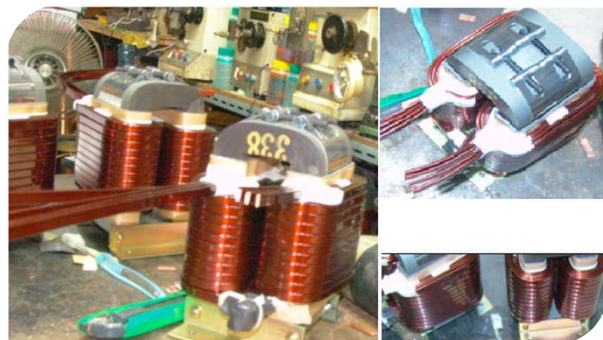
HEMP filters range, dimensions and weight

Product model	Current rating	Voltage rating	Phase	Max.dc break* down(V)	Dimension(mm)			Weight (kg)
					Lengths**	Width	Depth	
HEM 22P35	35	380/ 220ac	2P	5,000	500	500	120	30
			3P	2,250	500	250	120	15
HEM 22P65	65	380/ 220ac	2P	5,000	750	640	170	60
			3P	2,250	750	320	170	30
HEM 22P100	100	380/ 220ac	2P	5,000	800	700	230	80
			3P	2,250	800	350	230	40
HEM 38P200	200	380/ 220ac	2P	5,000	950	900	250	130
			3P	2,250	950	450	250	70
HEM 38P300	300	380/ 220ac	2P	5,000	1200	900	250	200
			3P	2,250	1200	450	250	120
HEM 38P400	400	380/ 220ac	2P	5,000	1600	480	250	230
			3P	2,250	1600	960	250	130

All of the parameter could be changed depending upon the user requirements

* Tested voltage for 3 phase 380Vac : by EN 133200 at 5,000Vdc, 2 second

** Length is depend on the filter performance, here is a nominal length



All of our products developed and made by the 25 years craftsmanship



Korea Technology Institute co. emc.re.kr
TEL:82-31-763-6709 Fax : 82-31-764-6709

Feed through capacitor for ac power lines



Electric specifications;

- Capacitance : 0.1–2 μ F
- Voltage : 380vac
- Current : 35–400A
- Tested by EN 132400
5,000Vdc, 2 second, 380Vac
2,250Vdc, 220Vac
- Leakage current
Max: 200mA
- Dimension;
180/105(L) x 80mm (dia)



Applications;

- Power line filter for **HEMP, HPEM**
- Power line filter for various shielded equipments
- Anechoic chamber
- MIL 188–125 –1/2, 461F and commercial equipments

- * Capacitance could be changed by end user requirements.
- * Contact to KTI further more detailed information.

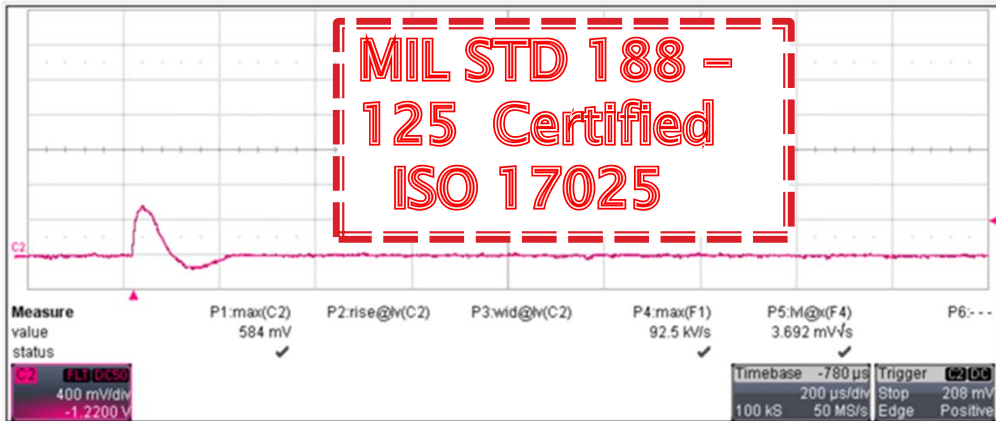


ISO 17025 certification and calibration test lab.
Korea Technology Institute co. LTD
emc.re.kr minkti@naver.com 031-763-6709

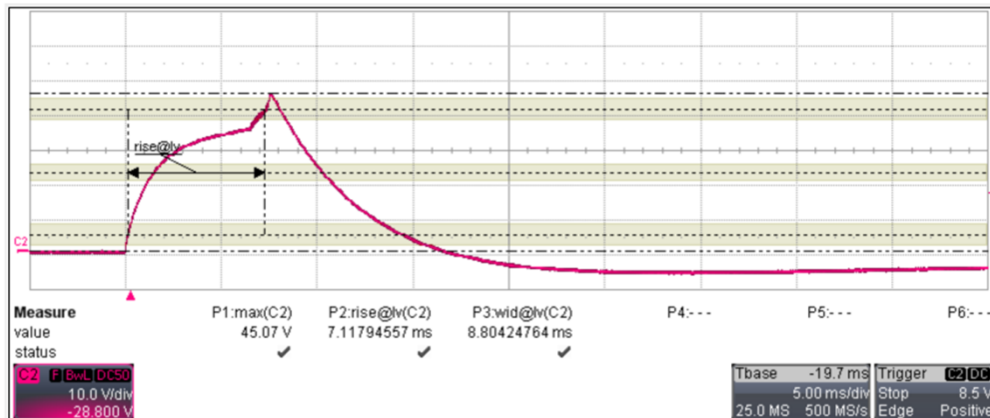
MIL STD 188 125-1 Test result

Short pulse :20/500ns/ 2,500A, Intermediate pulse: 1.5/3000us/250A

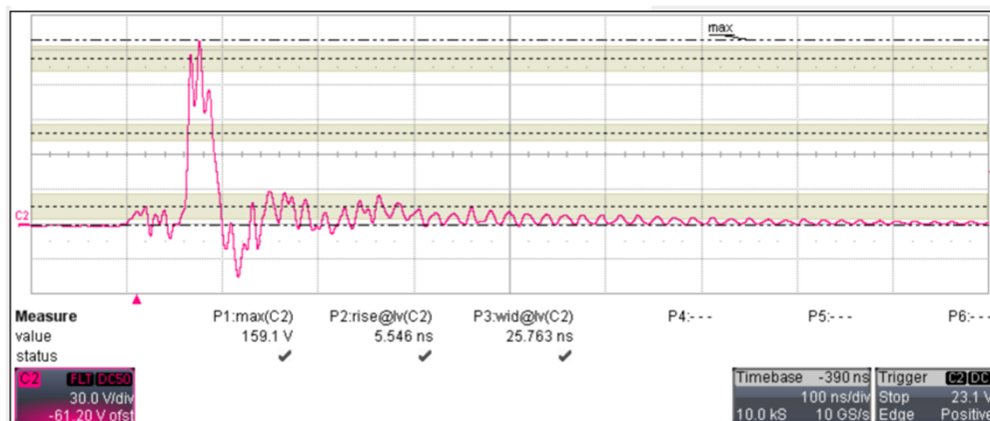
PCI short pulse, 100% for hot line



Intermediate pulse test results, 100% for hot line



Performance degradation test results of the HEMP protector after PCI test at 1.5kV injection



Test results for HEM 38P300 2P model

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TEST REPORT

성적서번호 : R-D2012-0001
페이지(1) / (총 13)

1. 의뢰자

- 업체명 : ㈜한국기술연구소
- 주소 : 경기도 광주시 도척면 상림리 51-19
- 의뢰일자 : 2012. 01. 06

2. 시험성적서의 용도 : PCI 시험에 대한 필터 성능평가용

3. 시험대상품목 또는 물질, 시료명



- 시험품명 : HEMP Power Line Filter
- 모델명 : HEM38P300
- 제조사 : ㈜한국기술연구소
- 주소 : 경기도 광주시 도척면 상림리 51-19

4. 시험기간 : 2012. 01. 16 ~ 2012. 01. 17

5. 시험방법 : MIL-STD-188-125-1 : 2005

6. 시험환경 : 온도 (20.5 ± 1.0) °C, 습도 (36.0 ± 1.0) % R.H., 기압 (101.0 ± 0.5) kPa

7. 시험결과 : 합격

확 인	 시험자 : 지 성 원	 기술책임자 : 임 옥 조
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2012. 02. 01

한국인정기구 인정 **KTR** 한국화학융합시험연구원



위 성적서는 국제시험기관인정협력체(International Laboratory Accreditation Cooperation) 상호인정협정(Mutual Recognition Arrangement)에 서명한 한국인정기구(KOLAS)로부터 공인받은 분야에 대한 시험결과입니다.

Sale records for HEMP hardening shelter design and constructions

1. HEMP hardening shelter design

Owner	Descriptions
1. Korea military academy	Buried type HEMP shelter for sub military office, Feb.2012
2. Joint military head office	HEMP shelter design, Yongsan

2. HEMP/EMC hardening shelter constructions

Owner	Descriptions
1. Korea military academy	Buried type HEMP shelter for sub military office, Feb.2012.
2. Various EMC shielding room	Samsung, KAIST, OTONICS..... 20 kind of shielding room has been constructed by KTI

