(2)

NCS TIB 85-10

NATIONAL COMMUNICATIONS SYSTEM

AD-A164 438

VOLUME III
TEST DATA
ELECTROMAGNETIC PULSE TESTING
OF PROTECTION DEVICES

SECTION 7

EQUIPMENT AND DEVICES
TEST DESCRIPTIONS

OCTOBER 1985

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION: Unclassified	1b RESTRICTIVE MARKINGS: None
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release distribution unlimited
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S): NCS TIB 85-10, Vol. III, Section 7	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION: Electrospace Systems, Inc. / 6b OFFICE SYMBOL (If applicable)	7a NAME OF MONITORING ORGANIZATION: National Communications System Technology & Standards
6c ADDRESS (City, State, and ZIP Code): 1725 S. Jefferson Davis Hwy., Suite 501 Arlington, VA 22202-0668	7b ADDRESS (City, State, and ZIP Code): Washington, D.C. 20305-2010
8a NAME OF FUNDING/SPONSORING ORGANIZATION: National Communications System / 8b OFFICE SYMBOL (If applicable): NCS-TS	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: DCA100-85-C-0010
8c ADDRESS (City, State, and ZIP Code): Washington, D.C. 20305-2010	10 SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO. 33127K; PROJECT NO.; TASK NO 01.6; WORK UNIT ACCESSION NO. CRDL D008

11 TITLE (Include Security Classification) Volume III, Electromagnetic Pulse Transient Threat Testing of Protection Devices ~~for Amateur/Military Affiliate Radio System Equipment (U)~~, Section 7, Equipment & Devices Test Descripts

12 PERSONAL AUTHOR(S): Dennis Bodson, NCS; Joseph Frizzell and Thomas Higdo, (ESI); Walter Rahke (Consultant)

13a TYPE OF REPORT	13b TIME COVERED FROM ____ TO ____	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Technical		1985, October, 31	

16 SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Amateur Radio Equipment EMP, Lightning Protection, Electromagnetic Pulse (EMP) Protection Devices Test, EMP, Lightning, Transient Electrical/Magnetic Pulses.

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

This technical report discusses the vulnerability of equipment used by amateur/MARS radio operators in the United States to disruption or damage by transient electromagnetic effects such as lightning, voltage surges, and electromagnetic pulse (EMP) waves. It also reports the results of two test programs; one to evaluate existing transient suppression devices and components, and one to evaluate the response of amateur radio equipment to an EMP transient environment.

Based on the test results, the report recommends procedures and a low-cost installation scheme which will significantly increase the operational survivability of amateur type communications equipment in a lightning or EMP environment.

This report consists of three volumes. Volume I (200 pages) contains the test results and recommendations for transient protection of amateur radio equipment. Volume II

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT	21 ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL: Dennis Bodson	22b TELEPHONE (Include Area Code): (202) 692-2124 / 22c OFFICE SYMBOL: NCS/TS

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE: UNCLASSIFIED

DTIC ELECTE FEB 20 1986

UNCLASSIFIED

Block 19 Continued - ABSTRACT
(136 pages) contains supporting documentation including: the test plans for the two EMI tests, descriptions/specifications of the tested transient suppression devices and the amateur radio equipment, and photographs of the test facilities and test set-ups. Volume III (1298 pages) contains the raw test data in the form of oscilloscope photographs attached to the test data sheets for both test programs, as well as, written test descriptions and bench check measurements from the equipment test program. For most purposes Volume I should provide sufficient information. Volume II would be required to obtain more detailed descriptions of the test programs and tested devices and equipment. Volume III would only be required if a separate analysis of the test data is being made.

UNCLASSIFIED

NCS TECHNICAL INFORMATION BULLETIN 85-10

ELECTROMAGNETIC PULSE/TRANSIENT THREAT TESTING OF PROTECTION DEVICES FOR AMATEUR/MILITARY AFFILIATE RADIO SYSTEM EQUIPMENT

OCTOBER 1985

PROJECT OFFICER

DENNIS BODSON
Senior Electronics Engineer
Office of Technology
and Standards

: APPROVED FOR PUBLICATION:

For MARSHALL L. CAIN
Assistant Manager
Office of Technology
and Standards

FOREWORD

The National Communications System (NCS) is an organization of the Federal government whose membership is comprised of 22 Government entities. Its mission is to assist the President, National Security Council, Office of Science and Technology Policy, and Office of Management and Budget in:

- o The exercise of their wartime and non-wartime emergency functions, and their planning and oversight responsibilities.
- o The coordination of the planning for and provision of National Security/Emergency Preparedness communications for the Federal government under all circumstances including crisis or emergency.

In support of this mission the NCS has executed a Memorandum of Understanding with the American Radio Relay League. Its purpose is to establish a broad framework for a cooperative and close working relationship with volunteer radio amateurs for support of national emergency communications functions. It is intended through joint coordination and exercise of the resources of both organizations, to enhance the nation-wide posture of telecommunications readiness for any conceivable national emergency. This particular Technical Information Bulletin is one of a series aimed at developing an awareness in the radio amateur community of practical, low cost EMP protective procedures, devices, and equipment which may if utilized significantly enhance the probability of amateur radio resources escaping serious damage during emergency situations involving EMP events.

Comments, on this TIB are welcome, and should be addressed to:

Office of the Manager
National Communications System
ATTN: NCS-TS
Washington, DC 20305-2010
(202) 692-2124

TEST: A **DATE:** 7-29/30-85

DESCRIPTION: This was a simulator field pulse, stand-alone equipment test of all systems.

PURPOSE: This first test was designed to evaluate the susceptibility of the internal wiring and components of the radio equipment to EMP.

CONFIGURATION: Equipment was on wooden carts 34 inches above the pulser floor. No interconnecting wiring or antennas were attached. Permanently attached wiring was coiled and placed under the equipment cases.

PULSER FIELD: 50KV/M **PHOTO:** 1 through 3

POWER: Off **INJECTION:** None

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: All equipment survived undamaged.

TEST: B1 **DATE:** 7-30-85

DESCRIPTION: Simulator field test of all equipment with interconnecting wires, power cords, and microphones attached.

PURPOSE: To test the susceptibility of the equipment to a field pulse with these short wires attached.

CONFIGURATION: Equipment on wooden carts 34 inches high. All interconnecting wires installed, microphone and power cord attached. No antenna coax attached. Power cords coiled.

PULSER FIELD: 50KV/M **PHOTO:**

POWER: Off **INJECTION:** None

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: B2 **DATE:** 7-30-85

DESCRIPTION: Simulator field test of all equipment with interconnecting wires, power cords, and microphones attached.

PURPOSE: To test the susceptibility of the equipment to a field pulse with these short wires attached.

CONFIGURATION: Equipment on wooden carts 34 inches high. All interconnecting wires installed, microphone and power cord attached. No antenna coax attached. Power cords are extended to full length.

PULSER FIELD: 50KV/M **PHOTO:**

POWER: Off **INJECTION:** None

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: C1 **DATE:** 7-31-85

DESCRIPTION: (System 2) this was a test with equipment cases grounded and short wires attached. Field pulse.

PURPOSE: Test provided the most stringent test of equipment susceptibility to a field pulse in an unpowered condition.

CONFIGURATION: Equipment on pulser ground plane, cases grounded to ground plane. All short wires installed. Power cords were coiled and raised 2 inches above the floor.

PULSER FIELD: 50KV/M **PHOTO:** 19

POWER: Off **INJECTION:** None

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: C2 **DATE:** 7-31-85

DESCRIPTION: This was the first test of a system with power-on. Pulse field only.

PURPOSE: To provide medium stress from pulser field with power-on.

CONFIGURATION: Radio equipment was on wooden cart 34 inches above pulser floor. All interconnecting wires, mike, and power cord installed (no antenna coax). AC power provided by Honda generator outside pulser field and on wooden cart. Radios and generator were not grounded. Transceiver in receive mode, on frequency 28.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 20

POWER: On **INJECTION:** None

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: C3 **DATE:** 7-31-85

DESCRIPTION: Pulser field test with the radio equipment grounded and power-on.

PURPOSE: To exert maximum pulse field stress to the equipment in a power-on condition.

CONFIGURATION: Equipment on floor, cases grounded to pulser ground plane, power-on, receive mode, frequency 28.3 MHZ. AC power from Honda generator through an isolation transformer and a power receptacle box. Box and safety wire grounded to ground plane.

PULSER FIELD: 50KV/M **PHOTO:** 21

POWER: On **INJECTION:** None

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: C4 **DATE:** 8-1-85

DESCRIPTION: Pulser field test with the radio equipment grounded and power-on.

PURPOSE: To exert maximum pulse field stress to the equipment in a power-on condition.

CONFIGURATION: Equipment on floor, cases grounded to pulser ground plane, power-on, receive mode, frequency 28.3 MHZ. AC power from Honda generator through an isolation transformer and a power receptacle box. Box and safety wire grounded to ground plane. Neutral AC power lead also grounded to the pulser ground plane.

PULSER FIELD: 50KV/M **PHOTO:** 24

POWER: On **INJECTION:** None

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

Series D Tests

The series D tests began the evaluation of the protection devices and schemes with the radio equipment. Protection devices were used primarily on the power lines and on the antenna coax, based on the previous test series.

The series D tests were the first simultaneous field pulse and injection pulse tests. The injection currents were obtained from two L shaped wire pick-up antennas that were placed in the pulser working volume. For most of the tests the power injection current was injected onto the hot lead of an AC power receptacle box, which was installed on the edge of the pulser ground plane. The RF injection current was injected into the center conductor of a UHF connector and through two sections of RG-8 coaxial cable, each three feet long, into the radio equipment's antenna port. The UHF connector was grounded to the pulser ground plane through a metal hold-down bracket. The RF protection devices being evaluated during this test program were installed at the juncture of the two coaxial sections, midway between the hold-down bracket and the radio equipment.

The AC power drive antenna had a vertical element 55 inches high and a horizontal element 72 inches long. The horizontal element was 55 inches

above the pulser ground plane and was parallel to the pulser's wire elements. The AC drive current was 130 amps and 6.5 KV.

The RF drive antenna had a vertical element 72 inches high and a horizontal element 15 feet long, which started 74 inches above the pulser ground plane and rose to 120 inches above the ground plane. The horizontal element was at a right angle to the overhead pulser wire elements. The RF drive antenna current was 275 amps and 13.75 KV.

Due to the single AC drive antenna and RF drive antenna only one radio system could be tested at a time, when an injection pulse was required.

TEST: D1 **DATE:** 8-2-85

DESCRIPTION: (System 2) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 31

POWER: On **INJECTION:** Yes

ANTENNA: ON **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-300 UHF

TEST NOTES:

TEST: D2 **DATE:** 8-2-85

DESCRIPTION: (System 1) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 33

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-300 UHF

TEST NOTES:

TEST: D3 **DATE:** 8-2-85

DESCRIPTION: (System 4) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 35

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-350 UHF

TEST NOTES:

TEST: D4 **DATE:** 8-2-85

DESCRIPTION: (System 5) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 36, 37

POWER: ON **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-350 UHF

TEST NOTES:

TEST: D5 **DATE:** 8-5-85

DESCRIPTION: (System 10) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 2

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-300 UHF

TEST NOTES:

TEST: D6 **DATE:** 8-5-85

DESCRIPTION: (System 11) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 3

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-300 UHF

TEST NOTES:

TEST: D7 **DATE:** 8-5-85

DESCRIPTION: (System 16) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 4

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-300 UHF

TEST NOTES:

TEST: D8 **DATE:** 8-5-85

DESCRIPTION: (System 3) a power-on test with protection devices and field and injection pulses.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment grounded to pulser floor ground plane. Transceiver in the receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 5

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-150 UHF

TEST NOTES:

TEST: D9 **DATE:** 8-5-85

DESCRIPTION: (System 8) a power-on test with protection devices and field and injection pulses.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Power supplied by a 12 volt DC automobile battery in a closed metal box. Radio is connected to the battery by a 6 foot 2 pair cord, protection device connected from positive to negative wire of power cord 16 inches from radio. Radio equipment case grounded to pulser ground plane, battery not grounded. Radio on receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 6

POWER: On - Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: FCC-250-120 UHF

TEST NOTES:

TEST: D10 **DATE:** 8-5-85

DESCRIPTION: (System 9) a power-on test with protection devices and field and injection pulses.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Power supplied by a 12 volt DC automobile battery in a closed metal box. Radio is connected to the battery by a 6 foot 2 pair cord, protection device connected from positive to negative wire of power cord 16 inches from radio. Radio equipment case grounded to pulser ground plane, battery not grounded. Radio on receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 7

POWER: On - 12V Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: FCC-250-150 UHF

TEST NOTES:

TEST: D11 **DATE:** 8-5-85

DESCRIPTION: (System 6) a power-on test with protection devices and field and injection pulses.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Power supplied by a 12 volt DC automobile battery in a closed metal box. Radio is connected to the battery by a 6 foot 2 pair cord, protection device connected from positive to negative wire of power cord 16 inches from radio. Radio equipment case grounded to pulser ground plane, battery not grounded. Radio on receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 8

POWER: On - 12V Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: FCC-250-150 UHF

TEST NOTES:

TEST: D12 **DATE:** 8-5-85

DESCRIPTION: (System 12) a power-on test with protection devices and field and injection pulses.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Power supplied by a 12 volt DC automobile battery in a closed metal box. Radio is connected to the battery by a 6 foot 2 pair cord, protection device connected from positive to negative wire of power cord 16 inches from radio. Radio equipment case grounded to pulser ground plane, battery not grounded. Radio on receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 9

POWER: On - 12V Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: FCC-250-150 UHF

TEST NOTES:

TEST: D13 **DATE:** 8-5-85

DESCRIPTION: (System 13) test of handheld radio with protection device on antenna.

PURPOSE: To test the effectiveness of the protection device to a pulser field.

CONFIGURATION: Handheld radio on a nonconducting surface 6 inches above the pulser ground plane. Antenna vertical, power-on, tuned to frequency 146.27 MHZ in the receive mode. Audio was being monitored during the test.

PULSER FIELD: 50KV/M **PHOTO:** 10

POWER: Battery **INJECTION:** No

ANTENNA: Rubber Duck **INJECTION:** No

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: FCC-450-120 UHF with BNC connectors

TEST NOTES:

TEST: D14 **DATE:** 8-5-85

DESCRIPTION: (System 7) test of handheld radio with protection device on antenna.

PURPOSE: To test the effectiveness of the protection device to a pulser field.

CONFIGURATION: Handheld radio on a nonconducting surface 6 inches above the pulser ground plane. Antenna vertical, power-on, tuned to frequency 146.27 MHZ in the receive mode. Audio was being monitored during the test.

PULSER FIELD: 50KV/M **PHOTO:** 11

POWER: Battery **INJECTION:** No

ANTENNA: Rubber Duck **INJECTION:** No

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: FCC-450-120 UHF with BNC connectors

TEST NOTES:

TEST: E1 **DATE:** 8-6-85

DESCRIPTION: System 2 test with protection devices.

PURPOSE: To evaluate the effectiveness of an assembled RF protection device.

CONFIGURATION: System 2 was on ground plane of pulser with equipment cases grounded. AC power provided by Honda portable generator from outside field. Transceiver in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 27

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: SIOV RF Test Box

TEST NOTES:

TEST: E2 **DATE:** 8-6-85

DESCRIPTION: System 2 test with protection devices.

PURPOSE: To evaluate the effectiveness of an assembled RF protection device.

CONFIGURATION: System 2 was on ground plane of pulser with equipment cases grounded. AC power provided by Honda portable generator from outside field with transceiver in transmit mode at 3/4 power, tuned to frequency 10.364 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 28

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: SIOV RF Test Box

TEST NOTES:

TEST: E3 **DATE:** 8-6-85

DESCRIPTION: System 2 test with protection.

PURPOSE: Recheck of commercial protection device.

CONFIGURATION: System 2 was on ground plane of pulser with equipment cases grounded. AC power provided by Honda portable generator from outside field with transceiver in transmit mode at 3/4 power, tuned to frequency 10.364 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 29

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: FCC-250-300 UHF

TEST NOTES: E4 not used.

TEST: D15/R/D15T **DATE:** 8-7-85

DESCRIPTION: (System 2) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ with different RF protector.

PULSER FIELD: 50KV/M **PHOTO:** 3,4

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: Alpha Delta Transi-Trap RT

TEST NOTES: D15T transceiver in transmit mode on frequency 10.364 MHZ.

TEST: D16 **DATE:** 8-7-85

DESCRIPTION: (System 11) a power-on field and injection pulse test with protection devices.

PURPOSE: To test effectiveness of protection device.

CONFIGURATION: Radio equipment on pulser ground plane, grounded case, power-on, receive mode.

PULSER FIELD: 50KV/M **PHOTO:**

POWER: On **INJECTION:** Yes

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: D17R/D17T **DATE:** 8-7-85

DESCRIPTION: (System 11) a power-on field and injection pulse test with protection devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 37, 38

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: IS - NEMP

TEST NOTES: D17T Transceiver in transmit mode on frequency 10.374 MHZ.

TEST: D17R1/D17R2 **DATE:** 8-7-85

DESCRIPTION: (System 11) test with protective devices.

PURPOSE: To test the effectiveness of the protection devices.

CONFIGURATION: System 11 on pulser floor, grounded to pulser ground plane. "L" shape RF drive antenna attached directly to SIOV AC test box hot lead. Radio plugged into SIOV AC test box.

PULSER FIELD: 50KV/M **PHOTO:** 39

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC test box

RF PROTECTION DEVICE: IS - NEMP

TEST NOTES: D17R2 - Repeat of D17R1.

TEST: D18R/D18T **DATE:** 8-8-85

DESCRIPTION: (System 11) test with protective devices.

PURPOSE: To test the effectiveness of power protection device.

CONFIGURATION: Radio equipment was grounded to the pulser ground plane. The transceiver was in the receive mode on frequency 18.3 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 10, 11

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: Archer 61-7785

RF PROTECTION DEVICE: IS - NEMP

TEST NOTES: D18T transceiver in transmit mode.

TEST: D19 **DATE:** 8-8-85

DESCRIPTION: (System 3) test with protective devices.

PURPOSE: To test the effectiveness of protection devices.

CONFIGURATION: Transceiver in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 12

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: IS - NEMP - 1

TEST NOTES:

TEST: D20 **DATE:** 8-8-85

DESCRIPTION: (System 3) test with protective devices.

PURPOSE: To test the effectiveness of protection devices.

CONFIGURATION: Transceiver in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 13

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: IS - NEMP - 1

TEST NOTES:

TEST: D21 **DATE:** 8-8-85

DESCRIPTION: (System 3) test with protective devices.

PURPOSE: To test the SIOV AC test box effectiveness.

CONFIGURATION: Power-on, RF antenna disconnected.

PULSER FIELD: 50KV/M **PHOTO:** 14

POWER: On **INJECTION:** Yes

ANTENNA: Off **INJECTION:** None

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: D22 **DATE:** 8-8-85

DESCRIPTION: System 3 test with protection devices.

PURPOSE: To test the effectiveness of protection devices.

CONFIGURATION: Receive mode, power-on.

PULSER FIELD: 50KV/M **PHOTO:** 15

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: IS - NEMP - 2

TEST NOTES:

TEST: E5 **DATE:** 8-8-85

DESCRIPTION: System 11 test with protection devices.

PURPOSE: To test the effectiveness of the protection device.

CONFIGURATION: System 11 in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 3

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 420

RF PROTECTION DEVICE: SIOV RF Test Box

TEST NOTES:

TEST: E6 **DATE:** 8-8-85

DESCRIPTION: System 11 test with two assembled protection devices.

PURPOSE: To evaluate the effectiveness of the protection devices.

CONFIGURATION: System 11 in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 4

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: Siemens UHF Test Box

TEST NOTES:

TEST: E7/E8 **DATE:** 8-8-85

DESCRIPTION: System 11 test with two assembled protection devices.

PURPOSE: To evaluate the protection devices.

CONFIGURATION: System 11 in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 5, 6

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: Joslyn UHF Test Box

TEST NOTES: System 11 in transmit mode.

TEST: E9/E10 **DATE:** 8-8-85

DESCRIPTION: System 11 test with equipment turned at an angle to the pulse field incident lines.

PURPOSE: To test the susceptibility of the equipment to a change in the incident angle of the pulse field.

CONFIGURATION: System 11 equipment turned on the right side of the equipment case. Transceiver in the receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 7, 8

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: Joslyn UHF Test Box

TEST NOTES: Test E10 transceiver in transmit mode on frequency 10.374 MHZ.

TEST: E11 **DATE:** 8-8-85

DESCRIPTION: System 11 test with equipment turned at an angle to the pulser field lines.

PURPOSE: To test the susceptibility of the equipment to a change in arrival angle of the field.

CONFIGURATION: Equipment siting on its back at an angle of 60 degrees with respect to the pulser ground plane.

PULSER FIELD: 50KV/M **PHOTO:** 9

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: Joslyn UHF Test Box

TEST NOTES:

TEST: E12 **DATE:** 8-8-85

DESCRIPTION: System 3 test with equipment turned at an angle to the pulse field.

PURPOSE: To test the susceptibility of the equipment to a change in arrival angle of the field.

CONFIGURATION: Equipment was on its left side, transceiver in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 16

POWER: On **INJECTION:** Yes

ANTENNA: Off **INJECTION:** No

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE:

TEST NOTES:

TEST: E13 **DATE:** 8-8-85

DESCRIPTION: System 3 with assembled RF device.

PURPOSE: To test the effectiveness of the device.

CONFIGURATION: System 3 in normal test position, grounded, on pulser floor, power-on and antenna on.

PULSER FIELD: 50KV/M **PHOTO:** 17

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: SIOV RF Test Box

TEST NOTES:

TEST: E14/E15 **DATE:** 8-8-85

DESCRIPTION: System 3 with two assembled test protection devices.

PURPOSE: To test the devices with System 3.

CONFIGURATION: System 3 on pulser floor, grounded, power-on, antenna on, powered by Honda generator.

PULSER FIELD: 50KV/M **PHOTO:** 18

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: SIOV RF Test Box

TEST NOTES: Test E-15 repeated E-14.

TEST: E16 **DATE:** 8-8-85

DESCRIPTION: System 11 test with assembled protection devices.

PURPOSE: To test the devices.

CONFIGURATION: System 11 on pulser floor, grounded, power by [illegible]da generator.

PULSER FIELD: 50KV/M **PHOTO:** 19

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES:

TEST: E17 **DATE:** 8-8-85

DESCRIPTION: System 10 test with assembled protection devices.

PURPOSE: To test the protection devices.

CONFIGURATION: System 10 on pulser floor, grounded, power and antenna on.

PULSER FIELD: 50KV/M **PHOTO:** 20

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES:

TEST: F1 (SYSTEM 2) **DATE:** 8-7-85

DESCRIPTION: SYSTEM 2 test without protection on the RF antenna.

PURPOSE: To test system 2's inherent protection capabilities

CONFIGURATION: System 2 grounded to pulser ground plane with power on, in receive mode. Protection device on the AC power lines but not on the antenna coaxial line.

PULSER FIELD: 50KV/M **PHOTO:** 20

POWER: On 120V **INJECTION:** Yes

ANTENNA: Connected **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: None

TEST NOTES: Receiver sensitivity dropped.

TEST: F2 (SYSTEM 2) **DATE:** 8-7-85

DESCRIPTION: SYSTEM 2 test without protection on the RF antenna.

PURPOSE: To test system 2's inherent protection capabilities

CONFIGURATION: System 2 grounded to pulser ground plane, with power on, in transmit mode, tuned to frequency 10.374 MHZ. Protection on AC power but not on antenna coaxial line.

PULSER FIELD: 50KV/M **PHOTO:** 21

POWER: On 120V **INJECTION:** Yes

ANTENNA: Connected **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F3 (SYSTEM 2) **DATE:** 8-7-85

DESCRIPTION: SYSTEM 2 test with no protection on the power or antenna inputs, full field and injection test.

PURPOSE: To test system 2's inherent protection capabilities

CONFIGURATION: System 2 grounded to pulser ground plane, with power on, in receive mode, no protection provided. Honda generator protected by T11 Model 428.

PULSER FIELD: 50KV/M **PHOTO:** 22

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F4 (SYSTEM 2) **DATE:** 8-7-85

DESCRIPTION: SYSTEM 2 test with no protection on the power or antenna inputs, field and injection pulses.

PURPOSE: To test system 2's inherent protection capabilities

CONFIGURATION: System 2 grounded to pulser ground plane, with power on, in transmit mode, turned to frequency 10.374 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 23

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F5R (SYSTEM 10) **DATE:** 8-8-85

DESCRIPTION: SYSTEM 10 test with no protection on the antenna coax, protection was on AC power lines.

PURPOSE: To test system 10's inherent protection capabilities on its antenna input circuitry.

CONFIGURATION: System 10 grounded to pulser ground plane, in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 21

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F5T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 10 in transmit mode with no protection on antenna coax.

PURPOSE: To test system 10's inherent protection capabilities on its antenna input circuitry.

CONFIGURATION: System 10 grounded to pulser ground plane, in CW transmit mode tuned to frequency 10.374 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 21

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: T11 Model 428

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F6R **DATE:** 8-8-85

DESCRIPTION: SYSTEM 10 unprotected test with full field and injection currents.

PURPOSE: To test system 10's inherent protection capabilities to a full EMP simulation.

CONFIGURATION: System 10 on pulser floor grounded to pulser plane, in receive mode. No protection on power line or on antenna coax.

PULSER FIELD: 50KV/M **PHOTO:** 23

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Receiver was detuned by pulse.

TEST: F6T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 10 completely unprotected test with full field and injection pulses.

PURPOSE: To test system 10's inherent protection capabilities in the transmit mode to a full EMP simulation.

CONFIGURATION: System 10 on pulser floor grounded to pulser ground plane, in CW transmit mode, tuned to frequency 10.364 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 24

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F7R **DATE:** 8-8-85

DESCRIPTION: SYSTEM 11 test in a completely unprotected configuration with full field and injection pulses.

PURPOSE: To test system 11's inherent protection capabilities in the receive mode to a full EMP simulation.

CONFIGURATION: System 11 on pulser floor, grounded to pulser ground plane, in the receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 25

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F7T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 11 test in a completely unprotected test, transmit mode, with full field and injection pulses.

PURPOSE: To test system 11's inherent protection capabilities in the tranmit mode to a full EMP simulation.

CONFIGURATION: System 11 on pulser floor, grounded to pulser ground plane, in the transmit mode, tuned to frequency 10.364 MHZ

PULSER FIELD: 50KV/M **PHOTO:** 26

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F8R **DATE:** 8-8-85

DESCRIPTION: SYSTEM 1 test with two assembled protection devices.

PURPOSE: To test system 1's response to this protection configuration.

CONFIGURATION: System 1 on pulser floor, grounded to pulser ground plane, in the receive mode, protection on AC power line and RF coaxial cable. AC power provided by Honda generator.

PULSER FIELD: 50KV/M **PHOTO:** 27

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES:

TEST: F8T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 1 test with two assembled protection devices, in transmit mode.

PURPOSE: Tc test system 1's response to protection provided by these two protection devices.

CONFIGURATION: System 1 on pulser floor, grounded to pulser ground plane, in CW transmit mode, tuned to frequency 10.374 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 28

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES:

TEST: F9R **DATE:** 8-8-85

DESCRIPTION: SYSTEM 1 test without protection on the antenna coax receive mode.

PURPOSE: To test system 1's inherent protection capabilities on its antenna input in the receive mode.

CONFIGURATION: System 1 on pulser floor, all equipment cases grounded to pulser ground plane. In receive mode of operation.

PULSER FIELD: 50KV/M **PHOTO:** 29

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F9T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 1 test with no protection.

PURPOSE: To test system 1's inherent protection capabilities to a full EMP simulation in the transmit mode.

CONFIGURATION: System 1 on pulser floor with equipment cases grounded to pulser ground plane, in CW transmit mode, turned to 10.374 MHZ.

PULSER FIELD: 50 KV/M **PHOTO:** 30

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F10R **DATE:** 8-8-85

DESCRIPTION: SYSTEM 5 test with two assembled protection devices.

PURPOSE: To test the assembled protection device's capabilities with System 5 under a full EMP simulation.

CONFIGURATION: System 5 on pulser floor with equipment cases grounded to pulser ground plane, in the receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 31

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box.

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES: Bench check made after F10R/F10T.

TEST: F10T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 5 test with two assembled protection devices.

PURPOSE: To test the protection device's capabilities with System 5 in the transmit mode.

CONFIGURATION: System 5 on pulser floor, with equipment cases grounded to pulser ground plane, in the transmit mode, tuned to frequency 10.374 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 32

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box.

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES: Bench check made after F10R/F10T.

TEST: F11R **DATE:** 8-8-85

DESCRIPTION: SYSTEM 5 test with no protection in the receive mode.

PURPOSE: To test System 5's inherent protection characteristics, when subjected to a full EMP simulated pulse.

CONFIGURATION: System 5 on pulser floor with equipment cases grounded to pulser ground plane, in the receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 33

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F11T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 5 test with no protection, transmit mode.

PURPOSE: To test System 5's inherent protection characteristics, when subjected to a full EMP simulated pulse.

CONFIGURATION: System 5 on pulser floor with equipment cases grounded to pulser ground plane, in the transmit mode, tuned to frequency 10.?74 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 34

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Transceiver's frequency display was disrupted. The display was restored by switching the transceiver off and back on.

TEST: F12R **DATE:** 8-8-85

DESCRIPTION: SYSTEM 4 test with no protective devices, in the receive mode.

PURPOSE: To test System 4's inherent protection characteristics, (survivability) to a simulated EMP.

CONFIGURATION: System 4 was on the floor of the pulser, the equipment cases were grounded to pulser ground plane. The antenna coax was attached to terminal 2 on the antenna tuner.

PULSER FIELD: 50KV/M **PHOTO:** 35

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: The transceiver's frequency display was disrupted (lost). The display was restored by switching the power off and back on.

TEST: F12T **DATE:** 8-8-85

DESCRIPTION: SYSTEM 4 test with no protective devices, in the transmit mode.

PURPOSE: To test System 4's inherent protection characteristics, (survivability) when subjected to a full EMP simulation.

CONFIGURATION: System 4 was on the floor of the pulser, the equipment cases were grounded to pulser ground plane. The antenna coax was attached to terminal 2 on the antenna tuner.

PULSER FIELD: 50KV/M **PHOTO:** 36

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Transceiver's frequency display was disrupted.

TEST: F13R **DATE:** 8-8-85

DESCRIPTION: System 3 test with no protection in the receive mode.

PURPOSE: To test the system's inherent protection characteristics when stressed by a full EMP simulation.

CONFIGURATION: System 3 on pulser floor, equipment case grounded to pulser ground plane. Microphone in place.

PULSER FIELD: 50KV/M **PHOTO:** 37

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Transceiver's display and audio disrupted. Both recovered when the transceiver's power switch was turned off and on.

TEST: T13R **DATE:** 8-8-85

DESCRIPTION: System 3 with no protection in the transmit mode.

PURPOSE: To test the system's inherent protection characteristics in the transmit mode when pulsed with a full EMP simulation.

CONFIGURATION: System 3 on pulser floor with equipment cases grounded to the pulser ground plane. Microphone in place, in CW transmit mode.

PULSER FIELD: 50KV/M **PHOTO:** 38

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F14R **DATE:** 8-9-85

DESCRIPTION: System 16 protected with SWAN AC test box AC power protection and UHF coaxial "T".

PURPOSE: To test the protection devices with system 16.

CONFIGURATION: System 16 on pulser floor with equipment cases grounded to pulser ground plane, in receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 2

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: Swan AC Test Box

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES: Swan - AC Test Box was attached to the Swan transceiver before the test.

TEST: F15R **DATE:** 8-9-85

DESCRIPTION: System 16 test with no protection on the antenna coax.

PURPOSE: To test the system's inherent protection characteristics with no protection on the antenna inject current.

CONFIGURATION: System 16 assembled on floor of pulser with equipment cases grounded to the pulser ground plane. AC power protection in place.

PULSER FIELD: **PHOTO:** 3

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: Swan AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES: No problem noted.

TEST: F16R **DATE:** 8-9-85

DESCRIPTION: System 14 test with assembled protection devices.

PURPOSE: To test the effectiveness of the protection devices with system 14 in a full EMP simulation.

CONFIGURATION: System 14 assembled on pulser floor, equipment cabinets grounded to pulser ground plane, in receive mode. Protection devices in place.

PULSER FIELD: 50KV/M **PHOTO:** 5

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: UHF coaxial "T"

TEST NOTES:

TEST: F16T **DATE:** 8-9-85

DESCRIPTION: System 14 test, protected by assembled devices, transmit mode.

PURPOSE: To test the effectiveness of the protection devices in protecting system 14 in the transmit mode.

CONFIGURATION: System 14 assembled on the pulser floor with equipment cases grounded to the pulser ground plane, in CW transmit mode, tuned to frequency 10.374 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 6

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: UHF coaxial "T"

TEST NOTES:

TEST: F17T **DATE:** 8-9-85

DESCRIPTION: System 14 test with no protective devices.

PURPOSE: To test the system's inherent protection characteristics with a full EMP simulation in the transmit mode.

CONFIGURATION: System 14 assembled on the pulser floor, with equipment cases grounded to pulser ground plane, equipment in transmit mode. No protective devices applied.

PULSER FIELD: 50KV/M **PHOTO:** 7

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F17R **DATE:** 8-9-85

DESCRIPTION: System 14 test with no protective devices. Recieve mode.

PURPOSE: To test the system's inherent protection characteristics with a full EMP simulation.

CONFIGURATION: System 14 assembled on pulser floor, with equipment cases grounded to the pulser ground plane, in receive mode. Injection currents on AC power and RF coax.

PULSER FIELD: 50KV/M **PHOTO:** 8

POWER: On **INJECTION:** Yes

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F18R **DATE:** 8-9-85

DESCRIPTION: System 7, handheld radio, receive test, unprotected, field pulse.

PURPOSE: To test the system's inherent protection characteristics to a full simulated EMP environment.

CONFIGURATION: System 7, handheld radio on non-conducting surface 6 inches above pulser floor, with antenna in vertical position, recieve mode, tuned to frequency 145.30 MHZ.

PULSER FIELD: 50KV/M **PHOTO:** 23

POWER: Battery **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** none

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F19R **DATE:** 8-9-85

DESCRIPTION: System 13 handheld radio receive test, unprotected, field pulse test.

PURPOSE: To test the system's inherent protection characteristics to a full EMP simulated environment.

CONFIGURATION: System 13, handheld radio, on a non-conducting surface 6 inches above the pulser floor, antenna in the vertical position, receive mode, no protective devices.

PULSER FIELD: 50KV/M **PHOTO:** 24

POWER: Battery **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F20R **DATE:** 8-9-85

DESCRIPTION: System 7 handheld radio test with antenna in the horizontal position, no protective devices.

PURPOSE: To test the system's inherent protection characteristics to a full EMP simulated environment.

CONFIGURATION: System 7, handheld radio, on a non-conducting surface 6 inches above the pulser ground plane, antenna and transceiver in horizontal position.

PULSER FIELD: 50KV/M **PHOTO:** 25

POWER: Battery **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** none

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F21R **DATE:** 8-9-85

DESCRIPTION: System 13, handheld radio test with antenna in the horizontal position, no protective device in use.

PURPOSE: To test the system's inherent protection characteristics (survivability) in a simulated EMP environment.

CONFIGURATION: System 13, handheld radio, on a non-conducting surface 6 inches above pulser ground plane, antenna and transceiver in a horizontal position.

PULSER FIELD: 50KV/M **PHOTO:** 25

POWER: Battery **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F22T **DATE:** 8-9-85

DESCRIPTION: System 13 handheld transceiver test in transmit mode, no protection.

PURPOSE: To test the system's inherent survivability in an EMP field.

CONFIGURATION: Handheld transceiver in vertical position, antenna installed, power on, in transmit mode, 6 inches above simulator ground plane.

PULSER FIELD: 50KV/M **PHOTO:** 22

POWER: Battery **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Audio received by other handheld after the test pulse.

TEST: F23T **DATE:** 8-9-85

DESCRIPTION: System 7 handheld test in transmit mode, no protection.

PURPOSE: To test the system's inherent survivability to an EMP field.

CONFIGURATION: Handheld transceiver in vertical position, 6 inches above pulser ground plane, power on, in transmit mode, no protection on antenna.

PULSER FIELD: 50KV/M **PHOTO:** 27

POWER: Battery **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Transmitted clear voice before and after the test.

TEST: F24R **DATE:** 8-9-85

DESCRIPTION: System 7 handheld test transceiver on floor of pulser in vertical position, no protection.

PURPOSE: To test the system's inherent survivability to an EMP field.

CONFIGURATION: Handheld transceiver in vertical position, in receive mode with antenna attached, sitting on simulator ground plane, no protection on antenna.

PULSER FIELD: 50KV/M **PHOTO:** 28

POWER: Battery - On **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F25R **DATE:** 8-9-85

DESCRIPTION: System 13 handheld radio test unprotected.

PURPOSE: To test the system's inherent survivability to an EMP field.

CONFIGURATION: Handheld transceiver in vertical position, in receive mode, with antenna attached, sitting on simulator ground plane, no protection on antenna.

PULSER FIELD: 50KV/M **PHOTO:** 29

POWER: Battery - On **INJECTION:** None

ANTENNA: Rubber Duck **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Receiving signal before, during and after field pulse.

TEST: F26 **DATE:** 8-9-85

DESCRIPTION: System 13 Battery charger test.

PURPOSE: To test the battery charger's susceptibility to an EMP pulse.

CONFIGURATION: Battery charger plugged into AC power supply, protected by (SIOV AC Test Box)

PULSER FIELD: 50KV/M **PHOTO:** 30

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: None **INJECTION:** No

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES: Measured 13 Vdc after test.

TEST: F27 **DATE:** 8-9-85

DESCRIPTION: System 13 battery charger plugged into AC outlet, no protection provided.

PURPOSE: To test the battery charger's susceptibility to an EMP field and injection pulse.

CONFIGURATION: Battery charger plugged into an AC outlet, no protection device in circuit.

PULSER FIELD: 50KV/M **PHOTO:** 31

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: None **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Measured 13 Vdc battery charger output after test.

TEST: F28 **DATE:** 8-9-85

DESCRIPTION: System 13 battery charger test.

PURPOSE: To test the battery charger's susceptibility to an EMP field and injection pulse.

CONFIGURATION: Battery charger plugged into AC outlet, charger cord extended from 6 inches to 3 feet high in pulser field.

PULSER FIELD: 50KV/M **PHOTO:** 32

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: None **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Charger still good after test.

TEST: F29 **DATE:** 8-9-85

DESCRIPTION: System 13 transceiver test while plugged into battery charger with no EMP protection.

PURPOSE: To test the transceiver's susceptibility to an EMP field and injection pulse through AC and battery charger.

CONFIGURATION: Handheld transceiver plugged into battery charger, battery charger plugged into the AC outlet box. No protection.

PULSER FIELD: 50KV/M **PHOTO:** 34

POWER: On AC/battery **INJECTION:** Yes

ANTENNA: No **INJECTION:** No

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: No damage noted.

TEST: F30 **DATE:** 8-9-85

DESCRIPTION: System 7 battery charger test with no protection.

PURPOSE: To test battery charger's susceptibility to an EMP field and injection pulse.

CONFIGURATION: Battery charger plugged into AC outlet box, charger cord extended from 6 inches to 3 feet above the pulser floor.

PULSER FIELD: 50KV/M **PHOTO:** 35

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: No **INJECTION:** No

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Charger output voltage dropped from 13 Vdc before test to 4Vdc after test.

TEST: F-31 **DATE:** 8-9-85

DESCRIPTION: System 7 handheld radio test while charging the battery with an unprotected AC power source.

PURPOSE: To test the susceptibility of a handheld radio, while charging.

CONFIGURATION: System 7 handheld radio with battery charger plugged in to AC power and radio, charger cord is 6 inches to 3 feet above pulser floor, radio is 3 feet above pulser floor.

PULSER FIELD: 50KV/M **PHOTO:** 36

POWER: On 120V AC **INJECTION:** Yes

ANTENNA: Rubber Duck **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Radio display does not function. Display is composed of random lines. Radio can change frequency and receive/transmit a signal, but frequency is unknown.

TEST: F32R **DATE:** 8-9-85

DESCRIPTION: System 12 test in the protected configuration.

PURPOSE: To test the susceptibility of the mobile radio to an EMP field and injection pulse in the protected configuration.

CONFIGURATION: Radio grounded to pulser ground plane. Powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 37

POWER: 12VDC Auto battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V362A80

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES: F32R1 test repeated F32R.

TEST: F33R **DATE:** 8-9-85

DESCRIPTION: System 12 test in an unprotected antenna configuration.

PURPOSE: To test the susceptibility of the mobile radio with no protection on the antenna input.

CONFIGURATION: Radio grounded to the pulser ground plane, powered by an auto battery, receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 39

POWER: 12V DC Auto Battery **INJECTION:** No - field only

ANTENNA: "L" wire **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F33T **DATE:** 8-9-85

DESCRIPTION: System 12 test in transmit mode with no protection.

PURPOSE: To test the susceptibility of the mobile radio to an EMP field and injection pulse on antenna without protection.

CONFIGURATION: System 12 equipment grounded to pulser ground plane, in transmit mode.

PULSER FIELD: 50KV/M **PHOTO:** 41

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: Yes **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F34R **DATE:** 8-9-85

DESCRIPTION: System 6 mobile transceiver tested in the protected mode.

PURPOSE: To test the susceptibility of the radio to an EMI field and injection pulse on antenna in the protected mode.

CONFIGURATION: System 6 grounded to pulser ground plane, on floor, powered by an auto battery through a two wire cord, receive mode.

PULSER FIELD: 50KV/M **PHOTO:** 42

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: Yes **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: UHF coaxial "T"

TEST NOTES:

TEST: F34T **DATE:** 8-9-85

DESCRIPTION: System 6 mobile transceiver test in the transmit mode with protection.

PURPOSE: To test the suscentibility of the radio to an EMP field and pulse on the antenna, while in the transmit mode.

CONFIGURATION: Radio equipment grounded to pulser ground plane, on floor of pulser, in transmit mode, powered by a 12V DC auto battery through a two wire cord.

PULSER FIELD: 50KV/M **PHOTO:** 43

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES:

TEST: F35R **DATE:** 8-9-85

DESCRIPTION: System 5 mobile transceiver test in the receive mode, no protection on the antenna.

PURPOSE: To test the susceptibility of the radio equipment to an EMP field and injection pulse on the antenna.

CONFIGURATION: Radio equipment grounded to the pulser ground plane, resting on the pulser floor, in the receive mode, powered by an auto battery through a two wire cord.

PULSER FIELD: 50KV/M **PHOTO:** 44

POWER: 12VDC Auto Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F35T **DATE:** 8-9-85

DESCRIPTION: System 6 mobile transceiver test in the transmit mode with no protection.

PURPOSE: To test the susceptibility of the equipment to an EMP field and injection pulse on the antenna with no protection.

CONFIGURATION: Radio equipment on pulser floor grounded to pulser ground plane, in transmit mode with no protection, powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 45

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F36R **DATE:** 8-9-85

DESCRIPTION: System 8, 2 meter transceiver test in receive mode with protective devices.

PURPOSE: To test the susceptibility of the equipment in a protected configuration to an EMP field and injection pulse on antenna coax.

CONFIGURATION: Radio equipment on pulser floor grounded to pulser ground plane, in receive mode, powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 46

POWER: 12VDC Auto Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES: Lost frequency display. Display returned by off/on switch.

TEST: F36T **DATE:** 8-9-85

DESCRIPTION: System 8, 2 meter transceiver test in the transmit mode, with protective devices.

PURPOSE: To test the susceptibility of the equipment, while in the transmit mode, to an EMP field and injection pulse on the antenna coax.

CONFIGURATION: Radio equipment on pulser floor, grounded to pulser ground plane, in transmit mode, powered by an auto battery through a two wire cord.

PULSER FIELD: 50KV/M **PHOTO:** 47

POWER: 12VDC Auto Battery **INJECTION:** No

ANTENNA: Yes **INJECTION:** Yes

POWER PROTECTION DEVICE: GEMOV V36ZA80

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES: Did not lose frequency display.

TEST: F37R **DATE:** 8-9-85

DESCRIPTION: System 8 test with protection removed from the antenna coax.

PURPOSE: To test the susceptibility of the equipment to an EMP field and injection pulse on the antenna, without antenna protection.

CONFIGURATION: Radio equipment on pulser floor grounded to pulser ground plane, in receive mode, no protection on the antenna inject. Powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 48

POWER: 12VDC Auto Battery **INJECTION:** No

ANTENNA: Yes **INJECTION:** Yes

POWER PROTECTION DEVICE: GEMOV V36ZA80

RF PROTECTION DEVICE: None

TEST NOTES: Display O.K. - audio received after the test.

TEST: F37R1 **DATE:** 8-9-85

DESCRIPTION: System 8 test with no transmit protection devices, in the receive mode.

PURPOSE: To test the susceptibility of the equipment to an EMP field and injection pulse on the antenna coax.

CONFIGURATION: Radio equipment on pulser floor, equipment case grounded to pulser ground plane, in receive mode, no transient protective devices, powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 49

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Display O.K.

TEST: F37R1 **DATE:** 8-9-85

DESCRIPTION: System 8 test with no transient protection devices, in the receive mode.

PURPOSE: To test the susceptibility of the equipment to an EMP field and injection pulse on the antenna coax.

CONFIGURATION: Radio equipment on pulser floor, equipment case grounded to pulser ground plane, in receive mode, no transient protective devices, powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 49

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Display O.K.

TEST: F37T **DATE:** 8-9-85

DESCRIPTION: System 8 test with no protection devices installed, in transmit mode.

PURPOSE: To test the susceptibility of the equipment to an EMP field and injection pulse on the antenna in the transmit mode.

CONFIGURATION: Radio equipment on pulser floor, grounded to the pulser ground plane, in the transmit mode, no protection devices, powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 50

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Transmitter is still working after the pulse signal received by a handheld transceiver.

TEST: F38R **DATE:** 8-9-85

DESCRIPTION: System 9 (430-450 MHZ) transceiver test in the receive mode with protection devices.

PURPOSE: To test the susceptibility of the radio equipment to an EMP field and injection pulse, while in the receive mode.

CONFIGURATION: Radio equipment on pulser floor, grounded to pulser ground plane in the receive mode, protection devices on the power and antenna lines. Powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 57

POWER: 12VDC Auto Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES:

TEST: F38T **DATE:** 8-9-85

DESCRIPTION: System 9 transceiver test in transmit mode with protection devices.

PURPOSE: To test the susceptibility of the radio equipment.

CONFIGURATION: Radio equipment on pulser floor, grounded to pulser ground plane, in the transmit mode, protection devices on the antenna coax and between the hot and ground of the power cord.

PULSER FIELD: 50KV/M **PHOTO:** 52

POWER: 12VDC Auto Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV V36ZA80

RF PROTECTION DEVICE: UHF Coaxial "T"

TEST NOTES:

TEST: F39R **DATE:** 8-9-85

DESCRIPTION: System 9 transceiver test in the receive mode, no protection on the antenna coax.

PURPOSE: To test the susceptibility of the radio equipment.

CONFIGURATION: Radio equipment on floor of pulser, grounded to pulser plane, in the receive mode, protective device across the hot to ground DC power line.

PULSER FIELD: 50KV/M **PHOTO:** 53

POWER: 12VDC Auto Battery **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: GE MOV 36ZA80

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F39R1 **DATE:** 8-9-85

DESCRIPTION: System 9, transceiver test with no protective devices, in the receive mode.

PURPOSE: To test the susceptibility of the radio equipment.

CONFIGURATION: Radio equipment on pulser floor, in the pulser ground plane, in the receive mode, no protective devices installed. Powered by an auto battery.

PULSER FIELD: 50KV/M **PHOTO:** 54

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F39T **DATE:** 8-9-85

DESCRIPTION: System 9 test with no protective devices, in the transmit mode.

PURPOSE: To test the susceptibility of the radio equipment.

CONFIGURATION: Radio equipment on the pulser floor, grounded to the pulser ground plane, in the transmit mode, no protection devices installed.

PULSER FIELD: 50KV/M **PHOTO:** 55

POWER: 12VDC Auto Battery **INJECTION:** None

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES:

TEST: F40 **DATE:** 8-9-85

DESCRIPTION: ASTRON VS-35 power supply test with protection

PURPOSE: To test the susceptibility of the AC to DC power supply to an EMP field and injection pulse.

CONFIGURATION: Power supply on floor plugged into the SIOV AC Test Box. SIOV AC Test Box plugged into the AC receptacle box. Powered by the portable Honda generator (outside field).

PULSER FIELD: 50KV/M **PHOTO:** 56

POWER: AC 120V **INJECTION:** Yes

ANTENNA: No **INJECTION:** No

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES: Power supply was upset and it recovered.

TEST: F41 **DATE:** 8-9-85

DESCRIPTION: ASTRON VS-35 power supply test with no protection.

PURPOSE: To test the susceptibility of the power supply to an EMP field and injection pulse without protection.

CONFIGURATION: Power supply on pulser floor plugged directly into the AC receptacle box. Powered by a portable Honda generator (outside the field).

PULSER FIELD: 50KV/M **PHOTO:** 57

POWER: AC 120V **INJECTION:** Yes

ANTENNA: No **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: Power supply was upset and it did not recover.

TEST: F42 **DATE:** 8-9-85

DESCRIPTION: Honda EG 650 power generator test

PURPOSE: To test the susceptibility of the Honda generator to an EMP field with lines attached.

CONFIGURATION: Honda generator in pulse field, running with AC power going to a SIOV AC Test Box through a 3 wire power cord.

PULSER FIELD: 50KV/M **PHOTO:** 58

POWER: 120V AC **INJECTION:** None

ANTENNA: No **INJECTION:** None

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES: No problem noted

TEST: F43 **DATE:** 8-9-85

DESCRIPTION: Honda EG 650 Test

PURPOSE: To test the susceptibility of the Honda generator to an EMP field.

CONFIGURATION: Honda generator running in pulse field without anything attached.

PULSER FIELD: 50KV/M **PHOTO:** 59

POWER: AC 120V **INJECTION:** None

ANTENNA: No **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: No problem noted.

TEST: F44 **DATE:** 8-9-85

DESCRIPTION: Honda EG 650 test

PURPOSE: To test the susceptibility of the Honda generator to an EMP field and injection pulse.

CONFIGURATION: "L" shaped AC injection antenna attached to hot lead of SIOV AC Test Box. SIOV box plugged into Honda AC outlet with 6 foot 3 wire cord. Honda running in pulse field.

PULSER FIELD: 50KV/M **PHOTO:** 60

POWER: 120V AC **INJECTION:** Yes

ANTENNA: No **INJECTION:** None

POWER PROTECTION DEVICE: SIOV AC Test Box

RF PROTECTION DEVICE: None

TEST NOTES: No problem to Honda noted.

DATE: 8-9-85

TEST: F45

DESCRIPTION: Honda EG 650 generator test

PURPOSE: To test the susceptibility of the Honda generator to an EMP field and injection pulse

CONFIGURATION: "L" shaped AC injection antenna attached to hot lead of AC receptacle box. Box attached to Honda generator through a 6 foot 3 wire cord. Honda running in field.

PULSER FIELD: 50KV/M

PHOTO: 61

POWER: 120V AC

INJECTION: Yes

ANTENNA: No

INJECTION: None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: No problem to Honda.

TEST: F46 **DATE:** 8-9-85

DESCRIPTION: Honda EG 650 Test

PURPOSE: To test the susceptibility of the Honda generator to an EMP field and direct injection pulse.

CONFIGURATION: "L" shaped AC injection antenna inserted directly into the "hot" lead of the Honda AC outlet. Honda running in pulser field.

PULSER FIELD: 50KV/M **PHOTO:** 62

POWER: 120V AC **INJECTION:** Yes

ANTENNA: No **INJECTION:** None

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: No problem to Honda noted.

TEST: F47R **DATE:** 8-9-85

DESCRIPTION: System 11 and Honda generator test in pulser, receive mode of operation.

PURPOSE: To test the susceptibility of system 11 and the Honda generator to EMP fields and injection pulse.

CONFIGURATION: System 11 plugged directly into Honda AC outlets, both in pulse field. Both grounded to pulser ground plane, transceiver in receive mode, Honda running.

PULSER FIELD: 50KV/M **PHOTO:** 63

POWER: 120V AC **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: No apparent problem to equipment

TEST: F47T **DATE:** 8-9-85

DESCRIPTION: System 11 and Honda generator test in pulser, transmit mode of operation.

PURPOSE: To test the susceptibility of both system 11 and the Honda generator to an EMP field and injection pulse.

CONFIGURATION: System 11 plugged directly into Honda AC outlet. Both in pulser field and grounded to pulser ground plane, transceiver in transmit mode. Honda running.

PULSER FIELD: 50KV/M **PHOTO:** 64

POWER: 120V AC **INJECTION:** No

ANTENNA: On **INJECTION:** Yes

POWER PROTECTION DEVICE: None

RF PROTECTION DEVICE: None

TEST NOTES: No apparent damage