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Materiel Test Procedure 6-3-052
Electronic Proving Ground

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U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

COUNTERMEASURES EQUIPMENT, NON-COMMUNICATIONS SYSTEMS

1. OBJECTIVE

The objective of this MTP is to describe the service test procedures required to determine the degree to which non-communication countermeasures equipments meet the military characteristics expressed in the Qualitative Materiel Requirements (QMR), or Small Development Requirements (SDR), and the suitability of the complete item for use by the Army.

2. BACKGROUND

An important tactic in modern warfare is the aggressive action taken to deny the enemy the use of his systems and equipment which utilize the electromagnetic spectrum. Such systems/equipment in the fields of communication, navigation, surveillance, weapons control and associated areas operate in various bands of the electromagnetic spectrum and are therefore vulnerable to intentional interference or countermeasures created by an opposing force. The contested spectrum currently ranges from long "radio" wavelengths, through the "radar" and infrared wavelengths to the visible portion of the spectrum.

Electronic countermeasures (EMC) exist in many forms broadly categorized as (1) electronic systems whose basic function is to radiate electromagnetic energy in diverse forms to disable, confuse, or deceive victim systems and (2) material or devices having electromagnetic reflection, absorption, or intrinsic radiation properties in ways to either mask real targets or create false targets.

The EMC systems mentioned in (1) above, generally incorporate the primary capabilities of:

- a. Victim signal detection and identification (intercept)
- b. Victim location (direction finding)
- c. Selection of the most effective jamming mode
- d. Transmission of the jamming signals

The jamming signal characteristics and manipulation may be designed for complex deception or confusion tactics in operation against specific types of victim system or may be of a multi-purpose nature; the latter usually designed to obscure the normal reception or sensing capability of several victim types.

Non-communication victim systems include both ground-based and airborne types categorized, for the purpose of this document, by the victim transmitter-receiver positional relationship as follows:

- a. Conjugate transmitter and receiver as in a monostatic radar set, characterized by reception and analysis of echoes of its own emission. Examples are:

- 1) Search/detection type: air and ground combat surveillance radars
- 2) Tracking type: gun direction, missile tracking, mortar/gun
- 3) Ground mapping: side looking airborne radar (SLAR).
- 4) Navigation: airborne doppler navigation radar, terrain avoidance radar, radar altimeter

b. Widely separated (non-conjugate) transmitter and receiver as in a drone control system, characterized by one-way transmission. Another example is a tactical position-fixing and navigation system comprised of several transmitters in a ground complex and receivers in aircraft and ground vehicles.

c. Receiver, receptor, or sensor only, e.g. an infrared detection system, airborne or ground-based.

General categories of these systems are illustrated in Figures 1 through 5. Since the victim receiver or sensor is the real target for jamming and the victim transmitter provides the potential means of locating and identifying the victim, the separation inherent in b. above and lack of emission in c. above become factors in accomplishment of the intercept/DF function and correlation with the jamming function.

In order to determine if an ECM system's operational characteristics and capabilities are in conformance with current requirements, the item must be subjectively tested under field conditions by user-type personnel.

3. REQUIRED EQUIPMENT

- a. Victim systems, real or simulated, airborne and ground-based types; conceptually related to the test item (see paragraph 2)
- b. Fixed-wing and/or rotary-wing aircraft with test instrumentation capabilities
- c. Electronic maintenance facility with avionics capability
- d. Signal generators
- e. Oscillators
- f. Frequency meters/counters
- g. RF power meters/wattmeters
- h. Spectrum analyzers
- i. Oscilloscopes
- j. Vacuum-tube voltmeters
- k. Multimeters
- l. R. F. attenuators, terminations, and couplers
- m. Field intensity measuring sets

4. REFERENCES

- A. MIL-STD-449(-), Measurement of Radio Frequency Spectrum Characteristics
- B. MIL-STD-463(-), Electromagnetic Interference Technology-Definition and System of Units
- C. ETA 40(R1), Operational and Organizational Maintenance Instructions for Multipurpose Jammer (MPJ) Installed in U-1A Aircraft (U), USAEPG, April 1963.

- D. ETA 41 (R1), Operational and Organizational Maintenance Instructions for Multipurpose Jammer (MPJ) Installed in 2 1/2 ton Truck (U), USAEPG, April 1963.
- E. ETA 140, Engineering Design Test of AN/ALQ-37 (XE-1) Multipurpose Jammer (U)
- F. USAEPG-TP-244, Engineering Test of Radar Jammer AN//ALQ-80 (U), USAEPG, September 1967.
- G. Electronic Warfare Against Countermortar/Counter battery Radars (U), U. S. Army Combat Developments Command, (AD 370-803 L) May 1963.
- H. Countermeasures Research (U), U. S. Army Electronics Command (AD 371-037) January 1966.
- I. Jamming Effectiveness Instrumentation Study - Technical Report, RADC-TR-197, Rome Air Development Center, 31 March 1960
- J. An Appartus for the Statistical Assessment of Jamming Effectiveness, Telecommunications Establishment, Ottawa, Canada, May 1959.
- K. Skolnik, M. E., Introduction to Radar Systems, McGraw-Hill Book Company, New York, 1962.
- L. Terman & Pettit, Electronic Measurements, 2nd Edition, McGraw-Hill Book Company, New York, 1952.
- M. Classified FM's and TM's
- N. MTP 3-1-002, Confidence Intervals and Sample Sizes
- O. MTP 6-3-500, Physical Characteristics
- P. MTP 6-3-502, Personnel Training Requirements
- Q. MTP 6-3-505, Emplacement, Action and March Order
- R. MTP 6-3-506, Durability
- S. MTP 6-3-507, Reliability
- T. MTP 6-3-509, Effect of Weather
- U. MTP 6-3-510, Transportability
- V. MTP 6-3-513, Qualitative Electromagnetic Interference
- W. MTP 6-3-523, Safety
- X. MTP 6-3-524, Maintenance
- Y. MTP 6-3-525, Human Factors
- Z. USATECOM Regulation 385-6, Safety Release

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP provide general guidance for determining the degree to which the test item meets current military requirements for countermeasures equipment capable of operation against enemy non-communication type electronic (victim) systems.

The tests, which cover a wide range of system/equipment types and deployments, are intended to be applied on a selective basis as required by the particular test item, and have been designed with consideration of the following factors:

- a. Test item and victim systems in applicable oppositions (see Figure 6).

- b. Different victim systems, within scope of test item.
- c. Systems deployed in representative tactical situations and at typical ranges.
- d. Test item primary functions of detection, location, and jamming.
- e. All systems operated and maintained by military personnel of appropriate MOS's.

The specific tests to be performed, along with their intended objectives, are listed below:

a. Operational Test - The objective of this subtest is to determine the capability of average trained crews to accomplish the entire ECM mission with the test item. This shall include:

- 1) Detection and identification of victim signals with respect to frequency, signal strength, modulation, and any unique signal or operating characteristics. Concurrently or immediately following detection, the direction and polarization of the victim signals shall be determined.
- 2) Operation of the test item (active jammer) against selected victim types in modes based on victim information derived from intercept/DF processes, visual observation, and/or external intelligence sources; the latter simulated for test purposes to encompass independent jammers (no intercept capability) and non-radiating victim systems.

b. Qualitative Electromagnetic Interference - The objective of this subtest is to determine the objectionable radiation or emission caused by operation of the test item, and the interference to the test item caused by electromagnetic radiation from other equipment in the system operating environment.

c. Physical Characteristics - The objective of this subtest is to determine the adequacy and suitability of vehicle, van, or shelter when provided or specified for use with the test item.

d. Ruggedness/Durability - The objective of this subtest is to evaluate the time in service, failure potential of components, and operational durability limits of the test item during transportation, emplacement and functioning.

e. Transportability - The objective of this subtest is to determine the suitability of the test item for movement in tactical situations by means of tactical vehicles.

f. Adverse Conditions/Effects of Weather - The objective of this subtest is to determine the capabilities and limitations imposed upon the operation of the test item caused by exposure to extremes of weather and terrain.

g. Maintenance - The objective of this subtest is to determine the accessibility and susceptibility of the test item to the accomplishment of the scheduled and non-scheduled maintenance tasks over the entire period of service testing, and needs for specialized tools and instruments to accomplish assigned levels of maintenance.

h. Reliability - The objective of this subtest is to determine the mission reliability of the test item in terms of failure-free operation time, mean time between failures, maintenance down time, and mean time for repair.

i. Safety - The objective of this subtest is to determine the safety hazards encountered during transportation, emplacement, functioning, and recovery of the test item throughout the period of testing.

j. Human Factors - The objective of this subtest is to determine the design operational features of the test item conducive to error and delay in mission accomplishment by user personnel.

k. Emplacement and Displacement - The objective of this subtest is to evaluate the degree or ease or difficulty associated with operation of the test item and needs for additional training in the same or different fields.

l. Personnel Training Requirements - The objective of this subtest is to determine the scope and effectiveness of pre-test training associated with operation of the test item and needs for additional training in the same or different fields.

m. Adequacy of Instruction Manuals - The objective of this subtest is to determine whether the instruction manuals conform to the applicable Army Regulations and are suitable for training operating and maintenance personnel possessing the required basic skills.

5.2 LIMITATIONS

The procedures contained in this MTP are applicable only to the following types of ECM systems:

a. Special and multi-purpose electronic countermeasures (ECM) systems (the test item).

b. Airborne and ground-based test items incorporating the primary functions of detection, location and jamming; separate or integrated.

c. Airborne and ground-based victim systems broadly classed as radar-type and one-way transmission or reception type.

d. Test item and victim systems operating in state-of-the-art portions of the electromagnetic spectrum.

Test item features, functions, or characteristics requiring application of security measures are excluded from consideration by this document, as are ECM systems/equipments designed for operation against communication systems only, variable-time (proximity) fuze ECM systems, countermeasures material and false target devices, and electronic counter-countermeasures.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Select and schedule suitable transportation and operational areas at representative environmental locations as required by applicable test directive, test procedure and corresponding MTP.

b. Upon establishing the scheduled availability of the test item coordinate the availability of the following:

- 1) Engineering safety release or other safety statement.
- 2) Maintenance support facilities, spare parts, and personnel.
- 3) Equipment, special facilities, and instrumentation with special attention to timely provision of additional supplies or special equipment not readily available at the test site.

c. Select test equipment having ideally an accuracy of at least ten times greater than that of the function to be measured, that is in keeping with the state of the art, and with calibrations traceable to the National Bureau of Standards.

d. Record the following information:

- 1) Nomenclature, serial number(s), manufacturer's name and function of the item(s) under test.
- 2) Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

e. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC).

f. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same types of equipment, and familiarize all test personnel with the contents of such documents. These documents shall be kept readily available for reference.

g. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation of the test item.

h. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test and that the item has successfully completed MTP 6-3-523, Safety.

i. Thoroughly inspect the test item for obvious physical and electrical defects such as cracked or broken parts, loose connections, bare or broken wires, loose assemblies, bent fragile parts, and corroded plugs and jacks. All defects shall be noted and corrected before proceeding with the test.

j. Prior to beginning any subtest, verify correct power source, necessary test instrumentation and inter-connection cabling, and that the equipment is aligned, if necessary, as specified in the pertinent operating instructions to ensure, insofar as possible, it represents an average equipment in normal operating condition.

k. Prepare a test item sample plan sufficient to ensure that enough samples of all measurements are taken to provide statistical confidence of final data in accordance with MTP 3-1-002. Provisions shall be made for modification during test progress as may be indicated by monitored test results.

1. Ensure that all support aircraft are properly instrumented as required, that arrangements for supporting and participating agencies, activities, and facilities have been made, and that authorization for electromagnetic radiation at specific frequencies, power levels, and modulations for required periods has been obtained.

m. Ensure that appropriate security measures are instituted as required to safeguard classified materiel and data.

6.2 TEST CONDUCT

6.2.1 Operational Test

NOTE: Performance assessment shall be accomplished throughout this test primarily by observers equipped with the means of recording visual, aural, and judgmental observation and related time factors. Observer activities shall not interfere with or influence in any manner, the functions of test item or victim system operators.

6.2.1.1 Detection and Location (Intercept/DF)

a. Deploy one or more emission-type victim systems in a representative tactical relationship with the test item, in consonance with the system types and the concepts of employment as expressed in the applicable QMR/SDR and current doctrine.

b. Prepare a description of the test phase to include a scenario-type sequence of events and scaled diagrams showing, as appropriate:

- 1) Location of ground-based elements
- 2) Flight paths and altitudes for airborne elements
- 3) Inter-element angular relationship (horizontal and vertical).

c. Connect test instrumentation and station observers as required to measure and record data.

d. Energize all equipment and calibrate all test instrumentation as a unit.

e. Operating from a planned start time, utilize average trained operators to detect and identify the victim signal with respect to frequency, signal strength, modulation and any unique signal or operating characteristics. Concurrently or immediately following detection, the direction and polarization of the victim signal shall be determined.

f. Record the following data in appropriate form:

- 1) Start and elapsed time of each operation

- 2) Victim signal parameters and characteristics, and deduced identification
- 3) Victim bearing from test item (azimuth and elevation/tilt)*
- 4) Test item location, ground or space coordinates
- 5) Number of test operators
- 6) Difficulties encountered

*NOTE: Where either test item or victim are in motion, bearings shall be obtained at short time intervals correlated with other test event timing.

g. Repeat the entire test for each tactical concept of employment, rotating the crew assignments for each trial.

6.2.1.2 Neutralization (Jamming)

a. Deploy several selected victim systems (transmitters-receivers) in a representative tactical relationship with the test item (active jammer) as outlined in paragraph 6.2.1.1, Step (a).

b. Prepare a description of the test phase as outlined in paragraph 6.2.1.1, Step (b).

c. Connect test instrumentation and station observers as required to measure and record data.

d. Energize all equipment and calibrate all test instrumentation as a unit.

e. Operating from a planned start time and utilizing average trained operators, subject the victim system(s) to active jamming by the test item.

f. Record the following data in appropriate form:

1) Input data

- (a) Time received and source(s)
- (b) Victim spatial and coordinates and direction of travel
- (c) Victim signal characteristics, analyzed and processed as required for jammer use.
- (d) Victim type, e.g. relative transmitter-receiver location

2) Jamming operation

- (a) Test item location, spatial coordinates, and direction of travel
- (b) Carrier frequency(s) and power levels
- (c) Modulation types, including deception-type signal characteristics
- (d) Antenna orientation and polarization including positioning/tracking
- (e) Jamming on-off intervals
- (f) Look-through interval data
- (g) Start and elapsed time of operation

3) Victim reaction

NOTE: Jamming effectiveness shall be determined by observations of victim system reaction or degree of operational degradation versus range and jamming mode. Due to the diversity of victim operations, only a broad measure of victim reaction to jamming is given herein; refinements should be developed as required by victim type.

- a. Barely perceptible degradation - light jamming
- b. Very noticeable degradation but system still operational - medium jamming.
- c. System inoperable - intense jamming

- a. Degree of degradation
- b. Parameters affected
- c. Duration

g. Repeat the entire test for each tactical concept of employment, rotating the crew assignments for each trial.

6.2.2 Qualitative Electromagnetic Interference Test

- a. Deploy friendly electronic systems/equipments, of representative tactically collocated types to the item under test, at various distances (slant range) and orientations with respect to the test item.
- b. Operate the friendly systems at intervals during the test phases outlined in paragraphs 6.2.1, and determine their effect on the test item and the test item's effect on the friendly systems in accordance with the procedures given in MTP 6-3-513.

6.2.3 Physical Characteristics

- a. Subject the item under test to physical characteristics determination according to the procedures given in MTP 6-3-500.
- b. Throughout the entire testing period, monitor any vehicle, van or shelter provided as part of or specified for use with the test item with respect to its adequacy and suitability for the intended mission.
- c. Record narrative comments, obtained from all test personnel through daily observation, interview and questionnaire, concerning the following:
 - 1) Equipment arrangement and mounting
 - 2) Ventilation, heating and air conditioning
 - 3) Lighting and blackout provisions
 - 4) Acoustical properties
 - 5) Protective features (CBR)
 - 6) Roadability and safety
 - 7) Any other features which might affect the overall adequacy, suitability and physical characteristics of the test item.
- d. Measure and record space required for:

- 1) Equipment (including integral and external antenna systems)
- 2) Power sources
- 3) Operator and maintenance activity

6.2.4 Ruggedness/Durability

a. Throughout the entire period, monitor the ruggedness-durability characteristics of the test item in accordance with the procedures given in MTP 6-3-506. Ensure that the test item has been subjected to at least the following exposures:

- 1) Transport vehicles, paved roads - 500 miles
- 2) Transport vehicles, secondary roads - 100 miles
- 3) Tactical vehicles, cross-country - 100 miles

b. In addition to the data specified in MTP 6-3-506, observe and record at 100-mile intervals, or at the end of the exposure, the incidence of defects in the test item and its components, including:

- 1) Inoperable electronic equipment (damaged enclosures, loose or broken connections, foreign material accumulations, damaged components).
- 2) Damaged or worn mechanical parts, to include component packaging, (bent or broken handles, and fasteners, defective seals, sluggish or restrained mechanical action).

6.2.5 Transportability

a. Subject the item under test to the transportability procedures given in MTP 6-3-510.

b. Utilizing appropriate tactical vehicles, transport the test item from a supply point to an emplacement site under daylight conditions.

c. Observe and record activities and times required to traverse the following applicable routes, for the distances noted:

- 1) Pavement - 50 miles
- 2) Secondary roads - 100 miles
- 3) Cross-country terrain - 50 miles

d. Repeat Steps (b) and (c) above, under conditions of darkness (blackout).

6.2.6 Adverse Conditions/Effects of Weather

a. Subject the test item to the effect of weather procedures given in MTP 6-3-509.

b. Repeat the procedures given in paragraph 6.2.1 under the following conditions, as applicable:

- 1) Darkness (blackout)
- 2) Conditions not previously encountered in the course of testing to include:

- (a) Moderate temperatures with rain
- (b) Frigid temperatures with:
 - (1) Snow
 - (2) Sleet or icing conditions
- (c) Hot temperatures with:
 - (1) High humidity
 - (2) Low humidity

6.2.7 Maintenance

a. Throughout the conduct of all testing as outlined in this MTP, maintain a record of performance of scheduled and unscheduled maintenance as prescribed in the appropriate test item maintenance instructions. Assessment of all maintenance factors shall be accomplished in accordance with MTP 6-3-524 with special attention to record accuracy.

b. Compare all replacement parts and components provided with the test item with anticipated and actual requirements, evaluating spare parts requirements under actual operating conditions.

c. Record the requirements for additional tools and instruments, short comings in authorized tools and instruments, and needs for specialized tools and instruments to accomplish assigned levels of maintenance.

d. Record all repair parts used, man hours and elapsed time required, and level of skill demanded.

6.2.8 Reliability

a. Starting with the initial assembly, set-up, and check-out of the test item upon receipt at the test agency, maintain a complete log of all assembly, installation, operation, disassembly, and maintenance activities for the purpose of reliability analysis in accordance with MTP 6-3-507. The log shall include the following information:

- 1) Number of times the test item is assembled and installed from the field transport configuration.
- 2) Number of times the test is disassembled and repacked in the field transport configuration.
- 3) Hours of operation, daily and cumulative
- 4) Equipment failures and malfunctions, including chronological data required to determine failure-free operating time, mean time between failures, maintenance downtime, and mean time for repair.
- 5) Effect of failures on the operational test conduct.

6.2.9 Safety

a. Throughout the conduct of all testing as outlined in this MTP, monitor all safety aspects associated with the test item in accordance with MTP 6-3-523.

b. In addition to data required by MTP 6-3-523, record narrative comments concerning the following:

- 1) Confirmation of safety release under conditions as specified in USATECOM Regulation 385-6.
- 2) Analysis to establish that no foreseeable hazards are present during testing or operation of the test item.
- 3) Inspection for high voltage hazard control and adequacy of protective provisions to include interlocks and warning placards.
- 4) Evaluation of any safety hazards, including radiological hazards, associated with storage, transportation, operation, and maintenance of the test item.

6.2.10 Human Factors

a. Throughout the conduct of all testing as outlined in this MTP, monitor and appraise human factors for the purpose of identifying design or operational features conducive to error and delay in mission accomplishment by user personnel in accordance with the procedures given in MTP 6-3-525.

b. Observe and record activities and average times of phases of the ECM missions as accomplished by average trained crews.

6.2.11 Emplacement and Displacement

a. Utilizing an average trained crew, install the test item complete and ready for operation in an applicable tactical situation in accordance with the instruction manual and MTP 6-3-505.

b. Observe and record the activities and times required to:

- 1) Dismount or otherwise make ready the test items, starting from the transportation configuration, and perform pre-operational adjustments.
- 2) Install the test items
- 3) Energize or otherwise prepare the test item for operation

c. Repeat Steps (a) and (b) above, at least three times, utilizing a different crew for each trial.

d. Repeat Steps (a) and (b) above, adding or subtracting one crew member for each trial, until the minimum and optimum crew sizes required to emplace the test item are established.

e. Utilizing an average trained crew of optimum crew size as determined above, recover the test item from an emplaced battlefield situation.

f. Observe and record the activities and times required to:

- 1) De-energize or otherwise inactivate
- 2) Remove from emplacement
- 3) Make ready for transportation and/or re-emplacement

g. Repeat Steps (e) and (f) above, at least three times rotating the crew assignments for each trial.

6.2.12 Personnel Training Requirements

a. Throughout the conduct of all testing as outlined in this MTP, monitor and evaluate all test item crew members and organizational maintenance personnel in accordance with MTP 6-3-502.

b. In addition to the data required by MTP 6-3-502, record narrative comments concerning the following training factors:

- 1) Scope and effectiveness of pre-test training
- 2) Needs for additional training in the same or different fields

6.2.13 Adequacy of Instruction Manuals

a. Throughout the entire testing period, review all operation and maintenance for compliance with applicable Army Regulations and utilize the manuals for classroom instruction and as references throughout the tests.

b. Record narrative comments concerning adequacy of the manuals with respect to:

- 1) Accuracy
- 2) Completeness
- 3) Clarity
- 4) Ease of use
- 5) Effectiveness of prescribed methods

6.3 TEST DATA

6.3.1 Preparation for Test

Data to be recorded prior to testing shall include but not be limited to:

a. Nomenclature, serial number(s), manufacturer's name, and function of the item(s) under test.

b. Nomenclature, serial number, accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

c. Damages to the test item incurred during transit and/or manufacturing.

6.3.2 Test Conduct

a. Data originating in all tests and phases shall be recorded in the following forms, as appropriate.

- 1) Operators', observers', and test controllers' logs
- 2) Narrative comment and observations
- 3) Maintenance records
- 4) Photographs; still, cine, and CRT

- 5) Diagrams
- 6) Radar plots (charts)
- 7) Tapes and graphic recordings

b. All data items shall be properly identified and annotated with respect to:

- 1) Test, subtest, test phase
- 2) Source
- 3) Time
- 4) Pertinent correlative information

c. Security classification shall be determined for each data item and appropriate security measures applied.

d. Data to be recorded in addition to specific instructions given in succeeding paragraphs for each subtest shall include:

- 1) Test item sample size (number of measurement repetitions)
- 2) Instrument or measurement system mean error stated accuracy

6.3.2.1 Operational Test

6.3.2.1.1 Detection and Location

Record the following:

- a. Start and elapsed time of each operation
- b. Victim signal parameters and characteristics, and deduced identification
- c. Victim bearing from test item (azimuth and elevation/tilt)
- d. Test item location, ground or space coordinates
- e. Number of test operators
- f. Difficulties encountered

6.3.2.1.2 Neutralization (Jamming)

Record the following:

- a. Input data
 - 1) Time received and source(s)
 - 2) Victim spatial coordinates and direction of travel
 - 3) Victim signal characteristics
 - 4) Victim type
- b. Jamming operation
 - 1) Test item location, spatial coordinates and direction of travel
 - 2) Carrier frequency(s) and power levels
 - 3) Modulation types, including deception-type signal characteristics

- 4) Antenna orientation and polarization including positioning/
tracking
- 5) Look-through interval data
- 6) Start and elapsed time of operation

c. Victim reaction

- 1) Degree of degradation
- 2) Parameters affected
- 3) Duration

6.3.2.2 Qualitative Electromagnetic Interference Test

Record test data and details of test setup in accordance with MTP 6-3-513.

6.3.2.3 Physical Characteristics

a. In addition to data required by MTP 6-3-500, record narrative comments concerning the following:

- 1) Equipment arrangement and mounting
- 2) Ventilation, heating and air conditioning
- 3) Lighting and blackout provisions
- 4) Acoustical properties
- 5) Protective features (CBR)
- 6) Roadability and safety
- 7) Any other factors which might affect overall adequacy, suitability and physical characteristics of the test item.

b. Record space required for:

- 1) Equipment
- 2) Power sources
- 3) Operator and maintenance activities

6.3.2.4 Ruggedness/Durability

In addition to data required by MTP 6-3-506, record incidents of defects in the test item and its components at specified intervals.

6.3.2.5 Transportability

In addition to data required by MTP 6-3-510, times for accomplish of transit and record transit speed in miles per hour, annotated to define type of terrain and mode of transport.

6.3.2.6 Adverse Conditional/Effects of Weather

In addition to data required by MTP 6-3-509, record data as specified in paragraph 6.3.2.1, annotated to show adverse conditions as applicable.

6.3.2.7 Maintenance

- a. Record data as specified in MTP 6-3-524.
- b. Record performance of scheduled and unscheduled maintenance.
- c. Record the requirements, short comings, and needs for specialized tools and instruments.
- d. Record all spare parts used, and level of skill demanded.

6.3.2.8 Reliability

- a. Record data as specified in MTP 6-3-507.
- b. Record number of times test item is assembled and installed from the field transport configuration.
- c. Record number of times test item is disassembled and repeated in the field transport configuration.
- d. Record hours of operation, daily and cumulative.
- e. Record equipment failures and malfunctions, including chronological data required to determine failure-free operating time, mean time between failures, maintenance downtime and meantime for repair.
- f. Record effects of failures on the operational test conduct.

6.3.2.9 Safety

- a. Record data in accordance with MTP 6-3-523.
- b. Record narrative comments concerning confirmation of safety release, analysis of foreseeable hazards, and evaluation of safety hazards associated with operation and test of the item.

6.3.2.10 Human Factors

- a. Record data in accordance with MTP 6-3-525.
- b. Record test phases on motion picture film.
- c. Record times of accomplishment of phases in hours and minutes.
- d. Record narrative comments pertaining to the capability of average trained crews to complete missions under all assigned conditions.

6.3.2.11 Emplacement and Displacement

- a. Record data in accordance with MTP 6-3-505.
- b. Record times for accomplishment of test phases under assigned conditions in minutes.
- c. Record all activities on motion picture film.

6.3.2.12 Personnel Training Requirements

- a. Record data in accordance with MTP 6-3-502.
- b. Record narrative comments concerning the scope and effectiveness of pre-test training and needs for additional training.

6.3.2.13 Adequacy of Instruction Manuals

Record narrative comments concerning the accuracy, completeness, clarity, ease of use, and the effectiveness of prescribed methods of the manuals.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to subtest title. Test criteria or test item specifications shall be noted on the test data presentation to facilitate analysis and comparison. Where necessary, test data measurement units shall be converted to be compatible with units given by test criteria or specifications.

Specific instructions for the reduction and presentation of individual subtest data are outlined in the succeeding paragraphs.

6.4.1 Data Reduction

The data reduction process shall be accomplished by manual and/or automatic processes, employed as appropriate to the nature and form of the raw data. Insofar as possible, automatic data processing (ADP) methods and facilities should be used to facilitate extraction of data pertinent to various test parameters in different combinations. However, ADP methods may not be feasible or economical for small scale tests.

6.4.2 Data Presentation

Presentation of test results shall consist of:

a. A composite documentation of the reduced and correlated data arranged by test phases in the general form of narrative description supported by diagrams, photographs, graphs, and tabular data. Mission aspects to be made clearly evident under specific conditions of personnel and environment are:

- 1) Accuracy and speed of intercept and direction finding
- 2) Accuracy and reaction of intercept-jamming interactions
- 3) Jamming effectiveness with respect to different jamming modes, ranges, and victim types.

b. Supplements or annexes to the basic document, delineating the common service test factors which are of sufficient scope, importance and/or complexity to warrant separate treatment. Each supplement shall include the applicable supporting data.

A written report shall accompany all test data and shall consist of conclusions and recommendations drawn from test results. The test engineer's opinion, concerning the success or failure of any of the functions evaluated shall also be included. In addition, equipment specifications that will serve as the model for a comparison of the actual test results should be included.

Equipment evaluation usually will be limited to comparing the actual

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test results to the equipment specifications and the requirements as imposed by the intended usage. The results may also be compared to data gathered from previous tests of similar equipment performed under similar conditions.



Figure 1. Victim type: Surface-to-surface radar-(detection/surveillance).

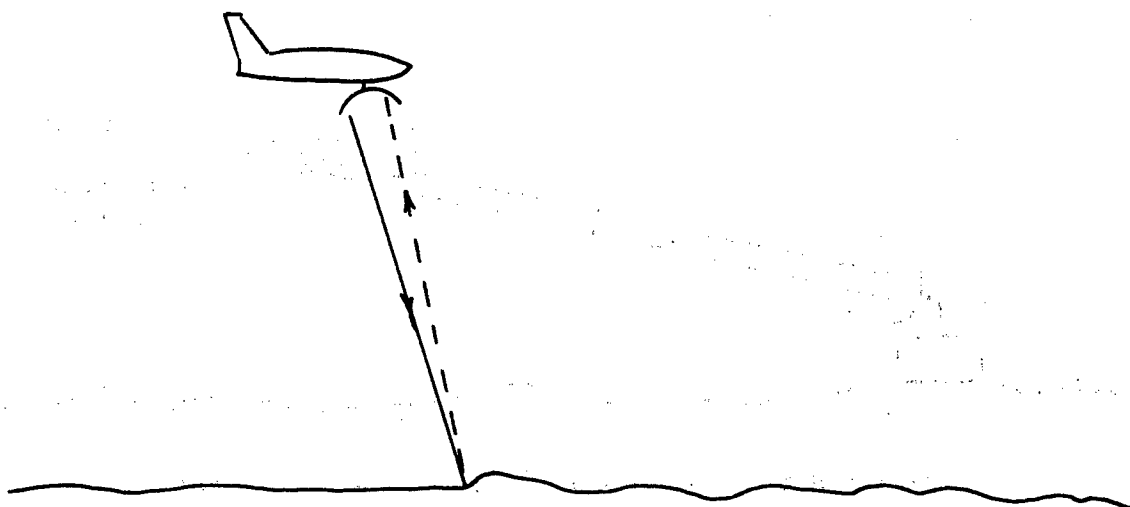
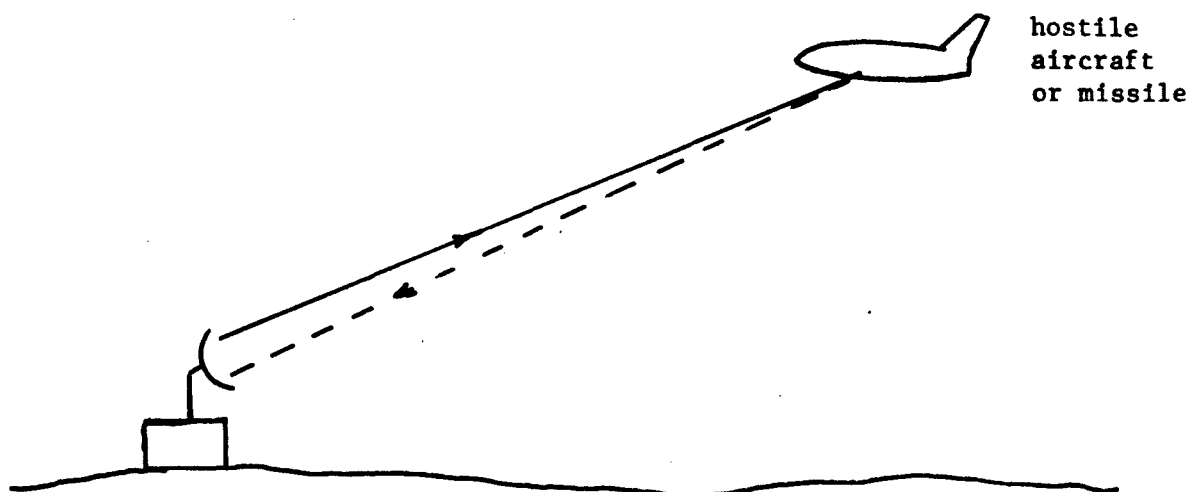
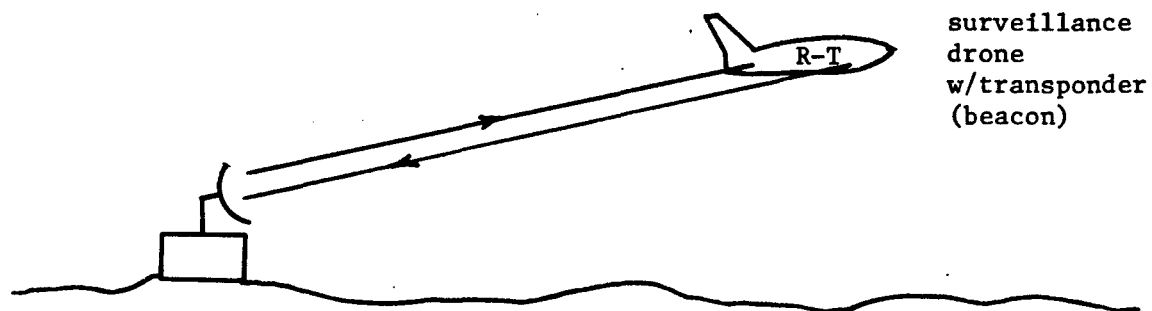


Figure 2. Victim type: Air-to-surface radar-(surveillance/navigation).

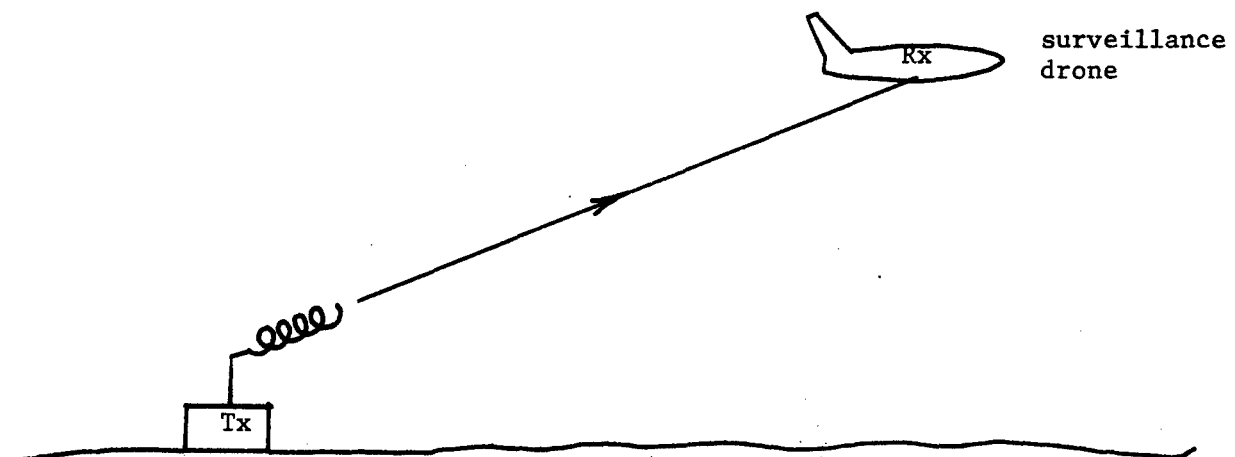


a. Detection or tracking radar

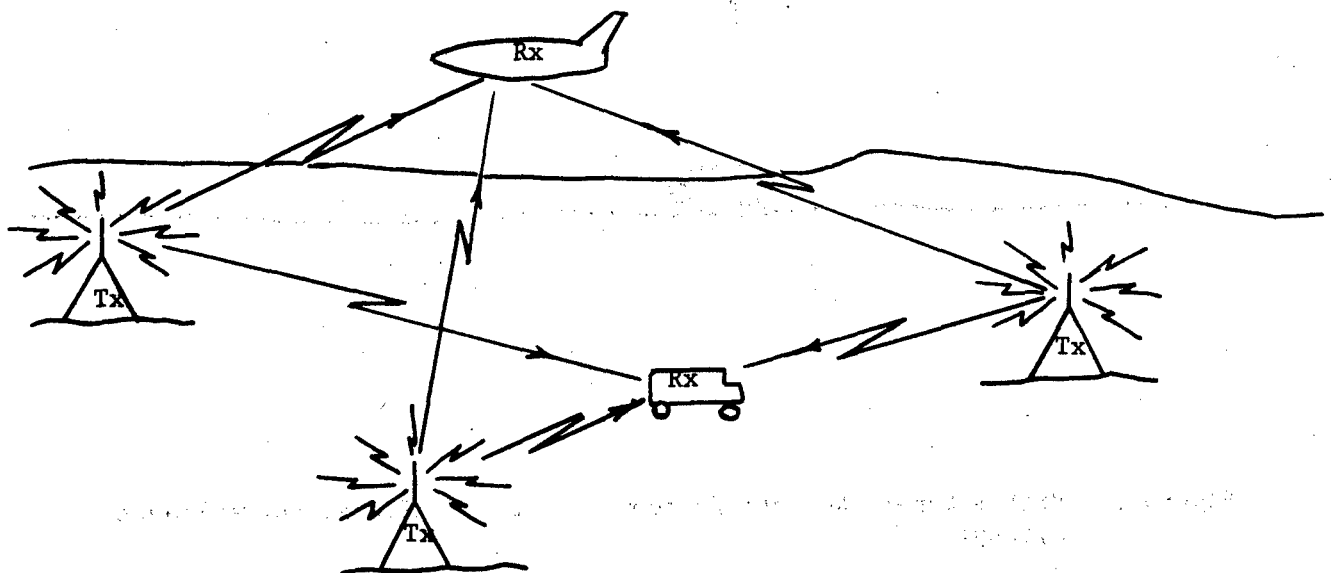


b. Drone tracking radar-(part of drone control system)

Figure 3. Victim type: Surface-to-air radars



a. Remote control system-(drone flight control)



b. Tactical position-fixing & navigation system-(air & ground vehicles)

Figure 4. Victim type: Non-conjugate transmitter-receiver systems

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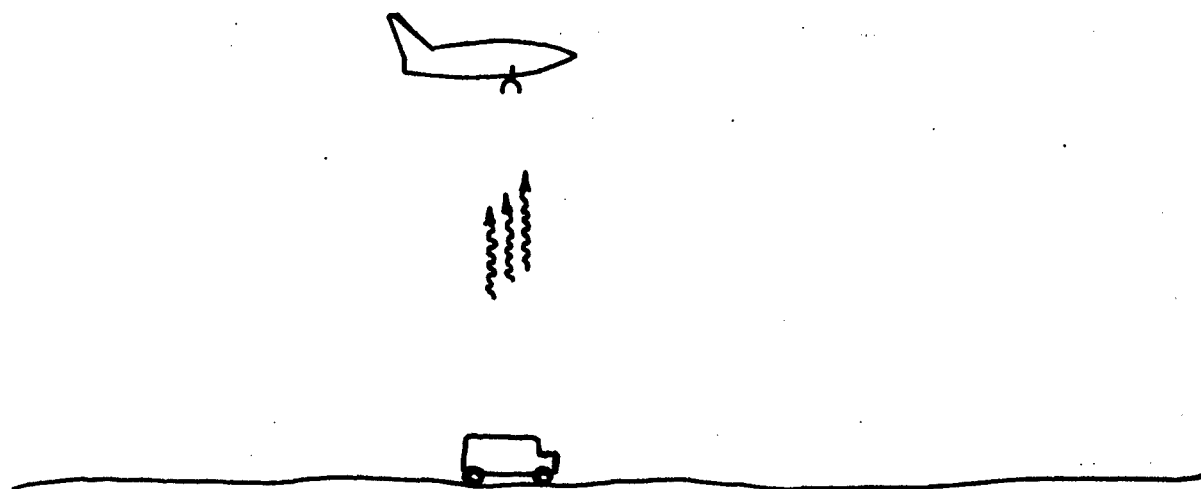
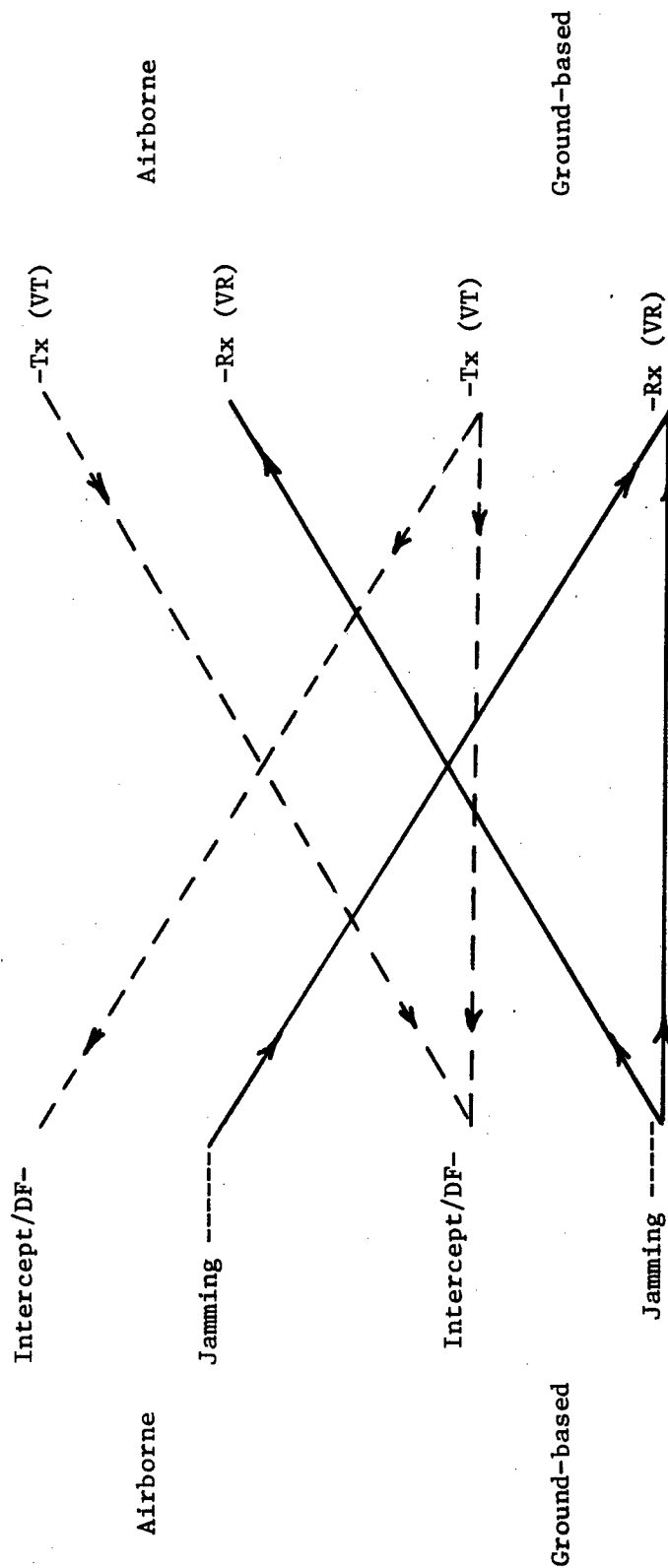


Figure 5. Victim type: Receptor/sensor-(airborne infrared surveillance system)

ECM System (test item)

Victim System

<u>Installation</u>	<u>Function</u>	<u>Vulnerable Component</u>	<u>Installation</u>
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Notes: 1. Tx = transmitter; Rx = receiver or sensor.

2. Transmit and receiver components of test item or victim system are not necessarily conjugate, e.g. intercept/DF may be ground-based, operating with an airborne jammer.

Figure 6. Possible ECM-Victim Combinations