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13. ABSTRACT (Maximum 200 words)
This TOP is a general guideline for electromagnetic interference testing of electronic, electrical, and electromechanical equipment, subsystems, and systems. This TOP is applicable to the measurement of emissions and the identification of susceptibilities for all systems and in all test categories.

14. SUBJECT TERMS		15. NUMBER OF PAGES
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U.S. ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

*Test Operations Procedure (TOP) 6-2-542 31 May 1994
AD No.

ELECTROMAGNETIC INTERFERENCE TESTS

1. SCOPE.

a. This TOP provides guidance for conducting electromagnetic interference (EMI) tests of electronic, electrical, and electromechanical equipment, subsystems, and systems. This guidance includes test planning, test execution, and test reporting. EMI tests are to measure and determine the electromagnetic emission and susceptibility characteristics of systems (including aircraft, missiles, vehicles, sheltered systems, electronics, etc.) procured for use by activities and agencies of the Department of Defense. The purpose of these tests is to:

(1) Determine the effectiveness of the electromagnetic interference suppression components of the system/subsystem under test.

(2) Determine the extent, if any, to which the test item will produce excessive undesired electromagnetic emissions that could affect other systems/subsystems.

(3) Determine the extent, if any, to which the operation of the test item would be degraded when subjected to various electromagnetic environments, both conducted and radiated that the item would encounter during its expected life.

*This TOP supersedes TOP 6-2-542, 1 February 1974.
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(4) Evaluate the performance of the test item in its actual tactical environment with respect to system/subsystem electromagnetic compatibility.

b. The limits, methods, and procedures described in this TOP are based on EMI testing in accordance with Military Standard (MIL-STD) 461D[1*] and MIL-STD-462D[2]. However, due to specifications requirements, MIL-STD-461A/B/C[3,4,5], MIL-STD-462[6], and MIL-STD-463[7] are also discussed.

c. This TOP is applicable to the measurement of emissions and the identification of susceptibilities for all systems and in all test categories.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

a. When testing in accordance with MIL-STD-461D, use the requirements outlined in paragraphs 4.2 to 4.6 of MIL-STD-462D (see appendix A, paragraph 1).

b. When testing in accordance with MIL-STD-461A/B/C, use the requirements outlined in MIL-STD-462.

2.2 Instrumentation.

a. When testing in accordance with MIL-STD-461D, use the requirements outlined in paragraphs 4.7 to 4.12 of MIL-STD-462D and American National Standards Institute (ANSI) C63.2[8], C63.4[9], C63.14[10], and C95.1[11] standards.

b. When testing in accordance with MIL-STD-461A/B/C, use the requirements outlined in MIL-STD-462, Notice 3 (EL), table II.

c. In either case, perform system calibration in accordance with MIL-STD-45662A[12].

3. REQUIRED TEST CONDITIONS.

Throughout the remainder of this TOP, reference will be made only to MIL-STD-461D and to the associated requirements in MIL-STD-462D. Should older specifications call for MIL-STD-461 A, B, C, and related MIL-STD-462, it is understood that they should be applied as appropriate, with exceptions delineated in appendix A of this TOP.

3.1 Required Information.

Obtain the following before writing the test plan:

(1) The military standard specification to which the item is being

*Superscript numbers correspond to those in appendix C, References.

tested, any tailoring of specification requirements, and justification for such tailoring. These can be obtained from the equipment specification.

(2) A description of the test item, its function, its configuration, its operational modes, and how it is to be deployed.

(3) Whether the test item is a system or a subsystem. If a subsystem, identify the main system, how it operates, and how the test item interfaces and interacts with the main system. If a system, determine how it operates and what environment(s) will be encountered during its expected life. d. Test item three-dimensional size, weight, and shelter type.

(4) Test item power requirements (e.g., 3-phase, 220 volts, 100 amperes, 60 hertz).

(5) External stimulation required in the normal operation of the test item. Some examples are 1-kilohertz tone to stimulate voice-channel-type equipment, water for water purification units, a T-1 input for digital multiplexers, and chemical and radiac sources for nuclear, biological, and chemical sensors.

(6) If the test item is radio equipment, operating frequency bands, antenna characteristics (i.e., antenna pattern, active/passive, polarization, and gain), transmitter and receiver front-end characteristics, transmitter output power, operational bandwidths, receiver sensitivity, and number of radios involved.

(7) If the test item is digital equipment, information on pulse duration, pulse repetition rates pulse rise and fall times, pulse characteristics (e.g., nonreturn-to-zero) and coding.

(8) Software/hardware required to activate each peripheral individually.

3.2 Test Plan.

a. In the test plan, include paragraph descriptions and a detailed diagram for each subtest. Define details of each subtest sufficiently to be understood by the nontechnical reader. As a minimum, include details of operating conditions and modes, test location (outside test area, anechoic chamber, etc.), test frequency ranges, susceptibility signals to be used, connection/placement point of transducers, description of test item parameters to be monitored for malfunction or degradation of test item operation during susceptibility testing, stimulation or monitor devices to be used, and any calculations to be performed.

b. In the test plan, outline specific signals to be input to the test item during the test (frequencies, types of modulation, spike characteristics, etc.) and the criteria to be used in determining whether a malfunction or

performance degradation has occurred.

c. Develop a test matrix to allow for tracking of the test program. Prepare a system compatibility matrix, including a list of all components, systems, and subsystems that could cause interactions, to determine system/subsystem compatibility requirements. These requirements will vary with each system/subsystem tested.

3.3 Pretest.

a. Check all test equipment for proper calibration and operation. Ensure that factors associated with test equipment (i.e., antenna factors, transducer factors, cable losses, amplifier gains, etc.) are on hand and applied properly. Check and verify automated data collection systems test setups to ensure correctness. For emissions testing, run ambient measurements of the test chamber/site to ensure an electromagnetic environment in accordance with MIL-STD-462D. If radiated susceptibility is to be performed in an open-field site, coordinate with the local frequency manager to avoid possible conflicts.

b. Conduct an initial visual inspection to ensure the test item is complete, all hardware is intact and operational, and ancillary equipment is properly mounted and grounded. Perform operational checks to ensure proper functioning of test item. Record nomenclature, model number, serial number, and manufacturer information.

4. TEST PROCEDURES.

Use testing requirements and procedures of MIL-STD-462D to determine compliance with the applicable emissions and susceptibility requirements in MIL-STD-461D.

4.1 Emission Tests.

4.1.1 Objectives. To measure, record, and evaluate any electromagnetic emissions, conducted and radiated, emanating from the test item and to determine whether the emanations are narrowband or broadband.

4.1.2 Method.

a. Refer to the test plan to determine the operating conditions and modes, control settings, and electrical loads and terminations to be used. Identify parameters and criteria for malfunctions and degradations.

b. Use a sample size of one test item, unless development or other prototype tests are involved requiring a larger sample size.

c. Perform conducted and radiated emissions testing with approved instrumentation in accordance with MIL-STD-462D. These tests must meet the

requirements given in MIL-STD-461D.

d. To correlate the conducted and radiated emissions results with the specified limits, collect data using antennas, transducers, and configurations as specified in MIL-STD-462D for individual tests, ANSI C63.2, and in table I of MIL-STD-462, Notice 3 (EL). (See appendix A, paragraph 2.)

e. Perform radiated emissions tests with the test item operating into an electrical or electromechanical load, as required. Position the test item from the measuring antenna at the distance given in table VII of MIL-STD-461A, Notice 4 (EL).

f. If the test chamber is not anechoic, reflected radiation can cause false readings. Reflections can be reduced by use of absorber materials within the shielded enclosure. (See page 6, paragraph 4.2.1, MIL-STD-462D, "Radio frequency (RF) absorber material.")

g. Turn the test item power on and stabilize the test items and instrumentation. Then perform operational checks.

h. Perform an RF ambient scan over the frequency spectrum of the test. Record the RF ambient level as a function of amplitude versus frequency with the test item turned off.

i. Operate the test item in all representative modes. Scan the full frequency range of the test and record amplitude versus frequency for each different operating mode. For MIL-STD-461A/B/C tests, record both narrowband and broadband emissions.

j. If over-the-limit emissions are detected, perform additional testing to identify the source and/or leakage point of the emissions.

4.1.3 Data Required.

a. Nomenclature, model, and serial number of the test item.

b. List of all data acquisition instrumentation, antennas, current probes, and other ancillary equipment used to perform the tests. The location of antennas, probes, and other ancillary equipment relative to the test item.

c. Records of operating conditions and modes, control settings, loads and terminations, and monitoring equipment used.

d. Location and description of test site, date and time of test, name of personnel, subtest designation, and test conditions or operating mode.

e. Plots of RF emission amplitudes versus frequency for both conducted and radiated emissions. Include applicable limits on the same plot.

f. Photographs and/or drawings of test configurations.

4.2 Susceptibility Tests.

4.2.1 Objectives. The objectives of the susceptibility tests are to determine:

(1) Whether the test item is susceptible to electromagnetic interference. This interference can be injected, induced, or radiated onto power, signal or control leads.

(2) Whether the specified frequencies, types of modulation, and spike characteristics cause degradation of test item performance and to determine the "threshold" of any susceptibility found.

4.2.2 Method.

a. Refer to the test plan to determine the operating conditions and modes, control settings, and electrical loads and termination to be used. Identify parameters and criteria for malfunctions and degradations.

b. Use a sample size of one test item, unless development or other prototype tests are involved requiring a larger sample size.

CAUTION

Susceptibility testing can create personnel hazards and can be destructive to test items.

c. Perform susceptibility testing in accordance with MIL-STD-462D and only with approved instrumentation (see appendix A, paragraph 2). Ensure that test items meet the applicable requirements given in MIL-STD-461D.

(1) Turn the test item power on and perform an operational check.

(2) Ensure that the test item is instrumented as required to monitor, measure, and record the operating characteristics in all representative modes.

(3) Operate the test item in all representative modes. Sweep the full frequency range of the test, while maintaining the appropriate test signal field level, and record any anomaly as a function of frequency for each different operating mode.

(4) If a malfunction or degradation of performance is observed, decrease the output signal level until the test item functions properly. Slowly increase the signal level until the anomalous condition repeats.

Measure and record this radiated field signal level as the threshold of susceptibility.

4.2.3 Data Required.

a. Nomenclature, model, and serial number of the test item.

b. List of all data acquisition instrumentation, antennas, coupling transformers, and other ancillary equipment used to perform the tests. The location of antennas, coupling transformers, and other ancillary equipment relative to the test item.

c. Records of operating conditions and modes, control settings, loads and terminations, and monitoring equipment used.

d. Location and description of test site, date and time of test, name of personnel, subtest designation, and test conditions or operating mode.

e. Tabulated listings of modes of operation, frequencies, signal levels, modulation characteristics, and thresholds of all susceptibilities.

f. Photographs and/or drawings of test configurations.

5. PRESENTATION OF DATA.

Format and present data in accordance with the Data Item Description: Electromagnetic Interference Test Report[13].

APPENDIX A. BACKGROUND INFORMATION

1. FACILITIES.

MIL-STD-462 supplies only minimal information on facilities, sweep times, sweep rates, etc. Therefore, it is necessary that the requirements in MIL-STD-462D be followed. MIL-STD-462D reflects current technology; provides standardization of test bandwidths, sweep times, and dwell times; and provides for quiet ambient levels for emission testing and guidance to ensure that Federal Communications Commission (FCC) rules are not violated during susceptibility testing.

2. TEST PROCEDURES.

a. The conical log spiral antenna is specified in table I, page 7, MIL-STD-462 Notice 3 (EL), for the frequency range 200–1000 megahertz (MHz). A better antenna, a double-ridged horn, is specified in MIL-STD-462D and shall be used for all military standard testing in this frequency range. The double-ridged horn is considered to be better for standardization for several reasons. At some frequencies, the antenna pattern of the conical log spiral is not centered on the antenna axis. The double-ridged horn does not have this problem. The circular polarization of the conical log spiral creates confusion in its proper application. Electric field from test items would rarely be circularly polarized signals. Therefore, questions are raised concerning the need for 3-decibel (dB) correction factors to account for linearly polarized signals. The same issue is present when conical spiral antennas are used for radiated susceptibility testing. If a second conical spiral is used to calibrate the field correctly for a circularly polarized wave, the question arises whether a 3-dB higher field should be used, since the test item will respond more readily to linearly polarized fields of the same magnitude.

b. Other linearly polarized antennas such as log periodic antennas are not to be used. It is recognized that these types of antennas have sometimes been used in the past; however, they will not necessarily produce the same results as the double-ridged horn because of field variations across the antenna apertures and far field/near field issues. Uniform use of the double-ridged horn is required for standardization purposes to obtain consistent results among different test facilities.

APPENDIX B. ABBREVIATIONS

ANSI	American National Standards Institute
dB	decibel
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EMICP	Electromagnetic Interference Control Procedures
EMITP	Electromagnetic Interference Test Procedures
EMITR	Electromagnetic Interference Test Report
EMP	electromagnetic pulse
ESD	electrostatic discharge
FCC	Federal Communications Commission
GHz	gigahertz
kHz	kilohertz
MHz	megahertz
MIL-STD	military standard
RF	radio frequency
TOP	Test Operations Procedure

APPENDIX C. REFERENCES

1. MIL-STD-461D, Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility, 11 January 1993.

2. MIL-STD-462D, Measurement of Electromagnetic Interference Characteristics, 11 January 1993.

3. MIL-STD-461A, Electromagnetic Interference Characteristics, Requirements for Equipment, 1 August 1968, with Notice 1, 7 February 1969; Notice 2, 20 March 1969; Notice 3 (USAF), 1 May 1970; Notice 4 (Army EL), 9 February 1973; Notice 5, 9 February 1973; Notice 6, 3 July 1973.

4. MIL-STD-461B, Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference, 1 April 1980.

5. MIL-STD-461C, Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference, 4 August 1986, with Notice 1, 1 April 1987; and Notice 2 (USAF), 13 October 1987.

6. MIL-STD-462, Electromagnetic Interference Characteristics, Measurement of, 31 July 1967, with Notice 1, 1 August 1968; Notice 2 (USAF), 1 May 1970; Notice 3 (Army EL), 9 February 1971; Interim Notice 4 (Navy), 1 April 1980; Interim Notice 5 (Navy), 4 August 1986; and Notice 6 (USAF), 15 October 1987.

7. MIL-STD-463, Definitions and System of Units, Electromagnetic Interference and Electromagnetic Compatibility Technology, 1 June 1977.

8. Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz - Specifications, American National Standards Institute, C63.2-1987, 5 February 1987.

9. Standard for Electromagnetic Compatibility - Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz - Methods of Measurement, American National Standards Institute, C63.4-1981, November 20, 1980.

10. Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD), American National Standards Institute, C63.14-1992, 21 October 1992.

11. Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields (300 kHz - 100 GHz), American National Standards Institute, C95.1-1982, 30 July 1980.

12. MIL-C-45662A, Calibration System Requirements, 9 February 1962, with Notice 1, 5 January 1983; Notice 2, 16 May 1984; Notice 3, 14 December 1984.

13. Data Item Description: Electromagnetic Interference Test Report (EMITR), 11 January 93, DI-EMCS-80200A.

REFERENCES FOR INFORMATION ONLY

a. Data Item Description: Electromagnetic Interference Control Procedures (EMICP), 11 January 93, DI-EMCS-80199A.

b. Data Item Description: Electromagnetic Interference Test Procedures (EMITP), 11 January 93, DI-EMCS-80210A.

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U.S. ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

*Test Operations Procedure (TOP) 6-2-542 31 May 1994
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ELECTROMAGNETIC INTERFERENCE TESTS

1. SCOPE.

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(1) Determine the effectiveness of the electromagnetic interference suppression components of the system/subsystem under test.

(2) Determine the extent, if any, to which the test item will produce excessive undesired electromagnetic emissions that could affect other systems/subsystems.

(3) Determine the extent, if any, to which the operation of the test item would be degraded when subjected to various electromagnetic environments, both conducted and radiated that the item would encounter during its expected life.

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(4) Evaluate the performance of the test item in its actual tactical environment with respect to system/subsystem electromagnetic compatibility.

b. The limits, methods, and procedures described in this TOP are based on EMI testing in accordance with Military Standard (MIL-STD) 461D[1*] and MIL-STD-462D[2]. However, due to specifications requirements, MIL-STD-461A/B/C[3,4,5], MIL-STD-462[6], and MIL-STD-463[7] are also discussed.

c. This TOP is applicable to the measurement of emissions and the identification of susceptibilities for all systems and in all test categories.

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2.1 Facilities.

a. When testing in accordance with MIL-STD-461D, use the requirements outlined in paragraphs 4.2 to 4.6 of MIL-STD-462D (see appendix A, paragraph 1).

b. When testing in accordance with MIL-STD-461A/B/C, use the requirements outlined in MIL-STD-462.

2.2 Instrumentation.

a. When testing in accordance with MIL-STD-461D, use the requirements outlined in paragraphs 4.7 to 4.12 of MIL-STD-462D and American National Standards Institute (ANSI) C63.2[8], C63.4[9], C63.14[10], and C95.1[11] standards.

b. When testing in accordance with MIL-STD-461A/B/C, use the requirements outlined in MIL-STD-462, Notice 3 (EL), table II.

c. In either case, perform system calibration in accordance with MIL-STD-45662A[12].

3. REQUIRED TEST CONDITIONS.

Throughout the remainder of this TOP, reference will be made only to MIL-STD-461D and to the associated requirements in MIL-STD-462D. Should older specifications call for MIL-STD-461 A, B, C, and related MIL-STD-462, it is understood that they should be applied as appropriate, with exceptions delineated in appendix A of this TOP.

3.1 Required Information.

Obtain the following before writing the test plan:

(1) The military standard specification to which the item is being

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tested, any tailoring of specification requirements, and justification for such tailoring. These can be obtained from the equipment specification.

(2) A description of the test item, its function, its configuration, its operational modes, and how it is to be deployed.

(3) Whether the test item is a system or a subsystem. If a subsystem, identify the main system, how it operates, and how the test item interfaces and interacts with the main system. If a system, determine how it operates and what environment(s) will be encountered during its expected life. d. Test item three-dimensional size, weight, and shelter type.

(4) Test item power requirements (e.g., 3-phase, 220 volts, 100 amperes, 60 hertz).

(5) External stimulation required in the normal operation of the test item. Some examples are 1-kilohertz tone to stimulate voice-channel-type equipment, water for water purification units, a T-1 input for digital multiplexers, and chemical and radiac sources for nuclear, biological, and chemical sensors.

(6) If the test item is radio equipment, operating frequency bands, antenna characteristics (i.e., antenna pattern, active/passive, polarization, and gain), transmitter and receiver front-end characteristics, transmitter output power, operational bandwidths, receiver sensitivity, and number of radios involved.

(7) If the test item is digital equipment, information on pulse duration, pulse repetition rates, pulse rise and fall times, pulse characteristics (e.g., nonreturn-to-zero) and coding.

(8) Software/hardware required to activate each peripheral individually.

3.2 Test Plan.

a. In the test plan, include paragraph descriptions and a detailed diagram for each subtest. Define details of each subtest sufficiently to be understood by the nontechnical reader. As a minimum, include details of operating conditions and modes, test location (outside test area, anechoic chamber, etc.), test frequency ranges, susceptibility signals to be used, connection/placement point of transducers, description of test item parameters to be monitored for malfunction or degradation of test item operation during susceptibility testing, stimulation or monitor devices to be used, and any calculations to be performed.

b. In the test plan, outline specific signals to be input to the test item during the test (frequencies, types of modulation, spike characteristics, etc.) and the criteria to be used in determining whether a malfunction or

performance degradation has occurred.

c. Develop a test matrix to allow for tracking of the test program. Prepare a system compatibility matrix, including a list of all components, systems, and subsystems that could cause interactions, to determine system/subsystem compatibility requirements. These requirements will vary with each system/subsystem tested.

3.3 Pretest.

a. Check all test equipment for proper calibration and operation. Ensure that factors associated with test equipment (i.e., antenna factors, transducer factors, cable losses, amplifier gains, etc.) are on hand and applied properly. Check and verify automated data collection systems test setups to ensure correctness. For emissions testing, run ambient measurements of the test chamber/site to ensure an electromagnetic environment in accordance with MIL-STD-462D. If radiated susceptibility is to be performed in an open-field site, coordinate with the local frequency manager to avoid possible conflicts.

b. Conduct an initial visual inspection to ensure the test item is complete, all hardware is intact and operational, and ancillary equipment is properly mounted and grounded. Perform operational checks to ensure proper functioning of test item. Record nomenclature, model number, serial number, and manufacturer information.

4. TEST PROCEDURES.

Use testing requirements and procedures of MIL-STD-462D to determine compliance with the applicable emissions and susceptibility requirements in MIL-STD-461D.

4.1 Emission Tests.

4.1.1 Objectives. To measure, record, and evaluate any electromagnetic emissions, conducted and radiated, emanating from the test item and to determine whether the emanations are narrowband or broadband.

4.1.2 Method.

a. Refer to the test plan to determine the operating conditions and modes, control settings, and electrical loads and terminations to be used. Identify parameters and criteria for malfunctions and degradations.

b. Use a sample size of one test item, unless development or other prototype tests are involved requiring a larger sample size.

c. Perform conducted and radiated emissions testing with approved instrumentation in accordance with MIL-STD-462D. These tests must meet the

requirements given in MIL-STD-461D.

d. To correlate the conducted and radiated emissions results with the specified limits, collect data using antennas, transducers, and configurations as specified in MIL-STD-462D for individual tests, ANSI C63.2, and in table I of MIL-STD-462, Notice 3 (EL). (See appendix A, paragraph 2.)

e. Perform radiated emissions tests with the test item operating into an electrical or electromechanical load, as required. Position the test item from the measuring antenna at the distance given in table VII of MIL-STD-461A, Notice 4 (EL).

f. If the test chamber is not anechoic, reflected radiation can cause false readings. Reflections can be reduced by use of absorber materials within the shielded enclosure. (See page 6, paragraph 4.2.1, MIL-STD-462D, "Radio frequency (RF) absorber material.")

g. Turn the test item power on and stabilize the test items and instrumentation. Then perform operational checks.

h. Perform an RF ambient scan over the frequency spectrum of the test. Record the RF ambient level as a function of amplitude versus frequency with the test item turned off.

i. Operate the test item in all representative modes. Scan the full frequency range of the test and record amplitude versus frequency for each different operating mode. For MIL-STD-461A/B/C tests, record both narrowband and broadband emissions.

j. If over-the-limit emissions are detected, perform additional testing to identify the source and/or leakage point of the emissions.

4.1.3 Data Required.

a. Nomenclature, model, and serial number of the test item.

b. List of all data acquisition instrumentation, antennas, current probes, and other ancillary equipment used to perform the tests. The location of antennas, probes, and other ancillary equipment relative to the test item.

c. Records of operating conditions and modes, control settings, loads and terminations, and monitoring equipment used.

d. Location and description of test site, date and time of test, name of personnel, subtest designation, and test conditions or operating mode.

e. Plots of RF emission amplitudes versus frequency for both conducted and radiated emissions. Include applicable limits on the same plot.

f. Photographs and/or drawings of test configurations.

4.2 Susceptibility Tests.

4.2.1 Objectives. The objectives of the susceptibility tests are to determine:

(1) Whether the test item is susceptible to electromagnetic interference. This interference can be injected, induced, or radiated onto power, signal or control leads.

(2) Whether the specified frequencies, types of modulation, and spike characteristics cause degradation of test item performance and to determine the "threshold" of any susceptibility found.

4.2.2 Method.

a. Refer to the test plan to determine the operating conditions and modes, control settings, and electrical loads and termination to be used. Identify parameters and criteria for malfunctions and degradations.

b. Use a sample size of one test item, unless development or other prototype tests are involved requiring a larger sample size.

CAUTION

Susceptibility testing can create personnel hazards and can be destructive to test items.

c. Perform susceptibility testing in accordance with MIL-STD-462D and only with approved instrumentation (see appendix A, paragraph 2). Ensure that test items meet the applicable requirements given in MIL-STD-461D.

(1) Turn the test item power on and perform an operational check.

(2) Ensure that the test item is instrumented as required to monitor, measure, and record the operating characteristics in all representative modes.

(3) Operate the test item in all representative modes. Sweep the full frequency range of the test, while maintaining the appropriate test signal field level, and record any anomaly as a function of frequency for each different operating mode.

(4) If a malfunction or degradation of performance is observed, decrease the output signal level until the test item functions properly. Slowly increase the signal level until the anomalous condition repeats.

Measure and record this radiated field signal level as the threshold of susceptibility.

4.2.3 Data Required.

a. Nomenclature, model, and serial number of the test item.

b. List of all data acquisition instrumentation, antennas, coupling transformers, and other ancillary equipment used to perform the tests. The location of antennas, coupling transformers, and other ancillary equipment relative to the test item.

c. Records of operating conditions and modes, control settings, loads and terminations, and monitoring equipment used.

d. Location and description of test site, date and time of test, name of personnel, subtest designation, and test conditions or operating mode.

e. Tabulated listings of modes of operation, frequencies, signal levels, modulation characteristics, and thresholds of all susceptibilities.

f. Photographs and/or drawings of test configurations.

5. PRESENTATION OF DATA.

Format and present data in accordance with the Data Item Description: Electromagnetic Interference Test Report[13].

APPENDIX A. BACKGROUND INFORMATION

1. FACILITIES.

MIL-STD-462 supplies only minimal information on facilities, sweep times, sweep rates, etc. Therefore, it is necessary that the requirements in MIL-STD-462D be followed. MIL-STD-462D reflects current technology; provides standardization of test bandwidths, sweep times, and dwell times; and provides for quiet ambient levels for emission testing and guidance to ensure that Federal Communications Commission (FCC) rules are not violated during susceptibility testing.

2. TEST PROCEDURES.

a. The conical log spiral antenna is specified in table I, page 7, MIL-STD-462 Notice 3 (EL), for the frequency range 200–1000 megahertz (MHz). A better antenna, a double-ridged horn, is specified in MIL-STD-462D and shall be used for all military standard testing in this frequency range. The double-ridged horn is considered to be better for standardization for several reasons. At some frequencies, the antenna pattern of the conical log spiral is not centered on the antenna axis. The double-ridged horn does not have this problem. The circular polarization of the conical log spiral creates confusion in its proper application. Electric field from test items would rarely be circularly polarized signals. Therefore, questions are raised concerning the need for 3-decibel (dB) correction factors to account for linearly polarized signals. The same issue is present when conical spiral antennas are used for radiated susceptibility testing. If a second conical spiral is used to calibrate the field correctly for a circularly polarized wave, the question arises whether a 3-dB higher field should be used, since the test item will respond more readily to linearly polarized fields of the same magnitude.

b. Other linearly polarized antennas such as log periodic antennas are not to be used. It is recognized that these types of antennas have sometimes been used in the past; however, they will not necessarily produce the same results as the double-ridged horn because of field variations across the antenna apertures and far field/near field issues. Uniform use of the double-ridged horn is required for standardization purposes to obtain consistent results among different test facilities.

APPENDIX B. ABBREVIATIONS

ANSI	American National Standards Institute
dB	decibel
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EMICP	Electromagnetic Interference Control Procedures
EMITP	Electromagnetic Interference Test Procedures
EMITR	Electromagnetic Interference Test Report
EMP	electromagnetic pulse
ESD	electrostatic discharge
FCC	Federal Communications Commission
GHz	gigahertz
kHz	kilohertz
MHz	megahertz
MIL-STD	military standard
RF	radio frequency
TOP	Test Operations Procedure

APPENDIX C. REFERENCES

1. MIL-STD-461D, Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility, 11 January 1993.

2. MIL-STD-462D, Measurement of Electromagnetic Interference Characteristics, 11 January 1993.

3. MIL-STD-461A, Electromagnetic Interference Characteristics, Requirements for Equipment, 1 August 1968, with Notice 1, 7 February 1969; Notice 2, 20 March 1969; Notice 3 (USAF), 1 May 1970; Notice 4 (Army EL), 9 February 1973; Notice 5, 9 February 1973; Notice 6, 3 July 1973.

4. MIL-STD-461B, Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference, 1 April 1980.

5. MIL-STD-461C, Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference, 4 August 1986, with Notice 1, 1 April 1987; and Notice 2 (USAF), 13 October 1987.

6. MIL-STD-462, Electromagnetic Interference Characteristics, Measurement of, 31 July 1967, with Notice 1, 1 August 1968; Notice 2 (USAF), 1 May 1970; Notice 3 (Army EL), 9 February 1971; Interim Notice 4 (Navy), 1 April 1980; Interim Notice 5 (Navy), 4 August 1986; and Notice 6 (USAF), 15 October 1987.

7. MIL-STD-463, Definitions and System of Units, Electromagnetic Interference and Electromagnetic Compatibility Technology, 1 June 1977.

8. Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz - Specifications, American National Standards Institute, C63.2-1987, 5 February 1987.

9. Standard for Electromagnetic Compatibility - Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz - Methods of Measurement, American National Standards Institute, C63.4-1981, November 20, 1980.

10. Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD), American National Standards Institute, C63.14-1992, 21 October 1992.

11. Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields (300 kHz - 100 GHz), American National Standards Institute, C95.1-1982, 30 July 1980.

12. MIL-C-45662A, Calibration System Requirements, 9 February 1962, with Notice 1, 5 January 1983; Notice 2, 16 May 1984; Notice 3, 14 December 1984.

13. Data Item Description: Electromagnetic Interference Test Report (EMITR), 11 January 93, DI-EMCS-80200A.

REFERENCES FOR INFORMATION ONLY

a. Data Item Description: Electromagnetic Interference Control Procedures (EMICP), 11 January 93, DI-EMCS-80199A.

b. Data Item Description: Electromagnetic Interference Test Procedures (EMITP), 11 January 93, DI-EMCS-80210A.

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