Raeph Smith C.25

MIL-E-6051C 17 JUNE 1960 SUPERSEDING MIL-I-006051B (USAF) 23 JANUARY 1959



MILITARY SPECIFICATION

ELECTRICAL-ELECTRONIC SYSTEM COMPATIBILITY AND INTERFERENCE CONTROL REQUIREMENTS FOR AERONAUTICAL WEAPON SYSTEMS, ASSOCIATED SUBSYSTEMS AND AIRCRAFT

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 This specification outlines design requirements and test procedures necessary to control the electronic interference environment of weapon systems, associated electronic and electrical subsystems, and aircraft.

2. APPLICABLE DOCUMENTS

2.1 The following documents. of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

MILITARY

MIL-B-5087	Bonding; Electrical (for Aircraft).
MIL-I-6181	— Interference Control Requirements, Air- craft Equipment.
MIL-T-9107	- Test Reports, Prep- aration of.
MIL-D-9310	— Data for Guided Mis- sile Weapon Sys- tems.

MIL-F-15733 - Filters, Radio Interference.

MIL-I-26600 — Interference Control Requirements, Aeronautical Equipment.

(Copies of documents required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Electro-interference environment control. Interference produced by the weapon system shall be controlled to eliminate undesired interaction and malfunctioning of all electronic and electrical subsystems in or associated with the weapon system regardless of whether the ultimate output of the subsystems is electrical, aural, video, or mechanical. This requirement applies to the entire frequency range of the installed subsystems and those for which complete installation provisions have been made. This requirement specifically includes electronic compatibility of subsystems when operating with their installed antennas and when perMIL-I-6051B

MIL-E-6051C

forming their intended radiation or reception function. There shall be neither unacceptable response nor malfunction from the output of any subsystem because of electro-interference produced by any or all of the installed or associated electrical, electronic, and other equipment of the weapon system when tested as specified herein. The data required herein shall be considered to be part of the design compatibility data and the acceptance test reporting for the system as specified in MIL-D-9310.

3.1.1 Exemption jor transients in manued aircraft. Transient responses are exempted from the requirements specified herein if they cause no malfunctioning or unacceptable degradation of performance, are less than one second in duration, and do not recur during normal operation more frequently than once every three minutes. However, at no time shall the transient voltages across the d-c input source for transistorized equipment exceed a level that is 50 percent greater than nominal power source voltage rating. Further, any transients appearing across the antenna of transistorized equipment shall not cause malfunction.

3.2 Interference control plan. Within ninety days after approval of the weapon system configuration by the procuring activity, the contractor shall submit to the procuring activity a detailed plan outlining his interference control program, the engineering design procedures, and techniques that will be used in complying with this specification. The design aspects of the interference environment which is created by the weapon system, the radio frequency media in which it will operate, utilization of the inherent shielding characteristics of the weapon, antenna location, shielding and bonding techniques, cable routing, and all other pertinent factors shall be included in the interference control plan. Addendums shall be submitted whenever it becomes necessary to revise or supplement the information in the interference control plan or at a date approved by the contracting officer.

2

3.2.1 The interference control plan is intended to indicate how interference control will be accomplished for a particular system. Military usage may dictate more stringent requirements or permit less stringent requirements resulting in conserving resources. The interference control plan shall be utilized to delineate any changes, including justification deemed advisable by the contractor,

3.3 Interference test plan. The contractor shall submit a detailed test plan showing the means of implementation and the application of the test procedures in this specification to the procuring activity thirty days prior to the starting date of the electrical-electronic compatibility test specified herein, or at such later date as the contracting officer may authorize.

3.4 Susceptibility characteristics of electrical and electronic subsystem contractorfurnished airbornc equipment. The interference control requirement stated herein shall be considered in the design phases of the weapon system. All support systems and subsystems shall incorporate interference control requirements in accordance with MIL-I-6181 for Army and Navy requirements and for Air Force requirements for class Ia equipment as defined by MIL-I-26600, and in accordance with MIL-I-26600 for other Air Force requirements. Specific attention shall be given to the interference susceptibility characteristics of the subsystem in relation to the predicted electronic interference environment. Where additional requirements are necessary, it shall be the responsibility of the weapon system contractor to impose these requirements on the subsystem. Compliance with the requirements relating to subsystems shall not relieve the weapon system contractor of the overall responsibility of controlling the weapon systems electro-interference.

3.5 Government-furnished equipment. It shall be the responsibility of the weapon

MIL-I-6051E



system contractor to comply with the requirements stated herein in connection with Government-furnished subsystems, provided these systems comply with the requirement indicated in the interference control plan.

3.6 Bonding. Bonding shall be accomplished in accordance with the requirements of MIL-B-5087. Bonding shall be provided for current return paths, antenna installations. and to provide equal potential between all equipments and the basic structure of the weapon system.

3.7 Shielding. The materials and construction methods used on weapon systems shall provide an attenuation to electromagnetic emanations that is generally over 60 db, for magnetic fields above 150 kc. This inherent shielding effectiveness is of considerable importance in preventing interference and interaction to subsystems caused by sources outside the weapon system. A great saving in weight, space, and money is realized when maximum use is made of this shielding effectiveness. Continuity of shielding shall be maintained in order to utilize the shielding effectiveness of the fuselage to a maximum degree. All coaxial cables, waveguides, and other antenna lead-ins shall have sufficient shielding effectiveness to use this inherent shielding advantageously. A solid or triplebraided shield may be necessary.

3.8 Interference control components. Interference control filters shall be in accordance with MIL-F-15733. When the environmental requirements of the weapon system dictate additional requirements on interference control components, they shall be detailed in the interference control plan. (Suppression components shall be held to a minimum and shall be applied as close to the interference source.)

4. QUALITY ASSURANCE PROVISIONS

4.1 General. All tests performed by the contractor shall be described by test reports and submitted to the procuring activity for approval and possible verification. When the

MIL-E-6051C

procuring activity waives verification, the tests and test reports shall be approved and certified. Evidence of certification and approval, either by the Government or the contractor, shall be in accordance with MIL-T-9107. The Government reserves the right to have technical representatives of the procuring activity present during testing.

4.2 Test conditions and procedures. In general, all electronic and electrical equipment included in the applicable weapon system specification shall be included in the weapon system test complex and shall be in normal operating condition as determined by the test procedures and techniques specified in the detailed subsystem specifications.

4.2.1 Power limits. When conducting acceptance tests, all electrical power shall be maintained within the limits specified in the detailed specification for the particular weapon system.

4.2.2 Test location. Test locations shall be chosen from areas under the contractor's or Government's control where the electromagnetic environment level is, preferably, not more than 4 db above the receiver internal background level. If this cannot be accomplished, the procuring activity shall approve the test site selected. Tests shall not be conducted in any area or at a time when the external electromagnetic environment would cast doubt as to the validity of the tests. If no reasonably satisfactory test location can be found, flight tests can be made when approved by the procuring activity.

4.2.3 Adjustments. During tests all electronic subsystems shall be adjusted for standard performance in an operating condition in accordance with the requirements of the subsystem performance specification for maximum indication of susceptibility.

4.2.4 Malfunctioning. Tests to indicate malfunctioning or unacceptable response for each subsystem shall be made at a representative number of frequencies or operating ranges

3

MIL-E-6051C

of the subsystem while all subsystems or equipments are operated. Specific tests shall be conducted at the image frequencies, intermediate frequencies, local oscillator frequencies, and fundamental transmitter frequencies through the fifth harmonic frequency. Subsystems with a multitude of fundamental frequencies shall be operated on the minlinum number of frequencies necessary to indicate electromagnetic compatibility. Frequencies shall be indicated in the interference test plan.

4.2.5 Headsets. Headsets of the proper impedance shall be used for detecting interference in the audio output of receivers. When special headsets are required for an equipment, they shall be used with that equipment when conducting these tests.

4.2.6 Output response. A complete description of the device used for measuring electrical, aural, video, and mechanical outputs of all electronic and electrical subsystem elements shall be included in the interference test plan.

4.2.7 External output meter. When an external meter is used for audio output measurements it shall have the following characteristics:

Sensitivity of 1,000 ohms/volt.

Damping factor, not more than 1.43.

Response time, not more than 1/2 second.

Maximum full scale, not less than 10 volts.

Minimum full scale, not more than 2 volts.

4.3 Tests.

4.3.1 Electrical-electronic compatibility test of system. The first electrical-electronic weapon system shall be subjected to a complete functional compatibility test. The weapon system shall be instrumented as outlined in the requested test plan to indicate compliance or noncompliance with the requirements herein. Any modification or relocation of the electronic or electrical subsystem or equipment of a production weapon system shall require a retest unless specifically waived by the procuring activity.

4.3.2 Specification compliance test system. Any changes or modification required as a result of the electronic compatibility test shall be incorporated in the system. In no case shall the specification compliance weapon system be more than five production systems removed from the electronic compatibility test system unless specifically authorized by the procuring activity. The contractor shall submit engineering details outlining modifications required for effecting compliance with this specification on all weapon systems produced prior to the specification test system.

4.3.3 General acceptance test. Each production system shall be given a limited test as outlined in the contractor's test plan to insure production compliance with the stated requirements. Government acceptance crews may conduct this test on manned systems. Each unmanned system shall be subjected to a simulated prelaunch countdown with the minimum instrumentation necessary to insure production compliance.

4.3.4 Unacceptable response. Unacceptable response for equipment providing aural outputs is an output greater than 1.125 microwatts (3 millivolts for 8 ohms; 26 millivolts for 600 ohms; and 50 millivolts for 2,000 ohms). The power level is the total output of the subsystem (receiver internal background noise plus extraneous interference). Output responses from any subsystem, regardless of the type of presentation other than aural response, shall be unacceptable when operation of other electrical or electronic subsystems produces a change or indication detrimental to weapon system performance. MIL-I-6051

MIL-I-6051B

MIL-I-6051A

4.3.5 No malfunctioning. The requirement of "no malfunctioning" shall be considered to have been met when the sum of all extraneous electro-magnetic energy that may be introduced into the most critical point of a subsystem is six db below that desired input which would produce operation, actuation, or functioning of the subsystem or equipment. Detailed test methods, instrumentation, monitoring point, and test procedures applicable to the functional usage of the particular subsystem shall be outlined in the test plan specified herein. For example, the key test point in a guidance subsystem is that relay which actuates a hydraulic valve for control purposes. In this case, an ammeter in the relay circuit, indicating no more than half the current required for operation, would be the no-malfunction limit.

5. PREPARATION FOR DELIVERY

5.1 This section is not applicable to this specification.

6. NOTES

6.1 Intended use. The purpose of this specification is to control the electromagnetic interference to the degree necessary to insure interference-free operation of electronic and electrical subsystems in all weapon systems. This specification is applicable to all items of equipment which utilize or may be affected by electrical phenomena. Such items may be operated individually, in combination, or collectively and comprise a portion of or a total weapon system.

6.2 Definitions.

6.2.1 Weapon system. A weapon system is composed of equipment, skills, and techniques, the composite of which forms an instrument of combat usually but not necessarily having an air vehicle as its major operational element. The complete weapon system includes all related equipment, materials, services, and personnel required solely

for the operation of the air vehicle or other major elements of the system so that the instrument of combat becomes a self-sufficient unit of striking power in its intended operational environment.

6.2.2 Support system. A support system is a composite of equipment, skills, and techniques which, while not an instrument of combat, can perform a clearly defined function in support of a military mission. Examples are weather, air-sea rescue, logistics, intelligence, and training systems.

6.2.3 Subsystem. A subsystem is a major functional part of a weapon system usually consisting of several equipments, which is essential to the operational completeness of the weapon system. Examples are airframe, propulsion, guidance, navigation, and communication.

6.2.4 Equipment. Equipment is a major functional part of a weapon system or subsystem, usually consisting of several components, which is essential to operational completeness of the weapon system or subsystem. Examples are radio compass, radio command set, and electrical power supply.

6.2.5 Component. A component is a functional part of a subsystem or equipment essential to operational completeness of the subsystem or equipment. Examples are radio transmitter unit, radio receiver unit, amplifier unit, analyzer unit, computer unit, and control box.

6.2.6 Government-furnished airborne equipment (GFAE). GFAE is that portion of equipment which, under the terms of a military vehicle contract is procured and furnished by the military directly to the air vehicle contractor for inclusion in an air vehicle.

6.2.7 Contractor-furnished airborne equipment (CFAE). CFAE is that portion of equipment that is furnished and included in the air vehicle by the air vehicle contractor.

5

AN-I-24a

MIL-I-6051B

MIL-I-6051A

MIL-I-6051

MIL-E-6051C

6.2.5 Weapon system contractor. A weapon system contractor is a prime contractor to the Government for detailed weapon system development, production, and installation of certain portions of weapon system. including necessary planning and scheduling under the supervision and final authority of the Government.

6.2.9 Prime contractor. A prime contractor is a contractor having a direct contract with the procuring activity.

6.2.10 Electromagnetic environment. The electromagnetic environment or area interference level is the signal and noise complex within which a weapon system, subsystem, or equipment is likely to be immersed for operational use.

6.2.11 Unacceptable response. Unacceptable response is an abnormality in the expected operation or output of a receiver or subsystem due to electro-interference which usually cannot be termed a malfunction but which may be considered intolerable.

6.2.12 Electro-interference. Electro-interference is an undesired electrical phenomena which is created by, or which adversely affects, any device whose normal functioning is predicated upon the utilization of electrical phenomena. Electrical interference is known coloquially and is referred to as radio

6

and electrical noise or interference, hash, jitter, grass, hunting, ambiguity, cross modulation, TV interference (TVI), hum, etc. The word "interference" may be used alone or with appropriate modifiers in reference to some manifestation of electrointerference when mutually understood.

6.2.13 Receiver internal background noise. The receiver internal background noise is the receiver output obtained at the test location under the following conditions:

- a. All controls at standard settings.
- b. All other aircraft equipment off.
- c. The actual aircraft antenna connected to the receiver input.

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians:

Army—Signal Corps Navy—Burean of Aeronautics Air Force

Preparing activity: Air Force

MIL-I-6051

MIL-I-6051B

MIL-I-6051A