

MILITARY EMI SPECIFICATIONS

Introduction

Most military and many other Government agencies require the control of electrical interference in the design of the products and systems which they procure. The specifications most commonly used belongs to the MIL-STD-460 series which includes:

- MIL-STD-461A—Electromagnetic Interference Characteristics Requirements for Equipment .
- MIL-STD-462 —Electromagnetic Interference Characteristics, Measurement of
- MIL-STD-463 —Definition & Systems of Units, Electromagnetic Interference Technology
- MIL-STD-469 —Radar Engineering Design Requirements, Electromagnetic Compatibility

In the past, the Army, Navy, and Air Force have used a number of general-purpose interference specifications and standards for equipments and subsystems used with shipboard, submarine, aerospace, and ground systems. In general, these specifications were similar but many of the individual requirements and test methods were stated differently and had major variations. Contractors had the problem of analyzing each of these differences to determine whether requirements were, in fact, the same or different. Since thousands of manufacturers did this every time a specification was changed, it became very costly and time consuming.

Impact of MIL-STD-461A

The purpose of MIL-STD-461 is to provide military interference reduction requirements in a coordinated document. The standards and specifications superseded by this document are as follows:

Coordinated Documents

- MIL-I-6181
- MIL-S-10379
- MIL-S-12348
- MIL-I-43121

Single Service Documents

| Army | Navy | Air Force |
|----------------|---------------|-------------|
| MIL-E-55301(E) | MIL-I-16910 | MIL-STD-826 |
| MIL-I-11748 | MIL-I-17623 | MIL-I-26600 |
| | NFEC-SPEC-50Y | |

A detailed dissertation and explanation of these standards could involve a volume larger than this issue of ITEM. Therefore, this write-up will briefly highlight the differences in the active versions of MIL-STD-461 as of this writing. For a quick reference to MIL-STD-461 requirements, remove the attractive Requirements Tree and post it by your desk. Additional copies are available from Fairchild Electrometrics Corporation, 88 Church Street, Amsterdam, New York 12010.

MIL-STD-461 was first issued on July 31, 1967, but was soon replaced by 461A, dated August 1, 1968. Since the basic document is inactive and superseded by the "A" revision, the resultant changes are not important. Notice 1, dated February 7, 1969, included an addition for GSA procurements, and a modification for electric hand tools. Tables showing a comparison of this standard with inactive standards were also added to the appendix. Notice 2, dated March 20, 1969, was even less significant, simply stating that the tables in the appendix were not applicable for Air Force procurements.

Through Notice 2, the standard was still effectively a joint service document. But then came the issuance of Notice 3 (USAF), dated May 1, 1970. This notice had the following first paragraph:

"This notice is applicable to all *Air Force procurements* and should be filed in front of MIL-STD-461A, dated 1 August and supersedes that document in those areas detailed herein. In case of joint military procurement, procurement specifications shall be determined by the Procurement Office."

Impact of Notice 3

Notice 3 contained significant changes. For instance, the conducted and radiated emission limits were relaxed (see Figure 1); the radiated susceptibility limits were increased (see Table 1); Figure 12 for broadband conducted emission from 20 Hz to 50 KHz was deleted; and many requirements were changed from mandatory to optional or "to be tailored". The subsystem concept was reintroduced with the following paragraph:

"**Subsystems.**—Units or equipments that are intended to be used together shall be tested as a subsystem. Tests on individual units of the subsystem are not required unless directed by the procuring activities. (For this purpose, a subsystem would not normally be considered to be an aircraft or ground C-E shelter.)"

TABLE 1
COMPARISON OF RADIATED SUSCEPTIBILITY LEVELS (RS03)

| Notice 1 & 2 | Notice 3 | *Notice 4 | |
|------------------------|---|-------------------------|---------------|
| | | Sheltered | Non-Sheltered |
| 14 kHz to 10 GHz—1 V/M | Within metallic structure | 10 kHz to 1.9 MHz | 1 V/M |
| | 14 kHz to 35 MHz—10 V/M | 2 to 29.9 MHz | 5 V/M |
| | 35 MHz to 10 GHz—5 V/M | 30 to 400 MHz | 10 V/M |
| | 10 to 40 GHz—20 V/M (optional) | | |
| Exposed | 10 kHz to 40 GHz—200 V/M (frequency tailored) | RS03.1 | |
| | | 2 to 29.9 MHz | 20 V/M |
| | | 30 MHz to 1.9 GHz | 50 V/M |
| | | 2 to 12.4 GHz | 10 V/M |
| | | RS03.2 | |
| | | function of Rcvr. freq. | 20 V/M |
| | | | 5 V/M |

*The susceptibility limits apply for both horizontally & vertically polarized fields from 30 MHz to 12.4 GHz

Among many other changes, new paragraphs to cover production testing, armament and design guidance were added. Thus, Notice 3 was the first real polarization of the joint service standard to a single service (USAF) since its issuance.

Impact of Notice 4

Not to be outdone, the Army (USAE, Fort Monmouth) issued Notice 4 (EL), dated 9 February 1971. The front page contained the following statement:

"This notice is applicable for all Army procurements and shall be filed in front of MIL-STD-461A, dated 1 August 1968 superseding the document in those areas detailed herein. In case of joint Military procurement, procurement specifications shall be determined and coordinated by the procurement office."

The changes contained within Notice 4 were even more far-reaching than Notice 3. In effect, a new 71 page document was issued which could stand alone without the basic standard or previous notices. Some of the changes can be seen on the Requirements Tree, Table 1 and Figure 1. Others include a new conducted transient emission requirement, a system/subsystem definition and application, a list of equipment which are specifically exempt from the requirements, plus extensive matrix tables of equipment types versus requirements.

Impact of MIL-STD-461B

It is interesting to note that while notices 3 and 4 were being issued, MIL-STD-461B was distributed in November 1970 and presently is being circulated by the Electronic Industry Association (EIA) for comment on behalf of the tri-services.

The only significant difference in requirements between 461A Notice 3 and 461B is the application of RE01 and RS01, magnetic field emission and susceptibility. In Notice 3 they are not required and in Notice 4, they are to be tailored to the item. Actually, MIL-STD-461B encourages the tailoring of requirements and especially the limits to the end item and its intended use, where 461A is less flexible. It should be noted that the proposed tailoring includes making some limits more severe as well as relaxing others. All of the test requirements including limits have been written for use with the present MIL-STD-462 test techniques. MIL-STD-461B acknowledges that MIL-STD-462 is currently under revision which when issued, will result in further revision of MIL-STD-461B.

**Figure 1:
Comparison of Limits for Conducted Narrowband Emissions**

