

## INTRODUCTION

We have all long awaited the issuance of MIL-STD-461B. If you will recall, this was to be the standard of specifications in the area of EMC. It was to set the pattern for EMC requirements and measurement for the free world for the next decade. The HEW FDA has patterned its requirements towards what they anticipated the B version to contain. NATO and other armed forces use MIL-STD-461 as a baseline and are sure to closely follow suit.

Now, we really are going to stick our necks out. Informed sources report that MIL-STD-461B has finally received the blessing of all three services (Army, Navy and Air Force) and has started through the route of final release. As of this date (December 1979), it has been edited and submitted for document management review. We have been informed that it will be released in February or March, 1980, at the latest.

The 1979 issue of ITEM provides a fairly accurate description of its contents. The Requirements Tree, provided as part of Electro-Metrics' insert, is also relatively accurate. (Copies of this Requirements Tree can be obtained directly from Electro-Metrics.) No attempt will be made to repeat what already has been covered in ITEM 79 on MIL-STD-461B. Instead, we will supplement the last issue by presenting some new insights into its contents.

## PARTS

MIL-STD-461B will have ten parts, as shown in Table 1. Part 1 will be the basic document and defines the basic requirement for the control of electromagnetic interference. It contains some definitions not included in MIL-STD-463 and defines the requirements for EMC documentation, such as test plan, control plan and test reports.

The first step towards tailoring the requirements in consideration of the equipment's or sub-system's intended environment is accomplished by the establishment of the sub-parts; Parts 2 through 10. For instance, if an equipment will be used in an aircraft, Part 2 shall apply. If the equipment is for a submarine, Part 6 will apply. This breakdown is obvious from Table 1.

The manner in which the requirements vary between parts is illustrated in Table 2. Here, it can be seen, as an example, that CS09 is applicable only in Parts 4, 5 and 6 and CE07 is applicable only in Parts 2, 3, 4, and 7. Table 3 gives another breakdown of the requirements versus the parts, and also describes the requirement.

## DELETIONS AND NEW REQUIREMENTS

Among the new requirements added since the last review of MIL-STD-461B include the following:

**CE07:** This is a time domain transient limit applicable to the power lines for Navy Air Force procurements. It limits conducted switching transients to  $\pm 50\%$  of nominal rms voltage on AC leads, and  $+ 50\%$ ,  $- 150\%$  of nominal line voltage on DC leads. No time duration is given.

**CS09:** This is a requirement to inject noise currents between the equipment case and structure. It applies to Navy procurements only and is for equipment and subsystems that have an operating frequency range of 100 kHz or less and an operating sensitivity of 1 microvolt or less. The injected current starts at 1 ampere at 60 hertz and decays in a varied fashion until it reaches 100 ma at 100 kHz.

**UM03,** These also are new requirements. Commercial equipment defined under Part 10 (UM05) does not apply to oscilloscopes, computers, etc., unless specifically specified by contract. (We assume that such devices will have to meet the FCC Part 15 Requirements for restricted radiation devices.) Part 10 does apply to tools, shop equipment, heaters, battery chargers, vending machines, laundry equipment and the like.

There are some significant deletions from MIL-STD-461A and earlier versions of MIL-STD-461B in the latest issue. (Significant only because of the often misapplication of the Standard.) The inverse filter method of measuring conducted emissions (CE05) has been deleted, as has the radiated requirement for overhead power lines (RE06). RE05 covering vehicles and engine driven equipment has been replaced by UM03 whereas CE02 and CE04 have been combined with CE01 and CE03. The requirement to measure magnetic fields over the .02 to 50 kHz frequency range has been dropped, as has the one signal generator method of measuring a receiver's rejection of undesired signals from 30 Hz to 10 GHz (CS08). The two signal generator method (CS04) is still in effect.

## DEFINITIONS

The following are some important definitions and other ramifications pertinent to MIL-STD-461B:

**Critical Area:** A location on a platform or installation containing equipment or subsystems which, if malfunctioning due to unwanted electromagnetic energy, could degrade the overall system performance and result in failure or abortion of a primary mission. All locations on a submarine and surface ship are considered critical areas.

**Non-Critical Area:** A location in a ground installation where EMI will not result in failure or abortion of a mission or degradation of the overall system performance. Examples of areas which may be considered non-critical are: office buildings, recreational areas, laundry, food servicing areas, drafting rooms and woodworking shops.

**Sheltered Subsystem:** Equipments and components designed specifically for installation in standard military shelters which comply with MIL-STD-285 and which are not intended to meet the natural environments, such as humidity, temperature, and so forth.

**Interconnecting Leads:** Control and signal lines which interface with other equipments or subsystems not being supplied under the same contract.

**Tailoring:** The process by which the requirements of this standard are adapted (i.e., modified, deleted or supplemented) to the peculiarities, characteristics or operational requirements of the material in an individual equipment or subsystem specification. The tailoring process does not constitute a waiver or deviation. The latter terms are defined in MIL-STD-480.

**System:** A composite of equipment, subsystems, skills and techniques capable of performing or supporting an operational role. A complete system includes related facilities, equipment, subsystems, materials, services and personnel required for its operation to the degree that it can be considered self-sufficient within its operational or support environment. (EMC requirements for systems are not included in this standard, but rather in such documents as MIL-E-6051, MIL-STD-1541 and 1542).

# ESSENTIAL APPARATUS FOR PERFORMING TESTS IN ACCORDANCE WITH MIL-STD-461A /462

TYPE NO.	DESCRIPTION	CE 01	CE 02	CE 03	CE 04	CE 05	CE 06	CS 01	CS 02	CS 03	CS 04	CS 05	CS 06	CS 08	RE 01	RE 02	RE 03	RE 04	RE 05	RE 06	RS 01	RS 02	RS 03	RS 04
6220-1A	Audio Isolation Transformer	x <sup>1</sup>						x					x									x		
6254-5S	RFI Transient Generator												x									x		
6338-5-PJ-50-N	LISN		x <sup>2</sup>		x <sup>2</sup>				x <sup>2</sup>							x <sup>2</sup>								
6338-57-PJ-50-N	LISN		x <sup>2</sup>		x <sup>2</sup>				x <sup>2</sup>							x <sup>2</sup>								
6512-106R	Feed-thru Capacitor	x		x									x			x		x						
6550-1	Power Sweep Generator							x														x		
6552-1A	Amplifier, 100 watts							x															x	x
6623-( )	Low Pass Filter, 50 ohms					x	x		x	x	x	x		x										x
6741-1	EMI Current Probe	x	x	x	x	x																		
6815-1	Precision Resistor, .01 ohm																					x		
6824-( )	High Pass Filter, 600 ohms	x	x																					
6920-0.5	Resistive Network	x <sup>1</sup>																						
7021-1	Phase Shift Network																							
7032-1	Isolation Transformer, 800 watts	x	x	x	x	x										x	x	x	x	x				
7033-1	Impedance Matching Transformer								x														x	
7054-1	Spike Generator, 10 uS																							
7054-1A	Spike Generator, 50 uS												x <sup>3</sup>									x <sup>3</sup>		
7144-1.0	Precision Resistor, 1.0 ohm																					x		
7144-10.0	Precision Resistor, 10.0 ohms																						x <sup>2</sup>	
7205-( )	High Pass Filter, 50 ohms	x	x																					
7334-1	Loop Sensor																	x						
7415-1	R.F. Coupler-High Pass Filter								x															
7429-1	Loop Antenna																					x		

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NOTE: x<sup>1</sup> See Notice 3, MIL-STD-462 for CE-01 in-lieu of current probe.  
 x<sup>2</sup> Required by Notice 3, MIL-STD-462, U. S. Army Contracts.  
 x<sup>3</sup> Used on B1 aircraft susceptibility tests.

INSTRUMENTS, COMPONENTS and ACCESSORIES  
for the RFI/EMC ENGINEER

TABLE 1. BREAKDOWN OF MIL-STD-461B

MIL-STD-461 Part 1	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
Part 2	Requirements for Equipment and Subsystems Installed Aboard Aircraft, Including Associated Ground Support Equipment
Part 3	Requirements for Equipment and Subsystems Aboard Spacecraft and Launch Vehicles, Including Associated Ground Support Equipment
Part 4	Requirements for Equipment and Subsystems Installed in Ground Facilities (Fixed and Mobile, Including Tracked and Wheeled Vehicles)
Part 5	Requirements for Equipments and Subsystems Installed in Surface Ships
Part 6	Requirements for Equipments and Subsystems Installed in Submarines
Part 7	Requirements for Ancillary of Support Equipments and Subsystems Installed in Non-Critical Ground Areas
Part 8	Requirements for Tactical and Special Purpose Vehicles and Engine Driven Equipment
Part 9	Requirements for Engine Generators and Associated Components, Uninterruptible Power Sets (UPS) and Mobile Electric Power (MEP) Equipment Supplying Power to or Used in Critical Areas
Part 10	Requirements for Commercial Electrical and Electromechanical Equipment

TABLE 2. TEST REQUIREMENTS OF PARTS

TEST METHODS	PARTS OF MIL-STD-461B									
	2	3	4	5	6	7	8	9	10	
CE01	X	X	X	X	X					
CE03	X	X	X	X	X	X				
CE06	X	X	X	X	X	X				
CE07	X	X	X			X				
CS01	X	X	X	X	X	X				
CS02	X	X	X	X	X	X				
CS03	X	X	X	X	X	X				
CS04	X	X	X	X	X	X				
CS05	X	X	X	X	X	X				
CS06	X	X	X	X	X	X				
CS07	X	X	X	X	X					
CS09			X	X	X					
RE01	X	X	X	X	X					
RE02	X	X	X	X	X	X				
RE03	X	X	X	X	X	X				
RS01	X		X	X	X					
RS02	X	X	X	X	X	X				
RS03	X	X	X	X	X	X				
UM03							X			
UM04								X		
UM05										X

**Navy Procurement:** Compliance with MIL-STD-1385 shall be accomplished and OD 30393 shall be used as a design guide in implementing the principles outlined in MIL-STD-1385. In addition, MIL-STD-1377 shall be used to determine the effectiveness of cable, connector and weapon enclosure shielding and filtering. For air weapons, all circuits shall be isolated from the equipment or subsystem case and the case bonded to airframe.

**Army Procurement:** Air Force and Navy definitions shall be used as specified in the procurement documentation.

**Air Force Procurement:** DH 2-5 shall be used as a design guide and compliance with MIL-STD-1512 shall be accomplished.

### MIL-STD-462B

MIL-STD-462 does not presently contain or define the procedures for the new requirements. Since the total revision of MIL-STD-462 may still be years away, we can expect to see many amendments or notices for MIL-STD-462 to be released later this year.

**TABLE 3. EMISSION and SUSCEPTIBILITY REQUIREMENTS**

REQUIREMENT	APPLICABLE 461B PART	DESCRIPTION
CE01	2 thru 6	Conducted Emissions, Power and Interconnecting Leads, Low Frequency (Up to 15 kHz)
CE03	2 thru 7	Conducted Emissions, Power and Interconnecting Leads, 0.015 to 50 MHz
CE06	2 thru 7	Conducted Emissions, Antenna Terminals, 10 kHz to 26 GHz
CE07	2, 3, 4, 7	Conducted Emissions, Power Leads, Spikes, Time Domain
CS01	2 thru 7	Conducted Susceptibility, Power Leads, 30 Hz to 50 kHz
CS02	2 thru 7	Conducted Susceptibility, Power Leads, 0.05 to 400 MHz
CS03	2 thru 7	Intermodulation, 15 kHz to 10 GHz
CS04	2 thru 7	Rejection of Undesired Signals, 30 Hz to 20 GHz
CS05	2 thru 7	Crossmodulation, 30 Hz to 20 GHz
CS06	2 thru 7	Conducted Susceptibility, Spikes, Power Leads
CS07	2 thru 6	Conducted Susceptibility, Squelch Circuits
CS09	4, 5, 6	Conducted Susceptibility, Structure (Common Mode) Current, 60 Hz to 100 kHz
RE01	2 thru 6	Radiated Emissions, Magnetic Field, 0.02 to 50 kHz
RE02	2 thru 7	Radiated Emissions, Electric Field, 14 kHz to 10 GHz
RE03	2 thru 7	Radiated Emissions, Spurious and Harmonics, Radiated Technique
RS01	2 thru 6	Radiated Susceptibility, Magnetic Field, 0.03 to 50 kHz
RS02	2 thru 7	Radiated Susceptibility, Magnetic Induction Field, Spikes and Power Frequencies
RS03	2 thru 7	Radiated Susceptibility, Electric Field, 14 kHz to 40 GHz
UM03	8	Radiated Emissions, Tactical and Special Purpose Vehicles and Engine-Driven Equipment
UM04	9	Conducted Emissions and Radiated Emissions and Susceptibility, Engine Generators and Associated Components, UPS and MEP Equipments
UM05	10	Conducted and Radiated Emissions, Commercial Electrical and Electromechanical Equipments