MIL-STD-461D/462D CS115 Test Method

ROBERT GOLDBLUM
R & B Enterprises

The process of revising MIL-STD-461 and MIL-STD-462 has been completed. The "D" version of the standards was published in January 1993. Copies became available in February 1993. To obtain a copy, contact the Defense Printing Service, Standardization Documents Order Desk, 700 Robbins Ave., Bldg. 4, Section D, Philadelphia, PA 19111-5094. Tel.: 215-697-2179.

Many significant changes have been reflected in the revisions to MIL-STD-461 and MIL-STD-462. These include deletions, additions, and modifications to older requirements. Most of the changes are the direct result of special studies undertaken by the Tri-Service EMI Standardization Working Group.

Many of the requirements and test methods in the revised documents can be understood and properly performed with a thorough study of the appendices. Appendices explain the rationale and soundness of each requirement, and provide information for tailoring in cases where a procuring activity must modify the MIL-STD-461D requirements or MIL-STD-462 test methods.

CS115 features a fast rise time waveform and a repeatable coupling mechanism.

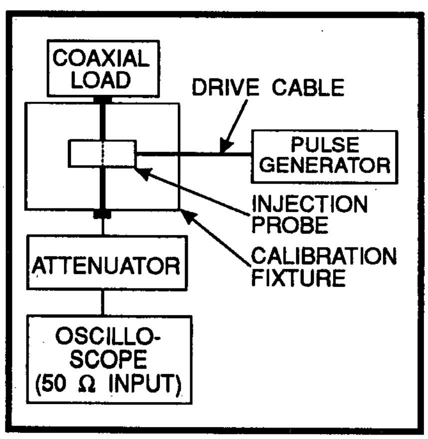

FIGURE 1. *Calibration Setup (Figure CS115-2 in MIL-STD-462D).*

CS115, "Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation," one of the new tests described in the revised standards, has been selected as the subject of this article to illustrate the importance of the appendices to the revised standards.

The CS115 requirement is applicable to all aircraft and space system interconnecting cables, including power cables. Figure 1 shows the calibration setup specified in MIL-STD-462, and Figure 2 shows the method used to measure the bulk cable injection. As specified in MIL-STD-461D, the EUT should not exhibit any malfunction or susceptibility when subjected to a calibrated 30 ns test signal at a 30 Hz rate for one minute.

The CS115 test is intended to replace the "chattering relay" type measurements (RS06 in previous versions of MIL-STD-461) which were commonly used in equipment procurement for aircraft applications. The chattering relay was found to be effective for determining upset conditions of equipment. The basic concept was to electrically connect the relay coil in series with a normally closed contact and allow the relay to continuously interrupt itself. The wire between the coil and the contact was used to couple the transient onto the EUT cables. However, use of the chattering relay measurements was criticized as unscientific; since an arcing process is involved, it does not produce a repeatable waveform. The particular relay being used and the condition of its contact and coil mechanisms play a major role in this measurement technique.

CS115 retains the most important characteristic of the chattering relay, the defined fast rise time waveform. CS115 also has the important advantage of a consistent, repeatable excitation waveform. The 5-ampere amplitude (500 volts across a 100-ohm loop impedance calibration fixture) covers most levels that have been observed during system level testing of aircraft to transient environments.

Without consulting the appendices, one might assume that the 30 ns pulse should appear on the cables when tested in accordance with Figure 2. This is not the case. The waveshape shown in Figure 3 represents the generator output into a matched 50-ohm load. Once this waveshape is connected to a current probe, either in a calibration fixture or around a cable, the Figure 3 waveshape is no longer observed. Figure 4, which has been taken from the appendix of MIL-STD-462,

Continued on page 154

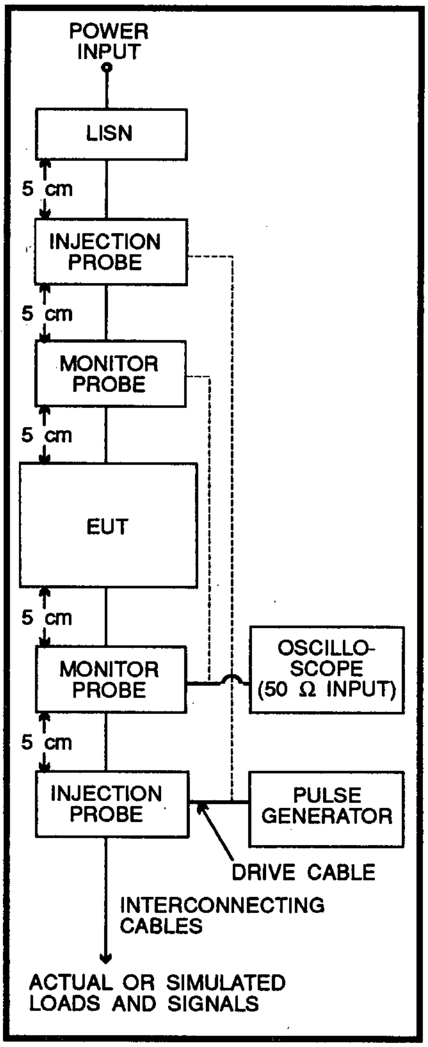

***FIGURE 2.** Bulk Cable Injection (Figure CS115-2 in MIL-STD-462D).*

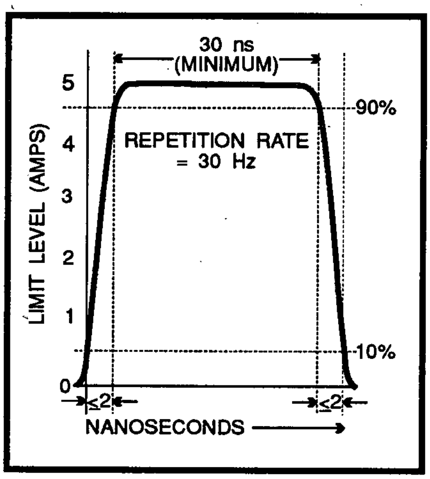

***FIGURE 3.** CS115 Calibrated Signal Source Characteristics for All Applications (Figure CS115-1 in MIL-STD-461D).*

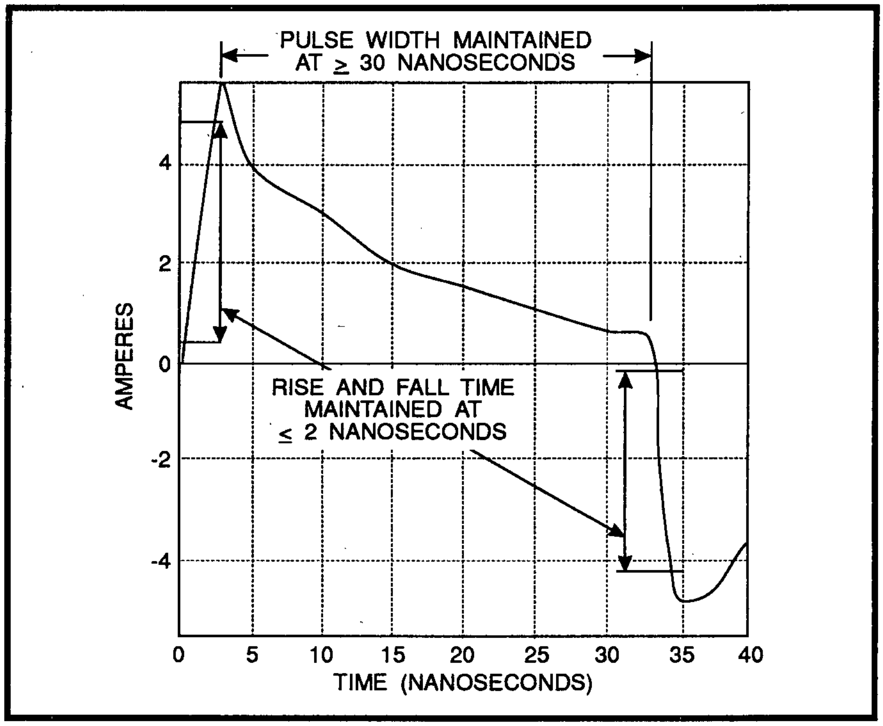

***FIGURE 4.** Typical CS115 Calibration Fixture Waveform (Figure A-11 in MIL-STD-462D).*

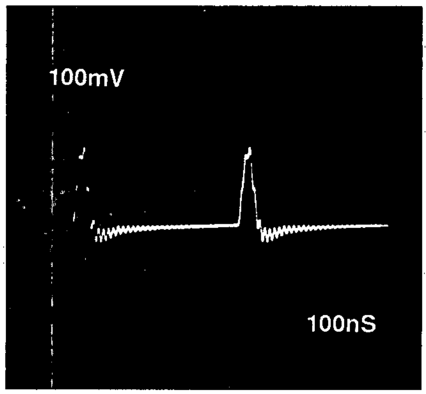

***FIGURE 5.** Current Response in 2-meter Wire (Short to Ground Plane).*

shows the typical CS115 calibration waveform that is observed when calibrating per Figure 3. Figure 5 shows what is typically found when monitoring the cable into which the transient is induced. This oscilloscope photo is of an initial pulse with a 35 ns pulse width and a 5 ns rise and fall time. What is actually seen on the cables when the test is performed will be dependent upon the bandwidth of the current probe, the impedance of the cables under test, the bandwidth of the oscilloscope, and the source impedance of the pulse generator.

MIL-STD-461D promises to effect major changes in many areas of E^3 testing. To thoroughly understand the CS115 test and other methods set forth in the new standard, users must consider them in conjunction with their corresponding appendices.

NOTICE

As part of its ongoing E^3 efforts, the U. S. Army is sponsoring an industry/government roundtable discussion of commercial and military EMC specifications at Fort Monmouth during the first week of May, 1993. MIL-STD-461D/462D will be among the topics discussed. Contact Mr. Carlos Alvarado at 908-532-1441 or 908-532-1712.

***ROBERT D. GOLDBLUM** is founder and president of R & B Enterprises, a manufacturer of CS115 pulse generators. He created the publication ITEM in 1971 and formed the EMC Science Center, Inc. in 1978. Through his publications and lectures, he has authored more than 100 works in the field of electromagnetic compatibility.*

Mr. Goldblum received his Bachelor's Degree in Electrical Engineering and a Master's Degree in Engineering Science from the Pennsylvania State University. He is a fellow of the IEEE and has served as editor of the IEEE EMC Newsletter for the past 24 years. Mr. Goldblum can be reached at (215) 825-1960.