Chapter 4
Electromagnetic Compatibility for Space Applications:
Test Specifications, Standards, and Methods

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ABSTRACT

In a space system or equipment, electromagnetic compatibility is a critical aspect affecting its operation, function, and performance. In the beginning of this chapter, an overview of the electromagnetic compatibility main considerations is provided. Then the main electromagnetic compatibility standards and relative useful handbooks for space applications are briefly presented. Testing methods and procedures to assess electromagnetic compatibility of space systems and units are discussed briefly covering all kinds of measurements. Moreover, information regarding the instrumentation and the testing facilities is also provided. Mission testing requirements and limits are also presented as examples for every electromagnetic compatibility test. Recent developments in test methods are also discussed where applicable.

INTRODUCTION

The main tool to assess electromagnetic compatibility of any electronic or electrical system for all industries, including space industry, is a variety of tests and measurements which represent actual phenomena in a controlled laboratory environment. What is very important when testing in laboratory environment, is to
ensure reproducibility and repeatability of test and/or measurements results. This is achieved primarily by the use of test standards produced by expert’s committees. In these standards measurements and instrumentation principles apply together with the theoretical background relative to the nature of the electromagnetic phenomenon.

The objective of this chapter is to provide an overview of the main aspects of the electromagnetic compatibility such as the technical standards available (or suitable for the space sector) and the main tests typically performed to on-board equipment in spacecrafts or satellites. Effort was made to include as many information as possible in the frame of this context, like instrumentation requirement, general test arrangements, experienced difficulties but also alternative test solutions. The information provided is dealing only with unit testing; system testing in the space sector utilizes similar test methods but tailoring is expected in some cases.

General measurement principles and requirements are also discussed.

BACKGROUND

According to the definition found in the new and the older EMC EU Directive, but also in other relative contexts, “Electromagnetic compatibility” is the ability of equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other equipment in that environment. This definition is valid for all systems and devices regardless of the operating environment (industrial, commercial, military or space).

Another useful definition is regarding “electromagnetic disturbance” which is any electromagnetic phenomenon which may degrade the performance of equipment or a system and may be electromagnetic noise, unwanted signals or changes in the propagation medium itself.

An important aspect of electromagnetic compatibility of systems or equipment is their “susceptibility” (immunity) which defines a measure of the ability to perform as intended without degradation in the presence of an electromagnetic disturbance.

In general, the assessment of the electromagnetic compatibility of a system or unit is performed by making specific tests based on methods described in relevant standards. Depending on the field of application different kind of standards applies. Some tests are similar or even identical. However, limits or performance criteria could be different for different application areas like between space and commercial systems or units.

Electromagnetic compatibility for space applications utilize test methods similar or identical to military ones, like MIL-STD-461-F/G. Differences are encountered in test limits or specific parameters of tests like for example frequency range or, in some case, in instrumentation. For systems used in commercial applications, like
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