

Reverberation chamber for electromagnetic compatibility testing of electric thrusters

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F. Kiefer¹, K. Holste² and P.J. Klar³
Institute of Experimental Physics I, Justus-Liebig-University, 35392 Giessen, Germany

Y. Rover⁴, U. Probst⁵ and C. Volkmar⁶
*Center of Competence for Nanotechnology and Photonics (NanoP), THM - University of Applied Sciences, 35390
Giessen, Germany*

The need for electromagnetic compatibility (EMC) of electrical devices on satellites increases dramatically as the number of satellites is rapidly growing and the density of electrical devices on the satellite increases due to their miniaturization. Thus, EMC of the electric propulsion system becomes an important issue for a safe operation of the satellite. Since electric thrusters usually need to be operated in vacuum, dedicated facilities are required to assess their EMC. Here, we present how a cylindrical vacuum vessel can be converted into a reverberation chamber suitable for EMC pre-compliance testing of electrical thrusters. We describe and validate its operation principle and discuss its limitations. Finally, we compare first measurement results of radiated emission measurements of a thruster and compare those with data obtained for the same thruster in a semi-anechoic chamber connected to a vacuum tank where the thruster is operated.

I. Nomenclature

f_0	=	lowest resonance frequency
f_{min}	=	lowest working frequency to comply EMC requirements
d	=	diameter of a cylindrical cavity
l	=	length of a cylindrical cavity
$\alpha(\Delta r)$	=	free space attenuation pending on distance difference
SNR	=	signal-to-noise ratio adapted on electric field results

II. Motivation and Background

The demand for electric propulsion (EP) increases as space launches get more affordable and more and more satellite formations are successfully commissioned. Commercialization drives this sector. On the one hand, time-to-market of space devices drastically needs to be reduced in order to be more cost effective. On the other hand, safe operation of devices, such as thrusters, on satellites in space must be ensured. Corresponding proofs of product quality and durability require exhaustive testing. In this context, interoperability becomes a major requirement as the density of electronic devices on satellites increases and the satellites themselves are further miniaturized. [1] EP systems like

¹ Research Assistant, Ion Propulsion Research Group, felix.kiefer@expl.physik.uni-giessen.de

² Senior Researcher, Ion Propulsion Research Group, kristof.holste@expl.physik.uni-giessen.de

³ Professor, Ion Propulsion Research Group, peter.j.klar@expl.physik.uni-giessen.de

⁴ Research Assistant, Space Electronics Group, yannik.rover@ei.thm.de

⁵ Professor, Space Electronics Group, uwe.probst@nanop.thm.de

⁶ Professor, Space Electronics Group, chris.volkmar@nanop.thm.de

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