

Evaluation of electromagnetic compatibility (EMC) performance of the Lunar Radar Sounder (LRS) onboard the SELENE spacecraft

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Electromagnetic compatibility (EMC) performance of the Lunar Radar Sounder (LRS) onboard the SELENE spacecraft have been evaluated based on the data obtained by the System EMC Test in October, 2006 at Tsukuba Space Center (TKSC) of Japan Aerospace Exploration Agency (JAXA). The main purposes of the LRS are (1) to observe the lunar surface and subsurface structures by using an FMCW radar technique in HF frequency range, and to observe the plasma waves and planetary radio waves in a wide frequency range from 10 Hz to 30 MHz. In order to detect the observations of the lunar subsurface echoes and planetary radio waves by the LRS system, the intensity of artificial noises from the spacecraft itself should be suppressed below the signal intensity. Based on Ono et al. [2000], the echo signal level from subsurface structures 5 km below the surface is estimated to be -104dBm, assuming transmitting power of 800 W, the spacecraft height of 100 km, and dielectric loss tangent of 0.06. The equivalent electric field intensity and input level at the LRS preamplifier are -10dBuV/m and 4uVrms, respectively. Jovian hectometric (HOM) and decametric (DAM) waves in active case, whose flux density is about 3×10^{-20} W/m² Hz at the moon, can be detected as the same level signal at the LRS preamplifier input. Therefore all components and whole system of the SELENE spacecraft are required to satisfy the following EMC regulations: (1) Radio emission (RE) noises should be less than -10dBuV/m, and (2) common-mode currents should be less than 20dBuA. In order to ensure that common-mode currents below the regulation level can not produce any large noises at the LRS preamplifier input, the impedance between the spacecraft panels in HF frequency range are also controlled to be below 1 ohm. The final evaluation of the artificial noise level from the spacecraft was carried out based on the data obtained by LRS receivers with 10m-tip-to-tip dummy antennas. The LRS data clearly shows that (1) the artificial noise level in a frequency range from 4MHz to 6MHz is enough low to detect the sounder echoes from the lunar subsurface structures 5km below the surface, and that (2) the artificial noise level in a frequency range from 1 MHz to 30MHz are generally enough suppressed to observe the Jovian HOM and DAM waves from the moon.