Feasibility study for a nanosatellite-based instrument for in-situ measurements of radio noise

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The radio environment on the earth is heavily affected by manmade sources such as radio transmissions, radars, and the like. The effect is particularly strong at MF frequencies and below, since the signals can propagate large distances via ionospheric bounce. Terrestrial magnetometer measurements have long been used to predict the Kp index, which is related to radio transmission at these ranges. Space weather measurements and models can also predict propagation of MF signals on the ground.

However, very few RF measurements have been made in situ at low earth orbits, particularly in the LF to HF range. This is in part due to the high cost of satellites compared to the limited practical and scientific interest in that frequency range. The problem is noise: scientific measurements are dominated by man-made noise, while natural noise makes practical applications such as communications difficult.

An LF-HF instrument in this range would more or less be measuring just noise, of one sort or another. It is difficult to justify high-cost scientific missions of this type.

However, nanosatellites could be a realistic low-cost platform to stage measurements in this understudied area. We are starting a feasibility study for an ultra-miniature and ultra-low-cost instrument that could make in-situ measurements of RF noise in low earth orbit.

The design philosophy will be based on ordinary radios rather than traditional plasma instruments. Measurements can be made with small coil antennas, especially when using high-permeability cores. We will be studying whether this approach can result in an instrument small enough to fit on a nanosatellite.