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CUBESAT FOR RADIO ASTRONOMY AT LOW FREQUENCIES (CURALF)

Abstract

Although space launches are becoming more common, the costs involved in launching big satellites are still very high. Cubesats are a solution that have emerged in the recent past as a worthy alternative as they provide a cost and time effective solution to the problem. After the successful launch of the NCLE (Netherlands China long Wavelength Explorer), efforts have been taken to reduce the size of the instrument while retaining its functionality. NCLE was an instrument of several cubesats together.

The project CURALF (CUbesat for Radio Astronomy at Low Frequencies) is being developed for a similar mission as NCLE. This includes a highly sensitive and linear receiver for a wide bandwidth: 80 kHz - 80 MHz. This is needed to perform the low frequency radio observations for unique science opportunities. The long term goal is to launch a swarm of satellites in space, that, all together, form an antenna at these low frequencies with a diameter of up to hundred kilometer. This is not possible on Earth, because our atmosphere blocks the signals in this frequency range. Since a lot of satellites are needed to fill the required aperture, small and cheap satellites must be used. The cubesat platform will makes this possible.

This paper focuses on the analog part of the payload. This consists of the antenna, the low noise amplifier, some filters and the analog-to-digital converter. The paper discusses the requirements, based on past data and missions, presents the system design and the specifications of the individual subsystem in detail.This includes the effect of the space environment, space radiation and plasma effects.

One of the major challenges in the NCLE design was coping with the internal RFI/EMC issues. In the design of CURALF, RFI/EMC is taken into account from the start onwards. In the paper this approach will be discussed in more detail.

The CURALF design is one step closer to the final goal of having hundreds to thousands of cubesats swarming around in a 100 km sphere to probe the very early Universe.