COMMUNICATION MODULE FOR SWARM NANOSATELLITES

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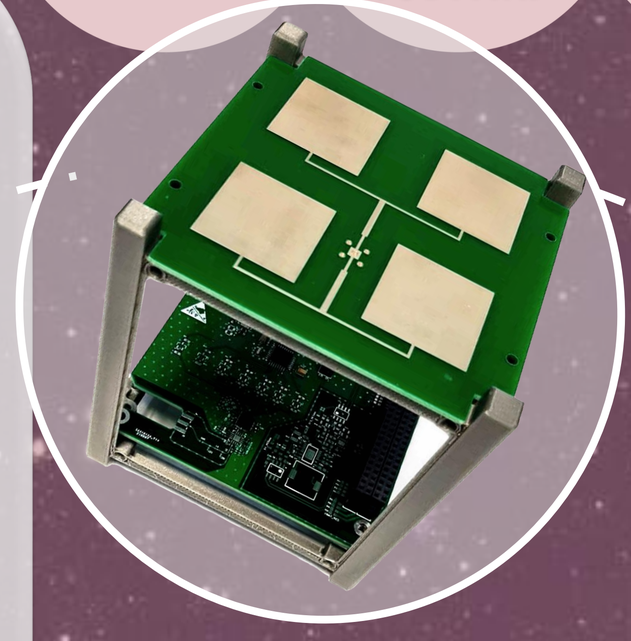
Introduction

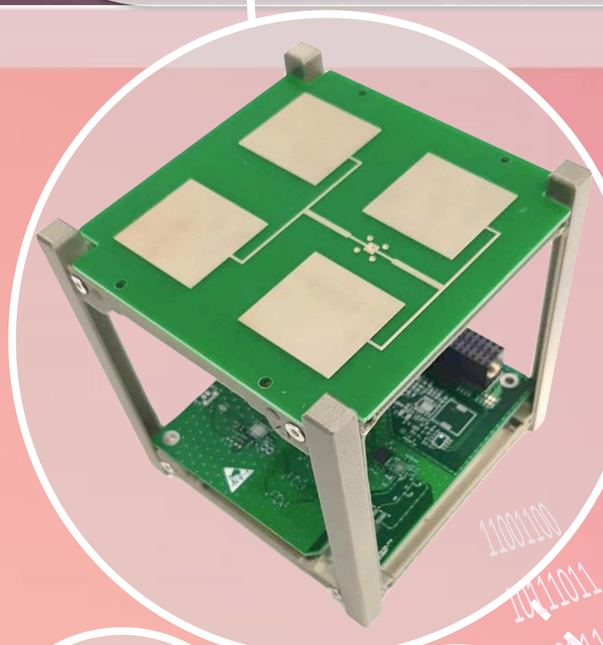
According to NASA, nanosatellite is anything that weighs between 1 and 10 kilograms. Our research is concentrated on swarm satellite systems and swarm communications. Swarm nanosatellites are systems consists of a group of nanosatellites communicating with one another and with ground station. In this method, wider region can be covered by satellites and more data can be collected at the same time. The nanosatellite will usually be in low earth orbit (LEO), so power, temperature, etc. factors must also be taken into account. It is of great importance to design a suitable communication module for swarm nanosatellites operating in the S band with low-cost, commercial off the shelf (COTS) sub-modules. S Band is the microwave band in the electromagnetic spectrum covering 2 to 4 GHz. In communication satellites, it is predicted that it will be more advantageous to use S band for data rate due to increased bandwidth.



Methodology

In **hardware design,** a transceiver radio frequency PCB is designed to operate in LEO conditions. In addition, with the designed microstrip patch antenna array, it is aimed to achieve much more efficiency at low cost and in a short time. The nanosatellite will usually be in LEO, so the appropriate components have been selected considering factors such as power and temperature. In the **software part,** the transceiver was configured according to swarm algorithms and the communication connection was established. Swarm communication consists of two types of communication. One is between ground control and the swarm, and the other is communication within the swarm.

To minimize the amount and effects of electromagnetic interference, PCB design has been ensured to comply with EMC and EMI design guidelines.

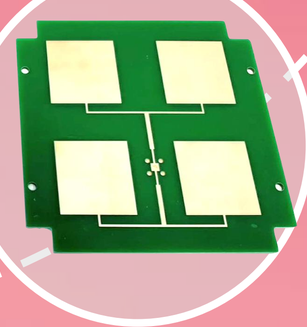


Transceiver

High Data Rate

Low Cost

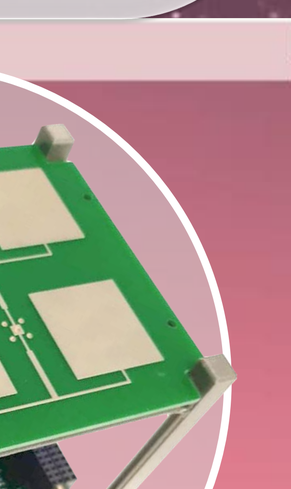
ANTENNA TEST SETUP



S BAND MICROSTRIP ARRAY ANTENNA
Allocated frequency 2.4 GHz

S BAND TRANSCEIVER
Microprocessor in the module handles the control of the front-end

SEPARATE FRONT-END DESIGN



INTEGRATED FRONT-END DESIGN

POWER REGULATOR DESIGN

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