

Antenna system for the DTUsat

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1 Purpose of the project

As part of the challenging quest of building a small satellite, the DTU_{sat}, within a year or so, it was decided that this satellites should have a communication system, enabling it (the satellite) to send and receive data. A natural part of such a system is the antenna system which is responsible for taking signals from the radio and transmit it to -hopefully- earth, and delivering received signals to the radio.

It is our aim during the following special course, to design and build a prototype of the antenna system for the DTU_{sat}.

Where the antenna system is taken to begin at the connectors (signal) from the radio. This implies that a possible feeding circuit is part of the antenna system, as is transmissions lines to the radio (see section 3 for more details), and of course the antenna it self.

2 Timetable and activities

The students participating in building the antenna system have all studied fundamental electromagnetism, but none have studied field theory nor antennas. Therefore the first part of the project involves a lot of reading. Here we have listed a number of things that we have to get into in order to enable us to chose the best design solution of the antenna for the DTU_{sat}:

- Electromagnetic wave propagation
- Different antenna types and antenna configuration, including antenna arrays.
- Antenna characteristics:
 - Polarisation and how it affects the propagation of the electromagnetic waves through the atmosphere.
 - Radiation pattern.
 - Impedance.
 - Radiation impedance etc.
- How similar problems have been solved in the past.

Further we need to get familiar with a simulation program for design of antennas (AWAS or WIPL). In order to know how these program works, it will be necessary to learn some of the theory behind integral equations.

After this we intend to design different solutions and by help of computer simulations (using the programs mentioned above) to find the better design.

When the design period is over we plan to make a number of prototypes, which will be tested at DTU. All of this should enable us to craft the flight model during a tree week course in January/Feburay 2002.

A precise timetable is stated below.

Period (week nr.)	Work specification
36-41	Learning about antenna technique and how similar problems have been solved. Specification of requirement for the antenna system. Getting familiar with simulation program.
42	Autumn break
43-48	Design and selection of best solution
51	Documentation
2-4	Prototype production and testing
Feburay	Flight model

3 Interfaces to other DTU Sat groups

Due to the nature of the antenna system, there will be a number of interfaces to other DTU Sat groups. The purpose of this section is to establish a brief overview of these interfaces.

There will quite obviously be a number of issues to clarify with the radio group. These include, choice of frequency, whether to have separate antennas for transmitting and receiving (half or full duplex), connectors, impedance matching etc.

Also there will be things regarding the antenna, which depends on, or will affect other groups, namely :

- the mechanical structure of the satellite (Where the antenna(s) can, or is to, be attached, its size, weight, deployment, placement of transmissionlines etc.).
- Soft- and/or hardware group regarding deployment(when to deploy).

- The power group, in case of the antenna(s) shadowing for the solar panels, thus reducing the available power on the satellite.
- The attitude control group, whom's abilities and decisions on attitude control, will have a major impact on the antenna design.
- Finally there is a question regarding the ground station group, with who polarisation, frequency, gain etc. is to be discussed - in the event of another group dealing with this part of the project.