How To Leverage Amateur Radio In Space

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Introduction

Who is this document for? You may belong to one or more of the following categories.

You want to deploy an amateur radio spacecraft.
You want to include amateur radio operators.
You want to use amateur radio frequencies.
You are interested in using SatNOGS.

Amateur radio is about the operators. The licensees in the amateur radio satellite service are individual people. They have a license not just to use communications resources in space, but they are also licensed to control spacecraft, with the permission of the spacecraft license holder.

The Amateur Radio Satellite Service is a non-commercial communications service available worldwide. It is dedicated to education, experimentation, and the amateur use of space.

The VHF international amateur satellite frequency allocation is 144.000 MHz - 146.000 MHz with 145.800 MHz - 146.000 MHz being recommended and preferred. The UHF international amateur satellite frequency allocation is 435.000 MHz - 438.000 MHz. There are other allocations on other bands, but these are the most heavily used at this time.

Providing a spacecraft that is useful to the amateur radio satellite service is not difficult, but there are aspects that may be non-intuitive coming from a commercial or academic background. There are expectations from the amateur radio community of spacecraft that operate on amateur radio bands.

The starting point is https://www.iaru.org/reference/satellites/

This site contains a wealth of information about Amateur Radio in Space. Carefully reviewing the entire site will put your project and your team in the best possible place to leverage the global amateur radio satellite service.

Once this set of documentation has been read, then community standards can be adopted.

Community Standards

The advice following about community standards is hard-won. If this advice is followed, the amateur radio aspects of your project have a much better chance of being successful.

1) Use forward error correction for digital downlinks. Use open protocols and

open source.

2) Test over the air, as soon as possible, in the lab, on the ground, well before launch.

3) Clearly describe how amateur radio operators will receive your signal. Operators of satellites in the amateur-satellite service must publish full details of their modulation, encoding and telemetry formats and equations before launch. Publish details long enough in advance so that amateur radio operators can implement and test receiver designs. Use Science-Technology-Engineering-Math (STEM) educational organizations to get the word out. Use your local AMSAT Societies and related groups to get the word out. Describe the air interface as early as possible, even if this is before any software is ready.

4) Make and publish a recording of your telemetry signal to allow amateurs to test demodulation and decoding of your signal.

5) What's in this for amateur radio operators? What is the added value of the project for the ham radio community? Is there an amateur radio transponder available for general use? If not, then support from the amateur community may be very low.

6) Incorporate SatNOGS.

SatNOGS has a very useful guide for satellite builders that want to use amateur radio.

https://wiki.satnogs.org/Satellite_Operator_Guide?
fbclid=IwAR2gE0q8XlWN3HatnLPuVIo9-
Y3TFq2uzAqgWN2O7ErjWCYymTrbS6cEbD0

Thank You

If you are reading this, you know that forward error correction or changing frequencies can't be done at the last minute. The amateur satellite community can be highly valuable active participants in your satellite mission, if they have the information they need about the project.

If the project provides useful communications services and engaging opportunities to amateur operators, then the benefits are plentiful and powerful. Announcing amateur radio plans early enough to get engagement and quality feedback, and publishing all the details, are the key concepts.

Do you know of a team that is starting to look at using amateur radio on their spacecraft? Please pass this along to them.