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Subject: Satellites transmitting on Amateur bands with undocumented protocols or without permission

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Introduction

There is an ever-increasing number of small satellites being launched these days. Many of these resort to the Amateur satellite service as an inexpensive way of obtaining spectrum access. This is currently generating two problems: some of these satellites have not obtained IARU frequency coordination or other necessary permits but still transmit on the Amateur bands, others obtain IARU coordination but do not publish the specifications of the protocols they use, so Amateurs all over the world cannot decode the satellite signal.

Background

Over the last few years, many small satellites have been launched, and many more will be launched in the near future. Most of them are built by universities, research centres, educational institutions, small companies and start-ups. Their main mission usually ranges from concept or technology demonstrators, to in-orbit validation of certain technologies, to small research missions. These satellites do not currently have an appropriate segment of spectrum for telemetry and telecommand, so they are resorting to the Amateur satellite service as an inexpensive way of obtaining spectrum access.

To obtain permission to use the Amateur spectrum, the person responsible for the satellite must be an Amateur radio operator and go through the IARU frequency coordination process. He must submit certain technical documentation and describe the satellite mission, so that IARU can check that it would make reasonable use of the radio spectrum and that the mission is compatible with the Amateur service.

Other than the fact that the satellite responsible is a licensed Amateur operator, in many cases the involvement of the satellite team with the Amateur radio community is very small, so many of these satellites provide very little (if at all) value to the worldwide Amateur radio community.

Since the main motivation for the satellite builders to use the Amateur satellite service is to obtain spectrum access, and not to collaborate with the Amateur radio community, there are two kinds of problems which are appearing with several of these satellite projects.

The first problem is when a satellite team is denied IARU frequency coordination because the mission is not compatible with the Amateur service (or perhaps because the team does not request frequency coordination at all). In many of these cases, the satellite ends up transmitting on the Amateur radio bands without permission.

The second problem is when a satellite team goes through the IARU frequency coordination process successfully but does not publish enough technical information about the protocols

they use so that interested Amateurs can build a decoder software for the signals transmitted by this satellite.

The Amateur radio community has an excellent technical background and has made decoders that can work with many of the satellites that transmit on Amateur radio bands. Some examples are the gr-satellites project by the author of this paper, the Soundmodems by Andrey Kopanchuk UZ7HO and the telemetry decoders by Mike Rupprecht DK3WN. However, many satellites use completely ad-hoc protocols, so creating a new decoder for these satellites without the appropriate documentation is usually a daunting task.

Problems caused to the Amateur satellite service

Satellites transmitting on the Amateur bands without permission suppose a serious problem to the Amateur satellite service. Since the frequencies they use have not been coordinated by IARU, they can cause interference to authorized Amateur satellites. Additionally, the large number of satellites being launched lately means that the spectrum (especially the 435MHz band, but also the 145MHz band) is quite crowded nowadays. Having satellites which do not offer any value to the Amateur service or the Amateur radio community only makes matters worse.

For satellites using undocumented or “secret” protocols, the problem is that radio Amateurs cannot decode the telemetry or other data from these satellites. On the one hand, this means that the data from the satellite is only useful to the satellite designers and provides no value to the Amateur community. On the other hand, using undocumented protocols can be seen as a violation of the ITU Radio Regulations stating that Amateur stations cannot encode messages to obscure their meaning.

Often, interested Amateurs contact the satellite designers to try to get more information about the protocols they use, but usually they do not provide enough documentation (and in some cases they refuse to provide anything). Therefore, making a decoder for these satellites involves reverse-engineering, which is a difficult and tedious task, with no guarantees of success.

What can IARU R1 do about this?

Regarding the problem of satellites transmitting on Amateur bands without permission or IARU coordination, the author recognizes that IARU can do very little to try to solve this problem. It is the duty of national administrations to employ legal measures with these satellites. Still, the author thinks that the Amateur community should be well aware of this problem, which will tend to get worse in the future.

Regarding the problem of satellites using undocumented protocols, the author and URE itself think that some changes to the IARU frequency coordination process might help solve this problem. Ideally, we would require the satellite responsible to submit, together with the frequency coordination form, enough technical information so that interested Amateurs can make a complete decoder based on this information. However, requiring such detailed information early in the frequency coordination process can be unreasonable, so it is worth to study what kind of information should be required and how and when it should be submitted to IARU.

Proposal

The author and URE propose the formation of a working group within IARU R1 to decide what changes to the IARU frequency coordination process would guarantee that interested Amateurs have enough technical information to make a decoder software. There has already been identified a suitable small group of radio Amateurs that are willing to be involved in this working group. At this point, there is no specific need for a budget to support the activities of the working group.

Since the problems addressed in this proposal are not specific to IARU R1, but rather affect the worldwide Amateur collective, another task of this working group will be to coordinate with the other IARU regions, so that this matter can be treated in a global basis and a joint effort can be made.

Finally, one other task of the working group should be to inform universities through their national societies of the concerns and rules for Amateur bands use and to organize a prospective survey of potential satellite projects to help spread the information.