CubeSat and SmallSat Licensing

Current Status - Which License
Issues
Path Forward

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Disclaimer

- I do not represent any other person or organization
- Views presented are my own
- Information is my best understanding of the situation.

History – Amateur Licensed Sats

- Nearly 100 satellites have been built and operated by hams since OSCAR 1 in 1961.
- Recently, as the cubesat revolution has taken place, most cubesats have been licensed as amateur
  - Exceptions have been those clearly government or commercial
- Some did not obviously fit within the amateur rules but were allowed to operate under amateur licenses
- Some clearly abused the amateur licensing process for commercial purposes

Recent Events

- In recent years, and with the growing number of cubesat launches and commercial interest in cubesats, there have been a number of events related to cubesats that suggested to FCC staff the need for greater scrutiny of and engagement with the cubesat community.
- These included several instances in which satellites were launched without required FCC review and numerous instances in which that review was treated as an afterthought.
- The result was that the FCC began to ask the cubesat community to be mindful of existing regulations, including regulations concerning what qualifies for an amateur license
- **That resulted in greater focus on whether "university" cubesats are properly considered amateur, or whether they should be considered experimental or commercial for FCC licensing purposes, which in turn resulted in cubesat operators seeking to coordinate experimental operations with the IARU.**

Recent Events

- The IARU Satellite Advisor initially declined to provide coordination for experimentals in the ham bands but has since agreed to do so on an “interim” basis
- Issues remain – discussed later

FCC Rules

- FCC Amateur Rules (Title 47 CFR Part 97)
- *Amateur service. A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.*
- In other words, unless you are building the sat just for you and other hams, and there is no outside money involved – it's not amateur

FCC Rules

- Prohibited Communications (97.113) :
- *(2) Communications for hire or for material compensation, direct or indirect, paid or promised, except as otherwise provided in these rules;*
- *(3) Communications in which the station licensee or control operator has a pecuniary interest, including communications on behalf of an employer, with the following exceptions:*
- *(iii) A control operator may accept compensation as an incident of a teaching position during periods of time when an amateur station is used by that teacher as a part of classroom instruction at an educational institution.*
- In other words, you can't be paid to operate a station unless you are a professor as part of teaching.
  - Further, if you are building a sat as part of your job as a professor, you are doing is a part of the business of the university – which takes you out of the amateur service

FCC Rules

- Some shades of grey
  - But the current interpretation is essentially unless the satellite is built by hams for hams it's not amateur and will not be allowed to operate under the amateur rules
  - Alternative, generally, is experimental license
- Amateurs should note that these rules are for the protection of the amateur radio service and its spectrum – from encroachment by commercial interests

Other Relevant Practices (FCC)

- Experimental licensed small sats can be accommodated in the ham bands
  - Experimentals are the bottom of the priority barrel
  - Must accept interference from anyone
  - Cannot interfere with anyone
- Can beacon or transmit around the world if the frequency usage has been coordinated by the IARU (if in amateur allocations and there are no other potential interference issues)
  - In other words, if hams themselves have arranged for non-interfering frequency usage the FCC is OK with that
- FCC requested a single point of contact for each launch
  - This has been done for some launches and groups of sats
  - -- Can make things faster and easier for everyone

It is extremely desirable that license applications to use frequencies in the ham bands have IARU coordination (FCC)

IARU Overview

- IARU Satellite Advisor, Hans vad de Groenendaal is charged with
  - “coordinate frequencies for amateur satellites”
  - “avoid interference as far as possible and to protect terrestrial amateur operation and make space mission as successful as possible”
  - His advisory panel has representatives from all three IARU regions (two from the US)
  - “We have no authority to reject. We recommend frequencies and point out problems in respect of the ITU regulations or technical issues. “ However the Advisor may decline to coordinate in which case the FCC will currently not accept an application (or notification)
- Has coordinated about 170 applications over the past 3 years

IARU Satellite Advisory Panel

- Meets more or less weekly by Skype for about an hour, plus many email exchanges
- Members are
  - Graham Shirville, G3VZV
  - Norbert Notthoff, DF5DP
  - Mike Rupprecht, DK3WN
  - Lee McLamb, KU4OS
  - Art Feller, W4ART
  - Shizuo Endo, JE1MUI
  - Special advisors
    - Ray Soifer, W2RS
    - Jan King, VK4GEY/W3GEY
- See http://www.iaru.org/satellite.html for more
- For coordination status see http://www.amsat.org.uk/iaru/
- IARU officers are listed here http://www.iaru.org/contact.html

Who are These Organizations ?

- FCC: Federal Communications Commission
  - US Government organization charged with regulating the use of frequencies inside the US except for those allocated to government use
  - Issues licenses of many kinds including amateur and experimental
- ITU: International Telecommunications Union
  - International organization charged by treaties between countries with bringing order to frequency usage throughout the world
  - Establishes what frequency ranges can be used by all kinds of radio transmitters
  - Made up of members and representatives from virtually every country
  - Holds World Administrative Radio Conferences (WARC) every three years to consider changes to the table of allocations

Organizations

- ARRL: American Radio Relay League
  - The national amateur radio member organization in the US
  - Promotes amateur radio and provides numerous services to licensee
  - Does not regulate, but advocates to the FCC for amateurs
  - Performs many other services for amateurs
  - Publishes QST

Organizations

- IARU: International Amateur Radio Union
  - Member society made up of representatives from amateur radio organizations from many countries
  - Advocates for amateurs at WRCs and promotes amateur radio, particularly in developing countries
  - Provide, through its Satellite Advisor, frequency coordination service for those building amateur radio satellites
    - Satellite Advisor has assembled a panel (committee) to assist him, made up of representatives from various parts of the world
  - DOES NOT REGULATE OR ISSUE LICENSES

Organizations

- AMSAT: Radio Amateur Satellite Corporation
  - The US member society that promotes amateur radio in space
  - Has built and operated many amateur radio satellites
  - Is not a member of the IARU (ARRL is) but has two members on the IARU frequency coordination advisory panel

Organizations

- NTIA: National Telecommunications and Information Administration
  - Establishes rules and issues licenses to government users of spectrum it controls
  - Mostly issues licenses through government agencies, or the agencies issues the license after work with the NTIA
  - Includes DOD usage managed by the military and other DOD organizations

Organization Summary

- ITU: Allocates spectrum internationally
- US Government: Is a member of the ITU, by treaty
- FCC: US government agency that makes rules and issues licenses for non-government users
- NTIA: Makes rules and issues licenses for government users
- ARRL: Advocates to US government (mostly the FCC) for amateurs
- IARU: Promotes amateur radio internationally and provides frequency coordination for amateur satellites. DOES NOT MAKE RULES OR ISSUE LICENSES
- AMSAT: Builds and operates amateur satellite for amateurs, can advocate to the ARRL for rule issues

What Kind of License

- Every space radio must be licensed
- These types are available
  - Commercial: For commercial gain and purposes
    - Earthquake monitoring constellation with data being sold
    - Get on orbit time for your newly designed commercial product (CMG, radio, antenna….)
    - Gather data for sale (land use, ship locations….)
  - NTIA: Government including DOD owned and operated, or for the government
  - FCC: Amateur: Strictly for personal use
  - FCC: Experimental: Not commercial, but for purpose of conducting an experiment

NTIA

- NTIA (DOD)
  - If your sat is owned or operated by a government agency, you must go this way
  - Frequencies are typically not near the ham bands
  - Probably cannot use amateur hardware
  - Probably will need to have a secure command uplink and may need to encrypt the downlinked data
  - Path starts with informal conversations with the spectrum managers of the government organization involved (e.g. AFRL, NASA……)
  - Formal process starts with a form 1494

Amateur

- Rules spelled out in Part 97. Read it and understand it.
- It is a “notification” process, not a separate license.
- Space station is operated by an individual with an amateur license
- Prior IARU coordination required
  - Start that process early
  - You may request specific frequencies or let the advisor/panel pick them
- Required information for the FCC
  - Mission and station descriptions, other general information from part 97
  - ODAR for your satellite and statements regarding orbital debris mitigation
  - SpaceCap output
  - IARU coordination letter
  - Additional NTIA required information (all spectrum is shared)
- Submitted to the FCC International Bureau
  - When acceptable information has been provided, the FCC will let you know via email that it is forwarding your SpaceCap output to the ITU
  - Don’t forget the other notifications required in Part 97

Experimental

- Same information as for amateur, plus descriptions and technical specs of all ground stations
  - Every station that will talk to the satellite and be controlled by the same operator can be listed on the same license.
  - Every station that will talk to the satellite should have an authorization.
  - Plus some additional technical information on the communications sytem – for NTIA coordination where necessary
- FCC process is started by filling out form 442 on FCC OET web site and attaching files in .pdf format
- Must include additional technical information for the NTIA notification form

IARU Policy

- Remains unclear
  - For what missions and for how long will coordination for experimentals be provided?
  - How does the panel decide which ones it will coordinate, based on “advised by the FCC in which service these satellite will be licenced”
  - How will a possible interference issue between an experimental sat and terrestrial amateur operation be handled?
- “The IARU urges administrations to take serious steps to find alternative allocations for experimental satellites and prioritise their participation of preparation for an agenda item at WRC18, if not at WRC15.”
  - Will the IARU and ARRL activity participate in finding other spectrum?

Remaining Issues

- IARU putting experimentals on a few frequencies – generating interference and operations difficulty
- Unclear if IARU will continue to coordinate experimentals which leaves future university cubesat builders in limbo
- Dual functions (amateur and experimental) are required to change frequency
- Emphasis on turning off the transmitter “immediately” when that is clearly impossible for an LEO sat
- Need to speed up the process in the fact of an increase in applications

Path Forward – Work Together

- ARRL and AMSAT work with FCC to develop a clearer understanding of the line between amateur and experimental, focusing on “Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.” as a valid amateur use, and continued recognition of the role of amateur radio in education
- Everyone lend help to NSF in effort to obtain reliable “small sat” spectrum for experiments that fall short of commercial but beyond amateur, including WRC 15 preparation
  - See R12-WP7B-C-0154!N12!MSW-E.docx

Questions