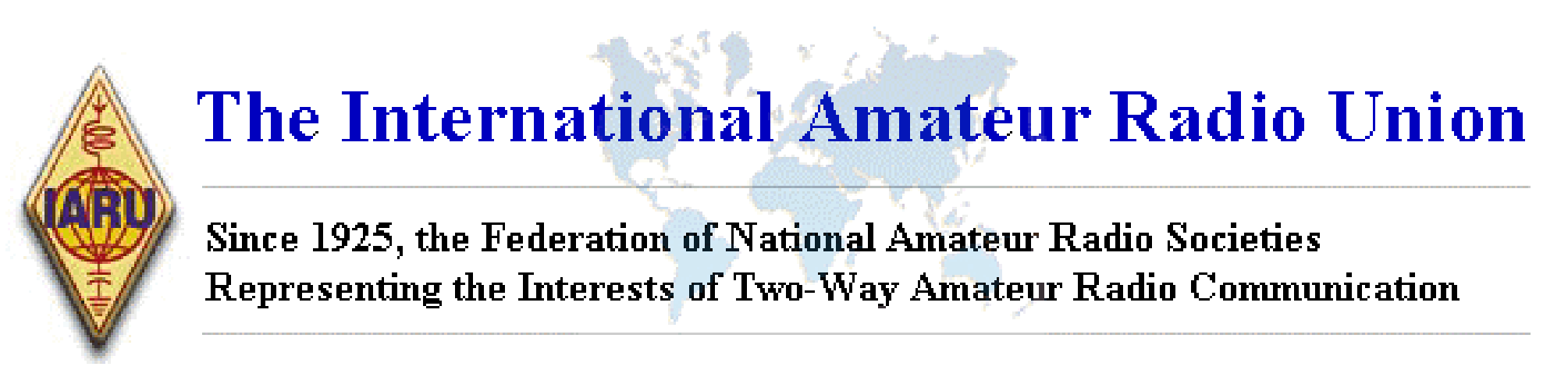
[](http://www.iaru.org)

**AMATEUR SATELLITE FREQUENCY COORDINATION REQUEST**

(Make a separate request for each space station to be operated in the amateur-satellite service.)

**Have you read the instructions? Here is the link** [**http://www.iaru.org/uploads/1/3/0/7/13073366/instructions\_iaru\_amateur\_satellite\_coordination\_request.doc**](http://www.iaru.org/uploads/1/3/0/7/13073366/instructions_iaru_amateur_satellite_coordination_request.doc)

**Administrative information:**

|  |  |  |
| --- | --- | --- |
| **0** | **DOCUMENT CONTROL** | |
| 0a | Date submitted |  |
| 0b | Document revision number |  |
|  |  | |
| **1** | **SPACECRAFT (published)** | |
| 1a | Name | CySat-1 |
| 1b | Notifying administration |  |
| 1c | API/A number. If the API number is not known yet, provide the date on which the information was submitted to the notifying administration. |  |
|  | | |
| **2** | **LICENSEE OF THE SPACE STATION (published) or responsible amateur in case of educational mission** | |
| 2a | First (given) name | Matthew |
| 2b | Last (family) name | Nelson |
| 2c | Call sign | KB0MGQ |
| 2d | Postal address | Howe Hall  537 Bissell Rd  Ames, IA, 50011 |
| 2e | Telephone number (including country code) | +1 (515) 294-2640 |
| 2f | E-mail address (licensee will be our point of contact and receive all correspondence) | mnelson@iastate.edu |
| 2g | Licensee’s position in any organisation referenced in item 3a. | Make to Innovate Program Coordinator |
|  | | |
| **3** | **ORGANISATIONS (published) — complete this section for EACH participating organization** | |
| 3a | Name of organization and/or educational institution | Iowa State University |
| 3b | Physical address | Ames, IA, 50011 |
| 3c | Postal address | Howe Hall  537 Bissell Rd  Ames, IA, 50011 |
| 3d | Telephone number (including country code) | (515) 294-6839 |
| 3e | E-mail address | tgt@iastate.edu |
| 3f | Web site URL | https://m2i.aere.iastate.edu/cysat/ |
| 3g | National Amateur Radio Society (including contact information) | American Radio Relay League  225 Main Street  Newington, CT, 06111-1494 USA  Tel:1-860-594-0200 Fax:1-860-594-0259  Toll-free:1-888-277-5289  hq@arrl.org |
| 3h | National Amateur Satellite organisation (including contact information) | AMSAT-NA |
| 3i | Does your National Amateur Satellite organization and/or National Amateur Radio Society supports this request? | National AMSAT Organisation  X yes  ☐no  National Amateur Radio Society  X yes  ☐no |

**Space station information:**

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| **4** | **SPACE STATION (published)** | |
| 4a | Type of mission  *Tick applicable box(es)* | ☐Amateur  X Amateur combined with Educational  ☐Amateur combined with other mission(s) |
| 4b | Mission(s) and frequency band(s*)* | This is a technology demonstration in LEO for future asteroid surveying in a later mission. |
| 4c | Planned duration of each part of the mission. | Once the RBF pin is removed, power will begin flowing and the countdown timers for the deployable components (antenna and possibly solar array, if confirmed) and the communication subsystem will initiate. While the timers count down, latch-up and firmware corruption routines will be performed. The satellite will be in passive beacon mode at this point (this involves an ASCII message containing minimal system status information and a welcome message for radio amateurs and will stay in this mode for roughly the first 24 hours of operations). After 45 minutes have passed, the antenna (and possibly the solar array) will be deployed. The ground station, will then attempt to pick up CySat1's beacon and establish contact. If bi-directional contact cannot be established, the beacon will at least give confirmation that CySat1 is partially functional. If contact is successful, a command will be sent which transitions CySat1 to diagnostic mode. Here, health and housekeeping data is gathered and will continue for up to a week. If function is determined to be nominal, CySat1 will transition to the main operating mode. All primary payload routines will be active during this mode. Different payload configurations will be tested to maximize data gathered. Finally, after a desired year or more of activity, CySat1 will transition to end of life mode. Here, corruption test routines will be performed to evaluate the level of success of the implemented redundancy system for the flight computer. |
| 4d | Proposed space station **transmitting** frequency plan.  List for each frequency or frequency band: | |
| 4d1 | requested frequency and function | Data transmission: 435 MHz |
| 4d2 | tuning range of transmitter and step increment | Tuning Range: 430-440 MHz  Step Increment: 25 KHz |
| 4d3 | EIRP | 31.4 using 1W transmitting power, .3 dB cable loss and 1.7 dB antenna gain. 38.3 when transmitting power upped to 5W. |
| 4d4 | ITU emission designator | 11K50F1DBN |
| 4d5 | common description of the emission including modulation type AND data rate | Frequency modulation, 9600 baud |
| 4d6 | Type of antenna, antenna gain and pattern | Monopole, 1.71-1.79 dBi gain, nulls at 90 and -90 degrees. Positive gain in vertical plane from -30 to 30 degrees and -150 to 150 degrees. 1.71-1.79 gain in horizontal direction in all directions. |
| 4d7 | attitude stabilisation, if used | No attitude stabilization used for radio purposes. Antennas are omnidirectional. |
| 4d8 | Service Area | Line of sight to Howe hall for majority of communications. Any amateur radio operator will be able to communicate with it, though. |
| 4e | Proposed space station **receiving** frequency plan.  List for each frequency or frequency range: | |
| 4e1 | requested frequency and function | Receiving commands: 145 MHz |
| 4e2 | tuning range of receiver and step increment | Tuning Range: 140-150 MHz  Step Increment: 12.5 KHz |
| 4e3 | ITU emission designator | 11K50F1DBN |
| 4e4 | common description of the emission including modulation type AND data rate | Frequency modulation, 9600 baud |
| 4e5 | noise temperature | less than 145 K |
| 4e6 | associated antenna gain and pattern | Dipole antenna, 3.73-7.06 dBi gain, fairly omnidirectional in horizontal and vertical plane |
| 4f | Physical structure. | The satellite is a 10cm x 10 cm x 30 cm cube satellite. For the radio, it is a 9cm x 9.5cm PCB with a metal housing to resist corruption. |
| 4g | *Functional Description.* | The radio communicates with our transmitting and receiving antennas to transmit and receive. The radio is attached to the flight computer in order to deliver received telecommands and to transmit back information. |
| 4h | *Power budget.* | While transmitting at peak power, the radio will consume 6W. The transmission power can be adjusted while in orbit to consume less as well. The radio will be in standby mode for a majority of the time, in which it will consume around .7 W. |
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| **5** | **TELECOMMAND (NOT published)** | |
| 5a | Telecommand frequency plan. | |
| 5a1 | Proposed space station telecommand frequencies, | 145 MHz |
| 5a2 | ITU emission designator(s) | 11K50F1DBN |
| 5a3 | common description of the emission including modulation type AND data rate | Frequency modulation, 9600 baud |
| 5a4 | link budget(s) | When our ground station transmits at 10W output power, the received signal of the satellite ranges from -82 dB when it is closest to just over -98 dB at peak range (2400 km). At -100 dB received power, our radio has a bit error rate of less than 1 in a trillion, which shows that we have plenty of signal strength. |
| 5a5 | a general description of any cipher system | We will be using a HMAC with SHA-2. The message will be timestamped prior to the HMAC to prevent replay attacks. The timestamp doesn’t need to be sent along with the message. Only critical messages will require authentication. For example, simple queries will not be ciphered, as we would encourage anyone to communicate with our satellite. |
| 5b | Positive space station transmitter control.  Explain how telecommand stations will turn off the space station transmitter(s) immediately, even in the presence of user traffic and/or space station computer system failure | There will be a specific command to cease any current transmissions. This command will be fed through the flight computer to be processed. In the event of user traffic, we will continuously send the cease transmission message and it will receive top priority by the flight computer to process. In the event of flight computer failure, the radio will not be transmitting anything because the radio is setup to immediately transmit anything it receives. If the flight computer is not sending anything to it, then it cannot transmit. Additionally, during bulk data transmission, the flight computer will require confirmation from the ground of received packets. If it receives no such confirmation, it will assume that it has traveled out of range and stop attempting to transmit. Other transmissions will require no such confirmation from the ground and will only be attempted to be sent once. |
| 5c | Telecommand stations. List telecommand station(s*)* | |
|  | Callsign | W0iastate |
| Physical location | Howe Hall |
| 5d | Optional: Give the complete space station turn off procedure. |  |
|  | | |
| **6** | **Telemetry (published)** | |
| 6a | **Telemetry frequencies** | |
| 6a1 | all telemetry frequencies or frequency bands, | There will be no telemetry. Any information that we want will be obtained by sending a command to retrieve that data. |
| 6a2 | ITU emission designator | N/A |
| 6a3 | common description of the emission including modulation type AND data rate | N/A |
| 6a4 | link budgets | N/A |
| 6b | Transmission formats | N/A |
|  | | |
| **7** | **Launch plans (published)** | |
| 7a | Launch agency | Orbital ATK |
| 7b | Launch location | Wallops Flight Facility |
| 7c | Expected launch date | October 2018 |
| 7d | **Planned orbit.** | |
| 7d1 | planned orbit apogee | 407km |
| 7d2 | planned orbit perigee | 403km |
| 7d3 | planned orbit inclination | 51.6 |
| 7d4 | planned orbit period | 93 minutes |
| 7e | List other amateur satellites expected to share the same launch. | CIRiS, CapSat, TJREVERB, SASSI2, TechEdSat-8, Virginia CC (three 1Us), Space Hauc, SOCRATES |

**Earth station information:**

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| **8** | **Typical Earth station — transmitting** | |
| 8a | Describe a typical Earth station used to transmit signals to the planned space station. | A control computer will analyze when the satellite will be visible, then control the azimuth and elevation of the antennas while the satellite is visible. The ground station will also automatically send some basic commands, such as querying for payload data and basic health of the satellite. |
| 8b | Link budget.  *Show complete link budgets for all Earth station transmitting frequencies, except telecommand.* | Received signal of satellite from ground station varies from -82 dB to -98 dB, depending on the distance. Our satellite needs greater than -104 dB to be functional. The SNR varies from 41 to 57, which also sufficient to be functional. |
|  | | |
| **9** | **Typical Earth station — receiving** |  |
| 9a | Describe a typical Earth station to receive signals from the planned satellite. | The receiving earth station will be the same as the transmitting. So, the receiving antenna will be tracking with the transmitting antenna. All commands will be fed into the control computer, and that will store the information for review. |
| 9b | Link budget. | Assuming only 1W output power from the satellite, received signal of ground station ranges from -101 to -117 dB, depending upon the distance. The ground station has a sensitivity of -121 dB, so this is sufficient as well. Additionally, the SNR varies from 23 to 39 dB, which is also sufficient to work. |

**Additional information:**

Do not attach large files. Indicate the URL where the information is available.

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| **10** | Please, supply any additional information that may assist the Satellite Advisor to coordinate your request(s). |

**Certification:**

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| **11\*** | X The licensee of the planned space station has reviewed all relevant laws, rules, and regulations, and certifies that this request complies with all requirements as understood by IARU to the best of his/her knowledge and confirms to meet the requirements of RR 1.56 and RR 1.57 in that the proposed satellite will operate without pecuniary interest.  Please list any commercial interests.  If none, please state none.  None |
| X The licensee of the planned space station has reviewed all relevant laws, rules, and regulations and disagrees with IARU interpretations of Treaty requirements. The IARU Satellite Advisor is asked to consider the following interpretation. Explanation follows. |

* Please tick ONE appropriate box.

**Signature:**

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| **12** | (REQUIRED!)    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Signature of space station licensee. Date submitted for coordination. |