Patent Search Report

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Patent Number: CN110677185B

Title: High throughput satellite for relaying data between a low earth orbit satellite and an endpoint

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Assignee: Asia Satellite Telecommunications Co Ltd

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Number of Claims: 20

Type of Patent: Utility Patent (UT)

**Patent Summary:** The patent is a utility patent for a satellite system in which data is relayed between one or more satellites and a ground station. The system is dependent on a high throughput satellite which uses multiple spot beams. A high throughput satellite means it has more power than standard satellites, and multiple spot beams means that the satellite can send data in a narrow beam to a specific, targeted location. The patent goes on to describe the way the high throughput satellite could collect data from multiple Low Earth Orbit (LEO) satellites as they pass through its spot beams coverage. The data collected could then be sent to a specific ground station location with another spot beam.

**Patent Discussion:** The patent is related to my team’s project because of the communication from the satellite to the ground station. The major differences between the patent and our project is that This is the basis of our entire project. An interesting component I learned from this patent was the use of spot beams. We are currently planning on using a patch antenna for sending signals from the satellite to the ground station. After reading this patent, I’m motivated to investigate potentially changing this to a spot beam implementation.

**Complete Summary:** Before this project, both my team and I have never worked with radio communications, satellites or many of the technologies used to build and design these things. For this reason, we have a very rudimentary knowledge of what building this system entails. That being said, I’ve discovered a lot of useful information from this research. There are many things I need to think about incorporating into our project if the time and budget allow for it. As discussed previously, the first would be to incorporate spot beam technology as mentioned in the patent discussion. In [3], two antennas are used instead of one to combat the tumbling problem. The tumbling problem is caused when the CubeSat is launched from the spacecraft that takes it into space. If the side of the CubeSat with the antenna is not facing the Earth, communication can be lost or disrupted. Two antennas minimize this risk and increases the probability of keeping in contact with the ground station. [2] Discusses many SDR systems and provides a comparison between them. We have not chosen a specific SDR at the time of this writing, so this comparison comes in handy. Even after having chosen an SDR, there is a useful chart that displays many of the components we must keep in mind when designing the system. These include modulation schemes, power consumption, coding schemes, and bandwidth. I began looking at patch antennas [4] to get an idea of what they were and how much one costs. This one only gives the price on request, but some of the specs are provided and may prove useful in the future. I also explored what some other teams are doing / have done in the past and found the Laboratory for Atmospheric and Space Physics [5]. This laboratory is at the University of Colorado Boulder and has successfully launched over a dozen CubeSat projects. They don’t go into much detail on the projects, but they do generalize and describe what works and what doesn’t, pitfalls projects have had, and some of the components used. For instance, one of their missions was aborted when the solar power panels failed on one of their CubeSats. This tells me how delicate the situation is up there, if something goes wrong, we can’t just get our hands on it and fix it. Proper consideration, planning, and part selection must be made to give us the best chance of success.

Works Cited

[1] Patent:

<https://patents.google.com/patent/CN110677185B/en?q=(satellite+communication)&oq=satellite+communication>

[2] Journal:

A. Zeedan and T. Khattab, "CubeSat Communication Subsystems: A Review of On-Board Transceiver Architectures, Protocols, and Performance," in IEEE Access, vol. 11, pp. 88161-88183, 2023, doi: 10.1109/ACCESS.2023.3304419.

<https://ieeexplore.ieee.org/document/10224067>

[3] Journal:

H. H. Abdullah, A. Elboushi, A. E. Gohar and E. A. Abdallah, "An Improved S-Band CubeSat Communication Subsystem Design and Implementation," in IEEE Access, vol. 9, pp. 45123-45136, 2021, doi: 10.1109/ACCESS.2021.3066464.

<https://ieeexplore.ieee.org/document/9380129>

[4] Product – Antenna:

<https://www.cubesatshop.com/product/isis-gps-patch-antenna/>

[5] Relevant Lab:

<https://lasp.colorado.edu/our-legacy/missions/cubesats/>