

International Bureau  
Federal Communications Commission  
Washington, D.C.

Regarding Capella Space's Earth Exploration Satellite Service Application  
International Bureau File Number SAT-LOA-20200914-00108

December 3, 2020

Dear International Bureau,

I would like to file comments and request the International Bureau proceed with caution regarding the subject application. I am a communications engineering consultant and a teacher of communications engineering. I am an advocate for using LEO-GEO inter-satellite linking to empower the deployment of LEO satellite systems in the furtherance of the commercial space industry and have written publicly on the topic <sup>1</sup>.

My concern is focused on ensuring that incumbent L-Band satellite applications do not experience interference, now or in the future, as a result of approving the Capella Space waiver request to use L-Band for inter-satellite linking. Two L-Band applications in particular come to mind. The world's Global Navigation Satellite Systems (GNSS) and the world's government-operated environmental monitoring agencies, e.g., the United States (US) National Oceanic and Atmospheric Administration (NOAA), operate L-Band applications whose downlinks are bookends to the L-band frequencies Capella Space proposes to transmit inter-satellite communications with.

Given the current public and congressional focus on interference issues that Ligado has faced with these same two applications in their attempts to use L-Band satellite frequencies for terrestrial communications, it would seem prudent for the international bureau to avoid the same mistakes the FCC made in 2011. Instead, the International Bureau should carefully review the risks for interference that the Capella Space waiver may create, to ensure that the availability of other L-Band satellite applications is not compromised.

One example of a risk of interference that should be explored is the potential for the three Capella Space satellites, as well as the many hundreds or perhaps thousands of satellites that may follow if the waiver is approved, to interfere with US federal and non-federal earth stations that receive Data Collection System (DCS) data and GOES Re-Broadcast (GRB) data from the NOAA Geostationary Operational Environmental Satellites (GOES). The lower end of the frequency band used by these applications is 1679.7 MHz. Although the proposed nominal Capella Space satellite orientation should significantly reduce the risk of direct radiation

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<sup>1</sup> Brian Kopp, Jonathan Harris, and Caio Lauand, "Utilizing Existing Commercial Geostationary Earth Orbit Fixed Satellite Services for Low Earth Orbit Satellite Communication Relays with Earth," *New Space Journal*, March 2019.

into these federal and non-federal NOAA GOES earth stations there are complicating factors to consider. For instance, the L-Band propagation loss is significantly less from LEO to earth than from GEO to earth, favoring the Capella Space transmissions over those from the GOES satellites. In addition, the Capella Space proposed 9.5dBi peak transmit antenna gain and attendant broad beamwidth will increase the likelihood for off-angle interference. There is also not a substantial difference in EIRP between the Capella Space proposed transmitter and that of the incumbent GOES spacecraft, giving only a slight advantage (less than the path loss disadvantage) to the GOES satellites. It is also not clear from the application file at what minimum angle to the earth's surface the Capella Space satellites will commence transmitting to a distance L-Band GEO satellite that has just risen over the horizon. A lower transmit angle coupled with a relatively broad beamwidth, could increase the risk of interference to an earth station. It is important to note that other countries in the western hemisphere operate earth stations that use these NOAA services and would likely be exposed to the same risk. Also, both GNSS and the NOAA GOES applications have a history of implementing less-than-aggressive front-end receive filters since the risk of significant out-of-band interference has been historically low. When considered together, these concerns suggest to me that the International Bureau should require an interference study before they consider approving the waiver and the Capella Space application.

Should you have any further questions regarding these comments please do not hesitate to contact me. I am familiar with the NOAA GOES DCS system in particular through both my consulting work and academic research and I have worked in the past on the US federal LEO-GEO inter-satellite linking system known as the NASA Tracking and Data Relay Satellite System (TDRSS).

Regards,

A handwritten signature in black ink, appearing to read 'B. Kopp' with a stylized flourish at the end.

Brian Kopp, Ph.D.  
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University of North Florida