APPENDIX A

RESPONSE TO QUESTION 7 OF FCC FORM 442 (PURPOSE OF EXPERIMENT)

Narrative Summary

Capella Space Corp. ("Capella") is a satellite imaging company, headquartered in San Francisco, California, that has developed technology to allow its satellites to "see" what other satellites cannot.

Capella satellites will be able to see through clouds and at night, permitting imaging during bad weather and/or low-light conditions, by utilizing Synthetic Aperture Radar ("SAR") images. Optical imaging, which is the current standard for Earth imaging, is limited to cloud-free locations with ideal light conditions. These limitations mean that 75% of the Earth surface remains undetected regardless of the number of optical satellites in space. In contrast, SAR imaging is an active imaging technique that utilizes radar antennae that emit pulses of microwave radiation at a pulse repetition frequency of 2000 pulses/second or more. The radar receiver measures the time, strength, and phase characteristics of the pulse echoes and uses this data to generate two-dimensional images.

Capella plans to deploy a constellation of SAR satellites (the "Planned SAR Constellation") that will be placed in polar orbit in the near future. In furtherance of this plan, Capella is seeking a conventional experimental radio license (the "Conventional License") for a single Capella SAR satellite (the "Capella Satellite"). The Conventional License will enable Capella to conduct in-space performance assessments and evaluate proposed Capella satellite technology and software prior to the deployment of the Planned SAR Constellation.

The Capella Satellite that is the subject of this application will operate in a sun-synchronous orbit with a 97-98 degree inclination and a nominal altitude of 620 km. Capella anticipates launching the Capella Satellite in the end of first quarter of 2020 on the SpaceX Falcon 9. The designed operating lifetime of the first Capella Satellite is approximately 3 years.

The Capella Satellite will utilize the 9300-9900 MHz frequency range for SAR imaging. Downlink communication between the Capella Satellite and gateway Earth stations will occur in the 8025-8400 MHz frequency range. Uplink communication will occur in the 2035-2037 MHz frequency range, but uplink communications are provided by third-party providers and not requested for authorization under this application.

The primary purpose of this experiment is to test and validate the performance of the Capella Satellite's new technologies. These technologies will be contained in certain components of the Capella Satellite, including a high-gain SAR antenna, a high-performance SAR radio, a high-power RF amplifier, a large-capacity power generation and storage subsystem, an innovative heat dissipation subsystem, and a high-performance SAR processing capability. The objective of combining these new technologies is to achieve the performance of large SAR satellites in a compact, scalable form factor.

The high-gain SAR antenna system is being manufactured by Capella Space in coordination with subcontractors for certain sub-components. The SAR antenna's innovative design results in a peak gain of 48.1 dBi while remaining compact enough to fit within a small satellite structure. The total aperture area when deployed on-orbit will be 10 m^2.

The high-performance radio was designed and developed by Capella Space. The radio utilizes an innovative software-defined radio design that allows it to function as both a radar, high datarate communications radio, and data processor. This flexibility allows the spacecraft to keep weight, power, and cost down while still advancing the state-of-the-art in satellite Earth observation capabilities. The radio offers transmit and receive bandwidths up to 600MHz and can operate in the radar frequency band of 9300-9900 MHz and downlink frequency band of 8025-8400 MHz.

SAR is an active imaging technique that requires a high-power transmitter on the satellite. The high power 600W pulsed SAR amplifier was developed by CTT Inc. This amplifier is one of the highest power X-band amplifiers ever integrated within a small satellite. This amplifier requires significant DC power and dissipates a large amount of heat. The amplifier requirements for power and heat prompted the design of the large capacity power generation and storage subsystem and innovative heat dissipation subsystem used on the satellite.

The Capella Satellite will have the capability to process SAR data in real time with the use of an onboard Graphics Processing Unit ("GPU") developed by Nvidia. This will be one of the first satellite-based GPUs. The Capella GPU will perform the SAR image focusing that is used to process the raw radar pulse data into SAR images.

Finally, the Capella Satellite will host an Inmarsat Data Relay System ("IDRS") that will enable TT&C with the satellite independent of the satellite being in contact with an Earth radio station. This is technology will enable near continuous communications with the satellite and real-time tasking capabilities.

These technologies will ensure that the Planned SAR Constellation will provide high-quality SAR imagery and data to Capella's commercial and government customers and for non-commercial, scientific, educational, or other public benefit purposes.

Overview of Operations

Capella seeks to authorization use the following frequency bands:

1) 8025-8400 MHz for downlink;[1]
2) 9300-9900 MHz for SAR imaging;[2] and

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[1] *Id.* at FN US258 (allocating the 8025-8400 MHz band on a primary basis for non-Federal EESS use).

[2] *Id.* (allocated on a secondary basis for non-Federal EESS).

3) 1626.5 - 1660.5 MHz, and 1668.0 - 1675.0 MHz for an Inmarsat Data Relay System ("IDRS") terminal to provide world-wide TT&C communications with the spacecraft.[3]

The proposed Capella system will also receive transmissions on the following frequencies. Because the Capella system will not transmit on these frequencies, Capella is not seeking corresponding authorization to engage in these transmissions. However, in each case, these transmissions will be permitted by authorizations held by third parties. These receive-only frequencies are listed here for informational purposes only.

1) 2035-2037 MHz for uplink;[4] — Earth to space.
2) 1518 MHz-1559 — GEO to LEO.

Mission control for the Capella Satellite will be physically located at Capella's headquarters in San Francisco, with backup command authority at Capella's facility in Boulder, Colorado. The ground system for the Capella Satellite will be implemented utilizing Amazon Web Services - GovCloud ("AWS") to facilitate remote/decentralized management by authorized personnel.

Capella has contracted with Kongsberg Satellite Services ("KSAT") and Amazon Web Servcies Ground Stations ("AWSGS") for ground-based telemetry, tracking, and command ("TT&C") and payload downlink antenna services for the Capella Satellite. Each provider works with Capella, national regulatory authorities, and international regulatory authorities to obtain all necessary licenses for station operations and transmission approval.

Command packets for the Capella Satellite will be generated on Capella's local production network. Each packet will be sent into Capella's AWS instance for encryption. A plaintext version of the packet will be stored in a database in the AWS instance. The packet then travels from the AWS production instance to a remote ground station from which it is subsequently radiated to the Capella Satellite. The Capella Satellite then receives the packet and forwards it on to the main flight computer, which will then decrypt and authenticate the packet before forwarding it on to the relevant processing module. The schedule for downlink and SAR imaging is generated on the ground and commanded to the satellite.

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[3] *See* U.S. Table of Frequency Allocations, FN 5.228, 5.228C, 5.228D, US52 *available at* https://transition.fcc.gov/oet/spectrum/table/fcctable.pdf (allocating the 2025-2110 MHz band for non-Federal Earth-to-space transmissions on a case-by-case, non-interference basis).

[4] *See* U.S. Table of Frequency Allocations, FN US347, *available at* https://transition.fcc.gov/oet/spectrum/table/fcctable.pdf (allocating the 2025-2110 MHz band for non-Federal Earth-to-space transmissions on a case-by-case, non-interference basis).

Telemetry, payload, and beacon packet generation will occur on the main flight computer of the Capella Satellite. Each packet will be encrypted, forwarded on to the downlink radio, and radiated to a ground station. The packet will then be forwarded on to Capella's production AWS instance which will decrypt the packet, allowing the packet to travel on to the local machine running the command/telemetry application on Capella's production network. A plaintext version of the packet will be stored in a database in Capella's AWS instance. Data will be accessed through an Application Programming Interface used by customers and Capella's online servers.