

From: Laura Stefani

To: Nimesh Sangani

Date: April 05, 2019

Subject: Additional Information Request

Message:

1. Concerning Page 3, Section 4, first paragraph, please provide information concerning the "integrated customer payloads". Does the subsystem description at p. 3 describe all subsystems including any customer payloads?

RESPONSE: The following is all of the information regarding the Blue Walker 1 ("BW1") customer payload. The BW1 platform includes two SDR radios. The hardware is composed of complete radio systems, in which the main board is identical but each is connected to an RF Front End tuned to two different bands: LTE5 (824-849 MHz) and LTE71 (663-698 MHz). Each Front-End will support the entire available LTE band bandwidth (25 MHz for the LTE5 band and 35 MHz for the LTE71 band), and the specific block will be programmed in the transceiver. However, for purposes of this experimental license, the frequencies requested (846.5-849.0 MHz and 891.5-894.0 MHz) will be the only frequencies used. Also, no commercial service is being provided, or will be provided, unless and until permanent authorization is obtained.

2. Please indicate which version of DAS was utilized for analysis.

RESPONSE: Debris Assessment Software 2.1.1 (DAS2.1.1) was used in order to analyze the change in the satellites orbit due to natural decay as well as to see if the orbit debris requirements are met.

3. The response at 7.2.1 does not address explosion risk. Please update to provide a full analysis. Please indicate whether there is a propulsion system, or any pressure vessels on board. Describe batteries and any batter flight heritage.

RESPONSE: A full analysis of the explosion risk would involve only consideration of the on-board batteries, as the BW1 does not have any propulsion system or pressure vessels. In this instance, space qualified lithium ion batteries are used on board the BW1 and they have been put through full analysis for failure modes. These batteries have previously flown on other satellite missions, such as NanoAvionics Lithuanica SAT-2, and no anomalous events have occurred. The risk of explosion is extremely low.

4. Please provide the inputs used for the DAS calculation of collision risk shown at 7.4 and provide the DAS output number.

RESPONSE: The DAS software only confirms that the requirement is met, and does not provide the exact output number. The following inputs were used.

- * Orbit altitude: 505 km
- * Inclination: 97.42 degrees
- * Area-to-Mass ratio: 0.0039
- * Launch date: 04/01/2019

5. In 7.5, the altitude shown is 505 km—but the mission statement indicates 600-700 km. Please clarify and update exhibits as necessary.

RESPONSE: The narrative indicated that the altitude would be "approximately" 600-700 km. Now that the satellite is developed and prepared for launch, the altitude will be 505 km. We notes that keeping the orbit below approximately 650 km has benefits, as the Commission recognized in the Orbit Debris NPRM proceeding.

6. At 7.6.1, please indicate which, if any, of the mitigation measures identified in the European Manual will be utilized.

RESPONSE: The following mitigation measures identified in the European manual will be used.

- * Disconnect ADCS sensors and actuators from power supply source
- * The batteries are disconnected from the solar arrays and bus
- * Solar arrays are short circuited
- * Telemetry transmission is switched off

7. At 7.7.1, please provide the DAS inputs and outputs. Will all components demise that would otherwise reach the ground with greater than 15 J energy?

RESPONSE: The input data was the orbital parameters as well as the geometrical and material properties of the all the subsystems in the satellite. For output, the DAS software only shows that this requirement is met (no actual numbers are given by the software). All the component will demise that would otherwise reach the ground with greater than 15 J energy.

8. Concerning the use of the 846.5-849.0 MHz and 891.5-894.0 MHz, please provide an FCC and ITU data search for other licensed operators that may be operating in these bands, specifically FIXED MOBILE and Radiolocation, as coordination may be required.

RESPONSE: The only FCC licensees operating on these frequencies in Midland County, Texas are cellular (radio code CL) licensees. ULS shows the following four active licenses: Call signs KNKA671, KNKN727, KNKN762 and KNK764. All licenses are held by the same entity, which has given AST&Science permission to use the frequencies requested at the site requested. (AST&Science already has submitted an exhibit to this application indicating this agreement.)

There are no non-Federal radiolocation licensees, nor is there an allocation for this use. While there is a footnote provision allowing for the grandfathering of Federal radiolocation licenses for offshore ships, Midland is not located near the coastline. Given these factors and the fact that this experimental will only occur sporadically at one fixed location in Midland, Texas, no coordination should be necessary.

Furthermore, for downlink transmissions, the power flux density in the frequency bands anywhere within the satellite's field of view will be less than -160 dBW/m²/4kHz (see calculation below). And the satellite will be on only occasionally when it is passing Midland.

Worst case PFD Calculation (Downlink):

BW1 @ Midland's Zenith
Shortest Slant Path - 505 km
BW1 TX Power - -7 dBW
BW1 EIRP - -4.7 dBW
Flux Density - -160.7 dBW/m²/4kHz

Regarding uplink transmissions, AST&Science will use a highly directional ground antenna to uplink the signal to BW1. As indicated in the narrative description of the proposed experiment, the ground antenna will be operated over a 90+/-35 degrees elevation range. Considering the expected lower than 45 dB sidelobe level near the horizontal direction (under the worst evaluation angle of the ground station antenna), and the proposed operation at a peak EIRP of no more than 28 dBW, the expected EIRP level near the horizontal direction will be less than -17 dBW. This EIRP level is much lower than the EIRP from a typical UE.