

August 25, 2021

BY ELECTRONIC FILING

Kerry E. Murray
Federal Communications Commission
45 L Street, N.E.
Washington, DC 20554

Re: *E210059 (Lunenburg, VT)*

Dear Ms. Murray:

This letter is in response to requests from the Federal Communication Commission to provide supplemental information with regard to the earth station application referenced above. Specifically, the Commission requested the following information:

1. Addition of county boundaries and distance/mileage scale to PFD contour plots
2. .kml file with PFD contour and census block boundaries
3. Clarification of power density (“clear sky power” value)
4. Confirmation that PFD contour will not cross any roads classified as “Other Freeways and Expressways or Other Principal Arterials,” with details on related analysis and assumptions
5. Clarification of discrepancy in height above ground level
6. Explanation of changes in antenna sidelobe levels
7. Explanation of clutter assumptions
8. Technical details related to site shielding

Responses are as follows:

1) Addition of county boundaries and distance/mileage scale to PFD contour plots

In accordance with 47 CFR § 25.136(a)(4)(ii) and 47 CFR § 25.136(a)(4)(iii) county boundaries and map legends with distance/mileage scale for measuring the relative size of the proposed PFD contour are included as Figures 1-3 in the appendix of this document

2) .kml files for PFD contours

The Federal Communications Commission has requested that a .kml file representing the PFD contour and relevant census block boundaries be submitted. This .kml file has been submitted as an attachment along with this supplement pleading.

3) Clarification of power density

To ensure compliance with 47 CFR § 25.136(a)(4)(ii) and 47 CFR § 25.136(a)(4)(iii) for the earth station related to this supplemental pleading, SpaceX used worst-case input power density. SpaceX did not change maximum power during rain fade conditions, so clear-sky maximum power is the same as during rain fade for this earth station application. This SpaceX license application is conservative and currently accounts for worst-case antenna input power density of -19.7 dBW/MHz.

4) Confirmation that PFD contour will not cross any roads classified as “Other Freeways and Expressways or Other Principal Arterials,” with details on related analysis and assumptions

In accordance with 47 CFR § 25.136(a)(4)(iii), SpaceX certifies that the PFD contour of the earth station related to this supplemental pleading will not cross any roads classified as “Other Freeways and Expressways or Other Principal Arterials:”

To make this certification, SpaceX uses QGIS software to conduct an analysis of a comprehensive dataset of roadways obtained from the 2017 release of the HPMS¹ ARNOLD² dataset, belonging to the Federal Highway Administration of the Department of Transportation. To ensure compliance with 47 CFR § 25.136(a)(4)(iii), SpaceX analysis considers the following categories within the dataset: “Interstate,” “Principal Arterial – Other Freeways and Expressways,” and “Principal Arterial – Other”. SpaceX uses QGIS and the comprehensive dataset of roadways to ensure that the PFD contour does not cross any roads classified as “Other Freeways and Expressways or Other Principal Arterials.” According to the website from which the dataset is obtained³: “[the dataset] derives and is collected from State DOT road data. ARNOLD consists of locations of all roads in the U.S.” Therefore, relevant state roadways are considered in our analysis.

¹ Highway Performance Monitoring System

² All Road Network of Linear Referenced Data

³ Source: <https://www.bts.gov/geography/geospatial-portal/NTAD-direct-download>

5) Clarification of discrepancy in height above ground level

The “height above ground level” in all earth station applications (1.7m), is the true centerline height of the antennas, and the value SpaceX uses to calculate the PFD contours. The “Antenna Centerline (AGL)” value previously used in Comsearch (0.91m) has been found to be a clerical error, and will be changed to 1.7m in all future Comsearch reports. Comsearch has informed us that it is not necessary to re-do coordination or update Comsearch reports based on this change, because the change is not expected to impact any relevant analyses. Related email correspondence with Comsearch has been submitted as an attachment along with this supplement pleading.

6) Explanation of changes in antenna sidelobe levels

There have been changes over time in the antenna sidelobe level toward the horizon used in SpaceX’s earth station applications. The changes are due to improvements in SpaceX earth station antenna design over time – newer antennas have a lower antenna sidelobe level toward the horizon.

While previous applications may feature an antenna sidelobe level towards the horizon of -1 dBi or -3 dBi, this application features an antenna sidelobe level towards the horizon of -8 dBi.

For the reasons explained above, an antenna sidelobe level towards the horizon of -8 dBi is a more accurate representations of reality for this earth station than values of -1 dBi or -3 dBi that may have been used in previous applications. See appendix Figure 4 for detail on antenna sidelobe measurements and related methodology.

7) Explanation of clutter assumptions

The “irregularly spaced sparse trees” and “sparse houses” clutter categories of the ITU P.452 model were used for this application. According to the ITU P.452 model, this translates to clutter assumptions of 4 meters nominal height and 0.1 kilometers nominal distance.

The “irregularly spaced sparse trees” and “sparse houses” clutter categories were determined to be most appropriate based on measurements and analysis via Google Earth software and in-person site survey. Figures 5-6 provide a visual of the site environment, obtained via Google Earth software and in-person site survey.

8) Technical details related to site shielding

No shielding was assumed in the PFD contour analysis for this earth station.

Sincerely,

David Liptsyn

David Liptsyn
Gateway Site Acquisition Analyst
SpaceX

Appendix

Figure 1: PFD Contour with county boundaries and distance/mileage scale

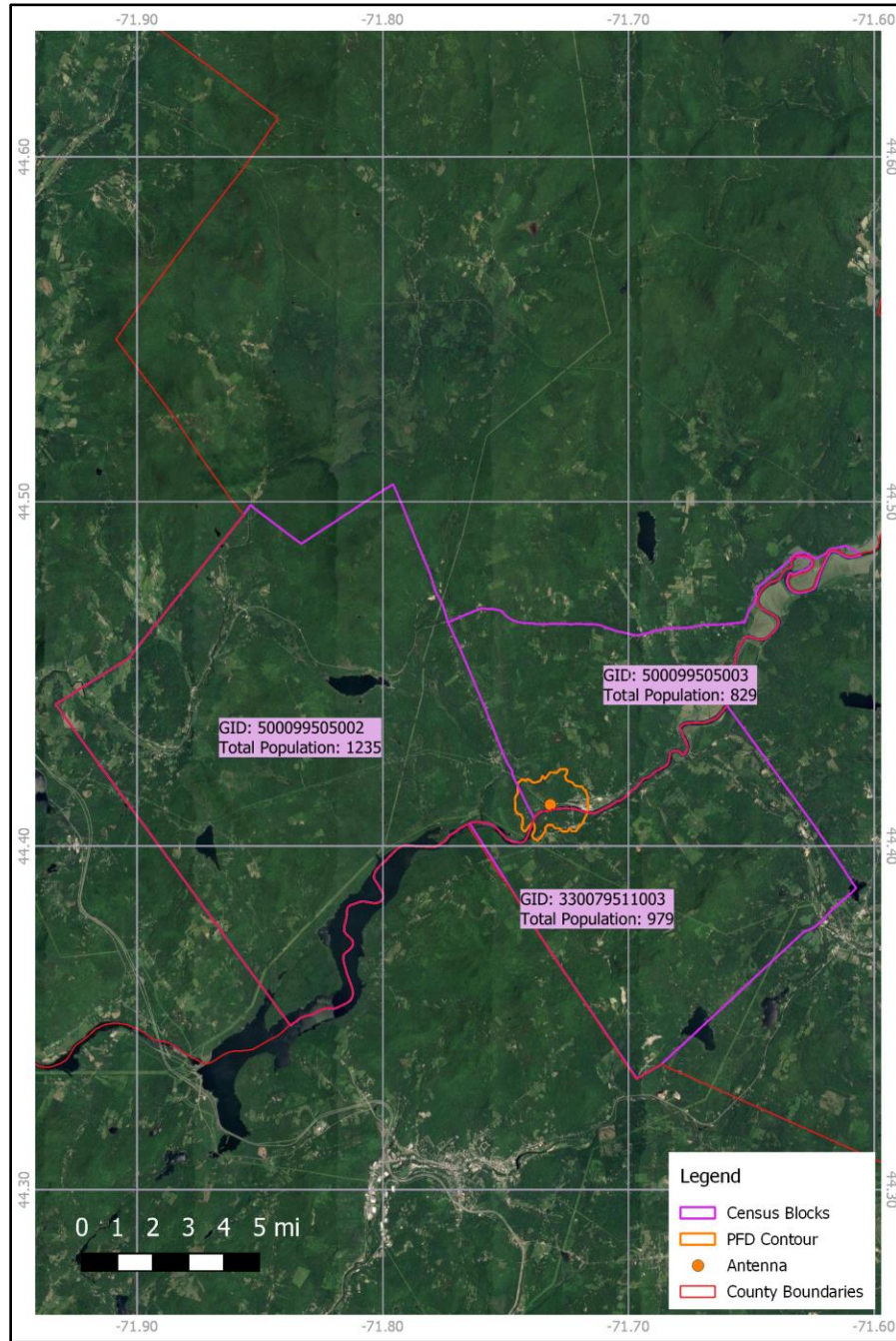


Figure 2: PFD Contour with distance/mileage scale

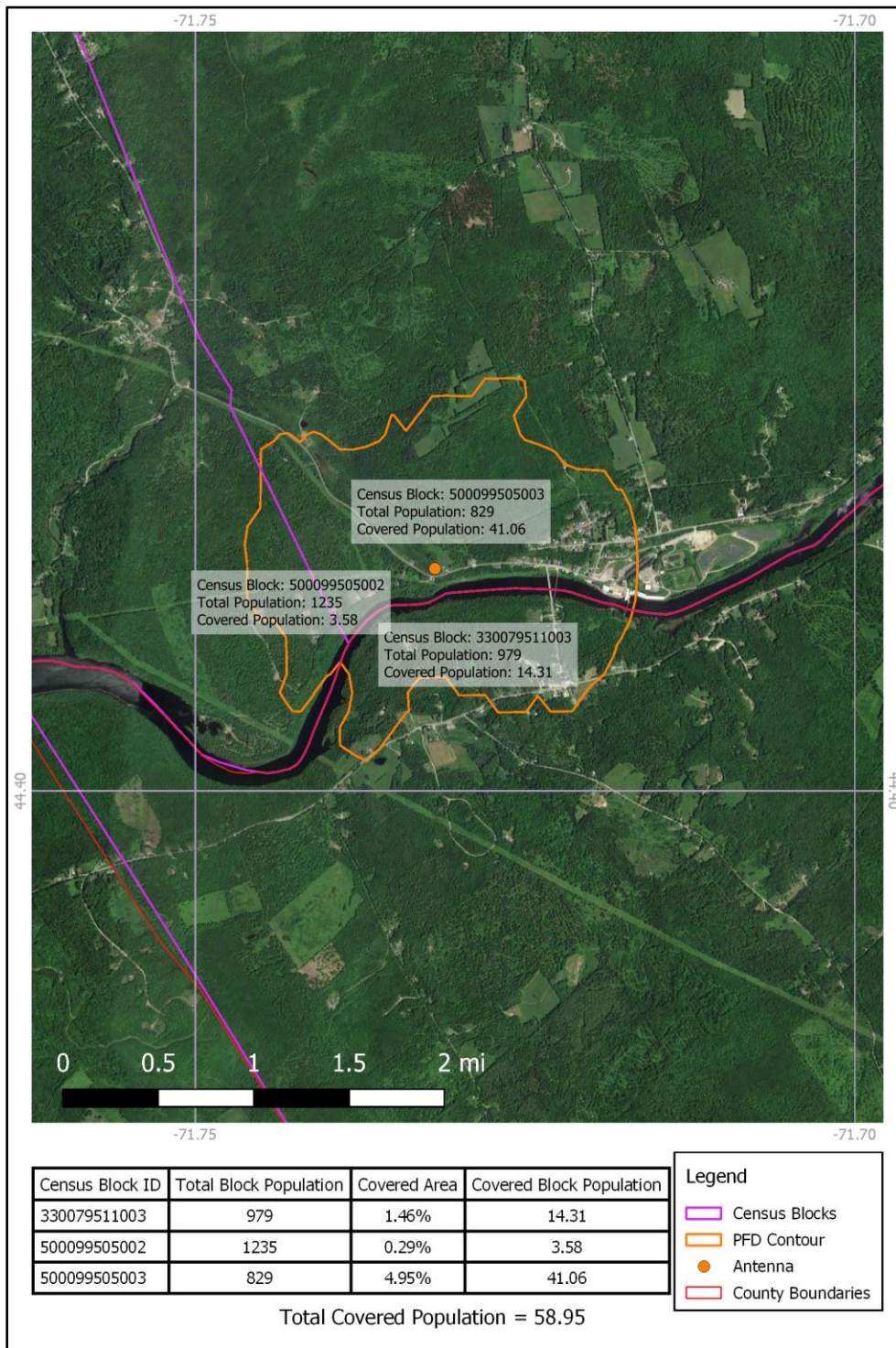


Figure 3: PFD Contour with population density and distance/mileage scale

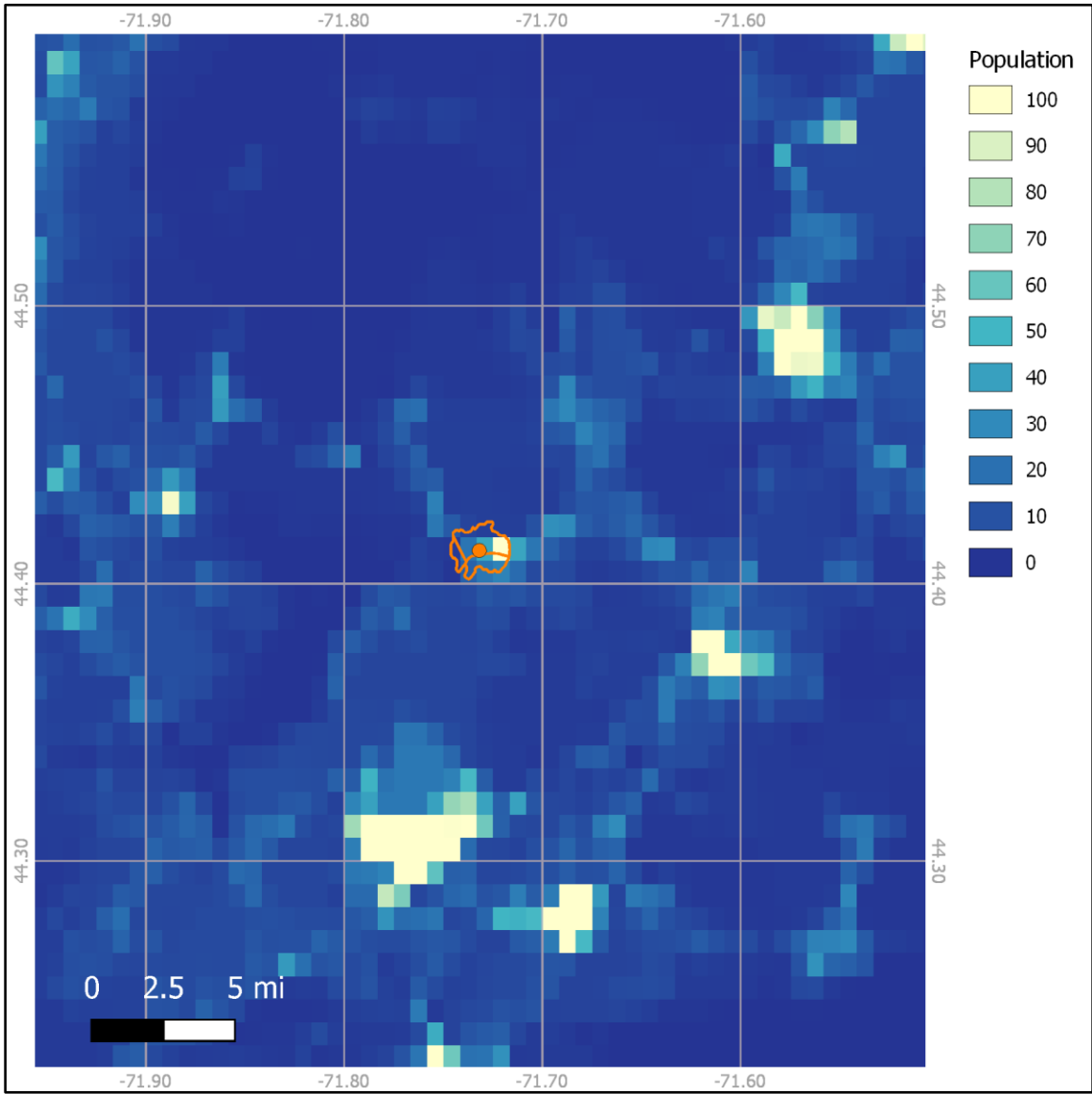


Figure 4: A measured antenna pattern is shown below for relevant off-axis angles that intersect the horizon. The maximum observed sidelobe level is -8.37 dBi. This measurement was completed by an independent third party (NSI-MI Technologies) at the NSI-MI Compact Antenna Test Range at the NSI-MI Technologies facilities in Atlanta, GA. All measurement equipment was also manufactured by NSI-MI to ensure accuracy and precision.

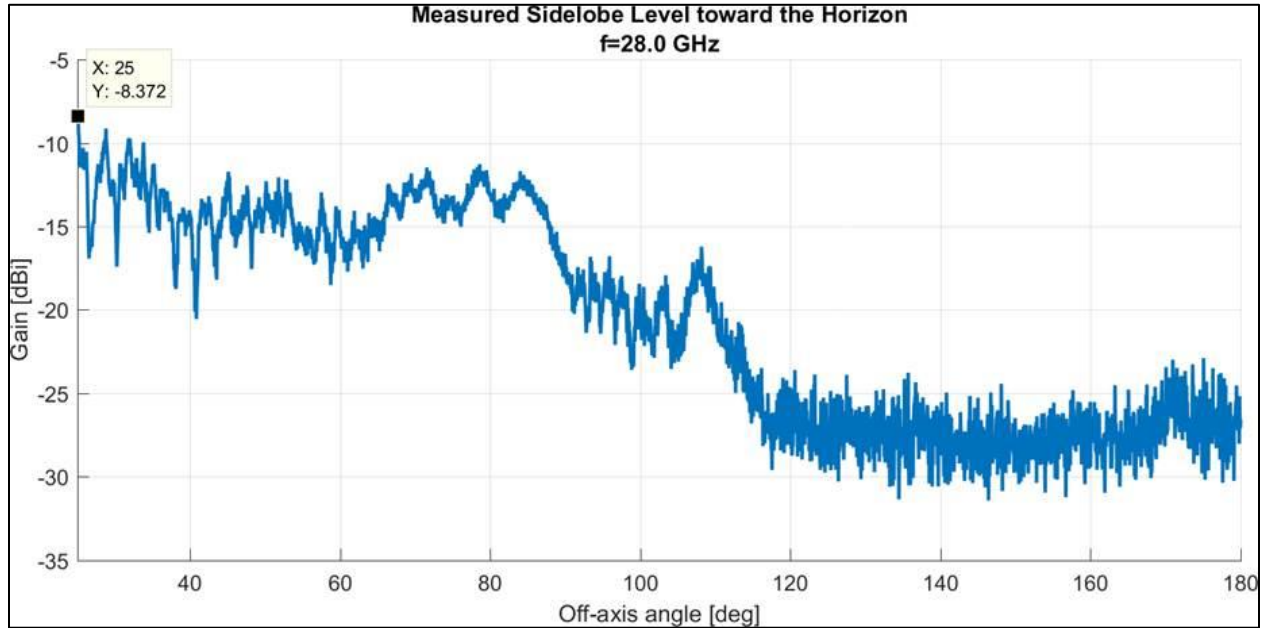


Figure 5: Google Earth satellite view for the earth station. As is pointed out in the figure below, the trees surrounding the earth station to north, west, and south are approximately 3 to 12 meters from the earth station, while the house to the east is approximately 40 meters from the earth station. Note that the distances from the earth station to surrounding trees and buildings are aligned with, or more conservative than, the clutter assumption of 100 meters of distance that is being used for PFD contour analysis. These measurements were confirmed by SpaceX during in-person site survey.

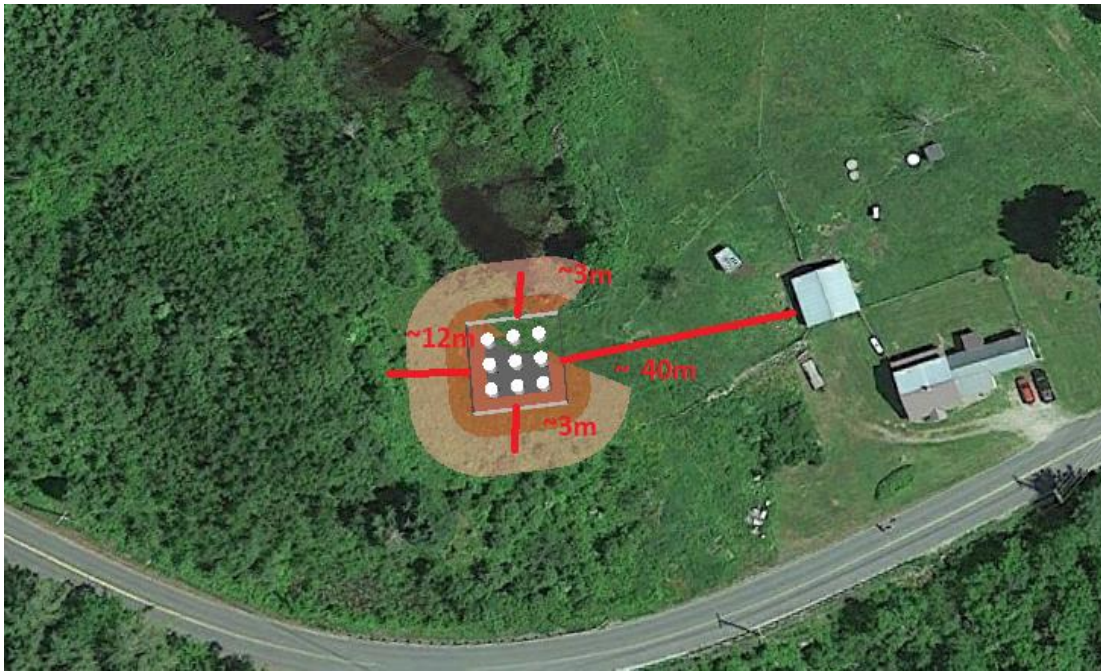


Figure 6: Photo of surroundings at earth station location obtained during in-person site survey. This was taken prior to the earth station's construction, with the orange cone representing the earth station location. This photo was taken facing westward, towards the anticipated earth station location. As can be seen in the photo, the height and distances of the earth station surroundings are aligned with, or more conservative than, the clutter assumptions of 4 meters height and 100 meters distance that are being used for PFD contour analysis.

