



70/80 GHz Backhaul Link

Analysis Summary for the FCC STA Application

August 2024

1. Configuration of the Operation

The configuration of the operation of Sceye’s 70/80 GHz backhaul flight test system is illustrated in Figure 1 below, where the operational altitude of Sceye’s HAPS above the ground is between 15 km and 20 km.

The maximum link distance for viable communication is constrained by the capabilities of the HAPS-borne payload and the ground station, based on which the maximum link distance is about 60 km corresponding to a minimum elevation angle of about 15° for a 15 km altitude (~ 20° for a 20 km altitude).

Sceye’s ground sites for flight testing are located in two locations only, namely Roswell and Tatum, and the Moriarty location will only be used for pre-flight indoor testing. Similar to previous flights, the flight trajectory from Roswell will be eastwards towards Tatum to avoid proximity with WSMR, though the exact flight path cannot be ascertained at this time.

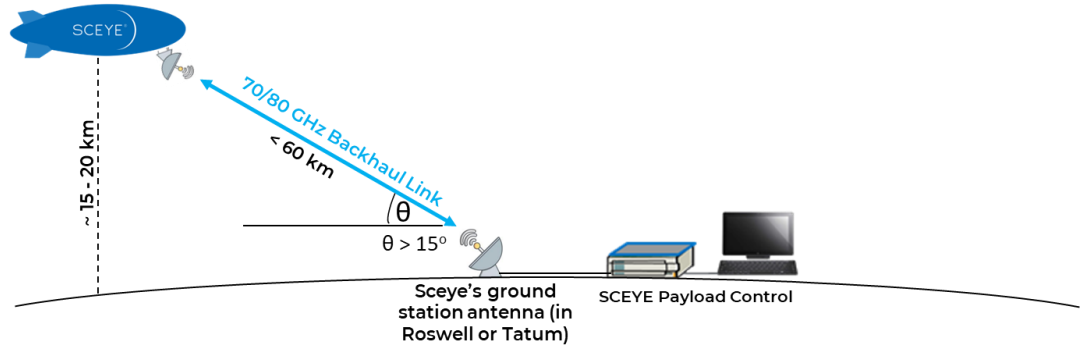


Figure 1: Configuration of the operation for flight testing, where the payload is aboard the HAPS. Note that this is a notional diagram and not to scale.

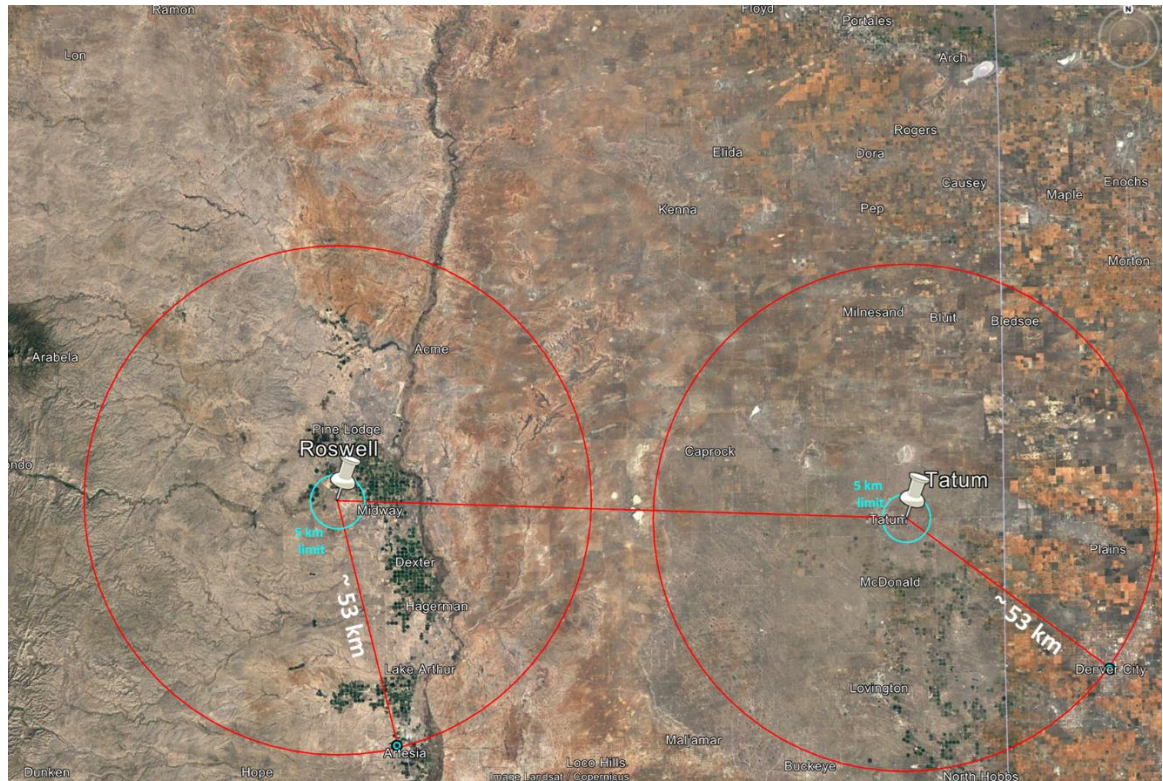


Figure 2: Sceye’s ground sites in Roswell and Tatum with the 5 km radius coverage limit (light blue), which is equivalently the limit of the illumination area of the main beam. Also shown are the registered sites about 53 km away (small light blue circles). Note that the trajectory is eastwards from Roswell to Tatum, but exact flight path is yet to be confirmed.

2. Interference Assessment: Engineering Analysis and Explanation

Here is a summary of key facts relevant to confirming that Sceye's flight tests will not cause harmful interference to incumbent Fixed Microwave Service licensees.

- After thoroughly reviewing the registered links sites listed in relevant 3rd party databases, we verified and confirmed that there are no fixed microwave service licensees within 50 km of either Roswell or Tatum. The nearest registered site from either Roswell or Tatum is about 53 km southwest. See Figure 2.
- The coverage area around each Sceye ground site is limited to a radius of less than 5 km (the horizon distance); see Figure 2. So, Sceye's ground antennas cannot radiate any signal towards any other registered site (the nearest registered site is more than 50 km away from either Sceye ground site).
 - o Indoor testing in Moriarty will not radiate any signal to any other site regardless of the separation distance since any radiation at this frequency will be blocked or absorbed by the hangar walls.
 - o Therefore, the rest of the analysis below is relevant to the payload only.
- The antenna main beam gain is 42 dBi with 1.2° 3-dB beamwidth, with more than 25 dB side-lobe attenuation at 5° and beyond. This is applicable to both payload and ground antennas.
 - o Antenna pointing is updated in real-time by highly accurate mechanical positioners with very tight resolution (0.003° tilt/0.006° pan), remotely controlled on the ground. So, the main beams of the payload and ground antennas will remain locked and aligned for the entire duration of the testing. Transmission can be terminated any time in case an unlikely error causes beam misalignment.
 - o As the minimum elevation angle of the ground antenna is around 15°:
 - the main beam of the payload antenna will illuminate a maximum area of less than 5 km in radius around the ground site in Roswell or Tatum, equivalent to the horizon limit of the ground sites. See Figure 2.
 - depending on the location of the HAPS and constrained by the 60 km link distance to Roswell or Tatum, the far sidelobes of the payload antenna will illuminate the nearest registered sites at angles above 5° from the payload's main beam.
- The antennas of registered sites are more directional than Sceye's with even higher side-lobe attenuation, and with 0° elevation angles. So:
 - o there is no direct line-of-sight between the payload and those registered sites.
 - o any radiation from the payload to the registered sites can only happen through the far sidelobes of both the payload and the registered site antenna.
 - o and therefore, the HAPS location relative to the registered sites is not critical since closer proximity will be equivalently offset by additional sidelobe attenuation and vice versa.
- The payload's maximum transceiver output power is -3 dBW or 0.5 W, tunable by 27 dB down to -30 dBW or 0.001 W. This is abundant flexibility to attenuate the transmitted payload signal level as needed.
- **Conclusion:** Considering all the above facts collectively, any unwanted radiation from the payload antenna towards any registered site will be attenuated in total by more than 230 dB, effectively resulting in ~ 0 W received at any other registered site. Therefore, Sceye's 70/80 GHz flight test system will not cause harmful interference to incumbent Fixed Microwave Service licensees operating in the 71 – 76 GHz and 81 – 86 GHz bands.