RaySat PAA-1000 Antenna STA Application

1.0 Introduction

Raysat Antenna Systems, LLC ("RAS") hereby requests a special temporary authorization ("STA") to operate up to 2 Vehicle Mounted Earth Station ("VMES") earth stations in the 14.0-14.5 GHz and 11.7-12.2 GHz frequency bands.

RAS seeks to test and demonstrate the new PAA-1000 earth terminal based on a fully electronic phased array antenna design in support of the US Army Battle Labs at Ft Gordon. Although the initial testing is in Ft Gordon the antenna may be used at other military bases as required.

2.0 Antenna

The PAA-1000 is a phased array antenna where the beam is electrically steered in the direction of the satellite. The PAA-1000 is the result of years of company funded research utilizing the latest, most up-to-date MMIC technologies. The antenna is low profile (less than 2.5" tall) and is ideally suited to be mounted unobtrusively on military vehicles. Granting this STA will benefit the public interest as this antenna will advance the state of the art for both military and commercial SATCOM-on-the-move solutions. The antenna is shown in the Figure 1 while the antenna panel and RF circuits are shown in Figure 2.

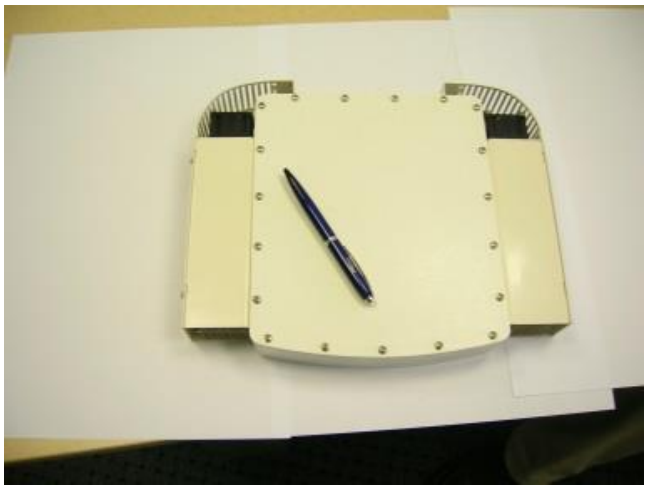


Figure 1
PAA-1000 Antenna

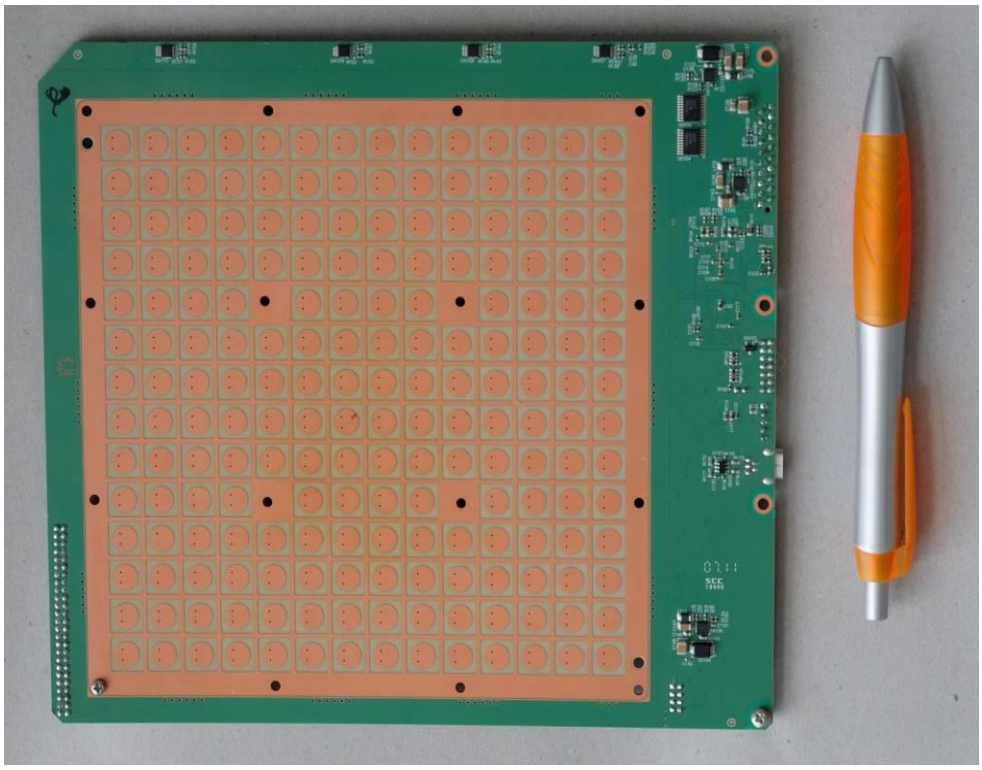


Figure 2A
Front View of Antenna Transmit Panel

Figure 2B
Front View of Antenna Receive Panel

3.0 Antenna Operation

As with all RAS antennas, the PAA-1000 has active control of the azimuth, elevation and polarization angles to maintain precise pointing towards the target satellite. The antenna consists of separate transmit and receive antenna panels.

Although the beam is steered electrically, the PAA-1000's satellite acquisition and tracking utilizes the same proven principles implemented in existing RAS mechanically steered antenna and for which the FCC has granted operating licenses. A simplified block diagram of the major components in the tracking and acquisition system is shown in Figure 3.

During operation the receive antenna uses a built-in GPS receiver to determine its position on the earth. It then uses the geographical position and the longitudinal position of the satellite to determine the appropriate elevation and polarization angle. Once the elevation angle is set the antenna's receive beam scans in azimuth. During the scanning process the antenna receives Eb/No information from the modem to verify the target satellite has been acquired. Once the satellite is acquired the receive beam scans in both azimuth and elevation to maintain peaking on the satellite. The antenna also has internal 3-axis gyroscopes and 2-axis inclinometers to help with the tracking while the antenna is in motion. The antenna will also use the information from the gyros to determine when the pointing offset has reached 0.5° and will initiate transmit muting when this occurs. The transmission will be muted within 100milliseconds of this occurring.

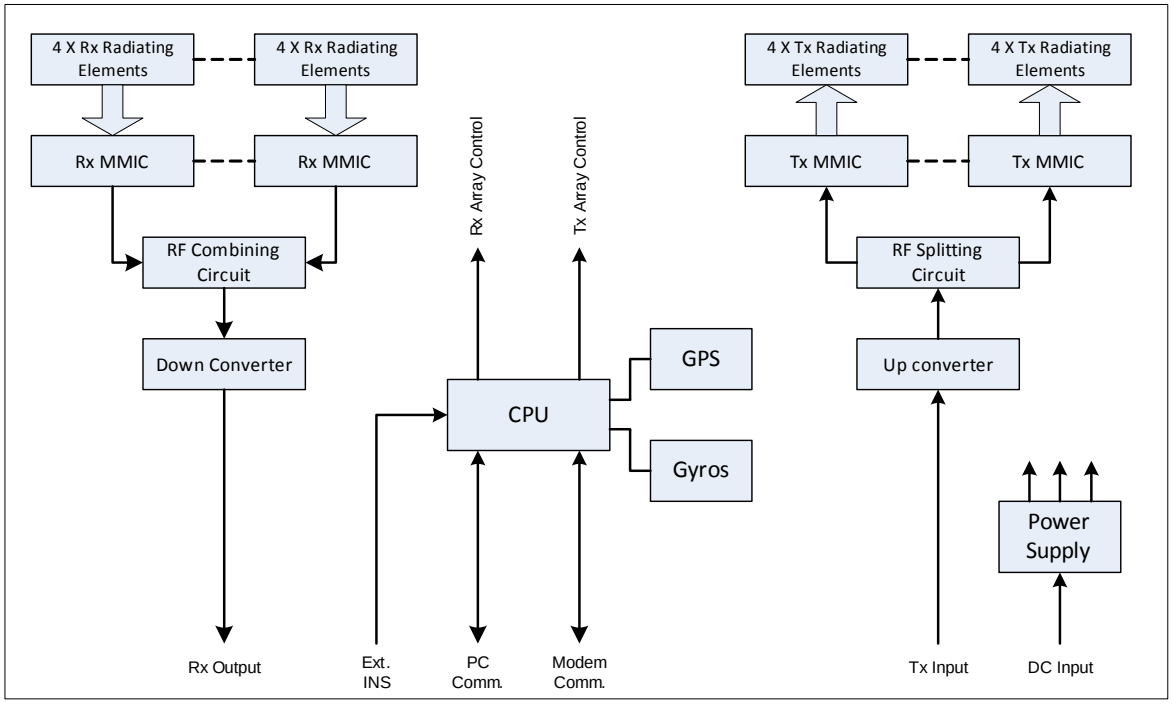


Figure 3
PAA-1000 Block Diagram

4.0 Antenna Patterns

The transmit gain pattern shown in Figure 4 exceeds the Commission's routine licensing guidelines, but by increasing the occupied bandwidth to 2.5MHz the EIRP density remains under the off-axis PSD mask even with a 0.5 degree pointing error in the GSO plane as shown in Figure 5. Thus, at all times transmissions from the PAA-1000 antenna are compliant with the Commission's 2-degree spacing levels.

The maximum level of off-pointing is set to 0.5° in the plane of the GSO arc after which the transmissions are commanded to turn off. In addition, reduced input power into the antenna ensures compliance with off-axis EIRP levels associated with two-degree spacing and the coordinated parameters of the serving satellite.

RAS has performed detailed analysis and has confirmed that the adjacent satellite interference levels produced under the worst case operating conditions with an occupied bandwidth of 2.5MHz would be no worse than a Section 25.209 compliant antenna with -14dBW/4kHz at its input flange.

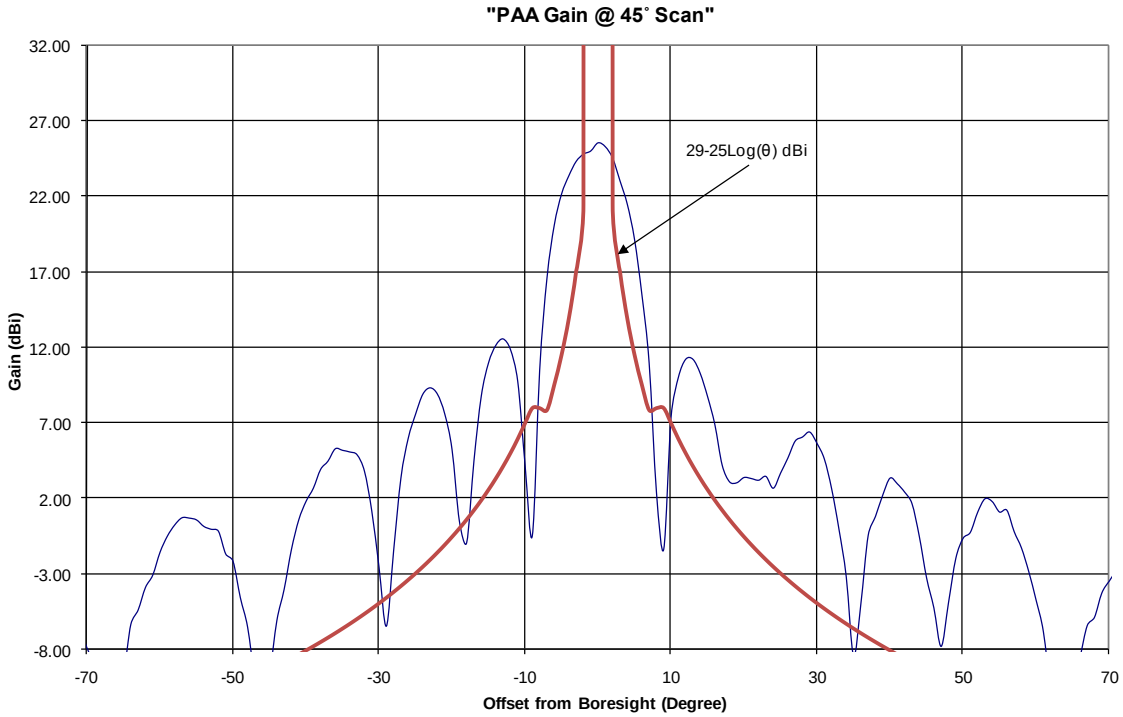
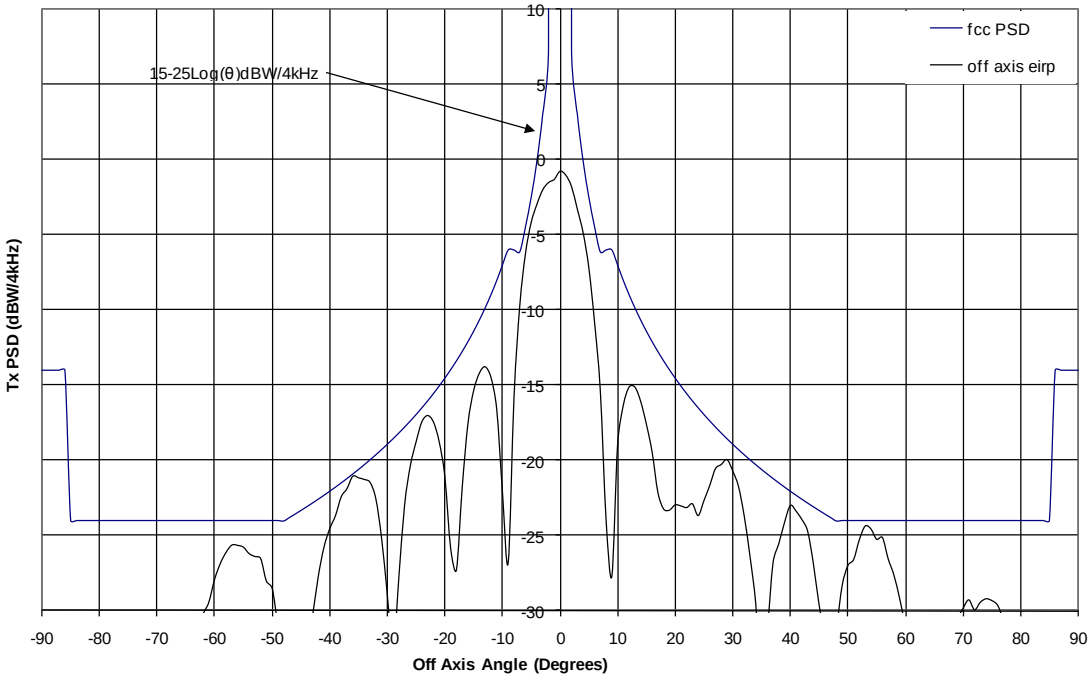


Figure 4, PAA-1000 Gain



PAA-1000 Transmit PST using 2.5MHz Bandwidth

5.0 CONCLUSION

As demonstrated herein, grant of the requested experimental STA would strongly serve the public interest. Specifically, grant of the requested authority would permit RAS to add a new antenna to its already authorized VMES operations and expand the range of mobile broadband options available to U.S. government users, without increasing the potential for interference to other users of Ku-band spectrum.