

Appendix to Rocket Lab USA, Inc. Launch STA Application

Application Number: 0822-EX-ST-2020

This document provides additional description and technical details for the application for Special Temporary Authority (STA) for which Rocket Lab USA, Inc. (“Rocket Lab”) has applied to authorize launch vehicle communications for its planned Electron Launch Vehicle flight from Wallops Island, VA. First, it briefly summarizes the purpose of the STA application and the communications that will take place during the launch. Next, it provides tables of technical details for the launch, including altitude information and specific frequency usage information.

Rocket Lab is in the process of coordinating its launch operations with appropriate federal incumbents and proposes only to operate consistent with coordination agreements reached with these incumbents, including the U.S. Air Force, U.S. Navy, NASA, NOAA, and AFTRCC (non-government).

Background and Launch Overview:

Rocket Lab has been granted two related STAs concerning pre-launch ground testing of the launch vehicle at the launch site (0336-EX-ST-2020 and 0623-EX-ST-2020). Rocket Lab seeks FCC authorization to use frequencies for transmissions from the launch vehicle to ground stations in the U.S. and other jurisdictions during various stages of the actual launch, which is planned for August/September 2020. The launch will occur at Rocket Lab’s launch complex (LC-2), which is located at the Mid-Atlantic Regional Spaceport on Wallops Island. The launch vehicle body consists of 3 stages:

- Stage 1 of the launch vehicle lifts off and travels due East approximately 90° azimuth while transporting the rocket out of the earth’s atmosphere and separates from stage 2 approximately T+170 seconds after lift-off and falls back to Earth, landing in the Atlantic Ocean. No radio transmissions will occur from stage 1 of the launch vehicle.
- After separation from stage 1, stage 2 of the launch vehicle ignites its engines to boost the vehicle into an elliptical orbit approximately 200km perigee and 600-650km apogee at 37-40° inclination. Stage 2 will transmit downlink telemetry data to NASA ground stations at Wallops Flight Facility and in Bermuda using channels centered on 2374 MHz and 2384 MHz. It is proposed that these telemetry transmissions will occur from a few hours before launch (T-5 hours) until approximately T+670 seconds when it goes out of view of the Bermuda tracking ground station.
- Stage 3, the kick stage, separates from stage 2 at approximately T+550 seconds. It then coasts to orbit apogee and then circularizes the orbit with its onboard Curie engine before deploying the payload over the southern Indian Ocean. It is proposed for stage 3 to transmit downlink telemetry to a ground station in Long Beach, California, as well as other sites outside the U.S. using 2272.5 MHz. Stage 3 uplink telemetry will use 2061 MHz from ground station transmitters located exclusively outside the U.S. It is also

proposed for stage 3 to transmit downlink telemetry to a ground station located outside of the United States using 401.15 MHz. A short ground test before launch on 401.15 MHz will also be required. Stage 3 will cease transmission after 4 full orbits of approximately 90 minutes each or earlier.

Rocket Lab also requests authorization to operate without periodically transmitting the call sign associated with this authorization, as this would significantly disrupt ongoing transmissions to and from the launch vehicle.

The payload customer for this launch is the U.S. Air Force.

DOWNLINK TRANSMIT BEAMS

Center Frequency	2385 MHz
Minimum 99% BW	7.8 MHz
Maximum 99% BW	7.8 MHz
Proposed minimum emission designation	N/A
Proposed maximum emission designation	7M80G1D--
Minimum transmit power	3 dBW
Maximum transmit power	10 dBW
Minimum PSD	-67.8 dBW/Hz
Maximum PSD	-60.8 dBW/Hz
Minimum Elevation Angle Transmit	0
Maximum Elevation Angle Transmit	0
Transmit Antenna Polarization	Linear 45 degrees
Requested licensing use case	(1) Launch Vehicle Downlink Telemetry to Wallops Island and downrange to Bermuda ground station.
Notes	(1) Transmission stops after line-of-sight to Bermuda is lost over the horizon. (2) Emission designation and maximum 99% BW excludes +/- 65 kHz of Doppler shift.

Center Frequency	2374 MHz
Minimum 99% BW	3.0 MHz
Maximum 99% BW	3.0 MHz
Proposed minimum emission designation	N/A
Proposed maximum emission designation	3M00G1D--
Minimum transmit power	3 dBW
Maximum transmit power	10 dBW
Minimum PSD	-63.8 dBW/Hz
Maximum PSD	-56.8 dBW/Hz
Minimum Elevation Angle Transmit	0
Maximum Elevation Angle Transmit	-1.5
Transmit Antenna Polarization	Linear 45 degrees
Requested licensing use case	(1) Stage 2 Launch Vehicle Downlink Telemetry to Wallops and downrange to Bermuda GS.
Notes	Emission designation and maximum 99% BW excludes +/- 65 kHz of Doppler shift.

Center Frequency	2272.5 MHz
Minimum 99% BW	0.02 MHz
Maximum 99% BW	0.73 MHz
Proposed minimum emission designation	20K0G1D--
Proposed maximum emission designation	302KG1D--
Minimum transmit power	-10 dBW
Maximum transmit power	0 dBW
Minimum PSD	-67.8 dBW/Hz
Maximum PSD	ITU RR Table 21-4 Limit
Minimum Elevation Angle Transmit	0
Maximum Elevation Angle Transmit	0
Transmit Antenna Polarization	RHCP
Requested licensing use case	<p>(1) Initial on-orbit downlink once outside the United States, over South Africa, Mauritius and Australia.</p> <p>(2) Request downlink to Long Beach, California.</p> <p>(3) All orbital downlinks may last up to 4 full 95-minute orbits.</p> <p>(4) Downlinks only occur while in view of a ground station as listed in the Ground Stations section below.</p>
Notes	<p>(1) The PFD/Hz towards the Earth will vary depending on the bandwidth and power utilized. At all times, we will comply with the PFD/Hz limits in Table 21-4 of the ITU RR.</p> <p>(2) Emission designation and maximum 99% BW excludes +/- 65 kHz of Doppler shift.</p>

Center Frequency	401.85 MHz
Minimum 99% BW	0.11 MHz
Maximum 99% BW	0.022 MHz
Proposed minimum emission designation	10K0G1D--
Proposed maximum emission designation	23KG1D--
Minimum transmit power	0 dBW
Maximum transmit power	0 dBW
Minimum PSD	-40.0 dBW/Hz
Maximum PSD	-43.0 dBW/Hz
Minimum Elevation Angle Transmit	5
Maximum Elevation Angle Transmit	0
Transmit Antenna Polarization	Linear 45 degrees
Requested licensing use case	<p>(1) Stage 3 secondary telemetry downlink only over Australia.</p> <p>(2) All orbital downlinks may last up to 4 full 95-minute orbits.</p> <p>(3) Downlinks only occur while in view of the ground station in Australia.</p> <p>(4) Request very short term in-hangar testing at launch site. Intermittent pre-launch transmitter testing in hangar for short periods.</p>
Notes	Emission designation and maximum 99% BW excludes +/- 10 kHz of Doppler shift.

UPLINK FREQUENCIES TO LAUNCH VEHICLE

Center Frequency	2061 MHz
Requested licensing use case	(1) On-orbit usage once outside the United States. No uplink from any U.S. mainland ground stations. Uplinks only from South Africa, Mauritius and Australia.
Minimum 99% BW	0.02 MHz
Maximum 99% BW	0.28 MHz
Proposed minimum emission designation	20K0G1D--
Proposed maximum emission designation	75K0G1D
Rx System noise temperature	1000
Minimum elevation angle tx	5
Maximum Rx antenna gain	4.5 dBi
Rx antenna polarization	RHCP
Notes	Emission designation and maximum 99% BW excludes +/- 65 kHz of pre-Doppler shift.

RECEIVING GROUND STATIONS / ANTENNAS (U.S.)

Location	LC2 Wallops Island, Goddard Space Facility
Rx Band	S-Band Ext.
Owner/operator	NASA/WFF
Latitude (dec)	37.92361
Longitude (dec)	-75.47722
Latitude (DMS)	37N 55m 25s
Longitude (DMS)	75W 28m 38s
Antenna description	8m NASA Operated Upper S-Band (Rx)

Location	LC2 Wallops Island, Goddard Space Facility
Rx Band	S-Band Ext.
Owner/operator	NASA/WFF
Latitude (dec)	37.928029
Longitude (dec)	-75.474451
Latitude (DMS)	37N 55m 41s
Longitude (DMS)	75W 28m 28s
Antenna description	6m NASA Operated Upper S-Band (Rx)

Location	LC2 Wallops Island, Goddard Space Facility
Rx Band	S-Band Ext.
Owner/operator	NASA/WFF
Latitude (dec)	37.841558
Longitude (dec)	-75.484489
Latitude (DMS)	37N 50m 30s
Longitude (DMS)	75W 29m 4s
Antenna description	NASA Off Axis Antenna

Location	Long Beach, CA, United States
Rx Band	S-Band
Owner/operator	KSAT
Latitude (dec)	33.824305
Longitude (dec)	-118.146587
Latitude (DMS)	33N 49m 27s
Longitude (DMS)	118W 8m 48s
Antenna description	KSAT Lite S-Band RX (3.7m)

LOCATIONS OF ALL TRANSMITTING GROUND STATIONS

Location	Purpose	Latitude/ Longitude
Wallops Island, Goddard Space Facility, VA, USA	Hangar testing UHF downlink	N: 37° 52m 21s W: 75° 26m 31s
Mingenew, Australia	Stage 3 Orbital Uplink S-Band transmissions	S: 29° 0m 38s E: 115° 20m 36s
Savanne, Mauritius	Stage 3 Orbital Uplink S-Band transmissions	S: 20° 30m 3s E: 57° 27m 0s
Hartebeesthoek, South Africa	Stage 3 Orbital Uplink S-Band transmissions	S: 25° 53m 9s E: 27° 42m 18s

LOCATIONS OF ALL RECEIVING GROUND STATIONS

Location	Purpose	Latitude/ Longitude
Wallops Island, Goddard Space Facility, VA, USA	Stage 2 Launch downlink telemetry from launch vehicle	N: 37° 50m 0s; W: 75° 29m 18s N: 37° 55m 41s; W: 75° 28m 27s N: 37° 49m 59s; W: 75° 29m 17s
Bermuda	Stage 2 Launch downlink telemetry from launch vehicle	N: 32° 21m 4s W: 64° 39m 31s

Long Beach, CA, United States	Stage 3 S-Band Orbital downlink transmissions	N: 33° 49m 27s W: 118° 8m 48s
Wagin, Western Australia	Stage 3 (Kick Stage) UHF Orbital downlink transmissions	S: 33° 16m 58s E: 117° 25m 43s
Mingenew, Australia	Stage 3 S-Band Orbital downlink transmissions	S: 29° 0m 38s E: 115° 20m 36s
Savanne, Mauritius	Stage 3 S-Band Orbital downlink transmissions	S: 20° 30m 3s E: 57° 27m 0s
Hartebeesthoek, South Africa	Stage 3 S-Band Orbital downlink transmissions	S: 25° 53m 9s E: 27° 42m 18s