Special Temporary Authority Request Orbital BTS (GSM) Test

Lynk Global, Inc.

22 May 2020

Introduction

The following document details an STA Request to the FCC by Lynk Global, Inc. (Lynk) for additional operations by our satellite *Lynk the World*, which was granted the call sign **WQ9XDP** under file number 2130-EX-ST-2019. This satellite commenced operations 13 May 2020. **This additional request is necessary due to COVID-19 travel restrictions**. Currently, Lynk has one approved testing site in the continental United States. This testing site is within Navajo Nation territory and cannot be accessed by non-residents. At the time of this filing, international travel is restricted and/or not recommended.

The STA Request to the FCC is for a space test that will run concurrently with the previously granted STA and encompass narrow tests from our free-flyer smallsat. The spacecraft payload is the same payload as deployed on the previously approved tests, but we propose operations at two new locations within the United States.

[redacted]

Test Time Frame: 01 June 2020 to 01 November 2020

Initial payload testing is expected to take place starting in June, but travel restrictions and other considerations may require additional use of these test sites through the remainder of the flight.
[redacted]

The details of these two test sites:

1. Falls Church, Virginia

Latitude, Longitude: 38°53'08.3"N, 77°09'49.6"W
Uplink Frequency Range: 824-826 MHz
Downlink Frequency Range: 869-871 MHz
[redacted]
Technology to be used: GSM

2. Sperryville, Virginia

Latitude, Longitude: 38°37'53.7"N, 78°13'19.6"W
Uplink Frequency Range: 824-826 MHz
Downlink Frequency Range: 869-871 MHz
[redacted]
Technology to be used: GSM

[redacted]

Our extensive interference analysis provided in multiple previous STA request documents, including those for 2130-EX-ST-2019, demonstrates that there will be no harmful interference impacting the existing licensed service quality due to the presence of the satellite downlink signal from this test. This is the result of a number of combined factors that first reduce the probability of occurrence to extremely low levels and then allow the existing device protocol to completely eliminate any residual effects to the normal operation of licensee user equipment.

During previous testing campaigns in February 2019, Fall 2019, and February 2020, Lynk and various U.S.-based mobile network operators coordinated the monitoring of their terrestrial networks for instances of interference during the testing window. These operators confirmed there was no reported interference.

Detailed Description

Lynk is developing a cellular-based nanosat communications network. The service would provide GSM or LTE cellular service around the globe operating on the majority of cellular bands used globally with downlink blocks between 724 and 960 MHz using a Low Earth Orbiting (LEO) nanosat. The spacecraft would effectively act as a high-altitude cell tower. There is a need to perform testing on prototype equipment, which will provide important information regarding the performance of the links and the network/system control capabilities. Lynk desires to perform a series of very short tests in various locations in around the globe, but COVID-19 travel restrictions require us to seek approval for locations closer to Lynk's headquarters.

[redacted]

[redacted]

[redacted]

[redacted]

The Lynk satellite, and especially its transmitter, is under the strict control of commands uploaded over our TT&C system. These commands are time tagged for execution at specific times, and consequently at specific locations and positions. Accurate timing of the spacecraft clock assures that the execution of spot beam transmissions is at the proper location and under the precise control of the command scripts that are continually planned, uploaded and executed by the payload.

This will ensure that the transmissions will only occur over the desired test areas.

The energy at the center of the main lobe of the antenna will be well below the typical signal level from terrestrial towers, and below the sensitivity of normal user devices at beam edge (-105 dBm per 200 kHz for GSM). [redacted]

This base-station will transmit on the broadcast channel as its downlink and respond to any uplink bursts from Lynk's test-enabled mobile phones or modules in the testing area. [redacted] On the ground, the devices consist of existing GSM phones or modules with augmented antennas. [redacted]

GSM communications tests will be conducted on carrier frequencies that are 200 kHz wide [redacted]

The GSM phone and module signal energy bandwidth are illustrated in Figure 2 below.

Additional information on the antennas being used and the link analyses is available if needed.

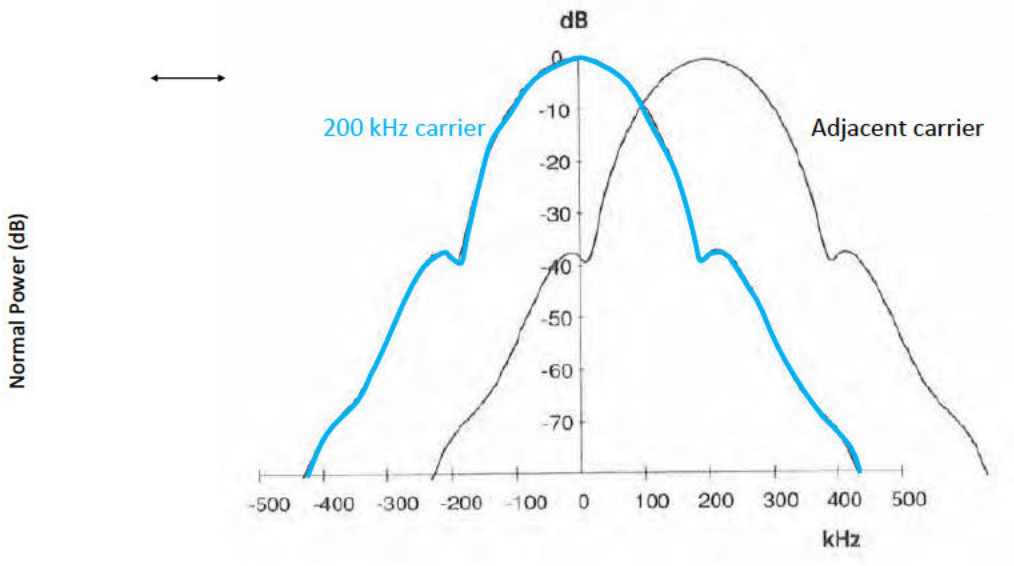

Figure 2 - [redacted] GSM Spectrum showing ACI Level in a 200 kHz channel

Table 1 below describes the general technical parameters of each ground transmitter for the Earth-to-Space link.

	GSM protocol
Transmit/Receive Bandwidth	[redacted]
Power	
Module (w/ antenna)	
Antenna: Gain	
Power EIRP (Boresight)	
Stnd mobile phone or module	
Antenna: Gain	
Power EIRP	
Antenna Height	
Radius of Operation	

Table 1 - Lynk STA Request Operational Parameters

Table 2 below describes the general technical parameters of the space transmitter for the Space- to-Earth link.

Table 2 - Lynk Downlink (Space-to-Earth) Transmitter Technical Parameters	
	GSM protocol
Channel Bandwidth	200 kHz
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
Max PSD (dBm per channel bandwidth)	-92.8 to -94.5 dBm per 200 kHz
Max PSD (dBm per kHz)	-116.5 to -115.5 dBm per kHz
Min PSD (at edge – per channel bandwidth)	-105** dBm per 200 kHz
Min PSD (at edge – per kHz)	-128 dBm per kHz

[redacted]

*** - 105 dBm is the sensitivity of a typical GSM device (6 dB noise figure) across a 200 kHz carrier channel.*

Table 2 - Lynk STA request operational parameters for space segment transmitter

Table 3 below describes the general orbital technical parameters of the space transmitter for the Space-to-Earth link.

Table 3 - Lynk Downlink (Space-to-Earth) Transmitter Technical Parameters	
Altitude and Eccentricity	[redacted]
Inclination	51.6°
Spacecraft	Lynk 6U Spacecraft

Table 3 - Lynk orbital operational parameters for space segment transmitter

Interference Mitigation

The Lynk STA request for 2130-EX-ST-2019 included an interference mitigation analysis. This analysis holds true for this STA request as well. A copy of this analysis is available should it be required. We have received no adverse comments from any of the MNOs who were engaged in the prior tests, and all have provided consent for follow-on tests on our current authorized mission.

Frequencies of Operation

Description of Payload Band Capability and Spectrum of Operation

The flight demo will operate a cell tower in orbit that uses a single GSM duplex carrier at any one point in time.