



BlackSky Global, LLC  
3415 S. 116<sup>th</sup> Street, Suite 123  
Tukwila, WA 98168

February 18, 2015

**Subject:** Re: file number 0829-EX-PL-2014, correspondence reference number 26735

Dear Ms. Nguyen,

This information is in response the FCC's February 3, 2015 request for information in regards to the above-referenced application number. This document contains responses to each of the questions contained in that email. Each question is listed in this document, with the answer following each question. Please let me know if you have additional questions.

Sincerely,

John Springmann, Ph.D.  
Lead Systems Engineer  
[jspringmann@blacksky.com](mailto:jspringmann@blacksky.com)

**Question 1:**

**"Please submit inclination angle, apogee (km)/perigee (km), orbit period (hours), fractions of hours in decimal and number of satellites in the system."**

97.4° inclination, 720 km altitude at apogee, 450 km altitude at perigee

Orbital period: 96.74 minutes, which is equivalent to 1.612 hours.

Number of satellites in system: 2

**Question 2:**

**"An analysis transmitting between satellites to satellite."**

There is no satellite-to-satellite communication. Even though two satellites are launching at the same time, there are only space-to-ground and ground-to-space links.

**Question 3:**

**"An analysis transmitting between satellites to ground stations."**

The table below shows the link budgets for all uplinks and downlinks. A description of each link (one link per table column) is as follows:

- **UHF Uplink (Ground to Space):** Ground to space link is near 450 MHz UHF using a RHCP crossed Yagi transmitting at 5 W RF to a whip antenna on the spacecraft.
- **UHF Downlink (Space to Ground):** Space to Ground link is in the 401-402 MHz commercial UHF band using a linearly polarized whip antenna on the spacecraft transmitting 2 W RF to a RHCP crossed Yagi at the ground station.
- **Typical S Band Uplink (Ground to Space):** Ground to space link is in the 2025-2110 MHz Space Operations Service band using a 3.7 m parabolic dish to transmit 25 W RF to a patch antenna on the spacecraft, both RHCP. Applicable to all ground sites except Fairbanks, AK.
- **Typical X Band Downlink (Space to Ground):** Space to Ground link is in the 8025-8175 MHz Earth Exploration Satellite band using a patch antenna on the spacecraft to transmit 8 W RF to a 3.7 m dish at the ground station, both RHCP. Applicable to all ground sites except Fairbanks, AK.



- Fairbanks S Band Uplink (Ground to Space): Ground to space link is in the 2025-2110 MHz Space Operations Service band using a 9.1 m parabolic dish to transmit 15 W RF to a patch antenna on the spacecraft, both RHCP. Applicable to the Fairbanks, AK ground site only.
- Fairbanks X Band Downlink (Space to Ground): Space to Ground link is in the 8025-8175 MHz Earth Exploration Satellite band using a patch antenna on the spacecraft to transmit 8 W RF to a 9.1 m dish at the ground station, both RHCP. Applicable to the Fairbanks, AK ground site only.

Note that this link budget assumes 720 km mean orbit altitude and a 10 degree elevation above the horizon.

(Intentionally left blank – see next page)



	UHF Uplink	UHF Downlink	Typical S Band Uplink	Typical X Band Downlink	ASF S Band Uplink	ASF X Band Downlink
From:	Ground	Space	Ground	Space	Ground	Space
To:	Space	Ground	Space	Ground	Space	Ground
Transmit Power (Watts):	5	2	25	8	15	8
Frequency, MHz:	450	401.5	2071.875	8080	2071.875	8080
Transmit Antenna Gain, dBi:	16	3	33.5	15	43.6	15
Losses to Antenna, dB:	2.85	0.73	1.99	0.95	0.56	0.95
Transmitter EIRP, dBm:	50.14	35.28	75.49	53.08	84.80	53.08
Slant Range, km:	2198	2198	2198	2198	2198	2198
Path Loss, dB:	152.4	151.4	162.7	174.5	162.7	174.5
Polarization Loss, dB:	3	3	0.67	0.23	0.67	0.23
Transmit antenna pointing loss, dB:	0.1	1.5	0	0.3	0	0.3
Receive antenna pointing loss, dB:	1.5	0	3	0.1	3	0.1
Isotropic signal at Receive antenna, dBm:	-106.86	-120.62	-90.88	-122.05	-81.57	-122.05
Receive Antenna Gain, dBi:	3	18.5	6	45.9	6	56
Losses to Receiver, dB:	1.72	1	1.72	1.11	1.72	1.11
Received Power at LNA input, dBm:	-105.58	-103.12	-86.60	-77.26	-77.29	-67.16
Receive Noise Figure, dB:	3.5	0.75	3.5	0.69	3.5	0.69
Sky Temperature, K:	230	121	290	69	290	69
System Noise temperature:	548	294	602	182	602	182
Receiver G/T, dB/K:	-26.11	-7.18	-23.52	22.19	-23.52	32.29
Data Rate, bps:	9,600	440000	100,000	1.00E+08	100,000	1.00E+08
Receiver Bandwidth, Hz:	40,000	845000	188000	1.51E+08	188000	1.51E+08
Noise Power, dBm:	-125.19	-114.65	-118.06	-94.21	-118.06	-94.21
CNR, dB/Hz:	19.61	11.53	31.46	16.95	40.77	27.05
Required S/N, dB:	14.8	10.6	10.6	10.6	10.6	10.6
Coding Gain, dB :	5.44	5	2	5.44	2	5.44
System Link Margin, dB:	10.25	5.93	22.86	11.79	32.17	21.89



Question 4:

“Location of ground stations including latitude and longitude.”

Location	Bands in Use	Address	Latitude/Longitude	Elevation AMSL (m)
Tukwila, WA	UHF only	3415 S 116th St #123, Tukwila, WA	47° 29' 55.44" N, 122° 17' 23.64" W	15.9
Redmond, WA	S/X only	6742 185th Ave, NE Redmond, WA 98052	47° 40' 00.88" N, 122° 05' 34.02" W	33
Fairbanks, AK	UHF, S, X	903 N Koyukuk Dr Fairbanks, AK 99775	64° 47' 37.0" N, 147° 32' 10.8" W	144
Prudhoe Bay, AK	UHF, S, X	Track 11, North Slope Lease Tracts, Umiat Meridian, AK	70° 13' 28.42" N, 148° 25' 38.02" W	9.1
Spaceport America, New Mexico	UHF, S, X	234 Aleman Rd Truth or Consequences, NM 87901	32° 59' 46.8" N, 106° 59' 3.9" W	1415

Question 5:

“Information of satellite transmitter antenna including gain, beamwidth, azimuthal range.”

Antenna	Gain	Beamwidth	Azimuthal Range <sup>1</sup>
UHF whip (Tx & Rx)	3 dBi	180° (nearly-omni)	Body-fixed*
S-band patch (Rx)	-	n/a – receive only	-
X-band patch (Tx)	15 dBi	18°	Body-fixed*

Question 6:

“Information of earth station receiver antenna including gain, beamwidth, azimuthal range, elevation above mean sea level (m), minimum angle of elevation and antenna height above terrain (m).”

Location	Beamwidth	Azimuthal Range	Elevation AMSL (m)	Min Elevation angle <sup>2</sup> (deg)	Height above terrain <sup>3</sup> (m)
Tukwila, WA	UHF: 30°	UHF: 0-360°	15.9	0°	UHF: 10
Redmond, WA	S/X: 1°	S/X: 0-360°	33	0°	S/X: 15.2
Fairbanks, AK	UHF: 30° S/X: 1°	UHF: 0-360° S/X: 0-360°	144	0°	UHF: 5 S/X: 4
Prudhoe Bay, AK	UHF: 30° S/X: 1°	UHF: 0-360° S/X: 0-360°	9.1	0°	UHF: 2 S/X: 2
Spaceport America, New Mexico	UHF: 30° S/X: 1°	UHF: 0-360° S/X: 0-360°	1415	0°	UHF: 5 S/X: 2

<sup>1</sup> Body-fixed means that the antenna is not steerable; it is rigidly attached to the body of the spacecraft. The entire spacecraft will slew such that the antennas are pointing at the ground station during a contact pass.

<sup>2</sup> 0° minimum elevation is desired. We can limit the minimum elevation for transmission, if necessary.

<sup>3</sup> Some locations are approximate – final designs in progress.



Question 7:

**“Stop Buzzer information including name and telephone number of person who will terminate the system if having interference occurs”**

24/7 POC for ground station operations is Dr. John Springmann, 206-351-5165