**NSL Standard Form for Specifying**

**Simplex and Duplex Operations Requirements**

1. **General Satellite Information** on Mission
	1. Project Name of Satellite: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Institution/Owner of Satellite: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. PO# to associate Electronic Serial Number (ESN): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. PI and Finance contact information for Simplex and Duplex
		1. PI for Project: Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Email: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Phone #: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1. Finance Contact: Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Email: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Phone #: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1. Other Contact: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	1. What company did you purchase your Simplex and/or Duplex product from? \_\_\_\_\_\_\_\_\_\_\_\_
	2. If known, Simplex ESN: \_\_\_\_\_\_\_\_\_\_\_\_\_\_, Duplex Serial Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
1. **Simplex Firmware** Data operation for Beacon
	1. TX Inhibit Timer (Default: 0 min): EM: \_\_\_\_\_\_\_\_\_, FM: \_\_\_\_\_\_\_\_\_\_
		1. This is the time between when the unit first powers on, to when it begins to Beacon transmit. This is usually defined by the launch vehicle and/or deployer. For example, Nanoracks requires a TX Inhibit of 45 minutes after being deployed from ISS. Globalstar and FCC require minimum of 1-hour beacon. This can be left at 0 if the spacecraft is handling the power up inhibit delay.
	2. First Contact Beaconing, and if yes, how many? (Default: yes, 10) EM: \_\_\_\_\_\_\_\_\_, FM: \_\_\_\_\_\_\_
		1. After the TX Inhibit timer is completed, if First Contact is selected, the unit will quickly transmit a set number of Beacons before transmitting at the regular Beacon Rate. If First Contact is declined, after TX Inhibit Timer is completed the unit will immediately begin Beaconing at the set Beacon Rate. Recommended to leave at default value.
	3. Beacon Rate (Default: 5 minutes): EM: \_\_\_\_\_\_\_\_\_\_\_\_, FM: \_\_\_\_\_\_\_\_\_\_\_\_
		1. This is the time period between Beacon transmissions. If set at 5 minutes, the unit will Beacon 12 times/hr. This can be no greater than 1 hr, or 1 transmission/hr.
2. **FCC/ITU/NTIA/Globalstar License** Several recent changes have been required for licensing: Any radio must include the ability to switch off the transmitter, spectrum must not interfere with Radio Astronomy frequencies, detailed Orbital Debris Assessment Report (ODAR), and space debris mitigation must be addressed. Globalstar radios are a solution for small satellites with the their very low power transmitters/low interference, owner of frequency spectrum that is outside of Radio Astronomy frequencies, and the Simplex and Duplex antennas pointing away from earth and toward the Globalstar constellation. Duplex can dynamically reduce power in orbit when link is strong.
	1. Who is going to do the license and ODAR, sponsor or owner? Examples are NASA ELaNa, In-House, NSL Consultant, Government Agency or other. Usually one of the flight sponsors with consultant does the ODAR and License. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Are your antennas pointing away from the earth toward Globalstar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. What is your attitude control plan? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. How do you receive commands from the ground to shut off the transmitter? \_\_\_\_\_\_\_\_\_\_\_\_\_
	5. NSL does not do the application but helps the owner with the ODAR and FCC/NTIA application and with the Globalstar application. NSL uses certified consultants to complete the ODAR and application process because of all the recent changes required for small satellites.
	6. You need to fill out the “NSL RF Spectrum Data Template for CubeSats” so we can help you with your license approval process. Contact Jeff Dailey at jfdailey@nearspacelaunch.com or Matt Orvis at mattorvis@nearspacelaunch.com to get this form and fill it out.
	7. Orbital Data:
		1. Lifetime: \_\_\_\_\_\_\_
		2. Altitude apogee and perigee: \_\_\_\_\_\_ and \_\_\_\_\_\_\_
		3. Inclination: \_\_\_\_\_\_\_
			1. Note that if the unit will be in a polar orbit, it is recommended to change the packet size from 36 bytes to 18 or 9 bytes, in order to maintain a throughput of over 90%.
3. **Simplex Data** Billing Plans
	1. Need to pay first month projected cost 1 month before launch date. If the launch or your satellite is a failure you get 60% refunded back to you for first month.
	2. Monthly payment fee for Simplex ($10/month and covers some basic health and safety data).
	3. To reduce monthly billing, you can buy your estimated annual data usage. You are only billed for the data you use.
	4. See the NSL Simplex Pricing Schedule for Data Cost.
4. **Duplex Data** Operation and Cost:
	1. There is a monthly fee of $100/month when you receive your EM unit. If you don’t plan to use your unit or do not want to pay the monthly fee you can have NSL deactivate your unit with a $100 fee. There is also a $100 activation fee when it is turned on again.
	2. See the Duplex rate schedule for data usage.

 Billing questions, Please email mattvoss@nearspacelaunch.com or scottorvis@nearspacelaunch.com

1. **References:** See AIAA Small Sat Papers on Simplex and Duplex coverage in -orbit results. Papers available on NSL Website: www.nearspacelaunch.com
	1. TSAT Globalstar ElaNa-5 Extremely Low-Earth (ELEO) Satellite, SSC14-WK-6, Utah, 2014
	2. Globalstar Link: From Reentry Altitude and Beyond, SSC16-WK-11, Utah, 2016

 Acronyms

* + EM = Engineering Model
	+ ESN = Electronic Serial Number
	+ FCC = Federal Communications Commission
	+ FM = Flight Model
	+ NSL = NearSpace Launch, Inc.
	+ NTIA = National Telecommunications and Information Administration
	+ ODAR = Orbital Debris Assessment Report
	+ PI = Principal Investigator