LEOPARDSat-1 Amateur Radio Information

Overview

LEOPARDSat-1 is a 1U CubeSat designed and operated by the CubeCats student organization at the University of Cincinnati. It was successfully launched to the ISS on April 11th, 2026 onboard the CRS NG-24 mission from Cape Canaveral Space Force Station. The primary scientific mission of LEOAPRDSat-1 is to test the radiation mitigation effects of Carbon-Carbon composites. However, as an educational project and due to the significant idle time during the mission, it will operate as a digipeater for amateur radio operators world-wide when not actively downlinking data to our Ground Station.

Orbit Information

LEOPARDSat-1 TLE (TBD)

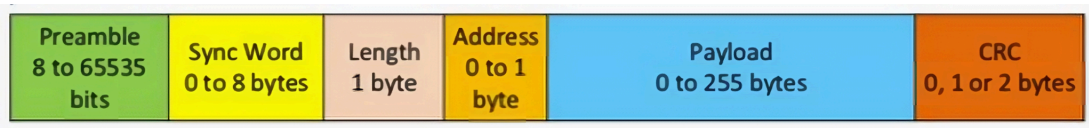
Link Information

LEOPARDSat-1 has a ***half-duplex*** link responsible for both Uplink and Downlink

Frequency	436.980 MHz
Bandwidth	14.7 kHz
Modulation	FSK
Data Rate	1200 bps
Polarization	Linear
TX Power	0.9 W

Packet Structure

Uplink and downlink both use the transceivers native packet structure as shown below



For LEOPARDSat-1:

- **Preamble Length:** 16 bits
- **Sync Word**: 0xC1, 0x94, 0xC1 (3 bytes)
- **CRC**: 2-Bytes CCIT

Beaconing

LEOPARDSat-1 will beacon for at least 2 weeks after detumbling and the latest received command. If you hear LEOPARDSat-1's beacon after deployment (**7/2**), please contact CubeCats at uccubecats@gmail.com to report the sighting. The beacon will have the same format as the Telemetry downlink payload described below.

Public Uplink/Downlink

LEOPARDSat-1 can be commanded through a properly formatted payload packet. The following is a list of valid commands available to the general public:

1) Telemetry Request

Transmits some basic status information on the state of the satellite payload. The uplink command is the following 6-byte packet payload frame is as follows:

Command					
0x01	0xAB	0xEF	0xAB	0xEF	0xAB

The resulting downlink packet payload bytes should be 16 bytes long with the following data:

Metadata				**Battery Pack Status**						**Temperature**					
Time Stamp				*% Charge*		*Voltage*		*Current*		*Cell 1*		*Cell 2*		*Pay.*	*MCU*
1	*2*	*3*	*4*	*1*	*2*	*1*	*2*	*1*	*2*	*1*	*2*	*1*	*2*	*1*	*1*

The timestamp is a Unix time stamp for the onboard clock (which may not be accurate to ground time). Battery pack data is for the pack as a whole with voltage is in mV, current is in mA. Interpretation of temperatures depends on the source

- The battery cell temperatures are tenths of a degree Kelvin, so to get the actual value in Celsius, divide the raw data number by 10, and subtract by 273.18.
- Payload temperature consists of the average of three sensors on the payload board and can be interpreted using the table below under the column "Standard Binary".
- The MCU temperature is directly measured in Celsius.

2) Repeater

Rebroadcasts an amateur radio message. The uplink package command begins similarly to the telemetry request, but with a variable length content section containing the actual message and its length in bytes. An amateur message can be up to 64 bytes long.

Command						**Len.**	**User Message**			
0x02	0xAB	0xEF	0xAB	0xEF	0xAB	*1*	*1*	*2*	*…*	*64*

The satellite should transmit an identical message out once the command is received

Additional Information

- [IARU Frequency Coordination Letter]

Payload Temperature Interpretation Table

Table 1. Temperature Data Format (Local and Remote Temperature High Bytes)

TEMP (°C)	LOCAL/REMOTE TEMPERATURE REGISTER HIGH BYTE VALUE (1°C RESOLUTION)			
	STANDARD BINARY(1)		EXTENDED BINARY(2)	
	BINARY	HEX	BINARY	HEX
–64	1100 0000	C0	0000 0000	00
–50	1100 1110	CE	0000 1110	0E
–25	1110 0111	E7	0010 0111	27
0	0000 0000	00	0100 0000	40
1	0000 0001	01	0100 0001	41
5	0000 0101	05	0100 0101	45
10	0000 1010	0A	0100 1010	4A
25	0001 1001	19	0101 1001	59
50	0011 0010	32	0111 0010	72
75	0100 1011	4B	1000 1011	8B
100	0110 0100	64	1010 0100	A4
125	0111 1101	7D	1011 1101	BD
127	0111 1111	7F	1011 1111	BF
150	0111 1111	7F	1101 0110	D6
175	0111 1111	7F	1110 1111	EF
191	0111 1111	7F	1111 1111	FF

(1) Resolution is 1°C/count. Negative numbers are represented in two's complement format.
(2) Resolution is 1°C/count. All values are unsigned with a –64°C offset.