

Table 1: Summary of Spacecraft Transmitters.

Launch	Satellite	Object	Size	Radio	Frequency	Satellite Service	Power	TNC	Protocol	Baud Rate/Modulation	Downloaded	Lifetime	Antenna	Status	Date	
Eurockot launch 30 June 2003	AAU1 CubeSat	27846	1U	Wood & Douglas SX450	437.475 MHz	amateur	500 mW	MX909	AX.25, Mobitex	9600 baud GMSK	1 kB	3 months	dipole	Dead	April 2013	
	DTU-sat-1	27842	1U	RFMD RF2905	437.475 MHz	amateur	400 mW		AX.25	2400 baud FSK	0 <sup>1</sup>	0 days	canted turnstile	DOA	April 2013	
	CanX-1	27847	1U	Melexis	437.880 MHz	amateur	500 mW		Custom	1200 baud MSK	0 <sup>1</sup>	0 days	crossed dipoles	DOA	April 2013	
	Cute-1 (CO-55)	27844	1U	Alinco DJ-C4 (data) Maki Denki (beacon)	437.470 MHz 436.8375 MHz	amateur	350 mW 100 mW		MX614 PIC16LC73A	AX.25 CW	1200 baud AFSK 50 WPM	>10 MB <sup>2</sup> N/A	118+ months	monopole	Alive	April 2013
	QuakeSat-1	27845	3U	Tekk KS-960	436.675 MHz	amateur	2 W	BayPac BP-96A		AX.25 <sup>3</sup>	9600 baud FSK	423 MB	7 months	turnstile	Dead	April 2013
	XI-IV (CO-57)	27848	1U	Nishi RF Lab (data) Nishi RF Lab (beacon)	437.490 MHz 436.8475 MHz	amateur	1 W 80 mW		PIC16C622 PIC16C716	AX.25 CW	1200 baud AFSK 50 WPM	>11 MB <sup>2</sup> N/A	118+ months	dipole	Alive	April 2013
SSETI Express 27 Oct 2005	XI-V (CO-58)	28895	1U	Nishi RF Lab (data) Nishi RF Lab (beacon)	437.345 MHz 437.465 MHz	amateur	1 W 80 mW		PIC16C622 PIC16C716	AX.25 CW	1200 baud AFSK 50 WPM	N/A	90+ months	dipole	Alive	April 2013
	NCube-2	28897 <sup>4</sup>	1U		437.505 MHz	amateur			AX.25	1200 baud AFSK	0 <sup>1</sup>	0 days	monopole	DOA	April 2013	
	UWE-1	28892	1U	PR430	437.505 MHz	amateur	1 W	H8S/2674R <sup>5</sup>	AX.25	1200/9600 baud AFSK		3 weeks	end-fed dipole	Dead	April 2013	
M-V-8 22 Feb 2006	Cute-1.7+APD (CO-56)	28941	2U	Alinco DJ-C5 Telemetry (beacon)	437.505 MHz 437.385 MHz	amateur	300 mW 100 mW	CMX589A H8S/2328 <sup>5</sup>	AX.25/SRLL CW	1200 AFSK/9600 GMSK 50 WPM	<1 MB N/A	2.5 months	dipole	Deorbited	April 2013	
Minotaur-1 11 Dec 2006	GeneSat-1	29655	3U	Microhard MHX-2400 Stensat (beacon) <sup>7</sup>	2.4 GHz 437.067 MHz	experimental amateur	1 W 500 mW	Integrated <sup>6</sup> PIC12C617	Proprietary AX.25		500 kB N/A	3 months	patch monopole	Deorbited	April 2013	
Dnepr 2 17 Apr 2007	CSTB1	31122	1U		400.0375 MHz	experimental	<1 W	PIC	Proprietary	1200 baud AFSK	6.77 MB <sup>2</sup>	19+ months	dipole		Aug 2008	
	AeroCube-2	31133	1U	FreeWave FGRM	915 MHz	experimental	2 W	Integrated <sup>6</sup>	Proprietary	38.4 kbaud	500 kB	1 week	patch	Dead	April 2013	
	CP4	31132	1U	TI CC1000/RF2117	437.325 MHz	amateur	1 W	PIC18LF6720	AX.25	1200 baud FSK	487 kB	2 months	dipole	Dead	April 2013	
	Libertad-1	31128	1U	Stensat	437.405 MHz	amateur	400 mW		AX.25	1200 baud AFSK	0 <sup>8</sup>	1 month	monopole	Dead	April 2013	
	CAPE1	31130	1U	TI CC1020	435.245 MHz	amateur	1 W	PIC16LF452	AX.25	9600 baud FSK	0 <sup>9</sup>	4 months	dipole	Dead	April 2013	
	CP3	31129	1U	TI CC1000/RF2117	436.845 MHz	experimental	1 W	PIC18LF6720	AX.25	1200 baud FSK	2.0 MB <sup>2</sup>	19+ months	dipole	Dead	April 2013	
	MAST <sup>10</sup>	31126	3U	Microhard MHX-2400	2.4 GHz	experimental	1 W	Integrated <sup>6</sup>	Proprietary	15 kbps		>2 MB	0.75 months	monopole	Dead	April 2013
NLS-4/PSLV-C9 28 Apr 2008	Delfi-C3 (DO-64)	32789	3U	Custom (transponder) Custom (beacon)	145.9-435.55 MHz 145.870 MHz	amateur	200 mW 400 mW	N/A PIC18LF4680	Linear AX.25	40 kHz wide 1200 baud BPSK	N/A 60 MB <sup>11</sup>	60+ months	turnstile	Alive	April 2013	
	Seeds-2 (CO-66)	32791	1U	Musashino Electric (data) Musashino Electric (beacon)	437.485 MHz 437.485 MHz	amateur	450 mW 90 mW		AX.25 CW	1200 baud AFSK	500 kB <sup>2</sup> N/A	60+ months	monopole	Alive	April 2013	
	CanX-2	32790	3U	Custom S-Band	2.2 GHz	space research	500 mW	Integrated	NSP	16-256kbps BPSK	250 MB	60+ months	patch	Active	April 2013	
	AAUSAT-II	32788	1U	Holger Eckhardt (DF2FQ)	437.425 MHz	amateur	610 mW	PIC18LF6680	AX.25	1200 baud MSK	8 MB <sup>22</sup>	60+ months	dipole	Alive	April 2013	
	Compass-1	32787	1U	Holger Eckhardt (data) BC549 (beacon)	437.405 MHz 437.275 MHz	amateur	300 mW 200 mW	C8051F123, FX614 PIC12F629	AX.25 CW	1200 baud AFSK/MSK 15 WPM	<1 MB <sup>2</sup> N/A	60+ months	dipole	Alive	April 2013	
	Minotaur 1 19 May 2009	AeroCube-3	35005	1U	FreeWave FGRM	915 MHz	experimental	2 W	Integrated	Proprietary	77 kbaud GFSK	52 MB	7 months	patch	Deorbited	April 2013
CP6		35003	1U	CC1000/RF2117	437.365 MHz	amateur	1 W	PIC18LF6720	AX.25	1200 baud FSK		4 months	dipole	Deorbited	April 2013	
HawkSat-1		35004	1U	Microhard MHX-425	437.345 MHz	amateur	1 W	Integrated	Proprietary		0 kB	0 days	monopole	DOA	April 2013	
PharmaSat		35002	3U	Microhard MHX-2400 Stensat (beacon) <sup>7</sup>	2.4 GHz 437.465 MHz	experimental amateur	1 W 500 mW	Integrated Integrated	Proprietary AX.25	10 kbps 1200 baud AFSK	650 kB N/A	10 days 1 month	patch monopole	Deorbited	April 2013	
ISL launch 01/ PSLV-C14 23 Sep 2009	BEESAT-1	35933	1U	Radio	436.000 MHz	amateur <sup>13</sup>	500 mW	CMX909B	Mobitex	4800/9600 baud GMSK		43+ months	monopole	Alive	April 2013	
	UWE-2	35934	1U	Custom	437.385 MHz	amateur			AX.25	1200 baud AFSK		1 week	dipole	Dead	April 2013	
	ITUSAT-1	35935	1U	Microhard MHX-425 BeeLine/CC1050	437.325 MHz 437.325 MHz	amateur	1 W 350 mW	Integrated	Proprietary CW	19200 baud	0 kB <sup>8</sup> N/A	43+ months	dipole	Alive	April 2013	
	SwissCube	35932	1U	Butler oscillator/RF5110G RF2516 (beacon)	437.505 MHz 437.505 MHz	amateur	1 W 100 mW	MSP430F1611 Integrated	AX.25 CW	1200 baud FSK 10 WPM	N/A	43+ months	monopole	Active	April 2013	
H-HA P17 20 May 2010	Hayato	36573	1U	Custom	13.275 GHz	Earth exploration	100 mW	Integrated		10 kbps/1 Mbps BPSK	0 kB <sup>8</sup>	18 days	patch	Deorbited	April 2013	
	Waseda-SAT2	36574	1U	TXE430-301A TXE430-301A (beacon)	437.485 MHz 437.485 MHz	amateur	150 mW 100 mW	H8/3052F <sup>5</sup> H8/3052F <sup>5</sup>	AX.25 CW	9600 baud FSK	0 kB N/A	0 days	monopole	DOA	April 2013	
	Nagai-Star	36575	1U	Data Beacon Radio	437.305 MHz 437.305 MHz	amateur	150 mW 100 mW		AX.25 CW	1200 baud FSK 50 WPM	N/A	1 month	dipole	Deorbited	April 2013	
NLS-6/ PSLV-C15 12 July 2010	Tisat-1	36799	1U	Alinco DJ-C6 CC1010 (beacon)	437.305 MHz 437.305 MHz	amateur	500 mW 400 mW	MSP430F169 MSP430F169	AX.25 CW	1200 baud AFSK 15-110 WPM	N/A	33+ months	monopole	Active	April 2013	
	StudSat	36796	1U	CC1020 MAX1472 (beacon)	437.505 MHz 437.860 MHz	amateur	500 mW 10 mW	UC3A0512 <sup>5</sup> UC3A0512 <sup>5</sup>	Custom AX.25 CW	4800 baud FSK 22 WPM	0 kB <sup>8</sup> N/A	5 days	monopole	Dead	April 2013	
STP-526 19 Nov 2010	RAX-1	37223	3U	Lithium-1	437.505 MHz	amateur	750 mW	Integrated	AX.25	9600 baud GMSK	4.8 MB	2 months	turnstile	Dead	April 2013	
	O/OREOS	37224	3U	Microhard MHX-2400 Stensat (beacon) <sup>7</sup>	2.4 GHz 437.305 MHz	experimental amateur	1 W 500 mW	Integrated Integrated	Proprietary AX.25	Variable 1200 baud AFSK	8 MB N/A	29+ months	patch monopole	Alive	April 2013	
	NanoSail-D2	37361	3U	Microhard MHX-2400 Stensat (beacon) <sup>7</sup>	2.4 GHz 437.270 MHz	experimental amateur	1 W 500 mW	Integrated Integrated	Proprietary AX.25	Variable 1200 baud AFSK	N/A	5 days <sup>14</sup>	patch monopole	Deorbited	April 2013	
Falcon 9-002 8 Dec 2010	Perseus (4)	37251	1.5U			government						1 month	dipole	Deorbited	April 2013	
	QbX (2)	37249	3U	TTC	450 MHz	government	1 W			9600 baud GMSK		1 month	quadrafilar helix	Deorbited	April 2013	
	SMDC-ONE	37246	3U	Pericle	UHF	government						1 month	turnstile	Deorbited	April 2013	
	Mayflower	37252	3U	Microhard MHX-425 Stensat (beacon) <sup>7</sup>	437.000 MHz 437.600 MHz	unlicensed unlicensed	1 W 1 W	Integrated Integrated	Proprietary AX.25	Variable 1200 baud AFSK	0 kB <sup>8</sup> N/A	2 days	dipole	Deorbited	April 2013	
PSLV-C18 12 Oct 2011	Jugnu	37839	3U	CC1070/RF5110G MAX1472 (beacon)	437.505 MHz 437.505 MHz	amateur	1 W 10 mW		AX.25 CW	2400 baud FSK 20 WPM	N/A	18+ months	monopole	Alive	April 2013	
ELaNa-3/ NPP 28 Oct 2011	AubieSat-1	37854	1U	Melexis TH72011	437.475 MHz	amateur	800 mW	ATmega1281 <sup>5</sup>	CW	20 WPM	0 kB	18+ months	dipole	Alive	April 2013	
	DICE (2)	37851	1.5U	L3 Cadet	465 MHz	meteorological	1 W	Integrated	Proprietary	1.5 Mbps BPSK		18+ months	dipole	Active	April 2013	
	HRBE	37855	1U	CC1000	437.505 MHz	amateur	850 mW		AX.25	1200 baud FSK	11	18+ months	monopole	Active	April 2013	
	M-Cubed	37855	1U	Lithium-1	437.485 MHz	amateur	1 W	Integrated	AX.25	1200 baud FSK	0 kB <sup>8</sup>	18+ months	monopole	Alive	April 2013	
	RAX-2	37853	3U	Lithium-1	437.345 MHz	amateur	1 W	Integrated	AX.25	9600 baud GMSK	242 MB	18+ months	turnstile	Active	April 2013	
Vega VV01 13 Feb 2012	Xatco-beo	38082	1U	GomSpace U482C	437.365 MHz	amateur	500 mW	Integrated	AX.25/CW	1200 baud MSK/20 WPM		14+ months	turnstile	Active	April 2013	
	ROBUSTA	38079	1U	MC12181/MAX2608	437.325 MHz	amateur	800 mW	PIC18F4580 <sup>5</sup>	AX.25	1200 baud AFSK	0 kB <sup>15</sup>	2 days	dipole	Dead	April 2013	
	e-st0r	38079	1U	BHX2-437-5	437.445 MHz	amateur	500 mW	PIC16	AX.25	1200 baud AFSK	0 kB <sup>8</sup>	3 days	dipole	Dead	April 2013	
	Goliat	38085	1U	Alinco DJ-C7 Microhard MHX-2420	437.485 MHz 2.4 GHz	amateur	500 mW 1 W	FX614/MSP430 Integrated	AX.25/CW Proprietary	1200 baud AFSK/20 WPM Variable	0 kB <sup>15</sup>	1 week	monopole	Dead	April 2013	
	PW-Sat	38083	1U	ISIS TRXUV	145.900 MHz	amateur	200 mW	Integrated	AX.25/CW	1200 baud BPSK/12 WPM		10 months	dipole	Dead	April 2013	
	Masat-1	38081	1U	Si4432	437.345 MHz	amateur	100/400 mW	dsPIC33F <sup>5</sup>	Custom/CW	GFSK/120 CPM	305 MB	14+ months	monopole	Active	April 2013	
ELaNa-6/NROL-36 13 Sep 2012	SMDC-ONE (2)	38766	3U	Pericle	UHF	government							turnstile	Alive	April 2013	
	AeroCube-4 (3)	38767	1U	FreeWave MM2 CC1101	915 MHz 915 MHz	experimental	2 W 1.3 W	Integrated Integrated	Proprietary Proprietary	38.4 kbaud 500 kbps FSK		8+ months	patch	Active	April 2013	
	Aeneas	38760	3U	MHX-425 Stensat (beacon) <sup>7</sup>	437.000 MHz 437.600 MHz	experimental amateur	1 W 1 W	Integrated Integrated	Proprietary AX.25	Variable 1200 baud FSK	N/A	8+ months	monopole	Alive	April 2013	
	CSSWE	38761	3U	Lithium-1	437.345 MHz	experimental	1 W	Integrated	AX.25	9600 baud GFSK	60 MB	8+ months	monopole	Active	April 2013	
	CP5	38763	1U	CC1000/RF2117	437.405 MHz	amateur	500 mW	PIC18LF6720	AX.25	1200 baud FSK	500 kB	4 months	dipole	Dead	April 2013	
	CXBN	38762	2U	Lithium-1	437.525 MHz	amateur	1 W	Integrated	AX.25	9600 baud GFSK		8+ months	turnstile	Active	April 2013	
	CINEMA	38764	3U	Emhiser	2200 MHz	space research	1 W	FPGA	Proprietary	1 Mbps FSK		8+ months	patch	Active	April 2013	
	Re	38765	3U	Helium-100	915 MHz	government	1 W	Integrated	AX.25	57.6 kbps FSK				dipole	Dead	April 2013
ISS 4 Oct 2012	FITSat-1	38853	1U	High-speed Custom Custom (data) Custom (beacon)	5.84 GHz 437.445 MHz 437.250 MHz	amateur	2 W 10 mW	PIC16F886 PIC16F1519 PIC16F1519	AX.25 CW	115.2 kbps FSK 1200 baud AFSK N/A		6+ months	patch monopole	Active	April 2013	
	TechEdSat	38854	1U	Radio (data) Stensat (beacon) <sup>7</sup>	437.465 MHz	amateur	1 W	Integrated	AX.25	1200 baud AFSK	N/A	6+ months	monopole	Alive	April 2013	
	F-1	38855	1U	VX-3R VX-3R	145.980 MHz 437.485 MHz	amateur	1 W 200 mW		AX.25 FM PWM CW	1200 baud AFSK N/A	0 kB	0 days	dipole	DOA	April 2013	
	WE-WISH	38856	1U	(data) (beacon)	437.505 MHz 437.505 MHz	amateur	100 mW		SSTV CW	30 kbps SSTV		5 months	monopole	Deorbited	April 2013	