NEWSLETTER-AMSAT-EA

05/2022 MAY

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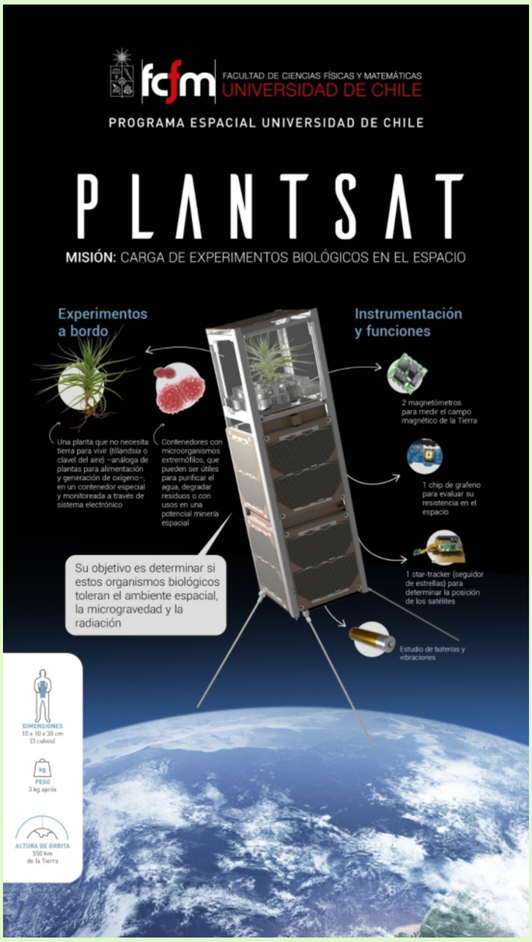
Plantsat



PlantSat (Satellite of the University of Chile for the aerospace research)is a CubeSat 3U satellite,built by students and engineers from the University of Chile. Its main mission is to monitor the behavior of a plant in a microgravity environment and under extreme solar radiation conditions.
Its objective is to study in a low orbit the growth of a plant, replicating the conditions that will experience life on the surface of Mars. These conditions include low force of gravity and high solar radiation.

Plantsat is a joint project between the researcher Mr. Matthew Lehmitz, who leads the scientific mission, GomSpace ,a danish company that kindly provide the satellite platform, the University of Chile that leads assembly, integration, testing and loading utility of the biosphere and Rocket Lab.

The 3U CubeSat satellite, provided by GomSpace, consists of two units containing the satellite systems (based on SUCHAI 2) and a unit consisting of the payload of the biosphere. The type of plant proposed for PlantSat is Tillandsia. This is a plant that can be found throughout the neotropics, high in the Andes mountains and near the shores of the Atacama desert. Its strength and versatility makes it an excellent candidate for surviving in harsh environments.

A launch from a plane was originally planned, but later the mission moved to the ION-SCV 005 tug to be launched on a Falcon-9 v1.2 (Block 5) in April 2022.

Telemetry Downlink Frequency 437.240 FSK Ax100

More info:

https://plantsat.spel.cl/

EA4GQS - Felix (Amsat-EA CEO)

In this newsletter we are going to talk about the architecture of modules/functional units of our URESAT satellite, which are the following:

- Solar panels
- EPS - Electric Power System
- Control processor (OBC – On Board Computer)
- Receiving system (RX)
- Transmitter
- Antenna system
- Mechanical structure
- Orientation Control System (ADCS)
- Thermal control system

Solar Panels and Power System (EPS)

Up to six satellite faces +X+Y+Z-X-Y-Z will be equipped with solar panels. Panels with opposite faces are connected to the same MPPT circuit. The MPPT (Maximum Power Point Tracker) circuit is a chip that makes the panel work at its optimal point, allowing to extract from it the maximum possible energy. It has two control loops. When the panel lighting varies, 1) modifies the working current-voltage point maximizing the extracted power, and at the same time, 2) keeps the output voltage stable.

One or several panels can be illuminated simultaneously. MPPTs are connected to the main power bus. A high-density battery and low weight is connected to the main power bus through a circuit switch.

The EPS battery charge control system monitors that the battery is not overcharged, or discharged below a limit.

Control Processor (OBC)

The microprocessor monitors different facts of the satellite (voltages, current, temperatures, counters) and generates periodic telemetry packets for observation by control operators.

The 32-bit control microprocessor includes capabilities of 1) baseband signal processing from the analog FM demodulator 2) telecontrol packet decoding. This microprocessor implements a rudimentary store-and-forward system, allowing read/write to non-volatile Flash memory using packets of remote/telemetry.

Receiver (RX) and transmitter (TX) system

The receiving system is based on an ad-hoc SDR. The SDR allows to implement different communications services and navigation without modifying the satellite. Allows to transmit and receive simultaneously (FULL DUPLEX operation) or remain in reception waiting for signals. Different waveforms (modulation/protocol) are possible to implement both in the receiving and transmitting chain replacing the software elements.

Antenna system and mechanical structure

The implemented antennas are very simple: a monopole for VHF and another for UHF made of tape measure, a very practical material because it conducts and therefore it serves as an antenna and because it recovers its position when it is released.

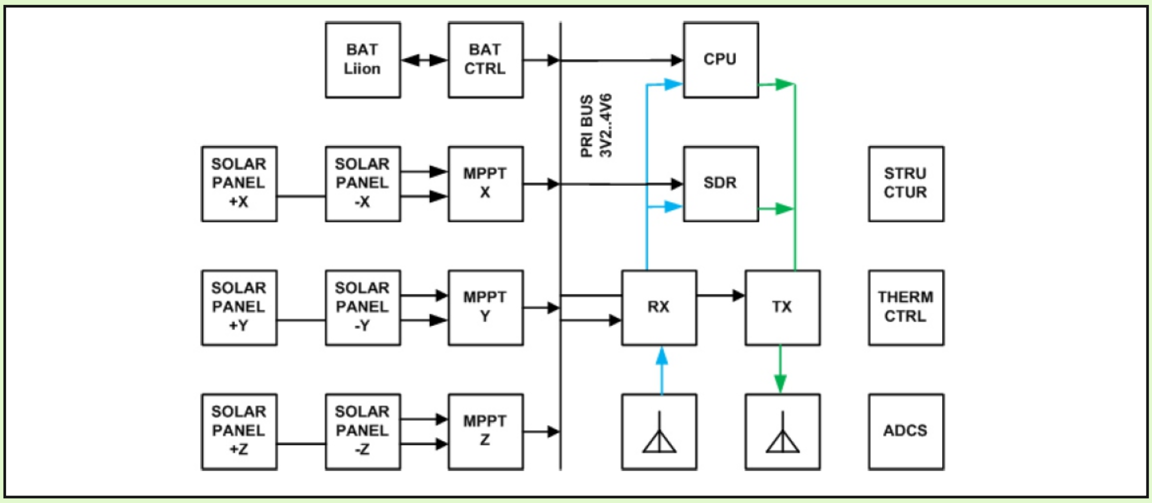
The metal structure uses additive manufacturing techniques and machinery in steel. It has the necessary robustness for the loads that appear during the launch and rise. The mechanical structure, determination/control of Orientation and thermal control are passive and do not consume electrical energy.

Orientation Control System (ADCS)

An orientation system based on magnets and diamagnetic materials has an important impact on the signal footprint on the earth's surface by the radiation pattern of the antenna. Having a single stabilized axis forces the use of low directivity antennas. The amplitude of precession is estimated in 30 degrees.

Thermal control system

The thermal control system makes sure that the satellite works in a reasonable temperature range. It is a complex issue that requires a lot of studies.



Calculation of QRG in a linear LEO satellite contact sked

EA1PA - Salva

After a long time without writing an article for the AMSAT-EA newsletter,I take the opportunity to participate again with these lines. My intention is to describe a practical situation we encounter often when we have a sked with another station and, in addition, the duration of the pass and the mutual sat footprint is very small.

First, I have to admit that I don´t like doing skeds with other stations. I prefer random contacts. But , I couldn´t reject a proposal from Joe, KE9AJ. Simply couldn't say no and we did it as a personal challenge. Most difficult part for Joe since the possible contact meant he had to work the satellite with practically zero or even negative elevation. I had it easier with a positive elevation, less than a degree, but with a few trees in that direction that could disrupt everything planned. So, I couldn't let him down, I had to be there to try.

Joe was in the state of Colorado and moved to the top of a nearby mountain, "Genesee Mountain" - DM79iq, to try to take advantage of its exceptional horizon to the east. On my side, I addressed myself to my usual “satellite” spot, “Monte de Tariego” - IN71sv, not far from my QTH in Venta de Baños, and which has good visibility, without major obstacles except the trees I mentioned before that could compromise my LOS.

Joe was going to make the great effort to climb up there with all the logistics, set up the installation, battery, antenna, ... and more things or details to have into account for an ephemeral pass of a few minutes; Honestly, I didn't care about the new locator or the new state, my ultimate goal was for Joe to get the contact done to reward his work, dedication, time and radio spirit that he shows in his outings with any of us.

Finally, the day marked on the calendar arrived: Sunday, May 15, satellite AO-07, mode B and we still had to decide the strategy. Consists mainly in establishing a meeting frequency, specifying who deals with calling CQ first on that QRG and, of course, "crossing your fingers" to be prepared for any unexpected change.

The QRG chosen for the appointment was 145.955 MHz as the reception frequency on Joe's rig. I would take care of calling CQ first to “reserve” frequency in advance so that when his AOS arrives, it would coincide with my LOS, Joe could answer my call as fast as possible.

The next step would be to estimate my QRG equivalent to that of Joe's rig, 145.955 MHz, to meet us at the correct frequencies on both sides. Namely, calculate the RX frequency of my equipment that I would have to tune to hear myself on the way down and be heard in Colorado on the frequency set by Joe.

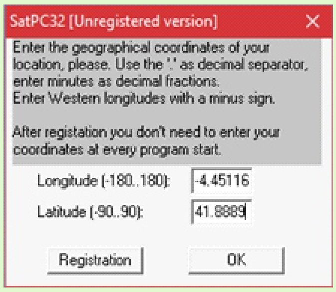
It is a bit confusing to explain in words, so I will explain it below. There are no mysteries, it's eas. I go step by step:

1. The initial or starting data is defined with the location of both stations:

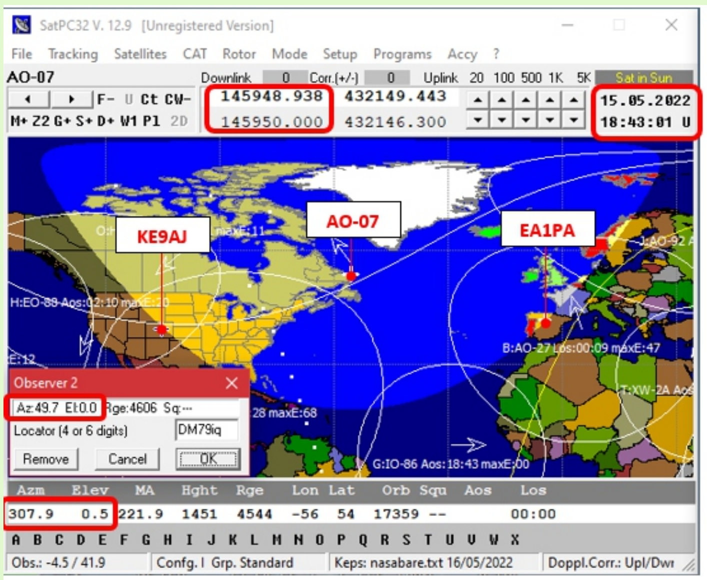
			GPS COORDINATES			
	CALLSIGN	LOCATOR	LATITUDE	LONGITUDE	ASL	DISTANCE
STATION A	EA1PA	IN71sv53	41.88890	-4.45116	877 m	7949 km
STATION B	KE9AJ	DM79iq48	39.70281	-105.29281	2508 m	

2. Doppler calculation using SATPC32 software.

- 2.1 Pass seen from IN71sv:
- The coordinates, latitude and length, corresponding to IN71sv.



- The pass for the AO-7 is simulated considering that the QSO will happen at 18:43 UTC on May 15. Access through the menu "Tracking" -> "Preview".



- The following data (downlink Doppler) is extracted:

QSO DATA			EA1PA	
UTC	DATE	SAT	AZ	307.9
18:43:01	05/15/2022	AO-07	EL	0.5
			VHF DOPPLER	-1.062
			The sat is moving away	

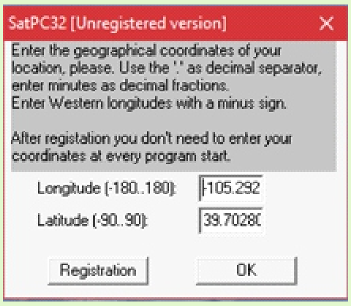
The receive frequency on IN71sv would be 145948.938 kHz for an tx frequency on the satellite of 145950 kHz.

$$145948.938 - 145950 = -1.062 \text{ kHz}$$

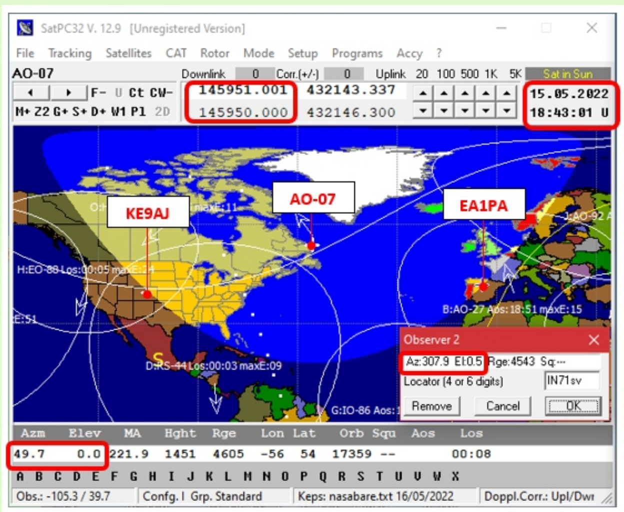
The satellite is moving away since the predicted “Doppler shift” has a negative value.

2.2 Pass seen from Dm79iq:

- Restart the program to enter the coordinates corresponding to DM79iq.



- The pass for the AO-7 is simulated at the same time as before from IN71sv. Again we go to “Tracking” -> “Preview”.



- In the screen above we check that the data is ok and we we look at the frequencies of the “Downlink”:

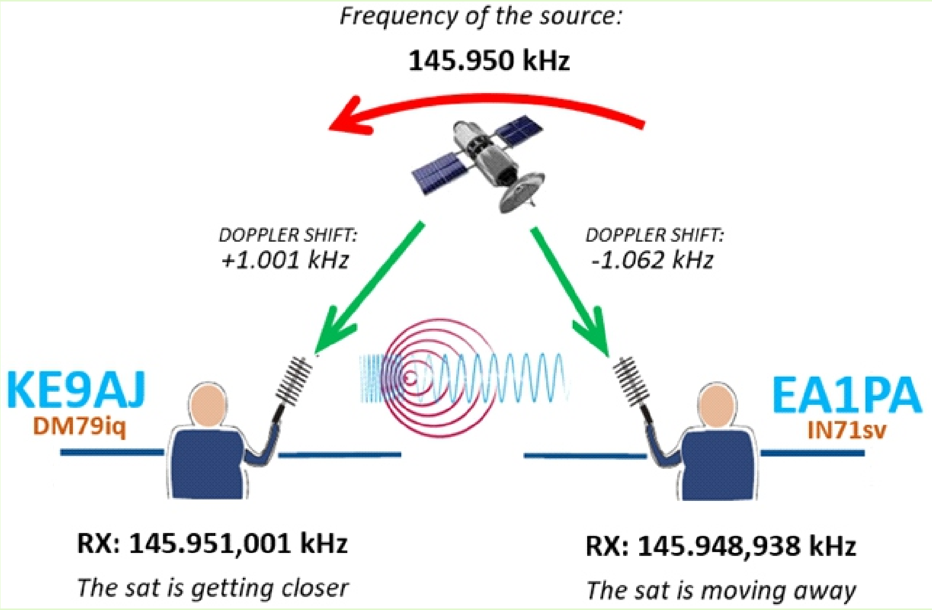
QSO DATA			KE9AJ	
UTC	DATE	SAT	AZ	49.7
18:43:01	05/15/2022	AO-07	EL	0
			VHF DOPPLER	1.001
			The sat is getting closer	

Now the receive frequency on DM79sv would be 145951.001 kHz for a satellite tx frequency of 145950 kHz.

1459951.001 – 145950 = +1.001 kHz

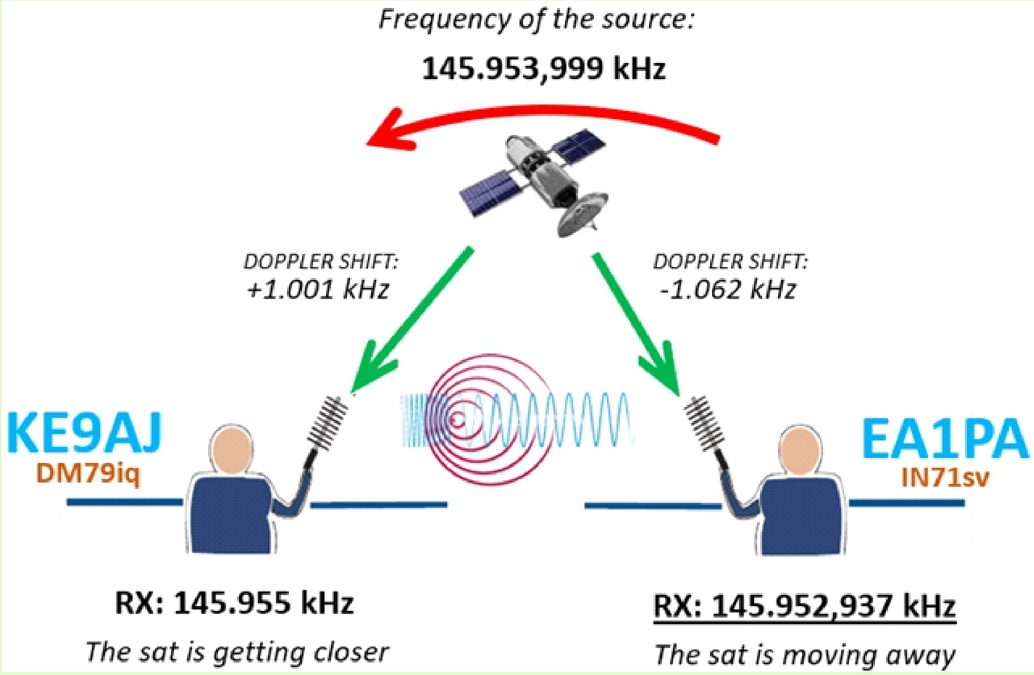
The satellite is approaching as the predicted Doppler has a positive value.

2.3 Collecting the Doppler data in RX in both stations , for a satellite frequency of 145950 kHz, we can get the following sketch:



3.QRG estimation in IN71:

Now travel the path towards my position. Remember that the input data is the receive frequency of 145955 kHz on Joe's side. So, we have it following:



145955 kHz on DM79 is equivalent to 145953.999 kHz on the sat

1459955 - 1.001 = 145953.999 kHz

145953.999 kHz on the sat its equivalent to 145952.937 kHz on IN71

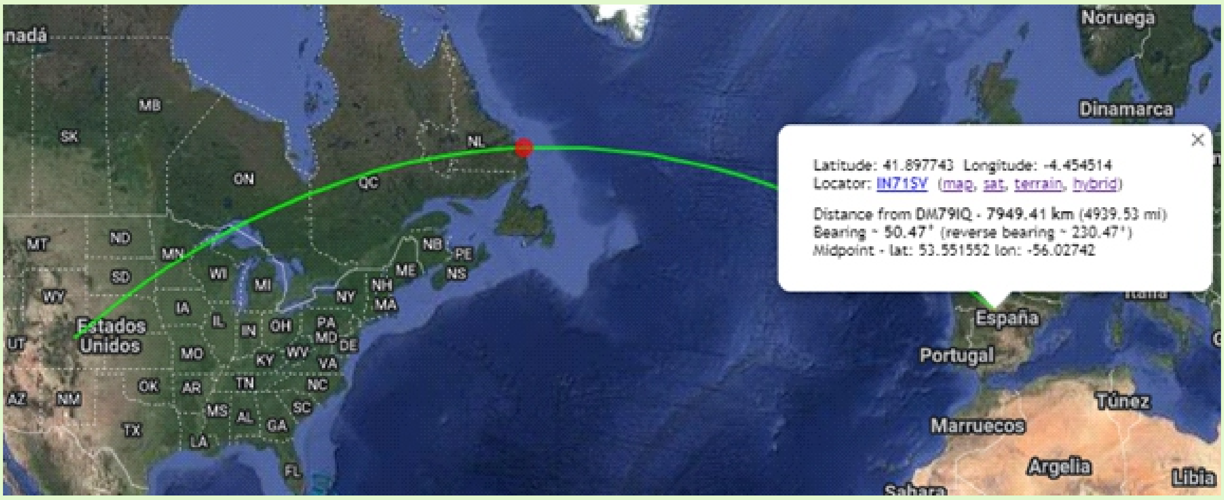
1459953.999 - 1.062 = 145952.937 kHz

Therefore, if I have not made any mistake, we can estimate that 145952.937 kHz is the approximate receive QRG for me to tune so Joe can hear me on the agreed-upon frequency of 145955kHz. Consequently, once my equivalent reception QRG is defined , I will adjust my transmission for the uplink until I hear me clearly on that frequency calculated for my rig.

At first glance, and in VHF, the difference does not seem to be too much and the frequencies between the two stations are relatively close, only slightly more of two kHz, but if we apply it to a satellite with mode J of operation, the Doppler is practically multiplied by 3. If we add to that a pass in which the maximum elevation is considerable and we intend to adjust to the limits of the trace with the other correspondent, the differences are already very substantial. So, I consider the calculation to be quite critical, and that is the key for a good contact under the circumstances described.

Going back to the story of the scheduled contact with Joe, with everything set and in position, the moment of truth arrived. As planned, place, time and QRGs, we managed to establish contact with relatively good signals. Was a special and exciting moment, a mixture of sensations when imagining the path traveled by the radio waves, back and

forth, through an "oldie bird" put into orbit in the 1970s, simply Awesome. Suddenly Joe's voice came out like a magical melody, like coming from deep space, clearly recognizable above the noise level and the typical "crackles" of the transponder. The exchange of reports was correct and we could tell we were really satisfied. Joe, thank you very much for giving me that moment, congratulations on your operation and performance in such conditions.



Let me highlight that our friend José, EB1AO, was waiting for our QSO to finish. He kindly patiently allowed the culmination of our QSO to later work Joe. Congratulations José, thanks to you also for your help and the evidence event audio.

As soon as I finished hearing José I stopped receiving the transponder, the pass ended for me. It all faded away despite my attempts to stretch and get on my feet trying to avoid the obstacles and rush the pass as much as possible. Anyway, it was short but very intense. It was time to get back home till the next weekend.. I still remember the way back to my QTH with a smile on my face and accompanied by a beautiful sunset on the local horizon.

I don't want to end the article without mentioning Juan Antonio, EA4CYQ, for teaching us how this matter of the QRG is calculated, sincerely the conferences in Iberradio Ávila 2019 marked me deeply. I hope everything is ok, and I apologize in advance for any mistakes, oversights, or omissions.

And finally, also thank Philippe, EA4NF, his encouragement and wisdom advice from an operator with plenty of experience, an unquestionable reference of portable operation on all types of situations.

Greetings to all. See you soon,

Salva
EA1PA

AMSAT-UK at EMFCamp 2022

Amsat-UK

June 2 to 5 2022 will take place the popular electromagnetic field event (EMFcamp) at Eastnor Castle Deer Park, Herefordshire, UK.

Imagine camping with electricity and high speed internet access in a crowded village full of creators and enthusiasts of the technology. The expect visitors from all over ready to learn, share and chat.

The EMF camp will feature a full program of talks and workshops and there will be both an Amateur Radio Village GX1EMF and an AMSAT-UK Village GB4EMF.

Among the scheduled talks we can find:

- Hacking the radio spectrum with GNU Radio by Dave Rowntree M0IEG.
- Reception of satellite beacons by Damian Bevan G4WPO.
- Launch of a rocket suspended by a balloon by Dave Johnson G4DPZ.
- Inside Datatrak: Resurrecting a Radio Navigation Network by Phil Pemberton M0OFX
- 2500 nerds, one pathetic robot by Chris Stubbs M6EDF
- Astro Pi Mark II: How to ship a Raspberry Pi from a factory in Wales to the International Space Station by Richard Hayler

More information about the event:

https://www.emfcamp.org/schedule/2022

https://wiki.emfcamp.org/wiki/Village:Amateur_Radio

https://wiki.emfcamp.org/wiki/Village:AMSAT-UK

https://www.emfcamp.org/

https://twitter.com/emfcamp

SAT Frequency Tables

EA1PA - Salva

SATELLITE	LOTW ID	UPLINK	CTCSS	DOWNLINK	MODE
AO-27 (Eyesat-1)	AO-27	145.850 MHz	-	436.795 MHz	FM
ISS Crossband Repeater	ARISS	145.990 MHz	67 Hz	437.800 MHz	FM
SO-50 (SaudiSat-1C)	SO-50	145.850 MHz	67 Hz	436.795 MHz	FM
CAS-3H (LilacSat-2)	CAS-3H	144.350 MHz	-	437.200 MHz	FM
IO-86 (Lapan A2)	IO-86	145.880 MHz	88.5 Hz	435.880 MHz	FM
CAS-2T	?	145.925 MHz	-	435.615 MHz	FM
AO-91 (RadFxSat / Fox-1B)	AO-91	435.250 MHz	67 Hz	145.960 MHz	FM
AO-92 (Fox-1D) Mode **U/V**	AO-92	435.350 MHz	67 Hz	145.880 MHz	FM
AO-92 (Fox-1D) Mode **L/V**		1267.350 Mhz			
PO-101 (Diwata-2)	PO-101	437.500 MHz	141.3 Hz	145.900 MHz	FM
UVSQ-SAT	UVSQ	145.905 MHz	-	437.020 MHz	FM
SO-114 (EASAT-2)	SO-114	145.875 MHz	-	436.666 MHz	FM
SO-115 (HADES)	SO-115	145.925 MhHz	-	436.888 MHz	FM

SATELLITE	LOTW ID	UPLINK BW	TYPE	DWNLINK BW	BAND WIDTH	BEACON	TELEMETRY
AO-07 Mode **A** (AMSAT-OSCAR 7)	AO-7	145.850 MHz 145.950 MHz	Normal	29.400 MHz 29.500 MHz	100 kHz	29.502 MHz	-
AO-07 Mode **B** (AMSAT-OSCAR 7)		432.125 MHz 432.175 MHz	Reverse	145.975 MHz 145.925 MHz	50 kHz	145.975 MHz	-
FO-29 (JAS-2)	FO-29	145.900 MHz 146.000 MHz	Reverse	435.900 MHz 435.800 MHz	100 kHz	435.795 MHz	-
AO-73 (FUNcube-1)	AO-73	435.130 MHz 435.150 MHz	Reverse	145.970 MHz 145.950 MHz	20 kHz	-	145.935 MHz
XW-2A (CAS-3A)	XW-2A	435.030 MHz 435.050 MHz	Reverse	145.685 MHz 145.665 MHz	20 kHz	145.660 MHz	145.640 MHz
XW-2B (CAS-3B)	XW-2B	435.090 MHz 435.110 MHz	Reverse	145.750 MHz 145.730 MHz	20 kHz	145.725 MHz	145.705 MHz
XW-2C (CAS-3C)	XW-2C	435.150 MHz 435.170 MHz	Reverse	145.815 MHz 145.795 MHz	20 kHz	145.790 MHz	145.770 MHz
XW-2D (CAS-3D)	XW-2D	435.210 MHz 435.230 MHz	Reverse	145.880 MHz 145.860 MHz	20 kHz	145.855 MHz	145.835 MHz
XW-2E (CAS-3E)	XW-2E	435.270 MHz 435.290 MHz	Reverse	145.935 MHz 145.915 MHz	20 kHz	145.910 MHz	145.890 MHz
XW-2F (CAS-3F)	XW-2F	435.330 MHz 435.350 MHz	Reverse	146.000 MHz 145.980 MHz	20 kHz	145.975 MHz	145.955 MHz
LO-87 (LUSEX-OSCAR 87)	LO-87	435.935 MHz 435.965 MHz	Reverse	145.965 MHz 145.935 MHz	30 kHz	145.900 MHz	-
EO-88 (Nayif-1)	EO-88	435.015 MHz 435.045 MHz	Reverse	145.990 MHz 145.960 MHz	30 kHz	-	145.940 MHz
CAS-4A (ZHUHAI-1 01)	CAS-4A	435.210 MHz 435.230 MHz	Reverse	145.880 MHz 145.860 MHz	20 kHz	145.855 MHz	145.835 MHz
CAS-4B (ZHUHAI-1 02)	CAS-4B	435.270 MHz 435.290 MHz	Reverse	145.935 MHz 145.915 MHz	20 kHz	145.910 MHz	145.890 MHz
JO-97 (JY1Sat)	JO-97	435.100 MHz 435.120 MHz	Reverse	145.875 MHz 145.855 MHz	20 kHz	-	145.840MHz
FO-99 (NEXUS)	FO-99	145.900 MHz 145.930 MHz	Reverse	435.910 MHz 435.880 MHz	30 kHz	-	-
TO-108 (CAS-6)	TO-108	435.270 MHz 435.290 MHz	Reverse	145.935 MHz 145.915 MHz	20 kHz	145.910 MHz	145.890 MHz
RS-44 (DOSAAF-85)	RS-44	145.935 MHz 145.995 MHz	Reverse	435.670 MHz 435.610 MHz	60 kHz	435.605 MHz	-
AO-109 (RadFxSat-2 / Fox-1E)	AO-109	145.860 MHz 145.890 MHz	Reverse	435.790 MHz 435.760 MHz	30 kHz	-	435.750 MHz
XW-3 (CAS-9) Hope-OSCAR 113	HO-113	145.855 MHz 145.885 MHz	Reverse	435.195 MHz 435.165 MHz	30 kHz	435.575 MHz	435.725 MHz

This is a reduced version of the table of frequencies and data of the current satellites. Can download the full table here:

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PORTABLE STATION OF THE MONTH - (DK9JC- John)

AMSAT-EA products in the URE store

For several weeks you have at your disposal several products of AMSAT-EA personalized with your callsign on the URE website.







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