

Making your first Amateur Satellite/ISS Contact with existing equipment

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What do we need to make Satellite contacts?

We will be making portable FM satellite contacts. “Easy Sats”

There are several SSB/CW satellites in orbit but this takes more expensive base station equipment to communicate through them.

You need to be able to transmit on VHF FM amateur radio frequencies of 145.850, 145.950 and 144.490 and receive on 436.795 and 435.180. ISS is transmit and receive on VHF only with a wide split. More on that later.

You also need to know when the satellite is going to be above the horizon for your QTH using satellite tracking software.

What equipment is needed for FM Satellite contacts?

What ever radios you use for satellites usually it will be half duplex. Full duplex is not real practical in handheld applications. I have tried this with my W32A and only get static on the UHF receive.

Dualband Handheld – Some handhelds work better than others

Separate VHF/UHF Handhelds

VHF Handheld and UHF receiver/scanner

Gain Antenna – Arrow or Elk are standard types

Satellite Tracking Software

Radio equipment

There are a couple of handhelds that lend themselves very well to amateur satellite communications.

Icom W32A: It has dual VFO's and the ability to mute the sub band upon transmitting.

Yeasu FT-60: This radio allows for programming the VHF/UHF split into the same memory channel.

Baofeng UV-3R (Plus) and UV-5R: These work great for satellite communications since the UHF receive and VHF transmit can be programmed into the same memory. 2 watts with the UV-3R or Plus is plenty to talk through the satellites.



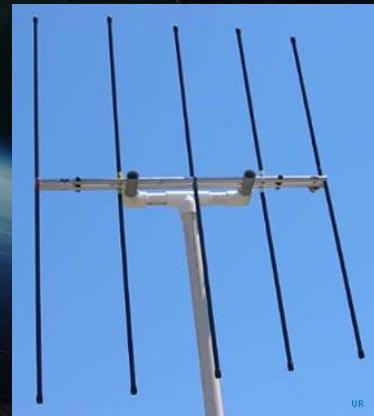
Antennas

You will need some gain to hear the satellites that are at a minimum of 250 miles away and could be up to 3000 miles.

Satellites transmit at low power so a gain antenna is a must.

I have successfully used an extended rubber duck antenna to make contacts on UO-14, SO-35 and AO-51. This is rare.

A beam antenna works best and you maybe able to use just a VHF beam since that is the transmit band and it should also receive the UHF frequencies even not tuned for UHF.



Satellite Tracking

Now that you have decided on your equipment you need to know when the satellite will be in range. The FM satellite are in low earth orbit (LEO). Passes over your QTH will be from 5 to 15 minutes in duration.

You need some sort of satellite tracking software.

Multiple programs are available for the Windows PC, MAC, Linux, iPhone, iPad, and Android devices.

Tracking programs use keplerian elements to give accurate location of the satellite you are tracking. These elements must be updated on a weekly basis or less. Updating the tracking elements is built into the tracking programs and can be setup to happen automatically.

One of the best for the Windows PC is Orbitron. It is free and very easy to use.



Satellite Tracking Programs

I will demo programs on the Windows PC, iPhone, iPad, Android and PPC. iPhone, and Android programs are shown here.



Satellite Tracking Terms

Start or AOS (Acquisition of Signal)

Middle or TCA (Time of Closest Approach)

End or LOS (Loss of Signal)

You also need to know where to point your antenna to talk with the satellite. Notice there is Azimuth and Elevation indicated in the example. This relates to where the satellite is in the sky relative to your QTH. Tracking programs also show a radar view that will assist in visualizing the satellites path in the sky.

Time - LOC	Satellite	Azm	Elv	Mag	Range	S.Azm	S.El
03-31-2014 01:39:18	ISS	267.5	0.0	ecl	2402	14.3	-37.2
03-31-2014 01:44:48	ISS	349.3	45.3	ecl	570	16.0	-37.0
03-31-2014 01:50:20	ISS	71.6	0.0	ecl	2412	17.6	-36.7
03-31-2014 03:16:21	ISS	287.9	0.0	ecl	2406	41.8	-29.5
03-31-2014 03:21:52	ISS	10.1	44.4	ecl	580	43.2	-28.8
03-31-2014 03:27:22	ISS	81.5	0.0	ecl	2411	44.0	-28.2



Satellite Tracking Terms continued...

Azimuth (Az) is measured in degrees around your QTH. Picture a 360 degree circle with 0 degrees being due north, 270 west, 180 south and 90 east.

Elevation (El) is measured in degrees above the horizon a satellite is from your QTH. 0 degrees would be at the horizon and 90 is directly overhead.

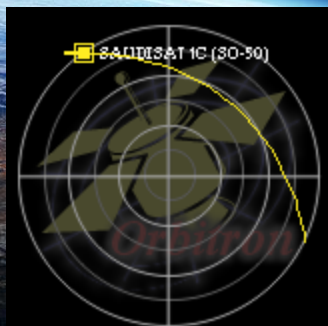
Tracking programs will give a constant Az/El reading as the satellite passes or in a prediction printout the Az/El at AOS/TCA/LOS or Start/Mid/End.

Satellite Tracking Terms continued...

With the information provided and a little practice with the programs, output you will know if the satellite is moving south to north, north to south, west to east, northwest to southeast, etc. The path of the satellite depends on the satellite orbit, your QTH and where the satellite is at the time of the pass.



SO-50 SW>NE



SO-50 NW>E



LituaniaSAT-1 W>E



NW>SE

What satellites are we looking for?

We are looking for the FM Amateur Radio Satellites known as “Easy Sats”.

The current active FM satellites are SaudiSat 1C (SO-50) and LituanicaSAT-1. Fox-1 is scheduled for a summer 2015 launch and will replace the failed AO-51.

SO-50 was launched in December 2002 and is still operational.

LituanicaSAT-1 is a Lithuanian satellite launched from ISS on February 28, 2014.

International Space Station (ISS) is FM as well. Voice contacts are rare. APRS Packet is active most of the time except during docking and undocking operations.

What Frequencies do we use?

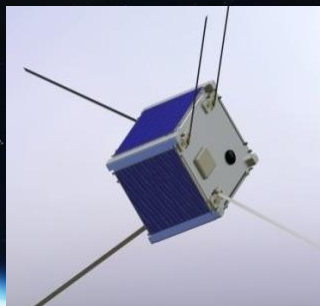


SO-50 (67.0 tone)

Uplink (Tx) – 145.850

Downlink (Rx) – 436.795

74.4 tone to turn on.



LituanicaSAT-1

Uplink (Tx) – 145.950

Downlink (Rx) – 435.180

(67.0 tone)



ISS Voice

Uplink (Tx) – 144.490

Downlink (Rx) – 145.800

APRS (Tx/Rx) – 145.825

Current FM satellites are a mode called V/u – VHF Uplink/UHF Downlink

Since the satellites are moving at a speed on the average of 17000 mph and you are standing still we must adjust for Doppler shift. Only needed for UHF.

Satellite Frequency Reference

SO-50 FM	V/u	Transmit with a 74.4 hz tone to turn on the 10 minute timer if the satellite is off, then use the 67.0 hz tone.							
Doppler Adjust	Downlink	436.815	436.810	436.805	436.800	436.795	436.790	436.785	436.780
Tone: 67.0	Uplink					145.850			
		AOS				MID			LOS
ISS Voice				APRS					
	Downlink	145.800		Downlink	145.825				
-1.31	Uplink	144.490		Uplink	145.825				
LituanicaSAT-1 FM	V/u	CW Beacon: 437.275							
Doppler Adjust	Downlink	435.190	435.185	435.180	435.175	435.170			
	Uplink			145.950					
		AOS		MID		LOS			



Program your memories with some kind of designator so you know what memory you are using such as SO50AOS, SO50AOS1, SO50MID, etc.

Your First Satellite Contact

Even though the FM satellites are repeaters in the sky, the contact is not like your local VHF or UHF repeater. Keep in mind passes are from 5 to 15 minutes at the most. Rag chewing is discouraged. Remember just like our terrestrial FM repeaters only one person can talk at a time. There could be many stations wishing to make contacts on the pass. Remember the satellite is passing in and out of other station's range as you are tracking it. A little planning before the pass is good to be well prepared. Review the upcoming passes that you wish to work. Passes of 20 degrees elevation or more are the best. Start with your pass information in hand. Either printed or on your phone. Have your radio tuned to the AOS UHF Rx frequency and be ready with the VHF Tx frequency. Headphones can be helpful. Open the squelch all the way. Point your beam at the heading indicated for AOS and wait and listen. When the satellite comes above the horizon you should start hearing signals and the noise floor of your receiver will diminish.

Your First Satellite Contact

Continue to monitor and follow the satellite as it rises above the horizon. Be sure to change your UHF frequency as the pass gets higher correcting for Doppler shift. Switch between receive memories to find the best frequency for receive. Stations can be garbled on one frequency and the next one 5 khz up or down will sound crystal clear. Unless you have cold feet and mic fright it is time to try your first FM satellite contact.

WHAT DO I SAY?



Your First Satellite Contact

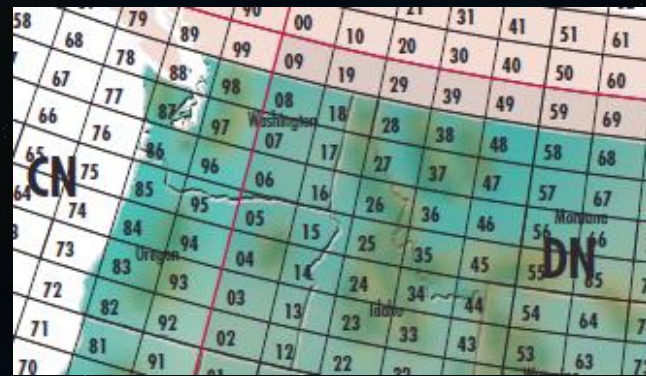
Cardinal Rule of Satellites:

DO NOT transmit unless you can hear the satellite downlink.

The satellite will always hear you. Even with a 2 watt handheld.

Contacts are quick and short. Call Sign phonetically, and Grid Square. Grid Square for Seaside is CN85. These are usually also said phonetically so it can not be misinterpreted.

Get your first contact under your belt and you will have the satellite bug. You can keep track of the grid squares that you contact. There are awards for getting certain number of grid squares via satellite. The satellite community is fairly small so you will most likely contact stations you have talked with before. CQ is usually not called on the satellite but you do hear it. QRZ is usually used or just put out your call and grid square if no stations are heard.



ISS Contacts

ISS is only active on VHF. Most of the time what is heard is APRS Packet. This is active most of the time. With the correct packet setup you can make contact with ISS and your station can be seen on the ISS heard map on the ARISS web site. Voice contacts is rare. ISS has scheduled school contacts and occasionally the hams on board will have some free time to make contacts. You can not only track the ISS for radio communications but for visual sightings as well. ISS is the brightest man made object in the sky. It is quite a thrill to see ISS and hear it as well.

ISS Voice -1.31 offset

Uplink (Tx) – 144.490

Downlink (Rx) – 145.800

APRS (Tx/Rx) – 145.825



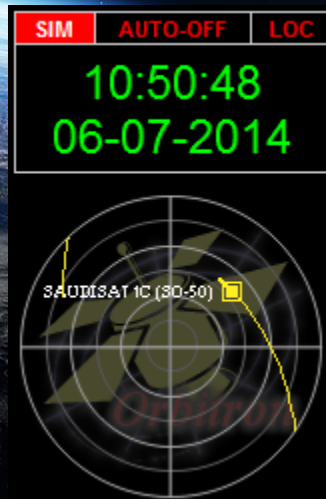
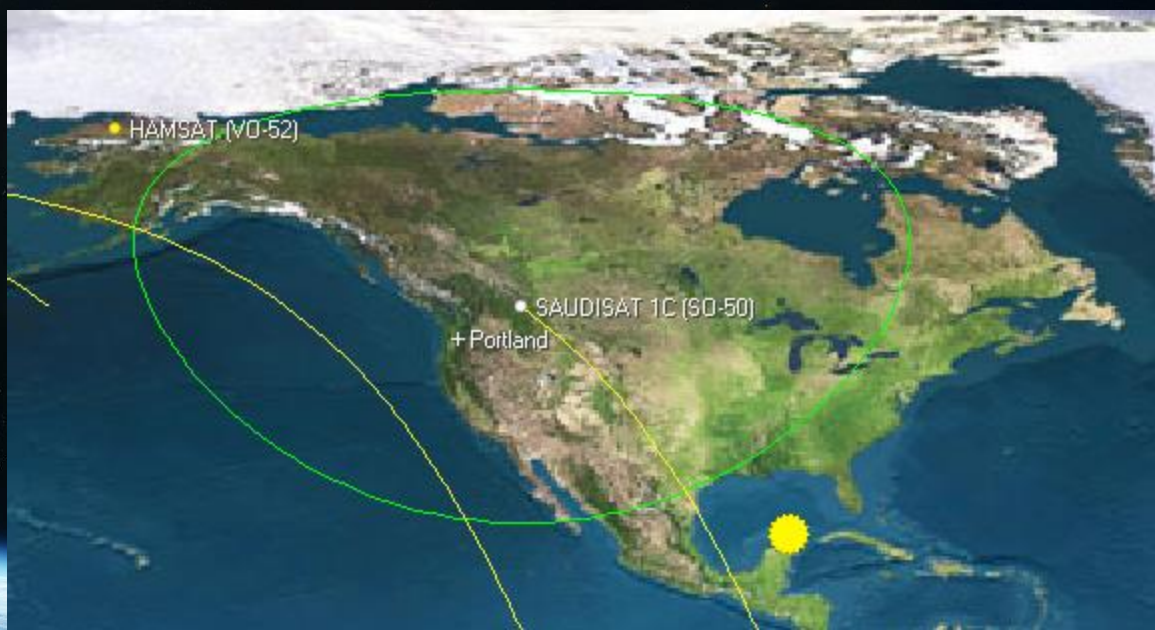
Satellite Tracking Software Demo/Questions/Live Demo

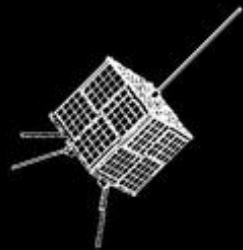
Demo of satellite tracking software:
Orbitron, and WxTrack for the Windows PC,
GoSatWatch, HamSat, ProSat for the iPhone/iPod/iPad,
Amsat Droid Free and ISS Detector for the Nexus tablet (Android).
Pocket Sat Tracker, SatCE and Traksat for the Pocket PC

Live pass of SO-50 at 1043 to 1057

And of course answer any questions.







**KEEP
CALM
AND
TRACK
SATELLITES**

