

Work FM Satellites with your HT!

Many hams already have the necessary equipment to work FM amateur satellites.
This guide offers a quick start for successfully "working" an FM bird.

All cited resources are available to you at one Web site:

work-sat.com

If you have 2M and 440 capabilities (either "split frequencies" in one HT, or two radios), you can work an FM amateur satellite! For example, in satellite SO-50's **VHF/UHF (V/U)** mode, the **UPLINK** frequency (**to** SO-50) for FM voice is 145.850 MHz*. The **DOWNLINK** frequency (**from** SO-50) is 436.795 MHz*.

First, you need to know **WHEN** and **WHERE** the satellite will be passing over your location. There are several commercial computer programs^[1] that will tell you. In the home office, I use **MacDoppler**. Outside, though, I use **PocketSat3** on my iPod touch/iPhone. On my netbook, **Nova for Windows** and **SatPC32** are marvelous. But **free of charge** info is also available online at ...

heavens-above.com - or - amsat.org - or - N2YO.com

Log in, plug in your longitude and latitude, and you will have access to amateur satellite pass information.

The one "absolute" for success is to **open up your squelch**. We are talking about "weak signals" from hundreds of miles away - so don't expect the satellite to be strong enough to break squelch like your local repeater. Sure, it's a little noisy - but that's part of the process: That noise is an aid in locating the satellite. When the frequency starts exhibit **quieting**, that's a sign that you are **capturing** the satellite's signal.

Improve your HT's stock antenna (most are rated at **NEGATIVE** 6 db or worse!). For BNC connectors, **Diamond's RH-205**^[2] will make the difference. For male and female SMA - and BNC - the **Smiley 270A** is a good performer. But for best success, you need more **GAIN**, so using an **Arrow Sat Antenna**^[3] Yagi is much better. If you prefer to homebrew your antenna^[4], go to the work-sat.com Web site's ANTENNAS page for construction article links.

For SO-50, set up your radio to tune for the **Doppler effect** on the 440 downlink. Start listening **above** the center frequency^[5] - you will **acquire** the satellite sooner and clearer. When the downlink gets scratchy or fuzzy, tune down 5KHz at a time, and reception should be clearer. Only transmit when you can **clearly** hear the satellite. Follow the signal down in frequency as the pass continues. The new AO-85 is a little different, with its 2M downlink and 440 uplink (see the frequency charts that follow).

Don't hold your whip antenna upright. Held in a vertical position, your transmitted signal is hitting land-based receivers. You need to tilt your HT's antenna so that it is **perpendicular** to the airborne satellite. Very few of the ham satellites are land-based (grin), so you must **TILT** your antenna about the same amount as the satellite's **ELEVATION**. You'll quickly get the hang of it - and hear the difference! You'll have best results with a modest beam or Yagi.

Ideally, we should be working the satellites in **full duplex** mode, where we can simultaneously listen to the downlink as we are transmitting. Although this method is preferred, it is not mandatory: Carefully monitor the downlink, and wait for a break in the conversations to announce yourself. You might find it helpful to record your sessions for later review. Even if you don't make a contact during a pass, a recording can help you recognize the callsigns and voices of other operators. Pocket recorders or smartphone apps are great for this. If working full-duplex, use an earpiece or headphones to monitor the downlink and avoid acoustic feedback.

Knowing your grid square - and having a grid square map - is a quick way of identifying locations of what you will hear. The **ARRL** and **Icom** have grid square maps: Icom's is free and available at better ham radio stores^[6].

It just takes a little preparation and planning for working amateur satellites. Not every pass is workable with an HT — don't go after the sub-10° elevation passes as you start "working the birds." Choose your passes wisely: Working higher elevation passes will give you better results.

When you clearly hear others, listen for a break in the action, and use the ITU-approved phonetics^[7] to announce your callsign, grid square, and op mode:

"KILO-SIX-LIMA-CHARLIE-SIERRA, DELTA-MIKE - ONE-THREE, handheld."

Check work-sat.com for the satellites' home Web pages – to make sure the sat is in the mode you can work with your setup!

Is there anything else up and running right now? There's AO-7, FO-29 (JAS-2), and others with SSB/CW transponders on board. AO-73 FUNcube-1 is "fun" to work! Info on these on the **SAT SKEDS** page at work-sat.com.

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Notes

[1] Links to Nova for Windows, PocketSat, MacDoppler, SatPC32, AMSAT Droid, SATme, GoSatWatch. GPREDICT – and more – available on the [Tracking](#) page at work-sat.com.

[2] The Pryme AL-800 has been discontinued. The Diamond RH-205 telescopes to 52" and collapses to 9". Use caution with either of these massive, heavy antennas: they have the potential of placing a lot of stress on your radio's BNC connector. Smiley antennas are available in BNC and male-or-female SMA at [HRO](#) or from Smiley's Web site at [htantennas.com](#).

[3] Arrow's Model 146/437-10WBP is a dual-band cross-Yagi design, with a diplexer built into the handle, with 3 elements on 2M and 7 on 440. See it in action in the December, 2007 issue of CQ Magazine. Links to Arrow – and others – are on the [Antennas](#) page at work-sat.com.

[4] Alex Diaz' Yagi-Uda plans, AMSAT's "Cheap and Easy" sat antenna articles, a tape measure beam construction article – and LOTS more – are all on the [Antennas](#) page at work-sat.com

[5] Here's how to program your radio for **SO-50** -

Ch #	Name	TX Freq	CTCSS	RX Freq	CTCSS
201	50 +4	145.850	67.0	436.815	None
202	50 +3	145.850	67.0	436.810	None
203	50 +2	145.850	67.0	436.805	None
204	50 +1	145.850	67.0	436.800	None
205	50 74	145.850	74.4	436.795	None
206	50 MID	145.850	67.0	436.795	None
207	50 -1	145.850	67.0	436.790	None
208	50 -2	145.850	67.0	436.785	None
209	50 -3	145.850	67.0	436.780	None

And here's how to program program your radio for AMSAT-NA's **Fox 1-A / AO-85** -

Ch #	Alpha	TX Freq*	TX Tone	RX Freq**	RX Tone
851	AOS-2	435.160	67.0	145.980	None
852	AOS-1	435.165	67.0	145.980	None
853	AO-85	435.170	67.0	145.980	None
854	LOS-1	435.175	67.0	145.980	None
855	LOS-2	435.180	67.0	145.980	None

[6] A .pdf copy of Icom's grid square map is available on the [Shack Aids](#) page at work-sat.com.

[7] Download the **ARRL's Handy Ops Guide** (FSD-220) at – you guessed it – [work-sat.com](#).

[*] [******] Always consult the sats' control team pages for possible frequency changes and updates (and problem reports).



Work-Sat.com

“Your Web site took me from zero knowledge to getting an HT and an Arrow. And just four months later, I have qualified for VUCC on the FM birds. A great site for the beginner on the birds. You un-mystify them.”

“I love the site and I greatly appreciate the information you have provided to get me going! Yours is a no-nonsense approach to working satellites ... “

“Simplicity ... the idea of working sats "sounds complicated" but that's really not the case. You keep the language simple, illustrations simple, and concept simple ... give folks the idea that any ham can do this (which they can) with the right equipment ... if they follow the directions you provide.”

K6LCS gave a fantastic presentation on amateur satellites. It was most informative and entertaining. Clint's passion for the subject was evident, and I would imagine that the club members individually and/or in a group will be eager to try satellite contact in the near future.

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HT Programming for SO-50, AO-85, AO-91, and the ISS

(Updated November, 2017)

SO-50

Channel #	Alpha	TX Freq	TX Tone	RX Freq	RX Tone
501	50 +2	145.850	67.0	436.805	None
502	50 +1	145.850	67.0	436.800	None
503	50 74	145.850	74.4	436.795	None
504	SO-50	145.850	67.0	436.795	None
505	50 -1	145.850	67.0	436.790	None
505	50 -2	145.850	67.0	436.785	None

AO-91 (aka, "FOX-1B")

911	AOS 2	435.240	67.0	145.960	None
912	AOS 1	435.245	67.0	145.960	None
913	AO-91	435.250	67.0	145.960	None
914	LOS 1	435.255	67.0	145.960	None
915	LOS 2	435.260	67.0	145.960	None

AO-85 (aka, "FOX-1A")

851	AOS 2	435.160	67.0	145.980	None
852	AOS 1	435.165	67.0	145.980	None
853	AO-85	435.170	67.0	145.980	None
854	LOS 1	435.175	67.0	145.980	None
855	LOS 2	435.180	67.0	145.980	None

ISS Frequencies

FM Voice - ITU Region 1		FM Voice - ITU Regions 2/3	
<i>Europe, Middle East, Africa, North Asia</i>		<i>N./S. America, Caribbean, Australia, S. Asia</i>	
145.800 downlink	145.200 uplink	145.800 downlink	144.490 uplink

FM SSTV downlink 145.800

AX.25 1200-baud packet 145.825

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