

# Work FM Satellites with your HT!

*Most hams already have nearly all the equipment to work FM voice satellites.  
This guide offers a quick start for successfully making contacts!*

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

[work-sat.com](http://work-sat.com)

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

First, you need to know **WHEN** and **WHERE** the satellites will be passing over your location. There are several commercial computer programs<sup>[1]</sup> that will tell you. In the home office, I use **MacDoppler** or **GPredict**. Outside, I'll use **PocketSat3** or **GoSatWatch** on my Smartphone. On Windows systems, **Nova** and **SatPC32** are marvelous. But there are free-of-charge info sources online, too, at ...

[heavens-above.com](http://heavens-above.com) -or- [amsat.org](http://amsat.org) -or- [N2YO.com](http://N2YO.com)

Log in to these sites, plug in your grid square, and you will have access to accurate 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 satellites to be strong enough to break squelch like your local repeater does. Sure, it's a little noisy - but that's part of the process: That noise is an aid in locating the satellites! When the frequency starts exhibiting **quieting**, that's a sign that you are **capturing** the satellites' signals.

Improve your HT's stock antenna (most are rated at **NEGATIVE 6db** - or worse!). The **Smiley 270A**<sup>[2]</sup> is a good performer, and is available in Male SMA, Female SMA, and Male BNC models. But for best success, you need more **GAIN**, so using an **Arrow Satellite Antenna**<sup>[3]</sup> or **Elk Log Periodic** is much better. If you prefer to home-brew your antennas<sup>[4]</sup>, go to the [work-sat.com](http://work-sat.com) Web site's **ANTENNAS** page for construction article links: You can get in to the world of high gain operations for as little as \$15!

For SO-50, set up your radio to tune for the **Doppler effect** on the 440 downlink. Start listening **above** the center frequency - you will **acquire** the satellite sooner and clearer. When the downlink gets scratchy or fuzzy, tune down 5KHz at a time, and reception may be clearer. Only transmit when you can **clearly** hear the satellite. Follow the signal down in frequency as the pass continues. The newer AO-91, and AO-92 birds are a little different, with their **440 uplinks** (which may require minor Doppler adjustment) and **2M downlinks**. See the frequency charts at the end of this document.

**If using a whip antenna, don't hold it upright.** Held in a vertical position, your transmitted signal is hitting land-based receivers. Most of our satellites are not land-based (grin). You need to tilt your HT's antenna about the same amount as the satellites **ELEVATION**. Get it perpendicular to the orbit's path! You will quickly get the hang of it - and hear the difference. Again, you will have much better results with a modest beam or Yagi antenna.

Ideally, we should be working the FM voice 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 key your mic and announce yourself. You might find it helpful to record your sessions for later review: Even if you do not 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. And if working full-duplex, use an earpiece or headset to monitor the downlink to avoid acoustic feedback.

Knowing your grid square - and having a grid square map - is a quick way of identifying locations of operators you will hear. The **ARRL** and **Icom America** have grid square maps: Icom's is free and available at better ham radio stores<sup>[5]</sup>.

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

When you clearly hear others, listen for a break in the action, key your mic and use the ITU-approved phonetics<sup>[6]</sup> to announce your callsign, grid square, and - **optionally** - operation mode:

**"KILO SIX LIMA CHARLIE SIERRA, DELTA MIKE ONE THREE, HANDHELD."**

**Check [work-sat.com](http://work-sat.com) for the satellites' home pages - to make sure the satellites are in the modes you can work with your setup!**

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# Notes

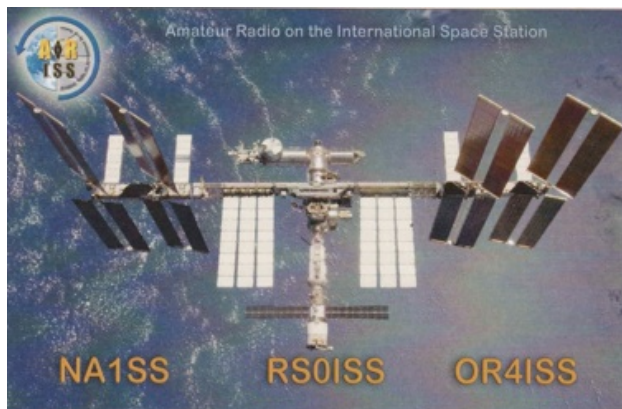
[1] - Links to several satellite pass data programs - as well as free online resources - available on the **TRACKING** page at [work-sat.com](http://work-sat.com).

[2] - The Diamond RH-205 is a collapsible 2M BNC antenna. Be careful using it - its mass places a lot of stress on your HT's antenna connector. The Smiley 270A (which out-performs antennas 3X its price!) is available at **Ham Radio Outlet** - [hamradio.com](http://hamradio.com) - or from **Smiley's Web site** at [htantennas.com](http://htantennas.com) .

[3] [4] - **Arrow's Model 146/437-10WBP** is a dual-band cross-Yagi design, with a diplexer built into the boom's handle. Links to the Arrow - as well as the **Elk** and build-'em-yourself antennas - on the **ANTENNAS** page at [work-sat.com](http://work-sat.com) .

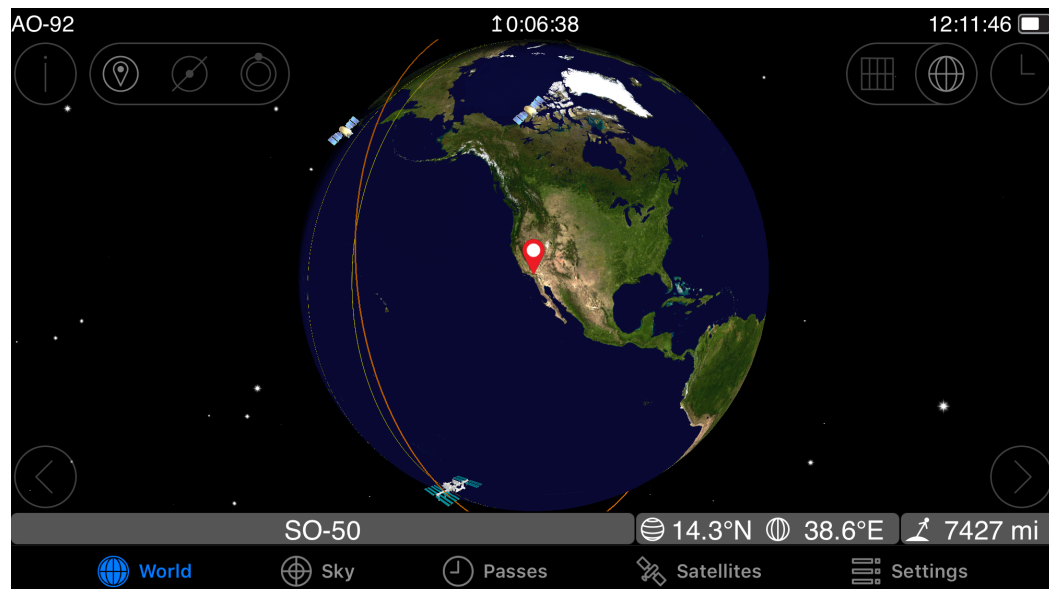
[5] - A .pdf copy of Icom's grid square map is available on the **SHACK AIDS** page at [work-sat.com](http://work-sat.com) .

[6] - Download the ARRL's Handy Ops Guide from the **SHACK AIDS** page at - you guessed it - [work-sat.com](http://work-sat.com) .



<i>A – Alpha</i>	<i>J – Juliet</i>	<i>S – Sierra</i>
<i>B – Bravo</i>	<i>K – Kilo</i>	<i>T – Tango</i>
<i>C – Charlie</i>	<i>L – Lima</i>	<i>U – Uniform</i>
<i>D – Delta</i>	<i>M – Mike</i>	<i>V – Victor</i>
<i>E – Echo</i>	<i>N – November</i>	<i>W – Whiskey</i>
<i>F – Foxtrot</i>	<i>O – Oscar</i>	<i>X – X-Ray</i>
<i>G – Golf</i>	<i>P – Papa</i>	<i>Y – Yankee</i>
<i>H – Hotel</i>	<i>Q – Quebec</i>	<i>Z – Zulu</i>
<i>I – India</i>	<i>R – Romeo</i>	

The International Telecommunications Union  
Standard Phonetic Alphabet





## 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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**ARRISS**  
Amateur Radio on the International Space Station



# HT Programming for SO-50, AO-91, AO-92, and the ISS

(02/23/2019)

## 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
<b>504</b>	<b>SO-50</b>	<b>145.850</b>	<b>67.0</b>	<b>436.795</b>	<b>None</b>
505	50 -1	145.850	67.0	436.790	None
506	50 -2	145.850	67.0	436.785	None

## AO-91

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

## AO-92 U/v Mode (occasional L/v mode)

921	AOS 2	435.340	67.0	145.880	None
922	AOS 1	435.345	67.0	145.880	None
<b>923</b>	<b>AO-92</b>	<b>435.350</b>	<b>67.0</b>	<b>145.880</b>	<b>None</b>
924	LOS 1	435.355	67.0	145.880	None
925	LOS 2	435.360	67.0	145.880	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>	
<b>145.800 downlink</b>	<b>145.200 uplink</b>	<b>145.800 downlink</b>	<b>144.490 uplink</b>

**FM SSTV downlink 145.800**

**AX.25 1200-baud packet 145.825**

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