

# 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 144/430mHZ (2m/70cm) capabilities - either "split frequencies" in one HT, or two radios - you can work FM voice satellites!**

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 **GoSatWatch** on my iPhone and/or **AMSAT Droid FREE** on an Android device. For Windows systems, **Nova** and **SatPC32** are marvelous. But there are free-of-charge info sources online, too, like ...

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

Log in to these sites, enter 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 for 2M reception (like the ISS' SSTV projects), 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 antennas 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.

Some satellites - like AO-91 - have **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 many 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 you 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."**

**Have questions? Join our [groups.io](https://groups.io) message group!**

Clint Bradford, K6LCS  
[k6lcs@ham-sat.info](mailto:k6lcs@ham-sat.info)

[work-sat.com](http://work-sat.com)  
(909) 999-SATS (7287)

**Updated February 5, 2024**

## Notes

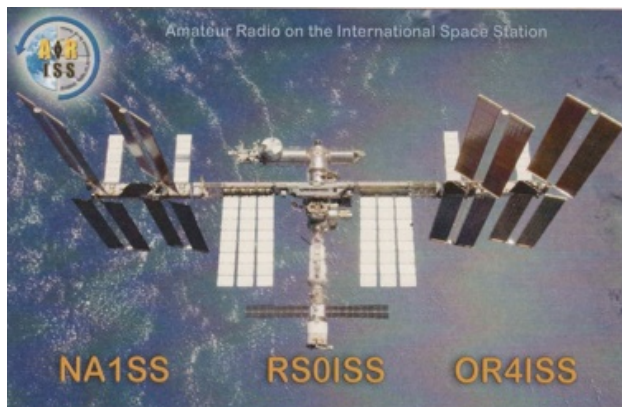
[1] - Links to several satellite pass data programs - as well as free online resources - available on the **TRACKING** page at [work-sat.com](http://work-sat.com).

[2] - Be careful using longer whip antennas on HTs: Their mass places stress on your HT's antenna connector. The Smiley 270A (which out-performs antennas 2X its price!) has a protective coil at its base, and 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 **Eik** and build-'em-yourself antennas - on the **ANTENNAS** page at [work-sat.com](http://work-sat.com) .

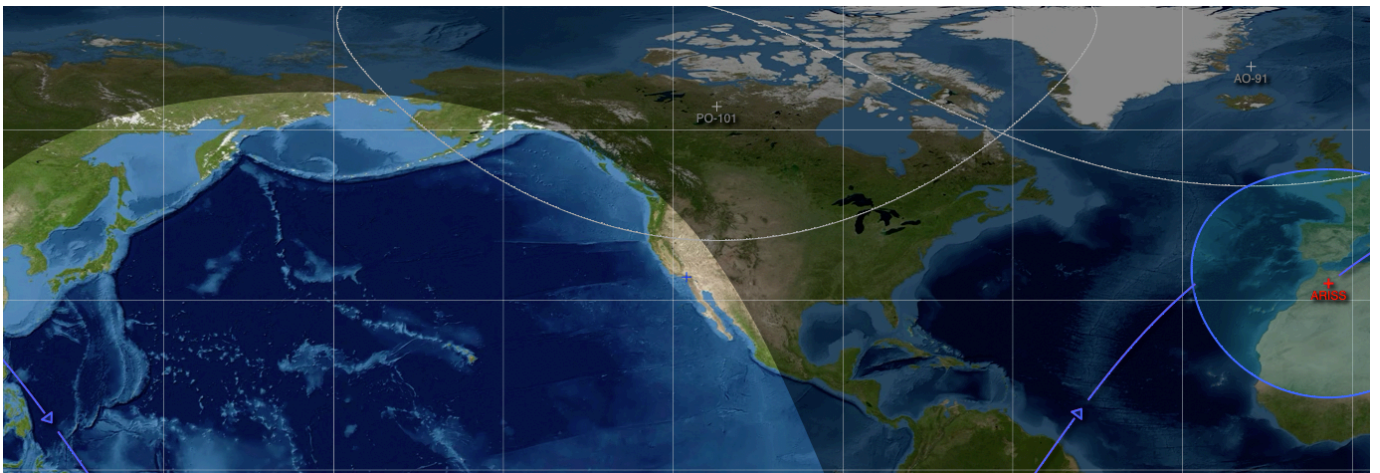
[5] - A .pdf copy of Icom's grid square map is available on the **SHACK AIDS** page at [work-sat.com](http://work-sat.com) .

[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.

**Clint Bradford, K6LCS**  
[k6lcs@ham-sat.info](mailto:k6lcs@ham-sat.info)

Jurupa Valley CA US DM13fx  
**(909) 999-SATS [7287]**



**ARISS**  
Amateur Radio on the International Space Station



GoSatWatch



gpredict

# Frequencies for SO-50, AO-91, PO-101, and the ISS

(Updated 02/05/2024)

## 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 - ONLY when in Sunlight!

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

PO-101 / Diwata-2	AMSAT's AO-27
Ops Schedule: <a href="https://twitter.com/Diwata2PH">https://twitter.com/Diwata2PH</a>	Not currently online.
Downlink 145.900, Uplink 437.500 141.3	Downlink 436.795, Uplink 145.850 67.0

## 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    145.200 uplink</b>	<b>145.800 downlink    144.490 uplink</b>

**FM SSTV downlink    145.800                      AX.25 1200-baud packet    145.825**

**ISS Crossband Repeater    UPLINK: 145.99 - 67.0 CTCSS**

**Accommodate for the Doppler phenomenon on the 437.800 DOWNLINK:**

437.810	437.805	<b>437.800</b>	437.795	437.790
AOS		MID		LOS

**Clint Bradford K6LCS    [work-sat.com](http://work-sat.com)    (909) 999-SATS**