

Getting Started with the FM Satellites

If you can program split-frequency memories in your dual-band radio, or your dual-band radio has two VFOs, you can work an FM satellite.

The primary FM voice mode for **SO-50** is workable with dual-band HTs! For the normal V/U FM voice mode with these two satellites, the **UPLINK** frequency - where you transmit - is 145.850 MHz. The **DOWNLINK** frequency - where you receive - is around 436.795 MHz.



First, you need to know when and where the satellite will be passing over your location. There are several computer programs that will tell you that. Some are free, and others are available for purchase, through the AMSAT web site <http://www.amsat.org/>. Most programs are easily updated with current satellite tracking data that is available on the Internet.

Using your longitude and latitude coordinates (or your grid locator - generally available from QRZ.com and many GPS receivers), you can access amateur satellite pass information - and a lot more information!

The screenshot shows the AMSAT website interface. At the top, there is a navigation menu with links: Launch Pad, Navigator, Sat Status, Keps, Passes, News, Store, Members, Contact Us, and Return. Below the menu is a table titled "AMSAT Online Satellite Pass Predictions - AO-51" with a link to "View the current location of AO-51". The table contains the following data:

| Date (UTC) | AOS (UTC) | Duration | AOS Azimuth | Maximum Elevation | Max El Azimuth | LOS Azimuth | LOS (UTC) |
|------------|-----------|----------|-------------|-------------------|----------------|-------------|-----------|
| 20 Nov 08 | 22:50:28 | 00:12:18 | 130 | 20 | 70 | 5 | 23:02:46 |
| 21 Nov 08 | 00:28:31 | 00:13:26 | 187 | 34 | 278 | 338 | 00:41:57 |
| 21 Nov 08 | 11:00:46 | 00:10:23 | 44 | 8 | 86 | 135 | 11:11:09 |
| 21 Nov 08 | 12:37:56 | 00:14:53 | 12 | 89 | 261 | 194 | 12:52:49 |
| 21 Nov 08 | 14:18:09 | 00:10:32 | 344 | 9 | 303 | 252 | 14:28:41 |
| 21 Nov 08 | 22:13:08 | 00:09:08 | 104 | 7 | 62 | 19 | 22:22:16 |
| 21 Nov 08 | 23:48:52 | 00:13:56 | 165 | 85 | 48 | 349 | 00:02:48 |
| 22 Nov 08 | 01:30:37 | 00:09:08 | 229 | 7 | 271 | 313 | 01:39:45 |
| 22 Nov 08 | 11:58:46 | 00:14:26 | 22 | 36 | 110 | 173 | 12:13:12 |
| 22 Nov 08 | 13:37:54 | 00:13:23 | 356 | 23 | 297 | 227 | 13:51:17 |

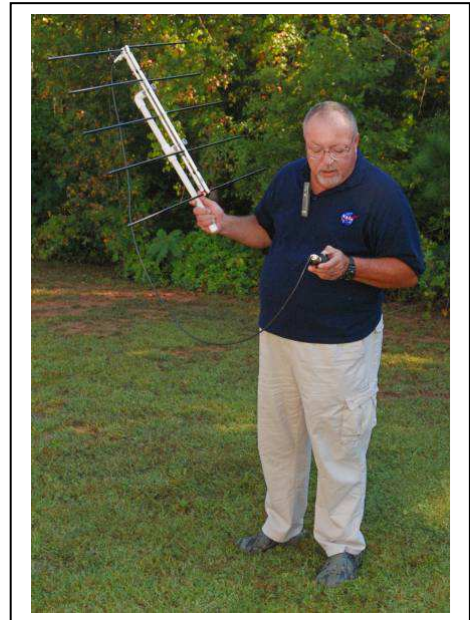
Below the table, it says "Your results are shown above" and "Use the form below to request more pass predictions".

The three things you need to do for success with the FM satellites are:

- **Open up your squelch**
- **Antenna, antenna, antenna**
- **Tune for the Doppler effect**

FM satellites do not transmit with much power – usually about 250mW for SO-50. With this in mind, it is necessary to leave your radio's squelch wide open to hear these signals. They are weak, but readable.

Use a good antenna for your handheld radio. Using an **Elk Antennas** dual-band log periodic like Tim N3TL has in this photo is a great improvement over the “duckie” antennas supplied with HTs. There is also the popular **Arrow Antennas** dual-band Yagi. If you prefer to homebrew your antenna, **Alex Diaz XE1MEX** has an excellent Yagi design. **Kent Britain WA5VJB** also has designs for homebrew satellite antennas. Good telescoping whip antennas for satellite operating are the **Pryme AL-800** and the Maldol AH-510R. These are large whips, and neither is good for radios with SMA connectors. Other smaller telescoping whip antennas that are useful for satellite operating are the **RH789** (BNC) and **SRH789** (SMA) whips from **Diamond Antenna** and the **Smiley Antenna 270A** (available in BNC and SMA versions). But a directional antenna – dual-band Yagi or log periodic – would be an improvement over the whips and duckies.



Set up your radio so you can to tune for the **Doppler effect**. Start listening 10 kHz above the center frequency - you will hear the satellite sooner and clearer. When the downlink gets scratchy or fuzzy, tune down in 5 kHz steps and reception should improve. Follow the signal down in frequency as the pass continues, and you should end up 10 kHz below the center frequency at the end of the pass.

Don't hold your whip antenna upright! Vertical antennas are not as efficient for satellite operation, and a HT held upright isn't either. The satellite isn't on the ground, which is what HTs and vertical antennas were designed for. Tilt it about the same amount as the satellite's elevation. This means that if you are facing the satellite as Patrick WD9EWK demonstrates in this photo, tilt it down **towards** the ground from horizontal an equal amount. If the satellite is to your back, tilt it up an equal amount **away** from the satellite's position off the vertical. You will be surprised at the difference. Make sure you can hear the satellite **BEFORE** transmitting.



Many use headphones - especially if working full duplex. If you have an Icom IC-W32A, Kenwood TH-D72A, or other 2m/70cm FM radio with two VFOs, you can listen to yourself while transmitting (**highly recommended**, but not necessary). Some hams record their sessions for later review with a small recorder or cell-phone recorder app. Even if you don't make contacts, it helps to familiarize yourself with the call signs, voices and personalities of the other operators.

Knowing your grid locator - and having a grid locator map - is a quick way of identifying locations of what you will be hearing. The ARRL and Icom have grid locator maps: Icom's map is free and available at amateur radio stores.

When you are ready to make your first satellite contact, make sure you can hear the satellite. If you can't, **DO NOT TRANSMIT!** When you hear others, try to find a break in the action, and announce your call sign and grid locator using the International Phonetic Alphabet and digits like this:

"WHISKEY-DELTA-NINE-ECHO-WHISKEY-KILO, DELTA-MIKE-FOUR-THREE."

On the FM satellites, it is not necessary to call CQ as on HF. Contacts are usually made quickly, with an exchange of call signs and grid locators when there are many stations on a pass - very similar to the conditions during a contest or when trying to work a DXpedition station on HF. If there are few stations trying to work the satellite during a pass, you may be able to pass along your name and city and state/province as part of the contact. Use digits when announcing your grid locator as in the example above, especially when making contacts with operators who may not understand much English.

There is a lot of satellite activity during the annual **ARRL Field Day** every June, where one satellite contact can add 100 bonus points to a station's score. There are also lots of awards from ARRL and AMSAT, among others, that are available as you fill your log with satellite contacts. Once you get familiar with satellite operating, try experimenting with your station. How small can you go?

Still have questions? Ask away! Find an "Elmer" or look up the AMSAT area coordinator for your area. Posting specific questions on the AMSAT bulletin board (e-mail list) will also help you find answers. AMSAT offers the "Getting Started with Amateur Satellites" book that contains additional information about the satellites and operating information.

<http://www.amsat.org/>

This document was a collaborative effort by Patrick Stoddard WD9EWK/VA7EWK, Gould Smith WA4SXM, and Tim Lilley N3TL for AMSAT. Photos provided by Patrick Stoddard WD9EWK/VA7EWK and Tim Lilley N3TL, and used with permission. Trademarks used in this document are the property of their respective owners. Use of trademarks in this document does not constitute an endorsement of any product or service by AMSAT.

FM Satellites and Frequencies

The following chart shows how a VX-8R could be programmed for **SO-50**:

| Ch # | Name | TX Freq | CTCSS (TX) | RX Freq |
|-------------|-------------|----------------|-------------------|----------------|
| 101 | SO50ON | 145.850 | 74.4 | 436.810 |
| 102 | SO50-1 | 145.850 | 67.0 | 436.810 |
| 103 | SO50-2 | 145.850 | 67.0 | 436.805 |
| 104 | SO50-3 | 145.850 | 67.0 | 436.800 |
| 105 | SO50-4 | 145.850 | 67.0 | 436.795 |
| 106 | SO50-5 | 145.850 | 67.0 | 436.790 |
| 107 | SO50-6 | 145.850 | 67.0 | 436.785 |
| 108 | SO50-7 | 145.850 | 67.0 | 436.780 |

SO-50 requires a 74.4 Hz CTCSS tone transmitted on 145.850 MHz to activate its repeater for 10 minutes. The memory channel "SO50ON" in the chart above will accomplish that. Then use the other memory channels with the 67.0 Hz CTCSS tone to talk through the satellite. SO-50's downlink frequency sometimes appears to jump up in frequency, so be ready to occasionally tune up 5 kHz instead of down 5 kHz when trying to follow the downlink.