Tech corner – How to work a satellite

Now that you've had the chance to build a directional satellite antenna of your own, let's put that device to good use. But before you point that thing skyward in hopes of making a contact, there are a few things you need to know.

It's helpful to learn your major grid square in advance. If you live in Utah County, Salt Lake County, Wasatch County, or Summit County, your major grid square is "DN40" for example. The three basic things you need to do to get started are 1) collect the target satellite info, 2) set up your radio, and 3) practice the pattern. Then, when the moment arrives, you'll be prepared to make the contact.

The mission

An amateur radio satellite is nothing more than a repeater station in space. What you're trying to accomplish is to make a contact with any other ham on Earth through that satellite repeater. You only have a few minutes as it passes over, and potentially several others are also waiting to make a similar contact.

Gather the satellite info

Probably the first thing you should do is pick a satellite. There are a number of active amateur satellites orbiting the Earth, but the three most popular are SO-50, AO-91, and AO-92. Let's use ***SO-50*** for this example, since it's possibly the simplest to demonstrate.

Next, download and install the HeavensAbove app. Heavens-Above is not the only satellite software available, but it's one of the best, IMO. Create a login (so it'll keep track of your location), then select Amateur Satellites–All Passes. Search or scroll down to SO-50. Notice that the "Downlink" is ***436.795 MHz*** and the "Uplink" is ***145.850 MHz***. Click Passes and select "all" passes. Pick a date and time that's most suitable to you. All times are local times, not UTC. At the time of this writing, it looks like SO-50 will pass at a very high elevation above the horizon on June 20, starting 9:01:29 am in the ***SSW***, peaking 9:06:11 am up ***63°*** in the ***ESE***, and ending 9:10:51 am in the ***NE***.

Set up your radio

The Baofeng UV-82 and Yaesu VX-8R are two of the best-suited dual-band, dual-watch HTs for satellite work, IMO. Many others are available so select one that's light-weight and is easy to operate with one hand. Program your radio as follows:

Chan	Tx Freq	Tone	Rx Freq
101	145.850	77.4	436.810
102	145.850	67.0	436.810
103	145.850	67.0	436.805
104	145.850	67.0	436.800
105	145.850	67.0	436.795
106	145.850	67.0	436.790
107	145.850	67.0	436.785
108	145.850	67.0	436.780

This will require you to set the "Frequency" of channels 101 and 102 to 436.810, each with a "–" offset of 290.960 MHz, then channel 103 to 436.805 with a "–" offset of 290.955, then channel 104 to 436.800 with a "–" offset of 290.950, etc.

Finally, make sure the squelch is turned off, or you won't be able to hear much.

What I personally do is use my Baofeng in Frequency (VFO) Mode, by setting the upper ("A") frequency to 145.850 MHz simplex and a T-CTCS of 67.0, then the lower ("B") frequency to 436.810 MHz, and at a

Tech corner – Work a satellite, cont'd

5.0K step. This is the "lazy" way to do it, because I a) rely on others to open the satellite repeater, which usually works, and I b) don't have to program these into my radio, but it works. Also, in the menu, set the TDR to ON, so that you can hear on "B" immediately after sending on "A".

Practice the pattern

Each pass of the satellite will take a different amount of time, due to its angle above the horizon. In this case, the satellite will move smoothly across the sky from 9:01:29 at the starting point, to 9:06:11 at the mid-point, to 9:10:51 at the final point. That's 9 minutes and 22 seconds of slow motion that'll test both your patience and your arm muscles.

Long before the starting point, practice making the sky sweep, to make sure you'll be following the correct satellite trajectory. It's very possible to get a visual on (see) your satellite, but often not likely. If you don't point your small-beamwidth antenna right at the satellite, your little radio might not detect its weak signal. And to ensure you're timing it right, let's divide the sweep into four equal sections.

Without your antenna, extend your arm and point to the SSW direction, about 10° above the horizon. That's the starting point. Next, move your arm to point at the ESE direction, about 63° above the horizon. This is the mid-point. Finally, move your arm to point at the NE direction, about 10° above the horizon. This is the final point. These three points enclose the two sky sections. Now, split up your timing by cutting the two sections in half, as follows:

Starting point: 0 minutes 0 seconds
First quarter point: 2 minutes 20 seconds
Mid-point: 4 minutes 40 seconds
Third quarter point: 7 minutes 0 seconds
Final point: 9 minutes 20 seconds

Now, try timing your pointing by moving your arm across the sky in this arc and at that pace. It's a little nerve-wracking, and it'll amaze you just how slowly two minutes crawls by. Next, try it again, this time holding your antenna. And then, try it again, but while holding both your antenna and your radio. Finally, do it once more, this time changing the lower (436.810) frequency down 5 kHz at each point, to keep up with the Doppler frequency shift of the satellite as it approaches and leaves:

Starting point: 436.805
First quarter point: 436.800
Mid-point: 436.795
Third-quarter point: 436.790
Final point: 436.785

You'll soon understand why avid satellite chasers use automatically controlled tracking equipment. Obviously, this takes a little coordination, and hence the practice. You can learn other tips on this page by AMSAT. And there's more.

Make the contact

When the starting point arrives, during each point in your sweep, you'll need to listen, because you'll hear people chattering. At an appropriate break, press the "A" PTT button, and if your call sign is KI7ABC and your major grid square is DN40, loudly say,

KILO-INDIA-SEVEN-ALFA-BRAVO-CHARLIE,
DELTA-NOVEMBER-FOUR-ZERO

I placed the comma in the above for you to know when to pause slightly, so that you don't run together your call sign and major grid square. If you're being heard by, say, N6DLO, and his major grid square is DM69, you should hear something like

KILO-INDIA-SEVEN-ALFA-BRAVO-CHARLIE,
this is NOVEMBER-SIX-DELTA-LIMA-OSCAR,
DELTA-MIKE-SIX-NINER

In response, say,

ROGER-ROGER-N6DLO, thanks for DM69.
SEVEN-THREE

That way, he'll also know that you heard *him*. Congratulations...you've just made your first satellite contact!

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