CROSS ROADS HAM RADIO CLUB
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You Think You Want To Work Satellites?

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Introduction

KE7RTB ANDY WILLMS Return To Base

- Licensed in Tacoma WA
- Member of W7DK 1 of the oldest ham radio clubs in America.
- Has Over 2,000 Satellite QSO.
- 1 QSO with astronaut on the ISS Mission # 67

Kjell Lindgren operating as NA1SS from CN86

- Moved to Huffman Texas in Aug of 2023
- Now a Member of CRHRC

CAUTION… BEWARE…

I caution you in this endeavor;
It is both fun, exciting, rewarding
and can be costly $$$
Not to mention Time Consuming.

ISS

When new hams get their licenses, they generally purchase a handheld transceiver (HT) and get on the local repeaters. This is fun for a while, but don't get stuck just talking on the repeaters. Ham radio has much more to offer. For example, one of the other cool things you can do with a Technician Class license is work the "birds," otherwise known as amateur radio satellites.

Did you know that amateur radio operators have been sending satellites into space since the early 1960s? The Orbiting Satellite Carrying Amateur Radio, or OSCAR I for short, was successfully launched into a low Earth orbit on December 12, 1961. It carried a small beacon transmitter whose purpose was to study radio propagation through the ionosphere. It only lasted a few weeks before

it dropped into Earth’s atmosphere and burned up, but it secured amateur radio’s place in space.
Now, there are dozens of amateur radio satellites in space, and as a Technician you can make contacts by bouncing your signals off of them. Think of them as repeaters in space.

Types of Ham Radio Satellites

There are two basic types of satellites: FM satellites and linear transponders. The FM satellites are basically cross-band repeaters. You might, for example, transmit on a frequency, called the uplink, in the 2 m band and receive on a frequency, called the downlink, in the 70 cm band. A satellite whose uplink frequency is in the 2 m and downlink frequency in the 70 cm band is said to be operating in mode V/U (V for VHF, U for UHF). Some satellites have an uplink frequency in the 70 cm band and a downlink frequency in the 2 m band. These satellites are said to be operating in mode U/V.

The International Space Station (ISS) is now equipped with a mode V/U repeater. Its uplink frequency is 145.990 MHz, and its downlink frequency is 437.800 MHz. It requires a CTCSS tone of 67.0 Hz.

Doppler Effect

In ham radio, the Doppler effect manifests as a shift in the received frequency of radio signals from moving sources, like satellites, causing a perceived change in frequency as the source approaches or moves away.

How it affects ham radio:

When a satellite passes overhead, its radio signals experience a Doppler shift as the satellite's speed relative to a ground station changes.

- **Frequency shift:**
- As the satellite approaches, the received frequency appears higher than the actual transmitted frequency (a "blueshift"). Conversely, as the satellite moves away, the received frequency appears lower (a "redshift").
- **Impact on satellite communications:**
- This frequency shift can make it difficult to maintain communication with satellites, especially on frequencies where the shift is more pronounced (like 70cm).

KE7RTB HT CHANNEL ALLOCATIONS

In my Yaesu FT5DR I utilize 5 channel allocations to aid in the Doppler effect.

CH#1 RX 437.790

CH#2 RX 437.795

CH#3 RX 437.800

CH#4 RX 437.805

CH#5 RX 437.810

Other ISS Radio Modes

APRS On ISS Freq 145.825 NOT 144.390

(ARISS.NET)

SSTV on ISS

Listed School Contact Frequency

Ham Radio Satellite Antennas

One of the cool things about working the FM satellites is that you don’t need a lot of sophisticated equipment. A couple of HTs—or an HT capable of duplex operation—and a handheld, dual-band Yagi, as shown on the next slides will do.

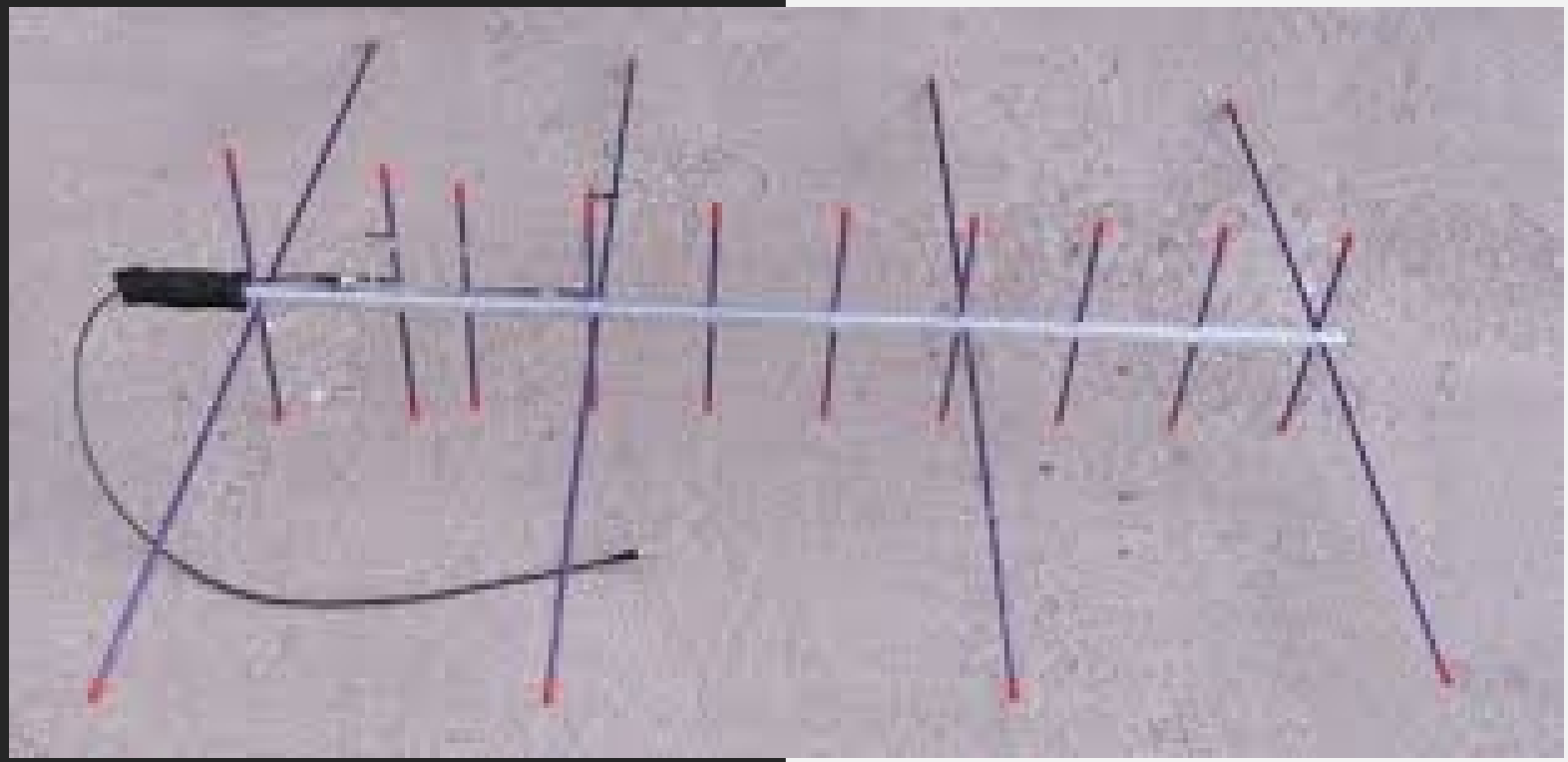
There are 2 differently-used antennas for satellite work is the Arrow II Portable. It consists of two Yagi antennas—a three-element 2 m Yagi and a seven-element Yagi—connected to a common boom. The two antennas are at right angles to one another. You can purchase this antenna with a duplexer that lets you connect it to a single radio or without the duplexer, which lets you connect it to two separate radios.

The ELK Satellite Antenna

Having both 2 Meter and 70 cm Bands in a compact, two foot long package, without having to bother with a duplexer is just a real lifesaver to most operating environments. From bouncing signals off of satellites, to working simplex two or three counties aways – you cannot go wrong with the Elk 2M/440L5! All Elk 2M/440L5 models come with a handle for handheld operation, making this antenna perfectly set up for satellite, DFing, EmComm, and very portable operation. The feed on all Elk Antennas is from the front of the antenna. The end where you connect the feedline is where you point the antenna.

ELK Satellite Antenna

Arrow Satellite Antenna



Finding A Satellite

If you’re a do-it-yourself type, these antennas are not difficult to build. A “cheap yagi” antenna for satellite work can be built using a wooden boom and stiff copper wire or welding rod. Or a TAPE antenna You can build one of these for a fraction of the cost of buying one.

Once you have the gear, you need to be able to find out when the satellites will be in view. Remember, this is all line of sight operation. You can only work the satellites if they are above the horizon. For finding out when satellites will be above the horizon, You may use N2YO.Com website. The amateur radio satellite passes page shows which satellites will be passing above the horizon at your location for next six hours, and provides the uplink and downlink frequencies, and the start and end times with the azimuth and elevation information you need point your antenna at the satellite.

Phone Apps Droid / Apple

Also there are numerous Apps for your phone that advise you when a pass is upcoming.

ISS Detector
Satellite Tracker
ISS Tracker
Sat Sat
Sky Live
Go Sat Watch

Operating the satellites can be a lot more fun than just talking to the hams on the local repeaters. Aside from making sure that your signal can hit the repeater, there’s no real challenge in that. Working the satellites, on the other hand, can be a lot more engaging. It’s a true test of your operating and technical skills.

Basic Items Needed

Desire
Radio (HT or Mobile / Base)
Antenna (H/B, ELK, Arrow or LEO)
Tri pod / Stand
Paper/Pen
Recorder (Sony PX470 / Radio)
SAT Tracking Tools / Apps, Compass, GPS.
ABR = Radio Cables & Connectors

Tips & Tricks

Uplink / Down Link (Doppler 70cm)

Degree Elevation / Polarity

- Proper Etiquette

NEVER CALL CQ CQ on a FM BIRD (only call CQ CQ on SSB birds) ..... Short Sweet and 2 the point. GRID SQUARE (QSO Recordings Good / Bad)

- Cell Phone Tools

- GRID CHASING

Final Thoughts

- **Credit to: Dan Romanchik, KB6NU**

  - N2NWK
  - KO4PDI
  - KE7RTB

- Don’t cheap (Cry Once Buy Once)

* Impedance explained in appendix

End of on-air portion
Questions? Discussions…

References and further information

- Satellite Status Page from AMSAT.ORG

www.amsat.org/status/

References & further information Continued

- ISS Status Page from ARISS.NET
- **Amateur Radio Stations heard via ISS**

Amateur Radio Stations heard via ISS