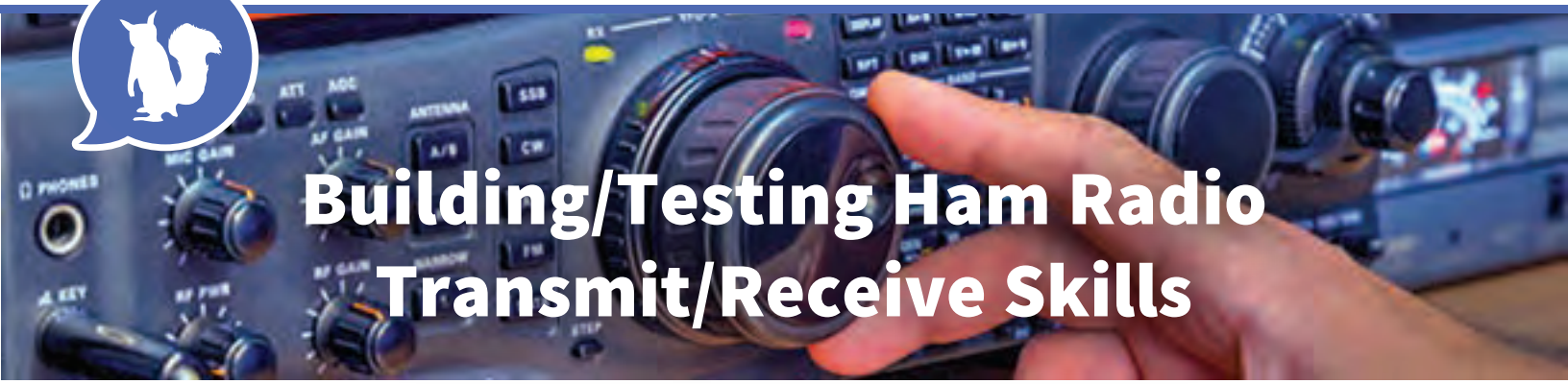


Building/Testing Ham Radio Transmit/Receive Skills

Introduction

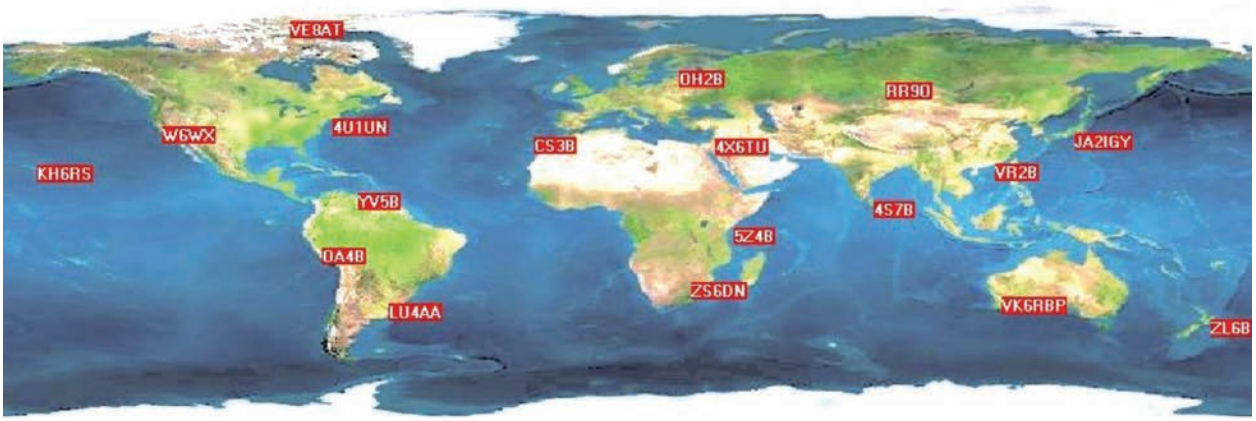
The purpose of this document is to demonstrate some of the sources of regular broadcast frequencies in order to assess your radio and antenna performance. Other aspects feature methods to test your transmission efficacy. A search of the web will find other stations for these purposes, but this will introduce the concepts.

Receive/Listening

There are a number of radio sites that regular transmit near frequency ranges of interest to the amateur radio operator. These stations are either beacons that routinely transmit known-strength signals or transmit time signals.

Beacons

Ham radio beacons are allowed to op rder to better understand propagation. These stations erate in o typically operate 24/7 and transmit signals of known strength. The International Beacon Project (http://www.ncdxf.org/beacon/index.html) transmits on five bands. Stations transmit on each of the five bands on a 10 second transmission schedule and then are silent until they come up again on the schedule.



NCDXF/IARU International Beacon Project

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00

Frequency	Beacon	Location
14.100	RR9O	Siberia
18.110	JA2IGY	Japan
21.150	VK6RBP	Australia
24.930	ZL6B	New Zealand
28.200	KH6RS	Hawaii

Beacon	Frequency
4U1UN	silent
VE8AT [2]	silent
W6WX	silent
KH6RS	28.200
ZL6B	24.930
VK6RBP	21.150
JA2IGY	18.110
RR9O	14.100
VR2B	silent
4S7B [4]	silent
ZS6DN	silent
5Z4B [7]	silent
4X6TU	silent
OH2B	silent
CS3B	silent
LU4AA	silent
OA4B	silent
YV5B	silent

If you are able to be on the webpage while listening to the station, you will be able to hear which beacon transmitted. Stations are all over the world and initial transmit station ID and a tone at 100W and then the tone at 10W, 1W, and 100mW.

Time Signals

A number of countries, including the US, provide time signals. These signals include various digital and voice transmissions. This website (https://www.smeter.net/stations/hf-time-frequency.php) covers time transmitters from 2.5 to 20 MHz. There are a large number of rows in this table, but just the beginning is given to show part of the site and encourage you to go there and try the various frequencies at different times to see how successfully and reliably you can receive the signals.

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00

Share This

HF Time & Frequency Standard Stations

The stations below are widely used to check current radio propagation conditions.

The primary functions of WWV and WWVH are to transmit official standard time on highly accurate reference frequencies traceable to the U.S. national standard. Other stations listed below serve similar functions in other countries.

In addition to those primary functions, these stations serve another important function in providing means to quickly check radio propagation conditions from multiple locations on a variety of widely spaced frequencies. That function is especially important to radio amateurs, shortwave listeners, and others interested in radio propagation. These stations serve that function better than most other shortwave stations, because they transmit constantly from known locations with known power levels using known antenna systems.

- Terrain map showing the 358-mile direct-path from WWV
- Terrain map showing the 3070-mile direct-path from WWVH

Time & Frequency Standard Stations

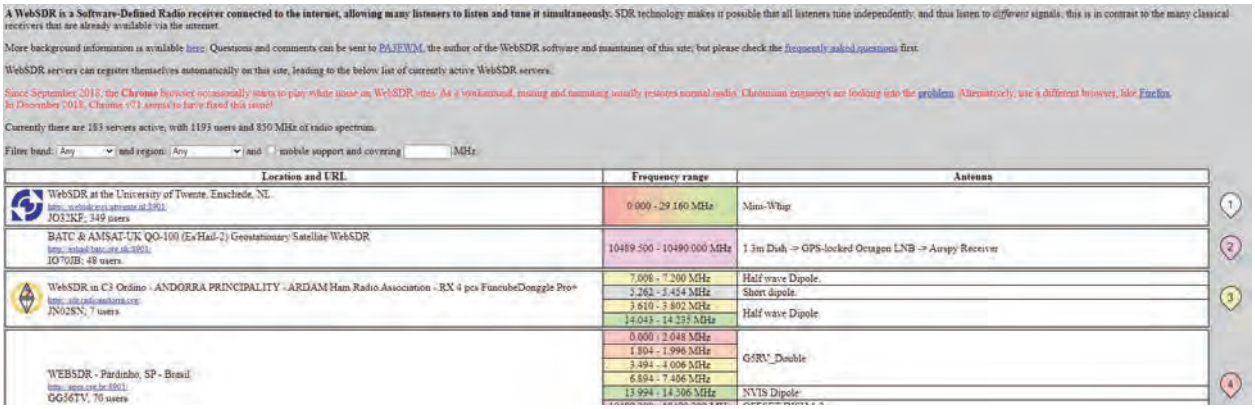
Freq.	Call	Power	Distance	Description
2500 kHz	WWV WWVH	2.5 KW 5 KW	358 Miles 3070 Miles	WWV Broadcasts National Institute of Standards and Technology (NIST) time and frequency signals from a location near Fort Collins, Colorado. WWV uses a male voice. WWVH Broadcasts National Institute of Standards and Technology (NIST) time and frequency signals from a site near Kekaha at Kokole Point on the Island of Kauai, Hawaii. WWVH uses a female voice. For both stations the transmission mode is DSB AM. Steady tone modulation is 50%. BCD time code modulation is 50%. Second pulses and minute and hour marker modulation 100%. Voice modulation is 50%. The antenna polarization is vertical. WWV and WWVH share 2500 kHz with BPM, Shaanxi Astronomical Observatory, Chinese Academy of Sciences, P.O. Box 18 - Lintong, Shaanxi, China. (See Double Time Markers)

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

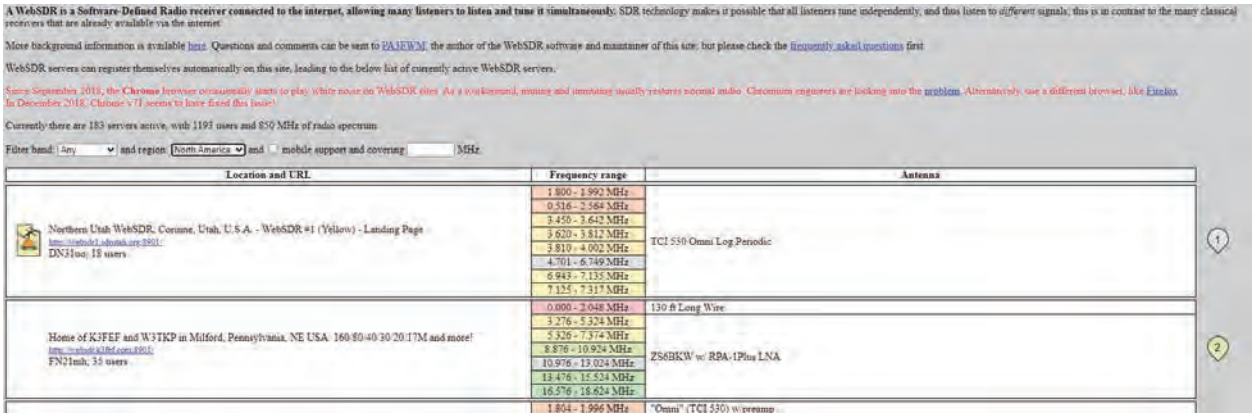
Web Software Defined Radio Ver. 1.00

Web SDR is a relatively new entrant into the world of radio. Using these features, you can listen through someone else's radio and antenna system that they've made available via a website interface. It is a listening-only facility, but it's interesting to see what's on the air in other locations.

A gateway to the available Web SDR equipment is on websdr.org. From that site, you can limit your area of interest and specific frequencies by using the filter boxes on the top.



Here, I've limited the equipment to North America and allowed for any bands:

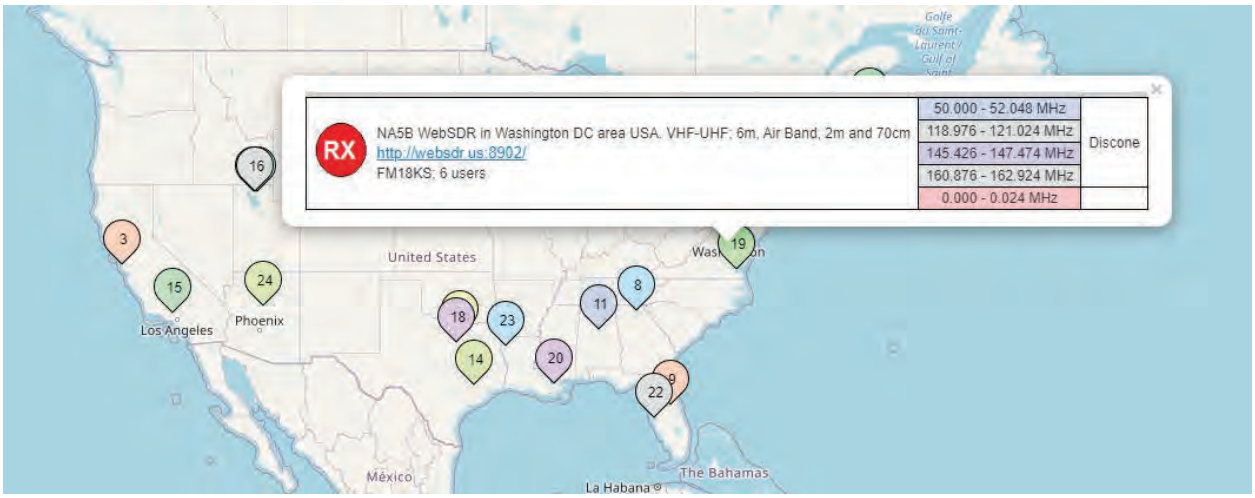


For ease of use, there's a map of the resulting stations at the bottom of the page:

You can zoom in on the map, as I've already done, and then you can click on a site to see the details and get a link to go to the site:

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00



Oftentimes, you may need to initially click a button to get the stream started, but they're not always so easily found as in this site:

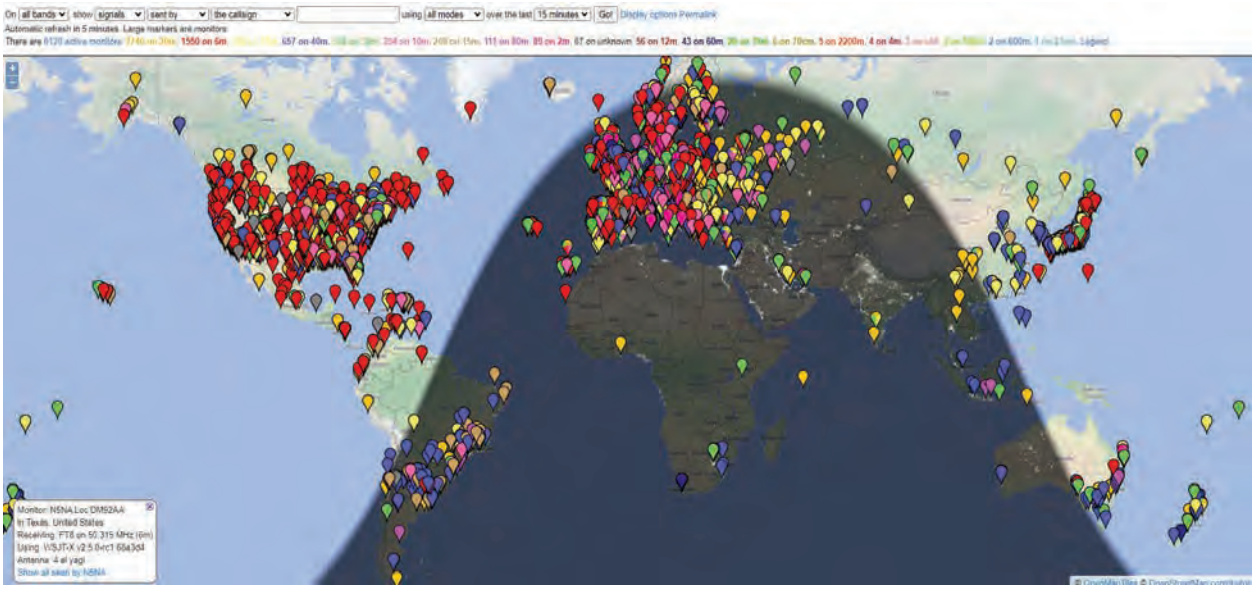
Then, you can enter a frequency of interest or, for testing, the one on which you're going to transmit. Make sure to set the appropriate mode and other parameters. If you're going to transmit, then you may want to use headphones on the computer so you can more easily distinguish your test transmission from the sounds picked up on the radio and also avoid feedback.

Digital Modes

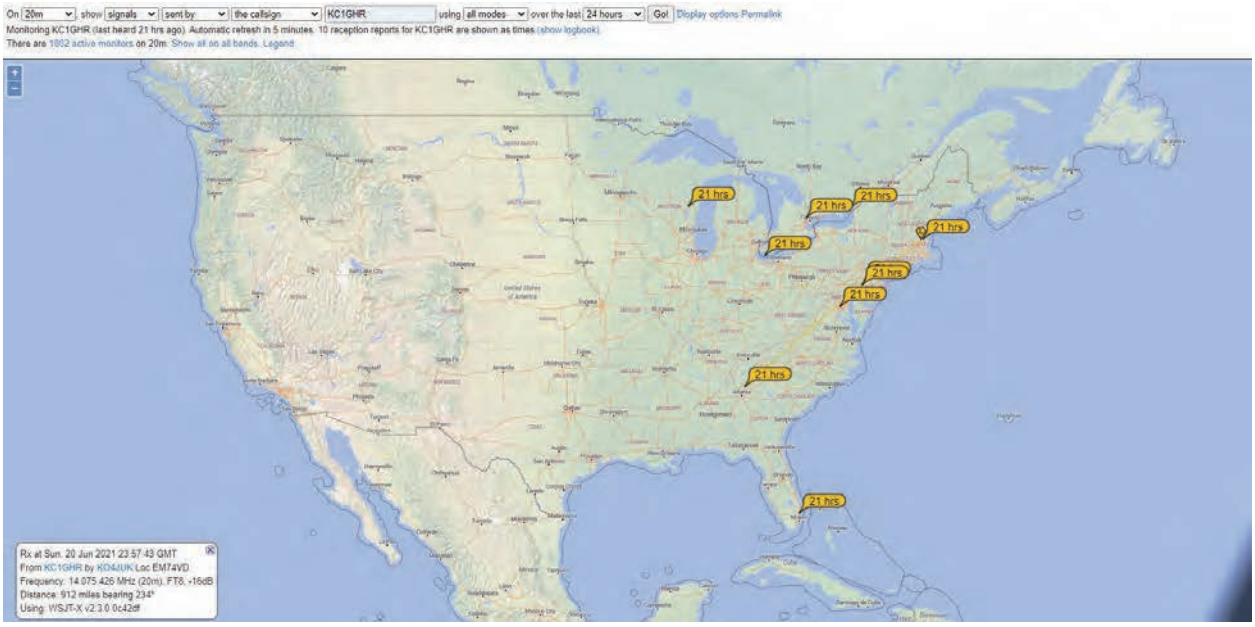
When you're transmitting using digital modes such as FT8, PSK31, etc., there are a number of monitors that constantly capture and report data to the internet. There are a number of great resources to see these results. The first one is graphical and is PSKReporter (https://pskreporter.info/pskmap.html) and provides a great mapping feature:

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00



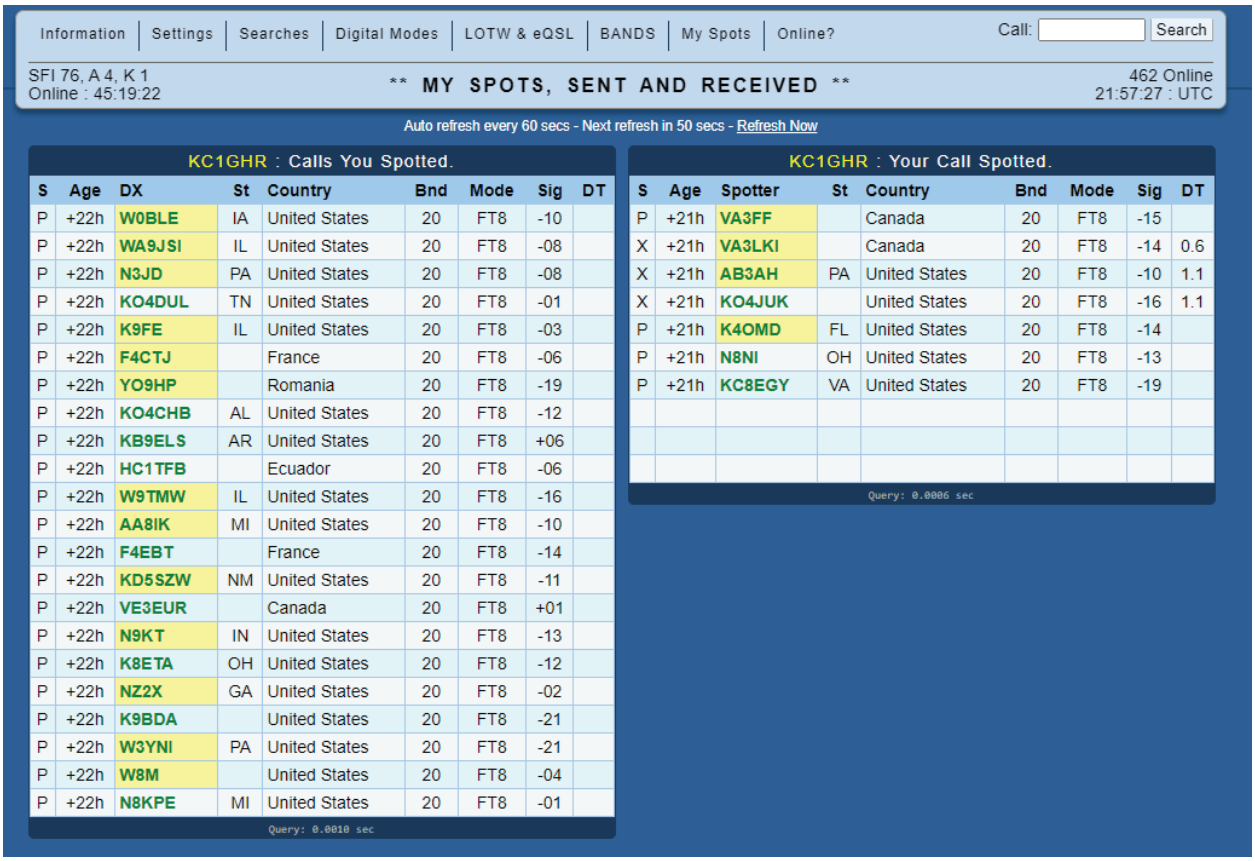
You can then do a search for your callsign to determine where you were able to reach with that particular radio and antenna arrangement:



Another great tracking website is Hamspots (https://hamspots.net/). Some features, like your spots, require a free account to login.

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00

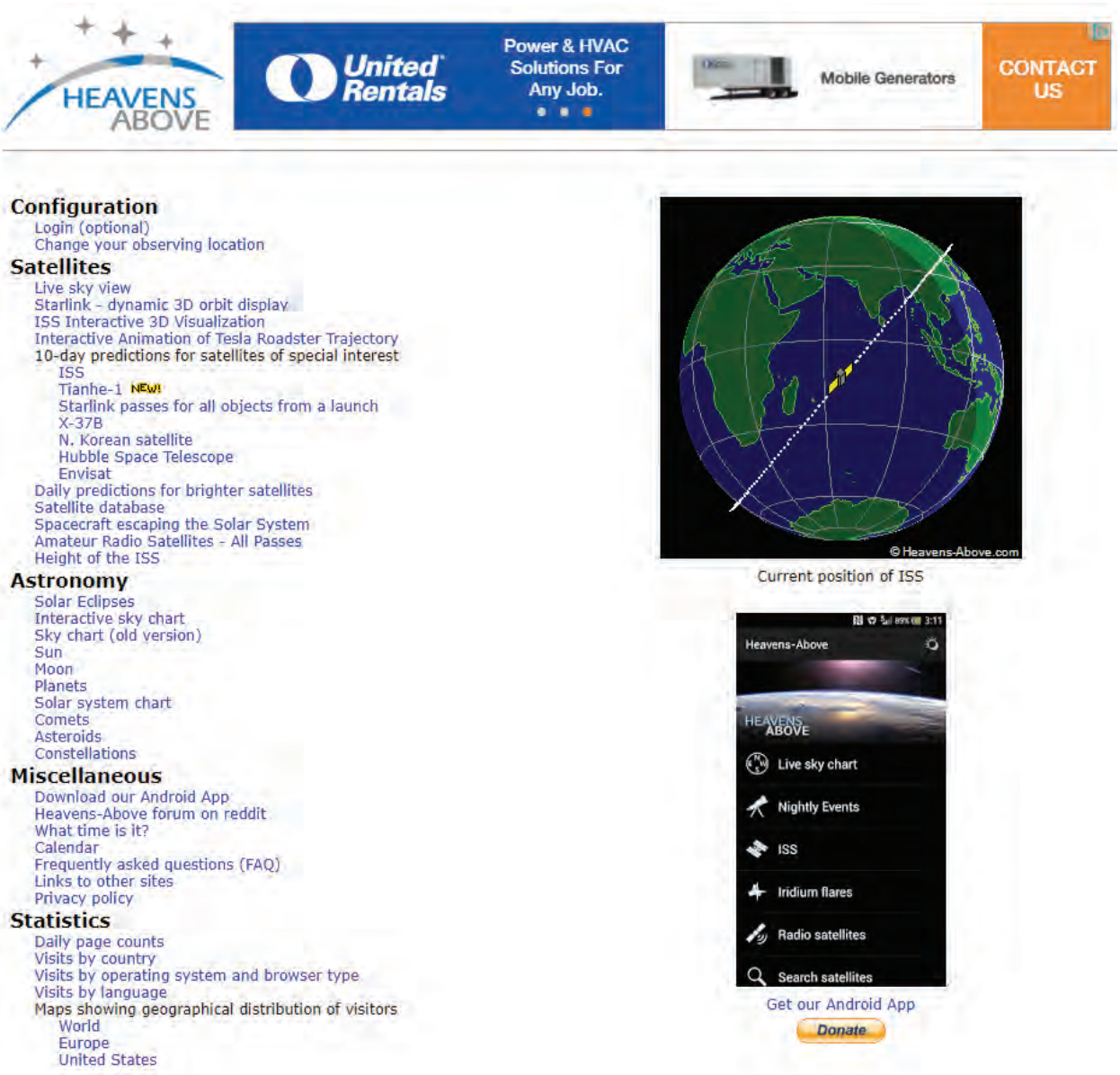


Fun Listening VHF/UHF while improving listening skills

There are many orbiting satellites and man-made objects in space. A number of these provide beacons and communications of various forms. One of the most convenient sites for this is Heaven-Above (www.heavens-above.com). The first time you go there you will have to set your location. You can also establish a login, if you'd like, but I haven't bothered doing that.

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00



You can select the Amateur Radio item from the menu to get a list of the satellites expected to pass over:

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00

Amateur Radio Satellites - All Passes

Search period start: 21 June 2021 17:38
Search period end: 22 June 2021 17:38 < >
Location: Tewksbury, 42.6106°N, 71.2342°W

Satellite	Date	Start	Highest point		End	Downlink Frequencies (MHz)
			Altitude	Azimuth		
ITAMSAT 1	21 Jun	17:38:52	22°	63° (ENE)	17:46:45	435.822/435.867
XW-2C	21 Jun	17:41:07	63°	76° (ENE)	17:48:38	145.795 - 145.815
KAITUO 1B	21 Jun	17:43:08	28°	71° (ENE)	17:49:29	145.475/437.950
HuskySat-1	21 Jun	17:43:33	22°	226° (SW)	17:49:19	.
AAUSAT CUBESAT 2	21 Jun	17:50:25	41°	262° (W)	17:58:19	437.432
CUTE-I	21 Jun	17:54:54	66°	73° (ENE)	18:05:25	437.470
ZACube-1	21 Jun	17:55:47	15°	269° (W)	18:00:48	437.345
XW-2F	21 Jun	17:56:39	71°	76° (ENE)	18:04:07	145.980 - 146.000
FALCONSAT 3	21 Jun	17:57:11	25°	185° (S)	18:03:06	435.103
BEESAT 3	21 Jun	18:00:04	23°	114° (ESE)	18:06:05	437.485
Oscar 11	21 Jun	18:03:15	51°	261° (W)	18:11:38	145.825
AO-27	21 Jun	18:21:04	52°	70° (ENE)	18:31:05	436.795
NOAA 15	21 Jun	18:24:16	24°	63° (ENE)	18:32:31	137.6200
PSAT 2	21 Jun	18:25:30	13°	171° (S)	18:29:51	145.825 / 435.350
NO-84	21 Jun	18:34:14	13°	232° (SW)	18:37:08	435.350 FM
NOAA 19	21 Jun	18:44:36	69°	72° (ENE)	18:55:30	137.1000
BEESAT	21 Jun	18:45:30	12°	90° (E)	18:49:28	436.000
METEOR M2	21 Jun	18:45:32	35°	67° (ENE)	18:55:11	137.100 / 137.900
ITUPSAT 1	21 Jun	18:54:30	16°	91° (E)	19:00:08	437.325
NUDT-PHONESAT	21 Jun	18:58:41	51°	261° (W)	19:05:42	437.300
TIGRISAT	21 Jun	19:01:42	16°	90° (E)	19:07:16	435.000
STRAND 1	21 Jun	19:05:35	23°	93° (E)	19:13:41	437.568
XW-2D	21 Jun	19:08:18	12°	270° (W)	19:11:07	145.860 - 145.880
XW-2B	21 Jun	19:12:53	11°	270° (W)	19:15:16	145.730 - 145.750
ITAMSAT 1	21 Jun	19:16:55	49°	260° (W)	19:26:56	435.822/435.867
KAITUO 1B	21 Jun	19:17:25	19°	266° (W)	19:22:45	145.475/437.950
CAS-4A	21 Jun	19:21:00	15°	143° (SE)	19:25:52	145.870
CAS-4B	21 Jun	19:34:25	18°	145° (SE)	19:40:01	145.925 MHz USB
FALCONSAT 3	21 Jun	19:36:11	14°	200° (SSW)	19:40:04	435.103
BEESAT 3	21 Jun	19:36:45	31°	311° (NW)	19:43:38	437.485

From that, depending on the time in relation to when you can listen, you can click on the satellite name to get additional information about the pass:

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00

XW-2C - Satellite Information

Home | Passes | Orbit | Close encounters

Designation

Spacetrack catalog number 40906
COSPAR ID 2015-049-H
Name in Spacetrack catalog XW-2C

Amateur radio information

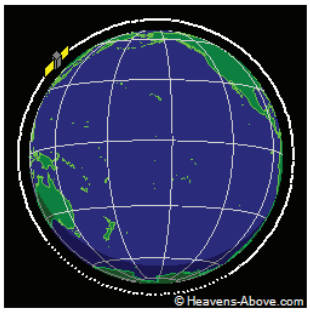
Downlink: 145.795 - 145.815 MHz
Uplink: 435.150 - 435.170 MHz

Satellite Details

Orbit	505 x 526 km, 97.5°
Category	Amateur radio
Country/organisation of origin	China
Intrinsic brightness (Magnitude)	?

Launch

Date (UTC)	19 September 2015 23:01
Launch site	Taiyuan Space Launch Center, China
Launch vehicle	Long March 6

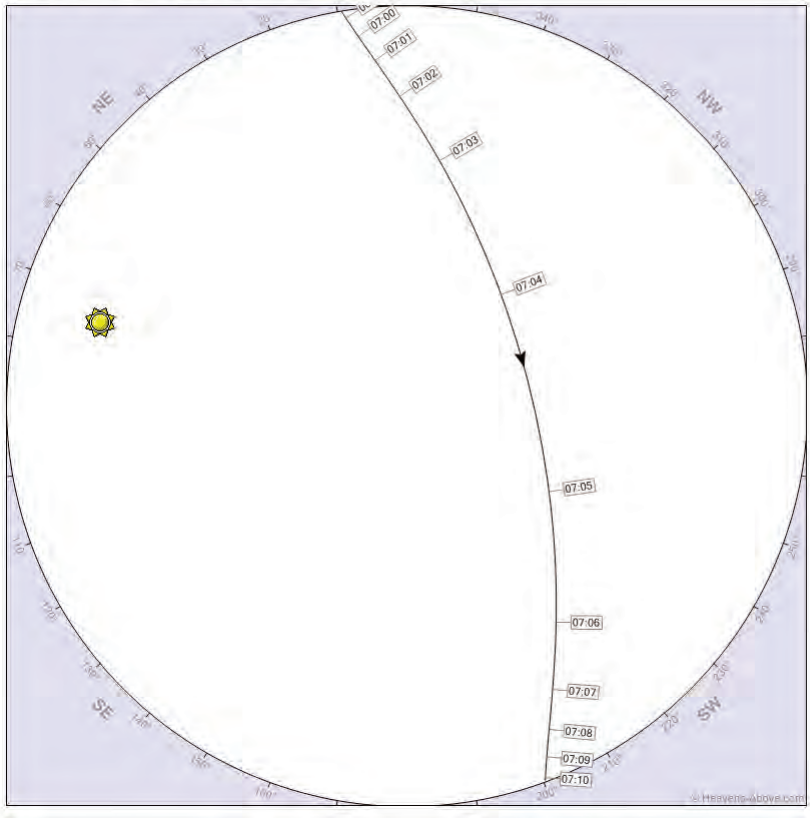


You'll see a menu in the upper right, above the graphic, which will show you the pass details and then pick a specific pass for viewing (I like passes that are at least 45 degrees above the horizon):

XW-2C - Pass Details

Home | Ground track | Info. | Orbit | Close encounters

Click on the chart to zoom in on that part of the sky

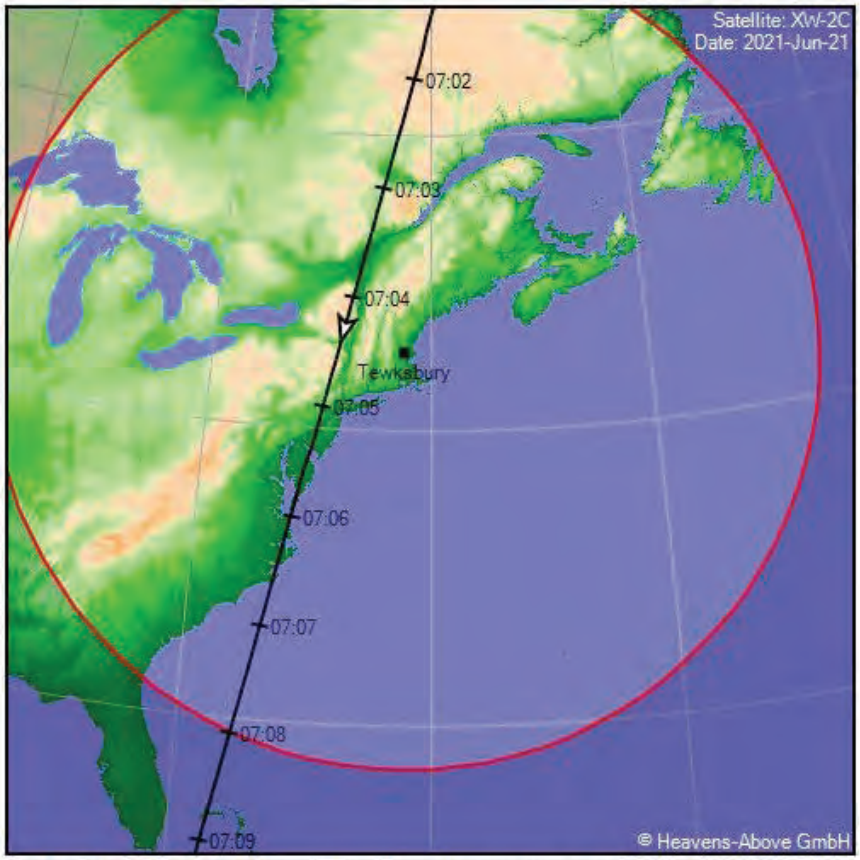


Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

Ver. 1.00

Note that the drawing has East on the left with the intention that the viewer would hold the graphic overhead looking up at it with north aligned to the top of the page. That would make East and West align correctly on the sky. The ground track can help put the pass in perspective:

Ground track



The highlighted circle is the region where the satellite is at least 10° above your horizon. The size of the circle depends on the height of the satellite.

Note that an arrow antenna (http://www.arrowantennas.com/arrowii/alaskanarrow.html) hooked up to an HT is fun to work with tracking and polarity and helps to build better tracking skills.

Final Note on Transmit/Receive Testing

It's really not about power with radio transmission and reception. Power plays a role, but is only part of the picture. Having a properly tuned antenna for maximum propagation, not just antenna matching where a lot of the power goes into the matching system. Try to maximize the antenna, which includes as much height as you can afford to accomplish. Try to get up at least ¼ wavelength (λ). NASA spoke to the astronauts with about 25W over about 240,000 miles but awesome line-of-sight. Similarly, operators

Building/Testing Ham Radio Receive/Transmit Skills *(continued)*

routinely communicate with the International Space Station (ISS) with less than 5W but, again, direct line of sight. Other factors, like sunspots and gray-line propagation, mean that certain times of day and space conditions will strongly influence ultimate success.