

HF RADIO

An Overview

High frequency (HF) is the ITU, International Telecommunication Union designation for the range of radio frequency electromagnetic waves (radio waves) between 3 and 30 megahertz (MHz).

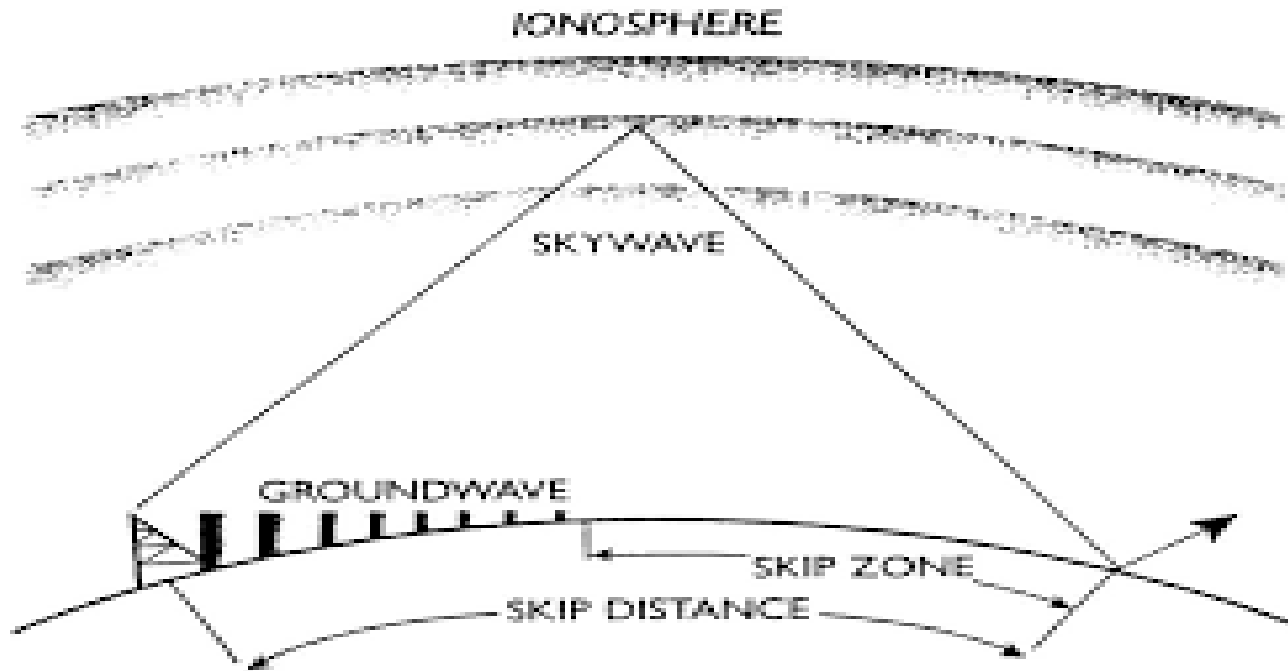
IAW FCC Band Plan HF starts @ 1.8 Mhz.
(97.313)

High Frequency (HF) radio is used for first-line and backup communications over long distances, mainly in remote regions of the developed world and in developing countries.

HF is used by many government agencies and the Military

The dominant means of long distance communication in HF band's is skywave ("skip") propagation, in which radio waves directed at an angle into the sky refract back to Earth from layers of ionized atoms in the ionosphere. By this method HF radio waves can travel beyond the horizon, around the curve of the Earth, and can be received at intercontinental distances. However, suitability of this portion of the spectrum for such communication varies greatly with a complex combination of factors:

This is called Radio Propagation: Radio propagation is the behavior of radio waves as they travel, or are propagated, from one point to another, or into various parts of the atmosphere.



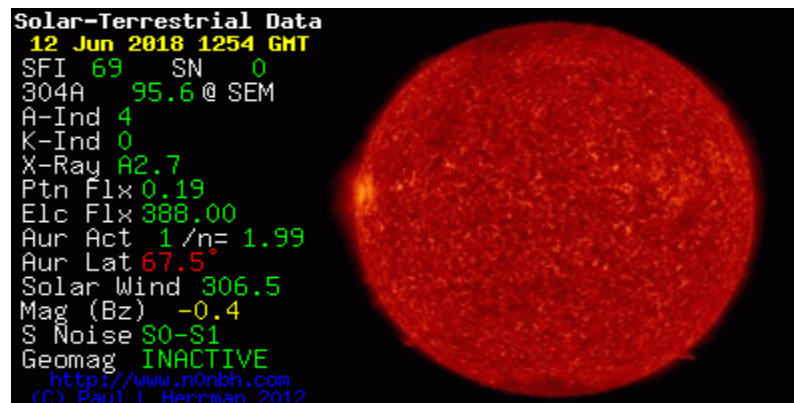
Sunlight/darkness (Grayline) at site of transmission and reception
 Transmitter/receiver proximity to solar terminator (Grayline)
 Season, Sunspot cycle, Solar activity,
 Polar aurora

Courtesy of ON6ZQ

Solar-Terrestrial Data - <http://www.n0nbh.com>

12 Jun 2018 1240 GMT		VHF Conditions		HF Conditions			Condition	K-In	A-In						
SFI	69	SN	0	Item	Status	Band	Day	Night	Quiet	0-2	0-7				
A	4	K	0	Aurora	Band Closed	80m-40m	Good	Good	Unsettled	3	8-15				
X-Ray	A2.7	Tromso		6n EsEU	50MHz ES	30m-20m	Poor	Poor	Active	4	16-29				
304A	95.6	@ SEM		4n EsEU	Band Closed	17m-15m	Poor	Poor	Minor storm	5	30-49				
Ptn Flx	0.19			2n EsEU	Band Closed	12m-10m	Poor	Poor	Major storm	6	50-99				
Elc Flx	388.00			2n EsNA	Band Closed	Geomag Field INACTIVE			Severe storm	7-9	>100				
Aurora	1/n=1.99			EME Deg	Good	Sig Noise Lvl	S0-S1			SFI A-In	K-In	Prop Opng			
Aur Lat	67.5°			MUF		MUF NO Tromso	14.26			>180	<8	<3	E-W open		
Bz	-0.4	SW 306.5		MS		Solar Flare Prb	11%			>180	<8	>3	N-S open		
												>250	>30	>3	Aurora

(C) Paul L Herrman 2013



Solar Flux Index (SFI)

A measure known as the solar flux is used as the basic indicator of solar activity, and to determine the level of radiation being received from the Sun. This gives a very good indication of conditions for long-distance communication.

The figure for the solar flux can vary from as low as 50 or so to as high as 300.

Low values indicate that the maximum useable frequency will be low and overall conditions will not be very good, particularly on the higher HF bands.

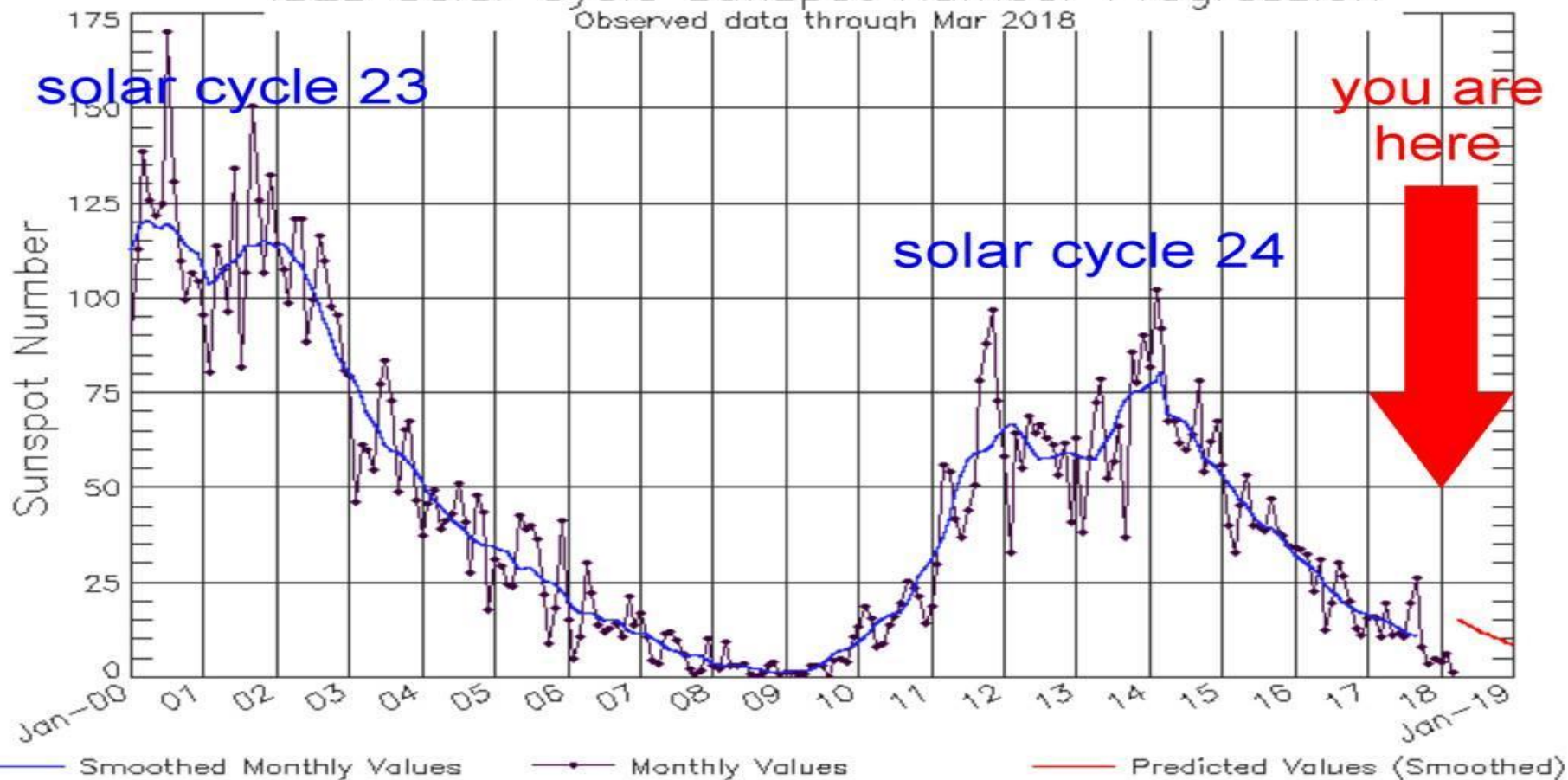
A and K indices

These two indices are used to determine the level of geomagnetic activity. These give indications of the severity of the magnetic fluctuations and hence the disturbance to the ionosphere. The lower the numbers the less geomagnetic disturbance the better the propagation.

Sunspot Number Progression

ISES Solar Cycle Sunspot Number Progression

Observed data through Mar 2018



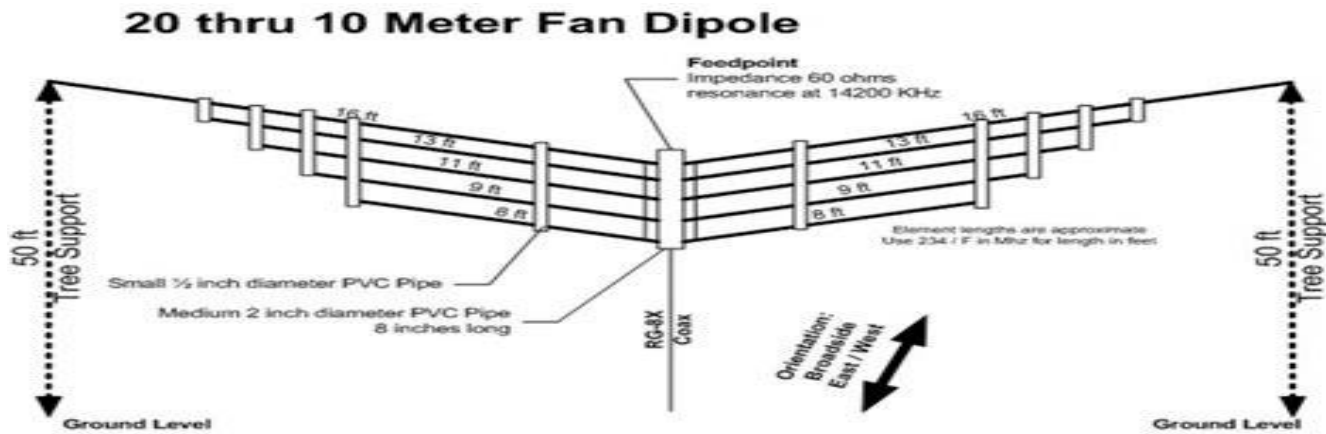
HF ANTENNAS



Multiband Vertical



Multiband Beam



Use an antenna tuner to help correct high SWR problems

Dipole Length Calculation

Dipole antenna length

A wave length is 984 feet

A $\frac{1}{2}$ wave length is 492 feet

A $\frac{1}{4}$ wave length is 246 feet

To figure a dipole length for a specific frequency or band, divide the wave length, in feet, by the frequency of band or a specific frequency.

For a Band

492 divided by 7.000 = 70.28 feet long dipole

For a Frequency

492 divided by 7.245 = 67.9 feet long dipole

Antenna Gain

The ability of an antenna to transmit and receive efficiently.

Antenna are magnetically polarized.

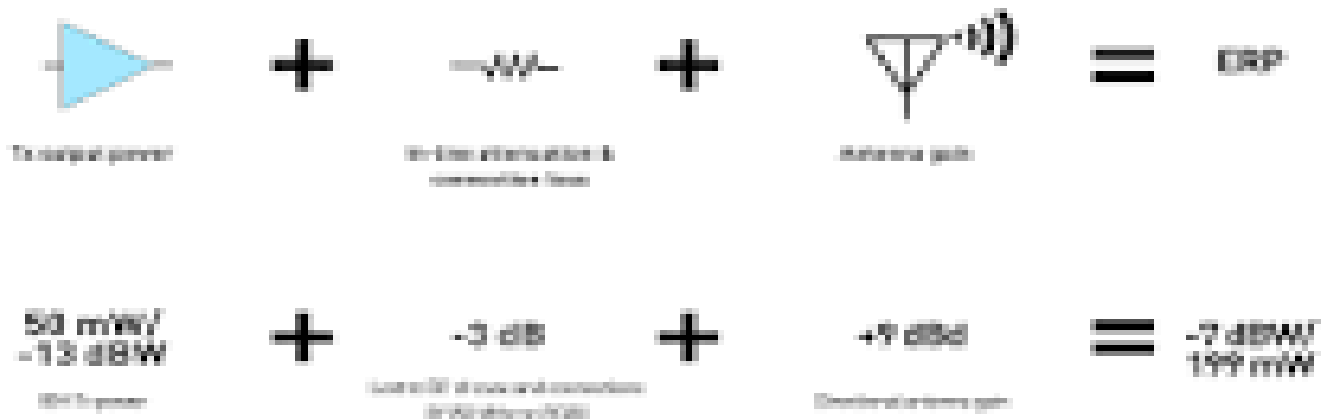
Vertical antennas are polarized vertically

Beam antennas are polarized horizontally

Effective radiated power is the term that describes station output, including the transmitter, antenna and everything in between, when considering transmitter power and system gains and losses.

What is ERP?

(Effective radiated power)



HF RADIOS



Yaesu FTDX3000 100 watts
160 through 6 Meters - SSB/CW/FM/AM/Digital



ICOM IC-7300 160 thru 6 meters – SSB/CW/FM/AM/Digital



TS 2000 Kenwood 160,80,40,30,20,17,15,12,10,6,Sub : 2 meter band, 70 cm band

HF Operation Equipment Antenna Tuner

Keep the antenna and rig matched to reduce high SWR. Most newer radios have built in tuners. These will handle SWR up 3:1. Beyond that an automatic or manual tuner is the best way to deal with high SWR.

The real cure is to check all connections/connectors for 50 ohms impedance and use a common mode choke.

A good SWR/Watt meter will indicate how mismatched your antenna and radio is. Some SWR Watt meters have a built in dummy load for tuning purposes. This is especially true if you are going to use a linear amplifier.

To work Digital modes the following items of equipment are necessary:

Computer

A windows machine is best as some of the digital modes will not run on MAC OS

DIGITAL HF PROGRAMS

Digipan, Fldigi, PSK31, WSJT-X.

PSK31 is a highly-efficient data mode that lets you work long distances, even when you can barely hear the signal.

PSK31 stands for **P**hase **S**hift **K**eying 31 baud (or 31 bits per second/bps). Unlike RTTY (radio teletype) the characters are formed by changing the phase of the sound wave, not by using different tones as in RTTY (Radio Teletype)

JT65, JT9, FT8: Weak signal digital communication by amateur radio. To use Digital modes you need a HF radio Sound card interface.

Digital HF RADIO

Connect your computer to your radio using a sound card interface.

Tigertronics Signalink Radio Specific

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West Mountain Radio

- Makes a number of digital mode interface devices.
- Variable prices







