



Can you talk to ALIENS using Direcway?

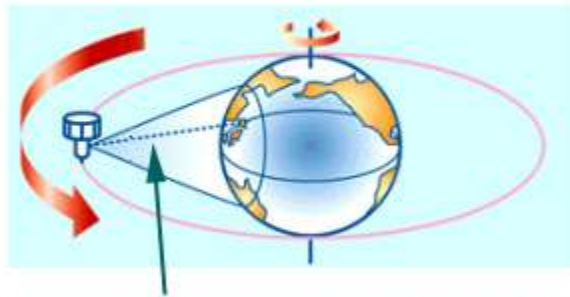


## Satellites:

The use of Satellites in GEOSTATIONARY Orbits continues to expand at a rapid rate, driven by the incessant demand for more communication services.

### Geostationary Satellite

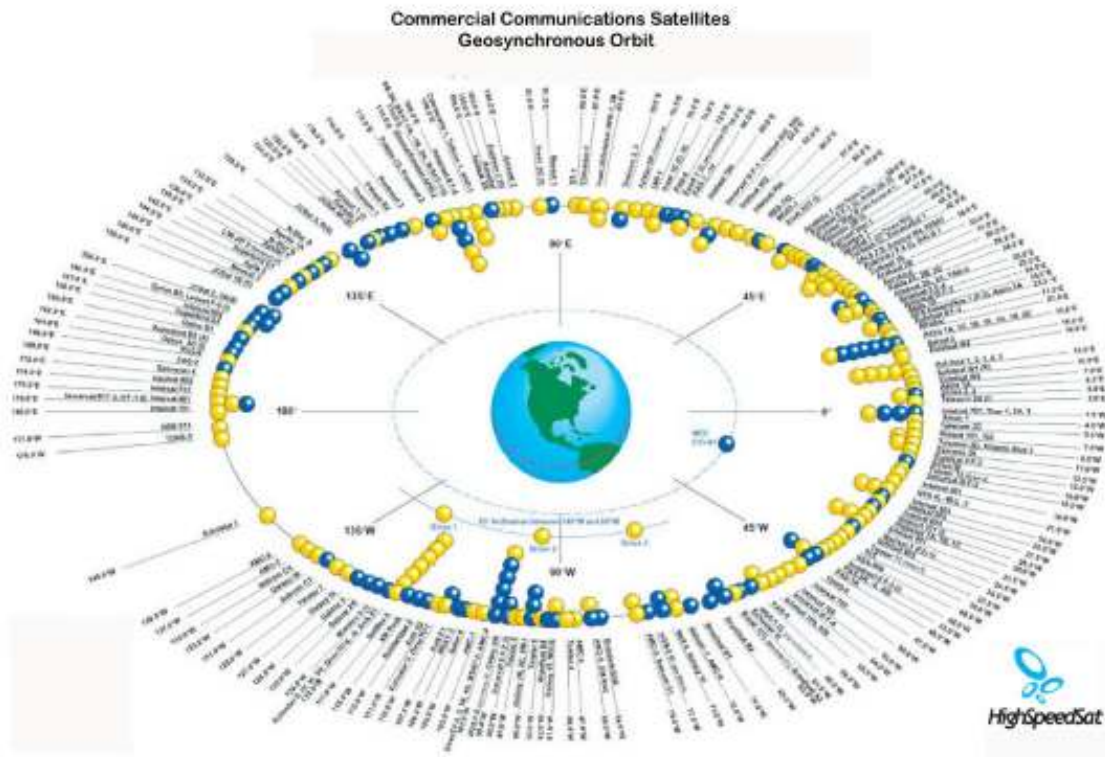
The Earth revolves once in 24 hours, the satellite orbits the Earth once every 24 hours making the satellite appear stationary in space from the ground.



A Geostationary satellite is always 22,300 miles above the Earth's Equator.

The number of Satellites in the Clarke Belt now numbers over 300 active units surrounding the globe, and more are being built to be placed in orbit.





You can see from the illustration that many Satellites are stacked in the same Longitude slot.

Most Birds have an expected life of 15 years when their station keeping fuel is exhausted. Ground Control for the Satellite keeps it in the proper location when affected by Sun and Moon gravity pulls.

Clarke Belt Satellites Orbit 22,300 miles above mean sea level in the direction of the Earth's rotation matching Earth's rotational speed and appear stationary in the sky.

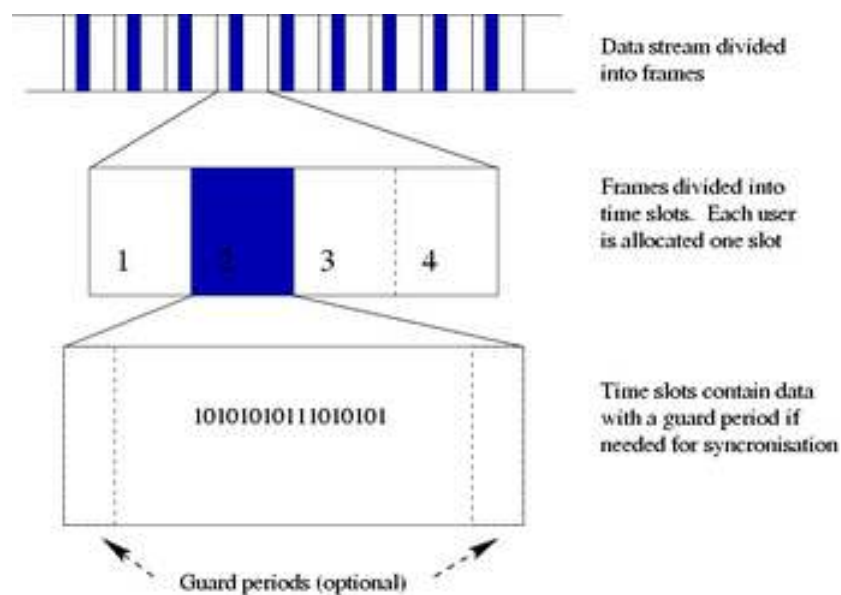
### **The Direcway Technology:**

Over 800,000 terminals have been sold by Hughes in 85 countries thru October 2005. I estimate there is at least 400,000 in the U.S alone.

Direcway uses 40 transponders on 8 satellites to cover the US. That's 10,000 terminals per transponder. User terminals are not always

actively sending and receiving data. Using IpoS (Internet Protocol over Satellite) patented by Hughes, Direcway can dynamically allocate bandwidth to only those terminals that are active.

The NOC equipment recodes Internet data packets into the Digital Video Broadcast-Satellite (DVB-S) MPEG-2 format. TV, Music, Data, and VoIP are all possible under this standard. These data packets are assembled into a data stream using the TDMA standard. (Time Division Multi Access)



Using Quadrature Phase Shift Keying (QPSK) to put the data stream on a carrier, data bits are converted to symbols. IE: 2 bits = 1 symbol. The transmitted symbol rate is 30MSPS and uses all of the transponders 36 Mhz bandwidth. No wasted Dollars here.

The Transmission of Data from the NOC through the satellite to a user terminal is transparent. The Multicast (from one to many) has a footprint that covers the US. The multicast is triple DES encrypted for security and controlled access. You have to pay for it.

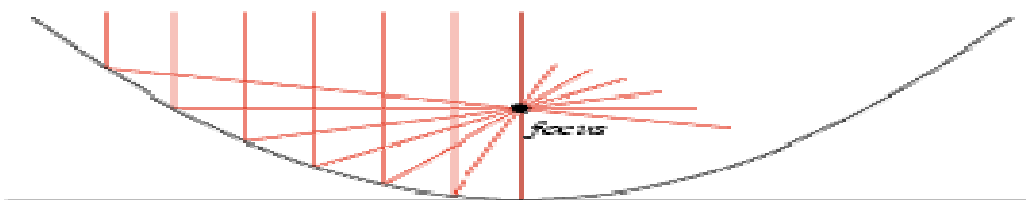
The DW modem, after processing, transfers data to your PC or LAN. Out bound data packets follow the same path back to the NOC except the outbound carrier is modulated using OQPSK (Offset Quadrature

Phase Shift Keying). The Offset Function smoothes out the transmitter power needs so the transmitter cost is lower. The data symbol packets are put into a NOC designated frequency and time slot. This is called MF-TDMA (Multiple frequency-Time Division multiple Access)

The DW6000 typically gets around 128Ksps upload speed (if your lucky), or about 10 channels per Mhz. This allows Approximately 360 frequency slots per transponder that has a 36 Mhz bandwidth. The Data packet to be sent is about 250 bits long. Given a DW7000 specified Transmit rate of 1.6 Mbps, that allows 6,400 time slots. The result of all this manipulation is the potential of 2.3 million packets per second outbound to a single satellite transponder. A system that easily accommodates thousands of user terminals.

The DW7000 is capable of receiving DVB-S2 formatted data packets which uses 8PSK modulation. In this case, 4 bits = 1 symbol. This technique enables the NOC to double the number of terminals on the network. Their uplink seems to be where Direcway has its biggest bottleneck.

### **Our Satellite Antennas:**

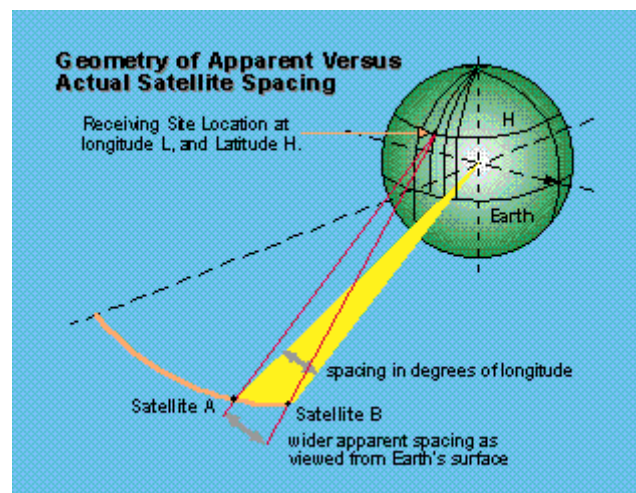


Our Earth bound Antennas use a Parabolic Reflector as a means to concentrate radio waves to or from a desired direction. A radio wave from the Satellite is reflected back to the feedhorn placed at the focus. An outgoing wave from our transmitter follows the same path in the opposite direction. This arrangement gives us a huge gain in directivity. Our antennas need directivity to sort out the desired

satellite from all the others which are spaced  $2\frac{1}{2}$  degrees or less directly across from the equator.

Our antennas operate in the KU band, roughly 10 to 14 Ghz and they Transmit and Receive on the same Assigned Transponder.

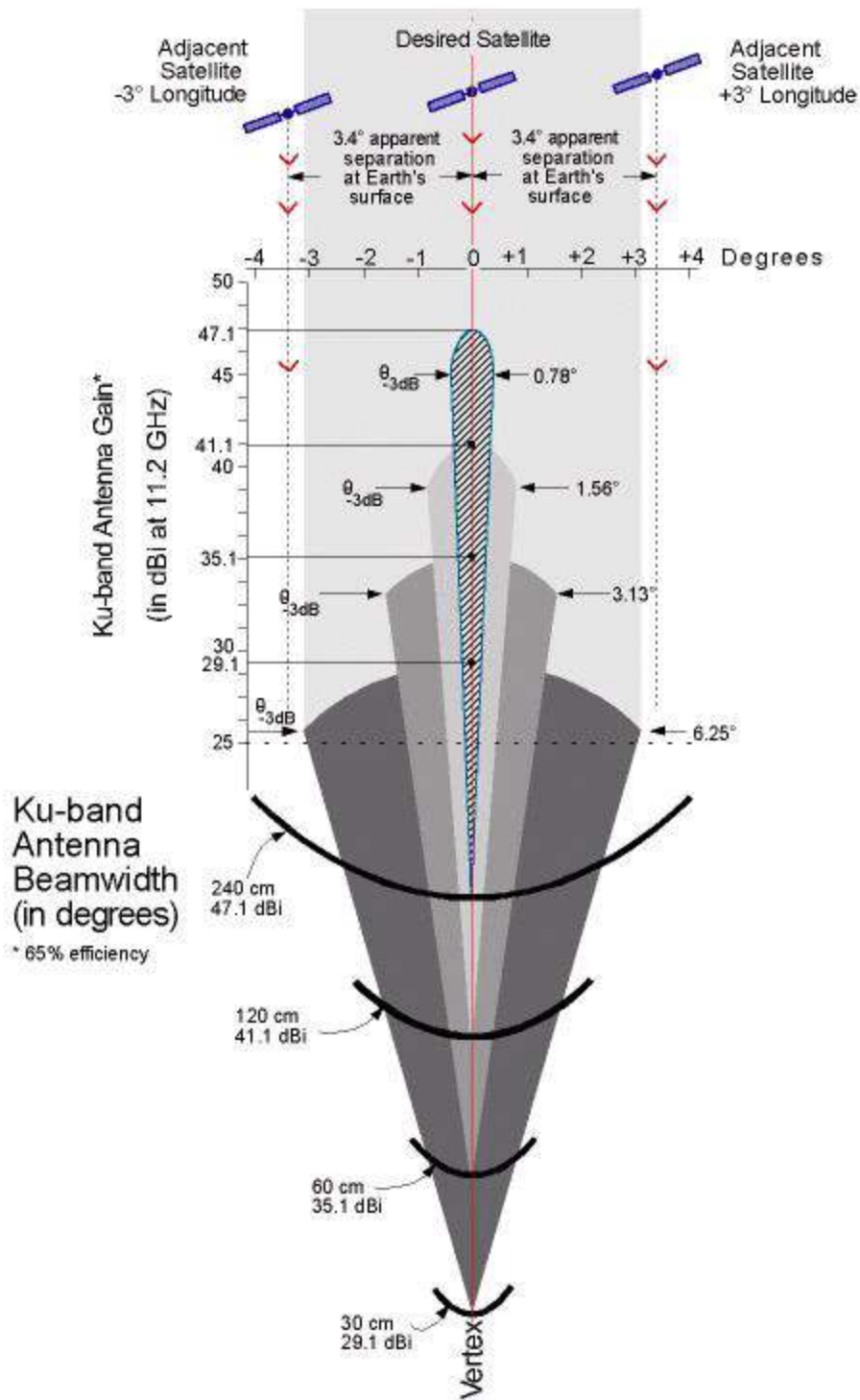
Antennas are said to have gain in Decibels above an Isotropic antenna. (dbi) An Isotropic Antenna Radiates equally in all directions and exists only as a theoretical concept. The gain comes from the redirection and concentration of radio waves into a beam, which can be pointed like a flashlight.



(The Green sphere is what an Isotropic Radiation Pattern looks like)  
The Yellow Beam is the result of using a Parabolic Reflector and the concentration of the energy inside the sphere into a beam.

### **VSAT Antenna Size: VSAT=Very Small Aperture Terminal:**

To get signals off of C Band satellites we needed a 10-foot dish.  
For KU band TV we were able to use an 18-inch dish. This diagram shows what we get with different sized Dish assemblies for KU band Internet. A larger dish = narrower beam and more gain.



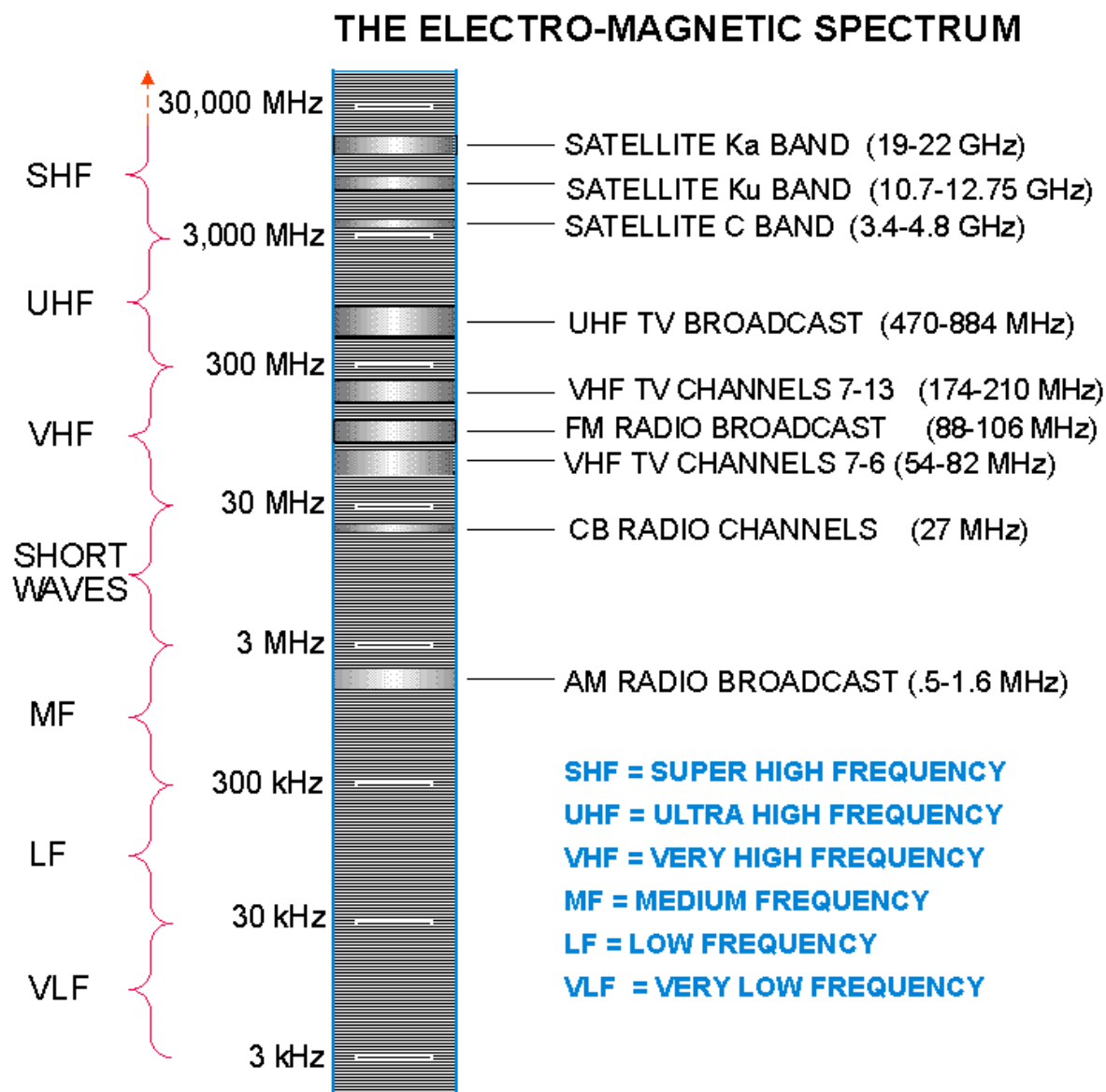
Locations on the edge of the Satellite footprint may need a bigger dish.

### **Bandwidth: How do you explain it?**

For Internet users, more bandwidth means faster downloads and uploads.

Telephone companies see it as a their copper lines Max Symbol Rate capacity. Radio/TV companies see it as a do not exceed or suffer FCC wrath.

Basically it is a piece of the Radio Spectrum in which someone can send and receive a radio signal through.



## **General Stuff**

The higher the frequency, the easier it is to build electronics circuits with wide bandwidth. What's possible at 12 Ghz is impossible at 12 Mhz.

We need a Carrier Wave to truck our digital information back and forth between the Ground and the Satellite. Ku band or about 12 Ghz.

To get our information to somewhere else we must put it on the truck. Its called Modulation. Modulating a Carrier produces sidebands on each side of the carrier. For Example: a 5 Kbps data stream would create a radio signal that is 10 KHz wide at the carrier frequency.

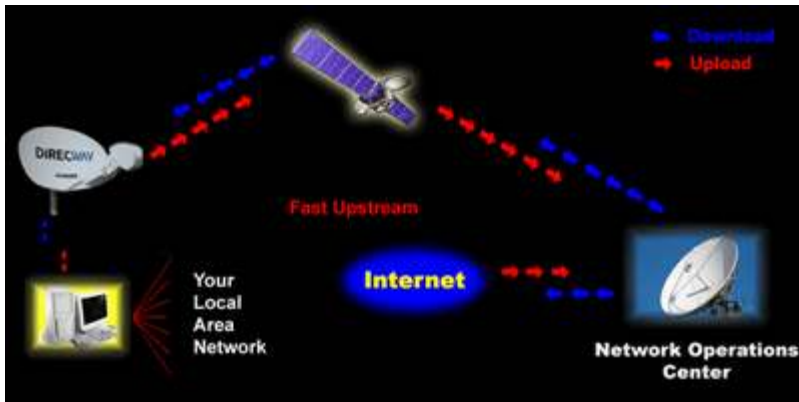
Eliminating one sideband, data compression, different types of modulation techniques, and carrier suppression are used to narrow the bandwidth.

At 12 Ghz, Satellite Transponders are capable of 36 Mhz of usable bandwidth plus a 4 Mhz guard band to suppress cross transponder interference.

So, for a 1 Mbps bandwidth, you could get 36 plus individual Vsat terminals through one Transponder. (Dedicated, hi cost use)

### **Transponders:**

Transponders are just repeaters. A received signal from an operations center is transmitted down to a specific earth surface area called a footprint. A signal from inside the footprint area is re-transmitted to the operations center.



This “Bent Pipe Internet System” is transparent to the user except for the .25sec to .5sec transit time “Latency” delay.

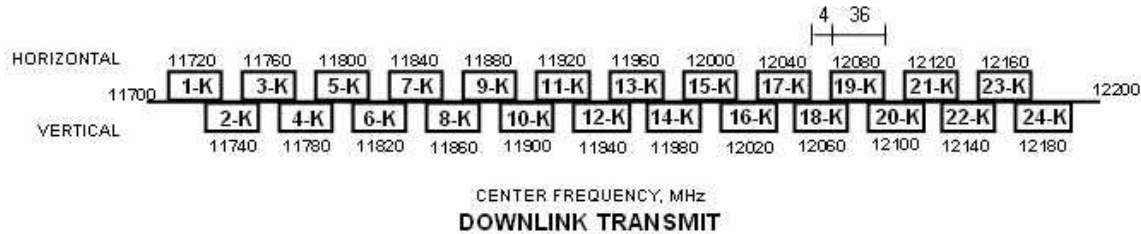
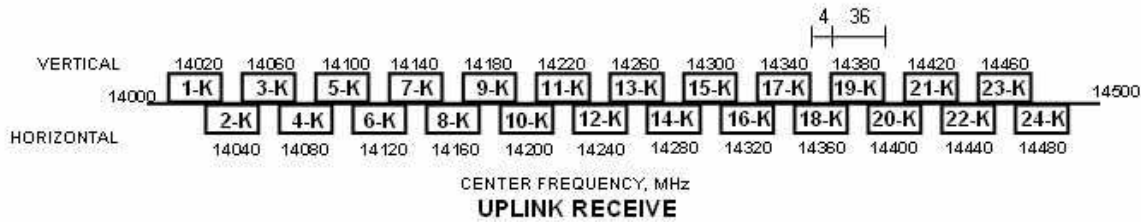
Early Satellite transponders transmitted down to earth at 3.7 to 4.2 Ghz. These “C” band satellites normally carried 24 active transponders that had 30 Mhz bandwidths. Now, the Satellites are usually Dual “C” band and “KU” band birds. “KU” band capacity is usually 12 to 24 transponders operating between 11.7 to 12.2 Ghz with output power levels of 20 to 120 watts. Bandwidth per transponder is 36 Mhz with a 4 Mhz guard band between transponders.

## **Horizons 1**

Horizons 1 at 127 degrees West Longitude has ONE transponder assigned to Direcway, transponder 22 at 12.140 Ghz . This is the Satellite I am registered on. Frequency used for receive between my DW6000 and the Antenna is 1390 Mhz. Receive Polarity is Vertical and Transmit is Horizontal.

# Horizons 1 Ku-BAND FREQUENCY PLAN

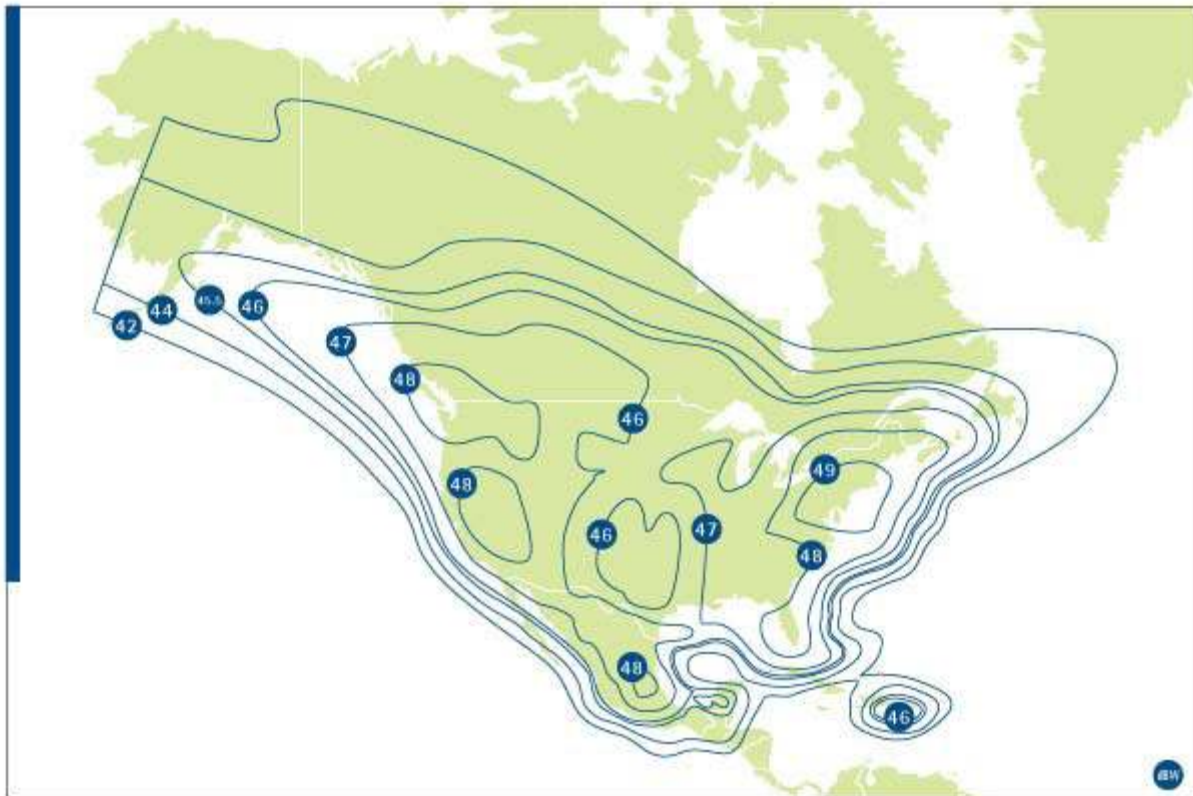
CONUS, Alaska, Hawaii, Puerto Rico and the Virgin Islands



The 1390 Mhz signal from the DW6000 is converted up to 14.440 Ghz when transmitting, and down converted to 1390 Mhz from 12.140 Ghz when receiving. This allows a long run of coax cable from the antenna to the Modem.

## Satellite Footprints:

All Geostationary Satellites send their signals toward the Earth. If a transponder transmits at 100 watts then that power is distributed over the entire footprint area. North America has a land area of 9,365,000 square miles. That's less than .000011 watt per square mile and our antenna is only about 5 square feet in surface area.



VERTICAL BEAM  
North America Ku-Band



This footprint for Horizons 1 looks like a contour map. The numbers are the expected db level you should get referenced to 1 watt or dbw. The expected signal level drops off rapidly along the edges and areas outside the footprint is not specified. Our antennas must provide enough gain to exceed the threshold these numbers suggest.