

# DIRECT BROADCAST SATELLITE TELEVISION (DBS)

IN THE  
UNITED STATES

Presented By

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# Citations

- This presentation is not original research.
- It is based on US patents, public released corporate statements, after market vendor data and standard satellite industry communication designs. It was compiled from material readily available to the public via popular internet search engines.
- Appropriate pages are noted and attributed to their authors in the source material index that can be found at the end of this document.

# Currently the Earth has 341 Satellites Down-linking Television Programing

- The 341 satellites in this category have the following common characteristics:
  - Geostationary
  - Known to broadcast TV signals
  - Currently in service
- The once experimental broadcast TV of the 1930's and growth media of the 1950's is now down-linked into homes from satellites, world wide, 24 hours a day.
- Direct Broadcast Satellites (DBS) are the lowest cost per viewer-program to operate.

# History of DBS

- 1962 – Telstar - TUNDRA satellite sent TV from Europe to the USA
- 1967 – Orbita - MOLNYA satellite TV Station network in the USSR
- 1972 - Anik 1 - GEO satellite TV Station network in Canada
- 1974 - ATS 6 - GEO satellite experimented with DBS by NASA (1 of 23 payloads)
- 1976 – Ekran - GEO satellite DBS network in the USSR
- 1989 - Astra 1A - GEO satellite DBS network in the UK, 4 Commercial TV Chan.
- 1991 - PrimeStar began analog TV DBS to USA
- 1994 - PrimeStar transitioned to all digital DBS
- 1994 - DirecTV, Dish, Astro, AlphaStar, & Sky Angel all began digital DBS to USA
- 1996 - DirecTV & Dish/EchoStar are all digital DBS to USA
- 1998 – Dish/EchoStar buys the DBS of News Corp ASkyB and MCI Worldcom.
- 1999 - DirecTV buys PrimeStar
- 2008 - Dish/EchoStar separate DBS = Dish Network & EchoStar = Satellites
- 2010 - DirecTV has 19 Million & Dish Network has 14 Million Customers

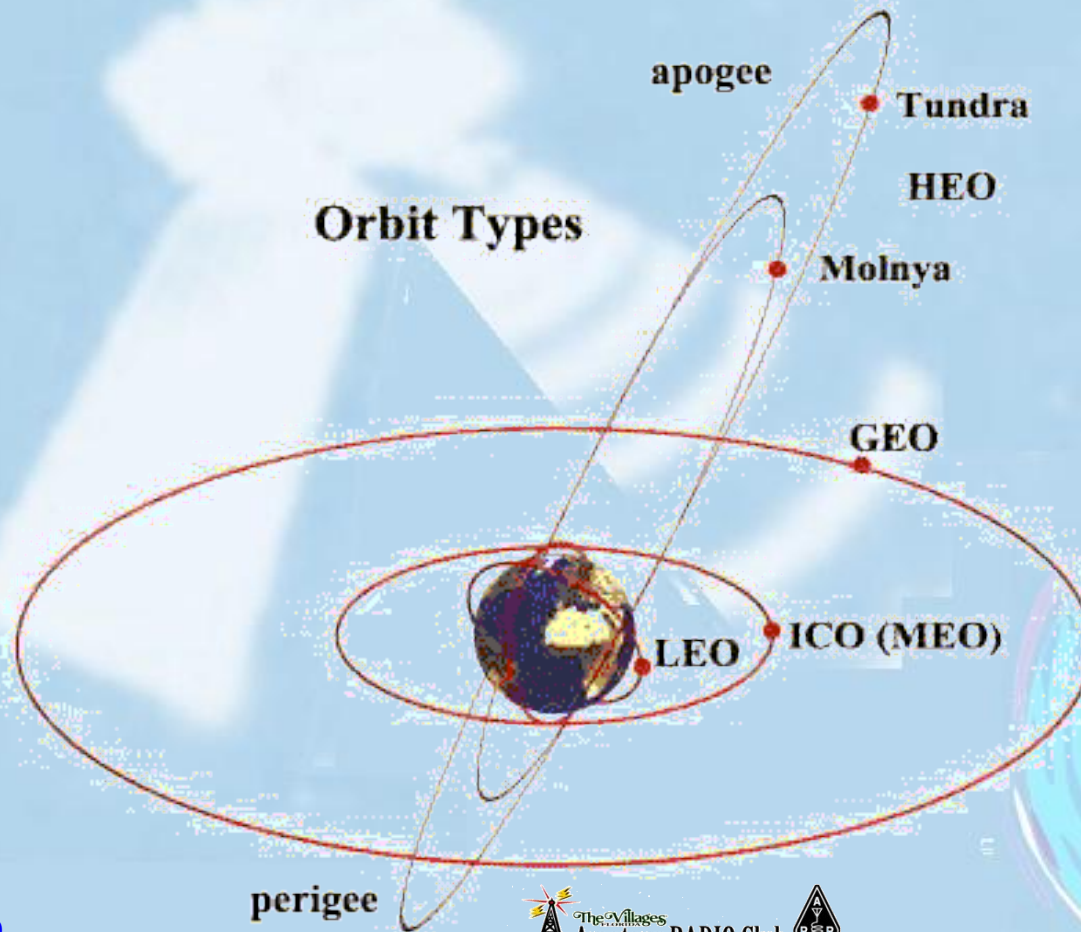
The other DBS operators are gone except Sky Angel as the sole surviving DBS pioneer from 1981 first round of FCC applicants. The independent Sky Angel has subscriber channels on the same satellites, transmission facilities, & receiving equipment used for Dish Network.

# Geosynchronous Satellite Orbits

A GEO orbit is an orbit around the earth with a period that matches rotation of the earth.

This means that for an observer on earth, a [GEO satellite stays in the same place](#).

An elliptic orbit or polar orbit is an orbit in which a satellite passes above or nearly above both poles of the earth on each revolution. Most have an inclination close to 90 degrees to the equator to improve ground coverage.



The TUNDRA and MOLNYA are highly elliptical orbits (HEO) with an apogee above a desired earth site provide more in-view time per orbit. LEO, MEO and GEO are normally at a constant radius from earth.

# Standard Satellite Links

- Uplinks
  - S = 2.1 GHz
  - C = 5.8–6.4
  - Ku = 14.0-14.5 GHz
  - Ka = 27-30 GHz
- Downlinks
  - S = 2.2-2.3 GHz
  - C = 3.6–4.2 GHz
  - Ku = 10.7-12.7 GHz
  - Ka = 18-20 GHz
- S Band - used for secondary satellite control & status
- C Band - normally a Transponder "Bent Pipe"
- Ku Band - normally a Transponder "Bent Pipe" with a 500 MHz Bandwidth Down-Link
  - 12.2-12.7 GHz ITU Region 2 for DBS
- Ka Band - normally a Transponder "Bent Pipe" with two 500 MHz Bandwidth DBS Down-Links
  - 18.3-18.8 & 19.7-20.2 GHz for DBS

# Generic DBS Receiver System



- Multiple QPSK Downlinks
- 30 dB Gain Parabolic Dish
- Low Noise Block Converter (LNB)
  - Input RF Carriers 12 GHz
  - Receivers RHCP or LHCP
  - Output IF 950 – 1450 MHz
- Home Receiver
  - IF Input
  - Superheterodyne Tuner
  - Proprietary Demodulator IC
  - Proprietary Crypto
  - MPEG Decoder
  - Output NTSC or HDMI
- Television Set

# USA DBS in 2010

- Free To Air
- DirecTv
- Dish Network

**dish NETWORK**

THE BEST  
**Packages as low as \$19.99/mo.**  
Restrictions Apply. See Website for Details.

**ORDER NOW!**

**Make the FREE and EASY Switch to DIRECTV**  
FREE Movies, FREE HD DVR Receiver, Save up to \$580!

**FREE** For 3 Months **starz** **SHOWTIME**  
With CHOICE EXTRA™ and above.\*

**FREE HD DVR Receiver Upgrade**  
Requires activation of CHOICE EXTRA™ Package or above. DVB Service and HD Access fee required.\*\*

Standard Professional Installation

**DIRECTV HD** **The MOST National HD Channels**

Higher customer satisfaction ratings than cable 9 years Running!  
2009 Customer Satisfaction Index, University of Michigan Business School Among the largest U.S. cable & satellite TV providers.

Other Packages Start at **\$299** / month      Save up to **\$580!**      **See MORE Deals!**

**TELE satellite**  
GLOBAL DIGITAL TV MAGAZINE 06-07-2010

Company Report **Mass Production at YINHE in China**  
An Amazing 4 Million Receivers Produced Annually

Company Report **SPAUN in Dubai**  
Big Business Growth With the Right Partner

Test Report **SATCATCHER and HORIZON**  
"Everywhere" Meters for DVB-T and DVB-C

Test Report **INFORM Color Mesh**  
The PINK Dish the Ladies Can't Resist

**TELE satellite** Test Report **Jiuzhou DTT6720**  
Outstanding Picture Quality Loaded with Features





## Free To Air (FTA)

➤ AMC 1	2 channels
➤ AMC 3	5 channels
➤ AMC 4	16 channels
➤ AMC 5	3 channels
➤ AMC 6	2 channels
➤ AMC 9	2 channels
➤ AMC 21	9 channels
➤ EchoStar 7	3 channels
➤ Galaxy 18	7 channels
➤ Galaxy 19	140 channels
➤ Galaxy 25	3 channels
➤ Galaxy 28	2 channels
➤ Galaxy 3C	6 channels
➤ SatMex 5	4 channels
➤ SatMex 6	5 channels
➤ SBS 6	1 channels

- 1980's 3 Meter satellite dishes
  - C-band 3.9 - 4.2 GHz
- 2000's ½ to 1 Meter satellite dishes
  - 11.7 - 12.2 GHz Ku band
- Most use DVB-S standard
  - BPSK, MPEG & Framing Standards
- Most content is ethnic or religious

# DirecTv



- 19 Million Customers
- 3407 programs (USA)
- Operating 12 Satellites
  - Ku @ 72 W Lon
  - Ka (2 Satellites) @ 99 W Lon
  - Ku (3 Satellites) @ 101 W Lon
  - Ka (3 Satellites) @ 103 W Lon
  - Ku @ 110 W Lon
  - Ku @ 119 W Lon
  - Spare (DBS 1)
- Packages with 285 Programs
  - Ku - QPSK + DVB
    - MPEG-2 & Framing Standards
  - Ka – 8PSK + DVB-S2 (HD)
    - MPEG-4 AVC

**Local Channels<sup>1</sup>**

abc CBS FOX NBC PBS CW myTV  
Available in select markets

**Premium Packages included:**

HBO 7 channels starz 12 channels SHOWTIME 9 channels cineMAX 3 channels SPORTS PACK Over 35 Channels

**Add HD ACCESS for just \$10.00/mo. and get over 80 HD channels.™**

# DirecTv Satellites

Posit	Satellite Name	Transponders	Comments	Vendor	Model	Launched	Vehicle	Launch site
72.5 W	DirecTv 1R	16 Ku-band	11 Transponders Active, 186 Channels, June 18, 2010	Hughes Electronics	HS-601HP	10-Oct-99	Zenit-3SL	Sea Launch (Odyssey)
99.2 W	Spaceway 2 (Spaceway F2)	72 Ka-band North America and Hawaii	Parked with DirecTv 1 & 11..... June 18, 2010 Full North America Coverage Ka-Band Alaska & Hawaii 3 Spot Beams to South America	Boeing Space Systems	BSS-702	16-Nov-05	Ariane 5 ECA	Guiana Space Center
99.2 W	DirecTv 11	32 (+12) Ka-band 55 (+15) Ka-band Spot-Beam	Parked with Spaceway 2..... June 18, 2010 Ka-band CONUS Beam (active) Ka-band Spot 1 Beam (New York) (active) Ka-band Spot 2 Beam (Santa Fe) (active) Ka-band Spot 3 Beam (Los-Angeles) (active)	Boeing Space Systems	BSS-702	19-Mar-08	Zenit-3SL	Sea Launch (Odyssey)
101.0 W	DirecTv 4S	48 Ku-band	Parked with DirecTv 8 & 9..... June 18, 2010 Full North America Coverage (tbd split 4/8) 32 Transponders Active, 918 Channels, June 18, 2010	Hughes Electronics	BSS-601HP	27-Nov-01	Ariane 4	Guiana Space Center
101.0 W	DirecTv 8	36 Ku-band	Parked with DirecTv 4 & 9..... June 18, 2010 Full North America Coverage (tbd split 4/8) 32 Transponders Active, 918 Channels, June 18, 2010	Loral Space Systems	LS-1300	22-May-05	Proton M	Baikonur Cosmodrome
101.1 W	DirecTv 9S	52 Ku-band + 2 Ka-band	Parked with DirecTv 4 & 8..... June 18, 2010 27 Active Ku-band Spot Beams	Loral Space Systems	LS-1300	13-Oct-06	Ariane 5 ECA	Guiana Space Center
102.8 W	Spaceway 1 (Spaceway F1)	72 Ka-band	24 Transponders Active, 238 Channels, June 18, 2010	Boeing Space Systems	BSS-702	26-Apr-05	Zenit-3SL	Sea Launch (Odyssey)
102.8 W	DirecTv 10	32 (+12) Ka-band 55 (+15) Ka-band Spot-Beam	Parked with Spaceway 1..... June 18, 2010 Ka-band CONUS Beam (active) Ka-band Spot 1 Beam (Tampa) (active) Ka-band Spot 2 Beam (Atlanta) (active) Ka-band Spot 3 Beam (Los-Angeles) (active)	Boeing Space Systems	BSS-702	7-Jul-07	Proton M	Baikonur Cosmodrome
102.8 W	DirecTv 12	32 (+12) Ka-band 55 (+15) Ka-band Spot-Beam	Parked with Spaceway 1..... June 18, 2010 Ka-band CONUS Beam (active) 50 Active Ka-band Spot Beams	Boeing Space Systems	BSS-702	29-Dec-09	Proton M	Baikonur Cosmodrome
109.8 W	DirecTv 5 (TEMPO 1)	32 Ku-band	3 Transponders Active, 2 Channels, June 18, 2010	Loral Space Systems	LS-1300	7-May-02	Proton	Baikonur Cosmodrome
119.0 W	DirecTv 7S (DTV 7S, DBS 7S)	54 Ku-band + 27 Ka-band spot beams	11 Transponders Active, 524 Channels, June 18, 2010	Loral Space Systems	LS-1300S	4-May-04	Zenit-3SL	Sea Launch (Odyssey)
NA	DirecTv 1 (DBS 1)	In-orbit backup	In-orbit backup June 18, 2010	Hughes Electronics	HS-601	18-Dec-93	Ariane 4	Guiana Space Center

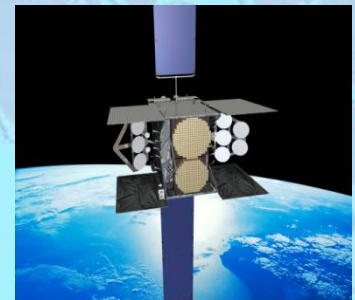
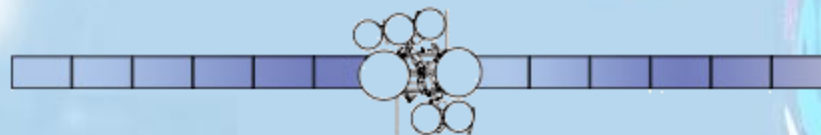
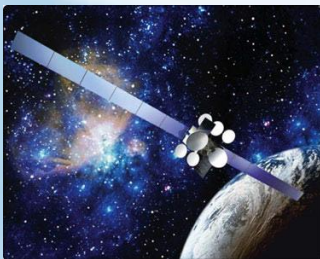
# Co-location of Satellites

PRIMARY USAGE	DIRECTV SATELLITE	RECEIVER DISPLAY	RECEIVER TRANSPONDER DISPLAY									
			1	2	3	4	5	6	7	8		
MPEG2: SD CONUS	D1R	72.5° conusbeams	1-8	na	na	na	na	na		na	na	
			9-16	na	na	na	na	na	na	na	na	
			17-24	na	na	na	na	na	na	na	na	
			25-32	na	na	na	na	na	na	na	na	
MPEG2: SD CONUS	G3C	95° conusbeams	1-8		na	na	na	na			na	
			9-16	na		na			na		na	
			17-24	na	na	na	na	na			na	
			25-32	na	na	na	na	na	na	na	na	
MPEG4: HD LIL	SW2 and D11	99° spotbeams	1-8							na	na	
			9-16	na	na	na	na	na	na			
		99S or 99B	17-24									
			25-32	na	na	na	na	na	na	na	na	na
MPEG4: HD CONUS	D11 conusbeams	99° conusbeams	1-8									
			9-16							na	na	
		99C or 99A	17-24	na	na	na	na	na	na	na	na	na
			25-32	na	na	na	na	na	na	na	na	na
MPEG2: SD CONUS SD LIL	D4S D8 D9S	101° D4S or D9S spotbeams	1-8									
			9-16									
			17-24									
			25-32									
MPEG4: HD LIL	SW1 and D10	103° spotbeams	1-8							na	na	
			9-16	na	na	na	na	na	na			
		103S or 103A	17-24									
			25-32	na	na	na	na	na	na	na	na	
MPEG4: HD CONUS	D10	103° conusbeams	1-8									
			9-16							na	na	
		103C or 103B	17-24	na	na	na	na	na	na	na	na	
			25-32	na	na	na	na	na	na	na	na	
MPEG2: HD CONUS	D5	110° conusbeams	1-8	na	na	na	na	na	na	na		
			9-16	na		na		na	na	na	na	
			17-24	na	na	na	na	na	na	na	na	
			25-32	na	na	na	na	na	na	na	na	
MPEG2: HD CONUS SD LIL	D7S	119° conusbeams spotbeams	1-8	na	na	na	na	na	na	na	na	
			9-16	na	na	na	na	na	na	na	na	
			17-24	na	na	na	na	na	na	na	na	
			25-32									

- 12 Physical Satellites + Spare
- 7 Virtual Satellites
- Mapping Virtual Transponders
- 72 W
  - Latin America + Spot Beams to North East USA for Local Stations = 186 Channels
- 99 W
  - USA HD = Est 300 Channels + 7 Spots Beams to North & South America
- 101 W
  - USA - 918 Channels Plus 24 Spots Beams to East & Midwest for Local Stations
- 103 W
  - USA HD = Est 320 Channels + 54 Spots Beams to North America
- 110 W
  - 3 Transponders Active, 2 Channels active on June 18, 2010 ??????
- 119 W
  - USA - 524 Channels Plus 27 Spots Beams to West & Southwest for Local Stations

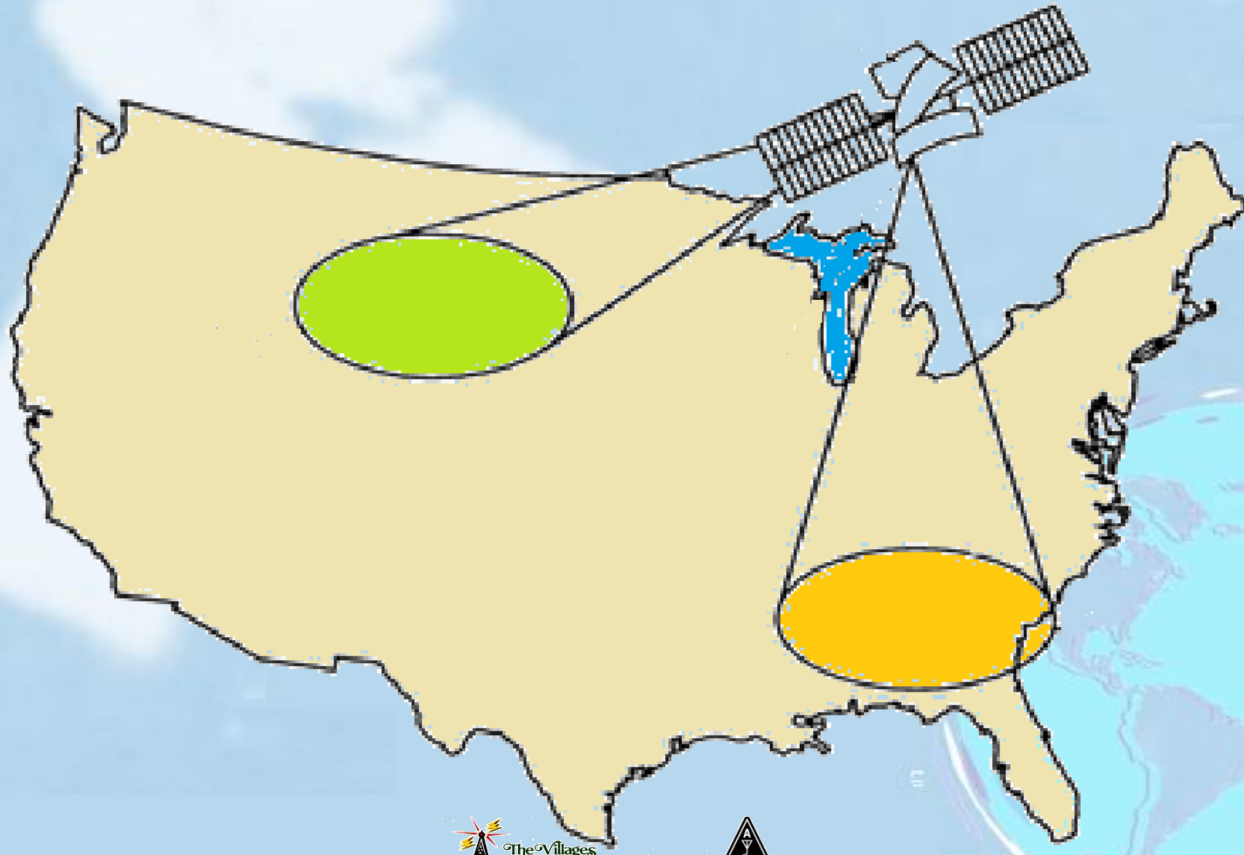
# Ka-band Boeing 702 satellites DIRECTV 10, 11 & 12

- 200 US HD channels from Two 3 Meter Transmit Antenna Phased Arrays
  - 36 active and 8 spare 492 MHz BW High Power Amplifiers (Traveling Wave Tube Amplifiers - TWTA)
- 1,500 spot beam HD channels from Four 2 Meter Transmit Antenna Phased Arrays
  - 54 active and 16 spare 80 MHz BW TWTAs
- One 2 Meter and Two 50 cm Receive Antennas
- 18,000 Watt Solar Array 158 X 8 Feet
- Batteries are 59 NiH cells with 328 Amp-Hours
- 8,157 LBS On-Orbit Weight



## Coverage on the Ground

- A simple parabolic antenna will form a round power density pattern (footprint) directly below the satellite
- Indirect angles form an elliptical footprint

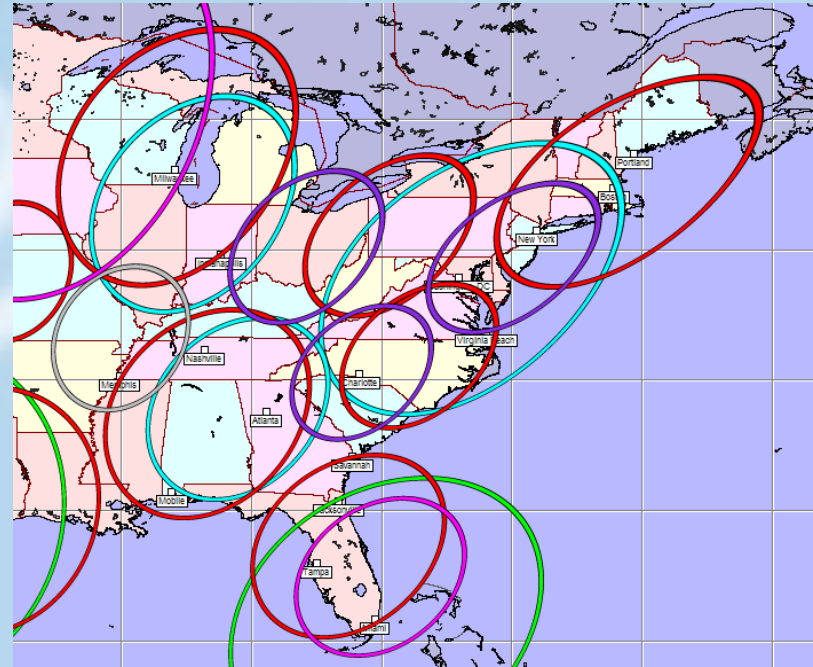


# Coverage on the Ground

- Combining of antennas plus control of amplitude and phase provides complex footprints
- Marketing requires tailored coverage
- Satellite Power Management requires tailored coverage



**Latin America Satellite Coverage: DIRECTV**

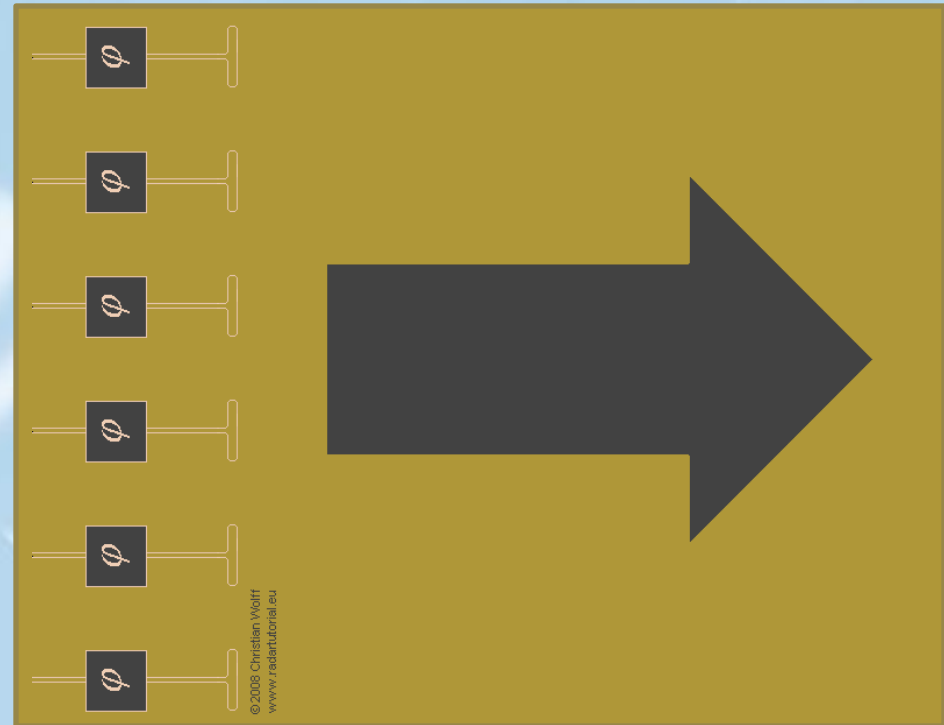


**East & Midwest US Spot Beam by Market: DIRECTV**

# Antenna Phased Arrays

- A phased array antenna is multiple elements combined in phase to form a direction high gain antenna
- Shifting the phase steers the beam in the desired direction.

2 M QUAD  
by W2RTV & KC2QEA



Generic Shifted Six Element Array



# Phased Arrays

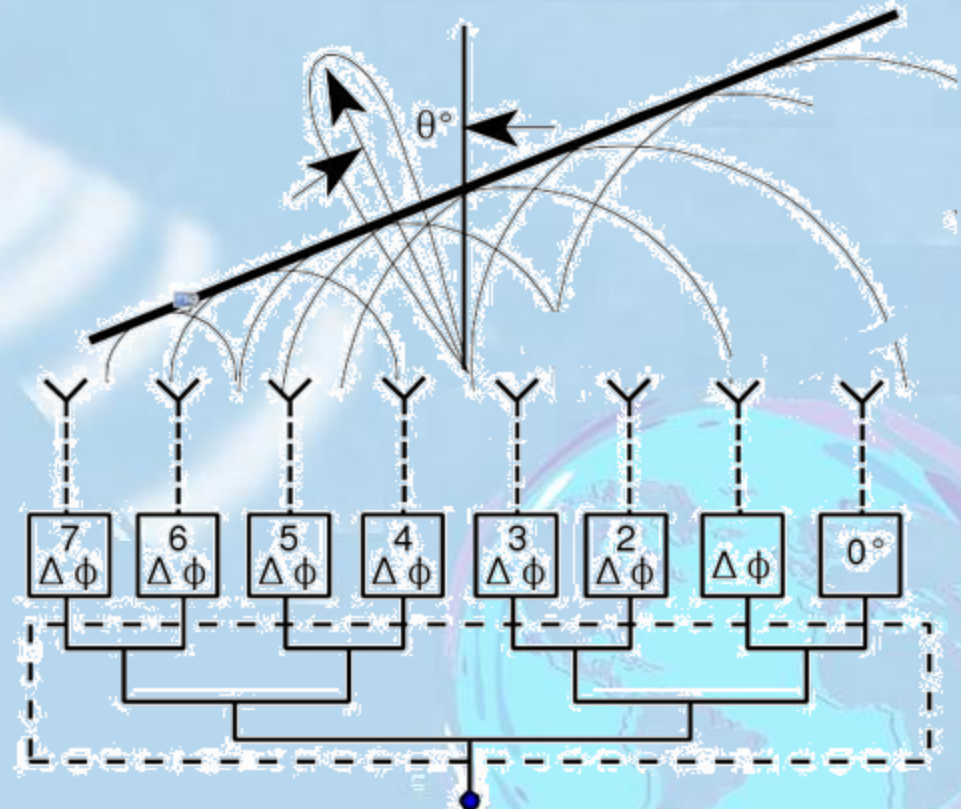
- A phased array antenna is composed of radiating elements each with a phase shifter. Beams are formed by shifting the phase of the signal emitted from each radiating element, to provide constructive/destructive interference to steer the beams in the desired direction.

## Advantages

- Multifunction operation by emitting several beams simultaneously
- Ability to permit the beam to jump from one target to the next in a few microseconds under computer control
- Fault of single components reduces the beam sharpness, but the system remains operational

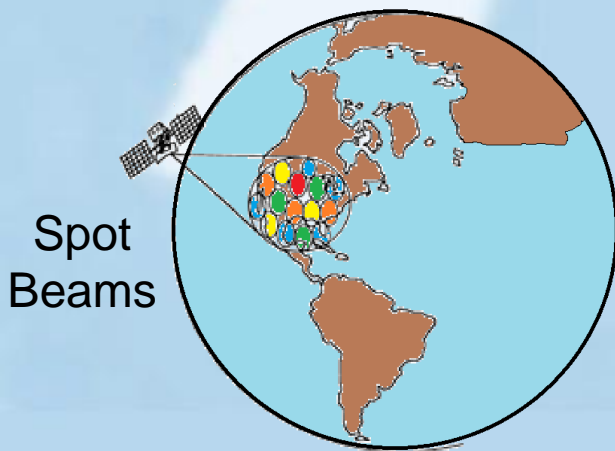
## Disadvantages

- Limited to a 120 degree in AZ & EL
- Gain deteriorates with increased angle
- Limited BW (~5 to 10%)
- Very complex - processor, phase shifters
- High costs



## 2000 Channels on One Satellite!

- 18.6-18.8 GHz & 19.7-20.2 GHz Downlinks
- Left & Right Circular polarization
- Steering antennas provides increased frequency reuse = Channels x Spot Beams
- This results in more bandwidth per satellite
  - National footprint 2000 MHz of bandwidth/satellite
  - Virtual 6000 MHz of bandwidth/satellite via Spot Beams



# Optimizing Satellite Downlinks

- Satellite Power Management and Marketing dictate downlink allocation
  - The national footprint and spot beams are monitored on the ground
  - A closed loop feedback is developed from nationwide monitoring stations
- Programming channels can be arranged by frequency, polarization, spot beam or satellite
- Current look up tables of program channels are sent to home receivers similar to network servers and Ethernet routers

# Receiving DirecTv DBS

- Receiving 7 Virtual Satellites
  - DIRECTV markets based on a small 18 Inch dish. Starting with one LNB in 1996 to today with 5 LNB to receive 99°, 101°, 103°, 110°, 119° degree satellites
  - 5 Ku
    - LHCP with 500 MHz BW
    - LHCP with 500 MHz BW
  - 2 Ka
    - LHCP with 1000 MHz BW
    - LHCP with 1000 MHz BW
- Demod IC
  - BCM4500 contains dual 7-bit A/D converters, an all-digital variable rate BPSK / QPSK / 8PSK / 16QAM receiver, an advanced modulation turbo FEC decoder, and a DVB / DIRECTV / DCII compliant FEC decoder. Output is delivered in MPEG-2 or MPEG-4. plus a DiSEqCTM controller for two way communication with LNB.



## DirecTv DBS Downlink Evolution

- DirecTv LNB, Dish & Receivers have morphed over the past 15 Years into five backwards compatible designs



# Receiving DirecTv Phase 1



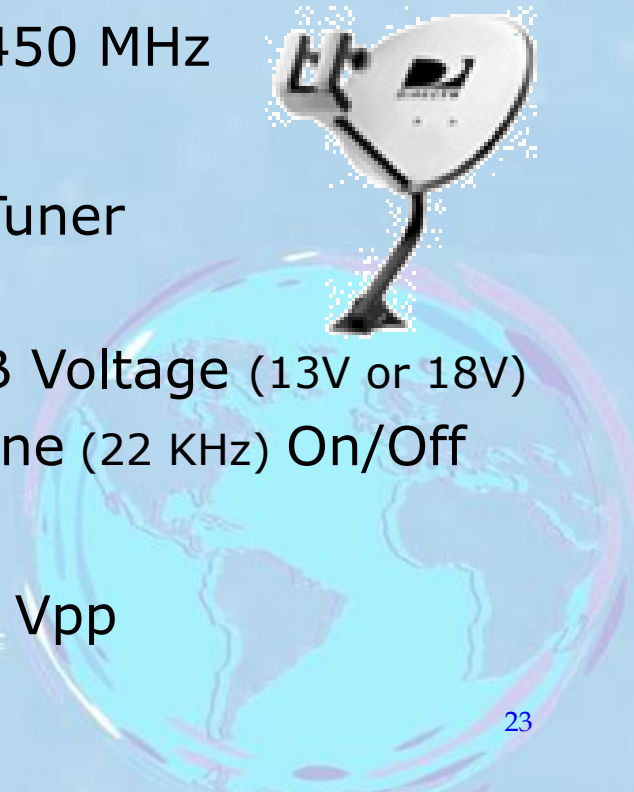
- Round Parabolic Dish
  - One Satellite (101)
- Low Noise Block Converter (LNB)
  - Input RF Carriers 12.2-12.7 GHz
  - Selects RHCP or LHCP (13V or 18V)
  - Output IF 950 – 1450 MHz
- Home Receiver
  - Superheterodyne Tuner
  - Power for LNB
  - Polarization by LNB Voltage (13V or 18V)
- Television Set
  - RF Ch 3 or NTSC 1 Vpp



# Receiving DirecTv Phase 2



- **Elliptical Parabolic Dish**
  - Two Satellites (101, 119)
- **Low Noise Block Converter (LNB)**
  - RF Carriers 12.2-12.7 GHz (22 KHz)
  - Selects RHCP or LHCP (13V or 18V)
  - Output IF 950 – 1450 MHz
- **Home Receiver**
  - Superheterodyne Tuner
  - Power for LNB
  - Polarization by LNB Voltage (13V or 18V)
  - Satellite by LNB Tone (22 KHz) On/Off
- **Television Set**
  - RF Ch 3 or NTSC 1 Vpp

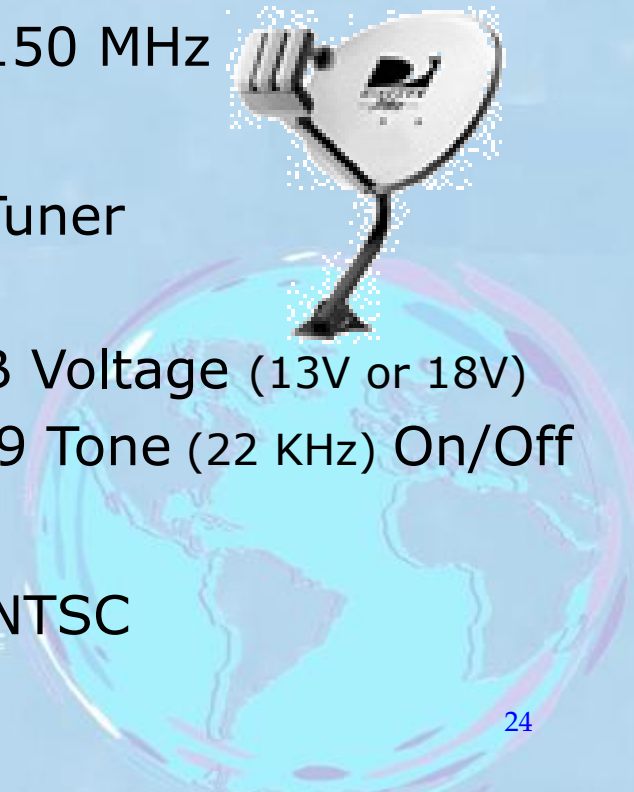


# Receiving DirecTv Phase 3



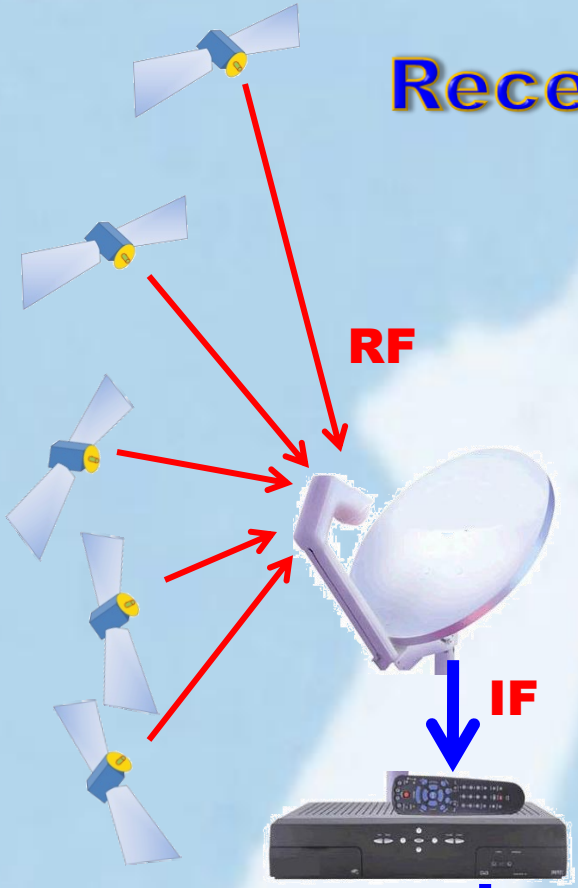
Phase III Dish			
(4) Outputs			
•	•	•	•
Each Output Carries			
A	A	A	A
C	C	C	C
B	B	B	B
Each Output Carries			
101	101	101	101
110	110	110	110
119	119	119	119

- Elliptical Parabolic Dish
  - Three Satellites (101, 110, 119)
- Low Noise Block Converter (LNB)
  - RF Carriers 12.2-12.7 GHz (22 KHz)
  - Selects RHCP or LHCP (13V or 18V)
  - Output IF 950 – 2150 MHz
- Home Receiver
  - Superheterodyne Tuner
  - Power for LNB
  - Polarization by LNB Voltage (13V or 18V)
  - Satellite 110 or 119 Tone (22 KHz) On/Off
- Television Set
  - HDMI, RF Ch 3 or NTSC





# Receiving DirecTv Phase 4



- Elliptical Parabolic Dish
  - Five Satellites (99, 101, 103, 110, 119)
- Low Noise Block Converter (LNB)
  - RF Carriers 12.2-12.7 & 18.3-18.8 & 19.7-20.2 GHz (22 KHz)
  - Selects RHCP or LHCP (13V or 18V)
  - Output IF 250 – 2150 MHz
    - Lo Ka = 250-750 IF and Hi Ka = 1650-2150 IF

- Home Receiver
  - Superheterodyne Tuner
  - Power for LNB
  - Polarization & Satellite Selection
    - 13V = Ka 99/101 RHCP
    - 18V = Ka 99/101 LHCP
    - 13V + 22 KHz Tone = 103/110/119 RHCP
    - 18V + 22 KHz Tone = 103/110/119 LHCP

MPEG4 Ku/Ka Dish			
Original AU9-S			
(4) Outputs			
●	●	●	●
Each Output Carries			
99	99	99	99
101	101	101	101
103	103	103	103
110	110	110	110
119	119	119	119



- Television Set
  - HDMI, RF Ch 3 or NTSC

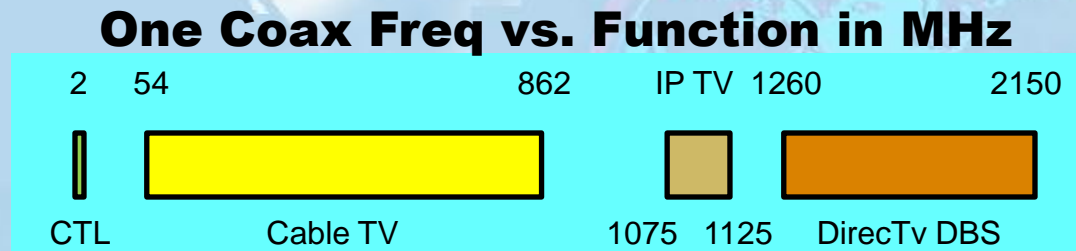


# Receiving DirecTv SWM (Phase 5)

- Single-Wire Multi-switch (SWM) is in the LNB
  - Looks the same as the Phase 4 LNB, has 1 wire instead of 4 Coaxial Cables
  - LNB/Switch are NOT Backwards Compatible
  - Receivers work with Phase 1-5
- Receiver commands LNB to select:
  - Satellite, Polarization and IF center frequency
  - Design by Entropic uses 2.3 MHz Control Carrier
  - Permits DBS & Off the Air / Cable in One Coaxial Cable



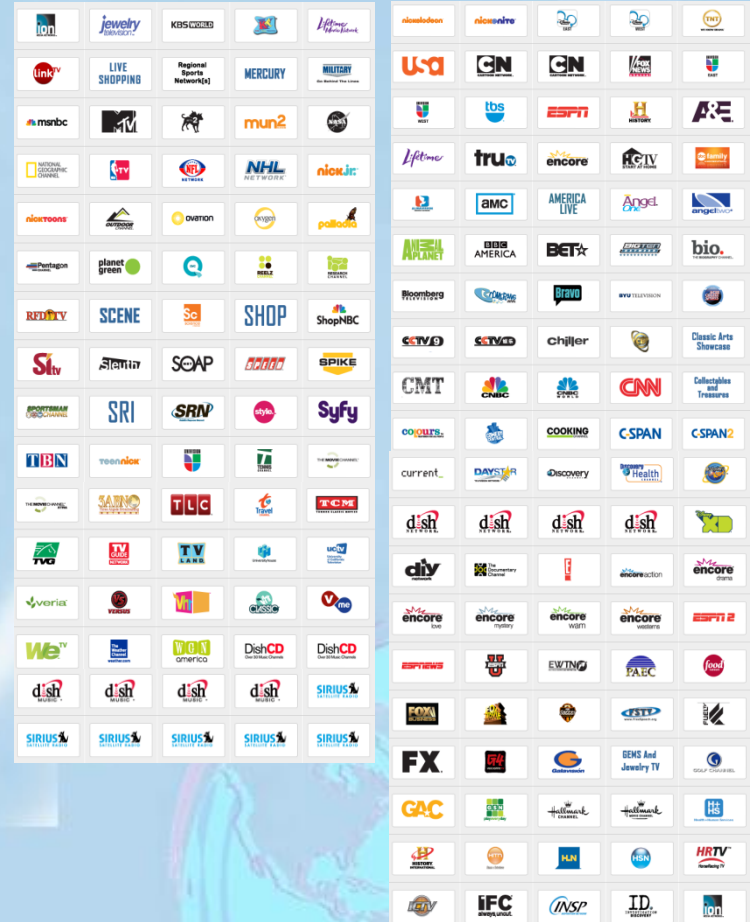
DBS IF Freq	}	1	974
		2	1076
		3	1178
		4	1280
		5	1382
		6	1484
		7	1586
		8	1688
		9	1790
		10	1892
		11	1994
		12	2096



# Dish Network



- 14 Million Customers
- 4435 programs (USA)
- Operating 9 Satellites
  - Ku/Ka (3 Satellites) @ 61 W Lon
  - Ku/Ka @ 72 W Lon
  - Ku (2 Satellites) @ 110 W Lon
  - Ku (2 Satellites) @ 119 W Lon
  - Ku/Ka @ 129 W Lon
  - Spare None (all above leased)
- Packages with 295 Programs
  - Ku - QPSK + DVB
    - MPEG-2 & Framing Standards
  - Ka – 8PSK + DVB-S2 (HD)
    - MPEG-4 AVC



# Dish Network Satellites

Lon	Status	Satellite Name	Comments	Satellite Model	Launch	Launch site
61 W	active	Echostar 3	Primary HD Service East. Provides national HD programming and HD spotbeam locals. 32 Ku-band transponders to cover Central/Mountain region to Eastern U.S.	A2100AX	5-Oct-97	Cape Canaveral
61 W	active	Echostar 12 (Rainbow 1, Cablevision 1)	36 Ku-band transponders to provide DTH telecommunications to CONUS	A2100AXS	17-Jul-03	Cape Canaveral
61 W	active	Echostar 15	32 Ku-band transponders to provide BSS services to CONUS and Puerto Rico	LS-1300	10-Jul-10	Baikonur Cosmodrome
73 W	active	Nimiq 5	A Canadian satellite operated by Telesat Canada. Echostar leases the satellite's capacity.	LS-1300	17-Sep-09	
110 W	active	Echostar 10 (Echostar X)	Direct-to-home transmission of voice, video and internet.	A2100AXS	15-Feb-06	Sea Launch (Odyssey)
110 W	active	Echostar 11 (Echostar XI)	29 Ku-band transponders to provide direct-to-home services to CONUS	LS-1300	16-Jul-08	Sea Launch (Odyssey)
119 W	active	Echostar 7	32 Ku-band transponders covering CONUS, Hawaii, Alaska and Puerto Rico.	A2100AX	21-Feb-02	Cape Canaveral
119 W	active	Echostar 14 (Echostar XIV)	103 Ku-band transponders to provide expanded DTH services for DISH Network's subscribers	LS-1300	21-Mar-10	Baikonur Cosmodrome
129 W	active	Ciel-2	Primary HD Service West. Provides national HD programming and HD spotbeam locals.	Spacebus-4000C4	10-Dec-08	

# Receiving Dish Network DBS

- Receiving 5 Virtual Satellites\*
  - Dish markets based on a small ½ M dish. Starting with one LNB in 1996
  - Today with 3 LNB to receive;
    - 61°, 72°, 77° degree satellites (East Coast)
    - 110°, 119°, 129° degree satellites (West Coast)
  - 3 Ku
    - LHCP with 500 MHz BW
    - LHCP with 500 MHz BW
  - 2 Ka
    - LHCP with 1000 MHz BW
    - LHCP with 1000 MHz BW



**\* 77° W is Non-USA Latin America DBS Only**

# Receiving Dish Network 300

- 18 Inch Round Parabolic Dish
- One Satellite (119 W Lon)
- Low Noise Block Converter (LNB)
  - Input RF Carriers 12.2-12.7 GHz
  - Selects RHCP or LHCP (13V or 18V)
  - Output IF 950 – 1450 MHz
  - One RG-6 Coaxial Cable
- Home Receiver
  - IF Superheterodyne Tuner
  - Power for LNB
  - Polarization by LNB Power (13V or 18V)
  - One RG-6 Coaxial Cable per Tuner
- Television Set
  - RF Ch 3 or NTSC 1 Vpp



# Receiving Dish Network 500

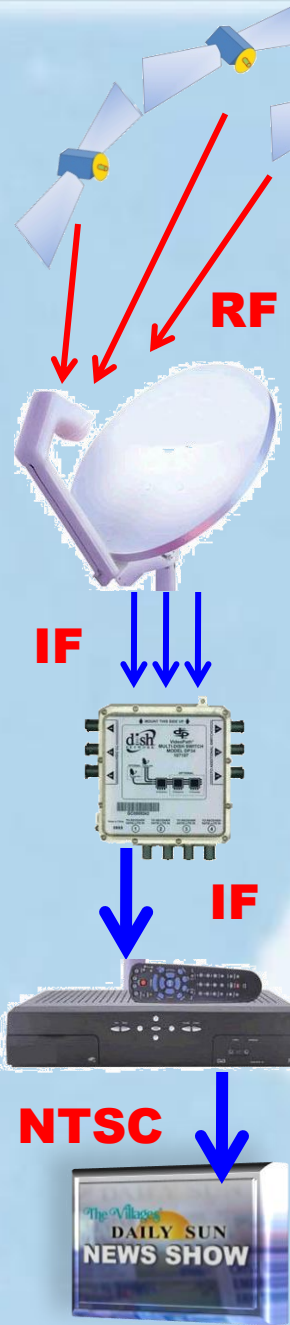


- 20 Inch Round Parabolic Dish
  - Two Satellites (110, 119)
- Low Noise Block Converter (LNB)
  - Input RF Carriers 12.2-12.7 GHz
  - Selects RHCP or LHCP (13V or 18V)
  - Output IF 950 – 1450 MHz
  - Two RG-6 Coaxial Cables
- Home Receiver
  - IF Superheterodyne Tuner
  - Power for LNB
  - Polarization by LNB Power (13V or 18V)
  - LNB/Satellite by Tone Command (22 KHz)
  - One RG-6 Coaxial Cable per Tuner
- Television Set
  - RF Ch 3 or NTSC 1 Vpp

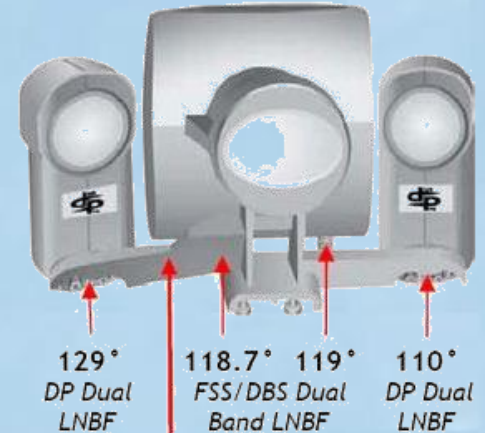


# Receiving Dish Network 1000+

- Primary 110 & 119
  - Add-On for HD 62 or 129
- Low Noise Block Converter (LNB)
  - RF Carriers 12.2-12.7 GHz
  - Power for LNBS on IF (~19 V PS)
  - Output IF 950-2150 MHz (Stacked IF)
    - RHCP 950-1450 MHz
    - LHCP 1650-2150 MHz
- Multi-Switch (or inside LNB)
  - Selects by DiSEqC 2.0 (22 KHz Carrier)
  - Digital Satellite Equipment Control
  - Receivers Control/Status to LNBS or MS
- Home Receiver
  - Superheterodyne Tuner
  - Power for LNB 19 V (10.5 V Min)
  - Polarization by DiSEqC 2.0
  - Satellite by DiSEqC 2.0
  - One RG-6 Coaxial Cable per Tuner
- Television Set
  - HDMI, RF Ch 3 or NTSC 1 Vpp



DISH 1000+ LNB Assembly

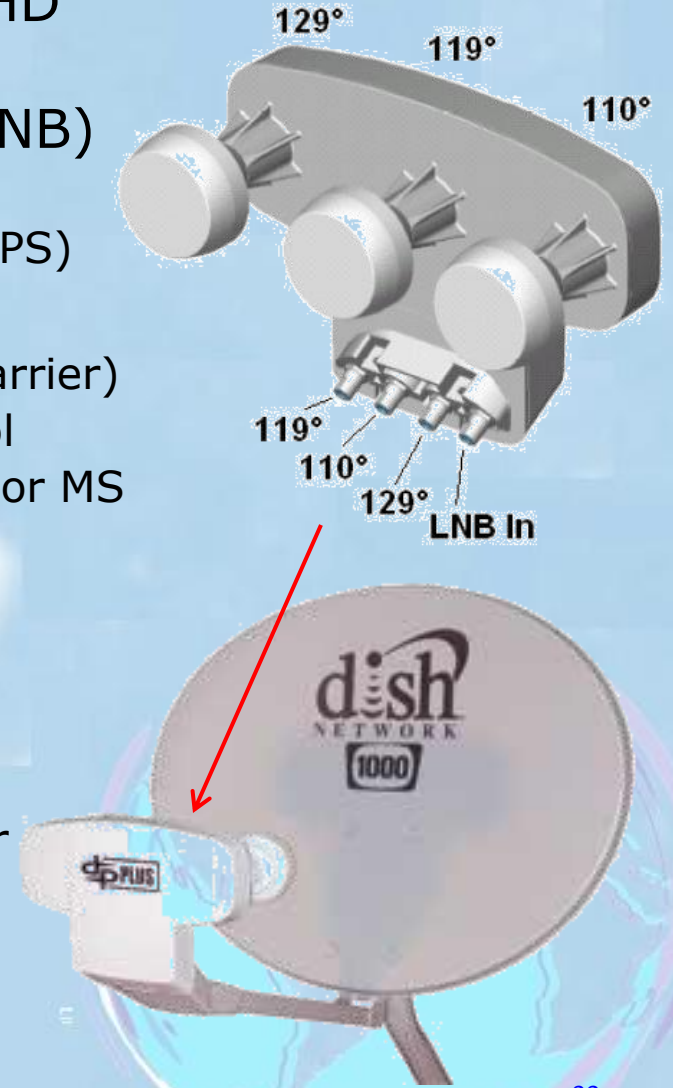
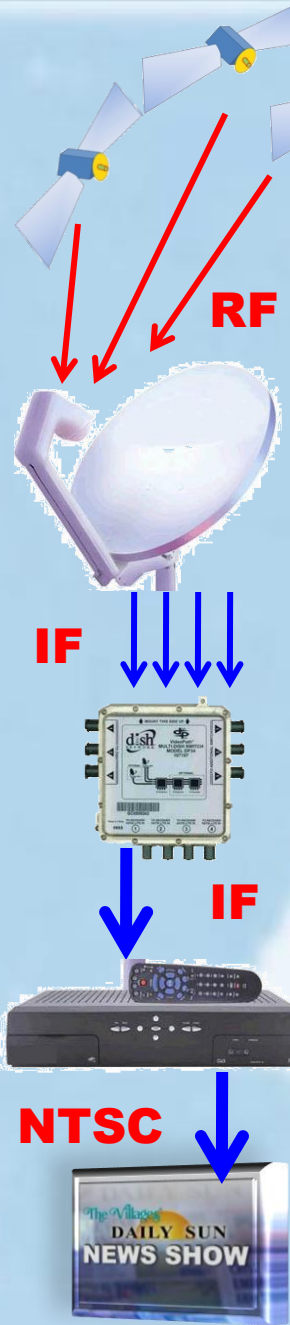


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# Receiving Dish Network 1000.2

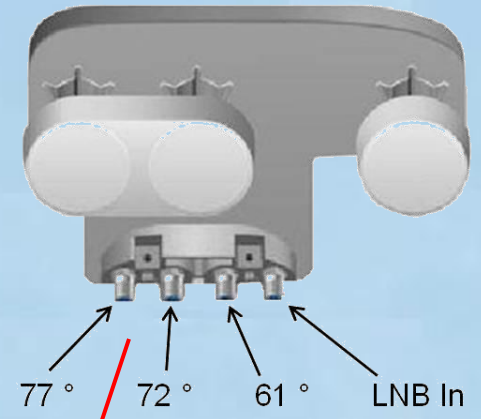
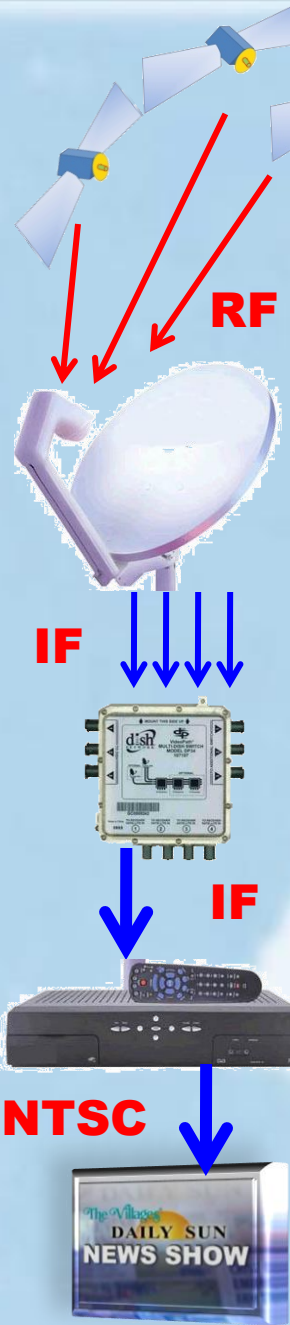
- Primary 110 & 119 Plus 129 HD
  - Add-On LNB for Special Packages
- Low Noise Block Converter (LNB)
  - RF Carriers 12.2-12.7 GHz
  - Output IF 950-2150 MHz (~19 V PS)
- Multi-Switch (or inside LNB)
  - Selects by DiSEqC 2.0 (22 KHz Carrier)
  - Digital Satellite Equipment Control
  - Receivers Control/Status to LNBs or MS
- Home Receiver
  - Superheterodyne Tuner
  - Power for LNB 19 V (10.5 V Min)
  - Polarization by DiSEqC 2.0
  - Satellite by DiSEqC 2.0
  - One RG-6 Coaxial Cable per Tuner
- Television Set
  - HDMI, RF Ch 3 or NTSC 1 Vpp



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# Receiving Dish Network 1000.4

- Primary 72 & 77 Plus 61 HD
  - Add-On LNB for Special Packages
  - 72 Package includes most of Primary 110 & 119
  - 77 Latin America Package
  - Designed as an East Coast equivalent to 1000.2
- Low Noise Block Converter (LNB)
  - RF Carriers 12.2-12.7 GHz
  - Output IF 950-2150 MHz (~19 V PS)
- Multi-Switch (or inside LNB)
  - Selects by DiSEqC 2.0 (22 KHz Carrier)
  - Digital Satellite Equipment Control
  - Receivers Control/Status to LNBs or MS
- Home Receiver
  - Superheterodyne Tuner
  - Power for LNB 19 V (10.5 V Min)
  - Satellite & Polarization by DiSEqC 2.0
  - One RG-6 Coaxial Cable per Tuner
- Television Set
  - HDMI, RF Ch 3 or NTSC 1 Vpp

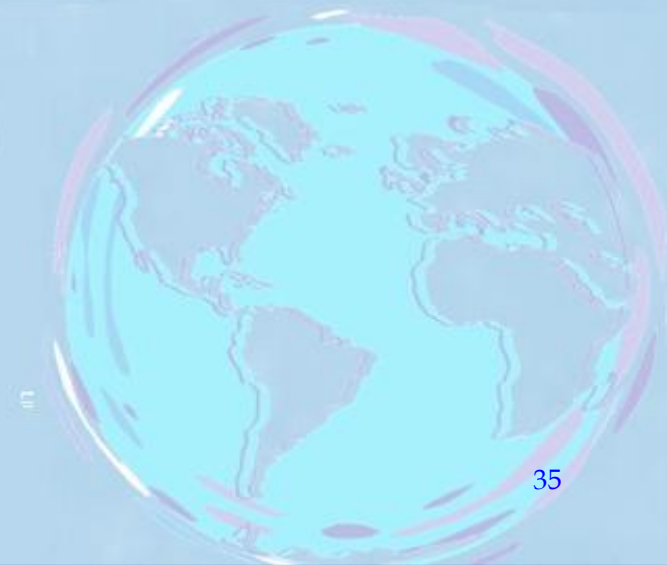


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