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**Chapter Zero: DBS BASICS** covers signal distribution basics common to ALL DBS providers. Customers calling SONORA DESIGN for assistance will be guided through the qualifying questions covered in this chapter.

**Chapter One** covers DIRECTV® SWM signals
**Chapter Two** sports bars, Garden Style MDUs
**Chapter Three** Buildings 3 to 8 floors.
**Chapter Four** Buildings 9 to 15 floors.
**Chapter Five** Buildings 16 to 23 floors.
**Chapter Six** Buildings 24 to 32 floors.
**Chapter Seven** Buildings 33 to 45 floors.
**Chapter Eight** legacy system upgrades.

**DBS BASICS**

**DBS RECEIVER**

-30 dBm

**RG6 Loss / 100 ft**

10 dB @ 2150 MHz

-60 dBm Min
Direct Broadcast Satellite (DBS) signals originate from one or multiple satellites located at a fixed position in the sky.

We can analyze your system with the answers to the following questions.

1. Who are you? (Name, phone number, e-mail)
   Homeowner, Installer, Distributor
2. Where are you located?
   City, Country
3. Is your system new, or is it being updated and or having signal reception issues?
   New, recent problem, updating system
4. If pre-existing, what changed
   Bad weather, adding receivers
5. What do you want SONORA to help you with?
   Troubleshoot a signal problem?
   Design an update or new system?
   Help you order a product?
6. Who is your signal provider?
   DIRECTV, DISH, BELL EXPRESSVU, SHAW
7. What does your dish look like?
   Round, elliptical
8. How many cables from the dish to the house?
   1, 2, 3, 4
9. How far is the dish from the house?
   50, 100, 150, or > 200 feet
10. How many receivers are presently operational?
11. Is there any electronics between the receivers and the dish?
    Switch, power supply, splitter
12. Where are the receivers? How far are they from the Main Point of Entry (MPOE)
    50, 100, 150, or > 200 feet
DBS receivers have operating windows defined as the maximum and minimum signal levels to provide maximum performance.

The DBS providers simplify signal distribution by designing the signal power for a region to match the dish used in that region. They each follow the same signal power model to get the correct amount of signal to your area using the smallest home reception dish.

Signal level is measured in decibels. dBm is a convenient way to measure signal power over a wide range of signal levels.

1. 0 dBm = 1 milliwatt of power
2. +10 dBm = 10 times the power of 0 dBm
3. -10 dBm = 1/10 the power of 0 dBm
4. Home DBS dishes start with a signal power of -30 dBm
5. You can connect a receiver directly to the dish and not overload the receiver.
6. A coil of wire symbol indicates a coax distance between devices.
7. RG-6 cable has a loss of 10 dB per 100 feet
8. Receivers need a minimum signal power of -60 dBm
9. You can connect a receiver 300 feet of RG-6 and get a picture. (Not recommended)
   -30 dBm at dish, -30 dB cable loss = -60 dBm
10. SONORA uses multi-colored lines to indicate the signal from the DISH may contain multiple satellites.
11. Receivers communicate with the dish to select the desired program.
Signal level mathematics for DBS is simplified to multiples of 5 dB. Coax cable and splitters have loss.

1. DBS dishes start at -30 dBm
2. 100 feet RG-6 = 10 dB loss
3. 2-way Splitter = 5 dB loss
4. 4-way Splitter = 10 dB loss
5. 8-way Splitter = 15 dB loss
6. DBS receivers need -60 dBm minimum

A typical home will have more than one television. The diagram illustrates a DBS signal split to four locations.

The three variables are the dish to splitter distance, the splitter type, and the splitter to receiver distances.

1. Dish distance 100 ft, 4-way splitter, receiver distance 100 feet
   -30 dBm -10 coax -10 split -10 coax = -60 dBm
2. Dish distance 150 ft, 4-way splitter, receiver distance 50 feet
   -30 dBm -15 coax -10 split -5 coax = -60 dBm
3. Dish distance 50 ft, 8-way splitter, receiver distance 100 feet
   -30 dBm -5 coax -15 split -10 coax = -60 dBm
Signal level mathematics for DBS is simplified to multiples of 5 dB. Coax cable and splitters have loss. Amplifiers have gain. SONORA features two fixed gain levels; 15 dB and 30 dB.

1. DBS dishes start at -30 dBm
2. 100 feet RG-6 = 10 dB loss
3. 2-way Splitter = 5 dB loss
4. 4-way Splitter = 10 dB loss
5. 8-way Splitter = 15 dB loss
6. LA141R amplifiers have 15 dB gain
7. LA281R amplifiers have 30 dB gain.
8. DBS receivers need -60 dBm minimum

A typical home will have more than one television. The diagram illustrates a DBS signal amplified and split to four or more locations.

The (4) variables are the dish to splitter distance, the amplifier gain, the splitter type and the splitter to receiver distances.

1. Dish 150 ft, amplifier 15 dB, 4-way splitter receiver 150 feet
   -30 dBm -15 coax + 15 dB amplifier -10 split
   -15 coax = -60 dBm
2. Dish 150 ft, amplifier 30 dB, 8-way splitter receiver 150 feet
   -30 dBm -15 coax + 30 dB amplifier -15 split
   -15 coax = -45 dBm
DBS dishes have Low Noise Blockconverters (LNB’s) that require DC power to operate. The DC must travel up the coax cable and arrive at a minimum voltage.

Along the way, the coax cable has resistance that decreases the voltage. The equation that models DC voltage loss is: \( V = I \times R \).

Assume
1. LNB uses 0.5 Amp of current.
2. Cable Resistance is 10 Ohms
3. \( V = I \times R \)
4. \( V = 0.5 \text{ Amp} \times 10 \text{ Ohms} = 5V \)

We can re-write the equation to solve for Resistance. If we start with 21V and we need 17V at the LNB, what is the maximum resistance for a 4 volt loss.
1. \( R = \frac{V}{I} \)
2. \( I = 0.5 \text{ Amp} \)
3. \( V = 21V - 17V = 4V \)
4. \( R = \frac{4V}{0.5\text{Amp}} = 8 \text{ Ohms} \)

What is the maximum distance that a 21 Volt supply can power an LNB with copper covered steel, RG-6 cable?
1. Copper covered steel RG6 = 8 ohms / 100 ft
2. solid copper RG6 = 4 ohms / 100 ft
3. 8 Ohms / 8 Ohms/100 feet = 100 feet
4. 8 Ohms / 4 Ohms/100 feet = 200 feet

When you cannot change the cable to solid copper, change the power supply to a higher voltage. Substitute model PI-29 for model PI-21.
DUAL SWITCHED 500
The DC voltage that powers the LNBS is also used to select the band of DBS signals requested by the receiver.

DBS receivers produce either 13V or 18V for selecting two bands. The DC must travel up the coax cable and arrive at a minimum voltage.

The 18V signal must arrive at greater than 16.5V for the LNB to select the 18V band. The voltage loss in the cable limits the length of cable between the receiver and the dish.

If we start with 18V and we need 16.5V at the LNB, what is the maximum resistance for a 1.5 volt loss.
Assume the LNB current is 0.1 Amp

1. \( R = \frac{V}{I} \)
2. \( I = 0.1 \text{ Amp} \)
3. \( V = 18V - 16.6V = 1.5V \)
4. \( R = \frac{1.5V}{0.1\text{Amp}} = 15 \text{ Ohms} \)

What is the maximum distance that a 18 Volt supply can power an LNB with copper covered steel, RG-6 cable?

\( 15 \text{ Ohms} / 8 \text{ Ohms}/100 \text{ feet} = 175 \text{ feet} \)
There is more program content than can fit within two 500 MHz bands. DBS receivers produce either 13V or 18V and add 22 kHz tones to those voltages for a possibility of selecting four bands.

Satellites may be collocated to produce two bands from one orbital location and two bands from a second orbital location, for a total of four bands.

The cable and any devices between the receiver and the LNBS must pass 22 kHz. The 22 kHz must remain isolated from the other coax cables.

There is more program content than can fit within a four 500 MHz bands. Two 500 MHz bands may be stacked in the LNB to produce a band of 1000 MHz. Four orbital location operating at the same downlink frequency is needed. It is also possible for two satellite to be collocated if they use different downlink frequencies (Ka and Ku).
DISH & Bell Canada use a switched 1000 MHz system. A stacking
switched LNB is used to allow Digital Video Recorders to receive
any (2) bands on a single coax. Voltages and DiSEqC control signals
from the receivers are sent to the multi-switched LNBs. Each of the
(4) coax cables from the LNB carries one 1000 MHz band.

The 1000 MHz bands are split into (2) bands each so any two bands can be
stacked and switched by the LNBs.

Note the yellow and blue bands being sent to the DBS DVR.

12 BAND STACKED SWITCHED 1500 MHz
There is more program content than can fit within a
downlink bands. Four orbital
multiple satellites are collocated
locations operating at two downlink frequency bands
is needed.

DIRECTV stacks, one 500 MHz band below the 950
-1450 MHz band and stacks one 500 MHz band above
the 950 -1450 MHz band.

A band converter was used at each receiver to up convert the lower band.
Multiple receivers are required in a home for independent channel selection over a single coax cable from the dish.

Channel stacking switch (CSS) technology developed by Entropic communications® selects individual transponders instead of switching an entire LNB band. The LNB allows just the receiver selected transponder to be switched down the cable.

Each receiver connected to the SPLIT8 is assigned (1) of the (8) available User Bands. A dual tuner DVR is assigned (2) User Bands. The first receiver connected is assigned User Band one by the LNB. User Band zero is for guide data.

While ALL (8) User bands are on the drop cable, only the User band assigned the receiver and the program band are needed by any single receiver.

Receivers communicate their program selection from the LNB via a bidirectional 2.3 MHz return band.
DISH & Bell Canada use a switched 2000 MHz system. The 1000 MHz bands are split into (2) bands each so any two bands can be stacked and switched in the LNB onto each drop cable.

An external stacker stacks a third band so the total single coax drop bandwidth is 950 to 3000 MHz. A three tuner video recorder acts as a video server.