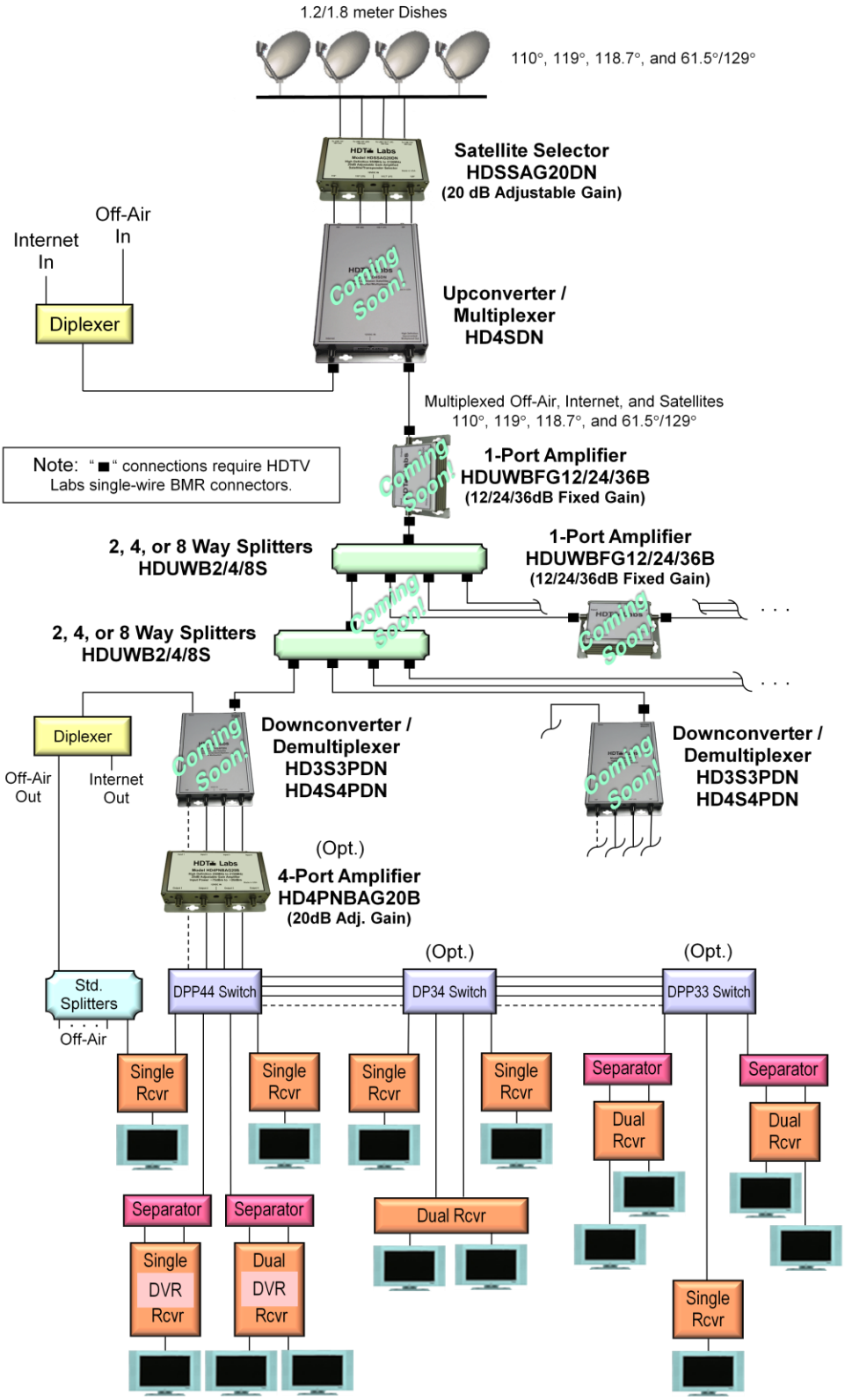
Typical HDTV Commercial Multiplexed / Demultiplexed System Diagram for DISH Network



Typical HDTV Commercial Multiplexed/Demultiplexed System Description for DISH Network

DISH ANTENNAS

The satellite dishes used in most commercial installations are typically 1.0 to 1.8 meters in diameter. The increased size improves the quality of the satellite signal and also helps to keep rain fade to a minimum. One dish is normally used for the reception of each desired satellite. The RF output signal levels of the smaller dishes are typically about -25 to -30 dBm, depending upon configuration parameters. The output levels of the larger dishes can vary between -15 and -25 dBm. Recommended RG-6 coaxial cable will have a loss of about 10dB per 100' at 2150MHz, when the connectors and ground blocks used are rated to 2GHz.

SATELLITE SELECTOR

Since most commercial installations will have considerable signal loss due to the number of devices and cable runs in the system, a Satellite Selector should be used to optimize system performance. The **20dB Adjustable Gain Satellite Selector (HDSSAG20DN)** is a combination of four power inserters, a 20dB adjustable gain amplifier, and independent power supply that ensures strong and consistent DC voltage levels to the dish LNBs and adds signal strength to the system.

Use the Adjustable Gain Satellite Selector to more accurately tune each of the four system channels and optimize the input levels to the next device. Connections from the dish LNBs can be to any of the four Satellite Selector input ports. Unused channels on the Satellite Selector do not require termination. The Adjustable Gain Satellite Selector allows you to build more reliable systems, use fewer parts, and produce a cleaner C/N output on all channels.

DIPLEXER

A diplexer consists of both a high pass and low pass filter that allows the differing frequencies of the Off-Air and Internet signals to share a common coaxial cable with the upconverted / multiplexed satellite signals. The Off-Air and Internet sources are input to the system via the HDTV Labs Upconverter / Multiplexer (HD4SDN) and distributed as outputs from the HDTV Labs Downconverter / Demultiplexers (HD3S3PDN / HD4S4PDN). The Off-Air signal is then routed through standard splitters to the back of any of the system receivers while the Internet signal can be connected to a customer broadband network.

UPCONVERTER / MULTIPLEXER

The **HD4SDN Upconverter / Multiplexer** takes signals from up to four satellite locations and along with the diplexer signals, combines them all onto one single-wire coax for distribution. Normally, each satellite signal at this point would require its own separate coaxial cable. Pre-wired buildings with single-wire

installations would require running additional cable for each new satellite signal. This would not be needed with the HD4SDN one-wire system. Another advantage when using the combination of HDTV Labs upconverters and downconverters is the amount of cabling in this section of a system is greatly reduced from up to four lines per device to just one.

SINGLE-WIRE CONNECTORS

The **HDTV Labs single-wire BMR connector** is designed specifically for systems using the HDTV Labs Upconverter / Multiplexer (HD4SDN) and Downconverter / Demultiplexer (HD3S3PDN / HD4S4PDN) devices. A bit larger than a standard "F" connector, the BMR connector has all the capabilities of an "F" connector while also passing the multiplexed single-wire signal.

1-PORT AMPLIFIERS

Inline one port amplifiers capable of passing the commercial multiplexed single-wire signal can be used anywhere between the Upconverter / Multiplexer output and the Downconverter / Demultiplexer inputs in the system design. The **HDUWBFG12/24/36B 1-Port Amplifier** is available in 12, 24, and 36dB fixed gain models. Use these amplifiers to overcome excessive splitter loss or signal degradation due to long individual cable runs.

SPLITTERS

Special splitters are required to pass the multiplexed single-wire signal. The **HDTV Labs 2, 4, or 8 Way splitters (HDUWB2/4/8S)** are designed for this purpose and can be used in any number and combination to optimize the system design. Each splitter, however, does introduce loss into the system and reduces signal strength in that line. The single-wire splitters have slightly more loss than the loss seen in common splitters. Typical values would be 3.5dB for the 2 Way, 7.0dB for the 4 Way, and 10.5dB for the 8 Way splitter.

When separating the diplexer outputs into Off-Air and Internet signals, common splitters may be used in any combination and number for the Off-Air inputs that are fed to the backs of any number of receivers.

DOWNCONVERTER / DEMULTIPLEXER

The **HD4SDN Downconverter / Demultiplexer** takes the one-wire combined signals and separates them back into the individual satellite and Off-Air / Internet signals for further distribution. The satellite signals from each Downconverter / Demultiplexer must be connected to a multi-switch or the first multi-switch in a cascaded design to send the signals to the set top boxes.

MULTI-SWITCHES

Three multi-switches commonly used in commercial installations are the DISH Pro Plus 44 (DPP44), DISH Pro Plus 33 (DPP33), and DISH Pro 34 (DP34). For reception of three satellites, all three types of multi-switch could be used, but for four satellite reception, the DPP44 would be the selection. Cascading multi-switches in a commercial installation can be done, but there is a risk that failure to the first or second switch would also disable the outputs of a third switch. If used, the DISH Pro Plus 33 (DPP33) must be the last switch cascaded since it has no ports to cascade.

The DISH Network multi-switches are designed to receive signal levels identical to that of a receiver and the parameters thus are the same. This means that the installer should hit the input of a switch within the -30 to -55 dBm window. However, as it is necessary to meet this same window at a receiver, the drop length from the switch needs to be considered. If the level at the switch is at the low end of -55 dBm and drop lengths are of concern, either a **HDUWBFG12/24/36B 1-Port Amplifier** before the downconverter or an **HD4PNBAG20B 4-Port 20dB Adjustable Gain Amplifier** after the downconverter, should be used to reduce the potential of outages and bring levels back into the required input window range. All switches provide satellite TV signals to the inputs of any combination of multiple receivers.

SET TOP BOXES, TV'S, AND DVR'S

DuoDvr VIP 722k and DuoDvr VIP 622 (2 TVs + DVR), VIP 922 DVR and Solo DVR VIP 612 (1 TV + DVR), Duo VIP 222k (2 TVs), and Solo VIP 211k (1 TV) are the current models of set top boxes being used to receive the HD DISH Network signal. The minimum input signal to each device by standards is a level of -51 dBm. However, for peak performance, our recommendation would be to use a stronger input level of about -30 dBm. This should result in the desired C/N ratio of about 16.

When DISH Pro Plus multi-switches are used, dual tuner and DVR receivers can be connected with a single wire if a DPP Separator is installed at the back of the receiver. This setup will not work, however, if you try to connect two single tuner receivers. The DPP Separator also will not work with DISH Pro multi-switches. For installations not using DPP multi-switches or separators, a single wire from the multi-switch is required for each receiver and two wires are required for both dual and DVR receivers.