

HOLLAND ELECTRONICS

Technical Bulletin

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Issue#101

Cable TV Applications For Home Distributions

What do you need to know to be CATV Compliant?

It has been reported to us by many higher-end home TV system installers that cable companies are telling customers that the reasons for failures in new technology products like digital programming and 2-way internet are the inadequate **amplifiers, splitters, and distribution** methods used by the private A/V company. Many times when the customer requests these new services, the cable company insists on ripping out those components that are non-cable approved or not properly specified for the new digital service. In some cases, they are correct in their assertions and in some cases they are just looking for a scapegoat which clouds the good reputation and work by the professional A/V company. The cable companies are concerned with maximum operating efficiency of all components in a system. To this end, they are replacing all lower performance products that might work in some cases to 70% with ones assuring 95+% performance and the highest data speeds. Their digital systems are now like a chain: the weak link or the sum of many poor components to make a weak link and slow the data.

We would like to let you know about some of these new requirements concerning amplifiers, passives and distribution routing that will both work better with digital cable and satisfy any suspecting cable technician or engineer upgrading a home or solving a trouble call.

We will both explain the reasons for these new features and give you the SCTE (Society of Cable Engineers) specification number as a reference which is used to set minimum standards for all cable TV products. That shiny splitter saying "high performance" is no longer acceptable to the cable industry for good reasons.

Splitters:

Though most splitters will work in an analog/digital environment, some percentage will not, resulting in slower data speeds and digital picture malfunctions such as "lock-ups". It is also possible for 2 modems or PPV devices generating return signals to interfere. We will list those features needed the most by the cable companies and adopted for their installations that should be adopted in your systems if you wish to both avoid some percentage of operational trouble and image trouble. Most MSO's (multiple systems operators, the cable company) now insist that all splitters meet the **SCTE: SP-406** standard as well as having the additional features that make a splitter truly perform in a "Digital" system.

Mechanical:

The newest and most obvious changes for digital/cable splitters are the flat ends and smaller hole openings on the F ports. This insures an inner metal-to-metal contact between the splitter port and the inner part of the connector which reduces micro-reflections at the higher frequencies where the downstream data lies. In some cases, the old splitter designs were partially responsible for modem speed reductions.

Electrical:

There are a few "buzz" words that have meaning;

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High return loss at modem frequencies (ask for greater than 30dB)

This new level of spec insures that no reflections occur as the modems transmit high level signals.

Higher Port-to-Port Isolation at up-stream modem frequencies: (greater than 40dB)

This reduces the possibility of 2 modems or digital set-tops from interfering with each other.

Capacitor Decoupled Ports:

Many times in larger or homes, the AC electrical return prefers to travel to ground through the cable shield rather than through the AC 3rd wire. This can result in the AC hum getting into the splitter which results in vertical hum bars in a picture and slower data speeds from modems. This new feature of putting blocking capacitors at each F port prevents this problem and is thus required by almost all cable systems. This feature also reduces power or lightning spikes coming in from the outdoor Cable system adding protection to the modems and sensitive splitter elements.

Low Intermod: Interfering spurious outputs need to be attenuated more than 100 dBc.

Modems put out large amounts of return signal (>55dBmV) and can actually distort the TV signal and create interference during a strong modem burst. The new standards for intermod from modems (SCTE SP-406) set the distortion to an acceptable level.

Learn the “buzz” words and the reasoning behind the new specifications so your installations will continue to perform and be accepted by all cable companies.

F Connectors on Wall plates

What is cable quality? The cable industry has established SCTE SP-409 which details the minimum requirements for these splice connectors. It used to be that anything would do but no longer. The new specs requires 2 main things:

1. **High return loss** of over 20dB at 1 GHz

This prevents reflections at the high downstream data frequencies

2. **Flat ended F Ports** with smaller apertures.

This also insures metal-to-metal contact between connector and splice.

Older, non-compliant designs that have one side “swedged” closed will work in most cases but not all. If you want full system acceptability, just choose the splice or wall plate with splice where both ends are flat. Usually these are also higher return Loss.

Cable TV Amplifiers for the Home in the new digital world

There are many amplifiers that have been used in small and large homes and in structured wiring panels that were sold as Cable amplifiers. Many are little more than a \$6 7-channel capacity off-air amp relabeled and sold for 10 times the amount. Some actually say video distribution amplifiers for cable TV, off-air etc. Most of the time, the cable technician installing a new outlet, cable modem activation, or just answering a service call for a bad picture sees these amplifiers and tells the homeowner that the amp is the problem and it must go. Who installed it? In some cases, he is looking for a scapegoat and in many cases it is the wrong amplifier.

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What do you need to know about amplifiers to trust your decision that the device you choose can handle the full channel loading of 110 channels, digital programming, Pay-per-view devices, and internet modems? Did it work before? Maybe without too much visual distortion. Did it need to have a flat response, high return loss, reverse pass band, low intermod diplexers, a push-pull output module IC? Perhaps not to get by. It might have names like "High performance" Super Channel", Plus Vision", True Cable". It might have had a case like a car audio amp with racing stripes and a slick brochure that told you how great it was with words your customer would love. That's why the cable technician went right for it.

What do you need to know about the basic specs and features that will insure you are using the right product and what "buzz" words do you need to know to explain the performance? Why is there a higher performance level needed for cable TV with digital?

Written Specifications

First, require any amplifiers you are using to have printed specifications indicating the distortion at full output, flatness, return loss etc. RL should be over 16 dB if it is an amplifier designed for cable TV use. If you do not see a distortion spec at the maximum output, then more than likely you have a home amp being used for high channel use that is distorting even if they have painted racing stripes on a nice case.

Output level vs number of Channels

This is the key specification that separates the home from CATV amplifiers. Just saying high output means nothing. Amplifiers can be great for a few channels but every time you double the number of channels out through the amp, you reduce the maximum output you can use by 3 dB and add distortion. So when an amp says 100 channels, the question is at what output and distortion. For example, a good CATV amp can output 44-46 dBmv with 110 channels at a good distortion spec. If it is a 30dB gain amp, then full output can be achieved with a 14dBmv input. If you had the same amp with an input of 7 channels, it would be capable of 60dB output.

Type of Amplifier

A low distortion amplifier for CATV applications must use a Push-pull design. This design has higher output power with lower distortion, eliminating the second harmonics. A Push-pull design can be made from separate transistors but the best amplifiers are ones that use a Hybrid Power IC module that is in every CATV amplifier that is on every pole in the world. The separate discrete component type are designed to operate slightly higher in frequency but have much lower output levels and higher distortion than the IC module approach.

Signal flatness in the 550-750MHz band

Many people think that if the cable has 78 channels they only need a 550Mhz amplifier.

The downstream data lies in that upper band and it requires an amplifier with both flatness and extra headroom (low distortion) to handle both TV and data signals. Ask your supplier about flatness curves and specs.

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Reverse capabilities

If a home has or will add internet modems or Pay-per-view service, you will need a reverse path amplifier.

The return data comes back to the cable company via frequencies between 5-40 Mhz . The cable amps all begin amplifying at 54 MHz so some path is needed for the reverse to get by. It is like salmon needing to bypass a dam. This is done by adding a diplexer circuit inside the amplifiers routing the reverse signals around the forward amp. Some amplifiers have this reverse path passive and some have it amplified. For homes with more than 4 splits on the incoming cable, you would need to amplify the reverse to have it overcome the splitter losses. If you have already installed a prior amp that is not 2-way, you can add 2 devices called diplexers around your amplifiers to pass the reverse signals back to the cable company. If you have a reverse amplifier, you should be sure it can handle the high input signals produced by a modem. If it is not know by the supplier, beware.

Other features:

Some other features are touted by some makers such as low noise. This is not needed in a cable system when signal levels are high. Features such a tilt controls, test ports etc are all extras.

Remember: You will be judged by your customer based on the performance of your installation both when it is installed and later when new features are added such as internet, digital, PPV, and even phone over cable. You should **Know** that it will stand up to the highest requirements which are based upon specifications, not buzz words like " digital". The cable guy will see your amplifier as a home type with limited performance if it is not a hybrid IC module type design or if it does not have real specs.

Home Distribution Layout for CATV.

Most high end installations use "Home run" systems which employs a direct cable from each outlet to a central distribution location. At that point, a 2,3,4, 8, or 16 way splitter is used. The reverse signals from PPV or internet modems cannot get enough signal to the cable company if it is degraded by over 8 dB. If you use splitters with over a 4-way split, you are out of luck. Many times the customer calls the cable company for new internet service and the first thing they do is rip out the " poorly designed home splitters and routing.

If you can identify the location of the modem, you should use a directional coupler (6dB) or 2-way splitter in front of you larger splitter bank to rout off to the modem location. Unfortunately, if the customer wishes to add modems or switch it to another room your design is out of luck unless you an amplifier with active reverse amplification. This suggestion early in the installation phase will save you from those " you didn't mention that " when we talked discussions.

Adding outlets to existing homes:

Many times a customer with cable will wish to add outlets due to internet or TiVo devices etc.

This will require now an amplifier but the splitters are all in a box on the outside of the house with no AC power. The solution is called a " **DROP AMP**". It is a cable TV quality amp using a special low distortion IC and has passive reverse diplexers build-in. The value of this amp is that it can be powered by low voltage from the house through one of the coax lines going to serve a TV.. This is the solution the cable companies use.