



# Why Send HD Over Coax?



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## HD Video Distribution Is In Demand

Prices for HDTVs are plummeting, while HD sources are multiplying. To keep up with technology, most businesses are upgrading to HD; in fact, many franchisees for restaurants and bars are required by corporate brand standards to upgrade to HD. If they don't, their businesses risk being marginalized as outdated or lacking innovation, and customers will head down the block for dinner or drinks instead. What's more, the explosive growth of digital signage has driven demand for HD video distribution systems. Bars and restaurants are all looking for efficient ways to upgrade to HD, making HD video distribution a rapid growth opportunity for integrators.

## Existing Solutions

Existing HD video distribution solutions are often labor intensive, requiring new cabling to each display. To share an HD source with 3 HDTVs in remote locations, you might pull new component cables to each HDTV, or CAT5 cabling (with baluns to provide the appropriate connection at each end), or perhaps HDMI cabling. Each represents substantial installation effort, and the expense of a hub of some sort.

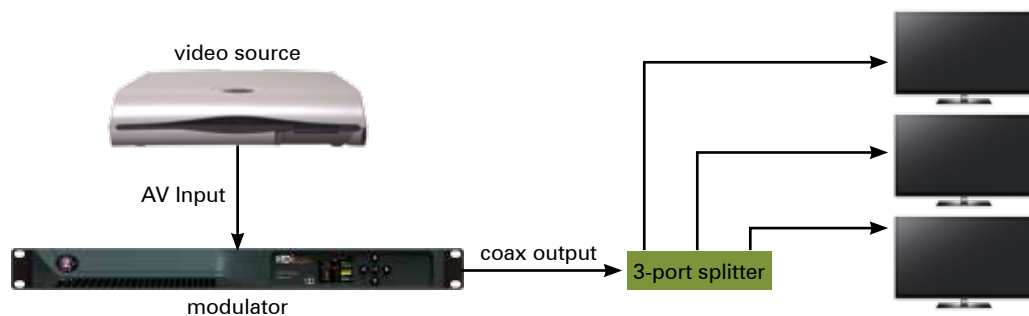
## A New (Old) Way

In contrast, distributing HD over coaxial cabling often allows the use of existing cabling, substantially reducing labor. This is accomplished using RF modulation of the source - a technique that's been around for some time, but has now made the leap to HD.

# HD Encoder/ RF Modulator

## RF Modulator Basics

An RF modulator turns an AV source into a TV channel, which is then broadcast over coaxial cabling within a building. At the TV, tuning in that channel displays the source connected to the modulator. All that's required is an "empty" or unused channel that the modulator can "take over" for broadcasting its source.



Standard definition (analog) RF modulators are common, and fairly simple; they turn the input source into an NTSC (analog) TV channel. Many restaurants and bars today are using analog modulators to provide television programming to their TVs by connecting cable or satellite boxes to modulators, which then push the cable programming out to all the TVs.

**The problem with analog modulators is their relatively poor picture and sound quality. Converting an HD source to an analog channel and then displaying it on an HDTV delivers disappointing results.**



HD modulators, which convert AV sources into HDTV channels, are more complex. When they receive an HD analog input, they must first encode the video as an MPEG2 stream (the DTV video format standard) and convert the audio to the DTV audio standard. Because the HD source contains many times more data than older SD sources, this real time conversion requires serious processing power.

Finally, the encoded stream is modulated onto an RF channel for broadcast. The modulator may create an ATSC channel, which is the standard for over the air broadcasts, or it may create a QAM channel, the standard for digital cable broadcast - in any case the new channel can share coaxial cabling with other existing ATSC or QAM channels. Finally, the channel is tuned in at the HDTV in true HD, so picture and sound quality are far superior to older, SD modulation techniques.

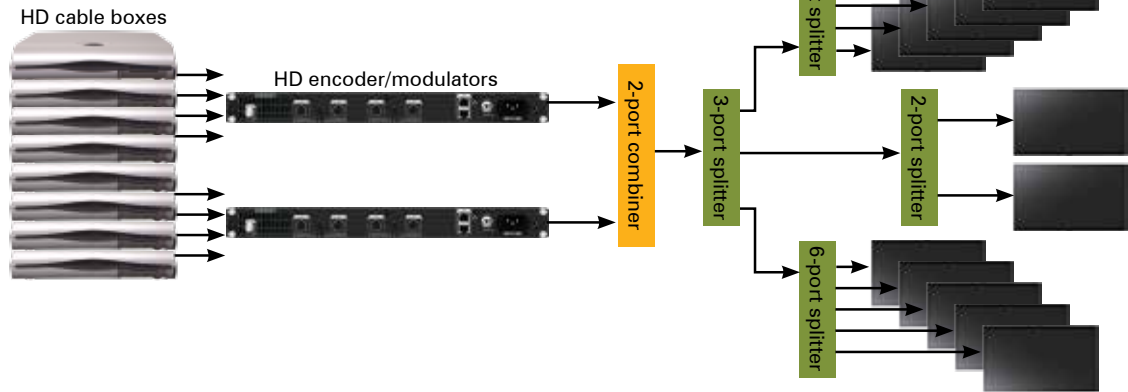
<b>Channel Format</b>	<b>Used for</b>	<b>Notes</b>
NTSC	SD analog over-the-air and cable broadcasts	NTSC modulators not known for top picture quality
ATSC	SD and HD <i>digital over-the-air</i> broadcasts	HDTV requires ATSC tuner to receive these channels
QAM	SD and HD <i>digital cable</i> broadcasts	HDTV requires ATSC tuner to receive these channels

## Killer Apps

With an HD RF modulator, you can share an HD DVR, cable/satellite box, media server, or Blu Ray player with all the HDTVs in a bar or restaurant using existing coax cabling. Or connect the Zone 2 output of an AV receiver to the modulator, and all sources connected to the AV receiver will be available on all of the HDTVs via coax. Or connect the VGA output of a computer to a modulator, and distribute digital signage to all connected HDTVs using simple to deploy coax cabling. You can even create private cable networks, using multiple modulators to create a custom channel lineup, as shown, which is perfect for sports bars and restaurants that want to display specific programming from specific channels.

### Design Example: Sports Bar

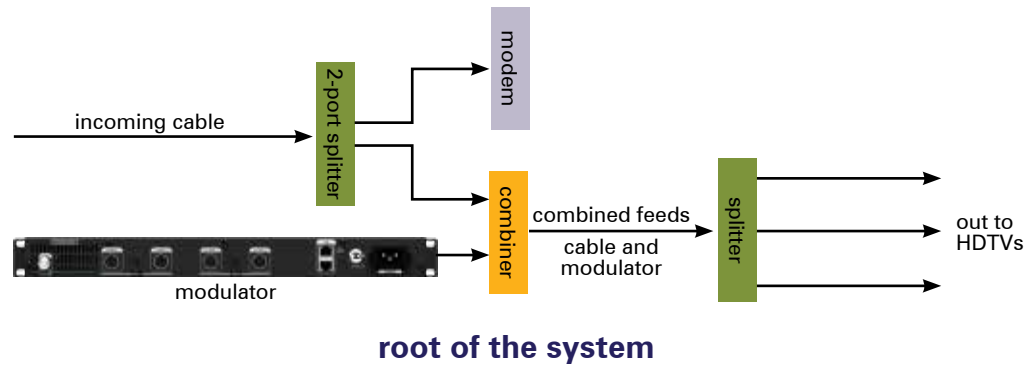
Feed 8 HD channels from cable boxes to 12 HDTVs:  
5 on eachside of the room, 2 behind the bar.



System expansion is also greatly simplified: when new HDTVs are added to a system, they can access the system’s HD source(s) simply by tuning in the RF modulator’s special HDTV channel. In most other systems, adding a display requires pulling new cables to that display.

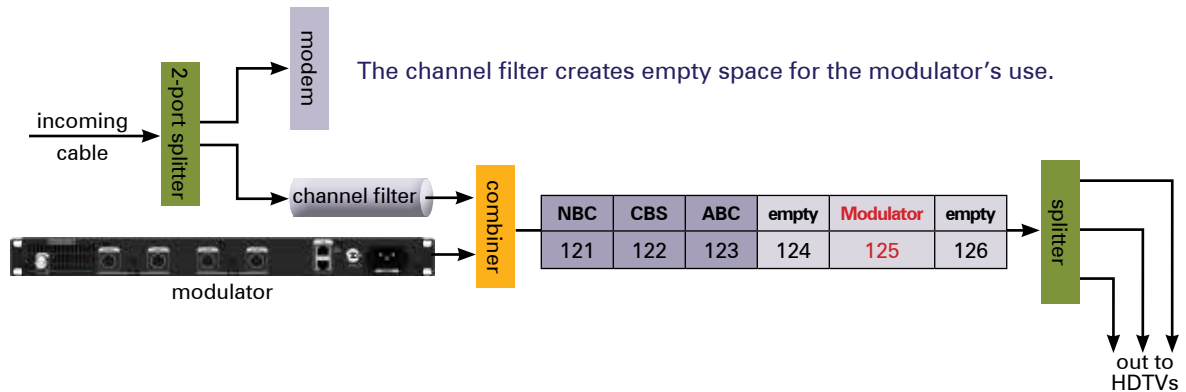
## A typical RF modulation installation

1.) The first step in installing an RF modulator is to connect it to the coaxial cabling in the building. The most desirable connection point is at the “root” of the cabling system, upstream of the main splitter (and/or RF amplifier) that feeds the TVs, but downstream of the splitter that feeds the cable modem (if there is one). A combiner enables the connection, as shown.

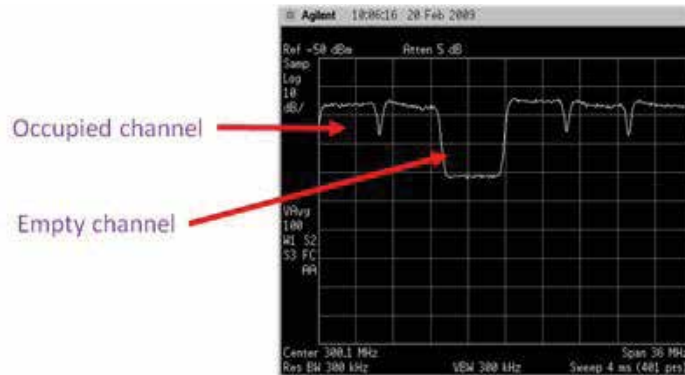


2.) Next, an empty channel is secured which can be used for broadcast. If there are already existing channels on the coax cable, there are two ways to secure an empty channel:

a. Install a channel filter on the incoming coax line. The channel filter is a notch filter that creates a band of empty channels - look for one that blocks a narrow band of channels to minimize disruption of the existing channel lineup.



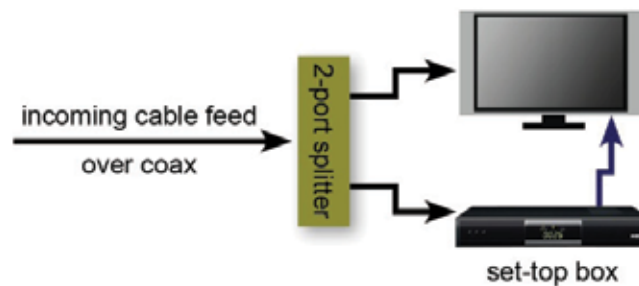
b. Use a spectrum analyzer to scan the cabling, and identify existing “empty” RF channels. This method requires that the modulator is “frequency agile,” meaning its output channel can be changed as needed to fill an empty channel.



**Spectrum analyzer identifies empty channels**

3.) Connect the HDTVs to the coax, as the HDTV’s tuner must receive the modulator’s channel directly. For HDTVs connected to set top boxes, the coax feeding the box is split; one length of coax runs to the box, and the other to the HDTV’s RF input, as shown.

**HDTV connected to coax and set-top box**



4.) Calculate signal losses for the coax distribution system.

a. Most HDTVs work well with input signal strengths of between 20 and +10dBmV, so the modulator’s signal should be in that range when it reaches the TVs.

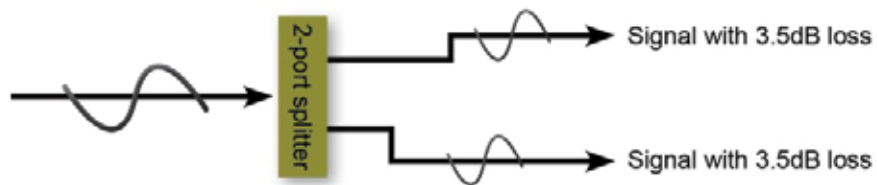
**b.** Each splitter or combiner contributes to signal loss; the losses are often marked in dB on the outputs of the devices. Each 100' run of coax also contributes about 3dB of loss.

**c.** Add up the dB losses in the modulator's path to the HDTVs, subtract that number from the dB output of the modulator, and you'll have a good approximation of signal strength at the HDTV.

**i.** For example, 18dB of losses subtracted from 20dB of modulator output leaves +2dB of signal strength at the HDTV.

**d.** If signal strength at the HDTV is too low (< 20dB), the modulator may have a gain adjustment that can compensate. If not, an RF amplifier may be added downstream of the modulator to boost signal strength.

**Splitters and combiners create signal loss**



**5.)** Finally, tune in the modulator's channel at the HDTV. With some HDTVs it may be possible to tune in the new channel simply by entering its number on the TV's remote. Other HDTVs require that new channels be "memorized" before they can be tuned in; this is accomplished by running a "channel scan" at the HDTV, a function easily found in the "Set Up" or "Installation" menu of the set.





## Tuning in HD Sources

Once the new channel is in the TV's memory, you can tune in that channel to view the HD source connected to the modulator. For control of the remote source, any standard RF, or IR repeater multi room control system can be used.

## Conclusion

HD video distribution over existing coax can be enormously efficient in terms of time and money. Better yet, the systems are easy to expand: to add HDTVs, simply connect them to the coax; to add more sources, simply add another modulator, and make another HD channel. With multiple modulators, it's possible to create a complete matrix distribution system any source at any TV – and accessing those sources will be as easy as changing the channel.