

## ATV DSB vs. VSB

### What are the advantages of transmitting DSB or VSB?

**DSB - AM Double Sidband:** Simpler, smaller components, lower cost, and ease of adding amplifiers. Ease of operating on more than one channel and on other than cable channels.

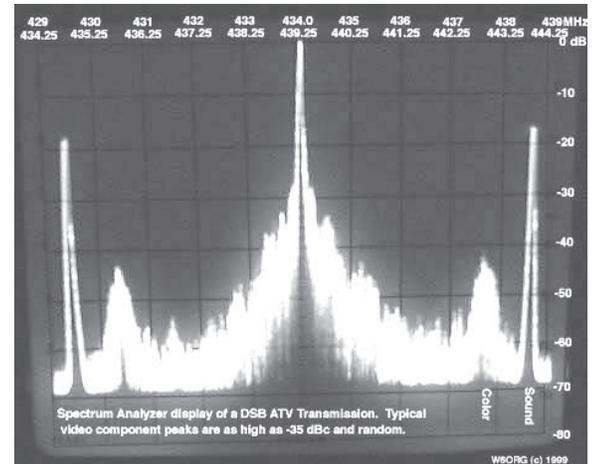
**VSB - AM Vestigial Sideband:** Run higher sound subcarrier up to -7 dBc vs. -15 dBc with DSB resulting in hearing sound down to about P2 rather than P3 depending on the TV set. Less interference potential to other mode users with in a few hundred kHz of the lower sideband color and sound subcarriers.

**Power:** There is insignificant difference between VSB and DSB - The amount of sideband power cut off with VSB is less than 1 dB and equals that thrown away in a good VSB filter in the antenna line. VSB is often confused with SSB. With VSB ATV you still have the carrier, upper sideband plus up to 1.25 MHz of the lower sideband video components.

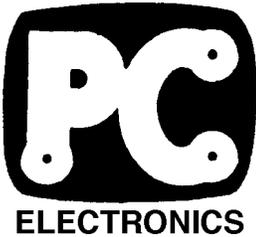
**Interference potential of DSB:** Since the video picture amplitude varies with the changing transitions from black to white and all shades of gray in-between a horizontal and vertical sync rate, the actual power at any one given narrow band frequency within the video passband is random and the response time so much lower in a narrow band receiver, that the potential for interference is very low to narrow band modes such as SSB and CW receivers. Therefore the only significant and consistent unnecessary sideband energy is the lower color and sound subcarriers which are already down more than -22 and -15 dBc. This is less than 5% of the total power transmitted. These two spot frequencies are usually unassigned +/- 200 kHz in any local technically generated band plan and give adequate guard band protection to FM voice, packet and SSB modes. A sound engineering band plan agreed to by a technical committee made up of no more than two of the most technically qualified representatives from each of the mode users in the band is a better way to work out the interference potential. Individual cases can be handled on known two meter coordination frequencies - time shift, cross polarize, minimum power as well as filtering to get the ATV sideband power at or below the noise floor in another mode receiver. At the same time, other modes need to have only sufficient preamp and system gain so that off channel transmissions don't overload their front ends per good engineering practice.

Except for Repeaters or at any comm site with more than one transmitter operating at the same time, or the band so full that the lower sound and color frequencies must be used, are VSB filters required for engineering reasons. Some areas require them for more for political reasons or unfounded fear of possible interference.

VSB filters are not practical for R/C, balloons, portable or mobile public service events due to their size and or weight. Cost is also a factor. VSB filters are made for just one frequency so unless all your ATV work is on just one frequency you would have to separate your downconverter antenna coax to the antenna through a coax relay to bypass the VSB filter to work an inband repeater, or switch VSB filters to transmit on another frequency.



DSB transmitted video modulated with typical camera video. Sound subcarrier at +/- 4.5 MHz is set between -15 and -18 dBc so as not to be cut off during periods of white video. Other significant sideband energy is the 3.58 MHz color subcarrier which rarely gets above -30 dBc. Sync sideband components are down greater than -40 dBc at +/- 1 MHz. VSB video would be identical except those components below -2 MHz in the spectrum analyzer photo would be down in the noise below -50 dBc.

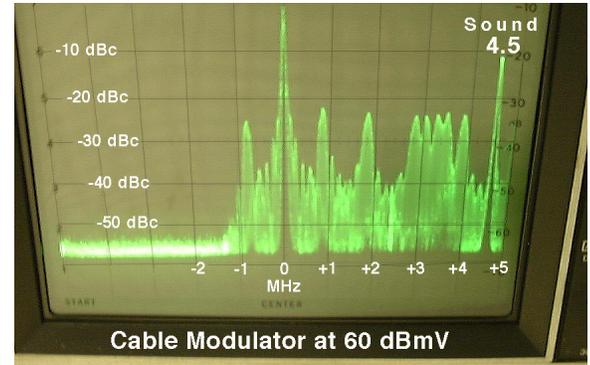


## ATV DSB vs. VSB cont.

If VSB is desired, and you want to run more than a Watt, you will for all practical purposes have to use a VSB filter in the transmitter antenna line. Broadcast TV VSB definition is that these lower sideband subcarriers cannot be greater than -60 dBc. All Amateur "linear" amplifiers intermod products just reinsert the lower sideband sound and color subcarrier components typically to within 10 to 20 dB of DSB. It is not too hard to preserve somewhat of a VSB video modulated RF signal with inexpensive devices up to a watt, but anything higher power costs a lot - Motorola has a nice 60 watt linear amp with 50 dB 3rd order intermod for just under \$3000. Even AEA's 50 watt amp when they had them reinserted the lower color and sound subcarriers to within 10 dB of DSB. So even if you start with a perfect VSB exciter like a cable TV modulator, by the time you boost the power up to something useable for ATV, you will be back to approaching DSB.

To illustrate, we took a professional quality headend cable TV modulator and connected it up to a PA5 20 Watt amplifier and compared the input VSB spectrum to the output. As can be seen, the PA5 intermod products reinsert the lower video sidebands to within a worst case of 14 dB of a normal DSB ATV transmitter, most of which are still about 40 dBc down or only 1 milliwatt out of a 10 watt PEP ATV transmitter. While of no real significance to most areas operating higher in the 70cm band, those on 421.25 would definitely have to put a VSB filter in the antenna line to prevent radiating >30 dBc of energy outside the ham band below 420 MHz. Those in Canada or within the "A" line at the northern US boundary who wished to use 434.0 would likewise need to use a VSB filter in the antenna line. Any ATV repeater would have to have a VSB filter in the antenna line regardless just to prevent intermod mixes in the final with other near by transmitters.

Generally, the higher the amplifier power, the higher the modulation intermod products. This is primarily due to the semiconductors junction capacities changing the dynamic impedance's over the modulation envelope similar to a varicap. Low intermod power devices are designed for low junction capacity and it is not unusual to use a device at a frequency well below its normal range - for example HF SSB linears use devices originally designed for VHF and UHF. The power module used in the PA5 was designed for FM/SSB multimode 70cm transmitters and runs in class AB. Power modules that are designed for class C FM transmitters typically have much worse intermod and in addition have very inadequate bias and supply regulation at the device which causes even more non-linearity. The bottom line is you can start out with a perfect VSB cable modulator plus amp and the receive video will be the same as seen with a DSB transmitter but your sound will still be there with a 2 P unit signal. However, a cable modulator generally does not have an adjustable sync stretcher so you typically have to drive an amp at 1/2 its rated PEP or 1 dB compression point to maintain the video to sync ratio.



ISS Model GL2610-XT Cable TV modulator with a fully modulated multiburst video applied which is worst case for showing sideband energy. Camera video is much less as seen in the previous photo. Note VSB lower sideband and compare after passing through a PA5 20 Watt amateur "linear" amplifier below - set to 10 Watts pep. Lower multiburst video and sound subcarrier are reinserted to about 14 dB of the upper sideband.

