Application Note
AN-1

Why VUSB-TV vs. AM-TV ?

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Should hams be concerned about spectrum conservation ? Yes ! There are several reasons why we should be concerned about how we use and conserve our spectrum.

1. We need to be good neighbors with our other hams and not interfere with their activities on adjacent frequencies.

2. To avoid violating FCC rules, we need to contain all of our emissions within our authorized frequency bands.

3. There is increased pressure from the commercial world to take away our ham bands, especially 70 cm, for commercial use. If they find us wasting spectrum, it becomes an argument for them to petition for all or part of our frequencies.

Many years ago, some of these reasons were the driving factors for hams to transition from AM to SSB for voice communications, particularly on the lower HF bands. For hams transmitting video, particularly on the popular 70cm band, we should cease altogether using AM modulation and move to using the much narrower bandwidth, Vestigial Upper Side Band (VUSB) modulation to conserve spectrum.

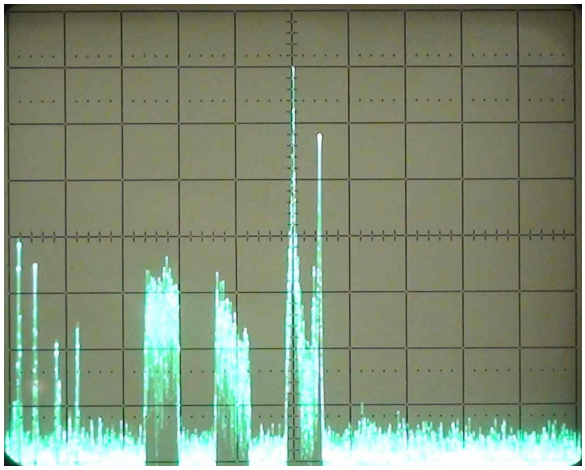

Fig. 1 Typical over the air broadcast spectrum from 150 MHz to 250 MHz The signal in the center is a local, Boulder, channel 11, NTSC analog TV station. Also seen are DTV stations on channels 7 and 9 from Denver. (10 MHz/div & 10 dB/div).

For the transmission of analog, NTSC, television signals, either broadcast or via cable, the FCC many years ago mandated that VUSB be used within a 6 MHz channel bandwidth. Newer digital TV transmissions, must also stay within the same 6 MHz channel bandwidth. See Figure 1 We hams should also adopt these standards.

The bandwidth for an analog, NTSC, video signal is 4.2 MHz. For VUSB, the video carrier and the entire 4.2 MHz upper sideband are transmitted along with 0.75 MHz of the lower sideband. The video carrier is located 1.25 MHz above the lower band edge. Also present in the 6 MHz channel is the FM audio sub-carrier, located 4.5 MHz above the video carrier.

Current practice among many TV hams has been to use low cost, conventional AM-TV transmitters on the 70 cm band. This is probably because for the last 30+ years there have been no commercial manufacturers, of ham TV equipment, such as ICOM, Yaesu, or Kenwood. There have only been small Mom & Pop cottage industries, and the only 70 cm, ham TV transmitters they offered for sale were AM-TV. Figure 2 shows the typical ham AM-TV spectrum. Compare this to the broadcast spectrum in Figure 1. With this wide spectrum, it is impossible for other TV hams to operate on other 70 cm TV channels without co-channel interference. The wide spectrum also causes potential interference to hams operating ssb and fm voice, cw, packet, etc. and also out of band emissions. Try putting this signal on channel 57 (420-426 MHz, carrier = 421.25 MHz) and see how long it takes for the FCC to shut you down !

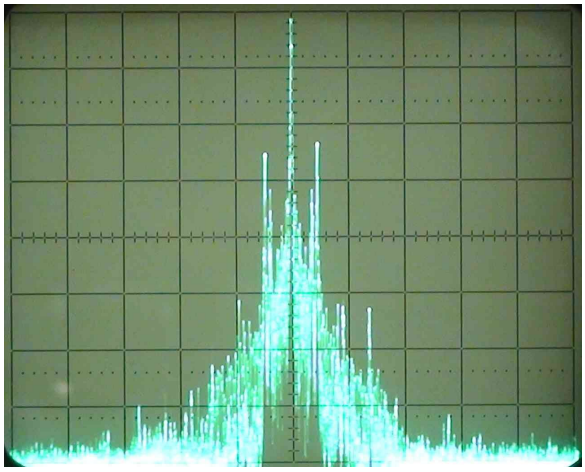

Fig. 2 Spectrum of a typical, commercially available, ham, 70 cm, AM-TV transmitter. (10 MHz/div & 10 dB/div)

The solution that has been used for many years by spectrum conscious TV hams has been to add an interdigital, 6 MHz, channel filter on the output of their AM-TV transmitters. These filters are available commercially from Spectrum International (Concord, MA) and DCI Digital Communications (Canada). They have several disadvantages: (1) Insertion loss of 1 to 2 dB, (2) operation restricted to a single channel, (3) large size (19" rack mount for DCI), (4) weight and (5) high cost. Unfortunately, many TV hams have not bothered to buy these filters for their transmitters. These filters are used on 70 cm, ham

TV repeaters where it is mandatory to use them to achieve the necessary isolation between the input and output frequencies.

KH6HTV VIDEO now offers a different alternative to the interdigital channel filter. This is to start with a VUSB-TV modulator which typically generates, at most a 1 mW (0 dBm) signal and then to use linear amplifiers to boost the power level to a useable level for radiation as a ham TV signal. Fig. 3 shows the typical output spectrum of a KH6HTV VIDEO TV transmitter. It's spectrum is much cleaner than the older AM-TV transmitter, Fig. 2, and most all of it's radiated energy is contained within it's allocated 6 MHz channel bandwidth.

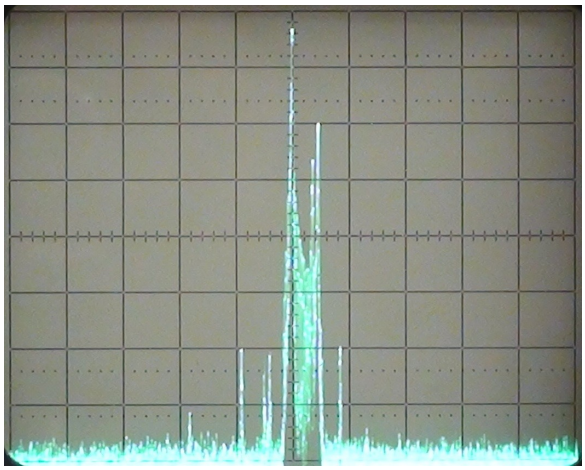

Fig. 3 Spectrum of KH6HTV VIDEO model 70-4, NTSC, VUSB-TV, transmitter (10 MHz/div & 10 dB/div)