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tech tips

Comparison Of VCR Formats

The VC93 ALL FORMAT VCR ANALYZER generates the signals necessary to service both the standard and enhanced formats of VHS, VHS-C, Beta, U-Matic, and 8 MM.

This Tech Tip defines the major differences between these formats, the enhancement to each format, and why these enhancements were developed.

Color Under Format

All standard formats such as VHS, VHS-C, Beta, U-Matic, and 8 MM use a "color under" system of recording. In this system the luminance is separated from the chroma information and sent to circuits to be processed. The luminance signal is then used to FM modulate a carrier before it is recorded on the video tape. The chroma signal is heterodyned with a local oscillator signal to down convert the 3.58 MHz frequency before being recorded on the video tape. This down conversion is where the color under term originated. Refer to Fig. 1.

The color under format is made up of the FM modulated luminance signal and down-converted chroma. Enhancements to each format consist of differences in the FM modulation of the luminance signals. The down-converted chroma signal remains the same as in the standard format.

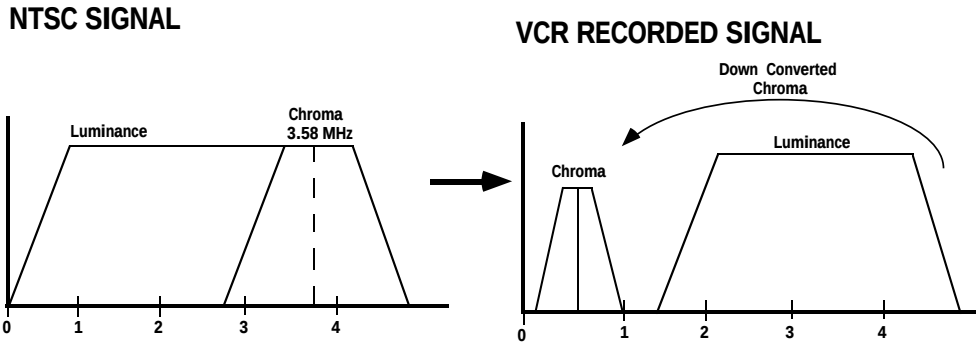
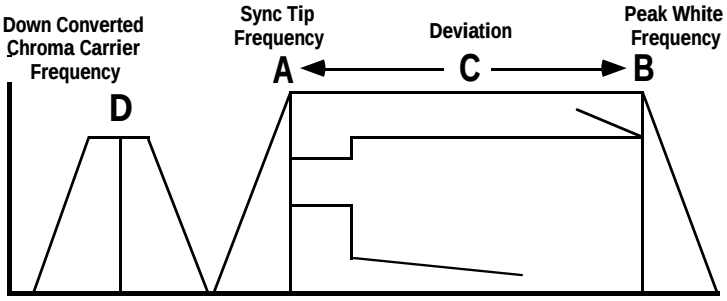


Fig 1: The frequency of the chroma signal is down-converted in the VCR "color under" format.



FORMAT	A (MHz)	B (MHz)	C (MHz)	D (KHz)
VHS	3.4	4.4	1	629
SUPER VHS	5.4	7	1.6	629
VHS - C	3.4	4.4	1	629
SUPER VHS-C	5.4	7	1.6	629
BETA	3.6	4.8	1.2	688
SUPER BETA	4.4	5.6	1.2	688
U-MATIC	3.8	5.4	1.6	688
U-MATIC SP	5.0	6.6	1.6	688
8 MM	4.2	5.4	1.2	743
HI 8	5.7	7.7	2	743

Fig. 2: VCR Format characteristics.

Refer to Fig. 2. This chart defines the modulation characteristics of the recorded video signal used in VCRs. Each column defines a characteristic of the recorded signal; A refers to the frequency of the luminance signal at the sync tips of the video signal, B defines the peak white frequency of the video signal, C refers to the deviation of the FM modulation, and D is the frequency of the down-converted chroma signal. The frequency of each characteristic is not allowed to drift or the signal being recorded will not produce the proper output on the television in playback.

VHS VCR Formats

In standard VHS and VHS-C, the sync tips cause the modulator frequency to drop to 3.4 MHz and the 100% white level causes the modulator frequency to increase to 4.4 MHz. Maximum deviation of the modulated signal equals 1 MHz.

Two limitations occur due to the frequency and deviation limits selected. The lower frequencies of the luminance signal mix slightly with the down-converted chroma signal. In addition, the frequency range limits the resolution to 240 lines. The NTSC signal is capable of 330 lines of resolution.

To improve picture quality (resolution) further, the enhanced formats were developed. Super VHS and Super VHS-C VCRs have higher resolution capabilities by raising the overall frequency of the luminance signal. Thus, the FMed signal is placed farther away from the chroma to reduce luminance and chrominance mixing.

In the case of Super VHS and Super VHS-C, the sync tips produce a modulator frequency of 5.4 MHz with 100% white level producing 7.0 MHz. Maximum deviation of the modulated signal equals 1.6 MHz. Fig. 3 shows the frequency spectrum of the standard and Super VHS & VHS-C formats.

A specially formulated tape is needed to handle the high frequencies. These improvements increase the resolution capability of the enhanced format to 400 lines. The resolution of the "Super" formats exceed the capabilities of the NTSC TV system. For optimum performance, the luminance and chroma signals can be fed to specially equipped monitors through a Y/C connection.

Beta VCR Formats

In standard Beta, the sync tips of the video cause the modulator frequency to drop to 3.6 MHz and the 100% peak white level causes the modulator frequency to increase to 4.8 MHz. Maximum deviation of the modulated signal equals 1.2 MHz (1.3 MHz for Beta I). The maximum lines of resolution for standard Beta is 240 lines.

Again, to improve picture quality, an enhanced format was developed called Super Beta. In Super Beta, only the luminance frequencies are increased to provide greater resolution. The deviation limits and the type of tape used are the same as the standard Beta format. In Super Beta, the sync tips of the video produce modulator frequencies of 4.4 MHz and the 100% peak white level produces a modulator frequency of 5.6 MHz. This increases the resolution to 400 lines. Once again, the resolution capabilities exceeds the capability of the NTSC TV system.

For optimum performance, a Y/C connector is provided to feed the chroma and luminance signals directly to specially equipped monitors. Even though the luminance signals are shifted up, a standard Beta VCR will play back a Super Beta tape and visa versa. Fig. 4 shows the frequency ranges for standard Beta and Super Beta.

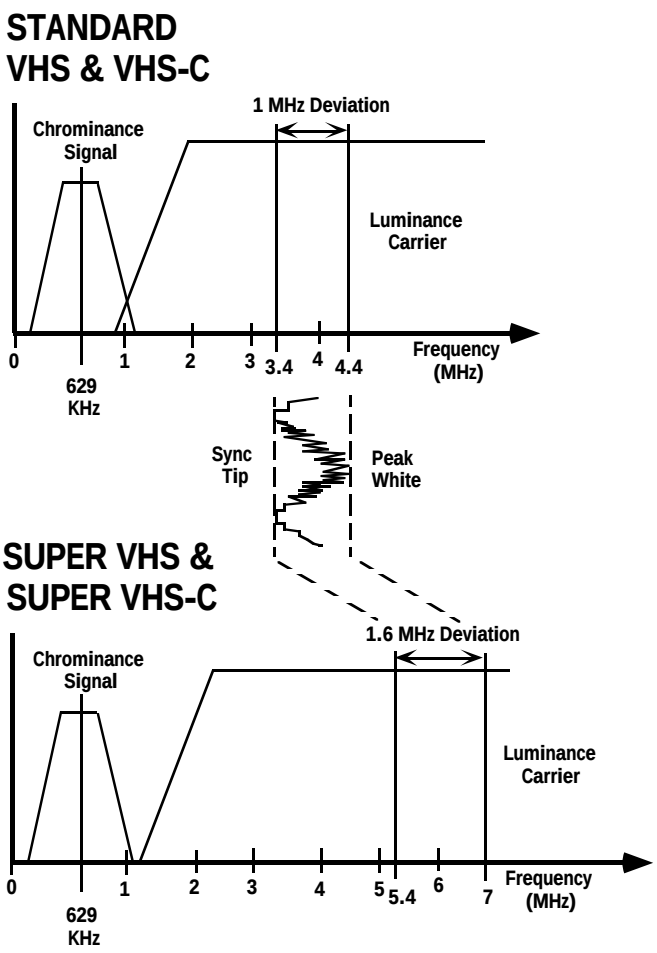


Fig. 3: VHS Super formats raise the luminance frequency to improve resolution from the existing format.

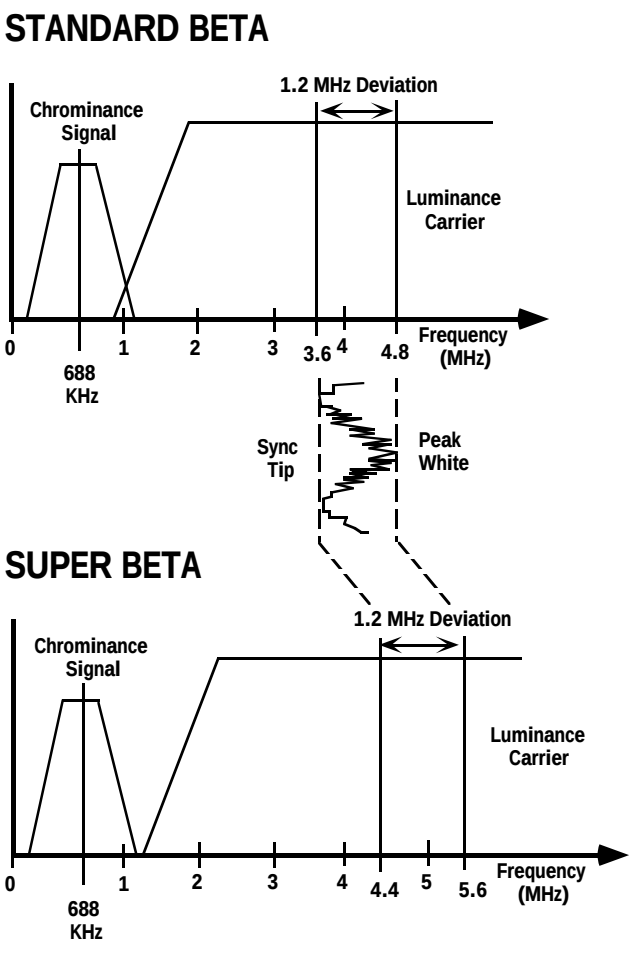


Fig. 4: The Super Beta format raises the luminance frequency to improve resolution from the existing format.

U-Matic VCR Formats

In standard U-Matic, the sync tips of the video cause the modulator frequency to drop to 3.8 MHz and the 100% peak white level raises the modulator frequency to 5.4 MHz. Maximum deviation of the modulated signal equals 1.6 MHz. Total potential lines of resolution for standard U-Matic is 250 lines.

To improve picture quality, an enhanced format was developed called U-Matic SP (Super Performance). In the U-Matic SP format, the luminance signal frequencies are increased to improve resolution capabilities.

The deviation limits, and the tape used, remains the same as in the standard U-Matic format. In U-Matic SP, the sync tips of the video produce a modulator frequency of 5 MHz and the 100% peak white level produces a modulator frequency of 6.6 MHz. U-Matic SP is capable of 330 lines of resolution. Fig. 5 shows the frequency ranges of standard U-Matic and U-Matic SP.

8 MM VCR Formats

In standard 8 MM, the sync tips of the video signal cause the modulator frequency to drop to 4.2 MHz while the 100% peak white level causes the modulator frequency to increase to 5.4 MHz. Maximum deviation of the modulated signal equals 1.2 MHz. For standard 8 MM, the total potential lines of resolution is 272 lines.

To improve picture quality, the Hi-8 format was developed. The Hi-8 format provides higher resolution capabilities by increasing the frequency of the luminance signal and deviation limit.

In the Hi-8 format, the sync tips of the video signal produce a modulator frequency of 5.7 MHz while the 100 % peak white level causes the modulator frequency to increase to 7.7 MHz. Maximum deviation of the modulated signal equals 2 MHz. Fig. 6 shows the frequency ranges of the standard 8 MM and the Hi-8.

A specially formulated tape is used to handle the high frequencies. These improvements increase the resolution to 432 lines. This also exceeds the resolution capabilities of the NTSC TV system. For optimum performance, a Y/C connector is provided to feed the chroma and luminance signals to specially equipped monitors.

For more information,
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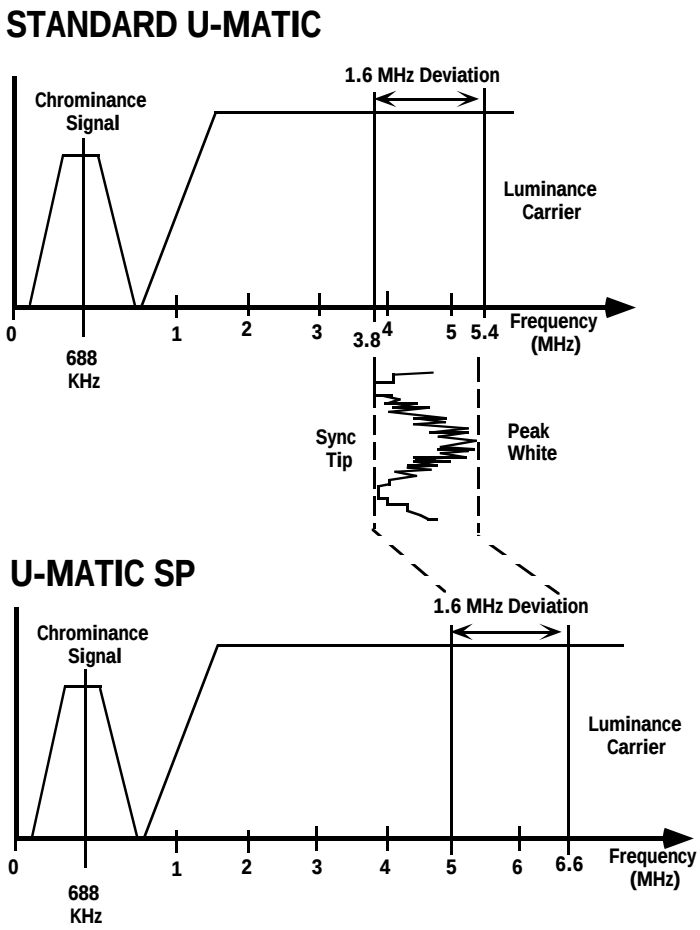

Fig. 5: U-Matic SP raises the luminance frequency to improve resolution from the existing format.

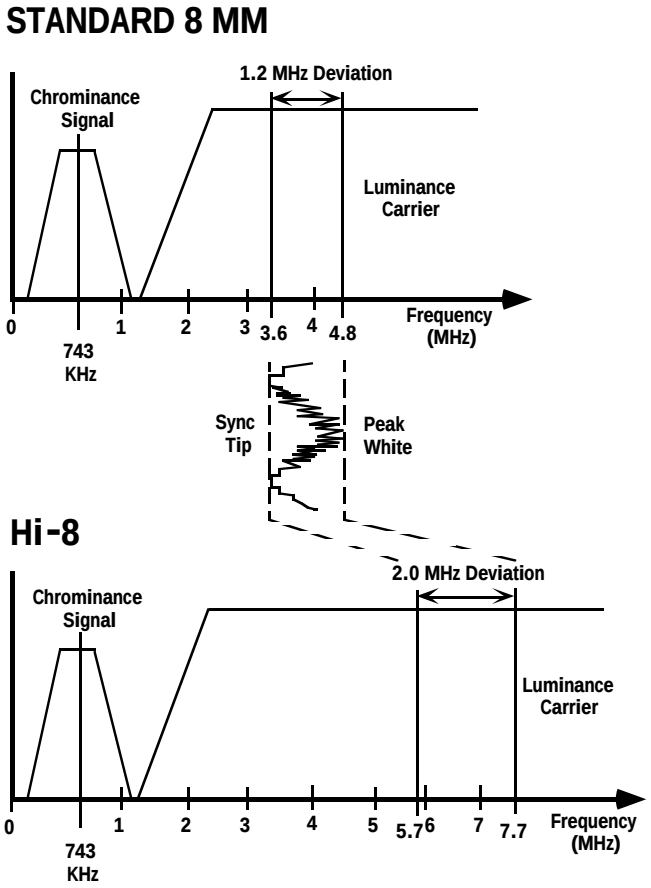

Fig. 6: The Hi-8 format raises the luminance frequency to improve the resolution of the existing format.

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