Answers to Quiz Given Thursday, October 26

Q1 - Why is Noise the Enemy of Compression?

Noise is continuous movement in the signal. The only thing can remove in compression is redundant information. A negligible change in a 10-bit value (even a difference between 1000 and 1001) due to noise causes the compression system to encode this difference.

Q2 – Which color is spatially offset?

Green. Offset by ½ pixel.

Q3 – What parameters would you look for when using a ramp test signal to test camera performance?

Camera Guru Ben sez: "Make sure there is no color in the signal, make sure the levels go from 7.5 IRE to 100 IRE on the WFM."

Diagram 1. If see thickening down near 7.5 IRE. Thickening is sub carrier presence; this is not what we want when injecting equal ramps in all three color circuits. Also, this means that the problem shows up on the left side. If we had a reversed ramp (high left to low right), the problem might still show up on the left side. Look at both the ramp and the chip chart to see if the problem is shading (if thickening is on the left in either case) or black adjustment (if thickening is in black regardless of direction of ramp).

Diagram 2 – shows knee problem. If there is thickening at the top of the ramp, then what? Not due to too much white. There is false color here. If turn off the knee there is no thickening, but with knee on there is thickening, then each color has a knee adjustment, so must adjust all colors (adjust red and blue and balance it out with the green reference).

Diagram 3. Order in analog camera: CCD->PPA (pre-preamp)->PA (preamp) ->VA (video amp) ->Shading->Processor (gamma, detail, etc)->Other Distortions->Encoder

Color bars go into the encoder directly. If see vector scope in the CCU from camera color bars, and they look good, then camera's encoder is properly adjusted. Can't use a chart for color bars; must generate these electronically/electrically. Won't have those colors in nature.

Back to the question. Look for thickening of ramp, which could indicate shading problem.

What if had good ramp, but turned on camera and looked at chip chart and saw lots of thickening on all parts of the chip chart? Only some parts of chip chart would indicate gamma. Assume well lit. Maybe it's gain (too low).

Cameras inject ramp at different places in the camera. The one we studied injects it at the output of the preamp. Other cameras may inject it at other places within the signal path.

Ramp is generated in the CCU, goes up the triax.

In a studio situation, the encoding is done in the CCU, not the encoder board in the camera.

Ramp probably comes from the proc amp (the processor stage in diagram 3).

Where to look at gamma errors in a ramp? Would see thickening in the middle IRE areas. The areas in the ramp are controlled by three different things: gain at 100%, gamma at ~ 50%, black at 7.5 IRE.

Gamma usually happens later (past the VA). Usually in the proc amp (one of the proc amps in the Ikegami, which has 3 proc amps).

Shading could affect the middle; that's where you compare the ramp to the incoming. Recall that shading uses a ramp and a parabola to adjust (left to right or top to bottom). Parabola adjustment assumes center is OK and left/right is wrong. If thick in the middle using both the ramp and the chip chart, have a shading problem.

Handing around the SH (shading board) from the 360 (tube-type). This board is static sensitive. Hold board by perimeter. To take a board from somebody else, touch the person holding the board, then grab the board.

Shading is early in the signal path because it takes care of problems caused by CCD or lens.

Gamma can be turned off. Gamma likely to be in the proc amp. Greek letter (a funky-looking Y). Diagram 4.

Q4. Part of Camera Checked by Color Bars?

Encoder. Color bars are fed directly to the encoder.

Ensure colors fall within their 2% tolerance boxes in the vector scope. Once encoder is correct, then turn off color bars and turn on camera, if then see any color, have problem with signal path from the lens to the encoder. Then will color balance the camera before the encoder.

Gain adjustments on the preamp and on the proc amp. When get to the CCU, the gain is considered to be the iris opening.

Q5 – The knee is used to do what?

It compresses the detail in the white (from 600 IRE down to 100 IRE). We distort the high end in order to maintain the detail.

White clip is something that is good. We do need it on occasion. This isn't a problem like it is in audio. White clip best to be described in an ENG (electronic news gathering) situation. ENG on the street, cars going by, somebody talking about something. If white panel truck goes behind the subject and picks up sunlight, auto iris will make subject too dark. We'd rather put that white panel truck up in clip and keep everything else the same.

A couple of approaches to auto-iris. Some look at the center of the screen. Flesh tone detector kept at 45 IRE even if a white truck or flashlight entered the frame, so good for ENG situations. Engineer has control of what auto-iris looks at; can point it to the subject. Not really a problem in the studio. Will have unpredictable lighting swings outdoors.

Q6 – Thickening of the steps of a video signal waveform of a chip chart on the WFM is an indication of what?

Color (sub carrier) appearing. Take it out by white balancing. Although, should have a camera that looks good without white or black balancing. Start with all CCU controls centered (on Ikegamas) or zeroed (on Sonys) for no influence. Should not have to balance at studio standard 3200K color temperature. Engineer's job to ensure camera works this way.

Outdoor cameras have filters that attempt to bring color temperature to the 3200K default.

Baseline is a chip chart lit flat at 3200K.

Start thinking as if we are in the machine instead of on the outside. We are engineers that are adjusting inside the camera, not just twisting knobs at the CCU.

Gamma handles grays (middle area of luminance). Gamma originally created to compensate for response of CRTs. Gamma lowers noise on the black level, so gamma won't go away even if CRTs go away.

Q7 – Why do we have to define 4 distinct fields (in NTSC)?

The phase difference of the color burst (0 degrees and 180 degrees) as it relates to vertical blanking (whether sync is ½-line shifted or not). Only for the purpose of **editing**. Editors need to know not to make cuts that would separate paired frames.

This happens in line 10. This is our only reference.

1. Subcarrier goes positive (at start of line 10) plus no half-line shift
2. Subcarrier goes negative plus half-line shift
3. Subcarrier goes negative and no half-line shift
4. Subcarrier goes positive plus half-line shift

Q8 – What part of a waveform moves in relation to the rest of the waveform to create interlaced video that can be displayed on a monitor?

Vertical blanking interval. The half-line shift. The actual broad pulse moves half a line.

How do you get interlaced to skip the line? Have 262 ½ lines per field.

Progressive puts 480 lines in one field per frame (525 lines total).

Each field will fill the screen.

The specs for interlacing were developed before this was ever implemented.

The half-line of video is our way of telling if we are on an even field or odd field. It's a marker for us, not the monitor. There is half a line of active video, then a broad pulse (pre-equalizing pulse).

The monitor relies on the vertical sync pulses (the ones between the pre- and post-equalizing pulses) to know when the start of active video is.

Hammerhead is at the bottom of the screen because vertical retrace hasn't happened yet.

The vertical retrace doesn't happen until the actual vertical sync pulses. Even in the lines containing the pre- and post-equalizing pulses, only the first pulse is used (to maintain horizontal sync during the vertical interval); the second pulse is ignored (is part of the hammerhead).

We don't need that first equalizing pulse at the end of the half line; it's just a visual marker for us. The frequency can't double because there isn't any oscillator that can double that fast. Similarly, the frequency can't divide in half because there isn't any oscillator that can do that that fast.

The engineers were just implementing the specification. The spec said there would be a half line at the first line and last line of active video, so they made it so. They didn't have to do that; the engineers could have continued active video through the remainder of the last line. The engineers just left this half line in to comply with the spec and as a visual marker to let us engineers know that this half-line shift is happening and that distinguishes an even field from an odd field.

The position of the vertical sync pulses is key for setting up the monitor. Shifting over the pre-equalization pulses and the vertical interval over is just how these vertical sync pulses are shifted over.

The diagram at ntsc-tv.com at http://www.ntsc-tv.com/images/tv/raster.gif showing trace/retrace/flyback is misleading. Looking at the chart, one would think that retrace starts immediately after finishing the last half-line of active video. In fact, it doesn't start until the vertical sync pulses. Since the vertical sync pulses are offset by half a line, the actual retrace happens at the half line. Since horizontal deflection happens continuously even during the vertical blanking interval (one reason or consequence of having horizontal sync within the vertical interval), at the time the monitor recognizes the first vertical sync pulse, the horizontal deflection is at the midway point, so retrace/flyback starts happening then. The vertical retrace doesn't happen for another three lines, not until after the three lines of pre-equalizing pulses.

Diagram 5 shows the vertically and horizontally shifted video, interpreting horizontal and vertical intervals as video. In each line, the first pulse is horizontal sync and the second pulse is the hammerhead. Six lines of gray (three lines times 2 fields/line). The long black lines are the broad pulses making up the actual vertical sync pulses.

Q9 – Circle only the Vertical SYNC pulse

The broad pulses with the serrations are the actual vertical sync pulses.

Q10 – Define parts of above vertical interval

Pre-equalizing, broad pulses and serrations, post-equalizing

Q11 – Why is line 10 so important?

Where we reference our sub carrier to horizontal relationship.

Q12 – First line of active video

21 (or 20, depending on your point of view, because of the half-line shift).

Q13 – What is the purpose of the larger trailing portion of both the H and V interval?

Meant for retrace. Allows the electron gun in the CRT time to retrace to its start position for the line (H) or field (V).

Q14 – Field 1 is an odd or even field?

Odd. Contains odd-numbered lines.

Q15 – Assume time in microseconds, fill in timing on this diagram between all of the arrows.

Line length is 63.5. 10.9 for width of horizontal blanking interval. 4.7 for width of sync pulse. 4.7 for width of breezeway + burst + back porch. 2.5 for burst width. 1.5 for front porch.

See http://www.ntsc-tv.com/images/tv/sync-wf.gif