Homework Review

Question 1 – Bias light

Used to reduce lag. Placed at the base of the tube. Reduced black noise (stuff that really isn't in the picture) by biasing up to cut off that black noise. Can be inside the prism assembly, where one bias light supports two or three tubes.

Q2 – Modulation Transfer Function

Includes the lens, prism, circuitry. Ability of camera to resolve various frequencies (high and low). How the tube can modulate to give us the waveform we want. Relates to frequency response. For example, somebody's pinstripe suit requires higher resolution. If modulation transfer function is not high enough, will lose detail.

Q3 – Pickup current 240 nA, expected signal voltage high or low?

If put 250 nA through a 100K ohm resistor, how much voltage can drop? IR drop would be pretty small 25 mV. Even at 1M ohm, still only 250 mV. So need a preamplifier for this low signal voltage.

Q4 – What should not move during Focus Rock adjustment?

Take 4x3 picture, as adjust focus it twists the picture. Setting the center of the tube with this adjustment. Ensuring that when look at a chart, the center will stay in focus and the outside will be out of focus. That way you know where the exact center of the tube is. Injects an adjustment voltage instead of us having to move it back and forth. Won't see that in a CCD camera; strictly a tube thing. Focus has to do where the pickup device is in relation to the lens. Back focus compensates for some of that. From center of lens to face of pickup device is focal length. Ensures beam running through center of individual pickup tube.

Q5 – Line by line clamping

Correcting the video blanking to zero volts for every line of video. Reduces low frequency hum and minimizes bounce.

Q6 – Sync Generator provides Signals

H sync, V sync, color sub carrier, camera blanking, system blanking, horizontal-rate clamp pulses, burst flag.

Vertical drive is pulse at 60 Hz. Horizontal drive is pulse at 15734 Hz.

Horizontal Sync vs. Horizontal Blanking

Diagram 1.

See ntsc-tv.com for useful web site. See http://www.ntsc-tv.com/ntsc-index-02.htm for a chart (scroll over a bit – labeled *horizontal sync complex*. Also diagram 1.

Sync pulse is 4.7 microseconds long, 63.5 microseconds apart (that is the time for a line). Horizontal blanking time is 10.9 microseconds. This includes from start of setup to end of setup, includes front porch, breezeway, back porch, burst, sync tip.

Vertical Sync and Vertical Blanking

Diagram 2. Serrations, broad pulses in vertical blanking. Broad pulses make up the vertical sync pulses. The rest are vertical blanking. Line 10 all the way to line 21 is back porch of vertical blanking. Broad pulses 4, 5, and 6. Pre-equalizing pulses lines 1, 2, 3. Post-equalizing pulses lines 7, 8, 9.

Vertical blanking analogous to horizontal blanking. Pre-equalizing pulse analogous to front porch. Serration pulses analogous to sync tip. Post-equalizing analogous to breezeway. 10-21 analogous to back porch. Put closed captioning, VITS/VIRS on these lines 10-21. Back then, took that much time to move the electron beam up to the top of the CRT from the bottom; modern CRTs don't take that much time.

Why serrations/broad pulses and equalizing pulses surrounding them? Maintain horizontal sync during the vertical interval. In CCIR, don't always do this. Lines pre and post hammerhead. Lines 4-6 go to broad pulses. Lines 10-20 are back into video so have normal horizontal sync pulses. Maintains horizontal timing all the time. Does this even though the pulses have varying widths. It is the 50% point of the trailing edge of the horizontal sync pulse.

See the half-line shift between the top line in the diagram and the second line in the diagram. Tells it to start/stop either at the beginning or half-way through the scan. This is how we get interlacing. This is the sole reason we have interlacing is the broad pulse shifts back and forth by ½ line. The color burst on line # 10 lines up four ways: no shift + normal burst phase, shift plus inverted burst phase, no shift plus inverted burst phase, shift plus normal burst phase. This is why we have four fields in an NTSC color frame.

A speaker is a linear motor. Can move the cone anywhere within its allowed movement range.

What is **burst flag**? A pulse that occurs at a horizontal rate. Its timing is critical. Flag happens during when you see burst in horizontal blanking interval. Turns on the sub carrier CW during the back porch. Also called **burst gate**. Horizontal sync and sub carrier are odd harmonics of each other; that's why they alternate phase on the burst for every field.

Europe has 8 fields in PAL where we have 4 fields. A PAL vector scope is way more daunting at first glance. Diagram 3. Have sub carrier, I, Q, colors like we do. Physically change R-Y and burst phase. Also, there are twice the number of squares for colors. This is because the color is switched every other line. Phase alternating line. Advantage is cancellation of hue changes, so they don't need tint/hue controls on PAL monitors/receivers. NTSC approach of tint control is a band-aid.

Burst pulse grows in amplitude (rises slowly) once burst flag/gate is on. The gate happens immediately, so why does the pulse amplitude grow gradually? We have to filter this at 4.2 MHz. Any sharp transition contains huge amounts of harmonics The filter shapes the burst so we don't distribute the harmonics. The filter rounds off the slope provided by the burst gate.

Four Fields in NTSC Color Frame

The four fields make up two frames. However, the phase of the sub carrier within the lines differs so that editors can't split up pairs of frames; they can cut only every other frame. It's a problem for editors and not monitors. The ntsc-tv.com picture of this refers to this as the color **superframe**. Field 1 and field 2 are in frame 1, and field 3 and field 4 are in frame 2. All four frames are in the same color superframe. The color superframe should not be split by editors.

High definition has interlaced, but HD has only two fields since it has no burst (the color information is encoded within the digital pixel information).

RS-170 is a catch-all for interlaced.

Question 7 – Three Factors in Choosing Video Camera

CCD cameras have a lot fewer potentiometers (10 vs. 150).

Price is a factor.

There are many factors. This can depend on studio vs. ENG use.

Q8 – Spatial Offsetting

Offset originally by half a pixel. Green is offset by half a pixel from red and blue to improve resolution. This is Sony's patent.

Q9 – Test signals used in a Camera

Color bars. Sawtooth. Diascope for test patterns. Electronic lens capping.

Color Bars

Main one is color bars – used to adjust encoder. Use vector scope to ensure colors coming out of encoder are correct. Use the tolerance boxes in the vector scope display.

Ramp/Sawtooth

Checking camera from front end of system. Pre-pre amp and preamplifier have to be adjusted and balanced to the rest of the camera.

Q10 – Electrical Structures associated with Pickup Tubes

Q11 – Mechanical Structures associated with Pickup Tubes

Q12 – Sync Generator in Camera Head Locked to Sources

Its own internal crystal oscillator for running *barefoot* without external sync (the camera head can run by itself). An external video or composite sync signal from CCU.

Q13 – Image Enhancement in Tube-type Cameras

Must be used sparingly for natural appearance. Increases modulation depth to 250-300 lines applied by a transversal filter. Detail.

Q14 – Coring

Slices out mid-amplitude range of detail signal so remove noise and low-level detail signals. Helps talent skin from looking too rough.

Q15 – Masking

Color correction. Negative lobes produced electrically by matrix operation.

Q16 – Gamma

Gamma correction compensates for CRT response. Nonlinear adjustment to video signal gain. Correction is inverse of CRT response to make effective response linear. Would suspect that it is the phosphors that respond non-linearly.

Q17 – Peak Black

Level of video corresponding to blackest part of video image. The darkest part of the picture you are seeing.

Q18 – Where do Lenses Differ Between Film and TV Usage?

Back-focal distance greater on video camera lenses; allows space for prism color separators. Where the last lens is in relation to the element.

Iris setting: use T settings in film, F-settings in video. T relates to actual light amount.

Q19 – Pre-knee

Compresses video from the CCDs down to 225% (pickup tubes would burn out if we tried to put that much light into them). Compresses highs of the signal. Still get detail even though we squish it down.

Q20 – Benefits of DSP for Video Cameras

High stability and reliability. Fewer potentiometers. Smaller, lighter weight, less heat. Accuracy can be stored and recalled. Precise alignment. Flexible signal processing and parameter setting.

Q21 – Figure 6.4.4 (B) which items are Analog?

CCDs, preamplifier, video amplifier, analog-to-digital converter. Everything within the marquee is digital.

Q22 – What's the Purpose of the Rest of the Pickup Tube?

Generate, focus, direct the scanning electron beam.

Q23 – DSP means ...

Digital Signal Processing

Q24 – Highlights in Camera Front-end Compressed by?

Pre-knee.

Q25 – Explain figure 6.4.3

Shows how pre knee reduces camera front-end dynamic range through white compression. That way luminance value can fit within a limited bit count. We'd waste bits just trying to do highlights otherwise.

Q26 – What Signal Parameter can be Corrected in the Preamplifier?

HF and MF. High and medium frequencies. Can adjust the high frequency roll off. Relates to resolution. Set for maximum without distorting the output.

Q27 – Enemy of Compression

Noise is the enemy of compression. Noise is random data so it gets captured as differences between frames. Encoder will encode noise as if it were important. Will waste all kinds of space on noise.

Q28 – Special Precautions for Target Ring

Keep it clean. Oils on fingers may cause resistance.

Q29 – 5 Advantages of using Pickup Tube vs. a CCD Imager

No fixed aspect ratio. Continuous imager surface (no anti-aliasing measures needed). Higher resolution.

Q30 – 5 Things Limiting Resolution Using Tubes

Beam alignment. Noise. Beam spot size. Photosensitive layer. Light wavelength. Lenses. Flare.

Q31 – 600% Translates to What IRE Value?

600 IRE. 100 IRE is 100%.

Q32 – Exposure Latitude

The total camera dynamic range.

Q33 – Why Cathode Driven Positive during Blanking

Stop flow of electrons to the target. Prevents electrons from leaving the cathode and traveling to the anode.

Q34 – Three items Contributing to Resolution Loss at Higher H & V Frequencies

Bright or dark situations make it harder to reproduce higher frequencies. In tube itself and the optical system, as said in the book.

Test Thursday

Be prepared for test on cameras. Not too much about really heavy-duty stuff. Tube stuff be aware of surface stuff like the target of a tube. Preliminary cameras.

May be a few questions on monitors.

Handout of Schematics

Compare block diagrams to schematics. Block diagram may explain what the schematic is doing.

5 pages of handouts.