Alignment Procedures Subindex

	Page Number
Color Temperature Adjustment	3-5
CRT Replacement	3-6
Digital Convergence	3-6
Focus Adjustment	3-3
Gemstar Adjustments	3-5
High Voltage Check	3-5
Horizontal Phase Adjustment	3-3
Horizontal Raster Adjustments	3-5
Operating Conditions	3-2
Required Test Equipment	3-2
Service Menu - Error Codes	3-4
Service Menu - Parameters	3-2
Service Mode	3-2
Vertical Raster Adjustments	3-5
X-Ray Shutdown Check	3-2

ALIGNMENT PROCEDURES

Operating Conditions

Unless otherwise noted, the following conditions must be observed when aligning the CTC195 chassis:

1. Chassis must be operated from a 120VAC isolation transformer, with line voltage set to 120VAC (±2.0V).
2. Picture controls (brightness, contrast, etc.) must be set to factory presets via the Picture Quality menu.
3. Procedures must be performed in the sequence given.
4. A 10X probe must be used for oscilloscope and frequency measurements.
5. Minimum warm-up time is 10 minutes.

Required Test Equipment

- Dual-Trace Oscilloscope
- Digital Voltmeter
- Frequency Counter
- Audio Signal Generator
- NTSC Signal Generator (B&K 1249, or equivalent)
- MTS Signal Generator (B&K 2009, or equivalent)
- Sweep/Marker Generator (or Standard Signal Generator)
- TAG001 Service Generator (stock # 215568)
- DC Power Supply (5.0V/0.25A) for TAG001
- Chipper Check® software
- Chipper Check® interface box and computer

All alignments with the exception of basic color temp and geometry require the use of Chipper Check® software and interface box.

X-Ray Shutdown Check

The following procedure should be performed prior to, and upon completion of service:

1. Momentarily apply a short between the shutdown test point (BC14901- located at back edge of chassis near main tuner) and chassis ground (main tuner shield). The instrument must shutdown immediately, then turn back on after ~ 2 seconds.
2. Apply and maintain a short between the shutdown test point and chassis ground (tuner shield). The instrument must shutdown immediately and remain shutdown (the instrument will attempt to restart several times, then remain off).
3. Remove the short from BC14901.
4. Enter the **Service Mode** and reset the error code parameter(s) to "0".

Service Mode

Most of the alignments for this chassis are software-driven; adjustments are made by modifying parameter values using Chipper Check and the service menu. When parameter values are modified, the corresponding T-chip registers, tuner registers and EEprom locations are updated.

A list of the software alignment parameters accessable using the front panel is shown in Table 1. The remainder of the alignments require Chipper Check®.

Entering the Service Mode Using the Front Panel Controls

1. Press and release the POWER button to turn the instrument on.
2. Press and *hold* the MENU button.
   a. Press and release the POWER button.
   b. Press and release the VOL+ button.
3. Release the MENU button.

The instrument will display the following menu:

P: 0 V: 0

The CH ∧ and CH ∨ buttons on the front panel (or the remote transmitter) are used to change the parameter (P) number. The VOL + and VOL - buttons are used to change the parameter value (V).

NOTE: Attempting to change the parameter number (using CH ∧ or CH ∨) at this point will cause the instrument to exit the service mode. A valid security code must be entered (using VOL + or VOL -) before selecting an alignment parameter.

Security Codes

When the service mode is first turned on, the parameter will be "0", which does not correspond to an alignment. This is the security code parameter, the purpose of which is to prevent accidental entry into the parameter groups. The value for parameter "0" must be set to 76 for Front panel access to chassis alignments, 80 for Front panel (remote control) convergence or to 200 for Chipper Check®.

Once a security code has been set, pressing CH ∧ or CH ∨ will result in the following display:

P: YY V: ZZZ

Where: YY = parameter number
ZZZ = current value

At this point, the CH ∧ and CH ∨ buttons can be used to change the parameter number and the VOL + and VOL - buttons can be used to change the value of the parameter selected.

ALIGNMENT PROCEDURES (Continued)

Error Codes

If certain failures occur in the chassis, error codes will be stored in the chassis EEprom. These error codes are displayed in parameters "1", "2" and "3". Parameter "1" stores the error code for the first failure experienced by the instrument. Similarly, parameter "2" stores the error code for the second failure. Parameter "3" is automatically updated to display the error code for the most recent failure experienced by the instrument. Error codes are summarized in Table 2.

The presence of a "0" in the error code values indicates that no failures have occurred since the time when the error code parameters were reset. These error codes can (and should) be reset to "0" after servicing with the VOL + and VOL - buttons.

Because a failure of a bus IC is a possible reason for needing service, normal acknowledgment checking is disabled in the service mode. If an IIC device has failed, its address will be stored in the error code area.

Exiting The Service Mode

The service mode can be exited at any time by pressing the POWER button. No additional steps are required to write new data into the EEprom(s); new data is entered as parameter values are changed.

CHASSIS ALIGNMENT

The CTC195 chassis requires the use of ChipperCheck®, a TV/PC interface box, and a suitable computer (min. 486DX/33MHz PC with 8Meg memory recommended) for the majority of the alignments. Basic geometry and color temperature are the only alignments accessable through the front panel. These adjustments have been included in this service manual as front panel procedures but can also be performed using ChipperCheck®.

ChipperCheck® software and the TV/PC interface box are available from:

TCE Publications
10003 Bunsen Way
Louisville, KY 40299
Tel. 502-491-8110

Instructions for the operation of ChipperCheck® software and connection of the TV/PC interface are included as context-sensitive help files in the ChipperCheck® software.

Horizontal Phase Adjustment

Test Points:	TP12704 (Luma)	Main PCB
	TP14303 (Filament)	Main PCB
Adjust:	Parameter #4	Range: 0 - 15

1. Tune the instrument to receive the color bar signal.
2. Connect the CH1 scope probe (100mV/2µsec/div.) to TP12704 (pin 38 of U16201); use the tuner shield as ground reference.
3. Connect the CH2 scope probe (100V/div.) to TP14303 (pin 8 of T14401).

Parameter	Description
0	Security Pass
1	Error Code
2	Error Code
3	Error Code
4	Horizontal Phase
5	EW DC (Horizontal size)
6	Pincushion Amplitude
7	Pincushion Tilt
8	Pin Top Corner Correction
9	Pin Bottom Corner Correction
10	Vertical Centering
11	Vertical Size
12	Vertical Countdown Mode
13	Red Bias
14	Green Bias
15	Blue Bias
16	Red Drive
17	Green Drive
18	Blue Drive
19	Gemstar OSD Horizontal
20	Gemstar OSD Vertical
21	Gemstar Horizontal PIP
22	Gemstar Vertical PIP
23	Gemstar PIP Window Vertical

Table 1 - Service Menu Parameters

4. Adjust *Horizontal Phase* (parameter #4) so that the time delay between the leading edge of horizontal sync (CH1) and the midpoint of the filament pulse (CH2) is 4.68µsec (± 0.5µsec), as shown in Figure 1.

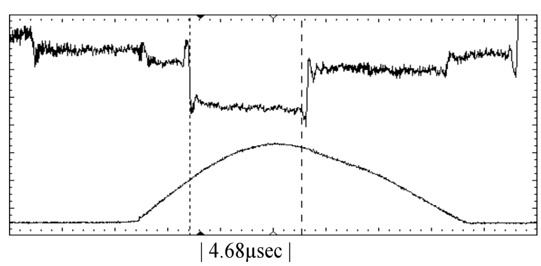

Fig. 1 - Horizontal Phase Adjust

Focus Adjustment

Test Point:	Observe Display	
Adjust:	Focus Control(s)	Main PCB

1. Tune the instrument to receive a crosshatch signal.
2. Cover the red and blue lenses.
3. Adjust the *Green Mechanical Focus* control, located on the CRT assembly for best overall focus.
4. Adjust the *Green Electrical Focus* control, located behind the speaker grill for best overall focus.
5. Repeat procedure for the red and blue CRT's.

Error Code	Chassis	Error	Device	Condition
0	All	Power OK		No Error Codes Thrown
1	All	16V Standby Supply	Micro	16V Standby supply below 12V
2	All	5V Run Supply	Micro	5.1V supply low
3	All	12V Run Supply	Micro	12V supply low
4	All	Run Supply Dip	Micro	Run supplies have fallen below standard levels less than 500 mSec
6	w/PAL/PIP	PAL\PIP Matrix Switch	U8100	Failure to receive ack from PAL\PIP Matrix Switch
8	All	XRP	U6201	XRP detected by T4
9	All	T4 POR	U6201	Power On Reset at T4
10	w/FPIP	FPIP POR	U8100	Power On Reset at FPIP
11	All	Stereo Decoder POR	U1600	Power On Reset at Stereo Decoder
12	All	AVR Latched	Micro	AVR input to micro held low
16	All	I2C Run bus Latched	Micro	Run I2C clock or data line clamped at logic 0
17	All	I2C Standby bus Latched	Micro	Standby I2C clock or data line clamped at logic 0
18	w/StarSight	I2C StarSight bus Latched	StarSight Module	SS I2C clock or data line clamped at logic 0
34	w/StarSight	StarSight Fault	StarSight Module	Failure to receive ACK from SS
44	w/FPIP	FPIP Fault	U8100	Failure to receive ACK from FPIP
56	w/Digital Convergence	Digital Convergence I2C bus		Failure to receive ACK from Digital Convergence Module
64	w/2nd Tuner	2nd Tuner DAC bus fault	U7902	Failure to receive ACK from 2nd Tuner DAC
128	All	Stereo Demodulator	U1600	Failure to receive ACK from Stereo Demodulator
130	w/Audio Compressor	Audio Compressor	U1501	Failure to receive ACK from Audio Compressor
134	All	Video Matrix	U6901	Failure to receive ACK from Video Matrix Switch
138	w/PAL/PIP	PAL\PIP C1 bus	U8100	
142	w/PAL/PIP	PAL\PIP C2 bus	U8100	
160	All	EEPROM bus	U3102	Failure to receive ACK from Main or 2nd Tuner EEPROM
186	All	T4 Chip	U6201	Failure to receive ACK from T4
192	w/2nd Tuner	2nd Tuner PLL	U7401	Failure to receive ACK from 2nd Tuner PLL
194	w/2nd Tuner	2nd Tuner DAC	U7902	Failure to receive ACK from 2nd Tune DAC
196	All	Main Tuner PLL	U7501	Failure to receive ACK from Main Tuner PLL
198	All	Main Tuner DAC	U7501	Failure to receive ACK from Main Tuner PLL
220	w/Decoder Interface	Decoder Interface		

Table 2 - Service Menu Error Codes

ALIGNMENT PROCEDURES (Continued)

Color Temperature Adjustment

Test Point:	Observe Display	
Adjust:	Parameter #13 (Red Bias)	Range: 0 - 127
	Parameter #14 (Green Bias)	Range: 0 - 127
	Parameter #15 (Blue Bias)	Range: 0 - 127
	Parameter #16 (Red Drive)	Range: 0 - 63
	Parameter #17 (Green Drive)	Range: 0 - 63
	Parameter #18 (Blue Drive)	Range: 0 - 63

1. From the customer control menu, reset the customer controls with "Picture Reset".
2. Tune the instrument to receive a gray staircase signal.
3. Set the Color bias parameter values to 63.
4. Set the Drive parameter values to 45.
5. Adjust the screen controls to just light the gray bar immediately next to the black bar without lighting the black bar.
6. Use the bias controls as a fine adjustment of the gray bar. No red, green or blue tinting should be apparent on the low light areas of the screen.
7. Enter parameter #s for the color drive controls (16 for red, 17 for green and 18 for blue) and adjust for proper white balance of the high light areas.
8. Check the low light to high light gray staircase tracking (black to white picture). Should any color other than gray or white be dominant in low light to high light areas the color temperature has not been properly set. Repeat the procedure if necessary.

NOTE: Color bias adjustments affect the low light (dark) areas while color drive adjustments affect the high light (white) areas.

9. Press the Power button on the front panel to initiate the AKB setup and exit the service mode. The screen will momentarily flash either green or red. If the screen flashes green the AKB setup is properly set. If the screen flashes red, AKB did not setup properly. In many cases the screen controls are set either too high or too low. Repeat the procedure with a slightly different setting of the screen controls. *AKB setup must exit with a green screen. If the alignment is exited with a red screen, AKB will return to original values and remain at those values until AKB is properly setup and exited with a green screen.*

High Voltage Check

High voltage for this chassis is *not* adjustable. To check high voltage, connect the positive lead of a voltmeter (using a high voltage probe) to one of the picture tube anodes. Connect the negative lead to the picture tube ground strap. The meter used for measuring high voltage must have an impedance of 1000 Mohm or more and be accurate within 5%.

Nominal high voltage (at maximum beam current) for this chassis is 37.1kV.

Maximum high voltage for this chassis is 38.3kV.

Gemstar Adjustments

1. Set parameter 20 to value 39, parameter 22 to value 45 and parameter 23 to value 3.
2. Adjust the *Gemstar OSD Horizontal* adjustment (Parameter #19) to center the Gemstar OSD display. The display will appear once any of the Gemstar parameters are selected and the value changed.
3. On models with PIP, adjust the *Gemstar Horizontal* adjustment (parameter #21) to best center the PIP display with respect to the Gemstar PIP window.

Note: Adjusting any of the Gemstar parameters will delete any TV guide information stored.

Horizontal Raster Adjustments

Test Point:	Observe Display	
Adjust:	Parameter #5	Range: 0 - 31
	Parameter #6	Range: 0 - 15
	Parameter #7	Range: 0 - 15
	Parameter #8	Range: 0 - 7
	Parameter #9	Range: 0 - 7

1. Select *Horizontal Size* (parameter #5) and adjust the raster such that the border lines on the outside of the pattern just touch the frame, making certain they are as much visible as possible.
2. Adjust *Pincushion Amplitude* (parameter #6) for straight vertical crosshatch lines at the left and right edges of the display. *Look only at the middle section of these lines at this time.* The top and bottom ends of the lines will be adjusted in the following steps.
3. Viewing the bottom left and right corners of the display, adjust *Pincushion Bottom Corner* (parameter #9) for straight vertical lines.
4. Viewing the top left and right corners of the display, adjust *Pincushion Top Corner* (parameter #8) for straight vertical lines.
5. Viewing the left and right edges of the display, adjust *Pincushion Tilt* (parameter #7) so that the vertical crosshatch lines are parallel to the sides of the picture tube mask.

Vertical Raster Adjustments

Test Point:	Observe Display	
Adjust:	Parameter #10	Range: 0 - 63
	Parameter #11	Range: 0 - 127
	Parameter #12	Range: 0 - 3

1. Adjust *the Vertical Size* (parameter #11) so that the fourth vertical line from the outside just touches the top and bottom frame.
2. Vertical Centering (parameter #10), is adjusted at the factory to provide 0 yoke current at line 141 of the first field of video and should not be adjusted.

Note: Vertical countdown (Parameter 12) must be set properly (normally 0):
0 = standard
1 = non-standard
2 = 50Hz
3 = 48Hz

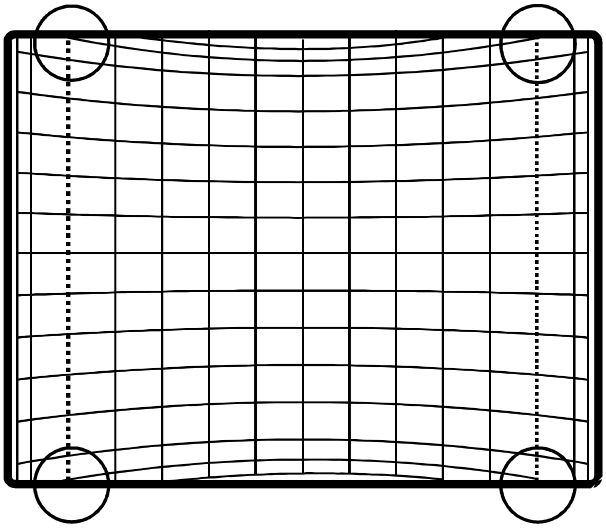

Fig. 2 - Vertical Size Adjust

CRT Replacement

CRT replacement may be broken down to the replacement of the center (green) CRT or one of the outer (red or blue) CRT's. When any CRT is changed, not only are the electrical characteristics of the replacement CRT different from the tube that was replaced, but it would be almost impossible to place the new CRT back in the exact physical location of the old one. Therefore, some mechanical and electrical "tweaking" may be needed.

Since both the red and blue patterns depend upon the correct placement of the green, failure of the green CRT becomes the more critical problem. The only customer size and centering control that shows a full screen patten for picture geometry is the green one. The remaining centering controls for the blue and red pattern require aligning them to the green one.

The steps after replacement of the green CRT are:

1. Adjust the electrical and mechanical lens focus. Use the crosshatch pattern available from the convergenge pattern displayed by entering the serviceman menu and selecting P:80.
2. Center the horizontal and vertical customer convergence controls in their range by:
   a. Using Chipper Check and moving the green centering buttons to the midrange value or,
   b. Using the green customer centering controls, move the centering pattern throughout its range, noting the limits, then choosing an approximate center.
3. Return to the convergence alignment pattern at P:80 and align the green CRT rotation and centering rings to place the green pattern over the blue and red patterns.
4. Using the customer convergence menu for green centering, observe the border lines. The lines should be just inside the frame around the screen. A 70-80% accuracy for this border is acceptable. If not, adjust the pattern using the customer centering controls.
5. Perform the picture geometry alignments as needed (Vertical/horizontal raster adjustments).

Red/Green/Blue CRT Replacement

In some cases, all three CRT's may have been removed. When they are replaced, there will be no references to which the CRT's may be compared to. In those cases, the following procedure may be used.

1. Using Chipper Check, access the R/G/B crosshairs (centering) and align the "Optical" and then "Electrical" focus on each tube. It may be necessary to loosen the yokes and rotate them slightly to adjust a tilted picture.
2. Mark mechanical center of PTV screen using strings. Begin with the green CRT. Using the crosshair pattern of Chipper Check, use the CRT centering ring magnets to bring the crosshair to mechanical center. NOTE: First, bring the magnets together and rotate the assembly 360 degrees around neck of tube to bring the crosshair as close as possible to the marked mechanical center (where center strings cross). If proper centering cannot be reached, begin separating the magnets to bring the crosshair to exact mechanical center. Once the green CRT is done, move to the red, then the blue carefully centering the crosshair pattern to the center of the screen.
3. Once optical and electrical focus and mechanical centering is done, perform all "Chassis Geometry".
4. After Chassis Geometry is complete, perform the "25 Point" Chipper Check adjustment.
5. After the "25 point" procedure the strings may be removed and the full DigiCon adjustment pattern may be accessed to perform the fine-tuning adjustments on the pattern.
6. Recheck overall focus and chassis geometry adjustments to make certain nothing has changed dramatically. Minor adjustments may be made, but if specific areas of the screen seem to be off more than 1/8 inches, begin this procedure again.

Digital Convergence

1. Enter the green customer centering menu selection and observe the border pattern. It should lie just within the frame of the set. Using the customer centering controls, move the pattern to the center of the screen. If 70–80% of the pattern is visible close to the frame, do not adjust further. If less border is showing, return to the geometry adjustments and begin again.
2. Recheck red centering using the red customer centering menu. The green crosshair should now lie on top of the red. Use the red centering control to move the crosshair on top of the green.
3. Recheck the blue centering using the blue customer centering menu. The blue crosshair should now lie on top of the green. Use the blue centering control to move the crosshair on top of the green.
4. Course adjustment is now completed. Enter the service menu again, this time going to V:80. Press CH UP and the digital convergence pattern should appear on the screen. Fine adjustment of the pattern can now be done. It is not possible to adjust the green CRT pattern. Instead, the red and blue patterns will be adjusted to the green. The cursor

showing the intersection being adjusted, will be yellow for the red adjustments and cyan for the blue adjustments. Color selection may only be done by pressing the DISPLAY or INFO button on the remote control.

The CHANNEL and VOLUME buttons on the remote move the cursor from one adjustment intersection to another. The MOVE buttons adjust the position of the selected pattern. The PWR button returns normal operation of the set.

EEPROM Replacement

There are two EEPROM's in the CTC195 whose failure represents problems for the digital convergence circuitry. The first is the DigiCon EEPROM, which affects all convergence alignments. The second is the main chassis EEPROM, which affects the geometry alignments. Although Chipper Check will initialize a replacement EEPROM with nominal values, until a complete alignment is done, picture quality may suffer.

Main EEPROM Replacement

Since the main EEPROM contains all the chassis geometry alignments, these adjustments are the only ones that need to be checked.

DigiCon EEPROM Replacement

All the DigiCon alignment values are stored in the DigiCon EEPROM. Further, the anti-banding calculations are also here. If the EEPROM values can be stored by Chipper Check before the replacement of the EEPROM, no further alignments should be necessary. However, since a decision has been made to replace the EEPROM, the data values contained should be assumed to be corrupt. Since chassis geometry has not changed, the front panel digicon controls (P:80) may be used to bring convergence back to some degree, however, the DigiCon IC has no way to calculate the anti-banding values. Chipper Check must be used to do this. Therefore, if a DigiCon EEPROM needs replaced, Chipper Check is the only way to bring the set back to factory specifications, restoring acceptable consumer performance.

The steps to restore the set to proper specifications and alignments after a DigiCon EEPROM replacement are:

1. Unplug the R/G/B yoke plugs. This will save a power supply overload because the DigiCon IC will rail the power output transistors against the power supply if the EEPROM is blank.
2. Connect Chipper Check and place the set into service mode.
3. Using the initialization file in Chipper Check, transfer those files to the DigiCon EEPROM. This sets the DigiCon EEPROM data to a nominal set of values allowing set operation with no danger to DigiCon circuitry.
4. Power down the set and reconnect the R/G/B yokes.
5. Enter service mode using Chipper Check.
6. Perform the Band Gap adjustment. (Set voltage across R19539 to exactly 1 volt using as accurate a meter as available.)
7. Using Chipper Check, enter the consumer green centering adjustment and check for accuracy. Boundaries need not be perfect, but at least 80–90 % of the boundary lines should lie very close the physical frame of the set. If they are not acceptable return to the chassis geometry alignment procedures.
8. Measure and mark the physical center of the screen. It is acceptable to measure the distance from the inside of the frame holding the screen and divide this length by 2. For example, if the screen measures 36 $^{5}/_{8}$" from one side to the other inside the frame, the physical center of the screen will be 18 $^{5}/_{16}$". Mark this point at the top and bottom of the screen, the place a string or other suitable reference between the two marks. This will serve as the horizontal center reference line.
9. In the same manner, measure and mark the vertical physical center by measuring the screen distance from inside the frame from the top to the bottom.
10. Now that the exact center of the screen is known, place the remainder of the convergence reference strings on the screen by measuring outward from the center lines. Chipper Check will provide the exact dimensions for the final 4 vertical and 6 horizontal lines.
11. Check the green screen geometry first, making certain the pattern is centered to the strings. No more than slight adjustments should be needed at this point. If there appear to be large discrepancies in the location or orientation of the pattern, return to the geometry adjustments and begin course alignment again.
12. Chipper Check will now allow the technician to begin the dynamic alignment of the green pattern using a preset configuration. The horizontal control at each alignment point should be set first, followed by the vertical.
13. Move through the complete pattern as allowed by the software.
14. When the pattern is aligned to the specifications, Chipper Check will perform the anti-banding, interpolating the values for lines that lie between the alignment strings. The pattern should appear to have perfect squares centered on the screen at this point.
15. If the pattern looks satisfactory, the alignment strings may be removed. If it does not, go back to step 13 and repeat the sequence until the screen alignment is acceptable.
16. Move to the red pattern and perform mechanical centering to the green pattern, if necessary. Then perform electrical alignment of the red pattern to the green according to the preset route of Chipper Check.
17. Move to the blue pattern and perform mechanical centering to the green pattern, if necessary. Then perform electrical alignment of the red pattern to the green according to the preset route of Chipper Check.
18. When the patterns are adjusted to specifications, exit the alignment and move to the full screen convergence pattern. This provides access to all adjustment points and enables the technician to perform additional "fine-tuning" of the convergence pattern. Chipper Check will now allow a "random" access to any crosspoint of the convergence pattern.
19. When the adjustments are complete, exit the Digital Convergence section of Chipper Check. All alignment data will be written to the new EEPROM.

ALIGNMENT PROCEDURES (Continued)

DigiCon IC Replacement

The DigiCon IC stores all alignment data in the DigiCon EEPROM. During any power up, these values are retrieved and stored in RAM (Random Access Memory) in the IC during the operation of the set. The geometry settings for the set are located in the main EEPROM and used by the T-Chip. There is only one adjustment needed upon replacement of the DigiCon IC. The proper steps are:

1. Power the set back up and perform the Band Gap Adjustment with Chipper Check. (Set the voltage across R19539 to exactly 1 volt.)
2. Check the screen converge with the full-screen digital convergence pattern. Touch up as necessary.

NOTE: Once the band gap adjustment has been made, Chipper Check is not required to touch up the convergence alignments. Parameter 80 from the front panel may be used.
No major adjustments in either the geometry or convergence should be required.