454 Cal Outline

1.	-12 v Supply (R1124)	±.032 v, 2 mv ripple
2.	1 v Calibrator (R1158)	Remove Q1275 and adj 12 v supply for 1 v ± .003 v at Cal Output
Reinstall Q1275		
3.	12 v Supply	12.0 - 12.2 v, 2 mv ripple
4.	75 v Supply (R1188)	± .278 v, 2 mv ripple
5.	H.V. (R1401)	-1960 v ±58.8v
6.	CRT Grid Bias (R1447)	Set Intensity for 12 v at TP1349. Use Single Sweep. Adj for very dim spot.
7.	Z Axis Comp (C1352)	Probe TP1349 with 10x probe. Use approx. 1.5 v of signal.
8.	Trace Rotation	Located at right side.
9.	Y Axis Alignment (R1485)	Located left rear of scope.
10.	Geometry (R982)	Located bottom rear of scope.
11.	Astigmatism	Located at right side.
12.	Step Atten Bal (R21, R121)	No shift 20 to 5 mv/div.
13.	100 mv Step Atten Bal (R28, R128)	No shift 50 mv to .1 v/div.

Interaction: Recheck step 12.

14.	Vertical Centering (R334)	Center traces in Chopped with Vert Pos, then center traces in Added Mode with R334.
15.	Grid Current	.4 div at 5 mv.
16.	Position Centering (R40, R140)	Adj for -6.2 v on pins Y and AJ with Position Controls. Center traces with R40 and R140.
17.	Output Amp Gain (R365)	Early instruments: Set for maximum. (Back off from end of pot) Late instruments: Center front panel gain and adjust R365 for proper display at 20 mv/div.

1. -12 v Supply (A1A4)	8 .038 v, 2 mv ripple
2. 6 v Calibrator (A1B5)	Remove A1A5 and adj 12 v supply for 1 v = .003 v/v Cal output
3. 12 v Supply (A1A5)	12.0 - 12.2 v, 2 mv ripple
4. 17 v Supply (A1A6)	4 .470 v, 2 mv ripple
5. 4 V. (A1A1)	-1.50 v ± 50 mv
6. CRT Grid Bias (A4A1)	Set Intensity for 12 v at TP13(4). Use single sweep. Adj for very dim spot.
7. A Axis Comp (C132a)	Probe TP13(4) with 10X probe. Use approx. 1.5 v of signal.
8. Trace Rotation	Located at right side.
9. X Axis Alignment (A1A6)	Located left rear of scope.
10. Geometry (C12a)	Located bottom rear of scope.
11. A Deflection	Located at right side.
12. Amp Atten Cal (A2A1, A2A2)	Adj Gain 20 to 5 mv/div.
13. 100 mv Step Atten Cal (A2A1, A2A2)	Adj Gain 20 mv to .1 v/div.

Intensifier: Scopeck every 1d.

14. Vertical Centering (A2A4)	Center traces in Chopped with Vert Pos; then center traces in Added Mode with A32A.
15. Grid Current	.5 div at 5 mv.
16. Intensifier Centering (A2A4)	Adj for -6.2 v on pins Y and Z with Intensity Controls. Center traces with A40 and A10.
17. Output Amp Gain (C32a)	Early instruments: Set for maximum. (Back off from end of pot)
	Late instruments: Center front panel gain adjustment (A9) for proper display at 20 mv/div.

18. Gain — Early instruments: Use 20 mv/div.

19. AC-DC-Gnd Switches

20. Added Mode — Use 50 mv Cal Signal from Test Scope.

21. Deflection Accuracy — ± 3%

22. Ch 1 Out DC Level (R52) — Ch 1, 20 mv--Ch 2, 10 mv--Center both traces in Gnd. Adj R52 for 0 v at Ch 1 Out.

23. Cascaded Deflection — Less than 1 mv/div

24. Var v/div Pots

25. Compression and Expansion — Use 2 div of signal. Both channels for 0.15 div max.

26. Alternate and Chopped — Chop Rate: 1 mHz ± 20%

27. V/div Compensations

	Ch 1		Ch 2	
v/div	corner	top	corner	top
.1 v	-	C9	-	C109
.2 v	C5D	C5A	C105D	C105A
2 v	C6E	C6A	C106E	C106A

Not always necessary to perform steps 28 and 29.

28. Delay Line Compensations — Use 106 + Output
C402---290 ns after rise.
R417, R419---Minimum tilt of waveform top.

Interaction: Recheck Gain, step 18.

29. Output Amp Compensations — Use 109 or 110 with special test fixture. (4 div or signal)

C353, R353	Optimum risetime and flat top.
C426, R426	Optimum square corner.
L394, L494	Smooth top after 6 ns.
R394, R494	Remove fast wrinkles.

Use R334 to position trace and repeat step 14 when complete. Output amp should make approx. 2 ns risetime.

1. Gain	Ta 1V instruments: Use 20 mv/div.
1b. AC-DC-Gnd Switches	
2a. Added Trace	Use 20 mv Cal Signal from Test Scope.
2b. Deflection Accuracy	± 3%
2c. Ch 1 Out DC Level (X2)	Ch 1, 20 mv--Ch 2, 10 mv--Center both traces in Gnd. Adj HS2 for 0 V at Ch 1 out.
2d. Channel Isolation	Note when 1 mv/div
2h. Max V/div Trace	
2j. Horizontal and Magnifier	Use X div of signal. Both channels for 0.1 div max.
2k. Alternate and Chopped	Chop rate: 1 kHz ± 20%
2l. V/div Compensations	

V/div	Ch 1 corner	Ch 1 top	Ch 2 corner	Ch 2 top
.1 V	-	CP	-	CLOP
.2 V	CP0	CP4	CLOP0	CLOP4
2 V	CP5	CP4	CLOP4	CLOP4

Not always necessary to perform steps 2b and 2k.

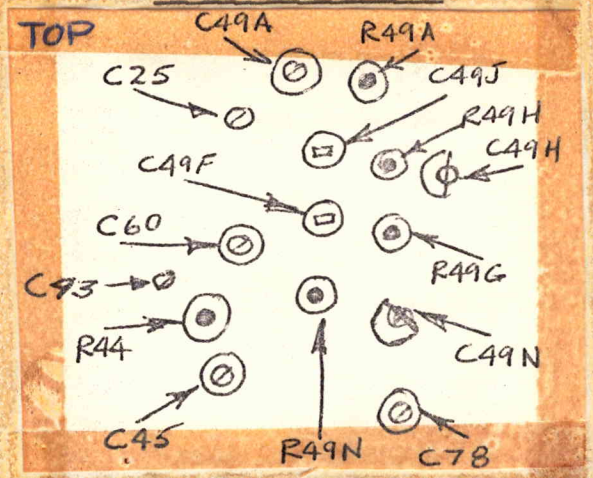
4b. Delay Line Compensations	Use 10V + Ohmpot. OP02---2V0 on after plus. OP17, OP18---Minimum ring of waveform top.

Interaction: recheck Gain, step 1b.

4c. Output Amp Compensations	Use 10V or 1V0 with special test fixture. (4 div or signal)
OP23, HS32	Optimum flattening and flat top.
OP20, HS30	Optimum square corner.
OP24, HP04	Smooth top after c to.
OP25, HP05	Remove fast wobbles.

Use HS34 to position trace and repeat step 1b when complete. Output amp should take approx. 2 ms flatline.

30. H.F. Compensations



Notes:

1. C44, R44, C78 affect all ranges.
2. Channel 2 adjustments have #1 immediatly after letter, ie: C145, R144, etc.
3. Pulse abberations are measured between risetime top and 50 ns after 50% point of step.
4. Adjustments in parentheses indicates interaction with previous positions.

V/div	Adjust	Max % abberations
20 mv	C45, R44, R49H, C49H, C78, C49J	5
10 mv	C49F, R49G, (C45, R44, C78)	6
5 mv	C49A, R49A, (C45, R44, C78)	7
50 mv	C49N, R49N, C43, C60, (C45, R44, C78)	5
.1 v	C25 (C45, R44, C78)	7
.2-10 v		7

31. Bandpass

mv/div	Bandpass	Risetime
20	150 mHz (approx 3.3 div at 100 mHz)	2.4 ns
10	100 mHz	3.5 ns
5	60 mHz	6 ns

32. Cascaded Bandpass — ~~35 mHz (25 mHz may be correct here)~~ 33 mHz

33. Bandwidth Limiter — 4-6 mHz

34. CMR — 20:1 at 50 mHz and 20 mv/div.

35. Trig Level Centering (R643, R843) — Use .2 div of Cal Signal from test scope.

36. Ch 1 Only DC Level (R511) — Located on A swp board.

37. Norm Trig DC Level (R272) — Located on Vert board.

38. Single Sweep

39. A Sweep Trig'd Light

40. Auto Recovery

Notes:

- CH4, RH4, CH7 affect all ranges.
- Channel 2 adjustments move up immediately after Doubler, ie: CH2, RH4, etc.
- Pulse adjustments are measured between vertical top and 90 ns after 50% point of step.
- Adjustments in parentheses indicate interactions with previous positions.

mv/div	Adjustments	Interactions
20 mv	CH5, RH4, CH2A, CH2B, CH6, CH3	5
10 mv	CH2C, RH2C, (CH5), RH4, CH6)	5
5 mv	CH2A, RH2A, (CH5, RH4, CH6)	5
20 mv	CH2B, RH2B, CH3, CH6, (CH5, RH4, CH6)	5
.1 v	CH5 (CH5, RH4, CH6)	5
.2-10 v		5

31. Bandpass

mv/div	Adjustments	Interactions
20	1.70 mHz (approx 3.3 div at 100 mHz)	2.4 ns
10	100 mHz	3.5 ns
5	60 mHz	5 ns

32. Crescendo Sampler

33. Transmission Limiter

34. Gain

35. Trig Level Control (Mode, Slope)

36. Ch 1 Only DC Level (7S12)

37. Horz Trig DC Level (2272)

38. Single Sweep

39. A Sweep Trig'd Light

40. Auto Recovery

45

Notes:

- CH4, RH4, CH7 affect all ranges.
- Channel 2 adjustments move up immediately after Doubler, ie: CH2, RH4, etc.
- Pulse adjustments are measured between vertical top and 90 ns after 50% point of step.
- Adjustments in parentheses indicate interactions with previous positions.

mv/div	Adjustments	Interactions
20 mv	CH5, RH4, CH2A, CH2B, CH6, CH3	5
10 mv	CH2C, RH2C, (CH5, RH4, CH6)	5
5 mv	CH2A, RH2A, (CH5, RH4, CH6)	5
20 mv	CH2B, RH2B, CH3, CH6, (CH5, RH4, CH6)	5
.1 v	CH5 (CH5, RH4, CH6)	5
.2-10 v		5

31. Bandpass

mv/div	Adjustments	Interactions
20	1.70 mHz (approx 3.3 div at 100 mHz)	2.4 ns
10	100 mHz	3.5 ns
5	60 mHz	5 ns

32. Crescendo Sampler

33. Transmission Limiter

34. Gain

35. Trig Level Control (Mode, Slope)

36. Ch 1 Only DC Level (7S12)

37. Horz Trig DC Level (2272)

38. Single Sweep

39. A Sweep Trig'd Light

40. Auto Recovery

41.	Sweep Start (R956)	Use 1 ms marks. A swp 1 ms/div. B swp 5 us/div. Delay time mult at 1.00. Adj R956.
42.	A Sweep Cal (R743)	Delay Time Mult to 9.00. Adj R743.

Interaction: Repeat steps 41 and 42.

43.	Delay Time Mult Linearity	Check 5.00 ± 0.02.
44.	Delay Jitter	A swp 1 ms/div. B swp 1 us/div. 1 ms marks. Check at 1.00 and 9.00 for less than 0.5 div.
45.	Norm Gain (R1036)	1 ms/div.
46.	Mag Gain (R1047)	
47.	Mag Regis (R1053)	
48.	A Sweep Length	Full: 10.5-11.5 div 4 Div: Not more than 4 div.
49.	A Var and Uncal Light	
50.	B Sweep Cal (R943)	Horiz Display to B. A swp 2 ms/div. B swp 1 ms/div. 1 ms marks. Adj for 1 mark/div.
51.	B Sweep Length	10.5-11.5 div
52.	B Var and Uncal Light	Right side of scope.
53.	1 us Timing (A: C740C---B: C940C)	±3%
54.	.5 us Timing (A: C740A---B: C940A)	±3%
55.	High Speed Linearity (C1081, C1091)	Use 10x Mag. .1 us/div. 5 ns sinewave.
56.	A and B Sweep Rates	± 3%
57.	B Ends A Operation	
58.	X Gain (R567)	100 mv Cal signal to Ch 1 at 20 mv/div. Trig Ch 1 Only or X-Y. Adj for 5 div. Located left side of scope.
59.	X Bandpass	2 mHz.

60.	<u>X-Y Phasing</u> (L568, R569)	X at 10 mv/div. Y at 50 mv/div. Use 10 div and adj R569 at 1 mHz and L568 at 2 mHz.
61.	Beam Finder	
62.	<u>Calibrator</u>	Rep Rate (T1275): 1 kHz Risetime: 1 us or less Duty Cycle: 50% ± 1%
63.	Output Waveforms	A Swp Out: 10 v Gates: 12 v