

7L13

FACTORY CAL PROCEDURE

EQUIPMENT REQUIRED

All TEKTRONIX test equipment must be calibrated to Factory Test Limits using methods specified in the applicable TEKTRONIX Factory Calibration Procedure. Other test equipment should be calibrated to its manufacturer's specifications. Any exceptions to test equipment accuracies are noted on this Equipment Required List.

Equivalent test equipment may be used. A Staff Engineer must approve any substitutions.

a. TEKTRONIX Instruments

- 1 067-0532-01
- 1 7613 Series mainframe
- 1 7000 Series vertical amplifier
- 1 7A22 vertical or equiv.
- 1 TYPE 184 TIME MARK GENERATOR
- 1 LFSWG
- 1 7L12 MOD 139U
- 1 067-0650-00
- 1 DC501 Counter

b. Calibration Fixtures and Accessories

- 1 Plug in extender (special)
- 1 Harmonic Generator -----(067-0534-00)
- 1 P6006 x10 probe or equiv.----- (010-128)
- 2 Plug-in extenders----- (067-0616-00)
- 2 18" 50 Ω BNC cables----- (012-0076-00)
- 1 lowpass filter (special)
- 1 6" Selectro to Selectro cable----- (175-0310-00)
- 1 BNC to 2 pin harmonica cable (special)
- 1 BNC to Selectro cable----- (175-0419-00)
- 1 BNC "T" connector----- (103-0030-00)
- 1 N male to BNC female adapter----- (103-0045-00)
- 1 GR to BNC male adapter----- (017-0064-00)
- 1 GR to BNC female adapter----- (103-0045-00)
- 3 x10 BNC attenuators----- (011-0059-01)
- 1 50 Ω BNC termination----- (011-0049-01)

- 1) Spectral purity checker
- 2) 10V Power supply
- 3) Amplitude calibrator
- 4) Voltage reference comparator
- 5) 30Hz intermodulation checker
- 6) Sampler (special)
- 7) 9V Battery

c. Other Manufacturer's Equipment

- 1 20,000 Ω /V multimeter (Triplet 630NA or equiv.)
- 1 Hewlett-Packard 608E VHF signal generator
- 1 Hewlett-Packard 8614A signal generator
- 1 Hewlett-Packard 355C attenuator
- 1 Hewlett-Packard 355D attenuator
- 1 Hewlett-Packard 8472A (NEG) crystal detector or equiv.
- 1 Hewlett-Packard 431C PF power meter

PRELIMINARY INSPECTION

a. Visual Inspection

CHECK: for unsoldered joints, rosin joints, lead dress and long ends. Check for loose hardware and protruding parts. Check controls for smooth operation, proper indexing and knob spacing from front panel.

b. Preset - mid-range all internal pots.

c. Resistance check

CHECK: resistance at rear connector to ground. (as per following chart)

YIG POWER SUPPLY

PLUG: 7L13 center and right hand extenders into a 7000 Series mainframe.
CONNECT: multimeter pin # 1 of P2500 & GND.
CHECK: for +15vdc.

SWEEP

SET: 7L13 time/div to 10ms, mode to Norm, Source to Free Run
7613 Trig Source to Vertical Mode.

ADJUST: R113 (sweep cal) for a 10.0 div. trace.

CHECK: Horiz. pos. moves each end of trace to within 1cm of center screen.

CONNECT: x10 probe from test scope to pin #3 of tracking generator plug on
7L13 front panel.

ADJUST: R1250 for a sawtooth of 20v amp.
R1255 to center same sawtooth about 0vdc.

DISCONNECT: x10 probe.

plug special voltage comparison unit into middle slot of 7613.
Connect cable from the voltage comparison unit to tracking
generator plug on 7L13 front panel.

READJUST: R1255 & R1250 until the two green lights are on and two red lights
are out. (5ms sweep speed),

TRACKING GENERATOR

SET: 7L13 span to max, time/div to 2ms/div.

SET: 7613 Vert Mode to left.

CHECK: 7L13 trace is centered end to end.

SET: test fixture to 100ms and observe bright dot near center screen.

NOTE: the intensity & gate on controls may have to be readjusted to obtain the dot.

ADJUST: R1215 to set dot to center screen.

SET: test unit to 10ms & 7L13 to .5ms and observe dot.

SET: test unit to 1ms & 7L13 to 20 μ s and observe dot.

SET: 7L13 time/div to "OFF" and observe that the red off light comes on.

SET: 7L13 freq span to 50KHz and turn the \emptyset Lock switch on. Observe red \emptyset Lock light is on.

CHECK: for a 5V P-P sawtooth on A3, of sweep board. Jct of R1092 & R1090.

TRIGGERS

INSERT: 7A16 into right vertical slot. (v/div to .1v).

CONNECT: the mainframe 40mv calibrator to 7A16 input.

SET: 7613 trig souce to "vert mode".

ADJUST: 7L13 trig level for triggered display (\pm) (source to int) .

CHECK: that trig level knob is centered and if necessary, loosen it & center it.

SET: 7L13 mode to single sweep.

CHECK: sweep runs once each time the reset button is pushed, + and -.

SET: 7L13 time/div to .1sec and push the reset button and observe that the reset light comes on at the start of the trace and goes out when the trace ends.

SET: 7L13 Mode to Norm, time/div to 20ms .

DISCONNECT: Mainframe calibrator from the Vertical plug-in.

CONNECT: sine wave generator to the vertical plug-in input.

SET: vertical plug-in to .2volts/div.

ADJUST: sine wave generator for .5 divisions of signal at 15Hz.

CHECK: 7L13 triggers + and -.

ADJUST: sine wave generator for .5 divisions of signal at 1MHz.

SET: 7L13 time to 1 μ sec.

CHECK: 7L13 triggers + and -.

DISCONNECT: sine wave generator.

LINE TRIGGER

SET: 7L13 source to line.
Time/Div to 5m sec.

CONNECT: x10 probe from vertical plug-in to R1002-R1003 junction.

SET: vertical plug-in volts/div to .5 volts.

CHECK: for triggered display on + and -.

SET: source to free-run.

CHECK: that trace free runs.

REMOVE: x10 probe from vertical plug-in.

EXT TRIGGER

SET: 7L13 source to ext.

CONNECT: BNC T to the vertical plug-in.

CONNECT: one side of the T to the sine-wave generator. Connect the other side of the T to the ext trigger jack of the 7L13.

SET: vertical plug-in to 1 volt/div.
sine wave generator for .5 volts. @ 1MHz.

ADJUST: trig level control for a triggered waveform + and -.

SET: sine wave generator to 15Hz at .5 volts. Check for a triggered waveform + and -.

REMOVE: sine wave generator and all test cables.

MANUAL SCAN

SET: 7L13 source to Free Run, Mode to Norm.

SET: 7L13 time/div to Manual Scan.

ADJUST: vary the manual scan control and check that it moves the trace dot to the right of the left grat. line, & to the left of the right grat. line.

EXT HORIZ

SET: 7L13 time/div to ext horizontal.

CONNECT: variable power supply to the ext horizontal in jack.

SET: spot to the 10th graticule line using the power supply.

CHECK: power supply reads 10 volts ± 1 volt.

SET: 7L13 time/div to off and note that the dot is apprx at the center of the screen.

TIMING

SET: 7L13 mode to norm, source to int, time to .1ms.

SET: vertical V/div to .5V/div.

CONNECT: 184 at .1ms marks to vertical.

ADJUST: R1190 for 1 mark/div.

SET: 7L13 time to 50 μ s.
184 to 50 μ s.

ADJUST: R1200 for 1 mark/div.
NOTE: rock in above adjustments.

CHECK: timing from 1 μ s to 10sec $\pm 5\%$.

DISCONNECT: vertical plug-in & reconnect extender.

FUNCTION I-F

SET: 7L13 Gain CCW, Gain variable to Cal
ATTENUATOR CW (ref level -30dBm)
display mode to Lin
TIME/DIV to 10ms
Trigger Mode to Norm, Source to Free Run.

ADJUST: Vertical Position to bottom graticule line
R803 to move base line down to point where it stops moving down
(do not over adjust after trace stops moving).

CHECK: base line doesn't shift when switched between display functions
(10dB Log, 2dB Log, Lin).

SET: display function to 2dB Log.

CONNECT: H-P 608 to Hp 355C and D to P 560 on the I-F board.

SET: H-P 608 to 10MHz 0dBm output, attenuator to 0.

ADJUST: R801 to set trace to reference level (top grat. line)
Log Cal (front panel) for 5 divisions of change when 355D is
switched to 10dB position.

REPEAT: R801 & Log Cal adjustments to null interaction.

SET: display to Lin
H-P 355D to 0dBm.

ADJUST: lin ref. level (R733) to reference level (top grat. line).

SET: display to 10db/Log.

SET: H-P 355D to 70db.

ADJUST: R802 for 1cm.

SET: H-P 355D to 10db.

ADJUST: R703 for 7cm.

SET: H-P 355D to 0.

ADJUST: reference level linearity (R542) to ref level.

REPEAT: 10db Log adjustments to null interaction.

CHECK: trace moves down 1 div \pm .1 div for each 10dB
added on the H-P 355D.

SET: H-P 355D to 20
7L13 display to 2dB/Log, Gain to -80dBm ref level.

ADJUST: 40dB gain (R603) for ref level.

SET: H-P 355D to 40
7L13 gain to -100dBm ref level.

ADJUST: 60dB gain (R663) for ref level.

REMOVE: cable from P560 and replace connector.

CONNECT: H-P to J240 on res. bd.

SET: H-P 608 to 0 to -35dB at 10MHz
7L13 Gain CCW (-30dBm)
Resolution to 3MHz, Freq. Span to 5MHz.
display to 2dB/Log.

CHECK: for baseline rise.

SET: Res to 300KHz.

ADJUST: C322 - C348 for max rise.

SET: Res to 30K, 3K, .3KHz, and 30Hz.

CHECK: each for baseline rise.

RECONNECT: cable to J240.

CONNECT: H-P 608 to J80.

SET: H-P 608 to 35 - 45dBm at 105MHz
7L13 Res to 3MHz.

ADJUST: 3MHz resonator adjustments for max rise.

SET: res. to 300Hz.

ADJUST: 608 for max baseline rise.

CONNECT: 608 to DC501.

CHECK: for 105MHz ± 1 KHz.

RECONNECT: cable to J80.

2nd PHASE LOCK LOOP

CONNECT: special sampler in line between the reference mixer coupler and the 16-19MHz amplifier.

CONNECT: the 7L12 MOD 139U to center selectro of sampler and set up to see 17MHz at approx -50dB.

ADJUST: multiplier tweeks and related mixer plug to maximize the 17MHz signal.

CONNECT: front panel 2nd L.O. out to 7L12 MOD 139U and set 7L12 MOD 139U up to read 2.2GHz and sidebands of 17MHz & 34MHz approx 60db down from the 2.2GHz signal.

ADJUST: multiplier mixer plug for min. 17MHz sidebands (mixer rotation).

RECONNECT: sampler to 7L12 MOD 139U and set up to read 17MHz at approx. -50db.

PICK: R1620 for a value to put the 17MHz signal at -61db. (approx 20-50 Ω) (4 Ω /db).

RECHECK: the sidebands of the 2.2GHz signal (the 34MHz sidebands should be down now). not visible at 0dbm Ref. level.

RECONNECT: reference mixer coupler.

SET: 7L13 span width to 100KHz, phase lock front panel switch to on.

CONNECT: freq counter to Pin J of the pase detector board of the honey comb.

CHECK: for a frequency of 17.5MHz \pm 200KHz.

FRONT END PRESET

CONNECT: H-P 608 to R-F in.

SET: H-P 608 to 0dBm at 400MHz
7L13 Freq Span to Max, Res to Max
display to 10dB/Log.

ADJUST: 7L12 gain and freq to display signal on screen
tweek C15, C16, C17 for max sig (also 2nd mixer slug).

1ST LOOP PHASE LOCK

SET: 7L13 Freq Span MHz to 50KHz
Auto \emptyset Lock switch on
Vertical on test scope to .1v/div.

CONNECT: ground wire from pin 1 of P2210 on the tune control board.

DISCONNECT: error out coax.

CONNECT: x10 probe to port of J69.

ADJUST: R51 for OVDC balance of beat notes.

CHECK: 0-1800MHz for \approx 4VPP beat notes
and 2-1 relative amplitude.

DISCONNECT: ground wire from pin 1 of P2210 on the tune control bd.

RECONNECT: error out coax.

DISPERSION

SET: 7L13 Span width to 100MHz/div.

CONNECT: 184 time mark to the R.F. input of the 7L13.

SET: 184 to 10nsec and adjust R2510 for 1 mark/div.

SET: 7L13 Span width to 1MHz/div
184 to 1 μ sec and adjust R2530 for 1 mark/div.

SET: 7L13 Span width to 50KHz/div
184 to 10 μ sec and adjust R1960 for 1 mark/2div
down hole in front end under honeycomb.

LINEARITY

SET: center freq to 900MHz.

CONNECT: 184 to 7L13 R-F input.

SET: front panel controls & 184 as in following table & check disp & linearity to 5% & 5% respectively.

FREQ SPAN	RESOLUTION	184	MARKS/DIV
MAX	3MHz	10ns	9/5 div
100MHz	3MHz	10ns	1/div
50MHz	3MHz	20ns	1/div
20MHz	300KHz	10ns & 50ns	1/div
10MHz	300KHz	10ns & .1μs	1/div
5MHz	300KHz	10ns & .1μs	1/2 div
2MHz	30KHz	10ns & .5μs	1/div
1MHz	30KHz	10ns & 1μs	1/div
.5MHz	30KHz	10ns & 1μs	1/2 div
.2MHz	3KHz	10ns & 5μs	1/div
.1MHz	3KHz	10ns & 10μs	1/div
50KHz	3KHz	10ns & 10μs	1/2 div
20KHz	3KHz	10ns & 50μs	1/div
10KHz	300Hz	10ns & .1ms	1/div
5KHz	300Hz	10ns & .1ms	1/2 div
2KHz	300Hz	10ns & .5ms	1/div
1KHz	300Hz	10ns & 1ms	1/div
.5KHz	300Hz	10ns & 1ms	1/2 div
.2KHz	300Hz	10ns & 5ms	1/div

YIG BALANCE & READOUT MATCH-UP

SET: 7L13 Spanwidth to 10MHz/div
Midrange the 0Hz CAL Pot (R115) on the 7L13 front panel.

DISCONNECT: P2150 from the analog board.

ADJSUT: R2135 so that the 7L13 L.E.D. readout reads 900.

RECONNECT: P2150 (Readout will change to something other than 900.

CONNECT: 184 at 100MHz markers to the 7L13 R.F. input.

SET: 7L13 spanwidth to 5MHz div

ADJUST: 7L13 center Freq tuning dial until the 900MHz signal is located on the center graticule. While watching the 900MHz signal turn the Center Freq tuning pot until a reading of 900 is obtained on the L.E.D. readout.

ADJUST: R2505 to bring the 900MHz signal to center screen.

ADJUST: Freq tuning pot to center the 0 start marker.

SET: "0" start 1 minor to left of center; adj R2110 to read 0001 MHz.

CHECK: Yig balance & readout match up adjustments may interact. Repeat above procedure if necessary.

TRACKING

CONNECT: 184 & ringer to 7L13 input.

SET: 184 to 10ns & 7L13 span to 5MHz.

CHECK: tracking at every even 100MHz to a spec of $\pm 5\text{MHz} \pm 10\%$ of the span width setting.

SET: 7L13 span to max.

CHECK: that the ditch marker aligns approx under the proper frequency setting across the window as depicted by the L.E.D.

SET: 7L13 R-F center Freq. to 900MHz.

ADJUST: R2065 so that the L.E.D. & CRT readout agree.

CHECK: that front panel C-F adjustments moves digits approx $\pm 10\text{MHz}$.

SET: R1755 fully clockwise.

SET: 7L13 Freq Span width to 50KHz/Div.

CONNECT: A shorting strap across the reed relay S2608.

ADJUST: Turn the front panel phase lock switch off and center a signal two centimeters to the right of the graticule center. Turn the phase lock switch on and adjust R2605 to center the signal back to two centimeters to the right of graticule center.

NOTE: If R2605 does not have any range, select and lock on various signals through out the band until R2605 has sufficient range.

ADJUST: turn the phase lock switch off and on several times and observe that the signal does not shift from it's original position.

SET: phase lock switch to off.

SET: a signal two centimeters to the left of the graticule center. Turn the phase lock switch on and off several times and observe that the signal stays two centimeters to the left of the graticule center.

REMOVE: the shorting strap.

CHECK: phase lock continues to lock at various settings of the signal as seen on the graticule area when switching from 100KHz to 50KHz.

FINE TUNE RANGE ($\pm .5\text{MHz}$)

SET: 7L13 mode to norm, source to free run, function to 10db.

CONNECT: 10ns & 10 μ s marks 184 & ringer to 7L13 input.

SET: 7L13 res, to 30K, disp to 50K, \emptyset lock switch on.

ADJUST: 7L13 center Freq control from stop to stop and observe three complete wind

FRONT END

CONNECT: H-P 608 at 52.5MHz to 7L13 R-F in (608 atten to display a sig.).

SET: 7L13 to 2dB/log, Freq Span to 100MHz (resolution coupled).

TUNE: signal to center screen with R-F C-F coarse.

SET: Freq Span to 50Khz keeping signal centered with RF-CF control.

SET: Gain (7L13) for approx 1 div noise.

REMOVE: 608 and locate spurious at 52.5MHz.

CONNECT: 608 (slightly different freq) and adj. 2nd mixer for minimum spur & max sig.

SET: 608 to $\approx -30\text{dBm}$
7L13 Freq Span to 5MHz, Res to 3 meg.
Gain to display signal, center signal on screen.

FRONT END (cont.)

- CONNECT: the 9V battery red lead to pin AC and the junction of R1735 and R1729.
the 9V battery black lead to gnd.
- SWITCH: the battery switch to all three positions and note any amplitude changes
in the signal as it moves approx ± 2 div on the screen.
- NOTE: if the amplitude change exceeds .5db P-P then readjustment of C15, C16,
and C17 and 2nd mixer plug is in order.
- RECHECK: amplitude of 52.5 MHz spuri.

RESOLUTION

CONNECT: H-P 608 to R-F IN
 RECONNECT: H-P 608 to -30dBm at 50meg Hz
 7L13 Freq Span to 1MHz
 Res to 30K
 display to 2dBm/Log
 gain to display signal
 Lock switch on
 R-F Center Freq to center signal
 Res to 3MHz

ADJUST: 105MHz IF cavity and C82 & C456
 for center & shape see Fig. #2.

SET: Freq Span to .1MHz
 Res to 30K

ADJUST: R-F Center Freq Fine control to
 center signal.

REMOVE: jumper to disable K357 on
 resolution bd.

REMOVE: cable on M & N and connect to K & L

SET: Resolution to 3MHz

ADJUST: C472 & C475 as in Fig. #3.

RECONNECT: cables to pins M & N and K & L
 and replace jumper.

SET: Res to 300KHz

ADJUST: C322, C325, C328, C342, C345, C348
 for Fig. #4.

SWITCH: between 30KHz Res at 10KHz/div
 and 3KHz Res at 1KHz/div and
 note lower amplitude.

ADJUST: amplitude of each remaining
 resolution setting to match
 amplitude of lowest res setting
 of above two.

USE: R307 at 3MHz Res and 1MHz/Div
 R357 300KHz 100KHz
 R367 30KHz 10KHz
 R377 3KHz 1KHz
 R387 .3KHz 200Hz
 R2730 .03KHz 200Hz

NOTE: slow sweep speed when
 necessary to give
 calibrated display.

SET: Res to 30K Freq Span to 10K
 Gain CCW.

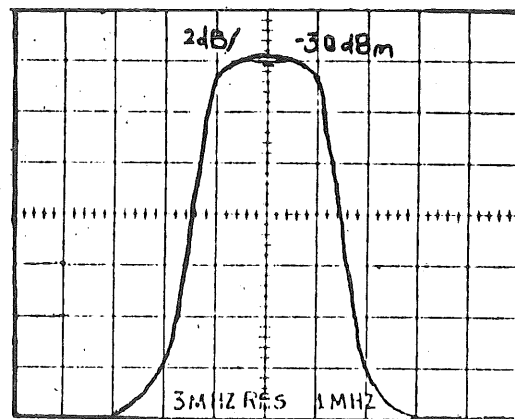


FIG. #2

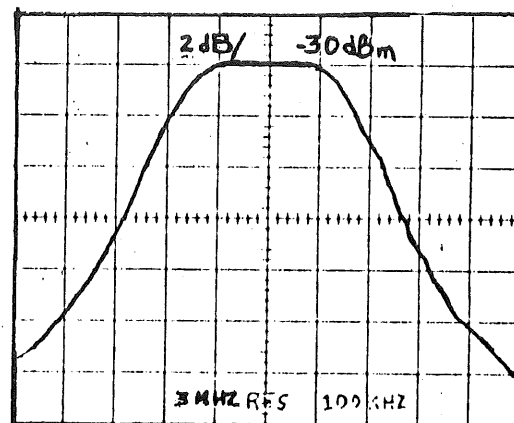


FIG. #3

NOTE: bandwidth at the -6dB
 point should be greater
 than 500KHz

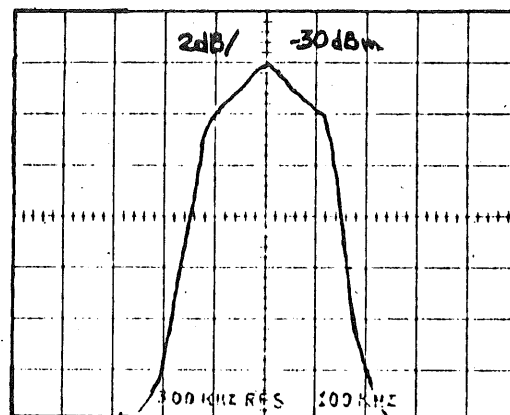


FIG. #4

NOTE: these adjustments may
 effect the waveshape
 of the 30KHz & 3KHz

(cont.)

ADJUST: 7L13 Vert Pos to set trace to bottom grat line

INSTALL: H-P 355D & C in line between 608 and 7L13.

SET: 355D & C to "0"dB.

SET: 608 for 7 div signal.

SET: 355D for 10dB
7L13 gain for -40dB ref level.

ADJUST: R267 (10dB gain) for 7 div.

SET: 355D to 20dB
7L13 gain for ~50dB

ADJUST: R297 (20dB gain) for ref level.

SET: H-P 355D to 30dB.

SET: 7L13 gain to -60dB.

CHECK: -80, -90, & -100dB levels are within
± 2dB.

CHECK: ref level is 7 div ± 2dB on all filters.

NOTE: if the 40 & 60 gain
are out of tolerance
R603 & R663 may be
readjusted

110dB GAIN ADJ.

CONNECT: H-P 355 C & D between the 50Meg calibrator and R-F input of 7L13.

CENTER: the 50Mg signal at 200Hz disp and 30Hz res. (8cm).

SET: 7L13 gain max CW and add 80dB of attenuation on 355D.

NOTE: insure that the sweep speed is adjusted for a calibrated display.

SET: activate the 10dB gain button.

ADJUST: R2735 for 8cm display.

NOISE FLOOR ADJUSTMENT

SET: 7L13 to 5KHz dis. (signal centered & \emptyset locked) 10dB log.

SET: Res to 3KHz, slow sweep speed, store, and use video filter.

ADJUST: R1755 CCW and observe decreasing noise floor. Leave R1755 at a point where noise floor is 70dB down at the ± 25 KHz points from center screen.

NOTE: If above adjustment cannot be made proceed with the spectral purity check.

SPECTRAL PURITY

CONNECT: spectral purity checker to input of 3 cavity filter.

SET: disp to 50KHz, res to 3K, 10dB log.

ADJUST: the in line pads (comes with spectral purity checker) to obtain 8cm IF signal.

CHECK: that the noise floor is $< \frac{1}{2}$ cm.

NOTE: If the noise floor is $> \frac{1}{2}$ cm then the reason you could not make the R1755 adjustment is excessive Yig noise.

F-M

CONNECT: 184 to 7L13 R-F input.

SET: 184 to 10ns
7L13 to 30KHz res
10K Freq Span
 \emptyset Lock off
LIN

ADJUST: gain & C-F controls to display 8cm signal.

CHECK: slow sweep speed & check horiz movement of trace doesn't exceed 1cm when it crosses the center line.

SET: \emptyset Lock on, 7L13 to .2KHz Freq Span and 30Hz Resolution, 10dB log

ADJUST: gain C-F Fine controls to center a 8 cm 10ns signal.

CHECK: set 7L13 time/div to 1 sec/div, horiz movement of trace doesn't exceed 1mm

FUNCTIONS AMPLITUDE and LINEARITY

a. AMPLITUDE

CONNECT: H-P 608--H-P 355C & 355D--7L13.

SET: H-P 608 to -30dBm at 50MHz
H-P 355C & 355D to 0
7L13 to display signal. (2dB log)

ADJUST: Log Cal and Ampl Cal (front panel) for 5 div of change with 10dB switched in.

SET: Function switch to Log 10dB, Log 2dB, and Lin 608 for 8 divisions of signal in the Function that has the greatest amplitude (attenuators off).

CHECK: the amplitude in the other two positions does not decrease more than .5dB (.5dB = .45 div in Lin).

b. LOG 2dB LINEARITY

SET: H-P 355D to 0
7L13 Gain for 2dB/div -30dBm
Res to 3KHz, Frq Span to 5KHz
608 to display 8 div.

CHECK: signal changes 1 div with every 2dB change in input signal, $\pm .3\text{dB}/2\text{dB}$ with no more than 1dB total error.

REPEAT: check starting with a H-P 355D setting of 40dB and a gain of 70dBm.

c. LIN LINEARITY

SET: H-P 355D to 0
7L13 to Lin
GAIN to -30dBm
H-P 608 for 8 div signal
H-l 355C to 6dB.

CHECK: signal is 4 div $\pm .8\text{div}$.

SET: H-P 355C to 12.

CHECK: signal is 2 div $\pm .8\text{div}$.
repeat check starting with the gain at 70dBm 355D to 40dB.

(FUNCTIONS AMPLITUDE and LINEARITY cont.)

d. LOG 10dB LINEARITY

SET: H-P 355D to 0
H-P 355C to 1
7LJ3 to LOG 10dB/Div
H-1 608 for 8 div
H-P 355D to 10.

CHECK: for 7 div \pm 1dB.

SET: H-P 608 for 7 div.
H-P 355D to 20.

CHECK: for 6 div \pm 1dB.

CHECK: remaining divisions
equal 10dB \pm 1dB.

SET: H-P 355D to 0.

SET: H-1 608 for 8 div.

DECREASE: signal in 10dB steps.

CHECK: each graticule line corresponds to each 10dB drop \pm 1.5dB.

CHECK: the 30KHz, 300Hz, 300KHz, +30Hz resolution filters in the
same manner as described above.

EXCEPTION: the 30Hz filter has a spec of \pm 2.0dB per 10dB drop
corresponding to each graticule line, and check for
a total of 2.5dB over 70dB.

CHECK: ultimate rejection on 30Hz filter is \approx -80dB down from
top of 8cm signal.

START SPURII AMP CHECK

SET: 7L13 10dB/div, res to 3Mg, disp to 20Mg, vert. pos to max CCW, R-F atten to read -20dBm.

SET: 608 to 50Mg.

CONNECT: 608 to 7L13 input.

ADJUST: 608 atten for 50Mg amp equal to start spurii amp.

CHECK: 608 atten reads -15dBm to -30dBm.

FLATNESS, SENS, & SPURII

a. FLATNESS

CONNECT: 067-0532-01 to 7L13 R-F in

SET: same to 50MHz, gain off
7L13 to Max Span, res to 3Mg, 2dB Log, ref-level to -30dBm, ref-level Variable for 7 div of signal.

ADJUST: C-F to position ditch marker to left of "0"Hz marker.

CHECK: flatness to spec of +1dB or -2dB over entire window.

NOTE: use 067-0650-00 and H-P 8614A when required to cover the window.

b. R425 ADJUST:

SET: 608 @ 10MHz @ -17dBm
7L13, disp to 100K, res to 300K.

CONNECT: 608 to J2700 on Yig Driver bd.

ADJUST: R425 for ref Lev (8div).

RECONNECT: J2700.

c. SENS (3Mg)

SET: function to Lin, 608 to 50MHz @-30dBm
7L13 Freq Span to 2MHz, res to 3MHz, 300Hz filter on.

SET: 7L13 gain for 1 div noise
608 for 2cm signal.

CHECK: sens > -80dBm.

(300K)

SET: 7L13 res. to 300K, Freq Span to 100K, gain for 1 div noise.

SET: 608 for 2cm signal.

CHECK: sens > 90dBm.

(30K)

SET: 7L13 res to 30KHz, Freq Span to 20K, gain for 1 div noise.

SET: 608 for 2 cm sig.

CHECK: sens > -100dBm.

(3K)

SET: 7L13 res to 3KHz, Freq Span to 2K, gain for 1 div noise.

ADJUST: sweep speed for calibrated rate.

SET: 608 for 2 div sig.

CHECK: sens > 110dBm.

(300Hz)

SET: 7L13 to 300Hz res, Freq Span to 200Hz, gain for 1 div noise
or max, which ever is greater.

ADJUST: sweep speed for calibrated rate.

SET: 608 for signal amplitude = 2x noise.

CHECK: sens > -120dBm.

(30Hz)

SET: 7L13 to 30Hz res, gain for 1 div noise or max or which
ever is the greater. (use 10Hz video filtering).

ADJUST: sweep speed for calibrated rate.

SET: 608 for signal amplitude = 2x noise.

CHECK: sens > -128dBm.

SPURII

SET: disp. to 100KHz, res to 30K, gain for 90dB ref level
function to 2dB Log, \emptyset Lock switch on.

REMOVE: Q2570 & connect a shorting strap from emitter to collector.

INSTALL: 7L13 into mainframe.

CHECK: that spurii are $\leq -100\text{dBm}$ (terminate R-F in when
checking the 52.5MHz spurii).

CALIBRATOR

a. AMPLITUDE $-30\text{dBm} \pm 0.3\text{dB}$

CONNECT: amplitude calibrator box (50 Ω out)
and power supply to 7L13 R-F in.

SET: 7L13 to Log 2dB/div
Freq Span to 200KHz, resolution to 300KHz
Center Freq to center 50MHz signal
Gain to -30dBm (Var to Cal).

ADJUST: 7L13 amplitude Cal (front panel) for 8 div.

REMOVE: cable from Cal box and connect it to 7L13 Cal out.

ADJUST: R956 for 8 div.

b. FREQUENCY

CONNECT: Type 184--20dB atten----"T" connector --7L13 R-F In
7L13 Cal Out--20dB-----↓

SET: Type 184 for 20ns markers
7L13 to center signals with a Freq Span of 1KHz and
resolution of 300Hz.

CHECK: signals are separated by no more than 5KHz.

I M DISTORTION

a. CHECK 3rd order Harmonics

CONNECT: H-P 608--20dB atten-- T conn--7L13
H-P 612--20dB atten--

SET: 7L13 Freq Span to 500KHz/div
Resolution to 30KHz
Log 10dB/div
Gain to -30
C-F to 470.

H-P 608 & H-P 612 Freq & Atten to display two full screen signals 2 div apart.

CHECK: I-M = < 70dB

ADJUST: C95 (I.M adj.) to minimize any sidebands present. (It may be helpful to increase the signal amplitudes while making this adjustment).
NOTE: this adj. may effect 3MHz Resolution waveform

SET: 7L13 resolution to 300Hz, 20K disp., 300Hz video filter.
Time/Div for max signal amplitude signals - 2cm apart.
H-P 608 & 612 atten for full screen.

CHECK: sidebands are not greater than 1 div high.

b. CHECK 2nd Order Harmonics

CONNECT: LFSWG in place of the H-P 612A.

SET: LFSWG for 1MHz out
7L13 C F to display 1MHz signal
LFSWG amplitude for full screen signal 30K res., 500K disp.
7L13 C F to display H-P 608 freq (300Hz video filter).
7L13 Atten to 10dB
7L13 Gain to -20 (-30dBm Ref Level).

CHECK: sidebands are not greater than 1 div high.

30 Hz INTERMODULATION DISTORTION CHECK

CONNECT: H-P 355 C&D atten between the 7L13 R-F input and the 30Hz Intermodulation checker.

SET: the H-P 355 C&D to 6dB.

SET: 7L13 Vert mode to 10dB log
7L13 R-F attenuation to -20dB.

SET: 7L13 Resolution to 3MHz Span width to 5MHz.

CENTER: the 95MHz signal from the I.M. checker to center screen of the 7L13 with the 7L13 R-F center freq dial.

REDUCE: 7L13 span width, resolution and time div settings to 30Hz resolution, 1KHz dispersion, and 1sec/div sweep speed.

OBSERVE: two signals \approx 1200Hz apart.

SET: H-P 355 C & D atten for exactly 8cm of signal amplitude.

SET: 7613 to store.

CHECK: intermodulation distortion products are not more than 1 div high

R F ATTENUATOR

RF ATTENUATOR

NOTE: This check need only be done if the accuracy of the attenuator is suspected to be incorrect. This can be done correctly only when using an external attenuator with a known accuracy.* It can only be checked approximately using H-P 355C & 355D attenuators because they are less accurate than the 7L13 attenuator.

*See staff Eng.

ATTEN accuracy -10dB \pm 2dB or 1% of setting, whichever is greater

CONNECT: H-P 608---ATTENUATOR---7L13 R F In.

SET: H-P 608 to -50dBm at 10MHz
External Atten to 60dB
7L13 Gain to -60, 2dB/div
C F to center 10MHz signal
Freq Span to 100KHz, Resol to 30KHz.

ADJSUT: H-P 608 for 7 divisions signal.

SET: 7L13 Atten to 10dB, External Atten to 50dB.

CHECK: signal is 7 divisions \pm 1div (.2dB)

CHECK: Atten accuracy as shown below:

<u>7L13</u>	<u>EXT ATTEN</u>	<u>MAX ERROR</u>
10	50	.2dB
20	40	.2dB
30	30	.3dB
40	20	.4dB
50	10	.5dB
60	0	.6dB

VIDEO FILTER

SET: 7L13 res to 3MHz, gain for -80dB ref level, 2dB log.

OBSERVE: a full screen of noise.

DEPRESS: 30KHz video filter and observe that the noise is averaged.

RELEASE: 30KHz video filter and depress 300Hz video filter.

OBSERVE: that the averaged noise obtained with the 30KHz filter is averaged still more.

DEPRESS: 10Hz video filter and observe that the noise obtained with the 300Hz filter is averaged still more (almost to being a clean noise floor).

FRONT PANEL CHECKS

a. VIDEO PROCESSOR

CONNECT: TYPE 184-50Ω BNC cable - 7L13 input.

SET: TYPE 184 for .1ms marks.
7L13 Freq Span to 0
Ø Lock off
Resolution to 3MHz
Gain -30.

ADJUST: 7L13 CF Display 8 div of marker
feedthrough riding on the side of the 0Hz marker.

SET: 7L13 for a triggered display at 20μs/div
Video Processor on.

CHECK: base of displayed markers widen 20μs
(set markers to 8 div ampl. with CF if necessary).

SET: Video Processor off.

REMOVE: TYPE 184..

b. BASELINE CLIPPER and CONTRAST

SET: 7L13 Freq Span to 200KHz
Resolution to 30KHz
CF to center 0Hz spurious.

SET: mainframe to chop.

CONNECT: 8 div. sig to left vert.

(FRONT PANEL CHECK cont.)

CHECK: Baseline Clipper will blank none to all of the signal.
Contrast varies from no contrast to full blanking.

CHECK: that left vertical signal is not clipped.

SET: mainframe to Right.

c. Vert Out: 50mv/div $\pm 5\%$, 50mv max offset

CONNECT: 11-P 608 to 7L13 Input.

SET: 11-P 608 and 7L13 controls for an 8 div display.

CHECK: signal at Vert Out jack is 400mv \pm 20mv.

REMOVE: 11-P 608.

SET: trace to midscreen with 7L13 Vert Pos.

CHECK: Vert Out d.c. level is 0v \pm 50mv.

d. Vert Position

CHECK: baseline can be moved at least 5 divisions up.
and down at least off screen with the Vert Pos control.

e. Ref Level Variable range: 10dB

CONNECT: 608 to 7L13 RF In.

SET: 7L13 to Log 2dB/Div
608 and 7L13 for a 3 div signal.

CHECK: Ref Level Variable control increases the
signal at least 10dB.

f. Ampl Cal range

CONNECT: Cal Out to RF In.

SET: 7L13 for 8 div signal in 2dB/Div.

CHECK: Ampl Cal will reduce the signal by at least 3dB, reset to 8 div.

SET: Atten for 10dB attenuation.

CHECK: Amp Cal will increase the signal >5dB.

RESET: sig to 8 div with atten set to 0.

POWER OUT

SET: 7L13 Span/div to 0, \emptyset Lock to off.

CONNECT: R-F power meter to 1st L.O. out on front panel.

CHECK: for > +5dB (crank 7L13 C-F thru range, 0 - 1800).

CONNECT: R-F power meter to 2nd L.O. out on front panel.

CHECK: for >-10dB.

READOUT & LIGHTS

CHECK: that the proper amount of light shows in the front panel push-switches when actuated and that no light is present when they're not used.

that marker light comes on when in max span.

that the upper left section corresponds to the front panel ref-level with the following exceptions;
when in 10db/log and a gain setting outside the blue area, A > sign precedes the ref-level numbers and when using the 30Hz 10dB gain feature, the ref-level readout will read -110dbm.

that the lower left section corresponds to function being used.

that < sign precedes the ref-level numbers when ref-level variable is used.

that > sign precedes the ref-level numbers when operator has set an uncalibrated state.

that lower right section corresponds to freq span setting except when set to "0" Hz the lower right indicated the time/div.

that lower middle corresponds to video filters being used.

that upper middle corresponds to C-F readout.

7L13 UNCAL SYSTEM

The following charts will be used to check the uncal system.

When the uncal light is on, the 7L13 is in an uncalibrated state.

When the uncal light is off, the 7L13 is in a calibrated state.

Any sweep times faster than the times stated on the scan/width versus resolution charts will result in an uncal situation and the uncal light will activate.

If chart times are the same as the time/div settings on the 7L13, the uncal light may or may not activate. Either condition is acceptable.

The uncal light will come on at any setting of the res-disp switch if the time/div is 2ms or faster.

VF = NONE

SCAN WIDTH/DIV

	3MHz	300KHz	30KHz	3KHz	300Hz	30Hz
MAX		40ms	4s			
100MHz		20ms	2s			
50		10ms	1s		<u>UNCAL</u>	
20			400ms			
10			200ms			
5			100ms	10s		
2			40ms	4s		
1			20ms	2s		
500KHz			10ms	1s		
200				400ms		
100				200ms	10s	
50				100ms	5s	
20	<u>CAL</u>			40ms	2s	
10				20ms	1s	
5				10ms	500ms	10s
2					200ms	4s
1					100ms	2s
500Hz					50ms	1s
200					20ms	400ms

RES BW

3MHz

300KHz

30KHz

3KHz

300Hz

30Hz

MAX

10ms

100ms

4s

100MHz

50ms

2s

50

25ms

1s

UNCAL

20

400ms

10

200ms

5

100ms

10s

2

40ms

4s

1

20ms

2s

500KHz

10ms

1s

200

400ms

100

200ms

10s

50

100ms

5s

20

CAL

40ms

2s

10

20ms

1s

5

10ms

500ms

10s

2

200ms

4s

1

100ms

2s

500Hz

50ms

1s

VF = 300Hz

SCAN WIDTH/DIV

	3MHz	300KHz	30KHz	3KHz	300Hz	30Hz
MAX	667ms	6.67s				
100MHz	333ms	3.33s				
50	167ms	1.67s				
20	66.7ms	667ms	6.67s			
10	33.3ms	333ms	3.33s			
5	16.7ms	167ms	1.67s			
2	6.67ms	66.7ms	667ms	6.67s		
1		33.3ms	333ms	3.33s		
500KHz		16.7ms	167ms	1.67s		
200		6.67ms	66.7ms	667ms		
100			33.3ms	333ms	10s	
50			16.7ms	167ms	5s	
20			6.67ms	66.7ms	2s	
10				33.3ms	1s	
5				16.7ms	500ms	10s
2				6.67ms	200ms	4s
1					100ms	2s
500Hz					50ms	1s
200					20ms	400ms

VF = 10Hz

SCAN WIDTH/DIV

	3MHz	300KHz	30KHz	3KHz	300Hz	30Hz
MAX						
100MHz	10s					
50	5s					
20	2s					
10	1s	10s			UNCAL	
5	500ms	5s				
2	200ms	2s				
1	100ms	1s	10s			
500KHz	50ms	500ms	5s			
200	20ms	200ms	2s			
100	10ms	100ms	1s	10s		
50		50ms	500ms	5s		
20		20ms	200ms	2s		
10		10ms	100ms	1s	7.07s	
5			50ms	500ms	3.54s	
2			20ms	200ms	1.41s	6.32s
1			10ms	100ms	707ms	3.16s
500Hz	CAL			50ms	354ms	1.58s
200				20ms	141ms	632ms