M 19 H Check-out

Band 2 , 450 Mhz to 950 Mhz

Set test fixture sw. width for "nominal" sw. width.
Set band sw. to Band 2
Set "tuning switch" on the side of the M1H cover to the "fixed tuning" position (sw. arm "down")
(Note - this switch position removes the lead from the "arm" of the tuning pot and grounds it ~~to~~ in order to simplify the setting of the center frequency in the center of the display.)
Turn power on.
A normal display should be present on 'scope.

1. Using 50 Mhz and 890 Mhz markers, locate the 700 Mhz birdy. Adjust band 2 centering trim pot to position the 700 Mhz birdy over the center graticule line. Sweep width should be decreased to 10 Mhz or less while making this adjustment. (Note - Prior to making this adjustment, and periodically during the checkout, remove the 'scope horizontal input ~~lead~~ cable and center the beam on the center vertical graticule line. This insures proper alignment of center frequency which ~~shooted~~ corresponds to zero volts sweep drive.)
2. Adjust sweep width so that the 550 Mhz birdy is positioned 2 cm. from the left edge of graticule (550, 600, 650, & 700 Mhz will now be spaced 1 cm ~~from~~ apart. Disregard any birdies to the left of 550 at this time. (However 450 & 500 will normally be ~~seen~~ crowded toward 550) Do not change sw. width setting during next 2 steps.
3. Set the "Tuning switch" on M1H can to the "Variable" Tuning position - (sw. arm "up") and adjust front panel tuning so that 900 Mhz & 950 Mhz markers are displayed. (These birdies will usually be more than 2 cm. apart and at times 950 Mhz may not be present.)

Band 2 (cont'd.)

4. Decrease the spacing between 900 & 950 Mhz by shortening the length of the .75 pf. capacitor lead (which runs from the collector of the 2N5109 thru the 100 pf. feed thru capacitor at the end of the varicap line. Loosen the solder on the end of the 100 pf feed thru and carefully push the lead thru the feed thru ~~slightly~~ slightly farther.

Note - A little experience will help to develop a "feel" for how much to move this lead. It is important to remember that the spacing between 900 & 950 will decrease when the cover is placed on the osc. compartment ~ therefor the cover should be slid into place when checking this spacing.

Additional tips:

A. For ~~fine~~ small adjustments the 900 - 950 spacing may be decreased slightly by depressing the "loop" (or lead) so that it lies closer to the 100 pf feed thru ~ also by "squaring up" the shape of the loop and dressing it closer to the 2N5109.

B. The spacing between 900 - 950 should normally not be decreased ~~much~~ to much less than 2 cm with the cover in place as this may cause excessive spreading of 450 to 500 Mhz spacing.

5. With the cover in place perform the following checks:

A Unlevel the output by switching the monitor sw. to "Ext." ~ Output at 950 mhz must be greater than ~~1.0~~ 1.0 volt peak using a D 152 detector. Return monitor sw. to "Int."

B Set the "tuning sw." to "fixed" position, Re-center 700 Mhz using the band 2 trim pot. at low sw. width ~
Re-set sw. width for 1 cm spacing of

Band 2 (cont'd.)

~~5. (cont'd.)~~

5. B (cont'd.)

550, 600, 650, & 700 Mhz markers ~
Re-check spacing between 900 & 950 without disturbing sw. width setting.

C. Check unleveled output at 450 & 950 Mhz. Output at 450 should be greater than 1.2 V. and output at 950 must be greater than 1.0 V. Adjust output loop as required and recheck leveled output marker spacing at 900 - 950 with normal sw. width set at 550 - 700 Mhz. with cover on osc. (Re-centering 700 Mhz will be required after a change in output coupling ~) Also a change in sw. width may be required - Re-adjust the "collector" lead dress or length as required to get 2 cm. or less spacing with cover in place & repeat items of Section 5 until all specs. are met.

D. With "tuning switch" in "fixed" position & with centering & sweep width set for proper display per above check the location of the 450 & 500 Mhz markers - these will normally be crowded somewhat toward 550

E. Without changing sw. width or centering, with power off remove one end of the 100 Ω resistor (R-4) from the clover leaf.
Substitute a larger value resistor for R4 to move 450 over to the left edge of the graticule (a value of 150, 180, 220, 270, etc. may be used depending on the amout of spreading required.) Note that 500 Mhz will also move to the left but not as much as 450 will. By proper choice of R4, 450 Mhz may be positioned at left edge of graticule

Band 2 (cont'd.)

with a corresponding positioning of 500 Mhz to within 1% of its ideal position.

Note - In some cases if 500 Mhz is more than 1% to the right of its ideal position, a choice of a slightly smaller value of R4 and a slight decrease of sw. width will produce a display with more evenly spaced markers between 450 & 700 Mhz with none of them over 1% off.

Note: When 700 Mhz is centered (in "fixed tune" position) & output, sweep width & linearity are OK (1% linearity from 450 thru 700 Mhz) with a 900 to 950 spacing of 2 cm or less (all with osc. cover in place), Band 2 is properly set up and the cover should be soldered in place (at 2 spots).

All markers above 700 Mhz will be spread to the right in an increasing spacing for each 50 Mhz higher in freq. This non-linearity will be corrected by trimming diode "break points" in the 1/2 H when the unit is being set up.

6. Band 2 "Pulling" check:

With 700 Mhz centered & output leveled, Rotate the attenuator vernier to reduce output 20 db. Observe the 700 Mhz birdy for frequency pulling. There should be little (1 or 2 Mhz) or no freq. pulling. Switch tuning to variable and check 950 Mhz pulling in the same manner. Pulling should be less than 5 Mhz.

If excessive pulling occurs do the following:

A. If pulling is excessive & if the birdy pulls to the left as output decreases, add a high resistance (approx. 220K) from the junction of the 39K (R20) and emitter of Q8 to the junction of R24 (22K) & R23 (68K).

Band 2 (Cont'd.)

6. A. (Cont'd.)

The resistor being added is R-22 and is a "*" value on the schematic (No resistor is used here ~~during~~ in production)

* Care should be excercized not to short the emitter of Q8 to gnd. as this will destroy Q8 and/or Q7.

B. If pulling is excessive & the birdy pulls to the right as output decreases then PIN diode CR-6 is defective or not operating over the proper portion of its "curve" to compensate for loading changes produced by CR7 & CR8. Either change ~~the~~ CR6 or change the value of R24 upward to 33K or 47K ~

Band 3 900 Mhz to 1400 Mhz

Set band switch to band 3

With "tuning switch" in "fixed" position;

I. adjust Band 3 centering Trim pot @ low sweep width for 1150 Mhz on center scope graticule. (after checking scope horiz centering with horiz input removed)

II. adjust sweep width control to place 900 Mhz marker at left edge of graticule

III. Check linearity (900 Mhz to 1150 Mhz (center freq.) Markers between 900 & 1150 may be to the left of their "true" position, if so adjust the "gimmick" either against the side of the osc. compartment (above the choke cloverleaf) or better, underneath & up against the emitter choke windings. This will usually correct linearity to within 1%. (The action of the gimmick also causes a reduction of unleveled output at 1400 Mhz which must be 1.0V. or greater.) Check unleveled output at 1400 Mhz.

* Note: The action of the gimmick, to Quote Tony. "either works or it doesn't" and dressing it more tightly against the osc. box (gnd.) serves no useful purpose. It may in fact decrease 1400 Mhz output below minimum specs.

If linearity of 1% cannot be obtained using the gimmick an alternate method is to parallel a 150 to 220 Ω resistor across the .22 uh choke in the collector circuit. This will usually correct linearity to well within 1%. This fix has 2 drawbacks. 1. It also causes a reduction in 1400 Mhz unleveled output & this should be checked - (must be at least 1.0V.) 2. It causes a "drop out" of oscillation at abt. 800 to 850 Mhz & below especially if the resistance is too low.

Band 3 (Cont'd.)

III. (Cont'd.) If the alternate linearity correction also does not correct linearity and/or if its use reduces 1400 Mhz output to below 1.0 V. then check the amount of solder on the (grounded) base tab of the 2N5947. The tab should be well soldered to gnd. with little or none of the "shoulder" of the tab showing. That is, a large fillet of solder should be flowed between the base & gnd. Very low base inductance is a must for 1400 Mhz performance — Again, to quote Tony, "It's impossible to get too much solder" between base and ground. If addition of solder does not help then the 2N5947 should be replaced if all other parts of the circuit are proved to be OK.

IV. Set Tuning switch to "Variable"

A. Check 1350 to 1400 Mhz spacing. Must be less than 2.2 cm. (or 2.0 cm) usually no problem

B. Check 1400 Mhz. output (unleveled) must be 1.0 V. or greater.

C. Install cover, set "Tuning" to "Fixed" & re-center 1150 Mhz

D. Re-set sweep width for proper 900 to 1150 Mhz presentation & recheck linearity (linearity @ 900 to 1150) & spacing & output at 1350 - 1400 without changing sweep width.

E. If all is Ok solder cover in place (2 spots)

V. Pulling Check.

A. With display centered on 1150 Mhz (fixed tuning) check pulling by rotating vernier to min. output (20 db down)

B. 1150 Mhz birdy will normally "pull" to the left as output decreases.

C. Sw. to Variable tuning & check 1400 for pulling. It will usually also pull to left or zig-zag about a vertical line.

C. Select by trial & error a value for R26 (usually in the neighborhood of 100K) which

Band 3 (Cont'd.)

will cause the 1150 Mhz birdy to stop pulling (or pull very slightly.)

Check the 1400 Mhz birdy for pulling with R26 in place. 1400 Mhz pulling should be very slight (3 to 5 Mhz) but not more than 10 Mhz max. If 1400 Mhz pulls to the right after adding R26, increase the value of R-26 so as to compromise compensation of pulling so that 1400 is not over compensated & 1150 is possibly slightly under compensated.

* Again, Pulling to the right as output is decreased is either a sign of over compensation if R26 is installed or if R26 is not yet in the circuit it indicates a pin diode malfunction. (CR17)

Squibbulation Check

Observe the output trace on 'scope while rotating the Vernier Atten. to min.

If squibbulation occurs change the 1N82 monitor diode ~ Replace it with one selected for low reverse resistance (20K - 30K)

Flatness Check

Using a negative output D-152 detector
Set up scope for 10 cm vertical deflection at full leveled output.
The maximum unflatness between band 2 and band 3 must not exceed 10%.

Positive Detector Flatness

Using a positive output D-152 detector
Repeat the previous step.
Adjust sweep width to sweep the entire band.
Set 'scope vertical sensitivity so that the 500 Mhz (Band 2) birdy is set at 10 cm Vertical deflection
(in other words, ignore output below 500 Mhz)

Positive Flatness (Cont'd.)

With scope set as above, check flatness of Band 2 and Band 3 (do not change scope gain when switching to Band 3)
Notice that band 3 usually has an output notch near the middle of the sweep range - This notch causes a droop in output (as measured with the power meter) which is usually outside the flatness specs.
To remedy this add a .75pf cap. from the cloverleaf junction of the two pin diodes (CR18 & CR19) to the side of the band 3 osc. box. The lead length of this capacitor is critical. First solder one end of the cap. into the clover leaf with abt. 1/4" lead length between clover leaf and cap. The body of the .75pf. cap should be against the osc. box with the other lead extending lengthwise along the box toward the output end of the module. The lead should be cut off at a point adjacent to the end of the box. Then using an insulated stick touch the end of the lead to ground (osc. box) and while observing the scope trace find the lead length which gives the best "positive" flatness.
When band 3 flatness has been adjusted by this means to within abt. 15% or less of the output @ 500 Mhz. the power meter flatness should be well within ±.75db. (-1.5db from 500 Mhz output)

Recheck Neg. Flatness

This completes checkout -

R.E. Grierson

Some M19H "Case Histories"

Symptom	Possible Trouble
1. Sweep Sample present (Birdies) but little (A) or no (B) R.F. output	1. A. Reversed or defective PIN diode inside tubing shields (CR 7, 8, 18, or 19) (g'nded) B. Shorted leveler input (pin 6)
2. Birdies on base line – (improper blanking of sweep sample) (Band 3)	2. * excessive lead length, CR 12 PIN diode. (~~little or~~ no lead length allowable) Also check C19 feed thru, Q13, & CR11
3. Markers drift after switching bands	3. Open choke in vari-cap bias or "drive" circuit especially the resistor wound chokes ~ check for no solder at choke end to resistor lead connection.
4. "incomplete" sweep ~ markers present for only abt. half the sweep range	4. Open circuit to end of varicap string ~ (open .22 μh choke or no solder inside feedthru at "cold" end of varicap string. ~ "Open" Ferrite choke –
5. Markers jitter (other than F.M.)	5. A. Noisy centering trim pot. B. Ferrite choke (L10, L11, L21, or L22) intermittently shorting to gnd.
6. Squibbulation	6. Replace monitor diode with a 1N82 having low reverse resistance (20K–30K Ω)

M19H

Check-out Specifications

Band 2

1. Frequency range – 450 to 950 Mhz.
2. Center frequency – 700 Mhz. with 0 Volts @ T.P. #1.
   (Note - Set Main tuning dial for 0 volts @ T.P. #1 at minimum sweep width)
3. Linearity – 1% of full sweep width from 450 - 700 Mhz.
   disregard linearity above 700 except that spacing between 900 & 950 must be 2 cm. or less.
4. Output –
   a. Unleveled – > 1.1 Volt peak @ 950 Mhz
      > 1.2 Volt peak @ 450 Mhz
   b. Leveled – .9 Volt peak
5. Freq. Pulling – less than 10 Mhz.

Band 3

1. Freq. Range – 900 to 1400 Mhz.
2. Center freq. 1150 Mhz @ 0 volts (tuning voltage)
3. Linearity 1%, 900 to 1150; 1350 to 1400
   spacing to be 2 cm. or less.
4. Output – > 1.1 volt peak at 1400 Mhz.
   > 1.2 volt peak at 900 Mhz.
5. Freq. Pulling – less than 15 Mhz at 1400 Mhz
   (typically less than 10 Mhz.)
6. Flatness – Overall flatness (band 2 & 3) not more than 10% unflatness (typically 6%)

R&B