

**PSL
RF PHOTODIODE BOARD
TEST PROCEDURE AND
TUNING PROTOCOL**

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E010017-00-C

RF Photodiode Board Test Procedure

All directions in this procedure pertain to the schematics DCC # D000455-01-C.

Make sure DC voltages are correct:

- 1) Power up (+ 15V / -15V / GND)
 - +15 draws 100 mA
 - 15 draws ~0mA
 - U1 pin 2— +5V
 - U2 pin 2— -5V
 - U11 pin 1—14.68V
 - U10 pin 1—4.8V
 - U11 pin 3—5.08V
 - U5 pin 3—6.99V
 - Diode reverse bias— -6.94V

Test the DC Path. In order to do this, the path to ground caused by R22 must be removed, and the inductor can be removed in preparation for later tuning:

- 2) Remove R22, Remove and short across L5 (solder a jumper where L5 was.)
- 3) Input 1V DC into J1. Read Voltage at J3. V-J3 should be 5 x V-J1 due to the gain in U7.
- 4) Disconnect DC voltage.

Test the feedback path. A signal of 150Hz is used here to both test the feedback, and to make sure the Op-Amps are stable:

- 5) Input 150 Hz, 2Vp-p into TEST INPUT SMA (J1)
- 6) U7 pin 3 should read 580mV, 150Hz on an Oscilloscope.
- 7) U7 pin 6 should show 3V, 150Hz on an Oscilloscope, verifying that U7 has a gain of 6.

- 8) U8 pin 3 should read 580mV, 150Hz on an Oscilloscope
- 9) U8 pin 6 should read 580mV, 150Hz on an Oscilloscope, verifying that U8 has a gain of 1.
- 10) If VC ADJUST = 0, and pin 3 of U5 = 6.99V, then U6 pin 6 should sum and invert their inputs resulting in a 150Hz, 580mV small signal riding on a -6.99VDC offset.
- 11) Disconnect AC test input.
- 12) Replace R22, remove the jumper across L5

Tuning the PD Circuit

In this section, calculations for the values of inductors L5 and L4, and capacitor C34 are performed, allowing the selection and/or verification of component values. For illustration, the ω frequency of 21.5 MHz is used throughout this example. If a different frequency is desired, a direct substitution is required.

Calculate the value of L5 for the frequency you are interested in, assuming that the diode has a capacitance of 80pF.

$$\omega = 1/\sqrt{LC}$$

so, for example, L5 and the diode's 80pF can resonate at 21.5 MHz by using the above formula.

$$(21.5 \times 10^6) \times 2\pi = 1/\sqrt{L \times 80\text{pF}}$$

Solving the above equation for L, we get L5 = .684 μ H

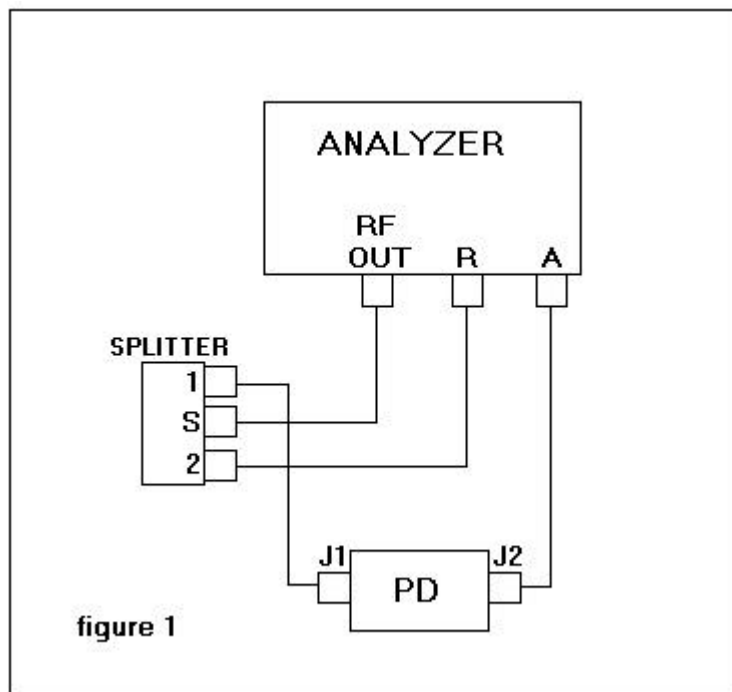
Now, we must calculate L4 and C34.

Pick an inductor value that is in stock, and design the capacitor around it. Start with an inductor for L4 that is roughly equal to or slightly larger than L5. For example L4 was picked at .68 μ H. Using the above equation, substituting 2 ω (43MHz) for ω (21.5MHz), substituting .68 μ H for L, and solving for C, we get C = 20.14pF

For both L5 and C34, we want to use variable parts. L4 and, of course, the capacitance across the diode will be constant. All tuning will be done with L5 and C34. Note: once the network of C34 and L4 is in place, the inductor L5 will need to be decreased in value so a variable inductor whose maximum value is around the calculated value should be selected.

Tune the ω passband peak:

- 1) Remove or omit C34 and L4.
- 2) Run a sweep using a Network Analyzer as per fig.1. Input into Test Input SMA (J1), and output out of RF OUT SMA (J2).



- 3) There should be a peak in the response near 21.5 MHz. Tune L5 until the resonant peak appears at 21.5MHz. (fig. 2)

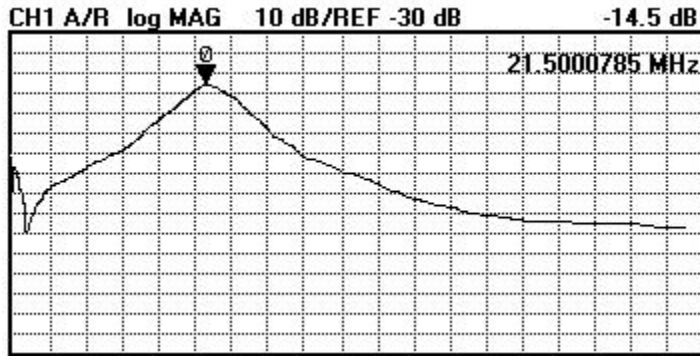


figure 2.

Tune the stopband trough:

- 1) Power down, and put in C34 and L4.
- 2) Power up and look at the analyzer. The peak at 21.5MHz will have moved. Change L5 until it is on the mark again.
- 3) Vary C34 until a deep trough forms at 43MHz. (fig.3) Make sure that the difference between the peak and trough is >30dB. If the trough forms but does not come back to 2ω , increase the value of L4. If the peak does not move to ω , try lowering the value of L5.

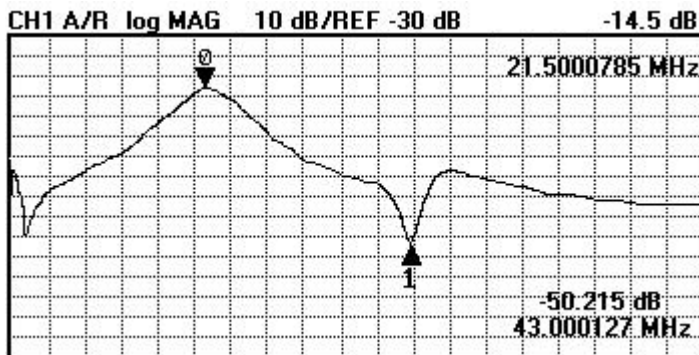


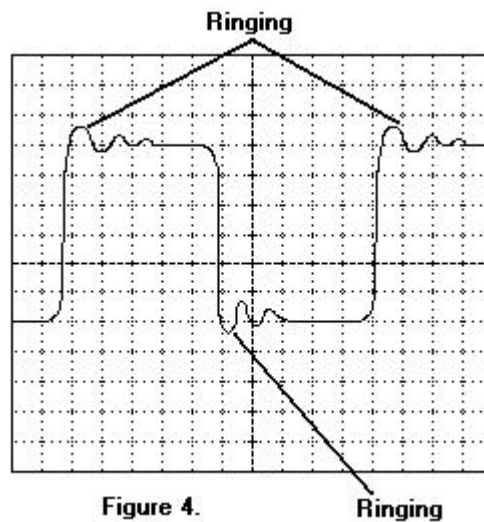
figure 3.

Impulse Response

U4 has been outfitted with an anti-oscillatory network that should stop any oscillations that might happen when an OPA547F drives a capacitive load. This test is to make sure it is doing its job.

- 1) Remove C41
- 2) Power up.

- 3) Input 1KHz, 2Vp-p square wave into Vc ADJUST (FLT5)
- 4) Read U4 pin 6 with an oscilloscope.
The square wave should appear with no ringing on the corners, and no oscillations on the top or bottom of the waveform.
- 5) If there is ringing or oscillation (fig.4), check to see if the inductor-resistor parallel network is in place on the trace between U4 and C32.



- 6) If the waveform looks square and pretty (fig.5), Power down, replace C41, close box and ship unit.

