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K2 APPLICATION NOTE: RF Detector Accuracy

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Some K2s indicate power output a bit less accurately than others. This is traceable in part to the 1N34A diode, which in some cases will have a bit of high-frequency roll-off. While the 1N34A provides power measurement to within about +/- 10%, this can be improved with a different diode.

Here are our test results:

- The 1N34A (germanium) has the best accuracy over all power levels (matches our firmware algorithm very well), but has the worst spread due to frequency.

- The 1N4148 (silicon) works well across the entire frequency range, but is inaccurate at low power levels (< 3W) because of the higher forward-bias voltage required. The 1N914Bs that we tested were much worse, even though they're supposed to be equivalent to the 1N4148.

- The 1N5711 (hot carrier) works well at all frequencies and has fair accuracy at both low and high power levels. This part is available from Mouser. We tried three different manufacturers' parts with identical results. Note that R68 must be changed to 220 ohms if you use this diode.

- The 1N191 (germanium) is the best overall choice, handling both low and high power with good accuracy, but without the frequency-related problems of the 1N34A. R68 must be changed to 220 ohms.

Our top two choices, the 1N191 and 1N5711, can improve power measurement accuracy to about +/- 5%. The only catch is that one of the voltage divider resistors (R68) must also be changed, because the detected voltage does not roll off as the frequency goes up. The original value of R68 (238 ohms) was a compromise, optimized for the 1N34A.

Other germanium diodes (1N270, 1N60) may work as well as the 1N191, although we haven't tried these yet. Keep in mind that R68 may have to be changed, depending on the diode used. Also, don't attempt a change unless you have an very accurate wattmeter or a 60 MHz + oscilloscope with which to confirm results. We used a 100 MHz scope to make sure that reference power measurements into the dummy load were accurate.

5V Regulator Considerations

Note that power measurement accuracy is highly dependent on the accuracy of the 5-V regulator since it's the reference for the on-chip A-to-D converter of the 16C77. Typically these regulators are within a few percent of 5 V. Suppose it's 5.10 volts (2% high). This will result in a decrease in indicated power readings of 4% (1.02^2 - 1.00 = .04), since power output is proportional to the square of the voltage reading. If the regulator is further off, you can use a pot at R68, setting the power to a known level using an accurate external instrument.