# Instructions for RFpwr.m

In the article *A Diode-Model-Based RF Power Sensor*, the third column (labeled *PwrSens Measurement*) of **Table 2** contains data produced by *RFpwr.m*, a well-commented and easy-to-understand *Octave* script. In what follows below, an outline is given that describes the generation of this third column data.

All *DC* measurements discussed below were made with a *Siglent SDM3065X 6½* digit desktop *DMM*. The meter probes were inserted into *2* millimeter diameter pin jacks mounted on the aluminum enclosure containing the *PwrSens* circuitry. Voltage measurements were made at the *Voltage Port* pin jacks, and current measurements were made at the *Current Port* pin jacks (See Figure 1). Also, mounted internal to the enclosure, a *DATAQ DI-245* data acquisition (*DAQ*) device was used to confirm the voltage measurements. Via a *USB* connection, the *DI-245* reported results to an external computer.

The **Table** 2, Column 3 data was generated by following the procedure:

1)  On the *PwrSens* hardware, with the *DMM* probes inserted in the *Current Port* pin jacks, I measured $I_{d1}$ = *1.00uA* and $I_{d2}$ = *1.78uA*. $I_{d1}$ and $I_{d2}$ were included in *RFpwr.m*, at the top of the file.

2)  On the *PwrSens* hardware, at the *Voltage Port* pin jacks, I measured $V_1$ = *−.1628* for $I_{d1}$ and $V_2$ = *−.1779* for $I_{d2}$.

3)  In the *Octave IDE*, I ran the *RFpwr.m* script. When prompted, I entered the $V_1$ and $V_2$ values (In what follows, measured values are displayed in a red font). Then, the software computed *NVt = 0.026146*.

    For $I_{d1}$ Enter $V_1$  = *−.1628*
    For $I_{d2}$ Enter $V_2$  = *−.1779*
    Computed Thermal Voltage = *NVt = 0.026146*

4)  I set the *IdSelect* switch back to $I_{d1}$.

5)  I programmed my *RF* generator (*Rigol DSG815*) to output *.01* milliwatts (*-20dBm*), applied this *RF* to *the PwrSens* hardware and measured $V_3$ = *−.15387* at the *Voltage Port* pin jacks.

6)  At the next *RFpwr.m* prompt for $V_3$, I entered the measured $V_3$ (displayed in a red font)

    For *RF On* Case $V_3$ = *−.15387*

    Peak *RF* Volts Across Input 50 Ohm Load = *0.031860*

    Power = *0.010151* Milliwatts and Power = *−19.935116 dBm*

7)  Rounded to three significant figures, the *Power = .0101* milliwatts is included in the third column, first row of **Table 2**.

8)  I set the *DSG815* to output *.1* milliwatts (*−10 dBm*), applied this *RF* to *PwrSens* and measured a $V_3$ = *−.10229*

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at the *Voltage Port* pin jacks.

9) At the next *RFpwr.m* $V_3$ prompt, I entered the measured $V_3$ value (displayed in a red font).

For *RF On* Case $V_3$ = *−.10229*

*Peak RF Volts* Across Input Termination = *0.101223*

*Power* = *0.102461* Milliwatts and *Power* = *−9.894412* dBm

10) Rounded to three significant figures, the *Power* = *.103* milliwatts is included in the third column, second row of **Table 2**.

11) I set the *DSG815* to output *1* milliwatts (*0 dBm*), applied this *RF* input to *PwrSens* and measured $V_3$ = *.09892* at the *Voltage Port* pin jacks.

12) At the next *RFpwr.m* $V_3$ prompt, I enter the measured $V_3$ value (displayed in a red font).

For *RF On* Case $V_3$ = *.09892*

*Peak RF Volts* Across Input Termination = *0.318132*

*Power* = *1.012077* Milliwatts and *Power* = *0.052136* dBm

13) Rounded to three significant figures, the *Power* = *1.01* milliwatts is included in the third column, third row of **Table 2**.

14) I set the *DSG815* to output *10 milliwatts* (*10dBm*), applied this *RF* to *PwrSens* and measured $V_3$ = *.7648* at the *Voltage Port* pin jacks.

15) At the *RFpwr.m* prompt, I entered the measured $V_3$ value (displayed in a red font).

For *RF* On Case $V_3$ = *.7648*

Peak *RF* Volts Across Input Termination = *0.999167*

*Power* = *9.983345* Milliwatts and *Power* = *9.992761* dBm

16) Rounded to three significant figures, the *PwrSens Measurement* = *9.98* milliwatts is included in the third column, fourth row of **Table 2**.

17) Done!   At the *RFpwr.m* prompt, I entered $V_3$ = *0* to terminate.

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