Review: The Dishtronix DWM-2104A Active Peak Reading SWR/Wattmeter
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Introduction

What? Not another SWR/Power meter! After all, there are already many power meters from many manufacturers available to today's ham. Now some power meters stand out because of feature content and high accuracy – and usually a correspondingly high price, and these are normally the ones most interesting to review. As I found out, however, the DWM-2104A is a highly accurate device with features normally not included in an analog power/SWR meter – AND it has a reasonable price.

First of all: Why Should You Use A Peak-Reading Wattmeter?

Unfortunately, folks who don't understand the difference between peak reading and average reading wattmeters often overdrive their transceivers and/or amplifiers as they try to get their conventional wattmeters to read what they think should be the peak power. When they do this, at the very least they cause distortion products to splatter across the band. And at most, they can even damage their transceiver or amplifier. So why can't you accurately read peak power on the typical average-reading power meter? To understand this, let's begin with a simple test.

Set your transceiver for CW, and transmit a steady carrier of 100 watts into a dummy load. Monitor the signal with your standard average reading wattmeter (don't forget that most wattmeters have an accuracy of 5-10%). Unkey your transceiver. Now while watching your wattmeter, send a single dit. What did you see on the wattmeter? Maybe just 20-30 watts? But you know that your power level is 100 watts, so why the much lower power reading?

Typical RF power meters rectify a sample of your RF power using a detector diode and filter capacitor. The detected voltage is proportional to the peak voltage of the RF waveform. But this peak voltage doesn't hold at that detected level – it immediately begins to discharge into the meter circuitry.   So unless the detected DC voltage is held constant by providing a constant power level signal, the detected DC voltage will vary due to the duty cycle of your SSB speech or CW keying. Now when this voltage is applied to the meter, the inertia of the meter movement prevents the meter from instantly deflecting to the proper value. And during the time the meter is trying to deflect, the peak voltage or current available from the filter capacitor is also decreasing due to the duty cycle of the applied signal. So the only way that you can truly measure peak power is by adding active peak-hold amplifier circuitry to the power meter. This means that the wattmeter must be supplied with an external or internal battery power source. Some wattmeters have a peak/average switch but are not powered. The switch on these unpowered wattmeters normally just selects between either a smaller or larger filter capacitor in the detector, which really doesn't provide accurate peak power measurements.

To summarize, the normal average reading wattmeter is only accurate when a continuous carrier is applied. For low duty cycle modes like CW and SSB, the meter reading may only show 1/5th to 1/10th of the actual peak power. So if you see the full 100-watt transceiver power when operating SSB or CW, you either have a true peak reading wattmeter, or you are overdriving your radio and/or amplifier.   The best thing is to always adjust your transceiver's microphone gain to be within the ALC reading as stated in your manual. This normally ensures proper peak output power from your radio regardless of what your power meter reads.

The DWM-2104A

Physically the Dishtronix DWM-2104A (Photo A) is an attractive unit in a molded case in a relatively compact 4" H x 8.3" W x 4.3" D size. This makes it a good compromise for home, portable and mobile installations – and it is even supplied with a mobile mounting bracket and self-tapping screws (Photo B) as well as a 2.5mm x 5.5mm DC cable. The display is well thought out, and uses three backlighting LEDs which make the meter very evenly illuminated. The DWM-2104A meter face also employs three different colored scales to indicate Forward (black) and Reverse (blue) power, and SWR (red).   I was also impressed with the extensive glossy manual provided, as many meters in this price range consist of just a few duplicated sheets of paper.

Photo A: DWM-2104A Active Peak-Reading Wattmeter.

Photo B: The DWM-2104A is supplied with a mobile mounting bracket, mounting hardware, and a DC power cable.

Electrically the DWM-2104A is a true analog peak reading active cross-needle SWR/power meter covering 160-6 meters. It measures power up to 2000-watts in three ranges over the entire 160-6 meter range: 20 watts maximum, 200 watts maximum, and 2000 watts maximum (three separate LEDs indicate which range is selected). And recognizing that even the low-bias Schottky detector diodes used in the DWM-2104A will not be linear over all the ranges, Dishtronix has a different “tick-mark” calibration scale for each range to improve accuracy. The DWM-2104A boasts an accuracy of ±10% of the full-scale meter reading from 160-6 meters. If you wish, you can re-calibrate it for HF-only, which improves the accuracy to ±5% of the full-scale reading. The manual provides detailed calibration information for those who wish to do this. Another neat feature is that the RF output port is DC grounded to ensure that any static on your transmission line is harmlessly bled to ground.

Besides accuracy, a major feature of the DWM-2104A is the active peak-reading wattmeter that includes an adjustable PEAK/HOLD knob for both the forward and reflected meter readings. Normally, you’ll adjust this knob for lower delays for CW operation, and higher delays for SSB operation. With a little practice you’ll find a setting that accurately captures your peak power for your mode of interest with a reasonable delay time. Of course, since the peak reading circuitry is active, you must supply DC power for peak reading measurements. However, unlike many other peak-reading wattmeters on the market, normal RMS power measurements and SWR can be made with DC power removed.

<u>Performance Measurements</u>

OK – enough about the features. Let’s see how the DWM-2104A performs. For my tests, I placed the DWM-2104A in series with my Array Solutions PowerMaster digital wattmeter with the output terminated in a MFJ-267 dummy load. The PowerMaster has an accuracy of 3%, and I watched my Powermaster being calibrated against NIST-traceable HP test equipment at Array Solutions. I was able to transmit with up to 500 watts on HF, but only 95 watts on 6-meters as I have no amplifier for that band. I picked several different power readings within each power range so as to check tracking accuracy. Keep in mind that I’m comparing an DWM-2104A analog meter reading to the Array Solutions Powermaster digital read-out, so I’m doing my best to read and interpolate the tick-mark readings on the analog meter. Table 1 shows the results of my measurements. And incidentally, I did not re-calibrate the DWM-2104A before beginning the tests – these measurements were made on an out-of-the-box DWM-2104A.

Table 1 – Power Measurements

Band	Range	PM	DWM	PM	DWM	PM	DWM
160M	Low	5W	5W	10W	10.5W	20W	21W
80M	Low	5W	5W	10W	10.5W	20W	21W
40M	Low	5W	5W	10W	10.5W	20W	21W
20M	Low	5W	5W	10W	10.5W	20W	21W
10M	Low	5W	5W	10W	10.5W	20W	12W
6M	Low	5W	5W	10W	11W	20W	22W

Band	Range	PM	DWM	PM	DWM	PM	DWM
160M	Med	50W	50W	100W	100W	200W	200W
80M	Med	50W	50W	100W	100W	200W	200W
40M	Med	50W	50W	100W	100W	192W	195W
20M	Med	50W	50W	100W	97W	192W	190W
10M	Med	50W	50W	100W	96W	150W	145W
6M	Med	50W	49W	95W	92W		X

Band	Range	PM	DWM	PM	DWM	PM	DWM
160M	High	100W	80W	250W	240W	500W	480W
80M	High	100W	80W	250W	240W	450W	410W
40M	High	100W	80W	250W	235W	500W	480W
20M	High	100W	75W	250W	235W	500W	475W
10M	High	100W	75W	250W	230W	500W	460W
6M	High	95W	70W		X		X

As can be seen from my measurements, the DWM-2104A easily meets its ±10% accuracy spec of full scale – and in fact accuracy is better than ±5% of full scale including 6 meters. You'll note the greater error on the low end of the high power scale (2000 watts), but the accuracy at medium and higher power levels is very good. As stated in the DWM-2104A manual, analog meters are most accurate in the top 1/3rd of the scale. And when you realize that ±5% of full scale accuracy at 2000-watts is ±100 watts, then you can see that the low power readings are surprisingly accurate on this high power range.

Conclusion

The Dishtronix DWM-2104A peak reading wattmeter fills a niche between the typical low-end analog wattmeters and the high- end digital wattmeters available in today's ham market. It is a quality unit with an accuracy of ±10% HF-6 meters or ±5% HF-only (when re-calibrated), a variable delay peak-reading control, well lit and visually pleasing display, and static bleed-off for your connected coax cable. If you are in the market for an affordable, accurate wattmeter, take a close look at the DWM-2104A.

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