KUN004: PSK31 Performance

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I have posted several times on the outstanding performance of the Kachina 505DSP on the PSK31 mode. Not only is it a snap to interface to a computer without requiring any special interface (I use two shielded audio cables), but it is capable of delivering signals with superb IMD characteristics as well.

Today, I set up my backup Icom IC-765 transceiver with no antenna and my laptop computer as a PSK31 "station". The AF and RF gains were very carefully controlled to minimize distortion created with the receiver. Two programs were used for the tests: SpectroGram 5.0 for numerical spectral estimation and DigiPan for IMD values. The Kachina 505DSP was operated into a dummy load.

With careful setting of gain levels in the 765, I found that by limiting the 505's output to 50 watts as shown on the FWD scale and being very careful with audio levels out of the soundcard, I could get IMD readings of -38 to -42 dB. At 100 watts output, the IMD degraded to -25 to -30 dB and adjustments were very "ticklish" at this power level. DigiPan reported IMD readings that were almost exactly the same, so I am confident of the data.

Note: these numbers represent the magnitude of the third-order components relative to that of the peaks of the two-tone spectrum. Since these peaks are 6 dB below peak transmitter output, the conventionally reported IMD value is obtained by adding -6 dB to the values above. This leads to final IMD values of -44 to -48 dB.

It is unlikely that I will work many stations that will report an IMD of -40 dB or better since much of what the other station sees depends on how *his* station is set up. But, it is comforting and satisfying to know that by careful adjustment, our Kachinas can output a near lab-quality signal. I am getting superb reports: "your signal looks just like a ladder - nothing on either side of the rails."

Now, on the practical side, what can you do to set up your station in the absence of another "station" on the operating table?

The next best approach is to use a good scope to view the output RF envelope of the transmitted signal. Turn on any of the PSK31 programs and let it run in BPSK idle mode. Put your soundcard mixer control panel on the screen so that you can get at the VOLUME and WAVE sliders. Sample the output of your transmitter, operated into a dummy load; one easy way is to use a T fitting at the dummy load and loosely couple the scope probe to the open port. It does not take much signal on a sensitive scope to get a good envelope pattern.

What you are seeking is the classic two-tone pattern shown for many years in the

ARRL Handbook and various SSB books. This looks sort of like a sinewave wrapped up around another sinewave. The key thing is that the peaks of the sinewave signals must be smooth and rounded and show no signs of flat-topping or clipping. If you see that, first reduce the transmitter mic gain. If that does not have the desired effect, then the problem is probably a distorted signal out of the sound card.

The next step is to place the VOLUME and WAVE control sliders at about 1/3 of maximum and take another look. Forget about running the full 100 watts of output, although you want to set the POWER level on the control program at 100 watts. Shoot for a FWD meter reading of 50 watts output. This corresponds to an average power of 25 watts which is more than adequate.

Experiment with the slider controls until you can find a combination of settings that (a) gives the desired power output, and (b) gives a nice, smooth two-tone signal on the scope. With that combination, you most likely have an IMD that is -25 dB or better. Always keep the sound card sliders at the lowest possible settings.

On my Creative Labs 64D sound card, I can run the VOLUME control to full without adding any distortion. However, the WAVE control starts adding distortion if it is moved much above the 1/3 position. Your mileage *will* vary since all cards seem to be different and distortion is not a spec normally published or given much attention.

No scope?

Some folks use the ALC meter as a guide. If you must, then no ALC indications should be visible nor should any compression of any type be used. This may be contrary to advice from others, but my experience with the 505 and 765 supports this viewpoint.

I hope these results and comments are of some help to new and old PSK31 operators. We have a tremendously effective and sophisticated radio!

Editor's note: George (W5YR - "Yellow Rose" of Texas) became a silent key in March, 2005 at the age of 75. He was a frequent contributor to everyone's store of knowledge and he is sorely missed. I'm sure he would rejoice knowing his results and comments above are still being shared with Kachina 505DSP owners.

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