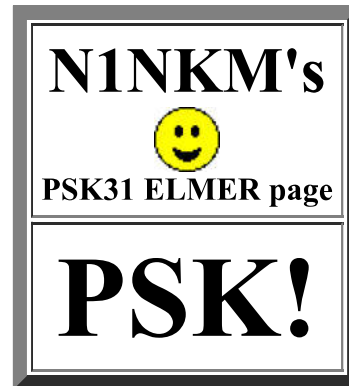




God Bless America!



WHAT IS PSK31?

**"PSK" stands for Phase-Shift-Keying. 31 means 31Hz.
It is a *really great* digital mode!**

UPDATED: 8/5/2015

The URL of this page is: www.mymorninglight.org/ham/psk.htm
If that is NOT what you see in your address bar,
copy & paste it, then hit ENTER.

Note: This page contains a number of small graphics. Please be patient if you are using a slow connection. :)

In my humble opinion, PSK31 is one of the BEST digital modes on Ham Radio! In the same bandwidth as ONE SSB conversation, there can be literally DOZENS of "keyboard-to-keyboard" text QSO's. Because of the extremely narrow bandwidth (31Hz!) you don't need a lot of power to have a good signal. Most DX PSK31 contacts are made with power levels at or below 30 watts!

As a default "standard", 20 watts is considered a "normal/maximum" operating power. Because PSK is so efficient, it is almost never necessary to run more than this. For this reason, QRP operation on this mode is common. (There is also PSK63, which is a faster version of PSK31, but it does not seem to be very popular for some reason!)

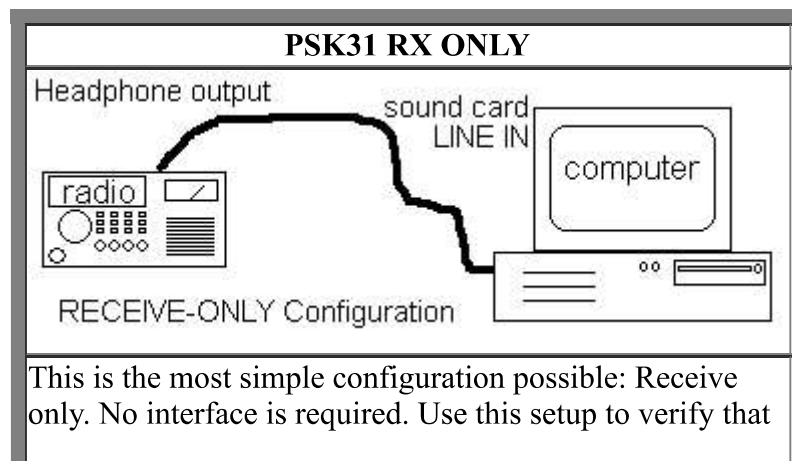
I won't be going into the technical details of HOW PSK31 works. Here is another site, explaining the [details of PSK31](#), how & why, etc! It is very well written. Now, when it comes to the math involved with the actual encoding/decoding... I just scratch my head! ;) It's quite beyond me! BUT, one doesn't have to know everything that's "under the hood" to drive a car, right? :) Let's just get to the BASICS of PSK31!

Think of THIS PSK31 Elmer page as more of an "operator's manual for the Layman" (PSK for Dummies???) to help you (and others) get the most out of this wonderful mode! **Most importantly, there's nothing nicer for EVERYONE than a CLEAN signal! :) It is my full intent to help you become a "PSK Elmer" who can help other users of this awesome mode to get much more benefit and enjoyment from it!**

A brief note on a new terminology for giving signal reports is worth sharing, here! It uses a similar format to the old "RST", but is called "RSQ". That means **R**eadability, **S**trength, and **Q**uality. Here is a WEBSITE which explains this "new" reporting system in better detail: <http://www.psb-info.net/Using-RSQ.html> The values range from 011 (not readable, barely visible signal, WIDE bandwidth) to 599 (Perfect print, strong signal, clean & narrow trace.) I give numerous examples, below. Enjoy! *(I changed this page to reflect the new "RSQ" terminology on 11/12/08.)*

Need software? [Download DigiPan!](#) (LINK UPDATED 5/28/13) **NOTE: The original DIGIPAN site is GONE, so this link takes you to the WAYBACK MACHINE archive. The download link DOES WORK!** This is the BEST, FREE software I know!!! (There are others, but DigiPan is the best of the bunch, IMHO.) DigiPan now supports a very handy MULTI-DECODER capability! Now you can monitor nearly every QSO! (Screen resolution & font size are limiting factors.) It will even highlight "CQ", "DX", or any other text string (such as your call) with a different color that you can define. Another software package that is decent, is called [HamScope](#). It supports several other modes, besides PSK. My favorite, there, is MFSK, but that's another topic! ;)

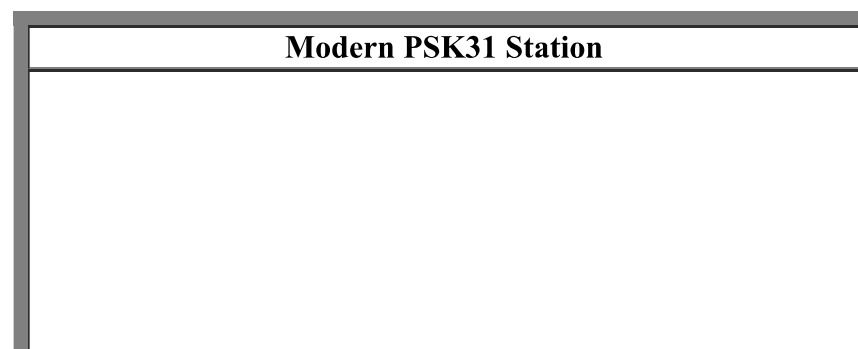
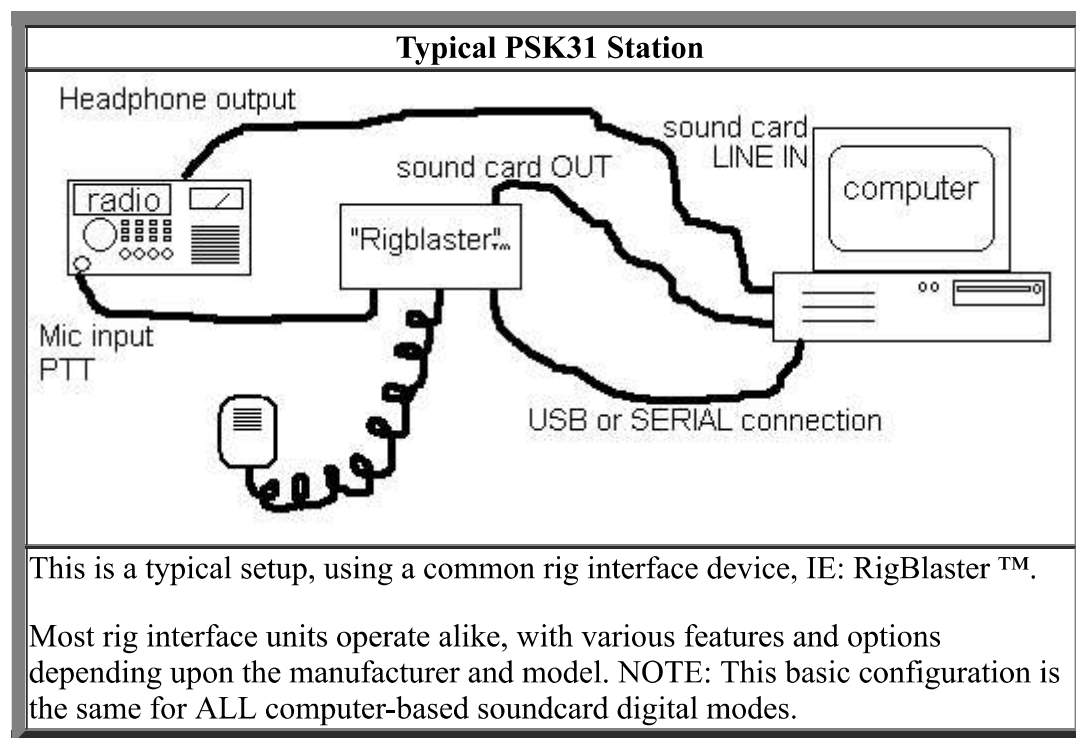
What do you need to start using this mode? How about a genuine [RigBlaster!?! \(I recommend any of them, wholeheartedly!\)](#) You will need that (or some other interface device) to connect your computer to your radio. :)

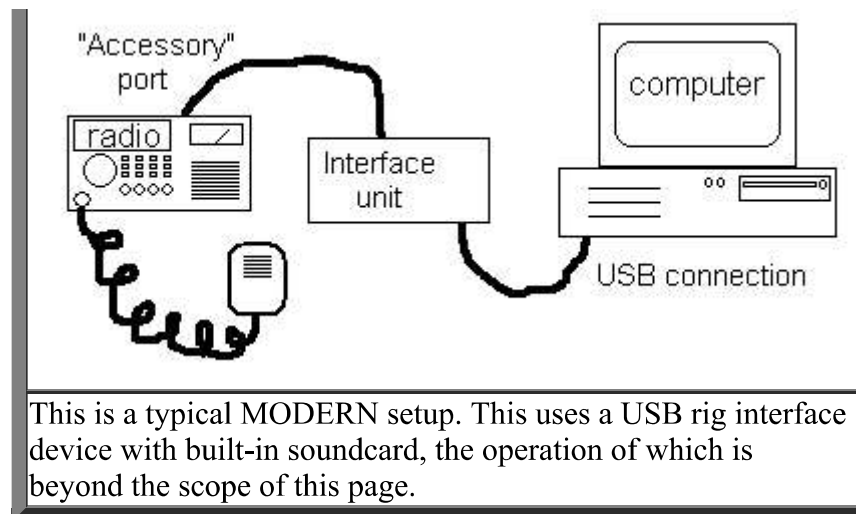


This is the most simple configuration possible: Receive only. No interface is required. Use this setup to verify that

your computer is capable of running the desired software, and that it is getting a useable signal from the radio. It will also give you opportunity to watch how the QSO's are done.

There are some modern rigs with BUILT-IN digital/soundcard interfaces, which connect directly to the USB port of the computer. Operation of these are beyond the scope of this page.



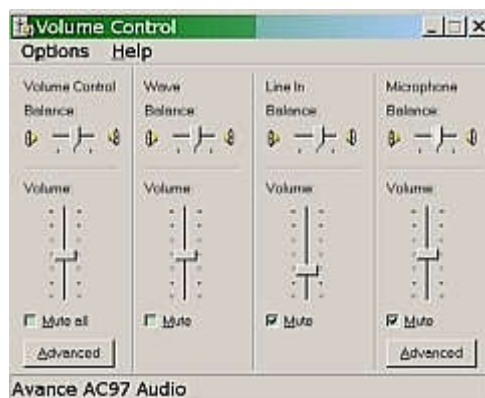


Follow the instructions with your interface unit to get it going, then follow the advice given here on this page to get your signal "tuned-up" and looking great on everyone's waterfall display!

BASIC setup guidelines

Once you have tuned your rig and antenna, the most important step is to ADJUST the audio levels coming from your computer, through the interface device, and into the radio.

In the Windows Volume Control window, you want to set the "MASTER" and "WAVE" controls to 1/2, as illustrated, below:



Set the level control on your interface (if it has one) to 1/2.

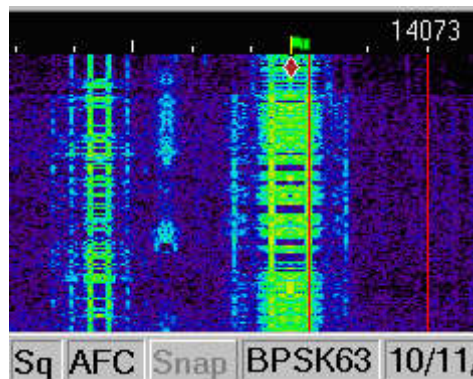
Set your rigs' RF OUT to MAX, then set the MIC GAIN to MIN. Start the computer transmitting. Your rig should switch to TRANSMIT. Check your wattmeter. It should read

zero. Turn up the mic gain until you read 20 watts (or 1/2 your rig's maximum output, whichever is less.) Your MIC GAIN should be somewhere between 1/4 to 3/4 range. If it has to be set down around "1" then lower the audio from the computer to 1/4 and try again.

You should ALWAYS see ZERO "ALC" on your rig! This is critical! If there is **ANY** ALC, then you are distorting, and thus transmitting a WIDE signal. This is to be AVOIDED at ALL COSTS, as it causes considerable QRM! (ALC is usually visible on a meter, either directly or by pressing a button.)

Note that on MOST RIGS, "ALC" is not a user control, it is internal. (ALC = "Automatic Level Control") It is designed to protect the finals of your radio from being overdriven. When there is too much audio input, the ALC circuits "clip" the audio, introducing significant distortion. When operating PSK, this not only causes a lot of QRM, it also wastes power in your transmitter on useless (as well as harmful) signal emissions.

You also want to set Windows to "NO SOUNDS" in the Control Panel. This will prevent your Windows "dings" and "YOU'VE GOT MAIL!!!" sounds from being transmitted!

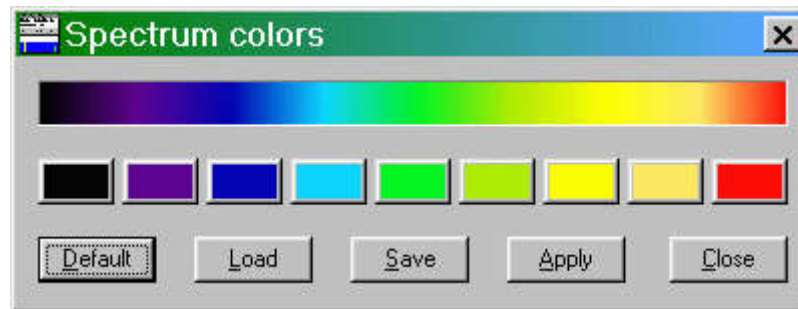


Here is a picture of PSK31 and PSK63 signals, side-by-side.

IMPORTANT NOTES:

I have modified the default spectrum colors used in DigiPan to be more "rainbow" like, better conveying intensity. It is this custom palette that I use in all of the screenshots on this page. Here is a screenshot of that palette that you are free to copy. Try it, and you will see that it makes the waterfall much more informative than the default! If you are seeing RED traces, your receive audio level is too high. Lower the volume on the radio a little.

Some of these screenshots were made with my old Drake TR3, and some were made with my Icom IC718. There is relatively little difference, as long as you are using a good receiver.

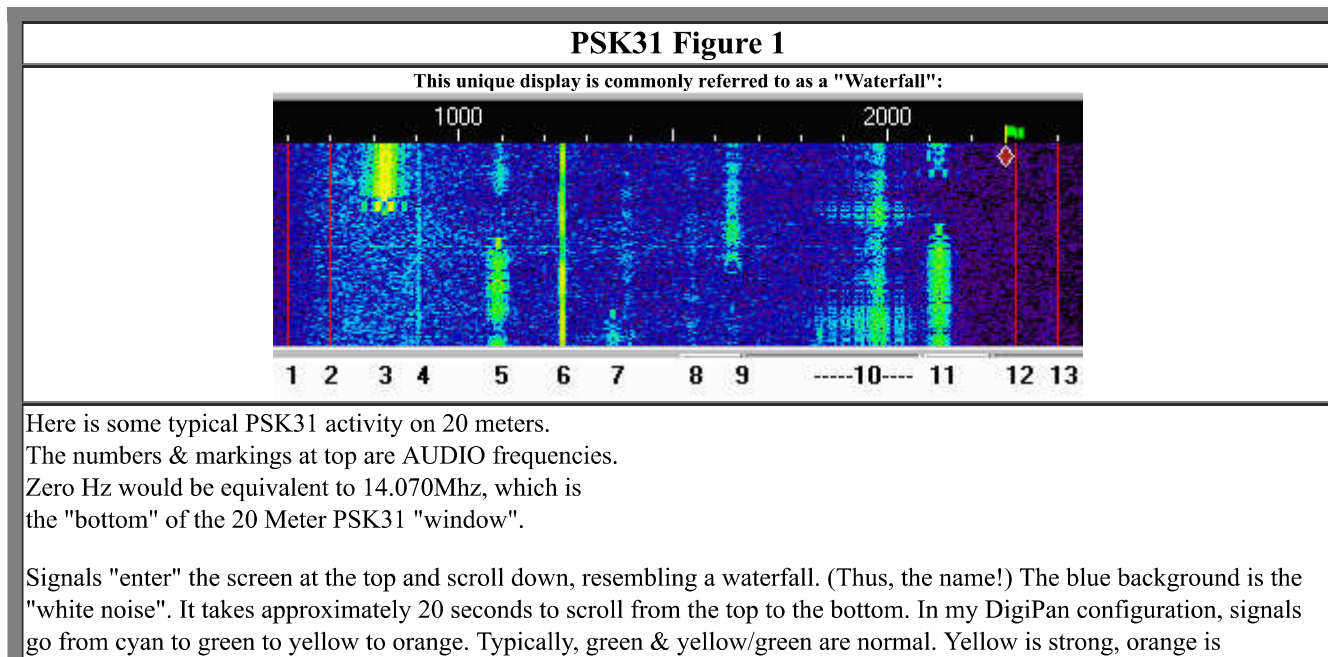


PSK31 info & advice

This page displays some images of various PSK31 signals along with explanations & operating tips. Please pass this URL along to others and post it in HAM Newsgroups, Clubs, WEBSites, etc. :) You are welcome to LINK to this site, also. Please let me know if you do! N1NKM2(at)AOL.COM (Yes, there is a 2 in the e-mail address.)

Here is the URL, to CUT & PASTE: www.mymorninglight.org/ham/psk.htm

NOTE: You can NOT link directly to ANY of the graphics on this site! You MUST ONLY link to the PAGE, itself. Thanks!



EXTREMELY strong. (The software used here is DigiPan. The colors can be customized. I chose RED as the absolute clipping limit color. The default is bright yellow. My custom palette is shown further above.)

REFERENCES:

- 1 & 2 = markers for my TR/3's lower audio BW (600 - 700 hz)
- 3 = Strong signal, with mild sidebands. RSQ = 587
- 4 = weak, steady carrier
- 5 = an ongoing QSO: RSQ of sta.#1 = 119, RSQ of 2 = 449
- 6 = a steady carrier, probably a tune-up
- 7 = two weak signals, very close together
- 8 = a VERY WEAK signal RSQ=019
- 9 = another weak QSO (RSQ = 019 & 239)
- 10 = a HORRIBLE signal!! RSQ = 343
- 11 = a QSO; one weak, one good signal (RSQ of good =559)
- 12 & 13 = markers for my TR/3's upper audio BW (2300-2400hz)

Item #3 in Figure 1, above, is a strong signal with mild sidebands. His signal is more than twice as "wide" as it should be. (This is usually caused by having the audio drive a little too high.) The normal bandwidth for a "clean" PSK31 signal, is TECHNICALLY 31Hz, but allowing for some room between signals, 40hz is a practical limit. This signal is about 100Hz wide, thus using up enough room for two and a half QSO's! (40 + 40 + 20)

Item #10, above, is a VERY WIDE signal! This type of distortion is usually caused by using the built-in Mic Processor in most modern radios. YOU **NEVER** want to have the Mic Processor active with PSK31! A wide signal like this has the potential to interfere with several others on either side. That is a "No-No!" He is occupying over 300 hz! That's about 7 or 8 QSO's wide!!! You can also see the effects of QSB (fading) on this signal. the fading is most obvious in his "sidebands". Compared to some foreign stations I have seen, this guy's QRM is mild! I have seen signals which literally occupied TWO THIRDS of the window!!! That's about 1600hz wide!

Remember: You're only SUPPOSED TO BE 31Hz WIDE!!! (like #11)

(Scroll down for something [REALLY WILD!!](#))

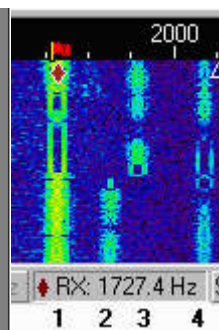
PSK31 Figure 2

1 = an example of a GREAT signal!

The diamond marks the RECEIVE freq, the little red "flag" is the TX. (The offset is due to my old tube rig's freq. drift! SOMEDAY I will update these pix with signals captured by my new Icom rig!) I was in QSO with this person when I snapped this screenshot. "RSQ"=589

2 & 3 = Moderate signals, showing severe QSB (RSQ=449)

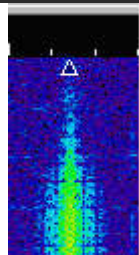
4 = somewhat weak signal with QSB (fading)



NOTE: The double-lines in the signal are where the operator stopped typing. This is referred to as "idling". Most PSK31 software will give an "IMD" (InterModulation Distortion) reading when an "idle" is received.

Signal #1 is as good as a PSK31 signal can get! The "edges" are very sharp. There are no sidebands. Although they are much weaker, the other signals shown here are also good.

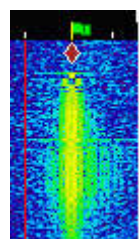
PSK31 Figure 3



RSQ=456

Here are three examples of BAD SIGNALS. The sidebands are very obvious, and are being affected by QSB. That is why they are not constant. Since they are weaker than the main signal, the visual effect of QSB on the sidebands is greater.

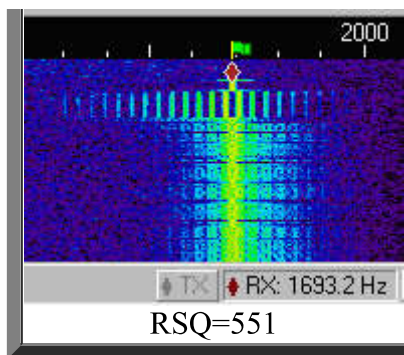
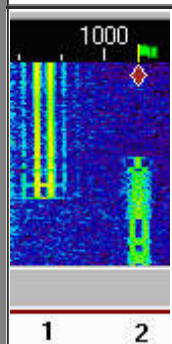
The TOP signal is not as severe as the second one. The bottom one is HORRIBLE! I count 12 sidebands coming from the lower side of that one!



RSQ=575

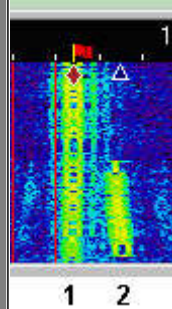
It is very likely that these operators have their Mic Processors (or "compression") turned on. That is something you definately DO NOT want to do, because **this** is the result! <:P

NOTE: These are not RFI problems, these are audio drive problems. Please scroll down to [figure 9](#) for more information, and some good advice to HELP stations like this! :)

**PSK31 Figure 4**

Signal #1 (left) in this image is "idling". His audio drive is too high, which is causing the very noticable sidebands next to the two solid lines. He is probably in the process of fine-tuning his station. "RSQ"=557

The other signal (#2, on right) is good. "RSQ"=558



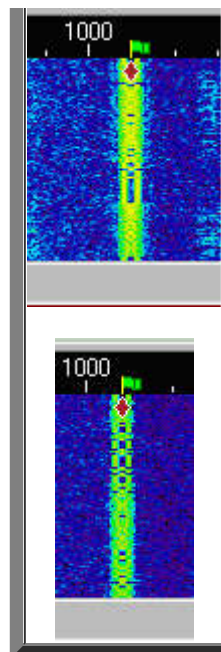
Here, at #1, we have a moderately strong signal, with some fairly nasty sidebands. "RSQ"=557

Notice how the signal at #2 is "bent"? This is caused by his transmitter's frequency drifting. This is especially problematic with older analog and tube rigs.

PSK31 Figure 5

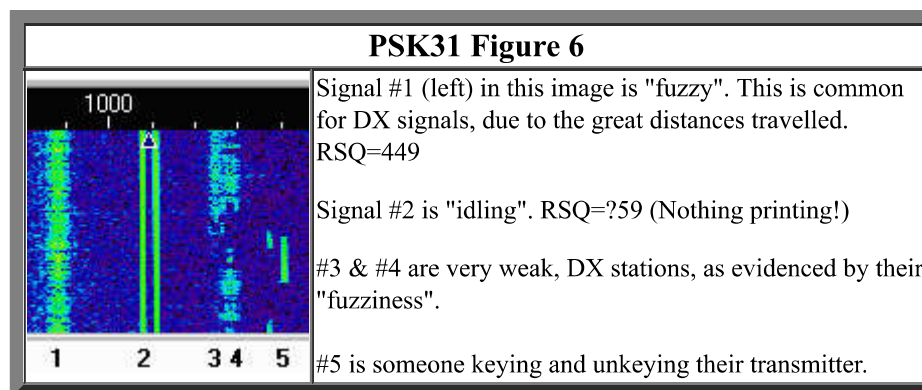
Here are two examples of GOOD SIGNALS.

The top one is STRONG, as evidenced by the yellow in the middle. This kind of signal is always 100%

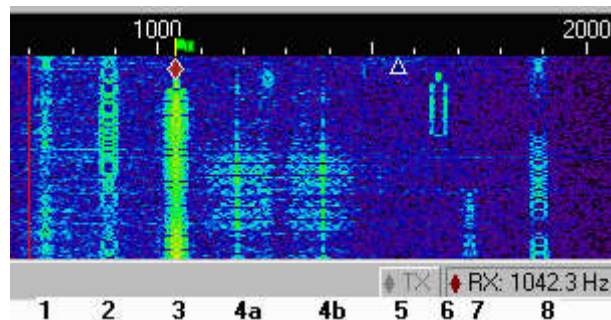


print, unless there is SEVERE QSB and/or QRM!
There is only the very SLIGHTEST indication of sidebands, here. "RSQ"=589

The bottom one is average strength, and nice & clean.
This signal will almost always yield nearly 100% print, possibly only dropping 1 letter every now and then with QRM or QSB. "RSQ"=559



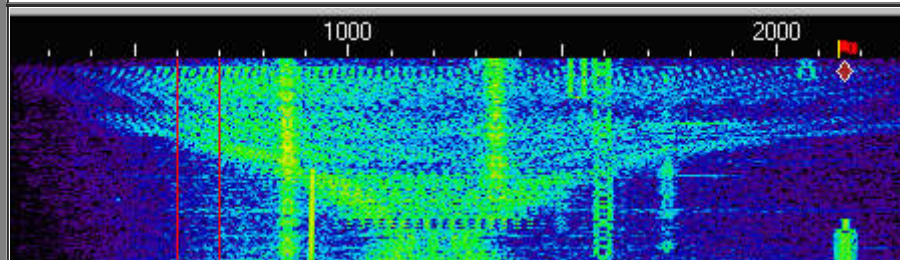
PSK31 Figure 7



REFERENCES:

- 1 = Very weak, DX signal, "RSQ" = 219
- 2 = moderately weak signal, "RSQ" = 429
- 3 = Good, solid signal, "RSQ" = 559
- 4a & 4b = a LID, running PACTOR in the PSK band! >:[
- 5 = a good place to call CQ! :)
- 6 = A station idled briefly, then ended the transmission.
- 7 = another WEAK signal, "RSQ" = 119
- 8 = another weak signal with QSB, "RSQ" from 000 to 429

PSK31 Figure 8



WHAT on God's green Earth is **THIS?!?!?!?**

I captured this extreme oddity Sunday Evening, 5/26/02 while enjoying a nice QSO. (Red diamond, on far right of image). This extremely weird signal started off looking a little like someone with RF feedback, about 200Hz wide, and wavering back and forth, a little like the narrow end of a tornado. I waited a few seconds before realizing that I was watching something really unusual! It started getting wider and wider! I waited until it completely filled the screen, top-to-bottom, and it just about made it side-to-side as well! (It was well over 2kHz wide when it stopped.) It had a very strange warbling sound in the speaker... like someone's rig was REALLY going berserk with feedback! If I gave a RSQ, it would be **070!**

I decided to post it here, simply because it was SOOOOOO WEIRD!!!! As you can plainly see, it obviously caused some significant QRM to several QSO's that happened to be within it's wake. Wow! What a wild scene!

If you notice patterns like these, below, **ESPECIALLY** if you are in QSO with the "offender", **PLEASE** let him know that his station is generating wide-band QRM! Most likely, he is totally unaware that his station has an RFI feedback problem which is causing interference. It's not only terrible for everyone else on the band, but it is wasting power for him, and causing QRM to others!

Everyone I have QSO'ed with about such things, has appreciated the input! We need to help each other, here... if you see a terrible signal calling CQ, **LET THE STATION KNOW** in a polite way. By observing when he keys and unkeys, you can quickly determine whether or not his station is causing the problem. The interference will **ALWAYS** track **EXACTLY** with his transmissions, starting and stopping when he keys and unkeys.

Here are some suggestions to offer to the station with a bad signal:

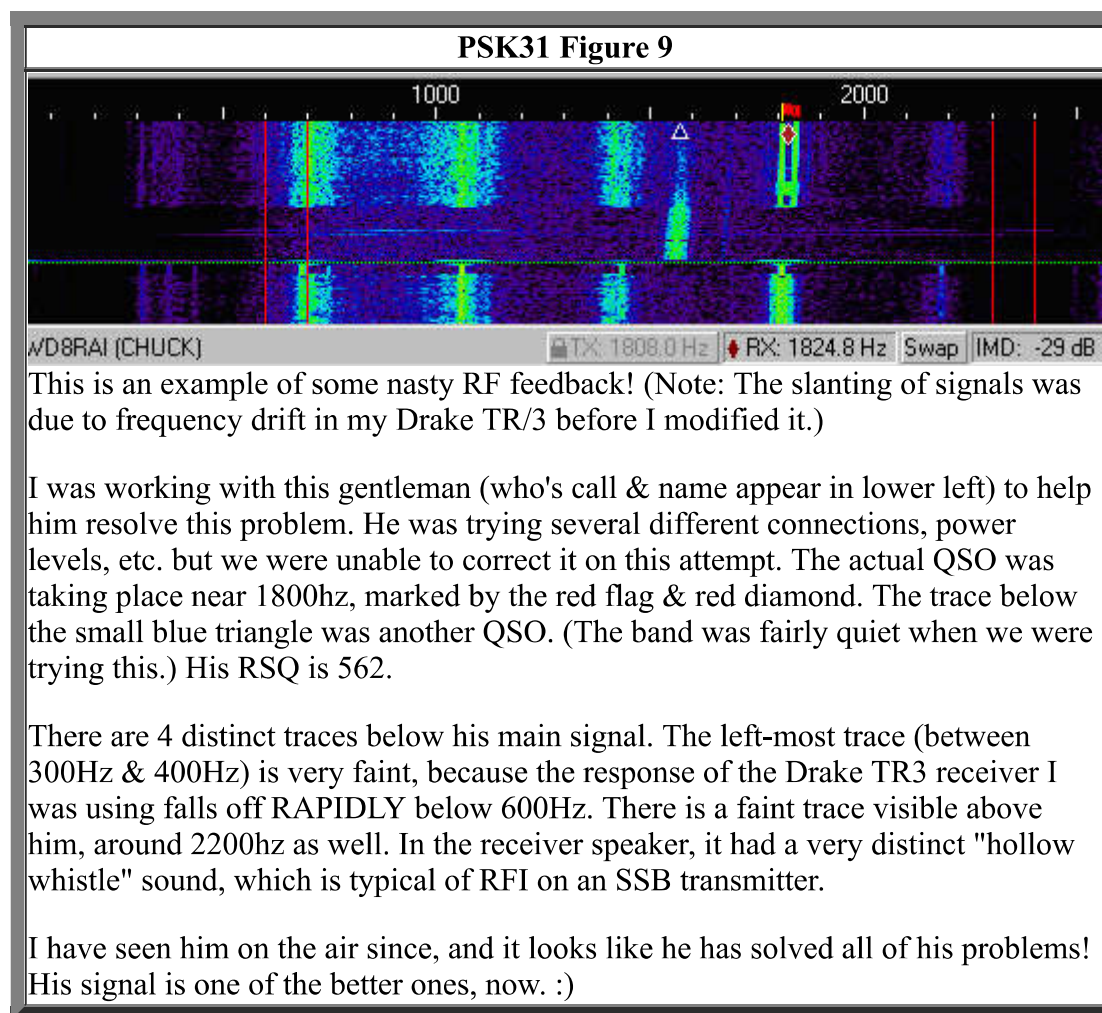
#1 Make sure that the Mic Processor is turned ***OFF***.
I cannot stress this enough!

#2 All SSB rigs have an ALC circuit, and a meter reading for it. This must be at ZERO! You will need to turn the audio coming from the computer down first. The little "speaker" icon in the lower right corner (of Windows) gives you the volume control "sliders". You should have the MASTER and the WAVE controls set to the middle, or slightly less. If you have the computer "slider" controls down below 25% and there is still a reading on the rig's ALC meter, you will need to turn down the audio control on your interface box. Some have a knob, others have a screwdriver slot.

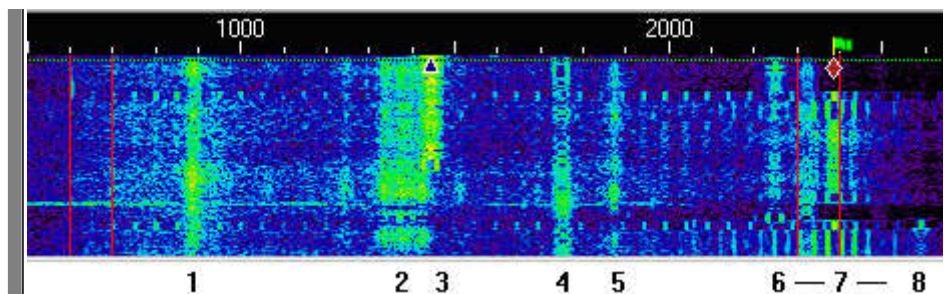
#3 Here is a quick way to set power: While sending an "idle" signal, turn the control up until you see the ALC meter just begin to move. Now, switch to your wattmeter, and turn the control down until your transmitter power decreases by about 1/5'th. (If you were transmitting 50 watts, you will now be at 40. If 100, you will be at 80.) That should get you within tolerance. Relying on another station's report can help you fine-tune. You may find yourself dialing power down to 20 or 30 watts. **THIS IS STILL PLENTY** for this mode! :)

Finally, #4 - **GROUNDING**. Make sure everything is tied to a common ground! One good way to do this is to power everything from the same power strip. This also prevents "ground loops". A small capacitor across the mic input and computer audio output may also be necessary to reduce any RFI-induced problems.

Believe me, helping him helps EVERYONE enjoy PSK31 even more! :)



PSK31 Figure 10



Example of **SEVERE** RFI feedback!

REFERENCES:

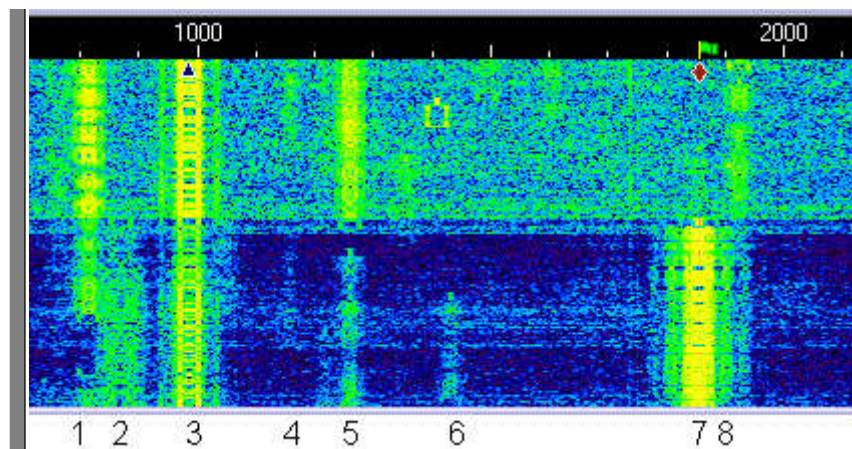
1 - 6 = QSO's, being QRM'ed by the RFI of #7!

8 = a WEAK signal, also being QRM'ed

The station at ref. # 7 is the "offender" in this display. His "primary" signal looks almost normal, except for the sidebands directly adjacent to it. Observe carefully, how the small, evenly-spaced vertical lines perfectly coincide with his single-tone "end transmission" signal! He was obviously testing his station, having keyed, unkeyed, then keyed again in quick succession. You can also see the vertical "waves" of lighter blue areas, extending out on both sides of his signal. This is all the result of RF getting back into his audio circuits. This is causing a LOT of QRM across the ENTIRE waterfall! (RSQ=551)

Also notice the spacing... they appear to be 60Hz apart. He most likely has a serious ground-loop problem, and the 60hz is mixing with his signal, and producing all kinds of nasty artifacts.

PSK31 Figure 11



Example of Receiver Desense

REFERENCES:

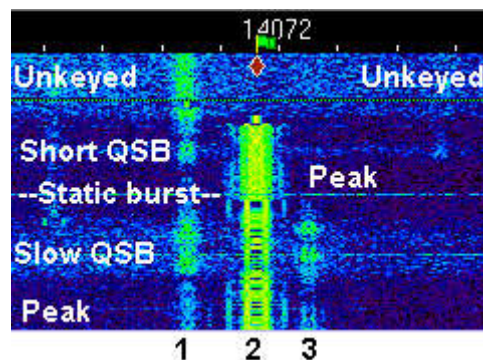
1 - 6 = QSO's, being affected (on my rig, only) by the desense of the STRONG signal, **#7**! It does not indicate a problem with his signal, nor with the receiver. Annoying, yes, especially when copying a weak signal (like the QSO at **#6**)... but it's a normal function of the radio.

7 - This is the STRONG signal. **8** designates where one of his sidebands may be interfering with a QSO that is right nearby. You can very clearly see the difference in the "noise floor" when he unkeys... the background suddenly changes from dark blue & black to light blue & green! His RSQ would be 596, the "6" being due to the very strong sidebands.

The effect is due to the receiver's AGC being activated by the strength of this signal. The receiver automatically reduces its sensitivity when a strong signal comes in. This is perfectly normal, and on SSB, is very desirable! It prevents a strong signal from knocking you out of your chair, if you had the volume up to copy a weak one. The AGC automatically reduces the volume, almost instantly.

Because PSK is so narrow, there are literally DOZENS of QSO's within the same bandwidth as a single SSB "voice channel". When ONE strong signal comes in, the gain for the whole bandwidth (about 3Khz) is decreased. If I had a NARROW filter in the rig, centered it on one of those weaker signals, and made sure he was outside the filter, this would not happen.

PSK31 Figure 12



Example of slow QSB on PSK

REFERENCES:

1 = relatively weak QSO

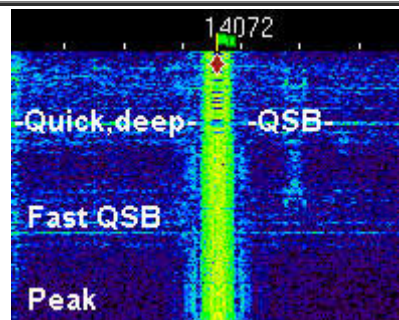
2 = Strong signal

3 = another weak QSO

"Unkeyed" shows the normal RX noise

"Peak" shows max desense when his signal peaked.

You can clearly see where the effect of QSB on the strong signal causes the background noise to rise. The weak signals also increase when the strong signal's desense decreases. As explained above, this is NORMAL BEHAVIOR for the radio.

PSK31 Figure 13

Example of fast QSB on PSK

Here you can see the effect of fast QSB on a strong signal. (RSQ=598) The thin horizontal lines are where the receiver is less desensed, and the noise floor rises. These are like a

quick "fwiff fwiff fwiff" in the speaker. A very brief, deep QSB caused the strong horizontal line, highlighted above. Again, this is NORMAL behavior for the radio.

The effect can be changed if you have a "FAST/SLOW AGC" control on your rig. In the SLOW mode, fast QSB would not cause the horizontal lines, but would most likely weaken the desired signal enough to cause a letter or two to be missed during the fades.

If you found this page useful, I'd like to hear from you! :)
N1NKM2@AOL.COM (Yes, there is a 2 in there.)

Return to the N1NKM [HOME PAGE](#)