

DIGITAL HAPPENINGS #3

(October 2012)

By W0NAC ("Matt")

I hope everyone out there in the County Hunting community has had a good month. I know that I have! Since last month's "DIGITAL HAPPENINGS" was published, I turned 80 years old, and I'm "still kickin" and in general having a great time! Who could ask for more?

So, how many of you have taken the plunge into digital or are contemplating doing so? There are days when I feel like a "voice in the wilderness". Then there are other days when I get to help someone get started on digital and I feel like my efforts are paying off. I know full well that going digital can be a challenge, but if you'll just take that first step down the path, I sincerely believe that you'll be rewarded with hours of enjoyment.

OK, I'll get down off my soapbox now and get on with the article...

HOW TO ADJUST YOUR SYSTEM FOR A CLEAN SIGNAL

Let me begin with a few caveats. Since it is not feasible to cover every combination of interface, software, and rig that is out there, I will, for purposes of this article, assume use of a standard setup using a SignalLink USB interface, Fldigi software, and one of the standard transceivers made by ICOM, YAESU, or KENWOOD. I have been informed that TEN-TEC has an entirely different way of adjusting their rigs, so if you own a TEN-TEC, you will need to consult your manual carefully and give it priority over anything I say here.

That being said, there are two fundamental goals you must strive to meet when tuning your system for digital operation. First, most digital modes require that everything in your system be as linear as possible. Second, you don't want to exceed the ratings on your transceiver final amplifiers and burn them up! Believe me, this is a real possibility if you drive them too hard. I will discuss typical transceiver power limitations first.

If you look at the Specifications section of your transceiver manual, you might see something like this:

Output Power	SSB/CW/FSK/FM	Max. 100W	
		Min. 5W	
	AM	Max. 25W	
		Min. 5W	(This example is from a KENWOOD TS-590S manual)

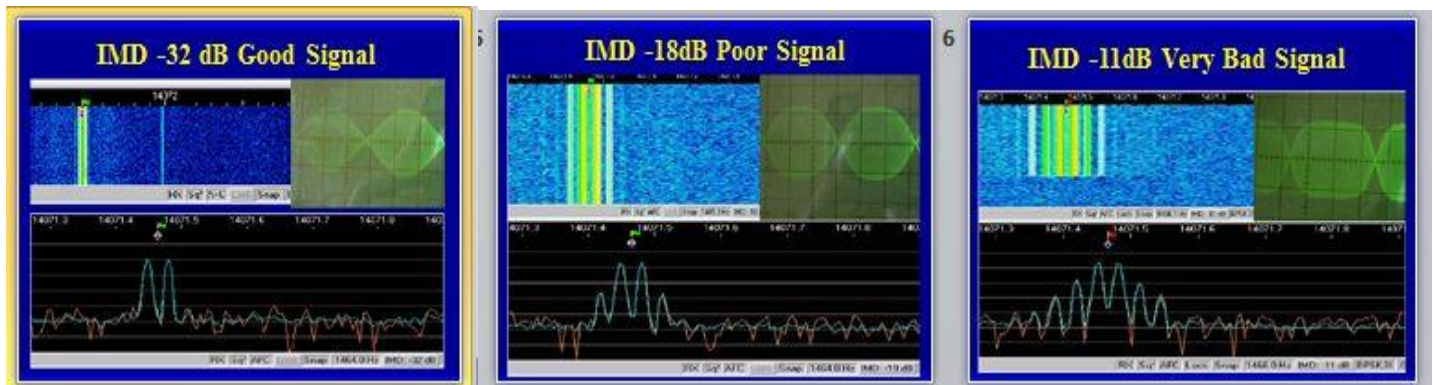
OR

Output Power	SSB, CW, FM, RTTY	2-100W (1.8-50 MHz Bands)	
	AM	1-40W (1.8-50 MHz Bands)	(From an ICOM 7000 manual)

Almost all digital modes operate with a duty factor of nearly 100%. This is equivalent to the proverbial “brick on the key” when operating CW. This means that the AM ratings are probably the best ones to observe if you don’t wish to damage your transceiver. Also, even though your manual’s ratings might lead you to believe that you can safely get 100W out of your transceiver, doing so will probably drive your final amplifiers into non-linear operation and your signal will only be a little stronger (maybe 3 dB), but very distorted, broad, and difficult to print. Probably the maximum RMS power output you can expect to get (with no distortion) from most 100W transceivers is about 30-40 Watts. Besides, most digital modes have excellent low signal capabilities, so high power is not generally needed. For example, JT-65 can provide reliable copy for signals with a S/N ratio of -25 dB! Admittedly this is an extreme example, but many digital modes are superior to even CW.

Now, what is the best way to adjust your transceiver output for the maximum digital signal it can produce without distortion? Here are the basic steps (repeated from last month) with some additional explanations and examples. Again, if you own a TEN-TEC transceiver, you should consult your manual, because the following procedures might not produce optimum results.

Before I begin, you need to know what is meant by a “clean” digital signal. I will illustrate this for a PSK-31 signal (perhaps the most popular digital mode). Here are 3 cases where various quality signals are displayed as they would be seen on your waterfall, on an oscilloscope, and on a Spectrum Display.



The leftmost picture shows a “Good” signal with an IMD of -32 dB. You can observe the almost complete lack of unwanted 3rd order products on all three display formats. In the middle picture you can see the increasing level of 3rd order products (harmonics). These show on the waterfall display as additional bands on either side of the main signal. On the spectrum display, you can see the 3rd order products increasing to either side of the main signal peaks. In the rightmost picture, you can see the results of severe over-driving. This “Very Bad” signal is over 3 times broader than normal for this mode and has very distinctive multiple bands displayed on the waterfall. It also contains growing 3rd, 5th, 7th and higher order unwanted sidebands.

Naturally, our goal is to produce a signal that looks like the one on the left!

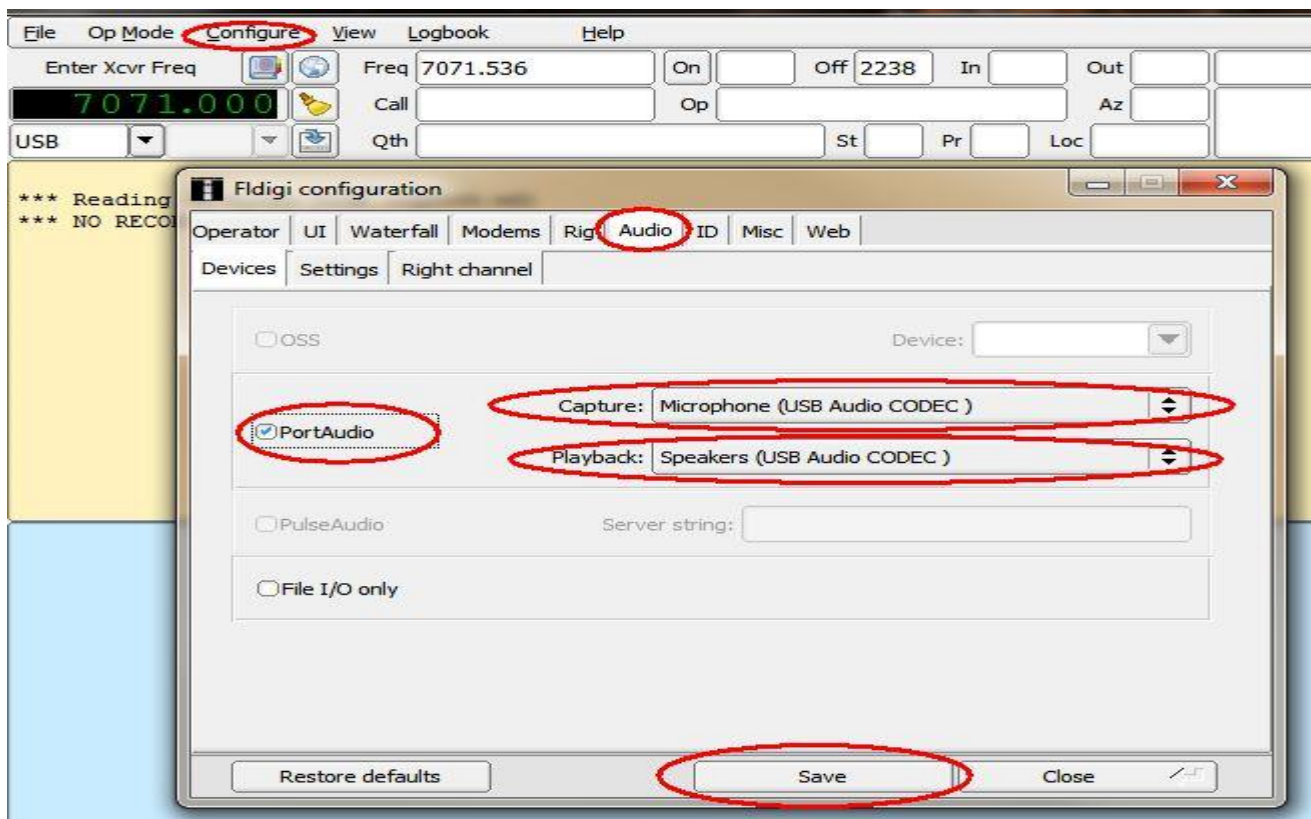
Please keep in mind that you will be controlling the transceiver power output by adjusting the level of the modulated audio arriving at the transceiver audio input (usually Microphone input). What makes things confusing is that in some setups, there can be several controls in series with each other that need to be adjusted individually to get the desired output. To make matters even more confusing, the level controls for

your computer soundcard have different names and work differently depending on whether the operating system you are using is Windows XP, Windows Vista, or Windows 7.

Regarding control of sound I/O on the PC, It has been said that **“You are in a maze of twisty little passages, all alike”**. Fortunately when using an interface with a built in soundcard (like the Signalink USB), things get much easier because you can use the Signalink soundcard for just digital operations and use the computer soundcard independently for **all** other audio functions.

Some communications software has built in level controls designed to help you adjust the Windows audio levels. Unfortunately, most of these software controls were designed to interface with the audio controls in Windows XP. Since Windows 7 audio controls are different from XP, the sound controls built in to your communications software often won't work in Windows 7 and must be ignored!

I will now attempt to describe the controls you will need to adjust for the default system listed earlier, but first, you need to make sure that the Signalink built-in soundcard connections are configured properly for your communications software. You do this for Fldigi in the following screen which is accessed by clicking on the “Configure” Tab and then clicking on the “Sound Card” selection in the drop-down menu:



After clicking on the “Audio” tab, make sure that “PortAudio” is checked and that “Microphone (USB Audio CODEC)” is selected in the “Capture:” box and that “Speakers (USB Audio CODEC)” is selected in the “Playback:” box. Then, “Save” and “Close”.

Once you are connected properly, the only levels you need to set for Windows 7 are those for the Signalink Microphone CODEC and Speakers CODEC/Application Level. Once adjusted properly, these computer settings can remain fixed. This leaves ONLY the TX and RX controls on the face of the Signalink USB which

may need tweaking from time to time. You can't get much simpler than that! This simplicity of operation is one of the main reasons I have recommended the Signalink USB interface.

There are more detailed Windows 7 setup instructions available at the following link:

<http://www.tigertronics.com/windows7.htm> . For additional help in Fldigi setup, please refer to the Fldigi manuals available at the following link: <http://www.w1hki.com/download.html> . The manuals you will need to download (and print) are all under the "Help" column and are titled "Fldigi-Help", "Fldigi manual (pdf)"

Now for the steps needed to produce a clean signal:

- 1) Begin by setting your transceiver power output control full up (100% power). Please note that if you are driving a linear with your transceiver (as I do occasionally) and only need 30-40W output to drive the linear, you can leave the transceiver power output control at a lower setting without harming anything,
- 2) Set your transceiver meters so that ALC action is displayed as well as power output. Having an external SWR/Power output meter connected between your antenna and your transceiver can also be very useful as the LED scales on many transceivers can be hard to interpret accurately.
- 3) Start with the Signalink TX control set at 0
- 4) If you are using a transceiver rated at 100 Watts PEP SSB, then limit the power output to less than ~40 Watts to avoid distortion and overloading your finals.
- 5) Trigger your transceiver to transmit mode (using your communications software and the PTT control built in to the Signalink interface), and then gradually increase the Signalink TX control (with the transceiver connected to a dummy load of course), and watch as power output increases for any ALC action. When ALC action begins to show a bit, back off on the Signalink TX control slightly until ALC action just disappears. This will give you the maximum power output with acceptable distortion for your rig.

There may be times when you wish to operate at power output levels well below the maximum – perhaps QRP levels. To do this, simply back off the TX control on your Signalink interface (**not** the transceiver power output control) until the desired power output is observed. Again, an external Multi-range SWR/Power meter can be helpful for adjusting the output power more precisely.

If you carefully follow these steps, you are almost guaranteed to have a clean signal, but if you have any doubt about your signal quality, there are several other things you can do to check your IMD (Intermodulation Distortion).

First, there are hardware devices available that you can use to monitor your own IMD. A quick Google search turned up what looks like a great device offered by KK7UQ at the following link: <http://www.g4ilo.com/imd-meter.html> . I have seen others advertised in QST and CQ Magazine also.

Second, you can set up a separate monitor receiver with Digipan operating in full duplex mode. Detailed instructions for doing this are available at: <http://www.rsg-info.net/IMD-Measurement.html> .

Lastly, you can solicit critical over-the-air reports from other operators. This is probably the method most digital operators use, but accurate reports require that these operators observe certain conditions. These conditions include only measuring IMD when the signal being measured is un-modulated (i.e. in IDLE) and with an S/N ratio above 36 dB. I also recommend that you use the PSK-31 mode for all IMD checks.

DIGITAL ACTIVITIES IN OCTOBER

The number of mobiles putting out counties using digital modes was very low last month. It may be that the price of gasoline is keeping a lot of folks at home. I know that travel expenses are one of several factors that have limited Sharon and my trips this fall.

I had the pleasure of helping four people last month. I furnished W9SUQ (Larry) several sets of sample macros for Fldigi and demonstrated how to modify/save them (I plan on discussing the use of macros in next month's article).

I answered several digital questions from W9JR (Rich) and helped N8HAM (Jim) get his Fldigi installation working correctly.

Finally, I have spent considerable time helping VK4AAR (Alan) get going on digital. This was a bit challenging because of the great time difference and because he had to use equipment that he already had on hand that I was not familiar with. He is ending up with an Emachine Windows 7 computer, a Rascal GLS interface, and a USB to Serial converter for PTT control (through his Rascal GLS). We are now in the process of installing a MISO (Mike In Speaker Out) device for audio control since his Rascal GLS does not have an internal sound card. The MISO will act just like a second sound card (similar to the one internal to a Signalink USB interface) and free up his computer sound card for use by SKYPE. If you are using an interface that has no internal sound card, the MISO may be right for you. It is simple, inexpensive (\$10.00), and sets itself up automatically when plugged into a spare USB port. If you want to know more about this neat little device, go to the following link: http://www.packetradio.com/catalog/index.php?main_page=product_info&cPath=13&products_id=2150

I will be happy to help anyone get started. Just email me or call me on the phone. My email is w0nac@comcast.net and my phone number is 303-799-3658. Call any time.

I have included Table 1 which has been updated from last month as several new calls were added. If I have left anyone off the list you have my sincere apology! Just drop me a quick email and include your stats, if you know them, and I will be pleased to add you to the list. Conversely, if you are on the list and feel that you don't belong, please also drop me an email and I will remove you.

Logger will currently give you your status for the **USA – Digital Award** (Go to “View/Edit/Book/USA-Digital/All”), but for the **5-Mode award**, Logger only reports those counties for which all 5 Modes have been worked. You can see this by going to “View/Edit/Book/5-Mode/All”. A fix has been requested that will report on the status of 1,2,3,4 and 5 completed counties, but it may be a while before this is released.

Table 1 - Active Digital County Hunters Award Status

#	CALL	NAME	STATUS* (M,F,I)	USA - DIGITAL	(1 MODE)	(2 MODES)	FIVE MODE	(4 MODES)	(5 MODES)
				Counties (of 3077)			COUNTIES (3 MODES)		
1	AA8R	Randy	F	1000+	-	-	-	-	-
2	AC0B	Cliff	F	-	-	-	-	-	-
3	AD1C	Jim	F	-	-	-	-	-	-
4	K0DEQ	Bill	F	-	-	-	-	-	-
5	K0PVW	Rob	F	-	-	-	-	-	-
6	K0WJ	Lou	F	-	-	-	-	-	-
7	K4PBX	Jim	F	-	-	-	-	-	-
8	K5GE	Gene	F	-	-	-	-	-	-
9	K5SF	Dick	F	-	-	-	-	-	-
10	K7REL	Tom	F	-	-	-	-	-	-
11	K8QWY	Ed	F	-	-	-	-	-	-
12	K8ZZ	Ed	F	-	-	-	-	-	-
13	KC3X	Hollis	F	-	-	-	-	-	-
14	KC6AWX	Bob	F	-	-	-	-	-	-
15	KD5YUK	Billy	F	-	-	-	-	-	-
16	KD7KST	Bill	M/F	1792	-	-	-	-	-
17	KG5RJ	Gregory	F	-	-	-	-	-	-
18	KM1C	Bill	F	-	-	-	-	-	-
19	N0KV	Barry	M/F	-	-	-	-	-	-
20	N0LXJ	Sharon	M/F	1298	3077	2201	1109	349	138
21	N1API	Al	F	-	-	-	-	-	-
22	N3HOO	Ed	F	-	-	-	-	-	-
23	N4JT	Jim	F	572	3077	3058	-	-	-
24	N5MLP	Ron	M/F	-	-	-	-	-	-
25	N6PDB	Dennis	F	91	3077	2477	66	0	0
26	N8CIJ	Dick	F	-	-	-	-	-	-
27	N8HAM	Jim	I	-	-	-	-	-	-
28	NA8W	Darl	F	-	-	-	-	-	-
29	NF0N	Mike	F	-	-	-	-	-	-
30	NN9K	Pete	F	-	-	-	-	-	-
31	NT2A	Gene	F	-	-	-	-	-	-
32	NU4C	Paul	F	-	-	-	-	-	-
33	NW6S	Jim	F	-	-	-	-	-	-
34	NX4W	Lloyd	M/F	-	-	-	-	-	-
35	W0NAC	Matt	M/F	1699	3077	2767	1825	830	220
36	W0QE	Larry	F	-	-	-	-	-	-
37	W4HI	Gary	F	-	-	-	-	-	-
38	W4SIG	Kerry	F	-	-	-	-	-	-
39	W4YDY	Dave	F	-	-	-	-	-	-
40	W6RK	Risto	F	-	-	-	-	-	-
41	W6RLL	Joe	F	-	-	-	-	-	-
42	W7IN	Larry	F	-	-	-	-	-	-
43	W7QQ	Bill	M/F	-	-	-	-	-	-
44	W9JR	Rich	F	90	3077	1674	44	0	0
45	W9SUQ	Larry	F	-	-	-	-	-	-
46	WA4UNS	Doug	F	-	-	-	-	-	-
47	WA7JHQ	Sterling	F	-	-	-	-	-	-
48	WB0M	Jeff	F	-	-	-	-	-	-
49	WB2ABD	Paul	F	-	-	-	-	-	-
50	WD4OIN	Jack	F	-	-	-	-	-	-
51	WQ7A	Terry	F	-	-	-	-	-	-
52	WY4D	Bennie	F	-	-	-	-	-	-

For November I plan on discussing “How to use macros with specific examples” and “How to make your first digital contact”.

Future topics in the coming months include –

“How to ‘put out’ counties mobile using digital modes”

“How to operate as a mobile OM/YL team using digital modes”

“How to fine tune your Interface”

“Other Interesting modes (JT-65)”

So long again.....Please email me with your comments/suggestions at w0nac@comcast.net and don't forget to send me your counties worked status on the **USA – Digital and 5 Mode Awards** so I can update the Digital County Hunter list again next month.

Thanks and 73's

Matt – W0NAC