



# *PVRC Newsletter*

## *July 2020*

**Newsletter Editor:** John K3TN [jpescatore@aol.com](mailto:jpescatore@aol.com)

**Website:** <http://www.pvrc.org>

**Meeting Info:** <http://www.pvrc.org/chapters.htm>

**Facebook:** <https://www.facebook.com/groups/PotomacValleyRadioClub/>

### **President's Letter – Tom K3AJ**

#### **Coming Attractions**

Since we don't publish the Newsletter in August, I thought I would now provide some early insight into how we will be conducting elections this fall. The Officers have been spending a lot of time discussing some options, and the Trustees have been consulted and given their blessing. Here is what we are going to do:

- We will be using an online election service. We reviewed several and chose one that is easy to use, secure and economical. Each voting member will receive an e-mail notice with a link to their ballot. Once a member has voted, they will receive a confirmation of their vote and the results are tabulated electronically.
- The PVRC Bylaws specify that only "active members" may vote, and an "active member" is one who "participates in club activities." We will be using a very broad and inclusive definition which will be publicized in advance of the voter list being created. There will be plenty of opportunity to ensure that no one active in PVRC is left out.
- The timing of elections will remain the same, with nominations and voting occurring in accordance with the timeline outlined in the Bylaws.

Keep an eye on the reflector and the September Newsletter for more details.

Our ability to send ballots will be dependent on us having a valid e-mail address for each member. Please ensure that your contact info is correct in the PVRC Roster. You can submit requests to update information directly from your listing in the roster by clicking on your callsign in the roster.

On another note, on behalf of the Trustees and Officers of PVRC, I am pleased to announce that PVRC will be establishing a PVRC scholarship through the ARRL Foundation Scholarship Program, starting with the Foundation's 2021 scholarship year. Frank, W3LPL has volunteered to manage this effort for PVRC. He will be working with the Officers and Trustees to create the parameters for the award of this scholarship and will manage fundraising. Member contributions to the fund supporting this PVRC scholarship will be made directly to the ARRL Foundation and will be tax deductible to the full extent of the law and your own unique tax situation (consult your tax advisor if

you need advice about your eligibility for a tax deduction). No PVRC funds will be expended or committed other than an annual \$15 administrative fee. Please stand by for information on how contributions can be made once the fund is officially established.

73 and Go PVRC!

Tom K3AJ  
President, PVRC

### W4IPC Named "Young Ham Lends a Hand" Winner – CQ via Wayne N1WR

Connor Black, W4IPC, of Chesapeake, Virginia, is this year's winner of the "Young Ham Lends a Hand" contest. Connor, who is 18, was first licensed in 2018 and has been instrumental in helping the members of the Great Bridge High School Amateur Radio Club, W4GBH (of which he was president in the 2019-2020 school year), get licensed and get on the air.



More broadly, he is an avid contester and DXer and has been helping get high school students interested in those activities.

Connor has paired up with Remote Ham Radio to expand the number of remote ham stations in schools and colleges for youth to operate from anywhere in the world. He has been a pioneer in this endeavor by using his own home station as the first remote youth-only station. Connor has also invited young hams to his home station in the past to compete in the Virginia QSO party, and to operate amateur satellites.

The "Young Ham Lends a Hand" program is sponsored jointly by the Radio Club of America and the Quarter Century Wireless Association. The winner is usually announced at the Dayton Hamvention® Youth Forum but was announced via e-mail this year by moderator Carole Perry, WB2MGP, as a result of the COVID-induced cancellation of the Hamvention. The goal of the competition is to encourage volunteerism among young hams. The winner receives a check for \$100.



**CW Rise Time, Transmit Delay, and Clicks – Rick N1RM**

There was some lively discussion on the PVRC reflector last month discussing “wide” CW signals in contests. It blossomed into a more general discussion of a couple of parameters that some radios let you adjust. Transmit Delay and CW Rise Time are very different things but sometimes get confused with each other.

**Transmit Delay**

Transmit Delay (Tx Delay) is a setting to help protect external equipment that is doing switching of your transmit or receive path, such as a transmit or receive amplifier. Think of Tx Delay as a “promise” that you make to your amplifier or other external keyed equipment that you will wait a certain amount of time after sending it a key signal before sending it RF power to deal with. In general, you would like it to be as short as you can make it without risking damage to the external equipment. The needs for this delay vary drastically between different equipment. Think of the time it takes an original SB-220 amplifier to activate its open frame output relay compared to a modern QSK amplifier using PIN diode switching. On most rigs Tx Delay is adjustable to accommodate different external equipment.

Figure 1 shows the timing for a K3 with Tx Delay set to 8 milliseconds. The straight key input in this test is being driven by a signal generator simulating a continuous stream of dits at 35 wpm. Key Out is the signal the K3 sends to the key line of an external amplifier. Note that the cursor at the beginning of the RF output waveform shows that power begins appearing about 7.8 msec after Key Out is activated (goes to zero), which is reasonably close to the 8 msec setting.

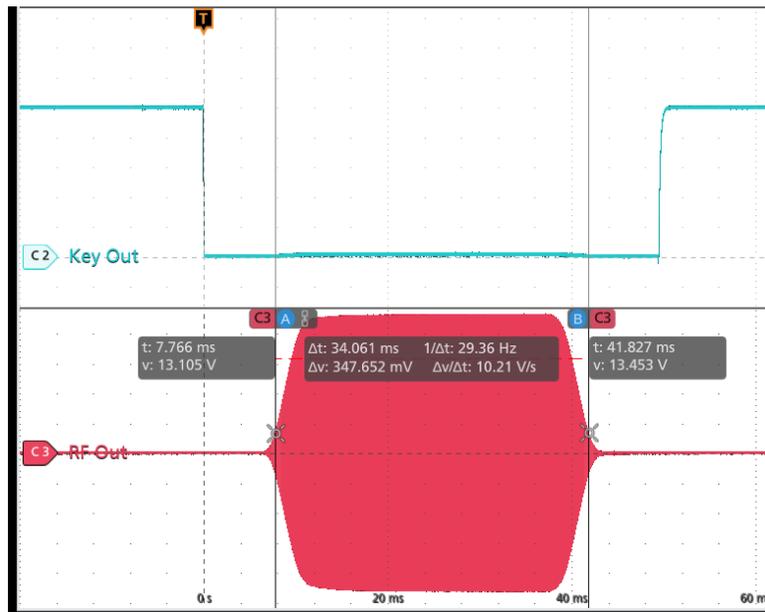


Figure 1 - 8 millisecond Transmit Delay

## CW Rise Time

What is CW Rise Time and why do we care? The way most of us are introduced to CW waveforms is to be shown an RF signal that goes from zero to full power instantaneously, stays on for one dit or dah, and then returns to zero, also instantaneously. Since the transitions are instantaneous, we could say that this signal has zero rise time. We can think of it as modulating a carrier with a square wave. A square wave has lots of energy at odd harmonics of its base frequency. These harmonics also modulate the carrier causing it to take up more bandwidth. The harmonics only occur at the beginning and end of the signal, so what you end up with is a nice pure single frequency signal sandwiched in between bursts of harmonics. Those bursts are what we hear as “clicks”.

In real circuitry, zero rise time is impossible to achieve, and isn't desirable. In fact, to reduce those harmonic bursts, we can purposely lengthen the rise time, causing the RF output to gradually increase instead of trying to switch on instantaneously, as shown by the green line in Figure 2. Doing this can be thought of as modulating the carrier with a triangle wave instead of a square wave. Triangle waves generate both odd and even harmonics, but at a lower amplitude than square waves. We still have harmonics on the leading and trailing edges, but they are not quite as offensive. Increasing the rise time further reduces the frequency of the modulating triangle wave, so the harmonics do not widen the signal as much.

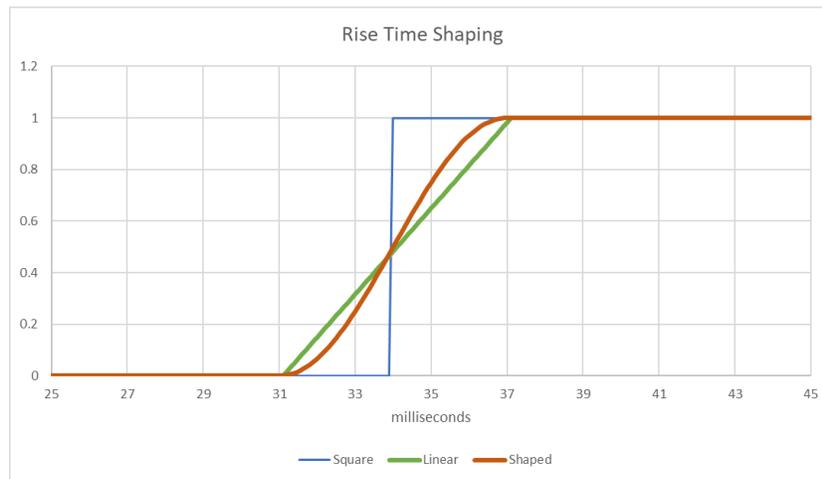


Figure 2 - Pulse shape as well as rise time can reduce clicks.

## CW Pulse Shaping

To further reduce the harmonics generated by the modulation on the rising and falling edges of the output signal, we can pick a modulating waveform that has even lower harmonic content than a square or triangle wave. Theoretically sine waves have no harmonic content. Look at the red trace in Figure 2. Visualize it as a half cycle of a sine wave going from its minimum at around 31 msec to its maximum at around 37 msec. This has the same 6 msec rise time as the linear edge, but has far less harmonic energy, producing a nearly “click free” signal. The K3 uses a pulse shape very similar to this.

### Real Radios and the Ugly Truth: Rise Time and “Marketing Milliseconds”

I wanted to look at the effects of rise time, but my K3 proudly refuses to let you change it. I started wandering through the menus on my IC7100 and found that it allows you to change rise time.



Figure 3 - IC7100 Allows you to set rise time.

I hooked it up to my scope to see what 2 msec rise time looks like and got a real surprise! As shown in Figure 4 the first dit out of the gate does indeed have a 2 msec rise time, but all subsequent dits have rise times of about 5.6 msec. The trailing edges are all about 2 msec.

My inner conspiracy theorist was all over this! What if I was a marketing director of a company selling radios to hams. I’m trying to match the features of “Brand Y”, but don’t want to get the reputation of being an offensive click generator. Wouldn’t these waveforms do the trick?

It is more likely that this is just the result of a designer who was frustrated trying to manage RF power control and timing along with a ponderous set of user adjustable settings. I know I’m paranoid, but am I paranoid enough?

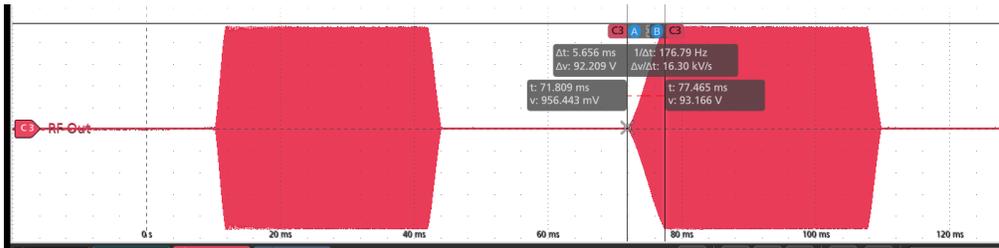


Figure 4 - Only the first dit actually has a 2 msec rise time in the IC7100

It gets even weirder with longer rise time settings. Figure 5 shows the timing when the radio is set to 8 msec rise time. The first dit has a 6 msec rise time and all subsequent dits have nearly 13 msec leading edges!

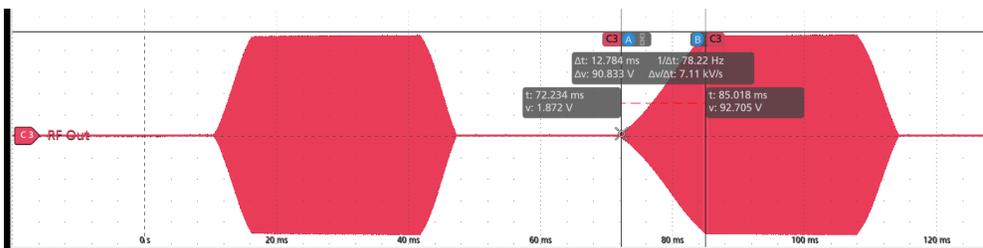


Figure 5 - More surprises in IC7100 rise time settings

### The K3 QRO Feature – breaking the promise!

The K3 also has a couple of surprises. Look at what happens in the K3 when you increase the Tx Delay to the maximum setting of 20 msec while trying to send 35 WPM dits. The first dit ends up shorter than the subsequent ones. The RF does not turn on until after the 20 msec delay, but the cost of keeping the Tx Delay promise is reducing the length of the first dit to only about half of the 34 msec that it is supposed to be.

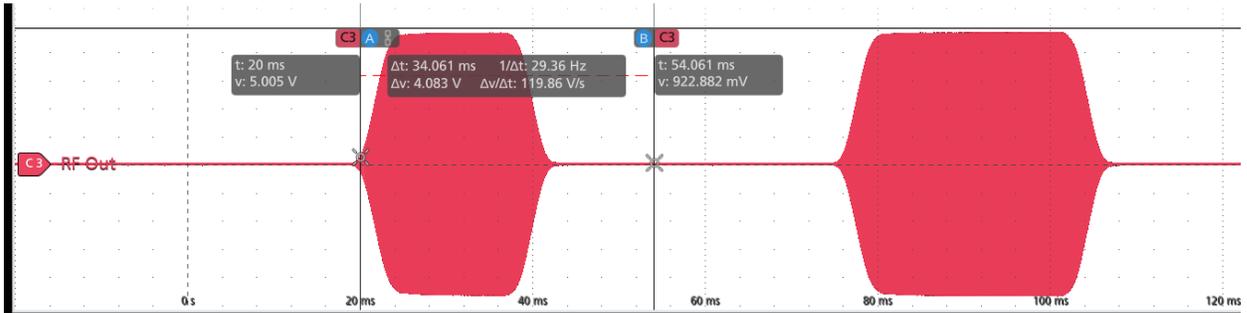


Figure 6 - Increasing delay times in the K3 can cause the first dit to be truncated

I remember this being discussed in the K3 group several years ago. It really affected the high-speed CW guys because their first dits were almost disappearing. In typical Elecraft fashion, N6KR (Wayne, the K3 designer) took the comments as a personal challenge and added “QRQ” mode to the menu settings. It must have been a real bear to implement, because the list of side-effects in the manual is bizarre. One of those side-effects is that it now will “break the promise” to your amp about Tx delay. Figure 7 shows what the output looks like when QRQ mode is enabled, and Tx Delay is set to 20 msec.

Now the first dit is the correct 34 msec length, but it starts less than 6 msec after Key Out. To Elecraft’s credit, this is documented in the user manual. How many of you K3 owners have read and remembered that?

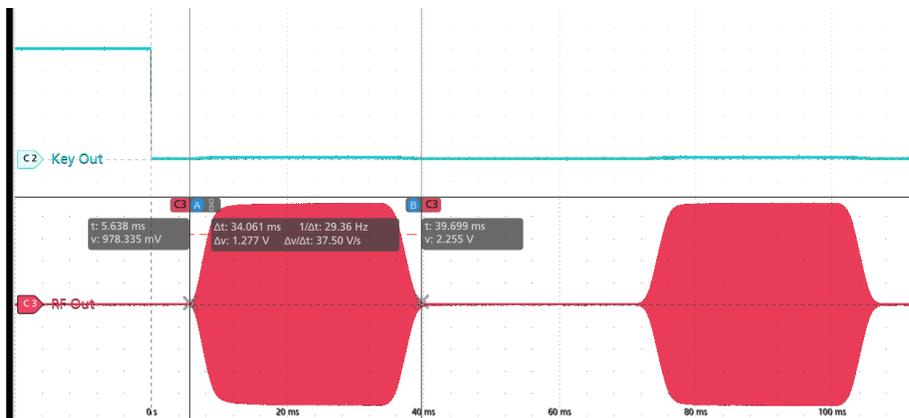


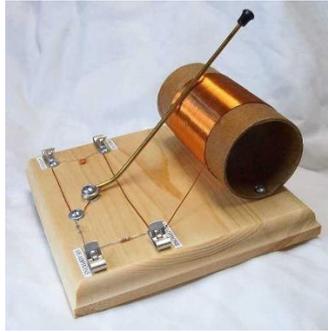
Figure 7 - K3 QRQ mode "breaks the promise" concerning Tx Delay

### Conclusion

If you got this far, there should no longer be any confusion between the definitions of rise time and Tx Delay. In addition, these experiments showed me that you can study manuals, meticulously set myriad parameters, and yet still cannot be sure of what your radio is doing unless you directly observe it!

**The Modern Version of the First Receiver Many of Us Built – John K3TN**

For many of us, listening to the local AM broadcast station using a diode, an alligator clip to the plumbing and cheap headphones was our first homebrew experience. The modern equivalent: [Hackaday](#) shows how an enterprising “maker” made a receiver out of the smart chip in a credit card!



Flinstones Xtal Receiver



Jetsons Xtal Receiver



Thanks to N1WR, N1RM and W3IP for inputs to the July Newsletter.

The PVRC Newsletter takes August off to sharpen pencils, replace the ribbon in the typewriter and add paper to the fax machine. You can still send anything you have now to [jpescatore at aol dot com](mailto:jpescatore@aol.com) at any time for the September issue.

73 and CUL – John K3TN

## A Text Messaging Application for JTAAlert/WSJT-X – Mike W3IP

I have recently become interested in working a station in each of the 488 FFMA grids (i.e. the grid squares in the continental US) on 6 meters. FT8 is currently the mode of choice - for better or worse, that is where most of the activity is between contests. I use [JTAAlert](#) along with WSJT-X to help sift through all the real-time decodes to highlight wanted calls, states, and countries.

What about wanted grids? Unlike the other discriminators (call, state, country) which have a straightforward manual text interface, the JTAAlert developer creates the wanted grids list from one of a few logging program databases - none of which I use. Instead, I have developed a target list of wanted callsigns in wanted grids by scraping information from spots, forums, e-mail lists, and chat rooms.

All this works well if I am in front of my computer and looking at the JTAAlert and WSJT-X screens, otherwise the alert is missed. Here is how to relay this information to your cell phone by text message or email. Spoiler alert, this is a Windows solution - I have no info on how to do this on a Mac or Linux machine.

JTAAlert has an interesting feature called a "user defined alert". The feature will launch an application that you specify every time an alert is triggered inside JTAAlert. Conveniently, JTAAlert also places all the information it has about that alert (callsign, frequency, date, time, grid, country, etc.) into several "environment variables" that can be accessed by the application that you launch.

I started by checking the JTAAlert help file and then the Internet to see if a solution already existed. There were a couple of solutions out there, but they had "issues". One solution required that you use what appeared to be an unsecured email system, another was for the Windows 10 operating system - and I have Windows 7. I tried it anyway - it didn't work, but it did provide me with a starting point to create a workable solution. I had three priorities for this project - keep it simple, make it easy to replicate by others, and don't spend any money on this. This translated to "don't use anything more complicated than a text editor (i.e. Notepad) to make this work".

More research pointed to Windows Power Shell (which is part of the Windows 7 SP1, 8 and 10 operating system) as a tool that only requires a few lines of code to send a text message or email via your internet service provider. For Windows 7 users, Windows Power Shell must be updated from Microsoft (no cost). Your Windows 7 edition must already include SP1 (Service Pack 1). Check by left clicking on the start button, right click on Computer, then select Properties. "Service Pack 1" should appear on one of the lines under "Windows Edition". The update is called Windows Management Framework 5.1 and is available at <https://www.microsoft.com/en-us/download/details.aspx?id=54616> Make sure you download the correct version for your computer - either the 32 or the 64 bit download

Now for the code! Start a new copy of Notepad, then copy the following 11 lines to Notepad:

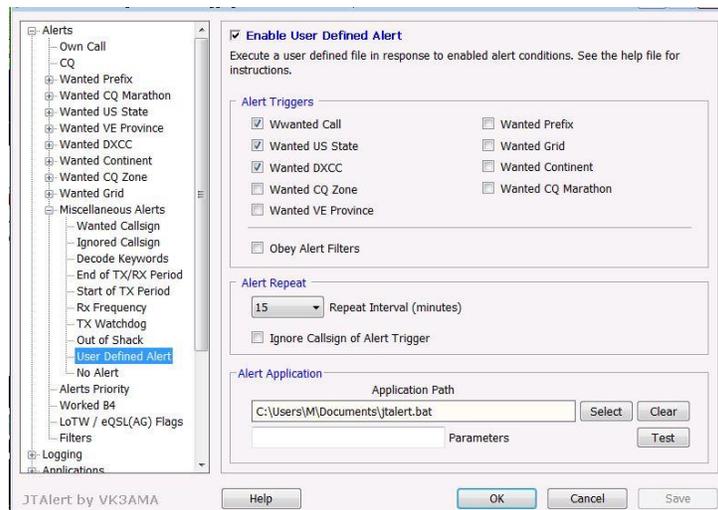
```
$User = "your_user_name@your_ISP.com"
>Password = ConvertTo-SecureString "your_password" -AsPlainText -Force
$Cell = "your_cell_number@your_cell_carrier.com"
$SMTPServer = "smtp.mail.your_ISP.com"
$SMTPPort = 587
$cred = New-Object System.Management.Automation.PSCredential $User,$Password
# We want just enough info here to know what the Grid is about
$Subject = "JAlert"
$Body = $Env:JAlert_Grid+" "+ $Env:JAlert_Call+" "+ $Env:JAlert_Country+" "+
$Env:JAlert_Time
Send-MailMessage -From $User -to $Cell -Subject $Subject -Body $Body -SmtpServer
$SMTPServer -Priority High -Credential ($cred) -UseSsl -port $SMTPPort -
DeliveryNotificationOption OnFailure
```

Change the placeholders in the first four lines above to your actual information. Leave the double quotes in place. In Notepad, the last two lines should display as a single long line. That is correct. Save the file as jtlartermail.ps1 You will need the full path name later. Don't forget where you put the file!

```
Start a second copy of Notepad, then copy the following 2 lines below to Notepad.
cd c:\windows\System32\WindowsPowerShell\v1.0
powershell -executionpolicy bypass -InputFormat Text -File
c:\Users\M\Documents\jtlartermail.ps1
```

Save this file with the name jtalert.bat in the same folder as the .ps1 file. Run jtalert.bat to test the files you just created. You should receive an empty text message within a few seconds on your cell phone. If not, check for errors in your .ps1 and .bat file. Your cell phone provider may have a special address that you must use for text messages - for example, Verizon uses vzwpx.com or vtext.com, ATT uses txt.att.net.

Open JAlert>settings>Manage Settings>Miscellaneous Alerts>User Defined Alert.



Check the alert triggers you want to receive texts from, select the repeat interval (i.e. if the station is still active, how long before JTAlert will send another text message). Be careful what you wish for. For example, if you have no worked countries in your 20-meter JTAlert database, and you are tuned to the 20 meter FT8 frequency during a time of good propagation, you will start receiving a LOT of texts!

Click select in the Alert Application window, find and highlight the JTAlert.bat file you created, then click open.

Click Save, then OK. Your text messaging software is now active. If you want to stop the texts, clear the Application Path in the Alert Application window.

Good DX!

### **“As the PL-259 Turns” – Exclusive Streaming on the PVRC Reflector**

*The next four pages spawned from a thread where Frank W3LPL had been explaining optimal RF gain and preamp settings. We join Frank midstream, as he shifts to recommending wrench tightening of all PL-259 connectors...*

### **The Importance of Tightening PL259 Connectors**

KD4D operated here last weekend in the WPX contest. Mark is a very proficient contester and when he changed bands, he immediately discovered that the ambient background noise did NOT drop by at least 6 dB on 10 meters. All the other bands were fine.

After some basic troubleshooting Mark discovered that he had failed to follow a basic W3LPL prime directive: When he connected a PL-259 connector to the 10-meter antenna he failed to wrench tighten the PL-259.

Any finger-tightened PL-259 in your station is an invitation to bad station performance. All PL-259 connectors must be wrench tightened to provide a reliable RF path for the coax shield. It should take only about 1/4 turn of your wrench.

Are all of your PL-259 connectors wrench tightened? No proficient contester or DXer installs them finger tight. Never!

Every proficient station owner checks their PL-259s before every contest to verify that he hasn't forgotten to wrench tighten one or more PL-259s at some point before the contest. This simple -- but necessary -- routine procedure takes just a minute or two in most stations.

**73 Frank W3LPL**

Frank:

1. On a standard PL-259, what kind of wrench is used to tighten?
2. Any thought about using a dielectric grease (such as Permatex) on the outer threads?  
I seem to remember that one PVRC member determined that a couple of dB of noise was introduced on his 160 receiving array when he used Permatex.

**73, Dave K3ZJ**

Hi Dave,

A small pair of pump pliers works very well for tightening PL-259s about 1/4 turn. Tighten the PL-259 just enough so you can't remove it by hand.

**73 Frank W3LPL**



**Sealing Coax Connectors**

As long as we are discussing PL-259 and other types of coax connectors, I thought I would continue the discussion by raising the question of the preferred tape or other sealing methods to seal outside connectors to prevent moisture, etc. These are the tapes that I am aware of:

- 1) Coax-Seal;
- 2) Scotch 33+;
- 3) Scotch 88;
- 4) Merco M307: and
- 5) 3M Temflex 2155 Rubber Splicing Tape.

I don't know the difference between Scotch 33+ and 88. Furthermore, I read somewhere about the preferred way of wrapping the tape. The preferred way is to begin the wrap from the coax and continue the wrap onto the connector. What has been your experience? I would appreciate your advice, opinions, and views.

**Tnx es 73 Fred W3ICM**

Scotch 33+ is 7 mils thick, Scotch 88 is 8.5 mils thick. They're both excellent professional-grade made-in-USA electrical tapes. I use Scotch 33+ - occasionally Scotch 88 - but I never use imported electrical tape. Merco 307 is made-in-Taiwan competitor to Scotch 33+

Always store tape in a temperature (50-80 degrees F) and humidity (<75%) controlled environment. Its shelf life is significantly reduced when stored in high or low temperatures or high humidity typical of a garage or shed.

Electrical tapes should always be applied with a minimum of 50% overlap turn-to-turn. If the taped joint is not horizontal, the turns should be overlapped like roof shingles so that

water drains over each successive layer. Wind Scotch 33+ with sufficient tension to produce a uniform wind. For most applications this tension will reduce the tape's width to about 5/8 of its original width. The last turn of Scotch 33+ and other electrical tapes should be applied with no stretch.

Scotch 130C is a premium grade made-in-USA liner-less self-vulcanizing rubber tape. It's the only rubber tape I ever use. Available in multiple widths from 3/4" to 1.5" and even wider

Temflex 2155 is an import made-in-Brazil self-fusing rubber tape similar to Scotch 130C with a liner that you remove during installation. Available in 3/4" and 1.5" widths. All self-sealing rubber tapes must be stretched during installation to about 3/4 of their original width and overlapped at least 50%turn-to-turn with the tacky side OUT.

### **73 Frank W3LPL**



I use 3 layers of tape: Scotch 88 or 33+ first and last with 130c in between. The 130c is a rubber splicing tape we use at work. It gets applied sticky side out. This comes off fairly clean if you need to take it apart and reuse the connectors or cables. When you do that last wrap, don't tear the tape to finish. Cut it with a knife or scissors and finish the wrap without stretching to avoid it unwrapping later.

### **Ty K3MM**

Is that first layer of 33 or 88 necessary? I've tried 2 layers, with the 130c and then covered with 88... wondering what the purpose of the first layer of 88 is  
The 2-layer technique seems to seal well and does come off well.

### **Regards, Dave N3AC**

Working at US Tower Services in Frederick, the first layer of tape is commonly called a courtesy wrap. If you ever find a presentation done by Andrew Corp called "Connector University", watch it! I am not going to go looking for it.

After the first layer, then you have the "Goop" that you double wrap up and down the connection. Then the third layer to seal the splice.

Now in the Wireless industry, almost every connection gets cut open once a year as technicians to the "annual, antenna & line" recordings. So, you try to leave the connection so that the person following you, or it might even be you can open up the joint!

**Dan K3SKE**  
Glen Allen, VA

I have used Scotch 2242 as the first layer for a long time. It is very stretchy and only sticky on one side.? Wrap it sticky side out, stretched about 50 percent, as the first layer, for a clean take-off. Then I use Scotch 33+ or 88, wrapped normally, typically starting at the connector end so I get a good tight wrap there.  
2242 is available at Home Depot.

**73, Pete N4ZR.**

This [video](#) is a rather convincing demo of the relative performance of heat shrink and cold shrink tubing

**73 Frank W3LPL**

### **More on Tightening PL 259s**

Which size of water pump pliers do you use for PL-259 connectors, 5", 7", or 10" (or other size) (all other things being equal, including the ham's muscle power)?

**73, Paul -- N4PD**

You shouldn't be using much muscle...Just enough so you can't disconnect to PL-259 by hand.Be sure you've seated the teeth in the PL-259 before you tighten the connector shell.The smaller 5-7-inch water pump pliers are a little more convenient than the more common 10-12 inch Channel Locks.

**73 Frank W3LPL**

If the current set of pliers from Harbor Freight is the same as what I bought there the smallest one should work well. It's about 6" long, the jaws area bout 5/16" wide and the jaw is about a perfect fit for a PL-259 and based on a test I just did on a PL-259, they have plenty of torque to tighten the PL259 barrel.

Don't know if buying the full set just for this is cost effective but if you "need" the other 2 sizes, this would work just fine. Now that I'm putting my shack back together, I'm going to "frank" all the connectors I use. :)

Thanks for a tremendous discussion about this topic. I confess to not always using pliers but that's going to change.

**Cliff W3CB**

The more challenging situation is sealing a PL-259 connection into a box; e.g., antenna switch box or phasing box mounted outdoors. Its rather awkward to get the tape to cover properly, even more so if other connectors are close by.

I have used several methods for both in-line and box connections. Each of these is much easier than wrapping tape properly for a weathertight seal.

#1: Adhesive-lined heat shrink: The silicone adhesive in 3M products provides a watertight seal. The material is not expensive (about \$1 per foot for a 10-ft length) and is much faster to install than multiple layers of tape.

The connection can be slit open. DAP Silicone-Be-Gone will remove the adhesive if one has to open up the connector. I use this for in-line connections as well as connections to boxes.

#2: A roll-on cable sealing sleeve, such as Raychem RVS-12 or LCH-11-205: This is a reusable tube that is rolled onto the cable before the connection is made, and then rolled back over the connector. Silicone dielectric grease can be used (the RVS-12 has grease incorporated) to fill any voids. This sealer can be rolled back off the connector at any time to disconnect the cable, and then rolled back on. It's not cheap but can be found on eBay or at other supply houses. You can decide whether it's worth \$15 of your time at the top of the tower to open up a connection and the reconnect and reseal it. This also works for in-line connections and connections to a box. When sealing a connector to a box, you can use a shorter size of roll-on sealer and silicone dielectric grease to help fill any voids and it definitely beats trying to tape up a connector to a box in tight quarters! It takes just a few seconds to roll back or roll on. The extra cost may be particularly warranted for connections that are accessed frequently; e.g., to insert an analyzer for troubleshooting, or when time is especially valuable (DXpedition, Field Day setup).

#3: For in-line connections, cold-shrink tubing is another good solution. This is a one-time application, like heat shrink. It's also quick and doesn't require heat. With care, cold shrink can be used on connectors on boxes as well.

#4: Rather than mount sockets on the outside of a box, place the coax connection inside the box. The cable enters the box via a cable gland, which provides both a strain relief and a seal. The PL-259 connector inside the box does not need to be taped or sealed.

All of the above methods may be used for non-coax connections as well; e.g., rotator cables.

**Eric K3NA**

<b><u>PVRC Officers:</u></b>		<b><u>Trustees:</u></b>
President:	K3AJ Tom Valenti	K3MM, N3OC, K2AV, K4ZA, W3LPL, N4MM, N4ZR, W2RU, W3LL
Vice President:	N4GU Mike Barts	
Vice President:	W3MMM Jay Horman	<b><u>PVRC Charter Members (all SK):</u></b>
Secretary:	N3QE Tim Shoppa	W3GRF, W4AAV, W4KFC, N0FFZ, W4LUE, W7YS, VP2VI/W0DX,
Treasurer:	K2YWE Dan Zeitlin	W3IKN, W4KFT

Newsletter Editor: John K3TN [jpescatore@aol.com](mailto:jpescatore@aol.com)  
PVRC Website: <http://www.pvrc.org>  
PVRC Meeting Info: <http://www.pvrc.org/chapters.htm>  
PVRC on Facebook: <https://www.facebook.com/groups/PotomacValleyRadioClub/>

**PVRC 6M DXCC Standings – Frank W3LPL**

Below are the 6M DXCC totals for PVRC members, transcribed from the ARRL DXCC data as of the 20<sup>th</sup> of each month or so. Thanks to Frank for the data each month to make this a regular feature. Please report any omissions or errors to [Frank](#).

Call	DXCC	Call	DXCC	Call	DXCC
W3BTX	167	K4SO	120	N4VA	106
K1HTV	164	K3XA	119	W2YE	106
W4DR	158	KG7H	116	K3ZO	103
N4MM	147	K5EK	114	W3OR	103
W3LPL	137	K3SX	112	N4PY	102
W3UR	132	W3EKT	111	W4FQT	102
K2PLF	131	W3LL	111	K3WC	100
K4SN	131	N4DB	110	W4TJ	100
K4CIA	124	WX4G	110		
NW5E	123	W4PK	109		

**Membership News – Tim N3QE**

PVRC did not add any new members in the latest reporting period.

Chapter leaders please remember to complete the [Meeting Attendance Report](#). Members can check and update their roster details via the [Roster Lookup](#).

**Upcoming Contests – from [WA7BNM](#)**

July 2020	
+ RAC Canada Day Contest	0000Z-2359Z, Jul 1
+ VHF-UHF FT8 Activity Contest	1700Z-2000Z, Jul 1
+ Worldwide Sideband Activity Contest	0100Z-0159Z, Jul 7
+ VHF-UHF FT8 Activity Contest	1700Z-2000Z, Jul 8
+ IARU HF World Championship	1200Z, Jul 11 to 1200Z, Jul 12
+ Worldwide Sideband Activity Contest	0100Z-0159Z, Jul 14
+ North American QSO Party, RTTY	1800Z, Jul 18 to 0559Z, Jul 19
+ CQ Worldwide VHF Contest	1800Z, Jul 18 to 2100Z, Jul 19
+ Worldwide Sideband Activity Contest	0100Z-0159Z, Jul 21
+ Worldwide Sideband Activity Contest	0100Z-0159Z, Jul 28

**From the PVRC Treasurer – Dan K2YWE**

PVRC has chosen not to implement an annual dues requirement. We depend on the generosity of all our club members to finance our annual budget. In addition, active PVRC members are expected to participate and submit logs for at least two PVRC Club Competition contests per year.

When contemplating your donation to PVRC, each member should consider the benefit you are receiving from PVRC and its many opportunities for your personal growth in our wonderful hobby, then donate accordingly.

Direct donations to PVRC via Credit Card or PayPal may be made by clicking this "Donate" button and clicking the next Donate button that appears on your screen:



**Donations to PVRC are not tax deductible**

**Eyeball QSO Directions**

The latest info on local club meetings and get togethers will always be sent out on the [PVRC reflector](#) and posted on the PVRC [web site](#).



**Green: ARRL VHF Circle**  
175 mile radius  
Around 38.075N,  
78.171W

**Red: ARRL HF Circle**  
175 mile radius  
Around 37.43168N,  
77.858482W

**Blue: CQ HF Circle**  
250 mile radius  
Around 37.43168N,  
77.858482W



**Now a Word From Our Sponsors**

*PVRC doesn't ask for dues, but the Club does have expenses. You can also support the Club by buying from the firms listed who advertise in the newsletter!*



**Your source for DX News!**

Get a free two week trial of The Daily DX and The Weekly DX by sending a request to [bernie@dailydx.com](mailto:bernie@dailydx.com).

The Daily DX  
3025 Hobbs Road  
Glenwood, Maryland 21738  
Phone: 410-489-651



**PVRC QSL Cards**  
by  
**LZ1JZ QSL Print**



## GREEN HERON ENGINEERING LLC

(585) 217-9093  
www.greenheronengineering.com

---

**RT-21 DIGITAL ROTATOR CONTROLLERS**  
*Unmatched Performance for any Rotator*

**RT-21**



**RT-21D**



**RT-21 AZ/EL**



**Rotator Packages**



**FREE Shipping for PVRC Members**  
At Checkout Enter Coupon Code "PVRC"

**Heavy Duty Custom Mast Clamps**  
-for G-2800 and Orion



**Wi-Fi Option**  
-control your rotator from any web browser device

---

**GH EVERYWARE WIRELESS CONTROLS**

- Internet access for switches and rotators
- Eliminate cables and tethered control boxes
- Create customized on-screen controls
- Great circle maps

---

**GH Everywhere Base and Remote**

- USB and wireless relay controls
- Utilizes your existing antenna switches




---

**Select-8 Wireless Remote Coax Switch**

- Built-in GHE Wireless
- Powered through the coax
- Tower leg Mount
- Amphenol RF connectors






# We Can Help with Your Tower and Antenna Projects!



## DX ENGINEERING Yagi Antennas

Elevate your contesting and DXing prowess with a high-performance HF Yagi antenna. Our lineup includes DX Engineering's own 20/15/10M Skyhawk™ and 17/12M Skylark™; rugged EAntenna Yagis exclusively offered in North America by DX Engineering; and more than 65 elite directional Yagi and log cell Yagi antennas German-engineered by OptiBeam. Enter "Yagi" at [DXEngineering.com](http://DXEngineering.com).

## OPTIBEAM



DX Engineering's Amateur Radio Blog for New and Experienced Hams. Visit [OnAllBands.com](http://OnAllBands.com) and enter "Tower" to view our new video series on Tower Climbing Safety.

## DX ENGINEERING Vertical Antennas

Choose from a great selection of proven winners, including DX Engineering's THUNDERBOLT® DXE-8040VA-1, which gives you an impressive presence on the 80 and 40 meter bands; easy-tuning, high-performance Butternut Antennas; DX Engineering's 43-foot multi-band antenna packages, covering 160 through 10 meters; the Hustler 4-, 5-, and 6-band BTV series; and verticals from Comtek, Cushcraft, Diamond, Hy-Gain and others. Enter "Vertical" at [DXEngineering.com](http://DXEngineering.com).



Detail from the DXE-8040VA-1

## DX ENGINEERING Vertical Antenna Accessories

Add performance and ease of use to your verticals with the patented OMNI-TILT™ Base, which makes lowering and raising your antennas safe and simple; patented Radial Plate and Radial Wire Kits for connecting essential radial wires and feedline to your quarter-wave vertical antennas; 80, 60, 30, 17, and 12 meter add-on kits for Hustler BTV series antennas; and more.



DXE-TB-400



DXE-AS25G



DXE-MASTLOCK

## DX ENGINEERING

### Tower Accessories

Upgrade your towers with DX Engineering designed and manufactured accessories. These include Advanced Design Thrust Bearings (for 2" and 3" O.D. masts); Tower Accessory Shelves; the Mastlock Tower Accessory, which locks your tower mast in position for worry-free antenna maintenance; and stainless steel Genius Clamps for mounting round tubing and pipe members perpendicular or parallel to each other. We also carry guy and antenna support rope, tail kits, mast kits, hardware and more. Enter "Tower Accessories" at [DXEngineering.com](http://DXEngineering.com).



DXE-SSGC-2P

## American Tower Company

## TBX Tower ROHN Products LLC



### Towers

Make DX Engineering your go-to source for proven antenna towers. Choose from Rohn/American Towers, including Rohn G-Series guyed towers and Amerite 25 Series bracket towers; lightweight freestanding aluminum towers from Universal; and packaged tower kits from TBX, which come with rotor plate, top plate, hardware pack and top section steps. Enter "Tower" at [DXEngineering.com](http://DXEngineering.com).

## RigExpert NANUK

### RigExpert Analyzer and NANUK Case Combos

In the field, an antenna analyzer is especially at risk for weather and shock damage. We've paired select RigExpert Antenna Analyzers with perfectly sized NANUK equipment cases. Each case is filled with cubed, sectioned foam for custom configuration. Available separately or in combos. Enter "Nanuk Combo" at [DXEngineering.com](http://DXEngineering.com).



## Request Your New Catalog Today at [DXEngineering.com](http://DXEngineering.com)!

**Showroom Staffing Hours:**  
9 am to 5 pm ET, Monday-Saturday

**Ordering (via phone):**  
8:30 am to midnight ET, Monday-Friday  
9 am to 5 pm ET, Weekends

**Phone or e-mail Tech Support: 330-572-3200**  
8:30 am to 7 pm ET, Monday-Friday  
9 am to 5 pm ET, Saturday  
All Times Eastern | Country Code: +1  
[DXEngineering@DXEngineering.com](mailto:DXEngineering@DXEngineering.com)



**800-777-0703 | [DXEngineering.com](http://DXEngineering.com)**



**Email Support 24/7/365 at [DXEngineering@DXEngineering.com](mailto:DXEngineering@DXEngineering.com)**  
**We're All Elmers Here! Ask us at: [Elmer@DXEngineering.com](mailto:Elmer@DXEngineering.com)**



# Array Solutions Your Source for Outstanding Radio Products

## Professional Grade Equipment from Array Solutions



**OM Power Amplifiers, The New RF Power Benchmark!**

**Summer Sale - July 15 - August 31 on ALL OM Power Amplifiers**



**\$300-\$400 Off**

Call us or see the Array Solutions website for details. Now is the time to get the most powerful and reliable amp for Contesting, DXing, Ragchewing and those Digital Heavy Duty Modes!

### Tubes



**GU-74b  
GU-84b  
FU-728f**

Tested singles and matched pairs available, 1 year warranty

### Amplifier Repairs

- We service ACOM, OM Power, Alpha, ETO, and most brands.
- Fast turnaround, and communication with our test Technicians
- Service report and test data included
- Tube testing for some common tubes [www.arrayolutions.com/amplifier-service](http://www.arrayolutions.com/amplifier-service)

### Switches for Six Antennas



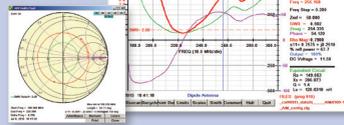
**5kW - DC to 6m  
RATPAK - 1x6  
Choice of Multiple Controllers**



**SIXPAK - 2x6**

### VNAuhf Back in Stock!

**Vector Network Analyzer**  
5 kHz - 1.3 GHz **\$1295**



### Surge Arrestors

**AS-302, AS-303** Coaxial cable arrestors. DC to 500 MHz. N-type or SO-239 connectors. **AS-300SB** Stacking fixture available. **AS-309H**, ladder line arrestor. All have static bleed function. **AS-8SP, AS-12SP** and **AS-16SP** control cable arrestors. Protect your rotator's and other control cables.



### Baluns & RF Transformers

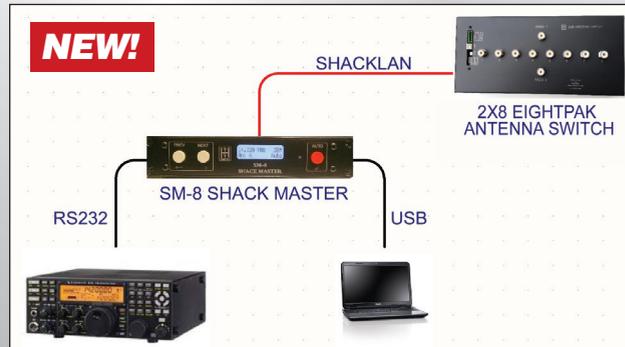
Ratios 1:1, 1:2, 2:1, 4:1 and more. RF line isolators. Ratings 3, 5, 10 kW+. Get the most out of your antenna by stopping the coaxial cable from becoming part of it.



### Hamation Station Automation

Hamation remote and Local Station Control products allow you to automatically or manually select antennas, bandpass filters, and control accessories. Accessories can be StackMatches, Antenna switches, antenna phasing systems, SteppIR controller, turning radios on and off, etc. All of this can be done directly from the Ethernet as well!

Wiring are simple phone cables that daisy chain to all the devices. Wireless control is also available to your tower-located switches. Call us to learn how to set up simple or complex systems. Below is a simple basic system that can switch antennas as you change bands. We can interface to any radio CAT port, not just RS232.



A more complex system could be a SO2R contest station as shown.



### The Shared Apex Loop Array™!

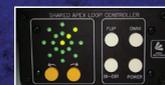
Capture the whole band or the whole HF spectrum at once with the Shared Apex Loop Array 2nd Generation. Can be remote controlled over the internet or in your station. 8 directions of directivity.



The Shared Apex Loop Array™ is a revolutionary receiving antenna that will change the way that you listen to the radio! The patented design provides performance in a size and over a wide range of frequencies that will please both the rag-chewer and DXer alike.

Three models to choose from:

- AS-SAL-30 - optimized for VLF, BCB, 1.8-10 MHz
- AS-SAL-20 - optimized for BCB, and 1.8-30 MHz
- AS-SAL-12 - optimized for 3-30 MHz



### StackMatch

The original, not the imitations. For phasing 2, 3, 4 and even 6 antennas. Also it can be used to combine vertical and horizontal polarized antennas to diminish fading.



### PowerMaster II



RF Power and SWR meter. Couplers for 3 kW, 10 kW or higher available for HF/6 m. VHF and UHF couplers for 1.5 kW. You can connect up to 5 couplers to the display to monitor RF power on different TX lines.



**www.arrayolutions.com**

2611 North Beltline Rd., Suite 109  
Sunnyvale, Texas 75182 USA  
sales@arrayolutions.com  
Phone 214-954-7140 Fax 214-954-7142

**Check our Website for more new products!**

Array Solutions' products are in use at top DX and Contest stations worldwide as well as commercial and governmental installations. We provide RF solutions to the DoD, FEMA, Emcomm, UN, WFO, FAA and the State Dept. for products and installation of antennas systems, antenna selection, filtering, switching and grounding. We also offer RF engineering and PE consulting services.

# HAM RADIO OUTLET

WWW.HAMRADIO.COM

**NOBODY BEATS AN HRO DEAL!**



## IC-9700 | All Mode Tri-Band Transceiver

- VHF/UHF/1.2GHz • Direct Sampling Now Enters the VHF/UHF Arena • 4.3" Touch Screen Color TFT LCD • Real-Time, High-Speed Spectrum Scope & Waterfall Display • Smooth Satellite Operation



## IC-718 | HF Transceiver

- 160-10M\*\* • 100W • 12V operation • Simple to use • CW Keyer Built-in • One touch band switching • Direct frequency input • VOX Built-in • Band stacking register • IF shift • 101 memories



## ID-5100A Deluxe

VHF/UHF Dual Band Digital Transceiver

- Analog FM/D-Star DV Mode • SD Card Slot for Voice & Data Storage • 50W Output on VHF/UHF Bands • Integrated GPS Receiver • AM Airband Dualwatch



## IC-7851 | HF/50MHz Transceiver

- 1.2kHz "Optimum" roofing filter • New local oscillator design • Improved phase noise • Improved spectrum scope • Dual scope function • Enhanced mouse operation for spectrum scope



## IC-705 | HF/50/144/430 MHz All Mode Transceiver

- RF Direct Sampling • Real-Time Spectrum Scope and Waterfall Display • Large Color Touch Screen • Supports QRP/QRPP • Bluetooth® and Wireless LAN Built-in



## ID-4100A | VHF/UHF Dual Band Digital Xcvr

- Compact, Detachable Controller for Flexible Installation • DV/FM Near Repeater Search Function • Apps for iOS™ and Android™ devices • Wireless Operation with VS-3 & UT-137 Bluetooth® Headset & Module • MicroSD Card Slot



## IC-7700 | HF/50MHz Transceiver

The Contester's Rig • HF + 6m operation • +40dBm ultra high intercept point • IF DSP, user defined filters • 200W output power full duty cycle • Digital voice recorder



## IC-7100 | All Mode Transceiver

- HF/50/144/430/440 MHz Multi-band, Multi-mode, IF DSP • D-STAR DV Mode (Digital Voice + Data) • Intuitive Touch Screen Interface • Built-in RTTY Functions

## IC-V86 | VHF 7W HT

- 7W Output Power Plus New Antenna Provides 1.5 Times More Coverage • More Audio, 1500 mW Audio Output • IP54 & MIL-STD 810G—Rugged Design Against Dust & Water • 19 Hours of Long Lasting Battery Life • 200 Memory Channels, 1 Call Channel & 6 Scan Edges



## IC-7610 | HF/50 MHz All Mode Transceiver

- Large 7-inch color display with high resolution real-time spectrum scope and waterfall • Independent direct sampling receivers capable of receiving two bands/two modes simultaneously



## IC-2730A | VHF/UHF Dual Band Transceiver

- VHF/VHF, UHF/UHF simultaneous receive • 50 watts of output on VHF and UHF • Optional VS-3 Bluetooth® headset • Easy-to-See large white backlight LCD • Controller attachment to the main Unit



## IC-R30 | Digital/Analog Wideband Xcvr

- 100 kHz to 3.3 GHz Super Wideband Coverage • P25 (Phase 1), NXDNTM, dPMRTM, D-STAR Mode • 2.3" Large LCD Display & Intuitive User Interface • MicroSD Card Slot for Voice & Data Storage • USB Charging & PC Connection



## IC-7300 | HF/50MHz Transceiver

- RF Direct Sampling System • New "IP+" Function • Class Leading RMDR and Phase Noise Characteristics • 15 Discrete Band-Pass Filters • Built-In Automatic Antenna Tuner



## IC-2300H | VHF FM Transceiver

- 65W RF Output Power • 4.5W Audio Output • MIL-STD 810 G Specifications • 207 alphanumeric Memory Channels • Built-in CTCSS/DTCS Encode/Decode • DMS

## ID-51A PLUS2

VHF/UHF D-STAR Portable

- RS-MS1A, free download Android™ application • New modes for extended D-STAR coverage • Terminal Mode & Access Point Mode allow D-STAR operation through Internet • DV & FM repeater search function • Dplus reflector link commands



**New Ham Radio Outlet Coming Soon!**



**Tell Us Where To Build The Next Ham Radio Outlet Superstore!**  
For everyone who wanted an HRO store close to them... now is your ultimate chance. Let us know now at: [www.hamradio.com/newstore](http://www.hamradio.com/newstore)

\*\*Except 60M Band. \*\*\*Frequency coverage may vary. Refer to owner's manual for exact specs. QST May 2020. The Icom logo is a registered trademark of Icom Inc. Toll-free including Hawaii, Alaska and Canada. All HRO 800-lines can assist you. If the first line you call is busy, you may call another. Prices, specifications and descriptions subject to change without notice.

# HAM RADIO OUTLET

WWW.HAMRADIO.COM

**\*FREE 1 OR 2 DAY DELIVERY TO MOST OF USA!**

**NEW**



## FTDX101MP | 200W HF/50MHz Transceiver

- Hybrid SDR Configuration • Unparalleled 70 dB Max. Attenuation VC-Tune • New Generation Scope Display 3DSS • ABI (Active Band Indicator) & MPVD (Multi-Purpose VFO Outer Dial) • PC Remote Control Software to Expand the Operating Range • Includes External Power With Matching Front Speaker



## FT-891 | HF+50 MHz All Mode Mobile Transceiver

Rugged Construction in an Ultra Compact Body • Stable 100 Watt Output with Efficient Dual Internal Fans • 32-Bit IF DSP Provides Effective and Optimized QRM Rejection • Large Dot Matrix LCD Display with Quick Spectrum Scope • USB Port Allows Connection to a PC with a Single Cable • CAT Control, PTT/RTTY Control



## FTM-400XD | 2M/440 Mobile

- Color display-green, blue, orange, purple, gray • GPS/APRS
- Packet 1200/9600 bd ready • Spectrum scope • Bluetooth • MicroSD slot • 500 memory per band



## FTDX3000 | 100W HF + 6M Transceiver

- 100 Watt HF/6 Meters • Large and wide color LCD display • High Speed Spectrum Scope built-in • 32 bit high speed DSP /Down Conversion 1st IF



## FTM-300DR | C4FM/FM 144/430MHz Dual Band

- 50W Reliable Output Power • Real Dual Band Operation (V+V, U+U, V+U, U+V) • 2-inch High-Res Full Color TFT Display • Band Scope • Built-in Bluetooth • WiRES-X Portable Digital Node/Fixed Node with HRI-200



## FT-70DR C4FM/FM 144/430MHz Xcvr

- System Fusion Compatible • Large Front Speaker delivers 700 mW of Loud Audio Output
- Automatic Mode Select detects C4FM or Fm Analog and Switches Accordingly • Huge 1,105 Channel Memory Capacity • External DC Jack for DC Supply and Battery Charging



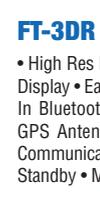
## FT-991A | HF/VHF/UHF All Mode Transceiver

- Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 Inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO



## FT-2980R | Heavy-Duty 80W 2M FM Transceiver

- Massive heatsink guarantees 80 watts of solid RF power • Loud 3 watts of audio output for noisy environments • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users



## FT-3DR C4FM/FM 144/430 MHz Xcvr

- High Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Simultaneous C4FM/C4FM Standby • Micro SD Card Slot



## FT-65R | 144/430 MHz Transceiver

- Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access



## FTDX101D | HF + 6M Transceiver

- Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream



## FTM-100DR | C4FM FDMA/FM 144/430 MHz Xcvr

- Power Packed System Fusion Transceiver • High Audio Output Power • Rugged Powerful Transmitter • Integrated 66ch High Sensitivity GPS • 1200/9600 APRS Data Communications



## FT-60R | 2M/440 5W HT

- Wide receiver coverage • AM air band receive
- 1000 memory channels w/alpha labels • Huge LCD display • Rugged die-cast, water resistant case • NOAA severe weather alert with alert scan



**5 Ways to Shop!**

- RETAIL LOCATIONS – Store hours 10:00AM - 5:30PM - Closed Sunday
- PHONE – Toll-free phone hours 9:30AM - 5:30PM
- ONLINE – WWW.HAMRADIO.COM
- FAX – All store locations
- MAIL – All store locations

**YAESU**  
The radio

ANAHEIM, CA  
(800) 854-6046

OAKLAND, CA  
(877) 892-1745

PORTLAND, OR  
(800) 765-4267

PHOENIX, AZ  
(800) 559-7388

MILWAUKEE, WI  
(800) 558-0411

WOODBIDGE, VA  
(800) 444-4799

PLANO, TX  
(877) 455-8750

SAN DIEGO, CA  
(877) 520-9623

DENVER, CO  
(800) 444-9476

ATLANTA, GA  
(800) 444-7927

NEW CASTLE, DE  
(800) 644-4476

SALEM, NH  
(800) 444-0047

Shop Anytime From Anywhere  
with Our Online Superstore  
**WWW.HAMRADIO.COM**

# HAM RADIO OUTLET

WWW.HAMRADIO.COM

**NOBODY BEATS AN HRO DEAL!**



**\$600**  
INSTANT SAVINGS

### TS-990S | 200W HF + 6M Transceiver

- World's first dual TFT display • 200W output on all bands
- ±0.1ppm TCXO ensures both high stability and reduced power consumption • Triple 32-bit DSP's dedicated to main/sub receivers and band scope • Main receiver employs full down conversion, new mixer & narrow band roofing filters • Third order intercept point (IP3) +40dBm for highest level of RX performance (main receiver)

**Call For Special Price!**



**\$40**  
INSTANT SAVINGS

### TM-D710G | 2M/440 Dualband

- V+V/V+U+U operation • Built-in GPS • Built-in TNC for APRS & DX-Cluster operation • 50W 2M & UHF • 1,000 memories • Dual receive • Green or amber backlight colors • Latest APRS firmware w/new features • Sky Command II remote functions

**Call For Special Price!**



**\$50**  
INSTANT SAVINGS

### TH-D72A

*2M/440 HT w/extended RX*

- 5W TX, RX 118-524 MHz, VxU, VxV, UxU • APRS w/built-in 1200/9600 TNC
- Built-in GPS, Built-in USB, digipeater
- Echolink® compatible
- Mil-Spec STD810

**Call For Special Low Price!**



**\$700**  
INSTANT SAVINGS

### TS-890S | HF/50MHz Transceiver

- Receive performance on a whole other level from narrow bandwidth roofing filters that only full down conversion can provide • CW Morse code decode/encode possible with stand-alone unit • 150dB Blocking dynamic range (BDR) • Expanded touch operation scope • Kenwood Sky Command® II Support • Remote operation achieved without host PC Direct remote-control function (KNS)



**\$25**  
INSTANT SAVINGS

### TM-V71A | 2M/440 DualBand

- High RF output (50W) • Multiple Scan • Dual receive on same band (VxV, UxU) • Echolink® memory (auto dialer) • Echolink® Sysop mode for node terminal ops • Invertible front panel • Choice of green/amber for LCD panel • 104 code digital code squelch • "Five in One" programmable memory • 1000 multifunction memory

**Call Now For Your Low Price!**

### TH-D74A

*2M/220/440 HT w/D-STAR!*

- D-STAR compatible • APRS ready w/ built in GPS • Color weather station information • Built-in KISS mode TNC • High-performance DSP voice processing • Standard compatibility for Bluetooth

**Call For Low Price!**



**\$50**  
INSTANT SAVINGS



**\$300**  
INSTANT SAVINGS

### TS-590SG | HF/50MHz Transceiver

- Equipped with 500 Hz/2.7 kHz roofing filter as standard • ALC derived from TS-990S eliminating spike issues • Antenna output function (shared with DRV connector) • CW - morse code decoder function • Improved 1st mixer • New PFB key with multi-function knob • New split function enabling quick setting • LED backlight with selectable color tone



**\$25**  
INSTANT SAVINGS

### TM-281A | 2M Mobile

- 65 Watt • 200 Memories • CTCSS/DCS • Mil-Std specs • Hi-quality audio

**Call For Special Low Price!**



### TH-K20A | 2M Handheld

- 2M 5.5W • VOX • CTCSS/DCS/1750 Burst built-in • Weather alert

**Call For Special Low Price!**

**HRO is family owned and operated by active hams!**

**5 Ways to Shop!**

- RETAIL LOCATIONS – Store hours 10:00AM - 5:30PM - Closed Sunday
- PHONE – Toll-free phone hours 9:30AM - 5:30PM
- ONLINE – WWW.HAMRADIO.COM
- FAX – All store locations
- MAIL – All store locations

**KENWOOD**

ANAHEIM, CA (800) 854-6046	OAKLAND, CA (877) 892-1745	PORTLAND, OR (800) 765-4267	PHOENIX, AZ (800) 559-7388	MILWAUKEE, WI (800) 558-0411	WOODBIDGE, VA (800) 444-4799
PLANO, TX (877) 455-8750	SAN DIEGO, CA (877) 520-9623	DENVER, CO (800) 444-9476	ATLANTA, GA (800) 444-7927	NEW CASTLE, DE (800) 644-4476	SALEM, NH (800) 444-0047

Shop Anytime From Anywhere  
with Our Online Superstore  
**WWW.HAMRADIO.COM**