Building a DMR Codeplug From Scratch 11-MAR-2020 K3JZD

This exercise builds a Radioddity GD-77 Codeplug from scratch. A 'Codeplug' is nothing more than a computer file that contains the programming information for a DMR. It is not a physical object. A 'Codeplug' data gets 'Uploaded' to your DMR, using a Programming Cable that is designed to be used with your particular radio.

Table of Contents

1. General

Given that DMR stands for 'Digital Mobile Radio', one has to avoid calling it a 'DMR Radio' or a 'DMR Mode Radio' as that introduces a redundancy. So it will just be a 'DMR' here.

This exercise uses the Radioddity GD-77 Programming Software. While each brand of DMR has its own Programming Software, which may look different that what is shown here for the GD-77, the information that is needed is pretty much the same for all.

The Radioddity GD-77 is a dual band HT which will operate on 146 MHz or 440 MHz. The Radioddity GD-77 will do both Digital DMR Communications and normal Analog FM Communications. If your DMR unit will not do all of that, then some of what is in this Codeplug will not be applicable to you.

One thing that makes building a Codeplug for a DMR (programming a DMR) more complex and confusing than just programming a 'normal VHF/UHF FM Radio' is that is that the DMR Codeplug (programming) consists of a hierarchy of 'things' that work together. One has to put information into multiple different 'things' just to be able to add in one new communications Channel – it is not all in one place and focused on that communications channel like it is in a 'normal VHF/UHF FM Radio'.

Another thing than makes building a Codeplug for a DMR (programming a DMR) difficult is that there is a whole new vocabulary that you have to deal with. These are Commercial Business Radios that are being adapted to ham radio use. So, we are stuck with the Commercial Business Radio vocabulary. And since Commercial Business Radios are generally programmed by a radio shop and given to users who just use the radios, the radio's User Manuals are all about using them, not programming them.

You will need your own DMR ID to use in your Codeplug. Go here to get that done: https://www.radioid.net/register#!

This document does not touch on how to get registered with Brandmeister, nor how to setup a Local Hotspot. Those items all become necessary, but are not covered here.

Caveat : I do not claim to be an expert on Digital Mobile Radios or Codeplugs. This effort is based on how I understand it. It is being written as I setup a new Codeplug for my GD-77. Describing it was a learning experience. Corrections gladly accepted.

2. Building Your Codeplug

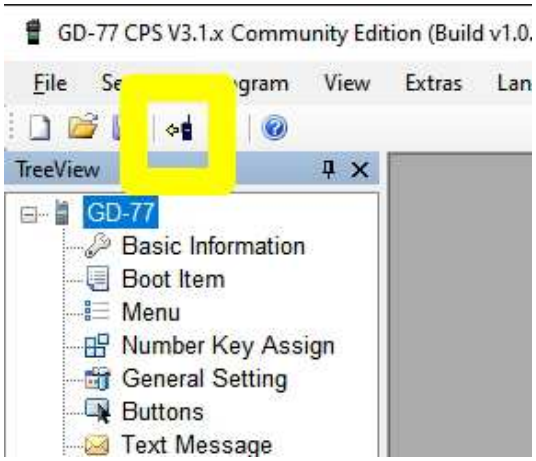
This Codeplug is being setup for Western Pennsylvania (WPA). It is being setup to use with 'Local Hotspots', repeaters, and direct communications with other stations using Simplex. 'Local Hotspots' are separate two-way RF-to-Internet interface devices that connect your radio to the Internet. My convention is to Prefix all of my Low Power Hotspot Channels with a "Z" (for ZumSpot) to make them readily identifiable. Any Channel without a "Z" Prefix will use High Power for reaching repeaters or for simplex operation over the air.

The first step is to obtain the Codeplug Programming Software (CPS) for your DMR. Often the place where you bought it from will make that available for download. Or, you may have to go to the manufacturer's web site and obtain it from there. Or, search on Google, as someone may have created a 'better version' as is the case here.

The Codeplug editing software that I am using here for my Radioddity GD-77 came from:
https://www.rogerclark.net/radioddity-gd-77-community-cps-for-firmware-3-1x/

The second step is to obtain the Programming Cable for your radio. Many manufacturers will include that with the radio. These cables are usually radio specific.

Next, you want to make an archive copy of the Codeplug that came in your new radio. Startup your Codeplug editing software and then connect the Programming Cable to your radio. Click on the "Read" icon in the header to Download what is in your new radio into your Codeplug software.

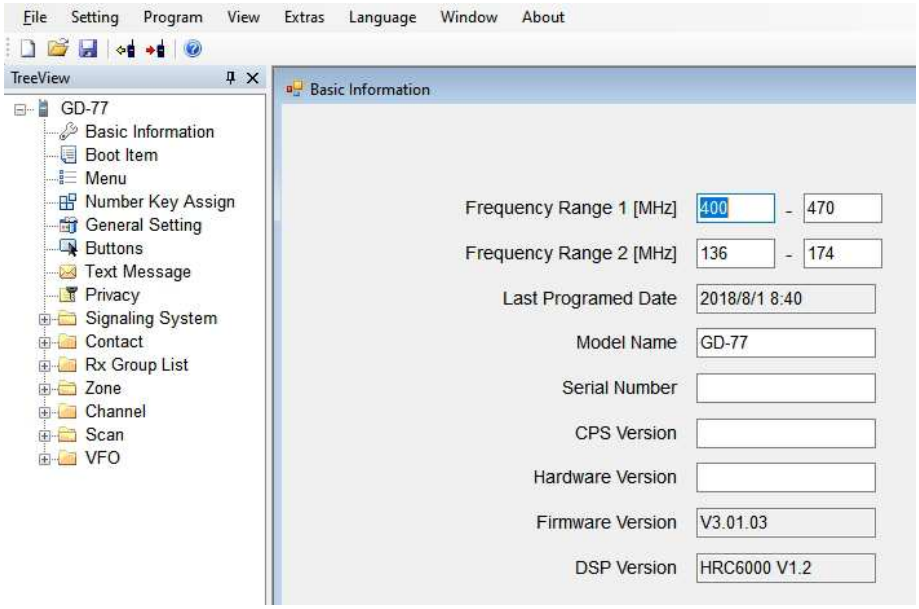


Then do a 'Save' and save that Empty Codeplug somewhere on your computer for safekeeping. Use a File Name something like *"GD77_In_Radio_When_Received_20200111"*

Now do another 'Save As' to create a new Codeplug file to work with. I use a filename something like "*K3JZD_GD77-WPA_202011*" which incorporates the current date.

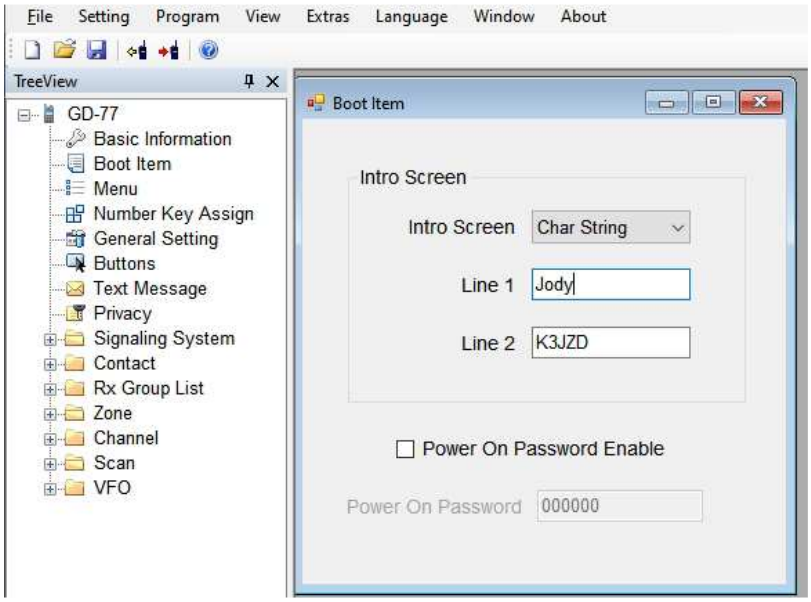
So, now we have a new working Codeplug – it time to populate it.

Double Click on the "Basic Information" icon on the left to display that form



There is not anything that really needs to be changed here. This is Info only. Close this form.

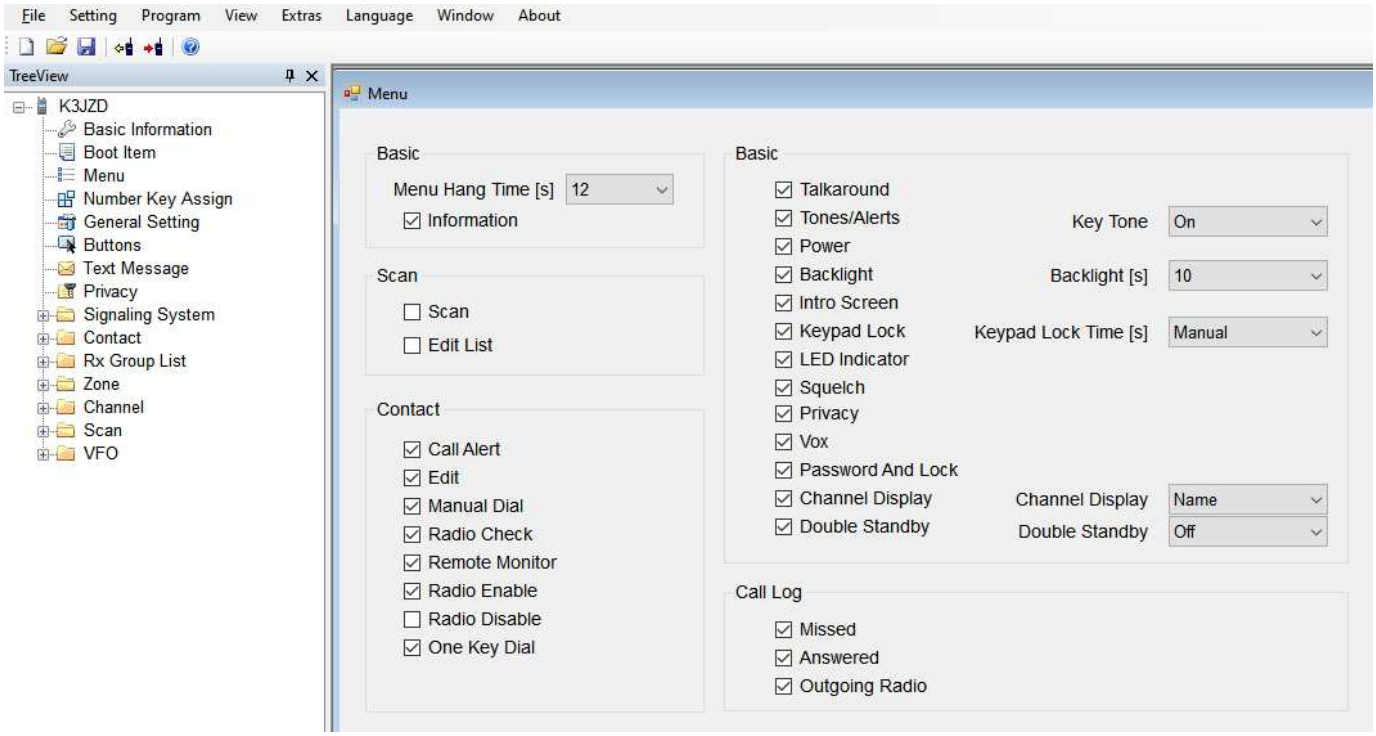
Double Click on the "Boot Item" icon on the left to display that form



Here you customize what you will see on the display when turning on the radio. Close this form.

NOTE: Do a periodic "Save" as you go through this programming process . . . .

Double Click on the "Menu" icon on the left to display that form.

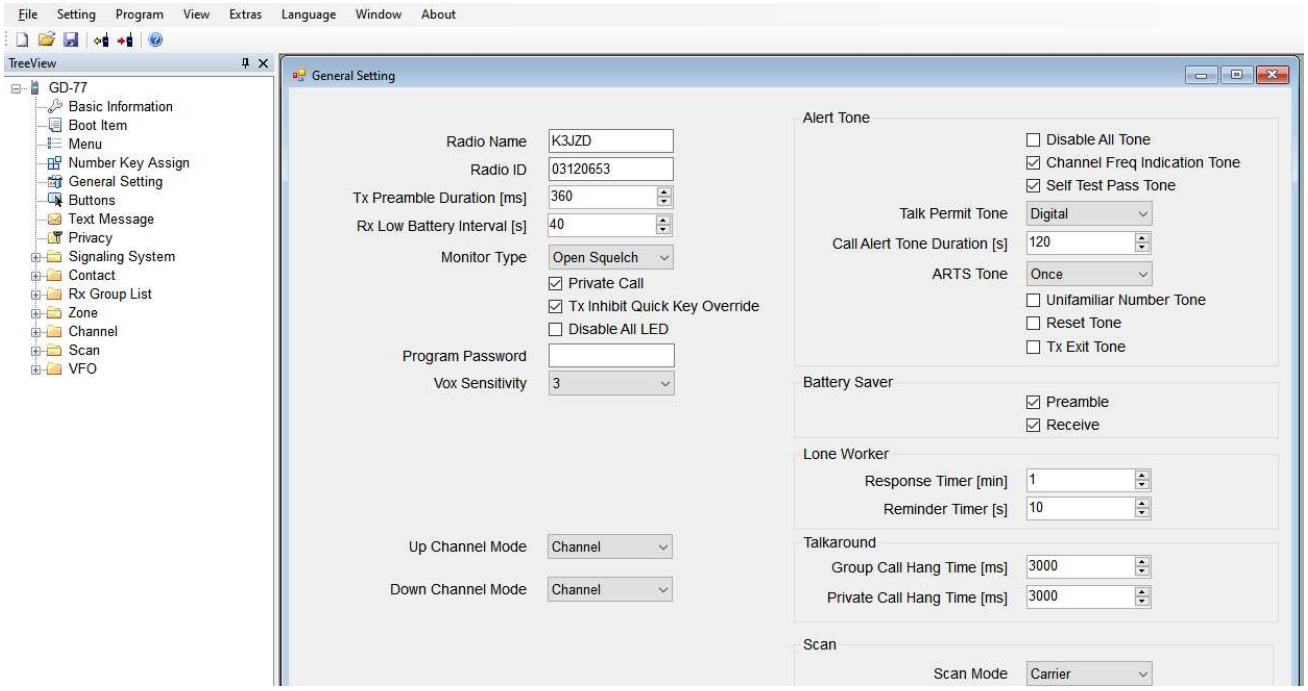


This is where a commercial radio shop would typically remove many of these things from the radio's Menu so that the Radio's User would not be able to control much of anything on his radio. We want to leave most of these options available to us for now.

I did uncheck 'Radio Disable", as that seems meaningless. I give myself a little more "Backlight" time, and I change the "Channel Display" to "Name". I turn also off the "Double Standby" – doing that provides me with a simple Display that shows me the "Zone" and the "Channel" (that will make some sense later).

It is probably best to leave all of the other stuff alone for now. However some features may not be applicable to the amateur radio service. You can always come back later to tweak these Menu selections further. Close this form.

Double Click on the "General Settings" icon on the left to display that form.



This form requires some changes. I make my Radio Name my Callsign. You have to enter your personal Radio ID (your DMR ID) here. I have made some other customizations based on what I have typically seen in some other Codeplugs. I checked "Tx Inhibit Quick Key Override" and checked "Channel Frequency Tone". I changed "Talk Permit Code" to "Digital" and I changed "Scan Mode" to "Carrier". (Not sure those other customizations were necessary, but they seemed like good ideas). Some of the other stuff on this screen relates to DMR functions that we cannot use in the ham radio service. We are not able to take full advantage of all of the features that are available in these DMRs. You can always come back to this later.

Close this form.

3. DMR Terminology

Now we get into the "Zones", "Digital Contacts", "Rx Group Lists", and "Channels". Here is where the terminology becomes new. The interrelationship between these various items gets 'interesting', because lots of things have to be correct to be successful.

"Zones" may be the easiest thing to understand. A "Zone" contains a collection of "Channels". DMR "Channels" can be thought of as being similar to repeater frequencies or simplex frequencies in a FM radio. You give each "Zone" a meaningful name. What you put into each of your Zones is up to you. It is simply a way of sorting your "Channels" intelligently. Whenever you select a "Zone", the screen displays only those "Channels" that you have chosen to put into that "Zone". I put the "Channels" that are setup to use my Hotspot into a "ZumSpot" Zone. The "Channels" that I have setup to use DMR repeaters go into a "Digi Repeater" Zone. The "Channels" that I have setup to use regular FM Analog frequencies go into an "Analog" Zone. The digital "Channels" that I have setup to use for direct over-the-air station-to-station simplex contacts go into a "Simplex" "Zone". While "Zones" are highest in the hierarchy, they are not populated until last.

"Digital Contacts" are a brand new kind of an animal for us. And is also a bit of a misleading name to use. Everything in the Digital World has a number. You are identified in the digital world by some number, not by your call sign (remember these are business radios where the users do not have call signs). In the DMR world, you are identified by your Radio ID (your DMR ID).

In the DMR world, there are "Talk Groups" which could be thought of as FM Repeaters or as "Chat Rooms" on the Internet. "Talk Groups" are public places out on the DMR Network which allow multiple people to interact with each other. These DMR "Talk Groups" also have an ID Number. Each DMR ID Number is unique, throughout the world. Naturally these ID Numbers get rather long. And no one wants to remember a bunch of numbers. So, a Codeplug provides you with a way to define your "Digital Contacts" with a meaningful name, and then map that meaningful name to a DMR ID number.

So, think of "Digital Contacts" as a simple translation tool. You can map the "Western PA Talk Group", which is has an ID Number of "00031422" to something meaningful like "WPA TG" (abbreviations are required so that they will fit into the display on your radio). Once enter this number to name mapping, then you will refer to refer to it as "WPA TG" from that point forward.

The downside of being able to define these number to name mappings within your own personal Codeplug is that each person may chose to use different meaningful names, particularly since they must be abbreviated to fit into the space available on the radio's display panel. Thus one person may call it something and another person may call the same thing something completely different. Makes for some interesting conversations !!!

Here is where you can go to find all of the ID Numbers for the individual DMR Users: https://www.radioid.net/database/dumps#!

Here is where you can go to find all of the ID Numbers for the public "Talk Groups": https://brandmeister.network/?page=talkgroups

"Rx Group Lists" is undoubtedly another new and confusing item for us. One explanation for the need for a "Rx Group List" that I found online is:

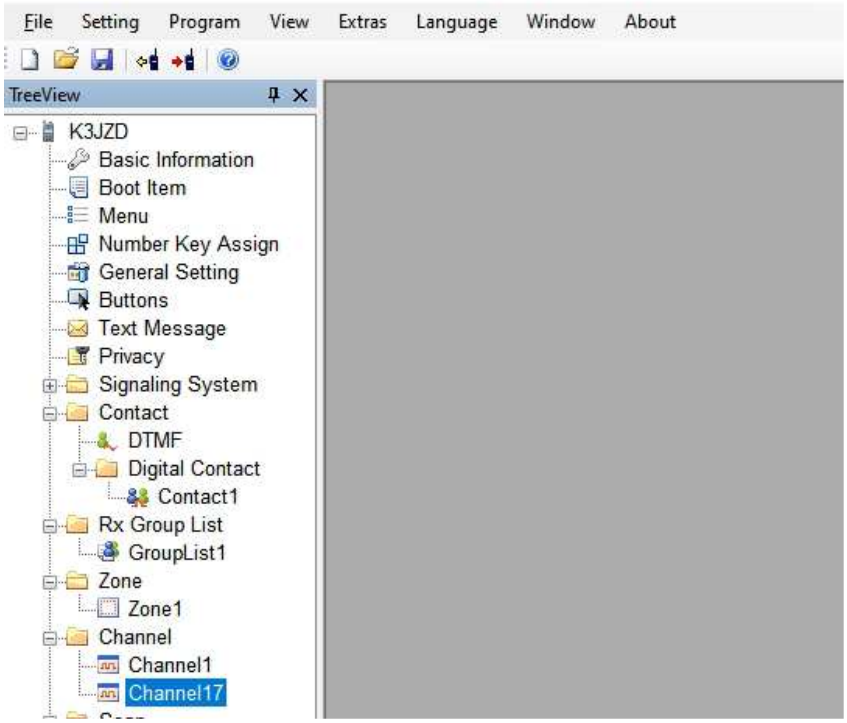
The RX Group List controls which groups a radio will hear when tuned to a selected Talk Channel. For example, if members of the Maintenance group should also be able to listen to other groups on the channel, those other groups would be added to the RX Group List; if members of the Maintenance group should only hear traffic related to their own group, then only the Maintenance group would be added to the group list.

So, this is pretty much a business radio thing, with very little applicability for us. What I have learned is that it is best to always have just one entry in the "Rx Group List" that corresponds to the same entry in the "Digital Contact" list. Essentially, we always have to tell a DMR to listen on the same Channel as it is talking on. Duh!! (This may become a little clearer as we get into doing the setup)

"Channels" are really the heart of your Codeplug. The data that goes into "Channels" ties it all together. Here, RF frequencies are assigned, transmit power is assigned, and the appropriate "Digital Contact" and "Rx Group List" entries are mapped. "Channels" are what you see in your "Zones" and what you will use to tell the radio where to go to. More detail on what goes into the "Channel" form will be covered whenever we get to it below. For now, just remember that one needs to have an appropriate "Digital Contact" entry and a corresponding "Rx Group List" entry predefined before you can setup a "Channel".

This whole hierarchical method of building your "Channels" is more of a pain in the butt than anything else. Too many steps and it is too easy to screw up something. However, it does provide some small efficiency in the case where you have one or more local DMR Repeaters which allow you to access the same public "Talk Groups" on the DMR Network as you access via your Local Hotspot (remember, "Talk Groups" are like Internet Chat Rooms).

OK. Back to Setting up your Codeplug. When you look at your empty Codeplug, you may now see a bunch of generic entries in the "Digital Contact" list (Open "Contacts" to get to "Digital Contact"), "Rx Group List", "Zone", and "Channel". I have found it to be confusing to leave then all in there and rename them when I need them. All but the first entry in each list can be deleted by right clicking and selecting Delete from the popup menu. (I cannot seem to delete Channel 17 for some reason – there is something quirky about Channel 17 in this GD-77 programming software). So I initially delete all of the ones that I am able to delete to keep things simple. And then I will add in only what I need later.


File
Setting
Program
View
Extras
Language
Window
About
TreeView
K3JZD
Basic Information
Boot Item
Menu
Number Key Assign
General Setting
Buttons
Text Message
Privacy
Signaling System
Contact
DTMF
Digital Contact
Contact1
Rx Group List
GroupList1
Zone
Zone1
Channel
Channel1
Channel17

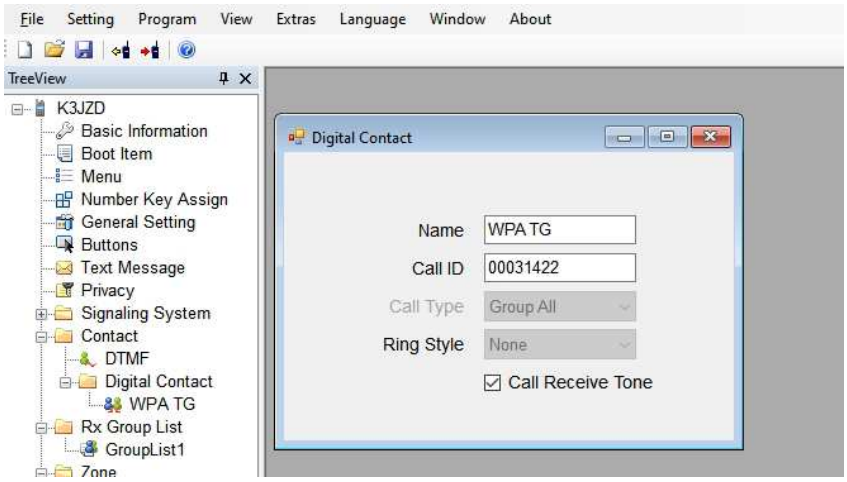
4. ZumSpot Channels

a. Western PA Talk Group

So, now let's create everything that we need to be able to use the "**Western PA Talk Group**" Channel with a ZumSpot (aka HotSpot).

Right Click on the "Contact1" entry in the "Digital Contact" List. Select Rename from the popup menu. Rename it to "WPA TG" and click somewhere else.

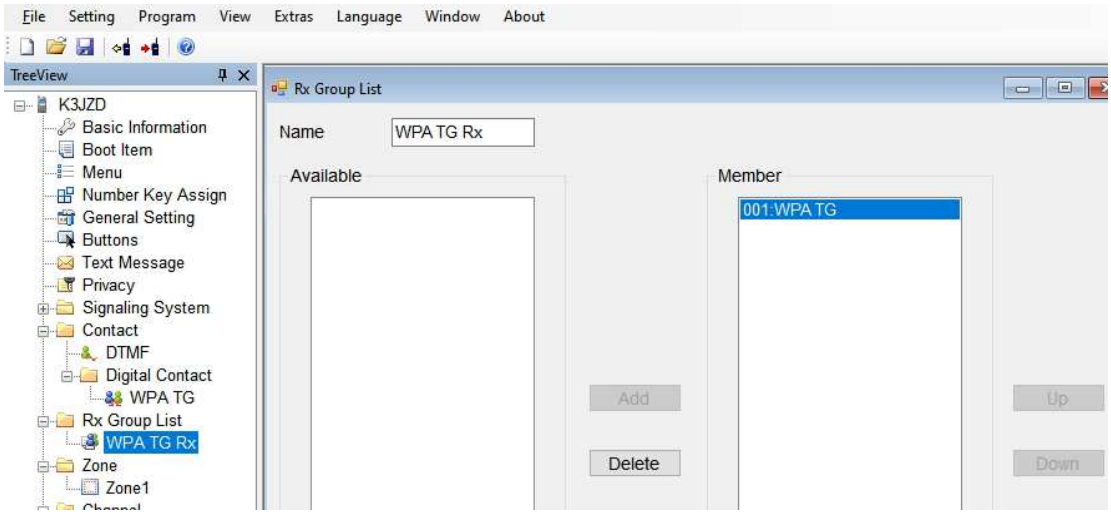
Double Click on this "WPA TG" entry. Change the "Call ID" to 31422 and click somewhere else (the leading zeroes will automatically be added)



Close this form (you are doing the periodic Saves aren't you)

Right Click on the "GroupList1" entry in the "Rx Group List" List. Select Rename from the popup menu. Rename it to "WPA TG Rx" and click somewhere else.

Double Click on this "WPA TG Rx" entry. In this initial case, you will see that the "WPA TG" Contact has already been added to the Member list (it will always be a list of one as we will see later). Close the form.



Now it is time to create the "Channel". Right Click on the "Channel1" entry in the "Channel" List. Select Rename from the popup menu. Rename it to "Z WPA" and click somewhere else.

Double Click on this "Z WPA" "Channel" entry. Now we have a rather busy form to work with. First, make sure that the "Mode" is set to "Digital". Change it if it is not.

We are going to create a Hotspot Channel (Thus the "Z" in the "Name"). A Hotspot Channel is a Simplex Channel. You will have already setup your Hotspot's Send and Receive frequencies in your Hotspot Configuration Software (outside of the scope of this document). In my case, I use 438.80000 MHz there, which is commonly used. So, I need to put 438.8000 MHz into both the "Rx Freq" and the "Tx Frequency" here. "Squelch" should be set to "Normal". Hotspot operation always uses Low Power, so change the "Power Level" to "Low".

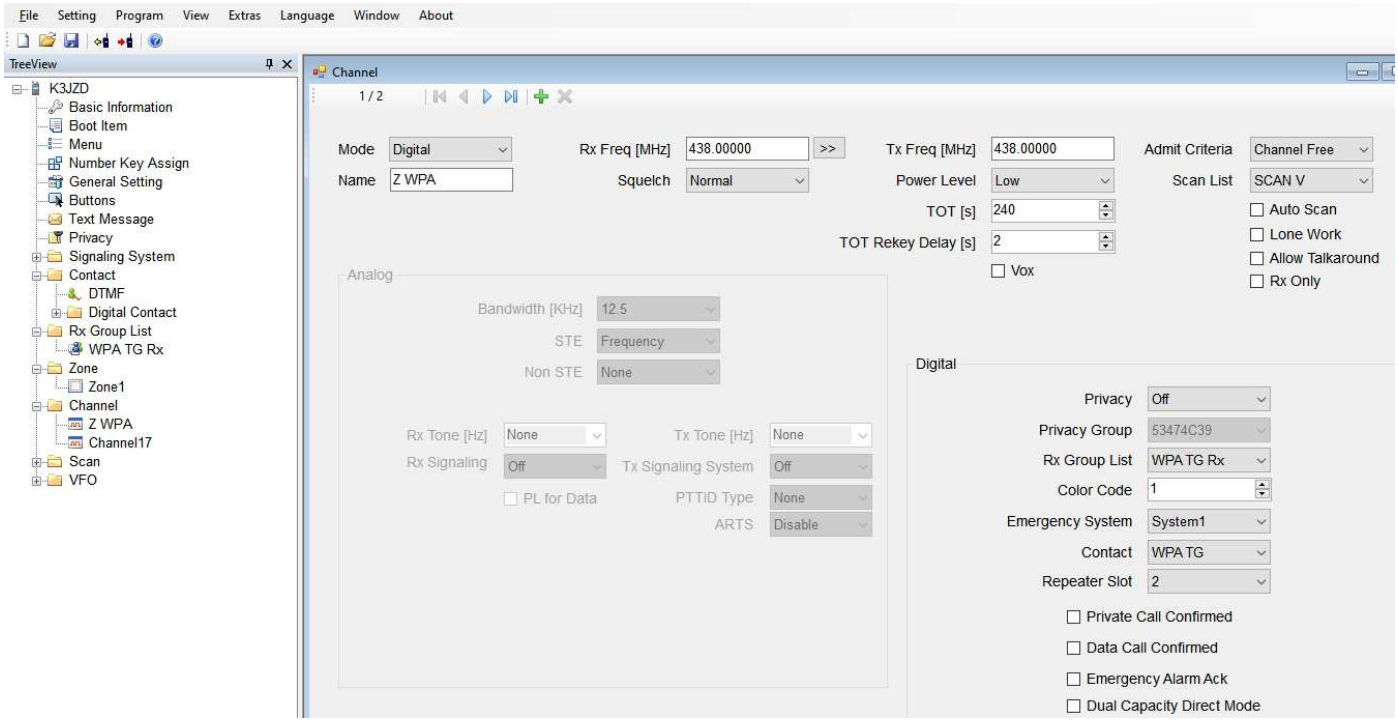
"TOT" means Time Out Timer. By convention I set this to 240 seconds as I do not want to be too long winded on a Talk Group. I set my "TOT Rekey Delay" to 2 seconds as I want to be able to release the PTT and press it again if I do need to be long winded for some reason or another.

"Admit Criteria" should be changed to "Channel Free". That prevents you from talking over someone who is already on the Channel.

Because there is only the one "Rx Group List" entry, that "WPA TG Rx" has been defaulted into the "Rx Group List" entry. And the first "Digital Contact" entry ("Z WPA") has been defaulted into the "Contact" entry. In this case, both of these are OK here.

By convention, "Color Code" is typically 1 and "Repeater Slot" is typically 2 for Talk Groups that are accessed via a HotSpot. Change them here. All else can be left as is for now. Close the form.

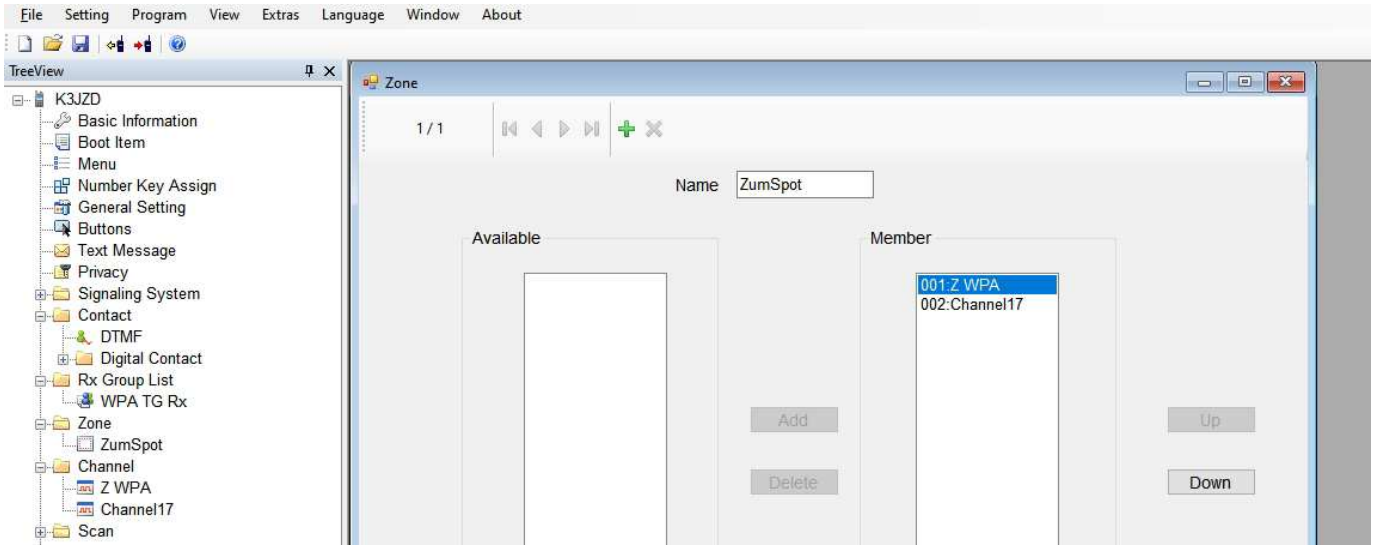
[THERE IS AN ERROR IN THIS NEXT SCREEN SHOT - BOTH FREQUENCIES SHOULD BE 438.80000]



Next we will assign this newly created "Z WPA" Channel to a "Zone". Right Click on the "Zone1" entry in the "Zone" List. Select Rename from the popup menu. Rename it to "ZumSpot" and click somewhere else.

Double Click on this "ZumSpot" entry in the "Zone" list. What we see initially is our new "Z WPA" Channel is in the "Available" box at the left side. And our troublesome 'stuck' "Channel17" is already in the "Member" box on the right side.

Select "Z WPA" in the "Available" box and click on the "Add" Button. That will move the "Z WPA" Channel into the "Member" box. Select "Z WPA" Channel in the "Member" box and click on the "Up" Button. That will move the "Z WPA" Channel to the top of the list. We are setting up how our "Channels" will be displayed in the Zone List in radio's display panel. We will deal with the 'stuck' "Channel17" that is in here next.



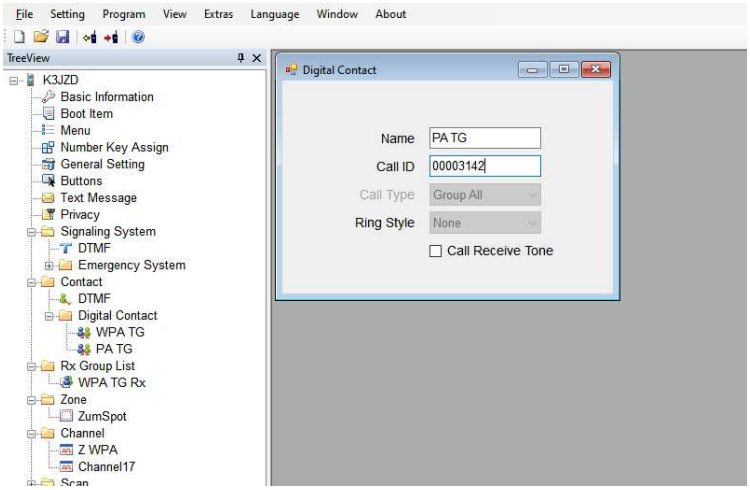
At this time we could Upload our Single-Channel Codeplug to our radio to prove that the radio will accept our Codeplug and that what we have entered into it will work. However I do not think that is a good idea to do that until after we deal with that 'stuck' "Channel17". So, let's hold off on doing that and add in another "Channel" first.

b. PA Talk Group

Let's create "Channel" for the **"PA Talk Group"**. This will be nearly identical to the "WPA Talk Group" Channel we just setup, but a little different. So, I will detail the steps again.

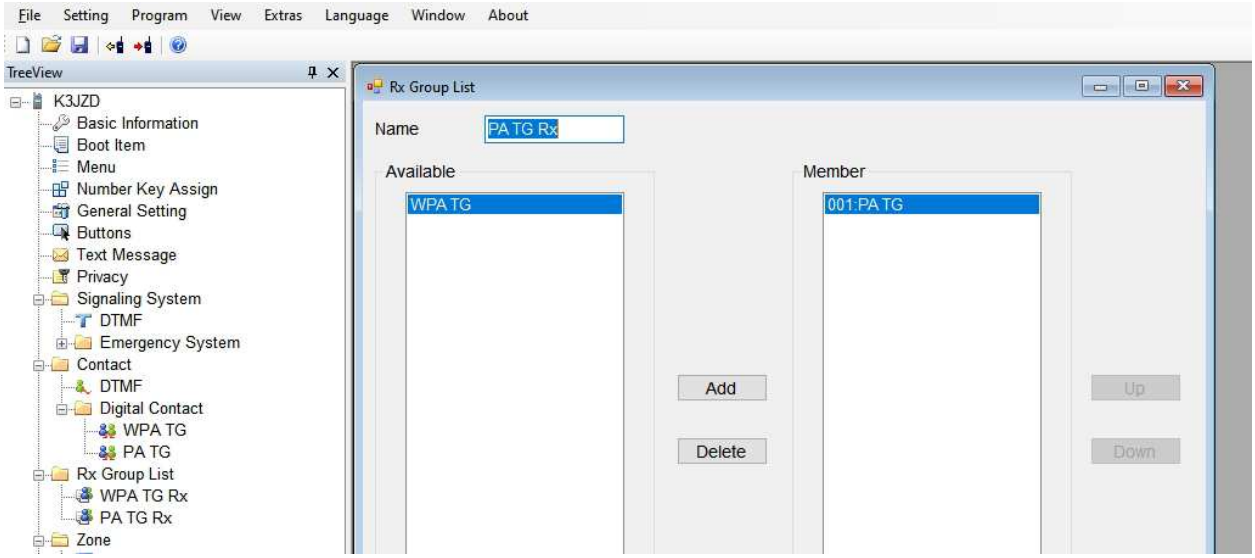
Right Click on the "Digital Contact" folder. Select "Add" and then "Group Call" from the popup menu. Right Click on the newly created "Contact2" entry, Rename it to "PA TG" and click somewhere else.

Double Click on this "PA TG" entry. Change the "Call ID" to 3142 and click somewhere else (the leading zeroes will automatically be added) Close this form



Right Click on the "Rx Group List" folder. Select "Add". Right Click on the newly created "GroupList2" entry, Rename it to "PA TG Rx", and click somewhere else.

Double Click on this "PA TG Rx" entry. In this case, you will see that the "PA TG" Contact is in the "Available List". Select "PA TG" and click on the "Add" Button. This will move "PA TG" over to the "Member" List. Close the form.



Right Click on the "Channel17" entry in the "Channel" List. Select Rename from the popup menu. Rename it to "Z PA" and click somewhere else.

Double Click on this "Z PA" entry in the "Channel" list. First, make sure that the "Mode" is set to "Digital". Change it if it is not.

We are going to create another Hotspot Channel (Thus the "Z" in the "Name"). Put 438.8000 MHz into both the "Rx Freq" and the "Tx Frequency". "Squelch" should be set to "Normal". Hotspot operation always uses Low Power, so change the "Power Level" to "Low".

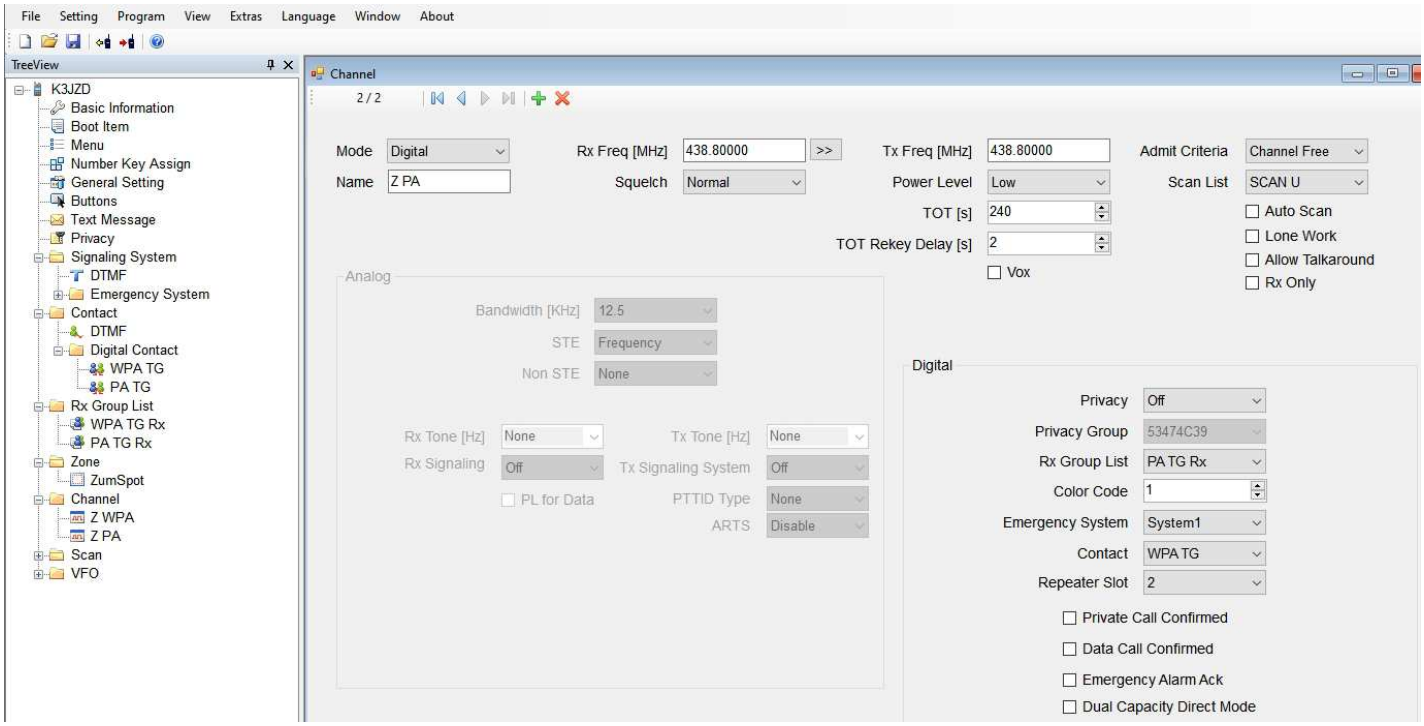
Set the TOT to 240 seconds and set the "TOT Rekey Delay" to 2 seconds

Set "Admit Criteria" to "Channel Free".

You will see that the first item in the "Rx Group List" has been defaulted into "Rx Group List" here. Change that to "PA TG Rx". And the first item in the "Digital Contact" List has been defaulted into the "Contact" entry. Change that to "PA TG".

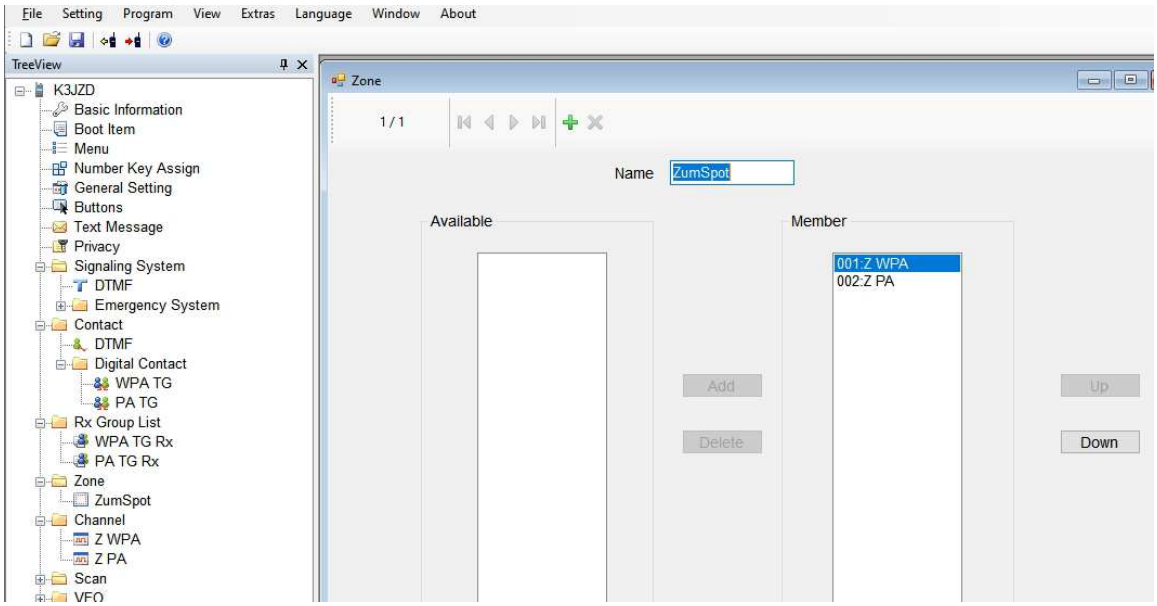
By convention, the Hotspot accessed "Color Code" is typically 1 and "Repeater Slot" is typically 2 for Talk Groups. Change them here. All else can be left as is for now.

Close the form.

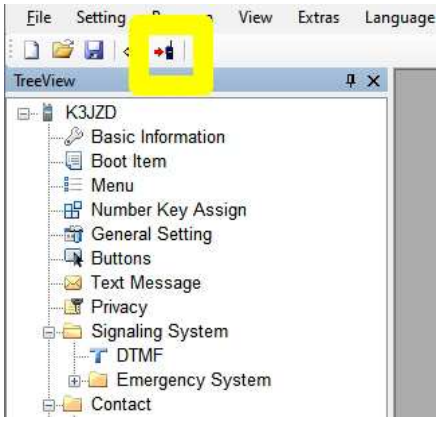


Now we will assign this newly created "Z PA" Channel to a "Zone". Since this is also a ZumSpot Channel, we will add it to the ZumSpot "Zone" that we already have setup.

Double Click on this "ZumSpot" "Zone" entry. Because our new "Z PA" Channel was created from that 'stuck' "Channel17" that was already in the "Member" box on the right side (along with the "Z WPA" Channel that we had already put there earlier), there is not really anything that we need to do here. Close the form.



OK. We now have a Codeplug with One "Zone" which has Two "Channels" in it. It is time to see if the radio will accept our Codeplug. Save your Codeplug. Connect the Programming Cable to your radio. Click on the "Write" icon in the header to Upload this Codeplug to your radio.



When the Upload is finished, turn your radio off and disconnect the cable. Then turn on your radio back on and exam your radio. If all looks OK, it is acceptable to send a brief Test message on a Talk Group. However, your HotSpot software may need to be tweaked to be successful (outside the scope of this document).

c. ***ZumSpot Parrot***

Stealing some text from Mike – N9GI:

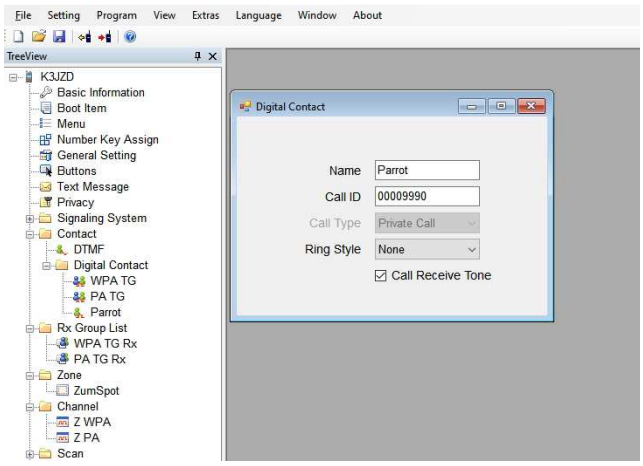
There is one more channel we need to set up. This one is called the Parrot. The Parrot is very important. On analog we hear people called "Kurchunkers". Most of the time they are doing this to see if they are getting into the repeater. On DMR we use the Parrot.

(The Parrot echoes back what you say to it a few seconds after you release your PTT).

So, let's create everything that we need to be able to use the "Parrot" with our ZumSpot.

Right Click on the "Digital Contact" folder. Select "Add" and then "Private Call" from the popup menu. Make sure you selected "Private Call". Note that icon for a Private Call "Digital Contact" is different. Right Click on the newly created "Contact3" entry, Rename it to "Parrot" and click somewhere else.

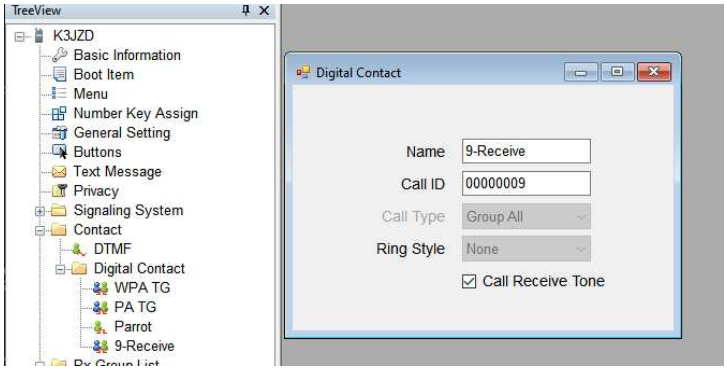
Double Click on this "Parrot" entry. Change the "Call ID" to 9990 and click somewhere else (the leading zeroes will automatically be added) Close this form



We have to do something special for this to work. (I don't fully understand why, but . . . .)

Right Click on the "Digital Contact" folder. Select "Add" and then "Group All" from the popup menu. Make sure you selected "Group All". Right Click on the newly created "Contact4" entry, Rename it to "9-Receive" and click somewhere else.

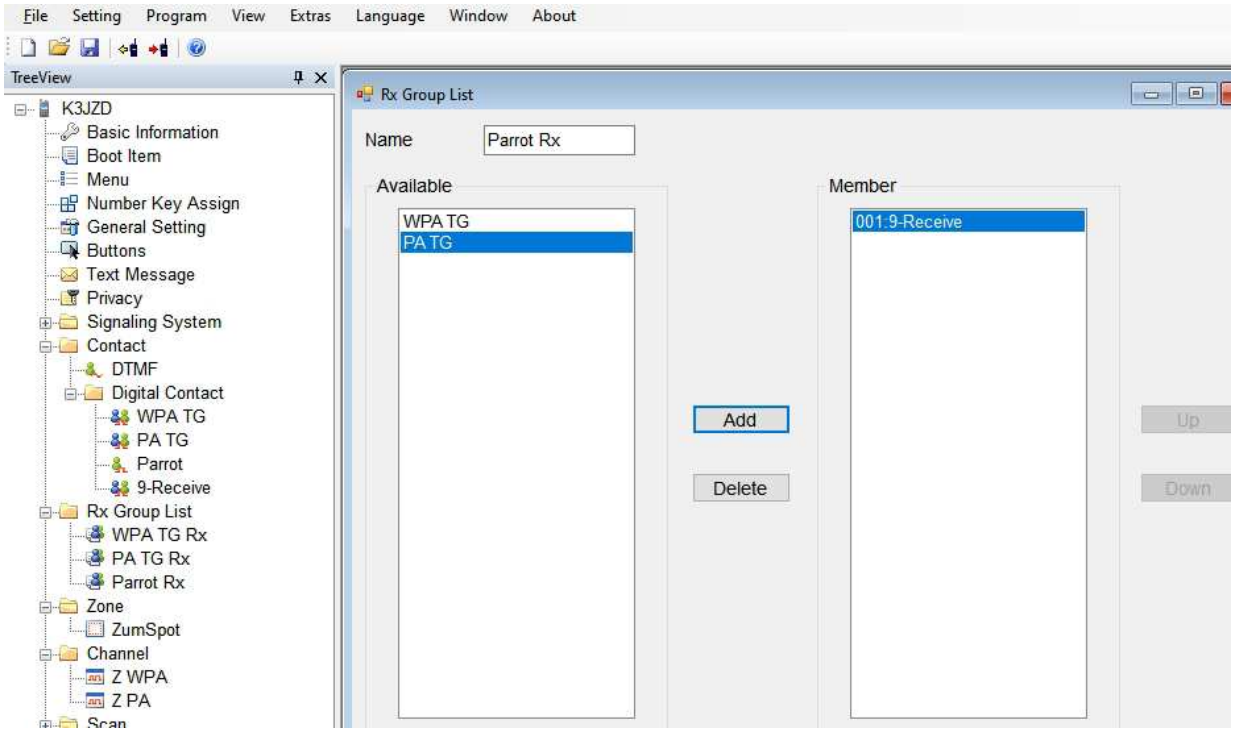
Double Click on this "9-Receive" entry. Change the "Call ID" to 9 and click somewhere else (the leading zeroes will automatically be added) Close this form



Now we need to create a corresponding "Rx Group" so we will hear the Parroted response. Right Click on the "Rx Group List" folder. Select "Add". Right Click on the newly created "GroupList3" entry, Rename it to "Parrot Rx", and click somewhere else.

Double Click on this "Parrot Rx" entry. You will see that the "9-Receive" Digital Contact is in the "Available List". You will not see the Private "Parrot" Digital Contact there. Select "9-Receive" and click on the "Add" Button. This will move "9-Receive" over to the "Member" List.

Close the form.



Now we will create the Parrot "Channel".

Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created Channel to "Z Parrot 9990" and click somewhere else.

Now we are going to do a labor saving step. Since we are setting up another ZumSpot Channel, much of the data that is required will be the same as what is already in the previously created ZumSpot Channels. So we will Copy and Paste that data.

Right Click on the "Z WPA" entry and select "Copy" from the popup menu. Right click on the "Z Parrot 9990" entry and select "Paste" from the popup menu.

Now Double Click on this "Z Parrot 9990" entry in the "Channel" list.

Make sure that the "Mode" is set to "Digital".

Make sure that both the "Rx Freq" and the "Tx Frequency are set to 438.80000

"Squelch" should be set to "Normal". "Power Level" should be set to "Low".

"TOT" should be set to 240 seconds "TOT Rekey Delay" should be set to 2 seconds

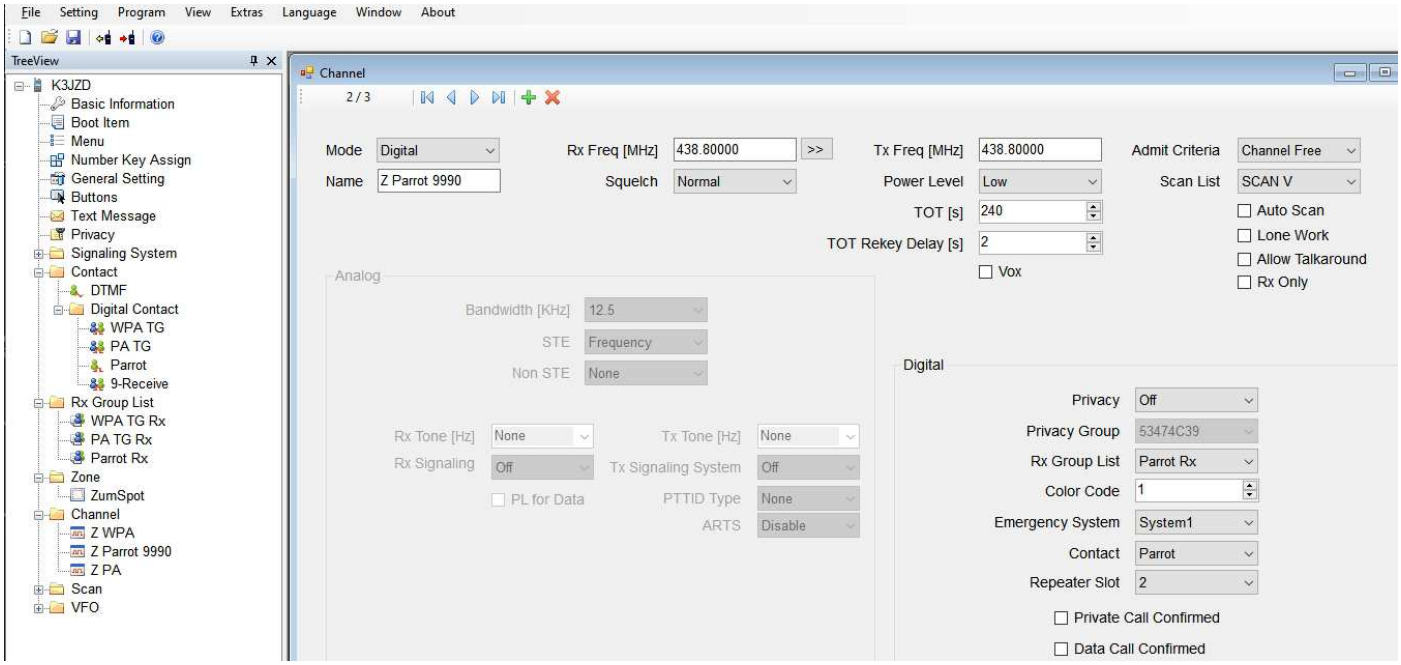
"Admit Criteria" should be set to "Channel Free".

"Color Code" should be set to 1 and "Repeater Slot" should be set to 2

Change the "Rx Group List" to "Parrot Rx".

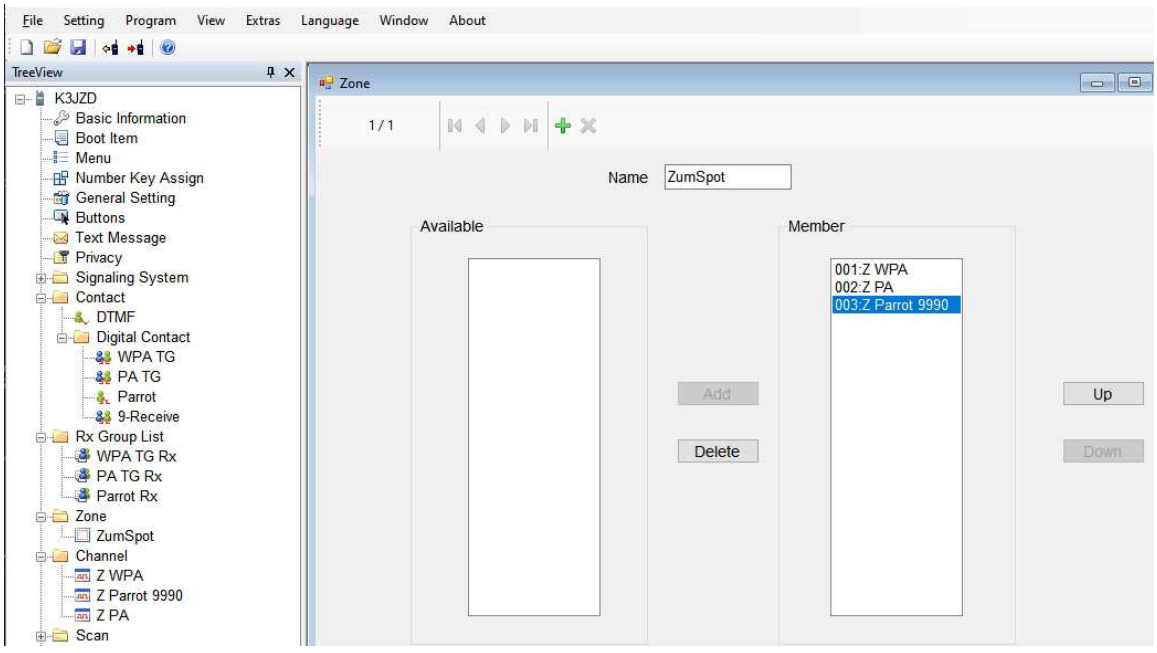
Change the "Contact" to "Parrot".

All else can be left as is for now. Close the form.



Now we will assign this newly created "Z Parrot 9990" Channel to a "Zone". Since this is also a ZumSpot Channel, we will add it to the ZumSpot "Zone" that we already have setup.

Double Click on this "ZumSpot" "Zone" entry. You will now see "Z Parrot 9990" in the "Available" list. Select "Z Parrot 9990" and Click on "Add". This will put the "Z Parrot 9990" into the "Member" list. Close the form.



OK. We now have an updated Codeplug containing the Z Parrot 9990" Channel. It is time to test this updated Codeplug. Save your Codeplug. Connect the Programming Cable to your radio. Click on the "Write" icon in the header to Upload this Codeplug to your radio.

Find "Z Parrot 9990" on your radio's menu. Press the PTT and leave a short Testing Message. Release the PTT and wait for your Message to be Parroted back to you.

NOTE: *I discovered that "Z Parrot 9990" did not all fit into my display. So I later shortened my Channel Name to just "Z Parrot".*

d. Adding More ZumSpot Talk Group Channels ??

Well by now you should have the idea on how to create ZumSpot Channels: (1) define a new Digital Contact, (2) Define a new Rx Group Item, (3) Define a new Channel, and (4) Put the new Channel into a Zone.

Some ideas for additional Talk Groups that might be of interest are: the Tactical Talk Groups with DMR IDs of 310 to 315 (Tactical Groups are used to take traffic off of the main Talk Groups), Mid-Atlantic Talk Group with a DMR ID of 3173, Northeast Talk Group with a DMR ID of 3172, the Nationwide Talk Group with a DMR ID of 3100, the PEMA Talk Group with a DMR ID of 31420, and the PA Tactical Talk Group with a DMR ID of 31421.

5. DMR Repeater Channels

One thing that comes into play when using Over-the-Air DMR Repeaters is the usage of Color Codes and Time Slots. The Color Code used on DMR repeaters is typically 1. This is an 'access code', similar to the PL Tone that is used on a lot of Analog FM repeaters. A DMR Repeater is like having two repeaters in one, divided by Time Slots a 1 and a 2. The repeater owner typically establishes rules for the use of Color Codes and Time Slots on their DMR Repeater

While more popular in Central PA and Eastern PA, WPA currently has a serious shortage of DMR Repeaters. I am only aware of three DMR Repeaters that are in the WPA Area:

- **W3WGX DMR Repeater** at Seven Springs. **146.835 (-600)**. This is an open repeater, According to their web site: https://www.repeaterbook.com/repeaters/details.php?ID=7656&state_id=42

  DMR Access uses Color Code 1. You can access the PA Talk Group (3142) and the PA Tactical Talk Group (31421) anytime on Time Slot 1. You can access the Tactical Talk Groups 310 to 319 on Time Slot 2.

- **WC3PS DMR Repeater** in Greensburg. **145.440 (-600)**. This is an open repeater. According to their Web Page (http://www.wc3ps.org/?page_id=3016)

  The DMR side is Color Code 1. Time Slot 1 is connected 24/7 to PA Statewide Talkgroup 3142. Other wide area talkgroups can be connected by users initiating a Group Call key up on Time Slot 1. Time Slot 2 is generally used for local (repeater only) comms using Local 9 talkgroup, as well as TAC communications initiated by users initiating a Group Call key up on the desired TAC talkgroup on Time Slot 2. All user initiated connections will automatically drop 15 minutes after the last RF transmission received by the repeater.

- **WC3PS DMR Repeater** in Greensburg. **442.150 (+5 MHz)**. This is an open repeater. According to their Web Page (http://www.wc3ps.org/?page_id=3016)

  The DMR side is Color Code 1, Time Slot 2 and is connected 24/7 to the TGIF Network Systemwide Talkgroup 9 (NOT a local repeater only talkgroup as on the 145.440 MHz repeater). Other talkgroups can be accessed via a Group Call to their talkgroup number on Time Slot 2. More details on the available DMR talkgroups for the TGIF system can be found at tgif.network/talkgroups.php. This network is new and has only been on air since September 23, 2018. Time Slot 1 is currently NOT used on the TGIF Network, and it is being considered whether it can be used for local only DMR repeater communications. More information on this will be forthcoming, as well as the possibility that we will have our own WEARS Talkgroup assigned on Time Slot 2.

I do not have a lot of experience in using any of these DMR Repeaters yet. But, relying on just using my HotSpot which requires that I have an active Internet connection does not seem like a good idea. So, setting up a few Channels in my Codeplug to allow me to access some WPA Talk Groups through these Over-the-Air DMR repeaters seems like a good idea.

a. ***'PA Talk Group' via the Seven Springs W3WGX DMR Repeater***

So, let's setup a Channel for Over-the-Air access to the '**PA Talk Group' via the Seven Springs W3WGX DMR Repeater**. Since this will be a little different than the ZumSpot Channels we already setup, I will go step by step here (but briefer)

Actually, this is where we will see some advantage to having the separate "Digital Contact", "Rx Group List" entries. (The following assumes all of the above is already setup in your Codeplug).

We can start right to the "Channel" setup to add access to the 'PA Talk Group' via W3WGX.

Right Click on the "Channel" folder. Select "Add" from the popup menu. Rename the newly created "Channel3" to "W3WGX PA" and click somewhere else.

Now Double Click on this "W3WGX PA" entry in the "Channel" list.

Set the "Mode" to "Digital"

Set the "Rx Freq" to 146.835

Set the "Tx Frequency to 146.235

Set the "Squelch" to "Normal"

Set the "Power Level" to "High"

Set "TOT" to 240 seconds

Set "TOT Rekey Delay" to 2 seconds

Set "Admit Criteria" to "Channel Free"

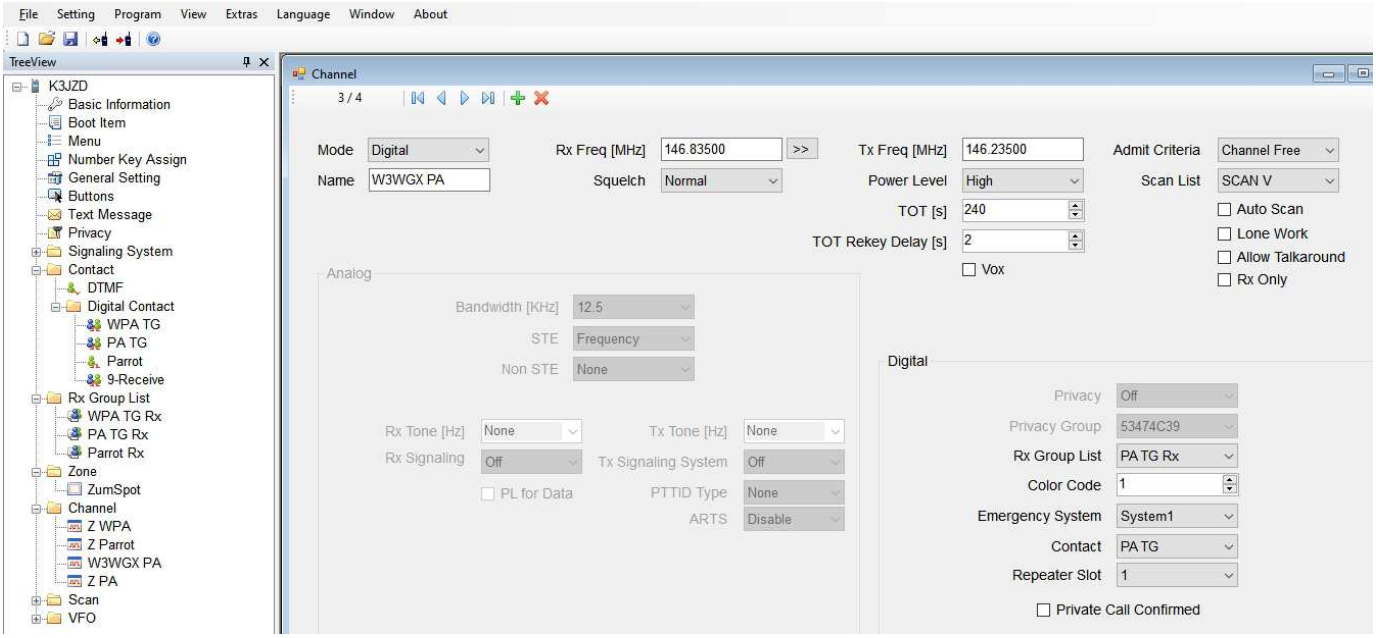
Set "Color Code" to 1 (based on W3WGX Web Page guidance)

Set "Repeater Slot" to 1 (based on W3WGX Web Page guidance)

Change the "Rx Group List" to "PA TG Rx"

Change the "Contact" to "PA TG"

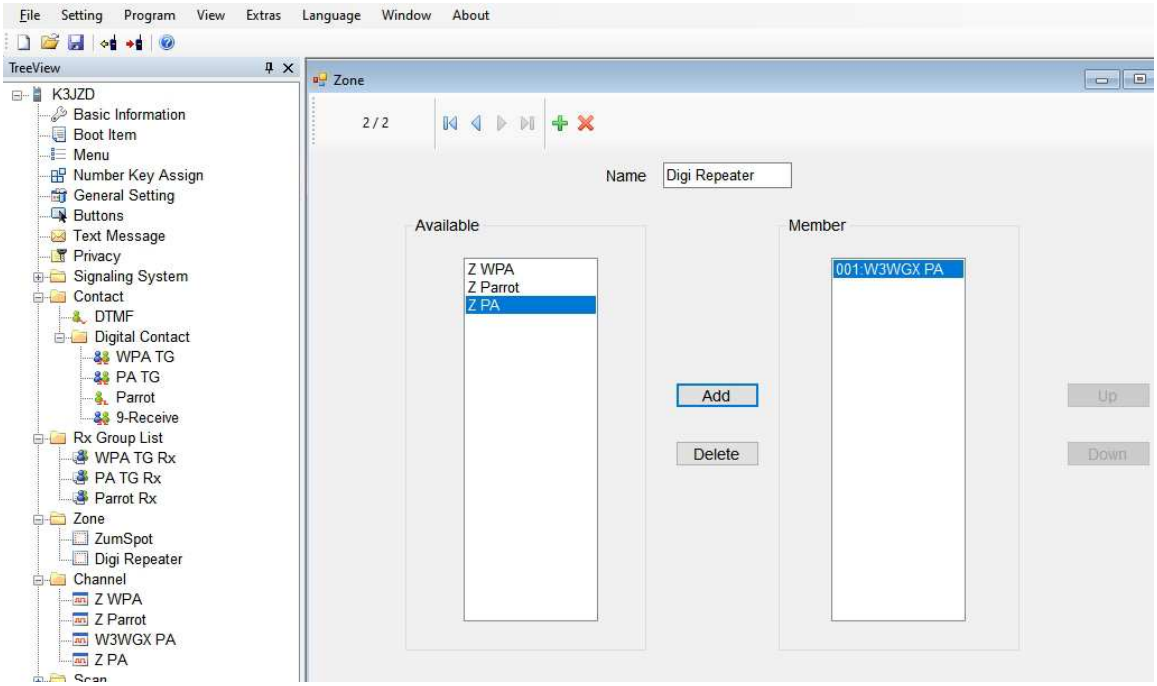
All else can be left as is for now. Close the form.



The only other thing we need to do is create a new "Digi Repeater" Zone and put this Channel into it. Right Click on the "Zone" folder. Select "Add". Right Click on the newly added "Zone2" entry and select Rename from the popup menu. Rename it to "Digi Repeater" and click somewhere else.

Double Click on this "Digi Repeater" entry in the "Zone" list. We will see this new "W3WGX PA" entry in the "Available" box at the left side.

Select "W3WGX PA" in the "Available" box and click on the "Add" Button. That will move the "W3WGX PA" Channel into the "Member" box. Close this form.



So, by already having the "PA TG Rx" entry in the "Rx Group List" and already having the "PA TG" entry in the "Digital Contact" list, we were able to quickly produce this new over-the-air Repeater Channel by simply reusing that data. You will see this again as we add more Channels.

Since we have created a new "Zone" and a new "Channel", it makes sense to test this iteration of the Code Plug in the radio before going any further. Save your Codeplug and Upload it to your radio. ***(NOTE** : I later renamed "Digi Repeater" to "Digi Rptrs" Zone so it fit my display better)*

NOTES:

1. You will need to connect your radio to an outside antenna to have any chance of hitting this W3WGX DMR Repeater at Seven Springs. I can hit it with 5 watts with a 4 El 2M Beam.
2. Since this Channel is using High Power, if you are using a HT with just a rubber duck on it, it is best to keep it away from your HotSpot as the RF Modem in some HotSpots can be damaged by too much RF power near them.

b. 'PA Tactical' Channel' via the Seven Springs W3WGX DMR Repeater

Now let's setup a Channel for Over-the-Air access to the '**PA Talk Group Tactical' Channel (PA TAC) via the Seven Springs W3WGX DMR Repeater**.

We did not create "PA TAC" entries for "Digital Contact" or "Rx Group List" whenever we were doing the ZumSpot Channels. So we must do that now. Here it is again, albeit briefer and without the illustrations:

Right Click on the Digital Contact folder. Select "Add" "Group Call" from the popup menu. Select the newly created "Contact5" entry. Right Click and select "Rename" from the popup menu. Rename it to: "PA TAC". Double Click on the "PA TAC" entry and enter "32421". Close the form.

Right Click on the Rx Group List folder. Select "Add" from the popup menu. Select the newly created "GropuList4" entry. Right Click and select "Rename" from the popup menu. Rename it to: "PA TAC Rx". Double Click on the "PA TAC Rx" entry and move the "PA TAC" entry in the Available list to Member list. Close the form.

Now we can do the "Channel" setup to add access to the "PA TAC" Talk Group via W3WGX.

Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channel4" to "WGX PA TAC" and click somewhere else. (We have to do some abbreviating so it fits on the radio's display panel)

Now let's use the Copy and Paste trick to quickly setup this "WGX PA TAC" Channel.

Right Click on the "W3WGX PA" entry and select "Copy"

Right Click on the "WGX PA TAC" entry and select "Paste"

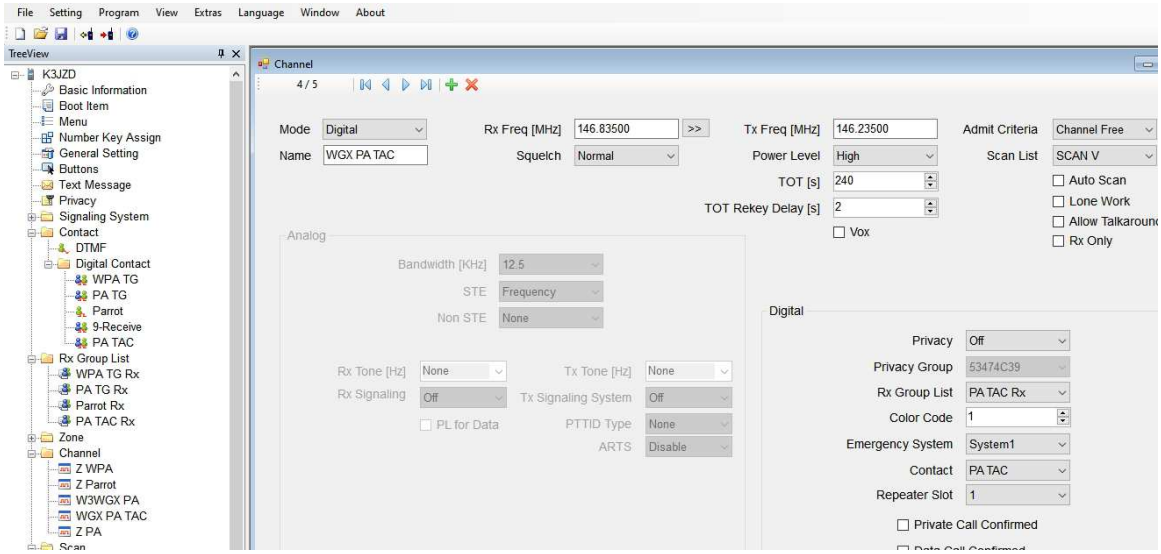
Now Double Click on this "WGX PA TAC" entry in the "Channel" list.

Quickly look over the items in this form that we care about to verify the Copy-Paste.

Change the "Rx Group List" to "PA TAC Rx"

Change the "Contact" to "PA TAC"

That's it. All else can be left as is for now. Close the form



Now let's put this "WGX PA TAC" Channel into (what is now called) the "Digi Rptrs" Zone list. Double click on the "Digi Rptrs" entry in the Zone list. Select "WGX PA TAC" in the Available list and Click on "Add" to move it to the Member list. Close this form.

c. *'PA Talk Group' via the Greensburg WC3PS 2 Meter DMR Repeater*

Next, let's setup a Channel for Over-the-Air access to the '**PA Talk Group' via the Greensburg WC3PS 2 Meter DMR Repeater**. I will go step by step again here (but again briefer).

Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channel5" to "WC3PS-2 PA" and click somewhere else. (once again you have to abbreviate so stuff fits in the radio's display panel – the "-2" in the Name will indicate that this is the WC3PS 2 Meter Repeater, not the WC3PS 440 Repeater where we will use "-4")

Now, although this is a different repeater, we can still benefit from doing a Copy-Paste to quickly setup this new Channel.

Right Click on the "W3WGX PA" entry and select "Copy"

Right Click on the "WC3PS-2 PA" entry and select "Paste"

Now Double Click on this "WC3PS-2 PA" entry in the "Channel" list.

Quickly look over the items in this form that we care about to verify the Copy-Paste.

The "Rx Group List" should already be to "PA TG"

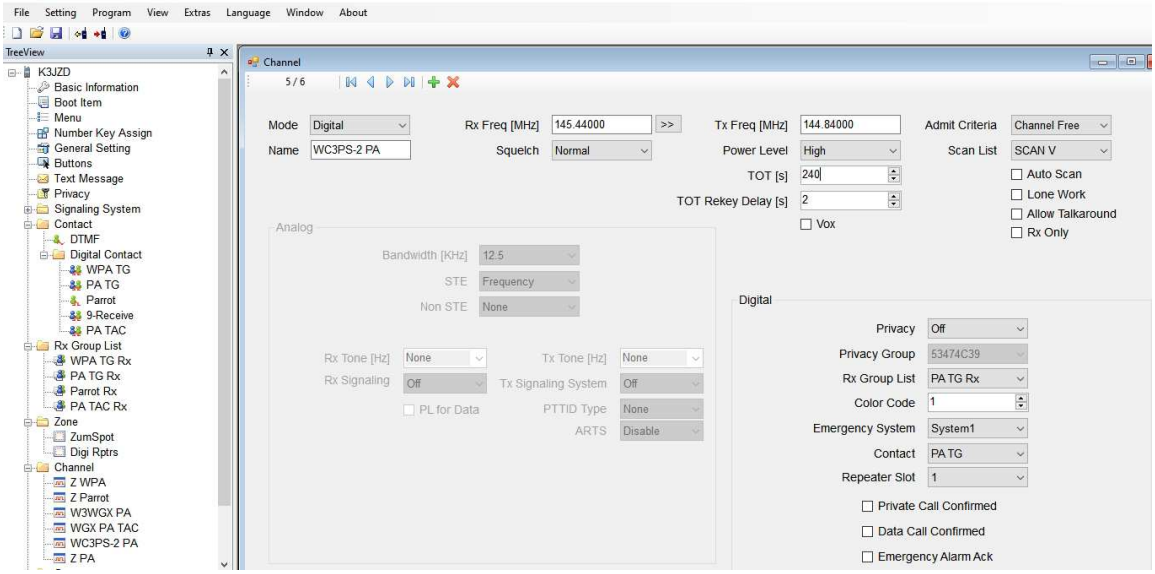
The "Contact" should already be "PA TG"

All that we really need to change here are the Rx and Tx Frequencies

Change the "Rx Freq" to 145.440

Change the "Tx Frequency to 144.840

That's it. All else can be left as is for now. Close the form



Now let's put this "WC3PS-2 PA" Channel into the "Digi Rptrs" Zone list. Double click on the "Digi Rptrs" entry in the Zone list. Select "WC3PS-2 PA" in the Available list and Click on "Add" to move it to the Member list. Close this form.

d. 'PA Tactical' Channel via the Greensburg WC3PS 2m DMR Repeater

Now let's setup a Channel for Over-the-Air access to the '**PA Talk Group Tactical' Channel (PA TAC) via the Greensburg WC3PS 2 Meter DMR Repeater**. With brief steps again.

Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channel6" to "PS-2 PA TAC" and click somewhere else. (once again you have to abbreviate so stuff fits in the radio's display panel – the "-2" will indicate that this is the WC3PS 2 Meter Repeater, not the WC3PS 440 Repeater where I will use "-4". This need to abbreviate to fit the radio's small display panels is where people who are holding two different radios, with each having their own personalized Codeplug, will run into trouble whenever one tells the other which Channel to switch to !!)

Here, it looks like the easiest Copy-Paste with the least work and the least chance of error will be to copy from the "WC3CS-2 PA" Channel to the "PS-2 PA TAC" Channel.

Right Click on the "WC3CS-2 PA" entry and select "Copy"

Right Click on the "PS-2 PA TAC" entry and select "Paste"

Now Double Click on this "PS-2 PA TAC" entry in the "Channel" list.

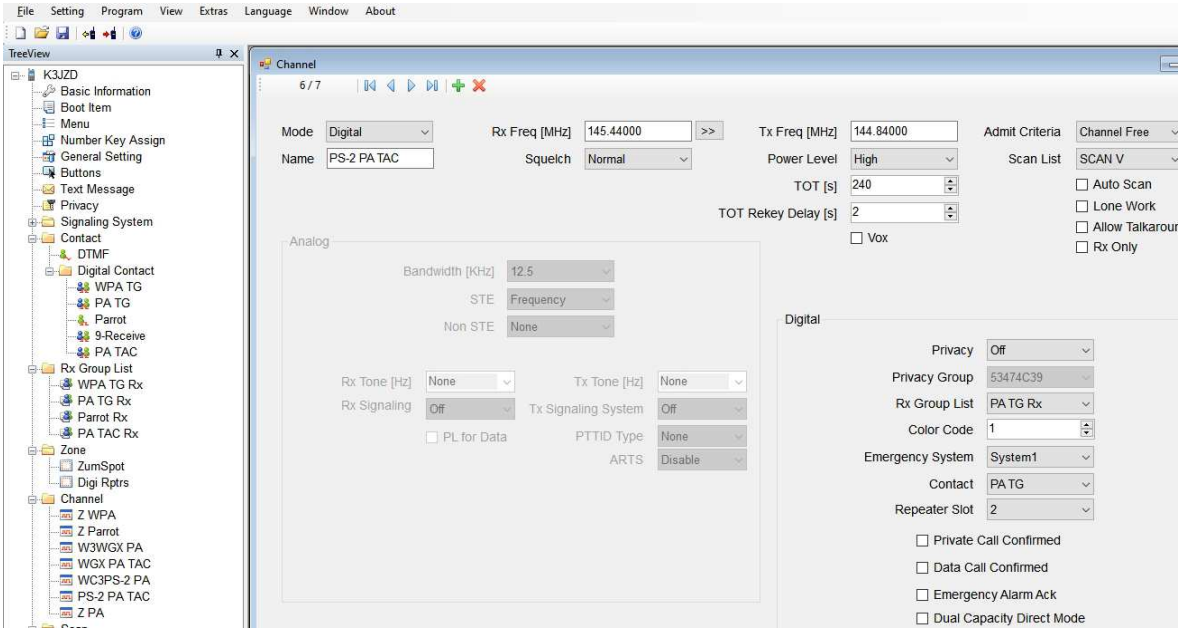
Quickly look over the items in this form that we care about to verify the Copy-Paste.

Change the "Rx Group List" to "PA TAC"

Change the "Contact" to "PA TAC"

ALSO, Change the "Repeater Slot" to "2" (based on WC3PS Web Page guidance)

That's it. All else can be left as is for now. Close the form



Now let's put this "PS-2 PA TAC" Channel into the "Digi Rptrs" Zone list. Double click on the "Digi Rptrs" entry in the Zone list. Select "PS-2 PA TAC" in the Available list and Click on "Add" to move it to the Member list. Close this form.

e. "Local 9" Talk Group on the Greensburg WC3PS 2m DMR Repeater

The **Greensburg WC3PS 2 Meter DMR Repeater** has a "Local 9" Talk Group. From the Internet, I see that:

> A *Local Talk Group 9* (Local 9) (TG 9) is used to contact stations in your immediate area using a single stand alone repeater. No network connection is required at the repeater. If your existing internet connection to the repeater is lost, *Local 9* communications will still remain in play.

That sounds useful, so next I will setup a Channel for Over-the-Air access to the **"Local 9" Talk Group on the Greensburg WC3PS 2 Meter DMR Repeater**. With brief steps again.

Right Click on the Digital Contact folder. Select "Add" "Group Call" from the popup menu. Select the newly created "Contact6" entry. Right Click and select "Rename" from the popup menu. Rename it to: "Local-9". Double Click on the "Local-9" entry and enter "9". Close the form.

Right Click on the Rx Group List folder. Select "Add" from the popup menu. Select the newly created "GropuList5" entry. Right Click and select "Rename" from the popup menu. Rename it to: "Local-9 Rx". Double Click on the "Local-9 Rx" entry and move the "Local-9 Rx" entry from the Available list to Member list. Close the form.

Now we can create the "Channel" setup to add access to this WC3PS "Local-9" Talk Group.

Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channel7" to "PS-2 Local9" and click somewhere else. (We have to do some abbreviating so it fits on the radio's display panel)

Now let's use the Copy and Paste trick again to quickly setup this "PS-2 Local9" Channel.

Right Click on the "PS-2 PA TAC" entry and select "Copy"

Right Click on the "PS-2 Local9" entry and select "Paste"

Now Double Click on this "PS-2 Local9" entry in the "Channel" list.

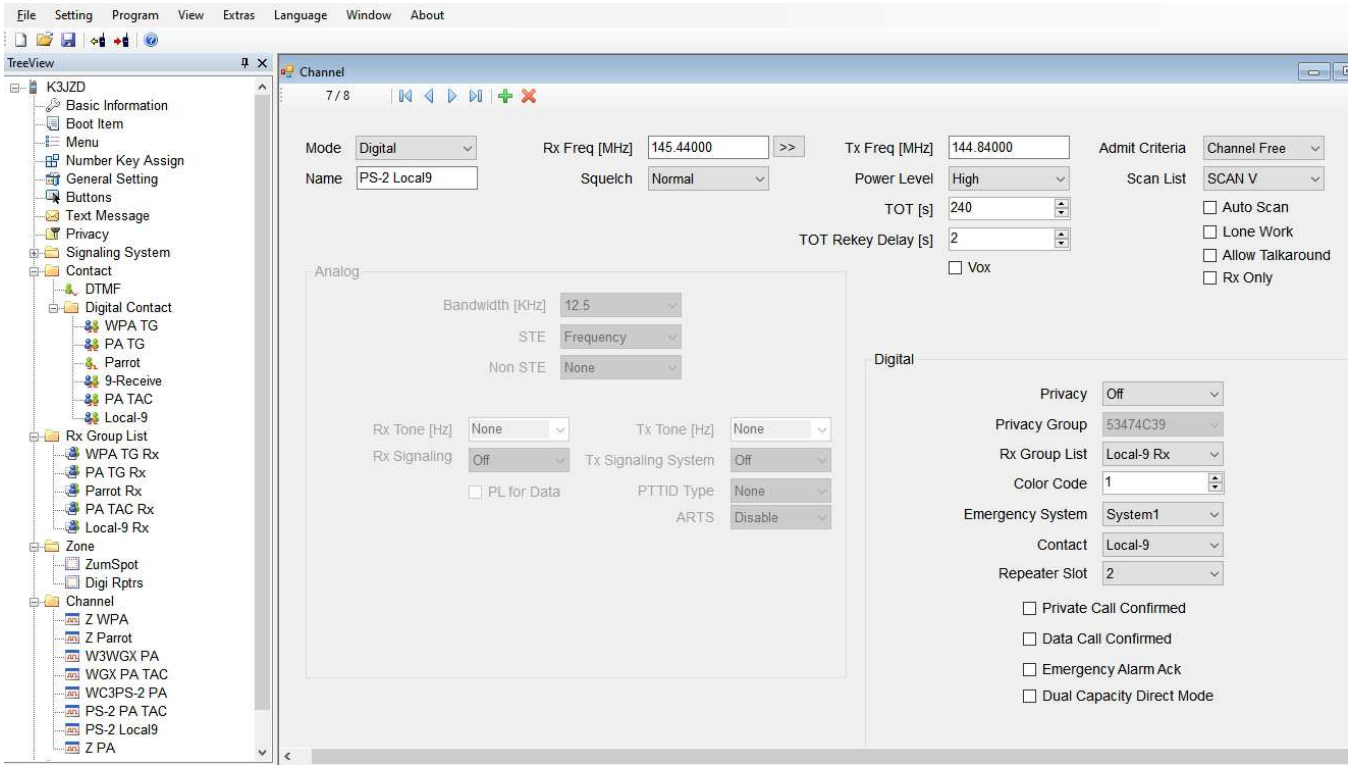
Quickly look over the items in this form that we care about to verify the Copy-Paste.

Change the "Rx Group List" to "Local-9 Rx"

Change the "Contact" to "Local-9"

Verify that "Repeater Slot" is "2" (based on WC3PS Web Page guidance)

That's it. All else can be left as is for now. Close the form



Now let's put this "PS-2 Local9" Channel into the "Digi Rptrs" Zone list. Double click on the "Digi Rptrs" entry in the Zone list. Select "PS-2 Local9" in the Available list and Click on "Add" to move it to the Member list. Close this form.

6. DMR RF Simplex Channels

According to information found on VA3XPR's Web Site, these are the UHF and VHF Simplex Frequencies that exist today :

> Below are the recommended simplex frequencies to be used with DMR in Canada and the United States. In addition to this information, please note the following radio configuration items:
>
> - **Admit Criteria**: Please set this to "Always"
> - **In Call Criteria**: Please set to "TXI" or "Always"

FREQUENCY	BAND	TALKGROUP ID	TIMESLOT	COLOUR CODE
441.0000	UHF	99	1	1
446.5000	UHF	99	1	1
446.0750	UHF	99	1	1
433.4500	UHF	99	1	1
145.7900	VHF	99	1	1
145.5100	VHF	99	1	1

Basically, anyone with a DMR that has a Channel which uses one of these RF Simplex Frequencies can talk to anyone else that is in RF range and on the same RF Frequency who has a similar Channel setup in their DMR. It would be a Public Channel, much the same as the 146.52 Simplex Frequency used by 2m FM radios.

a. VHF 145.7900 MHz DMR Simplex Channel

Let's setup a DMR Channel for the **VHF 145.7900 MHz DMR Simplex Frequency**.

Right Click on the Digital Contact folder. Select "Add" "Group Call" from the popup menu. Select the newly created "Contactxx" entry. Right Click and select "Rename" from the popup menu. Rename it to: "D-Simplex TG". Double Click on the "D-Simplex" entry and enter "99". Close the form.

Right Click on the Rx Group List folder. Select "Add" from the popup menu. Select the newly created "GroupListxx" entry. Right Click and select "Rename" from the popup menu. Rename it to: "D-Simplex Rx". Double Click on the "D-Simplex Rx" entry and move the "D-Simplex Rx" entry from the Available list to Member list. Close the form.

Now we can do the "Channel" setup to add access to this VHF 145.7900 MHz Digital Simplex Talk Group.

Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channelxx" to "D-145.790" and click somewhere else. (We have to do some abbreviating so it fits on the radio's display panel)

Let's setup this D-145.790 Channel. Double Click on the "D-145.790" entry in the Channel List

Set the "Mode" to Digital

Set the "Rx Freq" to 145.7900

Set the "Tx Freq" to 145.7900

Set the "Power Level" to High

Set the "TOT "to Infinity (one less than 15)

Set the "Admit Criteria" to Always

Set the "Privacy" to Off

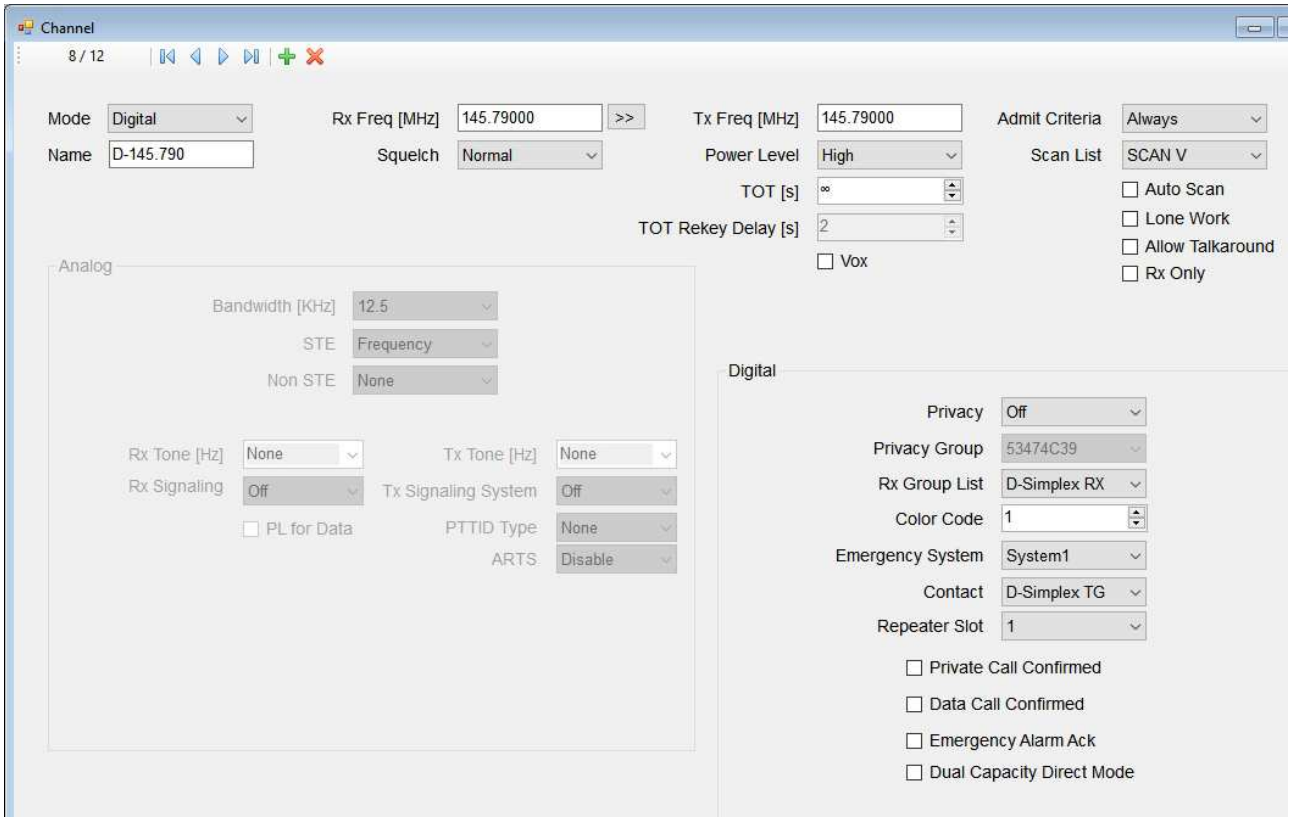
Select "D-Simplex Rx" from the "Rx Group List" Dropdown List

Select "D-Simplex TG" from the "Contact" Dropdown List

Set the "Color Code" to 1

Set the "Repeater Slot" to 1

Leave everything else as it was defaulted to and Close this form



At this time, I created a new "Simplex" Zone : Right Click on the "Zone" folder. Select "Add". Right Click on the newly added "Zonexx" entry and select Rename from the popup menu. Rename it to "Simplex" and click somewhere else.

Double Click on the "Simplex" Zone, select "D-145.790, and click on "Add" to move it into the Member List. Close this form

You have been saving your Codeplug often, haven't you ???

Upload your Codeplug and test your entries.

b. VHF 145.5100 MHz DMR Simplex Channel

Let's setup a DMR Channel for **VHF 145.5100 MHz DMR Simplex Frequency** using Copy-Paste.

Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channelxx" to "D-145.510" and click somewhere else. (We have to do some abbreviating so it fits on the radio's display panel)

Right Click on the "D-145.790" Channel and select "Copy". Right Click on the "D-145.510" Channel and select "Paste".

Double Click on the "D-145.5190" entry in the Channel List.

Everything from the Copied "D-145.790" Channel will be correct as is, except for the "RX Frequency" and the "Tx Frequency".

Change the "Rx Freq" to 145.5100

Change the "Tx Freq" to 145.5100

Leave everything else as it was defaulted to and Close this form

Double Click on the "Simplex" Zone, select "D-145.510, and click on "Add" to move it into the Member List. Close this form

c. More DMR RF Simplex Channels

There are also the UHF Digital Simplex Channels. They are at 441.000, 446.5000, 446.0750, and 443.500 MHz. You can create new Channels for them using the same Copy-Paste-Edit procedure that was just used to create the 145.5000 VHF Simplex Channel.

7. FM Analog Channels

The GD-77 will do FM Analog as well as DMR Digital. So, I also want add a Channel to access the K3MJW FM Analog Repeater and a Channel for 146.52 FM Analog Simplex.

a. K3MJW Analog Repeater Channel

This time, let's start out by creating the "Analog" Zone first. Right Click on the "Zone" folder. Select "Add". Right Click on the newly added "Zonexx" entry and select Rename from the popup menu. Rename it to "Analog" and click somewhere else. Close this form.

Creating Analog Channels is Simpler – all we have to do is fill in the data in the "Channel" form.

Let's do the K3MJW Repeater first. Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channelxx" to "K3MJW" and click somewhere else.

Double Click on the "K3MJW" entry in the Channel List

Set the "Mode" to Analog

Set the "Rx Freq" to 146.64000

Set the "Tx Freq" to 146.04000

Set the "Power Level" to High

Set the "TOT "to Infinity (one less than 15)

Set the "Admit Criteria" to Always

Set the "Bandwidth" to 25

Set the "Rx Tone" to None

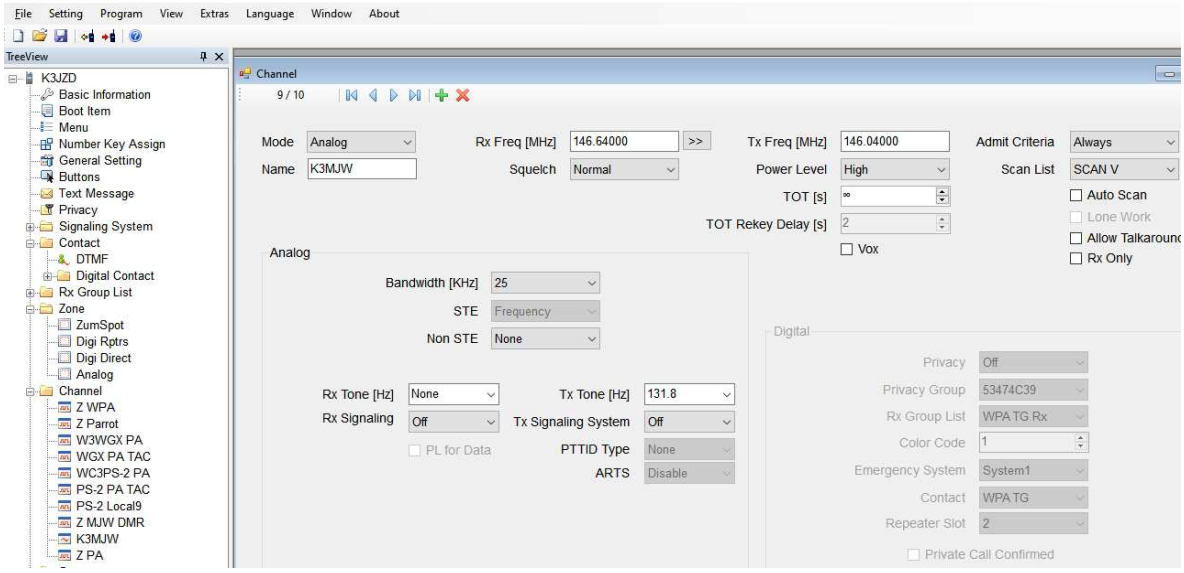
Set the "Tx Tone: to 131.8

Set the "Rx Signaling" to Off

Set the "Tx Signaling" to Off

Leave everything else as it was defaulted to ad Close this form

Double Click on the "Analog" Zone, select "K3MJW", and click on "Add" to move it into the Member List. Close this form



b. ***146.52 MHz Analog Simplex Channel***

Now let's do the 146.52 Simplex Channel. Right Click on the "Channel" folder "Channel" List. Select "Add" from the popup menu. Rename the newly created "Channelxx" to "146.52" and click somewhere else.

We will do the Copy - Paste again. Right Click on the "K3MJW" Channel entry and select "Copy". Right Click on the "146.52" Entry and select "Paste"

Double Click on the "146.52 entry in the Channel List

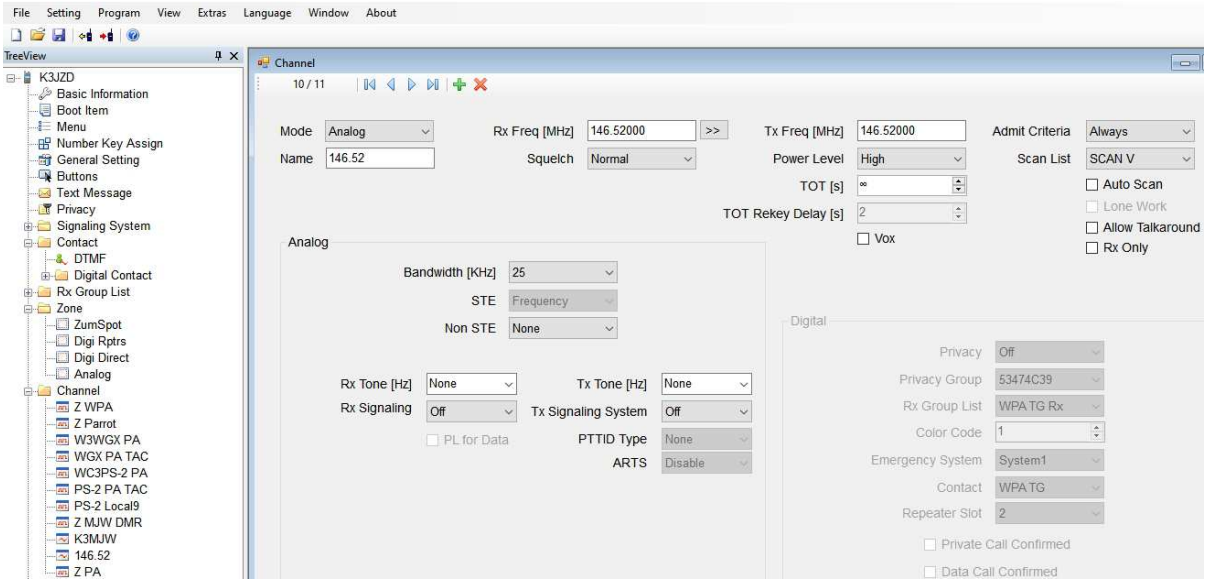
Set the "Rx Freq" to 146.52000

Set the "Tx Freq" to 146.52000

Set the "Tx Tone: to None

Look at everything else, and then close this form

Double Click on the "Analog" Zone, select "146.52", and click on "Add" to move it into the Member List. Close this form.


File Setting Program View Extras Language Window About
TreeView
K3JZD
Basic Information
Boot Item
Menu
Number Key Assign
General Setting
Buttons
Text Message
Privacy
Signaling System
Contact
DTMF
Digital Contact
Rx Group List
Zone
ZumSpot
Digi Rptrs
Digi Direct
Analog
Channel
Z WPA
Z Parrot
W3WGX PA
WGX PA TAC
WC3PS-2 PA
PS-2 PA TAC
PS-2 Local9
Z MJW DMR
K3MJW
146.52
Z PA
Channel
10 / 11
Mode Analog
Name 146.52
Rx Freq [MHz] 146.52000
Squelch Normal
Tx Freq [MHz] 146.52000
Power Level High
TOT [s] ∞
TOT Rekey Delay [s] 2
Vox
Admit Criteria Always
Scan List SCAN V
Auto Scan
Lone Work
Allow Talkaround
Rx Only
Analog
Bandwidth [KHz] 25
STE Frequency
Non STE None
Rx Tone [Hz] None
Rx Signaling Off
PL for Data
Tx Tone [Hz] None
Tx Signaling System Off
PTTID Type None
ARTS Disable
Digital
Privacy Off
Privacy Group 53474C39
Rx Group List WPA TG Rx
Color Code 1
Emergency System System1
Contact WPA TG
Repeater Slot 2
Private Call Confirmed
Data Call Confirmed

8. Going Forward

At this time, I think I have covered just about every different type of 'Channel' situation, so I am going to wrap up this document.

You may wish to Add in the 'PA Talk Group' and 'WPA Talk Group' Channels for the **Greensburg WC3PS 440 DMR Repeater.** Simply reference how you did it for the Greensburg WC3PS 2 Meter DMR Repeater. Use Copy and Paste to make it easier to do. Pay attention to the rules for the Greensburg 440 MHz DMR Repeater that are on the WC3PS Web Page – some things are a little bit different on that Repeater.

You may wish to Add in new ZumSpot Channels for the "PA TAC" (31421) and the "WPA TAC" (31422) Talk Groups. We did not do them whenever we were setting up ZumSpot Channels earlier. There is also a "PEMA/ARES" Talk Group (314320) that you may want to add.

You may wish to Add in some new Over-the-Air DMR Repeater Channels for Local Tactical Talk Groups (TAC Talk Groups) 310 to 315 which are intended to be used locally (but are Network Channels that can be accessed from anywhere) According to the Internet:

The "TAC 310" talkgroup is available on DMR repeaters associated with the DCI network and other participating partner networks. To access "TAC 310", simply program your DMR radio to use timeslot 2, talkgroup ID 310 on any participating DMR repeater and then just key your PTT (Push-To-Talk). From that point, the "TAC 310" talkgroup will be active on your DMR repeater and you can arrange to meet other DMR users there. Your conversation will only be heard on other DMR repeaters that have also activated "TAC 310", so no need to worry about being heard unnecessarily around the globe. After 10 minutes of inactivity on "TAC 310" from your local DMR repeater, the connection will automatically drop.

Note that this just discusses TAC 310. But since then, TAC 311 to TAC 315 have subsequently been implemented and behave similarly. However, every DMR Repeater may not have all of these Local TAC Channels setup. Rely on the guidance on the Repeater's Web Page.

You may wish to add in Channels for other Analog FM Repeaters that are on 2 Meters or on 440 MHz, or you could add in additional Channels for other FM Analog Simplex Channels on 2 Meters or on 440 MHz.

9. Summary

Note that if you are having problems, you are not alone. There are many things that can be wrong, beyond the contents of your Codeplug.

Strange things like TYT Radios being locked to the Business Frequencies and not allowing transmissions on Ham Frequencies was a giant roadblock at getting DMR going at Skyview. (That was overcome, but you had to know about it to know that it was what was preventing successful communications). Other brands of DMRs may have their own quirks.

The ZumSpot's Pi-Star software must be setup with access to your WiFi Network and the ZumSpot must be setup to use the same frequency as you are using in your Codeplug (ie 438.80000 MHz). Often a little tweaking in the Pi-Star software is required to tune the ZumSpot exactly to your radio's Frequency. If it is not tweaked just right you will have a high Bit Error Rate (BER). Lots of how-to for setting up the pi-star configuration is on the web

The Over-the-Air DMR Repeaters that you are tying to access must be in-range and healthy. Your signal must be strong enough at the Repeater. Unlike FM, where a poor signal is scratchy, with DMR if it is not solidly into the DMR Repeater it is simply ignored.

Basically, all of these pieces must be setup correctly for you to enjoy this Mode of Operation. And there is an operating protocol that you will have to learn – as always, listening to learn the ropes before jumping in there and talking is good practice.

NOTE: A lot of Copy-Paste-Edit was used to create this document. There may be instances where the Edit part of that was not done correctly. And there are most likely typos still in this document. Corrections can be sent to k3jzd@arrl.net