

Creating your first RD-5R Codeplug

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This document will walk you through the steps involved in configuring a Radioditty/Baofeng RD-5R radio for use on a nearby DMR repeater. Modern versions of the Baofeng DM-5R might work similarly, but I don't have access to that radio and cannot therefore confirm that the same procedures apply.

Obtain the correct programming cable

Because the RD-5R is in the same case as the ubiquitous UV-5R FM radio and its kin, some users incorrectly assume that the RD-5R uses the same programming cable as the UV-5R. In fact, the cables are **not interchangeable**. The UV-5R cable contains a chip that converts serial signals to USB signals. The RD-5R does the conversion in the radio, so its cable doesn't have a conversion chip. Make sure you have the correct cable at hand. If your radio did not come with a cable, you'll need to order one separately.



Figure 1. UV-5R programming cable (left) and RD-5R cable (right). Note how much larger is the USB connector on the UV-5R cable, because it contains a conversion chip that the RD-5R cable does not use. I labeled my RD-5R cable.

Install appropriate software

To program the RD-5R, you must use customer programming software (CPS) provided by the manufacturer. At the time this document was written, the RD-5R CPS could be downloaded from [the Radioddity website](#) as part of a firmware and software package. The file that the CPS creates is called a *codeplug*. The popular radio programming software, CHIRP is *not appropriate for this radio*.

DMR Use

The section immediately below covers DMR repeaters. A section on FM (analog) repeaters follows it.

Obtain a DMR ID

Every radio amateur who wishes to use a DMR radio must first obtain a unique, numerical ID from [radioid.net](#). If you have not already done so, apply for a DMR ID first. You may proceed with other parts of codeplug writing while awaiting your DMR ID assignment. After you receive your ID, enter it into the CPS. In the tree view on the left side of the CPS, double click “General Setting”. A General Setting dialog box will open. Enter your numeric, DMR ID in the “Radio ID” field. In the “Radio Name” field, enter your call sign and your first name, e.g. “W9LW Jay”. The radio will transmit the contents of the “Radio Name” field as a “talker alias,” which on some networks, will display other the radios of other users.

Obtain repeater information

It is essential to gather certain information about the repeater you intend to use, including:

- Transmitter and receiver frequencies
- Color code (which, despite its name, is a *numerical* code ranging from 1 to 15).
- A list of supported *talkgroups*, including the *timeslot* assigned to each.

About talkgroups

DMR networks are divided into talkgroups. You can think of each talkgroup as a virtual channel. Users select different talkgroups, based on with whom they wish to communicate. Some talkgroups are devoted to geographic areas. Others are devoted to topics or purposes. Each talkgroup has a name and a numerical ID. For example, 3118 is the numerical ID for the Indiana statewide calling talkgroup, devoted to establishing communications with users anywhere in Indiana, USA.

It is important to understand that not every DMR repeater supports the same set of talkgroups. In addition, not every talkgroup with the same name has the same numerical ID, depending on the network to which a repeater is connected. For example, on the [Brandmeister network](#), talkgroup 91 is the worldwide talkgroup, but other repeater networks use numerical ID 1 for their worldwide talkgroup.

It is therefore imperative to learn exactly what talkgroups, including their numerical IDs, the repeater you wish to use supports. Some repeater owners put such information in online repeater directories, such as [RepeaterBook.com](#) and [php.rfinder.net/websearch.html](#). Unfortunately, some repeater owners do not update such directories. The most reliable source, therefore, is often a repeater owner’s own web page, which can sometimes be found via web searches. In some cases, it might be necessary to contact a repeater owner directly (e.g. by looking up their call sign on [grz.com](#)) to obtain an up-to-date list of talkgroups and the timeslots to which they are assigned.

Brandmeister repeaters are a special case

When a repeater is part of the Brandmeister network, that repeater automatically supports every Brandmeister talkgroup that exists. You are not limited to talkgroups listed by the repeater owner. In fact, knowing that you can use any Brandmeister talkgroup, some Brandmeister repeater owners don't even provide lists of supported talkgroups. You can find a searchable list of all Brandmeister talkgroups on the Brandmeister website at <https://brandmeister.network/?page=talkgroups>. Also, Brandmeister repeaters allow you to use any talkgroup on any timeslot. Repeater owners, however, sometimes have timeslot preferences that you should learn and follow. For example, the owner might prefer that timeslot 2 be reserved for local and regional talkgroups and that all wider area talkgroups (e.g. Worldwide) use timeslot 1. Such preferences can sometimes be found in the above-listed repeater directories or on the repeater owner's own website. It is a best practice to attempt obtain and comply with such preferences.

Add talkgroups to Digital Contacts

When you have a list of talkgroups supported by your local repeater, you must add them to the list of Digital Contacts in your codeplug.

In the tree view on the left side of the CPS (see Figure 2, below), right-click on the Digital Contacts folder, click "Add" and then click "Group Call". A new contact will appear in the contact list under the Digital Contacts folder. Double-click the new contact. A new Digital Contact dialog box will open. Put the talkgroup name (e.g. "Worldwide") in the Name field. Put the talkgroup number (e.g. 1 or 91) in the Call ID field.

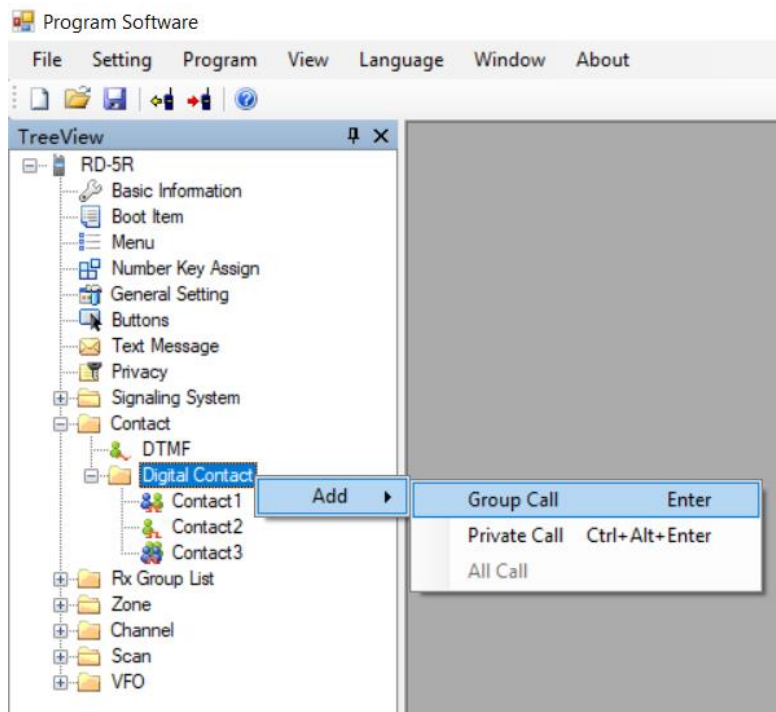
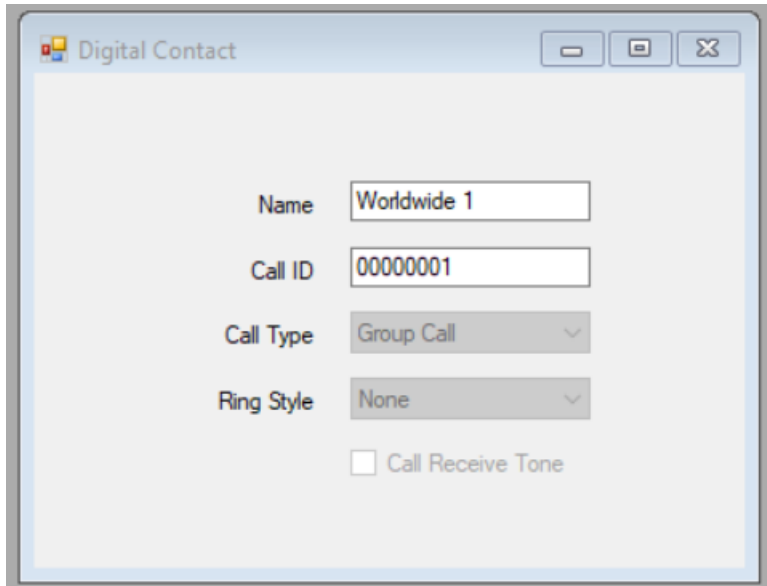


Figure 2. Adding a group call (talkgroup) to the Digital Contact list



As a personal preference, I include the talkgroup number in the name, even though I must also put the number in the Call ID field. This is because different networks use different numbers with the same names and helps me select the appropriate talkgroup when creating channels. So, for example, I created a digital contact named “Worldwide 1” for the Worldwide talkgroup on the MARC network and another digital contact named, “Worldwide 91” for the Worldwide talkgroup on the Brandmeister network.

Repeat the above process (starting with right-clicking the Digital Contacts folder) for each talkgroup supported by your local repeater.

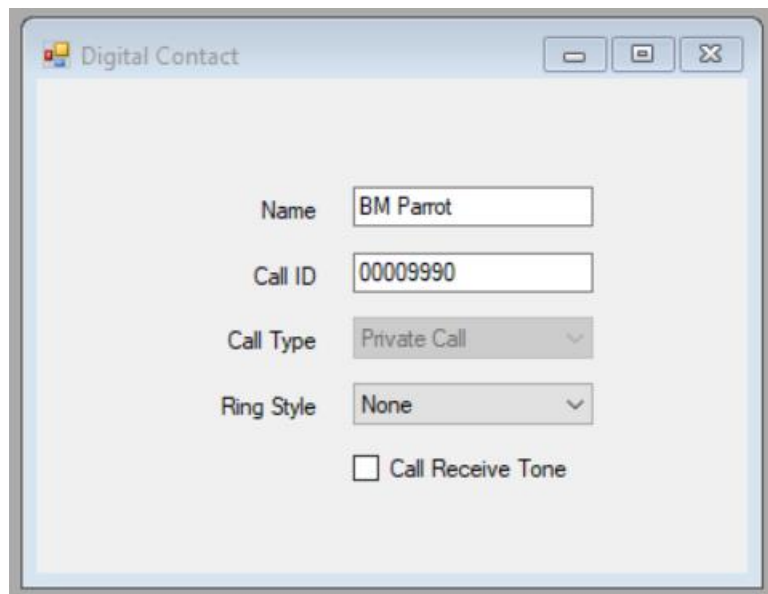
Parrot or Echo – a special digital contact

Most repeaters support a service that echoes whatever you transmit. Some people refer to this as the “parrot” or “echo” service. This helps you know whether you are within range of the repeater and how well the repeater hears your signal. There are at least two different parrots, depending on to what network your local repeater is connected.

For repeaters on the **Brandmeister** network, the parrot is a *private call* to ID 9990. In this case, right-click the Digital Contacts folder, click “Add” and then click “Private Call”. Type “BM Parrot” or “BM Echo” in the Name field and 9990 in the Call ID field.

For repeaters on other networks (MARC, etc.) the parrot is talkgroup 9998. Enter it as a *group call* digital contact, just like any other talkgroup.

If you don’t know which network your local repeater uses, you might be able to tell by its list of supported talkgroups. For example, if the repeater uses talkgroup 91 for Worldwide, it’s a probably a Brandmeister repeater. If it uses talkgroup 1 for Worldwide, it’s probably not a Brandmeister repeater. If you’re not sure, ask the repeater owner whether the repeater is on the Brandmeister network.



Rx group lists

Unlike some other DMR radios, Rx group lists are **mandatory** with the RD-5R. (There is an exception to this rule, but it requires the use of “monitor mode,” which is beyond the scope of this document.) Every talkgroup you add to the Digital Contacts list (above), you must also add to an Rx group list. Each Rx group list may include one or more talkgroups. This gives you a choice of creating an Rx group list for each talkgroup or putting all your talkgroups in a single Rx group list. Note that the latter choice (all talkgroups in a single Rx group list) will mean you’ll hear traffic on talkgroups other than the one you have selected, which could confuse newer users.

Nonetheless, my preference is to put all the talkgroups for a given repeater in a single Rx group list dedicated to that repeater. This allows me to know whether a timeslot on which I intend to transmit is already in use. It also allows me to monitor multiple talkgroups without scanning. (Channel scanning on the RD-5R is quite slow.) When I hear a call I want to answer, however, I must look at the radio quickly to see what talkgroup that user was on (because it might not be the talkgroup I’m set to) and then change channels as necessary before answering.

In the tree view on the left side of the CPS (see Figure 3), right-click the Rx Group List folder and then click “Add”. A new group list will appear in the tree view. Double click on it. A new dialog box will open. In the Name field, type a relevant name. Because I create a group list per repeater, I name my group lists after each repeater, for example, “Fort Wayne” for the repeater in Fort Wayne, Indiana, USA. Now, in the “Available” list at left, select all the talkgroups you want in this group list and then click the “Add” button.

Repeat this process for each Rx group list you wish to create.

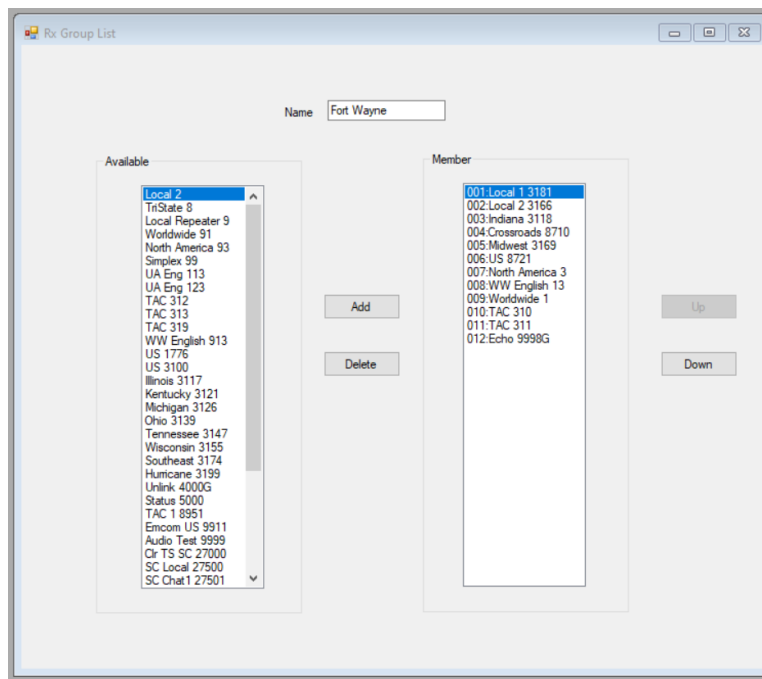


Figure 3. Creating an RxGroup list for a single repeater.

Channels

Create a channel for each talkgroup-repeater combination. For example, if you plan to use talkgroup 13 on both repeater A and repeater B, you'll need two channels devoted to talkgroup 13, one for each repeater.

In the tree view on the left side of the CPS, right-click the Channel folder and then click "Add". A new "ChannelX" item will appear under the Channel folder, where X is the next available number in sequence. Double click that new item to open a dialog box for that channel (see Figure 4, below).

In the Channel dialog box, make the following settings:

- **Mode:** Set to "Digital" for DMR use.
- **Name:** Change from "ChannelX" to a relevant name. I always identify the repeater with the first part of the channel name and the talkgroup with the second part. For example, if I'm creating a channel to use the Worldwide talkgroup (talkgroup number 1) on the K9MMQ repeater in Fort Wayne, Indiana, USA, I might name the channel "FW WW" for "Fort Wayne repeater, Worldwide talkgroup". The CPS allows up to 15 characters in the Name field, but the RD-5R will display only the first 11 characters, so I abbreviate as necessary to limit channel names to 11 characters. If I also create a Worldwide channel to use on the NT9M repeater in LaGrange, Indiana, USA, I might name that channel, "Lagrange WW".
- **Rx Freq (MHz):** Enter the frequency on which you will receive the repeater (the repeater's transmit frequency).
- **Tx Freq (MHz):** Enter the frequency on which you will transmit to the repeater (the repeater's receiver frequency).
- **Admit Criteria:** Set this to "Color Code."
- **Privacy:** Leave this set to "off".
- **Rx Group List:** Select an Rx group list you created above that includes the talkgroup this channel will use.
- **Color Code:** Set this to the color code used by the repeater this channel will use (see, "Obtain repeater information", above).
- **Contact:** Set this to the talkgroup this channel is for. Using the example from the Name field above, I'd choose "Worldwide 1".
- **Repeater Slot:** Set this to the *timeslot* that your repeater uses with the above-referenced talkgroup. For example, the K9MMQ repeater in Fort Wayne, Indiana, USA supports Worldwide 1 only on timeslot 2. For Brandmeister repeaters, follow any preferences communicated by the repeater owner.

Figure 4. Example channel settings to use Worldwide talkgroup 1 on a DMR repeater.

Repeat the steps above for every combination of talkgroup and repeater you wish to use. For reasons explained below, if a repeater supports more than 16 talkgroups (as do all Brandmeister repeaters), I choose my *favorite* 16 talkgroups and make channels only for those 16. I explain why in the Zones section, below.

Zones

The channels you create in the step above will not appear on your radio unless you create a zone to hold them. A zone is analogous to a memory bank in a typical, amateur FM radio. Unlike such FM radios, however, there is no default, “all channels” zone. You must there manually put in at least one zone every channel you want to see on the RD-5R.

My personal preference is to dedicate a zone to each DMR repeater I use and place in a zone only channels associated with that repeater. The RD-5R allows only 16 channels per zone, which is why I mentioned in the “Channels” section above, choosing my favorite 16 talkgroups per repeater.

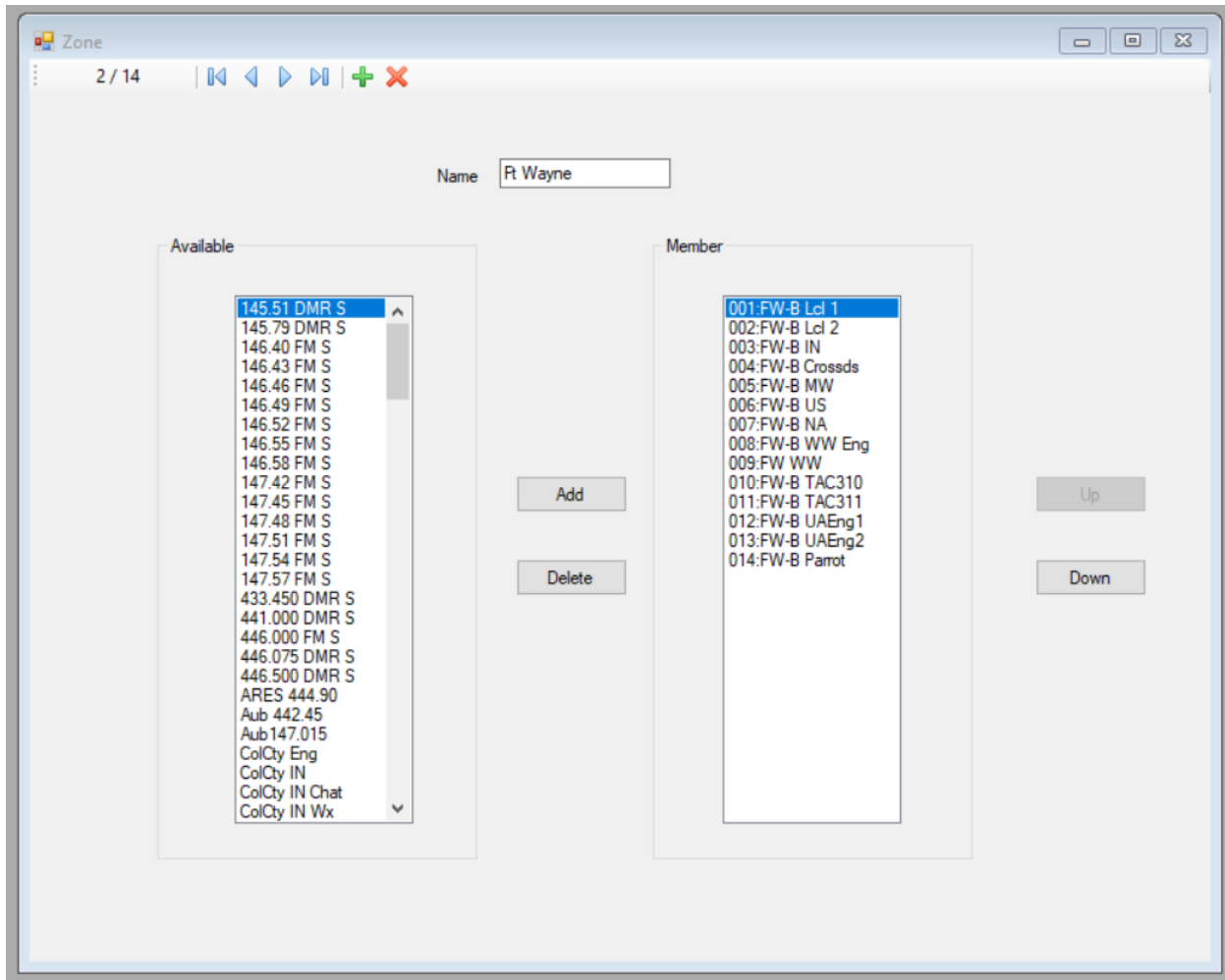


Figure 5. Example zone settings for a DMR repeater

In the tree view at the left side of the CPS, right-click on the Zone folder and then click “Add”. A new zone will appear below the Zone folder. Double click the new zone. A new Zone dialog box will open. Replace the contents of the Name field with something more relevant, such as the location or name of the repeater that this zone is for. In my example, I might enter “Fort Wayne” for the K9MMQ repeater in Fort Wayne, Indiana, USA.

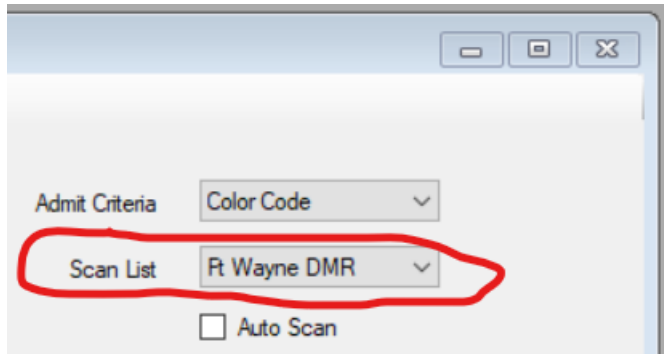
In the “Available” list on the left side of the dialog box, select up to 16 channels that you will use with the repeater this zone is for. In my example, I’ll select the 16 channels whose names begin “FW”, because they’re all set to the frequency and color code of the K9MMQ repeater in Fort Wayne, Indiana, USA. Click the “Add” button to move the selected channels to the “Member” list. Optionally, select a channel in the “Member” list and then use the “Up” or “Down” buttons to move that channel up or down in the list. This is how you control the order in which channels will appear on your radio.

Optional: Scan lists

The RD-5R will scan channels. It will only scan, however, channels that appear in a scan list. In addition, the radio must be set to a channel associated with the desired scan list. Note, however, that channel

scanning on the RD-5R is so slow that many users find it unsatisfactory. If you wish to use scanning, follow the steps below.

In the tree view on the left side of the CPS, right click on the Scan folder and then click, "Add". A new scan list will appear below the scan folder. Double click it and a new Scan dialog box will open. Using the same procedure described for zones, above, name the scan list something relevant and add channels from the "Available" list to the "Member" list. Optionally choose one or two priority channels with the drop-down menus at the bottom of the dialog box.



In the tree view, double click a channel from which you'd like to begin scanning. In the channel dialog box that opens, select your new scan list in the Scan List drop-down menu near the upper right-hand corner of the dialog box. This enables the initiation of scanning when this channel is selected on the radio.

Note: The radio comes by default with its "Double Wait" (dual watch) function set to

"on." This function scans between the "A" and "B" VFOs. It also *disables scan list scanning*. To use scan list scanning, you must disable "Double Wait" through the radio's Menu key. The sequence is, "Menu", "Set", "Radio Set," "Double Wait".

DMR simplex frequencies

The procedure for adding DMR simplex frequencies to the RD-5R is essentially the same as that described above, with the exceptions described below.

The following frequencies are recommended for DMR simplex:

- 441.0000
- 446.5000
- 446.0750
- 433.4500
- 145.7900
- 145.5100

In the digital contact list, you must create a group contact for talkgroup 99 and add this new contact to at least one Rx Group List (the one you intend to select in your DMR simplex channels).

In the channel dialog for each DMR Simplex channel:

- Assure that the transmit and receive frequencies are the same.
- Set "Admit Criteria" to "Always" or "Channel Free." The latter will prohibit transmission if there's any signal on the frequency.
- Set "Rx Group List" to a group that contains talkgroup 99.
- Set the color code to 1.
- Set the repeater slot to 1.

- It's a good idea to indicate in the channel name that it's DMR simplex (e.g. "145.51 DS").

DMR Hotspots

Some users install DMR hotspots in their homes, autos or elsewhere. These devices connect to the Internet (via WiFi or ethernet) and receive and send DMR signals on amateur radio frequencies, typically in the UHF band. Configuring a hotspot itself is beyond the scope of this document.

Configuring the RD-5R for hotspot use is, however, essentially the same as the procedure described above, with a few exceptions. Hotspots typically operate on simplex, so the transmit and receive frequencies in the CPS channel dialog box would need to match. Most (but not all) hotspots use timeslot 2 for all talkgroups, so all channels configured for the hotspot would need to be set to "Repeater Slot" 2. Most hotspots are on the Brandmeister network, so you may choose any talkgroup listed on the Brandmeister website (see link above). For the same reason, the parrot channel would be a private call to ID 9990 (see above). Any users whose hotspot differs from the description above (e.g. dual-band or duplex hotspots) must understand how their hotspot is configured and configure their codeplugs accordingly.

Digital contact list

The RD-5R can display the call sign and name of the person you are receiving. If you're using a network that doesn't send the other person's "talker alias" (radio name), however, you will only see the other operator's call sign and name if you add them to your codeplug in advance. Doing so is an operation that is beyond the scope of this document. I will note, however, that the radio can store a total of only 256 digital contacts, including talkgroups and individuals.

Analog (FM) Repeaters

The section below covers adding analog (FM) repeaters to your code plug.

Obtain repeater information

It is essential to gather certain information about the repeater(s) you intend to use, including:

- Transmitter and receiver frequencies.
- Continuous tone-coded squelch system (CTCSS) frequency (if required).

You can often obtain such information from the websites of clubs that operate repeaters, or online repeater directories, such as RepeaterBook.com and php.rfinder.net/websearch.html.

Channels

Create a channel for each FM repeater you wish to use, using the same procedure described in the DMR section above, with the following differences.

- **Mode:** Set to "Analog" for FM use.
- **Band Width (KHz):** Set to "25."
- **Tx Tone (Hz):** Set to the CTCSS tone frequency the repeater requires.

Ignore all the settings in the "Digital" part of the dialog box.

Repeat the steps above for every FM repeater you wish to use, as always, starting by double clicking on a new table row.

Zones

Following the procedure described in the Zones section above, add every newly created channel to at least one zone. My personal preference is to dedicate a zone to each geographical grouping of FM repeaters. For example, I put all FM repeaters located in Fort Wayne, Indiana, USA in one zone.

Optional: Scan lists

If you wish, create a scan list for your FM repeaters, following the same procedure described in the Optional: Scan lists section above.

FM simplex frequencies

The procedure for adding FM simplex frequencies to the RD-5R is essentially the same as that described above. In the channel dialog box, you must assure that the transmit and receive frequencies are the same. It's a good idea to indicate in the channel name that it's simplex (e.g. "146.52 S"). CTCSS tones are not typically used in FM simplex communication.

Clean up your codeplug

Your codeplug might include some default or example contacts, channels, zones, etc. To reduce confusion in the future, delete any such items that you did not customize.

Save your completed codeplug

When you have finished creating your codeplug, save it somewhere on your computer's hard drive. The CPS will by default save it to a folder such as "C:\BaoFeng\RD-5R v1.0.0.4\DATA" and that's fine if you make note of where that folder is.

Write your codeplug to the radio

Plug the programming cable into the radio and the other end into a USB port on your computer. Turn on your radio. Click "Program" on the menu bar at the top of the CPS and then click "Write". Wait for the process to complete and then unplug the programming cable from your radio. Your radio should now be ready to use with the codeplug you created above. My first action after programming my radio is to set the radio to a parrot channel and test the repeater's ability to hear me.