Choose Your 2m Frequency Wisely

Written for amateur radio operation in Colorado
Bob Witte, KØNR

Note: For radio operating outside of Colorado, please refer to my article on HamRadioSchool.com

You've just purchased your first 2-meter (144 to 148 MHz) FM transceiver and have been chatting with both old and new friends around town on the 2m band. You and your buddies decide to find an out of the way frequency to hang out on. After tuning around, you find a nice, quiet frequency that no one seems to using and start operating there. Nothing to worry about, right?

Not so fast, there are a few more things to consider when selecting a frequency on the 2m band. Let's take a look at the key issues.

FCC Rules

The first thing we need to know are the frequencies that the FCC has authorized for our particular license class. For the HF bands, the frequency privileges depend greatly on the license class of the operator. Above 50 MHz, the frequency allocations are the same for Technician licenses and higher. In particular, the 2M band extends from 144 MHz to 148 MHz. The FCC Rules say that any mode (FM, AM, SSB, CW, etc.) can be used on the band from 144.100 to 148.000 MHz. The FCC has restricted 144.0 to 144.100 MHz to CW operation only.

Band Plans

Knowing the FCC frequency authorizations is a good start but we need to check a bit further. Amateur radio operators use a variety of modulation techniques to carry out communications. Often, these modulation techniques are incompatible since a signal of one type can't be received by a radio set to another modulation type. For example, an SSB signal can't be received on an FM receiver (and vice versa). We need to use our authorized frequencies wisely by sharing the band with other users and avoiding unnecessary interference. Thus, it makes sense to have a *band plan* that divides the band up into segments for each type of operation.

2m Band Plan

As shown in the table, the 2m amateur band plan supports a wide variety of radio operation. Large portions of the band are dedicated to FM operation, consistent with the popularity of the FM mode. There are portions of the band designated for repeater *outputs* (which is the frequency that we tune to receive the repeater) and repeater *inputs* (which is the frequency we transmit on to use the repeater). Notice that these segments are positioned 600 kHz apart consistent with the standard 2m repeater offset. There are also frequencies designated for FM simplex.

On the low end of the band, we see segments for some of the more exotic modes. At the very bottom is the CW portion, which includes Earth-Moon-Earth (EME) operation. EME operators communicate by bouncing their signals off the moon.

2m Band Plan

As approved by the ARRL VHF-UHF Advisory Committee,
simplified by KØNR to reflect usage in Colorado.

The Colorado Council of Amateur Radio Clubs (CCARC) publishes the official *2 Meter Frequency Use Plan* for the 2 meter band in Colorado.

144.000- 144.100	CW
144.100- 144.275	Single-sideband (SSB Calling Frequency = 144.200)
144.275- 144.300	Propagation Beacons
144.300- 144.500	OSCAR (satellite) APRS Frequency = 144.390 MHz
144.500- 144.900	FM Repeater Inputs
144.900- 145.100	Packet Radio
145.100- 145.500	FM Repeater Outputs
145.500- 145.800	Misc. and experimental modes
145.800- 146.000	OSCAR (satellite)
146.010- 146.385	FM Repeater Inputs
146.400- 146.595	FM Simplex (National Simplex Calling Frequency = 146.52 MHz)

146.610-147.390	FM Repeater Outputs
147.405-147.585	FM Simplex
147.600-147.990	FM Repeater Inputs
Note: The FM channel spacing in Colorado is 15 kHz (repeaters and simplex).	

Further up the band, we see segments for SSB operation and beacon operation. SSB is the preferred voice mode for so-called "weak signal" operators. The mode is more efficient than FM when signals are weak, so it is the way to go when you are trying to push the limits of 2m DX. Beacons are transmitters that are always on, transmitting a short CW message as a propagation indicator for distant stations. We often think of 2 meters as a local coverage band but when conditions are right, contacts can be made with stations over a thousand miles away. Of course, conditions are not always right so having a beacon on the other end of the desired communication path lets you know how propagation is in that direction.

Radio amateurs also use 2 meters for OSCAR satellite operation, sending signals *to* a satellite (uplink) or receiving signals *from* the satellite (downlink). The OSCAR segments don't specify a particular modulation type since CW, SSB and FM are all used for OSCAR operation. Because of their elevation above the earth, satellites can hear signals from all over the US simultaneously, so they are very susceptible to interference.

Most of this non-FM operation can be easily interfered with by signals from other users. EME signals, for example, are usually quite small since the signal has to make the round trip from the earth to the moon and back. If a local FM operator fires up in the EME portion of the band, an EME signal that can't be heard by an FM receiver can be wiped out by the FM signal. Similarly, an operator chatting across town on 2m could interfere with a satellite hundreds of miles away and not know it. This is particularly a problem with FM receivers, which won't even notice low level CW and SSB signals.

FM Operating

The most common 2m rigs are basic FM mobile or handheld transceivers. These radios usually tune the entire 2m band from 144 MHz to 148 MHz in 5 kHz steps. The band plan indicates the proper range of frequencies for FM operation but there is more to the story. FM operation is "channelized", meaning that specific 2m FM frequencies are identified by the band plan. The use of channels is especially important for repeaters, since they don't easily move around in frequency and are coordinated to minimize interference. The idea is to have all stations use frequencies that are spaced just far enough apart to accommodate the signal without interfering with the adjacent channels.

You might think that the spacing between channels would be 5 kHz, which is the tuning step of most FM radios. This doesn't work because an FM signal occupies a bandwidth that more than 5 kHz wide. Even though we talk about a signal being on a specific frequency, the signal actually spills out on either side of the frequency by about 8 kHz. This means that a typical FM signal is about 16 kHz wide.

(You may recall that amateur 2m FM uses ±5 kHz frequency deviation. So doesn't this mean the bandwidth is 10 kHz? No, it doesn't work quite that way and the signal is actually wider than 10 kHz. I might be able to show the math behind this but it makes my head hurt. Perhaps in some future article.)

The channel spacing needs to be at least as wide as the bandwidth of the signal, which allows room for each signal without interfering with the adjacent channel. In Colorado, the channel spacing is 15 kHz, which is a bit tight for our 16 kHz-wide signal. In other parts of the country, a 20 kHz spacing has been adopted to provide for more separation between channels. Obviously, you get more channels on the band with 15 kHz spacing than with 20 kHz, but you have to put up with more adjacent channel problems.

When using a repeater, you just need to dial in the published repeater frequency and set the transmit offset, either + 600 kHz or – 600 kHz. Most modern 2m radios automatically take care of setting the proper offset (based on the band plan). If you need to set the offset manually, the rule is very simple. If a repeater's output frequency is in the 147 MHz range, it uses a + 600 kHz offset. Otherwise, it requires a – 600 kHz offset. For repeaters that require a CTCSS tone for repeater access, you will have to set the proper tone frequency on transmit.

For simplex operation, the standard simplex frequencies listed in the table below should be used. These simplex frequencies are grouped in the 146 MHz and 147 MHz range as listed in the table below. **The National Simplex Calling Frequency (also referred to as the calling frequency) is 146.52 MHz.**

2m FM Simplex Frequencies Colorado Band Plan	
146 MHz Range	146.400, 146.415, 146.430, 146.445, 146.460, 146.475, 146.490, 146.505, **146.520**, 146.535, 146.550, 146.565, 146.580, 146.595
147 MHz Range	147.405, 147.420, 147.435, 147.450, 147.465, 147.480, 147.495,147.510, 147.525, 147.540, 147.555, 147.570, 147.585

The FCC View on Band Plans

Sometimes I hear radio amateurs say, “Band plans are voluntary so I don’t need to pay any attention to them. I can do whatever I want as long as I don’t break the FCC rules.” Unfortunately, such an attitude does not promote efficient use and sharing of the amateur bands. Imagine the chaos on the ham bands if everyone took this approach. It also may be a violation of FCC rules.

On Oct 18, 2000, in a ruling concerning a repeater operator’s failure to conform to the prevailing band plan, FCC Special Counsel for Amateur Radio Enforcement, Riley Hollingsworth commented on the issue. He said “Band plans minimize the necessity for Commission intervention in Amateur operations and the use of Commission resources to resolve amateur interference problems. When such plans are not followed and harmful interference results, we expect very substantial justification to be provided, and we expect that justification to be consistent with Section 97.101.”

Section 97.101 is the part of the FCC rules that says (among other things):

- In all respects not specifically covered by FCC Rules each amateur station must be operated in accordance with good engineering and good amateur practice.
- Each station licensee and each control operator must cooperate in selecting transmitting channels and in making the most effective use of the amateur service frequencies.

The FCC has clearly stated that they expect hams to share the bands by following accepted band plans. More importantly, this is the right thing to do for the benefit of the amateur radio service.

Summary

The fine points of the band plan can be a bit confusing. However, a few simple guidelines can help, especially if you are operating only FM.

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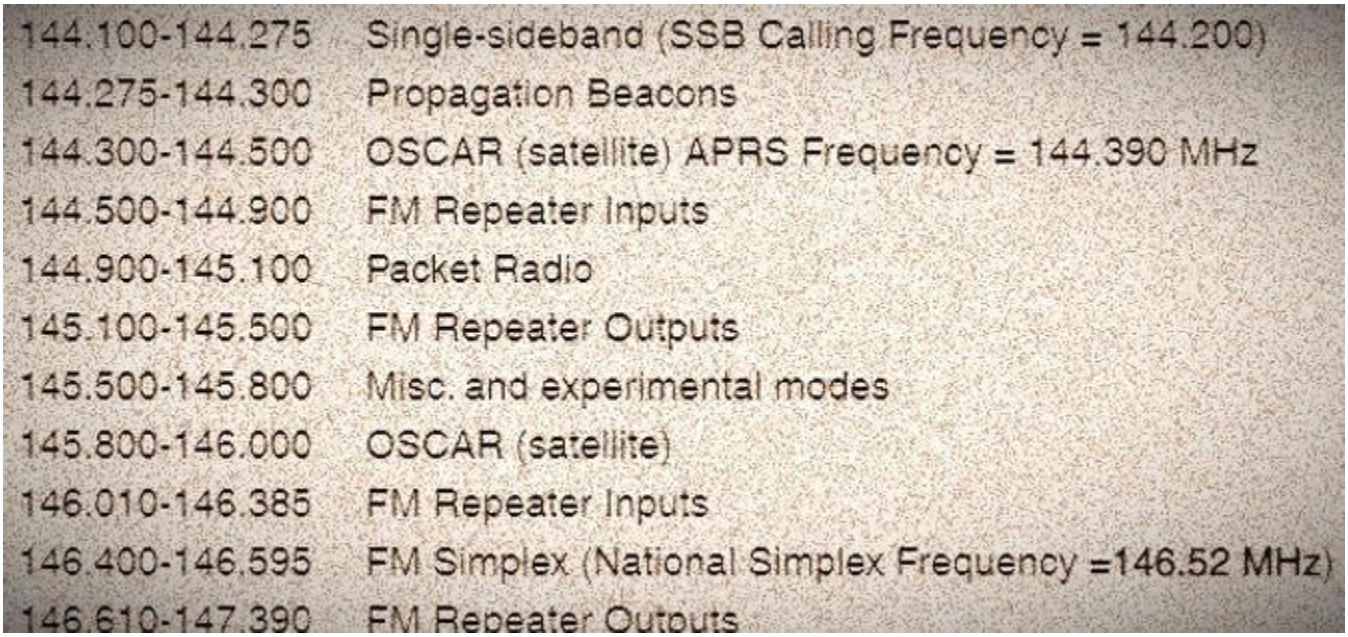
    - FM voice simplex and repeater operation should occur only above 145.100 MHz (and only in the OSCAR subband if you are working an FM satellite)
    - When operating through a repeater, make sure you are tuned to the published repeater frequency with the proper transmit offset.
    - When operating simplex, use a simplex frequency designated by the band plan.

We’ve only covered the 2m band in this article. If you are operating on other bands, be sure to check the appropriate band plan before transmitting. Note that this article is written for amateur radio operation in Colorado. Other locations may have different band plans.

What Frequency Do I Use on 2 meters?

 Bob KØNR
6 min read

You've just purchased your first handheld transceiver and have been chatting with both old



and new friends around town on the 2 Meter band. There are many different frequencies to choose from, so how do you find an appropriate frequency to use?

FCC Rules

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Often, these modulation techniques are incompatible since a signal of one type can't be received by a radio set to another modulation type. For example, an SSB signal can't be received on an FM receiver (and vice versa). We need to use our authorized frequencies wisely by sharing the band with other users and avoiding unnecessary interference. Thus, it makes sense to have a *band plan* that divides the band up into segments for each type of operation.

2 Meter Band Plan

As shown in the table, the ARRL 2 Meter amateur band plan supports a wide variety of radio operation. Large portions of the band are dedicated to FM operation, consistent with the popularity of the FM mode. There are portions of the band designated for repeater *outputs* (which is the frequency that we tune to receive the repeater) and repeater *inputs* (which is the frequency we transmit on to use the repeater). Notice that these segments are positioned 600 kHz apart consistent with the standard 2m repeater offset. There are also frequencies designated for FM simplex.

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2 Meter Band Plan Adapted from the ARRL web site

144.000-144.100 CW (Continuous Wave, Morse Code)

144.100-144.275 Single-sideband (SSB Calling Frequency = 144.200)

144.275-144.300 Propagation Beacons

144.300-144.500 OSCAR (satellite) APRS Frequency = 144.390 MHz

144.500-144.900 FM Repeater Inputs

144.900-145.100 Packet Radio

145.100-145.500 FM Repeater Outputs

145.500-145.800 Misc. and experimental modes

145.800-146.000 OSCAR (satellite)

146.010-146.385 FM Repeater Inputs

146.400-146.595 FM Simplex (National Simplex Frequency =**146.52 MHz**)

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Radio amateurs also use 2 meters for OSCAR *(Orbiting Satellite Carrying Amateur Radio)* operation, sending signals to a satellite (uplink) or receiving signals from the satellite (downlink). The OSCAR segments don't specify a particular modulation type since CW, SSB and FM are all used for OSCAR operation. Because of their elevation above the earth, satellites can hear signals from all over the US simultaneously, so they are very susceptible to interference.

Most of this non-FM operation can be easily interfered with by signals from other users. EME signals, for example, are usually quite small since the signal has to make the round trip from the earth to the moon and back. If a local FM operator fires up in the EME portion of the band, an EME signal that can't be heard by an FM receiver can be wiped out by the FM signal. Similarly, an operator chatting across town on 2m could interfere with a satellite hundreds of miles away and not know it. This is particularly a problem with FM receivers, which won't even notice low-level CW and SSB signals.

FM Operating

The most common VHF radios are basic FM mobile or handheld transceivers. These radios usually tune the entire 2m band from 144 MHz to 148 MHz in 5 kHz steps. The band plan indicates the proper range of frequencies for FM operation but there is more to the story. FM

operation is “channelized”, meaning that specific 2m FM frequencies are identified by the band plan. The use of channels is especially important for repeaters since they don’t easily move around in frequency and are coordinated to minimize interference. The idea is to have all stations use frequencies that are spaced just far enough apart to accommodate the signal without interfering with the adjacent channels. You might think that the spacing between channels would be 5 kHz, which is the tuning step of most FM radios. This doesn’t work because a typical FM signal occupies a bandwidth that is about 16 kHz wide.

The channel spacing needs to be at least as wide as the bandwidth of the signal, which allows room for each signal without interfering with the adjacent channel. In Colorado, the channel spacing is 15 kHz, which is a bit tight for our 16 kHz-wide signal. In other parts of the country, a 20-kHz spacing has been adopted to provide for more separation between channels. Obviously, you get more channels on the band with 15 kHz spacing than with 20 kHz, but you have to put up with more adjacent channel interference.

When using a repeater, you just need to dial in the published repeater frequency and set the transmit offset, usually either + 600 kHz or – 600 kHz for a 2-meter band repeater. In some parts of North America, non-standard repeater offsets may be used, which will be indicated in the repeater directory. For repeaters that require a CTCSS tone for repeater access, you will have to set the proper tone frequency on transmit.

Choosing an appropriate simplex frequency can be a little tricky, since it depends on whether your region uses the 15-kHz or 20-kHz channel spacing. Across all of North America, the National Simplex Frequency (also referred to as the *calling frequency*) is 146.52 MHz. In areas that use 15-kHz channels, the adjacent channels are 146.535, 146.550, 146.565 MHz, etc. moving upward. Below the calling frequency are 146.505, 146.490, 146.475 MHz and on. In areas that use 20 kHz channels, the frequencies are 146.540, 146.560, 146.580 MHz moving up and 146.500, 146.480, 146.460 MHz moving down.

There is usually another group of FM simplex frequencies in the 147 MHz. The *typical* layout of simplex channels is the table below. However, it is important to note that your local band plan may be different than this.

2m FM Simplex Frequencies (typical usage, check your local band plan)

15 kHz Channels

146.400, 146.415, 146.430, 146.445, 146.460, 146.475, 146.490, 146.505, **146.520**, 146.535, 146.550, 146.565, 146.580, 146.595, 147.405, 147.420, 147.435, 147.450, 147.465, 147.480, 147.495, 147.510, 147.525, 147.540, 147.555, 147.570, 147.585

20 kHz Channels

146.400, 146.420, 146.440, 146.460, 146.480, 146.500, **146.520**, 146.540, 146.560, 146.580, 146.600, 147.400, 147.420, 147.440, 147.460, 147.480, 147.500, 147.520, 147.540, 147.560, 147.580

Band Plan

While the ARRL band plan sets the guidelines for band use across the US, VHF band plans are really defined on a statewide or regional basis. This means it is best to find the specific band plan for your region. This may be a challenge to find the right information, but try searching the web for "2-meter band plan" and your state. A good source is your local frequency coordination body. Inquire with a local club or experienced ham about your local coordinating body, or conduct an online search for your area.

Summary

The fine points of the band plan can be a bit confusing. However, a few simple guidelines can help, especially if you are operating only FM.

- FM voice simplex and repeater operation should only occur in the designated band segments for your area. Stay out of the weak signal and satellite sub-bands.
- When operating through a repeater, make sure you are tuned to the published repeater frequency with the proper transmit offset.
- When operating simplex, use a simplex frequency designated by your local band plan.

We've only covered the 2 Meter band in this article. If you are operating on other bands, be sure to check the appropriate band plan before transmitting. You can read about the 70 centimeter band plan in a counterpart article, *What Frequency Do I Use on 70 Centimeters?*

Bob, KØNR

Getting Started on 2m SSB

Try the "Other Mode" on 2 Meters

Bob Witte, KØNR
10 Dec 2016

In the past decade, a new breed of amateur radio transceiver has hit the marketplace — radios that cover from HF through VHF/UHF frequencies. These radios include the ICOM IC-706, the ICOM IC-9100, the Yaesu FT-100 and the Yaesu FT-991. This is not an exhaustive list since there are new radios being introduced every year with additional capability.

These radios include "all-mode capability" which means that they can operate FM, CW and SSB on the VHF bands. Clearly, FM is the most commonly used mode on VHF and UHF but having SSB opens up a whole new range of operating fun.

Why SSB?

FM is the most popular mode primarily due to the wide availability of FM repeaters. These repeaters extend the operating range on VHF and enable low power handheld transceivers to communicate over 100 miles. FM is also used on simplex to make contacts directly without repeaters. The main disadvantage of FM is relatively poor performance when signals are weak, which is where SSB really shines. A weak FM signal can disappear completely into the noise while a comparable SSB signal is still quite readable. How big of a difference does this really make? Perhaps 10 dB or more, which corresponds to one or two S-units. Put a different way, using SSB instead of FM can be equivalent to having a beam antenna with 10 dB of gain, just by changing modulation types. So this is a big deal and radio amateurs interested in serious VHF work have naturally chosen SSB as the preferred voice mode. (You will also hear them using Morse code or CW transmissions, which is even more efficient that SSB.)

Just as an example of what is possible on SSB, during one VHF contest I was operating portable on Garden of the Gods Road in Colorado Springs. I had just dismantled my 2m yagi antenna and was listening to 2m SSB on a short mobile whip antenna. Suddenly, I heard WA7KYM in Cheyenne, Wyoming calling CQ from about 160 miles away. I figured that with my puny little antenna and only 10 watts of power, there was no way he was going to hear me. But, what the heck, it was a contest and it would be more points so I gave him a call. To my surprise, WA7KYM heard me and we made the contact without much signal strength to spare. Now, to be accurate, this contact has more to do with WA7KYM's "big gun" station (linear amplifier, low noise preamp and large antenna array) than it had to do with my 10 watts and a small whip. The key point here is that this contact would not have happened using FM and was only possible because of SSB.

When and Where to Operate

The SSB portion of the band runs from 144.100 MHz to 144.275 MHz and Upper Sideband (USB) is used. The 2M SSB calling frequency is 144.200 MHz, so that is the first place to look for activity or to call CQ. One of the realities of 2m SSB operation is that many times, no one is on the air. There is just not that much activity out there, compared to 2m FM. Some amateurs get discouraged, turn off the radio and and miss the thrill of working distant stations during a band opening. To get started on 2m SSB, the trick is to get on the air at times when you know there will be activity— during VHF nets and VHF contests.

Here in Colorado, the local Rocky Mountain VHF Plus net is on Monday night at 8:00 PM local time on 144.220 MHz (USB). This net is centered in the Denver area but VHF enthusiasts check in from all around Colorado. It is very common to have stations check in from the bordering states of Wyoming, Nebraska, Kansas, New Mexico or even Oklahoma. More information on the net and other VHF activities can be found at http://www.rmvhf.org

VHF Contests

Think of VHF contests as "VHF activity weekend" since they are a great opportunity to just get on the air and work most of the local 2m SSB enthusiasts. The main contests are the ARRL June

VHF Contest, the ARRL January VHF Contest, the ARRL September VHF Contest and the CQ Worldwide VHF Contest in July. For more information, take a look at the article How to Work a VHF Contest.

Equipment

The required equipment for getting started on 2m SSB is pretty basic – a transceiver capable of 2m SSB and a 2m antenna. If you own one of the rigs mentioned above then you are probably ready to go. The 2m antenna you already have is probably vertically polarized since that is what we use for 2m FM, both mobile and base stations. All of the 1/4-wave and 5/8-wave antennas that are commonly used for 2m mobile work are vertically polarized. Most omni-directional base station antennas such as those made by Cushcraft, Diamond, Comet, etc. are vertical, too. These antennas will work for SSB but most of the really active 2m SSB stations use horizontally-polarized antennas. Vertically-polarized stations can work horizontally-polarized stations but there will be a substantial signal loss (about 20dB?). If vertical is all you have, then give it a try. If you can get a horizontal antenna, then your results will be much better.

The most common horizontally-polarized antenna on 2m is a Yagi mounted so that its elements are parallel to the ground. There are a variety of horizontally-polarized, omni-directional mobile antennas, such as the HO antenna made by M2 (see http://www.m2inc.com).

Get on the Air

This information is intended to get your started on your way to operating 2m on the SSB portion of the band. You will learn more as you get into it and you will find that most of the people hanging out down on sideband are friendly, knowledgeable and helpful. They are always happy to see new call signs on the band.

Some resources available on the web are:
Rocky Mountain VHF Plus web page: http://www.rmvhf.org
VHF Operating articles by KØNR (similar to this one) at: http://www.k0nr.com/
North East Weak Signal Group web site at: http://www.newsvhf.com/

Improved IC-705 SOTA/POTA station

Posted on 28 September 2023 by Bob K0NR — 5 Comments ↓

This past year, Joyce/\K0JJW and I did quite a few Summits On The Air (SOTA) and Parks On The Air (POTA) activations, often as part of an RV camping trip. During this time, we made some improvements to our portable gear. For SOTA, we primarily use the VHF/UHF bands but we have been sprinkling in a bit more HF activity. For POTA, we often don't have a Height Above Average Terrain advantage, so we definitely use the HF bands.

The ICOM IC-705 is a great backpack portable rig for SOTA and POTA.

Our main goal was to have a backpack portable station for SOTA and POTA that can cover HF through 70 cm, on the most popular bands/modes including CW, SSB, FM and FT8.

Using The IC-705

This 4.5 Ah battery from Bioenno is a compact, lightweight battery for portable operating.

The Icom IC-705 is a great transceiver for covering most HF, VHF and UHF bands. With an external battery, the transceiver puts out 10 watts of RF power. (This is a bit less than the 50 watts from our Yaesu FT-90, which is our default choice for 2m and 70 cm SOTA.) We have accumulated a number of Lithium Iron Phosphate batteries from Bioenno. They are all set up

with PowerPole connectors and are easily interchanged. See a previous post, My SOTA Battery Journey.

Arguably the biggest weakness of the IC-705 is the lack of an internal antenna tuner for the HF bands. Of course, you can operate without a tuner by making sure your antenna is always 50 ohms. I find that limiting, especially under portable conditions where the antenna configuration might be compromised. Also, some common end-fed antennas that cover multiple bands are not a good match for all bands. There are *external* automatic antenna tuners available for the IC-705, so initially those looked like a good solution. Then I remembered that I had a small MFJ-902 Travel Tuner that could do the job. The MFJ-902 is a classic T-network with two variable capacitors and one variable inductor. I gave it a try and was impressed with how easy it was to tune using the SWR meter of the IC-705. This thing is simple and it works.

The MFJ-902 Travel Tuner is a simple T-network antenna tuner.

The rear panel of the tuner has two SO-239 connectors, one for the transceiver and one for the antenna. I put a BNC adapter onto the transceiver port and used a short BNC cable to connect to the IC-705.

The rear panel of the Travel Tuner, with an SO-239-to-BNC adapter installed.

A typical picnic table setup using the IC-705 with the MFJ-902 tuner.

The Travel Tuner is compact and not very heavy, so it works out well for backpack portable use. It can handle up to 150 watts, which is overkill for the IC-705 but it may come in handy when used with a higher power transceiver. Still, I am on the lookout for an even more compact (probably lower power) manual antenna tuner.

A typical end-fed half-wave wire antenna for 15 meters.

We have collected a variety of HF antennas, focused mostly on 20 meters and higher. These are typically end-fed, including single-band half-wave designs as well as multiband random-length antennas. These are used in the classic SOTA configuration with one end of the wire supported by a lightweight fishing pole and the coax connection on the ground, fed by a 25-foot length of RG-8X coaxial cable.

FT8 Solution

With the popularity of FT8 on the HF bands as well as 6 meters, I figured we should include that mode in our portable kit. My first thought was to use a compact Windows computer running the standard WSJT-X software. Ultimately, I chose the SDR Control app for the Apple iPad (by Marcus/DL8MRE), which supports specific Icom radios. The iPad connects to the IC-705 via its WiFi connection, which simplifies the connection/cabling challenge. The SDR Control app does cost $49.99, so it is not your inexpensive iOS app but I have found it to be worth the price. Because this app is focused only on iOS and certain Icom radios, it is well-tuned to be a no-fuss solution. I am currently using the app only for FT8 but it has other features and modes for me to explore.


The portable station for FT8, running SDR Control on an iPad.

The Powerwerx PWRbox is shown in the photo above, which we often use for operating POTA. (This box is a bit heavy for hiking.) The PWRbox holds a 20 Ah battery as described here. Also shown in the photo is a handy little stand for the IC-705, the NEEWER Folding Z Flex Tilt Head. It does a great job of holding and stabilizing the radio at a variety of angles. (Hat tip to Kyle/KD0TRD.) It is also a little heavy for backpack portable, so it usually gets left behind on a hike.

The Maxpedition bottle holder case works well with the IC-705.

For a protective case for the IC-705, we use the Maxpedition 12-Inch X 5-Inch Bottle Holder. I've seen other IC-705 users recommend it and OH8STN mentioned it on his blog. At first glance, the case seems a bit large but this provides enough room inside to stow a small Bioenno battery and other accessories. The side pouch is a good place for storing the microphone and power cord.

Wrap Up

This post shares some new equipment configurations we are using for SOTA and POTA, mostly focused on the IC-705. I really like that radio for portable ops as it is the best solution for operating HF through UHF. The SDR Control software on an iPad has also turned out to be a win for us.

What are you using for your portable station?
Do you have any tips or other operating ideas?

73 Bob K0NR

Related

More On SOTA and POTA

Why Use FT8 For POTA?

June QST: SOTA, POTA and VHF Contest

This entry was posted in Equipment, Ham Radio, HF, POTA, SOTA, VHF/UHF by Bob K0NR. Bookmark the permalink.

5 Replies to "Improved IC-705 SOTA/POTA station"

1. John on 29 September 2023 at 1:06 am said:

   Nice setup. Another plus for the MFJ-902: passive components = less likely to fail.

   Reply ↓

   - Bob K0NR on 30 September 2023 at 11:16 am said:

     Yes, definitely.

     Reply ↓

2. Pingback: Why Use FT8 For POTA? - The KØNR Radio Site
3. Pingback: Pourquoi utiliser FT8 pour POTA ? | Royal Radio club du Borinage
4. Pingback: Top Five K0NR Blog Posts for 2024 - The KØNR Radio Site

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sFavorite Links

- Chaffee Lake Amateur Radio Association (W0CLA)
- Colorado 14er Event
- Colorado SOTA Web Site
- Colorado VHF Group (KV0CO)
- Ham Radio School
- KB6NU's Ham Radio Blog
- Matt K0MOS SOTA Blog
- QRP Am Radio Club Intl
- Rocky Mt VHF Plus
- SOTA Watch
- The ARRL Web Site
- Tri-Lakes Monument Radio Association (W0TLM)
- VHF Grid Locator (K2DSL)

The Future of Emcomm

Posted on 17 October 2024 by Bob K0NR — 10 Comments ↓

Here comes Starlink!

 I've been reading a number of reports from the areas affected by the two major hurricanes (Helene and Milton). The North Carolina experience is particularly interesting because people have experienced the loss of communication and electrical service for several weeks. I can imagine this same thing happening in other parts of the country, including my area. As one example, read the on-the-ground disaster report from Thomas/K4SWL.

There are two important technology disruptions showing up in North Carolina: satellite-based internet (Starlink) and mobile-phone-to-satellite (SMS) text messaging. Starlink is having a significant impact during this incident, while mobile phone satellite messaging is still emerging. Steve N8GNJ has some worthy thoughts on these topics in Zero Retires 173. Although I have served in many ARES/RACES deployments over the years, I don't consider myself an expert in this area. I'd appreciate comments from Emcomm folks who have spent more time thinking about this.

 A typical ham radio emcomm station with multiple radios covering multiple bands.

Types of Emergency Communication

Most relevant emergency comms lump into 1) short-range comms (< 5 miles) between family, friends, and neighbors. 2) medium-range comms (50 miles) to obtain information and resources. 3) long-range comms (beyond 50 miles) to connect with distant family, friends, and resources.

1. **Short-Range Comms:** This is the type of communication that is well served by mobile phones, except when the mobile networks are down. This is happening a lot in North Carolina. Lightly licensed VHF/UHF radios such as FRS and GMRS can be used to replace your mobile phone. Think: wanting to call your neighbor 3 miles away to see if they are OK or can provide something you need. (I have a few FRS/GMRS radios in my stash to share with neighbors. See TIDRadio TD-H3) VHF/UHF ham radio is, of course, even better for this, except the parties involved need to be licensed. (OK, you can operate unlicensed in a true emergency, but that has other issues. See The Talisman Radio.)
2. **Medium-Range Comms:** This is a great fit for VHF/UHF ham radio using repeaters or highly-capable base stations. GMRS repeaters can also serve this need. These communications will typically be about situational awareness and resource availability in the surrounding area. For example, someone on the local ham repeater may know whether the highway is open to the place you want to drive.
3. **Long-Range Comms:** Historically, this has been done by HF ham radio and a lot of emergency traffic is still handled this way. The shift that is happening is that setting up a Starlink earth station feeding a local WiFi network can help a lot of people in a very effective manner. Compare passing a formal piece of health-and-welfare traffic via ham radio to letting a non-licensed person simply get Wi-Fi access to their email or text messaging app. Hams are doing this, but many unlicensed techie folks have set up these systems and freely shared them with the public.

Mobile Satellite Messaging

Various providers now offer a basic text messaging capability using smartphones talking to satellites. Today, this capability is often limited to emergencies ("SOS"), and it is relatively slow. With time, this capability will certainly improve, and basic satellite texting will become ubiquitous on smartphones. This will be great for checking in with distant friends and families, but it may not be that useful for Short Range and Medium Range comms. Someday, it might include voice comms, but in the near term, it is probably just text-based.

Evan K2EJT provides some useful tips based on his experience here in this video. However, he doesn't address the Starlink capability.

Summary

While much of the public appreciates the usefulness of ham radio during emergencies, I am already hearing questions like "Doesn't Starlink cover this need?" My view is that Starlink (and similar commercial sats) is very useful and will play an important emcomm role, but it does not cover all of the communication needs during incidents such as hurricanes, blizzards, wildfires, earthquakes, etc. Similarly, Mobile Satellite communications will be a great help during

emergencies in the future but will probably not cover every need. Emcomm folks (ARES and RACES) will need to adapt their approach to take this into account.

Those are my thoughts. What do you think?

73 Bob K0NR

One Radio To Rule Them All (Ham, GMRS, FRS, MURS)?

Posted on 8 September 2021 by Bob K0NR — 15 Comments ↓

The common Baofeng UV-5R can transmit and receive on a wide range of frequencies…but not necessarily within FCC rules.

From time to time, the question is raised about using radio equipment in multiple radio services. One common example is a licensed radio amateur that wants one radio to cover the Family Radio Service (FRS), General Mobile Radio Service (GMRS), and the 2m/70cm ham bands. Some people also want the Multi-Use Radio Service (MURS)…or maybe even marine VHF or aircraft VHF. The thinking goes that if one radio can transmit and receive on all these frequencies and that person is authorized to use those frequencies, then one radio can do it all.

This seems like a reasonable objective but the problem is that the FCC has a few rules and regulations that come into play. This leads to an important note: *I am writing about the FCC rules and regs here…you may choose to ignore them but that's on you.*

Part 97: Amateur Radio Service

First, the good news. The Amateur Radio Service, governed by FCC Part 97, has very few restrictions on the type of equipment you can use. Heck, you can build a transceiver from parts and put it on the air. So the ham rules are not going to be a major limitation.

Part 95: FRS, GMRS and MURS

FRS, GMRS, and MURS radios are governed by FCC Part 95. Section 95.591 says this about FRS radios:

§ 95.591 Sales of FRS combination radios prohibited.

Effective September 30, 2019, no person shall sell or offer for sale hand-held portable radio equipment capable of operating under this subpart (FRS) and under any other licensed or licensed-by-rule radio services in this chapter (devices may be authorized under this subpart with part 15 unlicensed equipment authorizations).

Section 95.1761 says this about GMRS transmitters:

(c) No GMRS transmitter will be certified for use in the GMRS if it is equipped with a frequency capability not listed in § 95.1763, unless such transmitter is also certified for use in another radio service for which the frequency is authorized and for which certification is also required. No GMRS transmitter will be certified for use in the GMRS if it is equipped with the capabilities to operate in services that do not require equipment certification, such as the Amateur Radio Service. All frequency determining circuitry (including crystals) and programming controls in each GMRS transmitter must be internal to the transmitter and must not be accessible from the exterior of the transmitter operating panel or from the exterior of the transmitter enclosure.

(d) Effective December 27, 2017, the Commission will no longer issue a grant of equipment authorization for hand-held portable unit transmitter types under both this subpart (GMRS) and subpart B of this part (FRS).

The Midland MXT400 is a typical GMRS mobile transceiver.

Similarly, MURS radios have this restriction (Part 95.2761):

(c) A grant of equipment certification will not be issued for MURS transmitters capable of operating under both this subpart (MURS) and under any other subparts of this chapter (except part 15).

The FCC is saying (requiring) that FRS, GMRS and MURS radios must work on their designated frequencies and nothing else. At one time, it was legal to sell a combination FRS/GMRS radio but the FCC has specifically removed that option. Part 95.1761 seems to leave an opening for a GMRS radio that is also certified for use in another radio service, but that is a very thin opening and it specifically excludes the Amateur Radio Service.

Now, why would the FCC put these restrictions in the regulations? The answer is pretty simple: these radio services are intended to be used by everyday, non-technical folks. The radios need to be simple to use and not include the capability to wander off onto any old frequency. Hence, the rules lock down the frequencies that the radios can use.

(As a side note, this regulatory approach is good for amateur radio. Imagine if FRS radios had Channel 30 set up to transmit on 146.52 MHz, with a note in the manual that says “only use this channel if you have an amateur radio license.” We would have a crapton of unlicensed operating on 2 meters.)

Part 90: Private Land Mobile Radio Services

Part 90 regulates a broad range of land mobile radio, including public service, police/fire, search and rescue, forestry, utilities, and businesses. Licensing is very specific under Part 90. A radio

license will specify a particular set of frequencies allowed, specific power levels and emission types, and even the allowed operating location of the radios.

Radios designed for Part 90 are usually programmed by a radio tech to operate only those specific frequencies that a licensee is authorized to use. This results in a relatively simple operating set up with the user just selecting from the preset channels on the radio. Part 90 radios normally cover a wide range of frequencies so that the manufacturer and the radio shop can sell one radio model to any licensed user.

In many cases, these Part 90 radios cover the adjacent amateur bands, such as 2m and 70cm. (For example, the Anytone AT-D878UV is Part 90 certified and covers 140-174 MHz and 400-480 MHz.) So this does open up the possibility of using a Part 90 radio under a Part 90 license *and* using it on the ham bands. A typical scenario is when a Search and Rescue member has a Part 90 radio set up to use the S&R frequency as well as the 2m/70cm amateur bands. The key to this is starting with a radio that is Part 90 certified and then programming it for the amateur band. Of course, you need to be authorized to use the Part 90 frequency and have an amateur radio license.

Getting Creative on Radio Configuration

A few years ago, Anytone Tech tried to market the TERMN-8R VHF/UHF radio as legal for the ham bands, GMRS, MURS and Part 90 use. An early review of this radio is here on the PD0AC blog. Basically, the radio had three distinct operating modes: GMRS, MURS, and Commercial/Normal. Initially, the FCC approved the radio but later took a closer look and canceled the authorization. The TERMN-8R is still available but without the three modes. It is marketed as a Part 90 radio that also does the amateur bands.

The Anytone TERMN-8R handheld transceiver.

I recently became aware of the Anytone AT-779UV which is sold in the USA as a Part 95 GMRS radio. However, using the programming software, the radio can be configured to cover the 2m and 70cm amateur bands or a much broader range of frequencies (136-174 & 400-470 MHz). If you change the radio configuration to operate on the ham bands (or wider), the radio is no longer Part 95 certified. The configuration via software takes some knowledge and effort so it is not a mode that you can easily switch back and forth. It is really no different than other software-programmable radios.

Wrap It Up

So there you go, your dream of One Radio To Rule Them All (FRS, GMRS, MURS, and the 2m/70cm ham bands) is not going to happen. At least not legally. You can configure a radio to do this…but it will not meet FCC regulations. However, you can configure a Part 90 radio to operate legally on Part 90 frequencies and on the amateur bands.

A Better Antenna for Dualband Handhelds

Posted on 20 January 2018 by Bob K0NR — 6 Comments ↓

I'm a fan of using a half-wave antenna on a 2m handheld transceiver (HT). These come in a variety of forms but I've tended to use the telescoping half-waves that mount on the HT. These include the Halfwave 2 Meter Flex antenna from Smiley and the MFJ-1714 from MJF. One of the disadvantages of these two antennas is that they are designed for 2m operation only. Put it on a dualband HT and you can only use one of the bands.

Now there is a dualband alternative.


The RH 770 dualband antenna

During a discussion of various VHF radios and antennas on the SOTA reflector, Phil/G4OBK recommended this antenna: TWAYRDIO RH 770 SMA-Male Dual Band Telescopic Handheld Antenna. I was mildly skeptical in that the antenna looks like ~~cheap~~ ~~lowcost~~ economy stuff from China. However, for $16.55 (free shipping), it seemed like something I should try out.

I've since used this antenna on several SOTA activations and have found it to work quite well. Not having to worry about whether I'm operating on 2m or 70 cm is a big plus. I liked the antenna so much, I now have three.

Recently, I wondered how well the antenna is really performing so I did a side-by-side comparison with the Smiley 2m halfwave. Now this kind of comparison is always a bit dicey unless you have a calibrated antenna range but simple comparisons are useful. I got on 2m fm with another ham running a home station some distance away such that I was not pegging his S-meter. We did several A/B comparisons between the Smiley and the RH 770. Much to my surprise, the RH 770 performed significantly better than the Smiley. That is, the other ham saw his meter deflect higher with the RH 770. I can't give that to you in dB but I can say it's a little better. I actually thought that the single-band design might win out due to less complexity in the antenna but the opposite was true. Your mileage may vary. No warranty expressed or implied.

The only thing I don’t like about the RH 770 is that the telescoping sections slide up and down really easy. Too easy for my taste. I’d rather have some stickiness to it so that I am sure it will remain fully extended. But I admit this is more of a personal impression than actual problem.

The antenna is available with a male SMA connector, a female SMA connector or a BNC. That should pretty much cover it.

So thanks Phil/G4OBK for pointing out this antenna. I also highly recommend it.

73, Bob K0NR