

Reliable Communications for an Unreliable World

Craig Carnahan - N7LB

Ideally, everything required for reliable communications (between your family, friends, neighbors, etc.) is already in place before an emergency hits (be it man-made or courtesy of “mother nature”) but if not, **the lack of communication preparedness exposes several problems**, normally centered around:

A) Lack of equipment for all parties involved

While one radio is better than none, if cell phones are down (or overloaded), or if power is out over a large area, can you really expect that “all” of the people important to you are going to be near your “one” radio?

B) Proper training in the use of the radio devices prior to the emergency

It’s great if you have all the right equipment, but if you are the only one that understands how to use it, chances are slim your spouse, kids, neighbors, or friends will be willing to spend time during the emergency to teach themselves how to operate it when you’re not there.

C) The equipment selected (prior to the emergency) isn’t designed to work within the current crisis

Little ½ watt FRS or 1-2 watt GMRS radios might work well when you’re in the house and the family’s out back in the yard, but we all know that the manufacturer’s claim of 35 mile range with FRS radios is really more like 35 acres. So when you’re at work, the spouse is shopping, and/or the kids are at school and suddenly an emergency situation arises, can you really count on your cell phone on an instantly overloaded public network? Will your low powered FRS/GMRS radios magically have the range needed to reach your family or friends across town? What about communicating with family or friends out of town or across the country?

D) No available power for the communication devices selected

Assuming the emergency lasts longer than a few hours, are you able to communicate for days or weeks? Is your equipment adaptable to run on more than just normal 110-120 VAC, or do you plan on never losing AC power? If you can run the communication equipment on DC, solar, wind, or have a back-up generator, have you tested it lately? Is it easily movable if you’re forced to relocate? Will both your communication gear and power supply survive multiple power surges, brownouts, or blackouts while the power company attempts to isolate and fix their power grid failures?

In most disaster zones, electricity is non-existent or scarce at best, and establishing power during the critical first 24 hours of an emergency is of utmost importance.

E) Individuals assume the cost of radio gear needed will be too high for their budget(s)

Most folks still assume that both ham radio and commercial gear are ALL too high priced for their budget, so they ignore these sources to solve their communication requirements. Usually knowing a ham within their neighborhood (and remembering large antennas on top of a large tower), they simply aren’t ready to invest that level of money and resources to a communication need that may never arise (in their opinion). Most are shocked to learn that they can enter the ham radio world of communication for less than \$100 and do not need a tall tower with a large antenna to get started.

Folks that are involved in communications for their career (or ones whose lives depend on it), generally count on wireless communications gear that is comprised of multiple types of equipment. If you have their budget(s), satellite communications work well (provided the correct satellite is in range and hasn’t been hit with space junk , or simply quit working – plus it’s hard to get a tech to make a onsite call in space).

Even our military understands that satellite communication has drawbacks, which is why they also use both “HF” (high frequency) and “VHF/UHF” (very high/ultra high frequency) bands, depending on their specific mission need. Many reconnaissance units are specifically trained to set-up both HF and VHF/UHF antenna systems (and keep a low profile while doing it).

Most individuals not familiar with radio communications hear the term HF and think of CB radios, or hear UHF and think of the relatively cheap (but underpowered) FRS radios that have very limited range. Both HF and VHF/UHF frequency bands have their pros and cons, but most folks find carrying around a radio the size of a CB, a car battery to power it, and an antenna 9 feet long (or larger) a bit much as a “walk-around” radio, so for the purpose of this discussion, let’s look at establishing a reliable communication connection using VHF or UHF equipment. Both VHF and UHF have several advantages for local communication requirements, among which are:

- A) First, VHF/UHF equipment is small and lightweight, making it easy to clip on your belt, or toss in the glovebox, back-pack, or purse.
- B) Second, some radios (even with small battery packs) can last for days powered on, and can be re-charged in just 3-4 hours, or can use “AA” or “AAA” battery pack shells,

meaning you can power them with standard batteries if you have the need. Some even have the ability to plug the radio (for power) into your car, truck, or van's cigarette lighter (finally a use for that if you don't smoke)!

- C) Third, the gain antennas for the VHF and UHF bands are much smaller compared to the HF bands. Many HOA's think they're your TV or satellite antenna, so hopefully no HOA Police are reading this article. If so, forget I mentioned it! If you are interested, call us and we can discuss some interesting antennas for additional range.

One thing I need to mention, in the VHF/UHF frequency world, "**Height is Might**" – meaning that the higher the antenna, the more punch (or gain) your signal has. A poorly made (or installed) outside antenna at 20 feet (the apex of your house for example) will almost always outperform an expensive indoor antenna. Antenna design can be discussed for hours, so if you want more information, call me with your needs.

- D) The fourth benefit of VHF/UHF communication is how quiet the radio receivers can be. These small radios use FM, or frequency modulation, rather than CB radios that use AM, or amplitude modulation. Instead of hearing racket all day long from the speaker, you can turn on the radio, set the squelch, set a PL tone (called a Privacy Code in the FRS/GMRS world) and literally leave the radio on all day and night without hearing a peep if that's what you want.

The only time you'll hear anything is when someone has both "your" frequency and "your" PL tone entered on their radio and calls you. Even then, you can further enhance your privacy by adding DCS (digital coded squelch) on top of your PL tone. Of course, you just made it much harder to talk to your radio, so you need to make sure everyone you want to talk to knows how to control or implement those advanced features (remember item "B" listed on page one).

- E) The fifth benefit is one I hesitate to bring up, but I know you're going to ask me if I don't address it, so here goes. *My CB radio has 4 watts output on AM and 40 channels, so how many watts do I get with this FM radio, how many channels does it have, and how far can I talk?*

Great question, but it requires a more complicated answer, so let me start with the easy stuff and then I'll explain the answers.

First, most VHF/UHF handheld radios have 5 watts output on VHF and 4 watts output on UHF. Many of these VHF/UHF newer radios can use 2.5KHz channel spacing (instead of wider 10 KHz channel spacing used in CB), so we can get 4 channels into the same space as 1 CB channel, but the BIG surprise is the bandwidth these radios cover. If you trust my math, **the frequency bandwidth of the radios divided by 2.5KHz (per channel) gives the radio over 63,000 possible channels.**

The reason I hesitate to tell you this is that most of these channels are already spoken for by various agencies, companies, schools, etc., many of which would complain very forcefully to the FCC if you suddenly started chatting with your pals on "their" frequencies. **Just because the radio can transmit there, does not mean you should plan on talking there.**

- F) The sixth benefit is that the radios can also act as handheld scanners, and you are legally allowed to listen to your local government agencies of choice. The built-in LED flashlight (available on some models) is really handy when changing a tire in the middle of the night as well.

I'll bet you thought I forgot about the last part of your question, you know, how far can I talk with this radio? That's the hardest answer to articulate, because it depends on so many variable factors.

Let's assume for a minute you're an unlicensed user with the standard rubber antenna that comes with the radio and your buddy has a similar setup. On flat level ground with no metal buildings blocking your RF signal, 4 to 5 miles (or more) is the norm, but it can vary wildly depending on many factors.

If you (or your buddy) install a better antenna, your range can easily double. If you (or your buddy) install an outdoor antenna and get some height (even 15-20 feet), some folks talk 25 miles or more. I've talked 120 miles on UHF simplex (no repeaters) from Tucson to Gilbert, but I was up at the village of Summerhaven, which is roughly 8,000 feet high on Mt. Lemmon, so your range may vary, but the real distance jump comes with what's next.

Many of these radios are actually designed as wide-bandwidth commercial radios (136-174MHz on VHF and 400-520MHz on UHF), but they will operate (with a license) on the amateur (or ham radio) bands. What makes that so special? With a ham radio license you get access to repeaters, many of which are based on mountain tops. Remember that "**Height is Might**" VHF/UHF frequency rule? A mountain top repeater at 8,000 feet (or higher) can easily repeat your signal for a hundred miles or more in all directions, plus many repeaters can be "linked" together in different ways.

Living in AZ we're lucky to have multiple mountain top linked systems all around the state. I'm not joking when I say that a little 5 watt FM HT radio can hit a mountain top repeater (all by itself) and that linked repeater will re-broadcast your transmission to multiple linked repeaters. What's that mean for the "range" question? Well, you can be sitting at a restaurant in Tucson and talk to someone in Flagstaff, how's that for range for a 5 watt handheld radio?

Still not enough range? Well, there's a second linking method. Hams are now using internet based VOIP technology to link repeaters from all over the world. With the correct touch tone codes (entered on the front of the radio's keypad), you can bring up an "EchoLink" or "IRLP" repeater in all 50 states and many foreign countries. All that is needed is your Technician (beginner) class amateur radio license.

Why can't I just use my cell phone? I have a great data plan package! Cell phones are based on a very complex infrastructure that is easily overwhelmed by a variety of issues, including the number of users attempting to use the service at any one time, earthquakes, hurricanes, floods, fires, and most any other disaster. If your local cell phone towers are knocked out of service, you have no cell service, even if the rest of the country is still up and running. VHF/UHF radio service is different because it's a direct two-way service that not only endures disasters very well, but when combined with the additional benefits of Amateur Radio, is able to reach far beyond the distance of cell phones, family radios, or even CB radios because of both:

- A) the higher transmitting power allowed to Amateur Radio operators, and
- B) the additional frequencies (or bands) assigned to Amateur Radio operators

As a reference, Amateur Radio operators have twenty-six different bands (or chunks of frequency), set aside for their use by the FCC, ranging from 1.8 MHz (near AM broadcast radio) up to 275 GHz. Again, ham radio frequencies are not normally thought of in terms of "channels", but if there were, using the previous 2.5KHz channel sample, these band allocations would represent millions of channels available for Amateur Radio use.

Amateur Radio operators even practice working each other (without normal grid power) every year during an event called "Field Day", where they set up a portable station with temporary antenna(s) to work other Amateur Radio operators around the world – all without any grid power for their radios.

Skills learned during Field Day events are useful in emergencies, when regular local communications such as home telephones and cell phones are not available due to disasters such as terrorism, tornadoes, hurricanes, etc.

"Oh no, ham radio is way too technical and expensive for me, the antennas and towers are huge, plus who wants to learn Morse Code, I just want to talk." Morse Code has been gone as a FCC requirement for several years, and your FCC Technician class license gives you all ham radio privileges above 30 MHz. These privileges include the very popular 2m, 1.25m and 70cm bands. Technicians may operate FM voice, digital packet (computers), television, and single-sideband voice. You can even make international radio contacts via satellites, using relatively simple station equipment. Technician's also have additional privileges on certain HF frequencies, including 200 KHz of voice privileges on the 10m band, with a maximum power level of 200 watts PEP (vs. 12 watts PEP on CB).

But don't you still need an antenna system designed by NASA to talk a few hundred miles away, or a few countries away? Not if you have a 5 watt handheld VHF/UHF radio, a decent antenna, and a ham radio license so that you can access linked repeaters. If you wish to work HF (10 meters) you can even use a wire antenna between two trees or two poles and up to 200 watts PEP.

Don't I need to know a lot of math or electronics to pass the FCC test? Not at the beginner Technician class level (which is all you need to use these radios on linked repeaters). Your FCC test consists of just 35 multiple choice questions and you need to get just 26 right out of 35 to pass (that's just 74%, hardly that difficult, plus you can miss every single math question on the test and still pass).

We have 6 year olds with their license and the hobby has exploded in popularity during the past several years, with over 725,000 hams in the U.S. alone, and more than 3,000,000 worldwide. It's true that the test pool consists of several hundred questions and that the examiners choose just 35 questions for your particular test, but here's an example of an actual question (with the actual answers provided to you by the FCC):

What could happen if a person accidentally touched your antenna while you were transmitting?

- A. Touching the antenna could cause TV interference
- B. They might receive a painful RF burn
- C. They might develop radiation poisoning
- D. All of these choices are correct

Well, that does sound easier than I thought, but I don't have to time to attend classes every week, plus I don't want to look foolish asking some "engineering types" for help in class.

Guess what, we have a solution for that as well.

"Ham Test Online" is an internet based, self-paced training class we offer to folks that want to be able to reliably communicate with their family, friends or neighbors using technology that, up until now, was either outside their budget, they didn't know existed, the FCC license requirements stopped them, or lack of a local training site stopped them. The training is so well done that the local developer's (they live in AZ) offer you a 100% guarantee - you pass your FCC test or you get your training class money back. No other method, be it book or class based, offers this money back guarantee.

Most folks (outside of the communication geeks or ham radio folks like me) are usually not even aware of this type of VHF/UHF technology and how inexpensive it has recently become, or how easy it is to get your ham radio license.

To make it even easier, we can pre-program your radios with a variety of different frequency templates available (you can always listen in on conversations, be they on Police, Fire, or even NASCAR frequencies) or actually jump in yourself on your allocated ham radio frequencies once you get your FCC license. So the same radio that can be used for ham radio can also be used for a variety of other frequencies!

That's a huge benefit, as it means you can use the radio right now and the same radio when you obtain your amateur radio license. No more throwing away money on equipment (like the limited range FRS radios) that you'll probably never use again (once you get your ham radio license).

If you are interested, call us toll-free at 866-448-4327 and ask about our various specials, including a special bundle with the “Ham Test Online” training class, or how to get a radio that already programmed for your area (REGARDLESS OF WHERE YOU LIVE WITHIN THE U.S.)

I think you’ll be surprised just how inexpensive it is to become a ham radio operator today, and once you do, a world of contacts can open up for you.

If I haven’t convinced you to look at using VHF/UHF technology as an essential part of your communication strategy yet, consider this:

The tragic events of Sept. 11, 2001, and Hurricane Katrina in 2005 highlighted two phenomena common in disasters:

A) commercial network communications tower sites were destroyed, and

B) network traffic overwhelmed what little commercial communication systems remained —

two distinct issues that caused failure in both public safety and consumer-oriented communications over wide-spread areas.

Power failures cut off the internet, and in New York City, debris raining down onto ground-based infrastructure, like switching equipment, destroyed much of any commercial communication gear left.

In the early stages of both emergencies, however, a group of individuals stepped in and provided much of the critically needed communication requirements to various public service agencies (that had no communication capabilities) with privately owned radio equipment, at no cost to the taxpayer and with communication skills hardly considered “amateur” in nature.

In New York City, a group called the “Amateur Radio Emergency Service” (known as ARES) was activated within five minutes of American Flight 11 crashing into the north tower, the first attack. Private, non government Amateur Radio Operators, called “Hams” for short, worked in shifts for two weeks, mainly using VHF and UHF communication gear.

When Hurricane Katrina hit the Gulf Coast in 2005, Amateur Radio Operators were functioning three days *before* landfall. At the request of the American Red Cross, Amateur Radio Operators then supplemented communications at more than 200 shelters. 700 Amateur Radio Operator volunteers were working by Sept. 6th, again mainly using VHF and UHF communication gear.

In closing, and to borrow an idea from my old WV Troop 34 Boy Scout group, nothing makes more of an impact during a crisis or emergency than being prepared for it.

You can have a great bug-out location, the best stockpile of food and water, enough firearms and ammunition to re-stock the 3rd Army, and even a reliable power source, but

“if you can’t reliably communicate, you’re alone”.

Thank you for your time and interest. Please give us a call or stop by our **RF Gear 2 Go** booth at various hamfests (just look for the radios that can be pre-programmed by us for your area) if you have any questions!

Craig Carnahan – N7LB
RF Gear 2 Go Founder

480-633-0378 Local Phoenix Area
866-448-4327 Toll-Free