Thoughts on 2 Meter Packet Radio
By WA4ZKO - May 2010

Over the last few years I've received many inquiries/comments regarding my stance on 2 meter packet radio. It's no secret that I'm NOT a big promoter of using 2 meters for packet radio. I take that stance for a variety of reasons. Some folks agree, some wanted clarification, and one seemed a tad too easily offended.

In a variety of discussions over the years I've covered my thoughts on this topic ad nauseam. So I figured it was time to put my thoughts on it together in one spot. You may not agree with me, but if you're not clear on my stance after reading all of this, then sorry...I tried.

First off, in general I have no beef with the 2 meter band. It's one of my favorite weak signal bands.

Second, I primarily look at packet radio as a tool for EMCOMM. I see packet radio as a relatively cheap and effective solution to a real world backup communications need. Unlike some other digital modes promoted for EMCOMM, packet radio is not a solution looking for a problem to solve. Even if you disagree with that view, keep that "bias" in mind as you read though this.

Third, I just don't foresee any real future for a large packet network beyond EMCOMM. Build and maintain a large packet network just for experimentation? I agree we need a lot more experimentation throughout the hobby. The problem is can experimentation alone justify keeping a large packet network on the air long term? I seriously doubt it. Considerable packet radio history would seem to support me on that one. Successful packet networks will need to fill a real world long term need, not the whim of the week.

Forth, for the folks thinking they will get all kinds of daily usage if they just get enough nodes on the air..... you dearly need a reality check. Many seem to long for a return to the so called "glory days" of packet radio back in the 1980's and 1990's. I hate to break it to those folks, but those so called "glory days" of packet radio are NOT coming back and that is a good thing. In most cases those "glory days" were poorly thought out, poorly implemented, poorly maintained, and just slap anything on the air approaches that resulted in many unusable networks that inevitably collapsed. Unfortunately it appears far too many folks did not learn much from that period of packet radio history. Let us not repeat the past.

Fifth, am I a big promoter of 2m packet? Nope. Why not? The reasons are many, so let me just summarize ten of them here (short version):

1. We have better bands for data.
2. 2 meters for packet radio far too often takes well intentioned folks down a "failed" road.
3. Tends to keep far too many stuck in the slow lane of 1200 baud packet radio.
4. Why self-QRM if you don't have to? (Read that one again)
5. Why create more potential QRM issues with your served agencies in a cramped EOC/MCP?

7. We've already have one data application on the band, APRS.

8. Tends to promote the proliferation of "wannabe BBS" TNC mailboxes.

9. Tends to promote the proliferation of KA-Nodes.

10. Your served agencies and communities deserve better.

The above aside, if 2m 1200 baud packet meets your needs and you truly feel it’s the best choice then have at it. I’m not condemning it far and wide. All I ask is that folks give the above some serious consideration. Are you using the right tool for the job or just taking easy road? Fair enough?

Now for the longer version……

1. We have better bands for data.

220, 70cm, and 33cm are much better suited for data. If nothing else, 6m and 2m tend to be noisy bands. I've seen a good line of t-storms several counties away seriously degrade 6m and 2m links with QRN. Even during calm weather, both bands tend to have high noise floors and more prone to a variety of QRM/QRN issues.

We ran a lot of 2m packet in the early 1990's. Then towards the late 90's, we ran some tests with 220 and 70cm here locally and frankly never looked back. A somewhat shaky 30 mile 2m link using 45w rigs was suddenly rock solid at 25w on 220.

What was the difference? Bit more gain in the antennas? Nope, it might have helped a wee bit, but it really doesn't account for much since TX powers were 2-3 dB lower than what was being used on 2m. and 220 incurs a bit more feedline loss. The big difference is how it propagates and the much lower and CONSISTENTLY lower noise floor that 220 offers at most sites.

220 is the best kept secret in VHF/UHF ham radio for a reason. 220 offer a great blend of 2 meter's rural range combined with UHF's urban penetration and low noise floor. You get the proverbial best of both worlds (2m/70cm). The band is also more resistant to t-storm QRN degradation. Being nearly UHF, 220 can usually coexist with other VHF-HI systems without the need for expensive and limiting filtering.

Yeah for a long time 220 rig availability left a lot to be desired. That's not the case anymore. You have plenty of options for 1200 baud packet on 220. Used or new 220 gear is plentiful and cheap now. Today it’s as easy to get a 220 rig as it is to get a 2m rig.

Probably the only fault I can find in 220 is that there are few if any decent 9600 baud rigs available. R&L/Jetstream blew a great opportunity with their recent venture into 220 mobile radios. Had they built their Jetstream JT220M rig with an eye towards 9600 baud packet the packet radio community would of flocked to it. Yeah you can hunt around and maybe find the MFJ data radios on 220, but those rigs leave a lot to be desired.

That said, 220 is a wonderful band for 1200 baud packet links.
2. 2 meters for packet radio far too often takes well intentioned folks down a "failed" road.

The use of 2m 1200 baud too often results in well intentioned packet folks all pilling onto one overloaded, hidden transmitter full, QRM prone 2m frequency, and trying to cover way too large of an area on too few frequencies (often just one). Often this approach will result in user access, inter-node traffic, and (even worse) BBS-to-BBS forwarding going over the same frequency.

The results of such packet network "design" (I'm being charitable) are predictable and packet radio history covers it well. The frequency rather quickly graduates into becoming a total zoo. This "zoo network" seems to work (sort of) during normal times, yet stumbles badly or collapses upon itself if subjected to much loading. Then far too often the “fix” is to just add more nodes or (even worse) digi’s to the frequency which only adds to the problem.

Far too often the concept of a backbone is lost as the goal seemingly becomes how many nodes can we put up on a frequency, how big is our "MH" or Nodes lists, and in general a network assembled without much consideration as to what the primary goals really are. Enough throughput to support more than a few casual users? You gotta be kidding me!

Now in fairness, if their only goal is just experimentation and having fun, I tip my hat to them and say have at it. If the goal is a serious packet network that could reliably support more than a few concurrent users, sustained loading, and thus be reasonably useful for "real world" EMCOMM data needs - then I can only shake my head at how some never learn.

3. Tends to keep far too many stuck in the slow lane of 1200 baud packet radio.

We all know it's long past time to move on from 1200 baud packet. We've known it for years. If you've traveled the country like I have over the years, you'll realize that many packet folks just don't seem to learn. You'll also notice that most of the 1200 baud only networks are almost always those adopting the 2m 1200 baud only mentality. History shows what happens (or doesn't happen) with these networks. Most see about zero usage. May I suggest that if you want a system to be used, then it needs to be useful….simple enough?

Sorry, but today there is no excuse for not embracing 9600 baud packet. There are several "off the shelf" rigs that perform well at 9600 baud. While most of these are not backbone grade, they are fine for general 9600 baud usage. We dearly need to start thinking of 9600 baud of a user speed, not just a backbone speed.

For backbones, a little patience in watching eBay will turn up used Kantronics D4-10’s (19.2k capable UHF data radios). You can also find GE MDS data radios from time to time. The GE MDS data radios are very fast and purpose built for data links. Someone good with IF design/hacking could probably come up with mods to push the GE MDS rigs to 19.2 or 38.4k, maybe even 56k.
A lot of folks have been turned off from 9600 baud by trying to use “off the shelf” rigs they thought were "9600 baud ready" and the rigs were very poor performers. Even if they got data flows on the link, it often wasn't very impressive nor seemingly worth the headache. 1200 baud is easy, probably too easy. A poor 9600 baud link will not seem any faster than 1200 baud and could even be slower. Also shoddy station practices will often work (sort of) on 1200 baud packet but clobber you on 9600 baud.

I recently worked with a packet group out near Los Angeles. They had deployed RMS WinLink at 9.6k on a 430 MHz channel using a very common 70cm mobile (brand starts with an A, grin). This is one of the rigs that is advertised as 9600 baud ready, but is a horrid performer at 9600 baud. Fine rig for 1200 baud, but it flat sucks at 9600 baud.

As soon as the radio was mentioned, I knew where the bulk of their problem was. I suggested trying some better radio choices and presto they got night and day differences in the speeds. Some parameter tweaks took performance up even more. These folks were literally ready to toss in the towel on deploying 9600 baud packet. Now that they have their first taste of what decent 9600 baud WinLink access is like, they're hooked. They are now planning the deployment of better 9600 baud spec'd radios as budgets/time allow. Trust me; once you've used a decent 9600 baud network...going back to 1200 baud is downright painful.

It would be nice if the ARRL Lab would create a 9600 baud "grading" system based upon both TXDelay and BER specs. I'd also love to see a minimum spec to be met before a rig can be advertised as a 9600 baud ready. A standard minimum spec for "user grade" and "backbone grade" would be great. These "grades" would help folks make better rig purchase decisions and put some heat on the manufactures to build better rigs.

Today we even have a nice "off the shelf, plug-n-play" solution....the Kenwood TM-D710 mobile. Most of the packet shortcomings in the D700/D7 handhelds have been improved upon with the D710 2m/440 mobile. The RF deck (like the D700) appears built for 9600 baud packet with very fast TXDelays and excellent BER specs. The D710's RF deck is frankly, darn near backbone grade!

You say, but a D710 is $500 new Jeff. Okay, check out what you would pay for a good dual band mobile and 1200/9600 baud TNC purchased separately? Yeah.....not such a bad deal now is it? Plus you're going to be hard pressed to find a dual-band mobile that has the D710's RF deck specs.

Take the Kenwood TM-D710 mobile, add the PG-5G serial cable option, plug in your laptop/PC, fire up your favorite packet terminal software, and presto you're in business. You've got yourself a fairly high power 2m/440 packet station that can not only do 1200 baud, it can do 9600 baud and do it well. This makes 9600 baud packet about as plug-n-play as it can get folks. IMHO, the Kenwood TM-D710 is a no-brainer choice for an EOC or MCP type deployment. It offers a lot of voice, APRS, and packet capabilities all packed into one small unit well suited for such cramped environments. Nice choice for a home packet station too.
My only gripe with the Kenwood TM-D710A, beyond some cosmetic “user interface” issues, is the built in TNC. While the TNC’s command set and KISS capabilities got considerable improvements, it still doesn't do as well with noisy signals as an external TNC would. So just like with the D7 and D700’s internal TNC, signals need to be reasonably strong for the D710 to work well if you’re using the built in TNC. Then again, your data links should be designed for and used with strong signals. Pushing your luck with weak data links is never a good idea for any data application. Data links are a very different beast compared to voice links and many folks fail to fully appreciate this.

Also many folks have excellent 9600 baud rigs at their disposal and don't even realize it. You're kidding Jeff? Nope. Many of the HF/VHF/UHF multi-mode rigs have very good to excellent specs for 9600 packet! Check the ARRL lab tests for your particular rig and you might be pleasantly surprised. Pricey choice for a standalone full-time node or backbone radio, but very practical for end user access and portable/EMCOMM operations!

I can't over emphasize that just because a rig says it's 9600 baud "capable" or "ready" does NOT mean it does 9600 baud worth a nickel. Many such rigs have slow turn around times (TXDelay), marginal frequency stability, and bad to atrocious Bit Error Rate (BER) specs. Please research your rig before buying it. For many "ham" rigs supposedly designed for 9600 baud packet, the ARRL Lab results in the product reviews may be a great place to get a feel for how the rig will perform (or not) at 9600 baud. NOTE: Seems the ARRL Lab is not doing BER testing on the latest rigs?????

So don't give me that garbage that getting on 9600 baud is too hard or too expensive. Was arguably the case in the 80's and 90's, but that's just BS. Let us start shifting off the 1200 baud side roads and get on the 9600 baud interstates.

4. Why self-QRM if you don't have to?

I simply don't feel it's a good idea to put your main "busy" data band on the same band as what will likely be your primary voice band (2m) during both normal and EMCOMM times. Why risk self QRM issues if you don't have to? It's not like we have a shortage of spectrum. Take a moment and reread those last 3 sentences.

Let's face it, we've already got APRS on the 2m band, do you really want the potential headaches of adding another (likely much busier TX wise) data application to a band only 4 MHz wide and with a fairly long wavelength? Sure you can try filters and so forth, but WHY BOTHER with the costs, losses, and other headaches those introduce? Even then, your typical filtering choices in such a cramped environment can only do so much for you.

Back in the early days of packet radio you might get away with arguing that not everyone has bands other than HF and 2 meters, but that's not the case today. Just about every ham has access to at least 2 meters and 440. The average VHF/UHF active ham is probably carrying at least 2 or 3 bands on their belt. Come on folks we've got much better choices for your data bands.....USE THEM. You often hear folks talking up the "use it or loose it" slogans all the time. I say talk is cheap, try walking the walk for a change.
5. Why create more potential QRM issues with your served agencies in a cramped EOC/MCP?

Now I realize that not everyone's served agencies are using VHF-HI for their public safety channels, but it's still very common. In my area, virtually all of our served agencies are very dependant upon both VHF-HI simplex and repeater channels for their primary communication channels. Even if your served agencies are on UHF/800 MHz, during a real disaster you may find the 154/155 MHz medical and inter-agency SIMPLEX channels suddenly in heavy use.

You take the above and mix in a busy 2m packet channel within an already crowded (both space and RF hot) situation like an EOC or MCP and you've got a recipe for big self-QRM/interagency QRM problems. Trust me if the ham gear is interfering with the public safety gear...guess whose gear is going to get turned off or worse?

2m is a relatively small band (4 MHz of spectrum) with a fairly long wavelength. This makes it very difficult to get enough isolation by physically spacing out the antennas from each other. The thing is it doesn't even have to be this way to begin with. Ah...can you say 220 MHz anyone? Even UHF is much better. With UHF you've got a much shorter wavelength and 30 MHz of spectrum (most areas) to spread out in. Even if you operate at 441 MHz, you're a pretty good ways away from the 453-460 UHF public safety spectrum. 420/430 is even better.

So you say “Jeff have you heard of filtering?” Sure, I've even deployed a lot of it. Problem is it's not a cure all. In a really cramped RF environment, even a notch or two may not do as much as you think. Trust me, been there done that. Steep notch filtering also limits frequency agility, introduces additional losses into often already compromised antenna systems, and they use up physical space in such EOC/MCP environments. Not to mention the costs and maintenance.

Bottom line? Why fool with this if you don't have to? As hams, we are NOT locked into just a few set channels like the public safety folks are. We have many better data bands and tons of good spectrum at our disposal. We were given that spectrum and flexibility for a reason. So can we please get away from this "HF and 2m only" mentality?


Back in the 80's and 90's you could usually get on nice commercial sites fairly easily and cheaply. Unless you're really lucky, this is not the case anymore. Today’s packet networks are probably going to be more dependant upon "home" towers than ever before. Most home users probably aren't going to welcome a busy 2m packet port on their tower causing desense issues to nearby VHF receivers. Their 2m voice operations will probably cause you a lot of intermittent node receiver desense issues too. It's a mess that doesn't have to be.

7. We've already got one data application on the band, APRS.

APRS is not as bad since it's down at the bottom of the band and it is likely receiving much more than it's actually transmitting. WinLink and BBS access could easily be a whole different story.
If you and your served agencies are using repeaters for the voice channels, then the self-QRM may not be too bad if the signal levels are high enough. Problem is, and one few think about till it's too late, is that during a real emergency your and/or their repeaters may be down or overloaded. If VHF-Hi and/or 146 MHz simplex is in heavy use with a lot of weak distant stations, mobiles, and handhelds in use, then serious desense issues become very likely.

8. Tends to encourage the "wannabe BBS" scene. AKA the TNC Mailboxes.

Often on these 2m packet "networks" (being nice again) you'll find a proliferation of TNC based mailboxes popping up all over the place. While they have their place for sure, they're often used in ways they were not designed for. The built in mailbox on such a TNC was never intended to replace a full service BBS on many levels. Unfortunately too many folks try to use them that way with little or no regard for the limitations of a TNC based mailbox.

These TNC based mailboxes simply don't have enough storage and routing flexibility to serve effectively as a multiuser BBS. Often they can only handle one connection at a time. Even if you can deal with the shortcomings and toss in a 512k RAM expansion, their message capacity is severely limited for EMCOMM usage. While a 1200 baud user base may need some time to fill it, 9600 baud users could potentially quickly fill 512k TNC mailbox to capacity.

These units are pretty much designed to handle very basic p-mail needs of a handful of "casual" packet ops that don't want or need a full service BBS. If that's all you need and the limited capability of these units fits your needs, then go for it as they’ll do that fairly well for you.

9. Tends to promote the proliferation of KA-Nodes.

Come on folks, do I really need to say more? Don't even waste your time trying to sell me on a KA-Node being much of a node for today’s networks. In comparison, even the antiquated (yet still fairly useful) TheNet is several steps towards being a real packet node. Yeah these "wannabe" nodes could be put on any band, but the 2m packet scene seems to be magnets for the KA-Nodes.

Okay, if you've got a situation where you need a simple "bare bones" node at a site where space/power/access are VERY limited, then yeah maybe this makes some sense. A KA-Node is better than a plain digipeater, but most folks could do a lot better.

10. Your served agencies and communities deserve better.

Let's wake up and face a reality of today’s EMCOMM world. If we truly wish to serve our served agencies and communities well, then we have to bring more to the table than just voice. Offering backup “data communication” to our served agencies is no longer optional, it's pretty much mandatory. Well designed packet networks can meet many of these data needs. On that note, how about we learn from the past and do it right this time around?
Final thoughts.

All that said, if 2m 1200 baud packet meets your needs and you truly feel it's the best choice, then have at it. I'm not condemning it far and wide. All I ask is that folks give the above some serious consideration and learn from the past history of packet networking. Fair enough?

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