Tuning Packet Parameters for Best Performance

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For vhf/uhf FM 1200b packet - Try this as first approximation - if it doesn't work something is wrong with the RF path or one of the TNCS or radios..

TXdelay 30
MAXframe 7
Paclen 0
Frack 2
Responsetime 0
Dwait 0
Persist 180
Slottime 35
Retries 10

Connect to another packet radio station and be sure you can send/receive at all. Deviation should be set for 3.5KHz max - 3.0KHz will not degraded in a path with good S/N. If this works then try this:

Set the receiving packet station with all monitor functions disabled except MON ON.

At command prompt in the TX packet station set the TNC in TRANSPARENT MODE (usually T/enter at the command prompt)

With a terminal program SEND a 10K file (see below). The sending TX will transmit very long packets (7 data frames of 256 characters each I believe), so there may only be a few actual transmissions. The RX end will not do any sending at all. The file will be received and decoded UNPROTO - if the receiving end prints near perfectly, your two stations are working pretty good together. You will see in the decoded end the ID frames of the TX station. this test in Transparent mode will not take but a few seconds - it is FAST. The same file at 9.6kb flies! However, there is no error correction so we can't attain these speeds.

Is everything still working okay?

NOTE: Read all of this before starting any of the other tests.

Do you have to have the squelch set on the radio? Open the squelch - if the DCD/RCV LED (GREEN usually) comes on because you opened the squelch, you

will have to use squelch. Do not set the squelch too 'close' or 'loose',
you don't want an occasional noise pulse to open the squelch and keep you
from transmitting. Do not set it too 'tight' as that degrades the overall
sensitivity of your system.

Most MFJ TNCS have built in "firmware DCD" so the squelch may be left full
open all the time. PacComm Tiny 2 TNCs can be fitted with an optional 'DCD'
board for this purpose.

If you have a Kantronics TNC set

CD SOFT

Now you can run the squelch full open - the DCD/RCV LED will not light
except when receiving a 1200b packet signal and your system will have the
greatest sensitivity and another delaying factor (incoming signal opening
the squelch) will be omitted. You cannot obtain maximum throughput rate if
you need to use squelch, but that particular factor is not as critical as
some others.

9.6kb has all this 'squelch' stuff built in. Receive data for the TNC must
be taken before audio stages as low frequency response below voice band is
required. RXA is normally taken right at the discriminator output and is
UNSQUELCHED, so where you set the squelch on your radio is of no
consequence. The DCD/RCV GREEN LED will only light on 9.6kb packet
signal.

Now let's optimize these AX.25 parameters - an empirical task that should be
done using native AX.25 w/o AGW PE. You'll need a terminal program that can
send a file. Winpack is recommend (free) if you don't have anything else.
The plus with Winpack is that it is also AGW compliant. We've been using
the file c:\winpac\docs\guidelines.txt which is not quite 9K.

Start with two packet stations on a simplex vhf/uhf frequency - no other
packet or voice users on there at all and excellent signals. (Bench Tests -
no worry about S/N, and no one else to time share the packet channel.)

The basic idea is to be CONNECTED and send a long file (say 9K w/o
compression) and watch the PTT LED (RED) and the DCD or RCV LED (GREEN)

blink back and forth as packets are sent, received, and acknowledged. The
LEDS never come on at the same time - that is impossible. Ideally, the
RED/GREEN ON/OFF/ON/OFF sequence on each TNC will be rhythmic with minimum
OFF/OFF time between. The RED on the TX end is on for the same length of
time as the GREEN on the RX end. The RX end is sending acknowledgement
packets which are very short bursts... The RED on that end is short and
matches the GREEN on the other end.

While you are watching the blinky/blink on the receive TNC, watch on the
Receive screen and see that there is data being presented with each lighting
of the GREEN LED... now you have it. As you adjust parameters (below) there
may come a time when you think there is zero time no LED off - then you've
made it! (Don't push that too hard as you won't use those parameters on a
shared LAN!)

On a 'bench test' like this there should never be a sent packet w/o a
decode/presentation/ack at the receive end.

Here is what happens to the blinky/blink rhythm when the receive end did not
hear (or could not synchronize with) the sending end at all, thus the
sending end has to wait, wait, wait, for the acknowledgment packet- then has
to send an 'AREYOUSTILLTHERE?' packet, get the ack from that, and
continuing. This is a dreaded RETRY. AREYOUSTILLTHERE? packets will
adversely affect throughput. This sequence is on the sending TNC:

RED/GREEN/RED/GREEN/RED/GREEN/RED/GREEN/RED . . . . . red?/green/
RED/GREEN/RED/GREEN

Using a stop watch - time the total time required to send the file. Our 9K
file at a radio rate of 1200b between two stations (sans digi, switch, node
etc, in between) will take about three minutes - and that will vary, but not
by more than 10 or 15 seconds either way. (A 9.6kb transfer should take not
more than 1/3 the time of a 1200b and with good equipment you can approach
1/5th (5 times as fast as 1200) throughput. I've not yet done enough
testing with the "9.6kb ready" ham radios, so would like to hear anyone's
results. With our Kenwood and a vanilla Mitrek on the bench we have
achieved 1/3 (3x as fast as 1200b) with the same radios. We have not done
the Mitrek-on-Mitrek tests - that comes next week.)

NOTE: Mitreks are not recommended for tactical use - they are too big!

(10
lbs!)

Keep in mind for throughput rate optimization you need to adjust the following parameters on both transceivers of this test link.

TXD (transmitter delay)
Each end of the link has an optimum TX/RX turn around time which is transceiver dependent. This is involved with the time it takes to stop transmitting and be able to synchronize the incoming signal on RX, and vice
versa, stop receiving and be ready to TX a signal on which the other end can
synchronize.

This is addressed with the AX.25 parameter Transmitter Delay (TXD) in milliseconds, usually entered in 10s of MS.

TXD 25

equals 250 milliseconds.

TXD is the amount of time after the transmitter PTT is actuated until the
first packet containing a DATA frame is sent. Generally the transmitter is
modulated during TXD by M/S diddle or 'scramble' (like the old RTTY RYRYRYRYRY.) This diddle time allows the TX to (1) settle on frequency, and
(2) come up to full power and the RX on the other end to get on frequency
after TX and synchronize. Radios with true FM (e.g. crystal controlled) generally require less time to synchronize than synthesized radios. Synthesized radios generally take a little longer and will require longer
TXD. Optimum TXD (lowest value w/o retires) is the target. TXD becomes more
important at 9.6kb as 100 ms can be equated to100 characters.

As for the newer synthesized mobile vhf or uhf or dual band 'Rice' radios,
most will easily do TXD 40 and probably 30 - and recently we've shown the
Kenwood TM-G7 will do TXD 20. Not bad for a synthesized radio. The old crystal controlled Mitreks we use on our backbones will do TXD 15 w/o any
modifications for faster TX/RX turn around. We are investigating some mods
to get that down to TXD 50 or 60 to optimize for 9.6kb. Commercial data radios will do less than 50ms for TXD.

If you can achieve a TXD of 20 (200ms), you may not want to spend much time
testing below that. If TXD 25 or 30 is the best - live with it, Life is too
short.

Now that you are certain you get a decode in the other end's RX on every
transmission with your lowest value for TXD....and he/she can do the same
when sending to you. . .

Let's minimize the REDOFF/GREENOFF dead time between the RED/GREEN/RED/GREEN
sequence - there can be a lot of time wasted there that reduces effective
throughput.

There are several timing parameters that effect how long the receiving side
TX waits to turn ON after it has received a packet.

RESPONSETIME - in milliseconds is the basic AX.25 parameter to control this.(Response time is entered in 10s of ms) A responsetime entry of 5 will
keep the PTT from starting for 50 milliseconds after the receiver has received a packet and needs to send an acknowledgement packet. This allows
the sending transceiver on the other end to stop TX and get the RX ready.
This is dead time; No RED/GREEN on at all. Once the PTT is closed, there is
still the TXD to wait for data packets.

DWAIT - in milliseconds is another parameter similar to RESPONSE TIME - This
inhibits the PTT for DWAIT time after ANY transmission has been detected on
the channel by the TNC. It is used primarily to protect digipeated packets.
If the TNC is also set up as a digipeater and needs to digipeat a received
packet it will NOT WAIT to do the digipeating, but WILL WAIT through DWAIT
to simply send a data or acknowledgement packet. If all stations on a LAN
use the same DWAIT (16 or 160 ms is recommended), then any digipeater on
the LAN will have priority. If there are no digipeaters, nodes, or switches within the radio horizon set DWAIT to zero.

Now that we've finished that tutorial, set RESPONSE TIME and DWAIT to ZERO -
we don't use them for our 'bench tests.'

For delay times between TX/RX we use an algorithm which is governed by Persist and Slottime parameters and has some randomness built in. All we
need to know is that the larger value of Persist and the smaller value of
Slottime the more aggressive the exchange. That is, the quicker the PTT will
go down to send an ack after a received packet or, on the other end, to

send
the next data packet after an acknowledgment. So far as I know, most TNCs do
not use RESPONSETIME at all with the Persist/Slottime algorithm, so you can
leave RESPONSTIME ZERO.

For your two-station throughput tests, shoot for the least amount of dead
time between RED/GREEN/RED/GREEN blinky blinks, while getting decodes on
every transmission w/o RETRIES. Because of the randomness built into the
Persist/Slotttime algoryghm, the blinky/blink may not be precisely rythmic -
there will be some times where you can actually tell that both LEDs are off
for a half second perhaps - but most exchanges should be RED/GREEN/RED/GREEN
and move right along - with decoded data being presented on the receive
screen with every transmitted packet and no retries.

My experience is that Persist greater than 180 and Slottime less than 30 are
approaching aggressive. However, play with those test aggressively- Persist
can range from 0 to 255 and Slottime the same.

This pretty much covers the AX.25 parameters that affect basic timing
between two TNCs/radios.

As you move these radios further apart and have real paths to deal with the
parameters will have to be less aggressive. (We've assumed no signal
degradation due to path and no noise or interference for the basic tests.)

Over our five-mile test range here w/o any other packet stations on the
channel, we can use the following numbers with virtually no retries.

TXdelay 20
MAXframe 7
Paclen 0
Frack 2
Responsetime 0
Dwait 0
Persist 200
Slottime 15
Retries 10
Both radios on low power (3 - 5 w)

We can actually get more aggressive, but there is no reason to do so as once
we add additional folks on the LAN, we'll have to be more sharing of the
channel. More on those parameters later, along with those on the list not

discussed.

If you can send that 9K file in 3 minutes at 1200b you are doing as good as
we are and we are the experts until one of you reports 2.5 minutes!

How to get your TNC out of Transparent mode. In most TNCs, Send 3 CTRL C within one second. No ENTER required, just old down the CTRL key and tap C three times - not too fast, but I think it needs to be within about 1000 ms.

I have no idea how adding AGW to this mix will affect all this - certainly
will increase the time required. KN6KB suggests keeping the 128 paclean and
maxframe 2 in Paclink AGW (channel) as those parameters apparently only affect the exchanges between Paclink AGW and AGW PE. The AX.25 TNC parameters above can be put into the AGW PE Properties - or most can. (I've
not played yet with AGW PE PRO).

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