

APRS Beginner Guide 2011

Answers the question: How does APRS work?

Primarily North America, but some worldwide information included.

The latest version can be found at: <http://k9dci.home.comcast.net/>

PLEASE read the Background section soon.

The down-side of APRS is that you need to know much of this stuff to have as much fun as the rest of us.

APRS is not quite Plug-n-Play.

PREFACE, ABSTRACT, INTRODUCTION, DISCLAIMER, ETC.

This document should help you get started. I provide simple explanations of some of the more tricky things, with only the necessary background – something I sought when I got started not too many moons ago, but could not find. There is a little help for the Kenwood radios, but if you don't know your radio menus, spend a couple of evenings with the radio manual in hand and play with everything. You'll remember later, or know where to hunt for things.

I do not assume you are familiar with standard, AX.25, Packet, though it can help a bit. I gave careful thought to what I included. I have intentionally left out some detail in order to make this easier to understand. Experts may take issue with my omissions, but as I learned about APRS, I found that precise, all inclusive explanations made it difficult to absorb the fundamentals. It is my belief that if you seek an advanced understanding of APRS, this introduction shall serve you well. COMMENTS and CORRECTIONS ARE WELCOME MyCall at ar1.net

This is a work in progress. I began with the most important information and will add sections over time. While it is slanted towards North America and the Kenwood radios, because I own a D7 & D700, most information is universal although some terminology changes between radios and TNCs.

If you break something, you're responsible, not me. If I break something I have to fix it. You're in the same boat. That's the limited liability clause. Praise is nice, but money is nicer. Have fun.

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What Really is APRS?

Automatic Packet Reporting System

- Local, Real-time, data exchange WITH or WITHOUT infrastructure.
- What is the repeater frequency in this town. Who is in range.
- GPS or computer is not required to use APRS effectively.
- Messages, Bulletins, Weather, Traffic, Satellites in view, Telemetry, National Weather Service warnings.
- Display nearby: Mobiles, Hand Helds, Fixed, Nets, Meetings, Repeaters (freq & Tone), Hamfests.
- Positions of all the above including: EchoLink/IRLP/Winlink nodes, Storms,, Aircraft, DFing aids
Un-manned assets such as: Supplies, Rockets, High Altitude Balloons, Buoys, Weather Stations
- Use for: Public service, Disaster, Search And Rescue Marathons, Races, Other Events.
- RF primarily on 2 Meters, but also 440, 6 Meters & HF.
- Local Area coverage extended via digipeaters – fixed or mobile.

Via Internet

- World-Wide observing locations, status and information about of all the above
Including: Mapping, Messaging, Tracking, Telemetry, Email, QRZ lookup, CQ.
- Satellite Digipeaters extend APRS to remote locations.

APRS is a digital mode designed to provide primarily local, semi-automatic communication. APRS is based on the Amateur Packet protocol (AX.25). Data is sent in short packets. A TNC formats these packets. Regular Packet is mainly a station-to-station messaging protocol that also has broadcast or bulletin capability. This is to say that Packets are sent FROM one call sign TO another – more on this below. However, APRS is primarily a one-to-many protocol but with station-to-station messaging capability. APRS allows rapid dissemination of information to all interested stations.

APRS packets can be received directly, or through digital repeaters (digipeaters). Unlike voice repeaters, packets typically travel through successive digipeaters (radially outward) to cover a larger area. Amateurs have put up digipeaters all over the North America, though there are areas with few or none. Some digipeaters cover a wide area, some just fill-in poor coverage areas and some were put up without serious regard to coverage or standards, though with good intentions.

APRS is considered Tactical because it is designed to quickly and automatically provide information about such things as the status and/or location of stations and other things (objects) in the local area.

During normal conditions it can inform hams about local things such as other nearby hams and stations, repeaters, nets, meetings, special events and hamfests. During emergencies or severe weather, it can provide all participants with the location of things such as fixed stations, mobiles, supplies and storms. It also allows group and more general messages relevant to the operations. For special events, such as walks, bike-a-thons and marathons, it can provide participant location, tracking and status.

While initially intended for local information, with the addition of Internet GateWay stations (IGates) a new dimension was created. This allows world-wide station-to-station messaging (well before cell phone text messaging). Other enhancements include access to the QRZ database, email, world-wide CQ, and world-wide viewing of locations on maps.

Satellite APRS digipeaters bring most of these same APRS operations to all remote locations.

The newest addition (APRStt) allows anyone with DTMF capability to announce their approximate location at the repeater they are near. Shown at Dayton '09 it is in early stages of testing - July 2009.

WHY do APRS?

Why would I want the world to know where I am?

This is only one of the many uses of APRS. It is not required, can be turned off and only enabled locally.

Many hams put APRS in their cars and let it run. However, using it this way can show when you will arrive or just provide a general comfort-level knowing of your progress on vacation. While traveling, Voice Alert CQ keeps you in touch with other APRS users and the other local information features give the traveling ham information of interest such as the local repeater frequency, hamfest, gatherings and nets. During severe weather and emergencies it provides valuable information to all stations.

Please read the Background Section soon.

Explanations

MYCALL

What dash number should I use ?

"MYCALL" (MY CALLSIGN) D7 Menu 2-1 D700 Menu 3-1 D710 Menu 600

Packet requires (as does the FCC) your call sign. This is the FROM part of the AX.25 protocol and is your own call sign. For a fixed station, this is enough. The dash number is an OPTIONAL Secondary Station ID (SSID) and it allows you to have and then distinguish between your multiple APRS stations. It can provide a little additional information about your station. While these were important to set the symbol, they are now less important. You set the symbol in a menu. This is the symbol you display on the map software or internet. Here is a summary of the recommendations. Remember you also don't *need* an SSID. It's nice to have.

- 0 Home Station, Home Station running IGate.
- 1 Digipeater, Home Station running a Wide1-1 Digi, Weather Digipeater
- 2 Digipeater [#2 or] on 70CM
- 3 Digipeater [#3]
- 5 IGate (Not home station) -6 is for Operations via Satellite
- 7 HT (Kenwood D7 or Yeasu VX8R)
- 8 is for boats, sailboats and ships (maybe 802.11 in the future)
- 9 is for Mobiles
- 14 is for Truckers
- 15 is for HF [Ed. - though many use -9]

What Path do I use?

You should use the shortest path for the required purpose. Be considerate. The RF network is a shared resource designed and maintained by many. While getting to the Internet is not the only purpose for APRS, this is a reasonable yardstick for setting the shortest required path. The simplest way to determine if your path is sufficient to get to an IGate (Internet Gateway) is to go to one of the map web sites (listed below) to determine if you appear there.

While these paths will be sufficient most of the time, should these not work, DON'T GUESS at higher numbers. Consult a local expert to get the correct Path for your area. There are some differences across North America.

Recommended Path

PACKET PATH D7 Menu 2-B D700 Menu 3-B D710 Menu 612

Mobiles

In densely populated areas use WIDE1-1, WIDE2-1. The -1 and -1 add to provide 2 hops. The WIDE1-1 insures you will use coverage fill-in digis when needed (See Background below).

In sparse areas where IGates are few, start with the above, however, you may change to WIDE1-1, WIDE2-2. The -1 and -2 add to indicate 3 hops. More hops are required in very, very few areas.

Fixed Stations

Instead of the first WIDE1-1, substitute the call sign of your nearest wide area digi, or if needed, your local fill-in digi. Example: K9ESV-2, WIDE2-1

Airborne

This isn't actually a beginner issue, but I provide some information. Aircraft and Balloons really should not use the Mobile path at altitude. The WIDE1-1 brings up every fill-in and Wide coverage digi over an area of several states. It will cause many digipeaters to repeat your packets needlessly, flooding several states. A first choice for Airborne APRS should be only WIDE2-1. However, WIDE2-2 might be used to insure getting to an IGate at all times. Airborne APRS should not need Fill-in digipeaters. The altitude will directly get your signal to MANY WIDE AREA digipeaters.

That said, there is an issue when a balloon payload is landing and at a low altitude. The WIDE1-1 can help get the location to the net which can facilitate recovery. There are trackers (RTrak) that can, for example, change frequency to reduce .39 transmissions at altitude. The ideal case would be to change path and beacon rate with altitude. Another very important consideration is the beacon rate. During the flight, 1 minute is recommended. After landing, less frequent wouldn't hurt and can conserve precious battery capacity. These considerations are particularly important when several balloons are launched simultaneously. All this said, when the flight duration is short, perhaps a few hours, the flooding caused by a poor path will be short lived.

Beaconing

Beacon (BCN) means to transmit your GPS position "To Every APRS Station" in earshot. You can have it on or off – your choice. All APRS stations within earshot will receive and display this information.

You may add a little text (STATUS TEXT) such as your email, operating frequency, or other pertinent information. See the Addendum for more information on how to put frequency information in this space.

Beacon Rate

When moving slowly a rapid beacon rate provides unneeded clustered locations. Two minutes is fast for highway speeds. This locates you every two miles. When stationary, 20-30 minutes is adequate.

Position Comment

You can also select one of several canned POSITION COMMENT (Status types) along with your position. e.g. Off Duty, Enroute, Returning. There is an Emergency Status, **BUT BE CAREFUL** using this. Hams are monitoring. The Emergency Comment will appear on the Internet and hams WILL attempt to discover the problem.

Custom Position Comments

The CUSTOM position Comments are not programmable. They all simply say CUSTOM. To use these you, and all others involved in your event, must agree ahead of time, to the meaning of any you choose to use.

Voice Alert CQ

- An Automatic "Traveler CQ". APRS Radios only (or modify yours)

Details are in the Addendum below. Set the APRS radio to Tone AND Squelch (CT) (100 Hz. North America) - keep volume up and **LISTEN**. Turn it off if you don't want to QSO (use several memories).

*** **ONLY MOBILES should transmit this tone !** *** See **APRS Frequencies** for other countries.

When you hear an APRS "Squawk" you know you are in Simplex range of the mobile that just beamed.

Answer on .39 and QSY quickly to a voice channel. Fixed stations may also LISTEN on 144.390 with 100 Hz. carrier squelch, but fixed station must **NEVER** transmit Voice Alert Tone on APRS freq. You can also set up NON-APRS radios with Voice Alert CT while traveling and hear near-by APRS mobiles squawking!

CAUTION: Easy mistake. External APRS devices (trackers) plugged into the Speaker jack WON'T work with CT on; because the speaker is muted. You can't hear and the tracker can't decode. Wire the tracker after de-emphasis and before the CTCSS squelch; OR from discriminator, but add de-emphasis. See the Voice Alert Addendum at the end.

Sending Messages

APRS (usually) sends to all APRS stations within earshot (either directly, or through digipeaters). APRS has ways to send message packets to specific stations, similar to Cell phone text messages.

You can send to a single station or several APRS stations. There is no storage, so the destination station must be monitoring (watching the radio, or recording on a computer).

[The following is transparent to the APRS user, but the actual protocol is different from regular Packet. Since APRS uses the "TOCALL", or "UNPROTOCOL" to indicate All APRS stations, APRS adapted AX.25 to send messages.] See Messages – Internet Tunneling Below

One-To-One

Address the message TO: the call sign and SSID as it is being used on the air. TOTAL Message length is 45 characters in the D7 and 64 in both the D700 and D710.

Sending a message to another station is the same whether it is a local station or one that is active anywhere around the world (within range of an Igate).

When sent this way, the recipient station will return an Acknowledgement (ACK) to you. If the recipient's message memory is full, a REJECT message will be sent back to you. However, since this is RF, you may not receive the ACK (just as the original message may not reach the recipient), or a reject "REJ".

One-To-Many

PLEASE note that the term "Broadcast" has a specific meaning in FCC language. Broadcasts are sent to the general public. Hams do NOT broadcast in this sense – this would be illegal. Hams are allowed to send only to other hams. [Except in genuine emergencies where rules are very light] To prevent confusion here, I have coined the term Ham-cast to describe one ham sending to many other hams.

To allow APRS software to receive messages addressed to groups of stations, message group names are allowed. These names are programmed into a special area rather than the call sign. These One-To-Many messages can go to every station within earshot (as bulletins TO:BLN#, or ALL), or to some standard groups that most radios respond to (such as QST, CQ) or to groups you have set up (such as CLUB, LUNCH, MEET) in a few friends radio's. In the Kenwood radios, it is the MSG GROUP Menu.

To send to a group, the TO: is not a call sign, but a group name. For bulletins, you can have longer, multi-line messages by incrementing the # in the TO: BLN# (where # is 0-9 or A-Z) in subsequent messages.

Ignore the D700 bulletin groups to start. It limits or filters reception of bulletins.

Thus, an APRS station (non Digi) can also have several aliases – The FCC call, a bulletin alias, and several group aliases.

UNPROTO

For APRS, all stations are, by definition, in what you can think of as a Packet "Super-Group". The "APRS Group". The AX.25 protocol has a one-to-many broadcast-like parameter called "Unprotocol", "UnProto", or "UnNumbered Information" ("UI"). This is the Unproto parameter in the D7 and D700 that holds this "Group" name. [it appears to be hidden in the D710].

Because all APRS stations are already in the "APRS" Super-Group, this parameter is used to hold a little more information that is not in regular Packet. The Unproto parameter only has to start with the two letters "AP" – indicating that the packet is TO: APRS stations. The remainder of this parameter contains a letter, indicating the manufacturer or producer and three digits that identify the version of the TNC/software, or radio.

Create (Beacon) an Object:

An "Object" in APRS is another "thing" you want to appear on the map (Repeater, Ham Fest, Meeting, Storm, etc.). For D7 D700, D710 and VX-8R owners, the following is a close approximation to an Object. Other APRS "client" programs have a special provision for doing Objects in a more official way.

1. Bring up the MENU for MYCALL. Enter the name of the object (9 characters max). See Notes **
2. Add your call to STATUS TEXT to ID your station. 28 characters max (20 for the D7) See Notes **
3. If you want it at a different Lat/Lon location, then bring up the POSIT MENU and enter the Object's GPS coordinates there.
4. Send out the object's position a few times. Verify a digipeat with an echo.
5. Change your call back to your call and move on.

NOTE: With the D700, use another PM for the object and going back to your call is easier.

****NOTES:** Repeater Objects: Due to MYCALL restrictions you must cheat a bit. Put a Repeater frequency with no decimal. For 442.075 the only two options are: "442075" (better) or "442R07-5" (not so good)

For a Hamfest use HFEST-dd or HFESTd-d where dd is the date. While the standard recommendation is to use HFEST-dd, the D7 and D700 do not allow pseudo-SSID "dates" above 15, so split the digits above the 15th.

STATUS TEXT: To allow display on the TH-D7 arrange it as two 10 character lines first. Tone then Range. Examples: "T114 R30m Mtg 7PM We K9DCI" or "T123 R20m Net 7PM Su DE K4OC"

Keep a space in the 10th character for non TH-D7 displays (D7 doesn't need it due to line break).

Other possibilities include:

WRECK, TRAFFC, FIRE, TREE, POLICE, COP, FLOOD, NET, MEETNG, EYEBLL, LAUNCH, DEMO, DETOUR

APRS via Touch Tone (DTMF)

As this is being written an application is under development that would allow any radio with DTMF capability to appear on the APRS RF network and be associated with a given repeater. When added to an area repeater or other receiver, it allows ANYONE to make their presence known on APRS simply by sending their call sign in a simple DTMF code. For the latest, see <http://aprs.org/aprstt.html>

APRS Frequencies

Worldwide info: North America 144.390 MHz Voice Alert = 100 Hz.
 Argentina: 144.930 MHz
 Australia 145.175 MHz Voice Alert = 91.5 Hz.
 Europe, Finland, Ireland, Spain: 144.800 MHz Voice Alert = 136.5 Hz.
 Japan: 144.640 MHz (KYUSHU region: 144.660 MHz)
 New Zealand: 144.575 MHz
 Norway 144.800 Mhz Voice Alert = 123 Hz.
 Russia: 144.800 MHz
 UHF & 9600 baud
 Australia (VK): 439.100 MHz 1200 baud (in selected areas)
 France: 144.800 MHz (1200) 432.500MHz. (was SSTV) Voice Alert = 136.5 Hz.
 439.700 MHz 1200 baud
 Netherlands (PA): 430.5125 MHz 1200 baud
 New Zealand (ZL): 432.575 MHz 1200 baud allocated but little usage
 Puget Sound, WA: 440.800 MHz 9600 baud
 Puget Sound, WA: 144.350 MHz 9600 baud
 US Kansas / Missouri: 441.175 MHz 1200 baud (secondary / special event, no infrastructure)
 US Kansas / Missouri: 446.175 MHz 1200 baud (primary, with infrastructure)
 US Nationwide Proposed: 445.925 (proposed by Bob WB4APR)

NOTE: Not all of these have been fully adopted in some countries, so this is not the final word. One Australian web site says Voice Alert is 123.0 Hz. However I have been told this is a voice repeater tone used especially for IRLP and EchoLink systems. [<http://www.russellcoarc.org/aprs.htm>]

HF APRS

HF APRS uses Frequency Shift Keying (FSK) with a shift of 200Hz, at 300 bits per second. Due to the differences in audio tones used by various TNCs, the HF carrier frequency depends on the TNC.

40 Meters actual RF mark and space frequencies 7.034.400 and 7.034.200

30 Meters actual RF mark and space frequencies 10.149.400 and 10.149.200

Detailed information at: http://vk3.aprs.net.au/aprs_on_hf.htm <http://www.aprs.net/vm/DOS/HF.HTM>
http://www.wvraclub.org/documents/aprs/30m_HF_APRS.doc

Hints

Local events can use another frequency to stay very local or off the Internet.

Use another frequency to:

- Keep local events Very local
- Keep local events off the Internet
- Testing

Using Memories

Remember that memories don't always have to be on different frequencies. Switch between four memories on 144.39 without changing volume setting:

- First memory set with no CTCSS allows hearing all APRS transmissions.
- Second memory set with 100 Hz CT hears only Voice Alert CQ's.
- Third memory set with non-100 Hz CT hears nothing. No messing with the volume.
- Fourth memory set with a Non-100 Hz CT hears special stations (home, friends).

D7 Tips

Squelch setting is "F" then the lower side button "SQL".

Entering Text

- Pushing a button multiple times cycles through the letters and numbers for the key.
- The A/B button deletes characters. Hold to delete all: for messages and the heard LIST.
- The ENT button (lower right) gives quick access to "?", "-", and space.

In the Message TO: ENT gives the "-".

IN a message: For a "?", push ENT once.

For a space push ENT twice then rotate the click knob TWO CCW.

D700/ D7 / D710 Tips

Not transmitting Beacons

To transmit beacons, the menu should be set to Automatic [D700 3-C; D7 2-C; D710 611], the beacon indicator must be on (BCN) and the receiver must be squelched (quiet). Turn up the volume to make sure.

You can "force" a beacon packet to be transmitted by cycling BCN off, then, back on. On the D700, hold the F soft button, then push the BCN soft button. [soft buttons are along the bottom and change legends]

For the D700, the S-Meter below the frequency 144.39 can not say BUSY. This means the squelch is open because it is adjusted open (too "loose") and needs to be adjusted tighter (to the right/CW).

Sending Messages

To make messaging easier for the D700 ONLY, John Hansen, W2FS sells a PS2 keyboard adapter.

<http://www.coastalchip.com/Kenkey.htm>

Object Hint

When doing an object with the D700, use another PM for the object, then going back to your call is easier.

Internet Services

As long as your path is sufficient to get to an Internet Gateway (IGate), you have all these Internet services. The system of computers that gather APRS packets on the Internet is called the APRS-IS (Internet System). Hams have written software that then monitors all the resulting Internet APRS traffic and, then, does this other stuff. This is REALLY cool!

Have I made it to the Internet?

You are within range of an IGate if you can see yourself on any of the map sites or receive a response from any Internet service such as: WLNK-1 "H" or WHO-IS CallSign.

Keeping OFF the Internet - NOGATE

You can stay on 144.390 yet stay off the Internet. Put "NOGATE" or "RFONLY" as the last Path parameter and IGates will ignore you. This makes a typical path "WIDE1-1,WIDE2-1,NOGATE". I don't know why there are two choices. NOGATE is preferred. However, this is not implemented everywhere, so it may not work.

Mapping sites:

<http://map.findu.com/K9DCI-9> You can use * as a wild card character on findu >> K9DCI*

For finding hamfests use call sign HFEST*

<http://aprs.fi/>

[http://www.db0anf.de/app/aprs/stations/googlemap-K9DCI-*](http://www.db0anf.de/app/aprs/stations/googlemap-K9DCI-*.)

<http://www.wulfden.org/APRSQuery.shtml>

<http://map.aprsworld.net/k9dci-0> % is the wild card. The location on aprsworld can be off more than others.

For searching for hamfests Search for HFEST%

<http://www.oaprs.net/search> New OpenAPRS site which allows rather free form searches.

You don't need wild card characters (just abbreviate). It searches *all* of the APRS raw data, not just calls.

Other good sites:

APRS.org: <http://aprs.org> Bob Bruninga's EXTENSIVE information pages

AE5PL <http://aprs-is.net> Pete Loveall's EXTENSIVE info on the Internet System

E-Mail – Send only E-Mail

Instead of sending to another call sign, simply send the message TO: EMAIL

Put the email address first in the message followed by a space.

Follow the address with your short message.

This is a send only from RF to the Internet email system.

TOTAL Address + Message length is 45 characters in the D7 and 64 in both the D700 and D710.

OPTIONS

Sending, instead, to AE5PL-EM allows setting up email address shortcuts.

If the message is "me steve@bogus.com", you can thereafter use 'me' instead of the address.

A message of "me L" replies with a list of your shortcut addresses.

A message of "me r" resets (clears) this shortcut. See <http://www.aprs-is.net/Email.aspx>

APRSLink – E-Mail TO and FROM WinLink 2000

This allows sending AND receiving short emails. Unfortunately, this is rather complex and I may add details later. For now, read the APRSLink site. In short, you send multiple (numbered) messages. One for TO: address, another for Subject and one for each line in the message. You ask the server if you have any to receive. A resent position beacon is needed to know where you are for incoming mail.

If you want to try something, send a message TO: WLNK-1. The message should be simply the letter "H". The reply message is the command list.

<http://www.winlink.org/aprslink>

APRSLink is NOT part of WINLink, but only interfaces with it. <http://www.winlink.org/>

IMPORTANT TNC NOTE:

The Tasco TNCs in the D700, D7 and TS-2000 have a handshake and message length limitation that prevents using them in EmComm systems. A driver that is designed to alleviate this problem was in development early in 2009. See or ask on Yahoo group: w12kemcomm

WHO-IS – Call Sign Lookup

Instead of sending to another call sign, simply send the message TO: WHO-IS

Because some digis demand a number SSID, you can also send to WHO-15 (looks like IS)

Put only the call sign in the message.

You will receive a response with the name, license, state and country.

Prefix the call sign with an f and space to get full information: f K9DCI

See <http://www.aprs-is.net/WhoIs.aspx>

Messages – Internet Tunneling

Send a world-wide message the same as if it is local. TO: CallSign-SSID. There is no storage of messages, so the recipient station must be within range of an Igate, have beamed recently and be monitoring the radio.

However, you can see recent messages that successfully reached the Internet on web sites like Findu. At <http://www.findu.com/> Click Messages then change the call sign to the station you want to see.

CQ Server:

Enables world-wide APRS QSO's. READ CAREFULLY. CAN BE CONFUSING.

Basically, the initial "CQ xxx" gets sent to the server. Anyone (after you) who does the same (xxx), appears on your display. You then send messages DIRECTLY to each other, just as above (Tunneling).

See <http://www.aprs-is.net/CQSrvr.aspx>

Queries– nothing yet

Automatic questions to other APRS stations. This is part of the basic APRS specification, but it can be a bit complex to read.

Background: TOCALL, Alias, Path and Digipeaters:

If you understand little more about APRS, please understand how aliases and paths are used.

Above, I describe the FROM call sign needed by the AX.25 protocol. You must also specify the call of the station you are sending TO. Since APRS is primarily one-to-many, APRS stations send TO the same basic call sign, namely "APxxxx". "AP" stands for APRS. The "xxxx" part is allowed to vary and has nothing to do with where the message is going (**Unproto**). This happens to go by several names; TO CALL and UNPROTO being the most common.

To extend our range we also use repeaters – or Digital repeaters, Digipeaters or simply Digis. The AX.25 "Regular" Packet Protocol requires that you specify the exact call signs of the digipeaters you want your packet to go through and list them in the order in which they will be used. To specify a single, linear path through digis, a digi will only repeat a packet if its "call" is in the list and it is the first un-used one --- otherwise it remains silent. Though modified slightly with the current (new) paradigm, the first digi "uses up" the first call, the second digi uses the second call and so on. In effect, each digi "uses-up" its call sign in the path list. This list of call signs determines which digipeaters the packet goes through and this string of digipeaters is what we are calling an RF network. In regular Packet, this requires that you know the call of each digipeaters you want your packet to go through to get to its destination station.

APRS is a clever adaptation of "Regular" Packet. While you can still use specific station call signs in APRS, that is not the norm. To eliminate the need to know digipeater calls, all digipeaters essentially respond to the same call sign called an "Alias". **It is VERY IMPORTANT to understand that because of this, your APRS packet travels through MANY digipeaters, radially outward in ALL directions.**

As well as using their FCC assigned station call sign, all digis also recognize one, or more, "alias" call signs. To make APRS work, *ALL* digipeaters essentially respond to the same alias call sign, so no matter where you are, you will always use the same digi call signs. In the currently recommended and improved APRS Path, only

two parts of the Path parameter are needed, separated by a comma. This sounds like you only use two digis, but it means that your packet travels outward two hops, but read on.

There are two types of digis: wide area digis and local, fill-in digis. The wide digis are far apart and send to each other. Every so often, one of these is also connected to the Internet and is called an "Igate". The local digis fill-in a coverage hole to fix a problem and should only send to the nearest wide area digi.

There are also digis put up by well-meaning hams that may cause some confusion due to unusual coverage or settings.

In APRS, the path through digis is not a linear path from you to the destination station (as in regular Packet), but rather an expanding circle of digis, to all APRS stations within ear-shot.

This network of digipeaters is, to some extent, under the control of the user (rather than the network stations) because the path you set determines how many outward hops your packet takes. **HOWEVER**, be careful. This must be done correctly.

The result is that instead of specifying the specific digis, you specify the number outward hops that you want - the number of ever growing circles that your packet will propagate through. **REMEMBER**, APRS is for **LOCAL** information and messages, not long distances. Going too far sends your packets through to many digis and produces QRM filling up the APRS frequency with continuous packets.

For long distance communication, there is a way to use the Internet with APRS; **NOT** with these Path settings.

The now obsolete (but still allowed in some areas) RELAY,WIDE path you find in many tutorials on the net has been replaced. The "New Paradigm" described here was developed to minimize duplicate packets bouncing back and forth between digis needlessly, yet fit in the original AX.25 protocol, **AND** still be used in much of the existing TNC equipment. It is also designed to allow easily tracing where packets went to allow easier analysis of the operation of the RF network. Some Digis still recognize RELAY and may confuse things.

How does this work.

Looking at the path of "WIDE1-1,WIDE2-1", there are several pieces of information in that path, but essentially it says you want to go through two Digipeaters – the first has a call sign (alias) of "WIDE1-1" and the second is "WIDE2-1".

The goal is (sort of) to travel outward two WIDE AREA digi levels or hops. To insure these two WIDE AREA hops and also allow for small fill-in digis to cover RF holes, the following is done. ALL digis recognize (have aliases of) the first WIDE1-1. If your signal reaches a WIDE AREA digi directly, you've made the first step. The next layer of WIDE AREA digis will hear that digi and repeat your packet "using" the next WIDE2-1 in the path.

Fill-in digis recognize **ONLY** the initial WIDE1-1. If you are heard only by a fill-in digi, it sees its alias as the first unused call and repeats your packet. It's nearest WIDE AREA digi hears this and repeats using the second step of WIDE2-1.

WIDE AREA Digis have a slightly more complicated alias behavior. The second Alias has the form "WIDEn-N" (which is made to look the same as the Fill-In to fit the AX.25 protocol), but it is used differently. The ending "N" of this alias is used to count the number of hops desired, instead of wide digis "using up" this alias the first time. This alias doesn't get "used-up" per se, but rather each Wide digi will subtract 1 from "N" before transmitting it. When "N" is zero, no more digis will repeat it.

This was developed so software in the Digipeaters can orchestrate all this to prevent your packet from bouncing forever between repeaters. They each can figure out what has happened so far and won't repeat packets that have already entered an area.

There are simple rules about the numbers in the aliases, but due to the fact that at this time, not all digis are fully compliant with this relatively new Path paradigm, following the "Ideal" rules creates some confusion, so the rules are not given here. The above recommendations actually violate the rules, but this is to avoid the confusion by those who examine the paths.

Radio Setup

D700 APRS Setup

GPS hints:

Just pay attention to connecting the Tx and Rx lines for the GPS and it'll work. The tip is radio Tx and Ring is radio Rx. Double check baud rates.

These settings will help get you started. Also see Page 11 in the D700 Special Communications manual.

HOLD' means to hold for 1 second (it beeps and something changes) then RELEASE.

The "F" Function key is the bottom-left button on the D700.

1. Set the APRS Menus as shown below. Use the correct Frequencies for your area / country.
2. Set the left receiver "A" to 144.390 (VFO or MEM). (push left volume knob to adjust the "A" side). Start WITHOUT any Tone or CT. Listen for a while for the APRS "Squawks".
3. To turn on the TNC/APRS so "TNC APRS" appears at the top-left, HOLD the "F" key then the TNC soft-key. You should now hear packets and see call signs (above the 144.390, or filling that side) when packets are received. If this isn't happening, you aren't receiving other stations nor a Digipeater.
4. When the radio is getting the GPS output, "GPS" blinks at the top.
5. Now, force a beacon.
 - A. In AUTO mode (Menu 3-C), HOLD "F", push BCON (center button). BCN goes away on top
Do again so BCN comes back on top.
 - B. In PTT mode (Menu 3-C), just key up and release.
 - C. In Manual Mode (Menu 3-C), HOLD "F", push BCON (center button)

After you get things working you can set the receiver for Voice Alert, 100 Hz. CT.

When your radio hears its own packet "echo" from a digipeater, you will hear a Bee-Boop and see "MY POS" above the 144.390.

NOTE: You can not beacon rapidly and hear your Digi-echo. The Digi won't repeat you until you wait 30 SECONDS. If you don't change your position, you may also be limited to one digipeat per 20 or 30 MINUTES. If you are having trouble, remove the GPS plug and switch between two (near-by) positions in APRS menu 3-4 between beacons. Remember to push the "USE" soft button to actually put in into use.

D7 APRS Setup

GPS hints:

Just pay attention to connecting the Tx and Rx lines for the GPS and it'll work. On the little plug, the Tip is radio Tx and Ring is radio Rx. The PC port is identical. Double check the baud rates.

These settings will help get you started.

'HOLD' means to hold for 1 second (it beeps and something changes) then RELEASE.

The "F" Function key is the "A" button; upper right.

1. Set the APRS Menus as shown below. Use the correct Frequencies for your area / country.
2. Set the top receiver "A" to 144.390 (VFO or MEM). (push the A/B button to adjust "A" receiver).
Start WITHOUT any Tone or CT. Listen for a while for the APRS "Squawks".
3. To turn on the TNC so the TNC rectangle appears at the top, push the "TNC" button once. You should now hear packets and see call signs appear when packets are received. If this isn't happening, you aren't receiving other stations nor a Digipeater.
4. When the radio starts getting valid GPS output, it will beep.
5. Now, force a beacon.
Push the BCON button (6 or MNO). BCN appears on top. Radio transmits.

After you get things working you can set the receiver for Voice Alert, 100 Hz. CT.

When your radio hears it's own packet "echo" from a digipeater, you will hear a Bee-Boop and see "MY POS" at the bottom.

You can not beacon rapidly and hear your Digi-echo. The Digi won't repeat you until you wait 30 SECONDS. If you don't change your position, you may also be limited to one digipeat per 20 or 30 MINUTES. If you are having trouble, remove the GPS plug and switch between two (near-by) positions in APRS menu 2-4 between beacons. Remember to "USE" the change (push the MHz button, lower left)

D710 Setup – nothing yet

Same as the D700 except Menu numbers, I hope.

VX-8R Setup – nothing yet

When someone gets one and supplies the info ... Hopefully the terminology here is close enough for you to make sense of when looking at the VX-8R manual.

FTM-350R Setup – nothing yet

Now, I'm thinkin' it'll behave a lot like the VX-8R, eh?

APRS Menu Settings D7, D700, D710, D72

Menu

D700	D7	D710	D72	(from the manual)	
3-x	2-x	6xx		Name	>> Setting to use to get started
1	1	00	300	MY CALLSIGN = Your Call-SSID	>>K9DCI-9 For a D7 use "-7"
2	2	02	200	GPS UNIT = As required [NOT USED, NMEA, NMEA96]	>>NMEA [D72=Normal]*
3	3	03	340*	WAYPOINT = (Enables uploading stations to your GPS)	>>OFF D72 n/a/*
4	4	05	360	MY POSITION = D700 has 5 sub entries. D7 has 3. Put your location in one and & "USE" it. GPS input overrides this.	
5	5	06	372	POS AMBIGUITY	>>OFF
6	6	07	380	POSITION COMMENT = Pick as appropriate. (CUSTOM is whatever you mean)>>In Service	
7	7	09	3B0	POSITION LIMIT = Display/save beacons inside this radius	>>100
8	8	10	3C0	STATION ICON = Select best	>>car (for testing right now)
9	9	08	390	STATUS TEXT = There are 5 sub entries. D7 has 3. Make your own	>>"Setting up APRS"
A	A	08	390	STATUS RATE = Add text every so many beacons	>> 1/5 (1/4 or 1/5 more better)
B	B	12	3H0/1	PACKET PATH	>>WIDE1-1,WIDE2-1 [D72 3H0=New-N, 3H2=2]
C	C	11	3D0	TX PACKET =	>>AUTO
D	D	11	3D1	TX INTERVAL = Varies	>>30 min when fixed station. no less than 1 min moving except for <u>short</u> tests and special circumstances.
E	E	00	3I0	UNPROTOCOL	APK101=D700, APK002=D7, APK003=D72, Hidden in D710
F	F	24	3T0	BEEP = What U want	>>MINE
-	G	-	3U0	DISPLAY AREA	>>ENTIRE DISP
G	H	26	3V0	MILE/KILOMETER	>>mile
H	I	26	3V2	TEMPERATURE	>>F
I	M	01	3I0	DATA BAND = Receiver/side used for APRS	>>A
J	N	01	3I1	PACKET SPEED	>>1200 bps
K	-	16/18	3M0	DIGIPEATER = Needs it's own section.	>>OFF
L	-	18	3M0	UIDIGI = Needs it's own section.	
M	J	22	3Q0/1	AUTO MSG REPLY = If you want to auto reply to messages sent TO you.	>>OFF
N	K	22	3R0	REPLY MSG = What you want to send when replying with M turned ON.	>>[Mine blank]
O	-	-	3S1	BLN GROUP = 6 groups max. 4 char max each	>> Mine blank
P	L	23	3S0	MSG GROUP = For receiving 'group' messages. 6 groups max. 9 char max each	>>ALL,QST,CQ,KWD
-	P	01	321	TX DELAY	>> 400
3-x	2-x	6xx	1/2/3xx	Name	>> Setting to use to get started
D700	D7	D710	D72		

* On the D72 Set menus 200=Normal, 301=APRS. Menu 340 appears to send to an external GPS

Voice Alert Detail Addendum

Because many radios are set incorrectly with Voice Alert Tone on, I provide detail here.

Voice Alert is a CQ - LISTEN if you call CQ.

If you do not want to QSO on the road, turn the 144.39 Tx Tone OFF. Here is a simple way to do this.

Store THREE radio memory channels on 144.39. Choose names that work for you:

- "APRS" or "APRS CQ" or "VOICE AL" with the Voice Alert Tx Tone - CTCSS 100in the US).
- "RAW " or "APRS RAW" with no tones for raw monitoring of all packets, if you wish.
- "MUTED" or "SPECIAL" or "PRIVATE" with CTCSS 123 (or another) to hear nothing.
(This can also be an additional 'private', 'club' or 'group' form of Voice Alert)

On a trip, Bob Bruninga passed several D710's on the road, but not one of them automatically transmitted their voice freq. Some had comments saying call me on "146.52", but they weren't there. And "146.52" was not in standard APRS format to allow another D710 to auto-tuned to it.

One even said "call me on 52 or local repeater"... If he had set his D710 to auto-insert the freq in his beacon like the radio was designed to do, then we could find him no matter where he was...

Why is this so hard...

Here is how to set up an APRS mobile radio

- 1) Set three memory channels to 144.39 with these names:
 - "APRS" with ctcss 100 for voice alert (normal)
 - "RAW " with no tones for raw monitoring
 - "MUTED" with ctcss 123 so you won't hear anything ever
 - (Note, trusted agents can still call you using "123")

This keeps you from ever turning the volume down on side A and forgetting about it... Keep the volume always up, and mute if you have to with the channel knob only. And by saving your configuration in a PM, then at least every time you start up the radio, you ARE monitoring VA.

- 2) Set AUTO-PM-STORE to OFF so your rig will actually remember any settings you put into PM's. And save that in the PM too.
- 3) In the D700, set DISPLAY - MODE to 3, so that APRS hot-buttons are always on the screen for rapid access. And save this config in a PM.

The full D7XX settings link is at the top of www.aprs.org Though some people are still getting Google warnings about a malware site... Yes, just make sure the first 10 bytes of the status text is FFF.FFFMHz and that should do it. Do not put a space in front of MHz, unless it is a 5 character freq FFF.FF MHz. It has to be 10 bytes.

Change History

Rev 2.0	9/2/2008	Improved the Preface; digi Path Background sections Added E-MAIL; NOGATE; D7 and D710 Menu #s
Rev 3.0	9/6/2008	Adjusted the Path section Added APRSLink and WHO-IS
Rev 4.0	9/20/2008	Misc clarifications Added AESPL email info, Added to WHO-IS Messaging, Beacons, Hints, KenKey, Tunneling
Rev 5.0	5/15/09	Added aircraft path
Rev 5.1	6/14/09	Shortened, clarified Background Typos and spelling corrections. Added date to title so it shows in Google results Added several URLs. Added a bit on CQ Server info, Tasco Modem caution, Queries note.
Rev 5.1.1	6/26/09	Typos and misc minor improvements
Rev 5.1.2	6/29/09	Improved Message section.
Rev 5.1.3	7/16/09	Re-worded Airborne to mirror: http://www.aprs.org/newN/APRSpaths.gif
Rev 5.1.4	7/17/09	Loosened /clarified Copyright limitations/permissions.
Rev 5.1.5	7/17/09	Fixed the NOGATE section - removed reference to the little used !x!
Rev 5.1.6	7/18/09	Added digipeaters to overview. Improved various wording.
Rev 5.1.7	7/18/09	Embellished the Aircraft Path section.
Rev 5.1.8	9/2/09	Add other country RF Frequencies and Voice Alert tones. Add Message reject note. Misc improvements in wording and spell check. & comments via VK2JNG
Rev 5.1.9	9/2/09	Expanded HF section.
Rev 5.1.A	12/15/09	Minor edits. Added Norway freq via LA7SPA
Rev 5.1.B	12/16/09	Minor edits/clarifications in Digi section, D700 & D7 setups and elsewhere. Added FTM-350R section.
Rev 5.1.C	03/2/10	Added note about external Trackers in Speaker Jack. thanks NB7O Updated Puget Sound freqs. per KB7UVC [440.875 1200/9600 > 144.350 9600]. Improved SSID not required.
Rev 5.1.D	03/3/10	Updated title 2009 > 2010
Rev 5.1.E	03/11/10	Added D700/D7 Troubleshooting tips.
Rev 5.1.F	04/20/10	Added Object MYCALL restrictions.
Rev 5.1.G	05/20/10	Added note to turn off Voice Alert if QSOs not wanted.
Rev 5.1.H	8/29/10	Added Voice Alert Addendum. Updated France freqs per F4ARO Leszek
Rev 5.1.I	10/5/11	Explain CUSTOM Comments, rearrange Beacons sect. Improve Airborne & Addendum. D72 menus from K0WJ, updated title 2011

Yahoo Posting info:

I try to keep this updated in the D700 Yahoo group and won't update the vers number in the filename any more to eliminate link rot.

INFO FOR ME when posting

Subject : APRS Beginner Guide

Basics to get started with simple explanations and Kenwood radio menu settings. Ver 5

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73, Steve, K9DCI