APRS®

Automatic Position Reporting System
Protocol Reference Version 1.0 (draft)

Written and copyright by
Bob Bruninga, WB4APR
Mark Sproul, KB2ICI
Keith Sproul, WU2Z

This draft is for comment on the CURRENT protocol ONLY. Enhancements and improvements will be made later after this draft has gone final.

There are other documents that go along with this document. Some are from other sources.

APRSSymbols.pdf A list of all of the Icons.

NMEA-0183 A full description of the GPS/NMEA data.

Peet Bros Weather Data
http://www.peetbros.com/faqs.htm#Q6

There are some specific formats not finished in this document. These are listed below and will be supplied soon.

HURRICANE report format.

Implementation

APRS uses Amateur Radio Packet protocol (AX-25) and utilizes the unconnected mode (UI-FRAMES) exclusively. This means that packets are simply sent out and reception at the other end is not guaranteed.

The packets are sent to a series of destination addresses such as "APRS". In some cases this destination address may contain information as well.

This document deals with the data-gram portion of the packet. Examples of APRS packets will normally omit the TNC header. There is a section on the header and its components and how it affects APRS. The header examples will be in TAPR TINY-2 format. This is for ease of representation in the printed word since the actual header data is binary in nature.

PACKET TYPE
All APRS transmissions use AX.25 Unconnected Information (UI) frames.

RETRIES
Being an unconnected protocol, there are no "retries" but all packets are redundantly transmitted on a decaying algorithm so that new information is transmitted more frequently than old data, but without acknowledgement. In general the period between each packet is on the order of 1.5 to 2 times the previous period.

PACKET
Each APRS packet is a UI frame: Each packet has an originating call sign, a destination, and a data-gram portion. All three of these items are important. The digi-path used in the packet can be interpreted by the software but is not needed for the protocol.

ORIGINATION CALL SIGN
The origination station is the CALL SIGN and SSID as defined by the AX-25 protocol. This is normally the person's Amateur Radio call sign.

DESTINATION CALL SIGN
This destination call sign is used to signify the destination of the data gram. In addition, APRS uses this to differentiate originating systems. In some cases this may contain data as well.

ALLCALLS
These are copied by everyone. All APRS software will accept packets addressed to the generic BEACON calls listed below and will normally ignore all others. All other TO addresses are ignored unless you set CONTROLS-FILTERS-OTHER to ON.

VERSION
APRS software should use the TOcall announcing the version number. This takes advantage of these other wise unused bytes. Since AP is wild-carded, the following list of version identifiers is used:

Reserved DESTINATIONS

APRS	older versions of APRSdos
APRSM	older versions of MacAPRS
APRSW	older versions of WinAPRS
APWxxx	WinAPRS with version number
APMxxx	MacAPRS with version number
APXxxx	X-APRS with version number
APCxxx	APRS/CE, Windows CE, with ver
APSxxx	APRS+SA with version number
APExxx	Pic-Encoder with version number
APKxxx	Kenwood radios
APYxxx	Yaesu Radios (future)
APIxxx	ICOM Radios (future)
APZxxx	Experimental
gridsquare	6 character Maidenhead Grid (must be all 6)

This table will be added by the APRS-WG. Each software package MUST use the specified TO CALL for their product. The EXPERIMENTAL destination is designated for TEMPORARY use only while a product is being developed, before a special character is assigned to it.

Other standard PACKET destinations that are accepted include:

AIR
ALL
BEACON
CQ
GPS
DF
DRILL
DX
ID
JAVA
MAIL
MICE
QST
QTH
RTCM
SKYWRN
SPACE
SPCL
SYM
TEST
TLMTRY
WX
ZIPLAN

Other TOCALLS are ignored to protect ALTNETS.

SPECIAL

This is for special events. All APRS versions will accept packets addressed to SPCL. But stations operating in SPECIAL mode will ONLY see other packets addressed to SPCL. This is so they will not be cluttered by other traffic on the channel NOT involved in their special event. This really has little to do with the protocol, just what is displayed.

ALTERNATE NETS

Other stations can use other TO calls. They will transmit to the ALTNET call and will receive ONLY packets to that same call. These stations thus can operate on the channel with other APRS, but will only see themselves, and will not be seen by others.This really has little to do with the protocol, just what is displayed.

DATA GRAM

The datagram portion is where APRS gets most of its data, positions, weather, messages, etc. There are many different types of data-grams. The first character normally indicates the data type, however in some instances additional characters have to be checked to determine the exact data type. The data gram portion of the packet contains many options. Each of these options will be covered in detail.

APRS FORMATS

In the following APRS on-air formats, the abbreviations are D for degrees (or DAY), M for minutes (Both lat/long and time), h for hundredths (or Hours), N for North and W for West. Base91 characters are the ASCII printable characters from ! to }.

TIME FORMATS

APRS generally uses a military style DATE-TIME-GROUP consisting of the two digit day and 4 digit hour and minute. These can be expressed in local and zulu time. Recently only zulu formats are transmitted on the air. In addition, a DATELESS format is also supported.

121234/ is local time 1234 on the 12th
121234z is zulu time 1234 on the 12th
123456h is hours minutes and seconds in zulu 12:34:56 zulu

ICONS

The APRS ICONs are identified by a two byte combination of a TABLE character and a SYMBOL character. There is a primary table, the alternate table, and overlay characters. See SYMBOLS.TXT.

FORMAT CHARACTER

The first character of any APRS packet is a format identifier. It determines the format of the remainder of the packet.

THIRD PARTY FORMAT

One special format character} allows any APRS packet to be carried or transmitted by any other station. This is what allows both the ZIPLAN and IGATE messaging

capability! On receipt of a 3rd party packet, the original header is dropped and the packet is recursively parsed again, beginning at the {. To show that it has been carried by another station, the call of that station is extracted from the as-received header and inserted as a pseudo digi* in the digi path. Example:

W3XYZ>APRS,DIGI*:}W4ABC>APRS,WIDE:>121234zStatus

will be processed as W4ABC>APRS,WIDE,W3XYZ,DIGI*:>121234zStatus

Notice how the "carrying station" W3XYZ is inserted as if it had been a digi in the path.

POSITION REPORT:
There are many POSITION formats as determined by the first character of the datagram. There is one exception, and that is the !FIXED format which may occur anywhere up to the 40th character position in the packet. This variability is to support X1J TNC digipeaters which have a string of un-modifiable text at the beginning. All LAT/LONG formats are fixed field and use Degrees and Decimal minutes. Any of the minutes digits may be replaced with Spaces to indicate several orders of magnitude of in-precision. (see section on Ambiguity)

!	Stationary Posit or Ultimeter 2000
/	Moving Position report
@	Moving Position report with time

@280817/3610.19N/08414.99W-ccc/sss
@151909z/4011.58N/07942.35Wv000/000/-300-<132>

```
...!DDMM.hhN/DDDMM.hhW$...          Fixed format (digipeaters) no APRS
=DDMM.hhN/DDDMM.hhW$...             Fixed but is APRS message capable
/DDHHMMzDDMM.hhN/DDDMM.hhW$...      Stationary, time of last fix
@DDHHMMzDDMM.hhN/DDDMM.hhW$CSE/SPD/... Moving (with APRS)
@DDHHMMzDDMM.hhN/DDDMM.hhW\CSE/SPD/BRG/NRQ/....  DF report
[XXnnyy]....            Grid Square
[XXnn]...               Grid Square
/YYYYXXXX$csT           Compressed format which can be used
                        in place of LAT/LONG/cse/spd in all
                        formats. /$ are the ICON bytes and T
                        is a TYPE byte.  See YYYYNNNN.txt
```

POSITION AMBIGUITY

```
07623.3 W   is a .1 mile circle  (I think I am here... +/- SA)
07623.  W   is a 1 mile circle   (I'm in this neighborhood)
0762 .  W   is a 10 mile circle  (I'm somewhere in Glen Burnie)
076  .  W   is a 60 mile circle  (I'm in the Wash/Balto area)
```

COURSE/SPEED

The 7 bytes following the symbol character can be any of the following additional formats:

```
CSE/SPD - these are fixed field 3 bytes each
PHGabcd - Power, ant/height, Gain and Directivity
DFSxbcd - Omni DF report (Same as PHG, but x=sig str)
```

POWER-HEIGHT-GAIN

This optional field replaces the CSE/SPD fields with a report of transmitter power, antenna height-above-average-terrain and antenna gain. APRS uses this to plot radio range circles around all stations. The following details the format to be used in the BText of a TNC dedicated as an APRS digi-peater:

```
!DDMM.mmN/DDDMM.mmW#PHG5360/WIDE...(identifying comments)...
  |          |      | | ||||  |_____ makes station show up green
  |          |      | | ||||________ Omni (Direction of max gain)
  |          |      | | |||_________ Ant gain in dB
  |          |      | | ||__________ Height = log2(HAAT/10)
 LAT       LONG     | | |___________ Power = SQR(P)
                    | |_____________ Power-Height-Gain identifier *
                    |_______________ # is symbol for digipeater
```

As you can see by the integers in the PHG string, there are only 10 possible values for each of these fields as follows:

DIGITS	0	1	2	3	4	5	6	7	8	9		Equation
POWER	0,	1,	4,	9,	16,	25,	36,	49,	64,	81	watts	SQR(P)
HEIGHT	10,	20,	40,	80,	160,	320,	640,	1280,	2560,	5120	feet	LOG2(H/10)
GAIN	0,	1,	2,	3,	4,	5,	6,	7,	8,	9	dB	
DIR	omni,	45,	90,	135,	180,	225,	270,	315,	360,	.	deg	(D/45)

The DIRECTIVITY field offsets the PHG circle by one third in the indicated direction. This means a front to back range of 2 to 1. Most often this is used to indicate a favored direction or a null even though an OMNI antenna is at the site. Note that 0 means OMNI and 8 means 360 or a NORTH offset.

HEIGHTS are ABOVE-AVERAGE TERRAIN! Not above ground or sea level. Also, since DOS version 8.0 the Height character may be any ASCII character 0-9 and above. This is so that higher heights for aircraft or satellites may be incorporated.

On receipt, the PHG values are converted to a usable radio range using the following algorithms:

```
POWER = P^2
H = 10 as a default
H = ASCII(Hchar)-51   converts it to a decimal value
HAAT = 10*2^H
GAIN = 10^(G/10)      converts from DB to decimal
RANGE = SQR(2*H*SQR((P/10)*(GAIN/2)))
```

OMNI-SIGNAL-STRENGTH DIRECTION FINDING REPORT

APRS can localize jammers by plotting the overlapping signal strength contours of all stations hearing the signal. This OMNI-DF format replaces the PHG format with DFS to indicate DF Signal strength, and the transmitter power field is replaced with the relative signal from 0 to 9. The following beacon would represent a weak signal heard on an antenna with 3 dB gain at 40 feet:

```
@141923/3859.11N/07629.23W\DFS2230/comments
```

A signal of ZERO (0), is equally SIGNIFICANT because APRS uses these 0 signal reports to draw (usually BLACK) circles where the jammer is NOT! These BLACK circles are extremely valuable since you will get a lot more reports from stations that don't hear the jammer than from those that do. This quickly eliminates a LOT of territory!

WEATHER REPORT

APRS uses the underline symbol character for WX reports.For these, the COURSE/SPEED field is used for the WIND and the remainder of the comment line contains other weather items. See WX.TXT

```
@DDHHMM/DDMM.hhN/DDDMM.hhW_CSE/SPDgXXXtXXXrXXXpXXXPXXXhXXbXXXXXdU2k
     r is in hundredths of an inch of rain in the LAST HOUR
     p is in hundredths of an inch of rain in the LAST 24 HOURS
     P is in hundredths of an inch of rain since midnight
     s is INCHES of snow in the last 24 hours
     b is in tenths of millibars
     h is percent humidity (00=100%)
     dU2k is Ultimeter 2000,
     U5 is the 500,
     Dvs is Davis
     RSW is Radio Shack
     PIC is a PIC device (K4HG?)
     HKT is Heathkit
          The first character designates what version of APRS
          'd' = APRSdos
          'W' = WinAPRS
          'M' = MacAPRS
          'X' = X-APRS (Linux)
          'S' = APRS+SA
```

Lxxx is luminosity in Watts per square meter 999 and below
lxxx is luminosity in Watts per square meter 1000 and above
L is inserted in place of one of the rain values.

MIC-ENCODER

The Mic-E includes part of its position in the TOCALL. Therefore these need to be decoded by everyone.

STAND-ALONE-TRACKER

These TNC's send to the call of GPSxyz where the xyz is used to indicate the APRS ICON. SPCxyz is used for special events. SYMxyz is also defined, but not in general use. All APRS software should capture these packets.

GRID-IN-TO

For special events such as digipeating via the SAREX or space station MIR, the stations gridsquare is sometimes transmitted in the TOCALL to keep the packet as short as possible. In this case, the packet must begin with]$[, where $ is from the primary symbol table. And the] character tells APRS to look for the grid square posit in the BText.

NMEA (GPS)

The recommended GPS types to interpret are listed below: Others may be recognized if the programmer wishes.

```
$GPRMC,...,...,...      Raw NMEA strings from stand-alone-trackers
$GPGGA,...,...,...
$GPGLL,...,...,...
```

OBJECTS

OBJECT reports are identical to POSITs except that the posit is preceeded with a fixed nine character object name. The semicolon is the FORMAT identifier and a * separates the name and the posit. The position is time stamped in the usual manner. The call of the station sending the object should be attached to the object.

;OBJECT___*DDHHMMzDDMM.hhN/DDDMM.hhW$CSE/SPD/comments...

ITEMS

Items are the same as objects, except that the Format identifier is a), there is no time stamp, and the item name is variable length from 3 to 9 bytes followed by the standard ! format posit.

)ITEM!DDMM.hhN/DDDMM.hhW$...

This is the same format as the .POS files in the .POS directory.

REPLACEMENT OBJECT

A fundamental precept in APRS is that any station may take over reporting responsibilty of an object by simply transmitting the object in a new location (or the same location). The original station will cease transmitting that object when it sees an incoming same-named object from another station. Names ARE case sensitive. All receiving software must attach to the object the call of the sending station.

KILLED OBJECT

The station reporting an object may KILL the object from everyone else's screen by continuing to transmit it but with the * replaced with an underscore _. The format is the same.

AREA OBJECTS

Area objects can draw large shapes (BOX, CIRCLE, TRIANGLE and LINE) on the map with a size of from below a mile to 400 miles. The size and offset of the shape and its color is conveyed in theCSE/SPD field as XXX/YYY. (I owe you details)

LINE OBJECTS

The LINE object above can additionally draw "a line X miles either side of the line" if the width of this box is defined in the comment text within braces: {120}. This is for Weather watch boxes.

SIGNPOST

This special object will only appear on a map below the 8 mile scale. It appears as a highway sign and will display up to a 3 digit value on the sign if it is included in the comment text within braces {30}. The intention of this object is for displaying the speed of the flow of traffic past a point or any other changable quantity suitable for a sign.

STATUS PACKET

These packets announce the station's current mission or any other single line status to everyone. Each station may transmit one and only one. Only one is maintained on receipt. These packets are time-stamped so the sender knows when they were entered.

>DDHHMMzComments

APRS MESSAGES

An APRS message is a one line text string with a specified destination. The destination is the first 9 characters after the data type indicator (":"). The destination is followed by another ":", then the body of the message. The destination , or TO field can be any valid call sign or several special cases.

BLNn A bulletin, which gets transmitted once every 20 minutes for 4 hours

BLNa An announcement which gets transmitted once an hour for 4 days

NWS-xxx A special National Weather Service message

The end of a message is an optional message number, format "{xxxxx" the message number is limited to a minimum of one and a maximum of 5 characters. If a message is to you and has a message number, it must be acked. If no message number is present, then an ACK is not required. The message "number" is any PRINTABLE ASCII string and is not limited to numerals. Early versions of APRS had a numeric restriction and also a 1 character restriction.

:WU2Z :testing{003

An acknowledge to a message is the similar to a message

KB2ICI-14:ack003

The message being acked is the number string after "ack" (lower case).

Station to station messages begin with a colon and a 9 character addressee name padded with spaces to a total of nine characters followed by a colon:

:W3XYZ____:one line message text.....{345 (the {345 is the line#)

MESSAGE LINE NUMBERS:

Line numbers begin with the "{" character and may have from one to 5 bytes in them. Any printable ASCII character may be used but short numerical bytes are preferred. An ACK returns a copy of the line number.

MESSAGE ACK

An ACK is just a message with the letters ACK# where the # is the message line number (following the { character at the end of the line).

:W3XYZ____:ack345

If there is no message line number, then no ack should be sent.

MESSAGE GROUPS

You can specify special MESSAGE GROUPS to be calls that your station will also capture on your message page as if they had been addressed to you. Receive them as TO YOU, but do not ACK.

BULLETINS

Bulletins are simply messages to the call signs of BLN1, BLN2, ... BLN#. They will never be acked Bulletins sent to BLN# will decay to very long periods but bulletins sent to BLNx will decay down to once every NetCycle time and stay at that rate. Users must be alerted on arrival of a new BULLETIN.
Bulletins with a NUMBER are called BULLETINS and are usually time sensitive, such as a weather bulletin. Bulletins with a LETTER are called ANNOUNCEMENTS and, although are possibly timely in nature, are not time critical.

BULLETIN GROUPS

Bulletins may be sent to Bulletin groups, such as BLN#GRP All stations will also copy these bulletins, but if a station selects a list of Bulletin Groups, then his station will IGNORE all other bulletin groups (while still receiving the general BLN# bulletins). For example:

:BLN#WX___:This is a bulletin to the WX group

Everyone will receive it. But if a station is only interested in WX and nothing else, then he may set his BULLETIN GROUP to include WX. As soon as his BULLETIN GROUP is non zero, then he will IGNORE all other Bulletin groups except those in his list. (He still gets all basic BLN#'s tho)

DF REPORTS

The DF report includes a NRQ field in addition to the position, course and speed of the vehicle plus the bearing line.

@DDHHMM.xxN/DDDMM.xxW\CSE/SPD/BRG/NRQ/DF report...

NRQ indicates the Number of hits (for an N7LUE interface), the approximate Range and the Quality of the report. If N is 0, then it means nothing. Values from 1 to 8 give an indication of the number of hits per period relative to the length of the time period. So 8 means 100% of all samples possible, got a hit. The N is not processed, but is just another indicator from the automatic DF units. By entering a 9 as the HIT indicator, you can indicate to other users that your report is manual. The range limits the length of the line to the original maps scale of the sending station. The range is 2^R so, for R=4 would be 16 miles.

STATION CAPABILITIES

This packet is a free format text packet to define attributes for a station, each item is KEYWORD=VALUE, more than one can be on a line, separated by commas. Currently defined items are

IGATE
MSG_CNT=n

QUERIES

There are two types of APRS Queries. One is general to all stations and the other is in a message format to a single station. Queries always begin with a ?, are one-time transmissions (not scheduled for retry) and should not be acked. Similarly the responses to queries are one-time and should not be scheduled for repeated transmission and also should be sent without line numbers so that they are not acked.

?APRS?	Queries all stations (respond iwithn 2 mins)
?APRS?LLLLLL,OOOOOO,RRRR	Queries a radius around a LAT/LONG point
?WX?	Queries all WX stations
?IGAT?	Queries all Internet gateways They reply with a capabilities packet
?BLN?	
?POS?	
?PATH?	What is the local path (Recommended, not implemented yet)
W3ABC____:?APRS?	Queries just W3ABC (his posit/status)
:W3ABC____:?APRSP	Queries for W3ABC's Posit
:W3ABC____:?APRSS	Queries for W3ABC's Status
:W3ABC____:?APRSM	Queries for W3ABC's messages
:W3ABC____:?APRSO	Queries for W3ABC's Objects
:W3ABC____:?APRSD	Queries for stations heard DIRECT by W3ABC
:W3ABC____:?APRSH W4XYZ	Queries to see if W3ABC has heard W4XYZ

W3ABC sends back a packet with W4XYZ as an OBJ and sends back a message with the number of packets heard per hour from him. W3ABC responds with his Posit, Status, Messages or Objects as appripriate. For the APRSD he responds with a single MESSAGE back to the query station as follows: Directs= N3ABC W4XYZ AB3GH N5QSO ... In the case of the ?APRSH query, W3ABC sends back the POSIT of W4XYZ as an OBJECT and sends back a single line message as follows:

Hrd: 14 15 4 . 10 6 7 .

Which are his Heard statistics per hour for the last 18 hours.

ALL OTHER PACKETS

Any packet that does NOT meet any of the formats in this document are assumed to be a STATUS beacon and will show up as status as long as no other properly formatted Status has been received. Typical TNC ID packets fall into this category. Once a STATUS packet has been received it will not be overwritten by other non-status non-identified packets. Mac/WIn/+SA may capture and list ID packets separately.
Programs can decide handle these, or ignore them, but they must be able to process them without ill effects.

Table 1 - First character definitions

This table defines the meaning of the first character of the data-gram portion of an APRS packet.

!	Stationary Posit or Ultimeter 2000
"	---------- unused
#	Peet Bros U-II
$	GPS or Ultimeter 2000
%	Agrelo DFJr / MicroFinder
&	Reserved - Map Feature
'	---------- unused
(	---------- unused
)	Server Overlay Posits
*	Peet Bros U-II Weather Station
+	Shelter data with time
,	---------- unused
-	---------- unused
.	Space weather
/	Moving Position report
0-9	--- DO NOT USE
:	Message
;	Object
<	Station Capabilities
=	Stationary Posit (message capable)
>	Status with time
?	Queries
@	Moving Position report with time
A-Z	--- DO NOT USE
[	---------- unused
\	---------- unused
]	Grid Square
^	---------- unused
_	Weather Report
a-z	--- DO NOT USE
{	---------- unused
|	RESERVED, stream switch char
}	3rd party traffic
~	RESERVED, stream switch char

EXCEPTIONS TO THE ABOVE

T	Telemetry Data

There are several terms that need to be defined

Gateway	- a station that gates between VHF and HF
IGate	- a station that gates from Internet to RF in addition to RF to Internet
Email gateway	- a station that will forward a properly formated message to email
Digipeater	- a TNC or station that is set up to digipeat packets
WIDE-digi	- a Digipeater that has an alias of WIDE
WIDEn-n	- a digipeating scheme that allows WIDE-n packets
Trace digi	- a digipeater that substitutes its call for TRACE or WIDE
Posit	- Position report

Design Philosophy

It is important to note that APRS was written ONLY to be a real-time tactical communications tool to help the flow of information at things like special events, emergencies, SKywarn, the EOC and just plain in-the-field use under stress. But like the real world, 99% of the time it is just used 24 hours a day 7 days a week waiting for the unlikely serious application.

It is important to make sure that nothing we do to enhance 24/7 operations, *ever* undermines our ability to operate in local areas under stress. Here are the details of that philosophy:

1 The objective is to have a net-cycle time of 10 minutes under local use meaning that within 10 minutes of your arrival on the scene, you will have captured the entire Tactical picture without transmitting a thing (and adding QRM). This fundamental "net cycle time" assures users of a "no-worse-than" time latency in his information that he can trust.

2 ALL-Queries. These are not the solution. We do not want everyone doing an all-net-query each time he starts up just to find out. For each and every QUERY, it is like DOUBLING the rate, since EVERY station on the air then responds. This is bad QRM to everyone.

3 All stations, even fixed stations should BEACON their posit at the "net-cycle-time" rate. In a stress situation, stations are coming and going all the time. The POSIT not only shows you where he is without asking, but also that he "is still on the air".. This is important. We do it in voice nets, we do it in APRS. We must know who is on the air and available. I do not want hour-old ICONS on the map masquerading as usable assets when they long since shut down.

4 We cannot assume that all APRS users responding to a stress event understand all the ramifications of APRS and the statistics of the channel. We can not rely on user-settings to avoid killing a stressed net. Thus, APRSdos automatically adjusts its net-cycle time to try to anticipate when the software is under stress usage. It uses the following assumptions:

* The rate is 10 minutes for DIRECT operations
  (probably an event)
* The rate is 10 minutes for ONE digipeater
  (probably an event)
* The rate is 20 minutes for TWO digipeaters
* The rate is 30 minutes for THREE or MORE HOPS..

5 Since almost all home stations set their paths to 3 or more digipeaters for routine operations, then we have a default rate of 30 minutes. THis again I hope is a universal standard that everyone can BANK on. If you turn on your radio and APRS and do nothing else, then in 30 minutes under routine operations you can *assume* that you pretty much have the total picture of all APRS stations within range.

6 Digipeaters are our most valuable and important assets. Travelers who may be within range of a given digi for only a short while may completely miss a Digi beaconing less often than 10 minutes. More distant users have time to wait. With recent TNC firmware, DIGIS can set multiple paths and rates for their packets. I request the following settings for their self identifying posit beacons:

DIRECT	Once every 10 minutes
VIA WIDE	once every 20 minutes
VIA WIDE,WIDE	once every 30 minutes
VIA WIDE,WIDE,WIDE	once every hour
VIA WIDE4-4	once every 2 hours
VIA WIDE5-5	once every 4 hours

Notice that it takes you more than 4 hours to cover the distance of 5 WIDEs, so on any trip anywhere you will see all the digis you will need. You will see the local ones first, but will also see the ones in front of you before you need them too...

7 We can argue all day about what are the optimum rates, but I feel we must have a common expectation for all users. My best guess was 10 and 30 minutes for the two extremes (but common) usages and it is built into APRS that way. I do not like the 1 hour rate. It is too long to wait, and encourages people to QUERY. And for every Query, the "effective" rate for every station in the net just HALVED.

8 Finally, by having these two assumed rates, it gives all the network designers the fundamental assumptions of channel loading necessary for good engineering design.

NET CYCLE:

There is an assumed maximum refresh period that all data is at least transmitted once. For special events, this is 10 minutes. For local area, 20 mins and for routine wide area operations, this is 30 minutes. APRS uses the number of digipeaters in the UNPROTO path to determine this maximum refresh period. For none or one digi, it is 10. For 2 hops it is 20, and for 3 or more, it is 30. Other forms of adjusting the NET-CYCLE TIME are permitted.

APPENDIX:

This table gives a one-line summary of all APRS protocols:

```
>.....................  Status packet
>DDHHMMz..............  Time stamped status packet
!DDMM.hhN/DDDMM.hhW$... POSIT ( no APRS)
=DDMM.hhN/DDDMM.hhW$... POSIT (APRS message capable)
/DDHHMM/DDMM.hhN/DDDMM.hhW$...   Time of last fix (No APRS)
@DDHHMM/DDMM.hhN/DDDMM.hhW$CSE/SPD/... Moving (with APRS)
@DDHHMM/DDMM.hhN/DDDMM.hhW\CSE/SPD/BRG/NRQ/....  DF report
[XXnnyy]....            Grid Square
[XXnn]...               Grid Square
]$[.....                Grid-In-Tocall using symbol $
./YYYYXXXX$csT          Compressed (Used in any !=/@ format)
$GPRMC,...,...,...      Raw NMEA strings from stand-alone-trackers
$GPGGA,...,...,...
$GPGLL,...,...,...
'lllc/s$/.........      Mic-E no message capability
'lllc/s$/>........      Mic-E message capability
`lllc/s$/>........      Mic-E old posit
;OBJECT___*DDHHMMzDDMM.hhN/DDDMM.hhW$CSE/SPD/comments...
+OBJECT___*DDHHMMzDDMM.hhN/DDDMM.hhW$CSE/SPD/comments...  dos Internal
-OBJECT___*DDHHMMzDDMM.hhN/DDDMM.hhW$CSE/SPD/comments...  Kill object
_OBJECT___*ditto  Internal by APRS DOS showing object was killed
)ITEM!DDMM.hhN/DDDMM.hhW$...  Similar to .POS file format
:ADDRESSEE:Message text ........{xxxxx    Up to 5 char line number
:ADDRESSEE:ackXXXXX                      Ack for same line number
:BLN@     :Bulletin text long term       @ is serial line number
:BLN#     :Bulletin text short term      # is serial line number
:BLN#GROUP:Short or Long term GROUP Bltn
%BRG%Q                  DF Bearing and Quality
*DWTRRRRrrrr      Ultimeter-II MPH? (I may have these reversed)
#DWTRRRRrrrr      Ultimeter-II KPH?
!!....,......     Ultimeter-2000
$ULTW........     Ultimeter-2000 Packet mode
?APRS?.......     Many Query formats.  See above
<............     Reserved
(............     Avail
}packet......     3rd Party Packet
^............     Not used?
\............     Not used?
&............     Not used?
```