

APRS Tiny Web Pages

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Although APRS has revolutionized packet radio, it is also one step ahead of the next great leap in wireless technology which is handheld wireless access to Web pages. Although cell phones and pagers are just beginning to capitalize on this next wave of technology, APRS already has it! Take a look at the screen of your Kenwood TH-D7 or TM-D700... What you see are hundreds of Tiny Web Pages of information!

In this context, these radios already display over 200 pages of station information, 32 pages of Messages and 20 pages on the DX list on your dashboard or in the palm of your hand. The purpose of this paper is to show how we can exploit this display capability to give mobile and handheld APRS users wireless access to a wealth of on-line information. This paper will cover the following topics:

- The existing 252 Tiny Web Pages that can be displayed
- How we added Satellite tracking and schedule data using "push" techniques
- How we expanded to dozens of other categories based on "query" techniques
- The formats for using the DX list to display Tiny Web Pages
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Photo 1. This photo shows W4HFZ's mobile APRS installation. Using the Kenwood APRS mobile data radio, even without a laptop, he has access to hundreds of pages of display information. Now we are adding Tiny Web Pages and whole new databases to these displays.

EXISTING STATION PAGES (using "push" technology)

First I will review the appearance of the conventional usage of these Tiny Web Pages. These existing pages can be considered to use "push" technology, in the sense that you do not have to request them. Just turning on your radio and monitoring for a few minutes will update these 252 Tiny Web Pages automatically in your radio. In the following examples, I will use the screen of the TH-D7 HT to illustrate the Tiny Web Page. The TM-D700 is similar but the pages are larger and contain more text, so by using the HT in these examples you will see the worst case display scenario. The STATION pages follow 5 basic formats. The first page is just the list of stations:

STATION LIST

```

+-----+ The Station list shows three calls at a time and you can
| 1:WB4APR | scroll up or down the list through the entire 40
| 2:wu2z   |
| 3:KB2ICI |
+-----+
  
```

On selecting any station, you can cycle through 4 additional pages:

```

STATUS PAGE      ICON  DISTANCE      LAT/LONG      CSE/SPD/COMMENT
+-----+ +-----+ +-----+ +-----+
1 1:WB4APR      I  I  1:WB4APR      1 1 1:WB$APR      1 1 1:WB$APR
| To Alabama  | 1  FM19dx      1 1 N38 59.11    I  I Enroute
| for XMAS   | I  16.4mi -> 1 1 W7629.11    1 1 cse284°s055m I
+---e-w-----+ +-----+ +-----+ +-----+
  
```

Yet, these 4 formats are not limited to only Mobiles, but ANY station or object. Even in conventional APRS we use these pages every day to look at these kinds of information:

- CALLSIGN and SSID
- Station Type (Fixed, Digi, Moving, THD7, TMD700, Mic-E, WX etc)
- Station ICON (Over 300 but only the most common 16 are graphical)
- Grid Square
- Distance and Bearing from your present location
- Location to nearest 60 feet (Latitude/Longitude)

THE 5TH CUSTOM PAGE

In addition, each of these stations has additional information on its 5th page depending on the type of station as shown below:

```

STATION TYPE      DISPLAYS
-----
HOME STATION      XMTR Power, Antenna Height, Antenna gain, Directivity
WX STATION        Wind Direction and speed, Temp and Rain in last hour
MOBILES           Station type, Course and Speed, and comment
OBJECTS           Who posted it, course and speed, comments, etc
SATELLITES        Uplink and downlink frequencies, and present Doppler
HURRICANES        Who posted it, Wind Speeds, pressure, Course and Speed
  
```

PAGE SELECTION AND MESSAGE PAGES

We can SELECT these pages by moving forward or backward in the list or by setting the POSITION LIMIT so that we capture only stations within X miles of our current location. Thus we have complete control over our initial selection of these STATION Tiny Web Pages. Further, we can use standard APRS queries to query ANY station to report its pages or we can directly query any of these stations for additional information about their station or operation. These responding Tiny Web Pages are in the form of two page messages. Typical Query Responses from APRSDos stations look like this on the D7's Tiny Web Pages:

```

1st MESSAGE PAGE      2nd MESSAGE PAGE:
+-----+ +-----+
| >WB4APR      | | >WB4APR      | Response to a QUERY DIRE:CTS lists all
| Dir= wu2z 1  | | ( K3FOR N8PK 1 | stations heard direct by WB4APR
| K4HG KH2Z 1  | | 1 KB2ICI w4 I  |
+-----+ +-----+
+-----+ +-----+
| >WB4APR      | | >WB4APR      | Response to a QUERY HEARD shows number
| Hrd KB~ICI  | | 2 17 16 8  | of packets per hour for the last 12 hours
| 15 23 9     | | 1423 4     |
+-----+ +-----+
+-----+ +-----+
| >WB4APR      | | >WB4APR      | Response to a QUERY TRACE shows the path
| Path= WB4A I | | >K3ATI-12> 1 | from WB4APR to requesting station
| PR-11>N8PK 1 | | 1 K3XY-3>KB2 1 |
+-----+ +-----+

```

DX LIST

In addition to the Station list and the Message list, the radios also have the DX LIST which is used to capture DX spots as monitored from any DX cluster Frequency. These pages are 10 deep by two wide and display all the useful information provided in these DX spots. Unlike the other pages, however, these pages are volatile and are lost on each power down. This is usually not a problem due to the real-time value of these posts. It is the volatility of these DX LIST pages that make them attractive for some Tiny Web Page applications.

SATELLITE TRACKING PAGES and APRSdata.EXE

One of the first extensions of this Tiny Web Page concept (still using "push" technology) was to use the APRS network to post satellite tracking data to all mobiles and handhelds whenever one of the FM satellites comes into view. This is done by regional copies of my APRSdata.exe program that can transmit this information as a moving object to all stations within range. These Objects then provide the users with everything they need to know about the satellite right on their HT's Tiny Web pages as shown below:

```

+-----+ +-----+ Satellite-in-view PAGE
| 1:A027      | | 1:A027      | Showing Up and Down freqs plus doppler
| 145.85 -4   | | FM18RX      | Showing Range and direction
| 435.795 +6 1 | | * 1028mi -> I |
+-----+ +-----+

```

```

+-----+ +-----+
1 1:A027      | | 1:A027
1  N3859.11  | |  OBJECT
IW7629.11    | |  ~247 s999
+-----+ +-----+

```

Shows current position and its course and speed so you can tell if it is approaching or departing

By watching the Range page, or the amount of Doppler, the handheld user can tell when he can work the satellite. When the satellite gets to within about 1000 miles, you can usually work it from the mobile or the HT with your whip antenna.

SATELLITE SCHEDULES

But since these satellite objects are only usable if the user happens to be on the air at the time, the APRSdata program also provides a single Satellite Schedule every 10 minutes indicating all satellites that will be in view in the next 80 minutes. Since these schedules are repeated, it was decided not to displace good data in the POSITION or MESSAGE lists, but to write these schedules to the volatile DX LIST. These pages, although somewhat formatted to match the format of a typical DX spot can be used for displaying almost any kind of information. They are ideal for this scheduling application. Here is how these satellite schedules appear on the DX LIST:

```

..... Future PASS predictions updated every 10 minutes
1 UO22@1435 1 as listed in the D7's DX list showing all FM satellites
1 SO35@1453 I expected in the next 80 minutes
j UO14@1532 1
+-----+
+-----+
1 1:UO22@1435 SATS I Here is the same info displayed on the D700
UO14@1443 I which can display four satellites worth of
K025@1455 SO35@ I schedule data on one screen.
1510
+-----+

```

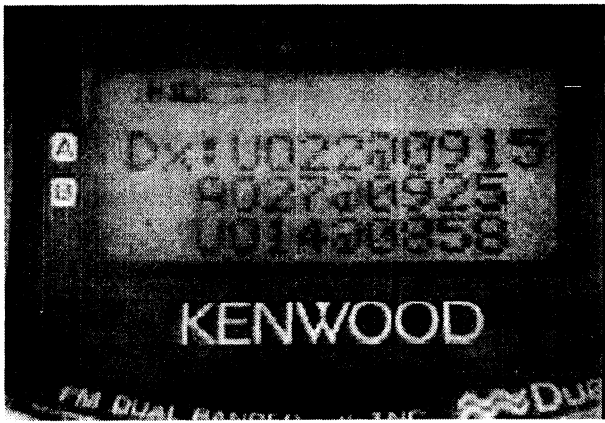
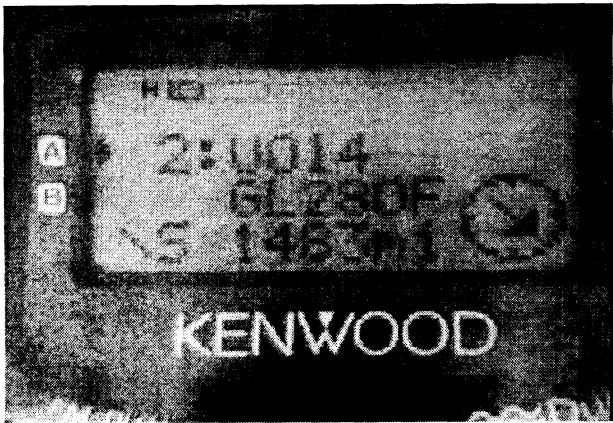


Photo 2. The left photo is just one of the 4 Tiny Web Pages that alerts the user that UO-14 is in view and is 1483 miles to the Southeast. Others show the Up and Down frequencies, position and direction it is headed. The right photo shows the Satellite Schedule for the next 3 satellites as it appears on the DX list.

GENERAL PURPOSE TINY WEB PAGES

The satellite Tracking Objects and 80 minute Schedules were just one of the first applications for the APRS Tiny Web Pages. As soon as we saw the power of this technique to PUSH information to the users, we realized that there could be an infinite depth of information that could be made available to users ON DEMAND. Just like the real WEB, users transmit QUERIES to the APRS system and the data is returned in any of the above variety of formats. All it takes to provide this service is someone in each major APRS area to run a copy of APRSdata.exe on an old PC connected to a TNC. Users in the area need no a-priori information to use the system. It will respond to Queries sent to the generic callsign of QDOS. The following two lists, then, summarize the information available to local users via their Tiny Web Pages. First there is the information already available on every APRS network:

- The location, range and bearing of the last 40 APRS stations around you
- The location, range and bearing of all DIGIpeaters in range
- 0 The local WEATHER including wind speed, direction, rain and temp
- ANY APRS bulletins
- Any APRS mail (think of this as Email)
- REAL one-line EMAIL from the radio TO anywhere

Next is the new data added to the network by local APRSdata servers.

- A Satellite Schedule every **10** minutes covering the next 80 minutes
- 0 Satellite positions every **1** minute when in view
- 0 Direction and range to the satellite from YOUR location
- 0 Satellite Uplink and Downlink Frequencies
- 0 Approximate Satellite Doppler for tuning

Finally are all the new data added to APRSdata and now available on demand by users from any local station running APRSdata information server. Just send a Message to QDOS with these Keyword Queries:

- HOSP Nearest Hospital
- 0 RS Nearest Ham Radio Stores
- 0 NWR Nearest NOAA WX Radio xmtrs and freqs
- 0 NWS Nearest Nation WX service sites
- 0 VOICE Nearest wide area Travelers VOICE repeaters
- 0 ATV Nearest ATV repeater or Shuttle retransmission repeater
- 0 CRASH Nearest old Aircraft CRASH sites (to avoid errors during SAR)
- CAMP Nearest Campground
- FD Nearest Field Day Site and talk in freq
- CLUB Nearest Ham Radio Club and meeting schedule
- NET Nearest Net and frequency

Other data files that have been suggested:

- 0 PD = Police Station (Local/Municipal) location and telephone number
- 0 SP = State Police Station/Barracks locations and a telephone number
- 0 EOC = EOC Locations and local government OEM freq.
- 0 BBS = List of local 2M packet BBS, location, freq., etc.

The following examples show the how some of this information is delivered to the TH-D7 handheld display in response to a Query. The first screen is the 10 second "immediate" screen that summarizes the data the instant the packet comes in. After that, it is stored in the STATION LIST along with the last such 40 items. Each such ITEM has actually 5 l¹Tiny-Web-Pages¹¹ of detail. Only the first two are shown here. The others show exact LAT/LONG, and CSE/SPEED and other data.

| IMMEDIATE PAGE | RECALL PAGE | |
|---|--|--|
| 1 AARC I 3rd Thurs 1 147.105 | 1:AARc FM18RX 13.6mi -> | In response to a CLUB query The is an actual ICON graphic and the -> is a compass rose showing the direction |
| R ^S 1 OBJECT (fm:WB4APR I | 3:RS FM18CD I 3.6mi c- | Location of the nearest Radio Shack in response to a RS query. |
| 1 NOAA) 164.250 | 1:NOAA FM18RX 1 1 13.6mi v] | In response to a NWR Query shows nearest NOAA WX radio station and frequency |
| / N8ADN (WEATHER 1 1 | 5:N8ADN ((dir015 sI3m 1 1 t043F rO.01" | Each home WX station transmits these every 10 minutes or so, or you can do a Query to get the closest one to you at any time... It shows WIND speed and direction, TEMP and RAINFALL |

APRS TINY WEB PAGES FORMAT

The existing APRS formats can be used to write any POSITIONAL or TEXT type information to the STATIONS or MESSAGE lists. But when you write to either of these pages, you may be overwriting information that the user wants to retain. This is why we find the DX LIST pages to be the target for most of our text information. These DX LISTS are volatile and are not retained whenever the radio is turned off. Thus, they are perfect as a scratch pad display area for our Tiny Web Pages.

Back in 1998 I re-defined this DX list as an "APRS RESOURCE" (See README\RESOURCE.TXT in all APRS dots) and defined how we could use this page to display "resource" information of use to mobile users. The following examples show how the Kenwood Radios parse and display the DX SPOT format. First is the on-air packet format:

```
URCALL>RESORC:DX de YOURCALL.~FIELD-ONE.ITEMNAME***FIELD-TWOFIELD-3333
*Wk*hk-kJr-k*9cFORTH
```

Notice that due to a program quirk in the original TH-D7, that the AX.25 TOCALL must NOT be any of the normally recognized APRS generic calls. Thus we chose RESORC as the target call for this kind of packet. Beyond this filter, the Parsing strings are the characters "DX de ". Once these are recognized, the remaining 59 characters are parsed into five separate fields and displayed as

shown below, two pages for the D7 and one page for the D700. The 14 characters shown as asterisks are ignored since they do not fit on the screens.

```

+-----+          +-----+
1 Dx:RESOURCE 1    1 Dx:RESOURICE 1
1 FIELD-ONE      |    | FIELD-TWO 1
| FORTH 1        |    | FIELD-3333 (
+-----+          +-----+

```

And on the D700 as: +-----+

```

( 1:RESOURCE      FORTH 1
|                FIELD-ONE
| FIELD-TWO FIELD
| -3333
+-----+

```

APRSdata.EXE TINY WEB PAGE FILE SERVER

The program APRSdata.EXE actually began as a satellite tracking program called APRStk.exe. This program was simply the addition of satellite prediction routines to normal APRSdos to predict the positions of all the moving satellites and to TUNE the new Kenwood radios automatically to any satellite that was in view. As soon as we put it on the air, we realized that we could use these same routines to serve out the Satellite objects and Schedules to local Mobiles and Handheld users as well. Then we quickly realized that ALL of the normal APRS Map Overlay Files built into every copy of APRSdos could also be made available on demand using the same techniques. This then evolved into the present APRSdata.EXE program. But it should be noted that ALL of the Tiny-Web Page positional information is maintained in the same original XXXX.POS format already used by APRSdos and other versions for map overlay display of local information. Thus, anyone can prepare ANY kind of Tiny Web Page Query/Response simply by editing all of the positional data into a .POS formatted file and giving it the NAME of the QUERY to be used on the air. For example, here are a few sample lines from the CLUB.POS file for all the clubs in our local area:

```

Mobileers!3905.46N/07637.33W/?nd Friday 146.805
AARC !3853.87N/07639.31W/3rd Thurs 147.105
MMARC!3911.60N/07640.87W/Unknown 145.13
USNA !3858.88N/07628.88W/Noon Tues 147.105
ARINC!3858.45N/07633.40W/Unknown 147.105
GARC !3859.92N/07650.79W/Noon Wed 146.835
SMARC!3844. N/07659. W/2Fri 1930 147.15
LARC !3906. N/07651. W/4th Wed 147.225
NCDXA!3900. N/07700. W/Sund 2000 147.000
AARC !3851. N/07708. W/Tues 1930 145.47
BARC !3924. N/07640. W/Tues 2030 146.67
CARA !3913. N/07653. W/4Tue 1930 147.135
GMRA !3900. N/07656. W/SAT 1130 146.88

```

The first variable length field is the NAME of the item. Next is the fixed format LAT/LONG and ICON. Then up to 20 characters of additional information for display. By aligning these characters in fixed columns, they appear nicely on the Tiny Web Pages on the TH-D7 HT.

NOTES

I chose **QDOS** as the **TO-CALL** key word that triggers the response from APRSdata since it is a DOS program. Unless or until other programs evolve with this capability, it will also respond to the key word "QUERY" as well.

Second, the initial versions of APRSdata respond only with the closest item of the given category. In many cases, you may want to have a second opinion or to see the second or nth closest similar item. In later versions I hope to add this ability by simply following the Query KEYWORD with a number. Thus CLUB gets you the closest club. But CLUB 2 gets you the SECOND closest CLUB and so forth.

Third, APRSdata sites should be reasonably spaced. It is OK to have minor overlaps, because a user half way between two APRSdata servers would then get TWO responses, one that is closest to him known by APRSdata server A and another response that is closest to him in the direction of APRSdata server B.

SUMMARY

Thus, using the existing APRS formats and the DX Spot format, you can write almost an infinite variety of Tiny Web Page information to mobile and handheld users. Be thinking how you can apply these techniques to your local area. Remember, none of this has any value unless someone in YOUR area prepares the various data base entries in the first place. So get out those databases and start building your .POS files for anything you can think of that a mobile or handheld user might want.

Will these Queries overload the APRS frequency? No. Each such query response is only a SINGLE 1 second packet. (Locally generated and managed.)

Also, Home stations don't need any of this. They already have access to all of it either in their respective APRS programs or by access to the WEB. These TWP's are only for the mobile who does NOT have a running APRS laptop. THUS it is a small number of users that will be requesting data at any time. Even during COMMUTER hours, less than 10% of all stations on the air are mobiles...

Oh the fun we will have building these TWP databases of AMATEUR RADIO RELATED or HAM TRAVELER data for users...!

For more information see <http://web.usna.navy.mil/~bruninga/satinfo.html>