SatPC32 and the IC-9700
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Table of Contents

Introduction

I recently bought the Icom IC-9700 primarily as a means of getting on MSK144 and FT-8 on 2 meters (and maybe the higher bands). One of my regular six meter meteor scatter contacts (Pete – KD9VV) got me interested in getting on the amateur satellites. Always up for a new challenge, I gave it a try.

Now I am by no means an expert on the IC-9700 or the *SatPC32* program yet, but I've been doing software work since 1972 and am pretty good at figuring out how stuff really works (search my callsign on GitHub and you can see some of my recent projects).

My intent by writing this is to describe some of the idiosyncrasies and annoyances that Pete and I have discovered using *SatPC32* with the IC-9700 and some tricks that might not be all that obvious from reading the documentation (which is very detailed).

I am making no effort to re-write either the *SatPC32* documentation or the IC-9700 manuals!

Some of the information here is also gleaned from posts on the IC-9700 support group.

Installing SatPC32

First of all, as best as I can determine, the *SatPC32* program only works under Windows. There are some suggestions on the IC-9700 support group about similar programs that might work on Mac computers.

The *SatPC32* software can be downloaded from Erich Eichmann's (DK1TB) website. Besides being able to download the software itself from Erich's page, he also provides a link to a very nicely written set of instructions on how to set the program and IC-9700 up to work together written by Stefan Wagner (VE4SW).

I followed Stefan's instructions (not using the *SatPC32* "Scope" capability though) and everything worked on the first try, so I see no need to elaborate on anything here with one exception.

After downloading and un-zipping the installation files you need to run the *setup.exe* program as administrator.

There is one ***VERY IMPORTANT*** thing to be aware of when setting up the options in the *SatPC32* software. After making changes sometimes the program will tell you that you need to restart the program for the changes to take effect. ***DO NOT*** exit the program using the 'X' in the upper right hand corner of the main window. Always use the "File – Quit" menu item to exit the program. If you use the 'X' your changes ***WILL NOT*** be saved.

The *Setup-Options* Menu Item

This menu item allows you to configure the options that are set when the *SatPC32* program starts up. At a minimum you want to enable "CAT Control" and I highly suggest enabling "Countd. W. Map".

The second setting brings up the *Countdown* window when the program starts. This window has a list of all the satellites in the selected group (*Standard* by default) which shows their AOS/LOS times and maximum elevations. If the window doesn't come up automatically, go to the "Accy" menu item and select "Countdown". That will show the window. Check the "Open Window at Program Start" box in the Countdown window and it should always come up when you start the program.

Having CAT control enabled at startup does something very clever with the IC-9700. When I'm not on the satellites, the radio is typically monitoring one of the local repeaters. When I start *SatPC32*, it automagically switches the radio to Satellite Mode. What's even more interesting is that when I exit from *SatPC32* (again, use "File-Quit") the radio goes back to the configuration it was in before starting *SatPC32*.

You can read about what the other settings do in the *SatPC32 User Manual* (under the "?" item on the menu bar).

Are We Ready to Go?

Nope! There is at least one other thing that might need some adjusting.

Errors in the *Doppler.sqf* File

Pete and I discovered there are some mistakes in the *Doppler.sqf* file that comes with the software. This file contains the uplink/downlink frequencies (approximately the center of the bandpass for linear satellites) and whether the transponders work in normal or reverse mode.

The mistakes we found have to do with the CAS-4A and CAS-4B satellites (there may be other errors that we haven't found). These are both marked as operating in normal mode but in reality like most of the linear satellites, they work in reverse mode.

The *Doppler.sqf* file is located in your "..\AppData\Roaming\SatPC32" folder. Make a copy of it in your documents folder before doing anything else in case you screw up!

Now edit the file using notepad; you can also open it using the "? – Auxiliary Files" menu item. Find the entries for CAS-4A and 4B. The lines should look like this (the frequencies in your file may be slightly different):

```
CAS-4A,145870,435224.9,USB,LSB,NOR,0,0,UHF/VHF SSB
CAS-4B,145925,435274.1,USB,LSB,NOR,0,0,UHF/VHF SSB
```

There are actually a few lines for each one. You want to change the "NOR" to "REV" on all of the entries for each one:

```
CAS-4A,145870,435224.9,USB,LSB,REV,0,0,UHF/VHF SSB
CAS-4B,145925,435274.1,USB,LSB,REV,0,0,UHF/VHF SSB
```

Save the file and you might also want to save a backup version of the modified file.

Some Required Reading

Also before you start trying to work the satellites, I highly recommend some reading!

A good starting place is this *Introduction to Amateur Satellites* by Emily Clarke (W0ECC).

The second thing you want to thoroughly digest is the *SatPC32 User Manual* which you can get to using the "?" item in the menu bar. Once you've read it, read it again!

Pay particular attention to the section on calibrating the frequencies covered in *Section 4 – CAT Menu* as you will need to do this on all of the linear satellites.

A Couple of Other Useful Links

These two web pages provide details about the frequencies used for the more popular satellites as well as some other notes about their operation:

Linear Satellite Frequency Summary
FM Satellite Frequency Summary

This website allows you to get pass predictions for the various satellites:

https://www.amsat.org/track/

And this site shows whether others are hearing each satellite and allows you to report your experiences:

https://www.amsat.org/status/

Uplinks and Downlinks

Most of the amateur satellites use a range of frequencies (or a single frequency for the FM birds) in either the 2 meter or 70cm for the uplink and downlink. Sometimes the uplink is on 2 meters and sometimes it is on 70cm. The downlink will always be on the other band.

When you're reading documentation about the satellites the uplink/downlink bands are often designated as "U/V" or "V/U".

There are a couple of exceptions. For example AO-07 has an optional 10 meter downlink and AO-92 has an optional 23cm uplink; there may be others.

Selecting the "CAT" item on the *SatPC32* menu bar will open a window that shows the available frequencies for the currently selected satellite.

Reverse & Normal Mode

To the best of my knowledge all of the linear satellites work in *Reverse* mode. What does that mean? It means that when you increase the uplink frequency, the downlink frequency will decrease and vice-versa.

Earlier I talked about the entries in the *Doppler.sqf* file for CAS-4A and CAS-4B needing to be modified so that they are marked as operating in *Reverse* mode.

One thing we have discovered is that although the *Doppler.sqf* shows a satellite operating in *Reverse* mode, *SatPC32* ***DOES NOT*** set the "NOR/REV" mode on the radio. It's not a problem with the *SatPC32* program as near as I can tell, but rather a shortcoming in the IC-9700 software. Going through the *CI-V Manual* for the radio, I cannot find a CI-V command to set the "NOR/REV' button, thus make sure to manually set it correctly for the satellite in use.

Transmit and Receive Bands and Settings

When it's in satellite mode, the IC-9700 uses both bands that are displayed on the screen. The "Main" band at the top of the screen is your receive band and the "Sub" band is the transmit band. You'll notice that the "Main" band is normally highlighted.

If you use the Spectrum Scope (which I highly recommend), make sure it is set to monitor the "Main" band. I always use it in "Center" mode.

There are a number of things you might want or have to set manually on the radio for either the transmit band or the receive band.

Remember when you manually set things on the radio, the settings are applied to the highlighted band (normally the receive band in satellite mode).

Receiver Manual Settings

Two things you may need to do on the receiver band are to turn on the noise blanker and/or noise reduction. You might also need to set the amount that each of these affect the received signal. Instructions on how to do that are in the IC-9700 manual, so I need not elaborate any further here.

The other function that you will most likely need is the RIT. One of the best features of *SatPC32* is that it adjusts the transmit and receive frequencies automagically to account for the Doppler shifts.

Unfortunately, there are quite a few stations on the satellites that aren't using *SatPC32* and don't understand *The One True Rule of Doppler Tuning*. As a result, you'll hear those stations changing frequency as you're trying to work them. Using the RIT function allows you to easily tweak your receiver tuning without changing the transmitter; let them chase you also!

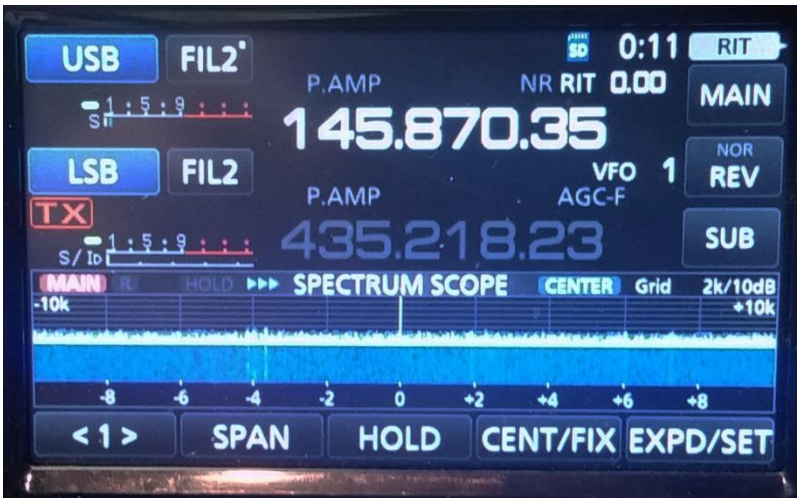
One thing to be aware of is that if you switch from a U/V satellite to a V/U one (or vice-versa) these settings will move with the band to the transmit (sub) band. It's not a problem though except that you'll possibly have to reset them again for the new receiver band.

Transmitter Manual Settings

At this point, there are none that I can think of.

What It Should Look Like

Here's what my radio looks like set up for CAS-4A. The downlink frequency (receive) is in the "Main" band and the uplink (transmit) frequency is in the "Sub" band. Notice the TX indicator is associated with the "Sub" band. Also notice I have "NR" and "RIT" turned on for the downlink.



Working the FM Satellites

Working the FM satellites is a bit different when it comes to tuning. True, the same Doppler shifts apply to both the transmit and receive frequencies, but dealing with them is not quite the same as dealing with the linear birds because of how FM works.

When working the FM satellites, there is rarely a need to change the uplink frequency however you will need to adjust the downlink frequency. You'll notice that when you select an FM satellite, *SatPC32* turns off the VFO function ("V-").

There are two ways that you can deal with the downlink. By touching the "Main" touch screen button, you can make changes to the receive frequency without affecting the transmit frequency.

An alternative method is to turn on the AFC function. With AFC turned on your receiver will automatically zero in on an FM (or CW) signal.

If you want to do it this way however, turn off CAT control (“C-“) otherwise *SatPC32* will move the receiver frequency back to where it thinks it should be. Also turn the VFO on “V+” which will cause *SatPC32* to read the new frequency from the radio.

As an example, here’s a little chart that Pete (KD9VV) sent me that shows how the folks using dual band handie-talkies set up their memories for SO-50:

Receive Frequency	Transmit Frequency	Offset Frequency	Offset Direction	Operating Mode	Name	Tone Mode	Tone
436.81500	145.85000		Split	FM	50 -4	Tone	67.0 Hz
436.81000	145.85000		Split	FM	50 -3	Tone	67.0 Hz
436.80500	145.85000		Split	FM	50 -2	Tone	67.0 Hz
436.80000	145.85000		Split	FM	50 -1	Tone	67.0 Hz
436.79500	145.85000		Split	FM	50 MID	Tone	67.0 Hz
436.79000	145.85000		Split	FM	50 +1	Tone	67.0 Hz
436.78500	145.85000		Split	FM	50 +2	Tone	67.0 Hz
436.78000	145.85000		Split	FM	50 +3	Tone	67.0 Hz
436.79500	*145.85000*		*Split*	*FM*	*50 74*	*Tone*	*74.4 Hz*

Notice the transmit frequency is always 145.850MHz but they change the receive frequency in 5KHz steps. The last entry in the table is a special entry needed for this particular satellite in that one must transmit the 74.4HZ CTCSS tone for 2 seconds to initially turn the satellite on.

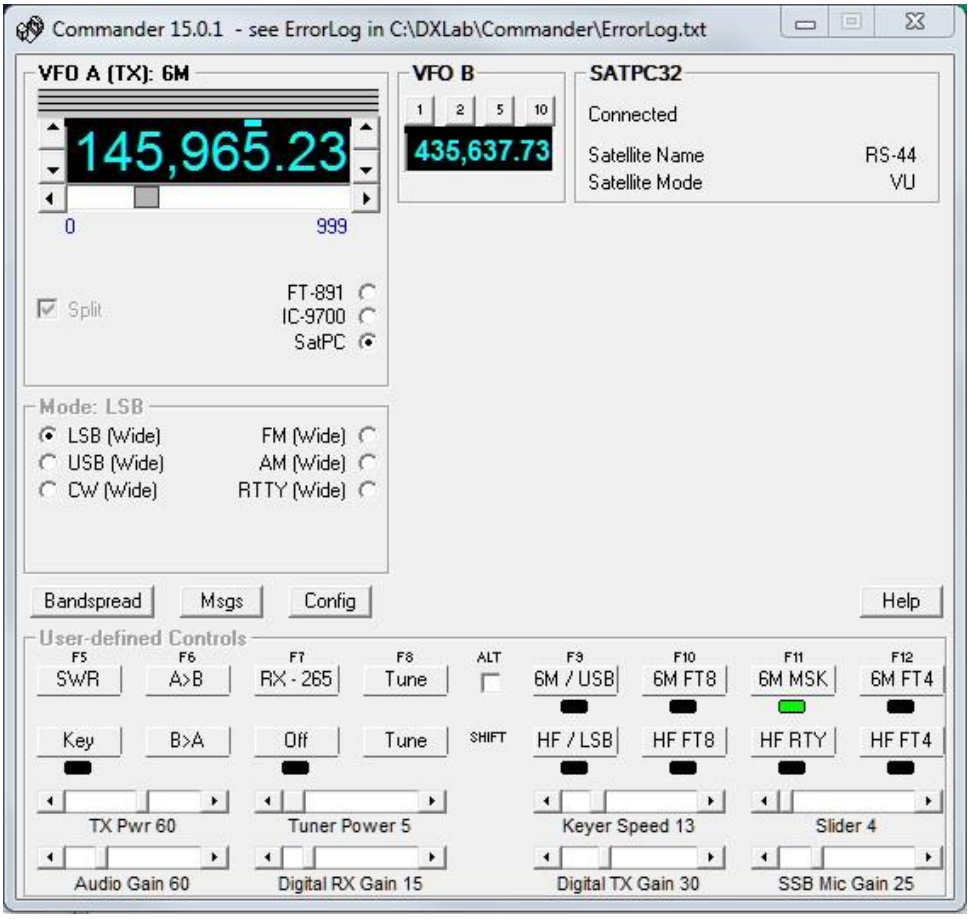
Semi-Automatic Logging

Dave (AA6YQ) has a simply wonderful suite of (free) programs that allow you to do almost anything possible with a radio connected to a PC. Two of these programs are *Commander* which can control your radio and also can communicate with *SatPC32* and *DxKeeper* which is a logging program. There are many more useful programs in the *DxLab* suite which you might find of interest.

In a post on the IC-9700 group, Dave provided a link to the instructions telling one how to setup these programs to log satellite contacts while using *SatPC32*.

I was already using both programs with my Yaesu FT-891 and *WXJT-X* for FT-8 on HF and 6 meters and for meteor scatter (MSK144) on 6 meters as well as a few other modes. One of the really neat features in the *Commander* program is that it allows one to create user defined buttons and sliders that can send sequences of commands to a radio with one click. I never have to physically touch the FT-891 except to turn it on or off!

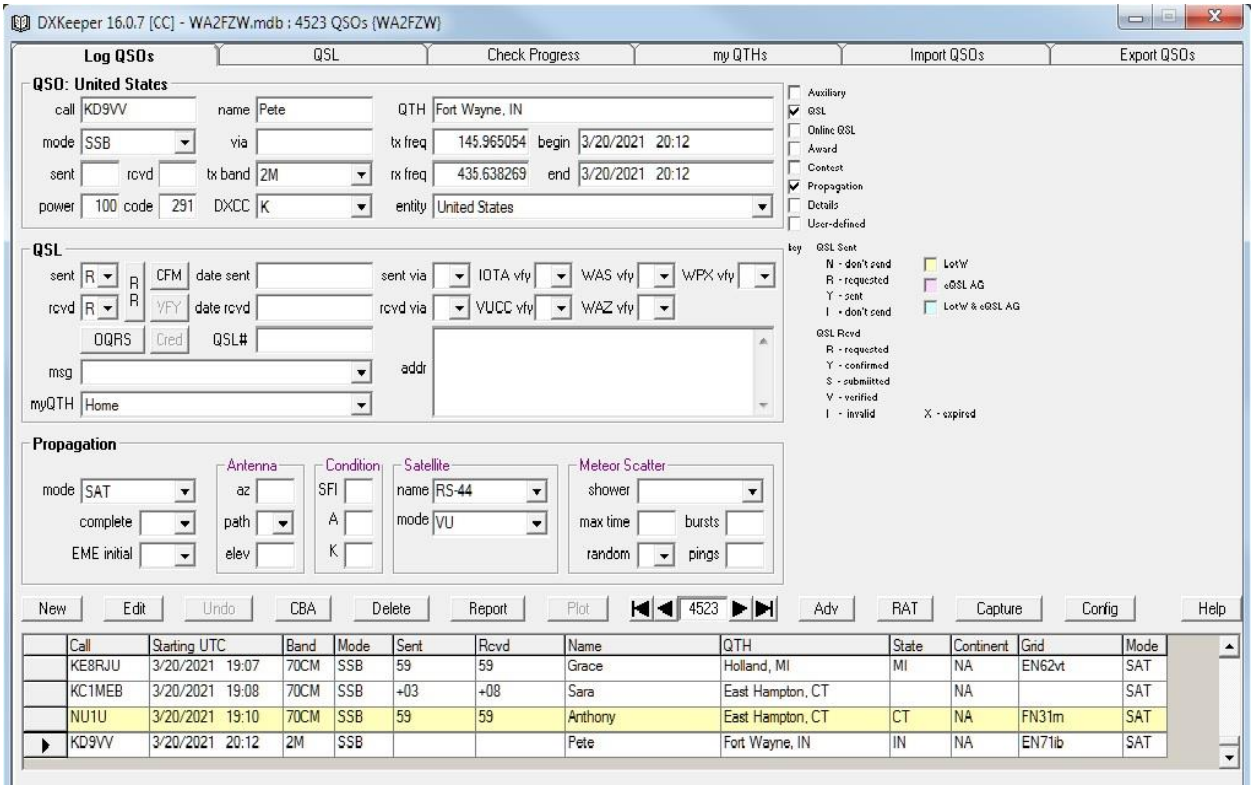
Here's what my *Commander* window looks like when communicating with SatPC32:



The VFO-A frequency is the RS-44 downlink and VFO-B contains the uplink frequency. In the upper right hand corner it shows that I am working RS-44 which is a V/U mode satellite.

The buttons and sliders at the bottom of the window are the custom ones that control my FT-891. You can see I can set modes, frequencies and a number of levels quite easily!

And here's what my DxKeeper window looks like:

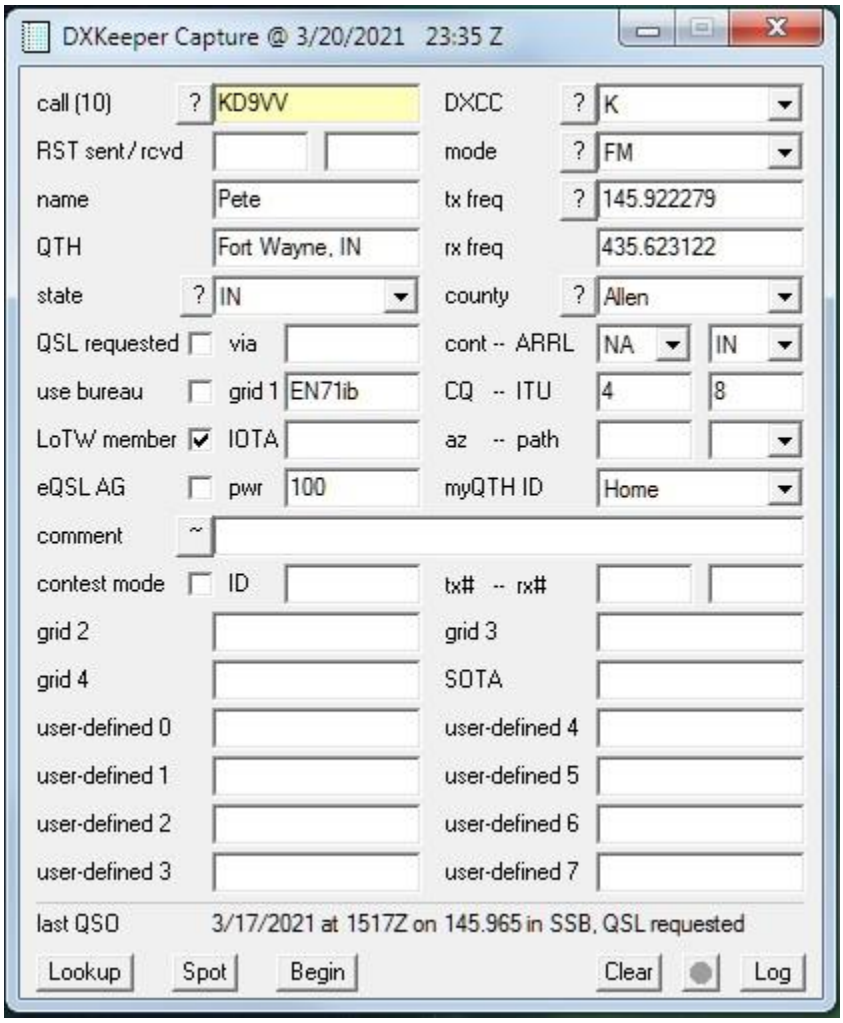


The last entry at the bottom of the page is a QSO with Pete (KD9VV) that really didn't happen but I used him as a test. Simply entering his call in the appropriate box on the main logging page or using the smaller "Capture" window, everything you want to know except the signal reports, grid and QSO end time are populated from the *Commander* connection to *SatPC32*.

If you look at the last two entries in the log, you'll notice that the entry for NU1U is highlighted in yellow. In *DxKeeper*, this indicates that that station is in *LoTW*; but Pete's entry is not highlighted even though I know he is in *LoTW*. I had logged the NU1U entry using a backdoor method via *WSJT-X*.

Thanks again to Dave there is a fix for that as well. You simply need to add another of Dave's programs into the mix. That program is *DxView*. DxView knows who is a member of *LoTW* and *eQSL* and a bunch of other stuff! After following Dave's instructions for setting *DxView* up, DxKeeper will show whether a station is a member of one of the two QSL confirming sites. More information on what you need to do to set it up is in one of Dave's posts on the IC-9700 group.

Here's a screenshot of the *DxKeeper* "Capture" window with *DxView* running. You'll notice Pete's call sign is now highlighted in yellow indicating he is on *LoTW*:



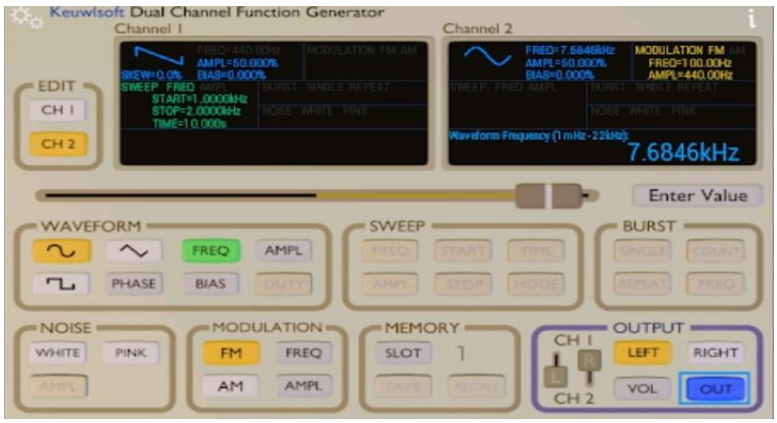
Also notice that Pete's grid is filled in. Pete is already in my DxKeeper log from numerous meteor scatter QSOs. If a station is already in your log, DxKeeper will populate all the fields.

This time I had satellite CAS-2T (which has issues, BTW) selected in *SatPC32*, which is why the mode is shown as FM. Clicking the "Log" button in the bottom right of the window will add the entry to *DxKeeper*.

A Useful App

When doing the frequency calibration for a satellite, the best approach is to either whistle into the microphone or to use CW. Since I'm a terrible whistler and haven't gotten around to hooking a key up to the radio yet, I use a different approach!

I found a nice audio function generator app for Android phones. I don't think it works on iPhones though, but I'll bet there is something similar. Here's what it looks like on the phone:



Instead of whistling, I turn on a 1,000Hz sine wave and hold the microphone over the phone's speaker. That results in seeing a nice straight line on the IC-9700 waterfall and makes the calibration process very easy.

Some Other Useful Programs

Posts on the IC-9700 group suggest a couple of programs that can automatically update the Keplerian data (they should be updated at least once per week); I haven't tried either of these however:

- The Kepler Updater
- TLE Tools

The Keps should be updates every few days. This Amsat page indicates the data is updated weekly around 2300 UTC on Thursdays, however an ARRL page seems to indicate that the amateur satellite data is updated every three or four days.

Another important thing is to keep your computer's clock accurate. I've been using the Dimension4 program which runs constantly in the background and keeps my computer right on time. You can also check your clock using the URL "Time.is"

Why does the computer's clock need to be accurate? The current time along with the Keplerian data is used to computer the Doppler corrections in *SatPC32*. If the computer's clock is off even slightly or the Keplerian files are not up-to-data, the Doppler computations will be inaccurate and you will have a hard time maintaining the correct frequencies.

Comments and Suggestions

As I said at the beginning, the intent here was not to re-document *SatPC32* or the IC-9700, but to provide a consolidated set of information from various sources that should help anyone get started using the program and the radio for satellite work.

As I learn new things which might not be apparent, I will update the document. If there's something you think I should include or if you think I got something wrong, feel free to e-mail me at WA2FZW@arrl.net.