

RadFxCat (Fox-1B) was sent aloft as a secondary payload on the United Launch Alliance (ULA) Delta II rocket that transported the JPSS-1 satellite to orbit. RadFxCat (Fox-1B) is one of five CubeSats making up this NASA Educational Launch of Nanosatellites (ELaNa) XIV mission, riding as secondary payloads aboard the JPSS-1 mission.

Since RadFxCat (Fox-1B) has met all of the qualifications necessary to receive an OSCAR number, I, by the authority vested in me by the AMSAT President, do hereby confer on this satellite the designation AMSAT-OSCAR 91 or AO-91. I join amateur radio operators in the U.S. and around the world in wishing AO-91 a long and successful life in both its amateur and scientific missions.

I, along with the rest of the amateur community, congratulate all of the volunteers who worked so diligently to construct, test and prepare for launch the newest amateur radio satellite.

William A. (Bill) Tynan, W3XO, AMSAT-NA OSCAR Number Administrator. 



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## Working the FalconSAT-3 Digipeater

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After 10 years of serving the U.S. Air Force with onboard experiments and as a training platform for the Air Force Academy in Colorado, FalconSAT-3 is now open for radio amateurs. Its 9600bps AX.25 V/U digipeater and packet mailbox quickly have become popular. The mailbox has been popular among those who used to work other packet satellites, and the digipeater is also drawing crowds. Unlike the ISS and NO-84 that operate on a single 2 m frequency (145.825 MHz), setting up for FalconSAT-3 requires a little extra work. Once you have configured your radio for FalconSAT-3, mindful of Doppler on the 70 cm downlink, you can have just as much fun working stations on this satellite. More information about FalconSAT-3 is available from AMSAT's web site<sup>1</sup>.

FalconSAT-3 uses an uplink frequency of 145.840 MHz and a downlink of 435.103 MHz (+/- for Doppler). The uplink doesn't change, but the downlink needs to be adjusted downward throughout a pass. Here is the frequency chart:

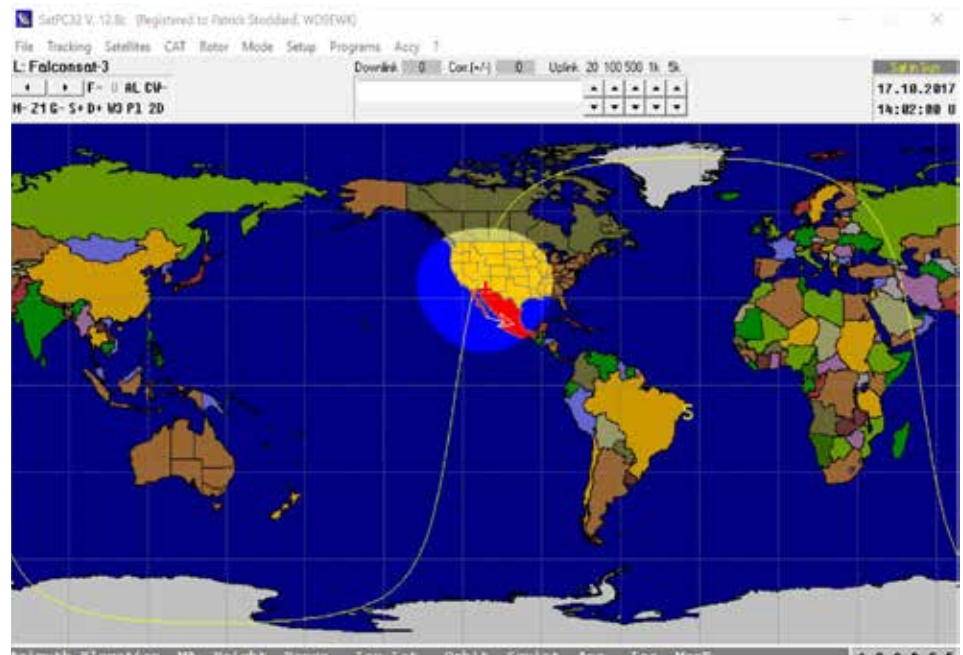
Channel	TX Freq (MHz)	RX Freq (MHz)
1	145.840	435.110
2	145.840	435.105
3	145.840	435.100
4	145.840	435.095
5	145.840	435.090

The Kenwood APRS-ready radios capable of cross-band full-duplex operation are great choices for a single radio to work this satellite. HTs like the TH-D72 and TH-D7, and mobile radios like the TM-D710 and TM-D700, work well with some changes to the configuration. Using two radios is also an option for this satellite, and one of those radios could be an SDR receiver with software like UZ7HO's HS-SoundModem software<sup>2</sup> to decode the 9600 bps data.

The first radio I tried with FalconSAT-3 was my TH-D72 HT. I had to adjust a few menu settings to be able to work 9600 bps packet and use both VFOs for the uplink and downlink frequencies. Menu settings I changed were:

Menu #310 (Data Band): A: RX B: TX  
 #311 (Data Speed): 9600 bps  
 #320 (DCD Sense): Ignore DCD  
 #3H0 (Type): Others  
 #3H1 (PATH): PFS3-1

These settings enable VFO B for transmitting and VFO A for receiving. The TH-D72 only stores one "other" packet path, so those who also work the ISS or NO-84 with a



FalconSAT-3 footprint. [All photos, Patrick Stoddard, WD9EWK.]





TH-D72 QSO between WD9EWK and K0FFY.



QSO with K7TAB using TM-D710G.

TH-D72 will have to change menu 3H1 between ARISS and PFS3-1 (among other settings). Unfortunately, the TH-D72 does not provide for more than one “other” path like the newer TH-D74 does.

Before starting to work a pass, make VFO B the main VFO, and activate the “DUP” function by pressing the F key followed by the 0 key. This will allow for full-duplex operation, and help your radio receive packets as soon as transmissions end. Andrew, KE8FZT, assembled a helpful web page<sup>3</sup> with these instructions and screenshots. I also completely open the squelch for VFO A and set menu 120 (Audio Balance), so it is 100% on VFO A since I’m not receiving on VFO B. When you activate the TNC, “APRS96” should appear on the screen.

When working passes, VFO B should be the main VFO almost all the time, except when adjusting the downlink frequency. When it is time to tune down 5 kHz, switch to VFO A, make the adjustment, and then switch back to VFO B.

Another radio I have used to work FalconSAT-3 is a Kenwood TM-D710G. Similar to the TH-D72, a few settings must be changed to prepare for this satellite.

- Menu #601 (Data Band): A: TX B: RX
- #601 (Data Speed): 9600 bps
- #601 (DCD Sense): Ignore DCD
- #612 (Type): OTHERS
- #612 (PATH): PFS3-1

The TM-D710G automatically operates in full-duplex mode whenever the two VFOs have frequencies in different bands. I use VFO A for the uplink and VFO B for the downlink. I turn the volume all the way down with maximum squelch for VFO A, and a reasonable volume level and open squelch for VFO B. When the TNC is activated, you should see “APRS96” on the screen.

Even though the TNC has been set to always transmit from VFO A and receive from VFO B, I leave the PTT on VFO A except when adjusting the downlink frequency. When I need to make an adjustment, I switch over to VFO B, adjust the downlink, then switch back to VFO A. I make sure the line of commands showing “KEY F MSG LIST BCON POS P.MON” appears on the bottom of the display because I use some of these keys to see messages sent and received





(MSG), stations heard (LIST), and for transmitting my position/comment packet (BCON). The hand microphone isn't used unless you decide to send a message to a call sign you do not see in the MSG or LIST screens, or you want to manually enter a message for another station.

One creative combination of radios I have used to work some passes is a Kenwood TH-D74 and a SDRplay RSP1 software-defined receiver. On Twitter, I referred to this setup as my "frankenstation." I transmit with the HT, and the SDRplay is connected to a computer running a few programs — HSDR<sup>4</sup>, a virtual audio cable, UZ7HO's HS-SoundModem, and ON6MU's UISS<sup>5</sup> — on a Windows 10 tablet. I still need to configure HS-SoundModem and my tablet so it can transmit as well as receive, but the TH-D74 works for a transmitter. I have to connect both radios to my Elk antenna through a diplexer.

The TH-D74 needs a few menu settings changed for FalconSAT-3, similar to what I changed on the TH-D72 and TM-D710G:

- Menu #504 (Packet Path): Use Others1, Others2, or Others3 with "PFS3-1"
  - #505 (Data Speed): 9600bps
  - #506 (Data Band): A Band (you could use the B Band, but I prefer using the A band)
  - #507 (DCD Sense): Off (Ignore)
- When the TNC is activated, "APRS96" will be on the screen.



### HSDR settings for soundcard output.

In HSDR, you use FM with the virtual audio cable as the output from the Soundcard (F5) menu. The output bandwidth set from the Bandwidth (F6) menu should match the audio bandwidth in your virtual audio cable, and be larger than the FM bandwidth used in HSDR. I use 48000 as the bandwidth in my virtual audio cable and for the output bandwidth in HSDR. While receiving, the AFC function can be activated, as HSDR is capable of tracking the Doppler shift in the downlink signal.

The HS-SoundModem program needs the same virtual audio cable selected as its Input Device as you selected in HSDR for the output, and for RX Sample Rate use the same bandwidth as the output bandwidth in HSDR. DCD A should have "FSK G3RUH 9600bd" to decode FalconSAT-3. Additional configuration is needed if you use HS-SoundModem to transmit, but this is the minimum required for this satellite. Since I used 48000 as the output bandwidth in HSDR, I use 48000 as the RX Sample Rate in HS-SoundModem.



"Frankenstation" using TH-D74 with SDRplay RSP1.

UISS can be installed and configured to use HS-SoundModem instead of the normal SoundModem program for 1200 bps packet. UISS has different windows to display the received packets, along with any APRS messages received during passes. This two-radio setup requires me to manually enter call signs for the APRS messages I send to other stations, but the process doesn't take much time as I can use the "phrases" (preloaded messages) in the HT.

No matter which setup I use to work FalconSAT-3 (remembering to adjust my downlink frequency or using AFC), working other stations on this satellite using APRS messages is similar to working other stations on the ISS or NO-84 digipeaters. Transmit your position/comment packets periodically, send messages to other stations you see on the screen, and reply to messages received from other stations. I have worked stations

with all three of these setups in the short time this satellite has been available to us.

With the TH-D72 and Elk log periodic, I made my first FalconSAT-3 QSO with Adam, K0FFY, in Iowa on September 24. We had tried to make a QSO on a mid-afternoon pass but didn't exchange messages in both directions. One pass later we did it. We also copied each others' position/comment packets.

With the TM-D710G and Elk log periodic, I worked Chris, K7TAB, on October 17 for my first satellite QSO with that radio. Chris drove south of Phoenix to park on the DM32/DM42 grid boundary, and he worked a FalconSAT-3 pass as well as an earlier SO-50 pass. I operated from my backyard. I didn't copy K7TAB's position/comment packet, but we did exchange messages. The TM-D710G is an excellent radio for working packet via orbiting digipeaters, and not just because of its three power levels (5/10/50 W).

As for the "frankenstation," K7TAB was also my first FalconSAT-3 QSO with that setup on October 1. I manually had to enter K7TAB-7 when I wrote the message to Chris on my TH-D74, but I used the prepared message for my location I keep in my Kenwood APRS-ready radios. The APRS Messages window from UISS displayed the messages between WD9EWK (me) and K7TAB-7, along with K7TAB-7 attempting to work KG5GJT-7 in Louisiana. The main UISS window also showed KO4MA working the FalconSAT-3 mailbox, while the rest of us kept the digipeater active. HDSDR makes the receive side of the station work easier, using the AFC function, since FalconSAT-3's downlink is on all the time.

For anyone wanting to try using SDR to receive FalconSAT-3, I have some RF recordings — large WAV files, written by HDSDR — that can be used to test your SDR receive setup. Look in folders with "FalconSat3" in the folder names in my Dropbox space<sup>6</sup>, and feel free to download

those WAV files.

Other radios, and combinations of radios and software could be used to work FalconSAT-3. The TH-D72 and TM-D710G could be operated in PACKET96 mode connected to a computer, and other software that controls the TNCs in these radios instead of using the APRS functionality built into these radios. With WiSP or the PB/PG software, stations can work the mailbox to send and receive messages and files with other stations.

## Notes

- 1 [www.amsat.org/falconsat-3/](http://www.amsat.org/falconsat-3/)
- 2 [uz7.ho.ua/packetradio.htm](http://uz7.ho.ua/packetradio.htm)
- 3 [andrewbnortham.com/ke8fzt/falconsat/](http://andrewbnortham.com/ke8fzt/falconsat/)
- 4 [www.hdsdr.de/](http://www.hdsdr.de/)
- 5 [users.belgacom.net/hamradio/uiss.htm](http://users.belgacom.net/hamradio/uiss.htm)
- 6 [dropbox.wd9ewk.net/](http://dropbox.wd9ewk.net/) 



UISS software modem setup.

