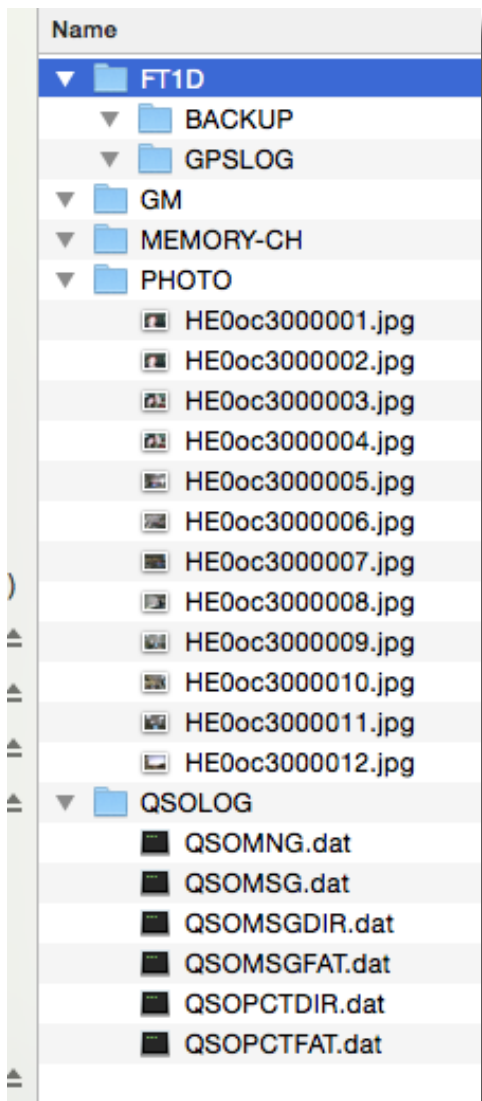


System Fusion Exploration - April 2015



Above: The directory structure on the SD card from an FT1D.

PHOTO contains photos taken by the microphone camera in jpg format.

QSOLOG contains data files from picture and text messaging. We're going to look more closely at QSOPCTDIR.dat

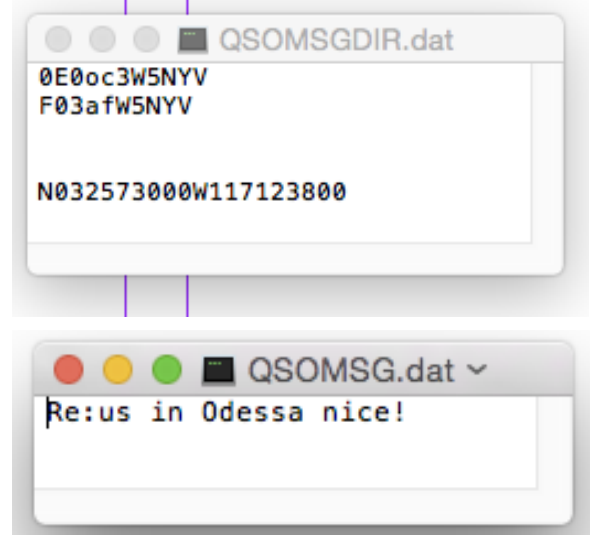
GM is for Group Monitor, a System Fusion function for alerting when people on a list are in range.

MEMORY-CH is stored memory channels.

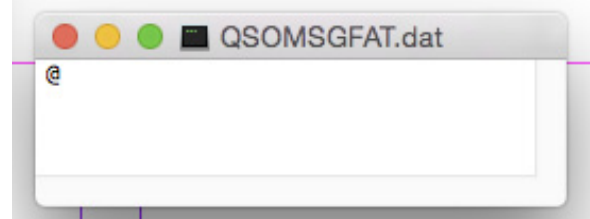
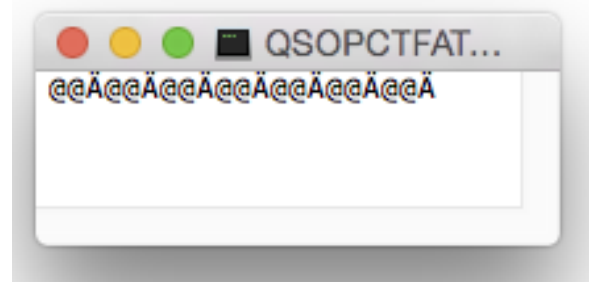
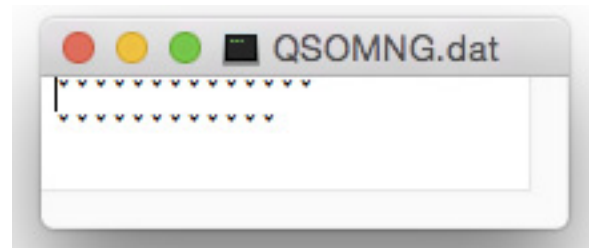
GPSLOG stores GPS logging data, if enabled, and...

BACKUP is for backups.

Below are two files related to the text messaging function. First, QSOMSGDIR.dat seems to record metadata of a text message. E0oc3 is the radio ID of my handheld, and F03af is my mobile rig. The GPS coordinates appear to be my driveway, which is where the text message was sent. QSOMSG.dat contains the actual content of the text message.



Some of the files are a bit more cryptic. Below are the final three files with their contents as read by a text editor on a desktop computer.



```

    QSOPCTDIR.dat
E0oc3W5NYV   WWW2015/03/04 15:57ÅHE0oc3000001.jpgN032573032W117123817a   ALL
E0oc3W5NYV   YYW2015/03/04 15:57ÅHE0oc3000001.jpgN032573032W117123817p   ALL
F03afW5NYV   W2015/03/04 15:57ÅHE0oc3000002.jpgN032573000W117123800
E0oc3W5NYV   2015/03/04 16:05L~HE0oc3000003.jpgN032573032W117123817a   ALL
E0oc3W5NYV   2015/03/04 16:05L~HE0oc3000003.jpgN032573032W117123817p   ALL
F03afW5NYV   2015/03/04 16:05L~HE0oc3000004.jpgN032573000W117123800
E0oc3W5NYV   2015/03/04 19:09)ñHE0oc3000005.jpgN033082645W117159349
E0oc3W5NYV   2015/03/04 19:094~HE0oc3000006.jpgN033082658W117159343
E0oc3W5NYV   2015/03/04 19:09~2HE0oc3000007.jpgN033082611W117159346
E0oc3W5NYV   2015/03/04 19:09&QHE0oc3000008.jpgN033082573W117159336
E0oc3W5NYV   2015/03/04 19:09++HE0oc3000009.jpgN033082561W117159299
E0oc3W5NYV   2015/03/04 19:20'[HE0oc3000010.jpgN033082535W117159371
E0oc3W5NYV   !!!2015/03/04 19:21jHE0oc3000011.jpgN033082549W117159355`   ALL
F03afW5NYV   YYU2015/03/09 14:55~rHE0oc3000012.jpgN0 00E000000000|

```

Above are the contents of the QSOPCTDIR.dat file. You can see it's somewhat human-readable. My callsign is W5NYV, which can be seen as part of the left-most column. The numbers immediately before my call sign are the radio ID. F03af is my FTM-400 mobile rig, and E0oc3 is the radio ID of my FT1D handheld.

Next seems to be a date code. You can see a lot of activity on March 4th at around 2:05pm and again at 3:57 pm, the day that the mobile rig was installed in my vehicle. This is when I tested the photography functions with the microphone camera. Right after the date codes are photo file names (see corresponding file names in directory structure snapshot at left).

Between the timestamp and the filename are additional characters. It's not clear yet what they indicate. They could be formatting, or some other sort of character that does not translate when these files are opened in a text editor.

Immediately after the filename are GPS coordinates. The first set of photographs were taken on my handheld, in my driveway at N032573032W117123817. The second set were taken on my handheld, at the PARC meeting, located at N033082645W117159349. The last line has a radio ID that belongs to the mobile rig in the radio. Coordinates areN000E000000000. I believe this is a reception (on the handheld) of a photograph taken with the mobile rig and then successfully transmitted to the handheld.

Immediately before some of the date codes are additional letters. You can see WWW, YYW, W, YYU, and !!! . I'm not sure yet what these indicate, if anything. On many Yaesu, there are codes for when APRS messages have been received (the asterisk, for example). However, these letters may be in the same category as the characters that appear between the timestamp and the photo filenames. So, if you find out, track it down, or figure it out, write me and let me know at scope@palomararc.org!

The final column sometimes contains the word ALL. This corresponds to who the photograph was transmitted to. When you take a photograph, you have the option of transmitting it to "ALL" System Fusion radios in range, or a custom Group Monitor list. That way, you can set up lists of people that might want photos of your Field Day setup to the "Field Day" Group Monitor list, or photos of you finally leaving the club meeting to your "Friends and Family" Group Monitor list.

There was discussion in one of the System Fusion forums that there is metadata added to the photos taken by the Yaesu microphone camera. This discussion was sparked by an operator that put his own JPGs on the SD card (not taken with the microphone camera) and then attempted to transmit the photo. This attempt failed. In discussions with Yaesu tech support, the representative said that there was metadata associated with the photograph, and only photos with the microphone camera could be sent from the radio. This metadata was assumed to be something that identified the photo as coming from the microphone camera. This would seem to be an attempt to force operators to use only the Yaesu microphone camera with the radio. If this metadata could be identified and duplicated, then other cameras can be attached to the radio.

Looking at metadata of the photos taken with the microphone camera in Adobe Lightroom, nothing

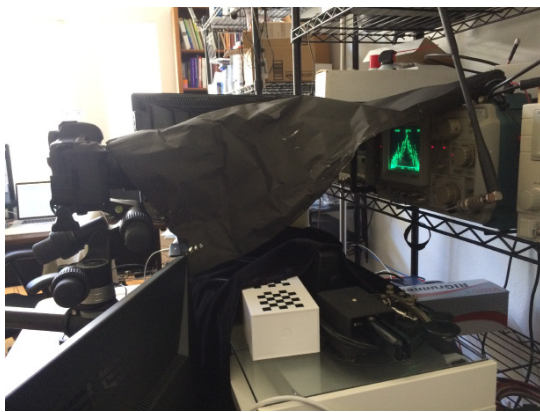
unusual was seen on a first pass. Opening up the photos in Photoshop and looking at the raw data didn't reveal anything remarkable there, either.

However, it occurred to the Scope Editorial Science Staff that simply placing photos in the PHOTO directory wouldn't necessarily work since the photos were also logged in the QSOPCTDIR.dat file. There might not be any extra metadata in the photo after all.

So, an experiment was made where a new photo, not taken with the microphone camera, was substituted in for a photo that was taken with the microphone camera, and already existed on the SD card and therefore already appeared in the QSOPCTDIR.dat log. By using the same filename, the photo would be "findable" by the firmware on the radio, if the firmware is using the listing in QSOPCTDIR.dat to transmit the most recently taken photo.

A 320 by 240 pixel test image was created in Photoshop, saved as a JPG, saved to the SD card as the latest image (replacing an existing image), and then image transmission was attempted. The image was successfully received on the mobile rig, thus proving that there is no metadata in the image preventing other cameras from being used.

It was assumed that the "smarts" to update and manage the QSOPCTDIR.dat file are in the radio, and not in the camera microphone. Therefore, if we can build an interface that mimics the one in the camera microphone, we should be able to take photos or images and send them out without having to use the camera microphone.



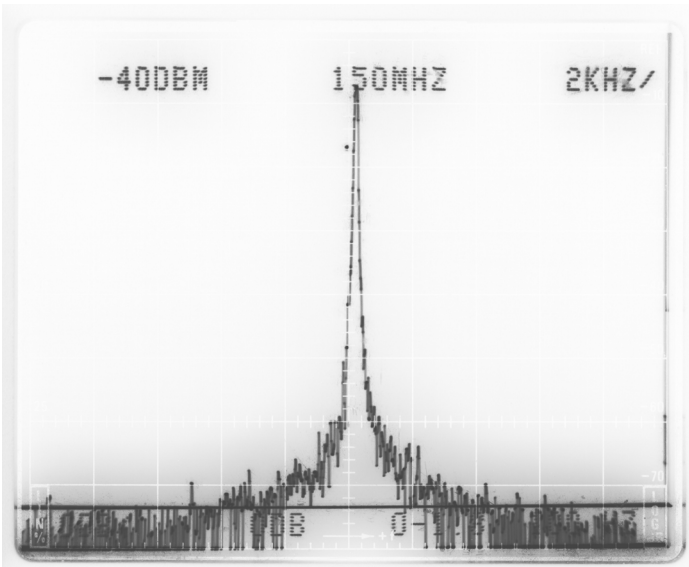
spectra measurement and photography setup. Photos and measurement images by Paul KB5MU

The next thing looked at was spectra from the FT1D, so we could see what's emanating from the radio. With assistance from Paul KB5MU in photographing the measurements from our spectrum analyzer, the four images on the facing page were obtained.

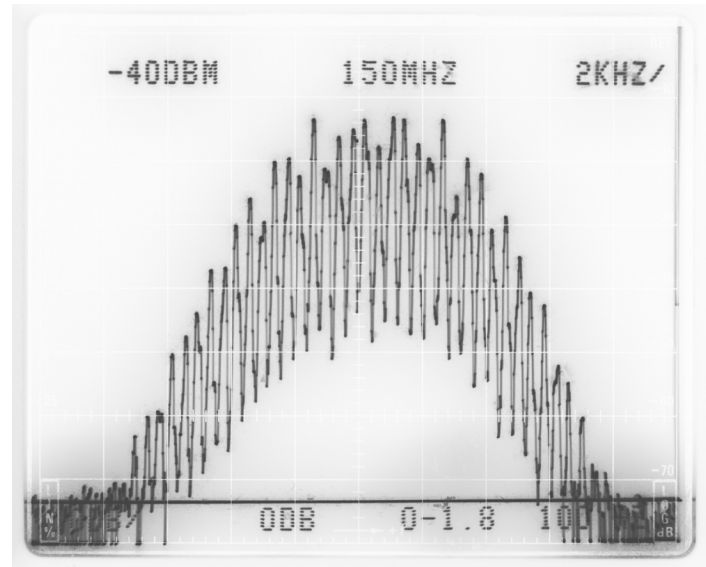
The FT1D was held 5 feet away from the Tektronix 492 and was set to lowest power. These images show the transmissions in the frequency domain. Frequency is the horizontal axis, and power in dBm is the vertical axis. For this set of measurements, the settings were 2kHz per division (horizontal) and 10dBm per division (vertical).

First, an FM carrier with no voice was measured. Then, an FM transmission of DTMF tone 4. Next, an FM voice transmission with max hold turned on was made over the course of about a minute and an half. Finally, a photograph was sent using data mode and the spectra measured. See spectra on next page.

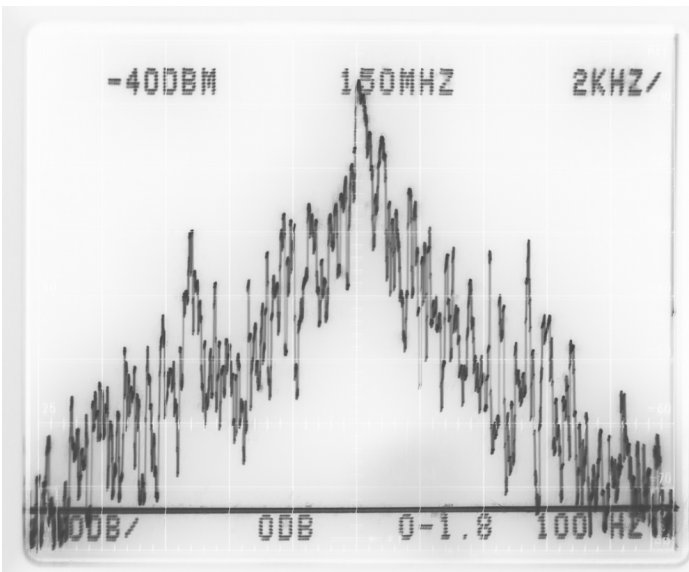
Michelle Thompson W5NYV
Paul Williamson KB5MU



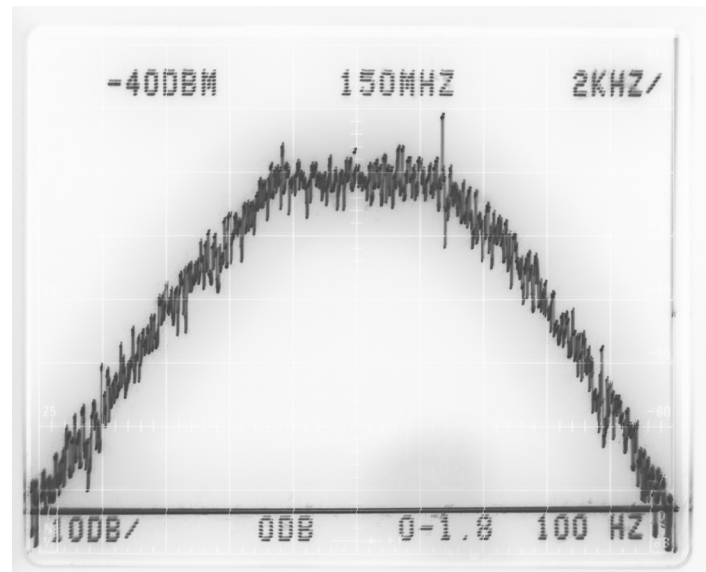
FM CARRIER WITH NO VOICE ON FT1D



FM TRANSMISSION OF DTMF TONE 4 ON FT1D



FM VOICE TRANSMISSION ON FT1D



MICROPHONE CAMERA TRANSMISSION USING DATA MODE