The Experiment:

On 7/11/2006, Frank Ghigo, John Ford, and Carla Beaudet performed an experiment to see whether the emissions from a digital camera located at the tourist bus stop could be seen by the GBT. As a preliminary experiment, the camera was tested in the anechoic chamber to gain a rough profile of its emissions in the range of the GBT PF1 receiver and at L band. This preliminary scan showed us not only what emissions frequency characteristics to expect, but also allowed us to compare the emissions with the ITU-R RA.769 limit, as a sort of sanity check, to see roughly whether this limit predicts well for interference levels.

The camera was taken to the top of the receiver room, and a series of 1 min. “on” scans and 1 min. “off” scans using PF1 and the L band receiver were performed, with the camera positioned on the rim of the L band feed. The camera was then taken to the tourist bus stop at the Robert C. Byrd sign at a distance of (very) roughly 150m to the PF1 feed. From this location, the elements of PF1 were visible, but the L band feed was occluded by its own feed horn as well as the side of the receiver room. In the plots that follow, the on-off plots indicate that the off scans are subtracted from the on scans, and the off-off scans serve as a control for comparison. The vertical axis on plots that are taken at the bus stop are scaled up to account for the large dynamic range represented on a linear scale.

Discussion:

The signature of the camera is seen clearly from the bus stop in the PF1 scans, and not seen from the bus stop in the L band scans. It seems reasonable to assume this is caused by the occlusion of the L band feed by both the feed horn itself and the side of the receiver room as seen from the bus stop. Any signal reaching the L Band receiver would be incidental reflection, whereas we could see the elements of the PF1 receiver from the bus stop. Furthermore, we were off-axis from the main beam of the PF1 receiver by a similar angle at both the Feed and the Bus Stop locations (about 45°), whereas we went from being in front of the feed about 30° off axis to being behind it, about 135° off axis in the case of L Band. Had this experiment been performed by tipping the structure so that the top of the receiver room was visible from the bus stop, we are fairly confident that we could have seen the camera in L Band.

In anechoic chamber testing, the camera emissions typically exceeded the ITU-R RA.769 limit by around 20dB when evaluated at a distance of 150m from the feed. In Figure 3: Camera ON - OFF at Bus Stop, the emissions seem to exceed the noise level by a factor more on the level of 5, or 7dB. The discrepancy, we believe, lies in integration time. The ITU-R RA.769 limit assumes an integration time of 2000 sec., and we integrated for only 60 sec. Had we integrated for 2000 sec, we could expect our noise floor to retreat another 16 dB, which more than makes up for the discrepancy.

PF1 Scans

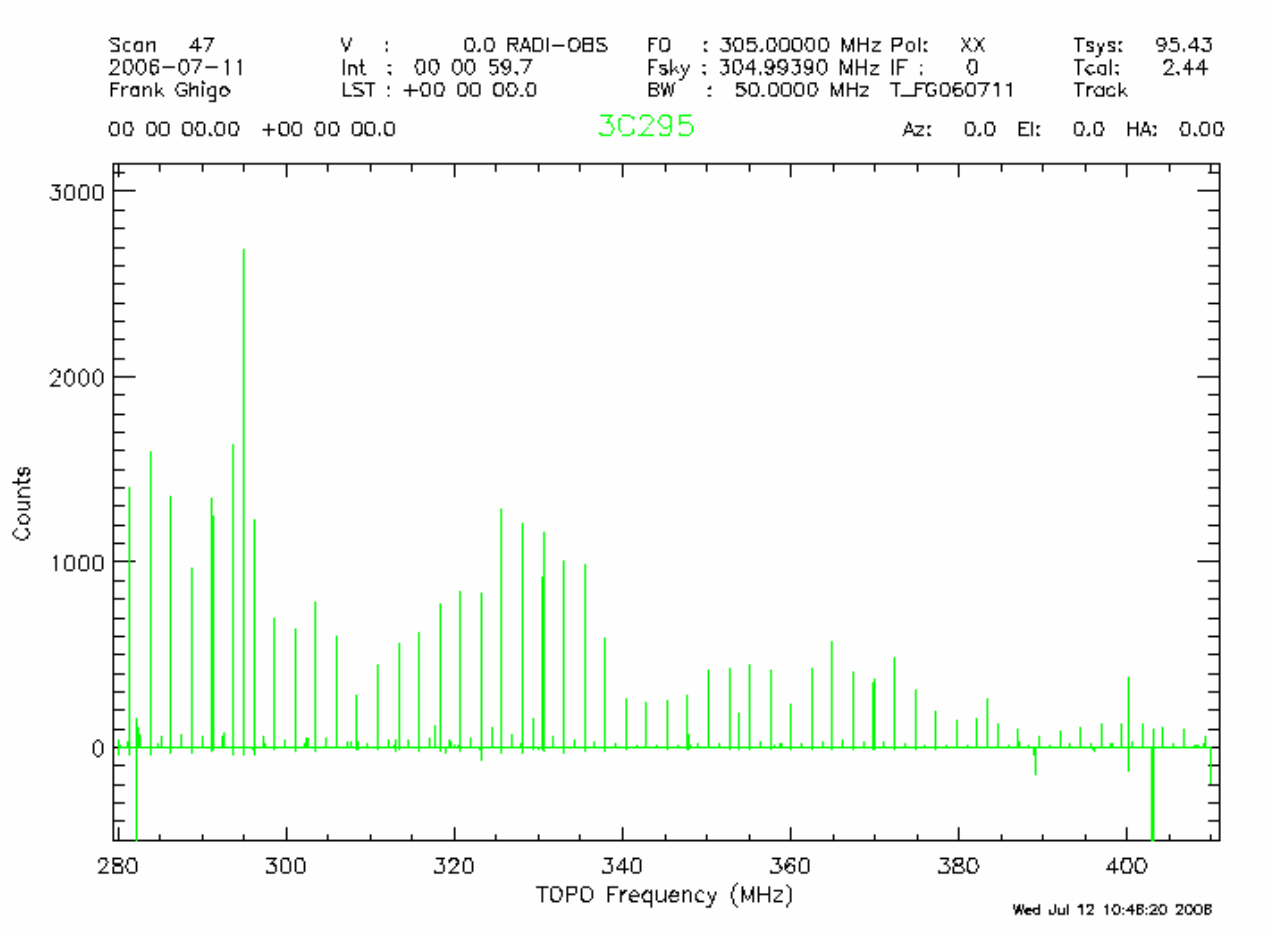

Figure 1: Camera ON – OFF at Feed

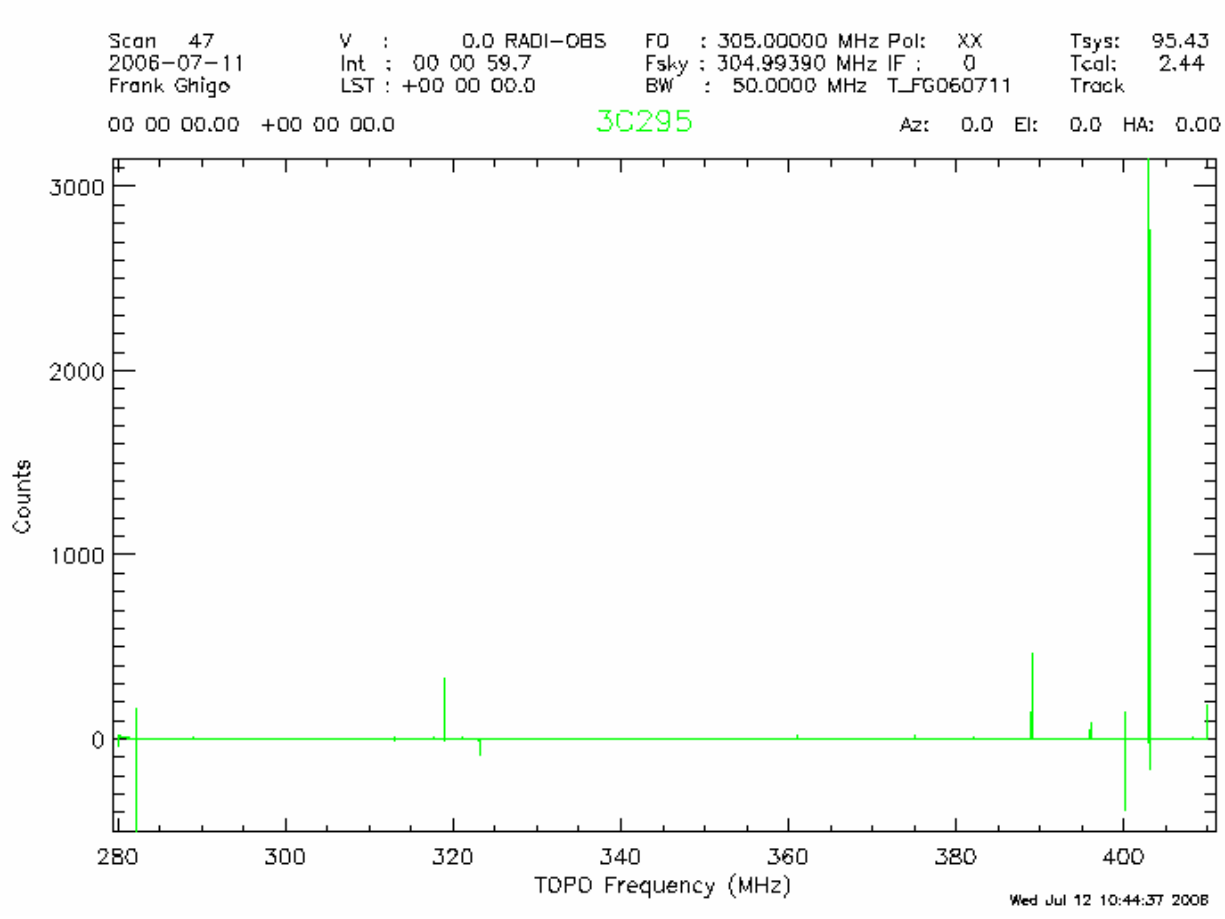

Figure 2: Camera OFF - OFF at Feed

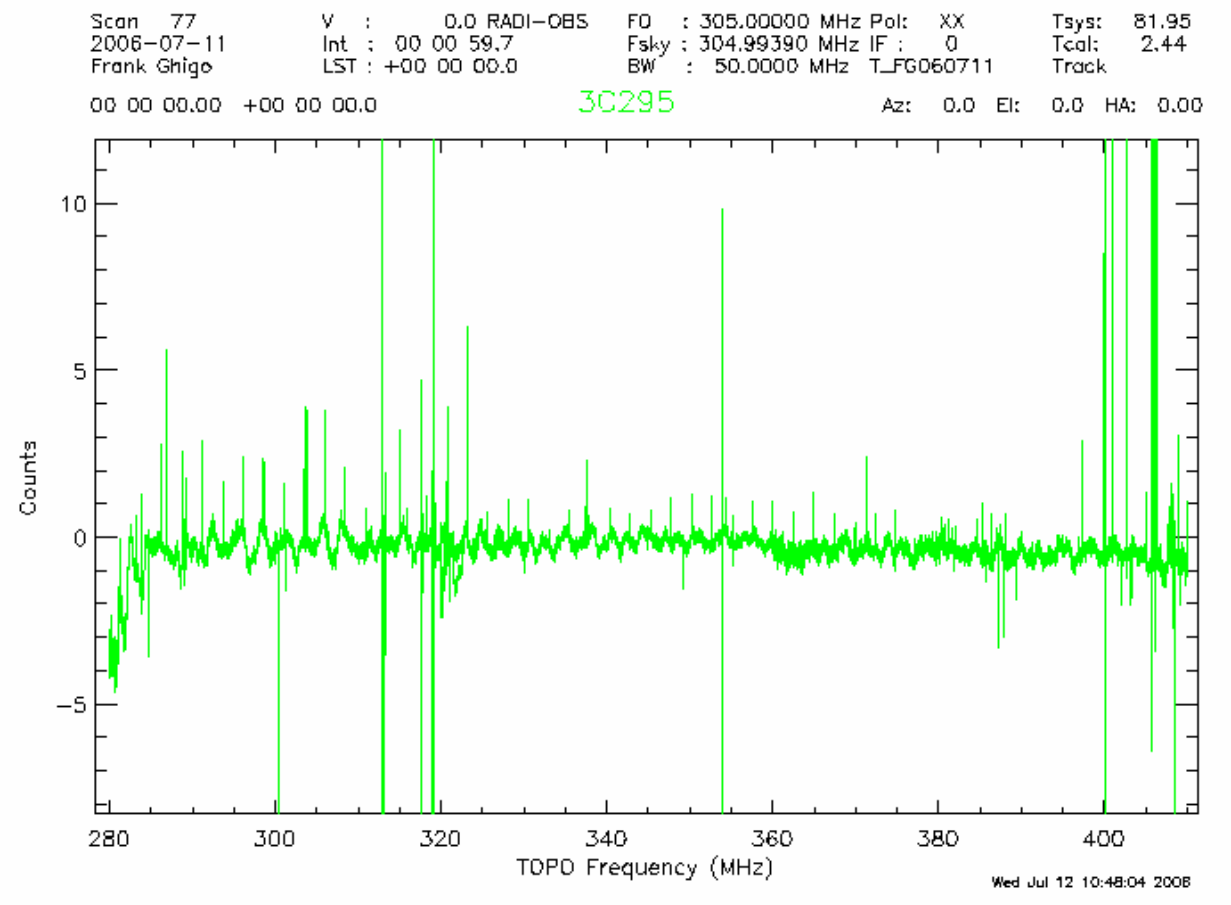

Figure 3: Camera ON - OFF at Bus Stop

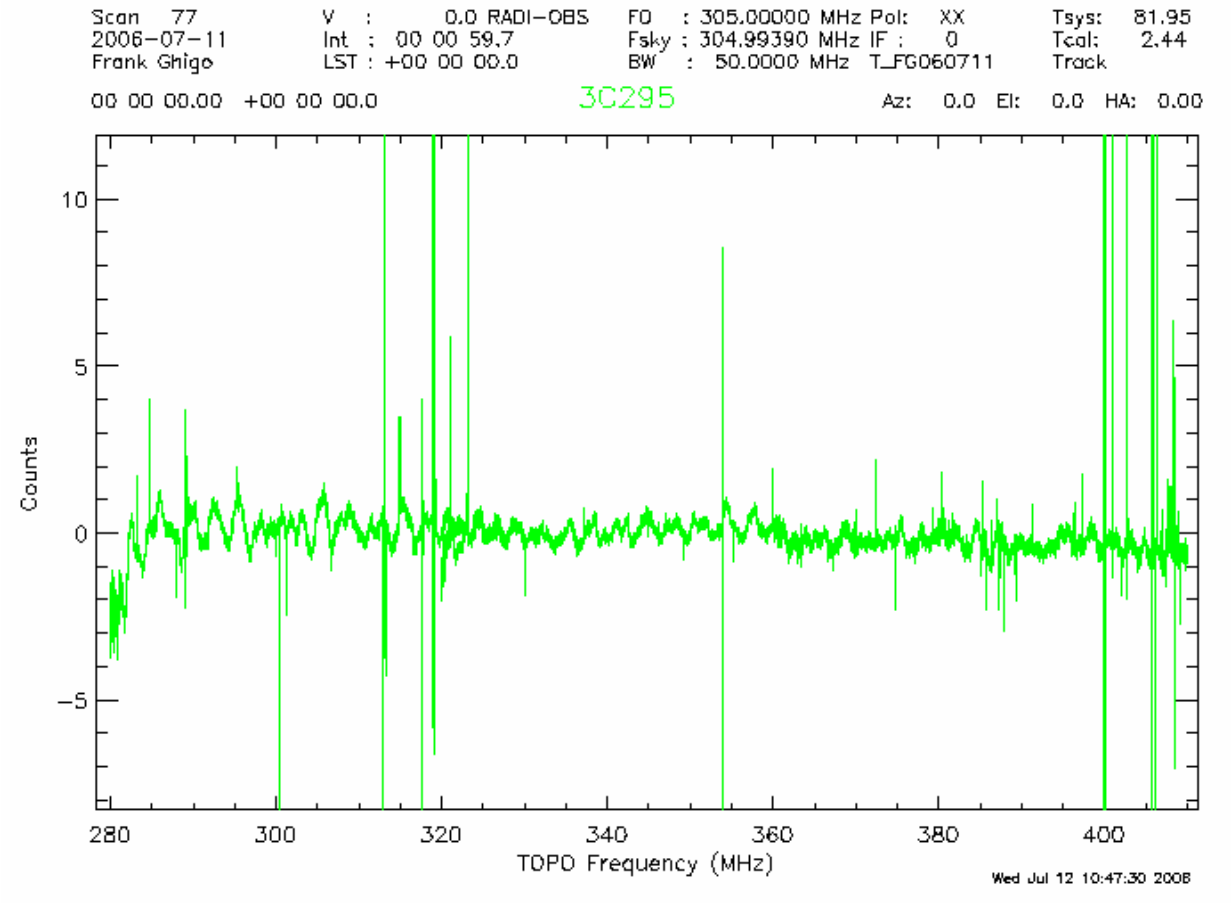

Figure 4: Camera OFF - OFF at Bus Stop

L Band Scans

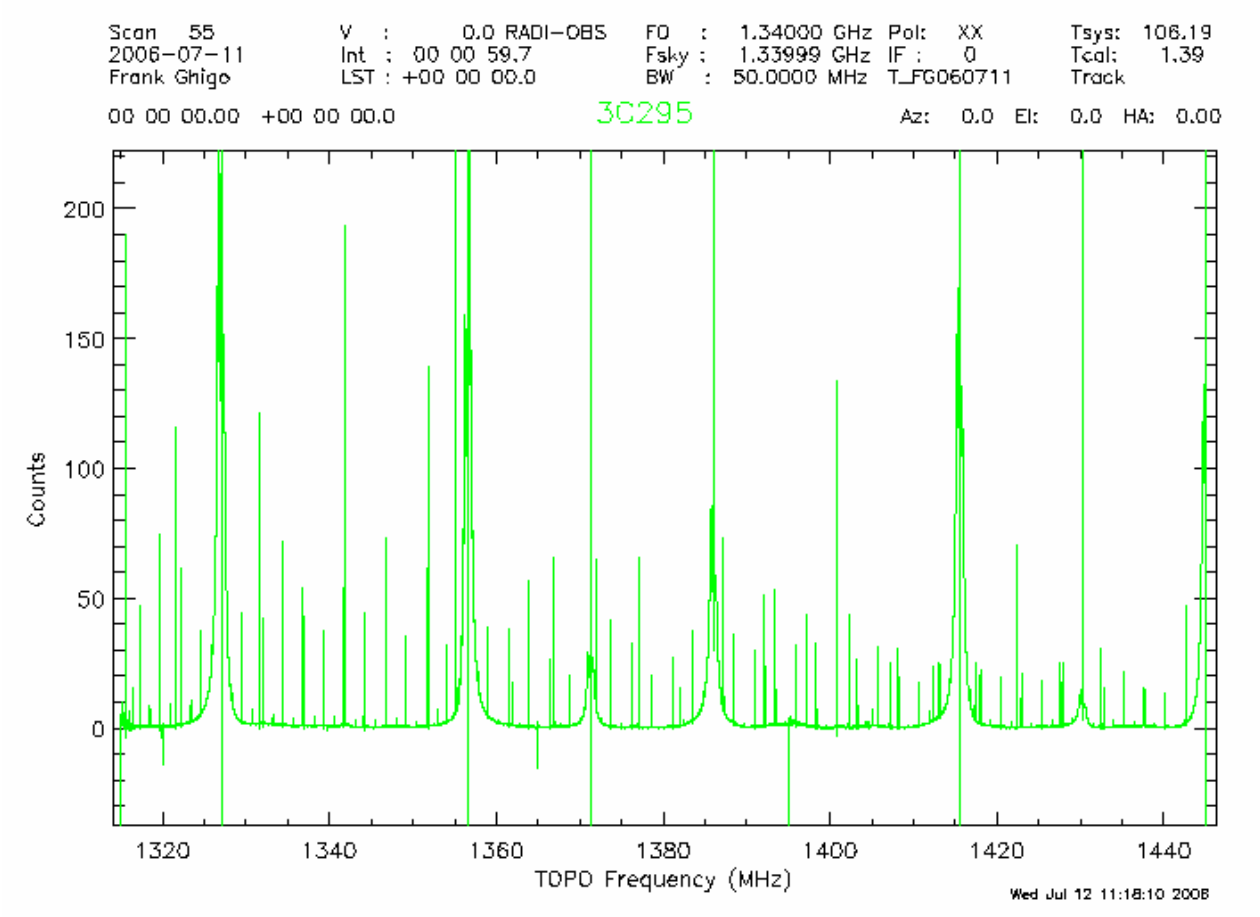

Figure 5: Camera ON - OFF at Feed

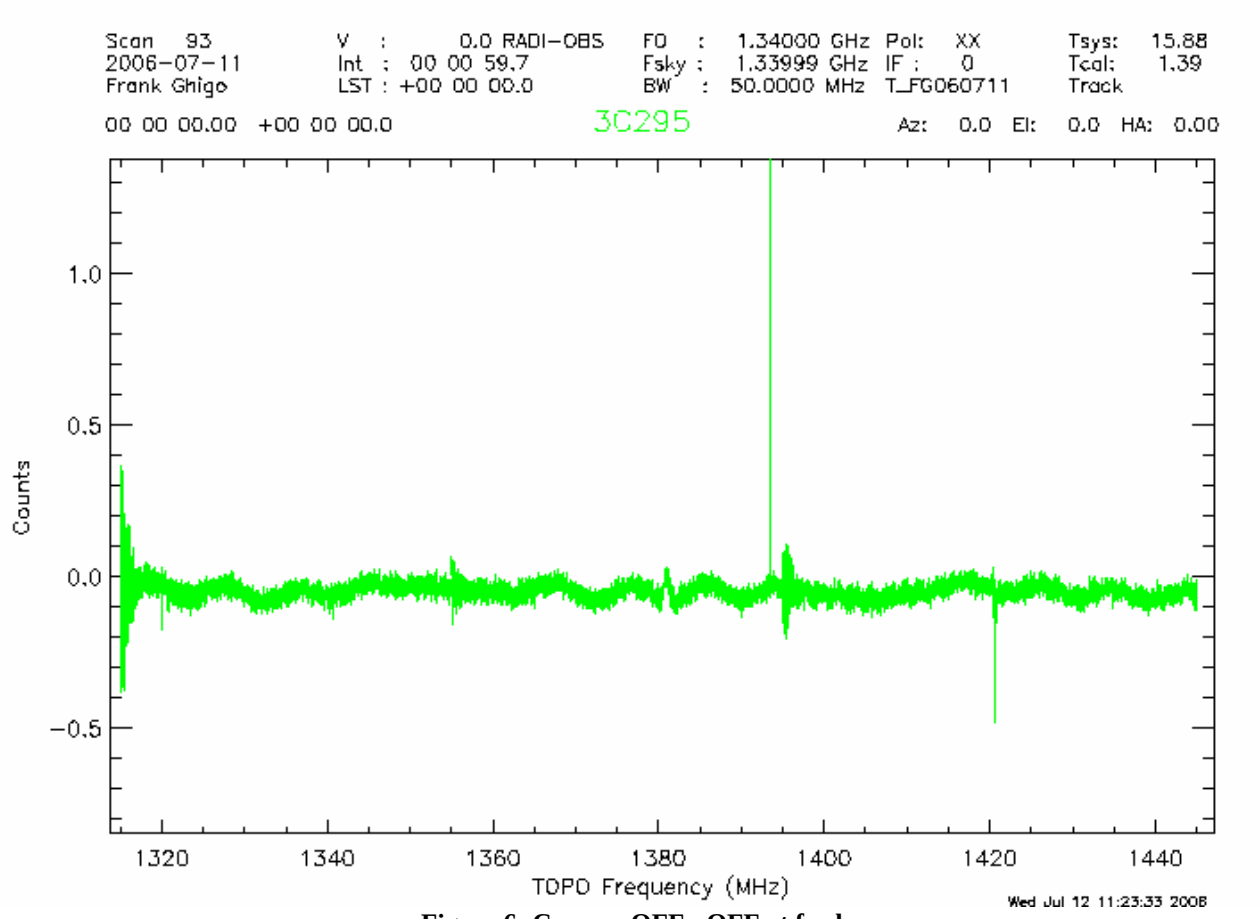

Figure 6: Camera OFF - OFF at feed

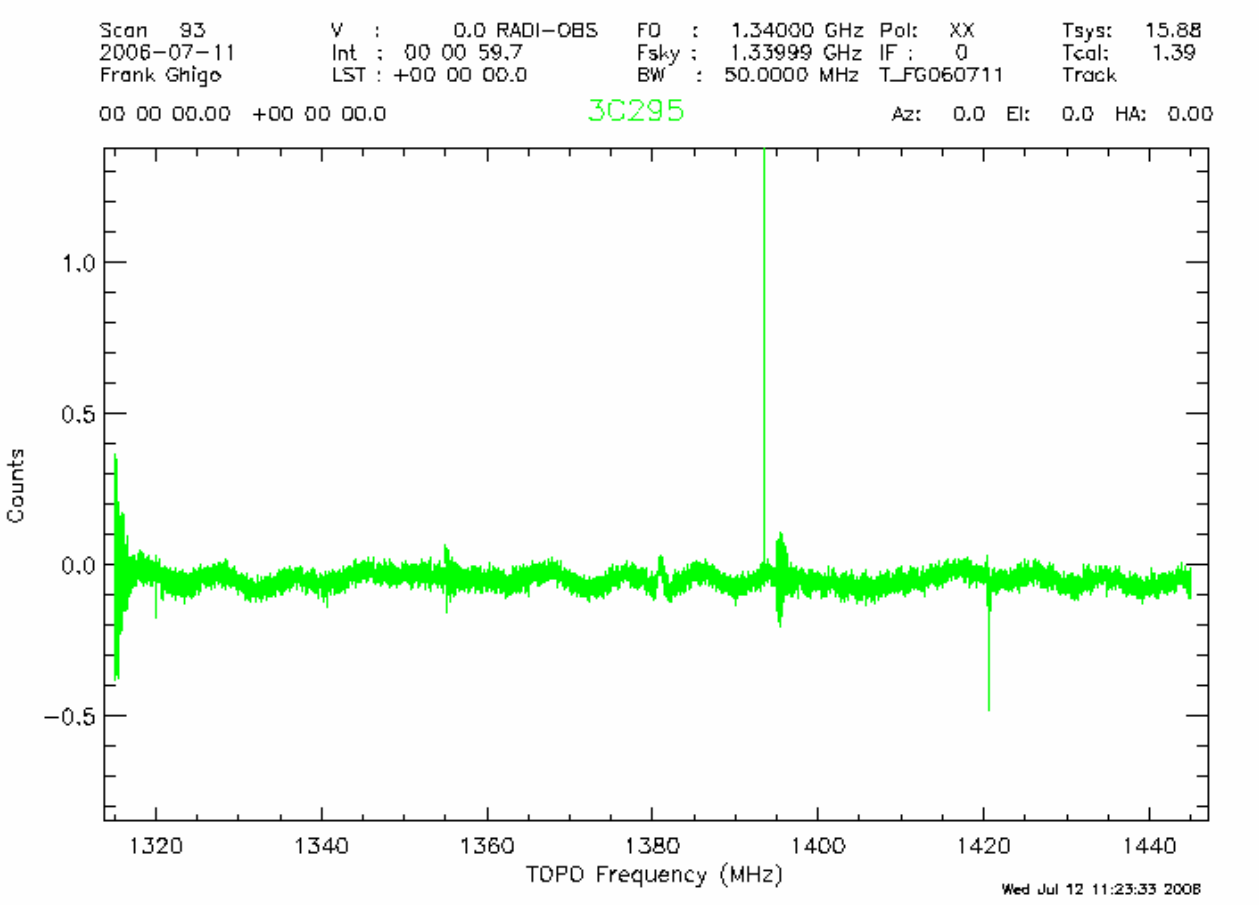

Figure 7: Camera ON - OFF at Bus Stop

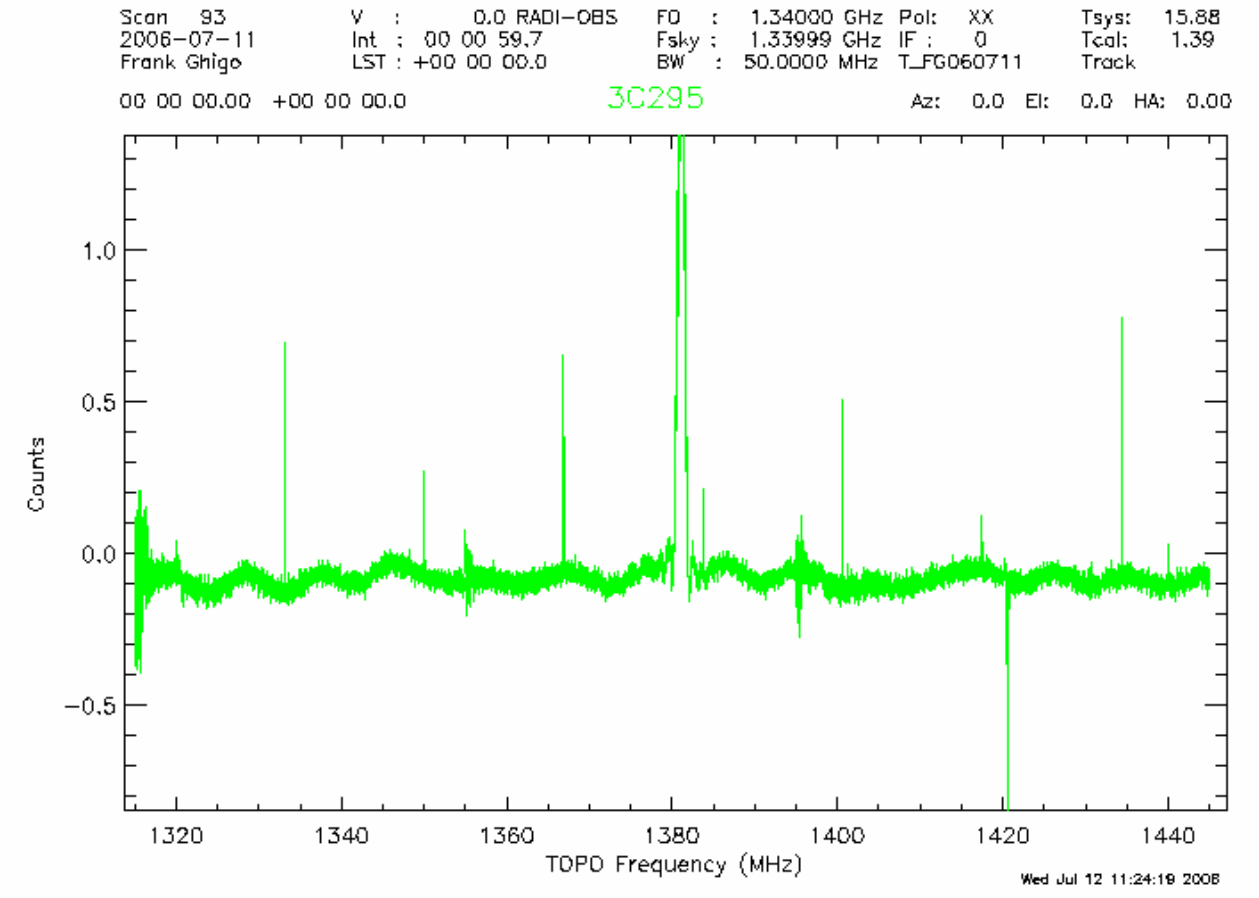

Figure 8: Camera OFF - OFF at Bus Stop

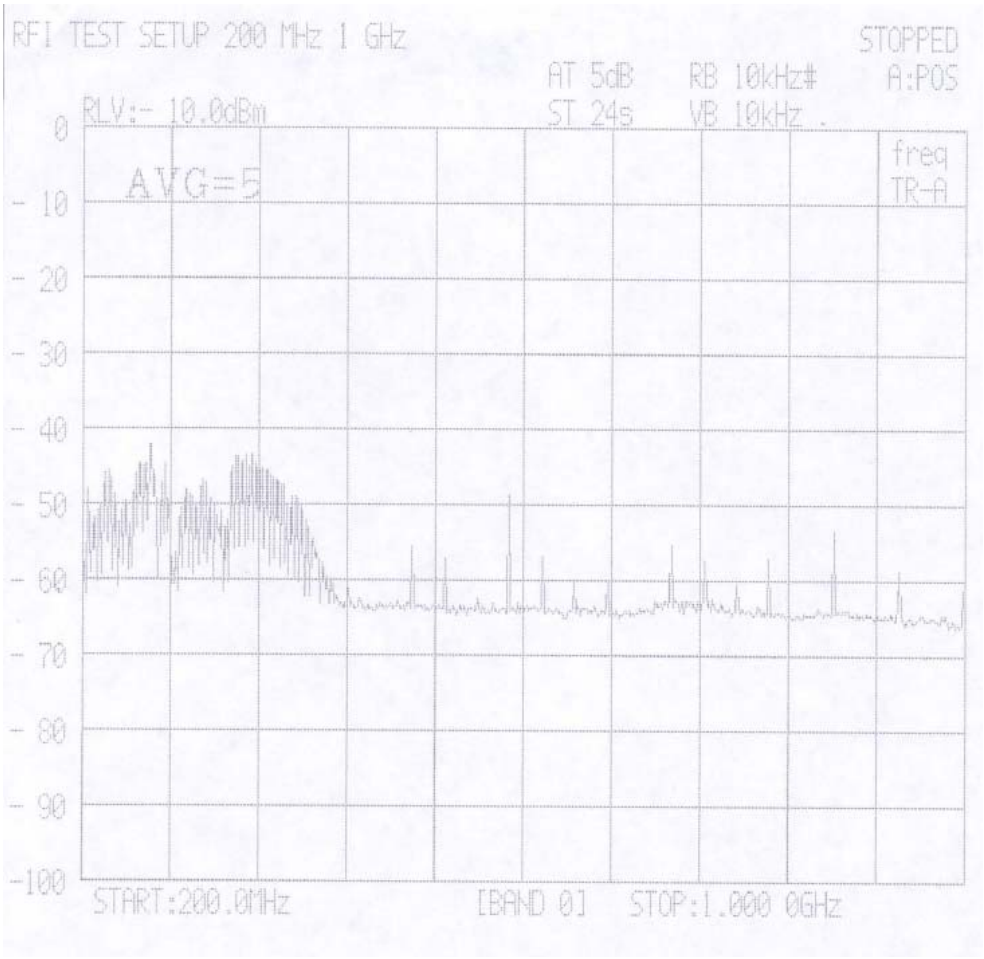

Figure 9: Kodak DC5000, 200 M Hz – 1 GHz, Anechoic Chamber Testing

Figure 10: Kodak DC5000, PF1 Band, Anechoic Chamber Testing

Figure 11: Kodak DC5000, L Band, Anechoic Chamber Testing