VSRT MEMO #079

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To: VSRT Group

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Subject: Sensitivity of ozone spectrometer to interference

The current 2-channel ozone spectrometer with 2.44 kHz resolution has a 1-sigma noise level of

$$T_s \Big/ \left(B\tau\right)^{1/2} = 27mK$$

For T_s = system temperature = 80 K. With an integration over 10 12 hour nights the noise level drops to 2.5 mK which is 45 dB below the system noise level. In a recent examination of long integration periods some "spurs" are observed. While initially it was thought that these were instrumental it is now clear that these are due to Radio Frequency Interference (RFI). While it has always been clear that spectrometers in ITU region 1 have to be well shielded from geosynchronous satellites for which 11.072 MHz is within the satellite TV band it is now becoming clear that spectrometers in region 2 could benefit from better shielding. In addition, the use of frequencies which include 11.072 GHz are also being used for wideband microwave links. When an attempt was made several ago to install a spectrometer in Alaska it was found that very strong RFI was present at Poker Flat due to a microwave link directed at Poker Flat.

The evidence for weak RFI with a common signature is seen at the spectrometers at Haystack, Chelmsford high school and Union College NY. Figure 1 shows an example of this signature. Prior to day 280 in 2015 some RFI was evident at Haystack with a different signature. The current source of this RFI has recently been identified as coming from a satellite at 20±10 degrees west. The frequency list at tracksat.com show that Intelsat 907 @ 27.5°w and other satellites further east have assigned channels which include 11.072 GHz.

A diffraction simulation of the Winegard DS-4048 (f=10.6") offset dish which is approximately 18" in diameter has a gain of 34 dBi and sidelobe level about -15dBi on the average.

In the USA many of the ozone spectrometers are completely exposed to the Clarke belt but it now appears that in some cases these may need to be moved to a location which provides some shielding to the east. Figures 4 and 5 of VSRT memo 77 show the use of a small shield. It is now clear from recent tests that this is not able to lower the RFI significantly and tests of a new shield shown in Figure 2 are in progress. So far small shields don't look promising as solutions using walls etc. like these described at http://www.satsig.net/satellite/reducing-interference-satellite-tv.htm may be required.

If shielding the spectrometer by blocking the paths to the Clarke belt with buildings or terrain is not possible it may be possible to shield the dish using a small shed to house the dish with a radome dielectric material in a window for the beam path to the ozone layer. In this case the building needs to have a metal barrier, which ideally is covered with microwave absorber to reduce reflections within the hut. In places where only a small reduction in sidelobe level to

reduce RFI is needed a cylindrical tube lined with absorber and a radome covered opening for the ray path is a possible solution.

If a simple open screen is used as in the photograph of Figure 2 it needs to be able to withstand strong winds and not allow a buildup of ice or snow.

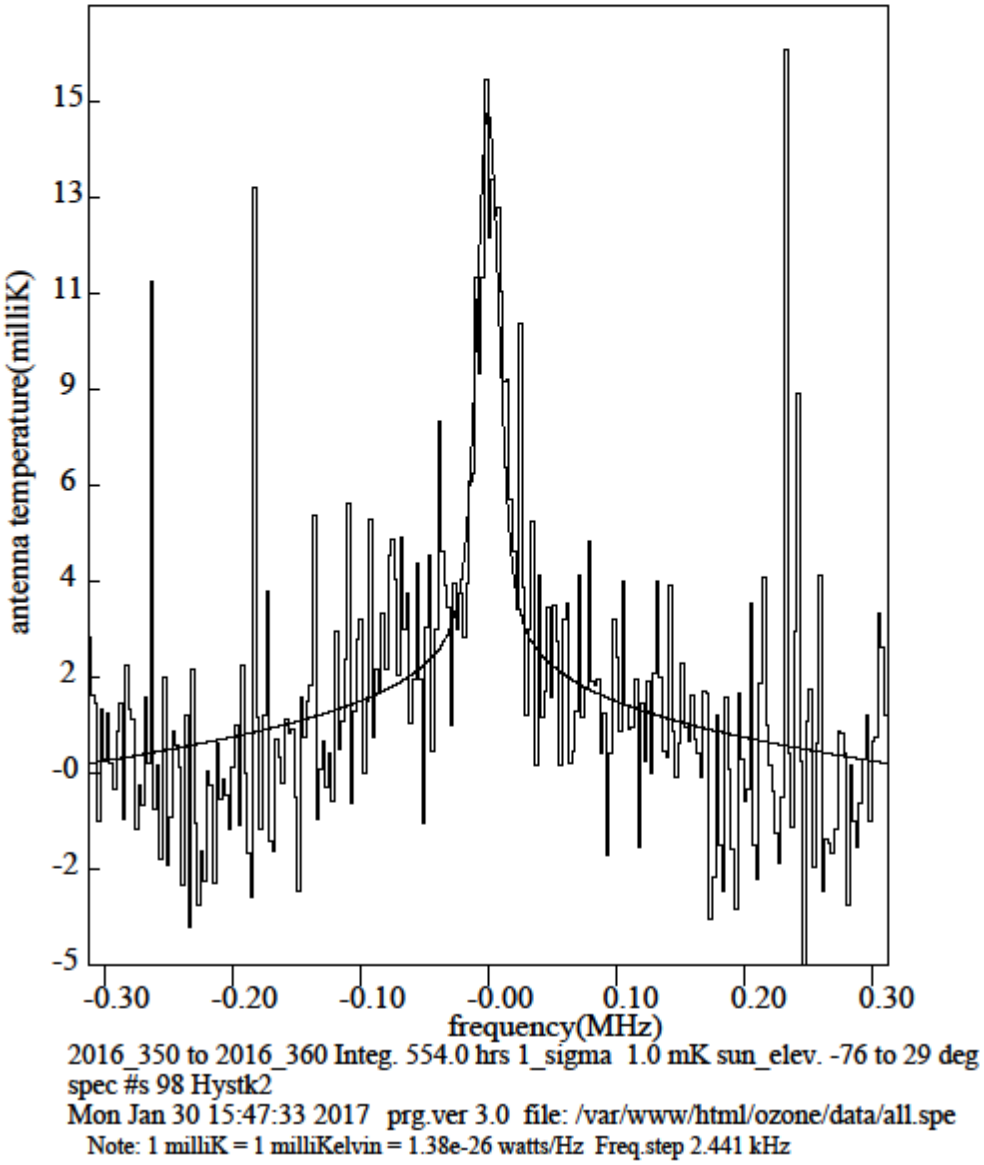

Figure 1. RFI spurs from geosynchronous satellite.

Figure 2. Test shield on east side of dish.