VSRT MEMO #002

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To: VSRT Group

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Subject: Test signals for VSRT

The simplest test of the VSRT interferometer is to point one feed (or dish) at the other. In this case noise from one LNA is radiated and coupled into the other LNA. This noise is correlated with the output noise and hence produces an overall correlation.

$$x_0(w) = n_0(w) + \alpha n_1(w) e^{-iw\tau}$$
$$x_1(w) = n_1(w) + \alpha n_0(w) e^{-iw\tau}$$

where n_0 and n_1 are the LNA noise signals

α is the fraction of the LNA radiated in a correlated manner.

τ is the delay distance between feeds

$$\overline{x_0 x_1^*} = \alpha\left(\overline{n_0 n_0^*}\right)e^{iw\tau} + \overline{n_1 n_1^*}e^{-iw\tau} = 2\overline{nn^*}\cos(w\tau)$$

where the superscript bar indicates a time average. With the very large bandwidth of the LNB I.F. the correlation will average to zero over frequency for any substantial separation of the feeds unless the I.F. is passed through a narrow band filter. When averaged over a wideband

$$\frac{1}{B} = \int_{-B/2}^{+B/2} \cos(w\tau)\, dw = sinc(B\tau/2)$$

which goes to zero with $\tau = 2\pi/B$ or the inverse bandwidth when B is in Hz. Figure 1 shows fringes and the fringe rate spectrum for 2 LNB feeds touching each other. The fringe rate peaks at the difference of L.O. frequencies.

Another useful test source is the signal from a fluorescent lamp. A circle lamp or spherical bulb is most useful as it provides a small diameter source. The frame grabber electronics combined with a few seconds of integration is sufficient to detect the lamp at a distance of several feet from the feed and at much larger distances if the dish is used along with the feed. Figure 2 shows the signal from a fluorescent circle desk lamp at a distance of about 2 feet from each feed. Fringes are too weak to be seen in the time series data but can be clearly seen in the fringe rate spectrum which is the average of 10^6 data samples. A spiral fluorescent lamp (A&H CF20/S/41K) is more compact than a circle lamp and its quite a good test source although there are some unwanted modulation spurs in this lamp around, 90 kHz. Other compact fluorescent lamps need to be tested.

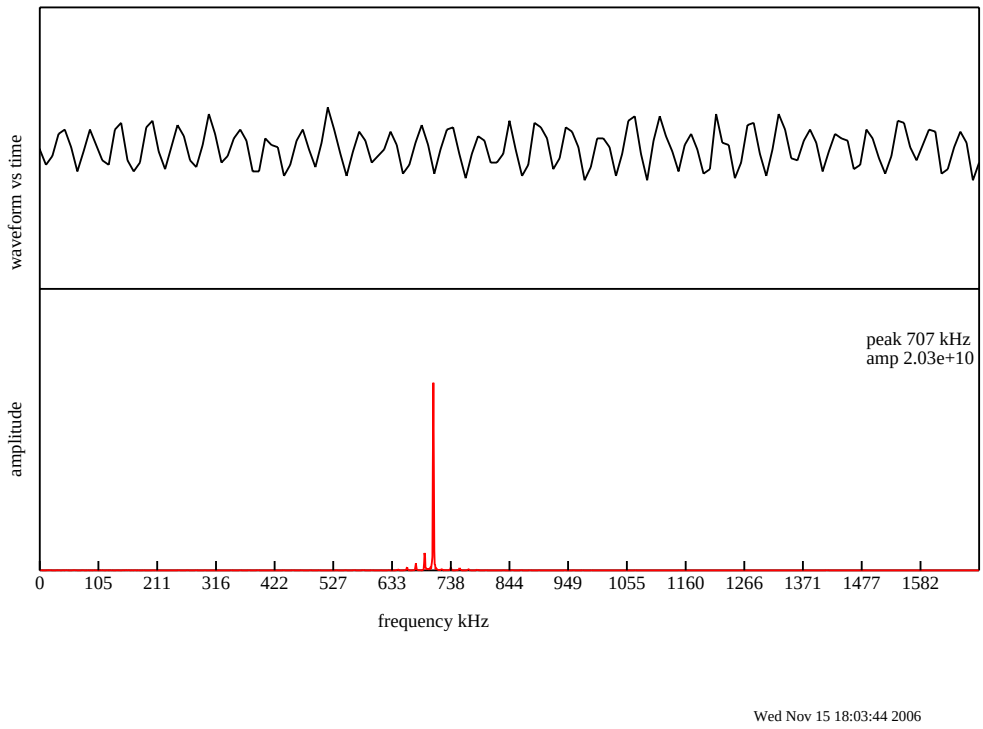

Fig 1. LNB feeds pointing at each other.

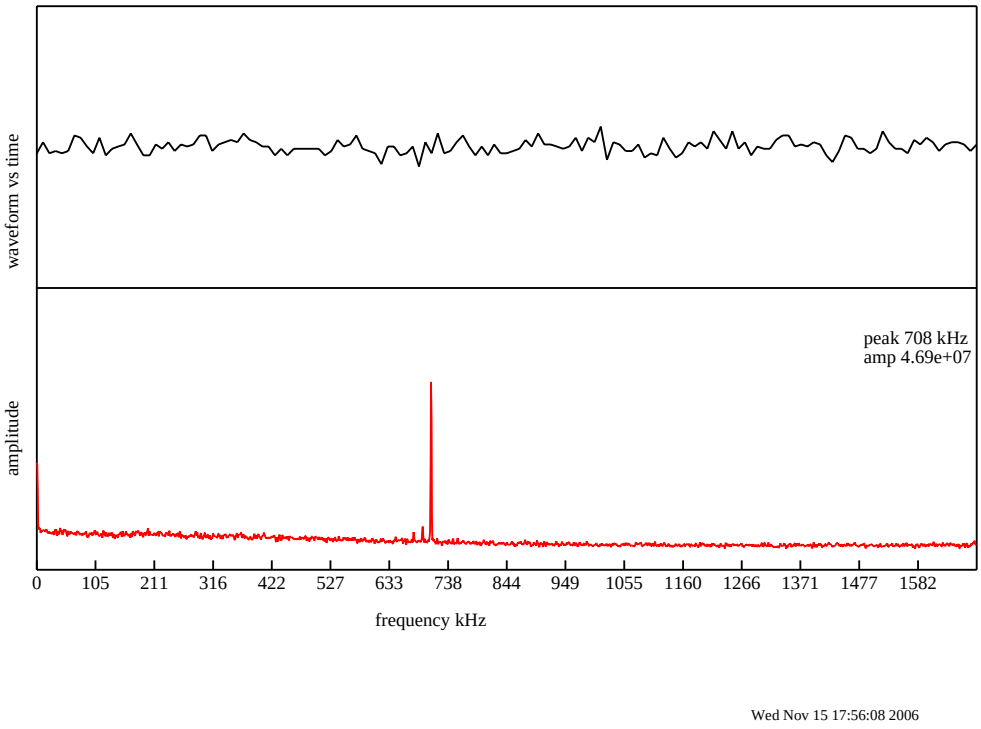

Fig. 2. Fringes from a fluorescent circle desk lamp.