Receiver spurious signals caused by front end monitoring activity
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As part of the ongoing inquiry into the quality and repeatability of the beam pattern measurement system at the NA FEIC, we have set up a room-temperature receiver based on a Schottky mixer and a feed optimized for 104.02 GHz. The LO for the receiver is a band 7 WCA, serial number Band7-B01. The signal source is a band 3 WCA, Band3-B01. For both the source and the receiver, the YIG oscillator is not in use – signals from two Agilent E8257D synthesizers are injected. The synthesizers are locked to the same 10 MHz reference. Both WCAs are under the control of the front end monitor and control module and the front end control software.

The source signal frequency is 104.02 GHz. The LO for the receiver is 98.02 GHz. Therefore a strong, stable tone at 6 GHz is expected in the USB IF.

It was observed that when the control software is doing ongoing monitoring the WCAs, there spurious tones in the IF output. Figure 1 shows the spectrum of the IF after ½ hour of peak-hold.

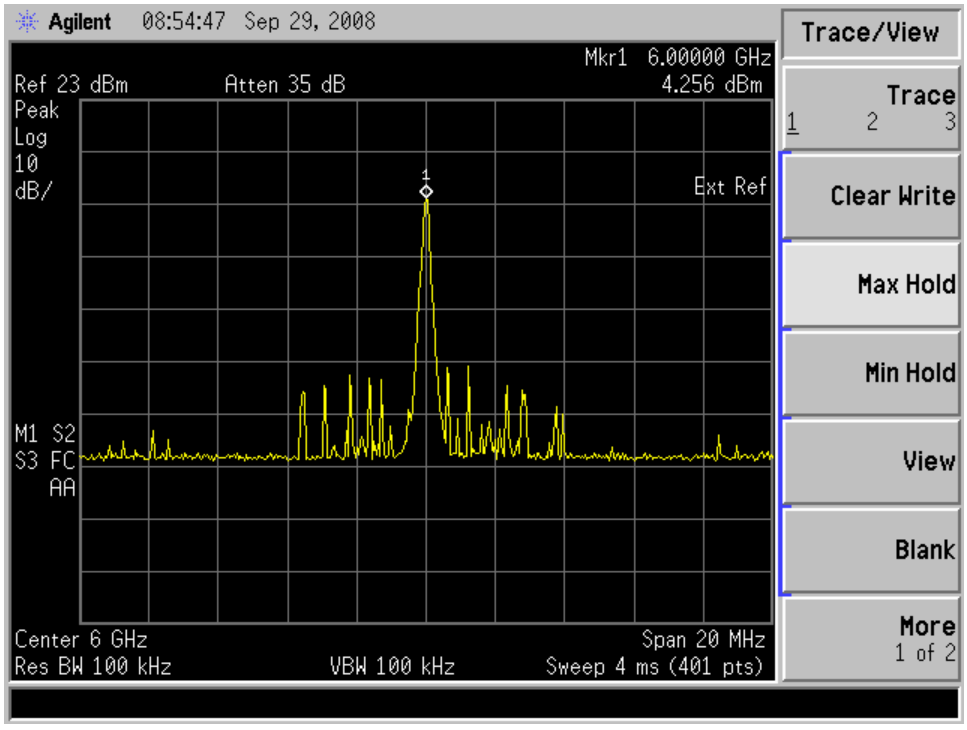

Figure 1 - monitoring receiver and source, ½ hour peak-hold

When the front end control software is stopped, so that no ongoing monitoring is occurring, the spectrum is very clean, as expected. See Figure 2.

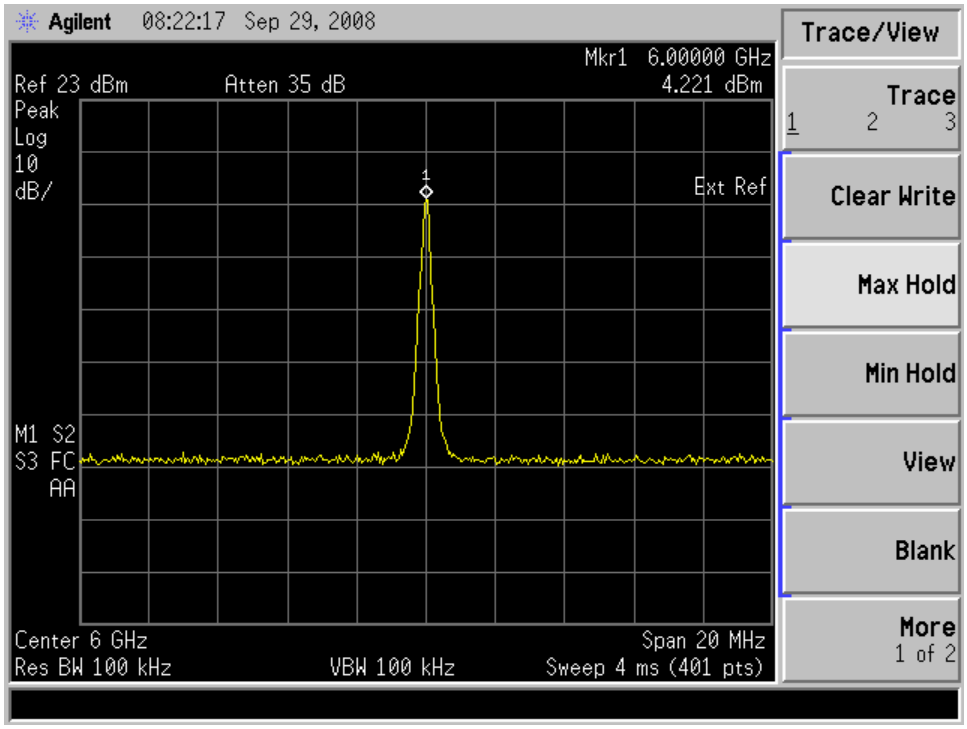

Figure 2 - no monitoring activity

To attempt to isolate the source of interference, I enabled monitoring for only the source (Figure 3), and then only the receiver (Figure 4.) Figure 5 shows the receiver monitoring situation after 1 ½ hours peak-hold.

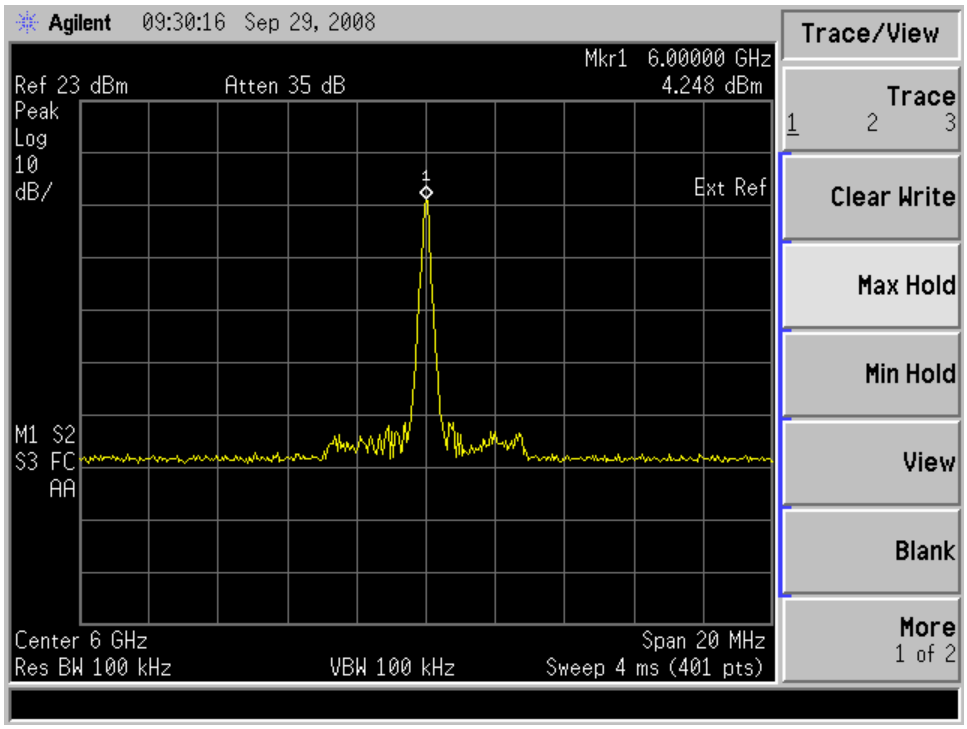

Figure 3 - source monitoring only

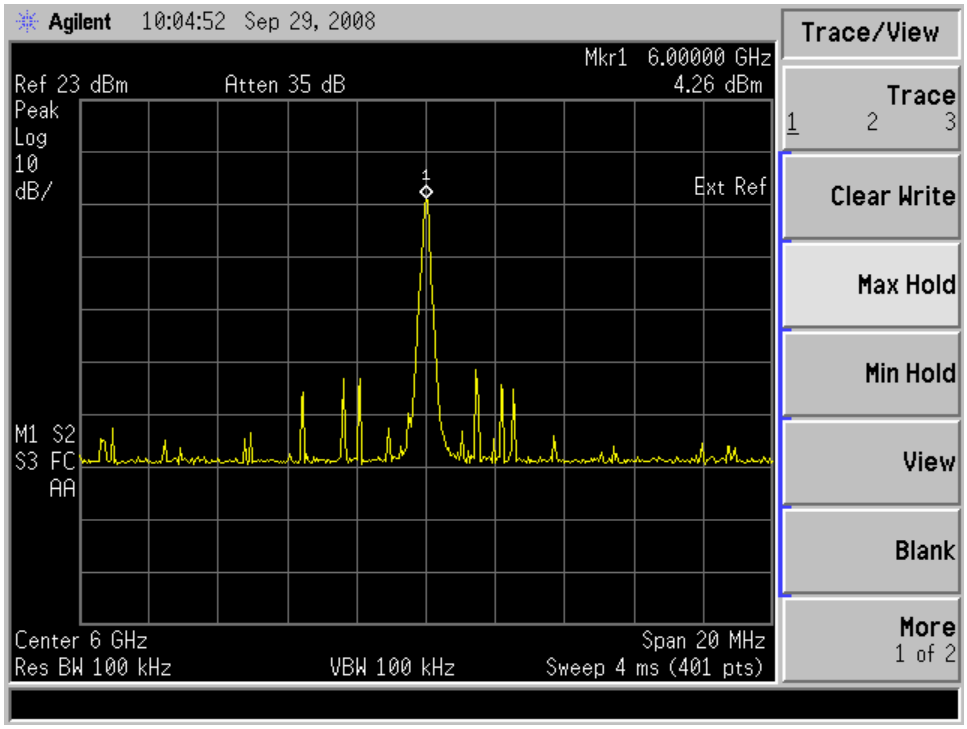

Figure 4 - receiver monitoring only

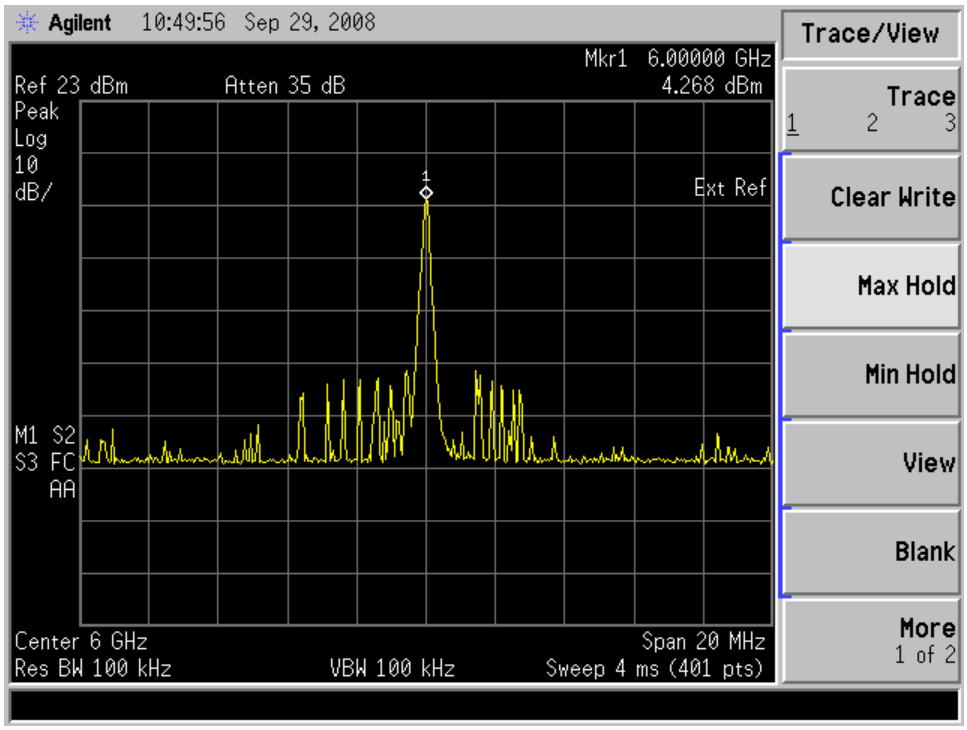

Figure 5 - receiver monitoring only, 1 1/2 hours peak-hold

Using the beam measurement system, I captured plots of phase vs. time. The sample rate is limited by the VNA to about 4 samples per second. Figure 6 and Figure 7 show the phase drift without and with monitoring activity, respectively. Qualitatively there does not appear to be any difference between these two plots. However, given that the spurious events are rather rare it is unlikely that they would be obvious at this sample rate.

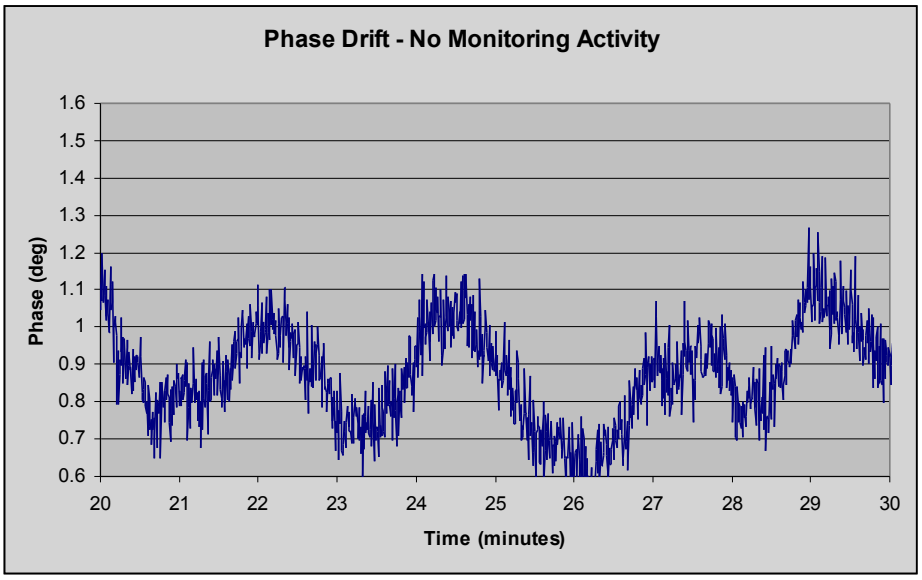

Figure 6 – no monitoring activity

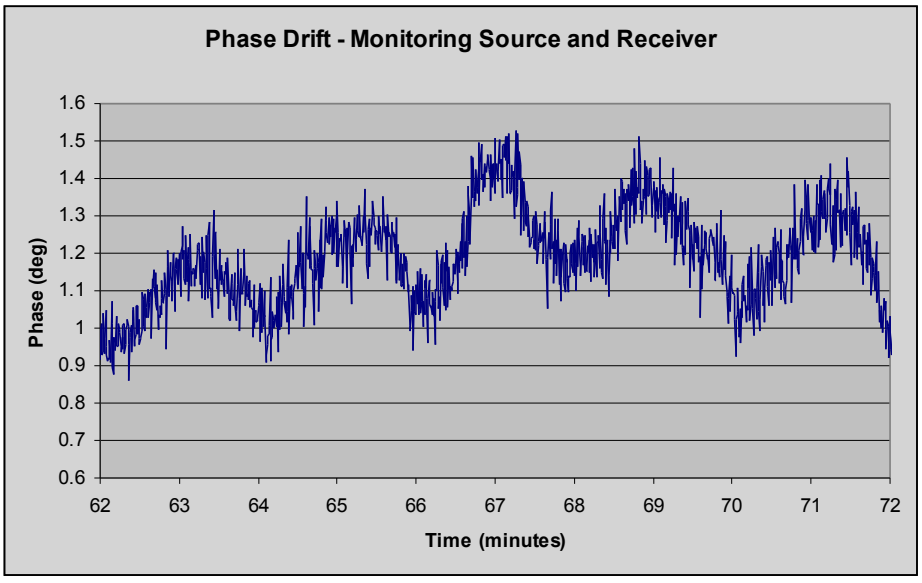

Figure 7 – monitoring source and receiver

These tones are not seen when using the front end with the monitoring on or off, but the IF spectrum will be monitored in future to confirm this.