Hello everyone, Monday, 31 Oct 2005

As you may know, I've started to do some work in chasing down the origin of the pulsed RFI that kills the sensitivity of my DBIRS system. If these pulses are more or less world-wide, they will disturb almost every low frequency system and effective measures to excise them will have to be incorporated into the LWA design. For those of you who are not familiar with the system and the phenomena that we observe, here are a few of their characteristics.

The system observes the spectrum from 0 to 62.5 MHz. It is a direct sampling machine running at 125 MHz and 12-bits. I'm seeing pulsed phenomena that do not show up in my older 5-60 MHz spectral scanning systems. I see these pulses with amplitudes >>7 sigma in the time series out of the sampler, often there are more than 1000 pulses per second. They are highly variable in structure. Their envelope is usually ~100 ns in length but they usually contain one or two very strong components that are off-scale and unresolved by the sampler. Often the pulses come in pairs about 3000 ns apart with the second pulse being about 1/3 the amplitude of the first. After the pulse there is ringing for at least 10,000 ns. My antenna is a single, active dipole; the noise level of the system is dominated by the galactic background or CW RFI and these pulses are 10 to 100 times background.

The pulses come and go. They are almost always there at ~100 to 1000 pulses per second in the daytime but they are much fewer and weaker at night, down to ~10 per second at < 1/10th the amplitude. This suggests that they are ionospherically propagated. Although this diurnal variation is suggestive of ionospheric propagation it does not really follow the local foF2. The pulses generally come up to their daytime levels a few hours after local midnight, then they drop down to their nighttime levels several hours before sunset. This suggests to me that they may originate far to the east of here and are propagated best by the ionosphere a few hours to the east. If the propagation is best when the ionosphere ~3 hours east of here is the most dense, the pulses could originate ~6 hour east, i.e. N. or S. America or Hawaii. At present, I have no direction-finding capability in order to be certain of this but I'm thinking of putting up a horizontal, rotatable dipole that I could use to determine the azimuth that nulls them out.

I've recently obtained a set of MCL bandpass filters in order to get some idea of the frequency range of the pulses. During one period yesterday afternoon when the pulses were very strong, here is what I found:

Filter	Bandpass (MHz)	Pulsed Voltage (mV)	Background Level (mV)	Remarks
None	0-125	>>100	~3	Pulses off scale
BBP10.7	9.5-11.5	2-10	~1	Very weak but visible pulses
BBP21.4	19.2-23.6	30-50	~2	Strong pulses
BBP30	27.0-33.0	50-100	~3	Very strong pulses
BBP60	55.0-67.0	10-30	~2	Weak pulses

One other odd fact was that, at 60 MHz, the pulse structure was definitely different from that at the other frequencies; instead of the second component (the one that trails the main pulse by ~3000 ns) being ~1/3 the main pulse amplitude, it was ~3 times the first pulse in amplitude. This suggests to me that the propagation paths for the two components may differ.

The fact that I still see the pulses at 60 MHz argues, to some extent, against ionospheric propagation, but what else would give these observed characteristics?

I'd certainly appreciate ideas and suggestions from anyone.

Cheers, Bill