**Notes for Beacon Measurement Slides**

Slide

1. This is a saga where identifying and correcting one problem led to discovering yet another problem to investigate.

2. It started with putting new equipment on Mt. Allison.

6. 80 GHz beacon is about 40 kHz below the intended 80832 MHz 47 GHz at 47088 MHz

8. The beacons have a reasonably strong signal and should be usable at many places in the South Bay. These numbers are obviously dependent on the RX antenna and noise figure.

10. Getting the frequency stable took several outings with careful observation of the RX frequency. As expected, the frequency drifted after the rig was turned on. As insulation was added, the drifting went a few kHz further. After some iterations of more insulation, the warm-up drift settled at a stable frequency.

15. Some HP / Keysight signal generators have both FM and PM. All it does is change the baseband frequency response to create the desired signal.

17. Slope detection: Hear FM with AM receiver.

20. I’ll skip the many pages deriving the important result. The important conclusion is that the probability distribution of noise magnitude R, is independent of the phase.

21. Hopefully a picture is worth many equations. Go slow and point out each of the components on the picture. The noise is a random value, at any instant, it might be stronger or weaker than the RMS value.

23. Noise is random. Sometimes it greatly exceeds the RMS value. This table was created from the equations we skipped over. With CNR around 10 dB, we expect to start hearing random clicks. These increase as CNR is reduced further. Eventually the desired audio is hard to copy.

25. Refer back to the vector diagram on slide 21.

26. Other sources have similar diagrams. Many include the effect of pre-emphasis.

27. After weeks of rain, there was finally a really good day to go outside. Mild temperature and no breeze typical on sunny afternoons.

29. My 24 and 47 GHz rigs use the same dish and tripod.

30. This is consistent with the publish graphs. If I was to do it again, I might be more diligent in recording when I heard clicks,

31. Actually the 30 second CW ID timing is possibly too often. When trying to measure SNR there are only 20 seconds of steady carrier before the amplitude is modulated.

32. Some detailed reading for the next time we have a lot of rainy days!

Many hams, even those with lots of experience using FM are not familiar with the clicks, sometimes called “pops”.

1.  The squelch circuit.   Typically this is set to only pass audio when the signals are strong.  Unless the squelch turned off, it will mute the pops.

2.  These are only noticeable in a narrow range of signal strength.  For CNR above about 10 dB, they are very infrequent.  Below about 8 dB CNR, there are a lot of other random phase shifts that are demodulated as noise which on average is worse than the clicks.

3.  In the typical use of FM, long stretches of unmodulated carrier are not common.  When someone stops talking, they let up the mike button.

Microwave beacons are an unusual situation in that there are long periods of unmodulated carrier and there are many reasons to listen to a weak beacon.