

PTTI WORKSHOP

SESSION A

“CLOCK PERFORMANCE AND ITS MEASURES: STABILITY AND ACCURACY”

**Moderator: Leonard Cutler
Hewlett-Packard Laboratories**

SHORT TERM STABILITY

- Short term stability—behavior (usually expressed in the time domain) where stochastic effects dominate—time range varies with type of standard
- Questions of drift *vs* flicker noise
- Often evidence of random walk of frequency
- Random frequency jumps lead to $\tau^{+1/2}$ behavior—sensitive to averaging time and position of time windows
- Other measure usually used to look at environmental effects
- In telecomm often see “phase hits”—how to characterize? (Separate into “jitter” and “wander” with 20 Hz sample rate and 10 Hz boundary)
- Noise should be related to physics whenever possible
- Air Force cares about 10^{-12} frequency steps
- Always need to characterize noise of measuring system

ENVIRONMENTAL EFFECTS

- Effects in space mainly temperature & radiation—Cs temperature coefficient small—Rb perhaps 100 times worse
- Telecomm concerned with temperature—often see $\pm 3 \rightarrow 10^\circ\text{C}$ occurring rapidly—need to worry about static and dynamic effects
- Rb response to magnetic field & radiation?
- Spaces Cs (Block I and Block II) show some drift—what is the cause?
- Space quartz looks good with respect to slow steady radiation
- Dual mixer scheme shows temperature coefficient
- Radiation effects on H maser wall coating (John’s Hopkins applied Physics Laboratory)
- Need to worry about cross coupling of environmental parameters
- Environmental effects often nonlinear—need to specify ranges
- Effects of shock and vibration
- Questions of mechanical stability

LONG TERM STABILITY

- Need more definitions—range of times, etc.

MOST IMPORTANT POINTS

- Communication, communication, communication...
- Better definitions
- Get involved with telecomm, etc. needs
- Telecomm and Frequency/Time communities need to communicate—Telecomm community is writing a document on frequency and time terms—should coordinate with CCIR, etc.—Helmut Hellwig chairs a committee (SCC 27) which is writing a standard on F&T matters—also IEEE document 1139