

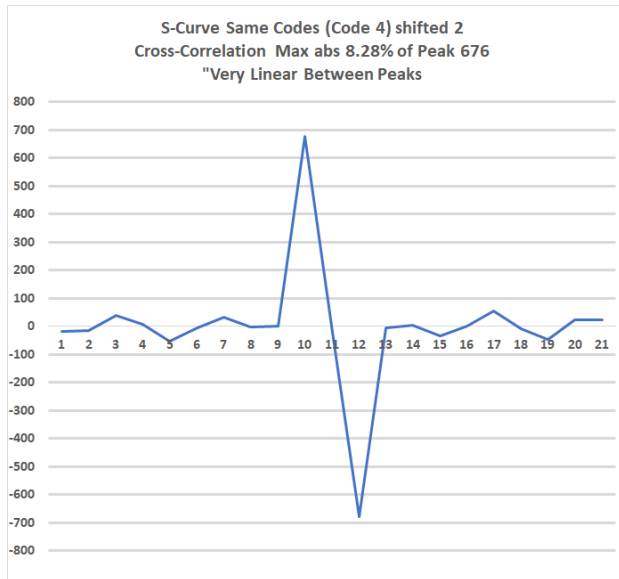


TECHNICAL PAPER 5

CSK Code Data Transport, Precision Timing, and Phase Lock Loop (PLL) Tracking

The S-Curve cross-correlation synchronization technology has been used since the first PN digital voice transceiver of 1967. It was a mature process in 1967-1979 when used in the PN navigation Phase Lock Loop (PLL) of the 1970s and has been the synchronization means of choice for the last 50 years of communications and navigation systems. The current high GHz processing speeds and options for faster optical correlation makes this technology especially powerful as a best choice for .5 nanosecond synchronization accuracies.

The CSK Codes are for communications and navigation data transport, time-keeping, and ranging. Tier0 shuffled codes are XORd forming Tier1 codes, and Tier1 code pairs are XORd forming Tier2 CSK Codes. The CSK Codes are optionally pre-analyzed and conditionally saved to memory for real time retrieval processes during later demodulation processes. Upon retrieval, CSK Codes are processed to extract 16 symbol codes for deterministic transmissions dependent on values of 4-bits transport data. The receive process is also deterministic with 16 specific symbol codes used to convert detected CSK symbols back to the original 4 bits of data. The random binary codes in these papers are samples for use locally in Universal Time synchronous demodulation processes without additional phase searches. All precision Universal Time and Receive Universal Time include time tics for 20 microseconds, 200 microseconds, 1 and 4 milliseconds, 1 second, and date-time are all available for the transmit and receive processes. The precision timekeeping binary code length of choice is a 512-bit CSK code.



The navigation function continually synchronizes time with Terrestrial nodes and maintains a Universal time clock using a Voltage Controlled Oscillator (VCO) and Delay Lock Loop (DLL) Technology defining the precision S-Curve shown in this figure. This is proven technology from the 1970s. The horizontal axis shows the difference in lead and delay phase error cross-correlation peaks in the expression $((I2E+Q2E)-(I2L+Q2L))/2$ that provides the input to the voltage controlled oscillator (VCO) to force corrective values between peaks towards the in-phase lock point at the horizontal position 11. The unique characteristic here is the linear "phase-offset peaks" defined by the "difference expression" above. All cross-correlations offsets of +/- 2-chips define the S-Curve VCO values, all of which define corrective values forcing a phase change toward the zero-error value at position 11. Outside the positive and negative peaks the difference values of matches-mismatches are between 0% and 9% of the CSK Code length.

Primary CSK Codes Advantages

- The S-Curve proven phase-lock-loop is common to all CSK Code symbol receivers
- All time-keeping for all transmitters and receivers have accuracies of .5 ns to 1 ns
- All CSK Code symbols are detectable with deterministic symbols without additional searches
- When universal time lock and receive time offset lock achieved, all track functions are ready