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SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
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CLOCK SYNCHRONIZATION AND RF SYNTHESIS

Abstract

Beam forming with phased array systems require phase synchronization between the independent transmitting/receiving elements. Usually the phased array systems are driven by a common clock source with a fixed tunings as required by independent elements. In a satellite constellation system, it is not possible to have a single clock source directly driving the others. Hence clock source itself can be derived in multiple ways.

A reference satellite is taken, and is made to transmit a known waveform Omni directionally. The important parameters of the reference waveforms are known to all satellites of the constellation. The wave is received by the member satellites with a Doppler frequency shift. A high frequency RF wave is chosen for the reference so that the frequency shift is appreciable. The distance between the reference satellite and the orbiting satellite is estimated and the Doppler shift is measured. Based on the Doppler shift, the relative velocity between the two satellites is obtained and using the distance, the time lapse between the two satellites is used to calibrate the clock.

The implementation of this technique can be done via a software defined radio and using the on board processing capabilities of the satellite.