

LO PHASE REFERENCE DISTRIBUTION BY COMMUNICATION SATELLITE

Bardin, J.C.^{1,2}, Weinreb, S.¹, Bagri, D.¹

¹Jet Propulsion Laboratory, California Institute of Technology

²University of California, Los Angeles

A satellite communication system suitable for distribution of local oscillator reference signals for a widely spaced microwave array has been developed and tested experimentally. The system uses a round-trip correction method to remove effects stemming from atmospheric fluctuations and radial motion of the satellite. This experiment was carried out using Telstar-5, a commercial Ku-band geostationary satellite. For this initial experiment, both earth stations were located at the same site to facilitate direct comparison of the received signals. The local oscillator reference frequency was chosen to be 300MHz and was sent as the difference between two Ku-band tones. The residual error after applying the round trip correction has been measured to be better than 3psec for integration times ranging from 1 to 2000 seconds. For integration times greater than 500 seconds, the system outperforms a pair of hydrogen masers with the limitation believed to be ground-based equipment phase stability. The idea of distributing local oscillators using a geostationary satellite is not new; several researchers experimented with this technique in the eighties, but the achieved accuracy was 3 to 100 times worse than the present results. Since then, the cost of both leased satellite bandwidth and the Ku-band ground equipment has dropped substantially and the performance of various components has improved. An important factor is the leasing of small amounts of satellite communication bandwidth. We lease three 100kHz bands at approximately one hundredth the cost of a full 36MHz transponder. Further tests of the system using terminals separated by large distances and comparison tests with two hydrogen masers and radio interferometry is needed.

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1. (a) Joseph Bardin
Jet Propulsion Laboratory
attn: Joseph Bardin
ms 168-214
4800 Oak Grove Dr.
Pasadena, CA
91109 USA
joseph.c.bardin@jpl.nasa.gov
- (b) 805-708-6093
- (c) 818-393-6984
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