

INTERNATIONAL COMPARISON OF ATOMIC FREQUENCY STANDARDS VIA VLF RADIO SIGNALS

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A study was made of data obtained over an 18 month period (July 1961 to December, 1962, inclusive) on the comparison of atomic standards located in six laboratories in the U.S., Europe and Canada, using the VLF signals of GBR (16 kc/s), Rugby, England and NBS (18 kc/s), Balboa, Canal Zone. Also included were data obtained by the U.S. Naval Observatory.

The statistical analysis was designed to separate the observations at each laboratory into three components: (a) long term mean differences among the atomic standards; (b) statistical estimates of the receiver uncertainties, $\hat{\alpha}_i$, (c) statistical estimates of the transmitter uncertainties, $\hat{\tau}$. $\hat{\alpha}_i$ includes receiver fluctuations, propagation effects peculiar to the path, and measurement uncertainties; $\hat{\tau}$ includes the transmitter fluctuations and propagation effects common to all paths.

The study shows that $\hat{\alpha}_i$ at each receiver varied from 0.39×10^{-10} (GBR data) at NEUT to 1.97×10^{-10} (GBR data) at NRC with an average for all stations of 0.88×10^{-10} measured against GBR and 0.99×10^{-10} when measured against NBA.

Average $\hat{\tau}$ for GBR is 1.25×10^{-10} and for NBA is 0.68×10^{-10} .

Finally, (1) all atomic standards agreed to within two parts in 10^{10} for the 18-month period, and (2) laboratory type standards agreed to within one part in 10^{10} .