Abstracts

Measurement and Control of Microwave Frequencies by Lower Radio Frequencies

R.C. Mackey and W.D. Hershberger. "Measurement and Control of Microwave Frequencies by Lower Radio Frequencies." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 64-68.

From the fields of nuclear and paramagnetic resonance comes a relation between precession frequency and magnetic field strength for nuclei and unpaired electrons. The relation is such that f/sub n/=K/sub n/H for nuclei and f/sub e/=K/sub e/H for electrons. Thus if the frequency of one oscillator is set for f/sub n/ and the frequency of another oscillator is adjusted so that simultaneous nuclear and electronic resonance occurs in the same magnetic field, the frequency ratio of the oscillators is given by the ratio of K/sub e/ to K/sub n/. Values of K/sub e/ and K/sub n/ have been tabulated for many substances and therefore allow frequency comparisons to be made. For example, protons in mineral oil and electrons in hydrogen have a precession frequency ratio of 658.228; hence for an f/sub e/ in x band, f/sub n/ is about 14 mc when the magnetic field is 3300 Gauss. Changing the value of H causes the frequencies to move up or down the frequency scale but their ratio is always constant. By this method microwave frequencies may be measured with equipment of a much lower frequency range. The precision of measurement is limited by the widths of the nuclear and electronic resonance curves and runs between one part in 10/sup 4/ to 10/sup 5/. This frequency measurement method may be made the basis of automatic control of microwave frequencies by quartz crystals or very stable lower frequency oscillators. An experimental model of such a system has been constructed and operated.

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