We present a novel concept of a modulated transmission line: a low-pass dynamic transmission line (DTL) whose capacitors are replaced by varactors that are externally modulated in tandem. The modulation voltages are periodic in time and identical in all the unit cells (and there is no pump wave). Accurate modeling leads to two bands, $\beta_1(\omega)$ and $\beta_2(\omega)$ for the propagation constant, separated by a gap $A\beta$. We have fabricated an eight-cell DTL and measured $\beta_{1,2}(\omega)$ for a range of frequencies of the signal wave up to the modulation frequency f_M = 310 MHz, finding very good agreement between the experimental and theoretical results. These are also compared with an effective medium description, with the dynamic permittivity $\varepsilon(t)$ being equal to the distributed capacitance $C(t)/a$ at every instant t and the permeability μ equal to the distributed inductance L/a, where a is the size of the unit cell. There is good agreement for long wavelengths, $\beta a \lesssim 1$, including the β-gap, which, for negligible resistive effects, is proportional to the modulation strength. Such gaps are characteristic of periodicity in time of a parameter and were predicted for "temporal photonic crystals." We have also confirmed experimentally that for every frequency f , a harmonic of frequency f_M - f is excited, giving rise to beats when $f \cong f_M/2$. We expect these experimental and theoretical results to open a new platform for useful applications.