We report on exotic magnetic ordered states and phase diagram of frustrated spin chain compound beta-TeVO4 studied by specific heat, neutron diffraction, and high-field magnetization measurements. This compound, comprising weakly coupled infinite chains of VO5 pyramids sharing corners, is proposed to be a new realization of the zigzag J1-J2 model [1]. In qualitative agreement with this proposal, we found an incommensurate, ICM, magnetic order with q1=(-0.208 0 0.436) below TN=4.65 K and a series of transitions between consecutive ICM magnetic phases, exhibiting pronounced temperature, T, and magnetic field, H, dependences. Of special interest is a long-scale modulated phase with high-order satellite magnetic reflections (fig. 1) that might reflect the formation of magnetic solitons [2] existing in a narrow T,H-range.