Chalcones are important intermediates in the biosynthesis of biologically active compounds such as flavonoids and their derivatives. In this work, 2-Hydroxy-3,4,6-trimethoxyacetophenone \( (C_{11}O_{5}H_{14}) \) was isolated from the stem bark of \textit{Croton anisodontus} Müll. Arg. (Euphorbiaceae) and a new chalcone 2E-1-(2’-Hydroxy-3’,4’,6’-trimethoxyphenyl)-3-(phenyl)-prop-2-en-1-one \( (C_{18}O_{5}H_{18}) \) was synthesized by the condensation reaction of Claisen-Schmidt in basic medium between the 2-hydroxy-3,4,6-trimethoxyacetophenone and benzaldehyde. The structure of this new chalcone was determined by Nuclear Magnetic Resonance and their vibrational properties were characterized through infrared and Raman spectroscopy at room temperature in the spectral ranges 400 cm\(^{-1}\) to 4000 cm\(^{-1}\) and 25 cm\(^{-1}\) to 4000 cm\(^{-1}\), respectively. Vibrational wavenumber and wavevector were predicted using the Density Functional Theory calculations with the hybrid functional B3LYP and the basis set 6-31 G(d,p). Calculated wavenumbers were found to reproduce the experimental ones with good agreement, allowing the assignment of the normal modes present in the FT-IR and FT-Raman spectra of HYTPHENYL crystal. The assignment of the normal modes was done in terms of the Potential Energy Distribution (PED). Furthermore, the Natural Bond Orbital calculations were performed to obtain the Highest Occupied Molecular Orbital (HOMO), Lowest Unoccupied Molecular Orbital (LUMO) and the quantum chemical parameters: energy gap, vertical ionization energy, vertical electron affinity, chemical potential, global hardness and electrophilicity index. The electrostatic surface potential maps were also constructed to display the charge density distribution and the sites of chemical reactivity of this new chalcone. Additionally, analysis of the antimicrobial activity and antibiotic resistance modulation was carried out to evaluate the antibacterial potential of the HYTPHENYL compound. Antimicrobial and modulatory antibiotic activities of the HYTPHENYL compound was investigated. Significant modulatory activity of the antibiotics tested were observed to HYTPHENYL compound against strains of \textit{Escherichia coli} 27 and \textit{Staphylococcus aureus} 358. The HYTPHENYL showed synergistic effects to these bacteria strains when it is associate with amikacin antibiotic. Other synergistic effect could be observed to \textit{Escherichia coli} 27 in presence of HYTPHENYL with the gentamicin antibiotic. Therefore, these results demonstrate that HYTPHENYL compound presents potential antimicrobial and may contribute to the control of bacterial resistance.