In the present study, polypyrrole/bentonite (PPy/Bnt) composite was synthesized into the Bnt interlayers by chemical oxidation polymerization. The irradiation process was carried out in air in a conventional gamma chamber, which uses a $^{60}\text{Co}$ source, and the composite was exposed to a dose of 40 kGy. Effects of irradiation on the composite were investigated by means of FTIR, UV-visible absorption, TGA, XRD, SEM and temperature dependent electrical conductivity in the temperature range of 290-410 K. The initial decomposition temperature of pristine PPy/Bnt composite was found higher than irradiated PPy/Bnt composite. The XRD patterns revealed that the intensity of the peaks changed with irradiation. It was found from temperature dependent conductivity measurements that the radiation significantly influenced the conductivity of PPy/Bnt composite. The conductivity results show that dominant conduction mechanisms were hopping for both PPy/Bnt composite and irradiated samples due to wide range of localized states present near the Fermi level.