We have studied the interplay between the layered crystal structure and the 5f magnetism in uranium-based tetragonal compounds $U_n T In_{3n+2}$. Single crystals of U_2RhIn_8 , $URhIn_5$ and UIn_3 were prepared by In self-flux method. The novel U₂RhIn₈ compound adopts the Ho₂CoGa₈-type structure with lattice parameters a = 4.6056(6) A and c = 11.9911(15) A. The behavior of U_2RhIn_8 strongly resembles that of related URhIn₅ and UIn₃ with respect to magnetization, specific heat and electrical resistivity except for magnetocrystalline anisotropy developing on stacking composition in the series UIn₃ vs. U₂RhIn₈ and URhIn₅. U₂RhIn₈ orders antiferromagnetically below $T_{\rm N} = 117$ K and exhibits slightly enhanced Sommerfeld coefficient $\gamma = 47 \text{ mJ} \cdot \text{mol}^{-1} \cdot \text{K}^{-2}$. T_{N} increases with increasing c/a ratio in contrast to the behavior of their $\operatorname{Ce}_n T\operatorname{In}_{3n+2}$ counterparts. Magnetic field leaves the value of the Néel temperature of $URhIn_5$ and U_2RhIn_8 unaffected up to 9 T. On the other hand, $T_{\rm N}$ increases with applied hydrostatic pressure up to 3.2 GPa with the $\partial T_{\rm N}/\partial p$ coefficient resembling URhIn₅ and UIn₃. Thermal expansion of U₂RhIn₈ reveals a hysteretic behavior of the antiferromagnetic transition pointing to its 1st-order character. The magnetic structure $^{1}/_{2}$) and the magnetic moment $\mu = 1.65 \ \mu_{\rm B}/{\rm U}$.