BN / Graphene / BN RF Transistors HAN WANG, MIT, THITI TAYCHATANAPAT, Harvard University, ALLEN HSU, PABLO JARILLO-HERRERO, TOMAS PALACIOS, MIT — In this work we demonstrate the first BN/graphene/BN transistor for high frequency RF applications. This sandwich structure allows a significant improvement in the mobility of graphene, which reaches more than 18,000 cm²/Vs at room temperature. Graphene field effect transistors (GFETs) have been fabricated with $L_{DS}= 800$ nm and $L_G=300$ nm. The minimum conduction point of these devices is very close to zero, a result of the negligible substrate doping to the graphene. A current density in excess of 1 A/mm and DC transconductance above 200 mS/mm are achieved for both electron and hole conduction. RF characterization is performed for the first time on this device structure and initial results show a current-gain cut-off frequency $f_T=10$ GHz. These experimental results have been combined with simulations of the small-signal model to study the scaling potential of these GFETs for high frequency applications. The impact of the access resistances ($R_s$, $R_d$), the capacitances ($C_{gs}$, $C_{gd}$, $C_{ds}$), and the transconductance ($g_m$) on the frequency performance of the GFETs has also been studied. Finally, the fabricated devices have been compared to GFETs fabricated with SiO₂ substrate and Al₂O₃ gate dielectrics. The improved performance obtained by the BN/graphene/BN structure is very promising to enable the next generation of high frequency RF electronics.