Let $G$ be a reductive algebraic group over an algebraically closed field of characteristic zero with simply connected commutator subgroup. The geometric Satake equivalence realizes the tensor category of representations of the Langlands dual $\hat{G}$ of $G$ as the monoidal category of $G[[t]]$-equivariant perverse sheaves (or D-modules) on the affine Grassmannian $\text{Gr}_G := G((t))/G[[t]]$ of $G$ (where the equivariant perverse sheaves are multiplied using a certain convolution product). The goal of this paper is to realize the tensor category of representations $\text{Rep}(U_q(\hat{G}))$ of the quantum group $U_q(\hat{G})$ corresponding to $\hat{G}$ as a geometric object closely related to the affine Grassmannian of $G$. Let $N$ be a maximal unipotent subgroup of $G$, let $N((t))$ denote the corresponding loop group, and let $\chi : N((t)) \to \mathbb{G}_a$ be a non-degenerate additive character (normalized to have conductor 0). Define a twisted version of the category of perverse sheaves (or D-modules) on $\text{Gr}_G$ which are $N((t))$-equivariant with respect to $\chi$ and call it the category of twisted Whittaker D-modules $\text{Whit}^\chi(\text{Gr}_G)$ on $\text{Gr}_G$. This theory was developed by E. Frenkel, K. Vilonen, and the author of the paper under review [Ann. Math. (2) 153, No. 3, 699-748 (2001; Zbl. 1070.11050)] and is motivated by the theory of Whittaker functions for $p$-adic groups. Now Jacob Lurie conjectures that $\text{Rep}(U_q(\hat{G}))$ and $\text{Whit}^\chi(\text{Gr}_G)$ are equivalent as chiral categories where $q = \exp(\pi ic)$. (Here the chiral structure on $\text{Rep}(U_q(\hat{G}))$ comes from its tensor structure.) The main result of the paper under review is an equivalence of chiral categories between the category of twisted Whittaker D-modules on the affine Grassmannian of $G$ and the category of factorizable sheaves $\text{FS}^c(\hat{G})$ if $c$ is irrational. Since it follows from the work of R. Bezrukavnikov, M. Finkelberg, and V. Schechtman in [Lecture Notes in Mathematics, 1691, Berlin: Springer (1998; Zbl. 0938.17016)] that $\text{FS}^c(\hat{G})$ is equivalent to $\text{Rep}(U_q(\hat{G}))$ if $q = \exp(\pi ic)$ is not a root of unity, this proves Lurie’s conjecture in the generic case.