Field theory of symmetry protected valence bond solid states in (2+1) dimensions AKIHIRO TANAKA, National Institute for Materials Science, Jpn, SHINTARO TAKAYOSHI, Department of Quantum Matter Physics, University of Geneva — With the scope of identifying possible symmetry-protected topological (SPT) states, we revisit the effective field theory description of 2d anti-ferromagnets in terms of nonlinear sigma models with topological Berry phase terms. We focus on ground states that can be characterized as spatially-uniform valence-bond-solid states residing on a square lattice, which implies that the spin quantum number $S$ be an even integer. A path integral representation of wave functionals allows us to study the topological properties of the ground state in terms of a field theory defined in a space whose dimensionality is reduced by one, which leads us to an interesting incarnation of the well-known Haldane-gap argument for 1d antiferromagnets. From this, we conclude that the ground state can be an SPT state when $S = 2 \times$ odd integer, while for $S = 2 \times$ even integer it is topologically trivial. We also discuss how our method generalizes to 1d and 3d antiferromagnets.