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Motivated by the channel estimation problem in wireless communication matrices are considered that have a sparse representation in terms of elementary matrices. The basic problem consists of identifying such a matrix from its action on only one vector. This can be restated in terms of a sparse approximation or sparse recovery problem. So many algorithms from this field apply to perform the practical reconstruction, and there are direct consequences from known results on random measurement matrices, such as the Gaussian, Bernoulli and partial Fourier ensemble. However, the main focus will be on identifying an operator being the sum of a few time frequency-shifts (that is, it has sparse spreading function). Reconstruction results for basis pursuit ( $\ell_1$  minimization) will be presented. They can as well be interpreted as sparse approximation results for particular finite Gabor frames. (Received April 13, 2007)