WEAK GPS ACQUISITION VIA COMPRESSED DIFFERENTIAL DETECTION USING STRUCTURED MEASUREMENT MATRIX

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Abstract- Quality of the acquisition algorithm is the main criteria for assessment of the GPS receiver. Compressed sensing has been used recently in the GPS signal acquisition process to improve the acquisition sensitivity and find visible satellites in the two dimensional search space. In this paper, strategies for constructing the GPS Dictionary matrix using different measurement matrices are analyzed for weak signal conditions. Conventional acquisition methods use pure random or Bernoulli measurement matrices requiring huge storage memory and resulting in high computational cost for faithful sparse signal representation. Based on the restricted isometry and coherence properties, the Kronecker product of hybrid 'L' deterministic measurement matrix has been proposed for fast calculation and easy hardware implementation of the GPS acquisition module. Simulation results for weak signals of C/N_0 25 dB-Hz show that the compressed sensing combined with post-correlation differential detection scheme has the ability to determine more number of visible satellites. It is inferred that using this approach, 92% probability of obtaining 1.2 times more visible satellites than the uncompressed data length of 8 msec is achieved with lower computation time and significant improvement in average post correlation SNR value of 0.84 dB is obtained for four visible satellites.

Index terms: GPS, weak signal Acquisition, Compressed sensing, differential detection