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Interconnecting of Ship Radars of Centimeter and Millimeter Wavelength Ranges

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Abstract—Complex application of radar information of the systems of different ranges allows to increase the efficiency of radar detection of the objects on a background of interferences from sea surface. Reflection characteristics of a sea in centimeter and millimeter wavelength range and restrictions related to their correlation property are the objects of researches and description in this paper. In this paper there are represented the results of experimental research of statistic characteristics (spectrums, distribution laws) of sea reflections including the case of their mutual processing as marks and outputs of narrowband Doppler filters. There are obtained the relations for estimation of working characteristics of the system complex in case of multiplexing and additive method of information aggregation. It is carried out comparison of the results with machinery experiment using real records of sea reflections. The basis is full-scale experiment together with mathematic modeling. It is shown that sea reflections correlation in centimeter and millimeter wavelength ranges is a factor restricting the efficiency of interconnecting of these ranges systems.

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INTRODUCTION

Complex application of radiolocation information of the systems with different ranges allows to increase the efficiency of radar detection of the objects on a background of interferences from sea surface. Development and fabrication of multi-frequency radar systems of different application, wide number of publications in patent and science-technical papers related to methods of reception-transmitting of multi-frequency signals [1], development of theoretical questions of rational processing of radiolocation information show that multi-frequency radar is one of the most developing and promising direction.

Application of multi-frequency signals in radar systems is specified by the purpose of decreasing of negative influence of reflected signals fluctuation on radar detection characteristics and accuracy of coordinate measurements. At that the frequency separation is selected using the condition of provision of statistic independence of the reflected signals.

In [1–3] there are developed general approaches to calculation of the characteristics of detection for multi-frequency radars for different information volumes used at each of decision-making systems. Initially we assume the objects signals fluctuations are independent at different frequencies and the different channel noise is independent statistically.

For radar systems detecting the objects on a background of internal noise of the receiving device such assumption is correct. Together with this detection of above-water objects lies under conditions of influence of intensive reflections from sea surface which effect on the possibility of their detection and radar range [4]. Situation irregularity lies in non-Gaussian behavior and partial correlation of the interference generated by sea reflections for centimeter and millimeter wavelength range radar systems [4]. The questions if development of adaptive signal detectors considering background of correlated area and target reflections are researched in [5–12]. Application of the noise map [5–8], fuzzy set [9, 10] for generation of adaptive thresholds allows to increase essentially the detection characteristics.

There is researched typical practice “adaptive” situation where a priori unknown correlation matrix of reflections is substituted by different type estimations shaped using learning sequence of finite volume [11, 12]. Proposed approaches give satisfied results for noise with space-time correlation, for example, both for

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ADDITIONAL INFORMATION

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