Optimizing Airborne Object Detection of Secondary Surveillance Radar in Intra-System Interference Conditions

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***Abstract*—Secondary surveillance radar (SSR) refers to the main sources of information support for both the airspace control system and air traffic control and is an open two-channel requesting system for transmitting an aerial object (AO) request signal, and response signal (RS) to the requester. The principle of constructing an aircraft responder (AR) (an open single-channel queuing system with refuses) and SSR as a whole (asynchronous information network) predetermined a significant density of intra-system interference both in the request channel and in the response channel. It also provided a possibility for an interested party to use an AR through an unauthorized request both to obtain on-board information and to paralyze aircraft responders by emitting request signals of the required intensity, which significantly reduces the quality of its work. The paper presents the synthesis and analysis of the optimal, based on the Neumann-Pearson criterion, the detector of air objects by the secondary surveillance radar in the conditions of the action of in-system and deliberate correlated and uncorrelated interference in the request and response channel. The detection of a burst of RSs in the SSR is reduced to a comparison with the threshold of the sum of the number of RSs with one detected pulse, and the RSs taken with a weight coefficient of the number of response codes with two detected pulses, which leads to an increase in the probability of detecting AO. The weight coefficient value shows how much, when an airborne object is detected, the RS from two detected pulses is more valuable than the RS from one detected pulse.**

Keywords—secondary surveillance radar, request signal, response signal, signal aircraft responder, aerial object, availability factor.

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