

# Methods of Design and Hardware Implementation of Digital Filters for High-Speed Radio Link in Earth Remote Sensing Systems

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**Abstract.** This article discusses the characteristic features, methods of calculation and end-to-end design of digital filters (DF) designed to generate and receive signals as a part of the currently developed radio systems of Earth remote sensing (ERS) with data rates from a few hundred Mbit/s up to several Gbit/s.

The provided eye diagrams illustrate the need to consider the changes in the value of the peak factor of the output signal of a DF on the efficiency of the transmitter output power (the OBO (Outback Back Of)) value, the linearity margin from the power amplifier (PA) saturation point), and the requirements to the character synchronization system when changing the "roll of factor".

The choice of the structure of non-recursive digital filters with respect to the recursive structure for building the forming and filtering elements for a high-speed radio link is demonstrated. Dependency graphs of the curve  $P_{er} = f(E_{bit}/N_o)$  are presented, taking into account the errors that arise due to the different kinds of imperfect realization of the characteristics of the radio links (including those due to non-ideal frequency characteristics of the DF).

In practice, these curves are obtained by assessing the level of values Error Vector Modulation (EVM) or Modulation Error (MER) with methods of modeling and research on the hardware working in X- and Ka-bands using vector analysis instruments.

**Keywords:** radio link, communication channel, frequency and energy resources, remote sensing, digital filters, non-recursive digital filter, modulation, signal constellation, information rate