

# Influences of Electrical Pulse Disturbances on Digital Device Operation

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**Abstract**—The method of calculating the parameters and characterizing the degree of pulse electrical disturbances influence on digital devices functioning is considered here. By means of this method, assessments of the consequences of the repetitive pulse disturbance influence on digital devices functioning on such factors as the pulse disturbance waveshape, its duration, its peak, and the mode of coding data being transmitted, etc. were carried out.

**Keywords**—*IEMI; data transmission; pulse disturbances;*

## I. INTRODUCTION

In the situation of a pulse electromagnetic field incident on a digital device, its case and external circuits are subjected to direct electromagnetic influence. Generally the case is made of metal, serving as a screen decreasing the level of electromagnetic field penetrating into the device. However, the case screening effect is restricted by its imperfections (port-of-entries, joints etc.). These imperfections are the channels for the electromagnetic field penetration into the case. As a rule the internal wiring elements are the main receptors receiving the penetrating field influence. The pulse electrical disturbances, which can lead to the distortions of data circulating among separate digital devices, are being induced in all of them.

The analytical method for calculating the occurrence of error probability in transmitting data packets under the influence of repetitive pulse disturbance has been offered in [1, 2]. Using this method enabled us to solve a range of practical tasks. For example, it can be effective in choosing the optimal values of average signal power-to-repetitive disturbance average power and disturbance repetition frequency-to-data transmission rate ratios, under which the most effective disturbance influence on actual digital devices is noticed. It should be added also, that the method underwent an experimental check, which showed that it adequately reflects the real mechanisms and regularities of repetitive disturbance influence on digital devices [3].

## II. ALGORITHM OF MODELING

As opposed to available analytical methods, a numerical method permits us to estimate the concrete consequences of the repetitive pulse disturbance influencing the function of digital devices in dependence on such factors as pulse disturbance waveshape, its duration, its peak value, the mode of coding data being transmitted, etc. For example, the algorithm proposed here provides for the assigning of several coding

modes, namely NRZ, RZ, Manchester, four-level and eight-level codes.

The results of the examination of the listed factors' impact on the quantity of the received data packets containing errors caused by the pulse disturbance influence are given in the presentation. In all cases it was assumed that transmission of 1000 packets of 1000 binary bits with a  $10^8$  bps rate would be performed. The amplitude of the signal being transmitted is equal to 2.5 V.

In the work presented here we have used the so-called "algorithm of the ideal receiver" as described in [4].

## III. INFLUENCE OF VARIOUS FACTORS

In this part of the paper the influence of four different factors are considered in detail:

- The shape of the pulse disturbance waveform
- The duration of the pulse disturbance
- The peak of the pulse disturbance
- The mode of the data coding

## IV. CONCLUSIONS

The numerical method of assessment of digital devices immunity to repetitive pulse disturbance influence has been offered. It permits us to assess the consequences of the repetitive pulse disturbance influence on digital devices in dependence on such factors as the disturbance waveshape, its duration, its peak value, the mode of data coding, etc. To demonstrate the capability of this method some example calculations have been performed.

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