Estimation of Efficiency and Noise-Immunity of Radio Communication System on a Basis of Linguistic Diagnosis

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Abstract—It is shown a possibility of linguistic diagnosis for efficiency and noise immunity estimation of radio communication system. On a basis of direct experts questioning membership functions for one of the system parameters are built.

Efficiency and noise immunity of radio communication systems can by defined theoretically and experimentally on a basis of known papers [1–4], etc. The last time for estimation of mentioned parameters there are widely used the experts questioning methods, which can be individual or group ones. The first methods are ranging method, rang correlation method, method of pairwise comparison, scale estimation method, methods of sums, rang sums, distances, "individual notebook." Among group methods there are known following: methods of "critical attack," nominal group, "brainstorm," "structural innovations," 365 method, expert focusing, committee method, "consultation," business game, solution integration, "court" method, "Delphi" method, "collective notebook," etc. Drawbacks of individual questioning methods are following:

– different system efficiency parameters cannot be joined into separate groups of factors,
– the experts process exact quantitive efficiency parameters,
– insufficiency of application to different uncorrelated factors,
– great volume of question statistical results,
– great laborness of experts agreement coefficient calculation.

Group methods are characterized with following drawbacks:

– complexity of organization and carrying out,
– multistage realization,
– complexity and uncertainty in planning,
– the methods, requiring independent and qualified estimation are expensive (experts service paiment).

The paper is aimed to eliminate mentioned drawbacks. With this purpose estimation of radio communication system efficiency is carried out on a basis of linguistic diagnosis, operating with fuzzy considerations, for example, as a result of dialog of deciding person and computer. Psychologically it is explained that the expert prefers to operate with qualitive fuzzy parameters rather than quantitive ones. The last is advisable, since radio engineering systems parameters are of different kind and it is hardly to estimate relative importance of particular quality parameters.

It is of interest to consider possibility of application of linguistic diagnosis for estimation of efficiency and noise-immunity of radio communication systems (RCS). According to linguistic diagnosis the system state and cause-and-effect relations between its parameters and also efficiency diagnosis can be described with the natural language and then formalized in form of fuzzy logic expression set "if … then, else." These expressions can be applied to radio communication system quality parameters. For example, if a value of input signal-to-noise ratio is low, relative value of information loss in a communication channel is average, frequency band utilization factor is low, and meansquare reception error is great, then efficiency and noise immunity of radio communication system are low.