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Retraction

Retracted: Decision Model of Wireless Communication Scheme Evaluation via Interval Number

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] M. Li, Y. Ouyang, W. Kang, X. Che, and R. Ye, "Decision Model of Wireless Communication Scheme Evaluation via Interval Number," *Security and Communication Networks*, vol. 2022, Article ID 5916061, 10 pages, 2022.

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Research Article

Decision Model of Wireless Communication Scheme Evaluation via Interval Number

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This study aims to evaluate the communication schemes of wireless communication systems to make reasonable decisions. Firstly, the wireless communication scheme is assessed based on the interval number technology, and the primary evaluation process and evaluation index system are described. Secondly, the analytic hierarchy process of interval numbers is studied. Besides, a decision model has been established for wireless communication scheme evaluation. Thirdly, the evaluation index of the wireless communication scheme is determined through the simulation analysis of the model. Finally, experiments verify the decision model for evaluating wireless communication schemes based on interval numbers. Channel encoding can be adjusted automatically and can effectively track electrical signals. The results demonstrate that under the same high signal-to-noise ratio (SNR), the error rate in the 16 quadrature amplitude modulation (QAM) mode decreases faster than that in the 2 frequency shift keying (FSK) mode, so the 16QAM mode is better than the 2FSK mode. Under a low SNR, the binary phase shift keying mode is superior to the 2FSK mode, and the 2FSK mode is superior to the 16QAM mode. The bit error rate of the communication signal in the additive white Gaussian noise channel is the lowest. These findings provide a solid foundation for a universal and scalable wireless communication system. This research has practical application value for scheme evaluation and model decision-making in the wireless communication field. Models need to be tested and evaluated based on large amounts of statistical data in future studies.

1. Introduction

The progress of information technology has promoted the rapid development of society and modern science and technology. This fast dynamic progress is inseparable from the support of communication technology and wireless communication technology. Mainly based on digital wireless communication technology, wireless communication technology plays an increasingly important role in communication, the army, daily life, and society [1]. The wireless communication system must achieve more functions and applications because of the need for service expansion and resource sharing [2]. The operating environment is increasingly complex for the wireless communication system, the requirements are continuously higher, and the system composition is even more complicated. In addition, the research of wireless communication technology and the development of communication-related products requires a shorter time, lower cost, and higher level [3]. Under this situation, engineers need more time and energy to analyze and study system problems, improve the cognitive level of the system, and evaluate the practical application of the system [4]. In the evaluation of wireless communication systems, the method used by national evaluators still has the characteristics of equipment-type tests. Evaluation tests are usually limited to the requirements of system development. In other words, system performance tests should be carried out under established and ideal test conditions [5]. This evaluation method has the deficiencies of single means, single purpose, low resource utilization rate, and poor experimental conditions. Besides, the evaluation results only stay at the test level, so it is difficult to evaluate the system's adaptability to the actual environment and system requirements. Therefore, it is essential to adopt more reasonable and effective evaluation methods based on a preliminary systematic evaluation to meet the growing evaluation needs. Consequently, the utility originating from western economics is applied to the assessment of equipment systems and becomes an important concept of equipment system research [6].

Western economics first introduced the concept of utility to describe consumer satisfaction with commodities. The idea of the effectiveness of the equipment system comes from the concept of utility, which corresponds to performance [7]. It describes the performance values of devices and procedures and the ability to implement one or more target tasks. It is an abstract expression of the difference between supply and demand in the system. Compared with the traditional performance test evaluation method, the evaluation of system effectiveness is higher in evaluation level and more practical [8]. However, the evaluation of the effectiveness of a wireless communication system through field tests often faces a limited field test environment, which still cannot meet the requirements of the evaluation environment. Meanwhile, the field test has apparent defects such as long-time consumption, high test cost, low safety, and unreproducible test results [9]. Although the evaluation results obtained through field tests are very real, the entire evaluation process is arduous and expensive, so conducting a comprehensive evaluation test [10].

On this basis, this study expounds on the basic principles of wireless communication scheme evaluation and decision-making and conducts the corresponding modeling and simulation experiments. The efforts reported here lay a foundation for evaluating wireless communication systems and decision-making methods based on interval numbers. In Section 2, the performance index of wireless communication is analyzed. In Section 3, an index system for assessing the effectiveness of wireless communication systems is established. In section 4, the research innovation is to combine interval numbers with wireless communication to study the decision-making model of wireless communication scheme evaluation. The advantage of interval numbers is that they can sort out all the sets within the closed interval and optimize the uncertainty of the system after being introduced into the model.

2. Relevant Theories of Decision-Making of Wireless Communication Scheme Evaluation Based on Interval Numbers

2.1. Wireless Communication Technology. Wireless communication technology has many advantages and traits. In terms of information exchange, the wireless communication mode is supplemented by electromagnetic wave signals, while the traditional communication mode uses cables to complete the transmission of signals [11]. This transmission mode may have significant limitations, but the transmission mode of electromagnetic wave signals is not limited by time and place. Meanwhile, it has the characteristics of long transmission distance and flexible and reliable transmission [12]. Wireless communication is widely used in various fields of life and work and plays greatly important functions and roles [13]. However, there are still some problems and shortcomings in the practical application of wireless communication technology, impacting the use range and performance of wireless communication technology. With the rapid development of modern science and technology, wireless communication technology has made major breakthroughs and attained new features [14]. With regard to the access form of wireless communication technology, the wireless connection can ensure the efficiency, flexibility, and speed of information transmission without being affected by time and place [15]. With the help of these advantages, international information exchange and economic and cultural development are more frequent, and communication technology has entered a new stage of development. Moreover, the access method of wireless communication technology adopts wireless communication and wireless access methods, with the characteristics of high reliability and high liquidity, which can break through the limitations of time and space factors and transmit information effectively, stably, and reliably [16]. Compared with wireless communication, wireless communication devices are smaller and have more ingenious information transmission, which significantly increases the scope and field of wireless communication technology.

2.2. Concept of Scheme Evaluation. Generally, schemes can be divided into personal, business, and system. The effectiveness of a single element represents the extent to which a single goal is achieved when using a device or system [17]. Operational efficiency, or troop efficiency, denotes the extent to which operational objectives are achieved throughout military operations under the synergy of forces, equipment, and operational command. There is no uniform definition of the system scheme. The definition proposed by the United States industry is currently used a single system or a system-wide system to achieve the mission's objectives under established operating conditions [18]. The system scheme contains task planning and deployment, system operation mode, and other factors according to the circumstances of the operating conditions. The specific and designated task that is described qualitatively and quantitatively set up according to different times, spaces, and quantities. The efficiency scale can be expressed by probability, completion rate, and other physical quantities, which clarifies the basic concept of system effectiveness [19].

2.3. Basic Process of Wireless Communication Scheme Evaluation. The evaluation of a wireless communication system must be practical. Therefore, the reasonable establishment process of the effectiveness evaluation is essential, which can be divided into the following stages: analyzing the effectiveness of the evaluation system, including analyzing the structure, environment, and objectives of the evaluation system; clarifying the technical and financial constraints of the evaluation system; establishing evaluation index system of wireless communication system efficiently; qualitative analysis of each index of the impact index system; and evaluating the effectiveness and efficiency of the evaluation system by the index system. An appropriate valuation algorithm should be determined to quantitatively calculate the system efficiency values, check the accuracy of the results, and make a comprehensive evaluation system [20]. Figure 1 reveals the specific process.

2.4. Evaluation Index System. Wireless communication scheme analysis is the basis of establishing an efficiency evaluation index system. It is necessary to use the system analysis method to analyze the functions and relationships of each system structure module, the goals and standards to be achieved by the system, and the environment that is interdependent with the system. The effectiveness evaluation index system is established based on the comprehensive collection of the relevant information of the system [21]. Generally, there are many factors that affect the evaluation results of the evaluation system, among which no one can be reflected in the effectiveness evaluation. In addition, some factors are extremely random while other factors are not easy for quantitative analysis, so evaluators must optimize the measurement metrics frequently under the foundation of qualitative analysis [22]. Therefore, the effectiveness of the evaluation index system should consider the following points: the institutional principle, the concision principle, the objectivity principle, the timeliness principle, the measurability principle, the integrity principle, the independence principle, and the consistency principle [23].

It is worth noting that there are inevitable contradictions in the establishment of an effectiveness evaluation index system based on the above principles. At this stage, evaluators should take complete account of the effectiveness of the evaluation index system and make appropriate changes to the index system in the evaluation process [24]. For example, the integrity principles and the concision principle of the evaluation index system are contradictory. Therefore, some indexes with little impact should be eliminated to minimize the number of evaluation indexes and make evaluation easier. The system effectiveness index reflects the essence of the system and the most basic understanding of the system function [25]. Combined with the analysis of the effectiveness of the system, the effectiveness indexes that can reflect the same function of the system are summarized and synthesized. In contrast, the effectiveness evaluation indexes that can reflect the various objectives and standards of the system are extracted. The selected effectiveness evaluation indexes and each index weight are the specific content and focus of system user requirements. Combined with an efficiency evaluation algorithm, system effectiveness evaluation reflects the degree to which the system's working ability meets users' needs [26].

2.5. Establishment of Wireless Communication Index. The efficiency analysis is the basis for establishing an effectiveness evaluation index system. It is necessary to use system analysis methods to analyze the functions and relationships of each system structural module, the goals and standards that the system must achieve, and the environment interdependent with the system. The effectiveness evaluation index system is established based on the comprehensive

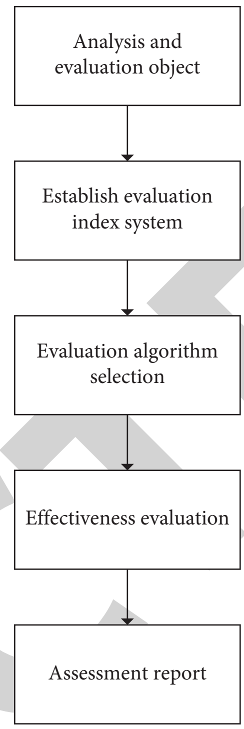

Figure 1: Basic process of wireless communication scheme evaluation.

collection of the relevant information of the system [27]. In terms of systematic evaluation of effectiveness, generally speaking, there are still many factors that affect the evaluation results, which cannot be reflected in the effectiveness evaluation. Therefore, the evaluator must always choose excellent measurement metrics based on qualitative analysis [28]. The goal of the wireless communication system task is to complete the communication between the sender and the receiver. Correspondingly, the communication capability of the wireless communication system is considered to be the objective of evaluating the effectiveness of the system. Seven indicator elements of wireless communication are established: quality, service, survivability, anti-interference ability, coverage, speed, and delay [29].

3. Evaluation Algorithm of Wireless Communication Scheme

3.1. Interval Number Analytic Hierarchy Process. As the most commonly used efficiency scheme evaluation method, the analytic hierarchy process (AHP) of interval numbers, combines the interval number theory with the AHP theory. The specific implementation is as follows. In the index classification of wireless communication systems, the "weight" value of different levels of decision-making is calculated according to the relevant theoretical knowledge of interval numbers. Then, the effectiveness of the system is evaluated using AHP [30].

Firstly, the effectiveness of the comprehensive AHP evaluation system is analyzed, and the objectives that must be prioritized are defined in a unique way. The overall goal of

AHP effectiveness evaluation is to meet the needs of users. Secondly, the criteria as part of the general aim of effectiveness evaluation are considered to be the low level of the goal. There are many standards in the general evaluation system. Thus, it is essential to distinguish the foremost standard and substandard. If necessary, the standards that have little impact on the evaluation system can be deleted to reduce the complexity of the evaluation according to the method of establishing the evaluation index system. Third, it is essential to analyze these standards' factors and their relationship. The upper and lower structures need to be built for the elements with adhesion to reflect the domination of the upper elements over the lower parts. In addition, a group relationship is set for the factors that have similar attributes and impact the upper piece, in which the upper element is subordinate. In this way, the efficiency evaluation index system is established [31]. The steps of the national health plan are as follows.

Step 1. Evaluate the system scheme based on in-depth analysis, the principal analysis level of the evaluation object and process is used to determine the target to be achieved by the evaluation object. Then, the influencing factors are decomposed from one layer to another to ensure that the elements of the same layer and the same group do not intersect. The elements of the upper layer and the lower layer form a tree relationship. The basic element is the evaluation index.

Step 2. Calculate the weight of lower elements relative to higher elements in the evaluation index system. Experts or evaluators subjectively judge the importance of the lower part relative to the higher part. Finally, the judgment matrix A is obtained:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix}, \quad (1)$$

where a_{mn} represents the evaluation value given by the mth evaluation expert for the nth evaluation index. Then, each row element of matrix A is standardized to obtain the weight value θ, which can be expressed as follows:

$$\theta = [\, \theta_1 \;\; \theta_2 \;\; \dots \;\; \theta_n \,]^T, \quad (2)$$

where

$$\theta_n > 0, \quad (3)$$

$$\theta_1 + \theta_2 \dots + \theta_n = 1. \quad (4)$$

According to the effectiveness evaluation, the importance of each element needs to be compared, and a_{ij} is assigned:

$$a_{ij} = \frac{\theta_j}{\theta_i}. \quad (5)$$

Step 3. Calculate the scheme evaluation matrix B_{ji}, as shown in the following equation:

$$B_{ji} = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1i} \\ b_{21} & b_{22} & \dots & b_{2i} \\ \dots & \dots & \dots & \dots \\ b_{j1} & b_{j2} & \dots & b_{ji} \end{bmatrix}. \quad (6)$$

In equation (6), b_{ji} denotes the evaluation value given by the ith evaluation expert to the jth evaluation index.

Step 4. Determine the evaluation of the grey class. Here, the class function describes an uncertain interval range, where whitening means improving certainty. The Whitening weight function of the grey class means quantifying the degree of grey class. There are three common whitening weight functions, as shown in the following equations:

$$g(b_{ji}) = \begin{cases} 0, \\ \dfrac{b_{ji} - b_1}{b_2 - b_1}, \\ 1, \end{cases} \quad (7)$$

$$g(b_{ji}) = \begin{cases} \dfrac{b_{ji} - b_1}{b_2 - b_1}, \\ \dfrac{b_3 - b_{ji}}{b_3 - b_2}, \\ 0, \end{cases} \quad (8)$$

$$g(b_{ji}) = \begin{cases} 0, \\ \dfrac{b_2 - b_{ji}}{b_2 - b_1}, \\ 1. \end{cases} \quad (9)$$

Step 5. Calculate the grey evaluation coefficient. The grey evaluation coefficient c_k^j is obtained according to the evaluation matrix B_{ji} and the whitening weight function $g_k(b_{ji})$.

$$c_k^j = \sum_{i=1}^{n} g_k(b_{ji}). \quad (10)$$

In equation (10), c_k^j refers to the kth grey evaluation coefficient of index element j.

Correspondingly, the total grey evaluation coefficient c^j can be written as the following equation:

$$c^j = \sum_{i=1}^{n} c_k^j. \quad (11)$$

The input layer is denoted as a_i, the hidden layer is denoted as b_j, and the output layer is denoted as c_k. Moreover, the connection weight between the input layer and the hidden layer is denoted as f_{ij}, and the connection weight between the hidden layer and the output layer is denoted as g_{jk}. Furthermore, the thresholds of the output and the hidden layer are denoted as d_l and e_m, respectively, and the predicted output value of the output layer is denoted as h_n. The neuron is regarded as net, then

$$net_j = \sum_{i=0}^{n} p_{ij} a_i. \tag{12}$$

The output from the hidden layer to the output layer can be expressed as the following equation:

$$c_k = f\left(net_k\right) = f\left(\sum_{i=1}^{n} g_{ik} b_j - d_l\right). \tag{13}$$

For the convenience of calculation, let

$$net_k = \sum_{j=0}^{n} g_{ij} b_j. \tag{14}$$

The signal error backpropagation process is as follows. The error function

$$E = \frac{1}{2}\sum_{k=1}^{n} e_k^2. \tag{15}$$

The error function of the hidden layer

$$E = \frac{1}{2}\sum_{k=1}^{n}\left[h_n - f\left(\sum_{j=0}^{n} g_{ij} b_j\right)\right]^2. \tag{16}$$

The error function of the input layer

$$E = \frac{1}{2}\sum_{k=1}^{n}\left[h_n - f\left(\sum_{j=0}^{n} g_{ij} p \sum_{i=0}^{n} p_{ij} a_i\right)\right]^2. \tag{17}$$

Among them, the error function is the function of the connection weight f_{ij}. The connection weight g_{jk} between the hidden and output layers, and reducing the error function value e can be realized by changing the connection weight. Next, the error signal δ_{jk} is defined, and then the corresponding weights and thresholds are adjusted to make them present the same gradient changes.

$$\delta_{jk} = \sum_{k=1}^{k} \left(h_k - c_k\right) c_k \left(1 - c_k\right), \tag{18}$$

$$\delta_{jk} = \delta_{jk} g_{jk} b_j \left(1 - b_j\right). \tag{19}$$

The weight of the hidden layer is adjusted according to the following equation:

$$\Delta p_{ij} = \eta \delta_{ij} a_i. \tag{20}$$

The weight of the output layer is adjusted according to the following equation:

$$\Delta g_{jk} = \eta \delta_{jk} b_i. \tag{21}$$

The threshold is adjusted according to the following equations:

$$\Delta d_l = -\eta \delta_{ij}, \tag{22}$$

$$\Delta e_m = -\eta \delta_{jk}. \tag{23}$$

Step 6. Calculate the grey evaluation weight matrix D and the weight vector e.

$$e_k^j = \frac{c_k^j}{c^j}, \tag{24}$$

$$D = \left[\, e^1 \;\; e^2 \;\; \ldots \;\; e^n \,\right]^T. \tag{25}$$

Step 7. Calculate the comprehensive scheme evaluation vector F according to the full matrix.

$$F = G^t D. \tag{26}$$

The total efficiency can be expressed as

$$E = F \; D. \tag{27}$$

Thus, the total efficiency value is obtained.

3.2. Construction of the Decision Model of Wireless Communication Scheme Evaluation. The main task of the overall modeling of the effectiveness evaluation scheme of wireless communication systems based on interval numbers is to model the wireless communication system. The basic structure modules of the system are similar to the general model of digital communication systems, as shown in Figure 2.

Accordingly, the overall decision model of wireless communication scheme evaluation is built, as presented in Figure 3.

The model is divided into four parts: signal input, simulation parameter configuration, wireless communication system simulation, and performance evaluation. The signal input part provides digital signals, voice input signals, and other external signals. In simulation parameter configuration, the evaluator must provide various types of parameters, including system simulation method, source and method of parameter encoding and decoding, parameters and methods of channel encoding and decoding, parameter modulation and demodulation mode, spread spectrum parameters, and simulation module controlling communication environment parameters of the wireless communication system. The wireless communication system simulation part consists of system simulation structure modules, which can be added or deleted according to the actual structure of the system to be evaluated. The performance evaluation includes the input signal, output signal, and relevant parameters of simulation parameter configuration of the wireless communication system. Meanwhile, the performance evaluation part can modify the stimulation parameters according to the evaluation results, and the simulation is repeated until getting satisfactory results.

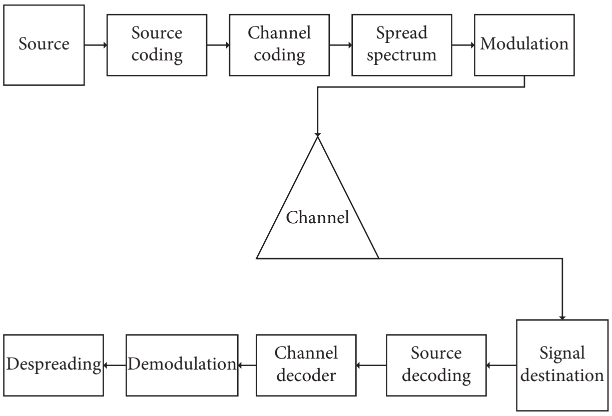

Figure 2: Wireless communication evaluation model.

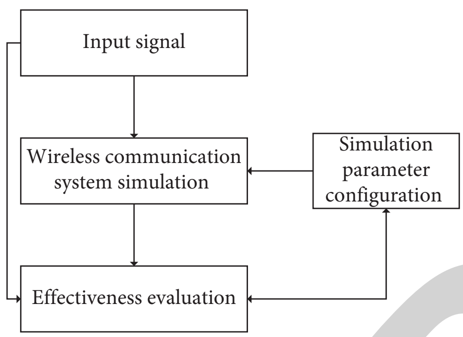

Figure 3: Decision model of wireless communication scheme evaluation.

3.3. Decision Simulation Process of Wireless Communication Scheme Evaluation. The wireless communication system is simulated according to the actual needs based on analyzing its characteristics and objectives. Meanwhile, the corresponding mathematical expression is put forward. This mathematical expression, combined with the relevant principles of the system, is also known as the mathematical model of the system. The factors that have little impact on the system in the process of establishing the system's simulation model are often ignored to improve the effectiveness of the simulation. For example, in the process of signal transmission, the error of relative delay and signal bandwidth is very small, which will significantly change when the signal strength is affected by the time-varying channel gain. Therefore, the signal bandwidth is approximately replaced by the relative delay. Next, the simulation is carried out. It is essential to select the appropriate simulation algorithm, software, and hardware platform combined with the system simulation model programming. The general sub-functions or modules of the system simulation model can be encapsulated and saved to reuse programming and simplify the programming process. The simulation program requiring observation and analysis of the change of system response usually needs to run many times, to modify the analog input signal data. Then, the simulation analysis is as follows. After the simulation operation stage, the user obtains sufficient simulation data information to be analyzed and processed for the subsequent system evaluation and result display. The above three aspects often need a running cycle to achieve satisfactory optimization and improvement results of the wireless communication system and provide a performance evaluation module. Finally, the information is transmitted to the actual system as a reference for optimization and reconstruction.

4. Simulation Analysis of the Decision-Making of Wireless Communication Scheme Evaluation

4.1. Simulation Analysis of Channel Coding, Decoding, and Common Digital Modulation. The voice signal of 25 seconds is selected according to the simulation process of channel coding. The result is shown in Figure 4, in which the channel coding data can be adjusted automatically and effectively track the electrical signal. It can be seen that when the signal data are 0–15 seconds, the tracking voltage of the circuit is about 0 V, and the fluctuation range is extensive. When the signal data are 15–25 seconds, the tracking voltage of the system circuit basically tends to be stable. After that, the above speech signal is intercepted for another simulation experiment, which produces the same result.

Simulink is used to debug 16 quadrature amplitude modulation (QAM), 2 frequency shift keying (FSK), and binary phase shift keying (BPSK). Figure 5 shows the experimental results. The bit error rate (BER) in the 16QAM mode and 2FSK mode is significantly lower than that in the BPSK mode. Under the same high signal-to-noise ratio(SNR) condition, the BER in the 16QAM mode decreases faster than that in the 2FSK mode, indicating that the modulation effect of the 16QAM mode is better than that of the 2FSK mode. Under the condition of low SNR, the BPSK mode is better than the 2FSK mode, while the 2FSK mode is better than the 16QAM mode.

4.2. Wireless Communication Channel Transmission. The propagation characteristics of radio waves in any wireless communication system depend on the radio wave propagation environment, namely the wireless communication channel. These environments include the ground state, building coverage, weather conditions, and the use of frequency bands, which limit the communication ability of both sides. Therefore, research on wireless communication channels is necessary and vital, providing key theoretical support for the simulation and evaluation of wireless communication systems. The research on the fading effect of different scales is critical in evaluating wireless communication schemes, as shown in Figure 6. From Figure 6, the large-scale disk refers to the slow change of signal level with distance in the environment of transmitting electromagnetic waves between transceivers. This attenuation signal refers to the attenuation of the electromagnetic wave transmission signal in the disk. Under the influence of scattering, refraction, and reflection of various substances in the channel, the signals arrive at the receiver along different paths and overlaps, resulting in large fluctuations in the received signal

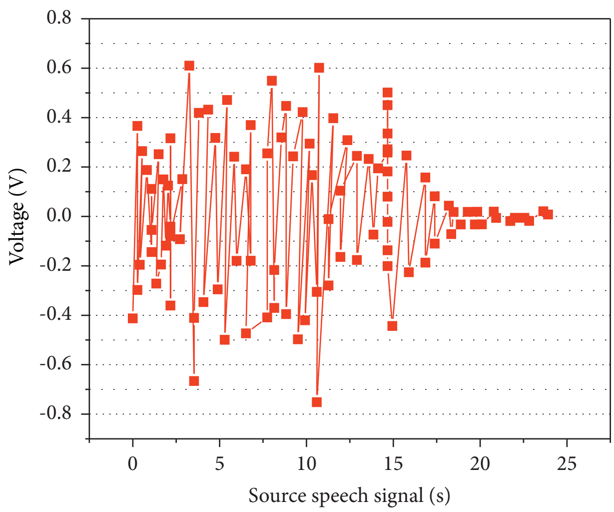

Figure 4: Source trace.

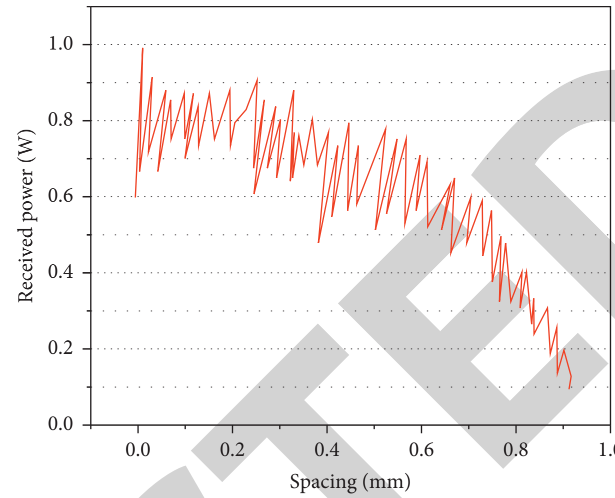

Figure 6: Fading effect of different scales.

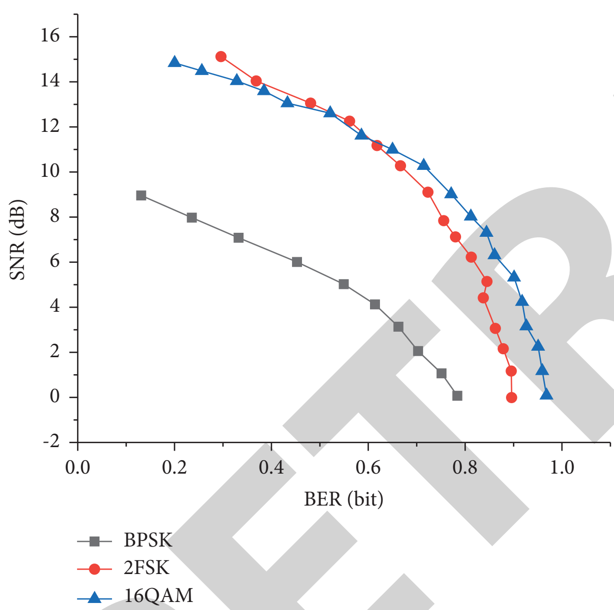

Figure 5: BER curves under three modulation modes.

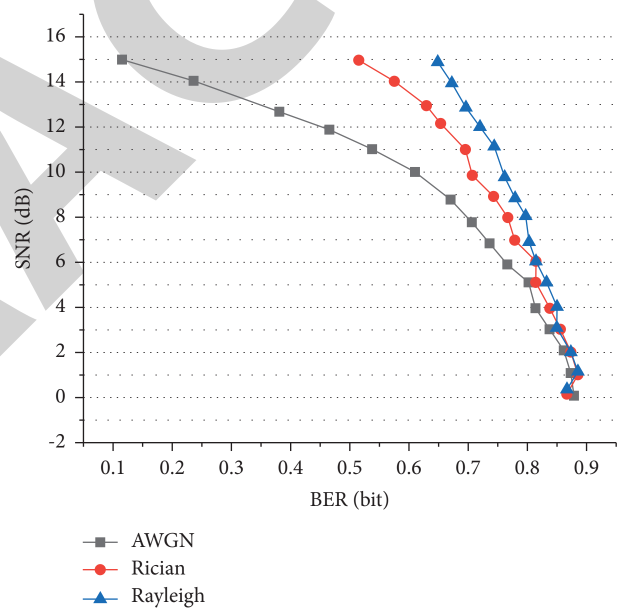

Figure 7: BER curves under three types of channels.

level. The average variation of the reception level in the short-term range is always tiny, which is also called the superposition of dozens of short-term fading levels. The main influencing factors are multichannel propagation and spectrum spread caused by the relative motion between transmitter and receiver caused by time delay spread.

4.3. Simulation Analysis of Wireless Communication Channel under Line-of-Sight Transmission. The 2FSK signal is simulated and analyzed under the corresponding conditions of the Ricean channel, additive white Gaussian noise (AWGN) channel, and Rayleigh channel. The experimental results are presented in Figure 7. The channel simulation results are realized using the simulink tool in MATLAB. In Figure 7, with the decrease of SNE, the BER of signal in the Rayleigh channel is the highest, followed by the Ricean channel and finally the AWGN channel. In other words, the BER of the signal in the AWGN channel is the lowest. This result indicates that antichannel reduction technology should be added to the wireless communication system.

4.4. Determination of Each Effectiveness Evaluation Index. The normal communication of the two receivers in the simulated electromagnetic environment under the interference of normal interference and electronic jamming is the primary commitment task. Therefore, the communication quality and anti-interference ability can be restored as evaluation indexes. The coverage ability determines a certain range of the latest news received from each other, followed by recovery. Besides, the communication rate and the delay

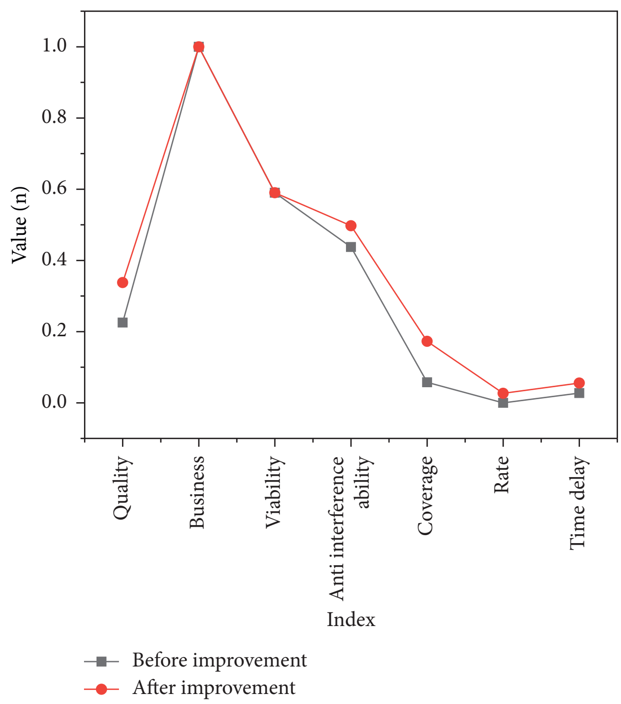

Figure 8: Comparison of effectiveness values of the system before and after optimization.

capability are relatively important indexes of communication capability and transceiver delay. In addition, communication congestion, living ability, and service also affect the communication performance of the wireless communication system. Finally, the corresponding matrix is shown in the following equation:

$$H = \begin{bmatrix} 1 & 2/5 & 2/5 & 1 & 2/3 & 1/2 & 1/2 \\ 5/2 & 1 & 1 & 5/2 & 5/3 & 5/4 & 5/4 \\ 5/2 & 1 & 1 & 5/2 & 5/3 & 5/4 & 5/4 \\ 1 & 2/5 & 2/5 & 1 & 2/3 & 1/2 & 1/2 \\ 3/2 & 3/5 & 3/5 & 3/2 & 1 & 3/4 & 3/4 \\ 2 & 4/5 & 4/5 & 2 & 4/3 & 1 & 1 \\ 2 & 4/5 & 4/5 & 2 & 4/3 & 1 & 1 \end{bmatrix}. \quad (28)$$

The division of this importance is not constant. On the contrary, there will be a variety of divisions. Different wireless communication systems, test environments, and index scores of different levels will affect the importance division and change the rating weights. Therefore, different importance division methods can be selected according to the actual test conditions and requirements. Because the division of importance depends on the experience and understanding of experts, the subjective judgment of the importance of each index of wireless communication system in a specific application environment will inevitably affect the objectivity of the evaluation. Therefore, when dividing the importance of each indicator, it is necessary to fully consider the opinions of many experts to improve the credibility of the system evaluation results. The feature vector of the normative judgment matrix is carried out for each column of elements, and then the mean value of the sum of elements of each row is taken as the combined weight Q:

$$Q = (0.2045, 0.0822, 0.0822, 0.2055, 0.1370, 0.1027, 0.1027)^T. \quad (29)$$

4.5. Effectiveness Evaluation. Figure 8 illustrates the comparison results of system effectiveness values before and after the system optimization. According to Figure 8, the performance of the optimized system has been improved in seven evaluation indexes: communication quality, service, survivability, anti-interference ability, coverage, speed, and delay. In addition, the communication quality and coverage have been improved, and the communication rate and communication delay have changed from good to qualified, suggesting excellent performance. However, the evaluation value of unqualified quality and standard quality decreases, while the evaluation value of extraordinary standard increases. At the same time, the anti-interference ability changes from good to excellent. Therefore, the system's overall efficiency has been improved, which also shows that the efficiency evaluation is effective and suitable for system improvement. The exact effectiveness improvement results can be obtained using other evaluation algorithms.

5. Conclusion

Under the background of the development of the efficiency evaluation component of wireless communication systems, the general method of wireless communication system efficiency evaluation is studied by combining computer simulation technology with system efficiency evaluation. Firstly, this study expounds on some evaluation indexes of the scheme evaluation model of wireless communication systems after clarifying the theoretical basis and process of effectiveness evaluation. Then, seven evaluation indexes are extracted and characterized to construct the efficiency evaluation index system of the wireless communication system. In addition, the wireless communication system is established, and the weight of each index is analyzed and determined in detail. Finally, the relevant conclusions are drawn to express the relationship between the effectiveness of wireless communication systems and the needs of system users. Experiments verify the effectiveness of wireless communication systems' interval number-based scheme evaluation model, which provides a favorable baseline for the final implementation of general components and the evolutionary evaluation of wireless communication system efficiency. The system effectiveness analysis results before and after optimization indicate that the system quality effectiveness is improved by 0.18, the system coverage area effectiveness is improved by 0.15, and the overall effectiveness of the model is verified. The follow-up research will refine the analysis and study of each module of the wireless system structure. It is expected to establish a communication system simulation environment based on massive statistical data to ensure that the system simulation is closer to the actual system and the evaluation of the simulation system is more convincing.

Data Availability

The labeled dataset used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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