US Patent & Trademark Office
Patent Public Search | Text View

United States Patent Application Publication	20250266932
Kind Code	A1
Publication Date	August 21, 2025
Inventor(s)	WANG; LI-HUA et al.

FRAME FORMAT GENERATION AND ANALYSIS SYSTEM AND FRAME FORMAT GENERATION AND ANALYSIS METHOD

Abstract

A frame format generation and analysis system includes a transmitting device and a receiving device. The transmitting device is configured to insert a signature sequence in a physical layer convergence protocol (PLCP) preamble, insert a remaining sequence between the signature sequence and a start frame delimiter (SFD), and transmit the PLCP preamble. The receiving device is configured to receive the PLCP preamble, and analyze whether the PLCP preamble includes the signature sequence. If the PLCP preamble includes the signature sequence, the receiving device generates an activating signal for activating a user-defined protocol.

Inventors: **WANG; LI-HUA (Suzhou, CN), Wang; Feng-Xiang (Suzhou, CN), Guo; Ming-Zhi (Suzhou, CN)**

Applicant: **REALTEK SEMICONDUCTOR CORPORATION** (Hsinchu, TW)

Family ID: **1000008295785**

Appl. No.: **18/973171**

Filed: **December 09, 2024**

Foreign Application Priority Data

CN	202410186538.X	Feb. 19, 2024

Publication Classification

Int. Cl.: **H04L1/1607** (20230101); **H04W72/0446** (20230101)

U.S. Cl.:

CPC **H04L1/1642** (20130101); **H04W72/0446** (20130101);

Background/Summary

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present disclosure relates to a frame format generation and analysis system and a frame format generation and analysis method, especially to a frame format generation and analysis system and a frame format generation and analysis method that insert a signature sequence in a physical layer convergence protocol preamble to facilitate subsequent analysis.

2. Description of Related Art

[0002] With the increasing demand for data transmission and requirements of users for convenience, wireless transmission technology has emerged. Currently, wireless transmission technology is widely used in consumer electronics and industrial-grade electronic products. Common communication protocols have been developed for different needs of all of the electronic products, and facilitate interactive communication among electronic products. However, common communication protocols have standardized specifications, and thus, common communication protocols have limitations. In some applications, these limitations may affect the efficiency of wireless transmission.

SUMMARY OF THE INVENTION

[0003] In some aspects, an object of the present disclosure is to, but not limited to, provides a frame format generation and analysis system and a frame format generation and analysis method that makes an improvement to the prior art.

[0004] An embodiment of the frame format generation and analysis system of the present disclosure includes a transmitting device and a receiving device. The transmitting device is configured to insert a signature sequence in a physical layer convergence protocol preamble, insert a remaining sequence between the signature sequence and a start frame delimiter, and transmit the physical layer convergence protocol preamble. The receiving device is configured to receive the physical layer convergence protocol preamble, and analyze whether the physical layer convergence protocol preamble includes the signature sequence, wherein if the physical layer convergence protocol preamble includes the signature sequence, the receiving device generates an activating signal for activating a user-defined protocol.

[0005] An embodiment of the frame format generation and analysis method of the present disclosure includes following steps: inserting a signature sequence in a physical layer convergence protocol preamble, and insert a remaining sequence between the signature sequence and a start frame delimiter, and transmitting the physical layer convergence protocol preamble by a transmitting device; and receiving the physical layer convergence protocol preamble, and analyzing whether the physical layer convergence protocol preamble includes the signature sequence by a receiving device, wherein if the physical layer convergence protocol preamble includes the signature sequence, the receiving device generates an activating signal for activating a user-defined protocol

[0006] Technical features of some embodiments of the present disclosure make an improvement to the prior art. The frame format generation and analysis system and the frame format generation and analysis method of the present disclosure utilize the transmitting device to insert the signature sequence in the physical layer convergence protocol preamble to facilitate subsequent analysis of the receiving device. If the receiving device analyzes that the physical layer convergence protocol preamble includes the signature sequence, the receiving device generates an activating signal for activating a user-defined protocol. In view of the above, the present disclosure can avoid the limitations of common communication protocols, thereby significantly improving the efficiency of wireless transmission.

[0007] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiments that are illustrated in the various figures and drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** shows an embodiment of a frame format generation and analysis system of the present disclosure.

[0009] FIG. **2** shows an embodiment a flowchart of a frame format generation and analysis method of the present disclosure.

[0010] FIG. **3** shows an embodiment of a physical layer convergence protocol (PLCP) preamble of the present disclosure.

[0011] FIG. **4** shows an embodiment of an operation diagram of a transmitting device of the present disclosure.

[0012] FIG. **5** shows an embodiment of a physical layer convergence protocol preamble of the present disclosure.

[0013] FIG. **6** shows an embodiment of an operation diagram of a receiving device of the present disclosure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] In order to improve the efficiency of wireless transmission being affected in some applications due to limitations of common communication protocols, the present disclosure provides a frame format generation and analysis system and a frame format generation and analysis method, which will be explained in detail as shown below.

[0015] FIG. **1** shows an embodiment of a frame format generation and analysis system **100** of the present disclosure. As shown in the figure, the frame format generation and analysis system **100** includes a transmitting device **110** and a receiving device **120**. For facilitating the understanding of operations of the frame format generation and analysis system **100**, reference is made to FIG. **2**. FIG. **2** shows an embodiment a flowchart of a frame format generation and analysis method **200** of the present disclosure. In some embodiments, the frame format generation and analysis system **100** and the frame format generation and analysis method **200** of the present disclosure can be utilized in IEEE 802.11b. However, the above-mentioned embodiment is merely utilized to describe one of the implementations, and the present disclosure is not limited thereto. In another embodiment, the frame format generation and analysis system **100** and the frame format generation and analysis method **200** of the present disclosure can be utilized in other technology based on actual requirements.

[0016] In step **210**, inserting a signature sequence in a physical layer convergence protocol preamble, insert a remaining sequence between the signature sequence and a start frame delimiter, and transmitting the physical layer convergence protocol preamble by the transmitting device **110**. In step **220**, receiving the physical layer convergence protocol preamble, and analyzing whether the physical layer convergence protocol preamble includes the signature sequence by the receiving device **120**. If the physical layer convergence protocol preamble includes the signature sequence, the receiving device **120** generates an activating signal for activating a user-defined protocol, which will be explained in detail as shown below.

[0017] FIG. **3** shows an embodiment of a physical layer convergence protocol preamble **300** of the present disclosure. As shown in FIG. **3**, the physical layer convergence protocol (PLCP) preamble **300** includes a synchronization sequence SYNC and a start frame delimiter SFD. In some embodiments, the length of the synchronization sequence SYNC can be 128 bits, and the synchronization sequence SYNC is all 1 sequence. Besides, the length of the start frame delimiter

SFD can be 16 bits, and the start frame delimiter SFD can be h′AOF3.
[0018] Reference is now made to both FIG. **4** and FIG. **5**. FIG. **4** shows an embodiment of an operation diagram **400** of the transmitting device **110** of the present disclosure, and FIG. **5** shows an embodiment of a physical layer convergence protocol preamble **500** of the present disclosure. In step **410**, compared to the embodiment in FIG. **3**, the transmitting device **110** inserts the signature sequence S**2** and the remaining sequence S**3** in the physical layer convergence protocol preamble **500**, and generates a bitstream having the above-mentioned frame format in step **420**. Subsequently, the transmitting device **110** executes a scramble operation to the bitstream in step **430**, executes a mapping operation to the bitstream in step **440**, and executes a digital front end (DFE) operation (e.g., filtering) to the bitstream in step **450**. Furthermore, the transmitting device **110** executes a digital to analog conversion to the bitstream in step **460**, and transmits it to the receiving device **120**.
[0019] In step **410**, compared to the embodiment in FIG. **3**, the transmitting device **110** of the present disclosure insert the signature sequence S**2** in the physical layer convergence protocol preamble **500** for facilitating subsequent analysis of the receiving device **120** for activating a user-defined protocol, thereby avoiding the limitations of common communication protocols and significantly improving the efficiency of wireless transmission.
[0020] Besides, the transmitting device **110** further inserts the remaining sequence S**3** between the signature sequence S**2** and the start frame delimiter S**4**. It is noted that, for electronic products to identify the type of the physical layer convergence protocol preamble **500**, the characters before the start frame delimiter S**4** will be analyzed. Therefore, the present disclosure inserts the remaining sequence S**3** before the start frame delimiter S**4** to ensure that electronic products can correctly determine the type of the physical layer convergence protocol preamble **500**.
[0021] In some embodiments, the physical layer convergence protocol preamble **500** includes the synchronization sequence S**1**, the signature sequence S**2**, the remaining sequence S**3**, and the start frame delimiter S**4**. The synchronization sequence S**1**, the signature sequence S**2**, the remaining sequence S**3**, and the start frame delimiter S**4** are arranged from left to right in sequence.
[0022] In some embodiments, the synchronization sequence SI includes all 1 sequence. As shown in the embodiment of FIG. **5**, the length of the synchronization sequence S**1** is 96 bits, and the synchronization sequence S**1** can be all 1 sequence.
[0023] In some embodiments, the signature sequence S**2** can be an alternative bit sequence or all 0 sequence. For example, referring to FIG. **1**, the register **111** of the transmitting device **110** can set the signature sequence S**2** as an alternative sequence of 0 and 1 (e.g., 01 sequence or 10 sequence), or set the signature sequence S**2** to be all 0 sequence. As shown in the embodiment of FIG. **5**, the length of the signature sequence S**2** can be 16 bits, and the signature sequence S**2** can be h′5555, which in binary is an alternative bit sequence of 0101. In some embodiments, the length of the signature sequence S**2** can be 16 bits, and the signature sequence S**2** can be h′0000, which in binary is an all 0 sequence.
[0024] In some embodiments, the remaining sequence S**3** includes all 1 sequence. As shown in the embodiment of FIG. **5**, the length of the remaining sequence S**3** can be 16 bits, and the remaining sequence S**3** can be h′FFFF, which in binary is all 1 sequence. In some embodiments, the start frame delimiter S**4** in FIG. **5** can be 16 bits, and the start frame delimiter S**4** can be h′AOF3. However, the above-mentioned embodiment is merely utilized to describe one of the implementations, and the present disclosure is not limited to the embodiment in FIG. **5**. In another embodiment, the lengths, the sequences, and the types of the synchronization sequence S**1**, the signature sequence S**2**, the remaining sequence S**3**, and the start frame delimiter S**4** of the present disclosure can be adjusted adaptively based on actual requirements.
[0025] In some embodiments, the type of the physical layer convergence protocol preamble **500** can be a long physical layer convergence protocol (PLCP) preamble. However, the above-mentioned embodiment is merely utilized to describe one of the implementations, and the present

disclosure is not limited thereto.
[0026] In some embodiments, referring to FIG. **1**, the register **111** of the transmitting device **110** can set the time inserting the signature sequence S**2**, for example, the time can be 12 μs, 16 μs, 20 μs, or 24 μs. Besides, the register **111** of the transmitting device **110** can also set the time of the remaining sequence S**3**, for example, the time can be 16 μs, 24 μs, 32 μs, or 40 μs. Furthermore, the total time of the signature sequence S**2** and the remaining sequence S**3** can be 52 μs. In addition, the synchronization sequence S**1** preceding the signature sequence S**2** reserves a period of time, thereby preventing the receiving device **120** from missing the analysis of the signature sequence S**2**. However, the above-mentioned embodiment is merely utilized to describe one of the implementations, and the present disclosure is not limited thereto. In another embodiment, the time between the sequences can be adjusted adaptively based on actual requirements.
[0027] FIG. **6** shows an embodiment of an operation **600** diagram of the receiving device **120** of the present disclosure. As shown in FIG. **6**, in step **610**, the receiving device **120** executes a package detection to receive the package including the physical layer convergence protocol preamble **500**. In step **620**, the receiving device **120** executes an automatic gain control (AGC), and the receiving device **120** executes a symbol boundary detection (SBD) in step **630**. Subsequently, the receiving device **120** executes a descramble operation in step **640** corresponding to the scramble operation in step **430**, and the receiving device **120** executes a start frame delimiter (SFD) detection in step **650**.
[0028] Refer is now made to both FIG. **5** and FIG. **6**. In operation **600**, the receiving device **120** executes the start frame delimiter (SFD) detection in step **650** before the period of the signature sequence S**2** to ensure that the signature sequence S**2** can be analyzed correctly.
[0029] In operation **600**, the receiving device **120** would also analyze whether the physical layer convergence protocol preamble **500** includes the signature sequence S**2**. If the physical layer convergence protocol preamble **500** includes the signature sequence S**2**, the receiving device **120** generates the activating signal for activating the user-defined protocol. For example, if the receiving device **120** analyzes that the signature sequence S**2** of the physical layer convergence protocol preamble **500** can be an alternative bit sequence or an all 0 sequence (for example, the signature sequence S**2** can be an alternative sequence of 0 and 1 (e.g., 01 sequence or 10 sequence), or the signature sequence S**2** can be an all 0 sequence), the receiving device **120** generates the activating signal for activating the user-defined protocol. In view of the above, the receiving device **120** of the present disclosure can analyze the physical layer convergence protocol preamble **500** for activating the user-defined protocol, thereby significantly improving the efficiency of wireless transmission.
[0030] In some embodiments, the receiving device **120** can transmit the activating signal to the medium access control (MAC) layer, and the medium access control layer activates the user-defined protocol. For example, the user-defined protocol can be a power adjustment protocol, a transmitting rate adjustment protocol, or a packet adjustment protocol. If the power adjustment protocol is active, the transmitting device **110** can increase TX power so as to enhance the transmitting distance of the transmitting device **110**. If the transmitting rate adjustment protocol is active, the transmitting device **110** can adaptively adjust TX rate so as to enhance the transmission efficiency between the transmitting device **110** and the receiving device **120** for further preventing frequency jamming situations from occurring. If the packet adjustment protocol is active, the receiving device **120** can utilize the same signature sequence S**2** mode to return response packet. The activation of the aforementioned user-defined protocols contribute to the successful transmission rate of the frame format generation and analysis system **100** of the present disclosure. However, the above-mentioned embodiment is merely utilized to describe one of the implementations, and the present disclosure is not limited thereto. In another embodiment, the user-defined protocol can be adjusted adaptively based on actual requirements.
[0031] It is noted that the present disclosure is not limited to the embodiments as shown in FIG. **1**

to FIG. **6**, it is merely an example for illustrating one of the implements of the present disclosure, and the scope of the present disclosure shall be defined on the bases of the claims as shown below. In view of the foregoing, it is intended that the present disclosure covers modifications and variations to the embodiments of the present disclosure, and modifications and variations to the embodiments of the present disclosure also fall within the scope of the following claims and their equivalents.

[0032] As described above, technical features of some embodiments of the present disclosure make an improvement to the prior art. The frame format generation and analysis system **100** and the frame format generation and analysis method **200** of the present disclosure utilize the transmitting device **110** to insert the signature sequence in the physical layer convergence protocol preamble to facilitate subsequent analysis of the receiving device **120**. If the receiving device **120** analyzes that the physical layer convergence protocol preamble includes the signature sequence, the receiving device **120** generates an activating signal for activating a user-defined protocol. In view of the above, the present disclosure can avoid the limitations of common communication protocols, thereby significantly improving the efficiency of wireless transmission.

[0033] It is noted that people having ordinary skill in the art can selectively use some or all of the features of any embodiment in this specification or selectively use some or all of the features of multiple embodiments in this specification to implement the present invention as long as such implementation is practicable; in other words, the way to implement the present invention can be flexible based on the present disclosure.

[0034] The aforementioned descriptions represent merely the preferred embodiments of the present invention, without any intention to limit the scope of the present invention thereto. Various equivalent changes, alterations, or modifications based on the claims of the present invention are all consequently viewed as being embraced by the scope of the present invention.

Claims

1. A frame format generation and analysis system, comprising: a transmitting device, configured to insert a signature sequence in a physical layer convergence protocol preamble, insert a remaining sequence between the signature sequence and a start frame delimiter, and transmit the physical layer convergence protocol preamble; and a receiving device, configured to receive the physical layer convergence protocol preamble, and analyze whether the physical layer convergence protocol preamble comprises the signature sequence, wherein if the physical layer convergence protocol preamble comprises the signature sequence, the receiving device generates an activating signal for activating a user-defined protocol.

2. The frame format generation and analysis system of claim 1, wherein the signature sequence comprises one of an alternative bit sequence and an all 0 sequence.

3. The frame format generation and analysis system of claim 1, wherein the transmitting device comprises: a register, configured to set the signature sequence to be a 01 sequence or a 10 sequence.

4. The frame format generation and analysis system of claim 1, wherein the remaining sequence comprises an all 1 sequence.

5. The frame format generation and analysis system of claim 1, wherein the physical layer convergence protocol preamble comprises a synchronization sequence, the signature sequence, the remaining sequence, and the start frame delimiter, wherein the synchronization sequence, the signature sequence, the remaining sequence, and the start frame delimiter are arranged in sequence.

6. The frame format generation and analysis system of claim 1, wherein the transmitting device comprises: a register, configured to set a first period inserting the signature sequence and a second period of the remaining sequence, wherein the first period ranges from 12 μs to 24 μs, and the second period ranges from 16 μs to 40 μs.

7. The frame format generation and analysis system of claim 6, wherein the receiving device executes a start frame delimiter detection operation before the first period of the signature sequence.
8. The frame format generation and analysis system of claim 1, wherein the signature sequence comprises one of an alternative bit sequence and an all 0 sequence, and the receiving device is configured to analyze whether the physical layer convergence protocol preamble comprises one of the alternative bit sequence and the all 0 sequence.
9. The frame format generation and analysis system of claim 1, wherein the receiving device transmits the activating signal to a medium access control layer, and the medium access control layer activates the user-defined protocol.
10. The frame format generation and analysis system of claim 1, wherein the user-defined protocol comprises one of a power adjustment protocol, a transmitting rate adjustment protocol, and a packet adjustment protocol.
11. A frame format generation and analysis method, comprising: inserting a signature sequence in a physical layer convergence protocol preamble, and insert a remaining sequence between the signature sequence and a start frame delimiter, and transmitting the physical layer convergence protocol preamble by a transmitting device; and receiving the physical layer convergence protocol preamble, and analyzing whether the physical layer convergence protocol preamble comprises the signature sequence by a receiving device, wherein if the physical layer convergence protocol preamble comprises the signature sequence, the receiving device generates an activating signal for activating a user-defined protocol.
12. The frame format generation and analysis method of claim 11, wherein the signature sequence comprises one of an alternative bit sequence and an all 0 sequence.
13. The frame format generation and analysis method of claim 11, further comprising: setting the signature sequence to be a 01 sequence or a 10 sequence by a register of the transmitting device.
14. The frame format generation and analysis method of claim 11, wherein the remaining sequence comprises an all 1 sequence.
15. The frame format generation and analysis method of claim 11, wherein the physical layer convergence protocol preamble comprises a synchronization sequence, the signature sequence, the remaining sequence, and the start frame delimiter, wherein the synchronization sequence, the signature sequence, the remaining sequence, and the start frame delimiter are arranged in sequence.
16. The frame format generation and analysis method of claim 11, further comprising: setting a first period inserting the signature sequence and a second period of the remaining sequence by a register of the transmitting device, wherein the first period ranges from 12 μs to 24 μs, and the second period ranges from 16 μs to 40 μs.
17. The frame format generation and analysis method of claim 16, further comprising: executing a start frame delimiter detection operation before the first period of the signature sequence by the receiving device.
18. The frame format generation and analysis method of claim 11, wherein the signature sequence comprises one of an alternative bit sequence and an all 0 sequence, wherein receiving the physical layer convergence protocol preamble, and analyzing whether the physical layer convergence protocol preamble comprises the signature sequence by the receiving device comprises: receiving the physical layer convergence protocol preamble, and analyzing whether the physical layer convergence protocol preamble comprises one of the alternative bit sequence and the all 0 sequence by the receiving device.
19. The frame format generation and analysis method of claim 11, wherein if the physical layer convergence protocol preamble comprises the signature sequence, the receiving device generates the activating signal for activating the user-defined protocol comprises: if the physical layer convergence protocol preamble comprises the signature sequence, transmitting the activating signal to a medium access control layer by the receiving device, and the medium access control layer

activates the user-defined protocol.

20. The frame format generation and analysis method of claim 11, wherein the user-defined protocol comprises one of a power adjustment protocol, a transmitting rate adjustment protocol, and a packet adjustment protocol.