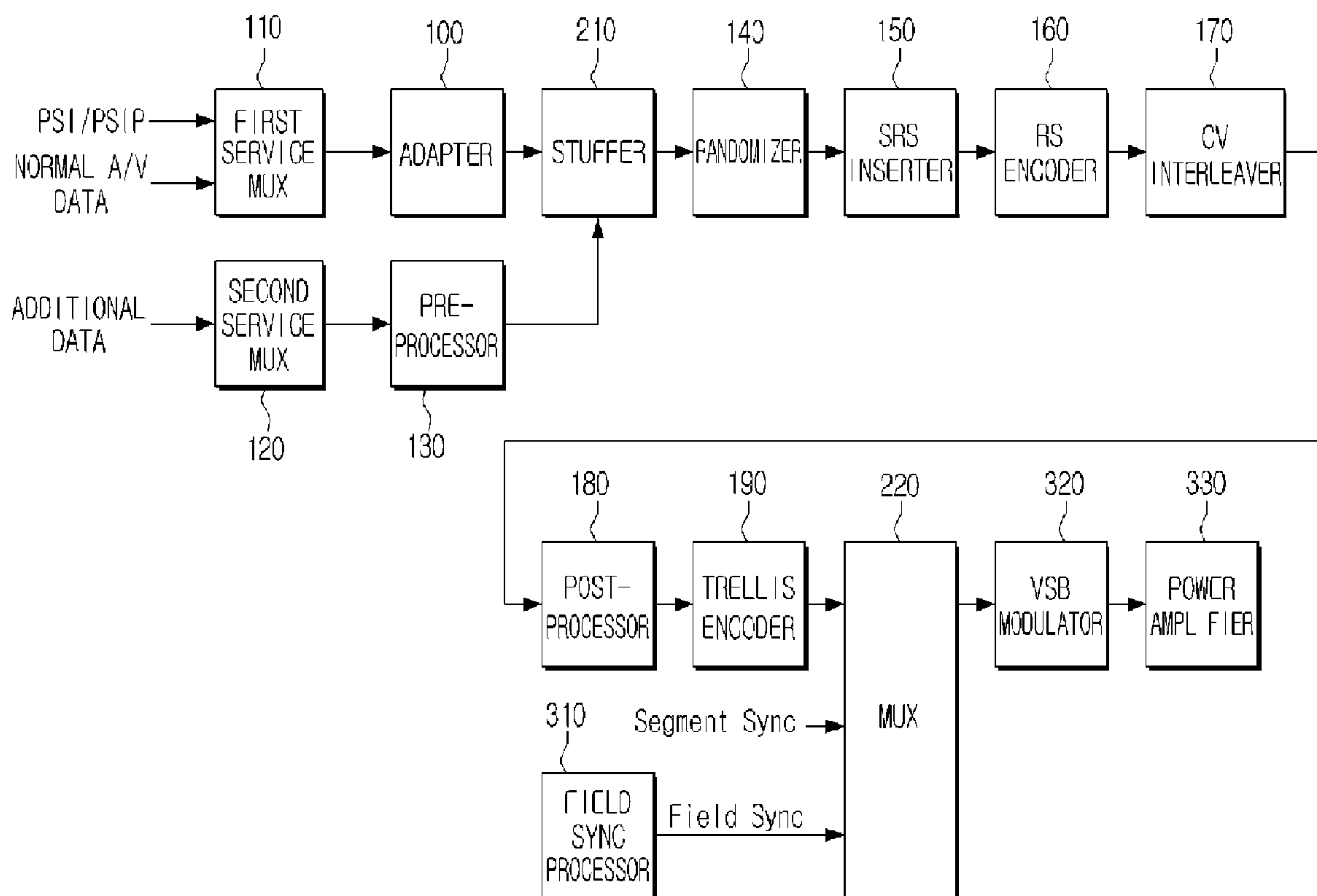




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(54) Title: DIGITAL TRANSMISSION AND RECEPTION DEVICES FOR TRANSMITTING AND RECEIVING STREAMS, AND PROCESSING METHODS THEREOF



(57) **Abrégé/Abstract:**

A transmission system is provided which transmits a transport stream (TS) having normal data and additional data. The transmission system includes a stream constructor which generates a TS, and a multiplexer (MUX) which causes mode information representing the characteristics of additional data to be contained in the TS. Therefore, it is possible for a reception system to use the additional data efficiently.



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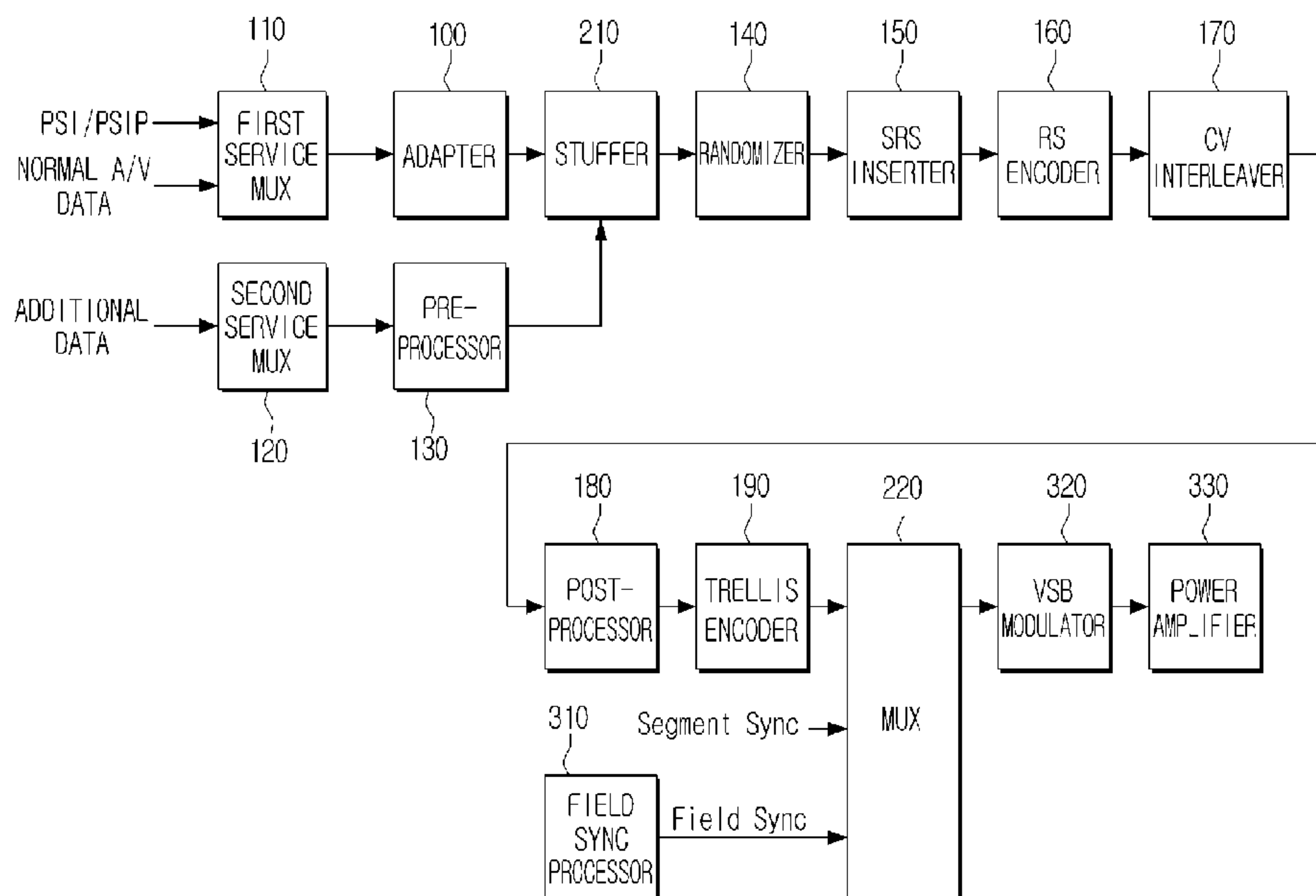
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(54) Title: DIGITAL TRANSMISSION AND RECEPTION DEVICES FOR TRANSMITTING AND RECEIVING STREAMS, AND PROCESSING METHODS THEREOF

[Fig. 2]



(57) Abstract: A transmission system is provided which transmits a transport stream (TS) having normal data and additional data. The transmission system includes a stream constructor which generates a TS, and a multiplexer (MUX) which causes mode information representing the characteristics of additional data to be contained in the TS. Therefore, it is possible for a reception system to use the additional data efficiently.

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Description

DIGITAL TRANSMISSION AND RECEPTION DEVICES FOR TRANSMITTING AND RECEIVING STREAMS, AND PROCESSING METHODS THEREOF

Technical Field

- [1] The present invention relates to a digital transmission device, a digital reception device, and processing methods thereof. More particularly, the present invention relates to a transmission system and a reception system which are capable of identifying a transmission mode or a reception mode using mode information, and a method for processing a stream using the same.

Background Art

- [2] Since digital technology has been developed, an effort of shifting from an analog broadcast system to a digital broadcast system is maintained. Accordingly, many countries have suggested diverse digital broadcast standards.
- [3] Among them, the Advanced Television System Committee (ATSC) standard and the Digital Video Broadcasting-Terrestrial (DVB-T) standard are remarkably used.
- [4] The ATSC standard adopts the 8-Vestigial Side Band (VSB) scheme, and the DVB-T standard adopts the Coded Orthogonal Frequency Division Multiplex (COFDM) scheme. Therefore, the DVB-T standard is strong in a multi-path channel, in particular, in channel interference, and is accordingly easy to implement a single frequency network (SFN).
- [5] However, since the DVB-T standard has a low data transmission rate, it is difficult to implement a high definition broadcast, while the ATSC standard is easy to implement a high definition broadcast.
- [6] Since each standard has both advantages and disadvantages, each country is trying to make up for the weak points and suggest an optimized standard.
- [7] As portable devices are widely distributed, an effort of viewing a digital broadcast using a portable device is being made. Due to frequent mobility of a portable device, streams used for the portable device must be processed more robust than normal streams.
- [8] Therefore, a technology for efficiently transmitting additional streams using existing digital facilities is being developed.
- [9] In greater detail, it is being developed that a robustly processed stream is additionally inserted into a normal stream which is transmitted to general broadcast reception devices, and a portable device receives and process it.
- [10] In this case, the additional stream can be inserted in any forms and in any places.

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Therefore, if a reception system is not aware of characteristics on the form or place of the additional stream, the reception system can receive it but cannot process it.

Disclosure of Invention

Technical Problem

- [11] The present invention seeks to provide a digital transmission device, which transmits information using at least one of a field sync and an SIC so that a receiving party can efficiently process additional data, a digital reception device, and a method for processing a stream using the same.

Technical Solution

- [12] A digital transmission device according to an exemplary embodiment of the invention may include an adapter which forms a space for inserting additional data in a transport stream, and a processor which generates a transport stream in which the additional data are inserted into the space, and inserts information representing characteristics of the additional data into at least one of a field sync and a signaling information channel (SIC).
- [13] The processor may include a field sync generator which generates the field sync containing the information, and a multiplexer (MUX) which multiplexes the generated field sync with the transport stream.
- [14] The processors may include a stuffer which inserts the SIC containing the information and the additional data into the transport stream.
- [15] The processors may include a stuffer which inserts the SIC containing the information and the additional data into the transport stream, a field sync generator which generates the field sync containing the information, and a MUX which multiplexes the generated field sync with the transport stream.
- [16] The digital transmission device may further include a supplementary reference signal (SRS) inserter which inserts an SRS into the transport stream.
- [17] The information may be information required to process the additional data or the SRS, and be at least one of a coding rate, a data rate, an insertion position, a type of a used error correction code, primary service information, an insertion pattern of the SRS, information regarding a size of the SRS, information needed to support time slicing, description of the additional data, information regarding modification of the information, and information to support Internet protocol (IP) service.
- [18] The information recorded in the field sync may be generated by distributing the entire mode information representing the characteristics of the additional data in a plurality of field syncs.
- [19] A method for processing a stream by a digital transmission device may include forming a space for inserting additional data in a

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- transport stream, and generating a transport stream in which information representing characteristics of the additional data to be inserted into the space is inserted into at least one of a field sync and a signaling information channel (SIC).
- [20] Generating the transport stream may include generating the field sync containing the information, and multiplexing the generated field sync with the transport stream.
- [21] Generating the transport stream may include inserting the SIC containing the information and the additional data into the transport stream.
- [22] Generating the transport stream may include inserting the SIC containing the information and the additional data into the transport stream, generating the field sync containing the information and multiplexing the generated field sync with the transport stream.
- [23] The method may further include inserting a supplementary reference signal (SRS) into the transport stream.
- [24] The information may be information required to process the additional data or the SRS, and be at least one of a coding rate, a data rate, an insertion position, a type of a used error correction code, primary service information, an insertion pattern of the SRS, information regarding a size of the SRS, information needed to support time slicing, description of the additional data, information regarding modification of the information, and information to support Internet protocol (IP) service.
- [25] The information recorded in the field sync may be generated by distributing the entire information representing the characteristics of the additional data in a plurality of field syncs.
- [26] A digital reception device may include an information detector which, if a transport stream in which normal data and additional data are mixed is received, detects information representing characteristics of the additional data from at least one of a field sync and a signaling information channel (SIC) of the transport stream, and a data processor which processes the transport stream using the detected information.
- [27] The information detector may restore the information recorded in the field sync by demultiplexing the field sync and performing an operation corresponding to forward error correction (FEC) which a digital transmission device has performed for the information.
- [28] The data processor may include a synchronizer which synchronizes the transport stream, an equalizer which equalizes the transport stream, an FEC processor which performs forward error correction of the equalized transport stream, and an additional data processor which detects and restores the additional data from the FEC-processed transport stream based on a location identified by the restored information.
- [29] The data processor may include a synchronizer which synchronizes the transport

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stream, an equalizer which equalizes the transport stream, and an FEC processor which detects the additional data from the equalized transport stream using the detected information, and performs forward error correction of the additional data.

- [30] The information detector may include an additional data processor which detects and processes the SIC and the additional data from the received transport stream, and detects the information from the SIC.
- [31] The digital reception device may further include a controller which, if a supplementary reference signal (SRS) is included in the transport stream, detects the SRS from the transport stream based on the restored information.
- [32] The data processor may include an equalizer which perform channel equalization using the SRS.
- [33] The information is information required to process the additional data or the SRS, and is at least one of a coding rate, a data rate, an insertion position, a type of a used error correction code, primary service information, an insertion pattern of the SRS, information regarding a size of the SRS, information needed to support time slicing, description of the additional data, information regarding modification of the information, and information to support Internet protocol (IP) service.
- [34] The information detector may detect the information by combining each mode signal area formed in each of a plurality of field syncs.
- [35] A method for processing a stream by a digital reception device may include receiving a transport stream in which normal data and additional data are mixed, detecting information representing characteristics of the additional data from at least one of a field sync and a signaling information channel (SIC) of the transport stream, and processing the transport stream using the detected information.
- [36] Detecting the information may include demultiplexing the field sync data in the transport stream, performing convolutional (CV) decoding of the detected field sync data, performing Reed Solomon (RS) decoding of the CV-decoded field sync data, and derandomizing the RS-decoded field sync data.
- [37] Detecting the information may include demultiplexing the field sync data in the transport stream, derandomizing the demultiplexed field sync data, performing convolutional (CV) decoding of the derandomized field sync data, and performing Reed Solomon (RS) decoding of the CV-decoded field sync data, so that the information in the field sync is restored.
- [38] Processing the data may include synchronizing the transport stream, equalizing the synchronized transport stream, performing forward error correction of the equalized transport stream, and detecting and restoring the additional data from the FEC-processed transport stream based on a location identified by the restored in-

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formation.

[39] Detecting the information may include detecting the SIC area from the received transport stream, and detecting the information from the SIC area by processing the SIC area.

5 [40] The method may further include if a supplementary reference signal (SRS) is included in the transport stream, detecting the SRS from the transport stream based on the restored information.

[41] The information may be information required to process the additional data or the SRS, and be at least one of a coding rate, a data rate, an insertion position, a type of a used
10 error correction code, primary service information, an insertion pattern of the SRS, information regarding a size of the SRS, information needed to support time slicing, description of the additional data, information regarding modification of the information, and information to support Internet protocol (IP) service.

[42] The information may be detected by combining each signal area formed in
15 each of a plurality of field syncs.

[42a] According to one aspect of the present invention, there is provided a digital transmission device, comprising: a processor to generate a transport stream which comprises normal data and additional data, and to insert information representing characteristics of the additional data into a signaling channel of the transport stream, wherein the additional data is
20 error-correction encoded before being inserted into the transport stream so that the additional data is more robust than the normal data.

[42b] According to another aspect of the present invention, there is provided a method for processing a transport stream by a digital transmission device, the method comprising: generating, by the digital transmission device, a transport stream which comprises
25 normal data and additional data, and inserting information representing characteristics of the additional data into a signaling channel of the transport stream, wherein the additional data is

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error-correction encoded before being inserted into the transport stream so that the additional data is more robust than the normal data.

[42c] According to still another aspect of the present invention, there is provided a digital reception device to receive a transport stream comprising normal data and additional
5 data, comprising: an information detector to detect information representing characteristics of the additional data from a signaling channel of the transport stream; and a data processor to process the transport stream using the detected information representing the characteristics of the additional data, wherein the additional data is error-correction encoded before being
10 inserted into the transport stream at a transmitter of the transport stream so that the additional data is more robust than the normal data.

[42d] According to yet another aspect of the present invention, there is provided a method for processing a transport stream by a digital reception device, the method comprising: receiving, by the digital reception device, the transport stream in which normal data and additional data are mixed; detecting, by the digital reception device, information
15 representing characteristics of the additional data from a signaling channel of the received transport stream; and processing, by the digital reception device, the transport stream using the detected information representing the characteristics of the additional data, wherein the additional data is error-correction encoded before being inserted into the transport stream at a transmitter of the transport stream so that the additional data is more robust than the normal
20 data.

Advantageous Effects

[43] According to the diverse exemplary embodiments of the present invention, information representing the characteristics of additional data which is transmitted together with normal data can be efficiently transmitted to a reception device using at least one of a
25 field sync and a SIC. In addition, a large size of information can be transmitted and received by a combination of a plurality of fields. Therefore, the reception device can easily identify the characteristics of the additional data and thus process a proper operation.

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Brief Description of the Drawings

[44] FIG. 1 is a block diagram illustrating a digital transmission device according to an exemplary embodiment of the present invention;

[45] FIG. 2 is a block diagram illustrating detailed configuration of the digital
5 transmission device;

[46] FIG. 3 is a block diagram illustrating a post-processor which can be applied to the digital transmission device of FIG. 2;

[47] FIG. 4 is a block diagram illustrating a field sync generator which can be applied to the digital transmission device;

10 [48] FIG. 5 is a block diagram illustrating another configuration of a field sync generator;

[49] FIG. 6 is a diagram illustrating configuration of mode information;

[50] FIG. 7 is a diagram illustrating another configuration of mode information;

[51] FIG. 8 is a diagram illustrating a process of mode information;

15 [52] FIG. 9 is a diagram illustrating configuration of a transport stream;

- [53] FIG. 10 is a diagram illustrating configuration of a field sync contained in a transport stream;
- [54] FIG. 11 is a diagram illustrating an exemplary embodiment of using a plurality of field syncs;
- [55] FIG. 12 is a block diagram illustrating a digital transmission device according to another exemplary embodiment of the present invention;
- [56] FIG. 13 is a block diagram illustrating a digital reception device according to an exemplary embodiment of the present invention;
- [57] FIG. 14 is a block diagram illustrating detailed configuration of the digital reception device;
- [58] FIG. 15 is a block diagram illustrating a field sync processor which can be applied to the digital transmission device;
- [59] FIG. 16 is a block diagram illustrating another example of a field sync processor which can be applied to the digital transmission device;
- [60] FIG. 17 is a block diagram illustrating another detailed configuration of a digital reception device according to another exemplary embodiment of the present invention;
- [61] FIG. 18 is a block diagram illustrating configuration of an additional data processor which can be applied to the digital reception device;
- [62] FIG. 19 is a flow chart illustrating a method for processing a stream in a digital transmission device according to an exemplary embodiment of the present invention;
- [63] FIG. 20 is a flow chart illustrating a method for processing a stream by transmitting mode information using a field sync;
- [64] FIG. 21 is a flow chart illustrating a method for processing a stream by transmitting mode information using an SIC; and
- [65] FIG. 22 is a flow chart illustrating a method for processing a stream in a digital reception device according to an exemplary embodiment of the present invention.

Best Mode for Carrying Out the Invention

- [66] Certain exemplary embodiments of the present invention will now be described in greater detail with reference to the accompanying drawings.
- [67] FIG. 1 is a block diagram illustrating a digital transmission device according to an exemplary embodiment of the present invention. As illustrated in FIG. 1, the digital transmission device includes an adapter 100 and a processor 200.
- [68] The adapter 100 forms a space for inserting additional data into a transport stream to be transmitted to a reception system. The transport stream may be a normal data stream.
- [69] The normal data stream may be broadcast data which are transmitted or received by existing digital broadcast transmission and reception systems. In addition, additional

data represents data which are processed to be stronger in errors than the normal data so that even portable devices on the move can receive and process the additional data, which can also be called turbo data.

[70] The processor 200 constitutes a transport stream in which additional data are inserted into the space formed by the adapter 100. The processor 200 inserts mode information representing the characteristics of the additional data into at least one of a field sync and an SIC of the transport stream. If the processor 200 inserts mode information into both the field sync and the SIC, the processor 200 may insert the same mode information or different mode information into them.

[71] That is, the additional data may be transmitted in diverse forms according to the size or use. Accordingly, only when the characteristics of the additional data, such as the insertion position and the size of the additional data, are notified the reception system, the reception system can identify the characteristics of the additional data and appropriately process the additional data. In this specification, information representing such characteristics is referred to as mode information.

[72] In more detail, the mode information is information required to process additional data or a supplementary reference signal (SRS), and may be at least one of the coding rate, the data rate, the insertion position, the type of used error correction code, primary service information, and, if a supplementary reference signal is contained in a transport stream, the insertion pattern of the supplementary reference signal, information regarding the size of the supplementary reference signal, information needed to support time slicing, description of the additional data, information regarding modification of the mode information, and information to support Internet protocol (IP) service.

[73] The insertion position of the additional data may be information representing into which packet of the transport stream the additional data are inserted, or information representing whether the additional data are inserted in a partial field of a packet or in a full packet. In addition, the primary service information refers to information needed to receive data to be primarily processed when diverse types of additional data are inserted.

[74] The insertion pattern of the supplementary reference signal is information representing whether the insertion pattern is a distribute pattern in which the supplementary reference signal is evenly distributed and inserted into the transport stream, or a burst pattern in which the supplementary reference signal is concentrated on and inserted into part of the transport stream.

[75] More specifically, if the supplementary reference signal is inserted into the transport pattern, the mode information can teach a period of packets in which the supplementary reference signal is inserted, and the size of the supplementary reference signal (for example, 10 bytes, 15 bytes, 20 bytes, 26 bytes, and so on) as well as the

position in which the supplementary reference signal is inserted in a packet.

[76] The configuration of the processor 200 and the format of the mode information can be implemented in diverse ways according to the exemplary embodiment of the present invention, which will be described below.

[77] FIG. 2 is a block diagram illustrating detailed configuration of the digital transmission device according to the exemplary embodiment of the present invention. As illustrated in FIG. 2, the digital transmission device includes a first service multiplexer (MUX) 110, a second service MUX 120, an adapter 100, a stuffer 210, a pre-processor 130, a randomizer 140, a supplementary reference signal inserter 150, an Reed Solomon (RS) encoder 160, a convolutional interleaver 170, a post-processor 180, a trellis encoder 190, a MUX 220, a field sync generator 310, a Vestigial Side Band (VSB) modulator 320, and a power amplifier 330. In FIG. 2, the remaining components other than the first service MUX 110, the second service MUX 120 and the adapter 100 belong to the processor 200.

[78] The first service MUX 110 constructs a normal stream by receiving input of a Program Specific Information/Program and System Information Protocol (PSI/PSIP) table along with normal audio data or normal video data.

[79] In FIG. 2, the first service MUX 110 and the adapter 100 are illustrated as separate components, but their functions may also be designed to be performed by a single component.

[80] A normal stream generated by the first service MUX 110 is provided to the adapter 100. As described above, the adapter 100 forms a space for inserting additional data into the normal stream. In greater detail, the space is formed by entirely emptying a portion of the packets constituting the normal stream or by generating an adaptation field in a portion of the packets. The adapter 100 provides the stuffer 210 with the normal stream having the space.

[81] The second service MUX 120 generates an additional stream by receiving input of additional data to be transmitted additionally. The generated additional stream is provided to the pre-processor 130.

[82] The pre-processor 130 pre-processes the additional stream so that the additional stream can be robust. More specifically, the pre-processor 130 may perform RS encoding, time interleaving, packet formatting, and so on. In addition, the pre-processor 130 may generate a place holder for inserting a parity corresponding to the additional stream.

[83] The pre-processor 130 may process Signaling Information Channel (SIC) as well as the additional stream. The SIC refers to a channel for informing detailed information regarding an additional channel for transmitting the additional data. The SIC may exist as an independent channel, or may be used by allocating part of a particular channel

such as a primary service. The SIC may include additional data location information, time slicing information, additional data decoding information, and so on.

[84] That is, when the mode information is transmitted through the SIC, the pre-processor 130 performs RS encoding and interleaving of SIC information including the mode information, and provides the stuffer 210 with the processed SIC information.

[85] The second service MUX 120 and the pre-processor 130 may be implemented singly or plurally according to the number of additional data.

[86] The stuffer 210 inserts the data provided by the pre-processor 130 into the space in the transport stream. That is, the additional data and the SIC data are inserted into the transport stream. Consequently, the mode information together with the additional data can be contained in the transport stream.

[87] A block including the adapter 100, the stuffer 210, and the pre-processor 130 can be called a MUX part.

[88] The transport stream generated by the stuffer 210 is provided to the randomizer 140.

[89] The randomizer 140 randomizes the transport stream, and provides the supplementary reference signal inserter 150 with the randomized transport stream.

[90] The supplementary reference signal inserter 150 inserts a known supplementary reference signal into the transport stream. The supplementary reference signal refers to a signal pattern which is commonly known to both the digital transmission device and the digital reception device. The digital reception device uses the supplementary reference signal in order to improve the reception performance.

[91] In FIG. 2, the supplementary reference signal inserter 150 is illustrated after the randomizer 140. In another exemplary embodiment of the present invention, however, a supplementary reference signal may be generated before operation of the stuffer 210, and inserted into a normal stream. Alternatively, the supplementary reference signal inserter 150 can also be located after the RS encoder 160.

[92] As described above, if the supplementary reference signal is inserted, the RS encoder 160 performs RS encoding and the convolutional interleaver 170 performs convolutional interleaving byte by byte.

[93] The post-processor 180 post-processes the interleaved transport stream. The configuration of the post-processor 180 is illustrated in FIG. 3.

[94] In FIG. 3, the post-processor 180 includes a detector 181, an outer encoder 182, an outer interleaver 183, an additional stream stuffer 184, and a parity compensator 185.

[95] The detector 181 detects the additional stream from the transport stream output by the convolutional interleaver 170.

[96] The outer encoder 182 adds a parity by encoding the detected additional stream. The parity may be inserted into the place holder generated in the additional stream by the pre-processor 130.

- [97] The outer interleaver 183 interleaves the encoded additional stream.
- [98] The additional data stuffer 184 inserts the interleaved additional stream into the transport stream again.
- [99] The parity compensator 185 compensates the RS parity modified by encoding of the outer encoder 182.
- [100] By the operation of the pre-processor 130 and the post-processor 180 as in FIG. 3, the additional stream can become more robust than the normal stream.
- [101] In the configuration of the post-processor 180 in FIG. 3, a byte-symbol converter (not shown) may be added prior to the detector 181, and thus a symbol-byte converter (not shown) may be added after the additional stream stuffer 184. The byte-symbol converter converts the interleaved transport stream from byte units to symbol units, and the symbol-byte converter converts the transport stream from symbol units to byte units again. Since the conversion method between byte units and symbol units is known, detailed description is omitted here.
- [102] Again, in FIG. 2, the trellis encoder 190 performs trellis-encoding of the transport stream output by the post-processor 180. If a supplementary reference signal has been inserted into the transport stream, the trellis encoder 190 prevents the supplementary reference signal from being modified by initializing a value pre-stored in internal memories into a predetermined value.
- [103] In more detail, the trellis encoder 190 replaces an input value of two symbols (referred to hereinafter as a 2-symbol input period), right before the supplementary reference signal is input, with a value corresponding to a value pre-stored in the internal memories, and performs the OR operation, so that each memory is reset during the 2-symbol input period. The corresponding value may be the same value as or a reverse value with the pre-stored value. Parity bits for values pre-stored in each memory are newly calculated, so the existing values are replaced with new values. The location of new parity may be modified if necessary. That is, the trellis encoder 190 modifies a value input in the 2-symbol input section after a parity value is generated by the RS encoder 160, so the trellis encoder 190 corrects a stream into a new codeword taking the modified value into consideration.
- [104] The transport stream trellis-encoded in this manner is output to the MUX 220.
- [105] The field sync generator 310 generates a field sync to be inserted into a plurality of groups of packets, and provides the MUX 220 with the field sync. A mode signal area to record the mode information may be formed in the field sync. The detailed configuration of the field sync will be described below.
- [106] The MUX 220 multiplexes the field sync into the transport stream. In addition, the MUX 220 multiplexes a segment sync into the transport stream.
- [107] The transport stream output by the MUX 220 is VSB-modulated by the VSB

modulator 320, amplified to an appropriate power by the power amplifier 330, and output through a wireless channel.

[108] As described above, the mode information can be transmitted to the reception device through at least one of an SIC and a field sync. In the exemplary embodiment illustrated in FIG. 2, part of the components constituting the processor 200 may be omitted, and more components which are not illustrated here may be added. In addition, the arrangement order of the components may be modified.

[109] FIG. 4 is a block diagram illustrating a field sync generator which can be applied to the digital transmission device. In FIG. 4, the field sync generator includes a randomizer 410, an RS encoder 420, a CV encoder 430, and a symbol mapper 440.

[110] The randomizer 410 randomizes mode information to be included in a field sync. The RS encoder 420 and the CV encoder 430 perform RS encoding and convolutional encoding of the randomized field sync data, and the symbol mapper 440 maps the converted data using a symbol.

[111] FIG. 5 is a block diagram illustrating another configuration of the field sync generator, in which the randomizer 410 may be located between the CV encoder 430 and the symbol mapper 440. That is, the field sync data are processed in the order of RS encoding, CV encoding, randomization, and symbol mapping.

[112] FIG. 6 is a diagram illustrating a format of mode information to be transmitted by the digital transmission device. The format in FIG. 6 is formed in bit units.

[113] The mode information in FIG. 6 consists of a distributed SRS flag (1 bit), an SRS (3 bits), a full packet flag 1 (1 bit), a mode of primary service (5 bits), a full packet flag 2 (1 bit), and a reserved (1 bit).

[114] The "distributed SRS flag" represents whether or not an SRS is inserted in a distribute pattern, as illustrated in the following table.

[115] Table 1

[Table 1]

[Table]

Item	Value
Burst SRS	0
Distributed SRS	1

[116] Table 1 shows that if a value of the distributed SRS flag is 0, the SRS has been inserted in a burst pattern, and if a value of the distributed SRS flag is 1, the SRS has been inserted in a distribute pattern.

[117] The "SRS" in FIG. 6 represents the size of an SRS in each packet. The SRS indicates different meanings according to whether an SRS is inserted in a burst pattern or in a

distribute pattern, as illustrated in the following tables.

[118] Table 2

[Table 2]

[Table]

In a burst pattern

SRS Bytes per Packet	Value
0	000
10	001
15	010
20	011
Reserved	100~111

[119] Table 3

[Table 3]

[Table]

In a distribute pattern

SRS Bytes per Packet	Value
48	000
56	001
80	010
112	011
Reserved	100~111

[120] As illustrated in Tables 2 and 3, the SRS can be expressed by diverse values such as 000, 001, 010, and 011, and thus the value represents the number of SRS bytes per packet.

[121] The "full packet flag 1" in FIG. 6 represents whether or not a packet including a first byte of the additional data has an adaptive field, as illustrated in the following table.

[122] Table 4

[Table 4]

[Table]

Item	Value
When a packet including a first byte of additional data uses an adaptive field	0
When a packet including a first byte of additional data does not use an adaptive field	1

- [123] As illustrated in FIG. 4, if a value of the full packet flag 1 is 0, a packet including a first byte of additional data transmits the additional data using an adaptive field, and if a value of the full packet flag 1 is 1, a packet including a first byte of additional data transmits the additional data without using an adaptive field.
- [124] The "mode of primary service" in FIG. 6 represents mode information of additional data to be primarily processed. Specifically, the mode information may be illustrated as follows.
- [125] Table 5

[Table 5]

[Table]

Size [sector (byte)]	Turbo coding rate	Mode information
0	-	00000
4(32)	1/2	00001
4(32)	1/3	00010
4(32)	1/4	00011
8(64)	1/2	00100
8(64)	1/3	00101
8(64)	1/4	00110
12(96)	1/2	00111
12(96)	1/3	01000
12(96)	1/4	01001
16(128)	1/2	01010
16(128)	1/3	01011
16(128)	1/4	01100
32(256)	1/2	01101
32(256)	1/3	01110
32(256)	1/4	01111
44(352)	1/2	10000
44(352)	1/3	10001
44(352)	1/4	10010
Reserved		10011~11111

[126] FIG. 5 recites the size of additional data and the coding rate only, but further includes information such as the data rate.

[127] The "full packet flag 2" in FIG. 6 represents whether or not an adaptive field appears in a last sector in a similar manner as illustrated in Table 4.

[128] The "reserved" in FIG. 6 is an area which is reserved for purposes of other uses.

[129] FIG. 7 is a diagram illustrating another format of mode information. In FIG. 7, the mode information is configured in the order of an SRS, a full packet flag 1, a full packet flag 2, a mode of primary service, an RS size of primary service, and a reserved (1 bit).

[130] The full packet flag 1, the full packet flag 2, the SRS, the mode of primary service, and the reserved correspond to those in FIG. 6.

[131] If the SRS is transmitted only in a distribute format, the "distributed SRS flag" may be omitted as in FIG. 7, and the SRS may be shown using the following table.

[132] Table 6

[Table 6]

[Table]

SRS Bytes per Packet	Value
0	000
48	001
56	010
80	011
112	100
Reserved	101~111

[133] The "RS size of primary service" in FIG. 7 represents the size of RS of additional data to be primarily processed, as illustrated in the following table.

[134] Table 7

[Table 7]

[Table]

Item	Value
RS (208,188)	0
RS (208,168)	1

[135] The mode information of bit units as in FIGs. 6 and 7 is converted to symbol units by the field sync generation unit 310.

[136] FIG. 8 is a diagram illustrating the operation of the field sync generator 310. As illustrated in FIG. 8, the RS encoder 420 adds an RS parity to mode information of 12 bits. If an RS(6,4) encoder of GF(8) is used, the mode information becomes 18 bits after RS encoding. Subsequently, the mode information is convolutional-encoded by the CV encoder 430. In this case, if 1/7 rate tail biting convolutional coding is performed, the mode information becomes 154 bits. That is, if 4 tail bits are added to the mode information of 18 bits and 1/7 convolutional coding is performed, the mode information of 154 bits are generated. The convolutional-encoded mode information is converted into mode information of 154 symbols by going through randomization and symbol mapping. The symbol mapper 440 may perform symbol mapping using the

following symbol map.

[137] Table 8

[Table 8]

[Table]

Value of bit	Symbol
0	-5
1	+5

[138] If the entire mode information cannot be inserted into a mode signal area in a single field sync due to the shortage of the mode signal area, the MUX 220 can distribute the mode information in a plurality of field sync. This will be explained below.

[139] FIG. 9 is a diagram illustrating configuration of a frame of a transport stream to be transmitted by the digital transmission device according to an exemplary embodiment of the present invention. In FIG. 9, one frame includes two fields, and one field includes one field sync segment which is a first segment, and 312 data segments.

[140] In a VSB data frame, a single segment can contain the same amount of information as a single MPEG-2 packet.

[141] That is, in the frame, one field sync packet is added to each group of 312 packets. One segment, that is, one packet includes segment sync of 4 symbols, and 828 data symbols, and thus has 832 symbols in total.

[142] FIG. 10 is a diagram illustrating configuration of a first field sync segment a which is added to a first field in a frame of a transport stream. As illustrated in FIG. 10, a mode signal area is included in a predetermined area of the first field sync segment a. Although not shown in FIG. 10, a PN sequence, such as PN511 or PN63, or VSB mode information can be included.

[143] In a conventional standard, a total of 104 symbols are defined as a reserved area. In the transmission device according to the exemplary embodiment of the present invention, part of the reserved area are used as a mode signal area to record the mode information. The size of the mode signal area may be 77 symbols. Among the reserved area of 104 symbols, the last 12 symbols are used as a pre-code area, 10 symbols preceding the pre-code area used as a characteristic code area. In the characteristic code area, a code representing the characteristics of the additional data, such as its version, provider, and an improvement format identifier is recorded.

[144] If the additional data are inserted into diverse areas and have diverse types, the size of the mode information may be too large to be expressed using only 77 symbols. Accordingly, in the digital transmission device according to the exemplary embodiment of the present invention, the mode information can be expressed using two or more

field syncs. That is, the mode information is divided and inserted into two field syncs a and b in a single frame as illustrated in FIG. 9.

[145] FIG. 11 is a diagram illustrating the form of the mode information distributed in the two field syncs a and b. In FIG. 11, the mode information of 154 symbols in total can be distributed and recorded in first and second mode signal areas of respective 77 symbols. Consequently, mode information of diverse sizes can be provided.

[146] FIG. 12 is a block diagram illustrating a digital transmission device according to another exemplary embodiment of the present invention, in which the digital transmission device includes an adapter 510, a randomizer 515, a stuffer 520, a de-randomizer 525, an SIC processor 530, a plurality of additional data processors 540 and 550, a multi-stream data deinterleaver 560, a randomizer 565, a supplementary reference signal inserter 575, an RS encoder 580, a byte interleaver 585, an RS parity compensator 591, TCM 1 to TCM 12 592-1 to 592-12, a MUX 593, a VSB modulator 594, and a power amplifier 595.

[147] The adapter 510 forms a space in a transport stream, and provides the randomizer 140 with the transport stream. The randomizer 515 randomizes the transport stream. In this case, the adapter 510 may externally receive the mode information and form the space in a position designated by the mode information.

[148] The SIC processor 530 includes a randomizer 531, an RS encoder 532, an outer encoder 533, and an outer interleaver 534. If SIC data are externally received, the randomizer 531 randomizes the received SIC data, and the RS encoder 532, the outer encoder 533, and the outer interleaver 534 perform RS encoding, outer encoding, outer interleaving of the randomized SIC data in sequence. The SIC data processed in this manner is provided to the multi-stream data deinterleaver 560.

[149] The plurality of additional data processors 540 and 550 include randomizers 541 and 551, RS encoders 542 and 552, time interleavers 543 and 553, outer encoders 544 and 554, and outer interleavers 545 and 555. The plurality of additional data processors 540 and 550 perform randomization, RS encoding, time interleaving, outer encoding, and outer interleaving of additional data which is externally provided, and provide the multi-stream data deinterleaver 560 with the processed additional data.

[150] In FIG. 12, the two additional data processors 540 and 550 are illustrated, but the number of additional data processors can be 1 or more than 2 according to an exemplary embodiment.

[151] The multi-stream data deinterleaver 560 deinterleaves data provided by the SIC processor 530 and the additional data processors 540 and 550 and provides the stuffer 520 with the deinterleaved data. In this case, the multi-stream data deinterleaver 560 may insert the additional data into a location set in the transport stream by the mode information and perform deinterleaving. The SIC data may always be inserted in a fixed

location regardless of the mode.

- [152] The stuffer 520 inserts the data into the space in the transport stream. Consequently, the transport stream in which the additional data are inserted in a location defined by the mode information.
- [153] The derandomizer 525 derandomizes the transport stream.
- [154] In FIG. 12, a block including the adapter 510, the randomizer 515, the stuffer 520, the derandomizer 525, the SIC processor 530, the additional data processors 540 and 550, and the multi-stream data deinterleaver 560 can be called a MUX part.
- [155] The stream processed by the MUX part is provided to the randomizer 565 for randomization.
- [156] The SRS inserter 575 inserts a SRS into the transport stream according to the mode information. The SRS inserter 575 may be placed after the RS encoder 580 in another embodiment.
- [157] Subsequently, the RS encoder 580 and the byte interleaver 585 perform RS encoding and byte interleaving the transport stream including the SRS.
- [158] The byte-interleaved transport stream is provided to a trellis encoder which includes an RS parity compensator 591, and the TCM 1 to TCM 12 592-1 to 592-12.
- [159] The RS parity compensator 591 transmits the transport stream to the TCM 1 to TCM 12 592-1 to 592-12. The TCM 1 to TCM 12 592-1 to 592-12 perform trellis-encoding of the transport stream in sequence, using each internal memory. Therefore, initialization of the memories is performed before SRS processing.
- [160] The RS parity compensator 591 compensates a parity for a value modified by initialization of the memories with an accurate value. The location of the parity may be changed if necessary.
- [161] After trellis-encoding, the MUX 593 multiplexes the trellis-encoded transport stream with a segment sync and a field sync. The field sync may be generated including separate mode information and provided to the MUX 593.
- [162] The multiplexed transport stream is modulated by the VSB modulator 594, is amplified to be appropriate for transmission by the power amplifier 595, and is transmitted through an antenna.
- [163] FIG. 13 is a block diagram illustrating a digital reception device according to an exemplary embodiment of the present invention. As illustrated in FIG. 13, the digital reception device includes a mode detector 700 and data processor 800.
- [164] The mode detector 700 receives a transport stream in which normal data and additional data are mixed, and detects mode information from at least one of a field sync and a SIC.
- [165] The data processor 800 processes the transport stream using the detected mode information.

- [166] The mode information may have been inserted into one or both of the field sync and the SIC according to an exemplary embodiment.
- [167] If the mode information has been inserted into the field sync, the mode information detector 700 may be implemented as a field sync processor (not shown) which detects and processes the field sync.
- [168] If the mode information has been inserted into the SIC, the mode information detector 700 may be implemented as an additional data processor (not shown) which detects and restores additional data and the SIC from the transport stream.
- [169] If the mode information has been inserted into both the field sync and the SIC, the mode information detector 700 may be implemented as both a field sync processor and an additional data processor.
- [170] As described above, the mode information detector 700 can be configured as one or more components in a technical aspect, and the remaining components other than the mode information detector 700 belong to the data processor 800.
- [171] The mode information detector 700 detects the mode information and provides the data processor 800 with the mode information.
- [172] In more detail, the mode information may be information required to process additional data or a supplementary reference signal (SRS), and may be at least one of the coding rate, the data rate, the insertion position, the type of used error correction code, and primary service information of additional data, and, the insertion pattern of the supplementary reference signal, information regarding the size of the supplementary reference signal, information needed to support time slicing, description of the additional data, information regarding modification of the mode information, and information to support IP service.
- [173] The data processor 800 receives and uses the detected mode information in order to process the transport stream. More specifically, the data processor 800 identifies the location of an SRS which is recorded in the mode information, and detects and uses the SRS in order to perform equalization or forward error correction (FEC). In addition, the data processor 800 identifies the insertion pattern of the additional data, the data rate, and the data coding rate which are recorded in the mode information, detects the additional data in the identified location, and decodes and restores the additional data.
- [174] If the digital transmission device has distributed and recorded the mode information in a plurality of field syncs, the mode information detector 700 detects the mode information by combining mode signal areas provided in the plurality of field syncs.
- [175] FIG. 14 is a block diagram illustrating detailed configuration of the digital reception device according to the exemplary embodiment of the present invention. As illustrated in FIG. 14, the digital reception device includes a synchronizer 910, an equalizer 920, an FEC processor 930, an additional data processor 940, and a field sync processor

950.

- [176] At least one of the additional data processor 940 and the field sync processor 950 may correspond to the mode information detector 700 in FIG. 13. That is, if the mode information is contained only in the field sync, the field sync processor 950 corresponds to the mode information detector 700, and the additional data processor 940 corresponds to the data processor 800. Alternatively, if the mode information is contained only in the SIC, the additional data processor 940 corresponds to the mode information detector 700, and the field sync processor 950 corresponds to the data processor 800. Thirdly, if the mode information is contained in both the SIC and the field sync, the additional data processor 940 and the field sync processor 950 correspond to the mode information detector 700.
- [177] In FIG. 14, the synchronizer 910 synchronizes the transport stream received through a wireless channel, and the equalizer 920 equalizes the synchronized transport stream. The FEC processor 930 performs forward error correction of the equalized transport stream.
- [178] The additional data processor 940 processes the additional data stream in the forward-error-corrected transport stream. In this case, the additional data processor 940 may also process the SIC data in the transport stream. Therefore, if the mode information is contained in the SIC data, the additional data processor 940 detects the additional data stream in a location defined by the mode information, and processes the additional data stream.
- [179] If the mode information in the SIC data includes the insertion location and the insertion pattern of the SRS, the additional data processor 940 may provide the equalizer 920 and the FEC processor 930 with this information.
- [180] In FIG. 14, the field sync processor 950 detects a field sync from the transport stream. If the field sync contains mode information, the field sync processor 950 restores the mode information, and provides the equalizer 920, the FEC processor 930, and the additional data processor 940 with the restored mode information. The field sync processor 950 may be located after the equalizer 920 according to the implementation of the reception device.
- [181] The equalizer 920 and the FEC processor 930 detects the SRS from the transport stream using information regarding the insertion location and the insertion pattern of the SRS from among the mode information, so that the SRS can be used for equalization and forward error correction. According to an exemplary embodiment, the SRS may not be used for forward error correction.
- [182] The additional data processor 940 detects the additional data in the transport stream using the location of the additional data from among the mode information, and decodes the additional data appropriately.

- [183] In FIG. 14, the components are arranged in a way that the additional data are processed after FEC. That is, FEC for the entire transport stream is performed. However, it is also possible to detect the additional data from the transport stream and then perform FEC of the additional data only, and also possible to implement the FEC processor and the additional data processor in one block.
- [184] FIG. 15 is a block diagram illustrating the field sync processor 950. The field sync processor 950 includes a field sync DEMUX 951, a CV decoder 952, an RS decoder 953, and a derandomizer 954.
- [185] The field sync DEMUX 951 demultiplexes a mode signal area of field sync data in a transport stream. Accordingly, if the field sync data are detected, the CV decoder 952 performs convolutional decoding of the mode signal area of the field sync data.
- [186] The RS decoder 953 performs RS decoding of the CV-decoded data.
- [187] The derandomizer 954 derandomizes the RS-decoded field sync data, and restores the mode information inserted in the mode signal area of the field sync.
- [188] Consequently, the restored mode information can be used for processing the transport stream and the additional data stream.
- [189] FIG. 16 is a block diagram illustrating another example of the field sync processor 950. In FIG. 16, the field sync processor 950 is implemented in the order of the field sync DEMUX 951, the derandomizer 954, the CV decoder 952, and the RS decoder 953. Therefore, after field sync data are demultiplexed and detected, derandomization, CV decoding, and RS decoding are performed in sequence.
- [190] Each component of the field sync processor 950 in FIGs. 15 and 16 can be omitted or added depending on a method for generating a field sync by a transmission device and an exemplary embodiment, and the order thereof can also be modified.
- [191] FIG. 17 is a block diagram illustrating a digital reception device according to another exemplary embodiment of the present invention. As illustrated in FIG. 17, the digital reception device includes a synchronizer 910, an equalizer 920, an FEC processor 930, an additional data processor 940, a field sync processor 950, and a controller 960.
- [192] The controller 960 outputs control signals to the equalizer 920 and the FEC processor 930 using mode information. The controller 960 may receive input of mode information processed by the additional data processor 940 or the field sync processor 950. Alternatively, the controller 960 may directly detect mode information from data processed by the additional data processor 940 or the field sync processor 950.
- [193] In FIG. 17, the components are arranged in a way that the additional data are processed after FEC. That is, FEC for the entire transport stream is performed. However, it is also possible to detect the additional data from the transport stream and then perform FEC of the additional data only, and also possible to implement the FEC processor and the additional data processor in one block.

- [194] FIG. 18 is a block diagram illustrating configuration of the additional data processor 940 which can be applied to the digital reception device.
- [195] As illustrated in FIG. 18, the additional data processor 940 includes a TCM decoder 941, a CV deinterleaver 942, an outer deinterleaver 943, an outer decoder 944, an outer interleaver 945, a CV interleaver 946, an RS decoder 947, and a derandomizer 948.
- [196] The TCM decoder 941 detects an additional stream from a transport stream output from the FEC processor 930, and performs trellis encoding of the additional stream.
- [197] The CV deinterleaver 942 performs CV-deinterleaving of the trellis-encoded additional stream. According to the configuration of the transmission device, the CV deinterleaver 942 may not be necessary.
- [198] The outer deinterleaver 943 performs outer deinterleaving, and the outer decoder 944 decodes the additional stream so that a parity added to the additional stream is removed.
- [199] In some cases, in order to improve the reception performance for the additional data, the process from the TCM decoder 941 to the outer decoder 944 can be repeated. For the repeated process, the data decoded by the outer decoder 944 go through the outer interleaver 945 and the CV interleaver 946 to the TCM decoder 941. The CV interleaver 946 may not be necessary according to the configuration of the transmission device.
- [200] The trellis-decoded additional stream is provided to the RS decoder 947. The RS decoder 947 performs RS decoding of the additional stream, and the derandomizer 948 derandomizes the additional stream. Consequently, the additional stream data are restored.
- [201] FIG. 19 is a flow chart illustrating a method for processing a stream in a digital transmission device according to an exemplary embodiment of the present invention. As illustrated in FIG. 19, a space for inserting additional data is formed in a transport stream (S1000), and the transport stream containing the additional data in the space and mode information representing the characteristics of the additional data is generated (S1010). The mode information may be inserted into at least one of a field sync and an SIC.
- [202] FIG. 20 is a flow chart illustrating a method for processing a stream by transmitting mode information using a field sync according to an exemplary embodiment of the present invention. As illustrated in FIG. 20, a transport stream in which normal data and additional data are mixed is generated (S1110).
- [203] Subsequently, a field sync including a mode signal area is formed (S1120). In the mode signal area, mode information is recorded. The field sync can be configured as described above.
- [204] After field sync can be configured, a digital transmission device inserts the field sync

into the transport stream (S1130). In more detail, a single field sync can be inserted into every processing unit which is preset. In this case, mode information can also be distributed in a plurality of field syncs as illustrated in FIG. 11.

[205] If the mode information is contained in a SIC, the mode information can be processed in the same manner as the additional data.

[206] FIG. 21 is a flow chart illustrating a method for processing a stream by inserting mode information into an SIC. As illustrated in FIG. 21, a space for inserting the additional data into a transport stream is formed (S1210), and the additional data and an SIC are processed (S1220). Operations S1210 and S1220 may be performed sequentially or concurrently.

[207] The SIC including mode information is provided from an external source, randomized, encoded, and interleaved. Detailed method of processing the SIC and the additional data is given above with reference to FIG. 12, so description thereof is not repeated here.

[208] The processed SIC and additional data are inserted into the space provided in the transport stream (S1230). Following this process, the transport stream is formed.

[209] The formed transport stream goes through randomization, encoding, interleaving, trellis encoding, and modulation, and is transmitted through a channel (S1240).

[210] FIG. 22 is a flow chart illustrating a method for processing a stream in a digital reception device according to an exemplary embodiment of the present invention. As illustrated in FIG. 22, the method includes detecting mode information from a transport stream (S1300) and processing the transport stream using the detected mode information (S1400). The mode information may be detected from a field sync or an SIC of the transport stream.

[211] In FIG. 22, it is assumed that the mode information is detected from a field sync. Firstly, if the transport stream is received, a mode signal area of a field sync is demultiplexed (S1310). The received transport stream includes normal data and additional data. The additional stream data may include various types of a plurality of stream data which are provided by a plurality of providers.

[212] If data are detected from the mode signal area of the field sync, the detected data are CV-decoded (S1320).

[213] Subsequently, the CV-decoded field sync data are RS-decoded (S1330) and randomized, so that mode information is restored (S1340).

[214] The restored mode information may be at least one of the coding rate, the data rate, the insertion position, the type of used error correction code, and primary service information of the additional data, and the insertion pattern and information regarding the size of an SRS.

[215] Subsequently, the SRS is identified based on the location identified using the

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restored mode information (S1410), and the transport stream is equalized using the identified SRS (S1420).

[216] Next, forward error correction of the equalized transport stream is performed (S1430), and the additional stream is detected from the corrected transport stream and decoded. As a result, the additional data are restored (S1440).

[217] Since these operations have been given above, detailed description is not repeated here.

[218] In FIG. 22, the order of performing each operation can be modified. That is, randomization (S1340) may be performed after demultiplexing (S1310). Furthermore, forward error correction (S1430) may be performed for only the additional data stream from among the transport stream. In addition, forward error correction (S1430) and detection and restoration of the additional data (S1440) may be performed together by one block. The SRS can be used for forward error correction (S1430) as well as for equalization.

[219] While the invention has been shown and described with reference to certain exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention as defined by the appended claims.

[220]

Industrial Applicability

[221] The present invention can be applied to a digital broadcast system.

[222]

[223]

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CLAIMS:

1. A digital transmission device, comprising:

a processor to generate a transport stream which comprises normal data and additional data, and to insert information representing characteristics of the additional data
5 into a signaling channel of the transport stream,

wherein the additional data is error-correction encoded before being inserted into the transport stream so that the additional data is more robust than the normal data.

2. The digital transmission device of claim 1, further comprising:

a field sync generator which generates a field sync; and

10 a multiplexer (MUX) which multiplexes the generated field sync with the transport stream.

3. The digital transmission device of claim 1, further comprising:

a supplementary reference signal (SRS) inserter which inserts a known data into the transport stream,

15 wherein the information is information required to process the additional data or the known data, and is at least one of a coding rate, a data rate, an insertion position, a type of a used error correction code, primary service information, an insertion pattern of the known data, information regarding a size of the known data, information needed to support time slicing, description of the additional data, information regarding modification of the
20 information, and information to support Internet protocol (IP) service.

4. The digital transmission device of claims 1 or 2, wherein the information is generated by distributing the entire information representing the characteristics of the additional data.

5. A method for processing a transport stream by a digital transmission device,
25 the method comprising:

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generating, by the digital transmission device, a transport stream which comprises normal data and additional data, and inserting information representing characteristics of the additional data into a signaling channel of the transport stream,

5 wherein the additional data is error-correction encoded before being inserted into the transport stream so that the additional data is more robust than the normal data.

6. The method of claim 5, further comprising:

generating a field sync; and

multiplexing the generated field sync with the transport stream.

7. The method of claim 5, further comprising:

10 inserting a known data into the transport stream,

wherein the information is information required to process the additional data or the known data , and is at least one of a coding rate, a data rate, an insertion position, a type of a used error correction code, primary service information, an insertion pattern of the known data , information regarding a size of the known data , information needed to support time
15 slicing, description of the additional data, information regarding modification of the information, and information to support Internet protocol (IP) service.

8. The method of claims 5 or 6, wherein the information is generated by distributing the entire information representing the characteristics of the additional data.

9. A digital reception device to receive a transport stream comprising normal data
20 and additional data, comprising:

an information detector to detect information representing characteristics of the additional data from a signaling channel of the transport stream; and

a data processor to process the transport stream using the detected information representing the characteristics of the additional data,

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wherein the additional data is error-correction encoded before being inserted into the transport stream at a transmitter of the transport stream so that the additional data is more robust than the normal data.

10. The digital reception device of claim 9, wherein the information detector
5 restores by performing an operation corresponding to forward error correction (FEC) which a digital transmission device has performed for the information.
11. The digital reception device of claim 10, wherein the data processor comprises:
 - a synchronizer which synchronizes the transport stream;
 - an equalizer which equalizes the transport stream;
 - 10 an FEC processor which performs forward error correction of the equalized transport stream; and
 - an additional data processor which detects and restores the additional data from the FEC-processed transport stream based on a location identified by the restored information.
12. The digital reception device of claim 10, wherein the data processor comprises:
 - 15 a synchronizer which synchronizes the transport stream;
 - an equalizer which equalizes the transport stream; and
 - an FEC processor which detects the additional data from the equalized transport stream using the detected information, and performs forward error correction of the additional data.
- 20 13. The digital reception device of claim 9, wherein the information detector comprises an additional data processor which detects and processes the additional data from the received transport stream, and detects the information from the received transport stream.
14. The digital reception device of one of claims 9 to 13, further comprising:

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a controller which, if a known data is included in the transport stream, detects the known data from the transport stream based on the restored information.

15. The digital reception device of claim 14, wherein the data processor comprises:

an equalizer which perform channel equalization using the known data; and

5 a forward error correction (FEC) which performs forward error correction using the known data.

16. The digital reception device of claim 14, wherein the information is information required to process the additional data or the known data, and is at least one of a coding rate, a data rate, an insertion position, a type of a used error correction code, primary
10 service information, an insertion pattern of the known data, information regarding a size of the known data, information needed to support time slicing, description of the additional data, information regarding modification of the information, and information to support Internet protocol (IP) service.

17. The digital reception device of one of claims 9 to 13, wherein the information
15 detector detects the information by combining each mode signal area.

18. A method for processing a transport stream by a digital reception device, the method comprising:

receiving, by the digital reception device, the transport stream in which normal data and additional data are mixed;

20 detecting, by the digital reception device, information representing characteristics of the additional data from a signaling channel of the received transport stream; and

processing, by the digital reception device, the transport stream using the detected information representing the characteristics of the additional data,

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wherein the additional data is error-correction encoded before being inserted into the transport stream at a transmitter of the transport stream so that the additional data is more robust than the normal data.

19. The method of claim 18, wherein detecting the information comprises:

5

demultiplexing the field sync data in the transport stream;

performing convolutional (CV) decoding of the detected field sync data;

performing Reed Solomon (RS) decoding of the CV-decoded field sync data;

and

derandomizing the RS-decoded field sync data.

10 20.

The method of one of claims 18 to 19, wherein processing the data comprises:

synchronizing the transport stream;

equalizing the synchronized transport stream;

performing forward error correction of the equalized transport stream; and

15 detecting and restoring the additional data from the FEC-processed transport stream based on a location identified by the restored information.

21. The method of claim 18, wherein detecting the information comprises:

detecting an area from the received transport stream; and

detecting the information from the area by processing the area.

22. The method of claim 18, further comprising:

20

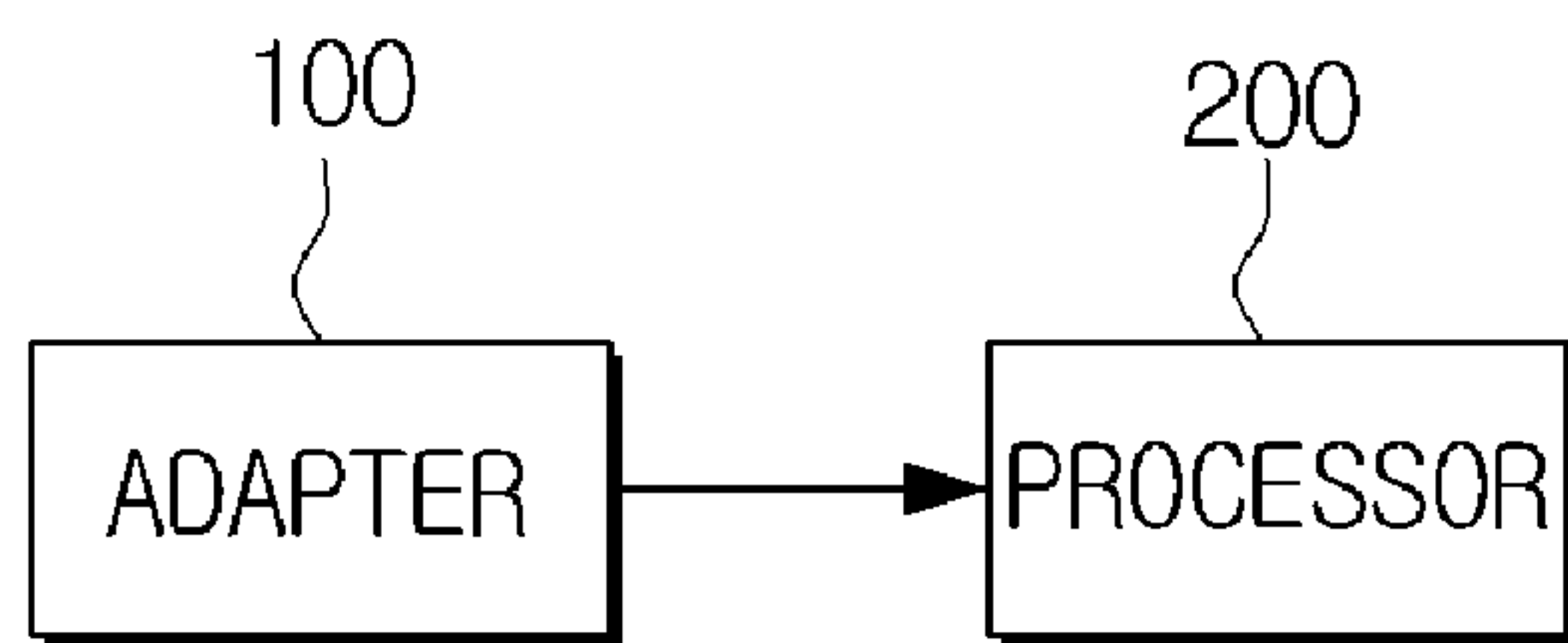
if a known data is included in the transport stream, detecting the known data from the transport stream based on the restored information.

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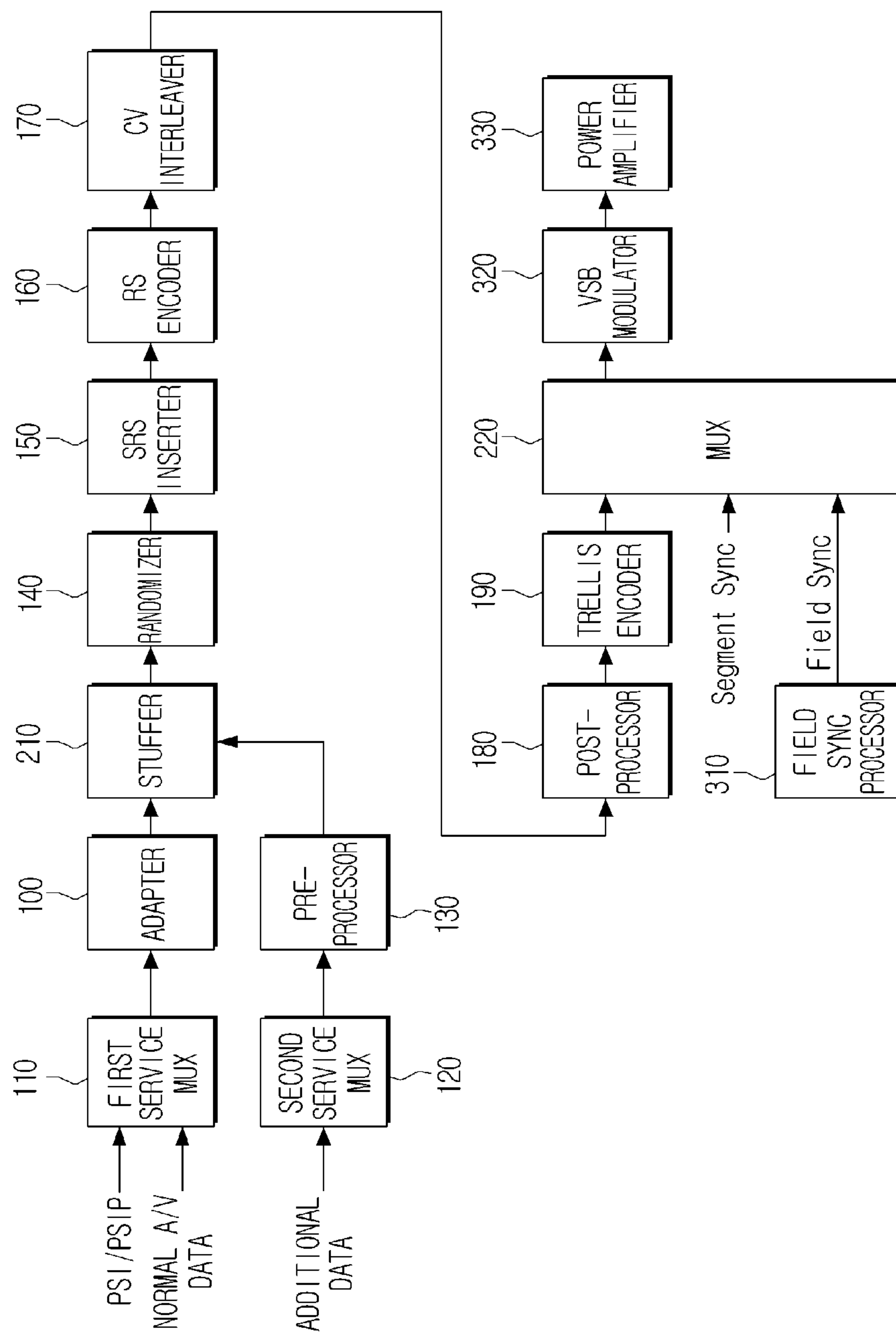
30

23. The method of claim 18, wherein the information is information required to process the additional data or the known data, and is at least one of a coding rate, a data rate, an insertion position, a type of a used error correction code, primary service information, an insertion pattern of the known data, information regarding a size of the known data,
- 5 information needed to support time slicing, description of the additional data, information regarding modification of the information, and information to support Internet protocol (IP) service.
24. The method of claim 18, wherein the information is detected by combining each mode signal area.

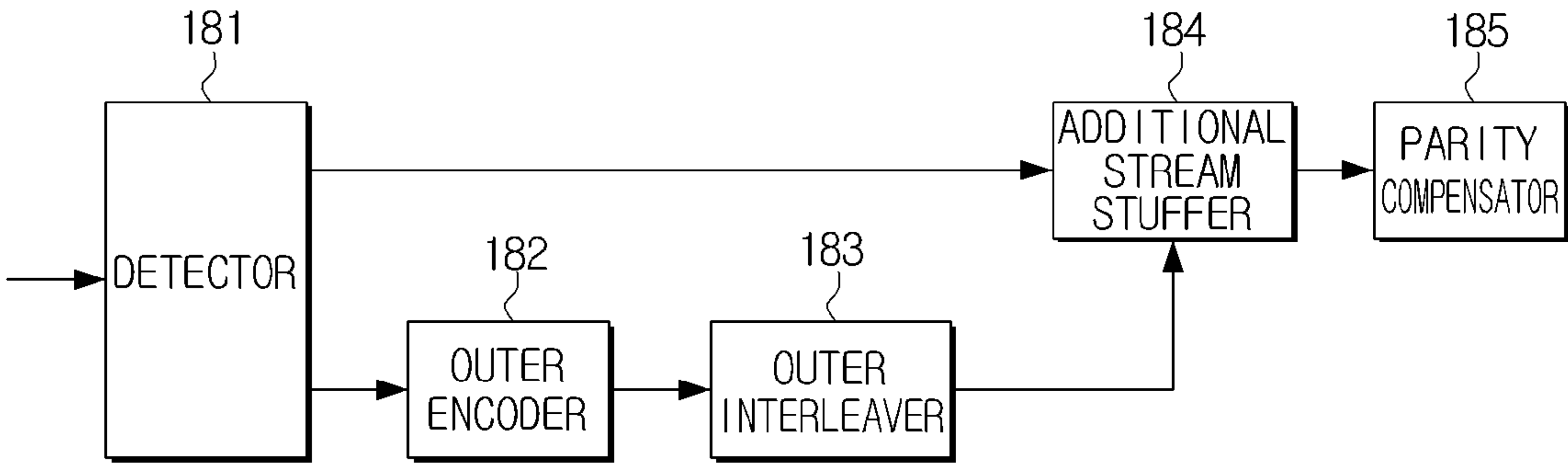
[Fig. 1]



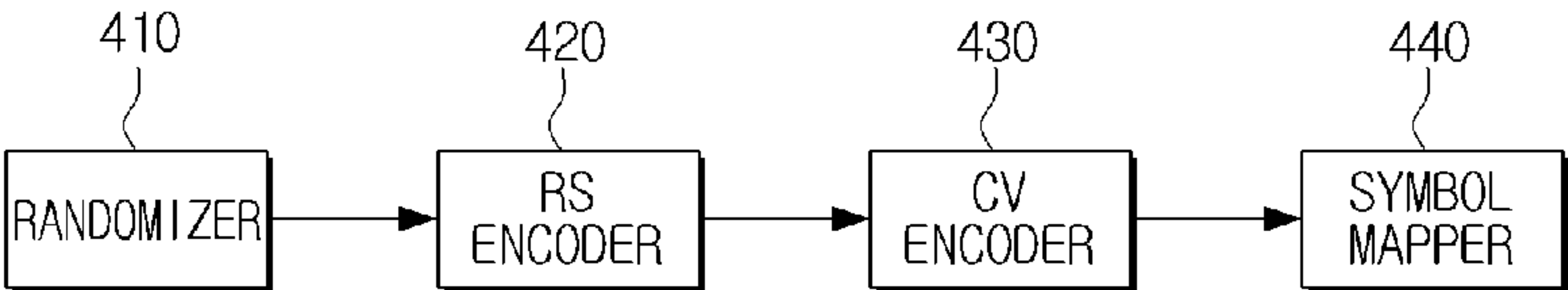
[Fig. 2]



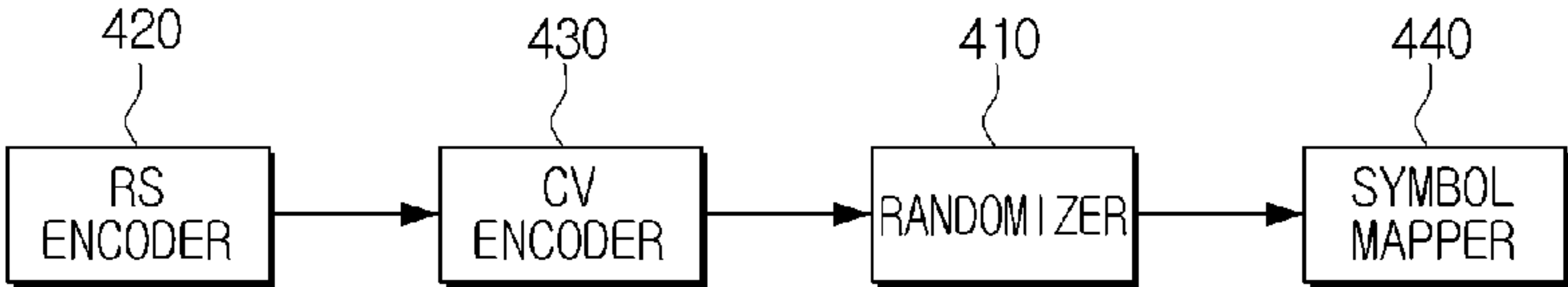
[Fig. 3]



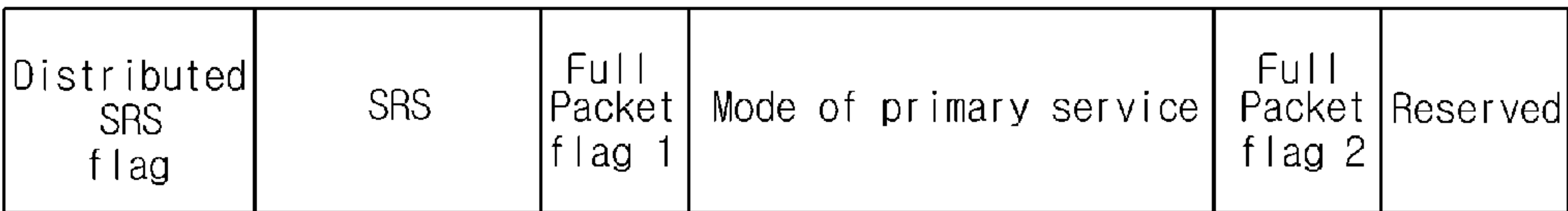
[Fig. 4]



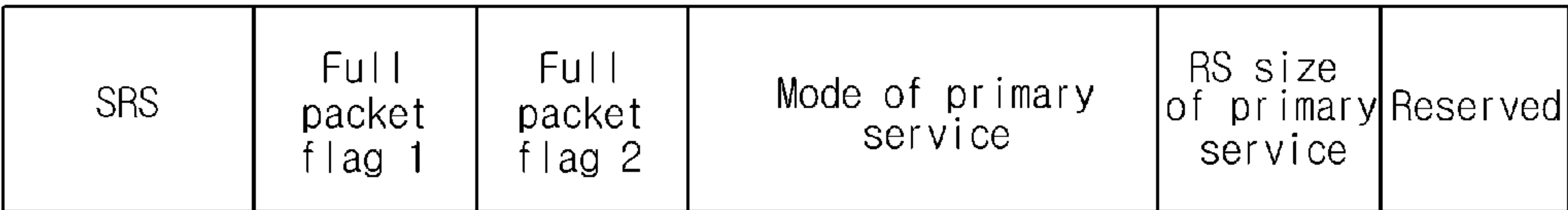
[Fig. 5]



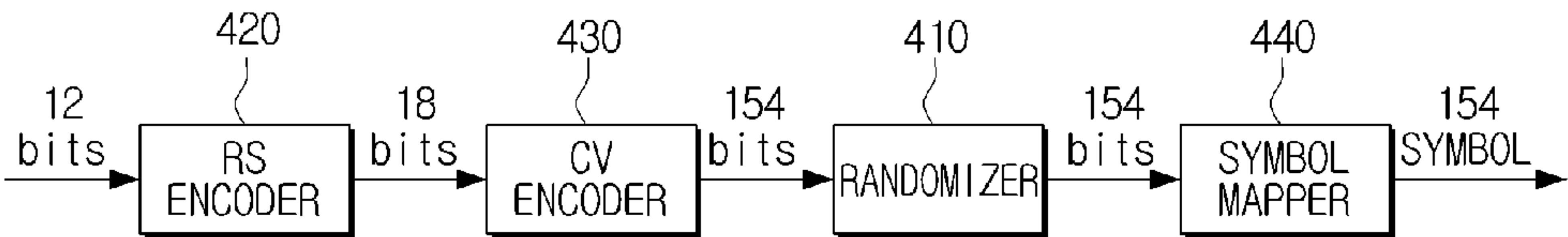
[Fig. 6]



[Fig. 7]



[Fig. 8]



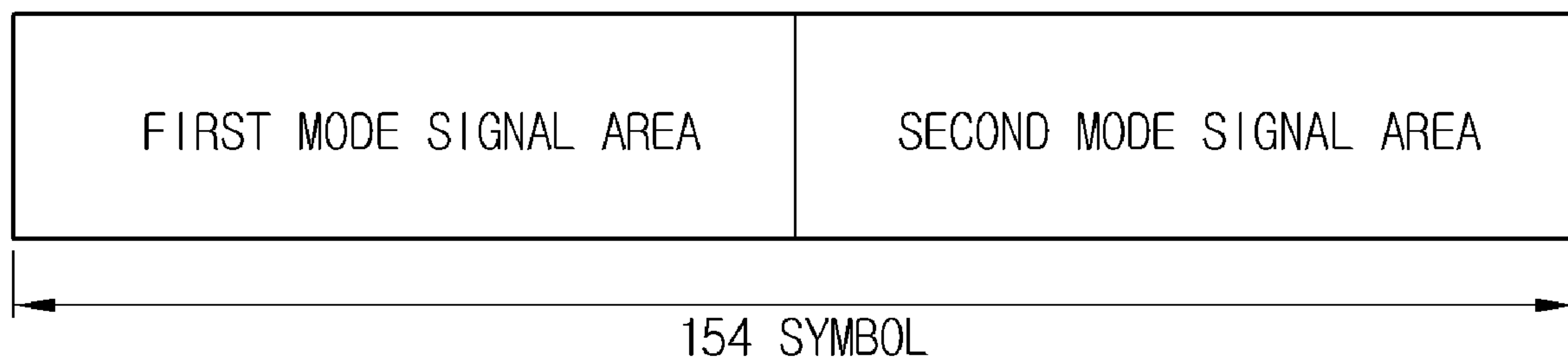
The diagram illustrates a video frame structure with two segments, 'a' and 'b'. Each segment consists of a 'Field Sync' header and a 'DATA' body. The total width of the frame is 832, and the total height is 312. The segments are labeled 'a' and 'b'.

The diagram illustrates the structure of a 104-symbol VSB mode signal. It is divided into four main sections:

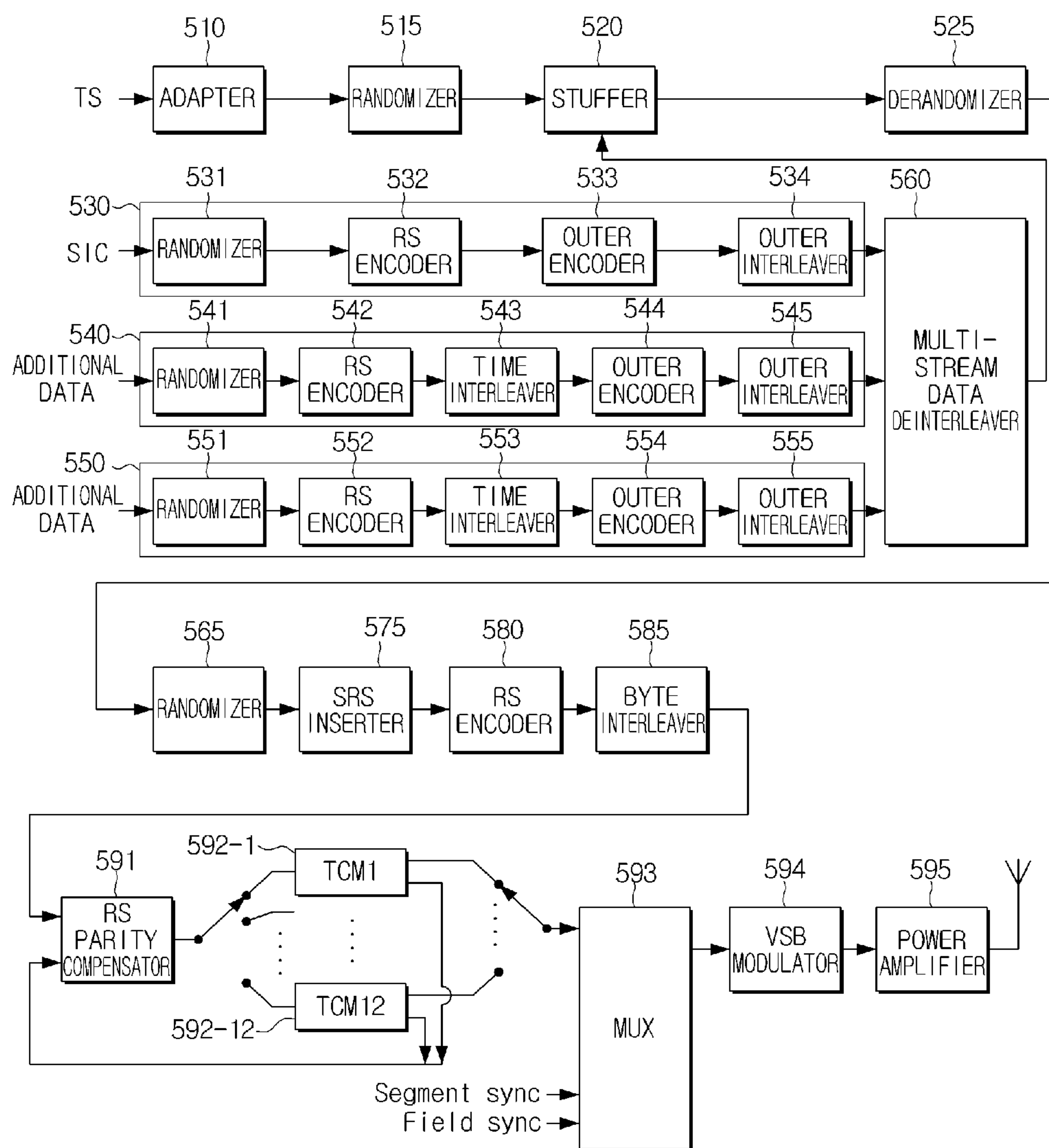
- MODE SIGNAL AREA**: 77 SYMBOLS
- RESERVED AREA**: 5 SYMBOLS
- CHARACTERISTIC code**: 10 SYMBOLS
- Precode**: 12 SYMBOLS

The total duration is 104 SYMBOLS. The diagram also shows a detailed view of the 104-symbol structure, which includes a VSB MODE field and a 104 SYMBOL field.

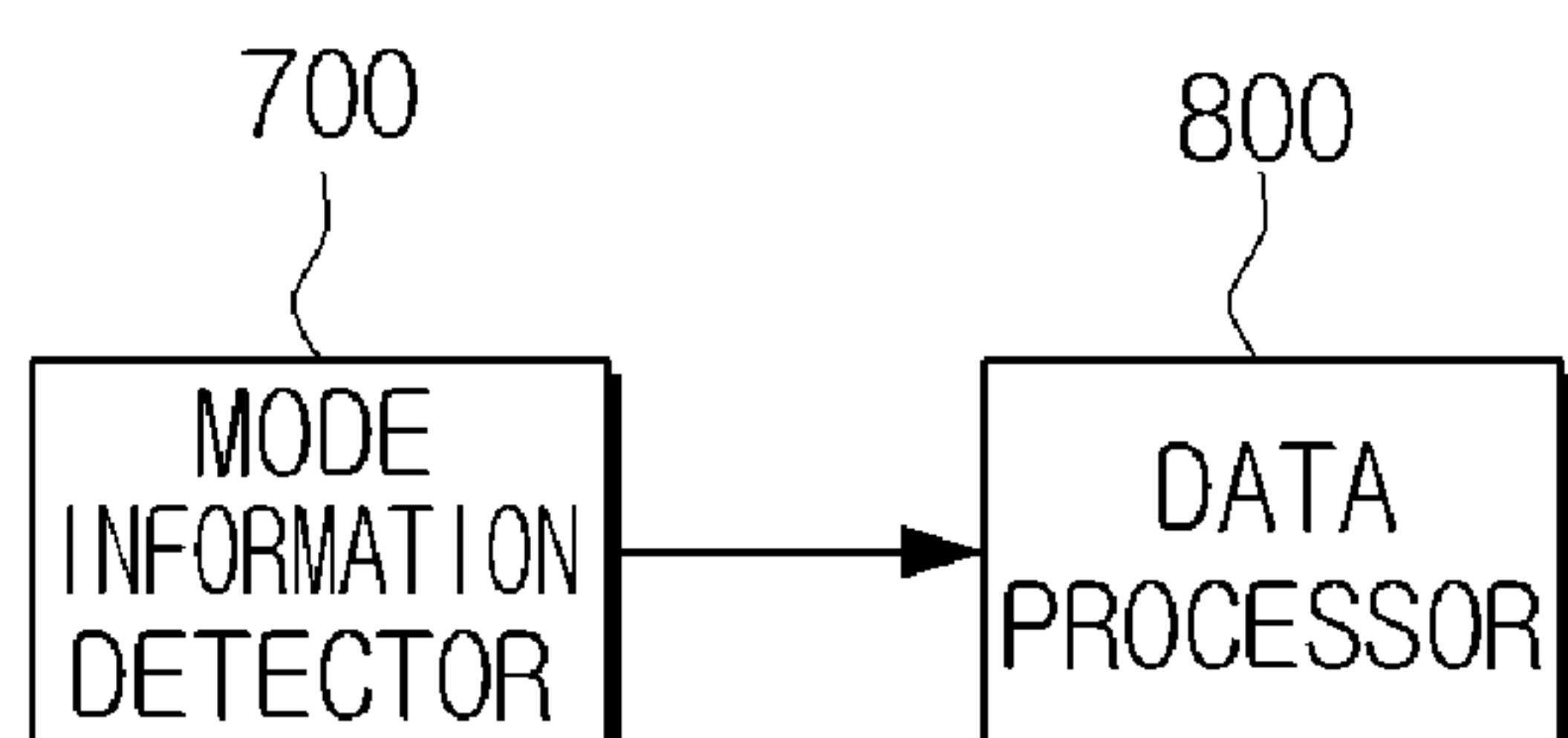
[Fig. 11]



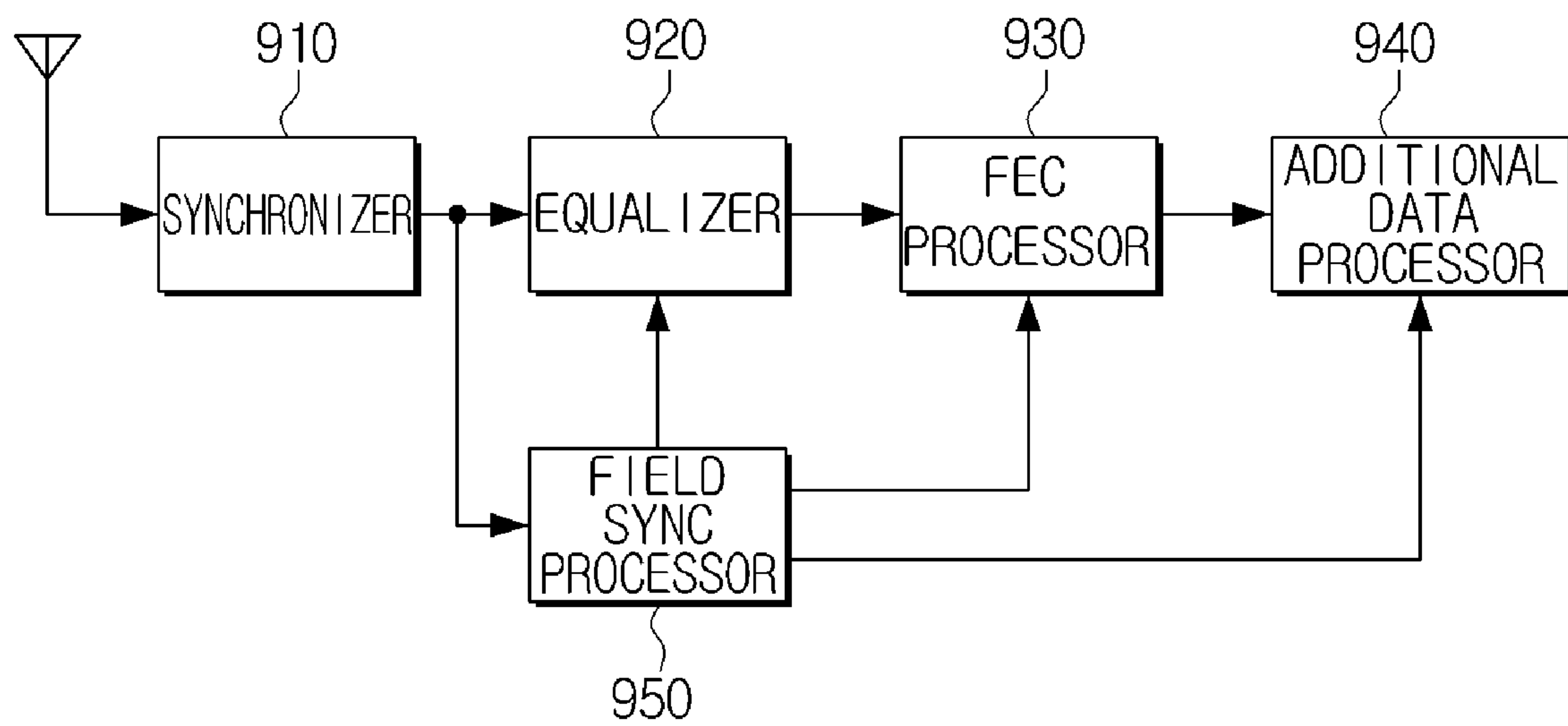
[Fig. 12]



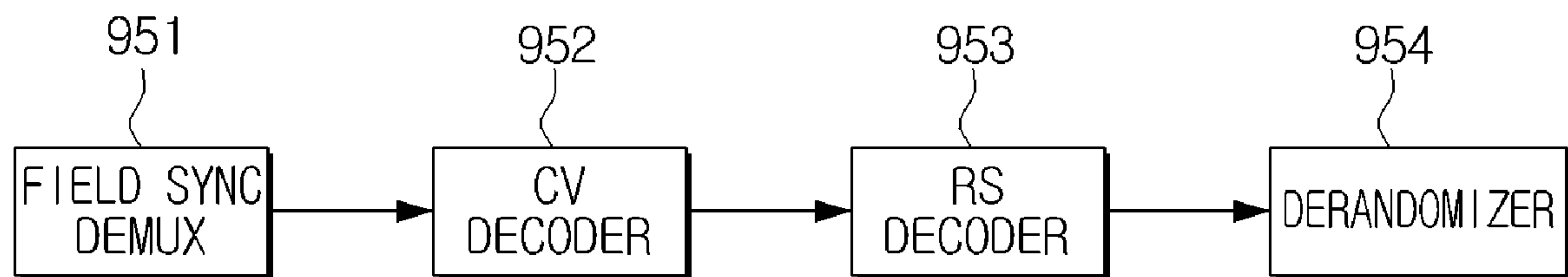
[Fig. 13]



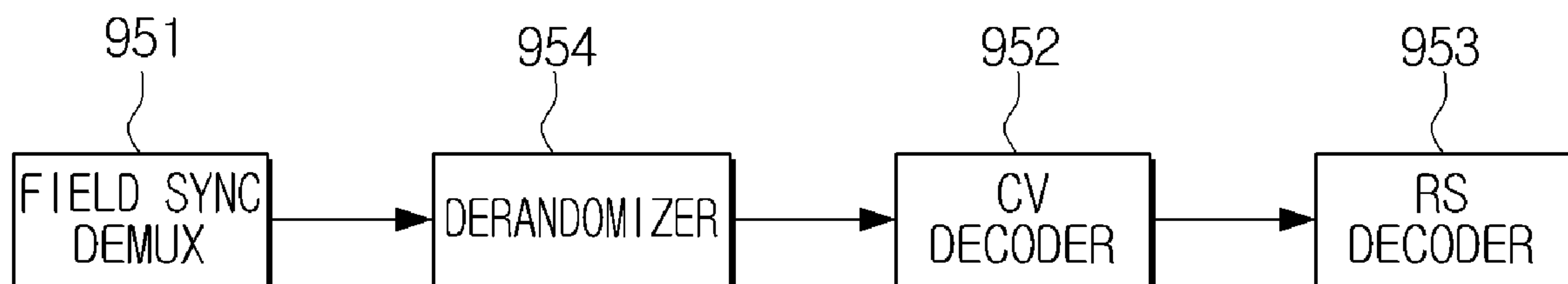
[Fig. 14]



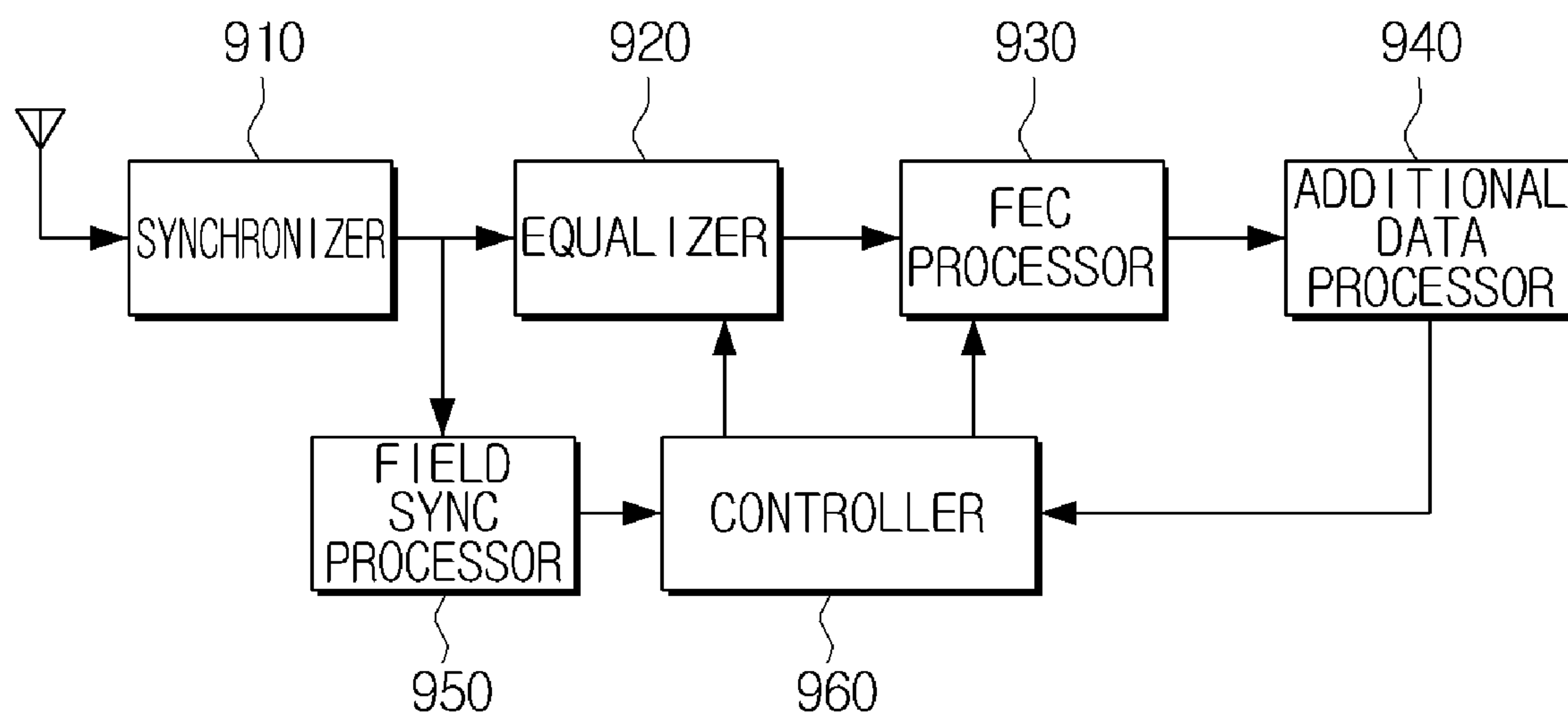
[Fig. 15]



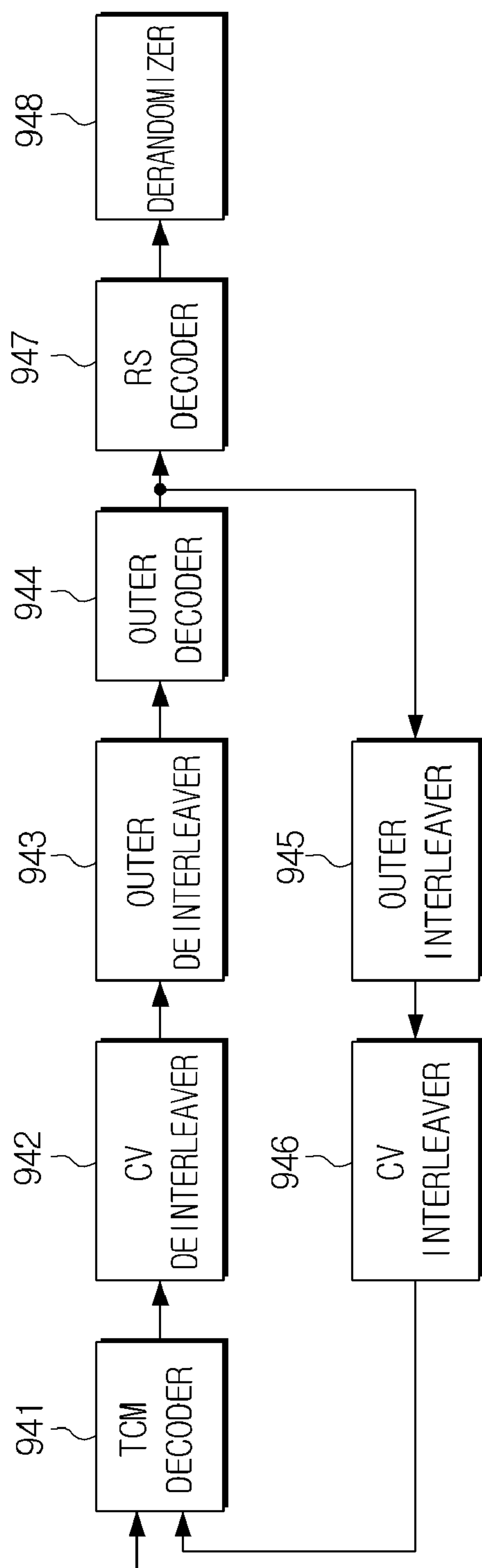
[Fig. 16]



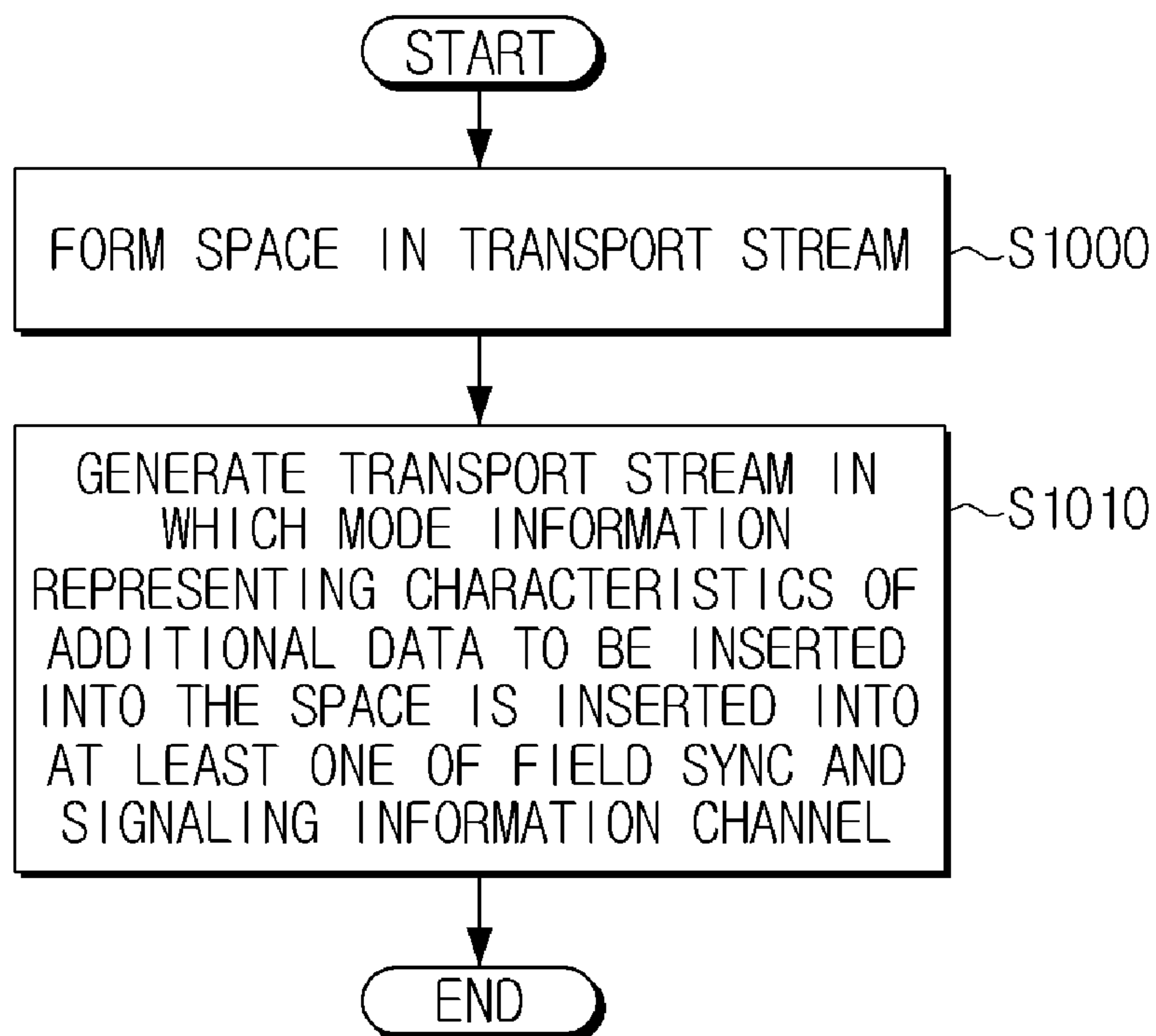
[Fig. 17]



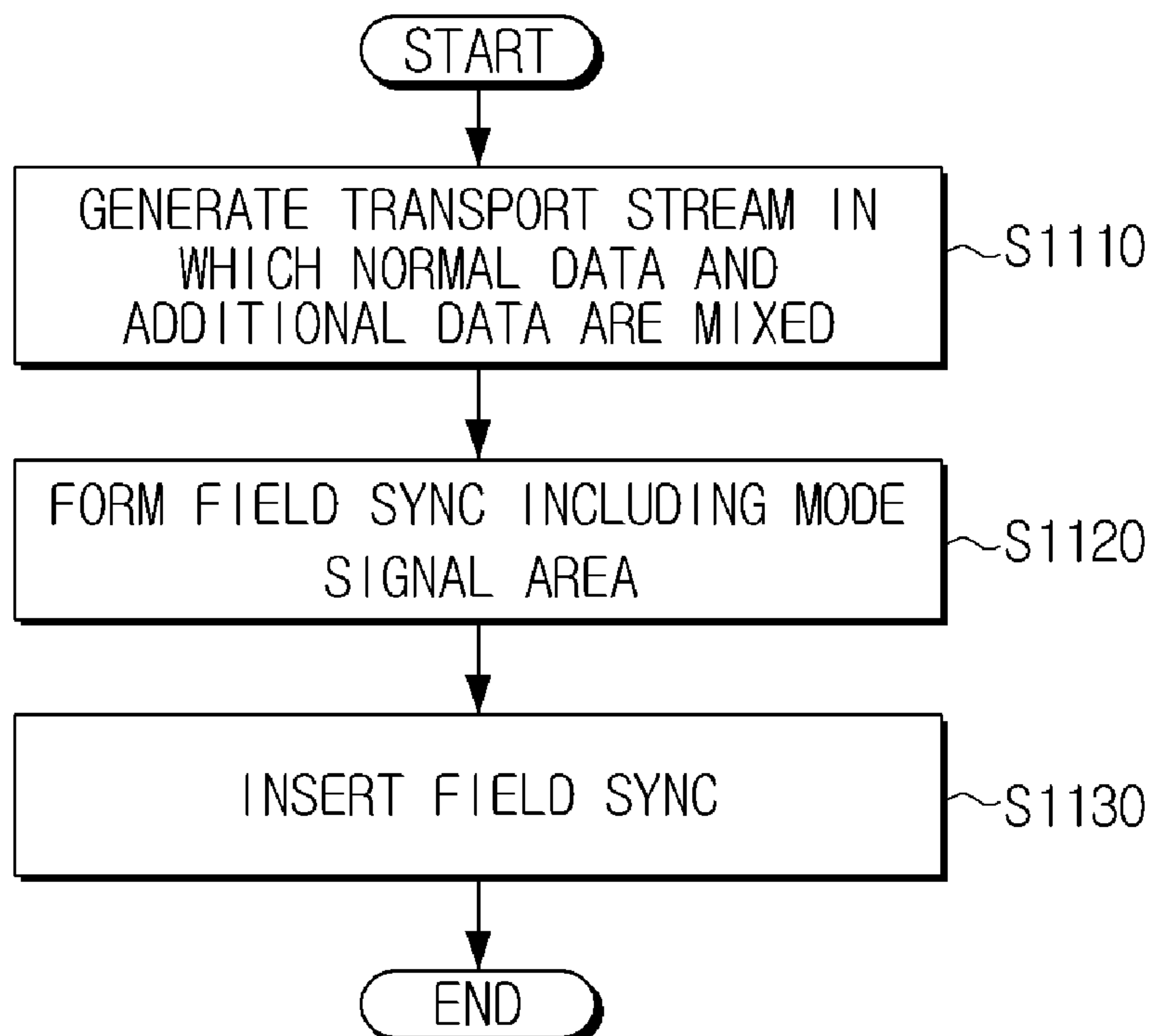
[Fig. 18]



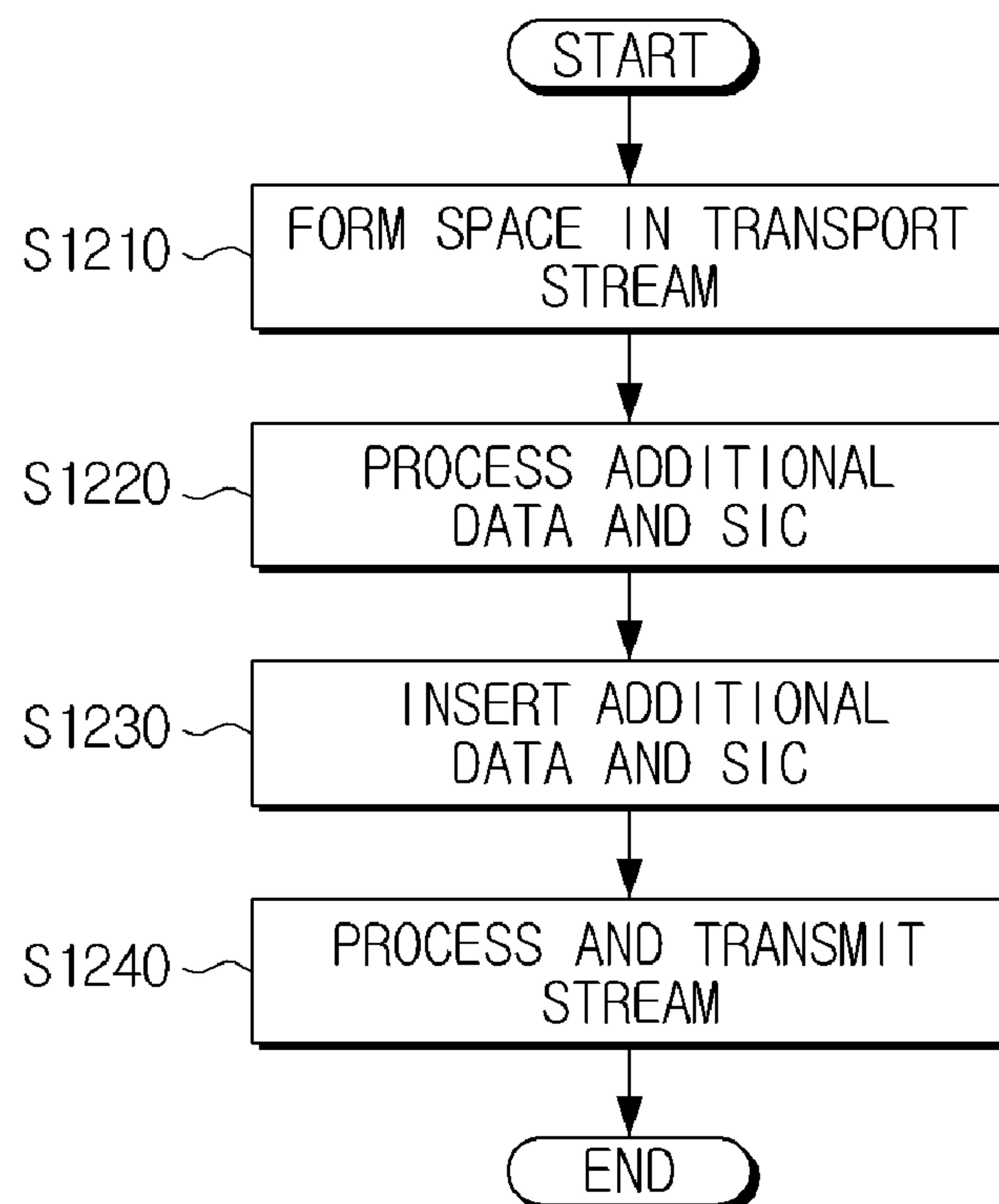
[Fig. 19]



[Fig. 20]



[Fig. 21]



[Fig. 22]

