



(22) **Date de dépôt/Filing Date:** 2005/05/04

(41) **Mise à la disp. pub./Open to Public Insp.:** 2005/11/17

(45) **Date de délivrance/Issue Date:** 2015/09/01

(62) **Demande originale/Original Application:** 2 565 736

(30) **Priorités/Priorities:** 2004/05/06 (US60/568,275);  
2004/12/06 (KR10-2004-0101931)

(51) **Cl.Int./Int.Cl.** *H04H 40/27* (2009.01),  
*H04N 5/44* (2011.01), *H04N 7/08* (2006.01),  
*H04N 19/61* (2014.01), *H03M 13/25* (2006.01)

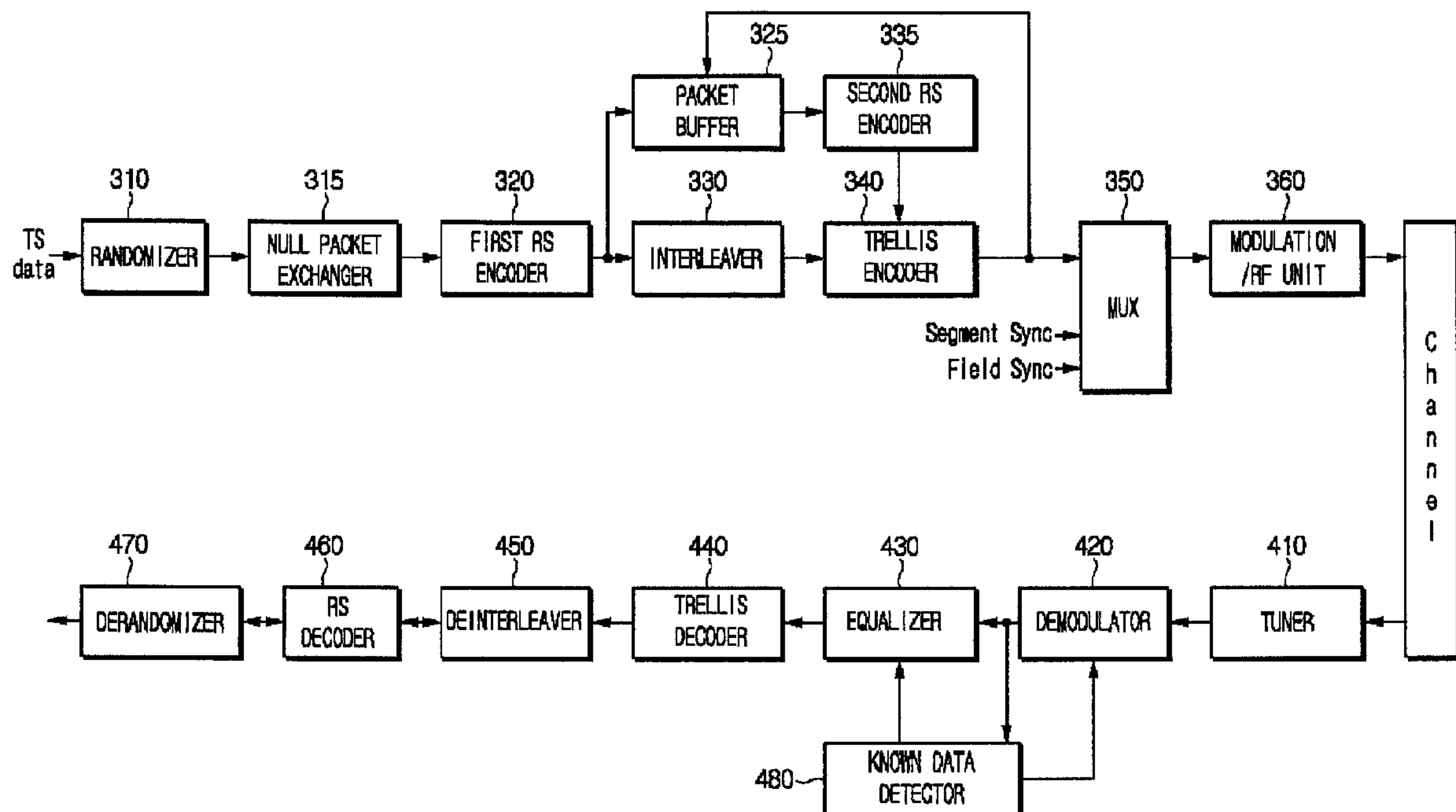
(72) **Inventeurs/Inventors:**  
CHANG, YONG-DEOK, KR;  
JEONG, HAE-JOO, KR;  
PARK, EUI-JUN, KR

(73) **Propriétaire/Owner:**  
SAMSUNG ELECTRONICS CO., LTD., KR

(74) **Agent:** SMART & BIGGAR

(54) **Titre : DERIVES DE PTERIDINE SERVANT D'INHIBITEURS DES POLO-LIKE KINASES UTILES DANS LE TRAITEMENT D'UN CANCER**

(54) **Title: DIGITAL BROADCASTING TRANSMISSION AND/OR RECEPTION SYSTEM TO IMPROVE RECEIVING PERFORMANCE AND SIGNAL PROCESSING METHOD THEREOF**



(57) **Abrégé/Abstract:**

A digital broadcasting transmission and/or reception system having an improved reception performance and a signal-processing method thereof. A digital broadcasting transmitter comprises a randomizer to input and randomize data streams including a

**(57) Abrégé(suite)/Abstract(continued):**

plurality of segments having at least one segment having one or more null packets, a null packet exchanger to create known data having a predetermined pattern and to replace the null packets at positions of the segments having the null packets of the randomized data streams to insert the known data, an encoder to encode the data streams to which the known data is inserted, and a modulation/RF unit to modulate, RF-modulate, and transmit the encoded data streams. A digital broadcasting receiver detects the known data from a signal received from the digital broadcasting transmitter and uses the detected known data for synchronization and equalization, so that a digital broadcasting reception performance of the digital broadcasting receiver can be improved at poor multipath channels.

**Abstract**

**A digital broadcasting transmission and/or reception system having an improved reception performance and a signal-processing method thereof. A digital broadcasting transmitter comprises a randomizer to input and randomize data streams including a plurality of segments having at least one segment having one or more null packets, a null packet exchanger to create known data having a predetermined pattern and to replace the null packets at positions of the segments having the null packets of the randomized data streams to insert the known data, an encoder to encode the data streams to which the known data is inserted, and a modulation/RF unit to modulate, RF-modulate, and transmit the encoded data streams. A digital broadcasting receiver detects the known data from a signal received from the digital broadcasting transmitter and uses the detected known data for synchronization and equalization, so that a digital broadcasting reception performance of the digital broadcasting receiver can be improved at poor multipath channels.**

Digital Broadcasting Transmission and/or Reception System  
to Improve Receiving Performance and Signal Processing  
Method Thereof

This is a divisional application of Canadian application serial No. 2,565,736.

**Technical Field**

- [1] The present general inventive concept relates to a digital broadcasting transmission and/or reception system and a signal processing method thereof, and more particularly, to a digital broadcasting transmission and/or reception system and a signal processing method thereof capable of improving reception performance of a reception system by inserting and transmitting a known sequence into a VSB (Vestigial Side Bands) data stream.

**Background Art**

- [2] Generally, an ATSC (Advanced Television Systems Committee) VSB mode, which is the U.S. terrestrial digital broadcasting system, is a single carrier method, and a field sync is used in a unit of 312 segments.
- [3] FIG. 1 is a block diagram for displaying a transceiver including a digital broadcasting transmitter and a digital broadcasting receiver according to an ATSC DTV standard as a general U.S. terrestrial digital broadcasting system.
- [4] Referring to FIG. 1, the digital broadcasting transmitter has a randomizer 110 for randomizing an MPEG-2 transport stream (TS), a Reed-Solomon (hereafter referred to as 'RS') encoder 120 for adding Reed-Solomon parity bytes into the MPEG-2 transport stream to correct a bit error caused by a channel characteristic in a transporting process, an interleaver 130 for interleaving the RS encoded data according to a certain pattern, and a Trellis encoder for performing trellis encoding by a 2/3-rate to the interleaved data and 8-level symbol mapping to perform error correcting coding for the MPEG-2 transport stream.
- [5] The digital broadcasting transmitter also includes a MUX 150 for inserting a segment sync and a field sync to the error correction coded data, and a Modulator/RF up-converter 160 for inserting a pilot tone after adding a certain DC value in a data symbol that the segment sync and the field sync are inserted, and for performing VSB modulation and up-converting to and transmitting an RF channel band signal.
- [6] Therefore, the digital broadcasting transmitter randomizes the MPEG-2 transport stream, outer-codes the randomized data through the RS encoder 120 which is an outer coder, and distributes the coded data through the interleaver 130. Also, the digital broadcasting transmitter inner-codes the interleaved data through Trellis encoder 140



by a 12 symbol rate, maps the inner coded data by an 8 symbol rate, and then inserts the field sync, the segment sync, and the pilot tone for VSB modulation, and converts to and transmits the RF signal.

[7] Meanwhile, the digital broadcasting receiver includes a tuner/IF 210 for converting a received RF signal to a baseband signal, and a demodulator 220 for synchronizing and demodulating the converted baseband signal, an equalizer 230 for compensating the demodulated signal for channel distortion caused by a multipath, a Trellis decoder 240 for applying error correction and decoding with respect to the equalized signal, a deinterleaver 250 for rearranging the dispersed data by the interleaver 130 of the digital broadcasting transmitter, an RS decoder 260 for correcting errors, a de-randomizer 270 for outputting the MPEG-2 transmission stream by derandomizing the corrected data through RS decoder 260.

[8] Hence, an operation sequence of the digital broadcasting receiver of FIG. 1 is a reverse order of the digital broadcasting transmitter, that is, down-converting the RF signal to the baseband signal, demodulating and equalizing the down-converted signal, performing channel decoding, and restoring the original signal.

[9] FIG. 2 shows a VSB data frame interleaved with a segment sync signal and a field sync signal for the U.S. digital broadcasting (8-VSB) system. Each data frame consists of two data fields, and each field contains a 1 field sync segment and a 312 data segment. In the VSB data frame, the segment is equivalent to one MPEG-2 packet, and can have a 4-symbol segment sync and 828 data symbols.

[10] In FIG. 2, the segment sync signal and field sync signal for sync signals are used for synchronization and equalization at the digital broadcasting receiver. That is, the field sync signal and segment sync signal are data between the digital broadcasting transmitter and receiver to be used as reference signals in equalization by the receiver.

[11] The VSB mode of the U.S. terrestrial digital broadcasting system depicted in FIG. 1 adopts a single carrier method, which has a weakness in multipath fading channel environments with Doppler. Therefore, performance of the digital broadcasting receiver depends on a capacity of the equalizer for eliminating such multipath.

[12] However, the existing transmitting frame of FIG. 2 has a weakness in degrading an equalization performance due to a low frequency in appearance, since the field sync, that is a reference signal of an equalizer, appears once every 313 segments.

[13] That is, it is difficult to estimate channels and to equalize the received signal by eliminating the multipath using an existing equalizer and such small data described above. Due to this, the conventional digital broadcasting receiver has a problem of reception performance deterioration in poor channel environment, particularly in Doppler fading channel environment.

79636-5

3

**Disclosure of Invention****Technical Problem**

[14] The present general inventive concept provides a digital broadcasting transmission and/or reception system and a signal-processing method thereof capable of generating and transmitting a transmission signal to which known data is added at a digital broadcasting transmitter and of detecting the transmission signal at a digital broadcasting receiver, so as to improve the reception capacity of the digital broadcasting receiver.

[15] Additional aspects and advantages of the present general inventive concept will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the general inventive concept.

**Technical Solution**

[16] The foregoing and/or other aspects and advantages of the present inventive concept may be achieved by providing a digital broadcasting transmitter comprising a randomizer to input and randomize data streams including one or more segments with at least one segment having one or more null packets, a null packet exchanger to create known data having a predetermined pattern and to replace the null packets at positions of the one or more segments having the null packets of the randomized data streams to insert the known data, an encoder to encode the data streams to which the known data is inserted, and a modulation/RF unit to modulate, RF-convert, and transmit the encoded data streams.

[17] The data streams may include information about the position at which the known data is inserted.



79636-5

4

[18] The encoder may include a first RS (Reed Solomon) encoder to add a parity of predetermined bytes to the data streams in which the known data is inserted in order to correct errors occurring by channels, an interleaver to  
5 apply data interleaving in a predetermined pattern with respect to the data streams to which the parity is added, and a Trellis encoder to perform a Trellis encoding of the interleaved data stream.

[19] The Trellis encoder may comprise a memory element  
10 for the Trellis-encoding operation, initializes the memory element at the position where the known data is inserted, and applies the Trellis encoding to the known data.

[20] The digital broadcasting transmitter may further comprise a packet buffer to input and temporarily store the  
15 data streams corresponding to the position where the memory element of the Trellis-encoder is initialized from the first RS encoder.

[21] The packet buffer may receive from the Trellis encoder the data streams changed according to the  
20 initialization of the memory element and may update the stored data streams.

[22] The digital broadcasting transmitter may further comprise a second RS encoder to apply the RS encoding to the encoded known data input from the packet buffer to create  
25 and output a changed parity to the Trellis encoder, to replace the parity added by the first RS encoder, and to apply the Trellis encoding to the replaced parity.

[23] The modulation/RF unit modulates the encoded data in a Vestigial Side Bands (VSB) modulation method.

79636-5E

5

[24] The foregoing and/or other aspects and advantages of the present general inventive concept may also be achieved by providing a signal-processing method of a digital broadcasting transmission system, the method comprising inputting and randomizing data streams including one or more segments having at least one segment having one or more null packets, creating known data having a predetermined pattern and replacing the null packets at positions of the segments having the null packets of the randomized data streams to insert the known data, encoding the data streams to which the known data is inserted, and modulating, RF-converting, and transmitting the encoded data streams.

[25] The encoding operation may include adding a parity of predetermined bytes to the data streams in which the known data is inserted in order to correct errors occurring by channels, applying data interleaving in a predetermined pattern to the data streams to which the parity is added, and performing a Trellis encoding of the interleaved data stream.

[26] The Trellis encoding operation may comprise initializing a memory element and performing the Trellis-encoding operation at the position at which the known data is inserted.

[27] The signal-processing method may further comprise inputting and temporarily storing the data streams corresponding to the position where the memory element for the Trellis-encoding operation is initialized from the first RS encoding operation, and inputting and updating the stored data streams as the data streams changed according to the initialization of the memory element in the Trellis encoding operation.



79636-5E

5a

[28] The signal-processing method may further comprise a second RS encoding operation of applying the RS encoding to the known data encoded according to the initialization of the memory element and creating a changed parity, wherein  
5 the Trellis-encoding operation is repeated to replace the parity added in the first RS encoding operation with the changed parity, add and apply the Trellis encoding to the changed parity.

[29] The modulation/RF operation may comprise  
10 modulating the encoded data in a Vestigial Side Bands (VSB) method.

[30] The foregoing and/or other aspects and advantages of the present general inventive concept may also be achieved by providing a digital broadcasting receiver  
15 comprising a tuner to receive a signal from a digital broadcast transmitter and to convert the received signal to a baseband signal, the signal that is encoded by inserting known data with respect to a data stream to which null packets are inserted at a specified position at intervals, a  
20 demodulator to demodulate the baseband signal, a known data detector to detect the known data from the demodulated signal, and an equalizer to equalize the signal demodulated using the detected known data.

[31] The known data may have a predetermined pattern.

25 [32] The known data detector may detect and output to the equalizer the known data using information of the positions at which the known data included in the received signal is inserted.

[33] The known data detector may comprise outputting  
30 the detected known data to the demodulator, and the demodulator may perform demodulating using the known data.

79636-5E

5b

[34] In the meantime, the foregoing and/or other aspects and advantages of the present general inventive concept may also be achieved by providing a signal-processing method of a digital broadcasting reception system, the signal-processing method comprising receiving a signal from a digital broadcast transmitter and converting the received signal to a  
5 baseband signal, the signal that is encoded by inserting known data with respect to a data stream to which null packets are inserted at a specified position at intervals, demodulating the baseband signal, detecting the known data from the demodulated signal, and equalizing the signal demodulated using the detected known data.

[35] The known data may have a predetermined pattern.

10 [36] The known data-detecting operation may comprise detecting the known data using information of the positions at which the known data included in the received signal is inserted.

[37] The known data-detecting operation may further comprise outputting the detected known data to the demodulation operation, and the demodulation operation  
15 comprises performing demodulation using the known data.

[37a] According to one aspect of the present invention there is provided a digital broadcast receiver configured to receive a signal from a digital transmitter, the receiver comprising: a tuner configured to receive the signal transmitted by the digital transmitter, wherein the received signal includes known data at a specified position in data, the known  
20 data being a predefined sequence known between the digital transmitter and the digital broadcast receiver, the data including the known data being encoded to be added a parity of specified bytes thereto, the encoded data being interleaved, the interleaved data including a data format that the known data segment is inserted in every predetermined interval, the interleaved data being trellis encoded to an 8-level symbol at a rate of 2/3 corresponding to  
25 the known data by an initialized trellis encoder of the transmitter, and the trellis encoded data being VSB modulated; a demodulator performing a VSB demodulation of the received, modulated signal; and an equalizer equalizing for removing an interference of the



79636-5E

5c

demodulated signal according to the trellis encoded symbol corresponding to the known data, wherein the known data is a predefined sequence known between the digital transmitter and the digital broadcast receiver, and wherein internal memories of the trellis encoder are initialized when the known data is input to the trellis encoder, the known data being different  
 5 from a segment sync of the data stream.

[37b] According to another aspect of the present invention there is provided a signal-processing method of a digital broadcast receiver configured to receive a signal from a digital transmitter, the signal-processing comprising: receiving the signal transmitted by the digital transmitter, wherein the received signal includes known data at a specified position in data,  
 10 the known data being a predefined sequence known between the digital transmitter and the digital broadcast receiver, the data including the known data being encoded to be added a parity of specified bytes thereto, the encoded data being interleaved, the interleaved data including a data format that the known data segment is inserted in every predetermined interval, the interleaved data being trellis encoded to an 8-level symbol at a rate of 2/3  
 15 corresponding to the known data by an initialized trellis encoder of the transmitter, and the trellis encoded data being VSB modulated; performing a VSB demodulation of the received, modulated signal; and equalizing for removing an interference of the demodulated signal according to the trellis encoded symbol corresponding to the known data, wherein the known data is a predefined sequence known between the digital transmitter and the digital broadcast  
 20 receiver, and wherein internal memories of the trellis encoder are initialized when the known data is input to the trellis encoder, wherein the known data is inserted after a segment sync of the data stream.

### Advantageous Effects

[38] According to the embodiment of the present general inventive concept, the  
 25 digital broadcasting transmitter creates and inserts the null packets into an MPEG-2 transmission stream packet, replaces the inserted null packets with the known data and sends the known data, and the digital broadcasting receiver detects the known data from a received



79636-5E

5d

signal from the digital broadcasting transmitter and uses the known data for the synchronization and equalization so that its digital broadcasting reception performance can be improved on poor multipath channel.

[39] Further, the present general inventive concept can improve an operational  
5 performance of an equalizer and improve digital broadcasting reception performance

by properly controlling the frequency and quantity of the known data for sync and equalization of a receiver.

### Description of Drawings

- [40] These and/or other aspects and advantages of the present general inventive concept will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:
- [41] FIG. 1 is a block diagram showing a transmission/reception system for a general US digital broadcasting system;
- [42] FIG. 2 is a view showing an ATSC VSB data frame structure;
- [43] FIG. 3 is a block diagram showing a digital broadcasting transmission and/or reception system according to an embodiment of the present general inventive concept;
- [44] FIG. 4 is a view showing a format of MPEG-2 packet data according to an embodiment of the present general inventive concept;
- [45] FIG. 5 is a view showing a format of data to which data interleaving is applied;
- [46] FIG. 6 is a view showing a format of data to which Trellis encoding is applied;
- [47] FIG. 7 is a flowchart showing operations of a digital broadcasting transmitter according to an embodiment of the present general inventive concept; and
- [48] FIG. 8 is a flowchart showing operations of a digital broadcasting receiver according to an embodiment of the present general inventive concept.

### Best Mode

- [49] Reference will now be made in detail to the embodiments of the present general inventive concept, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present general inventive concept while referring to the figures.
- [50] FIG. 3 is a block diagram showing a digital broadcasting transmission and/or reception system according to an embodiment of the present general inventive concept. The digital broadcasting transmission and/or reception system may have a digital broadcasting transmitter and a digital broadcasting receiver.
- [51] Referring to FIG. 3, the digital broadcasting transmitter includes a randomizer 310, a null packet exchanger 315, a first RS encoder 320, a packet buffer 325, an interleaver 330, a second RS encoder 335, a Trellis encoder 340, a multiplexer 350, and a modulation and RF unit 360.
- [52] The randomizer 310 randomizes inputted MPEG-2 transmission stream data in order to improve the usage of an allocated channel space.
- [53] The stream data input to the randomizer 310 has a null packet of a segment unit that does not include ordinary data within a segment in a predetermined interval, which



will be described in detail later.

- [54] The null packet exchanger 315 creates a specific sequence (hereinafter, referred to as 'known data') having a predetermined pattern defined beforehand between a transmitter and a receiver, so that the null packet is replaced with the known data in the segment corresponding to the null packet among randomized data streams.
- [55] The known data is used for synchronization and equalization at the receiver since its pattern is distinguished from general transmission and reception payloads so that the known data can be easily detected from payload data.
- [56] The first RS encoder 320 replaces the null packet with the known data by the null packet exchanger 315 in order to correct errors caused by channels, and applies the RS encoding to an outputted data stream, and adds a parity of predetermined bytes.
- [57] The interleaver 330 performs data interleaving in a prescribed pattern with respect to the parity-added packet output from the first RS encoder 320.
- [58] The Trellis encoder 340 converts to a symbol the data outputted from Interleaver 330, and performs 8-level symbol mapping through the Trellis encoding of a 2/3 ratio. The Trellis encoder 340 initializes a value temporarily stored in its memory device in a beginning point of the known data, to a specific value, and performs the Trellis encoding to the known data. For example, the value stored in the memory device is initialized to a '00' state.
- [59] The packet buffer 325 inputs and temporarily stores the known data from data stream outputted in the first RS encoder 320, inputs the known data changed according to initialization if the known data is changed according to the initialization of the memory device of the Trellis encoder 340, and temporarily stores the changed known data replacing the temporarily stored known data before the change, and inputs the changed known data to the second RS encoder 335 for parity re-creation.
- [60] The second RS encoder 335 receives the known data changed according to the initialization, and re-creates and inputs the parity according to the changed known data into the Trellis encoder 340 so as to replace the original parity with a newly created parity, and applies the Trellis encoding to the changed (recreated or input) parity.
- [61] Therefore, the packet data output from the Trellis encoder 340 to the MUX 350 has the known data changed according to the initialization of the memory device of the Trellis encoder 340 and the parity-added data format according to the initialization and the RS encoding.
- [62] The MUX 350 inserts a segment sync signal by a segment unit, as shown in the data format of FIG. 2, to data converted to a symbol by the Trellis encoder 340, inserts a field sync signal by a field unit, and inserts a pilot signal on an edge part of a low frequency band on a frequency spectrum by adding a predetermined DC value to a data signal of a predetermined level.



- [63] The modulation/RF unit 360 pulse-shapes and performs VSB modulation with respect to the data signal into which the pilot signal is inserted, wherein the VSB modulation amplitude-converts the data signal by putting the signal on an intermediate frequency (IF) carrier and the like, and RF-converts, amplifies, and sends the modulated signal in a predetermined band through an allocated channel.
- [64] In the meantime, the digital broadcasting receiver of FIG. 3 includes a tuner 410, demodulator 420, equalizer 430, a Trellis decoder 440, a de-interleaver 450, an RS decoder (460), a derandomizer 470 and a known data detector 480, and decodes a received signal by performing reverse operations of the digital broadcasting transmitter of FIG. 3.
- [65] The tuner 410 tunes the received signal and converts the tuned signal of a tuned band to a baseband signal.
- [66] The demodulator 420 detects a sync signal according to the pilot signal and the sync signal inserted in a signal of the baseband signal and performs demodulation.
- [67] Further, the equalizer 430 removes interference between received symbols by compensating for channel distortion caused by a multipath of channels from a decoded signal. That is, the signal of the baseband signal may be at least one of signals transmitted to the digital broadcasting receiver from the digital broadcasting transmitter through at least one of a plurality of paths, and the multipath of the channels may comprise a first channel and a second channel corresponding to the plurality of paths. The respective symbols of the signals are different from each other due to the different paths or channels through which the signals are transmitted. Therefore, the equalizer 430 can remove the interference occurring between the received symbols of the first and second channels or the plurality of paths, according to the detected known data.
- [68] The Trellis decoder 440 performs error correction, decodes the error-corrected symbols, and outputs symbol data.
- [69] The decoded data re-sorts distributed data by the Interleaver 330 of the digital broadcasting transmitter through the deinterleaver 450.
- [70] The RS decoder 460 corrects errors of the deinterleaved data, and the data corrected through the RS decoder 460 is derandomized through the derandomizer 470 so that the data of MPEG-2 transmission stream is restored.
- [71] In the meantime, the known data detector 480 detects the known data from the decoded data, and provides the known data for sync detection of the demodulator 420 and channel distortion compensation of the equalizer 430.
- [72] FIG. 4 is a view showing an MPEG-2 packet data format according to an embodiment of the present general inventive concept.
- [73] Referring to FIG. 4, a data frame of a general MPEG-2 data stream has a plurality



of segments each having a head part, such as a 3-byte header having a first byte as a sync signal and a PID (Packet Identity), and general payload data A intended to be transmitted. The general payload data of the segment may include a video signal and an audio signal.

[74] According to the embodiment of the present general inventive concept, at least one of the plurality of segments has a null packet, which does not include the general payload data, in a predetermined interval except for the header part. The null packet is disposed between a first number of segments and a second number of segments, and the first number may be the same as the second number. In this case, the null packet is periodically formed in the data stream.

[75] That is, the segment having the null packet does not include separate information intended to be transmitted except for the header part including information about a null packet position.

[76] On the other hand, the embodiment of the present general inventive concept inserts one null packet segment in every predetermined interval for the convenience of explanation, but the frequency and number of null packet segments can be adjusted according to a data transmission rate, channel environment, and so on.

[77] FIG. 5 is a view showing a data format of a data frame to which data interleaving is applied.

[78] Referring to FIGS. 3 through 5, the interleaver 330 disturbs the order of the data stream to distribute data in a time axis so that a transmission signal becomes strong in interference.

[79] Such a data distribution method of the interleaver 330 shows that the null data contained in the same segment regularly and in order appears once every 52 bytes in a width that is equal crosswise to appear sequentially and regularly once every 52 byte.

[80] FIG. 6 is a view showing a format of data to which the Trellis encoding is applied.

[81] Referring to FIGS. 3-6, the Trellis encoder 340 encodes one byte of data outputted from the interleaver 330 into four 8-level symbols.

[82] Each known data byte appearing every 52 bytes is encoded to 4 symbols.

[83] Hereinafter, a symbol created from the Trellis encoding with respect to the known data byte is referred to as a known symbol.

[84] Therefore, 4 known symbols appears every 208 symbols if the Trellis encoding is performed

[85] That is, the known symbol is regularly inserted in a general data stream in a predetermined interval, so that the known symbol can be easily detected from the general data stream.

[86] FIG. 7 is a flowchart showing operations of a digital broadcasting transmitter according to an embodiment of the present general inventive concept.

- [87] Referring to FIGS. 3-7, the randomizer 310 receives and randomizes the MPEG-2 transmission stream including the plurality of segments including the at least one segment having a null packet that does not include ordinary data (S510).
- [88] The data inputted to the randomizer 310 has the data format as shown in FIG. 4.
- [89] In FIG. 4, of the MPEG-2 packets according to the present invention, the at least one segment having the null packet includes the header part having a first byte as the sync signal and a 3-byte PID (Packet Identity), and does not include the general payload data.
- [90] Further, the null packet exchanger 315 creates a packet having the known data, and inserts the packet having the known data at the position of the null packet included in the data randomized in the randomizer 310 (S520).
- [91] The known data has a predetermined pattern as the data known between a transmitter and a receiver so that the known data can be distinguished from the general data and easily detected.
- [92] Further, the error correction encoding is applied to a transmission stream into which the known data output from the null packet exchanger 315 is inserted, so that the errors occurring by a channel are corrected (S530).
- [93] For the error correction encoding, the first RS encoder 320 adds a parity of predetermined bytes by performing the RS encoding, and interleaver 330 performs the data interleaving in a predetermined pattern, the Trellis encoder 340 converts the interleaved data to a symbol and performs a 8-level symbol mapping through the Trellis encoding of a 2/3 ratio.
- [94] In the meantime, the packet buffer 325 inputs and temporarily stores data output from the first RS encoder 320, and, if the known data is trellis-encoded in the Trellis encoder 340 according to initialization, the packet buffer 325 inputs from the Trellis encoder 340 the known data changed as initialized, updates the known data temporarily stored before change, and temporarily stores the changed known data.
- [95] The changed known data input to the packet buffer 325 is input to the second RS encoder 335 for parity recreation
- [96] The second RS encoder 335 applies the RS encoding to the changed known data to create a changed parity, and sends the created parity to the Trellis encoder 340.
- [97] Accordingly, the Trellis encoder 340 replaces a previous parity with the changed parity input from the second RS encoder 335, applies the Trellis encoding to the changed parity, and outputs the Trellis-encoded parity according to the output symbol data already Trellis-encoded.
- [98] Therefore, the packet data outputted to the MUX 350 in the Trellis encoder 340 is the data Trellis-encoded to the 8-level symbol with respect to the known data changed according to the initialization of the memory device of the Trellis encoder 340 and the



packet data parity-added by the RS encoding.

[99] Further, a segment sync signal is inserted to each segment of the symbol data, a field sync signal is inserted to each field, and a pilot signal is inserted on a frequency spectrum (S540).

[100] Further, the modulation/RF unit 360 performs the VSB modulation such as the pulse shaping of a signal into which a pilot signal is inserted, the amplitude modulation of an Intermediate Frequency carrier, and so on, RF-converts and amplifies the modulated signal, and transmits the amplified signal through an allocated channel (S550).

[101] As stated above, the digital broadcasting transmitter creates and inserts null packets into the MPEG-2 transmission stream, replaces the inserted null packets with the known data, and sends the known data, and the digital broadcasting receiver detects and uses the known data so as to improve its reception performance such as the sync acquisition and equalization performance.

#### **Mode for Invention**

[102]

#### **Industrial Applicability**

[103] The present general inventive concept relates to a digital broadcasting transmission and/or reception system and a signal processing method thereof, and more particularly, to a digital broadcasting transmission and/or reception system and a signal processing method thereof capable of improving reception performance of a reception system by inserting and transmitting a known sequence into a VSB (Vestigial Side Bands) data stream.

#### **Sequence List Text**

[104]

79636-5E

12

CLAIMS:

1. A digital broadcast receiver configured to receive a signal from a digital transmitter, the receiver comprising:

a tuner configured to receive the signal transmitted by the digital transmitter,

5 wherein the received signal includes known data at a specified position in data, the known data being a predefined sequence known between the digital transmitter and the digital broadcast receiver, the data including the known data being encoded to be added a parity of specified bytes thereto, the encoded data being interleaved, the interleaved data including a data format that the known data segment is inserted in every predetermined  
10 interval, the interleaved data being trellis encoded to an 8-level symbol at a rate of 2/3 corresponding to the known data by an initialized trellis encoder of the transmitter, and the trellis encoded data being VSB modulated;

a demodulator performing a VSB demodulation of the received, modulated signal; and

15 an equalizer equalizing for removing an interference of the demodulated signal according to the trellis encoded symbol corresponding to the known data,

wherein the known data is a predefined sequence known between the digital transmitter and the digital broadcast receiver, and

wherein internal memories of the trellis encoder are initialized when the known  
20 data is input to the trellis encoder, the known data being different from a segment sync of the data stream.

2. The digital broadcast receiver as claimed in claim 1, further comprising:

a known data detector detecting the known data from the demodulated signal and providing at least one of the demodulator and the equalizer with the detected known data.

79636-5E

13

3. The digital broadcast receiver as claimed in claim 1, further comprising:  
a Trellis decoder error correcting on the equalized signal.
4. The digital broadcast receiver as claimed in claim 3, further comprising:  
a de-interleaver de-interleaving the error corrected signal.
- 5 5. The digital broadcast receiver as claimed in claim 4, further comprising:  
a Reed Solomon (RS) decoder RS decoding the de-interleaved signal.
6. The digital broadcast receiver as claimed in claim 5, further comprising:  
a de-randomizer de-randomizing the RS decoded signal.
7. A signal-processing method of a digital broadcast receiver configured to  
10 receive a signal from a digital transmitter, the signal-processing comprising:  
  
receiving the signal transmitted by the digital transmitter,  
  
wherein the received signal includes known data at a specified position in data,  
the known data being a predefined sequence known between the digital transmitter and the  
digital broadcast receiver, the data including the known data being encoded to be added a  
15 parity of specified bytes thereto, the encoded data being interleaved, the interleaved data  
including a data format that the known data segment is inserted in every predetermined  
interval, the interleaved data being trellis encoded to an 8-level symbol at a rate of 2/3  
corresponding to the known data by an initialized trellis encoder of the transmitter, and the  
trellis encoded data being VSB modulated;
- 20 performing a VSB demodulation of the received, modulated signal; and  
  
equalizing for removing an interference of the demodulated signal according to  
the trellis encoded symbol corresponding to the known data,



79636-5E

14

wherein the known data is a predefined sequence known between the digital transmitter and the digital broadcast receiver, and

wherein internal memories of the trellis encoder are initialized when the known data is input to the trellis encoder,

5 wherein the known data is inserted after a segment sync of the data stream.

8. The signal-processing method as claimed in claim 7, further comprising:

detecting the known data from the demodulated signal and providing at least one of the performing a VSB demodulation and the removing an interference with the detected known data.

10 9. The signal-processing method as claimed in claim 7, further comprising:  
error correcting on the equalized signal.

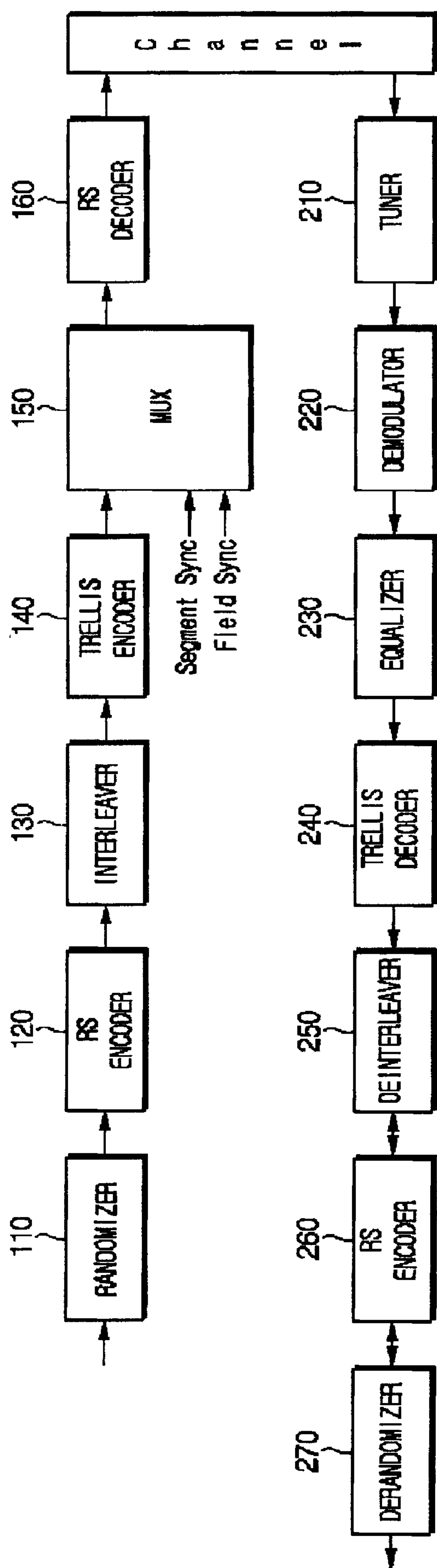
10. The signal-processing method as claimed in claim 9, further comprising:  
de-interleaving the error corrected signal.

11. The signal-processing method as claimed in claim 10, further comprising:

15 RS decoding on the de-interleaved signal.

12. The signal-processing method as claimed in claim 11, further comprising:  
de-randomizing the RS decoded signal.

1/5



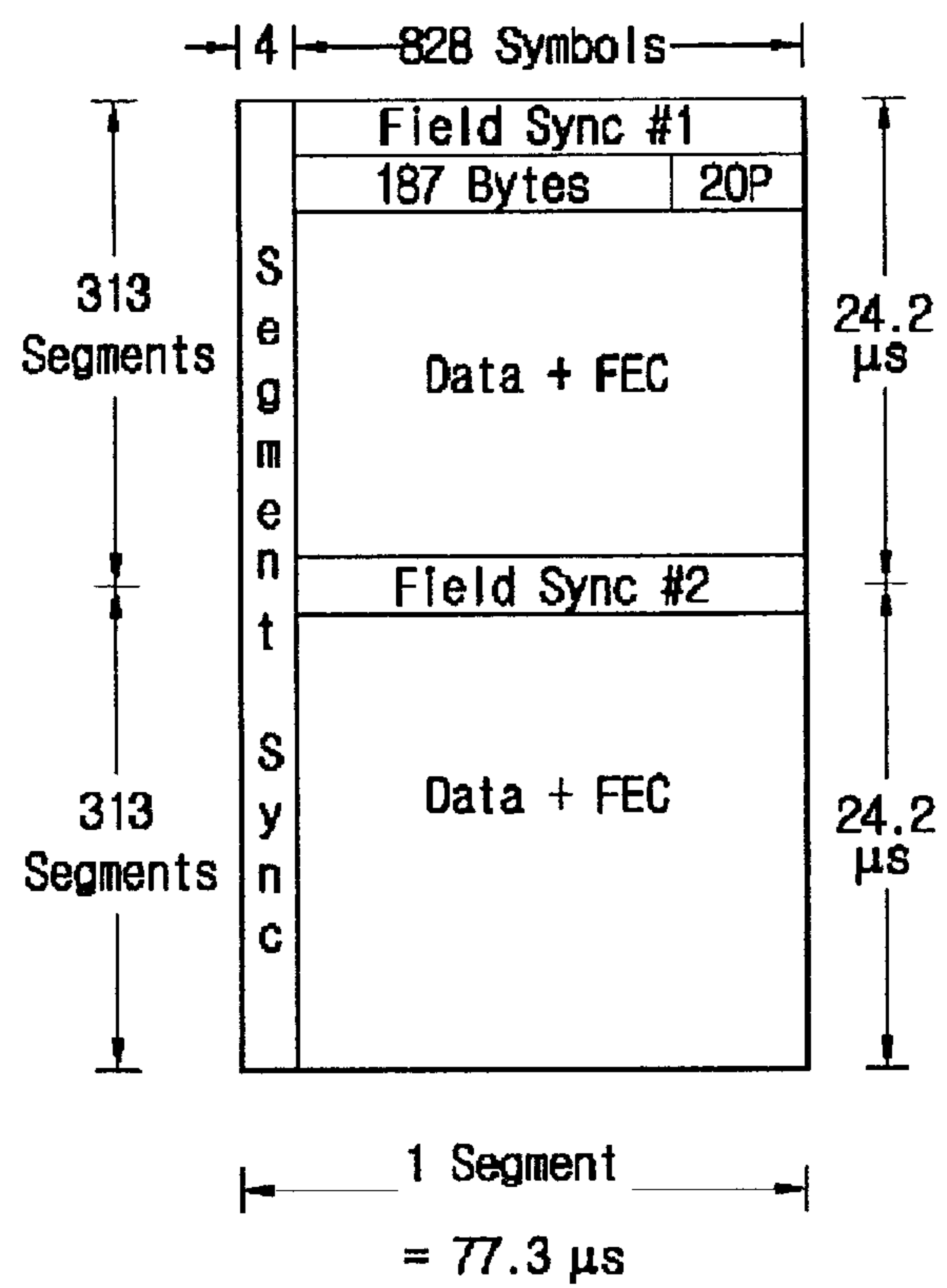
[Fig. 1]



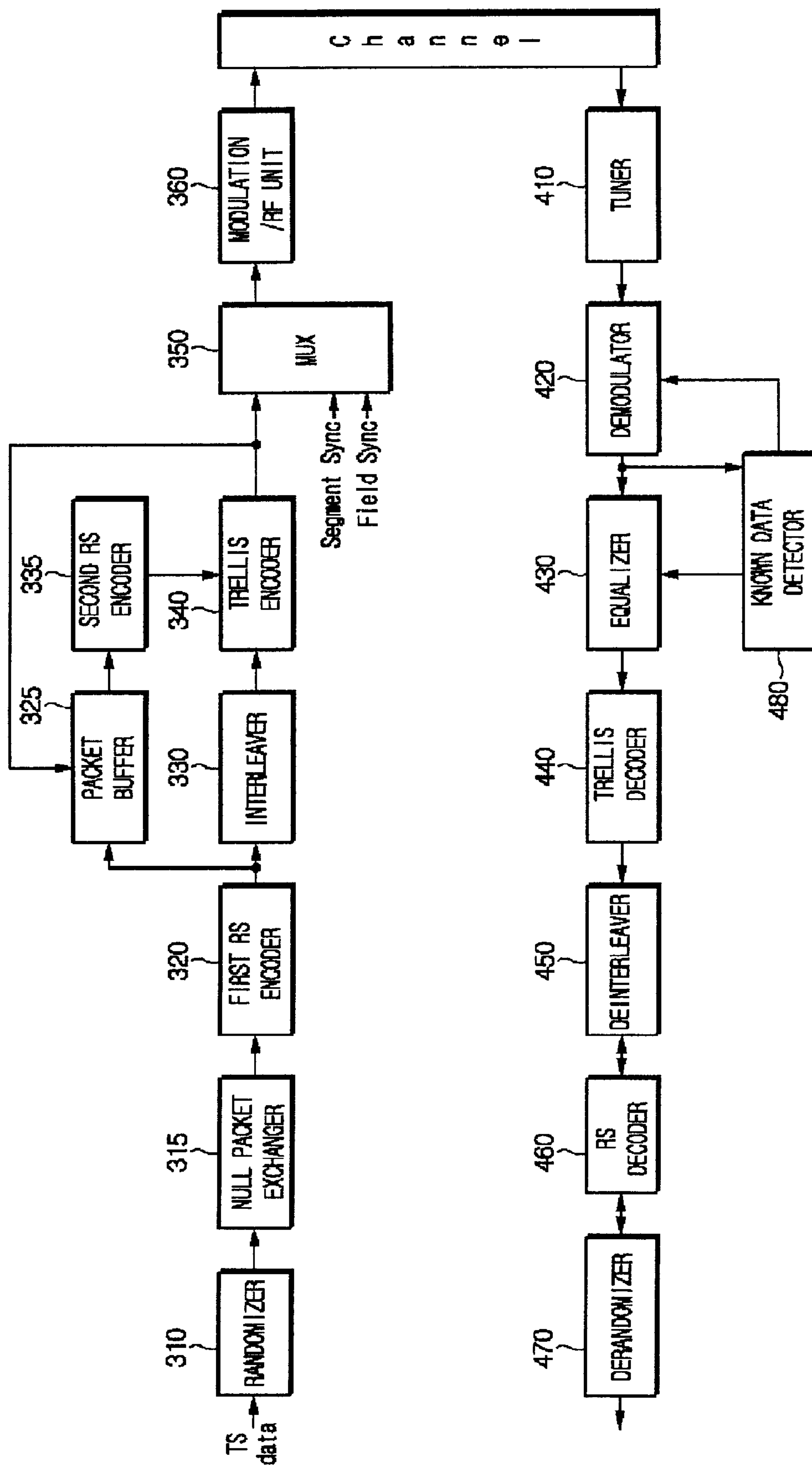
WO 2005/109877

PCT/KR2005/001313

[Fig. 2]

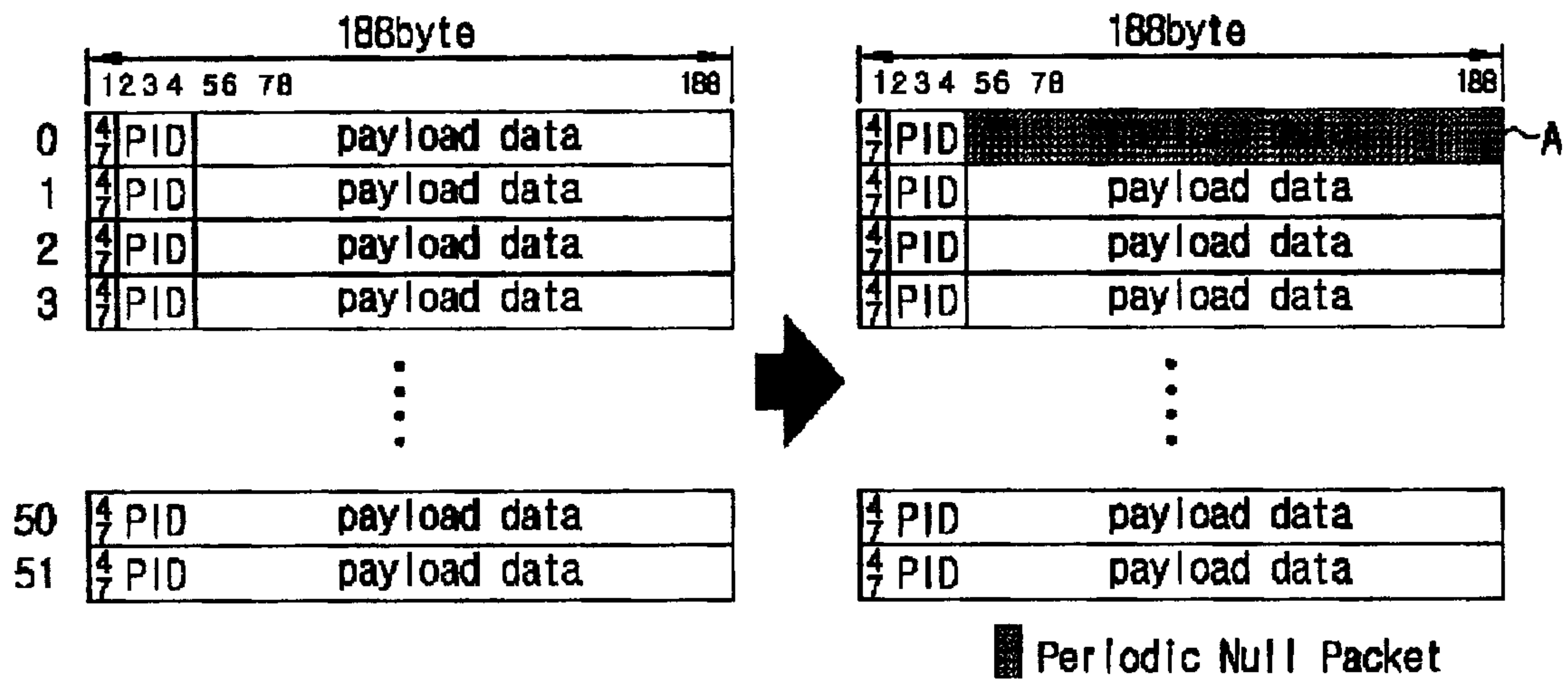


[Fig. 3]

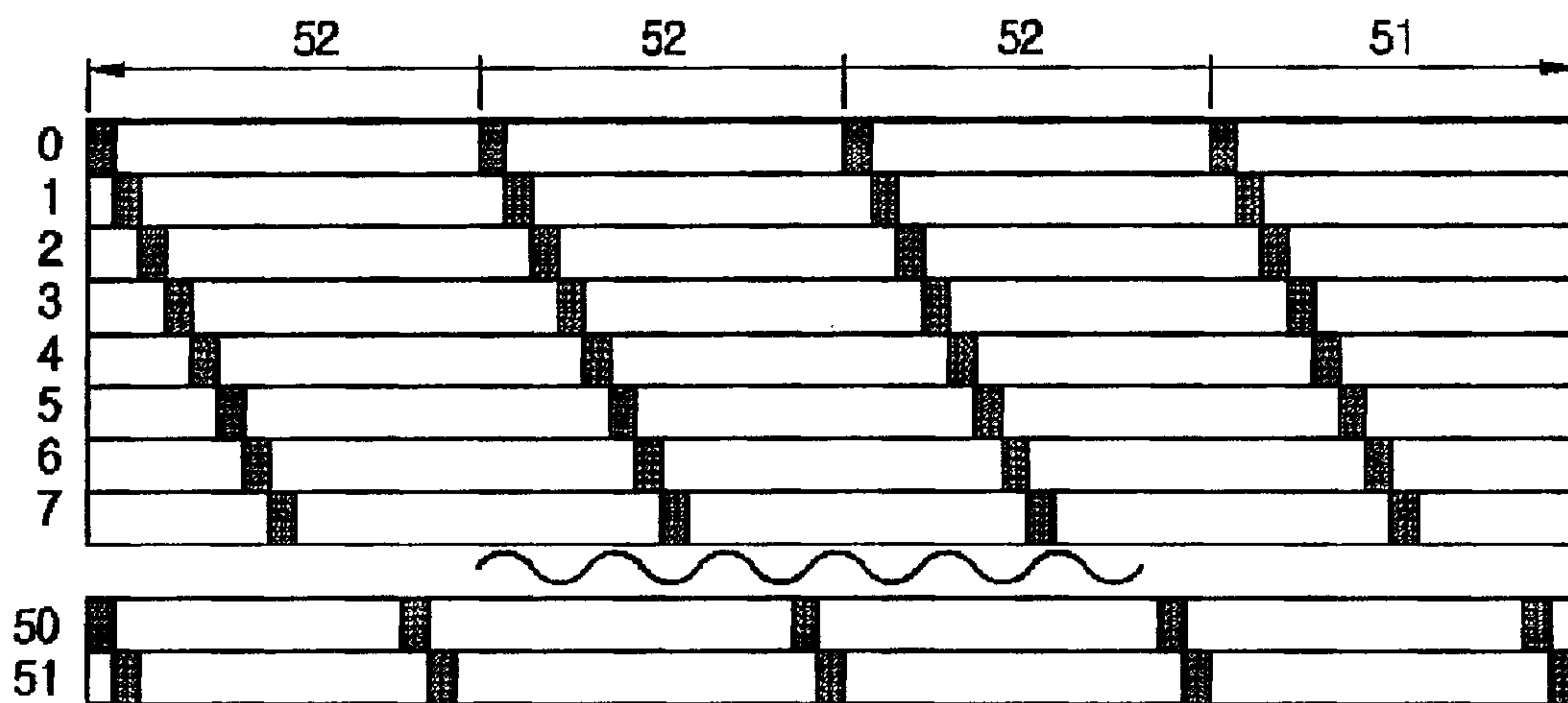




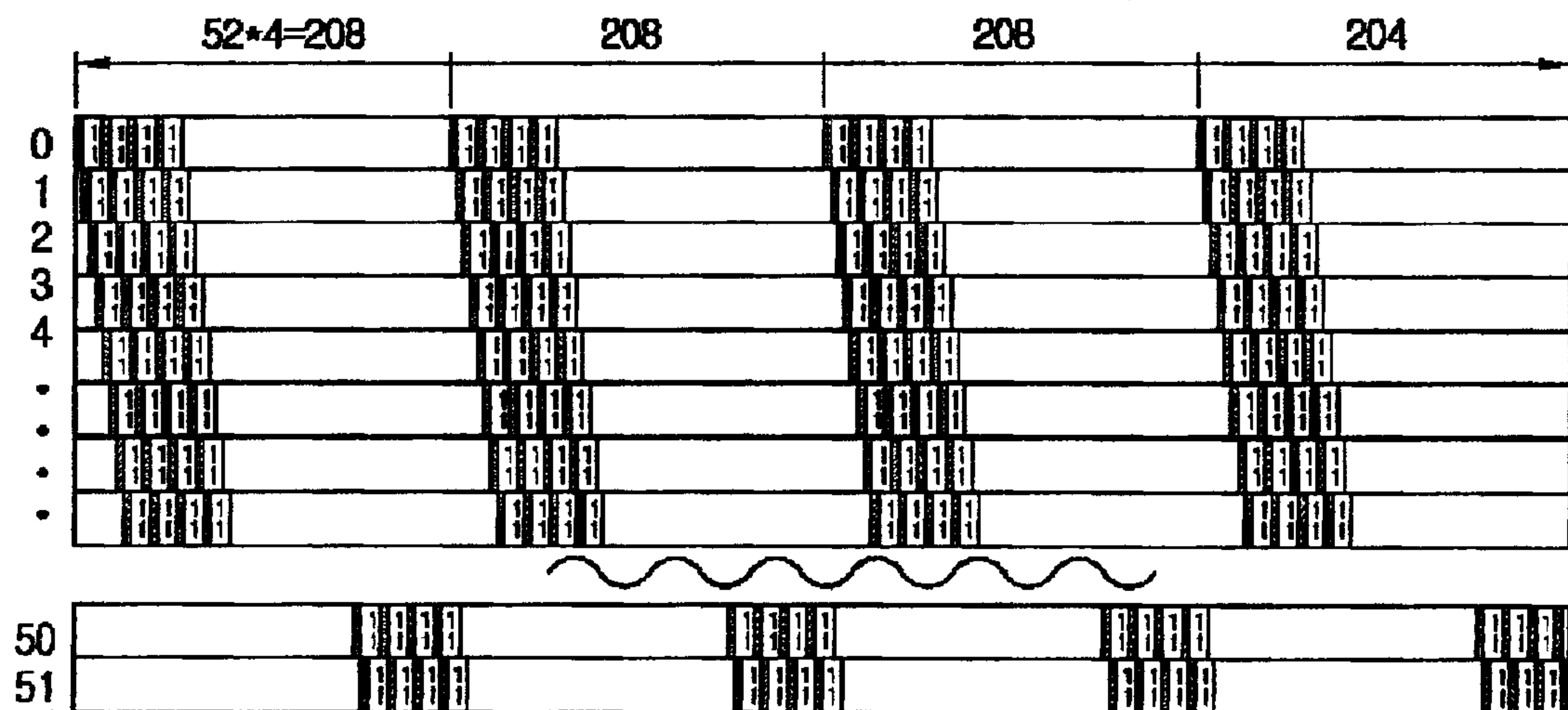
[Fig. 4]



[Fig. 5]



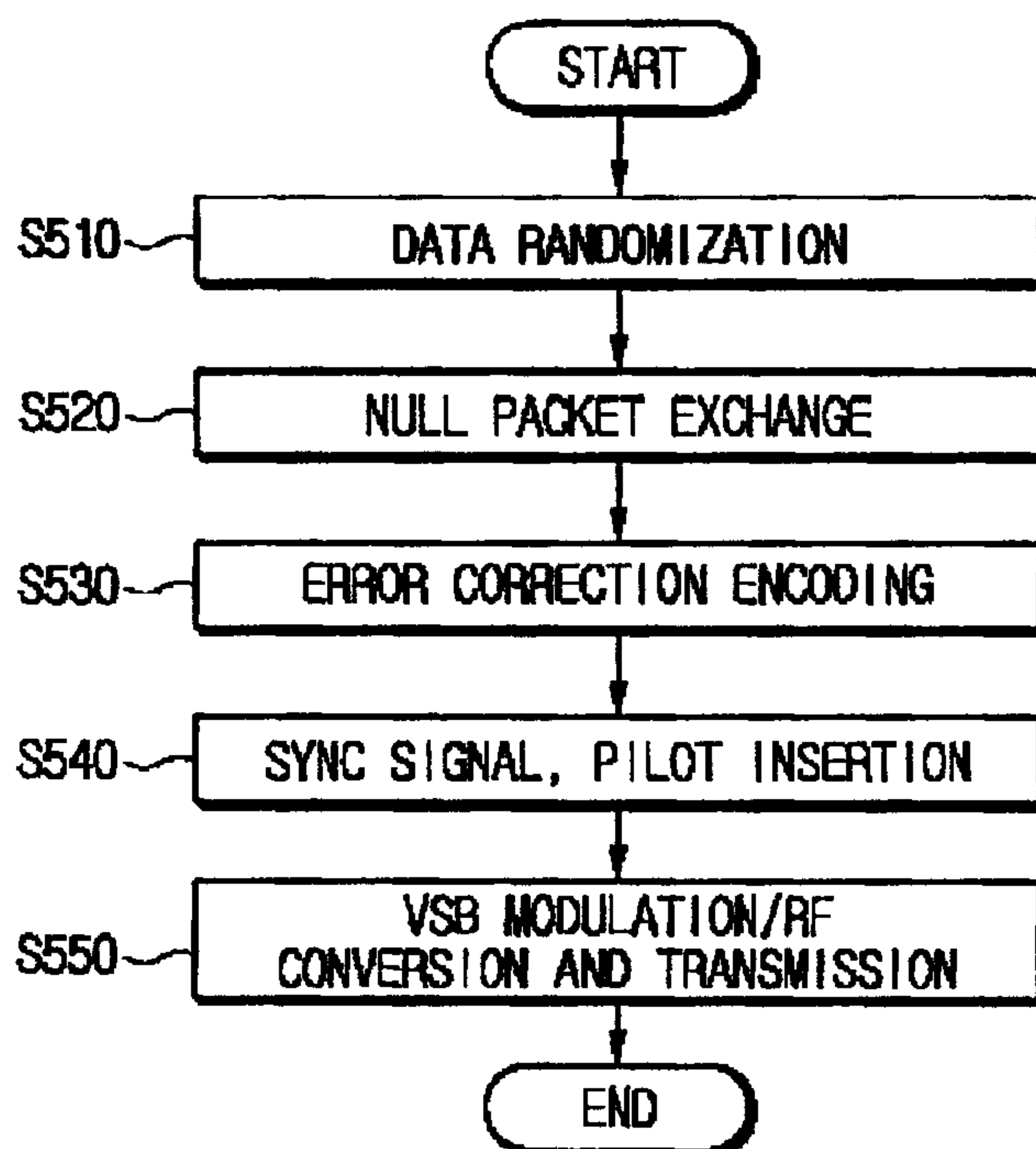
[Fig. 6]



WO 2005/109877

PCT/KR2005/001313

[Fig. 7]



[Fig. 8]

