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(54) **Title**: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS

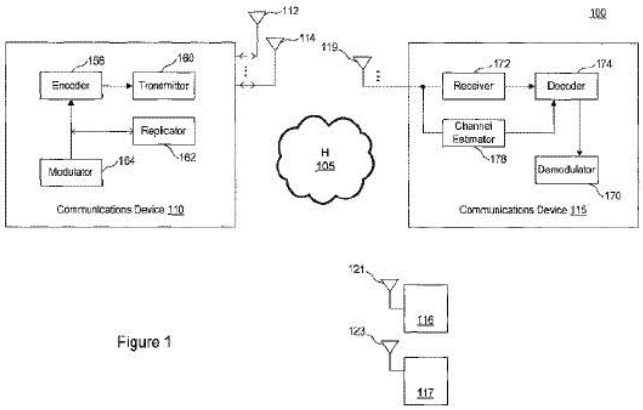


Figure 1

(57) **Abstract**: Examples are generally described that include transmission methods including inserting at least a portion of data from a first data stream into a second data stream to be transmitted over a communications channel. On receipt of the two data streams, examples of receiving methods include receiving the replicated data, decoding the replicated data using an estimated channel matrix, and generating an updated estimate of the channel matrix based, at least in part, on the replicated data.

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INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS

BACKGROUND

[001] Unless otherwise indicated herein, the materials described in this section are not prior art to the claims in this application and are not admitted to be prior art by inclusion in this section.

[002] Multiple-input multiple-output (MIMO) communication systems employ multiple transmit antennas and multiple receive antennas to communicate data symbols over a communications channel. MIMO communication systems may allow a plurality of mobile stations to be serviced utilizing a same frequency band. In this manner, MIMO communication systems may advantageously increase an amount of data the communication systems is able to send to users.

[003] MIMO systems may find use in a variety of applications including, but not limited to, wireless networks, cellular systems including 3G and 4G systems, such as 3GPP LTE-Advanced, local and wide area networks, and wireless broadband systems (such as WiMAX).

[004] Generally, a transmitter in a MIMO system may have a plurality of antennas. Receiving devices may each have a single antenna for receipt of data over the communications channel, or may have multiple antennas.

[005] The communications channel, however, may introduce a variety of non-idealities to a transmitted signal, such as may be caused by multipath interference, reflections, motion of one or more mobile stations, or other properties of a communications channel. The signals received by a receiver over the communications channel may be related to the transmitted signals by a channel matrix **H**. The channel matrix generally refers to a matrix of data which may represent the operation of the communications channel on the transmitted data symbols, including representations of such effects as reflections.

[006] Orthogonal frequency division multiplexing (OFDM) modulation techniques may be used to modulate data for transmission over a communications channel. OFDM generally involves modulating different portions of the data to be transmitted using different sub-carrier frequencies.

[007] Block coding techniques may be used in communication systems to encode data and transmit multiple data streams over a communications channel, which may improve the reliability of data transfer. Block coding techniques include space-time block coding, which

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may transmit multiple data streams across multiple antennas. Alamouti space time block coding is one particular type of space-time block coding known in the art. Space-time block coding techniques may require that the communications channel be constant during consecutive data transmission times, which may not always be advantageous. Another type of block coding technique is space-frequency block coding. Alamouti space-frequency block coding is one particular type of space-frequency block coding known in the art. Space-frequency block coding techniques may require that different frequencies experience similar communications channel properties, which may be more advantageous in some cases.

[008] Block coding techniques may commonly be used in conjunction with OFDM. Decoding of block encoded OFDM transmissions may require knowledge of properties of the communications channel over which the transmission is received. Accordingly, systems utilizing block encoded OFDM transmissions generally measure one or more properties of the communications channel, such as the channel matrix. One way to measure properties of the communications channel is to insert pilot symbols into the transmitted data streams. The pilot symbols may be known to the receiver and the known pilot symbols may be compared with the received signals to generate an estimate of one or more properties of the communications channel. The need to insert pilot symbols into the transmitted data streams may adversely effect a data rate attainable in the communications system.

BRIEF DESCRIPTION OF THE DRAWINGS

[009] The foregoing and other features of the present disclosure will become more fully apparent from the following description and appended claims, taken in conjunction with the accompanying drawings. Understanding that these drawings depict only several examples in accordance with the disclosure and are, therefore, not to be considered limiting of its scope, the disclosure will be described with additional specificity and detail through use of the accompanying drawings, in which:

[010] In the drawings:

Figure 1 is a schematic illustration of an example system that is configured for communication over a communications channel in accordance with at least some examples of the present disclosure;

Figure 2 is a schematic illustration of components of the communications device 110 arranged in accordance with examples of the present disclosure;

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Figure 3 is a schematic illustration of signals transmitted over a communications channel in accordance with examples of the present disclosure;

Figure 4 is a schematic illustration of components of the communications device 115 arranged in accordance with examples of the present disclosure;

Figure 5 is a schematic illustration of signals transmitted over the communications channel in accordance with some examples of the present disclosure;

Figure 6 is an example method for transmitting signals over a communications channel arranged in accordance with an example of the present disclosure;

Figure 7 is an example method for receiving signals over a communications channel arranged in accordance with an example of the present disclosure; and

Figure 8 is a block diagram illustrating an example computing device 800 that is arranged for generating an updated channel estimate in accordance with examples of the present disclosure.

SUMMARY

[011] The present disclosure describes a method of transmitting data over a communications channel. Some example methods may include modulating data, inserting data from one stream into another stream, and/or transmitting the data streams over a communications channel. The modulation may be performed in accordance with an orthogonal frequency division multiplexing technique, and may generate at least a first and second data stream for transmission using respective transmit antennas. The inserting may insert at least a portion of data from the first data stream into the second data stream.

[012] The present disclosure describes methods of decoding a signal transmitted over a communications channel. Example methods may include, receiving a pilot symbol over the communications channel, estimating a channel matrix of the communications channel based, at least in part, on the pilot symbol, receiving replicated data from multiple data streams transmitted over the communications channel, decoding the replicated data using the estimated channel matrix, and/or generating an updated estimate of the channel matrix based, at least in part, on the replicated data.

[013] The present disclosure describes communications devices. Example communications devices may include a modulator, a replicator, an encoder, and/or a transmitter. The modulator may be configured to modulate data in accordance with an orthogonal frequency division multiplexing technique for transmission over a communications channel using at

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least a first and a second transmit antenna. The modulator may be further configured to generate at least a first data stream for transmission with the first antenna and a second data stream for transmission with the second antenna. The replicator may be coupled to the modulator and configured to receive the first and second data streams. The replicator may also be configured to insert at least one data symbol from the first data stream into the second data stream. The encoder may be coupled to the replicator and may be configured to receive the first and second data streams including the inserted at least one symbol. The encoder may be configured to encode the first and second data streams in accordance with a block coding technique. The transmitter may be coupled to the encoder and may be configured to receive the encoded first and second data streams. The transmitter may be configured to transmit the fist data stream over the communications channel using the first antenna and further configured to transmit the second data stream including the inserted at least one symbol over the communications channel using the second antenna.

[014] Example communications devices may include a receiver, a decoder, and/or a channel estimator. The receiver may be configured to receive signals over a communications channel, wherein the signals are based at least in part on first and second data streams transmitted over a communications channel, wherein the second data stream includes at least one data symbol replicated from the first data stream. The decoder may be coupled to the receiver and the channel estimator. The decoder may be configured to receive the received signals and decode the at least one data symbol replicated from the first data stream. The channel estimator may be coupled to the decoder and the receiver, and may be configured to receive the received signals and the decoded at least one data symbol. The channel estimator may be configured to estimate a channel matrix of the communications channel based, at least in part, on the decoded at least one data symbol. The decoder may also be configured to decode subsequent received signals based, at least in part, on the estimate of the channel matrix.

[015] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

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DETAILED DESCRIPTION

[016] The following detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. The illustrative examples described in the detailed description, drawings, and claims are not meant to be limiting. Other examples may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented herein. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the Figures, can be arranged, substituted, combined, separated, and designed in a wide variety of different configurations, all of which are implicitly contemplated herein.

[017] This disclosure is drawn, inter alia, to methods, systems, devices, and/or apparatus generally related to use of replicated data as a pilot symbol in a communications system. Examples of transmission methods include inserting at least a portion of data from a first data stream into a second data stream to be transmitted over a communications channel. On receipt of the two data streams, examples of receiving methods include receiving the replicated data, decoding the replicated data using an estimated channel matrix, and generating an updated estimate of the channel matrix based, at least in part, on the replicated data.

[018] Figure 1 is a schematic illustration of an example system that is configured for communication over a communications channel in accordance with at least some examples of the present disclosure. A system 100 may be a multiuser multiple-input multiple-output system configured for communication over a communications channel 105. System 100 may include a communications devices 110, 115, 116, and/or 117. The communications devices may be operated by users (not shown).

[019] The communications device 110 may be implemented as a base station and may be configured to communicate with multiple mobile stations 115, 116, and 117. The communications device 110 may include antennas 112 and 114, which may be utilized to communicate over the communications channel 105 using multiple antennas for spatial diversity to communicate with multiple users over each frequency.

[020] The communications device 110 may include antennas 112 and 114, an encoder 158, a transmitter 160, a replicator 162, and/or a modulator 164. Antennas 112 and 114 may be coupled to the transmitter 160. The encoder 158 may be coupled to transmitter 160. The

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modulator 164 may be coupled to encoder 158. The replicator 162 may be coupled to modulator 164 and encoder 158.

[021] The modulator 164 may be configured to receive data for transmission over the communications channel 105. The modulator 164 may be configured to modulate the data in accordance with one or more modulation techniques, such as orthogonal frequency division multiplexing (OFDM). Any suitable modulator may be used, and modulator 164 may be implemented in hardware, software, or combinations thereof. The modulator 164 may accordingly generate multiple data streams for communication over the communications channel, one for transmission using each of the respective antennas 112 and 114 in some examples. Pilot symbols may be inserted into the data streams by the modulator 164 or may be inserted before or after the modulator 164 in some examples.

[022] The replicator 162 may be configured to receive one or more data streams generated by the modulator. The replicator 162 may be configured to replicate at least a portion of data from one data stream and insert the replicated data into another data stream, as will be described further below. Any suitable hardware, software, or combinations thereof may be used to implement the replicator 162, including a mixer.

[023] The encoder 158 may be configured to receive one or more data streams generated by the modulator 164 and which may have been modified by the replicator 162. The encoder 158 may be configured to encode the data streams in accordance with a block encoding technique, such as space-time or space-frequency block coding, including in some examples Alamouti space-time or Alamouti space-frequency block coding.

[024] The transmitter 160 may be configured to transmit the encoded data over the communications channel 105 via the cooperative operation of the transmitter 160 and one or more of antennas 112 and/or 114.

[025] Although not shown in Figure 1, the communications device 110 may also include components configured to receive, decode, and demodulate signals received over the communications channel. That is, the communications device 110 may both send and receive signals over the communications channel in some examples.

[026] The communications device 115 may include antenna 119, a receiver 172, a decoder 174, a channel estimator 178, and/or a demodulator 170. Antenna 119 may be coupled to the receiver 172 and the channel estimator 178. The channel estimator 178 may also be coupled to the decoder 174. The demodulator 170 may be coupled to the decoder 174.

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[027] The receiver 172 is configured to cooperate with antenna 119 to receive signals over the communications channel 105 and provide the received signals to decoder 174. Although not shown in Figure 1, in some examples, multiple antennas may be provided at the communications device 115. In examples using Alamouti encoding and decoding, however, a single receive antenna may generally be used to receive signals over the communications channel 105. Any suitable receiver may be used and the receiver 172 may be implemented in hardware, software, or combinations thereof. As will be described further below, the received signals may include data

[028] The decoder 174 may be configured to decode signals received from the receiver 172 to provide data. Any of a variety of decoding techniques may be used in accordance with a technique used to encode the signals received by the receiver 172. Examples of decoding techniques include block decoding techniques including space-time and space-frequency block decoding, and Alamouti space-time and space-frequency decoding in some examples. Any suitable decoder may be used and the decoder 174 may be implemented in hardware, software, or combinations thereof.

[029] The demodulator 170 may be configured to demodulate decoded data from the decoder 174. The demodulator 170 may generally implement any demodulation technique, including demodulation in accordance with orthogonal frequency division multiplexing (OFDM) techniques. Any suitable demodulator may be used, and the demodulator 170 may be implemented in hardware, software, or combinations thereof.

[030] The channel estimator 178 may be configured to estimate all or a portion of a channel matrix H associated with the communications channel 105. As will be described further below, the channel estimator 178 may utilize pilot symbols to estimate the channel matrix. The channel estimator 178 may also be configured to use decoded replicated data as a pilot symbol to estimate the channel matrix and/or update an estimate of the channel matrix. By utilizing replicated data to generate or update an estimate of the channel matrix, the communications device 115 may in some examples require fewer pilot symbols to be inserted into signals communicated over the communications channel 105. Reducing a number of pilot symbols inserted into the transmitted signals may advantageously improve the data rate of the communications system 100 in some examples.

[031] Although not shown in Figure 1, the communications device 115 may also include components such as a transmitter, encoder, and/or modulator, for transmitting signals over

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the communications channel 105. That is, in some examples, the communications device 115 may both transmit and receive signals over the communications channel.

[032] Communications devices 116 and 117 may be similarly configured to communications device 115. The communications device 116 may include antenna 121. The communications device 117 may include antenna 123.

[033] The communications channel 105 may generally include any suitable medium for transmitting electromagnetic signals. The communications channel 105 may be characterized by the channel matrix H describing the operation of the communications channel 105 on transmitted symbols. The channel matrix H may provide a representation of effects such as reflections in the communications channel. The channel matrix H may vary over time, and may be calculated periodically in some examples. While a single communications channel 105 is illustrated in Figure 1, any number of communications channels may be used.

[034] Any number of communications devices may be included in the communications system 100, including the communications devices 115, 116, and 117. Although not shown, the communications devices 116 and 117 may include analogous components to those shown in mobile station 115. The communications devices 115, 116, and 117 may be implemented as mobile stations in some examples.

[035] Figure 2 is a schematic illustration of components of the communications device 110 arranged in accordance with examples of the present disclosure. The modulator 164 may include a mapping and pilot insertion block 202, which may be coupled to a serial to parallel converter 204, which may be coupled to an inverse Fourier transform (IFFT) block 206, which may be coupled to a parallel to serial converter 208. The replicator 162 may be coupled to the parallel to serial converter 208. The encoder 158 may be coupled to the replicator 162.

[036] During operation, data for transmission over a communications channel may be provided to the mapping and pilot insertion block 202, which may be configured to map the data to symbols and insert pilot symbols into the data stream. In some examples, the pilot symbols may be inserted at a later point in the signal processing stream. The serial to parallel converter 204, IFFT 206, and parallel to serial converter 208 may be configured to modulate the data stream in accordance with an OFDM technique to generate multiple data streams for transmission over the communications channel. The replicator 162 may replicate a portion of the modulated data such that some data symbols from one stream are inserted into another stream. The space-time encoder 158 may then encode the data streams, including inserted

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symbols, for transmission over the communications channel. The configuration of Figure 2 may provide for space-time encoding of the data streams.

[037] Figure 3 is a schematic illustration of signals transmitted over a communications channel in accordance with examples of the present disclosure. The signals 302, 303, 304, and 305 of Figure 3 may be transmitted by the transmitter 160 of Figure 1 in some examples, and received by the receiver 172. The example of Figure 3 illustrates signals encoded using a space-time block coding technique. In particular, signals 302 and 303 may be transmitted during a first time period while signals 304 and 305 are transmitted during a second time period. Signals 302 and 304 may be transmitted from one location, such as by the antenna 112 of Figure 1. Signals 303 and 305 may be transmitted from another location, such as by the antenna 114 of Figure 1. The relationships between the signals 302, 303, 304, and 305 may generally be specified by the space-time coding technique used. Each of the illustrated signals may encode multiple data symbols, shown as boxes in Figure 3. For example, the signal 302 may encode the symbols 310-317. Pilot symbols may also be encoded by the signals. In the example of Figure 3, the symbols 310 and 314 may represent pilot symbols. The pilot symbols 310 and 314 may accordingly also be present at similar frequencies in the signal 303. Further, replicated data symbols from the signal 302 may be included in the signal 303. In this example of Figure 3, the data symbols 312 and 316 may have been replicated to symbol locations at corresponding frequencies at the second spatial location, as shown. Additional data symbols 318-321 may be included in the signals 303.

[038] The example of Figure 3 illustrates replicated data symbols inserted at a midpoint between two pilot symbols in a data stream. In other examples, replicated data symbols may be inserted at a location other than a midpoint between two pilot symbols, and the replicated data symbol may be inserted at a location closer to one pilot symbol than another. In some examples, some pilot symbols may have no replicated data symbols inserted between them. In general, any number or arrangement of replicated data symbols may be inserted into a data stream. As will be described further below, the replicated data symbols may be utilized in a manner similar to pilot symbols to estimate the communications channel. Since the replicated data symbols also encode data, the use of replicated data symbols as pilot symbols may increase the data rate of the over communications system in some examples.

[039] Figure 4 is a schematic illustration of components of the communications device 115 arranged in accordance with examples of the present disclosure. The demodulator 170 may include a serial to parallel converter 402, a fast Fourier transform unit (FFT) 404, a parallel to

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serial converter 406, and a mapping block 408. The serial to parallel converter 402 may be coupled to the FFT 404. The FFT 404 may be coupled to the channel estimator and a space-time decoder 174. The space-time decoder 174 may be coupled to the parallel to serial converter 406. The parallel to serial converter 406 may be coupled to the mapping block 408.

[040] In operation, signals received by the receiver 172, such as the signals 302-305 of Figure 3, may be provided to the serial to parallel converter 402 and converted into parallel streams. The FFT 404 may perform a Fourier transform of the streams, and provide the Fourier transformed signals to the channel estimator 178 and the space-time decoder 174. In accordance with the methods described below, the channel estimator 178 may estimate all or a portion of the channel matrix based on received pilot symbols and/or replicated data symbols. The space-time decoder 174 may decode the data streams in accordance with the estimated channel matrix. Moreover, the space-time decoder 174 may provide signals indicative of the replicated data symbols to the channel estimator 178. The replicated data symbols may be used by the channel estimator 178 to estimate all or a part of the channel matrix, or to update an estimate of the channel matrix. Decoded signals may be provided from the space-time decoder 174 to the parallel-to-serial converter 406 and converted into a serial data stream of decoded symbols. The symbols may be provided to the mapping block 408 and may be converted into a stream of output data. In this manner, data may be encoded, transmitted, received, and decoded in the communications system in some examples.

[041] In some examples, the positioning of the encoder and decoder relative to the FFT and IFFT blocks of the modulator may vary. In particular, the configuration shown in Figure 4 may correspond to examples using space-time coding and decoding techniques. In some examples, space-frequency coding and decoding may be used. In examples where space-frequency coding is used, the encoder 158 may be coupled between the serial to parallel converter 204 and the IFFT 206.

[042] Figure 5 is a schematic illustration of signals transmitted over the communications channel in accordance with some examples of the present disclosure. The example shown in Figure 5 may pertain to examples employing space-frequency coding techniques. Input data symbols 505 including symbols labeled S1-S11 may be provided to the modulator 164 of Figure 1. Following modulation, pilot insertion, data replication, and coding in accordance with a space-frequency coding technique, one signal stream 510 may be generated for transmission from a first location, such as the antenna 112 of Figure 1, and a second signal stream 515 may be generated for transmission from a second location, such as the antenna

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114 of Figure 1. The relationship between the symbols in the streams 510 and 515 is generally specified by the space-frequency coding technique.

[043] Pilot symbols 520-525 are shown in the data stream 510, with corresponding data symbols in the data stream 515. Data symbols 530-539 are included in the data stream 510, with corresponding data symbols in the data stream 515. The pilot symbols 520-525 have been inserted amongst the data symbols 530-539. Data symbols 530 and 531 have been replicated from one frequency to another frequency in the data streams 510 and 515. The replicated data symbols have been inserted at a location between the pilot symbols 523 and 524. As generally described above, any number or positioning of replicated data symbols may generally be used. In the example shown in Figure 5, data symbols have been replicated in pairs. Replicating a pair of data symbols may be advantageous in some examples for consistency with the coding technique employed to code the data stream.

[044] Figure 6 is an example method for transmitting signals over a communications channel arranged in accordance with an example of the present disclosure. The method may include one or more of blocks 605, 610, 615, 620, and/or 625. The various blocks described herein may be performed sequentially, in parallel, or in a different order than those described herein. It should also be appreciated that in some implementations one or more of the illustrated blocks may be eliminated, combined or separated into additional blocks. The method 600 may include block 605, "Modulate data in accordance with an orthogonal frequency division multiplexing technique to generate multiple data streams." Block 605 may be followed by block 610 "Insert pilot symbols into the data streams." Block 610 may be followed by block 615 "Replicate data from one data stream and insert the replicated data into another data stream." Block 615 may be followed by block 620 "Encode the data streams in accordance with a block encoding technique." Block 620 may be followed by block 625 "Transmit the data streams over a communications channel."

[045] Data may be modulated in accordance with an OFDM technique in block 605. The modulation may be performed, for example, by any suitable structure in a communications device, such as a DSP or other processing unit. In some examples, one data stream may be generated for each antenna to be used in transmitting the data over the communications channel.

[046] In block 610, pilot symbols may be inserted into the data streams. The insertion may be performed, for, example, by any suitable structure in a communications device, including a mixer or multiplexor. Generally, the pilot symbols correspond to symbols known by the

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transmitting and receiving devices of a communications system. By decoding signals encoding a known pilot symbol, a receiving device may generate an estimate of the channel matrix of the communications channel. Pilot symbols may be stored in any memory structure in communication with the communications device, or may be communicated to the communications device. Any number of pilot symbols may generally be inserted into the data streams with substantially any spacing. The more pilot symbols are inserted into the data streams, the more the overall data transmission rate of the communications system may decrease. However, in examples having more pilot symbols inserted into the data streams, the estimates of the channel matrix by a receiving communications device may be more accurate. Accordingly, there may be a tradeoff between data rate and accuracy of the channel estimation. As will be described further below, use of replicated data symbols as pilot symbols may advantageously increase the channel estimation accuracy while not impacting the overall data rate as severely as using more pilot symbols.

[047] In block 615, data may be replicated from one data stream and inserted into another data stream. The replication may be performed by any suitable structure in a communications device, including a mixer or multiplexor for example. In some examples, a same structure may be used to insert the replicated data as was used to insert the pilot symbols. The replicated data may include one or more symbols from a data stream. In some examples, pairs of symbols may be replicated. The data may be inserted such that it is transmitted at a same frequency band in each of the data streams. Any number of replicated data instances may be included in a transmission. As will be described further below, the replicated data may be utilized to improve estimates of a channel matrix associated with a communications channel. Accordingly, as more replicated data is inserted, the accuracy of the channel matrix estimate may increase. However, as more replicated data is inserted, the overall data rate of the communications system may be reduced, although the reduction may not be as severe as if more known pilot symbols were inserted. The replicated data may be inserted between two pilot symbols, and may be inserted at a midpoint between the two pilot symbols. However, the replicated data may be inserted at substantially any location in some examples.

[048] In block 620, the data streams may be encoded in accordance with a block encoding technique. The encoding may be performed by any suitable structure in a communications device, for example by a DSP or other processing unit. As described above, any block encoding technique may be used, including space-time coding or space-frequency coding.

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[049] In block 625, the data streams may be transmitted over a communications channel. The transmission may be performed by a transmitter acting in cooperation with one or more antennas in some examples. In some examples, each antenna may be used to transmit one of the data streams.

[050] Figure 7 is an example method for receiving signals over a communications channel arranged in accordance with an example of the present disclosure. The method 700 may include one or more of blocks 705, 710, 715, 720, 725, and/or 730. The various blocks described herein may be performed sequentially, in parallel, or in a different order than those described herein. It should also be appreciated that in some implementations one or more of the illustrated blocks may be eliminated, combined or separated into additional blocks. The method 700 may include block 705 "Receiving a known pilot symbol over a communications channel." Block 705 may be followed by block 710 "Estimating the communications channel based, at least in part, on the known pilot symbol." Block 710 may be followed by block 715 "Receiving replicated data from multiple data streams over the communications channel." Block 715 may be followed by block 720 "Decoding the replicated data using the estimate of the communications channel." Block 720 may be followed by block 725 "Updating the estimate of the communications channel based, at least in part, on the replicated data." Block 725 may be followed by block 730 "Decoding subsequently received data using the updated channel estimate."

[051] In block 705, a known pilot symbol may be received over a communications channel. The symbol may be received by any suitable receiver of a communications device. Signals may generally be received that encode the known pilot symbol. The received signals may also provide an indication that the encoded symbol is a pilot symbol.

[052] In block 710, the communications channel may be estimated based, at least in part, on the received pilot symbol. The estimation may be performed by any suitable structure of a communications device, such as a DSP or other processing unit. Generally, all or a portion of a channel matrix may be estimated by comparing a decoded received pilot symbol with the known pilot symbol. Known pilot symbols may be stored at the communications device or otherwise communicated to the communications device for comparison with decoded pilot symbols received over the communications channel. The estimated channel, including data estimating all or a portion of a channel matrix, may be stored in some examples.

[053] In block 715, replicated data from multiple data streams may be received over the communications channel. Any suitable receiver may be used to receive the replicated data.

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Examples of replicated data have been described above. Generally, signals are received that may encode the replicated data and the signals may also encode an indication that the data includes one or more replicated data symbols. Signals encoding the replicated data may be received by a single antenna in some examples.

[054] In block 720, the replicated data may be decoded using the estimate of the communications channel. Any suitable structure of a communications device may be used to perform the decoding, such as a DSP or other processing unit. In some examples, a joint detection technique is used to decode the replicated data, such as max-ratio combining. By decoding multiple copies of the replicated data, the decoding may be considered to be more accurate than the decoding of single data symbols. Accordingly, the decoded replicated data may be used to generate or update an estimate of the communications channel.

[055] In block 725, the estimate of the communications channel may be updated based, at least in part, on the replicated data. The updating may be performed by any suitable structure in a communications device, such as a DSP or other processing unit. The estimate may be updated by comparing the decoded symbol with the two instances of received signals encoding the symbol. In this manner, the channel estimate may be generated or updated, which may include all or a portion of the channel matrix. The updated channel estimate may be stored in some examples.

[056] In block 730, subsequently received data may be decoded using the updated channel estimate. That is, signals received following the updating of the channel estimate may be decoded using the updated channel estimate. The updated channel estimate may improve decoding performance in some examples.

[057] Accordingly, examples have been described above of estimating a communications channel based on pilot symbols and replicated data symbols. In this manner, the number of pilot symbols may be effectively increased through the use of replicated data symbols. The accuracy of the resultant channel estimates may in some examples approach the accuracy of an example where the effective number of inserted pilot symbols is equal to a sum of the number of pilot symbols plus the number of inserted replicated data symbols. Because the replicated data symbols also transmit data over the communications channel, however, the use of replicated data symbols may not impair the overall data rate of the system as severely as the use of more pilot symbols.

[058] Figure 8 is a block diagram illustrating an example computing device 800 that is arranged for generating an updated channel estimate in accordance with examples of the

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present disclosure. In a very basic configuration 801, computing device 800 typically includes one or more processors 810 and system memory 820. A memory bus 830 may be used for communicating between the processor 810 and the system memory 820.

[059] Depending on the desired configuration, processor 810 may be of any type including but not limited to a microprocessor (μP), a microcontroller (μC), a digital signal processor (DSP), or any combination thereof. Processor 810 may include one more levels of caching, such as a level one cache 811 and a level two cache 812, a processor core 813, and registers 814. An example processor core 813 may include an arithmetic logic unit (ALU), a floating point unit (FPU), a digital signal processing core (DSP Core), or any combination thereof. An example memory controller 815 may also be used with the processor 810, or in some implementations the memory controller 815 may be an internal part of the processor 810.

[060] Depending on the desired configuration, the system memory 820 may be of any type including but not limited to volatile memory (such as RAM), non-volatile memory (such as ROM, flash memory, etc.) or any combination thereof. System memory 820 may include an operating system 821, one or more applications 822, and program data 824. Application 822 may include a channel estimate routine 823 that is arranged to generate an estimate of a communications channel based on received pilot symbols, replicated data symbols, or combinations thereof. Program Data 824 may include known pilot symbols 825, replicated data symbols 826, channel estimate 827, or combinations thereof, that may be useful for generating channel estimates as generally described above. In some embodiments, application 822 may be arranged to operate with program data 824 on an operating system 821 such that channel estimates are generated and/or updated on the basis of received pilot symbols and replicated data symbols. This described basic configuration is illustrated in Figure 8 by those components within dashed line 801.

[061] Computing device 800 may have additional features or functionality, and additional interfaces to facilitate communications between the basic configuration 801 and any required devices and interfaces. For example, a bus/interface controller 840 may be used to facilitate communications between the basic configuration 801 and one or more data storage devices 850 via a storage interface bus 841. The data storage devices 850 may be removable storage devices 851, non-removable storage devices 852, or a combination thereof. Examples of removable storage and non-removable storage devices include magnetic disk devices such as flexible disk drives and hard-disk drives (HDD), optical disk drives such as compact disk (CD) drives or digital versatile disk (DVD) drives, solid state drives (SSD), and tape drives to

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name a few. Example computer storage media may include volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information, such as computer readable instructions, data structures, program modules, or other data.

[062] System memory 820, removable storage 851 and non-removable storage 852 are all examples of computer storage media. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which may be used to store the desired information and which may be accessed by computing device 800. Any such computer storage media may be part of device 800.

[063] Computing device 800 may also include an interface bus 842 for facilitating communication from various interface devices (e.g., output interfaces, peripheral interfaces, and communication interfaces) to the basic configuration 801 via the bus/interface controller 840. Example output devices 860 include a graphics processing unit 861 and an audio processing unit 862, which may be configured to communicate to various external devices such as a display or speakers via one or more A/V ports 863. Example peripheral interfaces 870 include a serial interface controller 870 or a parallel interface controller 872, which may be configured to communicate with external devices such as input devices (e.g., keyboard, mouse, pen, voice input device, touch input device, etc.) or other peripheral devices (e.g., printer, scanner, etc.) via one or more I/O ports 873. An example communication device 880 includes a network controller 881, which may be arranged to facilitate communications with one or more other computing devices 890 over a network communication link via one or more communication ports 882.

[064] The network communication link may be one example of a communication media. Communication media may typically be embodied by computer readable instructions, data structures, program modules, or other data in a modulated data signal, such as a carrier wave or other transport mechanism, and may include any information delivery media. A "modulated data signal" may be a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media may include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, radio frequency (RF),

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microwave, infrared (IR) and other wireless media. The term computer readable media as used herein may include both storage media and communication media.

[065] Computing device 800 may be implemented as a portion of a small-form factor portable (or mobile) electronic device such as a cell phone, a personal data assistant (PDA), a personal media player device, a wireless web-watch device, a personal headset device, an application specific device, or a hybrid device that include any of the above functions. Computing device 800 may also be implemented as a personal computer including both laptop computer and non-laptop computer configurations.

[066] The present disclosure is not to be limited in terms of the particular examples described in this application, which are intended as illustrations of various aspects. Many modifications and examples can may be made without departing from its spirit and scope, as will be apparent to those skilled in the art. Functionally equivalent methods and apparatuses within the scope of the disclosure, in addition to those enumerated herein, will be apparent to those skilled in the art from the foregoing descriptions. Such modifications and examples are intended to fall within the scope of the appended claims. The present disclosure is to be limited only by the terms of the appended claims, along with the full scope of equivalents to which such claims are entitled. It is to be understood that this disclosure is not limited to particular methods, reagents, compounds compositions or biological systems, which can, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular examples only, and is not intended to be limiting.

[067] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

[068] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.).

[069] It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases

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"at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to examples containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should be interpreted to mean at least the recited number (e.g., the bare recitation of "two recitations," without other modifiers, means at least two recitations, or two or more recitations).

[070] Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B."

[071] In addition, where features or aspects of the disclosure are described in terms of Markush groups, those skilled in the art will recognize that the disclosure is also thereby described in terms of any individual member or subgroup of members of the Markush group.

[072] As will be understood by one skilled in the art, for any and all purposes, such as in terms of providing a written description, all ranges disclosed herein also encompass any and all possible subranges and combinations of subranges thereof. Any listed range can be easily recognized as sufficiently describing and enabling the same range being broken down into at

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least equal halves, thirds, quarters, fifths, tenths, etc. As a non-limiting example, each range discussed herein can be readily broken down into a lower third, middle third and upper third, etc. As will also be understood by one skilled in the art all language such as "up to," "at least," "greater than," "less than," and the like include the number recited and refer to ranges which can be subsequently broken down into subranges as discussed above. Finally, as will be understood by one skilled in the art, a range includes each individual member. Thus, for example, a group having 1-3 items refers to groups having 1, 2, or 3 items. Similarly, a group having 1-5 items refers to groups having 1, 2, 3, 4, or 5 items, and so forth.

[073] While the foregoing detailed description has set forth various examples of the devices and/or processes via the use of block diagrams, flowcharts, and/or examples, such block diagrams, flowcharts, and/or examples contain one or more functions and/or operations, it will be understood by those within the art that each function and/or operation within such block diagrams, flowcharts, or examples can be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or virtually any combination thereof. In one example, several portions of the subject matter described herein may be implemented via Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs), digital signal processors (DSPs), or other integrated formats. However, those skilled in the art will recognize that some aspects of the examples disclosed herein, in whole or in part, can be equivalently implemented in integrated circuits, as one or more computer programs running on one or more computers (e.g., as one or more programs running on one or more computer systems), as one or more programs running on one or more processors (e.g., as one or more programs running on one or more microprocessors), as firmware, or as virtually any combination thereof, and that designing the circuitry and/or writing the code for the software and or firmware would be well within the skill of one of skill in the art in light of this disclosure. For example, if a user determines that speed and accuracy are paramount, the user may opt for a mainly hardware and/or firmware vehicle; if flexibility is paramount, the user may opt for a mainly software implementation; or, yet again alternatively, the user may opt for some combination of hardware, software, and/or firmware.

[074] In addition, those skilled in the art will appreciate that the mechanisms of the subject matter described herein are capable of being distributed as a program product in a variety of forms, and that an illustrative example of the subject matter described herein applies regardless of the particular type of signal bearing medium used to actually carry out the distribution. Examples of a signal bearing medium include, but are not limited to, the

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following: a recordable type medium such as a floppy disk, a hard disk drive, a Compact Disc (CD), a Digital Versatile Disk (DVD), a digital tape, a computer memory, etc.; and a transmission type medium such as a digital and/or an analog communication medium (e.g., a fiber optic cable, a waveguide, a wired communications link, a wireless communication link, etc.).

[075] Those skilled in the art will recognize that it is common within the art to describe devices and/or processes in the fashion set forth herein, and thereafter use engineering practices to integrate such described devices and/or processes into data processing systems. That is, at least a portion of the devices and/or processes described herein can be integrated into a data processing system via a reasonable amount of experimentation. Those having skill in the art will recognize that a typical data processing system generally includes one or more of a system unit housing, a video display device, a memory such as volatile and non-volatile memory, processors such as microprocessors and digital signal processors, computational entities such as operating systems, drivers, graphical user interfaces, and applications programs, one or more interaction devices, such as a touch pad or screen, and/or control systems including feedback loops and control motors (e.g., feedback for sensing position and/or velocity; control motors for moving and/or adjusting components and/or quantities). A typical data processing system may be implemented utilizing any suitable commercially available components, such as those typically found in data computing/communication and/or network computing/communication systems.

[076] The herein described subject matter sometimes illustrates different components contained within, or connected with, different other components. It is to be understood that such depicted architectures are merely examples, and that in fact many other architectures can be implemented which achieve the same functionality. In a conceptual sense, any arrangement of components to achieve the same functionality is effectively "associated" such that the desired functionality is achieved. Hence, any two components herein combined to achieve a particular functionality can be seen as "associated with" each other such that the desired functionality is achieved, irrespective of architectures or intermedial components. Likewise, any two components so associated can also be viewed as being "operably connected", or "operably coupled", to each other to achieve the desired functionality, and any two components capable of being so associated can also be viewed as being "operably couplable", to each other to achieve the desired functionality. Specific examples of operably couplable include but are not limited to physically mateable and/or physically interacting

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components and/or wirelessly interactable and/or wirelessly interacting components and/or logically interacting and/or logically interactable components.

[077] While various aspects and examples have been disclosed herein, other aspects and examples will be apparent to those skilled in the art. The various aspects and examples disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

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CLAIMS

What is claimed is:

1. A method of transmitting data over a communications channel, the method comprising:

modulating data for transmission over the communications channel in accordance with an orthogonal frequency division multiplexing technique to generate at least a first and second data stream for transmission using respective transmit antennas;

inserting at least a portion of data from the first data stream into the second data stream; and

transmitting the first and second data streams over the communications channel.

2. The method of claim 1, further comprising:

inserting pilot symbols into the first and second data streams.

3. The method of claim 2 wherein said inserting at least a portion of data from the first data stream into the second data stream comprises inserting the portion of data from the first data stream into the second data stream at a location between two pilot symbols in the second data stream.

4. The method of claim 3 wherein said inserting at least a portion of data from the first data stream into the second data stream comprises inserting a respective portion of data from the first data stream into the second data stream between each two pilot symbols in the second data stream.

5. The method of claim 1 further comprising encoding the first and the second data streams in accordance with a block coding technique.

6. The method of claim 5 wherein the block coding technique comprises a space-time block coding technique.

7. The method of claim 5 wherein the block coding technique comprises a space-frequency block coding technique.

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8. A method of decoding a signal transmitted over a communications channel, the method comprising:

receiving a pilot symbol over the communications channel;

estimating a channel matrix of the communications channel based, at least in part, on the pilot symbol;

receiving replicated data from multiple data streams transmitted over the communications channel;

decoding the replicated data using the estimated channel matrix; and

generating an updated estimate of the channel matrix based, at least in part, on the replicated data.

9. The method of claim 8, further comprising decoding subsequently received signals over the communications channel using the updated estimate of the channel matrix.

10. The method of claim 8 wherein said decoding the replicated data comprises using a joint detection technique.

11. The method of claim 8, wherein said decoding the replicated data comprises using a space-time block decoding technique.

12. The method of claim 8, wherein said decoding the replicated data comprises using a space-frequency block decoding technique.

13. The method of claim 8, wherein the replicated data includes same data symbols in multiple data streams.

14. A communication device comprising:

a modulator configured to modulate data in accordance with an orthogonal frequency division multiplexing technique for transmission over a communications channel using at least a first and a second transmit antenna, wherein the modulator is further configured to generate at least a first data stream for transmission with the first antenna and a second data stream for transmission with the second antenna;

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a replicator coupled to the modulator and configured to receive the first and second data streams, wherein the replicator is configured to insert at least one data symbol from the first data stream into the second data stream;

an encoder coupled to the replicator and configured to receive the first and second data streams including the inserted at least one symbol, wherein the encoder is configured to encode the first and second data streams in accordance with a block coding technique; and

a transmitter coupled to the encoder and configured to receive the encoded first and second data streams, wherein the transmitter is configured to transmit the fist data stream over the communications channel using the first antenna and further configured to transmit the second data stream including the inserted at least one symbol over the communications channel using the second antenna.

15. The communication device of claim 14 wherein the block coding technique comprises a space-time encoding technique.

16. The communication device of claim 14 wherein the block coding technique comprises a space-frequency encoding technique.

17. The communication device of claim 14 wherein the first and second data streams further include at least two pilot symbols, and wherein the replicator is configured to insert the at least one data symbol between the at least two pilot symbols.

18. A communication device comprising:

a receiver configured to receive signals over a communications channel, wherein the signals are based at least in part on first and second data streams transmitted over a communications channel, wherein the second data stream includes at least one data symbol replicated from the first data stream;

a decoder coupled to the receiver and the channel estimator, wherein the decoder is configured to receive the received signals and decode the at least one data symbol replicated from the first data stream;

a channel estimator coupled to the decoder and the receiver, wherein the channel estimator is configured to receive the received signals and the decoded at least one data

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symbol, wherein the channel estimator is configured to estimate a channel matrix of the communications channel based, at least in part, on the decoded at least one data symbol; and

wherein the decoder is further configured to decode subsequent received signals based, at least in part, on the estimate of the channel matrix.

19. The communication device of claim 18 wherein the decoder is configured to decode the at least one data symbol using a joint detection technique.

20. The communication device of claim 18 wherein the first and second data streams each further include at least one pilot symbol, and wherein the channel estimator is configured to receive the at least one pilot symbol and generate an initial estimate of the channel matrix based, at least in part on the at least one pilot symbol.

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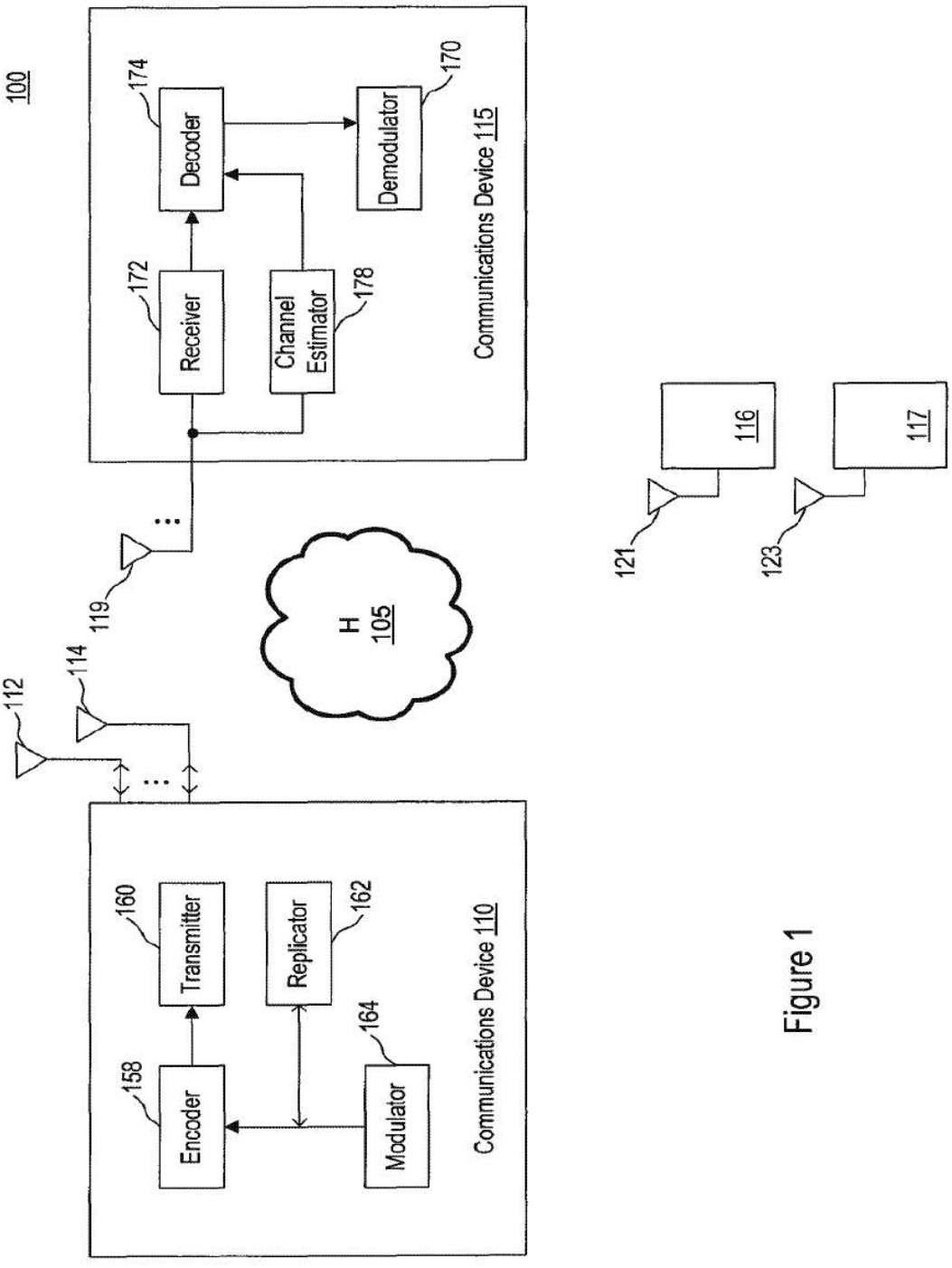

100
Communications Device 115
174
Decoder
170
Demodulator
172
Receiver
178
Channel Estimator
119
114
112
H
105
116
117
121
123
Communications Device 110
160
Transmitter
162
Replicator
158
Encoder
164
Modulator

Figure 1

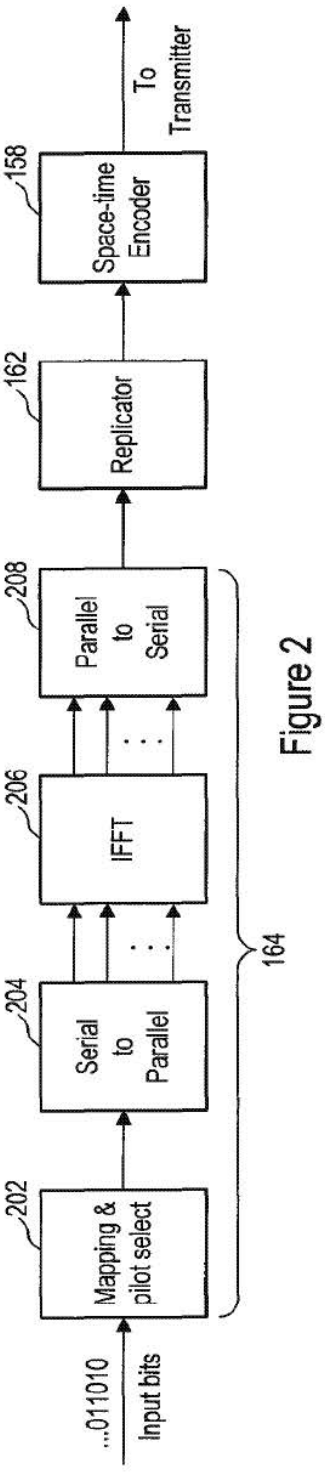


Figure 2

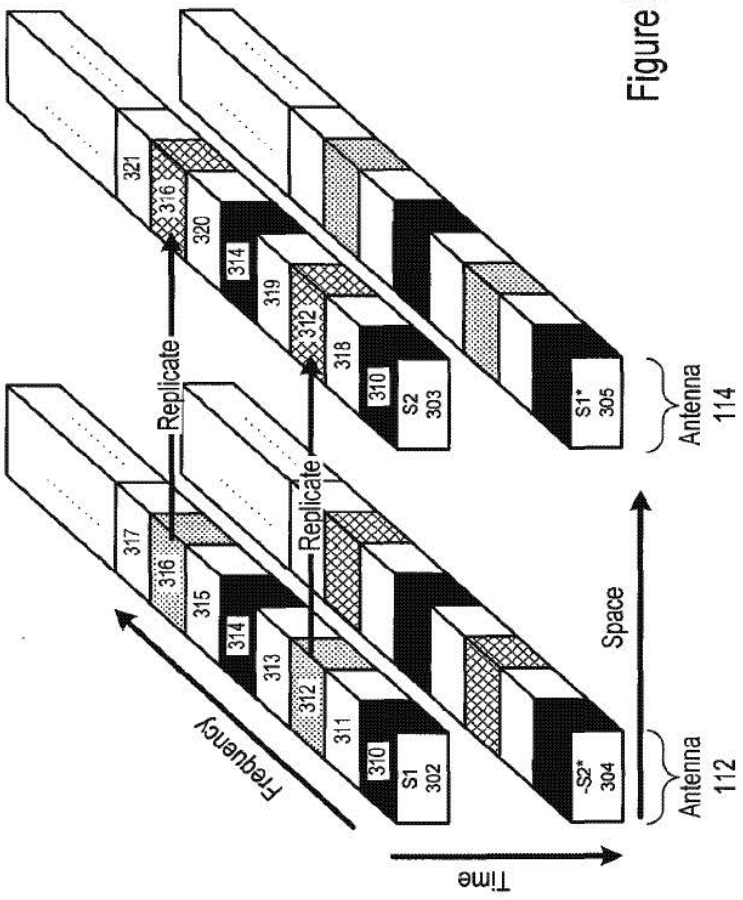


Figure 3

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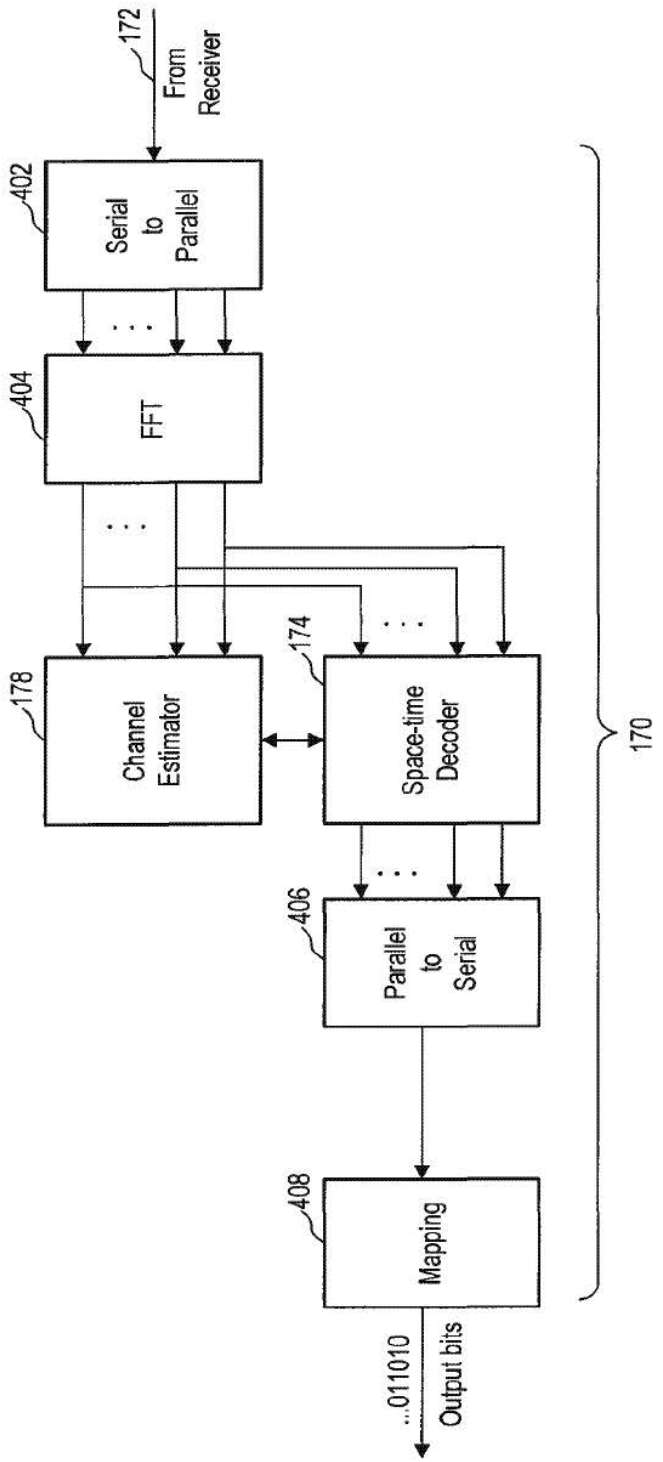

172
From Receiver
402
Serial to Parallel
404
FFT
178
Channel Estimator
174
Space-time Decoder
406
Parallel to Serial
408
Mapping
170
...011010
Output bits

Figure 4

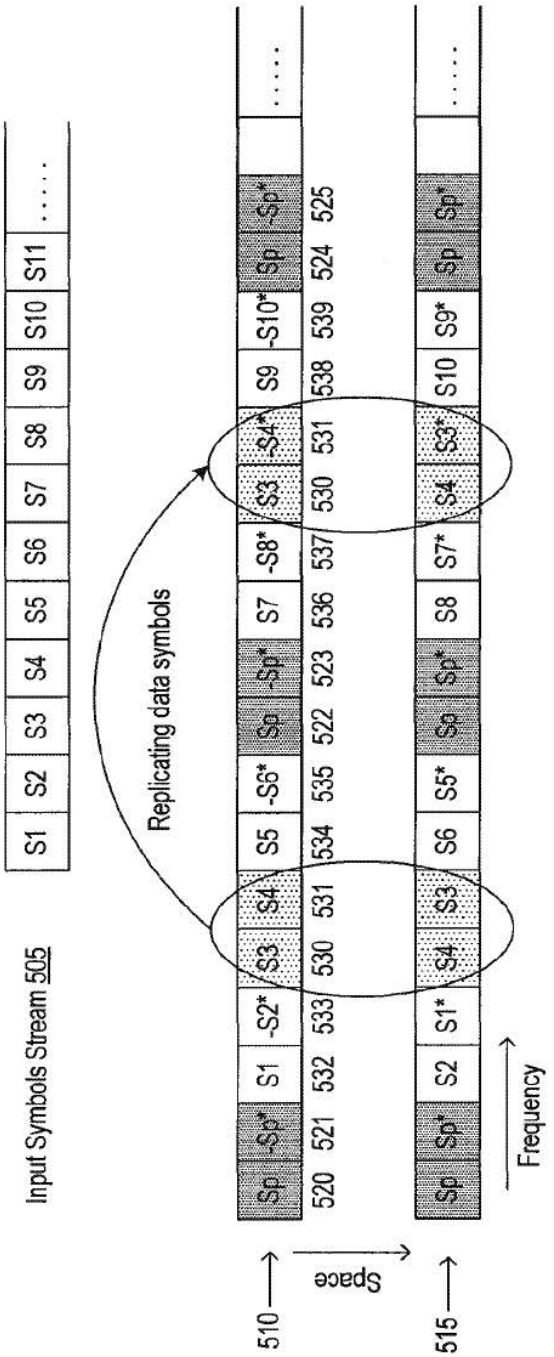


Figure 5

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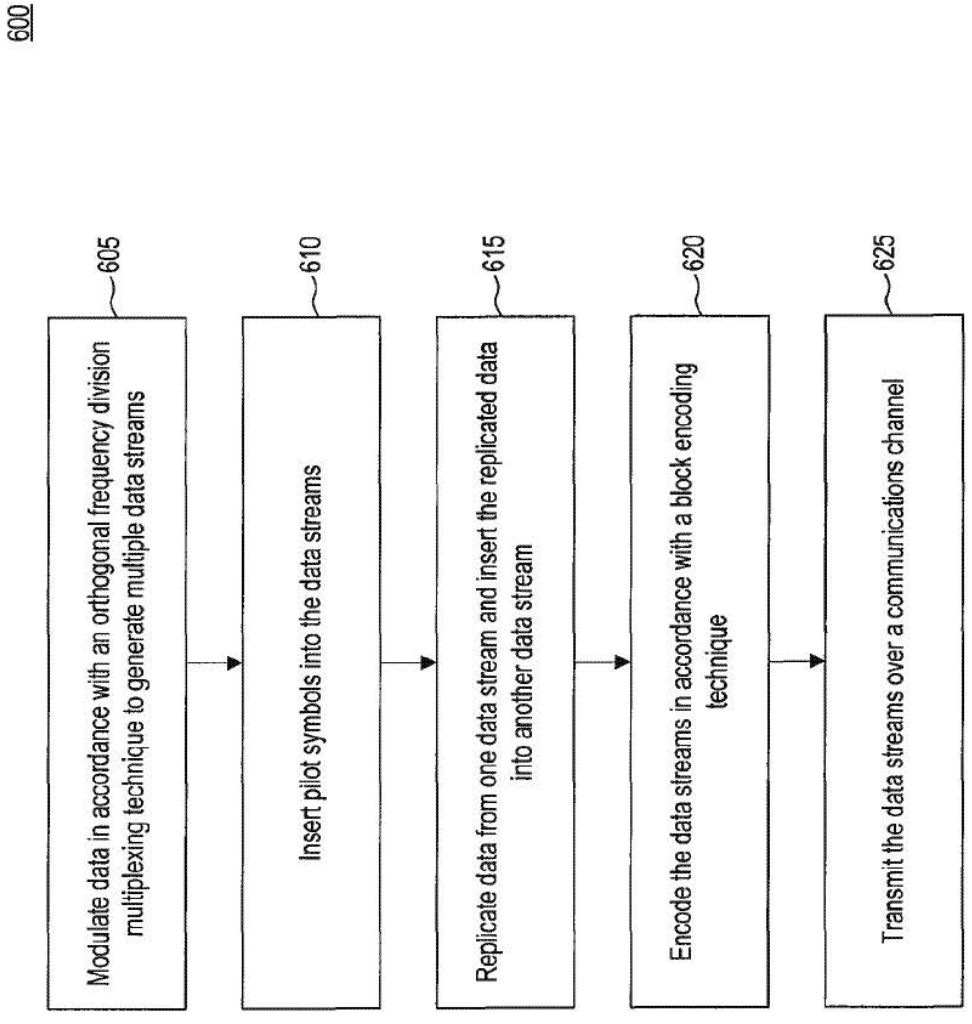


Figure 6

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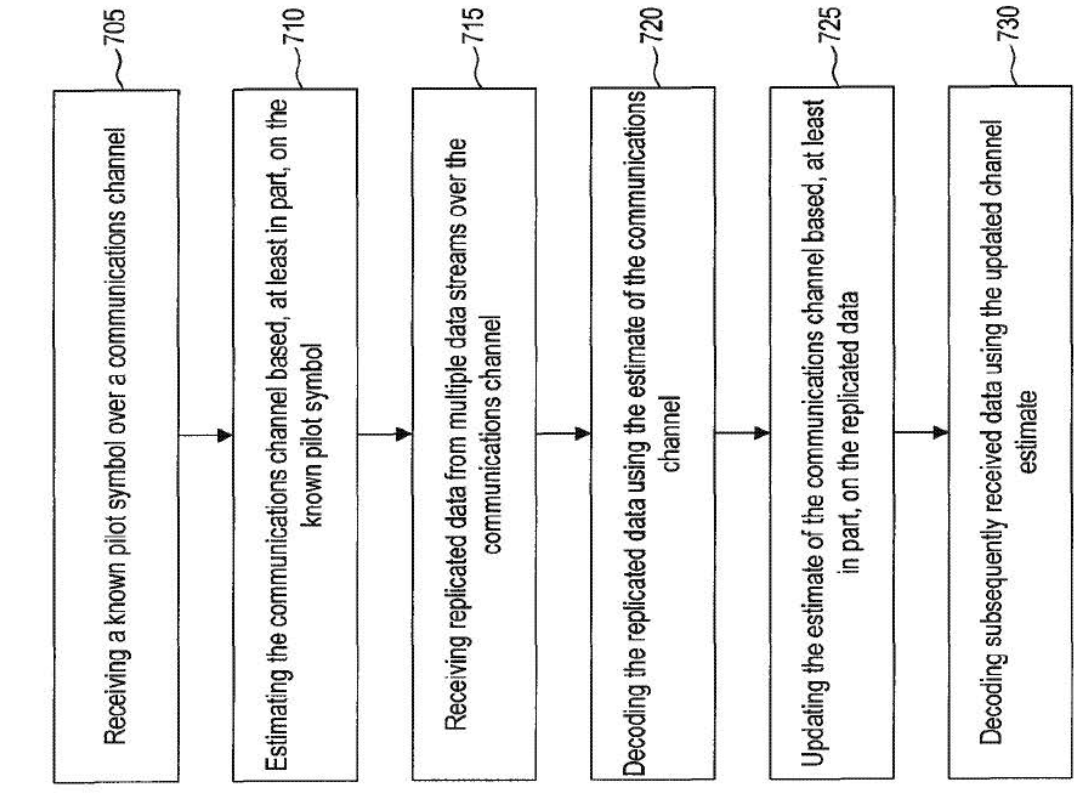


Figure 7

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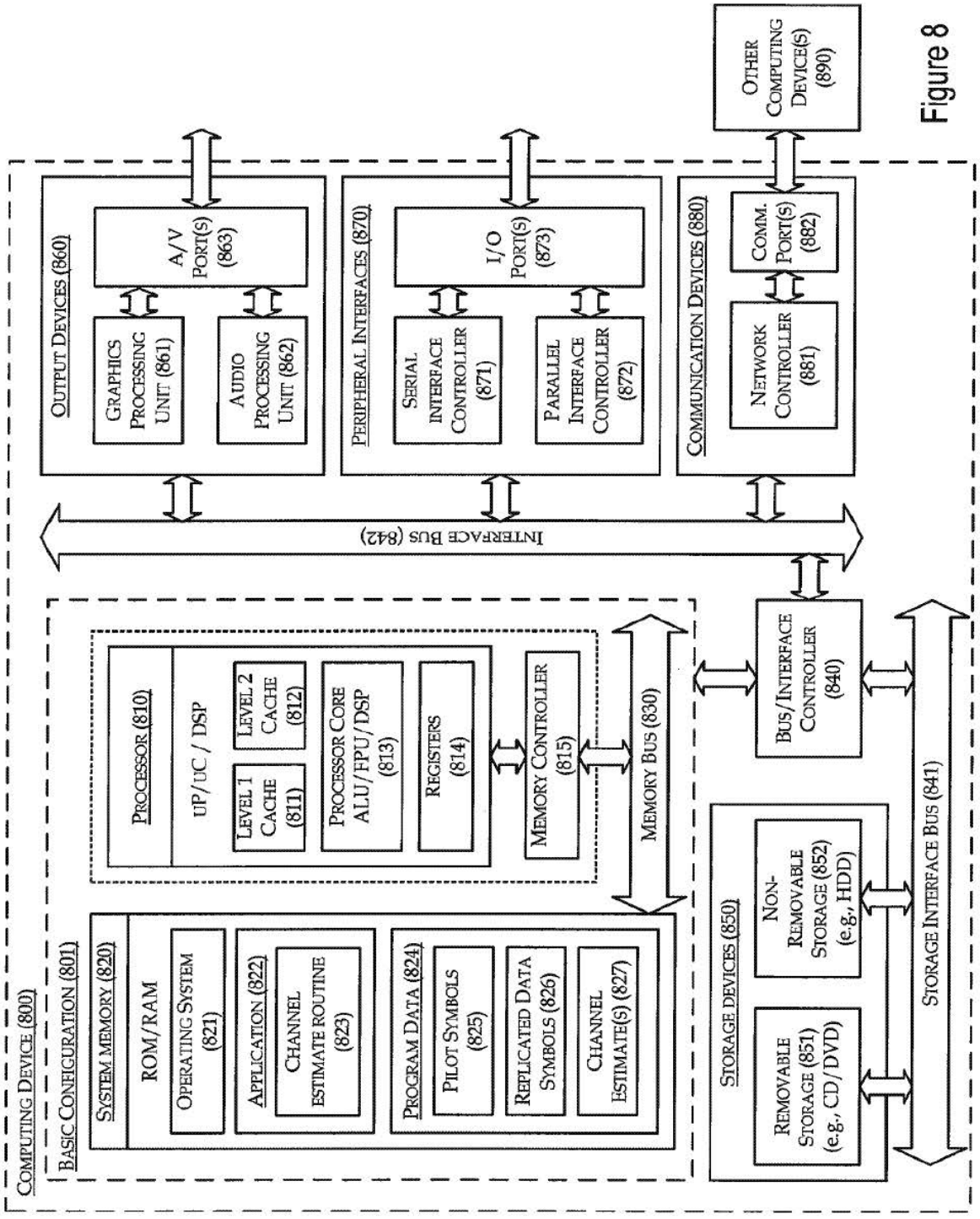


Figure 8

Petitioner Samsung Ex-1004, 0227

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/046106

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

H04L 27/28 (2006.01) ***H04J 11/00*** (2006.01)
H04B 7/04 (2006.01) ***H04K 1/10*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC, WPI: mimo, miso, ofdm, multiple antenna, first, second stream, insert, embed, overlap, replicat, pilot and similar terms.
INSPEC: mimo, miso, ofdm, multiple antenna, first stream, second stream, insert, embed, overlap, replicat, pilot and similar terms.
GOOGLE, GOOGLE SCHOLAR: mimo, ofdm, first, second, (insert or embed or overlap), stream, pilot

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7778337 B2 (TONG et al.) 17 August 2010 Abstract; Col. 4 line 12-Col. 6 line 21	1-20
A	US 7397862 B2 (OUYANG et al.) 8 July 2008 Abstract; Col. 1 line 64-Col. 2 line 19	1-20
A	US 2002/0122381 A1 (WU et al.) 5 September 2002 Abstract; Paras [0011]-[0015]	1-20

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 November 2010	09 NOV 2010
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **JUZER KHANBHAI** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2176

Form PCT/ISA/210 (second sheet) (July 2009)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2010/046106

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	7778337	CN	1605172	CN	101188597	EP	1442549
		US	2003072254	US	7248559	US	2007253324
		US	7545734	US	2007053282	US	2009225891
		US	2010271930	WO	03034644		
US	7397862	US	2007086538				
US	2002/0122381	CA	2351140	CA	2355433	EP	1185001
		EP	1185048	EP	1686703	US	6850481
		US	2002122383	US	6985434	US	2002122382
		US	7009931	US	2002041635	US	7233625
		US	2006104196	US	7336601	US	2007274408
		US	7403570	US	2008002568	US	7688710
		US	2007036069	US	7801019		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX

Petitioner Samsung Ex-1004, 0229

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01	1213

27076 7590 12/19/2012

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EXAMINER	
VO, DON NGUYEN	
ART UNIT	**PAPER NUMBER**
2634	

NOTIFICATION DATE	DELIVERY MODE
12/19/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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IPDocket_SE@dorsey.foundationip.com
pogson.phoebe@dorsey.com

Petitioner Samsung Ex-1004, 0230

Office Action Summary	Application No.	Applicant(s)	
	12/999,029	PANAH ET AL.	
	Examiner	Art Unit	
	Don N. Vo	2634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 December 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-20* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/14/10 & 5/11/12*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

Petitioner Samsung Ex-1004, 0231

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-6, 8-11, 13-15 and 17-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Luo et al (US 2010/0202559).

Regarding claims 1-6, 8-11, 13-15 and 17-20, Luo, as shown in figures 4-8 and 10-18, teaches method and apparatus for transmitting/receiving data over communication channel using plurality of antennas comprising modulating data for transmission over the communications channel in accordance with an orthogonal frequency division multiplexing technique to generate at least a first and second data stream for transmission using respective transmit antennas; (fig. 7, transmit antennas 1 and 2); inserting at least a portion of data from the first data stream into the second data stream; (fig. 7, symbol period 3) and transmitting the first and second data streams over the communications channel (fig. 7, transmit antennas 1 and 2). See also paragraphs [0048] – [0123].

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 7, 12 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Luo et al (US 2010/0202559).

Regarding claims 7, 12, and 16, Luo teaches all subject matter claimed except for the space-frequency block encoding/decoding technique. However, such space-frequency block encoding/decoding technique is well known in the art of digital communications for diversity system and therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the communication system of Luo by employing the space-frequency block encoding/decoding technique since it is just a matter of selecting a well-known technique as an alternative for providing diversity communications so that to arrive at the claimed invention.

Conclusion

7. **Examiner's note**: Examiner has cited particular columns and line numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to the specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. References Ding et al (US 2007/0135166), Ribeiro Dias et al (US

2008/0043857), Lim et al (US 2011/0026447) and Kobayashi et al (US 2011/0171944) are cited because they are pertinent to the method and apparatus for diversity communication system.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Don N. Vo whose telephone number is (571) 272-3018. The examiner can normally be reached on Mon-Fri (9:00AM - 6:00PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Daniel C. Washburn can be reached on (571) 272-5551. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Don N. Vo/
Primary Examiner, Art Unit 2611

Notice of References Cited	Application/Control No. 12/999,029	Applicant(s)/Patent Under Reexamination PANAH ET AL.	
	Examiner Don N. Vo	Art Unit 2634	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2007/0135166	06-2007	Ding et al.	455/561
*	B	US-2008/0043857	02-2008	Ribeiro Dias et al.	375/260
*	C	US-2010/0202559	08-2010	Luo et al.	375/295
*	D	US-2011/0026447	02-2011	Lim et al.	370/310
*	E	US-2011/0171944	07-2011	KOBAYASHI et al.	455/418
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Petitioner Samsung Ex-1004, 0236

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	78	insert$3 with (data adj stream) with antenna	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 14:42
S2	32969	mimo	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 14:42
S3	48	S1 and S2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 14:42
S4	159	insert$3 with stream with antenna with (data symbol)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 16:06
S5	100	S2 and S4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 16:06
S6	52	S5 not S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 16:07

12/10/2012 7:19:21 PM
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Petitioner Samsung Ex-1004, 0237

UNITED STATES PATENT AND TRADEMARK OFFICE

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BIB DATA SHEET

CONFIRMATION NO. 1213

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/999,029	12/14/2010 RULE	375	2634	P215801.WO-US.01

APPLICANTS
Ali Yazdan Panah, Austin, TX;
Robert W. Heath JR., Austin, TX;

**** CONTINUING DATA ***************************
This application is a 371 of PCT/US10/46106 08/20/2010

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
03/30/2011

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /DON NGUYEN VO/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		TX	7	20	4

ADDRESS

DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043
UNITED STATES

TITLE

INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS

FILING FEE RECEIVED		
1310	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Petitioner Samsung Ex-1004, 0238

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Field

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12/999,029
	Filing Date	December 14, 2010
	First Named Inventor	Ali Yazdan Panah
	Art Unit	2611
	Examiner Name	Shuwang Liu
	Attorney Docket Number	P215801.WO-US.01

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-6519296B2		Feb 11, 2003	Hladik	
		US-7522682B2		Apr 21, 2009	Obernosterer et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
		CHEON, H. et al., "PERFORMANCE ANALYSIS OF SPACE-TIME BLOCK CODES IN TIME-VARYING RAYLEIGH FADING CHANNELS", IEEE International Conference on Acoustics, Speech, and Signal Processing, 2002. Proceedings. (ICASSP '02)., Volume: 3, pp. III-2357-III-2360	
		CIRPAN, H. A. et al., "Nondata-Aided Channel Estimation for OFDM Systems With Space-Frequency Transmit Diversity", IEEE Transactions on Vehicular Technology, March 2006, Vol: 55, no: 2, pp: 449-457	
		KLEIDER, J. E. , "MISO joint synchronization-pilot design for OFDM systems", IEEE International Conference on Acoustics, Speech and Signal Processing, 2008. ICASSP 2008., March 31 2008-April 4 2008, pp: 3033-3036	
		LEE, K. F. et al., "A Space-Frequency Transmitter Diversity Technique for OFDM Systems", Proc. IEEE Global Telecommunications Conf. (GLOBECOM), 2000, Vol.3, pp: 1473-1477	
		LI, W. et al., "Effects of channel-estimation errors on receiver selection-combining schemes for Alamouti MIMO systems with BPSK", IEEE Transactions on Communications, Jan 2006, Volume: 54, no. 1, pp: 169-178	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.V./

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Field

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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	Application Number	12/999,029
	Filing Date	December 14, 2010
	First Named Inventor	Ali Yazdan Panah
	Art Unit	2611
	Examiner Name	Shuwang Liu
	Attorney Docket Number	P215801.WO-US.01

		LU, H. , "PHY 45-4- Reduced-Complexity ICI Mitigation for Mobile SFBC-OFDM with Application to DVB-H", IEEE Wireless Communications and Networking Conference, 2008. WCNC 2008., March 31 2008-April 3, 2008, pp.1183-1187	
		STAMOULIS, A. et al., "Intercarrier Interference in MIMO OFDM", IEEE Transactions on Signal Processing, Oct 2002, Volume: 50, Issue.10, pp: 2451-2464	
		SUN, Y. et al., "EM-based iterative receiver design with carrier-frequency offset estimation for MIMO OFDM systems", IEEE Transactions on Communications, April 2005, Volume: 53, Issue: 4, pp: 581-586	
		XIAOQIANG, M. A. et al., "AN EM-BASED CHANNEL ESTIMATION ALGORITHM FOR SPACE-TIME AND SPACE-FREQUENCY BLOCK CODED OFDM", IEEE International Conference on Acoustics, Speech, and Signal Processing, 2003. Proceedings. (ICASSP'03)., 6-10 April 2003, Vol.4, pp: IV-389-92,	
		YANG, H., "A road to future broadband wireless access: MIMO-OFDM-Based air interface", Communications Magazine, IEEE, Jan. 2005, Volume: 43, Issue: 1, pp: 53-60	

EXAMINER SIGNATURE

Examiner Signature	/Don Vo/	Date Considered	11/08/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.
[4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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PTO/SB/08a

(01-08)

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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

	Complete if Known
Application Number	To be allocated
Filing Date	Filed concurrently herewith
First Named Inventor	Ali Yazdan Panah
Art Unit	To be allocated
Examiner Name	To be allocated

Sheet	1	of	1

Attorney Docket No: P215801.WO-US.01

US PATENT DOCUMENTS

Examiner Initial*	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2002/0122381 A1	Sep 5, 2002	Wu, S. et al.	
		7397862B2	Jul 8, 2008	Ouyang, X. et al.	
		7778337B2	Aug 17, 2010	Tong, W. et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[2]

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		"International Search Report dated November 9, 2010 for Application No. PCT/US2010/046106"	

EXAMINER	/Don Vo/	DATE CONSIDERED	11/08/2012

Substitute Disclosure Statement Form (PTO-1449)

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.V./

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	11763	insert$3 with first with second with data	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 09:41
L2	49363	mimo (multiple adj antenna)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 09:42
L3	12	1 same 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 09:42
L4	139	1 and 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/10 09:46

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Petitioner Samsung Ex-1004, 0242

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	Art Unit
	DON N VO	2634

SEARCHED			
Class	Subclass	Date	Examiner
375	260, 267, 299, 347	12/6/12	DV

SEARCH NOTES		
Search Notes	Date	Examiner
INVENTOR SEARCHED	12/6/12	DV
EAST	12/10/12 & 12/11/12	DV

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

	/DON N VO/ Primary Examiner.Art Unit 2634

Petitioner Samsung Ex-1004, 0243

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	Art Unit
	DON N VO	2634

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/14/2012								
	1	✓								
	2	✓								
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	18	✓								
	19	✓								
	20	✓								

Petitioner Samsung Ex-1004, 0244

EAST Search History

EAST Search History (Prior Art)

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L1	10	insert$3 with (copy replica) with first with second with (data symbol) with stream	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 09:55
L2	1042	insert$3 with first with second with (data symbol) with stream	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:00
L3	2057	insert$3 with first with second with (data symbol) with (stream frame)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:00
L4	772003	antenna	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:00
L5	1042	2 same 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:00
L6	33037	mimo	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:00
L7	33	5 and 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:00
L8	2789	space adj time adj block adj cod$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:13
L9	5	(copy replica) with first with second with (data symbol) with stream with antenna	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:14
L10	914	first with second with (data symbol) with stream with antenna	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:16
L11	148	8 and 10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/12/11 10:16

12/11/2012 12:09:52 PM

Petitioner Samsung Ex-1004, 0245

To: ipdocket-se@dorsey.com,IPDocket_SE@dorsey.foundationip.com,pogson.phoebe@dorsey.com
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 27076

Dec 19, 2012 05:32:55 AM

Dear PAIR Customer:

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701 Fifth Avenue, Suite 6100
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Application	Document	Mailroom Date	Attorney Docket No.
12999029	CTNF	12/19/2012	P215801.WO-US.01
	892	12/19/2012	P215801.WO-US.01
	1449	12/19/2012	P215801.WO-US.01
	1449	12/19/2012	P215801.WO-US.01

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UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	: 12/999,029	Confirmation No.	: 1213
First Named Inventor	: Ali Yazdan Panah		
Filed	: December 14, 2010	Attorney Docket No.:	P215801.WO-US.01
Art Unit	: 2634	Customer No.	: 27,076
Examiner	: Don Nguyen Vo		
Title	: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS		

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE UNDER 37 C.F.R. § 1.111

Sir:

Receipt of the Office Action dated December 19, 2012 is acknowledged. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 6 of this paper.

CLAIM AMENDMENTS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A method of transmitting data over a communications channel, the method comprising:

modulating data for transmission over the communications channel in accordance with an orthogonal frequency division multiplexing technique to generate at least a first and second data stream for transmission using respective transmit antennas;

inserting at least a portion of data from the first data stream into the second data stream, wherein an estimated channel matrix is based, at least in part, on the portion of the data inserted from the first stream into the second stream; and

transmitting the first and second data streams over the communications channel.

2. (Original) The method of claim 1, further comprising:

inserting pilot symbols into the first and second data streams.

3. (Original) The method of claim 2 wherein said inserting at least a portion of data from the first data stream into the second data stream comprises inserting the portion of data from the first data stream into the second data stream at a location between two pilot symbols in the second data stream.

4. (Original) he method of claim 3 wherein said inserting at least a portion of data from the first data stream into the second data stream comprises inserting a respective portion of data from the first data stream into the second data stream between each two pilot symbols in the second data stream.

5. (Original) The method of claim 1 further comprising encoding the first and the second data streams in accordance with a block coding technique.

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6. (Original) The method of claim 5 wherein the block coding technique comprises a space-time block coding technique.

7. (Original) The method of claim 5 wherein the block coding technique comprises a space-frequency block coding technique.

8. (Original) A method of decoding a signal transmitted over a communications channel, the method comprising:

receiving a pilot symbol over the communications channel;

estimating a channel matrix of the communications channel based, at least in part, on the pilot symbol;

receiving replicated data from multiple data streams transmitted over the communications channel;

decoding the replicated data using the estimated channel matrix; and

generating an updated estimate of the channel matrix based, at least in part, on the replicated data.

9. (Original) The method of claim 8, further comprising decoding subsequently received signals over the communications channel using the updated estimate of the channel matrix.

10. (Original) The method of claim 8 wherein said decoding the replicated data comprises using a joint detection technique.

11. (Original) The method of claim 8, wherein said decoding the replicated data comprises using a space-time block decoding technique.

12. (Original) The method of claim 8, wherein said decoding the replicated data comprises using a space-frequency block decoding technique.

13. (Original) The method of claim 8, wherein the replicated data includes same data symbols in multiple data streams.

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14. (Currently amended) A communication device comprising:

a modulator configured to modulate data in accordance with an orthogonal frequency division multiplexing technique for transmission over a communications channel using at least a first and a second transmit antenna, wherein the modulator is further configured to generate at least a first data stream for transmission with the first antenna and a second data stream for transmission with the second antenna;

a replicator coupled to the modulator and configured to receive the first and second data streams, wherein the replicator is configured to insert at least one data symbol from the first data stream into the second data stream, wherein an estimated channel matrix is based, at least in part, on the at least one data symbol inserted from the first stream into the second stream;

an encoder coupled to the replicator and configured to receive the first and second

data streams including the inserted at least one symbol, wherein the encoder is configured to encode the first and second data streams in accordance with a block coding technique; and

a transmitter coupled to the encoder and configured to receive the encoded first and second data streams, wherein the transmitter is configured to transmit the fist data stream over the communications channel using the first antenna and further configured to transmit the second data stream including the inserted at least one symbol over the communications channel using the second antenna.

15. (Original) The communication device of claim 14 wherein the block coding technique comprises a space-time encoding technique.

16. (Original) The communication device of claim 14 wherein the block coding technique comprises a space-frequency encoding technique.

17. (Original) The communication device of claim 14 wherein the first and second data streams further include at least two pilot symbols, and wherein the replicator is configured to insert the at least one data symbol between the at least two pilot symbols.

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18. (Original) A communication device comprising:

a receiver configured to receive signals over a communications channel, wherein the signals are based at least in part on first and second data streams transmitted over a communications channel, wherein the second data stream includes at least one data symbol replicated from the first data stream;

a decoder coupled to the receiver and the channel estimator, wherein the decoder is configured to receive the received signals and decode the at least one data symbol replicated from the first data stream;

a channel estimator coupled to the decoder and the receiver, wherein the channel estimator is configured to receive the received signals and the decoded at least one data symbol, wherein the channel estimator is configured to estimate a channel matrix of the communications channel based, at least in part, on the decoded at least one data symbol; and

wherein the decoder is further configured to decode subsequent received signals based. at least in part, on the estimate of the channel matrix.

19. (Original) The communication device of claim 18 wherein the decoder is configured to decode the at least one data symbol using a joint detection technique.

20. (Original) The communication device of claim 18 wherein the first and second data streams each further include at least one pilot symbol, and wherein the channel estimator is configured to receive the at least one pilot symbol and generate an initial estimate of the channel matrix based, at least in part on the at least one pilot symbol.

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REMARKS

Status of the Claims

Claims 1 and 14 have been amended. No new matter has been added. Claims 1-20 are currently pending.

Office Action

In the Office Action dated December 19, 2012, the Examiner rejected claims 1-6, 8-11, 13-15, and 17-20 under 35 U.S.C. 102(e) as being anticipated by U.S. Publication No. 2010/0202559 to Luo et al. ("Luo"). Claims 7, 12, and 16 were rejected under 35 U.S.C. 103(a) as being unpatentable over Luo.

Claims 1, 8, 14, and 18 are Allowable

The Office has rejected claims 1, 8, 14, and 18 at page 2 of the Office Action, under 35 U.S.C. § 102(e), as being anticipated by Luo. The rejections are respectfully traversed.

Claim 1

Luo does not disclose the specific combination of claim 1. For example, Luo fails to disclose "inserting at least a portion of data from the first data stream into the second data stream, wherein an estimated channel matrix is based, at least in part, on the portion of the data inserted from the first stream into the second stream," as in the combination of claim 1.

Luo describes transmitting data and receiving data via multiple antennas using space orthogonal resource transmit diversity. *See* Luo, Abstract. Luo describes transmitting a first set of orthogonal symbols and a first reference signal over a first channel at a first antenna and receiving a second set of orthogonal symbols and a second reference signal over a second channel at a second antenna. *See* Luo, Fig. 7, and paragraphs [0090] and [0109]. Luo further discloses deriving a first channel estimate based on the first reference signal and a second channel estimate based on the second reference signal. *See* Luo, paragraph [0109]. The first channel estimate and the second channel estimate are then used to recover a bit of data from the first set of orthogonal symbols and the second set of orthogonal symbols. *See* Luo, Fig. 7, and paragraphs [0090] and [0109]. Thus, each channel estimate in Luo is based on a respective

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reference signal. Luo does not disclose "inserting at least a portion of data from the first data stream into the second data stream, wherein an estimated channel matrix is based, at least in part, on the portion of the data inserted from the first stream into the second stream," as in the combination of claim 1.

Therefore, Luo does not disclose the combination of claim 1. Hence, withdrawal of the 35 U.S.C. § 102(e) rejection is respectfully requested.

Claim 8

Luo does not disclose the specific combination of claim 8. For example, Luo fails to disclose "generating an updated estimate of the channel matrix based, at least in part, on the replicated data," as in the combination of claim 8.

As explained above, Luo further describes deriving a first channel estimate based on the first reference signal and a second channel estimate based on the second reference signal, and using the first channel estimate and the second channel estimate to recover a bit of data from the first set of orthogonal symbols and the second set of orthogonal symbols. *See* Luo, Fig. 7, and paragraphs [0090] and [0109]. Thus, each channel estimate in Luo is based on a respective reference signal. Luo does not disclose "generating an updated estimate of the channel matrix based, at least in part, on the replicated data," as in the combination of claim 8.

Therefore, Luo does not disclose the combination of claim 8. Hence, withdrawal of the 35 U.S.C. § 102(e) rejection is respectfully requested.

Claim 14

Luo does not disclose the specific combination of claim 14. For example, Luo fails to disclose "a replicator coupled to the modulator and configured to receive the first and second data streams, wherein the replicator is configured to insert at least one data symbol from the first data stream into the second data stream, wherein an estimated channel matrix is based, at least in part, on the at least one data symbol inserted from the first stream into the second stream," as in the combination of claim 14.

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As explained above, Luo describes transmitting a first set of orthogonal symbols and a first reference signal over a first channel at a first antenna and receiving a second set of orthogonal symbols and a second reference signal over a second channel at a second antenna. *See* Luo, Fig. 7, and paragraphs [0090] and [0109]. Luo further discloses deriving a first channel estimate based on the first reference signal and a second channel estimate based on the second reference signal, and using the first channel estimate and the second channel estimate to recover a bit of data from the first set of orthogonal symbols and the second set of orthogonal symbols. *See* Luo, Fig. 7, and paragraphs [0090] and [0109]. Thus, each channel estimate in Luo is based on a respective reference signal. Luo does not disclose "a replicator coupled to the modulator and configured to receive the first and second data streams, wherein the replicator is configured to insert at least one data symbol from the first data stream into the second data stream, wherein an estimated channel matrix is based, at least in part, on the at least one data symbol inserted from the first stream into the second stream," as in the combination of claim 14.

Therefore, Luo does not disclose the combination of claim 1. Hence, withdrawal of the 35 U.S.C. § 102(e) rejection is respectfully requested.

Claim 18

Luo does not disclose the specific combination of claim 18. For example, Luo fails to disclose "a channel estimator coupled to the decoder and the receiver, wherein the channel estimator is configured to receive the received signals and the decoded at least one data symbol, wherein the channel estimator is configured to estimate a channel matrix of the communications channel based, at least in part, on the decoded at least one data symbol," as in the combination of claim 18.

As described above, Luo discloses deriving a first channel estimate based on the first reference signal and a second channel estimate based on the second reference signal. *See* Luo, paragraph [0109]. The first channel estimate and the second channel estimate are then used to recover a bit of data from the first set of orthogonal symbols and the second set of orthogonal symbols. *See* Luo, Fig. 7, and paragraphs [0090] and [0109]. Thus, each channel estimate in Luo is based on a respective reference signal. Luo does not disclose a channel estimator "configured to estimate a channel matrix of the communications channel based, at least in part, on the

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decoded at least one data symbol," as in the combination of claim 18. Therefore, Luo does not disclose "a channel estimator coupled to the decoder and the receiver, wherein the channel estimator is configured to receive the received signals and the decoded at least one data symbol, wherein the channel estimator is configured to estimate a channel matrix of the communications channel based, at least in part, on the decoded at least one data symbol," as in the combination of claim 18.

Therefore, Luo does not disclose the combination of claim 18. Hence, withdrawal of the 35 U.S.C. § 102(e) rejection is respectfully requested.

Dependent claims 2-7, 9-13, 15-17, 19, and 20

Claims 2-7, 9-13, 15-17, 19, and 20 depend from and include all limitations of at least one of the independent claims discussed above. These claims are patentably distinguished over the applied references because of their dependency on patentable independent claims and also because of the additional limitations added by those claims. For brevity, additional distinguishing characteristics of the dependent claims are not discussed in this response. Silence as to additional distinguishing characteristics of the dependent claims not discussed in this response should not be interpreted as belief that the dependent claims are patentable only by virtue of their dependence on a patentable independent claim.

Cursory Rejection of Claims 2-6, 8-11, 13-15, and 17-20

The cursory nature of the rejection of claims 2-6, 8-11, 13-15, and 17-20 are objected to and it is submitted that the Office Action is deficient for at least this reason. Accordingly, to the extent that any rejections are maintained on the same grounds, it is requested that each claim be properly addressed in the next action and the next action be not made final such that a fair opportunity to respond may be provided.

It is noted that the Office Action fails to properly reject all of the claims. It is further noted that the Office Action fails to address all claim recitations in many of claims, including the independent claims 8, 14, and 18 in the manner required by law and as instructed by the MPEP.

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It is well settled law that "[a]ll words in a claim must be considered in judging the patentability of that claim against the prior art," (*see In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970); *see also* MPEP § 2143.03), and the Examiner must make "a searching comparison of the claimed invention – including all its limitations – with the teaching of the prior art" (*see In re Wada and Murphy*, Appeal 2007-3733, *citing In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995); *see* MPEP § 2141). Furthermore, under 37 C.F.R. § 1.104(b), the Office Action must be complete as to all matters. Where a claim is refused for any reason relating to the merits thereof, the grounds of rejection should be fully and clearly stated; the pertinence of each reference, if not apparent, must be clearly explained and each rejected claim specified. *See* MPEP § 707.07(d); *see* 37 C.F.R. § 1.104(b).

Although the Office Action states that claims 2-6, 8-11, 13-15, and 17-20 stand rejected, the entire body of the rejection is contained in a single paragraph. *See* Office Action, page 2, paragraph 2. While the Office Action addresses certain features of independent claim 1 in a cursory manner, the Office Action provides no further detail as to the remaining claims. Moreover, the Office Action fails to provide any details as to the specific sections and/or features in Luo relied upon to allegedly disclose the features in the respective combinations of most of the claims. For example, the Office Action fails to point out the teachings of Luo relied upon to disclose "generating an updated estimate of the channel matrix based, at least in part, on the replicated data," in the combination of claim 8.

It cannot be fully determined what grounds the Examiner uses to reject claims 2-6, 8-11, 13-15, and 17-20. Because the Office Action is not complete as to all matters, the Office Action is deficient in view of the requirements of 37 C.F.R. § 1.104(b) and well established precedent, and any subsequent action may not be made final.

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Favorable consideration and a timely Notice of Allowance are earnestly solicited. The Examiner is invited to contact the undersigned should a telephone conversation be useful in the efficient prosecution of this matter.

Respectfully submitted,

DORSEY & WHITNEY LLP

MARCH 18, 2013
Date

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Petitioner Samsung Ex-1004, 0257

Electronic Acknowledgement Receipt	
EFS ID:	15291082
Application Number:	12999029
International Application Number:	
Confirmation Number:	1213
Title of Invention:	INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS
First Named Inventor/Applicant Name:	Ali Yazdan Panah
Customer Number:	27076
Filer:	Brandon Paul. Hegstrom/Cecilia Tri
Filer Authorized By:	Brandon Paul. Hegstrom
Attorney Docket Number:	P215801.WO-US.01
Receipt Date:	18-MAR-2013
Filing Date:	14-DEC-2010
Time Stamp:	18:58:28
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		US-800279-02-US-REG_20130318_Response.pdf	534047 4262d1d34dba79be6b5a4f724820a0f07b5574b4	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	11
Warnings:			
Information:			
	Total Files Size (in bytes):	534047	

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/999,029	12/14/2010	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	03/18/2013	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $ =		OR	X $62=	0
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X $ =		OR	X $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/MARY EVANS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01	1213

27076 7590 05/08/2013

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EXAMINER	
VO, DON NGUYEN	
ART UNIT	**PAPER NUMBER**
2634	

NOTIFICATION DATE	DELIVERY MODE
05/08/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipdocket-se@dorsey.com
IPDocket_SE@dorsey.foundationip.com
warren.heather@dorsey.com

Petitioner Samsung Ex-1004, 0261

Office Action Summary	Application No. 12/999,029	Applicant(s) PANAH ET AL.	
	Examiner Don N. Vo	Art Unit 2634	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 March 2013*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-8 and 10-17* is/are rejected.

8)☒ Claim(s) *9 and 18-20* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some * c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Interim copies:

a)☐ All b)☐ Some c)☐ None of the: Interim copies of the priority documents have been received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

Petitioner Samsung Ex-1004, 0262

DETAILED ACTION

Acknowledgment

1. This Office Action is responsive to the Amendment filed on 03/18/2013.

Claim Objections

2. Claims 14-20 are objected to because of the following informalities:

In claim 14, line 10, "part." is suggested to change to – part, --; and

In claim 18, line 14, "based." is suggested to change to – based, --.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-6, 8, 10, 11, 13-15 and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Luo et al (US 2010/0202559).

Regarding claims 1-6, 8, 10, 11, 13-15 and 17, Luo, as shown in figures 4-8 and 10-18, teaches method and apparatus for transmitting/receiving data over communication channel using plurality of antennas comprising modulating data for

transmission over the communications channel in accordance with an orthogonal frequency division multiplexing technique to generate at least a first and second data stream for transmission using respective transmit antennas; (fig. 7, transmit antennas 1 and 2); inserting at least a portion of data from the first data stream into the second data stream; (fig. 7, symbol period 3) and transmitting the first and second data streams over the communications channel (fig. 7, transmit antennas 1 and 2). See also paragraphs [0048] – [0123].

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 7, 12 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Luo et al (US 2010/0202559).

Regarding claims 7, 12, and 16, Luo teaches all subject matter claimed except for the space-frequency block encoding/decoding technique. However, such space-frequency block encoding/decoding technique is well known in the art of digital communications for diversity system and therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the communication system of Luo by employing the space-frequency block encoding/decoding technique since it is just a matter of selecting a well-known technique as an alternative for providing diversity communications so that to arrive at the claimed invention.

Allowable Subject Matter

9. Claim 9 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. Claims 18-20 would be allowable if rewritten or amended to overcome the objection set forth in this Office action.

Response to Arguments

11. Applicant's arguments filed 03/18/2013 have been fully considered but they are not persuasive.

In the Remarks, Applicant traverses to the rejection by mainly arguing that the cited reference Luo et al (US 2010/0202559) fail to teach (a) "inserting at least a portion of data from the first data stream into the second data stream, wherein an estimated channel matrix is based, at least in part, on the portion of the data inserted from the first stream into the second stream" as now recited in claims 1 and 14 and (b) "generating an updated estimate of the channel matrix based, at least in part, on the replicated data," as recited in claim 8.

The examiner is respectfully not agreed.

Regarding (a), the newly added "wherein" clause is not given any patentable weight because "an estimated channel matrix" is not used by any other method step and therefore, not serving any useful purpose for the claim.

Regarding (b), similar rationale is applied for such recitation because "an updated estimate of the channel matrix" is not used by any other method step.

It is noted that such "updated estimate of the channel matrix" is later used by the recitation of claim 9. That is why the rejection to claim 9 is now withdrawn and objected as indicated above.

Applicant's arguments, see Remarks, filed 03/18/2013, with respect to claim 18-20 have been fully considered and are persuasive. The rejection of the claims has been withdrawn.

Based on the above rationale, it is believed that claims 1-8 and 10-17 are still met by Luo et al (US 2010/0202559) and the rejections are therefore still maintained.

Conclusion

12. **Examiner's note**: Examiner has cited particular columns and line numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to the specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Don N. Vo whose telephone number is (571) 272-3018. The examiner can normally be reached on Mon-Fri (9:00AM - 6:00PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Daniel C. Washburn can be reached on (571) 272-5551. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Don N. Vo/
Primary Examiner, Art Unit 2611

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	26	channel with estimat$3 with replicat$3 with data	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/05/01 09:03
L2	480	(insert$3 replicat$3) with first with second with stream with transmi$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/05/01 09:52
L3	71	channel with estimat$3 with replicat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/05/01 09:53
L4	1	2 same 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/05/01 09:53
L5	1	2 and 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/05/01 09:53
L6	75261	channel with estimat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/05/01 09:54
L7	6	2 same 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/05/01 09:54

EAST Search History (Interference)

<This search history is empty>

5/ 1/ 2013 9:56:11 AM

Petitioner Samsung Ex-1004, 0270

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	Art Unit
	DON N VO	2634

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
375	260, 267, 299, 347	12/6/12	DV

SEARCH NOTES		
Search Notes	Date	Examiner
INVENTOR SEARCHED	12/6/12	DV
EAST	12/10/12 & 12/11/12	DV
EAST	5/1/13	DV

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

	/DON N VO/ Primary Examiner.Art Unit 2634

Petitioner Samsung Ex-1004, 0271

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	Art Unit
	DON N VO	2634

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/14/2012	05/03/2013							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	O							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	O							
	19	✓	O							
	20	✓	O							

Petitioner Samsung Ex-1004, 0272

To: ipdocket-se@dorsey.com,IPDocket_SE@dorsey.foundationip.com,warren.heather@dorsey.com
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Cc: PAIR_eOfficeAction@uspto.gov
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May 08, 2013 05:34:29 AM

Dear PAIR Customer:

DORSEY & WHITNEY LLP
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SEATTLE, WA 98104-7043
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 27076 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

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Application	Document	Mailroom Date	Attorney Docket No.
12999029	CTFR	05/08/2013	P215801.WO-US.01

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Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RESPONSE UNDER 37 C.F.R. § 1.116
EXPEDITED PROCEDURE - EXAMINING GROUP 2600

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	: 12/999,029	Confirmation No.	: 1213
First Named Inventor	: Ali Yazdan Panah		
Filed	: December 14, 2010	Attorney Docket No.:	P215801.WO-US.01
Art Unit	: 2634	Customer No.	: 27,076
Examiner	: Don Nguyen Vo		
Title	: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS		

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE UNDER 37 C.F.R. § 1.116

Sir:

Receipt of the Office Action dated May 8, 2013 is acknowledged. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 4 of this paper.

Claim Amendments:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-7. (Canceled).

8. (Currently amended) A method of decoding a signal transmitted over a communications channel, the method comprising:

receiving a pilot symbol over the communications channel;

estimating a channel matrix of the communications channel based, at least in part, on the pilot symbol;

receiving replicated data from multiple data streams transmitted over the communications channel;

decoding the replicated data using the estimated channel matrix; ~~and~~

generating an updated estimate of the channel matrix based, at least in part, on the replicated data; and

decoding subsequently received signals over the communications channel using the updated estimate of the channel matrix.

9. (Canceled).

10. (Original) The method of claim 8 wherein said decoding the replicated data comprises using a joint detection technique.

11. (Original) The method of claim 8, wherein said decoding the replicated data comprises using a space-time block decoding technique.

12. (Original) The method of claim 8, wherein said decoding the replicated data comprises using a space-frequency block decoding technique.

13. (Original) The method of claim 8, wherein the replicated data includes same data symbols in multiple data streams.

Petitioner Samsung Ex-1004, 0275

14-17. (Canceled).

18. (Currently amended) A communication device comprising:

a receiver configured to receive signals over a communications channel, wherein the signals are based at least in part on first and second data streams transmitted over a communications channel, wherein the second data stream includes at least one data symbol replicated from the first data stream;

a decoder coupled to the receiver and the channel estimator, wherein the decoder is configured to receive the received signals and decode the at least one data symbol replicated from the first data stream;

a channel estimator coupled to the decoder and the receiver, wherein the channel estimator is configured to receive the received signals and the decoded at least one data symbol, wherein the channel estimator is configured to estimate a channel matrix of the communications channel based, at least in part, on the decoded at least one data symbol; and

wherein the decoder is further configured to decode subsequent received signals ~~based.~~ based, at least in part, on the estimate of the channel matrix.

19. (Original) The communication device of claim 18 wherein the decoder is configured to decode the at least one data symbol using a joint detection technique.

20. (Original) The communication device of claim 18 wherein the first and second data streams each further include at least one pilot symbol, and wherein the channel estimator is configured to receive the at least one pilot symbol and generate an initial estimate of the channel matrix based, at least in part on the at least one pilot symbol.

Petitioner Samsung Ex-1004, 0276

REMARKS

Status of the Claims

Claims 8, 10-13 and 18-20 are currently pending. Claims 1-7, 9, and 14-17 have been canceled without prejudice or disclaimer. Claims 8 and 18 has been amended. No new matter has been added.

Office Action

In the Office Action dated May 8, 2013, the Examiner rejected claims 1-6, 8, 10, 11, 13-15, and 17 under 35 U.S.C. § 102(e) as being anticipated by U.S. Publication No. 2010/0202559 to Luo et al. ("Luo"). Claims 7, 12, and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Luo. Claim 9 was objected as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Claim Objections

The Office has objected to claims 18-20 due to informalities. Claim 18 has been amended to address the concern raised by the Office. Withdrawal of the objection to claims 18-20 is respectfully requested.

Allowable Subject Matter

The Office's indication of allowable subject matter of claims 9 and 18-20 is appreciated. Claim 8 has been amended to include recitations of claim 9. Withdrawal of the 35 U.S.C. § 102(e) rejections of claims 8, 10, 11, and 13 is respectfully requested. Withdrawal of the 35 U.S.C. § 103(a) rejection of claim 12 is respectfully requested.

Petitioner Samsung Ex-1004, 0277

The Examiner is invited to contact the undersigned should a telephone conversation be useful in the efficient prosecution of this matter.

Respectfully submitted,
DORSEY & WHITNEY LLP

June 27, 2013
Date

Brandon Hegstrom
Registration No. 59,432
Telephone No. (206) 903-8769

BPH:ct

DORSEY & WHITNEY LLP
701 Fifth Avenue, Suite 6100
Seattle, Washington 98104-7043
(206) 903-8800 (telephone)
(206) 299-9288 (fax)

Petitioner Samsung Ex-1004, 0278

Electronic Acknowledgement Receipt	
EFS ID:	16178555
Application Number:	12999029
International Application Number:	
Confirmation Number:	1213
Title of Invention:	INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS
First Named Inventor/Applicant Name:	Ali Yazdan Panah
Customer Number:	27076
Filer:	Brandon Paul. Hegstrom/Cecilia Tri
Filer Authorized By:	Brandon Paul. Hegstrom
Attorney Docket Number:	P215801.WO-US.01
Receipt Date:	27-JUN-2013
Filing Date:	14-DEC-2010
Time Stamp:	17:51:31
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		US-800279-02-US-NAT_20130508_Final_OA_Response.pdf	293966 ec4b4e8e7a2e3132bcf7bb3f6862b1f545ab5142	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment After Final	1	1
	Claims	2	3
	Applicant Arguments/Remarks Made in an Amendment	4	5
Warnings:			
Information:			
	Total Files Size (in bytes):	293966	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/999,029	Filing Date 12/14/2010	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 = *		X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 = *		X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	06/27/2013	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 8	Minus	** 20	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 4	= 0	X $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/TARA WITCHER/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
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NOTICE OF ALLOWANCE AND FEE(S) DUE

27076 7590 07/09/2013

DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043

EXAMINER
VO, DON NGUYEN

ART UNIT	PAPER NUMBER
2634	

DATE MAILED: 07/09/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01	1213

TITLE OF INVENTION: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	10/09/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

Petitioner Samsung Ex-1004, 0282

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

27076 7590 07/09/2013
DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01	1213

TITLE OF INVENTION: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	10/09/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
VO, DON NGUYEN	2634	375-267000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

Petitioner Samsung Ex-1004, 0283

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29	NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27	NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.	NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Petitioner Samsung Ex-1004, 0284

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01	1213

27076 7590 07/09/2013

DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043

EXAMINER	
VO, DON NGUYEN	
ART UNIT	**PAPER NUMBER**
2634	

DATE MAILED: 07/09/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 309 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 309 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Petitioner Samsung Ex-1004, 0285

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 12/999,029	Applicant(s) PANAH ET AL.	
	Examiner Don N. Vo	Art Unit 2634	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the Amendment filed on 06/27/2013*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *8, 10-13 and 18-20, which are now renumbered as claims 1-8, respectively*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Don N Vo/
Primary Examiner, Art Unit 2634

Petitioner Samsung Ex-1004, 0287

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	Art Unit
	DON N VO	2634

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/14/2012	05/03/2013	07/02/2013						
	1	✓	✓	-						
	2	✓	✓	-						
	3	✓	✓	-						
	4	✓	✓	-						
	5	✓	✓	-						
	6	✓	✓	-						
	7	✓	✓	-						
1	8	✓	✓	=						
	9	✓	O	-						
2	10	✓	✓	=						
3	11	✓	✓	=						
4	12	✓	✓	=						
5	13	✓	✓	=						
	14	✓	✓	-						
	15	✓	✓	-						
	16	✓	✓	-						
	17	✓	✓	-						
6	18	✓	O	=						
7	19	✓	O	=						
8	20	✓	O	=						

Petitioner Samsung Ex-1004, 0288

RESPONSE UNDER 37 C.F.R. § 1.116
EXPEDITED PROCEDURE - EXAMINING GROUP 2600

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	: 12/999,029	Confirmation No.	: 1213
First Named Inventor	: Ali Yazdan Panah		
Filed	: December 14, 2010	Attorney Docket No.:	P215801.WO-US.01
Art Unit	: 2634	Customer No.	: 27,076
Examiner	: Don Nguyen Vo		
Title	: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS		

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE UNDER 37 C.F.R. § 1.116

Sir:

Receipt of the Office Action dated May 8, 2013 is acknowledged. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 4 of this paper.

OK TO ENTER: /D.V./

07/02/2013

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	Art Unit
	DON N VO	2634

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
375	260, 267, 299, 347	12/6/12	DV

SEARCH NOTES		
Search Notes	Date	Examiner
INVENTOR SEARCHED	12/6/12	DV
EAST	12/10/12 & 12/11/12	DV
EAST	5/1/13	DV
EAST	7/1/13	DV

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
375	267	7/1/13	DV

	/DON N VO/ Primary Examiner.Art Unit 2634

Petitioner Samsung Ex-1004, 0290

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	18961	replica$4 adj2 data	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/01 15:29
L2	76807	estimat$3 with channel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/01 15:30
L3	62	1 same 2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/01 15:30

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	8199	replica$4 adj2 data	USPAT; UPAD	OR	ON	2013/07/01 15:36
L5	26132	estimat$3 with channel	USPAT; UPAD	OR	ON	2013/07/01 15:36
L6	20	4 same 5	USPAT; UPAD	OR	ON	2013/07/01 15:36

7/1/2013 3:36:45 PM
C:\Users\dvo\Documents\EAST\Workspaces\Default EAST Workspace (Flat Panel LANDSCAPE).wsp

Petitioner Samsung Ex-1004, 0291

Issue Classification	**Application/Control No.**	**Applicant(s)/Patent Under Reexamination**
	12999029	PANAH ET AL.
	Examiner	**Art Unit**
	DON N VO	2634

CPC

Symbol			Type	Version
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CPC Combination Sets

Symbol			Type	Set	Ranking	Version
		/				
		/				

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 8	
/DON N VO/ Primary Examiner.Art Unit 2634 07/02/2013 (Primary Examiner) (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 7

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	**Art Unit**
	DON N VO	2634

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
375	267	H	0	4	B	7 / 02 (2006.01.01)						
CROSS REFERENCE(S)												
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)											

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 8	
/DON N VO/ Primary Examiner.Art Unit 2634 07/02/2013 (Primary Examiner) (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 7

Petitioner Samsung Ex-1004, 0293

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12999029	PANAH ET AL.
	Examiner	**Art Unit**
	DON N VO	2634

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17												
	2	6	18												
	3	7	19												
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	5														
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	7														
1	8														
	9														
2	10														
3	11														
4	12														
5	13														
	14														
	15														
	16														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	8	
/DON N VO/ Primary Examiner.Art Unit 2634	07/02/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	7

Petitioner Samsung Ex-1004, 0294

To: ipdocket-se@dorsey.com,IPDocket_SE@dorsey.foundationip.com,warren.heather@dorsey.com
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 27076

Jul 09, 2013 05:20:26 AM

Dear PAIR Customer:

DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 27076 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
12999029	NOA	07/09/2013	P215801.WO-US.01

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

27076 7590 07/09/2013
DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01	1213

TITLE OF INVENTION: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	10/09/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
VO, DON NGUYEN	2634	375-267000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 Dorsey & Whitney LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: THE BOARD OF REGENTS OF THE UNIVERSITY OF TEXAS SYSTEM

(B) RESIDENCE: (CITY and STATE OR COUNTRY): AUSTIN, TEXAS

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-1266 (enclose an extra copy of this form).

Petitioner Samsung Ex-1004, 0296

5. **Change in Entity Status** (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date SEPTEMBER 23, 2013

Typed or printed name Brandon P. Hegstrom Registration No. 59,432

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Petitioner Samsung Ex-1004, 0297

Electronic Patent Application Fee Transmittal

Application Number:	12999029
Filing Date:	14-Dec-2010
Title of Invention:	INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS
First Named Inventor/Applicant Name:	Ali Yazdan Panah
Filer:	Brandon Paul. Hegstrom/Cecilia Tri
Attorney Docket Number:	P215801.WO-US.01

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	1780	1780
Publ. Fee- Early, Voluntary, or Normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**2080**

Electronic Acknowledgement Receipt	
EFS ID:	16931634
Application Number:	12999029
International Application Number:	
Confirmation Number:	1213
Title of Invention:	INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS
First Named Inventor/Applicant Name:	Ali Yazdan Panah
Customer Number:	27076
Filer:	Brandon Paul. Hegstrom/Cecilia Tri
Filer Authorized By:	Brandon Paul. Hegstrom
Attorney Docket Number:	P215801.WO-US.01
Receipt Date:	23-SEP-2013
Filing Date:	14-DEC-2010
Time Stamp:	20:21:37
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$2080
RAM confirmation Number	7685
Deposit Account	501266
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)	
Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	US-800279-02-US-NAT_20130923_IssueFeePayment.pdf	160786 0e0b1c9716c3d38f123a6aed9e56a43c52ddbe06	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32264 8105a1554a3af6e541143e3c0cf1d19343cf4359	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	193050		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/999,029	10/22/2013	8565331	P215801.WO-US.01	1213

27076 7590 10/02/2013

DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 309 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Ali Yazdan Panah, Austin, TX;
Robert W. Heath JR., Austin, TX;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Petitioner Samsung Ex-1004, 0302

To: ipdocket-se@dorsey.com,IPDocket_SE@dorsey.foundationip.com,warren.heather@dorsey.com
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 27076

Oct 03, 2013 05:37:24 AM

Dear PAIR Customer:

DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
Columbia Center
701 Fifth Avenue, Suite 6100
SEATTLE, WA 98104-7043
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 27076 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
12999029	ISSUE.NTF	10/02/2013	P215801.WO-US.01

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	REQUEST ID
12/999,029	8565331	2634	28906

PAIR Correspondence Address/Fee Address Change

The following fields have been changed to Customer Number 119663 on 11/18/2016 via Private PAIR in view of the certification copied below that authorized the change.

- Correspondence Address

The address for Customer Number 119663 is:
119663
Xinova, LLC/Dorsey & Whitney LLP
701 5th Avenue
Seattle, WA 98104

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

An attorney or Agent of Record registered to practice before the Patent and Trademark Office who has been given power of attorney in this application

Signature:	/Jennifer L. Spaith/
Name:	Jennifer L. Spaith
Registration Number:	51916

PTO/SB/81A (12-08)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	8,565,331
Issue Date	10/22/2013
First Named Inventor	Ali Yazdan Panah
Title	INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS
Attorney Docket No.	P215801.WO-US.01

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

154241

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified patent to:

■ The address associated with the above-identified Customer Number.

OR

☐ The address associated with the Customer Number identified in the box at right:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Inventor, having ownership of the patent.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____.

SIGNATURE of Inventor or Patent Owner

Signature		Date	
Name	James T. Cox II	Telephone	512-499-4462
Title and Company	Assistant General Counsel, The University of Texas System		

NOTE: Signatures of all the inventors or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☐ A total of _____ forms are submitted.

This collection of information is required by 37 CFR 3.31, 3.32, and 3.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	33707809
Application Number:	12999029
International Application Number:	
Confirmation Number:	1213
Title of Invention:	INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS
First Named Inventor/Applicant Name:	Ali Yazdan Panah
Customer Number:	119663
Filer:	Ajay K. Gambhir/Katherine Gardner
Filer Authorized By:	Ajay K. Gambhir
Attorney Docket Number:	P215801.WO-US.01
Receipt Date:	13-SEP-2018
Filing Date:	14-DEC-2010
Time Stamp:	12:49:47
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	US-800279-02-US-NAT_37CFR373b_13SEP2018.pdf	100236 5b89905118f6dbd597455ab31c59a831acf6ba8e	no	2
Warnings:					

Information:					
2	Power of Attorney	US-800279-02-US-NAT_POA_13SEP2018.pdf	291768 60f8961a0240553222298a36bd94cc2b093c39383	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	392004	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/96 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: THE BOARD OF REGENTS OF THE UNIVERSITY OF TEXAS SYSTEM

Application No./Patent No.: 12/999,029 Filed/Issue Date: December 14, 2010

Titled: INSERTING AND DECODING REPLICATED DATA SYMBOLS IN WIRELESS COMMUNICATIONS

THE BOARD OF REGENTS OF THE UNIVERSITY C ,a University

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ☑ the assignee of the entire right, title, and interest in;

2. ☐ **an assignee of less than the entire right, title, and interest in (The extent (by percentage) of its ownership interest is** _____%); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made) the patent application/patent identified above, by virtue of either:

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 025011 , Frame 0144 , or for which a copy therefore is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____ , or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Ajay K GAMBHIR/ 2018-09-13

Signature Date

Ajay K GAMBHIR Attorney for Assignee

Printed or Typed Name Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01

CONFIRMATION NO. 1213

POWER OF ATTORNEY NOTICE



119663
Clairvolex Inc.
Attention: Allied Inventors
111 E Broadway
Suite 725
Salt Lake City, UT 84111

Date Mailed: 09/19/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/13/2018.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vnguyen/

Petitioner Samsung Ex-1004, 0310

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/999,029	12/14/2010	Ali Yazdan Panah	P215801.WO-US.01

CONFIRMATION NO. 1213

154241
IP Spring - AI
180 N. LaSalle St.
Suite 3700
Chicago, IL 60601

POA ACCEPTANCE LETTER

OC000000102388457

Date Mailed: 09/19/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/13/2018.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vnguyen/

Petitioner Samsung Ex-1004, 0311

To: ajay.gambhir@ipspring.com,paralegalteam@ipspring.com,docket@ipspring.com
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 154241

Sep 19, 2018 04:03:57 AM

Dear PAIR Customer:

IP Spring - AI
180 N. LaSalle St.
Suite 3700
Chicago, IL 60601
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 154241 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
12999029	N570	09/19/2018	P215801.WO-US.01
	N570	09/19/2018	P215801.WO-US.01

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM