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U.S. Patent 9,584,262

U.S. Patent 9,584,262 ("*AX Wireless*" or the "patent-at-issue") was filed on August 20, 2010. According to the paragraph in the specification entitled "Related Application Data", the application is a national stage application under 35 U.S.C. 371 of PCT Application PCT/US2010/046088 having an international filing date of August 20, 2010, which also claims the benefit of and priority to U.S. Patent Application 61/235,909, filed August 21, 2009, entitled "Header Repetition Scheme in Packet-Based OFDM Systems". Claim 1 of the patent-at-issue is generally directed to a wireless Orthogonal Frequency Division Multiplexing (OFDM) transceiver that receives, in a first narrow frequency band, a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits. The system also includes a demodulator to demodulate the first OFDM symbols to determine the first header bits and at least one header bit is repeated on a plurality of OFDM subcarriers. The transceiver also receives, in a second wider frequency band, a second packet comprising second number of OFDM symbols and header bits different from the first header bits. The demodulator then demodulates the second OFDM symbols to determine the second header bits. Lastly, the first narrow and second wider frequency bands have one or more overlapping frequency regions.

The primary reference, U.S. Pat. App. 2009/0116435 ("*Ericsson*"), was filed on July 10, 2008, and claims an earliest priority date on November 5, 2007. This patent application discloses a base station of a radio access network which includes a transceiver circuitry communicating a frame of information over a radio interface. A frame handler in the base station processes data to be transmitted to the first and second radio terminals using a frame format compatible with the radio access technology systems.

The primary reference, U.S. Patent 7,260,416 ("*Qualcomm*"), was filed on January 21, 2003, and claims priority on the same date. This patent is directed to a method for a wireless communication device which has two receiver portions to simultaneously receive at least two signals. The receiver portions are configured to convert the signals to a common frequency band. The first communication signal is a narrowband signal while the second communication signal is a wideband signal.

The secondary reference, U.S. Patent 9,191,036 ("*AT&T*"), was filed on September 30, 2014, and claims an earliest priority date on July 24, 2009. This patent discloses receivers in a mobile device configured to mitigate receiver overload and fully utilize available spectrum for communication. The system initiates a first provisioning for a first receiver corresponding to a first filter associated with the first portion of the electromagnetic spectrum. The system will also initiate a second provisioning for the second receiver for the second portion of the electromagnetic spectrum.

The secondary reference, U.S. Pat. App. 2007/0172000 ("*Sanyo*"), was filed on December 27, 2006, and claims an earliest priority date on December 27, 2005. This patent application discloses a symbol receiver which receives a first and second symbol that contains a plurality of signal points. The system also includes a demodulation unit to demodulate symbols such that the

signal points of the symbols are combined by mutual correspondence between the first and second symbols.

The secondary reference, U.S. Patent 10,212,019 ("*NXP*"), was filed on August 27, 2018, and claims an earliest priority date on September 23, 2008. This patent is directed to a communication device that determines an estimate of a communication channel and based on the estimate, determines a pair of modulation and encoding schemes to be used for a packet. This includes determining a first and second set of adjacent OFDM subcarriers.

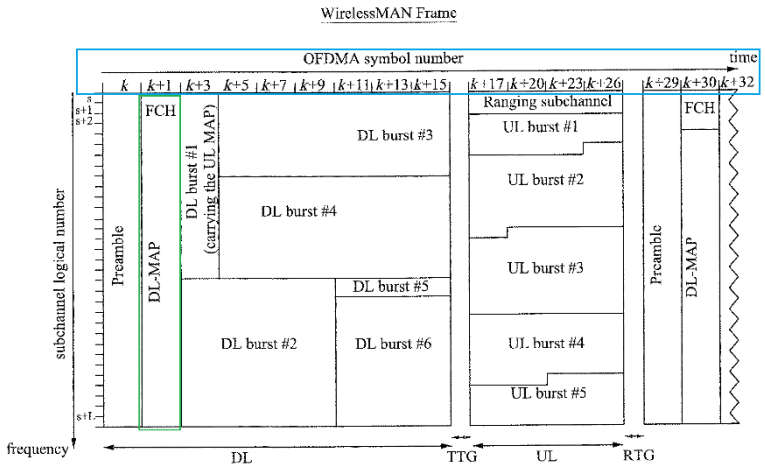
The secondary reference, U.S. Patent 8,189,516 ("*Samsung*"), was filed on October 3, 2006, and claims an earliest priority date on October 4, 2005. This patent is directed to a method of effectively transmitting and receiving packet data control channel in an OFDM wireless communication system. The system can transmit the packet data control channel separately for a diversity transmission mode and an Adaptive Modulation and Coding mode in the OFDM system.

A sample claim chart comparing claim 1 of *AX Wireless* to *Ericsson*, *Qualcomm, AT&T, Sanyo, NXP,* and *Samsung* is provided below.

US9584262 ("*AX Wireless*")	**A. US20090116435** ("*Ericsson*") **B. US7260416** ("*Qualcomm*") **C. US9191036** ("*AT&T*") **D. US20070172000** ("*Sanyo*") **E. US10212019** ("*NXP*") **F. US8189516** ("*Samsung*")
1.pre. A **wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver** operable to:	**A. US20090116435** "The **transceiving circuitry includes an OFDM receiver** for demodulating a signal from the base station transmitted across the first channel bandwidth and decode the signal." *Ericsson* at par. 0016 **D. US20070172000** "The **communication system** 100 **includes a transmitting apparatus** 10 **and a receiving apparatus** 12." *Sanyo* at par. 0049 "The present embodiments can be applied to high-speed data **communication system** such as UWB **that uses the Orthogonal Frequency Division Multiplex (OFDM) scheme**." *Sanyo* at par. 0042 **E. US10212019** "In some embodiments, **the wireless communication system** 100 **uses an OFDM technique**, and the subcarriers are selected to be mutually orthogonal (i.e., to minimize cross-talk between each pair of subcarriers)." *NXP* at col. 4:28-31 "Furthermore , although the **wireless communication system** 100 illustrated in FIG . 1 **includes a transmitting device** 102 **and a receiving device** 106, devices in the wireless communication system 100 may generally operate in multiple modes (e.g., a transmit mode and a receive mode)." *NXP* at col. 4:7-11 **F. US8189516** "Accordingly, an aspect of exemplary embodiments of the present invention is to provide an apparatus and method to efficiently **transmit/receive a packet data control channel in an OFDM wireless communication system**." *Samsung* at col. 4:14-17

1.a. **receive, in a first narrower frequency band, by a receiver** using wireless OFDM communications, **a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits**;	**A. US20090116435** "36. The apparatus in claim 34, wherein the **transceiver circuitry includes an OFDM receiver for demodulating a signal from the base station transmitted across the first channel bandwidth** and decode the signal." *Ericsson* at claim 36 "The **first channel bandwidth includes multiple sub-bands** and each sub-band corresponds to the second bandwidth. A **frame handler processes data to be transmitted to the base station into a frame using a frame format that is compatible with both the first radio access technology** and the second radio access technology." *Ericsson* at par. 0014 "The simplified function block diagram shows three buffers 42a-42a of N buffers corresponding to N Sub-bands that store **packet data units** (PDUs) **provided by the MAC layer to be transmitted on the downlink to radio terminals**." *Ericsson* at par. 0056 "The frame structure for a WirelessMAN OFDMA transmit signal is shown in FIG. 2. In general, the IEEE 802.16e standard refers to the overall document, while the term "legacy 802.16e terminals' refers to WirelessMAN OFDMA terminals or WiMAX terminals as well. The frame length for the signal is 5 ms, and time division duplexing (TDD) can be used within the frame. The **first OFDM symbol**, represented in the vertical direction in FIG. 2, is a preamble that facilitates initial synchronization by UEs/radio terminals to the downlink (DL) transmissions, channel estimation, and cell search. A **frame control header** (FCH) message that follows conveys parameters regarding radio resource "reuse' in the system and coding parameters of the DL-MAP message that follows it." *Ericsson* at par. 0034

(cont.)
1.a. **receive, in a first narrower frequency band, by a receiver** using wireless OFDM communications, **a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits**;



(Fig. 2)

B. US7260416
"1. A wireless device comprising:
a first receiver portion configured, during a handoff condition, to convert a first signal in **a first receive frequency band to a first converted signal in a first frequency band**; . . . ." *Qualcomm* at claim 1

"The communication device is able to extract information from each of the received signals when **the first communication signal is a narrowband signal** and the second communication signal is a wideband signal, such as a spread spectrum signal." *Qualcomm* at col. 3:16-20

C. US9191036
"As an example, asymmetric receiver configurations can include a pair of receivers with **a first receiver that includes a narrow-band filter that tunes band** β 144 and a second receiver with a wide-band filter that tunes band α 146. Such first receiver and second receiver can be configured, e.g., by a base station, to operate as a MIMO pair." *AT&T* at col. 9:6-11

D. US20070172000
"1. A receiving apparatus, comprising:
a symbol receiver which receives a first symbol assigned to a point of a plurality of signal points contained in a signal constellation, using a modulation scheme based on the signal constellation that contains a plurality of signal points having a plurality of kinds of amplitudes, ..." *Sanyo* at claim 1

(cont.) 1.a. **receive, in a first narrower frequency band, by a receiver** using wireless OFDM communications, **a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits**;	"4. A receiving apparatus according to claim 1, wherein said symbol demodulation unit multiplies, per symbol, either one of an in-phase component and a quadrature component by a weighting factor, for **a plurality of bits contained in each symbol** and then combines the symbols assigned to the respective signal points." *Sanyo* at claim 4 "The first modulation unit may assign a symbol to a signal point defined according to bits indicative of a quadrant to which the symbol is to be assigned and bits indicative of placement within the quadrant, wherein **the bits are contained in the symbols inputted by the input unit**, ..." *Sanyo* at par. 0009 "FIG. 2A shows a **burst format of an MB-OFDM scheme**. The horizontal axis of the format represents time. **A frame is roughly divided into** a preamble part, **a header part** and a data part." *Sanyo* at par. 0055 "PLCP Header corresponds to a control signal. "Payload corresponds to a data signal. **They are each composed of a predetermined number of symbols**." *Sanyo* at par. 0056 **E. US10212019** "1. A method, comprising: . . . determining, for data to be transmitted **via a first set of adjacent OFDM, subcarriers**, a first pair of a) a modulation scheme and b) an encoding scheme, and . . . ." *NXP* at claim 1 "4. The method of claim 1, further comprising: generating, at the communication device, **a physical layer header of the packet to indicate**: **data modulated on the first set of adjacent OFDM subcarriers is modulated** and encoded using the first pair of a) the modulation scheme and b) the encoding scheme, and . . . ." *NXP* at claim 4 "5. The method of claim 1, wherein: the **packet is a first packet**; and . . . ." *NXP* at claim 5 **F. US8189516** "1. A method for receiving a packet data control channel in an Orthogonal Frequency Division Multiple Access (OFDMA) wireless communication system, the method comprising:

(cont.) 1.a. **receive, in a first narrower frequency band, by a receiver** using wireless OFDM communications, **a first packet comprising a first number of OFDM symbols that carry a first plurality of header bits**;	**receiving a signal including a first packet data, a first packet data control information for the first packet data**, ..." *Samsung* at claim 1 "It can be noted that the system bandwidth 210 is composed of a plurality of sub-carriers 230. **Each of the sub-carriers** 230 **is composed of one or a plurality of OFDM symbols** in the time axis. Reference numeral 220 illustrates **one frame composed of several OFDM symbols**." *Samsung* at col. 6:7-11
1.b. **demodulate, by a demodulator connected to and in communication with the receiver**, **the first number of OFDM symbols to determine the first plurality of header bits**, wherein **at least one header bit of the first plurality of header bits in the first packet is repeated on a plurality of OFDM subcarriers**;	**A. US20090116435** "36. The apparatus in claim 34, wherein the transceiver circuitry includes an OFDM receiver for **demodulating a signal from the base station transmitted across the first channel bandwidth and decode the signal**." *Ericsson* at claim 36 "For example, in the figure, **the OFDM receiver** 54 a **demodulates data from sub-band 1, OFDM receiver** 54 b **demodulates data from sub-band n, and mixer** 52 c **demodulates data from sub-band N**. The demodulated outputs from the receivers for the 802.16e sub-bands, such as 54 a and 54 b in the figure, as well as those from the receivers for the 802.16m-only sub-bands, such as 54 c in the figure, are then decoded in a decoder 56 to generate 802.16m PDUs." *Ericsson* at par. 0058 "The frame structure for a WirelessMAN OFDMA transmit signal is shown in FIG. 2. In general, the IEEE 802.16e standard refers to the overall document, while the term "legacy 802.16e terminals' refers to WirelessMAN OFDMA terminals or WiMAX terminals as well. The frame length for the signal is 5 ms, and time division duplexing (TDD) can be used within the frame. The **first OFDM symbol**, represented in the vertical direction in FIG. 2, is a preamble that facilitates initial synchronization by UEs/radio terminals to the downlink (DL) transmissions, channel estimation, and cell search. A **frame control header** (FCH) message that follows conveys parameters regarding radio resource "reuse' in the system and coding parameters of the DL-MAP message that follows it." *Ericsson* at par. 0034

(cont.) 1.b. **demodulate, by a demodulator connected to and in communication with the receiver**, **the first number of OFDM symbols** **to** **determine the first plurality of header bits**, wherein **at least one header bit of the first plurality of header bits in the first packet is repeated on a plurality of OFDM subcarriers**;	**B. US7260416** "In the example, the dual mode receiver 200 is configured to simultaneously receive and **demodulate signals** from a GSM system and a WCDMA system." *Qualcomm* at col. 9:42-45 **D. US20070172000** "7. A **demodulation apparatus**, comprising: . . . **a preamble receiver which receives preambles corresponding respectively to the first symbol** and the second symbol received by said symbol receiver; . . . **a symbol demodulation unit which demodulates the first symbol** and the second symbol received by said symbol receiver, **based on the signal strength of the respective preambles** measured by said signal-strength measurement unit, ..." *Sanyo* at claim 7 "13. A demodulation method, including: **receiving a first symbol assigned to a point of a plurality of signal points contained in a signal constellation, by using a modulation scheme based on the signal constellation that contains a plurality of signal points having a plurality of kinds of amplitudes**, and a second symbol which is the same symbol as the first symbol modulated by using the modulation scheme but assigned to another signal point; . . . ." *Sanyo* at claim 13 "The **demodulation execution unit** 74 **includes a preamble receiver** 82, a signal strength measurement unit 84, **a symbol receiver** 86 **and a symbol demodulation unit** 88. The preamble receiver 82 receives preambles corresponding respectively to two symbols received by the symbol receiver 86. The signal strength measurement unit 84 measures the signal strengths of the respective preambles received by the preamble receiver 82." *Sanyo* at par. 0091 "10. A demodulation apparatus according to claim 8, wherein said **symbol demodulation unit combines the symbols assigned to the respective signals by varying the order of bits indicating quadrants of the respective signals to which the symbols have been assigned and the order of bits indicating placement within the quadrants**." *Sanyo* at claim 10

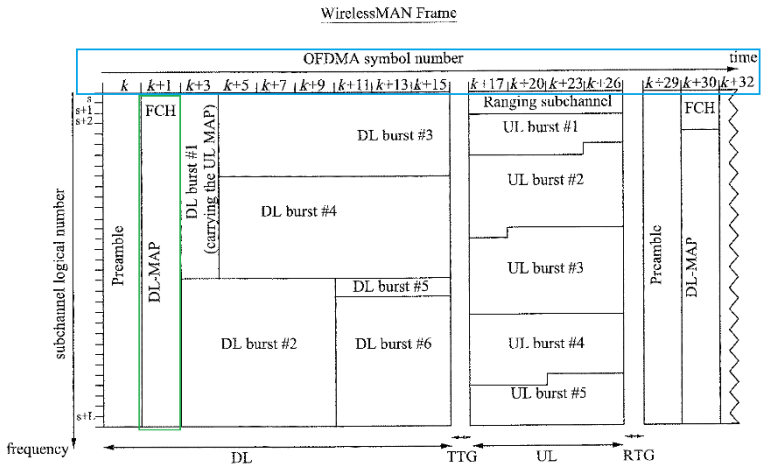
(cont.) 1.b. **demodulate, by a demodulator connected to and in communication with the receiver**, **the first number of OFDM symbols** **to** **determine the first plurality of header bits**, wherein **at least one header bit of the first plurality of header bits in the first packet is repeated on a plurality of OFDM subcarriers**;	"The baseband modulation unit 14 places **a preamble at a header portion** of a burst signal." *Sanyo* at par. 0050 **E. US10212019** "The transmitting unit 202 of the communication device 200 includes an encoder 220 (e.g., a convolution encoder) that encodes information bits, and a modulator 230 that modulates the encoded bits into symbols, which **symbols are mapped to subcarriers** **and converted to signals appropriate for transmission**, e.g., via transmit antennas 210-218. Similarly, the receiving unit 206 includes **a demodulator** 242 **and a decoder** 244 **for decoding and demodulating received signals**." *NXP* at col. 5:30-38 "4. The method of claim 1, further comprising: generating, at the communication device, **a physical layer header of the packet to indicate**: **data modulated on the first set of adjacent OFDM subcarriers** **is modulated** and encoded using the first pair of a) the modulation scheme and b) the encoding scheme, and . . . ." *NXP* at claim 4 **F. US8189516** "1. A method for receiving a packet data control channel in an Orthogonal Frequency Division Multiple Access (OFDMA) wireless communication system, the method comprising: **receiving a signal including a first packet data, a first packet data control information for the first packet data**, a second packet data, and a second packet data control information for the second packet data in a single frame from a transmitter, and **removing a cyclic prefix (CP) from the received signal, wherein the first packet data control information and the first packet data are received in the diversity mode** and the second packet data control information and the second packet data are received in the Adaptive Modulation and Coding (AMC) mode; . . . **demodulating the first packet data control information** and the second packet data control information for the FFT-processed signal; and . . . ." *Samsung* at claim 1

1.c. **receive**, in **a second wider frequency band**, **by the receiver** using wireless OFDM communications, **a second packet comprising a second number of OFDM symbols**, **less than the first number of OFDM symbols**, **that carry a second plurality of header bits, different than the first plurality of header bits**; and	**A. US20090116435** "4. The apparatus in claim 3 wherein **the second channel bandwidth is a multiple of the first channel bandwidth**." *Ericsson* at claim 4 "16. A method for operating a base station in a radio access network comprising: communicating **a frame of information over a radio interface with one or more first radio terminals configured in accordance** with a first radio access technology system that permits radio terminal communications over a first channel bandwidth and with one or more second radio terminals configured in accordance **with a second radio access technology system that permits radio terminal communications over a second channel bandwidth greater than the first channel bandwidth**; and . . . ." *Ericsson* at claim 16 **B. US7260416** "1. A wireless device comprising: . . . **a second receiver portion configured**, during the handoff condition, **to convert a second signal in a second receive frequency band distinct from the first receive frequency band to a second converted signal in a second frequency band**, wherein the first and second frequency bands at least partially overlap, and wherein the second receiver portion converts the second signal during at least a portion of the time that the first receiver portion converts the first signal; . . . ." *Qualcomm* at claim 1 "The communication device is able to extract information from each of the received signals when the first communication signal is a narrowband signal and **the second communication signal is a wideband signal**, such as a spread spectrum signal." *Qualcomm* at col. 3:16-20 **C. US9191036** "As an example, asymmetric receiver configurations can include a pair of receivers with a first receiver that includes a narrow-band filter that tunes band β 144 and **a second receiver with a wide-band filter that tunes band** α 146. Such first receiver and second receiver can be configured, e.g., by a base station, to operate as a MIMO pair." *AT&T* at col. 9:6-11

(cont.) 1.c. **receive**, in **a second wider frequency band**, **by the receiver** using wireless OFDM communications, **a second packet comprising a second number of OFDM symbols**, **less than the first number of OFDM symbols**, **that carry a second plurality of header bits, different than the first plurality of header bits**; and	**D. US20070172000** "1. A receiving apparatus, comprising: **a symbol receiver which receives** a first symbol assigned to a point of a plurality of signal points contained in a signal constellation, using a modulation scheme based on the signal constellation that contains a plurality of signal points having a plurality of kinds of amplitudes, and **a second symbol** which is the same symbol as the first symbol **modulated using the modulation scheme but assigned to another signal point**; and . . . ." *Sanyo* at claim 1 "Though the communication processing in the present embodiments are **used for UWB (Ultra Wide Band)** here as an example, the present invention is not limited thereto." *Sanyo* at par. 0045 **E. US10212019** "1. A method, comprising: . . . determining, for data to be transmitted via **a second set of adjacent OFDM subcarriers**, a second pair of a) a modulation scheme and b) an encoding scheme, wherein the **second pair is different than the first pair**; . . . ." *NXP* at claim 1 "4. The method of claim 1, further comprising: generating, at the communication device, **a physical layer header of the packet to indicate**: . . . **data modulated on the second set of adjacent OFDM subcarriers** is modulated and encoded using the second pair of a) the modulation scheme and b) the encoding scheme." *NXP* at claim 4 "6. The method of claim 1, wherein: . . . the method further comprises: **receiving, at the communication device, a second packet**; and . . . ." *NXP* at claim 6 **F. US8189516** "1. A method for receiving a packet data control channel in an Orthogonal Frequency Division Multiple Access (OFDMA) wireless communication system, the method comprising: **receiving a signal including** a first packet data, a first packet data control information for the first packet data, **a second**

(cont.) 1.c. **receive**, in **a second wider frequency band**, **by the receiver** using wireless OFDM communications, **a second packet comprising a second number of OFDM symbols**, **less than the first number of OFDM symbols**, **that carry a second plurality of header bits, different than the first plurality of header bits**; and	**packet data, and a second packet data control information for the second packet data in a single frame from a transmitter**, and removing a cyclic prefix (CP) from the received signal, **wherein the first packet data control information and the first packet data are received in the diversity mode and the second packet data control information and the second packet data are received in the Adaptive Modulation and Coding (AMC) mode**; . . . ." *Samsung* at claim 1 "It can be noted that the system bandwidth 210 is composed of a plurality of sub-carriers 230. **Each of the sub-carriers** 230 **is composed of one or a plurality of OFDM symbols** in the time axis. Reference numeral 220 illustrates one frame composed of several OFDM symbols." *Samsung* at col. 6:7-11 "3. The method of claim 1, wherein **predetermined symbols are punctured from AMC sub-bands** used for transmitting the second packet data composed of at least one sub-carrier and the **second packet control information is mapped to the punctured AMC sub-bands**." *Samsung* at claim 3
1.d. **demodulate, by the demodulator**, **the second number of OFDM symbols to determine the second plurality of header bits**,	**A. US20090116435** "36. The apparatus in claim 34, wherein the transceiver circuitry includes an OFDM receiver for **demodulating a signal** from the base station transmitted across the first channel bandwidth and decode the signal." *Ericsson* at claim 36 "The frame structure for a WirelessMAN **OFDMA transmit signal** is shown in FIG. 2. In general, the IEEE 802.16e standard refers to the overall document, while the term "legacy 802.16e terminals' refers to WirelessMAN OFDMA terminals or WiMAX terminals as well. The frame length for the signal is 5 ms, and time division duplexing (TDD) can be used within the frame. The first OFDM symbol, represented in the vertical direction in FIG. 2, is a preamble that facilitates initial synchronization by UEs/radio terminals to the downlink (DL) transmissions, channel estimation, and cell search. A **frame control header** (FCH) message that follows conveys parameters regarding radio resource "reuse' in the system and coding parameters of the DL-MAP message that follows it." *Ericsson* at par. 0034

(cont.)
1.d. **demodulate, by the demodulator**, **the second number of OFDM symbols to determine the second plurality of header bits**,



(Fig. 2)

B. US7260416
"In the example, the dual mode receiver 200 is configured to simultaneously receive and **demodulate signals** from a GSM system and a WCDMA system." *Qualcomm* at col. 9:42-45

D. US20070172000
"7. A **demodulation apparatus**, comprising:
. . .
a symbol demodulation unit which demodulates the first symbol and **the second symbol** received by said symbol receiver, based on the signal strength of the respective preambles measured by said signal-strength measurement unit, ..." *Sanyo* at claim 7

"The **demodulation execution unit** 74 **includes a preamble receiver** 82, a signal strength measurement unit 84, **a symbol receiver** 86 **and a symbol demodulation unit** 88. The preamble receiver 82 receives preambles corresponding respectively to two symbols received by the symbol receiver 86. The signal strength measurement unit 84 measures the signal strengths of the respective preambles received by the preamble receiver 82." *Sanyo* at par. 0091

E. US10212019
"The transmitting unit 202 of the communication device 200 includes an encoder 220 (e.g., a convolution encoder) that encodes information bits, and a modulator 230 that modulates the encoded bits into symbols, which **symbols are mapped to subcarriers and converted to signals appropriate for transmission**, e.g., via transmit antennas 210-218. Similarly,

(cont.) 1.d. **demodulate, by the demodulator**, **the second number of OFDM symbols to determine the second plurality of header bits**,	the receiving unit 206 includes **a demodulator** 242 **and a decoder** 244 **for decoding and demodulating received signals**." *NXP* at col. 5:30-38 "4. The method of claim 1, further comprising: generating, at the communication device, **a physical layer header of the packet to indicate**: . . . **data modulated on the second set of adjacent OFDM subcarriers** is modulated and encoded using the second pair of a) the modulation scheme and b) the encoding scheme." *NXP* at claim 4 "1. A method, comprising: **generating, at the communication device, a packet for transmission** via the communication channel…" *NXP* at claim 1 "6. The method of claim 1, wherein: the packet is a first packet; and the method further comprises: **receiving**, at the communication device, **a second packet**…" *NXP* at claim 6 **F. US8189516** "1. A method for receiving a packet data control channel in an Orthogonal Frequency Division Multiple Access (OFDMA) wireless communication system, the method comprising: . . . **demodulating the** first packet data control information and the **second packet data control information** for the FFT-processed signal; and . . . ." *Samsung* at claim 1
1.e. wherein **the first narrower and second wider frequency bands have one or more overlapping frequency regions**.	**B. US7260416** "1. A wireless device comprising: . . . **a second receiver portion configured**, during the handoff condition, **to convert a second signal in a second receive frequency band distinct from the first receive frequency band to a second converted signal in a second frequency band**, wherein **the first and second frequency bands at least partially overlap**, and wherein the second receiver portion converts the second signal during at least a portion of the time that the first receiver portion converts the first signal; . . . ." *Qualcomm* at claim 1

(cont.) 1.e. wherein **the first narrower and second wider frequency bands have one or more overlapping frequency regions**.	"The communication device is able to extract information from each of the received signals when the **first communication signal is a narrowband signal** and the **second communication signal is a wideband signal**, such as a spread spectrum signal." *Qualcomm* at col. 3:16-20 **C. US9191036** "2. The method of claim 1, wherein **the first portion of the electromagnetic radiation spectrum comprises a wide band comprising a sub-band adjacent to a frequency block utilized for broadcast of a wireless signal, and wherein the second portion of the electromagnetic radiation spectrum comprises a narrow band that spectrally overlaps the wide band**, wherein the wide band encompasses a greater range of frequencies than the narrow band." *AT&T* at claim 2 **D. US20070172000** "Since **in OFDM a plurality of carriers are densely arranged in a manner that they are partially overlapped to one another without causing the interference** thereamong, **the wideband transmission utilizing the narrow frequency range efficiently is achieved**, thus raising the frequency utilization efficiency." *Sanyo* at par. 0048