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U.S. Patent 8,467,366

U.S. Patent 8,467,366 ("*Neo Wireless*" or the "patent-at-issue") was filed on August 8, 2011 and claims the benefit of U.S. Provisional Patent App. No. 60/551,589, filed on March 9, 2004. Claim 1 of the patent-at-issue is generally directed to a multi-cell orthogonal frequency division multiple access (OFDMA) wireless communication system comprising a plurality of base stations (BS) serving and communicating with mobile stations (MS) in cells via communication channels. The MS is configured to transmit data signals to the BS over a data subchannel that comprises a plurality of adjacent/non-adjacent subcarriers within the communication channel. The MS is further configured to transmit ranging signals to the BS over a ranging subchannel for random access that is formed from a ranging sequence selected from a set of ranging sequences associated with the cell for identifying the MS. The ranging signal lasts over a period of one or multiple orthogonal frequency division multiplexing (OFDM) symbols and exhibits a low peak-to-average power ratio in the time domain. The ranging subchannel comprises at least one block of subcarriers within the communication channel, and power levels of subcarriers at both ends of a block are set to zero.

The primary reference, U.S. Pat. App. 2005/0058058 ("*Samsung1*"), was filed on July 30, 2004 and claims the benefit of Korea Pat. App. Ser. No. 2003-52898, filed on July 30, 2003. The patent generally relates to a method for controlling an operational state of at least one subscriber station in an Orthogonal Frequency Division Multiplexing/Orthogonal Frequency Division Multiple Access (OFDM/OFDMA) wireless communication system having ranging slots and ranging codes to be used for rangings. The subscriber station transitions from one operational state to another while performing various ranging processes.

The primary reference, U.S. Pat. App. 2005/0195791 ("*Samsung2*"), was filed on March 7, 2003 and claims the benefit of Korea Pat. App. Ser. No. 2004-15983, filed on March 5, 2004. The patent generally relates to a broadband wireless access communication system utilizing an OFDM/OFDMA scheme in which uplink time sync between a base station (BS) and a subscriber station (SS) and the intensity of a BS reception signal are set, and a ranging signal is transmitted from the SS to the BS in order that the SS gives a bandwidth request to the BS. It further describes a method for constructing and operating a ranging channel to be used by a SS and a method for receiving ranging codes transmitted through the ranging channel.

The secondary reference, U.S. Patent 7,496,028 ("*Samsung3*"), was filed on December 24, 2003 and claims the benefit of Korea Pat. App. Ser. No. 2002-83364, filed on December 24, 2002. The patent generally relates to a signal transmission apparatus for minimizing a peak-to-average power ratio (PAPR) in an OFDM communication system. Information data subcarrier signals are subdivided into subband signals, and additional information subcarrier signals and dummy sequences are inserted into it. An inverse fast Fourier transform (IFFT) block generates OFDM symbols by IFFT-transforming the subcarrier signals and dummy sequences. A controller only inserts the dummy sequences when the PAPR value of the data exceeds a predetermined PAPR threshold.

Patent Owner is now on notice that claims of this patent are invalid; as a result, any new or continued assertion of this patent may be considered meritless or brought in bad faith. *Octane Fitness, LLC v. ICON Health & Fitness, Inc.*, 572 U.S. 545, 554 (2014). Such considerations are relevant to whether a case is deemed "exceptional" for purposes of awarding attorneys' fees. 35 U.S.C. § 285; *see, e.g.*, *WPEM, LLC v. SOTI Inc.*, 2020 WL 555545, at *7 (E.D. Tex. Feb. 4, 2020), *aff'd*, 837 F. App'x 773 (Fed. Cir. 2020) (awarding fees for an exceptional case where plaintiff "failed to conduct an invalidity and enforceability pre-filing investigation"); *Energy Heating, LLC v. Heat On-The-Fly, LLC*, 15 F.4th 1378, 1383 (Fed. Cir. 2021) (affirming award of fees where, *inter alia*, the plaintiff knew "that its patent was invalid").

A sample claim chart comparing claim 1 of *Neo Wireless* to *Samsung1*, *Samsung2*, and *Samsung3* is provided below.

US8467366 (“*Neo Wireless*”)	**A. US20050058058** (“*Samsung1*”) **B. US20050195791** (“*Samsung2*”) **C. US7496028** (“*Samsung3*”)
1.pre. **In a multi-cell orthogonal frequency division multiple access (OFDMA) wireless communication system comprising a plurality of base stations and mobile stations, a mobile station configured to communicate with a serving base station in a cell via a communication channel, the mobile station comprising**:	**A. US20050058058** “1. A method for controlling an operational state of **at least one subscriber station in an Orthogonal Frequency Division Multiplexing/Orthogonal Frequency Division Multiple Access (OFDM/OFDMA) wireless communication system** having ranging slots and ranging codes to be used for rangings, the method comprising the steps of:” *Samsung1* at claim 1 “Therefore, **both the IEEE 802.16a communication system and the IEEE 802.16e communication system correspond to the OFDM/OFDMA BWA communication system**, and for the sake of convenience, the IEEE 802.16a and IEEE 802.16e OFDM/OFDMA communication systems will be described herein below.” *Samsung1* at par. 0006 “Referring to FIG. 1, **the IEEE 802.16a/IEEE 802.16e communication system has a multicell configuration, and is comprised of a base station** 100 **and a plurality of subscriber stations** 110, 120 **and** 130, **all of which are managed by the base station** 100. **Signal exchange between the base station** 100 **and the subscriber stations** 110, 120 **and** 130 **is achieved using the OFDM/OFDMA technology**.” *Samsung1* at par. 0007 “**The OFDMA technology can be defined as a two-dimensional access method which is a combination of Time Division Access (TDA) and Frequency Division Access (FDA). Therefore, when data is transmitted by OFDMA technology, the OFDMA symbols are separately carried by subcarriers and transmitted over predetermined subchannels. The “subchannel” is a channel comprised of a plurality of subcarriers, and in a communication system supporting OFDMA technology (hereinafter referred to as an “OFDMA communication system”), each subchannel is comprised of a predetermined number of subcarriers according to system conditions**.” *Samsung1* at par. 0008 “**The subscriber station determines which base station transmits a pilot channel signal having the highest CINR as a base station to which it currently belongs. Subsequently,**

(cont.) 1.pre. **In a multi-cell orthogonal frequency division multiple access (OFDMA) wireless communication system comprising a plurality of base stations and mobile stations, a mobile station configured to communicate with a serving base station in a cell via a communication channel, the mobile station comprising**:	**the subscriber station acquires the system synchronization with the base station by receiving a preamble of a downlink frame transmitted from the base station**." *Samsung1* at par. 0076 **B. US20050195791** "1. A method for assigning a ranging channel in **a broadband wireless communication system in which a subscriber station (SS) attempts ranging with a base station (BS)**, the method comprising the steps of:" *Samsung2* at claim 1 "FIG. 1 is a schematic view of illustrating **a broadband wireless access communication system employing an orthogonal frequency division multiplexing/orthogonal frequency division multiple access (OFDM/OFDMA) scheme**, wherein it transmits a physical channel signal using a plurality of sub-carriers." *Samsung2* at par. 0007 "First, **in a conventional OFDMA communication system, signal interference between a ranging signal and a data signal occurs among cells because frequency positions of ranging sub-carriers are different cell by cell. The present invention proposes a cell shared ranging frequency band in order to minimize the signal interference with data. This causes an SS A of a BS A and an SS B of a BS B to use a shared ranging frequency band, such that a collision between signals of neighbor cells may be allowed, but signal interference between a ranging signal and a data signal does not occur**." *Samsung2* at par. 0049 "As described above, **the present invention proposes a ranging channel structure and a ranging receiver, which are suitable to cellular channel characteristic when ranging is attempted in a cellular communication environment, thereby reducing initial wireless access delay and handover latency**." *Samsung2* at par. 0112 **C. US7496028** "**The OFDMA (Orthogonal Frequency Division Multiple Access) communication system must use a signal having a low peak-to-average power ratio (PAPR) in order to guarantee its normal system performance**. The reason for using a signal with a low PAPR will be described below." *Samsung3* at col. 2:34-38 "**A signal transmitted by the transmitter is received at the**

(cont.) 1.pre. **In a multi-cell orthogonal frequency division multiple access (OFDMA) wireless communication system comprising a plurality of base stations and mobile stations, a mobile station configured to communicate with a serving base station in a cell via a communication channel, the mobile station comprising**:	**receiver via a reception antenna after experiencing a multipath channel and getting noises therethrough**." *Samsung3* at col. 13:9-11
1.a. **an apparatus configured to transmit a data signal to the serving base station in the cell over a data subchannel,**	**A. US20050058058** "Referring to FIG. 1, **the IEEE 802.16a/IEEE 802.16e communication system has a multicell configuration, and is comprised of a base station** 100 **and a plurality of subscriber stations** 110, 120 **and** 130, **all of which are managed by the base station** 100. **Signal exchange between the base station** 100 **and the subscriber stations** 110, 120 **and** 130 **is achieved using the OFDM/OFDMA technology**." *Samsung1* at par. 0007 "The OFDMA technology can be defined as a two-dimensional access method which is a combination of Time Division Access (TDA) and Frequency Division Access (FDA). Therefore, **when data is transmitted by OFDMA technology, the OFDMA symbols are separately carried by subcarriers and transmitted over predetermined subchannels. The "subchannel" is a channel comprised of a plurality of subcarriers, and in a communication system supporting OFDMA technology (hereinafter referred to as an "OFDMA communication system"), each subchannel is comprised of a predetermined number of subcarriers according to system conditions**." *Samsung1* at par. 0008 "**The subscriber station** 550 **receiving the UL-MAP message from the base station** 500 **recognizes the uplink bandwidth allocated for data transmission, and transits data to the base station** 500 **through the uplink bandwidth** (Step 523)." *Samsung1* at par. 0041 **B. US20050195791** "In general, **the multiple access method in OFDMA can be achieved by either one or combination of a time division technique and a frequency division technique. The transmitted symbols are carried by a set of subcarrier,**

(cont.) 1.a. **an apparatus configured to transmit a data signal to the serving base station in the cell over a data subchannel,**	**subchannel, in which each subcarrier can be localized differently in time and frequency**." *Samsung2* at par. 0009 "First, **in a conventional OFDMA communication system, signal interference between a ranging signal and a data signal occurs among cells because frequency positions of ranging sub-carriers are different cell by cell. The present invention proposes a cell shared ranging frequency band in order to minimize the signal interference with data. This causes an SS A of a BS A and an SS B of a BS B to use a shared ranging frequency band, such that a collision between signals of neighbor cells may be allowed, but signal interference between a ranging signal and a data signal does not occur**." *Samsung2* at par. 0049 **C. US7496028** "**A signal transmitted by the transmitter is received at the receiver via a reception antenna after experiencing a multipath channel and getting noises therethrough**." *Samsung3* at col. 13:9-11 "1. **A transmission apparatus for minimizing a peak-to-average power ratio (PAPR) in an orthogonal frequency division multiplexing (OFDM) communication system, comprising**: **a subband divider for dividing information data subcarrier signals into subband signals**;" *Samsung3* at claim 1
1.b. **wherein the data subchannel comprises a plurality of adjacent or non-adjacent subcarriers within the communication channel**; and	**A. US20050058058** "**The OFDMA technology can be defined as a two-dimensional access method which is a combination of Time Division Access (TDA) and Frequency Division Access (FDA). Therefore, when data is transmitted by OFDMA technology, the OFDMA symbols are separately carried by subcarriers and transmitted over predetermined subchannels. The "subchannel" is a channel comprised of a plurality of subcarriers, and in a communication system supporting OFDMA technology (hereinafter referred to as an "OFDMA communication system"), each subchannel is comprised of a predetermined number of subcarriers according to system conditions**." *Samsung1* at par. 0008 **B. US20050195791** "In general, **the multiple access method in OFDMA can be achieved by either one or combination of a time division technique and a frequency division technique. The**

(cont.) 1.b. **wherein the data subchannel comprises a plurality of adjacent or non-adjacent subcarriers within the communication channel**; and	**transmitted symbols are carried by a set of subcarrier, subchannel, in which each subcarrier can be localized differently in time and frequency**." *Samsung2* at par. 0009 **C. US7496028** "**The OFDMA communication system, which is a multicarrier communication system, uses a plurality of carriers, i.e., a plurality of subcarriers, so orthogonality of each of the subcarriers is considered important**." *Samsung3* at col. 2:39-42 "**A signal transmitted by the transmitter is received at the receiver via a reception antenna after experiencing a multipath channel and getting noises therethrough**." *Samsung3* at col. 13:9-11 "**The IFFT block** 129 **performs (L+P=N)-point IFFT on a signal output from the pilot symbol inserter** 127, **and then provides its output to the P/S converter** 131. **Here, L represents the number of information data subcarriers over which the information data is transmitted, and P represents the number of additional information subcarriers over which additional information described below is transmitted**." *Samsung3* at col. 8:64-67 through col. 9:1-3 "1. **A transmission apparatus for minimizing a peak-to-average power ratio (PAPR) in an orthogonal frequency division multiplexing (OFDM) communication system, comprising**: **a subband divider for dividing information data subcarrier signals into subband signals**;" *Samsung3* at claim 1
1.c. **an apparatus configured to transmit a ranging signal to the serving base station in the cell over a ranging subchannel for random access**, wherein:	**A. US20050058058** "Referring to FIG. 1, **the IEEE 802.16a/IEEE 802.16e communication system has a multicell configuration, and is comprised of a base station** 100 **and a plurality of subscriber stations** 110, 120 **and** 130, **all of which are managed by the base station** 100. **Signal exchange between the base station** 100 **and the subscriber stations** 110, 120 **and** 130 **is achieved using the OFDM/OFDMA technology**." *Samsung1* at par. 0007 "**The IEEE 802.16a communication system, because it employs OFDM/OFDMA technology, needs ranging subchannels and ranging codes for the ranging procedure,**

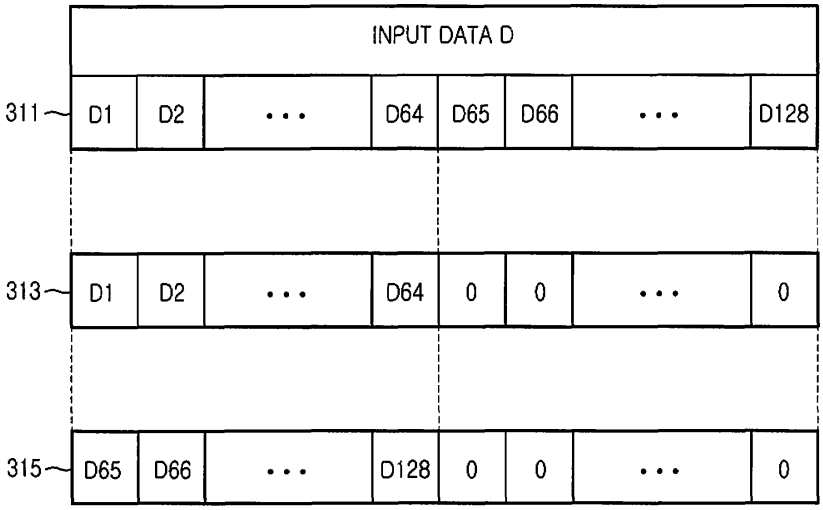
(cont.) 1.c. **an apparatus configured to transmit a ranging signal to the serving base station in the cell over a ranging subchannel for random access**, wherein:	**and a base station allocates the allowable ranging codes according to the objects, or types, of rangings**." *Samsung1* at par. 0018 "**A ranging channel is comprised of one or more subchannels, and unique number of subchannels constituting the ranging channel are included in an uplink (UL)-MAP message. Here, the ranging channel is a logical channel using ranging regions in a frame, and Initial Ranging, Periodic Ranging and Bandwidth Request Ranging are performed through the ranging channel**." *Samsung1* at par. 0010 "**In the ranging method, the subscriber station performs the initial ranging with the base station; performs the bandwidth request ranging based on a random access technique with the base station if the initial ranging is successful; and performs the bandwidth request ranging based on a scheduled access technique with the base station if the random access-based bandwidth request ranging is successful**." *Samsung1* at par. 0052 "1. **A method for controlling an operational state of at least one subscriber station in an Orthogonal Frequency Division Multiplexing/Orthogonal Frequency Division Multiple Access (OFDM/OFDMA) wireless communication system having ranging slots and ranging codes to be used for rangings**, the method comprising the steps of: **performing, by the subscriber station in a Null state, an initial ranging if an initial ranging request occurs, and transitioning from the Null state to an Idle state if the initial ranging is successful**; **transitioning to an Access state if a bandwidth request ranging request occurs in the Idle state, and performing in the Access state the bandwidth request ranging based on a random access technique**;" *Samsung1* at claim 1 **B. US20050195791** "**In performing the periodic ranging and the bandwidth request ranging, the OFDMA scheme utilizes a random access method in which a random ranging code is transmitted through a random ranging slot**." *Samsung2* at par. 0022 "**It is another object of the present invention to provide a ranging channel structure that permits a collision between**

(cont.) 1.c. **an apparatus configured to transmit a ranging signal to the serving base station in the cell over a ranging subchannel for random access**, wherein:	**ranging signals, but prevents interference between a ranging signal and a data signal**." *Samsung2* at par. 0024 "First, **in a conventional OFDMA communication system, signal interference between a ranging signal and a data signal occurs among cells because frequency positions of ranging sub-carriers are different cell by cell. The present invention proposes a cell shared ranging frequency band in order to minimize the signal interference with data. This causes an SS A of a BS A and an SS B of a BS B to use a shared ranging frequency band, such that a collision between signals of neighbor cells may be allowed, but signal interference between a ranging signal and a data signal does not occur**." *Samsung2* at par. 0049 "1. **A method for assigning a ranging channel in a broadband wireless communication system in which a subscriber station (SS) attempts ranging with a base station (BS)**, the method comprising the steps of:" *Samsung2* at claim 1 "7. **A method for transmitting a ranging signal from a subscriber station (SS) to a base station (BS) in a broadband wireless communication system**, the method comprising the steps of:" *Samsung2* at claim 7
1.d. **the ranging signal is formed from a ranging sequence selected from a set of ranging sequences associated with the cell for identifying the mobile station**;	**A. US20050058058** "Referring to FIG. 1, **the IEEE 802.16a/IEEE 802.16e communication system has a multicell configuration, and is comprised of a base station** 100 **and a plurality of subscriber stations** 110, 120 **and** 130, **all of which are managed by the base station** 100. **Signal exchange between the base station** 100 **and the subscriber stations** 110, 120 **and** 130 **is achieved using the OFDM/OFDMA technology**." *Samsung1* at par. 0007 "**The subscriber station performs the initial ranging with the base station. The subscriber station selects a random ranging slot from among the ranging slots allocated for the bandwidth request ranging based on a random access technique in the ranging slots for the bandwidth request ranging if the initial ranging is successful, and selects a random ranging code from among the ranging codes for the bandwidth request ranging. The subscriber station performs the random access-based bandwidth request ranging at the selected ranging slot using the selected**

(cont.) 1.d. **the ranging signal is formed from a ranging sequence selected from a set of ranging sequences associated with the cell for identifying the mobile station**;	**ranging code**." *Samsung1* at par. 0053 "In the foregoing description, **the subscriber stations existing in the Busy state** 840 **or the Hold state** 850 **should be able to identify the group IDs and the ranging codes allocated thereto in order to perform the scheduled access-based bandwidth request ranging**." *Samsung1* at par. 0103 "6. The method of claim 1, wherein **the step of performing the scheduled access-based bandwidth request ranging comprises the step of performing a bandwidth request ranging at a ranging slot corresponding to a group identifier (ID) received from a base station, using a ranging code mapped to the group ID and received from a base station**." *Samsung1* at claim 6 "7. The method of claim 6, wherein **the group ID and the ranging code mapped to the group ID are allocated by the base station, and the base station generates a number of groups equal to the number of ranging slots allocated for the scheduled access-based bandwidth request ranging from among the ranging slots, allocates the ranging codes such that the ranging codes are not duplicated in each of the groups, allocates a random group from among the groups to a subscriber station that has succeeded in the random access-based bandwidth request ranging, and allocates a random ranging code from among the ranging codes in the random group**." *Samsung1* at claim 7 **B. US20050195791** "Accordingly, **when SSs attempt wireless random access to a BS, the following points must be taken into consideration: First, ranging performed by the SS can be regarded as contention ranging because each SS randomly selects ranging codes and ranging time slots**." *Samsung2* at par. 0022 "First, **in a conventional OFDMA communication system, signal interference between a ranging signal and a data signal occurs among cells because frequency positions of ranging sub-carriers are different cell by cell. The present invention proposes a cell shared ranging frequency band in order to minimize the signal interference with data. This causes an SS A of a BS A and an SS B of a BS B to use a shared ranging frequency band, such that a collision between signals of neighbor cells may be allowed, but**

(cont.) 1.d. **the ranging signal is formed from a ranging sequence selected from a set of ranging sequences associated with the cell for identifying the mobile station**;	**signal interference between a ranging signal and a data signal does not occur**." *Samsung2* at par. 0049 "13. **An apparatus for transmitting a ranging signal from a subscriber station (SS) to a base station (BS) in a broadband wireless communication system, the apparatus comprising**: **a ranging band assigning unit for inputting ranging codes corresponding to a desired ranging class and outputting the ranging codes at at least one ranging band, which is included in a ranging channel assigned for an uplink frame where ranging is to be attempted**; and" *Samsung2* at claim 13
1.e. **the ranging signal lasts over a period of one or multiple orthogonal frequency division multiplexing (OFDM) symbols and the ranging signal exhibits a low peak-to-average power ratio in the time domain**; and	**A. US20050058058** "As illustrated in FIG. 2, **one OFDMA frame is comprised of a plurality of, for example 8, OFDMA symbols, and each OFDMA symbol is comprised of a plurality of, for example N, subchannels. Further, each OFDMA frame includes a plurality of, for example 4, ranging slots**. Reference numeral 211 represents ranging regions, or ranging slots, existing in an Mth frame, and reference numeral 221 represents ranging slots existing in an (M+1)th frame." *Samsung1* at par. 0009 "**A ranging channel is comprised of one or more subchannels, and unique number of subchannels constituting the ranging channel are included in an uplink (UL)-MAP message. Here, the ranging channel is a logical channel using ranging regions in a frame, and Initial Ranging, Periodic Ranging and Bandwidth Request Ranging are performed through the ranging channel**." *Samsung1* at par. 0010 **B. US20050195791** "Referring to FIG. 2, OFDMA symbol numbers are plotted along the abscissa axis and sub-channel numbers are plotted along the ordinate axis. Further, **one OFDMA frame includes a plurality of OFDMA symbols, e.g., eight OFDMA symbols**." *Samsung2* at par. 0010 "In accordance with another aspect of the present invention, **there is provided a method for transmitting a ranging signal in an OFDM/OFDMA communication system**." *Samsung2* at par. 0030 "FIG. 3B illustrates an enlarged ranging channel structure in

(cont.) 1.e. **the ranging signal lasts over a period of one or multiple orthogonal frequency division multiplexing (OFDM) symbols and the ranging signal exhibits a low peak-to-average power ratio in the time domain**; and	the (K+1)-th uplink frame of FIG. 3A, to which both the primary and secondary ranging channels are assigned. Referring to FIG. 3B, each of the primary and secondary ranging bands 301, 303, 305, and 307 include three OFDM symbols. However, **each ranging band may consist of two OFDM symbols. When each ranging band includes two OFDM symbols, the two OFDM symbols correspond to a first symbol and a second symbol of the relevant uplink frame**." *Samsung2* at par. 0062 "**Two symbols are used for the initial ranging (initial RNG) and the handover ranging (HO RNG). The two symbols use the same frequency region, but they are distinguished by ranging codes. However, only one symbol is used for the bandwidth request ranging (BR RNG) and the periodic ranging (PR RNG). Two symbols existing in the same ranging band use the same frequency region, but they are distinguished by different ranging codes**." *Samsung2* at par. 0063 "**Therefore, for the initial ranging and the handover ranging, an SS has only one opportunity to attempt ranging over a period of the two symbols. However, an SS can choose one of two opportunities and attempt ranging in case of the bandwidth request ranging and the periodic ranging**." *Samsung2* at par. 0064 **C. US7496028** "In particular, **the present invention proposes an apparatus and method for minimizing PAPR by using a subband division (SD) scheme that divides an input signal into a plurality of subbands (or subblocks), transmits data through some of the divided subbands, and transmits a dummy sequence through the remaining subbands**." *Samsung3* at col. 8:2-8 "**When the division is made into M subbands, the address bits have log2(M)=AM bits, and Am=m where m=1,2, . . . ,M. Therefore, N symbols input to the IFFT block** 129 **can be expressed as {Xn, n=0,1, . . . ,N−1}. The N symbols are transmitted through N subcarriers {fn, n=0,1, . . . ,N−1} being orthogonal with each other in a frequency domain. . . . Here, the OFDM symbol is a set of N symbols finally transmitted through the N subcarriers**." *Samsung3* at col. 12:9-20

(cont.) 1.e. **the ranging signal lasts over a period of one or multiple orthogonal frequency division multiplexing (OFDM) symbols and the ranging signal exhibits a low peak-to-average power ratio in the time domain**; and	"1. **A transmission apparatus for minimizing a peak-to-average power ratio (PAPR) in an orthogonal frequency division multiplexing (OFDM) communication system**, comprising:" *Samsung3* at claim 1
1.f. **the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of a block are set to zero**.	**C. US7496028** "In addition, **a signal output from the symbol mapper** 115 **will be referred to as "data D."**" *Samsung3* at col. 8:37-39  FIG.3 "**FIG. 3 is a diagram schematically illustrating a format in which zero padding is applied to the data D divided by the subband divider** 113 illustrated in FIG. 1. **Referring to FIG. 3, the data D, as described above, comprises 128 subcarrier signals D1th, D2th, . . . , D128th. In addition, it will be assumed in FIG. 3 that the number M of subbands is 2 (M=2). When the D1th, D2th, . . . , D128th subcarrier signals are input to the subband divider** 119, **the subband divider** 119 **divides the D1th, D2th, . . . , D128th subcarrier signals into two subbands. That is, a first subband is comprised of 64 subcarrier signals D1th, D2th, . . . , D63th, D64th, and a second subband is comprised of 64 subcarrier signals D65th, D66th, . . . , D127th, D128th** (see 311)." *Samsung3* at col. 10:25-37 "**After dividing into 2 subbands, if it is necessary to perform zero padding on the divided subband signals**

(cont.) 1.f. **the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of a block are set to zero**.	**under the control of the controller** 125, **the controller** 125 **performs a control operation of performing zero padding on the subcarrier signals corresponding to the second subband** (see 313) **and then performing zero padding on the subcarrier signals corresponding to the first subband** (see 315)." *Samsung3* at col. 10:38-44 "**The subband division scheme proposed in the present invention employs a PAPR threshold for a reduction in a processing time, and applies a dummy sequence or zero padding only to the signal exceeding the PAPR threshold rather than applying the dummy sequence or zero padding to all input signals, thereby improving transmission capability while minimizing a processing time and the number of operations**." *Samsung3* at col. 11:59-66 "**A signal transmitted by the transmitter is received at the receiver via a reception antenna after experiencing a multipath channel and getting noises therethrough**." *Samsung3* at col. 13:9-11