DECLARATION UNDER 37 CFR 1.131(a)

Application Serial Number: 16/796,888
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Inventor: Steve Shattil
Attorney Docket Number:

I, Steve Shattil, declare as follows:

1. I am the inventor of Patent No. 11,075,786 ('786).

2. This Declaration establishes constructive reduction to practice (and thus, invention) of the subject matter of each rejected claim prior to the effective date (under 35 U.S.C. 102(e)) of references on which the rejection is based.

3. I completed my invention as described and claimed in the subject patent 11,075,786 ('786) as evidenced by the following:

4. The subject matter of each of the rejected claims is disclosed in U.S. Patent appl. no. **10/131,163 ('163), filed April 24, 2002**.

5. The features of claim 1 (with emphasis) and corresponding support in '163, by way of example, but without limitation, are shown as follows:

Claim 1 (and claims 10 and 19 recite similar features). A method of communication in a wireless communication network that employs a first set of complex-valued codes to encode data symbols to be transmitted, and employs a second set of complex-valued codes to recover transmitted data symbols from a received signal, the method comprising:

6. Written support in ’163 includes the following: (emphasis added)

Page 109, third Par.:

> “Polyphase CI codes comply with the first two definitions of a spread-spectrum signal. However, a **complex-conjugate code**, rather than a code replica, is usually required to decode received signals.”

Page 129, third Par.:

> “Decoding may include any appropriate **inverse of the coding operation** represented by FIG. 49. For example, to extract an n^{th} data symbol value s_n from a vector of received CI symbol values $\boldsymbol{w}$, the **complex conjugate** of a vector of the n^{th} phase space (or CI code) values, w^*_n, may be correlated with the received CI symbol vector $\boldsymbol{w}$.”

7. A person of ordinary skill in the art (POSITA) understands the mathematical explanations of polyphase CI codes and phase spaces throughout the disclosure as employing complex-valued codes.

selecting a plurality of subcarriers to be transmitted;

8. Written support in ’163 includes the following: (emphasis added)

Page 52, third--fourth Par.:

> “FIG. 9B shows an arrangement of *N* incrementally spaced-in-frequency carrier signals divided into *M* sets of carrier signals. In this case, each of the *M* carrier sets includes *N/M* carriers.”
>
> “In a third embodiment of a CI architecture, each user is **assigned to one of the *M* carrier sets**.”

Page 54, fourth Par.:

> “FIG. 11 shows a **CI-OFDM** signal architecture for a plurality *M* of users. **Each user is**

provided with a unique set of carriers."

Page 152, second Par.:

"**Bandwidth can be dynamically allocated** to up-stream and down-stream channels depending on network traffic characteristics. Units requiring real-time or broadband services may be assigned to dedicated channels, whereas units having bursty data requirements may be assigned to a shared channel."

9. The POSITA recognizes from the disclosure that CI-OFDM is a type of OFDM in which each user is provisioned a unique set of carriers for transmission.

encoding the data symbols with the first set of complex-valued codes to produce encoded data symbols;

10. Written support in '163 includes the following: (emphasis added)

Page 129, first Par.:

"**Each data symbol value s_n is impressed upon a phase space** such that each set of CI code chip values expresses the value of the corresponding data symbol s_n."

11. The POSITA understands that CI codes (e.g., phase spaces) are used to encode data symbols. This encoding is illustrated in FIGs. 15B and 49.

applying the encoded data symbols to the plurality of subcarriers to produce a spread-Orthogonal Frequency Division Multiplexing (OFDM) signal; and

12. Written support in '163 includes the following: (emphasis added)

Page 129, second Par.:

"A CI superposition waveform bearing multiple data-symbol/pulse-position characteristics can be created by **applying weights to CI carriers** that correspond to sums of carrier weights for each data-symbol/pulse-position."

Page 201, second Par.:

"A transmitter weighting system 9808 is adapted to weight data symbols provided to **frequency bins of a frequency-domain-to-time-domain converter, such as an IFFT** 9809. Time-domain signals generated by the IFFT 9809 are provided to a transmission system adapted to prepare the time-domain signals for transmission into a communication channel."

13. The POSITA is taught that the weights are encoded data symbols, and the CI carriers are orthogonal. The POSITA is taught that an IFFT modulates the orthogonal subcarriers. FIGs. 15B and 49 illustrate how the encoding spreads each data symbol across the plurality of subcarriers.

transmitting the spread-OFDM signal;

14. Written support in '163 includes the following: (emphasis added)

Page 129, fourth Par.:

"The symbols w_n may optionally be interleaved by an interleaver 5004 prior to being prepared for **transmission** into a communication channel 5099 by a transmission system 5005."

Page 201, second Par.:

"A transmitter weighting system 9808 is adapted to weight data symbols provided to frequency bins of a frequency-domain-to-time-domain converter, such as an IFFT 9809. Time-domain signals generated by the IFFT 9809 are provided to a **transmission system** adapted to prepare the time-domain signals for **transmission into a communication channel**."

15. The POSITA is explicitly instructed to transmit the spread OFDM signals.

wherein the first set of complex-valued codes are complex conjugates of the second set of complex-valued codes.

16. Written support in ’163 includes the following: (emphasis added)

Page 129, third Par.:

> “Decoding may include any appropriate inverse of the coding operation represented by FIG. 49. For example, to extract an n^{th} data symbol value s_n from a vector of received CI symbol values ***w***, the **complex conjugate** of a vector of the n^{th} phase space (or CI code) values, w^*_n, may be correlated with the received CI symbol vector ***w***.”

17. The POSITA is taught that decoding employs complex conjugates of the codes employed for encoding.

Claim 2 (and claims 11, 20). The method of claim 1, wherein selecting is responsive to spectrum allocation or is configured to provide for orthogonal frequency division multiple access.

18. Written support in ’163 includes the following: (emphasis added)

Page 153, second Par.:

> “…a CI transmitter can process carriers to improve performance in the following ways:…
>
> - Adapt to different **spectrum allocations**.”

Page 54, fourth Par.:

> “FIG. 11 shows a **CI-OFDM** signal architecture for a plurality *M* of users. **Each user is provided with a unique set of carriers**.”

19. The POSITA recognizes from the disclosure that CI-OFDM includes a type of orthogonal frequency division multiple access in which each user is provided with a unique set of carriers, which is an allocation of spectrum.

Claim 3 (and claims 12, 21). The method of claim 1, wherein selecting comprises selecting subcarrier frequency spacing.

20. Written support in ’163 includes the following: (emphasis added)

Page 52, third Par.:

> “**Carrier-frequency spacing** in each carrier set may be **selected** to reduce correlated fading between adjacent carrier frequencies.”

Page 202, third Par. – Page 203, first Par.:

> “The control circuitry 9901 may **scale a transmitted bit rate by scaling the CI symbol duration**, the number of carriers, **the carrier spacing**, and/or the number of bits per symbol per carrier. This permits the scaleable CI system to operate in various communications environments requiring various operating parameters and/or characteristics. By scaling the operating parameters and/or characteristics of the CI system when control circuitry 9901 determines that different operating parameters and/or characteristics are necessary or advantageous, the control circuitry 9901 can dynamically change the operating parameters and/or characteristics, thereby providing compatibility or the desired performance. For example, **dynamically scaling the bit rate enables widely varying signal bandwidths, adjustment of delay-spread tolerances, and adaptability to different SNR requirements**. A scaleable CI system is particularly suitable for applications in mobile wireless communications, as well as other applications that support a variety of services in a variety of environments.
>
> “In accordance with aspects of certain embodiments of the scaleable CI modulation system, a CI modulation system can be designed with an upper limit on the number of carriers and a **variable symbol duration**. The control circuitry can dynamically scale the number of carriers below the upper limit to decrease the signal bandwidth and the transmission rate while delay-spread tolerance remains the same. The control circuitry 901 can also dynamically **increase the symbol duration to decrease the transmission**

rate and the signal bandwidth and provide an increase in delay-spread tolerance."

21. The POSITA finds explicit instruction to select the subcarrier frequency spacing.

Claim 4 (and claims 13, 22). The method of claim 1, wherein an inverse discrete Fourier transform (IDFT) produces the spread-OFDM signal, and selecting comprises providing a set of zero and non-zero values to input frequency bins of the IDFT.

22. Written support in '163 includes the following: (emphasis added)

Page 20, last Par.: (emphasis added)

> "FIG. 58E illustrates a spectral profile selected for transmission or reception in a particular communication channel. Frequency ranges characterized by interference, jamming, fading, and/or **frequency allocations to other systems, applications, and/or users can selectively be avoided**."

Page 54, fourth Par.:

> "FIG. 11 shows a CI-OFDM signal architecture for a plurality *M* of users. **Each user is provided with a unique set of carriers**."

Page 201, second Par.:

> "A transmitter weighting system 9808 is adapted to weight data symbols provided to **frequency bins of a frequency-domain-to-time-domain converter, such as an IFFT** 9809. Time-domain signals generated by the IFFT 9809 are provided to a transmission system adapted to prepare the time-domain signals for transmission into a communication channel."

23. The POSITA understands that an IFFT performs an inverse discrete Fourier transform. The POSITA understands that in OFDM, each user is provided with a unique set of carriers. Thus, the user puts non-zero values into the frequency bins corresponding to its assigned carriers and zero values into the frequency bins corresponding to its non-assigned carriers.

Claim 5 (and claims 14, 23). The method of claim 1, wherein selecting comprises selecting subcarriers for control signaling or pilot tones.

24. Written support in ’163 includes the following: (emphasis added)

Page 30, last Par.:

> “Alternatively, channel compensation may employ at least one **pilot** or training signal to probe the channel.”

Page 94, fourth Par.:

> “CI carriers may be selected or adjusted to affect various control procedures, such as, but not limited to, power control, carrier sense procedures, authentication, identification, validation, switching, routing, encryption key transmission, and/or conveying **control signals**.”

25. The POSITA is taught that subcarriers can include pilots or control signals.

Claim 6 (and claims 15, 24). The method of claim 1, wherein the plurality of subcarriers are contiguous subcarriers or interleaved subcarriers.

FIG. 9A illustrates contiguous subcarriers and FIG. 9B illustrates non-contiguous subcarriers.

26. Written support in ’163 includes the following: (emphasis added)

Page 13, sixth and seventh Pars.:

> “FIG. 9A shows a plurality *N* of **incrementally spaced-in-frequency carrier signals** that may be used as an underlying architecture for transmission protocols. Users and/or data channels having symbols that are redundantly modulated on all *N* carriers can be provided with *N* orthogonal phase spaces.
>
> FIG. 9B shows an arrangement of *N* incrementally spaced-in-frequency carrier signals

divided into *M* sets of carrier signals. Each set may include one or more users and/or data channels. Each set may or may not include a similar number of carriers. The carriers in each set may be **incrementally spaced or non-incrementally spaced**."

Page 9, last Par.: (emphasis added)

"The frequency profile of a CI superposition signal can be controlled by adjusting weights of CI carriers and/or selecting CI carrier frequencies. This enables conventional single-carrier protocols, such as TDMA and DS-CDMA, to be implemented with a CI carrier architecture distributed across **non-continuous frequency bands**."

Page 165, third and fourth Pars.:

"**Data symbols may be impressed onto each waveform within a symbol interval T_s = $1/f_s$**. The symbol interval and/or adjacent intervals may include guard intervals and/or cyclic prefixes, which are well known in the art.

"In order to separate a data symbol modulated on a particular waveform from interference contributed by other waveforms, the set of waveforms is first sampled at a sampling frequency f_{sample} that equals a desired waveform frequency f_n, or some harmonic or sub-harmonic thereof. The desired waveform's frequency f_n can be expressed as:

$$f_n = f_o + nf_s$$

where f_o is a base or carrier frequency and n is some integer. In this case, **frequencies of the adjacent waveforms** can be expressed as:

$$f_{n\pm 1} = f_o + (n\pm 1)f_s$$"

27. The POSITA is taught from the Figures and the mathematical description that subcarriers can be contiguous or non-contiguous (e.g., interleaved).

Claim 7 (and claims 16, 25). The method of claim 1, wherein encoding comprises multiplying a vector or matrix of data symbols with a vector or matrix comprising the first set of complex-valued codes.

FIG. 15B illustrates this product.

28. Written support in ’163 includes the following: (emphasis added)

Page 66, third Par.:

> “FIG. 15B shows a **matrix** that represents contributions of phase-shifted symbol values $s_{n'}$ to each carrier frequency f_n for each of a plurality of phase spaces $Ps(n')$. The columns correspond to phase spaces and the rows correspond to carrier frequencies f_n.”

29. The POSITA would recognize the matrix depicted in FIG. 15B as a complex-valued code matrix, and the corresponding descriptions teach its product with symbol values $s_{n'}$ to produce the disclosed carrier-frequency weights, which are subcarrier values.

Claim 8 (and claims 17, 26) The method of claim 1, wherein applying comprises modulating the encoded data symbols onto the plurality of subcarriers.

30. Written support in ’163 includes the following: (emphasis added)

Page 60, second Par.:

> “In another set of embodiments, individual carriers are **modulated** (e.g., in an IFFT) to generate CI/DS-CDMA signals.”

Page 67, third Par.:

> “The sum of the data-modulated phase-space values provides an effective complex weight $w_{eff}(n)$ for frequency bin f_n. Thus, column vectors (i.e., phase spaces $Ps(n')$ and their corresponding symbol values $s_{n'}$) are summed to generate the complex values $w_{eff}(n)$ associated with row vectors (i.e., frequency bins f_n).”

31. The POSITA understands that subcarriers are modulated with weight $w_{eff}(n)$ (i.e., the subcarrier values).

Claim 9 (and claims 18, 27). The method of claim 1, further comprising adding a cyclic prefix to the spread-OFDM signal before transmitting the spread-OFDM signal.

32. Written support in ’163 includes the following: (emphasis added)

Page 42, last Par.:

> “Modulated signals may include guard bands, **cyclic prefixes**, codes, and the like, which are well known in the art.”

33. The POSITA finds instructions to employ a cyclic prefix.

Claim 10. An apparatus for communication in a wireless communication network that employs a first set of complex-valued codes to encode data symbols to be transmitted, and employs a second set of complex-valued codes to recover transmitted data symbols from a received signal, the apparatus comprising:

at least one processor; and

a non-transitory computer-readable memory communicatively coupled to the at least one processor, the non-transitory computer-readable memory including a set of instructions stored thereon and executable by the at least one processor:

34. Written support in ’163 includes the following: (emphasis added)

Page 80, last Par.:

> “For example, the A/D converter 1848 may include a filter bank, such as a **signal processor** adapted to perform a Fourier transform, wavelet transform, or an equivalent operation.”

Page 146, fourth Par.:

> “The filter 6012 may include a filter bank. The filter 6012 may include **any type of signal processor** adapted to perform a Fourier transform operation. For example, the filter 6012 may perform one or more FFTs, DFTs, and/or OFFTs.”

Page 154, fourth Par.:

> "The hardware component(s) 6603.1 to 6603.j typically include a transmitter and/or receiver system, and a **storage medium** (e.g., disk drive, tape drive, CR Rom, DVD, flash memory, or any other storage device) **for storing application programs** and data. Hardware and/or the software may perform A/D conversion, as necessary. In some applications, modulation and/or demodulation may be performed digitally with any combination of software 6601.1 to 6601.i and hardware 6603.1 to 6603.j components."

Page 202, second Par. – third Par.

> "FIG. 99 illustrates a **control circuit** 9901 adapted to process one or more system requirements 9911 and, optionally, one or more channel characteristics 9912. The control circuit 9901 provides adjustment to one or more CI parameters 9902 in a CI transceiver 9903. CI parameter adjustment and/or selection affects one or more transceiver operating parameters 9921.
>
> The **control circuitry** 9901 may scale a transmitted bit rate by scaling the CI symbol duration, the number of carriers, the carrier spacing, and/or the number of bits per symbol per carrier. This permits the scaleable CI system to operate in various communications environments requiring various operating parameters and/or characteristics. By scaling the operating parameters and/or characteristics of the CI system when control circuitry 9901 determines that different operating parameters and/or characteristics are necessary or advantageous, the control circuitry 9901 can dynamically change the operating parameters and/or characteristics, thereby providing compatibility or the desired performance. For example, dynamically scaling the bit rate enables widely varying signal bandwidths, adjustment of delay-spread tolerances, and adaptability to different SNR requirements. A scaleable CI system is particularly suitable for applications in mobile wireless communications, as well as other applications that support a variety of services in a variety of environments."

35. The POSITA understands that a signal processor can include a variety of different processors,

including a processor with computer-readable memory. The POSITA understands that control circuitry in a transceiver can include chips and other processors that are regarded as a processor in communication with the non-transitory computer-readable memory.

Claim 19. A computer program product for operating a transmitter in a wireless communication network that employs a first set of complex-valued codes to encode data symbols to be transmitted, and employs a second set of complex-valued codes to recover transmitted data symbols from a received signal, the computer program product comprising a non-transitory computer readable storage device having computer readable program code stored therein, said program code containing instructions executable by one or more processors of a computer system:

36. Written support in ’163 includes the following: (emphasis added)

Page 154, fourth Par.:

> “The hardware component(s) 6603.1 to 6603.j typically include a transmitter and/or receiver system, and a **storage medium** (e.g., disk drive, tape drive, CR Rom, DVD, flash memory, or any other storage device) **for storing application programs** and data. Hardware and/or the software may perform A/D conversion, as necessary. In some applications, modulation and/or demodulation may be performed digitally with any combination of **software** 6601.1 to 6601.i and hardware 6603.1 to 6603.j components.”

37. The POSITA understands that a storage medium can include computer-readable memory.

DECLARATION

The declarant acknowledges that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon. The declarant attests that all statements made of the declarant's own knowledge are true and that all statements made on information and belief are believed to be true.

Date: May 9, 2025

Steve Shattil