A/PROV

PATENT
103118-006

Honorable Commissioner of Patents and Trademarks
Washington, DC 20231

NEW PROVISIONAL APPLICATION TRANSMITTAL LETTER

Sir:

Transmitted herewith for filing is the Provisional Patent Application of Inventor(s):

	Marcos C. Tzannes
Residence:	12 LaEspiral Orinda, CA 94563
Citizenship	United States
Post Office Address:	Same as above

Find authenticated court documents without watermarks at docketalarm.com.

For: Transceiver Supporting Multiple Applications

Enclosed are the following papers required to obtain a filing date under 37 C.F.R. §1.53(c):

0 Sheets of Informal Drawings
5 Pages of Specification, Drawings & Tables
0 Claims

The following papers, if indicated by an ☒, are also enclosed:

☐ A Declaration and Power of Attorney
☐ An Assignment of the invention
☐ An Information-Disclosure Statement, Form PTO-1449 and a copy of each cited reference
☐ A Small-Entity Declaration
☒ A Certificate of Express Mailing, Express Mail Label No. EE810799905US

Basic Fee: $150

☒ A check in the amount of $150 is enclosed to cover the Filing Fee.

Please address all communications and telephone calls to the undersigned.

Respectfully submitted,

Gail Leonick

Gail Leonick
Aware, Inc.
40 Middlesex Turnpike
Bedford, MA. 01730

DOCKET ALARM
Find authenticated court documents without watermarks at docketalarm.com.

PATENT
103118-0060

UNITED STATES PROVISIONAL PATENT APPLICATION

of

Marcos C. Tzannes

for a

A METHOD FOR RANDOMIZING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEMS TO REDUCE THE PEAK TO AVERAGE POWER RATIO OF THE TRANSMITTED SIGNAL

DOCKET ALARM Find authenticated court documents without watermarks at docketalarm.com.

A Method for Randomizing the Phase of the Carriers in a Multicarrier Communications Systems to Reduce the Peak to Average Power Ratio of the Transmitted Signal

By

Marcos Tzannes

Background of the invention

Discrete Multi-Tone (DMT) modems (a.k.a. multicarrier modems) transmit multiple individually modulated tones in parallel. The DMT transmitter is typically implemented by using an Inverse Fast Fourier Transform (IFFT) to generate the modulated waveforms (Figure 1). The resulting transmitted time domain signal, which is the linear combination of multiple modulated tones (carriers), can be approximated to have a Gaussian probability distribution. This approximation is accurate if the phase of the modulated tones is truly random. Since phase modulation is used to modulate signals in DMT systems, this implies that the transmitted data bits must be random as well. Most DMT transmitters use data scramblers for this reason. The scrambler, which is positioned before the IFFT modulator, will output data bits that are randomized in order to assure that the transmitted signal at the output of the IFFT modulator will have a Gaussian probability distribution. Generating a transmitted signal with a Gaussian distribution is important in order to transmit a signal with a low Peak to Average Power Ratio (PAR). The PAR of a signal is an important aspect of a system design because it effects the total power consumption and component linearity requirements of the system.

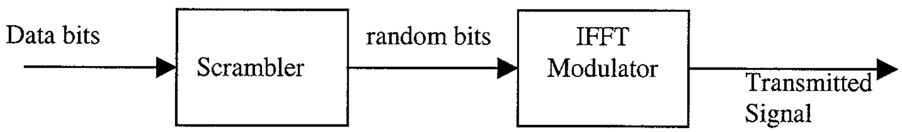

Figure 1: DMT modulator

The problem with DMT transmitters that operate in such a manner is the inherent assumption that the phase of the modulated carriers is random. If for any reason the phase of the modulated carriers is not random then the PAR can increase greatly resulting in system with high power consumption and/or with high probability of clipping the transmitted signal. Examples of cases where the phases of the modulated carriers are not random are when:

1) scramblers are not used
2) multiple tones are used to modulate the same data bits
3) the constellation maps (mapping of data bits to tone phases) used for modulation are not random enough.

There are obviously other cases where the phase of the IFFT carriers may not be random enough to generate a "Gaussian distributed" transmitted signal. This invention provides a mechanism to randomize the phase of DMT tones for the three examples above, as well as for other cases not specified in this invention which require such randomization to decrease the PAR of the transmitted signal.

DOCKET ALARM Find authenticated court documents without watermarks at docketalarm.com.

Overview of the invention

This invention describes a method for randomizing the phase of DMT carriers in order to reduce the PAR of the transmitted signal. The phase randomization is important in cases where several modulated carriers may have the same phase. As mentioned in the previous section, examples of when this would occur are:

1. The data bits being modulated are not truly random. This could occur, for example, if a scrambler is not being used and the data bits have a specific repetitive pattern (e.g. all zeros, or all ones)
2. The same data bits are used to modulate multiple carriers. This would occur in cases where it was desired (or required) to send the same data bits on different carriers and then combine the results at the receiver in order to receive the bits at a lower Bit Error Rate (this is a well-known method for using frequency diversity to decrease the BER).
3. Constellation maps do not provide a truly random phase mapping. Constellation maps are used map data bits to DMT carrier phases. An example of a commonly used constellation map is shown in table 1. This one bit constellation map will provide some randomness to the phase of the DMT tones, but this randomness is limited since there are only two possible phase states.

Data Bits	Phase of DMT carrier
0	90 degrees
1	-90 degrees

Table 1: one bit constellation map

For the conditions mentioned above, and other conditions where the DMT carrier phases are not sufficiently random, this invention describes how to efficiently randomize the phase of the modulated carriers in order to provide a low PAR in the transmitted signal.

The method for randomizing the phase of these tones is as follows:

The phase of each DMT carrier is randomized by adding a different phase shift to each DMT carrier. This phase shift is based on a variable that is known in advance by the DMT transmitter and the receiver. This variable is not related to the data bits so that it is independent of the randomness of the data bits. Examples of such variables are the DMT carrier number, the DMT symbol (or frame) count (or superframe count), etc.

DMT carrier number: DMT systems enumerate the carriers in ascending order in frequency. The DMT carrier number represents the location of a tone in frequency relative to other tones. As an example, in DMT ADSL systems there are 256 DMT carriers, separated by 4.3125 kHz, spanning the frequency bandwidth from 0 kHz to 1104 kHz. DMT carriers are numbered from 0 to 255. As an example, "DMT carrier number 50" represents the 50th DMT carrier located at the frequency position 50*4.3125=215.625 kHz.

DMT symbol count: DMT systems often use DMT symbol (or frame) counters to synchronize the data transmitted between the transmitter and the receiver. DMT symbol counters are used to number DMT symbols in time as they are transmitted and received by DMT systems. In DMT ADSL systems there is a symbol counter called a "frame counter" that is synchronized between the transmitter and the receiver that is based on a module 68 count. This means the ADSL DMT symbol count (frame count) counts from 0 to 68 and then repeats again from 0 to 68 and so on. The collection of 69 consecutive DMT frames is called a "DMT superframe" in ADSL systems. There is also an ADSL DMT "superframe counter" that is synchronized between the transmitter and the receiver that is based on a module 255 count of DMT superframes. This means the ADSL DMT superframe count counts superframes from 0 to 255 and then repeats again from 0 to 255 and so on.

In this invention, the phases of DMT carriers are randomized by adding different phases shifts to the DMT carriers based on variables such as the DMT carrier number and DMT symbol count. The invention uses

DOCKET ALARM Find authenticated court documents without watermarks at docketalarm.com.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.