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**Datasheet for the decision  
of 27 April 2007**

**Case Number:** T 1368/04 - 3.5.03

**Application Number:** 95305906.0

**Publication Number:** 0700170

**IPC:** H04B 1/707

**Language of the proceedings:** EN

**Title of invention:**

A method and apparatus for spread spectrum code pulse position modulation

**Applicant:**

AT&T Corp.

**Opponent:**

-

**Headword:**

Pulse position modulation/AT&T

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step - (yes) after amendment"

**Decisions cited:**

-

**Catchword:**

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Case Number: T 1368/04 - 3.5.03

**D E C I S I O N**  
of the Technical Board of Appeal 3.5.03  
of 27 April 2007

**Appellant:**

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**Representative:**

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**Decision under appeal:**

Decision of the Examining Division of the  
European Patent Office posted 29 July 2004  
refusing European application No. 95305906.0  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** A. S. Clelland  
**Members:** A. Ritzka  
M.-B. Tardo-Dino

## Summary of Facts and Submissions

- I. This appeal is against the decision of the examining division dated 29 July 2004, refusing European patent application number 95305906.0 for the reason that the subject-matter of each of claims 1 to 10 did not involve an inventive step having regard to the disclosure of
- D1: US 5 166 952 A and  
D2: US 5 313 457 A.
- II. Notice of appeal was filed on 14 September 2004 and the appeal fee paid. The statement of grounds of appeal was filed on 30 October 2004. The appellant requested that the appealed decision be set aside and that, as main request, the application be allowed based on the claims as refused by the examining division or, as auxiliary requests 1 to 3, on the basis of one of the sets of claims labelled "auxiliary set 1", "auxiliary set 2" and "auxiliary set 3" filed with the grounds of appeal. The appealed decision was based on claim 1 filed with letter of 5 May 2004 and claims 2 to 10 filed with letter of 3 September 2003.
- III. In a communication accompanying a summons to oral proceedings the board made observations regarding the clarity of claims 3 and 9 of the second and third auxiliary requests and the inventive step of the independent claims of all requests having regard to the disclosure of D1 and D2.
- IV. With the letter submitted 23 March 2007, in response to the communication, the appellant maintained the main

request and filed new sets of first to fourth auxiliary requests to replace the auxiliary requests on file. It was requested that a patent be granted on the basis of the main request or one of the first to fourth auxiliary requests. Claims 3 and 9 of the second and third auxiliary requests were said to have been amended to overcome the objections of lack of clarity. The appellant presented arguments regarding inventive step.

V. With a letter dated 26 March 2007, signed by a new representative with reference to the same general authorisation number 9312, four further sets of claims of first to fourth auxiliary requests were filed.

VI. At the oral proceedings held on 27 April 2007 the appellant presented a new main request replacing the main request on file and maintained the first to fourth auxiliary requests.

At the end of the hearing the chairman announced the decision of the board.

VII. Claim 1 of the main request reads as follows:

"Apparatus for transmitting information across a communication channel, said apparatus comprising a first carrier source and a means (475, 480) for applying a modulated carrier signal to an input of said communication channel, the apparatus

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a first spread spectrum code generator (420) for generating a first or second spread spectrum codeword to convey at least one bit of information, said codewords consisting of a plurality of chips

transmitted during a symbol duration, said codewords having a main lobe in one of said chip positions upon matched filtering in a receiver and side lobes, said main lobe having an amplitude which is much greater than the amplitude of the side lobes such that the interference caused by the amplitude of the side lobes on adjacent symbols is negligible with respect to the interference that results from conventional sources of interference,

said first spread spectrum code generator further comprising a means for delaying the transmission of said codeword by a positive or negative time period relative to said symbol duration to modulate the position of said main lobe (15) according to the position in said receiver output to convey one or more additional bits of information; and

a modulator (455) connected to said first spread spectrum code generator and said first carrier signal source, said modulator generating a first carrier signal modulated by said generated codeword having its position modulated relative to the center of said symbol duration, said means (475, 480) applying said modulated carrier signal to the input of said communication channel."

In view of the board's decision it is not necessary to give details of the auxiliary requests.

## Reasons for the Decision

### 1. *Background of the invention*

The application relates to a spread spectrum communication system in which a codeword with a particular pattern consisting of  $n$  chips transmitted in a timeframe allocated to a single bit is used. The codeword is chosen from a group of codewords that, upon matched filtering, which the board understands as implying autocorrelation, give a main lobe having an amplitude much greater than the amplitude of the side lobes. For conveying additional information per codeword the position of the codeword according to the centre of the symbol duration is shifted, which implies modulating the position of the main lobe as associated with the transmitted codeword at the output of a matched filter. The property of the chosen codewords, that the amplitude of the main lobe is much greater than that of the side lobes, reduces the influence of the shifted side lobes on adjacent codewords.

### 2. *Main request*

#### 2.1 Clarity

Claim 1 of the main request was amended in the course of the oral proceedings changing "codeword duration" back to "symbol duration" and limiting the codewords used to those having, upon matched filtering, a main lobe with an amplitude much greater than the side lobes such that the interference caused by the amplitude of the side lobes on adjacent symbols is negligible with

respect to the interference that results from conventional sources of interference.

The board notes that it is unclear how the transmission of a codeword could be delayed relative to the codeword duration, as previously claimed, since the time frame would be defined by the codeword itself. By contrast, the symbol duration, as claimed in the present claim 1, is independent of the particular codeword used.

As noted in point 1 above, in the board's view the feature of the codeword having a main lobe and side lobes upon matched filtering implicitly refers to the results of autocorrelation of the codeword. According to the description, column 6, lines 27 to 39, some of the side lobes may spill over into an adjacent symbol duration period, when the transmission of a spread spectrum codeword is delayed relative to the symbol duration period. However, since the amplitudes of the side lobes are much less than the amplitude of the main lobe, the interference on the adjacent symbols caused by the amplitudes of the side lobes is negligible with respect to the interference that results from more conventional sources. Thus, claim 1 as limited to these specific features is supported by the description, Article 84 EPC.

Claim 1 of the main request accordingly meets the requirements of Article 84 EPC.

## 2.2 Article 123(2) EPC

The amendments to claim 1 are based on claim 1 as published and the description as published at column 2,

lines 33 to 37 and column 6, lines 33 to 39. Thus, they comply with the provision of Article 123(2) EPC.

### 2.3 Inventive step

2.3.1 D1, which the examining division considered the single most relevant prior art document, relates to the modulation and demodulation of spread spectrum radio signals. According to a first embodiment a data bit sequence is Manchester encoded. Three chip codes of different lengths (normal, shortened, extended) are used depending on the Manchester encoded bit sequence. This results in a pulse shifted in one of two positions relative to a reference (see column 8, lines 40 to 69 and column 9, lines 51 to 55). According to a second embodiment two distinct chip codes of equal length are used. Each of the codes is assigned to a unique information data symbol (see column 9, lines 3, 4 and 56 to 59).

In each of the embodiments different codewords are assigned to different information data symbols, i.e. one bit of information is conveyed per codeword. As the problem underlying the apparatus of claim 1 of increasing the number of bits that are transmitted per particular codeword is not addressed in D1, the board does not consider D1 as the most relevant prior art document.

2.3.2 D2 discloses a communication system using a maximal length code having a 1023 chip length for signal spreading and suggests transmitting the maximal length code with reference to a reference time period, see column 12, lines 50 and 51. At the beginning of each



time period each user maximal length code sequence starts at a point in the maximal length code from the first to the 1023rd chip, depending on the data to be sent and the user to receive it, see column 12, line 67 to column 13, line 2. In other words the starting-point can be offset from the start of the code sequence. The chips belonging to the maximal length code that were not sent at the beginning of a time period because of the above mentioned offset are sent at the end to complete the maximum length code each time period in a wrap-around, i.e. cyclic, fashion, see column 3, lines 11 to 16. The difference in time between the reference time and the time when the first chip of the codeword is transmitted is used to encode information on what looks to be an otherwise conventional spread spectrum carrier, column 13, lines 26 to 30. A correlator and a peak detector are used in a receiver for decoding, see column 14, line 42 to column 15, line 29. The correlator includes 1023 mixers in which the incoming signal is compared to each of the possible permutations of the codeword and produces a signal having a main peak or lobe. The peak detector identifies which pattern matches the received signal using the signal generated by the correlator.

D2 is therefore considered the single most relevant prior art document.

- 2.3.3 The subject-matter of claim 1 of the main request differs from D2 in delaying the transmission of the codeword by a positive or negative time period relative to the symbol duration instead of cyclical modulation of the codeword within the symbol duration starting at a reference time. The problem underlying the subject-

matter of claim 1 can be seen as providing apparatus for transmitting information across a communication channel using a spread spectrum codeword and conveying more than one bit of information per codeword, whilst performing detection of the conveyed information in a simpler manner than in the method disclosed in D2.

The subject-matter of claim 1 solves this problem by using codewords having a main lobe and side lobes upon matched filtering, the main lobe having an amplitude which is much greater than the amplitude of the side lobes such that the interference caused by the amplitude of the side lobes on adjacent symbols is negligible with respect to the interference that results from conventional sources of interference, and by delaying the transmission of said codewords by a positive or negative time period relative to said symbol duration.

Delaying the transmission of the codeword by a positive or negative time period, i.e. delaying or advancing the transmission relative to said symbol duration, results in modulation of the position of the main lobe so that additional bits of information may be conveyed. As the amplitude of the side lobes is such that the interference caused by them on adjacent symbols is negligible with respect to the interference that results from conventional sources of interference, the conveyed information may be detected by means of a correlator using only the specific codeword as reference pattern. The detection may be performed in one step only.

This results in much simpler means of detection in the receiver in comparison to D2, which discloses a method performing the detection in two steps, using a correlator including 1023 mixers, in which the incoming signal is compared to each of the possible permutations of the codeword and which produces a signal having a main peak or lobe, and a peak detector identifying which pattern matches the received signal using the signal generated by the correlator. D2 does not suggest the provision of a detection performed in one single step using only one specific codeword.

The board thus considers that the subject-matter of claim 1 of the main request involves an inventive step having regard to the disclosure of D2.

#### 2.4 Remittal

The case is remitted to the department of first instance for further examination. The board notes that the remaining independent claims of the main request have not yet been adapted to reflect the limitations of claim 1. Nor has the description been adapted to the new claims.

#### 3. *The first to fourth auxiliary requests*

As claim 1 of the main request has been found to comply with the provisions of the EPC, the board has not considered the first to fourth auxiliary requests.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
  
2. The case is remitted to the department of first instance for further prosecution on the basis of claim 1 of the main request as filed during the oral proceedings.

The Registrar:

The Chairman:

D. Magliano

A. S Clelland