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D E C I S I O N
of 31 August 1998

Case Number: T 0396/98 - 3.5.1

Application Number: 9114366.7

Publication Number: 0473116

IPC: H04N 1/00

Language of the proceedings: EN

Title of invention:
Digital communication device

Applicant:
Canon Kabushiki Kaisha

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - (yes) after amendment"

Decisions cited:
-

Catchword:
-

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Case Number: T 0396/98 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 31 August 1998

Appellant: Canon Kabushiki Kaisha
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 5 December 1997 refusing European patent application No. 91 114 366.7 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: R. S. Wibergh
M. Lewenton

Summary of Facts and Submissions

I. This appeal is against the decision of the Examining Division to refuse European patent application No. 91 114 366.7.

II. The Examining Division argued that the subject-matter of Claim 1 of all requests (main request and three auxiliary requests) was obvious having regard to the combined teaching of the following documents:

D1: JP-A-1 144 762 (abstract)

D2: Schönfelder, "Digitale Filter in der Videotechnik", Drei-R-Verlag, Berlin 1988, pages 121 to 124.

III. In the grounds of appeal the Appellant argued against the finding of the Examining Division. A new set of claims was filed.

IV. In a communication pursuant to Article 11(2) of the rules of procedure of the Boards of Appeal the Rapporteur expressed the preliminary opinion that the appealed decision had been correct. Also the subject-matter of the new Claim 1 was regarded as obvious in view of D1 and D2.

V. With letter of 15 July 1998 the Appellant filed claims, a complete revised description and drawings according to an auxiliary request.

VI. Oral proceedings were held on 31 August 1998, in the course of which the Appellant filed a new set of claims and amended the description.

VII. The Appellant's final and only remaining request was that the decision under appeal be set aside and that a patent be granted on the basis of the following application documents:

Claims: nos. 1 to 10 submitted during the oral proceedings on 31 August 1998;

Description: pages 1 to 8, 10 to 18 filed with letter of 15 July 1998 (page 19 has been deleted);
page 9 submitted during the oral proceedings on 31 August 1998;

Drawing: sheets 1/8 to 8/8 filed with letter of 15 July 1998.

VIII. Claim 1 reads as follows (omitting the reference signs):

A digital device connected to a digital network for transmitting a digital signal consisting of a plurality of data symbols each symbol being represented by a plurality of bits, comprising:

first conversion means for converting, data symbol per data symbol, the respective data symbol into first data, the first data representing for a period of time of the symbol interval an envelope of an analog signal modulated based on the data symbol the first data representing the analog signal at a first sampling rate for modulation, and the number of the first data being determined by the symbol interval and the first sampling rate for modulation;

buffer means for temporarily storing the first data and

second conversion means for converting, data symbol per data symbol, the first data into second data by interpolation using only the first data stored in said buffer means, and for transmitting the second data to the digital network at a second sampling rate for the digital network, the second data representing for the period of time of the symbol interval the envelope of the analog signal the second data representing the analog signal at the second sampling rate for the digital network, and the number of the second data being determined by the symbol interval and the second sampling rate for the digital network.

Claim 4 is directed to a digital reception device corresponding to the device according to claim 1. Claims 9 and 10 are directed to the corresponding transmitting method and receiving method, respectively.

IX. The appellant argued as follows:

The invention resided in the conversion by interpolation of first digital modulated symbol data into second digital symbol data. The interpolation in any one symbol interval was performed with data which were stored in a certain buffer and belonged to that symbol only; neighbouring data were not used. In this way intersymbol interference was avoided. D2, the only document to be concerned with interpolation, was silent on signals representing symbols and could therefore not render the invention obvious.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The most important amendment to claim 1 is the feature that the second conversion means performs the interpolation symbol by symbol using only the first data, which data are stored in a buffer. The word "only" is not expressly mentioned in the application as filed but the Board finds that there is sufficient basis for its inclusion in the claim. According to the printed patent application, column 6, line 56 to column 7, line 19 "the six modulation results are temporarily saved in an unillustrated buffer for the subsequent interpolation... the interpolation using the saved six data is performed by the first interpolater... when the above interpolation is completed, the interpolation results are temporarily saved... the above-mentioned processes... are repeated in each symbol interval". The cyclical character of the interpolation is also evident from figure 2. In the view of the Board there can be no reasonable doubt that the skilled person would understand from the cited passages and figure that there is a separate interpolation step for each data symbol and that in this step exclusively input data belonging to that symbol are used.

There is thus no objection under Article 123(2) EPC.

3. The closest prior art documents are D1 and D2. D1 discloses a transmitting device (actually a fax apparatus) intended to be connected to a digital network such as ISDN for transmitting a digital signal representing data symbols. The device comprises means for converting the data symbols into digital data corresponding to a modulated analog signal. The digital data are converted to an analog signal which is low-

pass filtered and applied to subsequent analog-to-digital conversion to yield a digital output signal. The frequency of the output signal is different from that of the previous digital signal.

4. Starting out from this prior art the present inventors have recognised the drawback of having an intermediate analog stage. It would be preferable, especially for integration on a single chip, to perform all signal processing digitally. A further aim is to improve the transmission quality.

To this end the device according to claim 1 comprises interpolation means which replace the combination consisting of the D-A converter, the low-pass filter and the A-D converter of the prior art. For each symbol the first digital data are stored in a buffer; those data - and no other - are used to create interpolation data which represent the same symbol. According to an example given in the description, 6 samples at 9.6 kHz representing one symbol of data are converted into a corresponding set of 5 samples at 8 kHz.

5. D2 is a document which describes interpolation in general. From D2 it can be seen that interpolation is a standard method for converting digital samples at one frequency to corresponding samples at another frequency. In D2 the samples are treated consecutively in an identical manner. There is no division into symbols; in fact, symbols are not at all mentioned.

6. The Examining Division held that the subject-matter of the then Claim 1, which was more general than the present one and did not specify any particulars of the interpolation, was obvious in view of a straight-forward combination of D1 and D2. The Board agrees with that conclusion. The present Claim 1, however, makes it clear that the interpolation is performed cyclically on the basis of each symbol and that only data associated with a particular symbol are used to calculate the

output data for the same symbol. The advantage is, according to the Appellant, that intersymbol interference is reduced. The Board is prepared to accept this submission although the application is silent about any such effect.

7. A skilled person who sets himself the task of eliminating the analog stage in D1 would turn to D2 to find out how one series of digital data can be converted to another series using only digital processing. Applying this teaching to the prior art known from D1 would not yield the claimed subject-matter since there would be no reason to perform the interpolation using exclusively data belonging to one and the same symbol. The interpolation would rather be performed also across symbol borders.

In order to arrive at the invention the skilled person must have recognised that the interpolation principles according to D2 would not be perfectly suited to symbol data. There is however no evidence that he would have noted this. In fact, in the prior art according to D1 (analog) low-pass filtering seems to be performed irrespective of any symbol intervals, which would presumably also result in some intersymbol interference. Thus in the prior art the technical problem is neither recognised nor solved, but simply neglected. This is regarded as a strong indication that the present invention involves an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is to be granted in accordance with the Appellant's request.

The Registrar: The Chairman:

M. Kiehl P. K. J. van den Berg