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**Datasheet for the decision  
of 8 May 2012**

**Case Number:** T 1081/08 - 3.5.05  
**Application Number:** 03024384.4  
**Publication Number:** 1429505  
**IPC:** H04L 25/03, H04B 7/005,  
H04L 27/36  
**Language of the proceedings:** EN

**Title of invention:**  
Pre-emphasis of TMDS signaling in video applications

**Applicant:**  
Broadcom Corporation

**Headword:**  
Pre-emphasis of TMDS/BROADCOM

**Relevant legal provisions:**  
EPC Art. 52(1), 54, 56  
RPBA Art. 12(2), 12(4), 13(1)

**Keyword:**  
"Admissibility of the requests (first auxiliary request: no)"  
"Novelty and inventive step (main and second auxiliary request:  
no)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 1081/08 - 3.5.05

**D E C I S I O N**  
of the Technical Board of Appeal 3.5.05  
of 8 May 2012

**Appellant:**  
(Applicant)

Broadcom Corporation  
5300 California Avenue  
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**Representative:**

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**Decision under appeal:**

Decision of the Examining Division of the  
European Patent Office posted 6 February 2008  
refusing European patent application  
No. 03024384.4 pursuant to Article 97(2) EPC.

**Composition of the Board:**

**Chair:** A. Ritzka  
**Members:** P. Corcoran  
F. Blumer

## Summary of Facts and Submissions

- I. The present appeal is against the decision of the examining division to refuse the European patent application no. 03 024 384.4, publication no. EP 1 429 505. The decision was announced during oral proceedings on 24 January 2008 and the written reasons were dispatched on 6 February 2008.
- II. The decision under appeal was based on a request comprising a set of claims 1 to 2 filed during the oral proceedings on 24 January 2008.
- III. Claim 1 of said request reads as follows:
- "A transmitter (210) comprising:  
a memory (212) adapted to store plural coefficients that are predetermined based on an expected degradation characteristic of a channel (220);  
a pre-emphasizer (218) communicating with said memory (212) and the channel (220), and adapted to modify a signal using said coefficients prior to transmission of said signal over said channel (220), said pre-emphasizer (218) being adapted to modify a power over frequency spectrum of the signal proportionally to the reciprocal of the expected attenuation characteristic, such that a distortion of the transmitted signal due to the expected attenuation characteristic of the channel (220) is compensated, characterized in that  
the pre-emphasizer is adapted to delay a first frequency component of the signal to compensate for the expected delay of a second frequency component of the signal, wherein the time of transmission of the

first frequency component is adjusted proportional to the difference in propagation delay between the first and second frequency component, but opposite in sign."

Claim 2 of the request is a further independent claim directed towards a corresponding method.

IV. The examining division found that claims 1 and 2 of said request lacked novelty over the following document:

D3: EP 0 975 124 A.

V. Notice of appeal was received at the EPO on 16 April 2008 with the appropriate appeal fee being paid on the same date. A written statement setting out the grounds of appeal was received at the EPO on 5 June 2008. A new main and sole request comprising claims 1 to 2 was filed with said written statement.

VI. Claim 1 of the request filed with the written statement setting out the grounds of appeal reads as follows:

"A transmitter (210) comprising:  
a memory (212) adapted to store plural coefficients that are predetermined based on an expected degradation characteristic of a channel (220);  
a pre-emphasizer (218) communicating with said memory (212) and the channel (220), and adapted to modify a signal using said coefficients prior to transmission of said signal over said channel (220), said pre-emphasizer (218) being adapted to modify a power over frequency spectrum of the signal proportionally to the reciprocal of the expected attenuation characteristic, such that a distortion of the

transmitted signal due to the expected attenuation characteristic of the channel (220) is compensated, characterized in that the pre-emphasizer is adapted to delay a first component of the signal to compensate for the expected delay of a second component of the signal, wherein the time of transmission of the first component is adjusted proportional to the difference in propagation delay between the first and second component, but opposite in sign."

Claim 2 of the request is a further independent claim directed towards a corresponding method.

VII. In said written statement, the appellant submitted that D3 did not disclose the transformation of the signal to be transmitted into the frequency domain and the operation on the frequency domain representation of said signal in order to compensate for phase distortion caused by the transmission channel. In particular, the appellant argued to the effect that in D3 the frequency components of the input data were not computed in the process of generating the output data (cf. written statement: p.6, last paragraph) and that the FIR filter of D3 did not operate on "frequency components" and thus did not delay "frequency components" (cf. written statement: p.6, first paragraph).

VIII. In a communication accompanying a summons to oral proceedings to be held on 8 May 2012, the board gave its preliminary opinion that the appeal was not allowable.

- IX. In said communication, the board expressed the view that claim 2 of the appellant's request was to be interpreted as defining a method for pre-emphasising a signal to be transmitted in order to compensate for expected amplitude distortion (i.e. attenuation) and phase distortion (i.e. delay) caused by the transmission channel. In the board's opinion, the claim effectively recited an aggregation of two independent embodiments, disclosed separately in [0072] to [0073] and [0074] to [0075] of the published application, in a manner which left it open as to whether the modifications to compensate for each of the aforementioned types of distortion were performed separately or simultaneously. According to the board's interpretation of said claim, it was worded broadly in a manner which covered both the case in which the pre-emphasis modifications were performed on a time domain representation of the signal to be transmitted as well as the case in which the pre-emphasis modifications were performed on a frequency domain representation of the signal.
- X. The board further expressed the preliminary opinion that, in the light of the available prior art, the claimed invention lacked novelty or at least an inventive step over D3. In particular, the board was not inclined to follow the appellant's submissions to the effect that the claimed invention was novel over D3. Even if, for the sake of argument, the appellant's submissions in this regard were to be followed the board was of the opinion that the alleged differences over D3 did not involve an inventive step.

XI. In the context of considering the question of inventive step, the board made reference to the following textbook extracts as evidence of the relevant general knowledge of the skilled person:

D4: C.C. Bissell and D.A. Chapman, "Digital Signal Transmission", Chapter 2 Signals and systems, pp.16 to 61, 1992, Cambridge University Press, ISBN: 0-521-41537-3.

D5: M. C. Jeruchim, P. Balaban and K.S. Shanmugan, "Simulation of Communication Systems", Second Edition, Chapter 4, pp.133 to 201, 2000, Kluwer Academic/Plenum Publishers, ISBN: 0-306-46267-2.

XII. With a letter of reply dated 5 April 2012, the appellant filed an auxiliary request comprising claims 1 to 2.

XIII. Claim 1 of the auxiliary request filed with the letter of 5 April 2012 reads as follows:

"A transmitter (210) comprising:

a memory (212) adapted to store a plurality of coefficients that are predetermined based on an expected degradation characteristic of a channel (220);

a pre-emphasizer (218) communicating with said memory (212) and the channel (220), the pre-emphasizer (218) adapted to:

modify a signal using said plurality of coefficients prior to transmission of said signal over said channel (220),

modify a power over frequency spectrum of the signal proportionally to the reciprocal of the expected attenuation characteristic, such that a distortion of the transmitted signal due to the

expected attenuation characteristic of the channel (220) is compensated, and

delay a first component of the signal to compensate for the expected delay of a second component of the signal, wherein the time of transmission of the first component is adjusted proportional to the difference in propagation delay between the first and second component, but opposite in sign;

the transmitter (210) further adapted to:

transmit at least one pseudo-random data sequence, read a pixel error rate from a receiver, and use the pixel error rate along with an optimization algorithm to adjust the plurality of coefficients."

Claim 2 of the request is a further independent claim directed towards a corresponding method.

XIV. At the oral proceedings held as scheduled on 8 May 2012, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request as filed with the statement setting out the grounds of appeal dated 5 June 2008 (cf. VI above), or, subsidiarily, on the basis of the first auxiliary request, filed as "Auxiliary Request" with letter dated 5 April 2012 (cf. XIII above), or on the basis of the second auxiliary request, corresponding to the "New claims according to the main request" as filed on 24 January 2008 (cf. III above).

XV. During the oral proceedings held as scheduled on 8 May 2012, the board considered the appellant's requests and,



*inter alia*, expressed reservations about the admissibility of the first auxiliary request.

XVI. In particular, the board noted that the independent claims of the first auxiliary request had been amended to incorporate an additional feature group relating to the embodiments of the invention disclosed in [0064] and [0076] to [0080] of the published application.

This additional feature related to subject-matter which had initially been claimed in the form of originally filed independent claims 8 and 9 but which had not been pursued during first instance proceedings. The board further noted that the issuing of a reasoned decision in respect of said subject-matter during said first instance proceedings appeared to have been precluded by the actions of the then applicant and present appellant, in particular the following:

- (i) In response to an invitation from the search division to pay additional search fees, the applicant requested with the letter dated 26 March 2004 that only one search fee was to be debited, that the European search report was only to cover the subject matter first mentioned in the claims, and that no further search was to be carried out. Following the applicant's instructions, the search report was drawn up for those parts of the application which related to the originally filed claims 1 to 6 and 10. Thus, according to said search report, those parts of the application which related to originally filed claims 8 and 9 had not been searched.

- (ii) During the subsequent examination proceedings, the applicant responded to objections raised against originally filed claims 8 and 9 under Article 83 EPC by deleting said claims (cf. official communication dated 2 February 2005 and letter of reply dated 24 March 2005).
  
- (iii) Substantially similar subject-matter to that of the originally filed claims 8 and 9 was reintroduced in the form of an auxiliary request filed with the letter of 20 December 2007. However, this request was subsequently withdrawn during the oral proceedings held before the examining division on 24 January 2008 (cf. minutes of the oral proceedings, point 14. thereof).

It was further noted that the written statement setting out the grounds of appeal contained no indication that the appellant intended to pursue a request incorporating the aforementioned subject-matter during the appeal proceedings. Referring to its discretionary powers under the Rules of Procedure of the Boards of Appeal, in particular Articles 12(4) and 13(1) thereof, the board indicated that it had reservations about admitting the first auxiliary request into the proceedings.

XVII. The representative made oral submissions in support of the appellant's requests which are summarised as follows:

- (i) With respect to the main request, it was argued that the "components" of the signal referred to in the characterising part of claim 1 were implicitly

"frequency components". It only made sense to delay signal components in the frequency domain in order to compensate for phase distortion so claim 1 was to be interpreted as requiring the modifications to the signal to be performed directly on a frequency-domain representation of the signal.

More specifically claim 1 was to be interpreted as specifying that the signal to be modified comprised only two frequency components or "bands" which were delayed relative to each other by means of adjustable delay coefficients in order to compensate for expected differences in the propagation delay.

In contrast thereto, D3 disclosed a transmitter that modified a signal to be transmitted by means of a FIR filter which operated by applying an impulse function to time-domain components of the signal using fixed delay coefficients.

D3 did not disclose the application of an adjustable delay to the transmission times of a first and second frequency component of the signal as recited in claim 1. Moreover, it would not have been obvious for the skilled person to modify D3 in order to arrive at the subject-matter of claim 1.

- (ii) With respect to the first auxiliary request, the representative responded to the board's observations concerning admissibility by submitting that the independent claims of the request were not identical to the originally filed claims 8 and 9. In particular, claim 1 of the request recited a

first group of features substantially similar to those of claim 1 of the main request and additionally included a further group of features which was similar but not identical to the subject-matter of the originally filed claims 8 and 9. Thus, the request should not be seen as an attempt to reinstate subject-matter deleted or withdrawn during examination proceedings because the appellant was effectively seeking protection for a new combination of features.

The independent claims of said request nevertheless incorporated subject-matter which had been present during the examination proceedings, albeit in a somewhat different form. As this subject-matter had not been the subject of a final decision during the first instance proceedings, it would be unfair if the appellant were to be denied an opportunity to pursue it in the context of the appeal proceedings.

- (iii) With respect to the second auxiliary request, it was submitted that the independent claims of this request differed with respect to the corresponding claims of the main request in that they had been amended to specify explicitly that the signal components that were delayed were "frequency components". This amendment was intended to clarify and emphasise the difference between the claimed invention and D3.

XVIII. At the end of the oral proceedings the chair announced the board's decision.

## **Reasons for the Decision**

1. The appeal is admissible. However, the board finds that the appeal is not allowable for the reasons given below.

### *Admissibility of the appellant's requests*

#### 2. *Articles 12 and 13 RPBA*

- 2.1 According to Article 12(2) RPBA, the statement of grounds of appeal shall contain a party's complete case and specify expressly all the facts, arguments and evidence relied on.

- 2.2 Article 12(4) RPBA refers to the power of the board to hold inadmissible facts, evidence or requests which could have been presented or were not admitted in the first instance proceedings.

- 2.3 Article 13(1) RPBA stipulates that any amendment to a party's case after it has filed its grounds of appeal may be admitted and considered at the board's discretion and further provides that the discretion shall be exercised in view of, *inter alia*, the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy.

#### 3. *Main request - admissibility*

- 3.1 The main request was filed with the written statement setting out the grounds of appeal and seeks protection for substantially similar subject-matter to the request on which the impugned decision was based. Accordingly,

this request is not open to objections concerning its admissibility.

4. *First auxiliary request - admissibility*

4.1 The first auxiliary request was filed with the letter of 5 April 2012 and thus constitutes an amendment to the appellant's case at a relatively late stage of the appeal proceedings.

4.2 Claim 1 of said request recites subject-matter substantially similar to that of claim 1 of the main request and further includes the following additional feature group:

"the transmitter (210) further adapted to:  
transmit at least one pseudo-random data sequence,  
read a pixel error rate from a receiver, and  
use the pixel error rate along with an  
optimization algorithm to adjust the plurality of  
coefficients."

4.3 The aforementioned additional feature group is derived from the embodiments of the invention disclosed in [0064] and [0076] to [0080] of the published application and thus relates to subject-matter for which protection was initially sought in the form of separate independent claims, *viz.* originally filed claims 8 and 9. Said additional feature group thus relates to subject-matter which was not included within the scope of the European search report and which was not further pursued during first instance proceedings (cf. Facts and Submissions, item XVI. above).

- 4.4 The written statement setting out the grounds of appeal contained no indication that the appellant intended to pursue claims incorporating such subject-matter during the appeal proceedings (cf. Article 12(2) RPBA).
- 4.5 The appellant's submissions in support of the admissibility of the request are essentially twofold (cf. Facts and Submissions, item XVII(ii) above). On the one hand, the appellant has submitted that claim 1 of said request does not represent an attempt to reinstate originally filed claims 8 and 9 but rather seeks protection for a substantially new combination of features. On the other hand, the appellant has submitted that the additional feature group of claim 1 relates to subject-matter which was present during the examination proceedings, albeit in somewhat different form but which was not the subject of a final decision during said proceedings and should therefore be admitted to allow the appellant to pursue it in the context of the appeal proceedings.
- 4.6 Insofar as claim 1 of the first auxiliary request relates to a substantially new combination of features rather than a mere reinstatement of originally filed claims 8 and 9, it effectively represents a fresh case, namely a combination of originally claimed features with features taken from the description.
- 4.7 Moreover, the amendments to the appellant's case introduced with the present request give rise *inter alia* to the following issues which, in the board's view, it would be either inappropriate or impractical to deal with in the context of the present appeal proceedings:

- (i) The aforementioned additional feature group of claim 1 is open to objections concerning insufficiency of disclosure substantially similar to those raised against originally filed claims 8 and 9 during examination proceedings (cf. Facts and Submissions, item XVI(ii) above).
- (ii) According to the European search report, said additional feature group relates to unsearched subject-matter. This raises the question as to whether the prior art on file can be considered sufficient to permit the board to decide the question of compliance with the requirements of Article 52(1) EPC.

4.8 Admitting the request at such a relatively late stage in the proceedings would thus give rise to a situation in which critical issues which had already been raised at an early stage of the first instance proceedings but were not further pursued during said proceedings due to the decisions of the then applicant and present appellant not to pay additional search fees and to withdraw originally filed claims 8 and 9 and later requests comprising substantially similar subject-matter (cf. Facts and Submissions, item XVI. above) would now have to be considered in detail for the first time in the context of the appeal proceedings. This would run contrary to the purpose of second-instance proceedings.

4.9 To the extent that the board might not be in a position to proceed to a ruling on the aforementioned issues (cf. in particular item (ii) of 4.7 above), the case would have to be remitted to the department of first instance



for further prosecution. This would be contrary to the need for procedural economy, in particular having regard to the actions and omissions of the then applicant and present appellant during first instance proceedings which effectively precluded the department of first instance from issuing a reasoned decision with respect to said issues.

4.10 The appellant advanced no convincing arguments as to why it would be appropriate to permit the issues referred to under 4.7 above to be considered in detail for the first time in the context of the appeal proceedings or why a remittal to the department of first instance would be justified under the given circumstances.

4.11 In view of the foregoing, the board, exercising its discretion under Articles 12(4) and 13(1) RPBA, decided against admitting the first auxiliary request into the proceedings.

5. *Second auxiliary request - admissibility*

5.1 The claims of the second auxiliary request correspond to the claims of the request on which the impugned decision was based. Accordingly, the board saw no reason to object to the admission of this request into the proceedings.

*Allowability of admitted requests*

*Main request*

6. *Preliminary observations concerning the disclosure*

- 6.1 The application discloses, in general terms, that in order to compensate for at least one expected degradation characteristic of a transmission channel a signal can be "modified" or "adjusted" using pre-emphasis prior to transmission such that the signal at the receiver resembles the intended waveform as if the channel had not contributed to any distortion of the signal (cf. published application: [0008] and [0060]).
- 6.2 The description mentions "attenuation" and "delay" as specific examples of degradation characteristics which may be compensated for by pre-emphasis (cf. published application: [0013], [0021] and [0060]).
- 6.3 With respect to "attenuation" it is disclosed that this can be compensated for by adjusting the amplitude characteristics of the signal prior to transmission, i.e. by amplifying the signal (cf. published application: [0014]).
- 6.4 With respect to "delay" it is disclosed that this can be compensated for by adjusting the phase characteristics of the signal prior to transmission, i.e. by delaying components of the signal relative to each other (cf. published application: [0015]).
- 6.5 According to [0060] of the published application, pre-emphasis may comprise *inter alia* "adjusting the time of

transmission proportional to the difference in propagation delay, but opposite in sign". In [0075] it is stated that one or more components of a signal to be transmitted are delayed to compensate for the expected delay of one or more of the other components of the signal. In the board's judgement, the teaching of the application in this regard does not go beyond a general indication to the effect that the phase characteristics of the signal to be transmitted can be adjusted using an inverse phase distortion function ("opposite in sign") to compensate for the estimated phase distortion caused by the channel.

7. *Interpretation of claim 1*

7.1 The appellant made submissions to the effect that the wording of claim 1, in particular the characterising part thereof, requires that the pre-emphasis operations to compensate for phase distortion are performed directly on a frequency domain representation of the signal to be transmitted (cf. Facts and Submissions, items VII. and XVII(i) above).

7.2 The board does not, however, concur with the appellant's interpretation of claim 1 in this respect. In the board's view, said claim is worded in a broad manner which does not explicitly specify whether the pre-emphasis operations are performed on a time domain representation or on a frequency domain representation of the signal to be transmitted. On this basis, the board finds that the wording of the claim covers both of the aforementioned cases.

- 7.3 The board further finds that the application does not provide an identifiable basis for limiting the interpretation of claim 1 in the specific manner suggested by the appellant's representative during oral proceedings, i.e. such that the characterising part of the claim is to be construed as specifying that the signal comprises solely two frequency components or "bands" which are delayed relative to each other by means of "adjustable delay coefficients" (cf. Facts and Submissions, item XVII(i) above).
- 7.4 In particular, the description contains no direct and unambiguous disclosure of a signal whose spectrum is limited to just two frequency components or "bands". Neither is there any direct and unambiguous disclosure of "adjustable delay coefficients" being employed to directly operate on the frequency domain representation of a signal. The description merely refers in general terms to "pre-emphasis coefficients and/or parameters" which are used to adjust a signal before transmission (cf. for example, published application: [0062] and [0071]) but does not contain any direct and unambiguous technical teaching to the effect that these coefficients are "adjustable delay coefficients" used to operate on the frequency domain representation of a signal comprising solely two frequency components. Furthermore, the claim wording contains no mention of "adjustable delay coefficients" but merely specifies "plural coefficients that are predetermined based on an expected degradation characteristic of a channel".
- 7.5 The board thus finds that the characterising part of claim 1 is to be interpreted in the light of the disclosure as specifying that the pre-emphasizer is

adapted to modify the signal to be transmitted by applying a phase compensation function which produces a compensatory phase shift (i.e. "delay") that is the inverse (i.e. "opposite in sign") of the estimated phase degradation characteristic of the channel.

8. *Closest prior art*

8.1 D3, which is found to represent the closest prior art to the subject-matter of claim 1 of the main request, discloses a base station that transmits data over a channel ("propagation path") to a terminal (cf. D3: Fig.1; [0015]). The base station comprises a pre-emphasizer ("pre-distortion section") which includes a memory ("tap-coefficient memory") for storing the coefficients of an impulse response derived from the inverse propagation-path characteristic of the channel (cf. D3: [0018], [0032]). On this basis, D3 is found to disclose a transmitter comprising a memory adapted to store a plurality of coefficients and a pre-emphasizer communicating with said memory and the channel as recited in claim 1 of the main request.

8.2 D3 discloses (cf. D3: [0017], in particular col.4 1.51 - col.5 1.15) the determination of an expected degradation characteristic of a channel in the form of a "propagation-path characteristic",  $H(\omega)$ , and the computation of the inverse characteristic,  $1/H(\omega)$ . An outgoing signal ("down-transmission data") is modified by the pre-emphasizer prior to transmission using a FIR filter which performs a convolution operation using the (time domain) impulse response of the inverse characteristic  $1/H(\omega)$  (cf. D3: [0018]).

8.3 As may be inferred, for example, from [0017] and [0027] of D3, the propagation-path characteristic  $H(\omega)$  and the inverse characteristic  $1/H(\omega)$  are complex functions in the frequency domain. Thus  $H(\omega)$  comprises, at least implicitly, the estimated degradation characteristics of the channel in terms of both amplitude and phase distortion. Likewise, the inverse characteristic  $1/H(\omega)$  comprises, at least implicitly, the pre-emphasis adjustments in terms of both amplitude and phase which are required to counteract said estimated degradation characteristics.

8.4 The board judges that it is implicit in the disclosure of D3 that by pre-emphasising the signal to be transmitted using the information contained in the complex inverse characteristic  $1/H(\omega)$ , or likewise in the impulse response derived therefrom, the pre-emphasised signal will be adjusted to compensate for both the estimated amplitude distortion (i.e. attenuation) and the estimated phase distortion (i.e. delay) caused by the channel.

## 9. *Novelty*

9.1 In the decision under appeal, the examining division expressed the view that notwithstanding the fact that the FIR filter of D3 did not directly act on a frequency domain representation of the signal but rather operated on a time domain representation thereof, the frequency components of the processed signal were nevertheless delayed in the manner specified in claim 1.

9.2 The appellant has submitted counter-arguments to the effect that D3 does not disclose that the pre-emphasis

operations to compensate for phase distortion are performed directly on the frequency domain representation of the signal (cf. Facts and Submissions, item VII. above) and has alleged on this basis that the subject-matter of claim 1 is novel over D3.

- 9.3 In the board's judgement, the wording of claim 1 does not require that the delay of the signal components specified in the characterising part of the claim is achieved by operating directly on a frequency domain representation of the signal. Neither does the description provide a direct and unambiguous disclosure of a specific embodiment of the invention which would support such an interpretation of the claim.
- 9.4 Referring to its preceding observations concerning the interpretation of claim 1, the board finds that the wording of the characterising part of claim 1 does not require the pre-emphasizer to operate directly on a frequency domain representation of the signal but merely that it provides a compensatory phase shift or delay of frequency components relative to each other which is the inverse of the estimated phase degradation characteristic of the channel (cf. in particular 7.2 and 7.5 above). The pre-emphasis operations applied to the time domain representation of the signal of D3 will, in the board's judgement, provide such a phase shift.
- 9.5 The board therefore concludes that, although D3 discloses performing pre-emphasis operations on the time domain representation of a signal to be transmitted, the pre-emphasis operations disclosed therein will nevertheless produce a phase shift of signal components in the frequency domain which will

delay said frequency components in a manner substantially identical to that recited in the characterising part of claim 1.

9.6 In view of the foregoing, the board is not convinced by the appellant's submissions alleging an effective distinction in technical terms between the subject-matter of claim 1 and the disclosure of D3. In this regard the board refers to its preceding observations concerning the interpretation of claim 1 and, in particular, its finding that the description does not provide support for limiting the interpretation of claim 1 in the specific manner proposed by the appellant (cf. 7.3 and 7.4 above).

10. *Further observations*

10.1 Concerning the appellant's submissions to the effect that claim 1 requires the pre-emphasis operations to be performed directly on a frequency domain representation of the signal (cf. 7.1 above), the board notes that even if, for the sake of argument, these submissions were to be followed the alleged distinction over D3 would not involve an inventive step for the reasons which follow.

10.2 As noted in 8.2 above, the pre-emphasis operation disclosed in D3 involves the application of an impulse response function to the time-domain representation of the outgoing signal by means of a conventional convolution operation. An impulse response function is a time domain function typically denoted in the relevant technical literature by  $h(t)$ . In the frequency domain, the counterpart of the impulse response



function is a frequency response function or transfer function, typically denoted in the relevant technical literature by  $H(f)$  or  $H(\omega)$ , and the counterpart of the aforementioned convolution operation is a complex multiplication operation performed on a frequency domain representation of the signal.

10.3 The conjugate relationship between the respective functions and transform operations in the time and frequency domains is a matter of general knowledge in the field of signal processing as evidenced, for example, by the textbook extracts D4 and D5, in particular:

D4: Section 2.5.2, pp.41-43;  
Section 2.8, Summary pp.59-61.

D5: Section 4.1.1.1, pp.135;  
Section 4.1.1.6, pp.145-149;  
Sections 4.2.2 and 4.2.3, pp.186-189.

10.4 The board judges that, having regard to the aforementioned general knowledge, the skilled person would recognise without the exercise of inventive skill that a pre-emphasis operation which is specified and implemented with respect to the time domain representation of a signal may, as a matter of design choice, be specified and implemented with respect to the frequency domain representation of said signal.

10.5 It is further noted in this regard, that D3 (cf. D3: [0026]-[0028]) discloses the application of a frequency response function, *viz.* the inverse characteristic  $1/H(\omega)$ , to the frequency domain representation of an incoming signal ("up-data sent from the terminal", cf.

D3: [0024]) subsequent to its reception in order to "equalise" or compensate for distortions of said incoming signal caused by the propagation path.

10.6 The board judges that it would be readily apparent to the skilled person that a substantially identical compensatory operation could be performed on the frequency domain representation of an outgoing signal prior to its transmission. Such an operation would represent an obvious design alternative to the time domain convolution operation disclosed in [0032] of D3 and its deployment in the given context would not require the exercise of inventive skill.

10.7 Thus, even if the novelty of claim 1 were to be admitted on the basis of the interpretation referred to in 10.1 above, the board finds that said claim would not be allowable due to a lack of inventive step.

11. The preceding observations and findings apply *mutatis mutandis* to claim 2 of the main request.

12. The board therefore concludes that claims 1 and 2 of the main request do not comply with the requirements of Article 52(1) EPC. Consequently, the main request is not allowable.

### *Second auxiliary request*

13. *Interpretation of claim 1*

13.1 Claim 1 of the second auxiliary request, recites substantially the same subject-matter as claim 1 of the main request and is found to differ only in that the

characterising part of the claim explicitly specifies that the "components" of the signal which undergo a compensatory phase shift (i.e. delay) relative to each other are "frequency components".

13.2 The board takes the view that the aforementioned explicit specification of "frequency components" does not substantially alter the definition of the matter for which protection is sought vis-à-vis claim 1 of the main request.

13.3 In particular, the specification that the components of the signal which are subjected to delay are "frequency components" does not alter the board's finding with respect to claim 1 of the main request to the effect that the claim wording does not require the pre-emphasis operations to be performed directly on a frequency domain representation of the signal (cf. observations under 9.4 above).

14. In view of the foregoing, the board finds that claims 1 and 2 of second auxiliary request do not comply with the requirements of Article 52(1) EPC for essentially the same reasons as given in the case of the corresponding claims of the main request (cf. observations under 9. to 12 above, in particular 9.6 and 10.7). The second auxiliary request is therefore not allowable.

### *Conclusions*

15. In the absence of an allowable request the appeal must be dismissed.

**Order**

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

The appeal is dismissed.

The Registrar:

The Chair:

K. Götz

A. Ritzka