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**Datasheet for the decision  
of 15 April 2015**

**Case Number:** T 0946/13 - 3.5.03

**Application Number:** 08734202.8

**Publication Number:** 2090050

**IPC:** H04L29/06

**Language of the proceedings:** EN

**Title of invention:**

Method and apparatus of establishing a synchronisation signal  
in a communication system

**Patent Proprietor:**

Huawei Technologies Co., Ltd.

**Opponents:**

ZTE Deutschland GmbH  
ZTE Corporation

**Headword:**

Synchronisation signal/HUAWEI

**Relevant legal provisions:**

EPC Art. 54, 56, 83, 84, 123(2)  
EPC R. 80  
RPBA Art. 13

**Keyword:**

Admissibility of request filed at oral proceedings - yes  
Clarity - yes  
Added subject-matter - no  
Sufficiency of disclosure - yes  
Novelty and inventive step - yes (following amendment)

**Decisions cited:**

G 0003/14, T 0685/90

**Catchword:**



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Case Number: T 0946/13 - 3.5.03

**D E C I S I O N  
of Technical Board of Appeal 3.5.03  
of 15 April 2015**

**Appellant 1:** ZTE Deutschland GmbH  
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**Appellant 2:** ZTE Corporation  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted on 12 February  
2013 rejecting the opposition filed against  
European patent No. 2090050 pursuant to Article  
101(2) EPC.

**Composition of the Board:**

<b>Chairman</b>	F. van der Voort
<b>Members:</b>	T. Snell
	M.-B. Tardo-Dino

## **Summary of Facts and Submissions**

I. This decision concerns appeals filed by both the opponent and the opponent/intervener against the decision of the opposition division rejecting the oppositions filed in respect of European Patent No. EP 2 090 050.

II. Opposition had been filed by ZTE Deutschland GmbH (opponent 1 and appellant 1) on the grounds of Article 100(a) (novelty and inventive step), (b) and (c) EPC.

An intervention was later filed by ZTE Corporation (opponent 2 and appellant 2), citing the same grounds, which was admitted by the opposition division.

The opposition division rejected the oppositions and also rejected a request made by the opponents to apportion costs in their favour.

III. Appellants 1 and 2 are jointly represented and have effectively presented the same case. For the sake of convenience, the board will consider the appeals in common and refer to the appealing parties jointly as "the appellants".

IV. In the statements of grounds of appeal, the appellants requested that the decision be set aside and that the patent be revoked. The appellants requested further that the decision on the apportionment of costs made by the opposition decision be set aside and an apportionment of costs be made in favour of the appellants.

V. During the opposition procedure, documents E1 to E19, E19a, E19at, E19at-2, E20 to E22, and Exhibits 1a-1e,

2, 3 and 4 were cited by opponent 1 and/or opponent 2 (cf. the impugned decision, points 4, 8 and 14). During the appeal procedure, the appellants cited further documents, namely E19at-3 and E23 to E26.

The following documents are referred to in this decision:

E3: Huawei, "Cell-specific signals for initial synchronization and cell identification", 3GPP TSG RAN WG1 LTE Ad Hoc - R1-060225, Helsinki, Finland, 23-25 January 2006;

E9: LG Electronics, "P-SCH sequence design for multiple PSCs", 3GPP TSG RAN WG1 #48 - R1-070906, St. Louis, USA, 12-16 February 2007;

E16: Huawei, "P-SCH sequences", TSG RAN WG1 #49 - R1-072321, Kobe, Japan, 7-11 May 2007;

E18: 3GPP TS 36.211 V1.0.0 (2007-03), "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Physical Channels and Modulation (Release 8)";

E19: EP 1 936 902 A2;

E19a: KR 20070025175 (priority document of E19); and

E19at-3: Certified English translation of E19a.

VI. In a response to the statements of grounds of appeal, the respondent (patent proprietor) requested that the appeals be dismissed (main request), i.e. that the patent be maintained as granted. Alternatively, the respondent requested that the patent be maintained in

amended form on the basis of the claims of one of the first to tenth auxiliary requests filed with the letter dated 21 December 2012 during the opposition procedure. In addition, the respondent requested that documents E19, E19a, E19at, E19at-2, E20 to E25 and Exhibits 3 and 4 be not admitted, or if they were admitted, that the case be remitted to the opposition division.

All parties conditionally requested oral proceedings.

VII. In a communication accompanying a summons to oral proceedings, the board gave a provisional opinion on the following points:

(i) Re Article 100(c) EPC: The patent appeared to contain no added subject-matter.

(ii) Re Article 100(b) EPC: The invention, insofar as claimed in claim 1 of the patent, appeared to be not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art over the whole ambit of the claim. This concerned embodiments where L was greater than N.

(iii) Re the right to priority: It was doubtful that claim 1 of the patent was entitled to claim priority.

(iv) Re novelty: (a) If the priority claim were invalid, the subject-matter of claim 1 would apparently be not new with respect to the disclosure of E16; (b) If the priority claim were valid, E19, although potentially a document relevant under Article 54(3) EPC, would not be novelty destroying as the relevant parts of E19 were not derivable from the priority document E19a (cf. the translation E19at-3); (c) E3 did not appear to be novelty-destroying.

- (v) Re inventive step: The subject-matter of claim 1 of the patent appeared to involve an inventive step when starting out from document E3 as the various attacks appeared to be based on an ex-post facto analysis.
- (vi) Re the auxiliary requests: At least some of the objections with respect to the main request appeared to apply to claim 1 of each of the auxiliary requests. The board also questioned whether the auxiliary requests were admissible.
- (vii) Re the apportionment of costs: The board saw no reason to differ from the decision of the opposition division rejecting the request for a different apportionment of costs.
- VIII. In a letter of response to the summons dated 31 October 2014, the appellants submitted further arguments together with a new document, E26, which is an excerpt from Wikipedia.
- IX. In response to the summons, the respondent filed, with a letter dated 3 November 2014, claims according to first to fifth auxiliary requests.
- X. Oral proceedings were held on 2 December 2014. During the oral proceedings, the respondent filed claims according to new second and third auxiliary requests.

At the end of the oral proceedings, the board announced that it had reached conclusions on the following issues:



(i) The main request and the first auxiliary request were not allowable in view of the ground for opposition under Article 100(b) EPC.

(ii) Claim 1 of the new second auxiliary request complied with Articles 83 and 84 EPC. However, the claim to priority was invalid.

(iii) The new third auxiliary request was admitted to the appeal proceedings.

Before closing the oral proceedings, the board announced that it would likely issue a summons to attend a second oral proceedings.

XI. A summons was issued to attend oral proceedings on 15 April 2015. No written replies were received in response to the summons.

XII. Second oral proceedings were held on 15 April 2015.

The respondent maintained only the third auxiliary request, which consists of a single claim.

The appellants withdrew the request concerning the apportionment of costs.

The appellants requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the patent be maintained in amended form on the basis of the third auxiliary request as filed during the first oral proceedings on 2 December 2014.

After due deliberation, the chairman announced the board's decision at the end of the oral proceedings.

XIII. Claim 1 of the third auxiliary request reads as follows:

"A method of establishing a synchronization signal for a matched filter receiver for transmission in a communication system, comprising:

defining a set of discrete Fourier frequency coefficients,

transforming said set of discrete Fourier frequency coefficients into a discrete time representation, and

using said discrete time representation as said synchronization signal in said communication system,

the method characterized in

defining a centrally symmetric number sequence,  $d_u[n]$ , having a length  $L$ , wherein  $L$  is smaller than the number of discrete Fourier frequency coefficients of said set, and

performing a mapping of said centrally symmetric number sequence to arrive at said set of discrete Fourier frequency coefficients so that the set of discrete Fourier frequency coefficients represents the mapping of said centrally symmetric number sequence onto discrete Fourier frequency coefficients, said set of discrete Fourier frequency coefficients is a set of Fourier frequency coefficients that is centrally symmetric, and said centrally symmetric number sequence corresponds to puncturing a central element of a Zadoff-Chu sequence of odd length  $L+1$ , wherein said centrally symmetric number sequence,  $d_u[n]$ ,

is obtained by puncturing said central element of said Zadoff-Chu sequence of odd length  $L+1$ , so that  $d_u[n]$  is given by

$$d_u(n) = \begin{cases} W_{L+1}^{un(n+1)/2}, & n = 0, 1, \dots, L/2 - 1 \\ W_{L+1}^{u(n+1)(n+2)/2} & n = L/2, \dots, L - 1 \end{cases},$$

where  $W_N = \exp(-j2\pi/N)$ , for positive integer  $N$ ."

## Reasons for the Decision

### 1. *The patent*

The patent in suit concerns a method of establishing a synchronisation signal for a matched filter receiver.

The basic concept underlying the invention is that the elements of a centrally symmetric Zadoff-Chu sequence (henceforth, "ZC-sequence") are mapped to a set of discrete Fourier transform coefficients, whereby the central element of the ZC-sequence is "punctured" (i.e. removed) prior to mapping. The set of discrete Fourier transform coefficients are then transformed to the time domain by an inverse Fourier transform operation, in order to generate a synchronisation signal.

### 2. *Third auxiliary request - admissibility*

2.1 Since the respondent only maintained the third auxiliary request, the board has to decide on this request only. The third auxiliary request was filed on the afternoon of the first oral proceedings.

Accordingly, the board has first to decide on the admissibility of this request.

2.2 The appellants requested that the request be not admitted on a number of grounds:

- the request constituted a fresh case, requiring that the proceedings be continued in writing;

- the request was not a development of the previous fifth auxiliary request, i.e. the previous lowest ranking request pending at the time;

- the request could, and should, have been submitted earlier; and

- the request, prima facie, did not comply with Articles 123(2), 83, 84 and Rule 80 EPC.

2.3 Article 13 RPBA governs amendment to a party's case:

"(1) Any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and considered at the Board's discretion. 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.

(2) Other parties shall be entitled to submit their observations on any amendment not held inadmissible by the Board ex officio.

(3) Amendments sought to be made after oral proceedings have been arranged shall not be admitted if they raise issues which the Board or the other party or parties

cannot be expected to deal with without adjournment of the oral proceedings."

2.4 In the present case, although the third auxiliary request was first filed during the afternoon of the first oral proceedings, in the board's estimation, the amendments did not give rise to any fundamentally new issues with respect to compliance with Articles 123(2), 83 and 84 EPC which the board or the appellants could not be expected to deal with at the first oral proceedings. In this regard, the requests previously on file had been discussed at length at least with respect to compliance with Articles 83 and 84 EPC, and consequently the matters to be discussed were essentially familiar. As for novelty and inventive step, these issues had not yet been discussed in relation to any request, but it appeared to the board that the discussion would likely concentrate on the same or similar points as those which the parties had raised in writing and were thus in a position to discuss. Consequently, the board did not consider that the request either constituted a fresh case or that the appellants' right to be heard could not be respected by admitting the request.

2.5 The appellants argued that the request should not be admitted as claim 1 was prima facie not allowable under Articles 123(2), 83, 84 EPC and also infringed Rule 80 EPC. However, having heard the parties' comments as to compliance of claim 1 of the new request with Articles 123(2), 83, 84 and Rule 80 EPC, the board did not agree that these provisions were prima facie infringed and would be a bar to admissibility. These matters are considered in full below.

2.6 The board also noted that the third auxiliary request consisted of only one claim. At least in this respect, admitting the request was therefore not prima facie contrary to the principle of procedural efficiency (cf. Article 13(1) RPBA).

2.7 Although ultimately the first oral proceedings had to be adjourned, that was not due to the filing of the new request, but rather due to the large number of issues still to be discussed which were already on file. Therefore, the board considered that, in the present case, a possible adjournment of the oral proceedings was not related to the filing of the new request.

2.8 The appellants argued that the request could, and should, have been filed earlier. However, the board considered that the filing of the new request was essentially a response to the preceding discussion of various issues, in particular clarity with respect to the parameter N, at the first oral proceedings.

2.9 The board, using its discretion under Article 13(1) and (3) RPBA, therefore admitted the request to the appeal proceedings.

3. *Claim 1 - Rule 80 EPC*

3.1 Rule 80 EPC stipulates that amendments must be occasioned by a ground for opposition under Article 100 EPC.

3.2 Claim 1 of the third auxiliary request essentially differs from claim 1 as granted as follows:

(i) the wording "for a matched filter" is inserted after the wording "A method of establishing a synchronization signal";

(ii) the following text replaces the word "wherein" in "wherein the set of discrete Fourier frequency coefficients represents":

"the method characterized in defining a centrally symmetric number sequence,  $d_u[n]$ , having a length  $L$ , wherein  $L$  is smaller than the number of discrete Fourier frequency coefficients of said set, and performing a mapping of said centrally symmetric number sequence to arrive at said set of discrete Fourier frequency coefficients so that"; and

(iii) the following wording is added to the end of the claim:

"wherein said centrally symmetric number sequence,  $d_u[n]$ , is obtained by puncturing said central element of said Zadoff-Chu sequence of odd length  $L+1$ , so that  $d_u[n]$  is given by

$$d_u(n) = \begin{cases} W_{L+1}^{un(n+1)/2}, & n = 0, 1, \dots, L/2 - 1 \\ W_{L+1}^{u(n+1)(n+2)/2} & n = L/2, \dots, L - 1 \end{cases},$$

where  $W_N = \exp(-j2\pi/N)$ , for positive integer  $N$ ".

3.3 The appellants did not dispute that amendment (i) was occasioned by a ground for opposition under Article 100 EPC, that amendment (ii), first clause, concerned Article 100(b) EPC, or that amendment (ii), second

clause, was concerned with Article 100(c) EPC. Amendment (iii) was not discussed in relation to Rule 80 EPC, but is a substantive limitation clearly relevant to Article 100(a) EPC.

3.4 Instead, the appellants merely objected that the two-part form had been modified with respect to features in granted claim 1. The board however saw no reason to not admit the request only on this ground, since the two-part form is a purely formal requirement without any impact on the examination of the substantive issues. Furthermore, the appellants did not argue that the new claim was incorrectly formulated in the two-part form.

4. *Claim 1 - Articles 100(c) and 123 EPC*

4.1 Claim 1 as granted is based on claims 1, 2 and 8 of the application as filed (referring to the PCT publication WO 2008/134976).

4.2 With regard to the amendments (i) to (iii) mentioned above, these find a basis in the application as filed as follows:

Re (i): See paragraph [0009].

Re (ii): The further feature that the symmetric number sequence,  $d_u[n]$ , has a length  $L$ , wherein  $L$  is smaller than the number of discrete Fourier frequency coefficients of said set, derives for example from equation (9) of the application as filed (cf. paragraph [0044]), since it follows from this equation that  $L < N$ . The feature of "performing a mapping ..." derives for example from paragraph [0030].



Re (iii): See claim 9 as filed.

- 4.3 With regard to amendment (ii), the appellants argued that by relying on equation (9) for the basis of the amendment, an unallowable intermediate generalisation had been introduced, since equation (9) and paragraph [0044] were more detailed. In this respect, it was argued that these passages additionally disclose that the DC subcarrier is not used, that the sequence is mapped to equally-spaced subcarriers, and that the remaining carriers are set to zero.
- 4.4 In the view of the board, however, the skilled person reading the application as a whole would appreciate that the range  $L < N$  is not merely disclosed in the narrow context of equation (9) and paragraph [0044] but is inherent to the whole description. In this respect, the skilled person reading the description as filed would implicitly understand the invention (e.g. as set out in paragraph [0030] of the description as filed) in the sense that each one of the elements of a number sequence is mapped to a Fourier coefficient. If the sequence were longer than the number of Fourier coefficients ( $L > N$ ), the invention could not be carried out as described, since some sequence elements could not be mapped to a coefficient. The amendment therefore merely limits the claim to explicitly exclude those embodiments which were never embraced by the description as filed. Consequently, in the board's view, amendment (ii) is clearly based on the application as filed.
- 4.5 The appellants further argued that claim 1 represented an unallowable generalisation, since the only embodiments disclosed used the values  $L = 72$  and  $L = 64$ . However, the board notes that in paragraph [0040]

of the description as filed, it is stated that these choices of L are merely examples. Moreover, claims 1, 2, 8 and 9 as filed do not refer to specific examples.

4.6 The appellants further argued that the features "performing a mapping" and "represents the mapping" were not disclosed in combination. The board however notes that this combination is derivable from claims 1 and 4 as originally filed. The generalisation to performing a mapping without including the formula set out in claim 4 is supported by, inter alia, paragraphs [0011] ("achieved from a mapping"), [0030] and [0033] of the description as filed.

4.7 The board therefore concludes that claim 1 complies with Article 123(2) EPC. Consequently, the ground for opposition pursuant to Article 100(c) EPC does not prejudice maintenance of the patent as amended.

4.8 Further, the board is satisfied that claim 1 complies with Article 123(3) EPC. The appellants did not argue otherwise.

5. *Claim 1 - Article 84 EPC*

5.1 The appellants argued that the amendments did not comply with the requirement for clarity under Article 84 EPC, for the following reasons:

(i) the step of "performing a mapping" contradicted the requirement that the set of discrete Fourier frequency coefficients "represents the mapping";

(ii) the wording "the mapping of said centrally symmetric number sequence onto discrete Fourier frequency coefficients" leaves it unclear whether these

coefficients belong to the previously defined "set of discrete Fourier frequency coefficients" or are other coefficients;

(iii) the two "defining" steps of the claim (i.e. "defining a set of discrete Fourier frequency coefficients" and "defining a centrally symmetric number sequence") are performed in the wrong order; and

(iv) in the formula at the end of the claim, the variable "u" is undefined. Even if this objection applied to granted claim 5, clarity should be considered in view of the pending referral to the Enlarged Board of Appeal (EBoA).

5.2 In the board's view, claim 1 is clear within the meaning of Article 84 EPC with respect to points (i) - (iii) raised by the appellants, for the following reasons:

Re (i): The board fails to see any inherent contradiction between the respective wordings "performing a mapping" and "represents the mapping", it being clear that by performing the mapping as specified the resulting set of discrete Fourier frequency coefficients represents said mapping.

Re (ii): In the board's view, it is clear that "onto discrete Fourier frequency coefficients" is to be understood as meaning onto discrete Fourier frequency coefficients of the set. No other interpretation makes sense, since no other Fourier frequency coefficients are mentioned in the claim.

Re (iii): Claim 1 as formulated does not imply an order of steps. In fact, it is clear to the board that the

characterising features are to be understood as further details of the step of "defining a set of discrete Fourier frequency coefficients".

Consequently, the board considers that none of the points (i) - (iii) raised by the appellants gives rise to objection under Article 84 EPC.

5.3 Re (iv): This deficiency was already present in granted claim 5. In accordance with the conventional approach used by the boards, objection is not possible under Article 84 EPC in respect of features of granted claims, as clarity is not a ground for opposition. This practice has now been confirmed by the Enlarged Board of Appeal in decision G 3/14 of 24 March 2015.

5.4 Consequently, to the extent that clarity may be raised as an issue in these appeal proceedings, the board finds claim 1 to comply with Article 84 EPC.

6. *Articles 100(b) and 83 EPC*

6.1 The appellants argued that claim 1 embraced embodiments in which Fourier coefficients not used for the synchronisation sequence need not be set to zero but could convey any type of other information, e.g. payload information. Such payload information would however cause interference preventing the method from working. Consequently, the invention could not be carried out over the whole ambit of the claim.

6.2 The board notes firstly that this argument was raised for the first time in connection with claim 1 of the third auxiliary request, although it could have been raised earlier in connection with claim 1 as granted, since this claim also embraces embodiments in which

other information could be sent on unused carriers. That notwithstanding, the appellants have not provided any evidence that the invention would not be able to be carried out in such a case. In the board's view, interference usually merely degrades the performance rather than renders a system unworkable.

- 6.3 Furthermore, the board notes that the present patent is directed to a method for establishing a synchronisation signal, and is not concerned with the transmission of payload data. Consequently, such hypothetical and speculative embodiments as suggested by the appellants involving the transmission of payload data, or other data, within the synchronisation signal lie completely outside the scope of the disclosure. There is therefore no need to consider whether the disclosure is sufficiently clear and complete for such embodiments to be carried out by the person skilled in the art.

Consequently, the board finds the appellants' argument unconvincing.

- 6.4 The appellants also argued that claim 1 required that a discrete time representation was used as a transmission signal, which was impossible.

The board however notes that here also this argument was raised for the first time in connection with claim 1 of the third auxiliary request, although it could have been raised earlier in connection with granted claim 1. Furthermore, in the board's view, it would be clear to the skilled person that the claim is to be understood in its technical context rather than in a literal sense. It is implicit that the discrete time signal would have to be converted to a continuous signal before transmission, in the same way that it

would be understood that other unclaimed processing steps preceding transmission have to be carried out, e.g. modulation onto an RF carrier and amplification, etc.

6.5 The board concludes that the ground for opposition pursuant to Article 100(b) EPC does not prejudice maintenance of the patent as amended.

7. *Article 100(a) EPC*

7.1 *Claim 1 - validity of the priority right*

7.1.1 This issue is relevant in view of the prima facie high relevance of the non-patent document E16, which was published between the priority date and the filing date of the application on which the patent in suit was granted.

7.1.2 The appellants argued that claim 1 was not entitled to priority. Their arguments can be summarised as follows:

(i) claim 1 includes information, namely the formula for  $W_N$ , which was not included in the priority document;

(ii) the wording of claim 1 has been amended from "preparing said communication system for use of said discrete time representation ( $s_u(k)$ ) as said synchronisation signal in said communication system" in the priority document to "using said discrete time representation as said synchronisation signal in said communication system". The priority document however does not disclose "using said discrete time representation as said synchronisation signal in said communication system". Moreover, a preparation step is

presented as essential in the priority document, cf. page 8, lines 10-18;

(iii) in the statements of grounds of appeal, the appellants argued that the wording of claim 1 as granted included the wording "the set of discrete Fourier frequency coefficients represents a mapping of a centrally symmetric number sequence onto discrete Fourier frequency coefficients", whereas the priority document, e.g. in claim 2, used the wording "performing a mapping of the number sequence ( $d_u(n)$ ) to arrive at said set of discrete Fourier frequency coefficients ( $H_u(l)$ ) that is centrally symmetric", the former wording being more general. At the oral proceedings on 2 December 2014, the appellants argued that the amendments to claim 1 had not overcome the problem raised in connection with claim 1 as granted; and

(iv) the priority application in claim 2 includes the step "defining a number sequence ( $d_u(n)$ )", which is a different wording than that used in present claim 1.

7.1.3 Re (i): The person skilled in the art of ZC-sequence generation, i.e. a mathematician, would implicitly derive the formula  $W_N = \exp(-j2\pi/N)$  by comparing equations (7) and (8) of the priority document. Although the appellant argued that equation (8) was limited to ZC-sequences of length  $L + 1 = 73$ , the board takes the view that the skilled person would understand on the basis of common general knowledge that the formula applies generally to the term  $W_{L+1}$  in equation (7).

Re (ii): Claim 15 of the priority document discloses a "Transmitter for a communication system ... characterised in that said transmitter is arranged to

use said discrete time representation ...".  
Consequently, the priority document implicitly discloses the step of using the signal and not merely preparing the system for using the signal. Furthermore, neither claim 15 nor independent system claim 17 of the priority document includes any feature specifically for preparing the transmitter/system for using the signal. Consequently, the priority document provides a clear basis for omitting the "preparing" step from claim 1.

Re (iii): Since claim 1 now includes the step of performing a mapping as defined in claim 2 of the priority document, the wording "so that the set of discrete Fourier frequency coefficients represents a mapping" is effectively redundant. The board does not see that this wording could give a meaning to the claim wider than that disclosed in claim 2 of the priority document.

Re (iv): Claim 1 uses the wording "defining a centrally symmetric number sequence,  $d_u[n]$ ", which is based on claims 2 and 3 of the priority document. The subsequent wording "having a length L, wherein L is smaller than the number of discrete Fourier frequency coefficients of said set" (cf. point XIII above) is implicitly disclosed in the priority document for the same reasons as given in connection with Articles 100(c) and 123(2) EPC (cf. above points 4.2(ii) and 4.4).

7.1.4 Consequently, the board concludes that claim 1 of the third auxiliary request validly claims priority (Articles 87(1) and 89 EPC).

7.2 *Document E16*



As the priority is held to be valid, document E16 is not a prior art document within the meaning of Article 54(2) EPC and is consequently not relevant for assessing novelty and inventive step.

### 7.3 *Document E19*

- 7.3.1 E19 was not admitted by the opposition division. However, the respondent at the second oral proceedings stated that it did not maintain its objection to the admitting of E19. The board exercised its discretion to admit E19, priority document E19a, and the certified translation E19at-3 to these appeal proceedings, since it considered that E19 was prima facie highly relevant to the discussion on novelty (cf. Article 12(4) RPBA).
- 7.3.2 As the priority claim for claim 1 of the third auxiliary request is held to be valid (priority date 2 May 2007), E19 (publication date 25 June 2008, filing date 19 December 2007) constitutes a patent document comprised within the prior art in the sense of Article 54(3) EPC, but only to the extent that subject-matter disclosed in E19 validly enjoys a right of priority with respect to a priority date before 2 May 2007. The appellants argued that for the relevant subject-matter, priority was validly claimed based on priority document E19a, with filing date 14 March 2007. In the following, reference will be made to the figures of E19a and text of E19at-3.
- 7.3.3 The main point at issue with regard to novelty was whether E19 and E19at-3 disclosed puncturing of a ZC-sequence prior to mapping.

7.3.4 The appellants referred to paragraphs [0199] and [0237] of E19 and to various passages of E19at-3, as will be considered below.

7.3.5 The respondent took the view that E19 disclosed two methods, a first in which the DC carrier is "nullified" in the frequency domain, i.e. after mapping, and a second in which a sequence value corresponding to the DC position was removed. E19 drew a clear distinction between these methods (cf. paragraph [0120]). The priority document however only disclosed the first of these methods. Consequently, even if the second possibility disclosed in E19, paragraph [0120], corresponded to puncturing the sequence before mapping, this was not relevant to a novelty attack pursuant to Article 54(3) EPC.

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7.3.6 With regard to a novelty attack based on E19, the board agrees with the respondent that the most relevant passage is paragraph [0120], which includes the following text:

"Avoiding the sequence to have the DC component can be implemented by performing directly puncturing the DC component in the frequency domain, but, alternatively, the sequence can be generated by omitting one "n" value which corresponds to the DC component."

7.3.7 The board agrees with the respondent that only the second alternative is a disclosure of puncturing before mapping. The first alternative based on puncturing the DC component in the frequency domain (referred to by the respondent as "nullification") does not anticipate the claimed method, because puncturing occurs after mapping.

- 7.3.8 As to paragraphs [0199] and [0237] of E19, referred to by the appellants, these passages concern puncturing after a time domain sequence has been transformed into the frequency domain, i.e. not puncturing of the sequence itself, and are thus not relevant to novelty in respect of the claimed subject-matter.
- 7.3.9 Consequently, the essential point to be decided is whether the alternative embodiment of E19, paragraph [0120], in which a sequence element is omitted before mapping, has a basis in the priority document E19a (cf. certified English translation E19at-3).
- 7.3.10 The appellants referred to various passages and figures of E19at-3, in particular claims 15, 17 and 22, page 26, lines 15-21, page 33, page 49, lines 1-3, page 57, lines 7-11 in combination with Fig. 8, page 65, line 11, page 80, lines 3 and 4, and page 87 in combination with Fig. 17, as a basis for a valid priority claim for the subject-matter in question.
- 7.3.11 However, several of these passages do not concern a solution in which elements of a ZC-sequence are mapped to discrete Fourier frequency coefficients, as claimed. This applies to the passages on pages 26, 33, 57, 65 and 80 and to Fig. 8. These passages and this figure concern the alternative solution mentioned above in point 7.3.8, in which a time domain sequence is first converted to the frequency domain by performing an FFT (cf. Fig. 13).

Although page 87, lines 12-19, and Fig. 17 apparently concern a solution in which sequence elements are mapped directly to Fourier transform coefficients, there is no disclosure that a central element is punctured (removed) before mapping. In this respect,

Fig. 17, step S70 appears to be a mapping to even subcarrier coefficients, followed by puncturing at step S51.

Claims 15 and 22 and page 49 refer clearly to the "nullification" alternative. Claim 17 is not concerned with DC removal.

7.3.12 The board notes that puncturing after mapping as disclosed in Fig. 17 of the priority document appears to be an equivalent method to puncturing before mapping as far as the final result is concerned. However, a priority claim does not extend to equivalents of an embodiment described in the priority document. The situation here is analogous to the test for compliance with Article 123(2) EPC (cf. T 685/90).

7.3.13 The board concludes that E19 does not validly claim priority for an embodiment in which puncturing is carried out before mapping to Fourier frequency coefficients. Consequently, E19 need not be further considered for an examination of novelty in view of Articles 54(3) and 89 EPC.

#### 7.4 *Claim 1 - novelty with respect to E3*

7.4.1 D3 is a document submitted to a 3GPP working group by Huawei, i.e. the respondent and patent proprietor in the present case. It discloses an OFDM synchronization signal formed by mapping a centrally symmetric odd-length ZC-sequence to discrete Fourier transform coefficients. The mapping is defined in equation (13). It follows from this equation that  $H(0)$ , which is the DC component, takes the central value of the ZC-sequence, i.e. is in general non-zero. In this respect, the board follows the analysis given by the appellants

in the submission dated 31 October 2014, page 7, point (d).

7.4.2 In their respective statements of grounds, the appellants argued that it was an inherent property of a synchronisation signal for LTE that the DC component is zero. Consequently, the skilled person would implicitly understand that in E3 the central value is punctured in order to fulfil this requirement.

7.4.3 The board however notes that in E3, the coefficient at the DC subcarrier after mapping is explicitly the central (generally non-zero) element of the ZC-sequence. Consequently, there is no inherent disclosure of a zero DC component in E3, and certainly no disclosure of puncturing the ZC-sequence prior to mapping.

7.4.4 The board therefore concludes that the subject-matter of claim 1 is new with respect to the disclosure of E3 (Articles 52(1) and 54(2) EPC).

7.5 *Claim 1 - inventive step - E3 combined with E18*

7.5.1 As stated above, the subject-matter of claim 1 differs from the disclosure of E3 at least in that there is no disclosure in E3 of puncturing a central element of the ZC-sequence prior to mapping.

7.5.2 At the publication date of E3, there was apparently no requirement to have a DC subcarrier of zero in the synchronisation signal being considered by the 3GPP working group. The respondent observed in this respect at the oral proceedings that the DC subcarrier was originally not an issue. Nevertheless, it follows from E18, which is a specification of the LTE

synchronisation signal and was published later than E3, that the synchronisation signal should be transmitted on 72 subcarriers centered around the DC subcarrier (cf. section 5.7.1.2), which is assumed to be zero. The board notes however that E18 does not define the nature of the signals transmitted on the 72 subcarriers. In particular, in the board's view, it cannot be inferred that the signal itself has to be symmetrical about the DC subcarrier.

- 7.5.3 The problem to be solved starting out from E3 can be seen as how to provide a synchronisation signal compliant with the LTE standard as set out in E18.
- 7.5.4 The appellants argued that it would be obvious to solve this problem by puncturing the central element of the ZC-sequence. This view was supported by referring to equation (15) of E3, from which it followed that the sequence should ideally be of prime length, but if this was not possible, elements should be removed whilst retaining symmetry. This led immediately to the idea of puncturing the central element.
- 7.5.5 The board however finds this argument to be based on hindsight. In the first place, the skilled person has other options based on known synchronisation signals compliant with the standard, e.g. that described in E9, which will be discussed below. Consequently, there is no imperative to base a solution on a modified version of E3. Furthermore, even assuming the skilled person were to seek to modify the method described in E3, there is no hint in E18, or indeed in any other of the cited prior art documents, to perform puncturing of a central element of a ZC-sequence. In the board's view, the fact that E3 suggests truncation of the sequence, i.e. the removal of peripheral elements, does not

render obvious the puncturing of a central element, since removing a value from the centre of the sequence is conceptually different to removing elements at the periphery. For example, the central element may plausibly be more significant to correlation detection processing in the receiver than the peripheral elements. Instead of puncturing a central element, the skilled person starting out from E3 would plausibly be taught by E18 to map the entire odd-numbered centrally symmetrical ZC-sequence of E3 asymmetrically onto the downlink resource grid shown in E18, Fig. 4, which does not include the DC subcarrier (cf. E18, page 9, last line), e.g. by mapping a zero to any unused subcarriers. As stated above, E18 does not require that the synchronisation signal has a symmetric spectrum around zero, merely that these 72 subcarriers transmit the synchronisation signal. Consequently, the skilled person starting out from E3 would not on the basis of the teaching of E18 arrive at the subject-matter of claim 1 without the benefit of hindsight.

7.5.6 The board concludes that the subject-matter of claim 1 of the third auxiliary request involves an inventive step with respect to the combination of E3 with E18 (Articles 52(1) and 56 EPC)

7.6 *Claim 1 - inventive step - E3 combined with common general knowledge*

7.6.1 The appellants argued that it belonged to common general knowledge that no data should be transmitted on the DC subcarrier, i.e. that the DC subcarrier of an OFDM signal should be avoided. This was supported by reference to several documents, in particular E17, E18, E20 and E22, as well as paragraphs [0028] and [0039] of the patent in suit. Common knowledge would thus lead

the skilled person to modify E3 and, hence, arrive at the claimed invention.

7.6.2 The board does not dispute that at the priority date of the patent in suit it was conventional practice in OFDM systems to transmit no data on the DC subcarrier. However, this common knowledge in itself does not suggest to the skilled person how this goal should be achieved. Consequently, common knowledge would not lead the skilled person to modify E3 by puncturing the central element of the ZC-sequence without the benefit of hindsight. The board therefore finds the appellants' argument unconvincing.

7.6.3 The board concludes that the subject-matter of claim 1 of the third auxiliary request involves an inventive step with respect to the combination of E3 with common general knowledge (Articles 52(1) and 56 EPC)

7.7 *Claim 1 - inventive step - E3 combined with E9*

7.7.1 E9 (cf. Figure 1) describes a method for generating a synchronisation signal based on generating a time domain ZC-sequence (Figure 1, step 1), repeating the sequence (step 2), converting the result to the frequency domain using a discrete Fourier transform (step 3), and puncturing the frequency domain signal at the DC position (step 4).

7.7.2 The appellants argued that it would be obvious to apply the teaching of E9 to E3 with respect to puncturing the sequence and thus arrive at the subject-matter of claim 1 without inventive step. In this respect, it was argued that the sentence in E9 (cf. page 2, line 3) "Also, the sequence element corresponding [*sic*] DC position should be punctured to support simple



correlation" should be understood as "... the sequence element corresponding to the DC position ..", and therefore be taken to apply to step 1 of Figure 1, not step 4.

7.7.3 The board considers however that it would not be obvious to combine E3 and E9 and arrive at the invention without the benefit of hindsight. Firstly, the board notes that the mapping process in E9 is not directly compatible with that of E3, because the frequency domain coefficients generated in E9 are generated from a DFT of a time domain sequence, whereas in E3 the sequence is mapped directly to the frequency domain coefficients. This has the result that in E9, all sequence elements contribute to the DC value in the frequency domain, which is then punctured, whereas in E3, only the central sequence element contributes to the DC value. Puncturing in the frequency domain after DFT processing therefore does not correspond to puncturing the central element of the sequence. Secondly, if the skilled person were to attempt to apply the teaching of E9 to E3, he would likely note that repetition of the odd-length ZC-sequence of E3 an even number of times would result in a symmetric sequence, rendering puncturing unnecessary. Finally, E9 at most teaches that puncturing should be carried out in the frequency domain after mapping, which is the process referred to as "nullification" in the discussion above in relation to E19, whereas claim 1 requires puncturing of the ZC-sequence before mapping. In this respect, in the board's view, the ambiguous text in E9 referred to by the appellants has to be understood in the light of Figure 1, from which it is clear that it applies to "Step 4", i.e. to puncturing in the frequency domain, and not to puncturing the sequence in step 1 (cf. E9, page 2, line 1: "note that

the sequence position in frequency domain ...",  
underlining by the board).

7.7.4 The board concludes that the subject-matter of claim 1 of the third auxiliary request involves an inventive step with respect to the combination of E3 with E9 (Articles 52(1) and 56 EPC).

7.8 *Inventive step - further documents*

The appellants in the written submissions raised further attacks based on other documents cited in the procedure against the granted claims, inter alia an attack based on E23. However, these attacks were not raised in connection with claim 1 of the third auxiliary request. Further, none of these documents is prima facie more relevant than those referred to above. Consequently, there is no need for the board to consider these attacks further.

7.9 The board concludes that the ground for opposition pursuant to Article 100(a) EPC does not prejudice maintenance of the patent as amended.

8. *Remittal*

The board has not considered whether the description needs adaptation, which is matter which is considered best dealt with by the opposition division. The case is therefore remitted to the opposition division for further prosecution.

**Order**

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

- The decision under appeal is set aside.
- The case is remitted to the department of first instance with the order to maintain the patent in amended form on the basis of the third auxiliary request as filed during the oral proceedings of 2 December 2014 and with a description to be adapted.

The Registrar:

The Chairman:



G. Rauh

F. van der Voort

Decision electronically authenticated