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**Datasheet for the decision  
of 29 April 2021**

**Case Number:** T 1583/16 - 3.5.03

**Application Number:** 07847958.1

**Publication Number:** 2122858

**IPC:** H04B7/26

**Language of the proceedings:** EN

**Title of invention:**

Secondary synchronization sequences for cell group detection  
in a cellular communications system

**Patent Proprietor:**

Telefonaktiebolaget LM Ericsson (publ)

**Opponent:**

KELTIE LLP

**Headword:**

Cell group detection/ERICSSON

**Relevant legal provisions:**

EPC Art. 87(1), 54, 56

**Keyword:**

Priority - "same invention" (no)

Novelty - main and auxiliary requests 2, 2a, 3-6 and 8 (no)

Inventive step - auxiliary request 9 (yes)

**Decisions cited:**

G 0001/93, G 0002/10, G 0003/14



**Beschwerdekammern**  
**Boards of Appeal**  
**Chambres de recours**

Boards of Appeal of the  
European Patent Office  
Richard-Reitzner-Allee 8  
85540 Haar  
GERMANY  
Tel. +49 (0)89 2399-0  
Fax +49 (0)89 2399-4465

Case Number: T 1583/16 - 3.5.03

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.03**  
**of 29 April 2021**

**Appellant:** KELTIE LLP  
(Opponent) No.1 London Bridge  
London SE1 9BA (GB)

**Representative:** Ahmad, Sheikh Shakeel  
Keltie LLP  
No.1 London Bridge  
London SE1 9BA (GB)

**Respondent:** Telefonaktiebolaget LM Ericsson (publ)  
(Patent Proprietor) 164 83 Stockholm (SE)

**Representative:** Hoffmann Eitle  
Patent- und Rechtsanwälte PartmbB  
Arabellastraße 30  
81925 München (DE)

**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
2 May 2016 concerning maintenance of the  
European Patent No. 2122858 in amended form.**

**Composition of the Board:**

**Chair** K. Bengi-Akyürek  
**Members:** T. Snell  
R. Winkelhofer

## Summary of Facts and Submissions

I. This case concerns the appeal of the opponent (henceforth, "appellant") against the interlocutory decision of the opposition division concerning the maintenance of the present patent in amended form in accordance with the claims of the main request as filed on 22 September 2014. *Inter alia*, the opposition division held, with respect to the subject-matter of claim 1 of the main request, that the claim to the patent's priority was valid and that the requirements for novelty and inventive step were fulfilled, in particular because the following document published between the date of priority and the filing date was thus not comprised in the state of the art:

**D5:** Ericsson: "S-SCH sequence design", 3GPP TSG-RAN WG1 Meeting #48, R1-071027, St Louis, US, 12th-16th February 2007.

The priority document (US 60/883,898) is referred to in the following as **D4**.

- II. The appellant requests that the decision under appeal be set aside and that the patent be revoked.
- III. The proprietor (henceforth, "respondent") requests as a main request that the appeal be dismissed, i.e. that the patent be maintained in amended form on the basis of the claims of the **main request**.

Alternatively, the respondent requests maintenance of the patent in amended form on the basis of one of eight auxiliary requests numbered as **auxiliary requests 2, 2a, 3 to 6, 8 and 9**, using (apart from auxiliary

request 2a), the numbering scheme adopted by the opposition division (cf. point I.8 of the impugned decision).

The auxiliary requests are as follows:

- 2 = "Alternative main request" as filed on 13 October 2015;
- 2a, as filed on 22 March 2021 in response to a communication from the board pursuant to Article 15(1) RPBA 2020;
- 3 = "Auxiliary request I" as filed on 22 September 2014;
- 4 = "Alternative auxiliary request I" as filed on 13 October 2015;
- 5 = "Auxiliary request II" as filed on 22 September 2014;
- 6 = "Alternative auxiliary request II" as filed 13 October 2015;
- 8 = "Auxiliary request III" as filed on 28 February 2014;
- 9 = "Auxiliary request IV" as filed on 28 February 2014.

IV. The board's decision was announced at the oral proceedings held via videoconference on 29 April 2021.

V. Claim 1 of the **main request** reads as follows (with a feature numbering as used by the opposition division in the impugned decision):

"(1) A method of indicating frame timing parameters and an identity of a particular cell group from a number, M, of possible cell groups in a signal transmitted in an LTE cellular communication system that employs a radio frame in a physical layer,

(2) the radio frame consisting of 10 sub-frames numbered 0 to 9, each sub-frame having a duration of 1ms and being made up of two adjacent time slots of 0.5ms each, each of the two adjacent time slots being made up of seven OFDM symbols,

(3a) the method comprising:

transmitting primary synchronization signals (P-Sys) on a Primary Synchronization Channel (P-SCH) in the seventh OFDM symbol of the first one of the two adjacent time slots of sub-frame 0 of the radio frame and in the seventh OFDM symbol of the first one of the two adjacent time slots of sub-frame 5;

(3b) transmitting, in the sixth OFDM symbol of the first one of the two adjacent time slots of sub-frame 0 of the radio frame, on a Secondary Synchronization Channel (S-SCH), a secondary synchronization signal,  $S_1$ , that comprises a pair of sequences,  $\hat{S}_i, \hat{S}_j$  arranged in a first ordering; and

(4) transmitting, in the sixth OFDM symbol of the first one of the two adjacent time slots of sub-frame 5 of the radio frame, on said Secondary Synchronization Channel (S-SCH), a secondary synchronization signal,  $S_2$ , that comprises the pair of sequences,  $\hat{S}_i, \hat{S}_j$  arranged in a second ordering,

wherein:

(5) each member of the pair of sequences,  $\hat{S}_i, \hat{S}_j$ , is selected from a group comprising  $N_{seq}$  different sequences,

(6) wherein  $N_{seq}$  is at least  $\text{ceil} \left( \frac{1 + \sqrt{1 + 8M}}{2} \right)$  different sequences;

(7) the selected pair of sequences is uniquely identified with the particular cell group, wherein  $i, j \in [1, \dots, N_{seq}]$  and  $\hat{S}_i \neq \hat{S}_j$ ; and

(8) the first ordering of the sequences is used only for transmission in the sixth OFDM symbol of the first one of the two adjacent time slots of subframe 0 of the radio frame,

(9) and the second ordering of the sequences is used only for transmission in the sixth OFDM symbol of said first one of the two adjacent time slots of subframe 5."

VI. Claim 1 of **auxiliary request 9** reads as follows:

"A method of detecting timing parameters and an identity of a particular cell group from a number,  $M$ , of possible cell groups in a signal received in a cellular communication system that employs a radio frame in a physical layer, the radio frame comprising a number of time slots including two time slots associated with a synchronization channel, the method comprising:

receiving, in one of the time slots associated with the synchronization channel, one of first and second synchronization signals,  $S_1$  and  $S_2$ , wherein the first synchronization signal  $S_1$  comprises a pair of sequences,  $\hat{S}_i, \hat{S}_j$  arranged in a first ordering and the

second synchronization signal  $S_2$  comprises the pair of sequences,  $\hat{S}_i, \hat{S}_j$  arranged in a second ordering;

determining which of a number of predefined sequences best matches the received sequence  $\hat{S}_i$ , which of the number of predefined sequences best matches the received sequence  $\hat{S}_j$ , and whether the pair of received sequences  $\hat{S}_i, \hat{S}_j$  were arranged in the first ordering or the second ordering, wherein the number of predefined sequences is selected from a group comprising  $N_{seq}$  different sequences, wherein  $N_{seq}$  is at least

$\text{ceil} \left( \frac{1 + \sqrt{1 + 8M}}{2} \right)$  different sequences;

identifying the particular cell group by performing a cell group identification process that includes determining with which cell group the pair of received sequences,  $\hat{S}_i, \hat{S}_j$ , is uniquely associated; and

determining in which one of the two time slots associated with the synchronization channel the one of first and second synchronization signals was received by using information that indicates whether the sequences  $\hat{S}_i, \hat{S}_j$  were received in the first ordering or the second ordering;

receiving, in an other one of the time slots associated with the synchronization channel, an other one of the first and second synchronization signals;

determining whether a type of cell search procedure to be performed is an inter-frequency cell search procedure;



determining whether the type of cell search procedure to be performed is an inter-radio access technology cell search procedure;

determining whether the type of cell search procedure to be performed is an inter-cell cell search procedure;

if the type of cell search procedure to be performed is none of the inter-frequency cell search procedure, the inter-radio access technology cell search procedure, or the inter-cell cell search procedure, then performing

determining which of the number of predefined sequences best matches the received sequence  $\hat{S}_i$  of the other one of the first and second synchronization signals, which of the number of predefined sequences best matches the received sequence  $\hat{S}_j$  of the other one of the first and second synchronization signals, and whether the pair of received sequences  $\hat{S}_i, \hat{S}_j$  of the other one of the first and second synchronization signals were arranged in the first ordering or the second ordering,

wherein the cell group identification process further includes determining with which cell group the pair of received sequences,  $\hat{S}_i, \hat{S}_j$  of the other one of the first and second synchronization signals is uniquely associated."

## Reasons for the Decision

### 1. *Technical context*

The opposed patent relates to cell search and synchronisation procedures in LTE. To facilitate these procedures, primary and secondary synchronisation signals are transmitted on a primary synchronisation channel (P-SCH) and a secondary synchronisation channel (S-SCH) respectively. The patent concerns the *secondary* synchronisation channel used in the so-called "stage 2 processing". The synchronisation signal on this channel consists of a pair of signals  $S_1$  and  $S_2$  transmitted respectively in a 5ms sub-frame of a 10ms radio frame, as shown in Fig. 1 of the patent. Each synchronisation signal ( $S_1$  or  $S_2$ ) consists of a sequence pair  $\hat{S}_i, \hat{S}_j$ . Depending on the cell search type (see Fig. 3, blocks 303, 305), it is only necessary to detect one of the two synchronisation signals  $S_1$  and  $S_2$  in order to determine both the cell group and the 10ms frame timing.

### 2. *All requests - claim 1 - validity of the priority claim (Article 87(1) EPC)*

#### 2.1 The relevant parts of the priority document **D4** read as follows:

"[0006] This invention shows a method for constructing the minimum amount of S-SCH sequences needed, such that the pair [ $S_1, S_2$ ] uniquely define the cell group and frame timing and at the same time also give the possibility to detect the cell group using only one S-SCH."

"[0010] Assume that M unique cell groups are needed and that each cell group is defined by the pair of sequences  $\hat{S}_i, \hat{S}_j$ . Further, the S-SCH symbols consisting of these sequences are transmitted twice per 10ms (subframe 0,5), labeled  $S_1, S_2$  and the detection of at least one of these sequences should also give information about where subframe 0 is placed. The lowest number of sequences giving all above information is  $\text{ceil}(M \cdot (M-1)/2)$ , where  $\text{ceil}()$  means rounding up to the nearest integer. The reason for minimizing the number of sequences needed is to reduce the complexity in the UE for detecting the cell group. Two ways of how to construct  $S_i$  from  $\hat{S}_i, \hat{S}_j$  are shown in Figure 2(A), (B). [NB: claim 1 of the patent in suit appears essentially to correspond to Figure 2(A) of D4.]

[0011] In (A), the length of the  $\hat{S}_i, \hat{S}_j$  is half the length of  $S_i$ . Furthermore, if  $S_1, \hat{S}_i$  is transmitted first (if time)/lowest frequency (if frequency domain) and last (time)/highest frequency (f-domain) in  $S_2$  and vice versa for  $\hat{S}_j$ . The detector (UE) has a table over all sequence pairs and the specific orders of the pairs. Therefore, when detecting  $\hat{S}_i, \hat{S}_j$  the UE can, by using the look-up table, uniquely find the cell group and frame timing."

- 2.2 In accordance with the jurisprudence of the Boards of Appeal, the entitlement to priority (Article 87(1) EPC) is subject to the same principles as for assessing compliance with Article 123(2) EPC. In this respect, in accordance with the "gold standard", the claimed subject-matter must be directly and unambiguously derivable from the priority document, explicitly or implicitly, taking account of common general knowledge.

With regard to Article 123(2) EPC, the underlying idea is that an applicant shall not be allowed to improve their position by adding subject-matter not disclosed in the application as filed, which would give them an unwarranted advantage and could be damaging to the legal security of third parties relying on the content of the original application (cf. G 1/93 OJ 1994, 541, Reasons, 4; G 2/10 OJ 2012, 376, Reasons, 4.3).

2.3 Of the several issues brought up either by the appellant or the board regarding the validity of the priority, the following two issues are discussed here as they apply to claim 1 of each claim request:

- (i) It is not directly and unambiguously clear from D4 that  $\hat{S}_i, \hat{S}_j$  are both selected from the *same* group of sequences and can be in any combination except for  $\hat{S}_i = \hat{S}_j$ , as required by features (5) and (7) of claim 1. For example, based on the information in D4, it would apparently be possible to have two different sets of sequences respectively for  $\hat{S}_i$  and  $\hat{S}_j$ .
  
- (ii) The term "at least" in feature (6) is not directly and unambiguously derivable from D4. In D4, it is stated that "This invention shows a method for constructing the minimum amount of S-SCH sequences needed" (cf. paragraph [0006]) and "... The lowest number of sequences giving all above information is  $\text{ceil}(M \cdot (M-1)/2)$ , where  $\text{ceil}()$  means rounding up to the nearest integer. The reason for minimizing the number of sequences needed ..." (cf.

paragraph [0010]; board's underlining). In accordance with claim 1,  $N_{seq}$  can take any value above the minimum, even very high values, which goes against the teaching of D4.

- 2.4 Re (i): The respondent argued that the requirement that  $\hat{S}_i, \hat{S}_j$  have to be from the same group had no limiting effect in the context of claim 1, since a group could arbitrarily always be defined to include *all* sequences. The sequences of D4 were therefore also comprised in a group.

The board finds this argument unconvincing in view of the requirement of claim 1 that the sequence pair can be *in any combination*. This would not be the case if sequences were taken from *different* sets. For example, if  $\hat{S}_i$  were taken from a set **a** and  $\hat{S}_j$  from a different, disjunct set **b** such that only the combinations **a<sub>i</sub>, b<sub>j</sub>** are possible, even if a group were defined as **a+b**, not *all* combinations of the group would be possible, e.g. two sequences from set **a**.

- 2.5 Re (ii): The respondent argued that paragraphs [0006] and [0010] of D4 merely disclosed a lower bound for the number of sequences. This was clear from the wording of D4 which only refers to the "minimum amount of S-SCH sequences *needed*" (cf. paragraph [0006]). D4 was however silent as to the *actual* number of sequences to be used.

The board also finds this argument unconvincing. The clear teaching of D4 is that the *minimum* number of sequences should actually be used in order to reduce the complexity, e.g. the size of the look-up table. If the skilled person were to choose a higher number, this

would be their own idea rather something that is directly and unambiguously taught by D4.

- 2.6 Consequently, for the above reasons, claim 1 of the main request as well as auxiliary requests 2, 2a, 3 to 6, 8 and 9 respectively does not concern the "same invention" as disclosed in D4 within the meaning of Article 87(1) EPC, and therefore the priority claim is not valid for the respective claimed subject-matter.
3. *Main request and auxiliary requests 2, 2a, 3 to 6 and 8 - claim 1 - novelty with respect to D5 (Articles 52(1) and 54 EPC)*
- 3.1 As the priority claim is not valid as regards claim 1 of all requests, document **D5** is comprised in the state of the art in accordance with Article 54(2) EPC.
- 3.2 D5 is a document published by the proprietor of the patent. Sections 1, 2 and 2.1 of D5 *prima facie* disclose all the features of claim 1 of the main request and auxiliary requests 2, 2a, 3 to 6 and 8 respectively. Although neither of the parties has analysed D5 in detail in their submissions made in the appeal proceedings, this point was not disputed. Indeed, the respondent expressly had no comments to make with respect to D5 as regards any of these requests. As there are no points of dispute, and no other circumstances that would merit it, there is no need for a detailed analysis of this issue.
- 3.3 Consequently, the subject-matter of claim 1 respectively of the main request and auxiliary requests 2, 2a, 3 to 6 and 8 is not new (Articles 52(1) and 54 EPC).

4. *Auxiliary request 9 - claims 1 and 2 - inventive step (Articles 52(1) and 56 EPC)*

4.1 Claim 1 of auxiliary request 9 is based on a combination of claims 1, 5 and 15 as granted (i.e. claims 12 and 28 as originally filed).

4.2 It was common ground that the subject-matter of claim 1 differs from the disclosure of D5 in the following features:

*"determining whether a type of cell search procedure to be performed is an inter-frequency cell search procedure;*

*determining whether the type of cell search procedure to be performed is an inter-radio access technology cell search procedure;*

*determining whether the type of cell search procedure to be performed is an inter-cell cell search procedure;*

*if the type of cell search procedure to be performed is none of the inter-frequency cell search procedure, the inter-radio access technology cell search procedure, or the inter-cell cell search procedure, then performing*

*determining which of the number of predefined sequences best matches the received sequence  $\hat{S}_i$  of the other one of the first and second synchronization signals, which of the number of predefined sequences best matches the received sequence  $\hat{S}_j$  of the other one of the first and second*

*synchronization signals, and whether the pair of received sequences  $\hat{S}_i, \hat{S}_j$  of the other one of the first and second synchronization signals were arranged in the first ordering or the second ordering,*

*wherein the cell group identification process further includes determining with which cell group the pair of received sequences,  $\hat{S}_i, \hat{S}_j$  of the other one of the first and second synchronization signals is uniquely associated."*

- 4.3 The technical effect of these features is to detect both synchronisation signals at the receiver when the cell search procedure is not one of the *inter-frequency, the inter-radio access technology, and the inter-cell* cell search procedure. The motivation behind this is to improve the detection of the S-SCH synchronisation signal e.g. with respect to a trade off between reliability and speed.
- 4.4 The respondent argued that the objective technical problem was either "how to achieve stage 2 of the cell search procedure in such a manner that the cell search is as fast as necessary and as reliable as possible" (as submitted in the submission dated 22 March 2021, cf. page 6, section III, point 1; NB: "Stage 2" refers to the "currently proposed cell search scheme for LTE" set out in paragraph [0005] of the patent), or "how to improve the performance of the cell search procedure across all use cases" (as submitted at the oral proceedings before the board).
- 4.5 However, with respect to either of these formulations of the objective technical problem, claim 1 does not define a *complete* solution for achieving these goals,



e.g. as set out in Fig. 3 of the patent, even if the above distinguishing features would be a fundamental part of any solution. Thus, the board considers that the objective problem to be solved is "how to implement the scheme of D5 in the context of various cell search types present in LTE or other 3GPP-based networks".

4.6 Starting out from D5, the provision of these distinguishing features in order to solve the above objective problem is not obvious. In this respect, the basic idea of D5 is that the secondary synchronisation signal, as in the patent, is designed such that the cell ID and frame time can be detected within one 5ms sub-frame by receiving either  $S_1$  or  $S_2$ . This is expressly in order to be able to handle the requirements of handover from GSM to LTE, i.e. an inter-radio access technology cell search procedure (cf. the paragraph bridging pages 1 and 2 of D5). The synchronisation signal  $S_1$  or  $S_2$  proposed in D5, which is the same as that disclosed in the patent, achieves this goal, whilst apparently embracing the possibility that detection can be based on receiving more than one signal (cf. e.g. Fig. 4, in which the detection probability is shown graphically for one 10 ms radio frame, i.e. two sub-frames). However, there is nothing in D5 to suggest anything other than that the same processing would be applied irrespective of the cell search type.

4.7 In any event, there is no hint in D5 towards performing a discrimination step for determining whether the cell search type is one of the inter-frequency, the inter-radio access technology, or the inter-cell cell search procedure, and detecting the second synchronisation signal when none of these cases apply. Hence, there is no hint towards an *adaptive* application

of the scheme of D5 in the context of various cell search types present in LTE or other 3GPP-based networks.

4.8 The appellant argued that D5 starts from the premise set out in paragraph [0006] of the patent that both synchronisation signals will be detected, which was the known solution, and hence was common general knowledge. Therefore, D5 embraced this solution as well as detection based on receiving only one synchronisation signal. On the basis of trial and error, the skilled person would determine when the reception of more than one signal was required, which would lead in an obvious way to the claimed subject-matter. Thus, the distinguishing features took a step back to the prior art described in the patent in which cell ID and timing were determined by use of both synchronisation signals. If the search to be carried out was not one which could only use one synchronisation signal (e.g. if it was an initial cell search or a neighbour cell search), then the method could revert back to the prior-art method of using both synchronisation signals to detect cell group ID and frame timing. This lacked inventive step as reverting back to a prior art method as an alternative if a purported new method did not work would inherently appear to be obvious to the skilled person (cf. the notice of opposition, pages 14 and 15, concerning claim 15 of the patent as granted).

4.9 This argumentation however is based on an *ex-post facto* analysis. Even if the skilled person would have known on the basis of common general knowledge that receiving both synchronisation signals would result in a more reliable detection and would have been aware of the various cell search types to be handled in an LTE or 3GPP-based network at the patent's filing date, they

would first have had to conceive of the idea, not hinted at in D5, of making the processing *dependent* on detecting the type of cell search being performed. Only thereafter would the solution have been obvious. The appellant's argument that it would have been obvious to revert back to a prior art method if a new method did not work is not convincing here, because it relies partly on speculating, for which there is no evidence, that the method of D5 would not work, or would not work well enough, for cell search types which are not those defined in the characterising part of claim 1.

Furthermore, going back to the previous solution for only some of the cell search types is not the only possible approach in that eventuality. For example, the skilled person would plausibly have attempted to improve the design of the synchronisation signals and/or sequences of D5 such that the same method worked satisfactorily for all cell search types when receiving only one synchronisation signal.

- 4.10 It is concluded that the subject-matter of claim 1 involved an inventive step at the filing date of the patent (Articles 52(1) and 56 EPC).
- 4.11 The same assessment applies, *mutatis mutandis*, to independent claim 2 of the present auxiliary request.
5. The appellant raised no other objections against the claims of auxiliary request 9. The board also sees no reason to raise any objection *ex officio*. In this respect, the claims comply, *prima facie*, with Articles 123(2) EPC (cf. point 4.1 above) and 123(3) EPC, and are not open to examination with respect to Article 84 EPC in view of the claims being based on a combination of granted claims (cf. point 4.1 above and

G 3/14, OJ 2015, 102; Order).

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of claims 1 and 2 of auxiliary request 9 as filed on 28 February 2014, and a description and the drawings to be adapted accordingly.

The Registrar:

The Chair:



B. Brückner

K. Bengi-Akyürek

Decision electronically authenticated