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Datasheet for the decision of 29 April 2008

Case Number: T 1722/06 - 3.4.01

Application Number: 97952638.1

Publication Number: 1042687

IPC: G01S 5/12; H04W 64/00

Language of the proceedings: EN

Title of invention:
Communications localization system

Applicant:
KSI INC.

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 54, 56, 84

Keyword:
"Novelty (yes: main request and first auxiliary request)"
"Inventive step (no: main request and first auxiliary request)"
"Clarity (no: second auxiliary request)"

Decisions cited:
T 0305/87; T 0332/87

Catchword:
-

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Case Number: T 1722/06 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 29 April 2008

Appellant: KSI INC.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 13 June 2006 refusing European application No. 97952638.1 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: G. Assi
Members: P. Fontenay
B. Müller

Summary of Facts and Submissions

I. European patent application 97 952 638.1, filed on 23 December 1997 and published under the PCT under number WO 98/29758, was refused by decision of the Examining Division dated 13 June 2006.

In the "Reasons" for its decision the examining division held that the requests then on file did not meet the requirements of the EPC as to clarity (Article 84 EPC 1973), novelty (Article 54 EPC 1973) and inventive step (Article 56 EPC 1973). It based its conclusions concerning the patentability issues on documents WO-A-96/14588 (D3) and DE-A-44 09 178 (D4) inter alia.

II. The appellant (the applicant) lodged an appeal against this decision by a notice of appeal filed on 20 July 2006 under simultaneous payment of the appeal fee. The statement of grounds was filed on 13 October 2006.

III. By a letter dated 19 December 2007 the appellant was summoned to oral proceedings scheduled to take place on 29 April 2008.

IV. In a communication dated 5 February 2008, the Board made some observations concerning a main request and five auxiliary requests which had been filed with the statement of grounds of appeal. Beyond comments addressing the issues of clarity and added subject-matter, it also pointed out that it considered both documents D3 and D4 as particularly relevant when

addressing the patentability requirements laid down in Article 52(1) EPC.

V. By a letter dated 28 March 2008, the appellant requested that the decision under appeal be set aside and a patent be granted on the basis of a set of claims 1-24 according to a main request or alternatively on the basis of first or second auxiliary requests, said requests corresponding, respectively, to amended versions of the third, fourth and fifth auxiliary requests filed with the grounds of appeal.

Envisaging that the Board would have had no difficulty in allowing the appeal, the appellant indicated in its letter that the request for oral proceedings filed with the statement of grounds was withdrawn.

VI. The Board maintained the scheduled oral proceedings.

The decision of the Board was announced at the end of said oral proceedings which took place in the presence of the appellant's representative who had previously been informed that oral proceedings were due to take place as initially appointed.

VII. The wording of independent claim 1 according to the **main request** reads as follows:

"A system for passively locating a mobile radio communications transceiver (40) in an operating environment served by a wireless communication system, comprising:

first (10) and second (11) sensor stations of known location arranged to receive a radio signal from

the mobile transceiver and having an inter-site synchronisation mechanism for common time standard maintenance, the first sensor station (10) including a first signal characterisation processing unit (32) that is arranged to determine first time of signal arrival information corresponding to when the radio signal is received at the first sensor station (10), and the second sensor station (11) including a second signal characterisation processing unit (32) that is arranged to determine second time of signal arrival information corresponding to when the radio signal is received at the second sensor station (11);

a means arranged to determine a time difference of signal arrival locus (3) in the form of a two dimensional hyperbola for the mobile transceiver (40) based on the first time of signal arrival information and the second time of signal arrival information; and

a multidimensional parametric correlation processing unit (36) arranged to determine a probable position of the mobile transceiver (40) based on collateral information and the time difference of signal arrival locus (3), wherein the collateral information is related to a location of the mobile transceiver (40)."

The wording of independent claim 13 according to the **main request** reads as follows:

"A method of passively locating a mobile transceiver (40) in a wireless communications system that includes a first (10) and second (11) sensor station having known locations, the method comprising the steps of:

(a) receiving, at the first (10) and second (11) sensor stations having an inter-site synchronisation

mechanism for common time standard maintenance, a radio signal from the mobile transceiver (40),

(b) accessing collateral information related to a location of the mobile transceiver (40);

(c) determining a time difference of signal arrival locus (3) in the form of a two dimensional hyperbola for the mobile transceiver (40) based on the radio signal received at the first (10) and second (11) stations by:

(i) determining first time of signal arrival information corresponding to when the radio signal is received a (sic) the first sensor station (10);

(ii) determining second time of signal arrival information corresponding to when the radio signal is received at the second sensor station (11); and

(iii) determining the time difference of arrival locus based on the first time of signal arrival information and the second time of signal arrival information; and

(d) determining a probable position of the mobile transceiver (40) based on the time difference of signal arrival locus (3) and the collateral information."

The main request further includes dependent claims 2-12 and 14-24 referring back, respectively, to independent claims 1 and 13.

Independent claims 1 and 7 according to the **first auxiliary request** differ from independent claims 1 and 13 of the main request in that the wording "and comprises the configuration of a road network, topographical features and boundaries, the rate of

change of the time difference of signal arrival locus, signal strength or direction of arrival information" has been added at the end of claims 1 and 7.

Independent claims 1 and 7 according to the **second auxiliary request** differ from independent claims 1 and 13 of the main request in that the wording "and comprises the relative Doppler shift of the radio signal" has been added at the end of claims 1 and 7.

Both first and second auxiliary requests include dependent claims 2-6 and 8-12 depending, respectively, on independent claims 1 and 7.

VIII. As regards the relevance of document D4, the appellant essentially relied on the following submissions:

The principle relied upon in D4 is based on the determination of the distances separating the mobile transceiver from neighbouring sensor stations. Said distances define circles centred on the location of the various sensor stations. Hence, D4 does not define any set of positions taking the form of an hyperbola reflecting a time difference of signal arrival (TDOA) as recited in the independent system and method claims. In particular, the embodiment disclosed in the passage bridging columns 4 and 5 in D4 does not disclose a technique relying on TDOA measurements, but on the determination of the time advance of emitted signals. It would therefore be inappropriate to equate the term $\Delta Ti,j$ in the equations appearing in column 5 with a TDOA.

Furthermore, D4 requires the use of three antennas in order to provide sufficient information allowing the determination of the transceiver's location whereas the invention would necessitate only two stations communicating with the mobile transceiver.

Concerning the second auxiliary request, the appellant stressed that the term "relative Doppler shift" was supported by and clearly defined in the description as the "rate of change of TDOA" (cf. page 11, lines 19-27 of the published application, i.e. as published under the PCT).

Reasons for the Decision

This decision is issued after the entry into force of the EPC 2000 on 13 December 2007.

In accordance with Article 7(1), 2nd sentence of the Revision Act of 29 November 2000 ("Act revising the Convention on the Grant of European Patents (European Patent Convention) of 5 October 1973, last revised on 17 December 1991"), the revised version of the Convention shall not apply to European patent applications pending at the time of its entry into force, unless otherwise decided by the Administrative Council of the European Patent Organisation. Attention is drawn in this respect to Article 1 of its Decision of 28 June 2001.

When Articles or Rules of the former version of the EPC are cited, their citations are followed by the indication "1973".

1. The appeal is admissible.

2. Main request

2.1 Novelty

2.1.1 Although document D4 discloses all the features actually recited in independent method claim 13 according to the main request (cf. section "inventive step", infra), the Board notes that these features pertain to separate embodiments and that document D4, considered in its entirety, neither explicitly nor implicitly suggests to combine these various embodiments.

As already stated in decision T 305/87 (OJ EPO 1991, 429), it is not permitted when addressing novelty under Article 54 EPC 1973 to draw features pertaining to separate embodiments in order to create artificially a particular embodiment which would destroy novelty.

The Board therefore concludes that the subject-matter of independent claim 13 of the main request is new in view of Document D4, since none of the various embodiments described therein discloses in combination the method steps recited in this claim.

2.1.2 With regard to independent claim 1 of the main request, the Board notes that none of the embodiments described in D4 discloses the feature of a multidimensional parametric correlation processing unit arranged to determine a probable position of the mobile

transceiver based on collateral information and the TDOA locus.

Moreover, the features of claim 1 of the main request which are known from D4 pertain to distinct embodiments and are not disclosed in combination.

2.1.3 None of the other available prior art discloses in combination the features of independent claims 1 or 13. In particular, document D3 fails to teach the step of determining a time difference of signal arrival (TDOA) and the corresponding means arranged to determine a TDOA locus.

It results therefrom that the subject-matter of claims 1 and 13 according to the main request is new vis-à-vis the state of the art, within the meaning of Article 54(1),(2) EPC 1973.

2.2 Inventive step

2.2.1 Relevance of D4

Document D4 shares a common purpose with the present invention: locating a mobile transceiver in an operating environment served by a wireless communication system (cf. D4, column 1, lines 3-5; column 2, lines 53-59; column 3, lines 61-64; claim 1). Moreover, the fact that the system of D4 foresees a plurality of sensor stations able to communicate with a mobile transceiver located at a given position and that various embodiments combine the information derivable from received signal characteristics with additional

information justify, in the view of the Board, that this document would be taken into consideration by the skilled person when deciding on the inventive merits of the claimed system and method according to the main request.

This is in particular true considering that the additional information referred to in D4 constitutes collateral information in the sense of the present application. Particular reference should be made, in this respect, to the passage on page 12, line 21 to page 13, line 1 of the published application according to which: "*The phrase "collateral information" applies to observed characteristics that augment the timing data and also includes information derived from sources other than the radio emissions of the mobile radio transceiver. Collateral information includes information on the environment in which the mobile transceiver is believed to be operating, e.g., the configuration of the roadway network, topographical features and boundaries, signal propagation characteristics, information on the weather and its effect on signal propagation and roadway traffic conditions, and also includes verbalized or other description of route number, road name, speed, nearby landmarks, or other position-sensitive information communicated from the mobile transceiver.*" Reference is also made to the mention of geographic and topological information (cf. page 4, lines 24-26; claim 28 in the published application) comprising roadway configuration information (cf. original claims 10, 30), communicated information (cf. original claim 13, 33), direction of arrival of the signal from the mobile radio transceiver

(cf. original claim 39), or direction of motion (cf. page 11, line 20).

Consequently, the additional information referred to in D4 and obtained from other sources such as a compass (cf. D4, column 7, lines 18-33), from the direction of arrival of the signal (cf. D4, column 7, lines 34-43) or from road network data and moving velocities (cf. D4, column 10, lines 11-23) constitutes collateral information in the sense of the present application.

2.2.2 Identification of the closest prior art within D4

The fact that D4 discloses in separate embodiments most of the features of the claimed system and the steps of the claimed method confirms its relevance, but is not sufficient, as such, to justify that the skilled person would have considered this item of prior art as closest prior art, i.e. as a possible starting point in order to assess the inventive merits of the invention. When deciding on that issue, and in the absence of any hint at the contrary, each embodiment in D4 should be considered in isolation from the other separate embodiments.

In this respect, it would not be admissible, in the Board's view, to piece together artificially a more relevant state of the art from features belonging to separate embodiments despite the fact that these features are disclosed in one and the same document (cf. decision T 305/87, section 5.3 of the Reasons for a similar finding as to the novelty criterion). Each of the various embodiments disclosed in D4 should

therefore be considered as an independent candidate when deciding on its suitability as a possible starting point. This approach does not contradict the principle according to which the embodiments of a document should be interpreted in the light of the general teaching of that document or even be combined with features or statements applying to the invention when said features and comments are indeed representative for the general technical teaching disclosed in that respective document (cf. decision T 332/87, section 2.2 of the Reasons for a similar finding as to the novelty criterion).

In the present case, the example disclosed in column 4, line 57 to column 5, line 21, in D4, refers to a process and system which shares, in addition to a common purpose, structural and functional limitations with the claimed inventions and, in particular, a common concept of using the TDOA as source of information. For these reasons, said embodiment qualifies as closest prior art to be considered in the light of the general technical teaching of D4.

2.2.3 Features known from the closest prior art

More specifically, the embodiment referred to in this passage comprises first and second sensor stations of known location arranged to emit and receive radio signals to and from a mobile transceiver (cf. D4, column 5, lines 10-12; Figures 1 and 2) having an inter-site synchronisation mechanism for common time standard maintenance (cf. D4, column 3, lines 27-31; column 5, line 12-21). The mobile transceiver receives the signal generated by the two sensor stations and

calculates the actual TDOA separating the two signals (cf. D4, column 5, lines 2, 21; Figure 2). This functionality implies that the transceiver includes a signal characterisation processing unit arranged to determine a first and second time of signal arrival information corresponding to the time at which the radio signals emitted by the first and second sensor stations are received by the transceiver.

The argument put forward by the appellant contesting this finding as to the measurement of a TDOA in D4 is not convincing. While it is acknowledged that D4 indeed discloses a process relying on a timing-advance technique, this process does not apply to the embodiment discussed above and is explicitly presented in D4 as an alternative to said embodiment, which would apply in cases where the sensor stations would not be synchronised and the time offset of the emitted signals would not be known (cf. D4, column 5, lines 34-42).

While the passage in column 4, line 57 to column 5, line 21 in D4 discloses a system in which signals are first emitted by a first and second sensor station before being received by the mobile transceiver, D4 explicitly specifies in its introductory section that the reversal of the process is part of the general technical teaching provided by D4. Consequently, D4 discloses a second configuration, wherein a signal would be emitted by the mobile transceiver and received by said first and second sensor stations (cf. D4, column 3, lines 10-20). This reversed configuration implies that a signal characterisation processing unit is provided at each of said first and second sensor stations.

Moreover, as evidenced by the equations referred to in column 5, lines 2 and 21, in D4, the embodiment referred to in this passage relates to a system wherein means are provided to determine a TDOA locus based on the first time of signal arrival information and the second time of signal arrival information.

The set of points fulfilling the condition that the difference between the travel times of a signal transmitted between these points and two receivers located at two known positions is a constant ΔT, corresponds to an hyperbola. Hence, the indication in claims 1 and 13 of the main request that this set of points defines a two dimensional hyperbola does not constitute any additional functional limitation of the claimed system and method, but reflects a mere mathematical fact. Consequently, the corresponding features in independent claims 1 and 13 do not define any additional technical limitation as to the claimed method and process over the closest prior art.

2.2.4 Collateral information referred to in relation with the closest prior art

The embodiment referred to above in the passage bridging columns 4 and 5 further suggests the use of a third sensor station of known location in order to determine the absolute position of the mobile transceiver in a plane (cf. D4, column 5, lines 24-33). According to this embodiment, the use of a topographic map permits the identification of the third coordinate corresponding to the location of the mobile

transceiver. The map does not, however, contribute, as such, to the determination of said position.

2.2.5 Distinguishing features

The method of claim 13 of the main request differs therefore from this known process in that it comprises the additional steps of:
- accessing collateral information related to a location of the mobile transceiver which position is to be determined and
- determining a probable position of the mobile transceiver based on the TDOA locus and the collateral information.

The system of independent claim 1 of the main request differs accordingly from the system of D4 in that it comprises a multidimensional parametric correlation processing unit arranged to determine a probable position of the mobile transceiver based on such collateral information and the TDOA locus.

2.2.6 Reformulation of the technical problem solved

The technical effect achieved by these distinguishing limitations consists in identifying among a set of possible positions, defined by a predetermined TDOA, the position most probably corresponding to the actual position of the mobile transceiver.

According to the description, (cf. page 4, lines 14-17 of the published application) a problem solved by these additional features as to the use of collateral information is to minimize the costs and complexity of

methods or systems relying exclusively on TDOA measurements. Such methods and systems operate in environments requiring, *inter alia*, a large number of sensor stations so as to allow simultaneous communication between at least three sensor stations and a given mobile transceiver.

The Board points out, however, that the wording of independent claims 1 and 13 according to the main request is not limited to systems and methods relying on transmissions with two sensor stations only, contrary to the view defended by the appellant. This view is corroborated, for example, by the passage on page 7, lines 19-27 of the description according to which: "*The present invention does not require determining position by combining two or more equivalent hyperbola from three or more base stations; two base stations can be enough. [...] Nevertheless, there is nothing in the present invention that precludes using more than two base stations to further confirm the accuracy of a location or to permit locating mobile radio transceivers for which collateral information is not otherwise available.*" This view is further confirmed by the statement on page 8, lines 6 to 11 concerning the suitability of the invention in an environment comprising two or more sensor stations of known location.

The access to additional collateral information in an environment in which the position of the transceiver would already be identifiable by means of three sensor stations would reduce neither the costs of the system nor its complexity but, on the contrary, increase both.

As a consequence, the problem defined by the applicant in the introductory portion of the application would only apply to one of the possible alternatives actually claimed, namely a system and a method meant to operate in an environment comprising a first and second sensor station only. The objective technical problem must, hence, be redefined so as to apply to all alternatives actually encompassed by claims 1 and 13 of the main request.

The statement in the passage on page 7 of the description reproduced above and, in particular, the indication that nothing "*precludes using more than two base stations to further confirm the accuracy of a location*" suggests that a further TDOA measurement, defining at least a second hyperbola, participates in the identification of the transceiver position since it permits a selection to be made within a set of candidate positions. A similar suggestion would apply, by analogy, to each piece of information participating in the identification of the position and, in particular, to the collateral information. Reference is thus made both to an environment including two sensor stations only, wherein collateral information would permit the identification of specific points within the hyperbola, and to an environment with three or more sensor stations providing at least two measurements as to the time difference of signal arrival. In that latter situation the collateral information would permit to exclude ambiguities as to the position of the transceiver resulting from inaccuracies in the measurements carried out.

In summary, the collateral information would therefore solve the problem of uncertainties as to the determination of the transceiver's position resulting from TDOA measurements exclusively.

2.2.7 Obviousness of the claimed process (claim 13)

D4 discloses multiple embodiments relying on collateral information in order to identify the location of a mobile transceiver. It suggests, for example, as an alternative to TDOA measurements, to determine the distance between sensor station and mobile transceiver on the basis of the received signal's strength or of its quality (cf. D4, column 3, lines 6, 29 and 30), which constitute collateral information in the sense of the present application (cf. original claims 17, 18, 36, 37).

It further discloses in other embodiments to combine the information as to the distances separating the mobile transceiver from its neighbouring sensor stations with additional information such as the direction of transceiver's movement obtainable from a compass (cf. D4, column 7, lines 18-33) or the direction of arrival of the signal obtainable from directional antennas (cf. column 7, lines 34-43).

According to a still further embodiment it is proposed in D4 to combine the position determining process with traffic guidance systems. In this respect, it is further suggested, in order to increase the accuracy of the transceiver's location, to combine data relating to the distances separating the transceiver from neighbouring sensor stations with map information or

with transceiver's speed data (cf. D4, column 10, lines 11-20).

Thus, the various embodiments disclosed in D4 and referred to above teach to rely on other sources of information (i.e. on collateral information) in order to supplement the information as to the distance between transceiver and sensor stations.

The sources of collateral information referred to in D4, relying on signal characteristics such as its strength or quality, constitute alternatives to the embodiment relying on measurements of TDOA in order to determine the distances between transceiver and sensor stations. The skilled person would therefore find no real motivation in D4 leading to a combination of these various embodiments.

This reasoning, however, does not apply to the embodiments relying on information obtained from a compass, from a directional antenna or from a map and the speed of the mobile transceiver, which information is to be combined with distance data, independently of the process which did permit to determine these data. In particular, the reference in column 10, lines 11-23 in D4 to a higher precision constitutes an unambiguous incentive for the skilled person to adapt the embodiment reflecting the closest prior art in the light of this teaching.

For these reasons, the Board concludes that no inventive skills would have been required from the skilled person, in order to reduce uncertainties concerning the position of the mobile transceiver, to

supplement the data available from the process disclosed in column 4, line 57 to column 5, line 21, relying on TDOA measurements, with map information or speed data as suggested in the embodiment disclosed in column 10, lines 11-23 of D4.

The subject-matter of independent method claim 13 is accordingly not inventive in the sense of Article 56 EPC 1973.

2.2.8 Obviousness of the claimed system (claim 1)

The passage in column 10, lines 11-23, in D4, merely suggests to combine the distance determining process of D4 with traffic guidance systems. It does not provide any details as to a possible implementation. In particular, no indication is made in this passage as to a possible integration in a unique automatic system of the various processes to be combined. In the Board's view, the advantages resulting from such an integration over a system requiring human intervention are straightforward in that they permit accelerated processing and the simultaneous determination of various transceivers' positions.

It would therefore be obvious for the skilled person to integrate the process arrived at by combining the embodiments relied upon above (cf. section 2.2.7) in a corresponding system. In order to permit automatic processing, such a system would necessarily incorporate a multidimensional parametric correlation processing unit arranged to determine a probable position of the mobile transceiver based on collateral information and

the TDOA locus, as recited in independent claim 1 of the main request.

Consequently, claim 1 of the main request does not comply with the requirements of Article 56 EPC 1973.

3. First auxiliary request

3.1 The additional features recited in independent claims 1 and 7 according to the first auxiliary request refer to various possibilities as to the nature of the collateral information which could be used in the claimed system and method. Such collateral information could derive from the configuration of a road network, topographical features and boundaries, the rate of change of the TDOA locus, signal strength or direction of arrival information.

The analysis made above in relation with the main request shows that it would be obvious for the skilled person to adapt the embodiment reflecting the closest prior art, relying on TDOA measurements in order to determine the distance between transceiver and sensor stations, by combining the known process with a traffic guidance process making use of road network data.

It follows that one of the alternatives recited in claim 7 according to the first auxiliary request is not inventive for precisely the same reasons as those developed above in relation with the main request. The reasoning made above in relation with claim 1 is, insofar as this alternative is concerned, likewise, not affected by the amendments which have been carried out.

3.2 Moreover, the teaching of the embodiment of D4 relied upon suggests, as well, to take into consideration the speed of the mobile transceiver in order to conclude that a movement occurs along a road (cf. D4, column 10, lines 18-20). This determination of velocities results from successive position determinations (cf. D4, column 3, lines 21-26) and therefore, indirectly, from the rate of change of the TDOA when this approach constitutes the basis of the position determination.

The analyses developed above in relation with the main request would therefore apply, likewise, to this other alternative as to the rate of change of TDOA recited in independent claims 1 and 7.

3.3 Consequently, the subject-matter of independent claims 1 and 7 according to the first auxiliary request does not involve an inventive step within the meaning of Article 56 EPC 1973.

4. Second auxiliary request - clarity

4.1 Independent claims 1 and 7 according to the second auxiliary request differ from claims 1 and 13 of the main request in that they contain the further limitation that the collateral information comprises the relative Doppler shift of the radio signal.

4.2 The Board notes that the term "Doppler shift" has a recognised meaning in physics and refers, in the field of electromagnetism, to the change of frequency of electromagnetic waves resulting from the movement of any of the emitting sender, receiver or a possible obstacle encountered by the electromagnetic waves. The

"relative Doppler shift" would therefore correspond to the relative change of the measured frequency shift of the transmitted signal, i.e. the relative frequency change of the transmitted signal occurring between measurements carried out at different times.

The description, however, does not contain any disclosure relating to a process or system corresponding to this interpretation, i.e. which would rely on measurements of the frequency shift of the transmitted signal. The statement in the description on page 11, lines 19-21 and lines 26, 27 of the published application equates the "relative Doppler shift" with the rate of change of the TDOA and appears therefore to differ from the above definition. Furthermore, the association of the term "Doppler shift", which relates to a frequency, with the term "time difference of signal arrival", which defines a time period, is not comprehensible. It is in particular not understood how it would be possible for the skilled person to derive from successive TDOA measurements, any parameter relating to a change of frequency of the transmitted signal.

Hence, the contradiction resulting from the use of the terms "relative Doppler shift" in independent claims 1 and 7 of the second auxiliary request for defining a parameter which is not corresponding to the accepted definition of a Doppler shift renders the claimed subject-matter unclear under Article 84 EPC 1973, when interpreted in the light of the description.

4.3 In the case that a special meaning applies to a term employed in a claim, a definition of that term should

then result from the wording of the claim itself in order to meet the requirements of Article 84 EPC.

In the present situation, however, the reproduction in independent claims 1 and 7 of the definition contained in the description would not have been sufficient, since the rate of change of the TDOA would not permit to justify an inventive step as shown above in relation with the first auxiliary request.

5. In consequence, none of the requests filed by the appellant has been found allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher G. Assi