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Title of invention:
Subsea data communication system and method

Patent Proprietor:
Siemens Energy AS

Opponents:
GE Oil & Gas UK Limited
FMC Kongsberg Subsea AS
Proserv UK Ltd

Headword:
Subsea data communications/SIEMENS

Relevant legal provisions:
EPC Art. 54, 56

Keyword:

Novelty - main request and first auxiliary request (no)
Inventive step - second auxiliary request (no)

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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 1551/17 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 28 October 2021

Appellant I: (Opponent 1)	GE Oil & Gas UK Limited 2, High Street Nailsea Bristol Bristol BS48 1BS (GB)
Representative:	Illingworth-Law, William Illingworth Baker Hughes 245 Hammersmith Chalk Hill Road London W6 8DW (GB)
Appellant II: (Patent Proprietor)	Siemens Energy AS Oestre Aker Vei 88 0596 Oslo (NO)
Representative:	Kraus & Weisert Patentanwälte PartGmbB Thomas-Wimmer-Ring 15 80539 München (DE)
Appellant III: (Opponent 3)	Proserv UK Ltd Proserv House Prospect Road Westhill Aberdeenshire AB32 6FJ (GB)
Representative:	McGlashan, Graham Stewart Marks & Clerk LLP Aurora 120 Bothwell Street Glasgow G2 7JS (GB)
Party as of right: (Opponent 2)	FMC Kongsberg Subsea AS P.O. Box 1012 3601 Kongsberg (NO)

Representative: Murgitroyd & Company
Murgitroyd House
165-169 Scotland Street
Glasgow G5 8PL (GB)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted on 12 May 2017 concerning maintenance of the European Patent No. 2523357 in amended form.**

Composition of the Board:

Chair K. Bengi-Akyürek
Members: K. Schenkel
C. Almberg

Summary of Facts and Submissions

I. The appeals of the patent proprietor (appellant II) and of opponents 1 and 3 (appellants I and III) lie from the interlocutory decision of the opposition division maintaining the present European patent in amended form on the basis of a second auxiliary request filed during the oral proceedings before the opposition division on 28 March 2017.

Oral proceedings before the board were held on 28 October 2021 by videoconference.

- The proprietor requested that the appealed decision be set aside and that the patent be maintained on the basis of
  - claims 1 to 12 of the **main request** filed with its statement of grounds of appeal, or
  - claims 1 to 11 of the **first auxiliary request** subject to the appealed decision, or
  - claims 1 to 10 of the **second auxiliary request** subject to the appealed decision.

- Opponents 1 and 3 requested that the appealed decision be set aside and that the patent be revoked. Opponent 2 supported these requests.

At the end of the oral proceedings, the board's decision was announced.

II. In this decision, reference is made to the following prior-art documents:

DI1: GB 2 417 656 A; and

DI7: Halmoy, Sissel, "Smartcontrols (TM) For Smart Subsea Fields", Offshore Mediterranean Conference and Exhibition, conference paper, March 2001.

III. Claim 1 of the **main request** reads as follows (labelling by the board):

1) "A subsea data communication system for providing a data communication between a topside control system (11) and a subsea installation (12), wherein the
2) topside control system (11) comprises a topside low frequency modem (21) adapted to perform a data communication in a first frequency range, and wherein
3) the subsea installation (12) comprises a subsea low frequency modem (22) adapted to perform a data communication in said first frequency range,
4) said topside low frequency modem (21) being coupled to the subsea low frequency modem (22) by a data transmission line (14) of an umbilical (13) which connects the topside control system (11) to the subsea installation (12), wherein the subsea data communication system (10) comprises:
5) a topside high frequency modem (31) adapted to be arranged at the topside control system (11) and to perform a data communication in a second frequency range, the second frequency range being higher than the first frequency range,
6) a subsea high frequency modem (32) adapted to be arranged at the subsea installation (12) and to perform a data communication in said second frequency range, characterized by
7) a topside frequency multiplexer (35) adapted to couple the topside low frequency modem (21) and the

topside high frequency modem (31) to said data transmission line (14),

8) a subsea frequency multiplexer (36) adapted to couple the subsea low frequency modem (22) and the subsea high frequency modem (32) to said data transmission line (14),

9) wherein the topside and the subsea frequency multiplexers (35, 36) are configured so as to enable a simultaneous data communication between the topside and subsea low frequency modems (21, 22) in the first frequency range and between the topside and subsea high frequency modems (31, 32) in the second frequency range over said data transmission line (14),

10) wherein each frequency multiplexer (35, 36) comprises a first interface (51) towards the respective low frequency modem, a second interface (52) towards the respective high frequency modem and a third interface (53) towards the data transmission line,

11) the frequency multiplexer (35, 36) further comprising a low pass filter or a band pass filter (37) adapted to pass frequencies of said first frequency range and connected between the first interface (51) and the third interface (53) and

12) a high pass filter or a band pass filter (38) adapted to pass frequencies of said second frequency range and connected between the second interface (52) and the third interface (53)."

IV. Claim 1 of the **first auxiliary request** differs from claim 1 of the main request in that features 7) and 8) read as follows (added or amended wording underlined by the board):

7) "a single topside frequency diplexer (35) adapted to couple the topside low frequency modem (21) and the topside high frequency modem (31) to said data transmission line (14)"
8) "a single subsea frequency diplexer (36) adapted to couple the subsea low frequency modem (22) and the subsea high frequency modem (32) to said data transmission line (14)",

and in that, in features 9) to 11), the term "multiplexer" has been replaced by "diplexer".

V. Claim 1 of the **second auxiliary request** differs from claim 1 of the main request in that the following features have been added at the end (labelling by the board):

13) "wherein the subsea communication system further comprises a subsea signal distribution module (40) coupled to the data transmission line (14),
14) wherein said subsea low frequency modem (22) and at least one further subsea low frequency modem (22) are coupled to the subsea signal distribution module (40),
15) said low frequency modems implementing a multidrop communication scheme for enabling a data communication between the topside low frequency modem (21) and each of said subsea low frequency modems (22),
16) wherein said subsea high frequency modem (32) and at least one further subsea high frequency modem (32) are coupled to the subsea signal distribution module (40), the subsea signal distribution module (40) comprising an access multiplier (41) adapted to enable a point to point communication between said topside high frequency

modem (31) and each of said subsea high frequency modems (32)."

Reasons for the Decision

1. Main request - novelty (Article 54 EPC)

1.1 Prior-art document **DI1** discloses a system for communicating data between a topside control system ("surface facility") and a subsea installation ("subsea facility") over a data transmission line of an umbilical ("communication link", abstract; page 1, line 26 to page 2, line 14; FIG. 1). The topside system and the subsea installation each include a low-speed modem ("LSC Modem" 1/1a) and a high-speed modem ("HSC Modem" 5/5a) (*ibid.*).

Data transmission line 2 is coupled to the low-speed modems 1/1a via low-pass filters 4/4a and low-speed diplexers 3/3a and to the high-speed modems via high-speed diplexers 6/6a (FIG. 1). The high-speed diplexers are in turn coupled to the data transmission line via capacitors which ensure a *low* impedance for the operating frequencies of the high-speed modems and a *high* impedance for the operating frequencies of the low-speed modems and consequently constitute *high-pass filters* (page 3, lines 24 to 31; FIG. 3). The low-pass filter in the signal path to the low-speed modem implies that the latter is a "low-frequency modem". Conversely, the high-pass filter in the signal path to the high-speed modem implies that the latter is a "high-frequency modem".

Hence, between the data transmission line and the low- and high-frequency modems at the topside system and

those on the subsea side, coupling circuits are arranged which pass the signals in each frequency range to the corresponding modems. Said coupling circuits comprise implicitly a first interface towards the low-frequency modem, a second interface towards the high-frequency modem and a third interface towards the data transmission line, and are considered to be equivalent to the frequency multiplexers as claimed. Moreover, the "diplexer" circuits ensure that the operations of the modems do not affect each other and thus are configured to enable *simultaneous* communication in both frequency ranges between the topside modems and the subsea modems (cf. abstract).

DI1 therefore discloses a system with all the features of claim 1.

1.2 The proprietor argued that claim 1 described the detailed physical implementation of the system with a topside and a subsea frequency multiplexer, each frequency multiplexer having a first interface towards a low-frequency modem, a second interface towards a high-frequency modem and a third interface towards the data transmission line. Each frequency multiplexer coupled the data transmission line to the low-frequency and to the high-frequency modem. DI1, however, only disclosed on each side of the data transmission line *two* diplexers, namely *diplexer 3 and 6* and *diplexer 3a and 6a*, and low-pass filters 4 and 4a. These aforementioned components were *different* entities. The skilled person would not deduce from DI1 that a combination of these components would form a new entity having the three interfaces according to feature 10) and corresponding to the multiplexers as claimed. Claim 1 could not be interpreted as just a *distributed* system incorporating the respective functions. The

proprietor furthermore pointed to the two bidirectional arrows between each diplexer in Figure 1 of DI1 and the respective modem connected to it, and argued that they would render the disclosure unclear.

1.3 The board however notes that DI1, although not using the term "frequency multiplexer", discloses circuits which provide a connection with a low-pass characteristic between the data transmission line and a *low-frequency* modem as well as a connection with a high-pass characteristic between the data transmission line and a *high-frequency* modem. As to their functions, these circuits are equivalent to the claimed "frequency multiplexers". Claim 1 attributes the respective functions to an entity called "frequency multiplexer" but does not further specify the frequency multiplexer with respect to its physical implementation. Incidentally, it is noted that also the patent specification only describes the system by means of schematic block diagrams and is silent about their actual physical implementation.

As to the dual bidirectional arrows between the diplexers and the modems in Figure 1 of DI1, the board holds that, even if they were considered to be unclear, they would only raise questions concerning the *type* of connection between the modems and the diplexers but not the fact that the modems are coupled to the diplexers. The bidirectional arrows do therefore not affect the overall disclosure of DI1 as far as it is the basis for the above conclusions.

1.4 The board therefore concludes that claim 1 of the main request lacks novelty having regard to DI1 and that the main request is thus not allowable under Article 54 EPC.

2. First auxiliary request - novelty (Article 54 EPC)

2.1 Claim 1 of the first auxiliary request differs from claim 1 of the main request in that it further specifies that each "frequency multiplexer" is a "single frequency diplexer".

2.2 According to the skilled reader's common general knowledge, a "diplexer" is understood as a device which couples a *first* port via a first filter to a *second* port and via a second filter to a *third* port, both filters having a different frequency response in order to achieve frequency multiplexing. The board notes in this respect that the frequency-dependent coupling between the data transmission line and the low- and the high-frequency modems respectively is already specified in features 11) and 12) of claim 1 of the main request.

2.3 Blocks 3/3a, 4/4a and 6/6a, as shown in Figure 1 of **DI1**, provide the effect of a frequency-dependent coupling of the signals on the data transmission line either to the low-speed modem or to the high-speed modem (see point 1.1 above). Thus, blocks 3, 4 and 6 form together a functional entity that indeed provides the function of a single diplexer. The same applies for blocks 3a, 4a, and 6a. Hence, diplexers 3 and 6 of DI1 correspond to the "topside frequency multiplexer" as claimed, while diplexers 3a and 6a correspond to the "subsea frequency multiplexer" as claimed. As a consequence, DI1 in fact teaches that the frequency multiplexers are formed by single diplexers in accordance with present claim 1.

2.4 The proprietor argued that DI1 disclosed *several* diplexers and that elements 4 and 6 in **DI1** could not be understood as forming a *single* diplexer, since

otherwise a diplexer would be coupled to another diplexer ("diplexer 3") resulting in an element with *four* interfaces whereas a typical diplexer element only comprised *three* interfaces.

2.5 The board is not persuaded. Using the above understanding of the term "diplexer" (cf. point 2.2 above), elements 3 and 6 of DI1 are not diplexers, at least for the simple reason that they do not provide paths with *different* frequency responses. Rather, the skilled person would understand that a "diplexer" in the above sense requires the combination of elements 4 and 6 and that the capacitors provide a high-pass filter for element 6.

2.6 The board therefore concludes that the subject-matter of claim 1 of the first auxiliary request is not new having regard to DI1 and that the first auxiliary request is thus also not allowable under Article 54 EPC.

3. Second auxiliary request - inventive step (Article 56 EPC)

3.1 Claim 1 of the second auxiliary request further specifies that, on the subsea side, there are multiple low-frequency modems and multiple high-frequency modems. The low-frequency modem are arranged in a "multi-drop configuration" and the high-frequency modems are arranged in a "point-to-point configuration" by means of an "access multiplier".

3.2 Document **DI1** is undisputedly the most suitable starting point for assessing inventive step as regards present claim 1. It already addresses the *upgrading* or

extension of an existing subsea well complex (page 4, lines 7 and 8).

The claimed system differs from the system of DI1 essentially in features 13) to 16) (see point V above), i.e. in that (board's emphasis)

(i) multiple subsea low- and high-frequency modems are provided;
(ii) the subsea low-frequency modems implement a multidrop communication scheme;
(iii) the subsea distribution module comprises an access multiplier adapted to enable a point-to-point communication between the topside high-frequency modem and the subsea high-frequency modems.

As to the understanding of the terms recited in the distinguishing features, the proprietor stated that a "point-to-point communication" was an end-to-end communication and that, in the "multidrop communication scheme", all subsea modems were supposed to receive a message but only one had to respond. Furthermore, the claimed *access multiplier* was to be understood as some sort of *router*.

3.3 The technical effect resulting from those distinguishing features was extensively discussed during the oral proceedings before the board. In that regard, from the patent specification itself, it could merely be derived that an access multiplier "may itself act as a modem on each of its interfaces" (cf. paragraph [0057]) and that data communications between the topside high-frequency modem and each of the subsea high-frequency modems "may occur without the use of an access multiplier 41, e.g. by using other

communications schemes, such as a multidrop scheme". Hence, it could be inferred from that teaching that multidrop and point-to-point communication schemes for high-frequency communications correspond to *equally likely alternatives*, the selection of which depends on the practical constraints.

3.4 In the proprietor's favour, the board adopts the objective technical problem as framed by the proprietor at the oral proceedings, namely "how to find an efficient way to update the subsea communication system of DI1 with new components having different frequency and bandwidth characteristics".

3.5 The board holds that the mere use of a *multidrop configuration* in the low-frequency range and of a *point-to-point configuration* with an access multiplier in the high-frequency range does not yield a synergistic technical effect that goes beyond the individual effects arising from a juxtaposition of said specific configurations. Taking further into account that, in the system of DI1, the data communications over the two frequency ranges do not causally affect each other (see e.g. abstract), the problem of upgrading the system of DI1 can thus be treated independently for *both* available frequency ranges.

3.6 For upgrading the data communication scheme in the *high-frequency* range according to the above objective problem, the person skilled in the field of subsea data communication systems would have consulted prior-art document **DI7** which also addresses the problem of upgrading the communication schemes of existing subsea fields (cf. page 3, section 3.3, first paragraph: "Extensions and changes to existing subsea installations"). DI7 discloses, for this purpose, a

"LongSpeed powerline modem" that enables a point-to-point topology at a data rate of 33,6 kbit/s (page 5, first ten lines of the section entitled "LongSpeed powerline modem"). The "LongSpeed" modem can coexist on the same power-pair with powerline modems called "PLMS160" with a lower data rate of 2,4 kbit/s. The "LongSpeed" modem can therefore be regarded as a *high-frequency modem*. In addition, each subsea module has space for two "LongSpeed" modems (page 5, last paragraph). Moreover, the communication protocol used in the "new communication systems", which also refers to the "LongSpeed" system, is TCP/IP that implies a router or, in other words, an *access multiplier* as claimed.

As regards the *low-frequency* modem, DI1 discloses a typical data rate of 1,2 kbit/s. This very low data rate implies the use of legacy equipment, like for example the "Bell 202 modem" which operates at this data rate. This equipment had become an early standard in subsea communications and is also mentioned in the opposed patent itself (see paragraph [0004]). At the priority date of the opposed patent, it was, however, common general knowledge to connect multiple low-frequency modems according to a multidrop communication scheme. It was likewise known that a multidrop communication scheme was very simply implemented by connecting the modems in parallel or in series. Its drawback, namely that all connected modems have typically to share the overall system data rate, is evidently alleviated by the use of high-frequency modems in a point-to-point configuration as known from DI7, and would not have deterred the skilled person from adopting the multidrop configuration for the low-frequency modems.

3.7 In conclusion, the skilled person would, starting out from **DI1** and applying the teaching of **DI7**, have arrived at a system according to present claim 1, without exercising any inventive skills.

3.8 The proprietor argued that upgrading an existing system is costly and the skilled person would have replaced the whole system if new components were added.

However, DI1 already discloses that, in the case of upgrading an existing subsea system, the low-speed system remains in place and may continue to operate alongside the added high-speed system (page 4, lines 5 to 8). This argument is therefore moot.

3.9 Furthermore, the proprietor submitted that neither DI1 nor other documents on file provided a hint towards the use of *different* communication schemes over the different frequency ranges. As regards the use of the point-to-point configuration for the high-frequency modems, the proprietor merely stated that, in the high-frequency range, a multidrop configuration could not be easily implemented and that a point-to-point scheme like TCP/IP was generally better.

The board however finds that no synergistic effect can credibly be derived from merely having two different communication schemes and that DI1 is silent as to the communication scheme to be deployed in each frequency range. Hence, the skilled person would have been expected to take a decision as to the communication scheme for each frequency range *separately*. There was no reason preventing the skilled person from implementing *different* communication schemes. In the mentioned case, in which an existing system including only a low-frequency modem is upgraded (page 4, lines 5

to 8), the skilled person would have indeed considered different communication schemes for the high-frequency modems independently of the existing communication scheme applied in the low-frequency range.

3.10 In view of the above, the board concludes that claim 1 of the second auxiliary request lacks an inventive step, having regard to documents DI1 and DI7. The second auxiliary request is therefore not allowable under Article 56 EPC.

4. As there is no allowable set of claims, it follows that the patent is to be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chair:

B. Brückner K. Bengi-Akyürek

Decision electronically authenticated