

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/IB2024/059924

International filing date (day/month/year)
10.10.2024

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10.10.2023

International Patent Classification (IPC) or both national classification and IPC
INV. H04B7/06 H04B7/0404 H04L5/00

Applicant
TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:



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D-80298 Munich
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Date of completion of
this opinion

see form
PCT/ISA/210

Authorized Officer

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
- ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
- a. ☐ forming part of the international application as filed.
 - b. ☐ furnished subsequent to the international filing date for the purposes of international search (Rule 13ter.1(a)),
 - ☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the international application as filed.
4. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established to the extent that a meaningful opinion could be formed without a WIPO Standard ST.26 compliant sequence listing.
5. Additional comments:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>6-8, 11, 15, 16, 18-20, 22-25, 27, 29, 31, 32</u>
	No: Claims	<u>1-5, 9, 10, 12-14, 17, 21, 26, 28, 30, 33-38</u>
Inventive step (IS)	Yes: Claims	
	No: Claims	<u>1-38</u>
Industrial applicability (IA)	Yes: Claims	<u>1-38</u>
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Reference is made to the following documents:

- D1 US 2023/147639 A1 (GO SEONGWON [KR] ET AL) 11 May 2023
(2023-05-11)
- D2 HUAWEI ET AL: "Enhancements on SRS in Rel-17",
3GPP DRAFT; R1-2110786, 3RD GENERATION PARTNERSHIP
PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES
LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE
,
vol. RAN WG1, no. e-Meeting; 20211111 - 20211119 6 November 2021
(2021-11-06), XP052074567,
Retrieved from the Internet:
URL:[https://ftp.3gpp.org/tsg_ran/WG1_RL1/TSGR1_107-e/Docs/
R1-2110786.zip](https://ftp.3gpp.org/tsg_ran/WG1_RL1/TSGR1_107-e/Docs/R1-2110786.zip) R1-2110786.docx
[retrieved on 2021-11-06]
- D3 WO 2023/097555 A1 (QUALCOMM INC [US]; WANG RUNXIN [US] ET
AL.) 8 June 2023 (2023-06-08)
- D4 ERICSSON: "Rel-15 SRS power scaling in UL power control",
3GPP DRAFT; R1-1811499 SRS POWER SCALING IN UL POWER
CONTROL, 3RD GENERATION PARTNERSHIP PROJECT (3GPP),
MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ;
F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE
,
vol. RAN WG1, no. Chengdu, China; 20181008 - 20181012 29 September
2018 (2018-09-29), XP051518902,
Retrieved from the Internet:
URL:[http://www.3gpp.org/ftp/tsg%5Fran/WG1%5FRL1/TSGR1%5F94b/
Docs/R1%2D1811499%2Ezip](http://www.3gpp.org/ftp/tsg%5Fran/WG1%5FRL1/TSGR1%5F94b/Docs/R1%2D1811499%2Ezip)
[retrieved on 2018-09-29]
- D5 WO 2023/055106 A1 (LG ELECTRONICS INC [KR]) 6 April 2023
(2023-04-06)
- D6 US 2023/105787 A1 (CHEN BO [CN] ET AL) 6 April 2023 (2023-04-06)

Re Item V

Lack of novelty (Article 33(2) PCT) for claims 1, 17, 33-38

The solution proposed in **independent claim 1** of the present application cannot be considered as being novel with respect to the disclosure of **D1** (Art. 33(2) PCT). D1, in fact, discloses

A method performed by an UE, comprising:

transmitting a UE capability signaling indicating support for three transmit antennas;

[0264] Alternatively, in a UE capability report/configuration, such as “xTyR” of Embodiment 5 (y is not accurately divided by x), for each SRS transmission occasion for antenna switching, a base station may configure “xTyR” (e.g., 4T8R, 2T8R, 4T6R, 2T6R, **3T4R**, 2T4R, etc.) antenna switching to a terminal so as to have an overlapping Rx (Tx) antenna port for each occasion

and receiving a RRC configuration to indicate that the UE should apply a first or a second antenna switching

[0269] ... a base station configures (e.g., by RRC signaling)/activates (e.g., by MAC CE)/indicates (e.g., by DCI) SRS transmission to a terminal. [0274] For an antenna switching configuration for multi-panels of a terminal, a base station may configure/indicate to a terminal to perform SRS antenna switching with a subset of “xTyR” reported by the terminal by configuring **one or more** SRS resource sets.

A same reasoning applies to **independent claim 17** being the counter-part network device method, and to **claims 33-38** being the corresponding apparatus and program claims.

Re. the **remaining dependent claims** the following considerations are made as for a lack of novelty and/or inventive step as well:

Claims 2, 18 - *the first and the second antenna switching comprises one of the group consisting of: 3T6R or 4T8R antenna switching; 3T3R or 3T6R antenna switching; 3T8R antenna switching; and any combination of these*

see [0264] of D1 above

Claims 3, 19 - *the UE capability signaling comprises: a new bitfield that includes one or more of the following entries: {t3r3, t3r4, t3r6, t3r8}*

same as for claim 2 above

Claims 4, 20 - *the UE capability signaling indicates if the UE supports one or more corresponding Sounding Reference Signal, SRS, antenna-switching configurations*

[0277] Specifically, when a terminal reports capability information for SRS antenna switching for multi-panel to a base station, the terminal may report information indicating that SRS antenna switching can be completed within a single UL slot and "xTyR" for each panel (or integrated "xTyR" for a total of panels) to the base station as capability information

Claims 5, 21 - *if the UE capability signaling indicates txry, the UE can be configured with xTyR antenna switching*

see [0269] above

Claims 6, 22 (**lack of inventive step**) - *if a UE has 3 Tx and 4 Rx, the UE indicates support for legacy t2r4 antenna switching, which can be used to sound the 4 UE RX antennas in two Orthogonal Frequency Division Multiplexing, OFDM, symbols + one symbols gap period*

This subject-matter is disclosed in **D2** in the very same context, see section 3.1 "For two SRS resource sets of an xTyR antenna switching located in two consecutive slots, if UE is capable of transmitting SRS in all symbols in one slot, a minimum gap period of Y symbols exists between the last OFDM symbol occupied by the SRS resource set in the first slot and the first OFDM symbol occupied by the SRS resource set in the second slot"

Claim 7 (**lack of inventive step**) - *if a UE has 3 Tx and 4 Rx, the UE indicates support for new t3r3 antenna switching*

this subject-matter is disclosed in **document D3** at [0083] "For example, the UE 115-a, the base station 105-a, or both, may utilize one or more port arrangements referred to as 3T4R, 3T3R, 2T4R, 2T2R, 1T4R, 1T2R, 1T1R, 3T6R, 3T4R, 2T6R, 2T4R, 2T2R, 1T6R, 1T4R 1T2R, 1T1R, 3T8R, 3T6R, 3T4R, 2T8R, 2T6R, 2T4R, 2T2R, 1T8R, 1T6R, 1T4R, 1T2R, 1T1R, a subset of one or more of the preceding, or any combination thereof. As such, the UE 115-a, the base station 105-a, one or more other devices, or any combination thereof may utilize various port arrangements or antenna switching

combinations. Other combinations of transmission and reception antenna port numbers or quantities, port arrangements, antenna switching combinations, or any combination thereof, are possible and are contemplated by the subject matter discussed herein"

Claims 8, 24 (**lack of inventive step**) - *when UE is configured with 3T8R antenna switching, the UE sounds 3 SRS ports two times, and 2 SRS ports a third time*

This is a combination equivalent to the combinations disclosed in **D3** at [0083]

Claims 9, 25 (**lack of inventive step**) - *three ports are contained in one or more SRS resources*

this subject-matter is disclosed in **D3** at [0082], "In some examples, the UE 115-a may be configured with multiple SRS resources sets for antenna switching. For example, the UE 115-a may transmit two SRSs 230 using two SRS resources and three transmit ports"

Claims 10, 26 - *the three ports consist of one of the following: a 4-port SRS resource where the UE blanks one of the SRS ports; two or three concatenated SRS resources, where the total number of SRS ports over the concatenated SRS resources is equal to three; and a new three port SRS resource is introduced and used*

see [0261] of D1, "In the above example, two SRS resource sets may be configured. In addition, three 1-port SRS resources having 1 symbol may be configured in one SRS resource set (three SRS resources in one SRS resource set are configured, and each SRS resource is configured to be transmitted in one symbol with one first SRS port), and three 1-port SRS resources having 1 symbol with ports different from the ports of the resources may be configured in the other SRS resource set (three SRS resources are configured in one SRS resource set, and each SRS resource is configured to be transmitted in one symbol with one second SRS port)"

Claims 11, 27 (**lack of inventive step**) - *power scaling for all SRS ports should be the same, such that the UE should apply same power per SRS port regardless of if there are two or three SRS ports transmitted per SRS resource*

this subject-matter is disclosed in **document D4**

"5 Intra SRS resource set power scaling

We will here present a set of potential design alternatives for intra SRS resource set power scaling. Based on the above analysis we find it appropriate to use the same power for all SRS antenna ports that are transmitted in transmission period i and corresponding to a certain SRS resource set"

Claims 12, 28 (**lack of inventive step**) - *for an SRS transmission occasion where an SRS resource containing m SRS ports is transmitted, belonging to an SRS resource set with usage 'antennaSwitching' including also, at least, one SRS resource with three ports, the SRS power is $m/3$ of the SRS power for an SRS transmission occasion where an SRS resource containing three SRS ports is transmitted*

the Alternative 3 on page 8 of **D4** does in fact include also the case of three SRS ports, among others

Claims 13, 29 (**lack of inventive step**) - *if the UE is configured with one or more SRS resource sets with usage antenna switching and where SRS resources with different number of ports are configured in the SRS resource sets, the UE knows that it should concatenate the SRS resources to build three-port SRS resources*

This subject-matter is disclosed in **document D5** at [0175] "The DCI may include an SRS request field triggering one or more specific SRS resource sets among at least one SRS resource set set by configuration information. One or more SRS resource sets may be concatenated with each codepoint of the SRS request field. And, the same number of available slot offsets may be set for the one or more SRS resource sets"

Claims 14, 30 (**lack of inventive step**) - *receiving an additional configuration indicating that the UE should blank one SRS port for a 4-port SRS resource*

This technique is known from **D6** so as it shows at [0038], "In some instances, when there is no SRS resource with a quantity of SRS ports matching to a transmission rank of the UE available, the BS may activate the UE with an SRS resource having a quantity of SRS ports greater than the transmission rank of the UE. The UE may repeat an SRS transmission in the remaining SRS ports or mute the remaining SRS ports. For instance, the UE may have a transmission rank of R (e.g., equal to 1, 2, 3, 4, or more), but may be activated with an SRS resource having L SRS ports, where L is greater than R . The UE may transmit an SRS transmission using R SRS ports of the L SRS ports and repeat an SRS transmission in the remaining $(L-R)$ SRS ports or remain silence in the $(L-R)$ SRS ports"

Claims 15, 31 (**lack of inventive step**) - *the configuration is configured in an SRS resource Information Element, IE, as specified in TS 38.331*

and

Claims 16, 32 (**lack of inventive step**) - *The method of claim 14 wherein: the configuration is configured in an SRS resource set Information Element, IE, as specified in TS 38.331*

This use of IE is well known as D1 shows at [0203], "in an SRS resource set configuration (SRS-ResourceSet) in an information element (IE) for an SRS configuration (i.e., SRS-config)) for configuring an SRS resource set from a base station", regardless of the specific Standard used

Claim 23 (**lack of inventive step**) - *if a UE has 3 Tx and 4 Rx, the UE indicates support for new t3r3 antenna switching, which gives the network node only partial channel knowledge at the cost of reduced Uplink, UL, overhead*

This is an obvious trade-off between channel knowledge and UL overhead.

Re Item VII

Independent claims 1, 17, 33 and 36 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art document D1 being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

Furthermore, the features of the claims are not provided with reference signs to the drawings placed in parentheses (Rule 6.2(b) PCT).

Finally, document D1 should be acknowledged, and briefly discussed in the opening part of the description, so as to provide a sufficient indication of the relevant background art and put the invention into the proper perspective and the description should be brought into conformity with the amended claims.