



(51) International Patent Classification:

H04L 5/00 (2006.01) *H04L 27/26* (2006.01)

(21) International Application Number:

PCT/IB2017/058286

(22) International Filing Date:

21 December 2017 (21.12.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/453,777 02 February 2017 (02.02.2017) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

(54) Title: APPARATUSES AND METHODS OF SWITCHING BETWEEN DIFFERENT NUMEROLOGIES

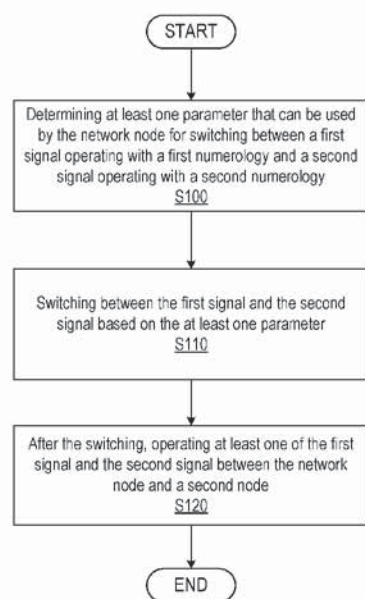


FIG. 13

(57) Abstract: A method, network node and wireless device are provided in which a method in the network node for switching between different numerologies supported by the network node includes determining at least one parameter that can be used by the network node for switching between a first signal operating with a first numerology and a second signal operating with a second numerology; switching between the first signal and the second signal based on the at least one parameter; and after the switching, operating at least one of the first signal and the second signal between the network node and a second node.

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
- in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

WEISBERG, Alan M.
CHRISTOPHER & WEISBERG, P.A.
1232 North University Drive
Plantation, FL 33322
ETATS-UNIS D'AMERIQUE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(PCT Rule 71.1)

Date of mailing
(day/month/year)

23.05.2019

Applicant's or agent's file reference
1557-454PWO

IMPORTANT NOTIFICATION

International application No.
PCT/IB2017/058286

International filing date (day/month/year)
21.12.2017

Priority date (day/month/year)
02.02.2017

Applicant
Telefonaktiebolaget LM Ericsson (publ)

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



European Patent Office P.B. 5818 Patentlaan 2
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 1557-454PWO		FOR FURTHER ACTION	See Form PCT/PEA/416
International application No. PCT/IB2017/058286	International filing date (day/month/year) 21.12.2017	Priority date (day/month/year) 02.02.2017	
International Patent Classification (IPC) or national classification and IPC INV. H04L5/00			
Applicant Telefonaktiebolaget LM Ericsson (publ)			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>11</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ (sent to the applicant and to the International Bureau) a total of <u>43</u> sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions). ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2). ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)). b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).			
4. This report contains indications relating to the following items: ☒ Box No. I Basis of the report ☐ 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 Article 35(2) with regard to novelty, inventive step or 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			
Date of submission of the demand 26.11.2018		Date of completion of this report 23.05.2019	
Name and mailing address of the international preliminary examining authority:  European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016		Authorized officer Tanbourgi, Ralph Telephone No. +31 70 340-3051	



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/IB2017/058286

Box No. I Basis of the report

1. With regard to the **language**, this report is based on
- ☒ 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 (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-64 as originally filed

Claims, Numbers

3, 5, 14, 16, 25, 27, filed with the demand for preliminary international examination
36, 38, 89, 95, 101,
107

1, 4, 6-12, 15, 17-23, filed with telefax on 12-04-2019
26, 28-34, 37, 39-45,
47-55, 57-65, 67-76,
78-87, 90-93, 96-99,
102-105, 108-116

Drawings, Sheets

1/17-17/17 as originally filed

- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☒ the claims, Nos. 2,13,24,35,46,56,66,77,88,94,100,106,3,5,14,16,25,27,36,38,89,95,101,107
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/IB2017/058286

5. ☐ This report has been established:
- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
 - ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).
6. ☒ With regard to top-up searches (Rules 66.1ter and 70.2(f)):
- ☒ A top-up search was carried out by this Authority on 02.05.2019 (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
 - ☐ Additional relevant documents have been discovered during the top-up search.
 - ☐ No top-up search was carried out by this Authority because it would serve no useful purpose.
7. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded".

Box No. IV Lack of unity of invention

1. ☐ In response to the invitation to restrict or pay additional fees, the applicant has, within the applicable time limit:
- ☐ restricted the claims.
 - ☐ paid additional fees.
 - ☐ paid additional fees under protest and, where applicable, the protest fee.
 - ☐ paid additional fees under protest but the applicable protest fee was not paid.
 - ☐ neither restricted the claims nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:
- ☐ complied with.
 - ☒ not complied with for the following reasons:
see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☒ all parts.
 - ☐ the parts relating to claims Nos. .

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/B2017/058286

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1, 4, 6-12, 15, 17-23, 26, 28-34, 37, 39-45, 47-55, 57-65, 67-76, 78-87, 90-93, 96-99, 102-105, 108-116</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>1, 4, 6-12, 15, 17-23, 26, 28-34, 37, 39-45, 47-55, 57-65, 67-76, 78-87, 90-93, 96-99, 102-105, 108-116</u>
	No: Claims	
Industrial applicability (IA)	Yes: Claims	<u>1, 4, 6-12, 15, 17-23, 26, 28-34, 37, 39-45, 47-55, 57-65, 67-76, 78-87, 90-93, 96-99, 102-105, 108-116</u>
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

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

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

1 Reference is made to the following documents:

- D1 INTEL CORPORATION: "Capability to support multiple numerologies", 3GPP DRAFT; R1-1609505, vol. RAN WG1, no. Lisbon, Portugal; 20161010 - 20161014 9 October 2016 (2016-10-09)
- D2 SAMSUNG: "Consideration on UE capability to process multiple numerologies", 3GPP DRAFT; R1-1609051, vol. RAN WG1, no. Lisbon, Portugal; 20161010 - 20161014 9 October 2016 (2016-10-09)
- D3 US 2012/140778 A1 (WANG BIN [CN] ET AL) 7 June 2012 (2012-06-07)
- D4 WO 2017/005295 A1 (ERICSSON TELEFON AB L M [SE]) 12 January 2017 (2017-01-12)
- D5 HUAWEI HISILICON: "Mechanisms of bandwidth adaptation for control and data reception in single-carrier and multi-carrier cases", 3GPP DRAFT; R1-1611655, vol. RAN WG1, no. Reno, USA; 20161114 - 20161118 13 November 2016 (2016-11-13)
- D6 ERICSSON: "On RRM requirements for NR", 3GPP DRAFT; R4-168036, vol. RAN WG4, no. Ljubljana, Slovenia; 20161010 - 20161014 19 October 2016 (2016-10-19)
- D7 WO 2018/097597 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 31 May 2018 (2018-05-31)

2 **Re Item IV**

Lack of unity of invention

This Authority considers that the application does not meet the requirements of unity of invention and that there are two inventions. The reasons, for which the inventions are not so linked as to form a single general inventive concept, as required by Rule 13.1 PCT, are as follows:

2.1 **D3 is considered as the closest prior art for currently amended claim 1.**

The common-matter linking together independent claim 1 (corresponding claims 12,23,34,111,112), independent claim 45 (corresponding claims 55,65,76,113,114), and independent claim 87 (corresponding claims 93,99,105,115,116) is not inventive over D3 (the references in parentheses applying to this document):

A method in a network node for switching between different numerologies supported by the network node, the method comprising:

- determining/receiving at least one parameter that can be used by the network node for switching between a first signal operating with a first numerology and a second signal operating with a second numerology (**fig.2a,§8**: non-MBSFN symbols and MBSFN symbols are switched with essential protection time gap between the switching; **fig.6,§69-78**: UE acquires the configuration pattern of the MBSFN subframe (=receives parameter) through the BCCH));
- the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing (In LTE, MBSFN can normally be operated with a 7.5 kHz or 15 kHz parameterization; normal design option)
- the at least one parameter including an interruption time due to switching (**fig.2a,§8**: an essential protection time gap (=determined parameter, interruption time) is needed when switching between the non-MBSFN symbols and the MBSFN symbols).

Therefore, the common matter does not constitute a single general inventive concept based on same or corresponding special technical features within the meaning of Rule 13.2 PCT. The following two groups of inventions are identified:

- 2.2 Group 1 (claims 1,4,6-12,13,15,17-23,25,26,28-34,37,39-44,87,90-93,96-99, 102-105,108-112, 115,116): Switching numerology based on determined/ received switching parameter

The following features of independent claim 1 (corresponding claims 12,23,34,111,112) and independent claim 87 (corresponding claims 93,99,105,115,116) are also anticipated by D3:

- switching between the first signal and the second signal based on the at least one parameter; and after the switching, operating at least one of the first signal and the second signal between the network node and a second node (**fig.2a,§8**).

However, D3 fails to disclose the features:

- the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal

These features are special technical features and solve the technical problem of ensuring that the UE has sufficient time to switch between different numerologies.

2.3 Group 2 (claims 45,47-65,67-76,78-86,113,114): Determining switching parameter as function of first and second switching parameters and using determined switching parameter for operational task

The remaining features of claim 45 (corresponding claims 55,65,76,113,114) are:

- determining at least one second parameter used by the second node for switching between the first signal operating with the first numerology and the second signal operating with the second numerology;
- determining a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter; and
- using the third parameter for at least one operational task.

These features are special technical features and solve the technical problem of effectively configuring a second node with a parameter (p.38,l.23-p.41, l. 19, steps 5-8).

2.4 Consequently, the special technical features and the technical problems corresponding to the two groups of inventions are not the same and hence, the two groups of inventions are not so linked as to form a single general inventive concept, as required by Rule 13.1 PCT.

3 Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

3.1 **Independent claims**

Group 1

- 3.1.1 **Claims 1,87:** The subject-matter of claims 1,87 is **new and inventive** in the sense of Article 33 PCT (**see Re Item IV, sections 2.1 and 2.2**).
- 3.1.2 Claims 12,23,34,93,99,105,111,112,115,116: The reasoning made for claims 1,87 applies mutatis mutandis to the corresponding claims 12,23,34,93,99, 105,111,112,115,116.

Group 2

- 3.1.3 Claim 45: Document D5 discloses (the references in parentheses applying to this document)

A method in a network node for switching between different numerologies supported by the network node and a second node, the method comprising:

- determining at least one first parameter used by the network node for switching between a first signal operating with a first numerology and a second signal operating with a second numerology (**p.1-2,implicit: gNB switches operating bandwidth(=numerology); therefore gNB knows parameters necessary to perform the switching, e.g., switching time**),
- ~~- the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing~~
- determining at least one second parameter used by the second node for switching between the first signal operating with the first numerology and the second signal operating with the second numerology (**p.2,§2: gap interval for bandwidth/carrier switching should be as small as possible to reduce latency, it is dependent of UE capability such as RF retuning time**);
- ~~- determining a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter~~
- wherein at least one of the the at least one first parameter and the at least one second parameter including an interruption time due to switching (**p.2,§2: gap interval for bandwidth/carrier switching should be as small as possible to reduce latency**,

it is dependent of UE capability such as RF retuning time; **fig.1,2,p.2,§3**: UE performs the switching, UE monitors downlink control channel for uplink grants or downlink data transmission); and

~~using the third parameter for at least one operational task.~~

D5 fails to disclose the following features:

- the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing
- determining a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter
- using the third parameter for at least one operational task

The objective problem solved by these features is understood as how to effectively configure a second node with a parameter

None of the cited documents disclose or point to the solution defined by claim 45.

Hence, the subject-matter of claim 45 is **new and inventive** in the sense of Article 33 PCT.

3.2 Claims 55,65,76,113,114: The reasoning made for claims 45 applies mutatis mutandis to the corresponding claims 55,65,76,113,114.

3.3 It is noted that D6 discusses the service interruption impact due to activation/de-activation of carriers/cels with different numerologies (**see ISR**).

3.4 **Dependent claims**

Claims 4,6-11,15,17-22,26,28-33,37,39-44,47-54,57-64,67-75,78-86,90-92, 96-98,102-104,108-110:

The claims dependent on claims 1,12,23,34,45,55,65,76,87,93,99,105 and as such also meets the requirements of the PCT with respect to novelty and inventive step.

4 **Re Item VI**

Certain documents cited

Certain published documents

Patent No	Pub. date	Filing date	Priority date (valid claim)
WO2016/087597 A2	31/05/2018	22/11/2017	22/11/2016, 14/12/2016

The above document can be potentially relevant for later examination procedures in the respective jurisdictions, according to the validity of the respective priority claims (**see ISR**).

5 Re Item VII

Certain defects in the international application

- 5.1 The independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT.
- 5.2 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1-D3,D5 is not mentioned in the description, nor are these documents identified therein.

6 Re Item VIII

Certain observations on the international application

- 6.1 Claims 12,115 have been drafted as separate independent network node claims.
- Claims 34,116 have been drafted as separate independent wireless device claims.
- Although the above mentioned claims have been drafted as separate independent claims, they relate effectively to the same subject-matter and differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack **conciseness**, and consequently, do not meet the requirements of Art. 6 PCT.
- 6.2 Claims 55,113 have been drafted as separate independent network node claims.
- Claims 76,114 have been drafted as separate independent wireless device claims.

Although the above mentioned claims have been drafted as separate independent claims, they relate effectively to the same subject-matter and differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack **conciseness**, and consequently, do not meet the requirements of Art. 6 PCT.

IN THE EUROPEAN PATENT OFFICE

AS

INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

International Application Serial No: PCT/IB2017/058286

International Filing Date: 21 December 2017

Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)

Title: APPARATUSES AND METHODS OF SWITCHING
BETWEEN DIFFERENT NUMEROLOGIES

Our File No.: 1557-454PWO (P71188 WO1)

VIA FACSIMILE ONLY to: 011-31-70-340-3016

Mr. Ralph Tanbourgi
The European Patent Office
P.B. 5818
Patentlaan 2
NL-2280 HV Rijswijk

REPLY TO WRITTEN OPINION OF THE IPEA

Dear Mr. Tanbourgi:

This letter is responsive to the Written Opinion of the International Preliminary
Examining Authority dated 13 February 2019.

International Application Serial No: PCT/IB2017/058286

International Filing Date: 21 December 2017

Applicant: Telefonaktiebolaget LM Ericsson (Publ)

Attorney Docket No: 1557-454PWO (P71188_WO1)

Differences Between the Claims as Amended and the Claims as Filed

Replacement sheets for the claims are submitted herewith. Claim sheets showing the marked up amended claims are submitted herewith as Appendix A.

Independent Claims 1, 12, 23, 34, 45, 55, 65, 76, 87, 93, 99, 105 and 111-116 have been amended to further define the interruption time due to switching and/or to further clarify the numerology.

Dependent Claims 3, 5, 14, 16, 25, 27, 36, 38, 89, 95, 101 and 107 have been cancelled due to their incorporation into their respective independent claims, without prejudice or disclaimer of subject matter.

Dependent Claims 4, 6-11, 15, 17-22, 26, 28-33, 37, 39-44, 90, 92, 96, 98, 102, 104, 108 and 110 have been amended to conform to the dependency resulting from the cancelled claims and not for reasons related to the cited references.

Basis for the Amendments

Support for the amendments to the independent claims can be found in Applicant's specification, at least at p. 32, ll. 10-29; p. 33, ll. 19-30 and p. 37, ll. 28-29.

Re Item IV**LACK OF UNITY OF INVENTION**

The Written Opinion of the International Searching Authority, Item IV, alleges that the Application does not meet the requirements of unity of invention and that there are two inventions. Specifically, the Written Opinion alleges that the inventions are not so linked as to form a single general inventive concept, as required by Rule 13.1 PCT. The Written Opinion categorizes Group 1 (Claims 1-44, 87-112, 115, 116) as switching numerology based on determined/received switching parameter and Group 2 (Claims 45-87, 113, 114) as determining switching parameter as function of first and second switching parameters and using determined switching parameter for operational task. Since different jurisdictions have different rules regarding unity of invention issues, Applicant will address any such alleged defects at the national stage level.

International Application Serial No: PCT/IB2017/058286

International Filing Date: 21 December 2017

Applicant: Telefonaktiebolaget LM Ericsson (Publ)

Attorney Docket No: 1557-454PWO (P71188_WO1)

Re Item V**STATEMENT CONCERNING THE CLAIMS****Group 1 Independent Claims**

The Written Opinion indicates that Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116 are allegedly not new under Article 33(2) PCT in view of the following reference:

D3 WANG BIN *et al.*: US 2012/0140778 A1, June 7, 2012

As discussed below in detail, Applicant respectfully asserts that D3 does not disclose or suggest all the features of amended independent Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116.

Applicant's disclosure describes techniques for switching between different numerologies based on at least one parameter. For example, the at least one parameter may include an interruption time due to the switching. Applicant's Specification, p. 32, ll. 10-29; p. 33, ll. 19-30. Applicant's disclosure describes that a switching delay (D_n) (i.e., time required by a node to switch between a first signal, S1, with a first numerology, N1, to a second signal, S2, with a second numerology, N2) may include at least a time to initiate switching (D_p) and some interruption time (D_i), during which the signals S1 and S2 may be interrupted at the node. *Id.* In the example, during D_i , the node may not transmit or receive any signal and may use its resources (e.g., radio circuitry) to adapt to the new numerology of the new signal to be transmitted after the change of the numerology. *Id.* The numerology may include a subcarrier spacing of the signals. The interruption may occur after the lower layers of the node (e.g., physical layer) actually perform the change in the numerology from N1 to N2 or vice versa. *Id.* Thus, Applicant's disclosure describes techniques for determining at least one parameter, e.g., an interruption time due to switching from a first subcarrier spacing of S1 to a second subcarrier spacing of S2, and switching between S1 and S2 based on the determined at least one determined. *Id.*, p. 37, ll. 28-29. D3 does not teach or suggest such an arrangement and does not offer the benefits provided by Applicant's claimed arrangement.

Independent Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116

Independent Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116 recite, in part,

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“determin[ing] at least one parameter that can be used by the network node for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

switch[ing] between the first signal and the second signal based on the at least one parameter, the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal” (emphasis added).

D3 describes converting an MBSFN subframe to a unicast service subframe and bearing the unicast service on the converted unicast subframe. D3 describes that when the non-MBSFN symbols employ a normal CP configuration, an essential protection time gap is needed between the non-MBSFN symbols and the MBSFN symbols; and when the non-MBSFN symbols employ the extended CP configuration, no protection time gap is needed between the non-MBSFN symbols and the MBSFN symbols. D3, ¶ [0008]. The WO equates the “essential protection time gap” in D3 as the claimed “interruption time due to switching.” However, D3 describes the essential protection time gap is only present when the non-MBSFN symbols employs a normal CP configuration. Thus, the essential protection time gap in D3 is related to *CP configuration* and not *subcarrier spacing*. Thus, D3 does not disclose or even suggest the claimed *determining at least one parameter that can be used by the network node for switching between a first signal operating with a first subcarrier spacing and a second signal operating with a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing*, as recited in amended Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116.

In addition, since the gap in D3 is for *CP configuration* and not *subcarrier spacing* D3 does not disclose or even suggest the claimed *switching between the first signal and the second signal based on the at least one parameter, the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first subcarrier spacing of the first signal to the second subcarrier spacing of the second signal*, as recited in amended Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116.

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Accordingly, D3 fails to disclose or suggest the above cited features of amended Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116.

Group 2 Independent Claims

The Written Opinion indicates that Claims 45, 47-65, 67-76, 78-86, 113 and 114 are allegedly not new under Article 33(2) PCT in view of the following reference:

D5 HUAWEI HISILICON: "Mechanisms of Bandwidth Adaptation for Control and Data Reception in Single-Carrier and Multi-Carrier Cases", 3GPP Draft; R1-1611655, Vol. RAN WG1, Reno, USA

As discussed below in detail, Applicant respectfully asserts that D5 does not disclose or suggest all the features of Claims 45, 47-65, 67-76, 78-86, 113 and 114.

Applicant's disclosure further describes another embodiment in which a first node (e.g., WD) determines at least one parameter (P) used by the first node for switching between the first numerology and the second numerology; determines at least one second parameter (Q) used by a second node (e.g., network node) for switching between the first numerology and the second numerology; and determines a third parameter (R) that is a function of the first and second parameters. Applicant's Specification, pp. 38-41. D5 does not teach or suggest such an arrangement and does not offer the benefits provided by Applicant's claimed arrangement.

Independent Claims 45, 55, 65, 76, 113 and 114

Independent Claims 45, 55, 65, 76, 113 and 114 recite, in part,

"determining at least one first parameter used by the network node for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

determining at least one second parameter used by the second node for switching between the first signal operating with the first numerology and the second signal operating with the second numerology;

determining a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter, the at least one of the at least one

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first parameter and the at least one second parameter including an interruption time due to switching; and

using the third parameter for at least one operational task" (emphasis added).

D5 describes mechanisms for bandwidth adaption for control and data reception. D5 describes that when a user equipment (UE) is scheduled to transmit/receive high-data-rate services (e.g., eMBB service), the gNB can switch the UE to operate in a second RF bandwidth that is larger than the first RF bandwidth. D5, Section. 2. However, D5 does not disclose or even suggest *determining a parameter for switching between a first signal operating with a first subcarrier spacing and a second signal operating with a second subcarrier spacing, different from the first subcarrier spacing*, as recited in amended Claims 45, 55, 65, 76, 113 and 114. For this reason alone, D5 fails to disclose all the features of Claims 45, 47-65, 67-76, 78-86, 113 and 114 and the rejection is overcome.

In addition, the Written Opinion equates the claimed *second parameter* with a gap interval taught in D5. The Written Opinion equates the claimed *first parameter* with a "switching time" (Applicant asserts that a switching time is not disclosed by D5). However, it is unclear from the Written Opinion exactly which parameter the Examiner asserts is the claimed *third parameter that is a function of at least one of the first and the second parameter*. The Written Opinion appears to re-assert the gap interval as the third parameter, as well. However, since Claims 45, 47-65, 67-76, 78-86, 113 and 114 include *determining at least one first parameter, at least one second parameter, and a third parameter that is a function of at least one of the first and second parameter* and the Written Opinion appears to only cite to **one parameter** actually disclosed in D5, a gap interval X (since the switching time is not taught and Applicant is unable to clearly discern a third parameter). The gap interval X simply cannot be more than one parameter as alleged in the Written Opinion. The gap interval X cannot be both Applicant's claimed second parameter and Applicant's claimed third parameter (which is a function of the first and second parameters). The rejection is lacking and should be withdrawn.

Accordingly, D5 fails to disclose or suggest the above cited features of amended Claims 45, 47-65, 67-76, 78-86, 113 and 114.

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Dependent Claims

The Written Opinion states that dependent Claims 3-11, 14-22, 25-33, 34-44, 88-92, 94-98, 100-104 and 106-110 from Group 1 and dependent Claims 47- 54, 57-64, 67-75, 78-85 from Group 2 are allegedly taught by D3, D5 and/or D1. Applicant disagrees.

Dependent Claims 3, 5, 14, 16, 25, 27, 36, 38, 89, 95, 101 and 107 have been cancelled due to their incorporation into their respective independent claims. Therefore, the rejection of Claims 3, 5, 14, 16, 25, 27, 36, 38, 89, 95, 101 and 107 is moot and the rejection should be withdrawn.

The remaining dependent claims, Claims 3-11, 14-22, 25-33, 34-44, 88-92, 94-98, 100-104 and 106-110 and Claims 47- 54, 57-64, 67-75, 78-85 are each dependent either directly or indirectly from one or another of the independent claims discussed above. Claims 3-11, 14-22, 25-33, 34-44, 88-92, 94-98, 100-104 and 106-110 and Claims 47- 54, 57-64, 67-75, 78-85 are believed patentable at least by virtue of their dependency from an independent claim believed to be novel and inventive. These claims recite additional limitations which, in conformity with the features of their corresponding independent claim, are not disclosed or suggested by the art of record. However, the individual reconsideration of the patentability of each claim on its own merits is respectfully requested.

Re Item VII**CERTAIN DEFECTS IN THE INTERNATIONAL APPLICATION**

The Written Opinion objects to the independent claims for not being in two-part form in accordance with Rule 6.3(b) PCT. The Written Opinion also states that the cited D1-D3 and D5 references are not mentioned in Applicant's written description. Since different jurisdictions have different rules regarding these issues, Applicant will address any such alleged defects at the national stage level.

Re Item VIII**CERTAIN OBSERVATIONS ON THE INTERNATIONAL APPLICATION**

The Written Opinion objects to the term "numerology" in Claims 1, 12, 23, 34, 87, 93, 99, 105, 111, 112, 115 and 116 as being allegedly vague and unclear. Applicant does not agree that the term "numerology" is unclear. However, solely for purposes of advancing prosecution of the Application, Applicant has amended independent Claims 1, 12, 23, 34, 45,

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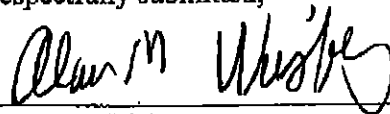
55, 65, 76, 87, 93, 99, 105 and 111-116 to include the additional features of Claim 5, as suggested by the Written Opinion, into the independent claims to further define the numerology as subcarrier spacing.

For the above reasons, Applicant respectfully asserts that all claims are in proper form, have industrial applicability, are novel and possess inventive step.

Respectfully submitted,

Date: April 12, 2019

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What is claimed is:

1. A method in a network node (10) for switching between different
5 numerologies supported by the network node (10), the method comprising:
determining at least one parameter that can be used by the network node (10) for
switching between a first signal operating with a first numerology and a second signal
operating with a second numerology, the first numerology being a first subcarrier spacing
and the second numerology being a second subcarrier spacing, the second subcarrier
10 spacing being different from the first subcarrier spacing (S100);
switching between the first signal and the second signal based on the at least one
parameter (S110), the at least one parameter including a predefined value corresponding to
a maximum allowed interruption time due to switching from the first numerology of the
first signal to the second numerology of the second signal; and
15 after the switching, operating at least one of the first signal and the second signal
between the network node (10) and a second node (10, 20) (S120).
2. (Cancelled)
- 20 3. (Cancelled)
4. The method of Claim 1, wherein the at least one parameter includes at least
one of numerology switching delay time, frequency of switching between numerologies,
specific time resources allowed for switching, time resources restricted for switching,
25 numerologies allowed for switching, and part of a spectrum allowed for switching.
5. (Cancelled)
6. The method of any of Claims 1 and 4, further comprising restricting
30 scheduling of at least one of a downlink and an uplink transmission in at least one
subframe adjacent a multicast having a different numerology.

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7. The method of any of Claims 1, 4 and 6, wherein operating the at least one of the first signal and the second signal between the network node (10) and the second node (10, 20) comprises at least one of transmitting the at least one of the first signal and the second signal to the second node (10, 20) and receiving the at least one of the first signal and the second signal from the second node (10, 20).

8. The method of any of Claims 1, 4, 6 and 7, wherein the second node (10, 20) is a wireless device (20).

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9. The method of any of Claims 1, 4 and 6-8, further comprising receiving from at least one of the second node (10, 20) and another node (10, 20) information regarding the at least one parameter; and wherein switching between the first signal and the second signal based on the at least one parameter comprises switching between the first signal and the second signal based at least upon the received information regarding the at least one parameter.

10. The method of any of Claims 1, 4 and 6-9, wherein switching between the first signal and the second signal is further based on a numerology supported by the second node (10, 20).

11. The method of any of Claims 1, 4 and 6-10, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

12. A network node (10) configured to switch between different numerologies supported by the network node (10), the network node (10) comprising processing circuitry (12) configured to:

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determine at least one parameter that can be used by the network node (10) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

switch between the first signal and the second signal based on the at least one parameter, the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and

after the switching, operate at least one of the first signal and the second signal between the network node (10) and a second node (10, 20).

13. (Cancelled)

14. (Cancelled)

15. The network node (10) of Claim 12, wherein the at least one parameter includes at least one of numerology switching delay time, frequency of switching between numerologies, specific time resources allowed for switching, time resources restricted for switching, numerologies allowed for switching, and part of a spectrum allowed for switching.

16. (Cancelled)

17. The network node (10) of any of Claims 12 and 15, wherein the processing circuitry (12) is further configured to restrict scheduling of at least one of a downlink and an uplink transmission in at least one subframe adjacent a multicast having a different numerology.

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18. The network node (10) of any of Claims 12, 15 and 17, further comprising a communications interface (18) in communication with the processing circuitry (12), the processing circuitry (12) configured to operate the at least one of the first signal and the second signal between the network node (10) and the second node (10, 20) by at least one of causing the communications interface (18) to transmit the at least one of the first signal and the second signal to the second node (10, 20) and causing the communications interface (18) to receive the at least one of the first signal and the second signal from the second node (10, 20).

19. The network node (10) of any of Claims 12, 15, 17 and 18, wherein the second node (10, 20) is a wireless device (20).

20. The network node (10) of any of Claims 12, 15 and 17-19, further comprising a communications interface (18) in communication with the processing circuitry (12), the processing circuitry (12) configured to:

cause the communications interface (18) to receive from at least one of the second node (10, 20) and another node (10, 20) information regarding the at least one parameter; and

switch between the first signal and the second signal based at least upon the received information regarding the at least one parameter.

21. The network node (10) of any of Claims 12, 15 and 17-20, wherein the processing circuitry (12) is further configured to switch between the first signal and the second signal based on a numerology supported by the second node (10, 20).

22. The network node (10) of any of Claims 12, 15 and 17-21, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

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23. A method in a wireless device (20) for switching between different numerologies supported by the wireless device (20), the method comprising:
- 5 determining at least one parameter that can be used by the wireless device (20) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing (S130);
- 10 switching between the first signal and the second signal based on the at least one parameter (S140), the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and
- after the switching, operating at least one of the first signal and the second signal
- 15 between the wireless device (20) and a second node (10, 20) (S150).
24. (Cancelled)
25. (Cancelled)
- 20
26. The method of Claim 23, wherein the at least one parameter includes at least one of numerology switching delay time, frequency of switching between numerologies, specific time resources allowed for switching, time resources restricted for switching, numerologies allowed for switching, and part of a spectrum allowed for
- 25 switching.
27. (Cancelled)
28. The method of any of Claims 23 and 26, further comprising restricting
- 30 scheduling of at least one of a downlink and an uplink transmission in at least one subframe adjacent a multicast having a different numerology.

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29. The method of any of Claims 23, 26 and 28, wherein operating the at least one of the first signal and the second signal between the network node (10) and the second node (10, 20) comprises at least one of transmitting the at least one of the first signal and the second signal to the second node (10, 20) and receiving the at least one of the first signal and the second signal from the second node (10, 20).

30. The method of any of Claims 23, 26, 28 and 29, wherein the second node (10, 20) is one of a second wireless device (20) and a network node (10).

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31. The method of any of Claims 23, 26 and 28-30, further comprising receiving from at least one of the second node (10, 20) and another node (10, 20) information regarding the at least one parameter; and

wherein switching between the first signal and the second signal based on the at least one parameter comprises switching between the first signal and the second signal based at least upon the received information regarding the at least one parameter.

32. The method of any of Claims 23, 26 and 28-31, wherein switching between the first signal and the second signal is further based on a numerology supported by the second node (10, 20).

33. The method of any of Claims 23, 26 and 28-32, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

34. A wireless device (20) configured to switch between different numerologies supported by the wireless device (20), the wireless device (20) comprising processing circuitry (22) configured to:

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determine at least one parameter that can be used by the network node (10) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

switch between the first signal and the second signal based on the at least one parameter, the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and

after the switching, operate at least one of the first signal and the second signal between the network node (10) and a second node (10, 20).

35. (Cancelled)

36. (Cancelled)

37. The wireless device (20) of Claim 34, wherein the at least one parameter includes at least one of numerology switching delay time, frequency of switching between numerologies, specific time resources allowed for switching, time resources restricted for switching, numerologies allowed for switching, and part of a spectrum allowed for switching.

38. (Cancelled)

39. The wireless device (20) of any of Claims 34 and 37, wherein the processing circuitry (22) is further configured to restrict scheduling of at least one of a downlink and an uplink transmission in at least one subframe adjacent a multicast having a different numerology.

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40. The wireless device (20) of any of Claims 34, 37 and 39, further comprising a communications interface (28) in communication with the processing circuitry (22), the processing circuitry (22) configured to operate the at least one of the first signal and the second signal between the network node (10) and the second node (10, 20) by at least one of causing the communications interface (28) to transmit the at least one of the first signal and the second signal to the second node (10, 20) and causing the communications interface (28) to receive the at least one of the first signal and the second signal from the second node (10, 20).

10

41. The wireless device (20) of any of Claims 34, 37, 39 and 40, wherein the second node (10, 20) is one of a second wireless device (20) and a network node (10).

42. The wireless device (20) of any of Claims 34, 37 and 39-41, further comprising a communications interface (28) in communication with the processing circuitry (22), the processing circuitry (22) configured to:

cause the communications interface (28) to receive from at least one of the second node (10, 20) and another node (10, 20) information regarding the at least one parameter; and

20 switch between the first signal and the second signal based at least upon the received information regarding the at least one parameter.

43. The wireless device (20) of any of Claims 34, 37 and 39-42, wherein the processing circuitry (22) is further configured to switch between the first signal and the second signal based on a numerology supported by the second node (10, 20).

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44. The wireless device (20) of any of Claims 34, 37 and 39-43, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

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45. A method in a network node (10) for switching between different numerologies supported by the network node (10) and a second node (10, 20), the method comprising:

5 determining at least one first parameter used by the network node (10) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing (S160);

10 determining at least one second parameter used by the second node (10, 20) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology (S170);

determining a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter (S180), the at least one of the at least one first parameter and the at least one second parameter including an interruption time due to switching; and

using the third parameter for at least one operational task (S190).

46. (Cancelled)

20

47. The method of Claim 45, wherein the at least one of the at least one first parameter and the at least one second parameter includes a predefined value corresponding to a maximum allowed interruption time due to switching.

25

48. The method of any of Claims 45 and 47, wherein a value of the at least one first parameter is the same as a value of the at least one second parameter.

30

49. The method of any of Claims 45, 47 and 48, wherein a value of the at least one first parameter is different than a value of the at least one second parameter.

50. The method of any of Claims 45 and 47-49, wherein the at least one second parameter includes a parameter that is determined based on at least one of predefined

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information, receiving information about the at least one second parameter associated with
the second node (10, 20) from another node (10, 20), at least one of statistics and historical
5 data, and feedback from the second node (10, 20).

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51. The method of any of Claims 45 and 47-50, wherein the at least one operational task includes at least one of configuring the second node (10, 20) with information related to a determined value of the third parameter, transmitting information
5 related to the determined value of the third parameter, using the information related to the determined value of the third parameter for scheduling of signals exchanged with the second node (10, 20), and performing switching between the first signal and the second signal based on the determined value of the third parameter.

10 52. The method of any of Claims 45 and 47-51, wherein the at least one operational task comprises at least one of transmitting the at least one of the first signal and the second signal to the second node (10, 20) and receiving the at least one of the first signal and the second signal from the second node (10, 20).

15 53. The method of any of Claims 45 and 47-52, wherein the second node (10, 20) is a wireless device (20).

54. The method of any of Claims 45 and 47-53, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single
20 Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

55. A network node (10) configured to switch between different numerologies
25 supported by the network node (10) and a second node (10, 20), the network node (10) comprising processing circuitry (12) configured to:

determine at least one first parameter used by the network node (10) for switching
between a first signal operating with a first numerology and a second signal operating with
a second numerology, the first numerology being a first subcarrier spacing and the second
30 numerology being a second subcarrier spacing, the second subcarrier spacing being
different from the first subcarrier spacing;

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determine at least one second parameter used by the second node (10, 20) for switching
between the first signal operating with the first numerology and the second signal
operating with the second numerology;

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determine a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter, the at least one of the at least one first parameter and the at least one second parameter includes an interruption time due to switching; and
5 use the third parameter for at least one operational task.

56. (Cancelled)

10 57. The network node (10) of Claim 55, wherein the at least one of the at least one first parameter and the at least one second parameter includes a predefined value corresponding to a maximum allowed interruption time due to switching.

15 58. The network node (10) of any of Claims 55 and 57, wherein a value of the at least one first parameter is the same as a value of the at least one second parameter.

20 59. The network node (10) of any of Claims 55, 57 and 58, wherein a value of the at least one first parameter is different than a value of the at least one second parameter.

25 60. The network node (10) of any of Claims 55 and 57-59, wherein the at least one second parameter includes a parameter determined based on at least one of predefined information, receiving information about the at least one second parameter associated with the second node (10, 20) from another node (10, 20), at least one of statistics and historical data, and feedback from the second node (10, 20).

30 61. The network node (10) of any of Claims 55 and 57-60, wherein the at least one operational task includes at least one of configuring the second node (10, 20) with information related to a determined value of the third parameter, transmitting information related to the determined value of the third parameter, using the information related to the determined value of the third parameter for scheduling of signals exchanged with the

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second node (10, 20), and performing switching between

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the first signal and the second signal based on the determined value of the third parameter.

62. The network node (10) of any of Claims 55 and 57-61, wherein the at least one operational task comprises at least one of transmitting the at least one of the first signal and the second signal to the second node (10, 20) and receiving the at least one of the first signal and the second signal from the second node (10, 20).

63. The network node (10) of any of Claims 55 and 57-62, wherein the second node (10, 20) is a wireless device (20).

64. The network node (10) of any of Claims 55 and 57-63, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

65. A method in a wireless device (20) for switching between different numerologies supported by the wireless device (20) and a second node (10, 20), the method comprising:

determining at least one first parameter used by the wireless device (20) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing (S200);

determining at least one second parameter used by the second node (10, 20) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology (S210);

determining a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter (S220), the at least one of the at least

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one first parameter and the at least one second parameter includes an interruption
time due to switching; and

using the third parameter for at least one operational task (S230).

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66. (Cancelled)

67. The method of Claim 65, wherein the at least one of the at least one first
5 parameter and the at least one second parameter includes a predefined value corresponding
to a maximum allowed interruption time due to switching.

68. The method of any of Claims 65 and 67, wherein a value of the at least one
10 first parameter is the same as a value of the at least one second parameter.

69. The method of any of Claims 65, 67 and 68, wherein a value of the at least
one first parameter is different than a value of the at least one second parameter.

70. The method of any of Claims 65 and 67-69, wherein the at least one second
15 parameter includes a parameter that is determined based on at least one of predefined
information, receiving information about the at least one second parameter associated with
the second node (10, 20) from another node (10, 20), at least one of statistics and historical
data, and feedback from the second node (10, 20).

20 71. The method of any of Claims 65 and 67-70, wherein the at least one
operational task includes at least one of configuring the second node (10, 20) with
information related to a determined value of the third parameter, transmitting information
related to the determined value of the third parameter, using the information related to the
determined value of the third parameter for scheduling of signals exchanged with the
25 second node (10, 20), and performing switching between the first signal and the second
signal based on the determined value of the third parameter.

72. The method of any of Claims 65 and 67-71, wherein the at least one
operational task comprises at least one of transmitting the at least one of the first

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signal and the second signal to the second node (10, 20) and receiving the at least one of the first signal and the second signal from the second node (10, 20).

5 73. The method of any of Claims 65 and 67-72, wherein the second node (10, 20) is a second wireless device (20).

 74. The method of any of Claims 65 and 67-73, wherein the second node (10, 20) is a network node (10).

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 75. The method of any of Claims 65 and 67-74, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency

15 Network, MBSFN, subframe.

 76. A wireless device (20) configured to switch between different numerologies supported by the wireless device (20) and a second node (10, 20), the wireless device (20) comprising processing circuitry (22) configured to:

20 determine at least one first parameter used by the wireless device (20) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

25 determine at least one second parameter used by the second node (10, 20) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology;

 determine a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter, the at least one of the at least one first parameter and the at least one second parameter includes an interruption time due to

30 switching; and

 use the third parameter for at least one operational task.

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77. (Cancelled)

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78. The wireless device (20) of Claim 76, wherein the at least one of the at least one first parameter and the at least one second parameter includes a predefined value corresponding to a maximum allowed interruption time due to switching.

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79. The wireless device (20) of any of Claims 76 and 78, wherein a value of the at least one first parameter is the same as a value of the at least one second parameter.

80. The wireless device (20) of any of Claims 76, 78 and 79, wherein a value of the at least one first parameter is different than a value of the at least one second parameter.

81. The wireless device (20) of any of Claims 76 and 78-80, wherein the at least one second parameter is determined based on at least one of predefined information, receiving information about the at least one second parameter associated with the second node (10, 20) from another node (10, 20), at least one of statistics and historical data, and feedback from the second node (10, 20).

82. The wireless device (20) of any of Claims 76 and 78-81, wherein the at least one operational task includes at least one of configuring the second node (10, 20) with information related to a determined value of the third parameter, transmitting information related to the determined value of the third parameter, using the information related to the determined value of the third parameter for scheduling of signals exchanged with the second node (10, 20), and performing switching between the first signal and the second signal based on the determined value of the third parameter.

83. The wireless device (20) of any of Claims 76 and 78-82, wherein the at least one operational task comprises at least one of transmitting the at least one of the first signal and the second signal to the second node (10, 20) and receiving the at least one of the first signal and the second signal from the second node (10, 20).

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84. The wireless device (20) of any of Claims 76 and 78-83, wherein the second node (10, 20) is a second wireless device (20).

5 85. The wireless device (20) of any of Claims 76 and 78-84, wherein the second node (10, 20) is a network node (10).

86. The wireless device (20) of any of Claims 76 and 78-85, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast
10 Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

87. A method in a network node (10) for switching between different
15 numerologies supported by the network node (10) and another node (10, 20), the method comprising:

receiving from the other node information regarding at least one first parameter to be used by the network node (10) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology
20 being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing (S240);

switching between the first signal and the second signal based at least upon the received information regarding the at least one first parameter (S250), the at least one first
25 parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and

after the switching, operating at least one of the first signal and the second signal between the network node (10) and the other node (10, 20) (S260).

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88. (Cancelled)

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89. (Cancelled)

90. The method of Claim 87, further comprising:

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transmitting to the other node information regarding at least one second parameter used by the network node (10) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology.

5

91. The method of Claim 90, wherein the information regarding the at least one second parameter used by the network node (10) transmitted to the other node (10, 20) is transmitted in response to receiving a request by the other node (10, 20).

10

92. The method of any of Claims 87 and 90-91, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

15

93. A network node (10) configured to switch between different numerologies supported by the network node (10) and another node (10, 20), the network node (10) comprising:

a communications interface configured to:

20

receive from the other node (10, 20) information regarding at least one first parameter to be used by the network node (10) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being

25

different from the first subcarrier spacing; and

processing circuitry (12) configured to:

30

switch between the first signal and the second signal based at least upon the received information regarding the at least one first parameter, the at least one first parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and

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after the switching, operate at least one of the first signal and the second
signal between the network node (10) and the other node (10, 20).

5 94. (Cancelled)

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95. (Cancelled)

96. The network node (10) of Claim 93, wherein the communications interface
5 is further configured to:

transmit to the other node (10, 20) information regarding at least one second
parameter used by the network node (10) for switching between the first signal operating
with the first numerology and the second signal operating with the second numerology.

10 97. The network node (10) of Claim 96, wherein the information regarding the
at least one second parameter used by the network node (10) transmitted to the other node
(10, 20) is transmitted in response to receiving a request by the other node (10, 20).

15 98. The network node (10) of any of Claims 93 and 96-97, wherein one of the
first signal and the second signal is comprised in at least one non-Multimedia Broadcast
Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the
second signal is comprised in at least one Multimedia Broadcast Single Frequency
Network, MBSFN, subframe.

20 99. A method in a wireless device (20) for switching between different
numerologies supported by the wireless device (20) and another node (10, 20), the method
comprising:

receiving from the other node (10, 20) information regarding at least one first
parameter to be used by the wireless device (20) for switching between a first signal
25 operating with a first numerology and a second signal operating with a second
numerology, the first numerology being a first subcarrier spacing and the second
numerology being a second subcarrier spacing, the second subcarrier spacing being
different from the first subcarrier spacing (S270);

switching between the first signal and the second signal based at least upon the
30 received information regarding the at least one first parameter (S280), the at least one first
parameter including a predefined value corresponding to a maximum allowed interruption

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time due to switching from the first numerology of the first signal to the second
numerology of the second signal; and

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after the switching, operating at least one of the first signal and the second signal between the wireless device (20) and the other node (10, 20) (S290).

5 100. (Cancelled)

101. (Cancelled)

10 102. The method of Claim 99, further comprising:
transmitting to the other node (10, 20) information regarding at least one second parameter used by the wireless device (20) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology.

15 103. The method of Claim 102, wherein the information regarding the at least one second parameter used by the wireless device (20) transmitted to the other node (10, 20) is transmitted in response to receiving a request by the other node (10, 20).

20 104. The method of any of Claims 99 and 102-103, wherein one of the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first signal and the second signal is comprised in at least one Multimedia Broadcast Single Frequency Network, MBSFN, subframe.

25 105. A wireless device (20) configured to switch between different numerologies supported by the wireless device (20) and another node (10, 20), the wireless device (20) comprising:
a communications interface configured to:
receive from the other node (10, 20) information regarding at least one first parameter to be used by the wireless device (20) for switching between a first

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signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being

5 different from the first subcarrier spacing; and

processing circuitry (22) configured to:

switch between the first signal and the second signal based at least upon the received information regarding the at least one first parameter, the at least one first

10 parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and

after the switching, operate at least one of the first signal and the second signal between the wireless device (20) and the other node (10, 20).

15 106. (Cancelled)

107. (Cancelled)

108. The wireless device (20) of Claim 105, wherein the communications

20 interface is further configured to:

transmit to the other node (10, 20) information regarding at least one second parameter used by the wireless device (20) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology.

25 109. The wireless device (20) of Claim 108, wherein the information regarding the at least one second parameter used by the wireless device (20) transmitted to the other node (10, 20) is transmitted in response to receiving a request by the other node (10, 20).

110. The wireless device (20) of any of Claims 105 and 108-109, wherein one of

30 the first signal and the second signal is comprised in at least one non-Multimedia Broadcast Single Frequency Network, non-MBSFN, subframe and the other of the first

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signal and the second signal is comprised in at least one Multimedia Broadcast Single
Frequency Network, MBSFN, subframe.

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111. A network node (10) configured to switch between different numerologies supported by the network node (10), the network node (10) comprising:

a parameter determination module (32) configured to:

5 determine at least one parameter that can be used by the network node (10) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

10 a signal switching module (34) configured to:

switch between the first signal and the second signal based on the at least one parameter, the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and

15 a signal operation module (36) configured to:

after the switching, operate at least one of the first signal and the second signal between the network node (10) and a second node (10, 20).

112. A wireless device (20) configured to switch between different numerologies supported by the wireless device (20), the wireless device (20) comprising:

a parameter determination module (38) configured to:

20 determine at least one parameter that can be used by the wireless device (20) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

25 a signal switching module (40) configured to:

switch between the first signal and the second signal based on the at least one parameter, the at least one parameter including a predefined value corresponding to a maximum allowed interruption time due to switching from the first numerology of the first signal to the second numerology of the second signal; and

30 a signal operation module (42) configured to:

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after the switching, operate at least one of the first signal and the second signal between the wireless device (20) and a second node (10, 20).

- 5 113. A network node (10) configured to switch between different numerologies supported by the network node (10), the network node (10) comprising:
a parameter determination module (32) configured to:

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determine at least one first parameter used by the network node (10) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

determine at least one second parameter used by the second node (10, 20) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology; and

determine a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter, the at least one of the at least one first parameter and the at least one second parameter including an interruption time due to switching; and

a parameter implementation module (44) configured to:

use the third parameter for at least one operational task.

114. A wireless device (20) configured to switch between different numerologies supported by the wireless device (20), the wireless device (20) comprising:

a parameter determination module (38) configured to:

determine at least one first parameter used by the wireless device (20) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being different from the first subcarrier spacing;

determine at least one second parameter used by the second node (10, 20) for switching between the first signal operating with the first numerology and the second signal operating with the second numerology; and

determine a third parameter that is a function of at least one of the at least one first parameter and the at least one second parameter, the at least one of the at least one first parameter and the at least one second parameter including an interruption time due to switching; and

a parameter implementation module (46) configured to:

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use the third parameter for at least one operational task.

115. A network node (10) configured to switch between different numerologies
5 supported by the network node (10) and another node (10, 20), the network node (10)
comprising:

a communications interface module (48) configured to:

receive from the other node (10, 20) information regarding at least one first
parameter to be used by the network node (10) for switching between a first

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signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being
5 different from the first subcarrier spacing;
a signal switching module (34) configured to:
switch between the first signal and the second signal based at least upon the received information regarding the at least one first parameter, the at least one first parameter including a predefined value corresponding to a maximum allowed interruption
10 time due to switching from the first numerology of the first signal to the second numerology of the second signal; and
a signal operation module (36) configured to:
after the switching, operate at least one of the first signal and the second signal between the network node (10) and the other node (10, 20).

15

116. A wireless device (20) configured to switch between different numerologies supported by the wireless device (20) and another node (10, 20), the wireless device (20) comprising:

a communications interface module (50) configured to:
20 receive from the other node (10, 20) information regarding at least one first parameter to be used by the wireless device (20) for switching between a first signal operating with a first numerology and a second signal operating with a second numerology, the first numerology being a first subcarrier spacing and the second numerology being a second subcarrier spacing, the second subcarrier spacing being
25 different from the first subcarrier spacing;
a signal switching module (40) configured to:
switch between the first signal and the second signal based at least upon the received information regarding the at least one first parameter, the at least one first parameter including a predefined value corresponding to a maximum allowed interruption
30 time due to switching from the first numerology of the first signal to the second numerology of the second signal; and
a signal operation module (42) configured to:

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after the switching, operate at least one of the first signal and the second
signal between the wireless device (20) and the other node (10, 20).

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