PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
YOON & LEE INTERNATIONAL PATENT & LAW FIRM

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)* **10 March 2020 (10.03.2020)**

Applicant's or agent's file reference
F201908-0003

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/KR2019/016957	**03 December 2019 (03.12.2019)**	04 December 2018 (04.12.2018)

International Patent Classification (IPC) or both national classification and IPC
H04B 17/19(2014.01)i, H04B 1/44(2006.01)i, H04B 17/14(2014.01)i

Applicant
SAMSUNG ELECTRONICS CO., LTD.

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

- [x] 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
- [x] 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 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/KR	Date of completion of this opinion	Authorized officer
International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	10 March 2020 (10.03.2020)	BYUN, Sung Cheal Telephone No. +82-42-481-8262

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2019/016957

Box No. I Basis of this 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 43*bis*.1(b))

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:
      ☐ in the form of an Annex C/ST.25 text file.
      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2019/016957

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)	Claims	1-15	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-15	NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:
D1: US 2010-0093282 A1 (RISTO MARTIKKALA et al.) 15 April 2010
D2: WO 2018-119153 A2 (INTEL CORPORATION et al.) 28 June 2018
D3: US 2014-0120968 A1 (RAYTHEON COMPANY) 01 May 2014

I. Novelty and Inventive Step (PCT Article 33(2) and (3))

1. Claims 1-13

1.1. Claim 1

D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses a mobile terminal comprising: Tx/Rx antennas (Ant1, Ant2); output terminals; a first transceiver module TRXM1; a second transceiver module TRXM2; and switching elements SW2, SW6 connected to output terminals (see paragraphs [0003], [0089]; and figure 3), and a mobile terminal, wherein: a RF signal is forwarded via an antenna loop leading from a Tx signal processing chain over the Tx/Rx antenna of the second transceiver module and the Tx/Rx antenna of the individually operated first transceiver module to a Rx signal processing chain of the first transceiver module; and a first signal measurement and adjustment block SAMB1 is specially adapted for performing a calibration based on a gain offset and/or phase mismatch measurement between a Tx baseband signal received from a common baseband processing unit and the RF signals received via antenna loop from transceiver module TRXM2 (see paragraphs [0074], [0093]).

Claim 1 differs from D1 in the features of: "a portable communication device comprising: a printed circuit board; and an antenna disposed on the printed circuit board". However, the different feature would be easily derived from the disclosure of D2 (see claim 16: a first and a

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second antenna disposed on a PCB).

It would have been obvious to a person skilled in the art to arrive at the matter defined in claim 1 by combining the teachings of D1 and D2. Therefore, claim 1 lacks an inventive step.

1.2. Claims 2-13

The additional feature of claim 2 would be easily derived from the disclosure of D2 (see paragraph [1189]; and claim 15: a printed circuit board (PCB) comprising a top layer and a bottom layer, wherein the IC chip comprises a transceiver and wherein the IC chip is connected to the top layer of the PCB, and an antenna elements can be placed on top and/or bottom of PCB).

The additional feature of claim 3 is considered to be a minor difference over the disclosure of D2, which falls under the general knowledge of a person skilled in the art.

The additional features of claims 4, 6 would be easily derived from the disclosure of D1 (see paragraph [0093]: “the first signal measurement and adjustment block SAMB1 is specially adapted for performing a calibration based on a gain offset and/or phase mismatch measurement between the Tx baseband signal received from the common baseband processing unit and the RF signals received via antenna loop from transceiver module TRXM2").

The additional feature of claim 5 would be easily derived from the disclosure of D1 (see paragraph [0030]: "the first transceiver module may additionally comprise at least one attenuation element with an adjustable attenuation factor for attenuating the signal amplitude of the coupled out RF transmit signal portion").

The additional features of claims 7-10 would be easily derived from the disclosure of D3 (see paragraph [0022]; and figure 1: "Antenna port 14 sees the quarter-wavelength line 18 plus an additional quarter-wavelength rotation, or open. Similarly, the antenna port 14 is connected (ON) to the Rx port when diode 26 is reverse biased. Antenna port 14 is connected to Rx port 20 through the quarter-wavelength transmission line 22").

The additional feature of claim 11 would be easily derived from the disclosure of D2 (see claim 88: "a first transceiver configured to receive a plurality of baseband signals, to up-convert the plurality of baseband signals to a horizontally polarized radio frequency (RF) signal in a first 5G frequency band and a vertically polarized RF signal in a 5G second frequency band").

The additional features of claims 12-13 would be easily derived from the disclosure of D2 (see paragraph [0641]: applications of mmWave technology can include WiGig and future 5G,

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and WiGig devices operate in the unlicensed 60 GHz band).

Therefore, claims 2-6, 11-13 lack an inventive step as being obvious over D1 in view of D2, and claims 7-10 lack an inventive step as being obvious over D1 in view of D2, further in view of D3.

2. Claim 14

Claim 14 relates to a portable communication device and has substantially the same technical features as those of claim 1 except for the feature of "perform calibration related to a signal path". However, the different feature would be easily derived from the disclosure of D1 (see paragraph [0093]: "the first signal measurement and adjustment block SAMB1 is specially adapted for performing a calibration based on a gain offset and/or phase mismatch measurement between the Tx baseband signal received from the common baseband processing unit and the RF signals received via antenna loop from transceiver module TRXM2").

It would have been obvious to a person skilled in the art to arrive at the matter defined in claim 14 by combining the teachings of D1 and D2. Therefore, claim 14 lacks an inventive step.

3. Claim 15

Claim 15 relates to a portable communication device, but claim 15 shares similar technical features with claim 1. Thus, the same reasoning as in claim 1 could be applied to claim 15.

It would have been obvious to a person skilled in the art to arrive at the matter defined in claim 15 by combining the teachings of D1 and D2. Therefore, claim 15 lacks an inventive step.

II. Industrial Applicability (PCT Article 33(4))

Claims 1-15 are industrially applicable.