PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	06 FEB 2007
Applicant's or agent's file reference CE13689N	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US06/20838	26 MAY 2006	21 June 2005

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H03F 1/30 (2006.01)
USPC - 330/149

Applicant MOTOROLA, INC.

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 43*bis*.1(a)(i) 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

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 66.1*bis*(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.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	08 December 2006	Blaine Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2005)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US06/20838

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. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material

      ☐ on paper

      ☐ in electronic form

   c. time of filing/furnishing

      ☐ contained in the international application as filed

      ☐ filed together with the international application in electronic form

      ☐ furnished subsequently to this Authority for the purposes of search

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US06/20838

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

1. Statement

Novelty (N)	Claims	4-10	YES
	Claims	1-3	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-10	NO
Industrial applicability (IA)	Claims	1-10	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-3 lack novelty under PCT Article 33(2) as being anticipated by French et al. (US 6,140,874 A).

Referring to claim 1, French et al. discloses a power amplifier (Fig. 14 and respective portions of the spec.), comprising: a non-linear low power pre-distortion amplifier (Fig. 14 ref. sign 105 and respective portions of the spec.) for transforming a carrier signal to a pre-distorted signal having a carrier component with out-of-phase nonlinear distortions; and a non-linear power amplifier (Fig. 14 ref. sign 102 and respective portions of the spec.) having non-linear characteristics similar to a portion of the non-linear low power pre-distortion amplifier for generating from the pre-distorted signal a transmission signal having an amplified carrier component with substantially diminished non-linear distortions.

Referring to claim 2, French et al. also discloses the non-linear low power pre-distortion amplifier comprising a non-linear low power amplifier (Fig. 14 ref. sign 102 and respective portions of the spec.) for generating from the carrier signal an amplified carrier component with non-linear distortions; an attenuator (Fig. 14 ref. sign 148 and respective portions of the spec.) coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; a phase shifter (Fig. 14 ref. sign 150 and respective portions of the spec.) coupled to the attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions; and a combining point (Fig. 20 ref. sign 162 and respective portions of the spec.) for generating the pre-distorted signal by combining the phase-shifted signal and the carrier signal.

Referring to claim 3, French et al. also discloses the non-linear power amplifier comprising a plurality of parallel non-linear power amplifiers (Fig. 15 ref. signs 154 and 156 and respective portions of the spec.).

Claims 4 and 5 lack an inventive step under PCT Article 33(3) as being obvious over French et al. (US 6,140,874 A) in view of Anderson et al. (US 6,646,505 B2).

Referring to claim 4, French et al. discloses the non-linear low power pre-distortion amplifier comprising: a first phase shifter (Fig. 14 ref. sign 150 and respective portions of the spec.) coupled to the carrier signal for generating a phase-shifted carrier signal; a non-linear low power amplifier (Fig. 14 ref. sign 102 and respective portions of the spec.) for generating from the carrier signal an amplified carrier component with non-linear distortions; and a first combining point (Fig. 20 ref. sign 162 and respective portions of the spec.) for combining the phase-shifted signal and the carrier signal, thereby generating a distortion signal having the out-of-phase attenuated nonlinear distortions; and a second combining point (Fig. 20 ref. sign 170 and respective portions of the spec.) for generating the pre-distorted signal by combining the phase-shifted carrier signal and the distortion signal, but fails to explicitly teach of a second attenuator coupled to the non-linear low power amplifier forgenerating an attenuated amplified carrier component with attenuated non-linear distortions; and a second phase shifter coupled to the second attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions. However, Anderson et al. discloses the non-linear low power pre-distortion amplifier comprising: a second attenuator (Fig. 3 ref. sign 80 and respective portions of the spec.) coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; and a second phase shifter (Fig. 2 ref. sign 54 and respective portions of the spec.) coupled to the second attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to have included the non-linear low power pre-distortion amplifier comprising: a second attenuator coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; and a second phase shifter coupled to the second attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions of Anderson et al. to the invention of French et al. in order to improve the linearity of an amplified output signal as suggested by Anderson et al. (col. 5 lines 50-55).

Referring to claim 5, French et al. further discloses the power amplifier comprising a delay element (Fig. 20 ref. sign 161a) for generating a delayed carrier signal, wherein the first combining point generates the distortion signal from combining the phase-shifted signal with the delayed carrier signal.

(Continued in Supplemental Box)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US06/20838

Supplemental Box

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Box V
2. Citations and Explanations

Claim 6 lacks an inventive step under PCT Article 33(3) as being obvious over Song et al. (US 2004/0179629 A1) in view of Leitch et al. (US 5,546,411 A).

Referring to claim 6, Song et al. discloses a base station, comprising: a receiver for receiving signals from a selective call radio (SCR); a transmitter for generating a transmission signal directed to the SCR; and a processor for controlling operations of the receiver and the transmitter, wherein the transmitter comprises: an up-converter (Fig. 1 ref. sign 138 and respective portions of the spec.) for transforming a signal at a first operating frequency to a carrier signal; a non-linear low power pre-distortion amplifier (Fig. 1 ref. signs 100 and 120 and respective portions of the spec.) for transforming the carrier signal to a pre-distorted signal having a carrier component with out-of-phase nonlinear distortions; and a non-linear power amplifier (Fig. 1 ref. sign 140 and respective portions of the spec.) having non-linear characteristics similar to a portion of the non-linear low power pre-distortion amplifier for generating from the pre-distorted signal a transmission signal for radiating from an antenna, wherein the transmission signal has an amplified carrier component with substantially diminished non-linear distortions, but fails to explicitly teach of a receiver for receiving signals from a selective call radio (SCR); a transmitter for generating a transmission signal directed to the SCR; and a processor for controlling operations of the receiver and the transmitter. However, Leitch et al. disclose a receiver (Fig. 2 ref. sign 204 and respective portions of the spec.) for receiving signals from a selective call radio (SCR); a transmitter (Fig. 2 ref. sign 202 and respective portions of the spec.) for generating a transmission signal directed to the SCR; and a processor (Fig. 2 ref. sign 203 and respective portions of the spec.) for controlling operations of the receiver and the transmitter. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to have included the receiver for receiving signals from a selective call radio (SCR); the transmitter for generating a transmission signal directed to the SCR; and the processor for controlling operations of the receiver and the transmitter of Leitch et al. to the invention of Song et al. in order to provide a high-efficiency method to transmit and receive radio signals as suggested by Song et al. (paragraph [0013]).

Claims 7-10 lack an inventive step under PCT Article 33(3) as being obvious over Song et al. (US 2004/0179629 A1) in view of Leitch et al. (US 5,546,411 A) in further view of Anderson et al. (US 6,646,505 B2).

Referring to claim 7, Song et al. and Leitch et al. (as discussed in the lack of inventive step of claim 6 above) disclose the non-linear low power pre-distortion amplifier, but fail to explicitly teach of the amplifier comprising a non-linear low power amplifier for generating from the carrier signal an amplified carrier component with non-linear distortions; an attenuator coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; a phase shifter coupled to the attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions; and a combining point for generating the pre-distorted signal by combining the phase-shifted signal and the carrier signal. However, Anderson et al. discloses a non-linear low power amplifier (Fig. 3 ref. sign 78 and respective portions of the spec.) for generating from the carrier signal an amplified carrier component with non-linear distortions; an attenuator (Fig. 3 ref. sign 76 and respective portions of the spec.) coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; a phase shifter (Fig. 3 ref. sign 82 and respective portions of the spec.) coupled to the attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions; and a combining point (Fig. 3 ref. sign 86 and respective portions of the spec.) for generating the pre-distorted signal by combining the phase-shifted signal and the carrier signal. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to have included a non-linear low power amplifier for generating from the carrier signal an amplified carrier component with non-linear distortions; an attenuator coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; a phase shifter coupled to the attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions; and a combining point for generating the pre-distorted signal by combining the phase-shifted signal and the carrier signal of Anderson et al. to the invention of Song et al. and Leitch et al. in order to improve the linearity of an amplified output signal as suggested by Anderson et al. (col. 5 lines 50-55).

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Referring to claim 8, Song et al. in view of Leitch et al. disclose the base station, but fail to explicitly teach of the non-linear low power pre distortion amplifier comprising: a first phase shifter coupled to the carrier signal for generating a phase-shifted carrier signal; a non-linear low power amplifier for generating from the carrier signal an amplified carrier component with non-linear distortions; a second attenuator coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; a second phase shifter coupled to the second attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions; and a first combining point for combining the phase shifted signal and the carrier signal, thereby generating a distortion signal having the out-of-phase attenuated nonlinear distortions; a second combining point for generating the pre-distorted signal by combining the phase-shifted carrier signal and the distortion signal. However, Anderson et al. discloses the non-linear low power pre-distortion amplifier comprising: a first phase shifter (Fig. 3 ref. sign 82 and respective portions of the spec.) coupled to the carrier signal for generating a phase-shifted carrier signal; a non-linear low power amplifier (Fig. 3 ref. sign 78 and respective portions of the spec.) for generating from the carrier signal an amplified carrier component with non-linear distortions; a second attenuator (Fig. 3 ref. sign 80 and respective portions of the spec.) coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; a second phase shifter (Fig. 2 ref. sign 54 and respective portions of the spec.) coupled to the second attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions; and a first combining point (Fig. 3 ref. sign 86 and respective portions of the spec.) for combining the phase-shifted signal and the carrier signal, thereby generating a distortion signal having the out-of-phase attenuated nonlinear distortions; a second combining point (Fig. 3 ref. sign 74 and respective portions of the spec.) for generating the pre-distorted signal by combining the phase-shifted carrier signal and the distortion signal. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to have included the non-linear low power pre-distortion amplifier comprising: a first phase shifter coupled to the carrier signal for generating a phase-shifted carrier signal; a non-linear low power amplifier for generating from the carrier signal an amplified carrier component with non-linear distortions; a second attenuator coupled to the non-linear low power amplifier for generating an attenuated amplified carrier component with attenuated non-linear distortions; a second phase shifter coupled to the second attenuator for generating a phase-shifted signal having an out-of-phase attenuated carrier component with out-of-phase attenuated non-linear distortions; and a first combining point for combining the phase-shifted signal and the carrier signal, thereby generating a distortion signal having the out-of-phase attenuated nonlinear distortions; a second combining point for generating the pre-distorted signal by combining the phase-shifted carrier signal and the distortion signal of Anderson et al. to the invention of Song et al. and Leitch et al. in order to improve the linearity of an amplified output signal as suggested by Anderson et al. (col. 5 lines 50-55).

Referring to claim 9, Song et al. in view of Leitch et al. disclose the base station comprising a first delay element (Fig. 1 ref. sign 108 and respective portions of the spec.) for generating a first delayed carrier signal, wherein the first attenuator is coupled to the first delay element for generating the attenuated signal; a second delay element (Fig. 1 ref. sign 122 and respective portions of the spec.) for generating a second delayed carrier signal, wherein the first combining point generates the distortion signal from combining the phase-shifted signal with the second delayed carrier signal; but fails to explicitly teach of a first attenuator for generating a first attenuated carrier signal, wherein the first phase shifter generates the phase-shifted signal carrier signal from the first attenuated carrier signal; a first detector for controlling gain and phase of the first attenuator and the first phase shifter, respectively, according to characteristics desired in the phase-shifted carrier signal; and a second detector for controlling gain and phase of the second attenuator and the second phase shifter,respectively, according to characteristics desired in the distortion signal. However, Anderson et al. discloses a first attenuator (Fig. 3 ref. sign 76 and respective portions of the spec.) for generating a first attenuated carrier signal, wherein the first phase shifter (Fig. 3 ref. sign 82 and respective portions of the spec.) generates the phase-shifted signal carrier signal from the first attenuated carrier signal; a first detector (Fig. 3 ref. sign 84 and respective portions of the spec.) for controlling gain and phase of the first attenuator and the first phase shifter, respectively, according to characteristics desired in the phase-shifted carrier signal; and a second detector (Fig. 3 ref. sign 74 and respective portions of the spec.) for controlling gain and phase of the second attenuator and the second phase shifter (Fig. 2 ref. sign 54 and respective portions of the spec.) respectively, according to characteristics desired in the distortion signal. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to have included the first attenuator for generating a first attenuated carrier signal, wherein the first phase shifter generates the phase-shifted signal carrier signal from the first attenuated carrier signal; the first detector for controlling gain and phase of the first attenuator and the first phase shifter, respectively, according to characteristics desired in the phase-shifted carrier signal; and the second detector for controlling gain and phase of the second attenuator and the second phase shifter, respectively, according to characteristics desired in the distortion signal of Anderson et al. to the invention Song et al. and Leitch et al. in order to improve the linearity of an amplified output signal as suggested by Anderson et al. (col. 5 lines 50-55).

Referring to claim 10, Song et al. in view of Leitch et al. disclose the non-linear power amplifier (Fig. 1 ref. sign 140 and respective portions of the spec.), but fail to explicitly teach of a plurality of parallel non-linear power amplifiers. However, Anderson et al. discloses a plurality of parallel non-linear power amplifiers (Fig. 3 ref. sign 62 and respective portions of the spec.). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to have included the plurality of parallel non-linear power amplifiers of Anderson et al. to the invention of Song et al. and Leitch et al. in order to output a linearized amplified signal that eliminates distortion (Song et al., paragraph [0013]).

Claims 1-10 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US06/20838

Supplemental Box

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Referring to claim 10, Song et al. and Leitch et al. disclose the non-linear power amplifier (Fig. 1 ref. sign 140 and respective portions of the spec.), but fail to explicitly teach of a plurality of parallel non-linear power amplifiers. However, Anderson et al. discloses a plurality of parallel non-linear power amplifiers (Fig. 3 ref. sign 62 and respective portions of the spec.). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to have included the plurality of parallel non-linear power amplifiers of Anderson et al. to the invention of Song et al. and Leitch et al. in order to output a linearized amplified signal that eliminates distortion as suggested by (Song et al. paragraph [0013]).

Claims 1-10 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.