Claims

【Claim 1】

A portable communication device comprising:

a processor positioned in a first printed circuit board;

a communication circuit; and

an antenna module comprising:

_____a second printed circuit board;

_____a first antenna and a second antenna positioned in the second printed circuit board;

_____a first transmission-reception circuit positioned in the second printed circuit board, wherein the first transmission-reception circuit comprisesing a power amplifier for amplifying a signal to be transmitted through the first antenna, and a first low noise amplifier for amplifying a signal received through the first antenna, wherein the power amplifier formsing a portion of a transmission path electrically connected with the communication circuit and the first antenna, wherein the first low noise amplifier formsing a portion of a first reception path electrically connected with the communication circuit and the first antenna, and wherein the transmission path or the first reception path in the first transmission-reception circuit is selectively provided by the communication circuit; and

_____a first reception circuit positioned in the second printed circuit board, wherein the first reception circuit does not comprise a power amplifier for amplifying a signal to be transmitted through the second antenna, and comprises a second low noise amplifier for amplifying a signal received through the second antenna, and wherein the second low noise amplifier formsing a portion of a second reception path electrically connected with the communication circuit and the second antenna;

_____a second transmission-reception circuit positioned in the second printed circuit

board;

a second reception circuit positioned in the second printed circuit board;

a first coupler electrically connected with the first transmission-reception circuit and the second transmission-reception circuit and configured to couple first reception signals outputted from the first transmission-reception circuit and the second transmission-reception circuit, and output the coupled first reception signals as one reception signal; and

a second coupler electrically connected with the first reception circuit and the second reception circuit and configured to couple second reception signals outputted from the first reception circuit and the second reception circuit, and output the coupled second reception signals as one reception signal.

~~【Claim 2】~~

~~The portable communication device of claim 1, further comprising:~~

~~a second transmission-reception circuit positioned in the second printed circuit board;~~

~~a second reception circuit positioned in the second printed circuit board;~~

~~a first coupler electrically connected with the first transmission-reception circuit and the second transmission-reception circuit; and~~

~~a second coupler electrically connected with the first reception circuit and the second reception circuit.~~

【Claim 2~~3~~】

The portable communication device of claim 1~~2~~, further comprising:

a first front end chip in which the first transmission-reception circuit, the second transmission-reception circuit, and the first coupler are positioned; and

a second front end chip in which the first reception circuit, the second reception circuit, and the second coupler are positioned.

【Claim 3~~4~~】

The portable communication device of claim 1~~2~~, further comprising:

a front end chip in which the first transmission-reception circuit, the second transmission-reception circuit, and the first coupler are positioned; and

a radio frequency integrated circuit (RFIC) in which the first reception circuit, the second reception circuit, and the second coupler are positioned.

【Claim 45】

The portable communication device of claim 12, further comprising:

a first front end chip in which the first transmission-reception circuit and the second transmission-reception circuit are positioned;

a second front end chip in which the first reception circuit and the second reception circuit are positioned; and

a radio frequency integrated circuit (RFIC)an RFIC in which the first coupler and the second coupler are positioned.

【Claim 56】

The portable communication device of claim 12, further comprising:

a radio frequency integrated circuit (RFIC) in which the first transmission-reception circuit, the second transmission-reception circuit, the first coupler, the first reception circuit, the second reception circuit, and the second coupler are positioned.

【Claim 67】

The portable communication device of claim 12, further comprising:

a third antenna and a fourth antenna which are positioned in the second printed circuit board,

wherein the third antenna is electrically connected with the second transmission-reception circuit, and

wherein the fourth antenna is electrically connected with the second reception circuit.

【Claim 78】

The portable communication device of claim 67, wherein the first antenna and the third

antenna are configured to operate as a first antenna array with respect to a wireless signal received by the communication circuit, and

wherein the second antenna and the fourth antenna are configured to operate as a second antenna array with respect to the wireless signal.

【Claim 8~~9~~】

The portable communication device of claim 7~~8~~, wherein the processor includes~~forms at least a portion of~~ a communication processor, and

wherein the communication processor is configured to:

form a first beam by using the first transmission-reception circuit, the second transmission-reception circuit, and the first antenna array; and

form a second beam by using the first reception circuit, the second reception circuit, and the second antenna array.

【Claim 9~~10~~】

The portable communication device of claim 8~~9~~, wherein the communication processor is further configured to:

perform an operation of forming the first beam such that the first beam faces a first surface of the portable communication device; and

perform an operation of forming the second beam such that the second beam faces a second surface different from the first surface.

【Claim 10~~11~~】

The portable communication device of claim 1, wherein the first antenna is positioned to face a first surface of the portable communication device,

wherein the second antenna is positioned to face a second surface different from the first surface,

wherein the first transmission-reception circuit is positioned to face a third surface which is opposite to the first surface, and

wherein the first reception circuit is positioned to face a fourth surface which is opposite to the second surface.

【Claim 11~~12~~】

The portable communication device of claim 1, wherein the second printed circuit board comprises a first rigid circuit board portion, a second rigid circuit board portion, and a flexible circuit board portion connected between the first rigid circuit board portion and the second rigid circuit board portion,

wherein the first antenna and the first transmission-reception circuit are positioned in the first rigid circuit board portion, and

wherein the second antenna and the first reception circuit are positioned in the second rigid circuit board portion.

【Claim 12~~13~~】

The portable communication device of claim 1, wherein the first antenna and the second antenna are configured to operate as an antenna array with respect to a wireless signal received by the communication circuit.

【Claim 13~~14~~】

The portable communication device of claim 1, wherein the first transmission-reception circuit comprises a first semiconductor formed with a first material, and

wherein the first reception circuit comprises a second semiconductor formed with a second material different from the first material.

【Claim 14~~15~~】

An antenna module comprising:

a printed circuit board;

a first antenna and a second antenna positioned in the printed circuit board;

a transmission-reception circuit positioned in the printed circuit board, wherein the transmission-reception circuit comprises~~ing~~ a power amplifier for amplifying a signal to be

transmitted through the first antenna, and a first low noise amplifier for amplifying a signal received through the first antenna, wherein the power amplifier formsing a portion of a transmission path electrically connected with a communication circuit and the first antenna, wherein the first low noise amplifier formsing a portion of a first reception path electrically connected with the communication circuit and the first antenna, and wherein the transmission path or the first reception path in the transmission-reception circuit is selectively provided by the communication circuit; and

a reception circuit positioned in the printed circuit board, wherein the reception circuit does not comprise a power amplifier for amplifying a signal to be transmitted through the second antenna, and comprises a second low noise amplifier for amplifying a signal received through the second antenna, and wherein the second low noise amplifier formsing a portion of a second reception path electrically connected with the communication circuit and the second antenna;

a second transmission-reception circuit positioned in the printed circuit board;

a second reception circuit positioned in the printed circuit board;

a first coupler electrically connected with the first transmission-reception circuit and the second transmission-reception circuit and configured to couple first reception signals outputted from the first transmission-reception circuit and the second transmission-reception circuit, and output the coupled first reception signals as one reception signal; and

a second coupler electrically connected with the first reception circuit and the second reception circuit and configured to couple second reception signals outputted from the first reception circuit and the second reception circuit, and output the coupled second reception signals as one reception signal.