

Claims

1. A Shared User Equipment-Side Distributed Antenna Component comprising:
 - 5 a backend transceiver,
 - a frontend transceiver, and
 - an evaluation signal generator;

10 wherein the backend transceiver is configured to receive an inbound signal from at least one base station using ultra-high frequencies and to output the inbound signal at intermediate frequencies;

15 wherein the evaluation signal generator is configured to create a frontend control portion comprising a frontend evaluation signal;

wherein the frontend transceiver is configured to generate an outbound signal using extremely high frequencies comprising the inbound signal using a relay bandwidth and further comprising the frontend control portion arranged below and

20 another frontend control portion arranged above the relay bandwidth and to transmit the outbound signal comprising the frontend control portions to a user equipment.

25

30
2. A system comprising:
 - 35 a transceiver of a user equipment, the transceiver comprising:

a receiving stage;

a frontend channel estimator;

5 a frontend channel equalizer;

a backend channel estimator; and

10 a backend channel equalizer;

wherein the receiving stage is configured to receive an inbound signal from a Shared User Equipment-Side Distributed Antenna Component, wherein the Shared User Equipment-Side Distributed Antenna Component enables a relay communication comprising a frontend communication using
15 extremely-high frequencies and a backend communication using ultra-high frequencies, wherein the inbound signal comprises a data portion, a backend control portion and a frontend control portion, the frontend control portion comprising a frontend evaluation signal and a configuration signal;

20 wherein the frontend channel estimator is configured to perform a channel estimation based on the frontend evaluation signal;

wherein the frontend channel equalizer is configured to equalize distortions, caused by using the extremely-high frequencies, based on the
25 channel estimation of the frontend channel estimator;

wherein the backend channel estimator is configured to perform a channel estimation based on the backend control portion; and

30 wherein the backend channel equalizer is configured to equalize distortions, caused by using the ultra-high frequencies, based on the channel estimation of the backend channel estimator; and

a Shared User Equipment-Side Distributed Antenna Component according to claim
35 1;

wherein the Shared User Equipment-Side Distributed Antenna Component and the transceiver establish a communication link using the receiving and transmitting stages of the transceiver and the frontend transceiver of the Shared User Equipment-Side Distributed Antenna Component; and

5

wherein the Shared User Equipment-Side Distributed Antenna Component and/or the transceiver are configured to perform a time synchronization based on an external, common time reference or based on a signal sent by the transceiver comprising a current time reference.

10

3. The system according to claim 2 comprising:

a plurality of receiving stages,

15

a common backend channel estimator for the plurality of receiving stages; and

a common backend channel equalizer for the plurality of receiving stages;

20

wherein the common backend channel estimator is configured to perform a combined channel estimation based on a plurality of backend control portions; and

wherein the common backend channel equalizer is configured to perform a combined channel equalization based on the results of the combined channel estimation.

25

4. The system according to claim 3 comprising a direct receiving stage configured to receive directly a signal from the base station;

30

wherein the common backend channel estimator is configured to perform a combined channel estimation based on the plurality of backend control portions and the signal received directly from the base station.

5. The system according to one of the claims 2-4,

35

wherein the transceiver comprises a frontend frequency estimator configured to perform a frontend frequency estimation based on the frontend control portion and

a frontend frequency compensator configured to perform a frontend frequency offset compensation based on the estimation; and/or

5 wherein the transceiver comprises a backend frequency estimator configured to perform a backend frequency estimation based on the backend control portion and a backend frequency compensator configured to perform a backend frequency offset compensation based on the estimation.

6. The system according to claims 2 - 5 comprising:
10

a transmitting stage; and

a frontend channel pre-estimator;

15 wherein the frontend channel pre-estimator is configured to calculate frontend channel coefficients in order to perform a channel pre-estimation based on the frontend evaluation signal in order to pre-compensate distortions which will be caused by using the extremely-high frequencies;

20 7. The system according to claim 6 comprising:

a backend channel pre-estimator;

25 wherein the backend channel pre-estimator is configured to calculate backend channel coefficients in order to perform a channel estimation based on the backend control portion in order to reduce distortions which will be caused by using the ultra-high frequencies.

8. The system according to claim 6 or 7, wherein the transmitting stage is configured
30 to transmit the frontend and/or backend channel characteristics and/or frontend and/or backend channel related parameters and/or frontend and/or backend signal processing related parameters to the Shared User Equipment-Side Distributed Antenna Component in order to remotely control the signal processing in the Shared User Equipment-Side Distributed Antenna Component.

35

9. The system according to one of the claims 2-8 comprising a signal processor;

wherein the signal processor is configured to calculate signal processing parameters in order to transmit the signal processing parameters to the Shared User Equipment-Side Distributed Antenna Component.

5

10. The system according to one of the claims 2-9,

wherein the data portion and the frontend control portion of an extremely-high frequency signal to be transmitted differ from each other with regard to a carrier
10 frequency, a code structure and/or a timeslot; and/or

wherein the data portion and the backend control portion of an ultra-high frequency signal to be transmitted differ from each other with regard to a carrier frequency, a code structure and/or a timeslot.

15

11. The system according to one of the claims 2-10, wherein the inbound signal comprises an additional frontend control portion having a different carrier frequency when compared to the frontend control portion and/or being shifted in time when compared to the frontend control portion.

20

12. The system according to one of the claims 2-11, wherein the frontend control portion and an additional frontend control portion are aligned in time and have different carrier frequencies in order to improve interpolation robustness or accuracy between further, subsequent frontend evaluation signals due to a joint
25 processing of the frontend control portion and the additional frontend control portion.

13. A system comprising:

30

a transceiver of a user equipment, the transceiver comprising:

a receiving stage;

a frontend channel estimator;

35

a frontend channel equalizer;

a backend channel estimator; and

a backend channel equalizer;

5

wherein the receiving stage is configured to receive an inbound signal from a Shared User Equipment-Side Distributed Antenna Component, wherein the Shared User Equipment-Side Distributed Antenna Component enables a relay communication comprising a frontend communication using
10 extremely-high frequencies and a backend communication using ultra-high frequencies, wherein the inbound signal comprises a data portion, a backend control portion and a frontend control portion, the frontend control portion comprising a frontend evaluation signal and a configuration signal;

15

wherein the frontend channel estimator is configured to perform a channel estimation based on the frontend evaluation signal;

20

wherein the frontend channel equalizer is configured to equalize distortions, caused by using the extremely-high frequencies, based on the channel estimation of the frontend channel estimator;

wherein the backend channel estimator is configured to perform a channel estimation based on the backend control portion; and

25

wherein the backend channel equalizer is configured to equalize distortions, caused by using the ultra-high frequencies, based on the channel estimation of the backend channel estimator; and

a Shared User Equipment-Side Distributed Antenna Component comprising:

30

a backend transceiver;

a backend channel equalizer; and

35

a frontend transceiver;

wherein the backend transceiver is configured to receive an inbound signal from a base station using ultra-high frequencies;

5 wherein the backend transceiver is configured to output the inbound signal at intermediate frequencies;

10 wherein the backend channel equalizer is configured to reduce the inbound signal from distortions caused by using the ultra-high frequencies, using a configuration signal received from a backend channel estimator of a user equipment via the frontend transceiver;

15 wherein the frontend transceiver is configured to output the inbound signal using extremely-high frequencies in order to generate an outbound signal and to transmit the outbound signal to the user equipment; or

wherein the frontend transceiver is configured to receive a configuration signal from the user equipment and to forward the configuration signal to the backend channel equalizer;

20 wherein the Shared User Equipment-Side Distributed Antenna Component and the transceiver establish a communication link using the receiving and transmitting stages of the transceiver and the frontend transceiver of the Shared User Equipment-Side Distributed Antenna Component; and

25 wherein the Shared User Equipment-Side Distributed Antenna Component and/or the transceiver are configured to perform a time synchronization based on an external, common time reference or based on a signal sent by the transceiver comprising a current time reference.

30 14. The system according to claim 13, the Shared User Equipment-Side Distributed Antenna Component comprising:

a frontend channel estimator;

35 a frontend channel pre-equalizer;

wherein the frontend channel estimator is configured to perform a channel estimation based on a frontend evaluation signal;

5 wherein the frontend channel pre-equalizer is configured to pre-equalize the inbound signal to reduce the distortions, which will be caused by using the extremely-high frequencies during transmission of the outbound signal, based on the channel estimation of the frontend channel estimator.

10 15. The system according to claim 13, the Shared User Equipment-Side Distributed Antenna Component comprising:

a frontend channel pre-equalizer;

15 wherein the frontend channel pre-equalizer is configured to pre-equalize the inbound signal to reduce the distortions, which will be caused by using the extremely-high frequencies during transmission of the outbound signal, based on the configuration signal received from a frontend channel estimator of the user equipment.

20 16. The system according to one of the claims 13-15, wherein the Shared User Equipment-Side Distributed Antenna Component comprises an encoder configured to encode and/or compress the inbound signal using signal processing parameters and/or compressing parameters received from the user equipment; and/or

25 wherein the Shared User Equipment-Side Distributed Antenna Component comprises a decoder configured to decode and/or decompress the outbound signal using decoding parameters and/or decompressing parameters received from the user equipment.

30 17. The system according to one of the claims 13-16,

wherein the frontend transceiver comprises a frontend frequency estimator configured to perform a frontend frequency estimation based on frontend control portion and a frontend frequency compensator configured to perform a frontend frequency offset compensation based on the estimation; and/or

35

wherein the backend transceiver comprises a backend frequency estimator configured to perform a backend frequency estimation based on backend control portion and a backend frequency compensator configured to perform a backend frequency offset compensation based on the estimation.

5

18. The system according to claim 17, wherein the Shared User Equipment-Side Distributed Antenna Component comprises a voltage controlled oscillator to obtain the frontend and/or backend frequency offset compensation, wherein an additional frontend control portion is a continuous wave signal used by the voltage controlled oscillator to perform an inverse frequency modulation.

10

19. The system according to one of the claims 1, 13-18, wherein the frontend transceiver is configured to receive an inbound signal from a user equipment using extremely-high frequencies;

15

wherein the backend transceiver is configured to transmit an outbound signal to a base station using ultra-high frequencies.

20. The system according to claim 19, comprising a frontend channel estimator and a frontend channel equalizer;

20

wherein the frontend channel estimator is configured to perform a channel estimation based on the frontend evaluation signal;

25 wherein the frontend channel equalizer is configured to equalize distortions, caused by using the extremely-high frequencies, based on the channel estimation of the frontend channel estimator.

25

21. The system according to one of the claims 13-20, wherein a frontend communication uses a frequency division duplex technique and wherein a backend communication uses a time division duplex technique.

30

22. The system according to one of the claims 2 to 21, wherein the system comprises a base station.

35

23. The system according to one of the claims 2 to 22, wherein the transceiver and/or the Shared User Equipment-Side Distributed Antenna Component use the backend control portion of the base station as a common time reference.
- 5 24. The system according to one of the claims 2 to 23,
- wherein the user equipment extracts a time reference from the backend control portion;
- 10 wherein the user equipment transmits the time reference to the Shared User Equipment-Side Distributed Antenna Component in order to obtain a common time reference.
25. The system according to one of the claims 2 to 24,
- 15 wherein the Shared User Equipment-Side Distributed Antenna Component is configured for simultaneously relaying two or more communication links serving one or more receiving and transmitting stages of the transceiver of one or more user equipments.
- 20
26. A method for signal processing in a Shared User Equipment-Side Distributed Antenna Component comprising the steps:
- 25
- receiving an inbound signal from at least one base station with a backend transceiver using ultra-high frequencies and to output the inbound signal at intermediate frequencies;
- 30
- creating a frontend control portion with an evaluation signal generator comprising a frontend evaluation signal ;
- generating an outbound signal with a frontend transceiver using extremely high frequencies comprising the inbound signal using a relay bandwidth and further
- 35 comprising the frontend control portion arranged below and another frontend

control portion arranged above the relay bandwidth and to transmit the outbound signal comprising the frontend control portions to a user equipment.

- 5 27. Computer readable digital storage medium having stored thereon a computer program having a program code for performing, when running on a computer, a method according to claim 26.