

Claims

1. A Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprising:
 - 5 a backend transceiver ~~(85)~~,
 - a frontend transceiver ~~(90)~~, and
 - 10 an evaluation signal generator ~~(95)~~;wherein the backend transceiver ~~(85)~~ is configured to receive an inbound signal ~~(105)~~ from at least one base station ~~(70)~~ using ultra-high frequencies and to output the inbound signal at intermediate frequencies;
- 15 wherein the evaluation signal generator ~~(95)~~ is configured to create a frontend control portion ~~(40)~~ comprising the frontend evaluation signal ~~(45)~~;
- 20 wherein the frontend transceiver ~~(90)~~ is configured to generate an outbound signal ~~(110)~~ using extremely high frequencies comprising the inbound signal ~~(105)~~ using a relay bandwidth ~~(185)~~ and further comprising the frontend control portion arranged below and another frontend control portion arranged above the relay bandwidth and to transmit the outbound signal ~~(110)~~ comprising the frontend control portions to a user equipment ~~(10)~~.
- 25 2. A transceiver ~~(5)~~ of a user equipment ~~(10)~~, the transceiver comprising:
 - a receiving stage ~~(15)~~;
 - a frontend channel estimator ~~(20)~~;
 - 30 a frontend channel equalizer ~~(21)~~;
 - a backend channel estimator ~~(22)~~; and
 - 35 a backend channel equalizer ~~(23)~~;

wherein the receiving stage ~~(15)~~ is configured to receive an inbound signal ~~(25)~~ from a Shared User Equipment-Side Distributed Antenna Component ~~(30)~~, wherein the Shared User Equipment-Side Distributed Antenna Component enables a relay communication comprising a frontend communication using extremely-high frequencies and a backend communication using ultra-high frequencies, wherein the inbound signal ~~(25)~~ comprises a data portion ~~(35)~~, a backend control portion ~~(50)~~ and a frontend control portion ~~(40)~~, the frontend control portion comprising a frontend evaluation signal ~~(45)~~ and a configuration signal ~~(46)~~;

wherein the frontend channel estimator ~~(20)~~ is configured to perform a channel estimation based on the frontend evaluation signal ~~(45)~~;

wherein the frontend channel equalizer ~~(21)~~ is configured to equalize distortions, caused by using the extremely-high frequencies, based on the channel estimation of the frontend channel estimator ~~(20)~~;

wherein the backend channel estimator ~~(22)~~ is configured to perform a channel estimation based on the backend control portion ~~(50)~~; and

wherein the backend channel equalizer ~~(23)~~ is configured to equalize distortions, caused by using the ultra-high frequencies, based on the channel estimation of the backend channel estimator ~~(22)~~.

3. The transceiver ~~(5)~~ according to claim 2 comprising:

a plurality of receiving stages ~~(15)~~,

a common backend channel estimator ~~(22)~~ for the plurality of receiving stages ~~(15)~~; and

a common backend channel equalizer ~~(23)~~ for the plurality of receiving stages ~~(15)~~;

wherein the common backend channel estimator ~~(22)~~ is configured to perform a combined channel estimation based on a plurality of backend control portions ~~(50)~~; and

wherein the common backend channel equalizer ~~(23)~~ is configured to perform a combined channel equalization based on the results of the combined channel estimation.

- 5 4. The transceiver ~~(5)~~ according to claim 3 comprising a direct receiving stage ~~(16)~~ configured to receive directly a signal from the base station ~~(70)~~;

10 wherein the common backend channel estimator ~~(22)~~ is configured to perform a combined channel estimation based on the plurality of backend control portions ~~(50)~~ and the signal received directly from the base station.

- 15 5. The transceiver ~~(5)~~ according to one of the claims 2-4,

wherein the transceiver ~~(5)~~ comprises a frontend frequency estimator ~~(17)~~ configured to perform a frontend frequency estimation based on the frontend control portion ~~(40)~~ and a frontend frequency compensator ~~(18)~~ configured to perform a frontend frequency offset compensation based on the estimation; and/or

20 wherein the transceiver ~~(5)~~ comprises a backend frequency estimator ~~(19)~~ configured to perform a backend frequency estimation based on the backend control portion ~~(50)~~ and a backend frequency compensator ~~(24)~~ configured to perform a backend frequency offset compensation based on the estimation.

- 25 6. The transceiver ~~(5)~~ according to claims 2 - 5 comprising:

a transmitting stage ~~(55)~~; and

a frontend channel pre-estimator ~~(65)~~;

30 wherein the frontend channel pre-estimator ~~(65)~~ is configured to calculate frontend channel coefficients in order to perform a channel pre-estimation based on the frontend evaluation signal ~~(45)~~ in order to pre-compensate distortions which will be caused by using the extremely-high frequencies;

- 35 7. The transceiver ~~(5)~~ according to claim 6 comprising:

a backend channel pre-estimator ~~(66)~~;

wherein the backend channel pre-estimator ~~(66)~~ is configured to calculate backend channel coefficients in order to perform a channel estimation based on the backend control portion ~~(50)~~ in order to reduce distortions which will be caused by using the ultra-high frequencies.

8. The transceiver ~~(5)~~ according to claim 6 or 7, wherein the transmitting stage ~~(55)~~ is configured 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 ~~(30)~~ in order to remotely control the signal processing in the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~.

9. The transceiver ~~(5)~~ according to one of the claims 2-8 comprising a signal processor ~~(68)~~;

wherein the signal processor ~~(68)~~ is configured to calculate signal processing parameters in order to transmit the signal processing parameters to the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~.

10. The transceiver ~~(5)~~ according to one of the claims 2-9,

wherein the data portion ~~(35)~~ and the frontend control portion ~~(40)~~ of an extremely-high frequency signal to be transmitted differ from each other with regard to a carrier frequency, a code structure and/or a timeslot; and/or

wherein the data portion ~~(35)~~ and the backend control portion ~~(50)~~ 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.

11. The transceiver ~~(5)~~ according to one of the claims 2-10, wherein the inbound signal ~~(25)~~ comprises an additional frontend control portion ~~(42, 200)~~ having a different carrier frequency when compared to the frontend control portion ~~(40, 175)~~ and/or being shifted in time when compared to the frontend control portion ~~(40)~~.

12. The transceiver ~~(5)~~ according to one of the claims 2-11, wherein the frontend control portion ~~(40, 175)~~ and an additional frontend control portion ~~(42, 200)~~ are aligned in time and have different carrier frequencies in order to improve interpolation robustness or accuracy between further, subsequent frontend evaluation signals ~~(45, 220)~~ due to a joint processing of the frontend control portion ~~(40, 175)~~ and the additional frontend control portion ~~(42, 200)~~.
13. A Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprising:
- a backend transceiver ~~(85)~~;
- a backend channel equalizer ~~(86)~~; and
- a frontend transceiver ~~(90)~~;
- wherein the backend transceiver ~~(85)~~ is configured to receive an inbound signal ~~(105)~~ from a base station ~~(70)~~ using ultra-high frequencies;
- wherein the backend transceiver ~~(85)~~ is configured to output the inbound signal ~~(105)~~ at intermediate frequencies;
- wherein the backend channel equalizer ~~(86)~~ is configured to reduce the inbound signal from distortions caused by using the ultra-high frequencies, using a configuration signal ~~(46)~~ received from a backend channel estimator ~~(22)~~ of a user equipment ~~(10)~~ via the frontend transceiver ~~(90)~~;
- wherein the frontend transceiver ~~(90)~~ is configured to output the inbound signal using extremely-high frequencies in order to generate an outbound signal ~~(110)~~ and to transmit the outbound signal ~~(110)~~ to the user equipment ~~(10)~~; or
- wherein the frontend transceiver ~~(90)~~ is configured to receive a configuration signal ~~(46)~~ from the user equipment ~~(10)~~ and to forward the configuration signal to the backend channel equalizer ~~(86)~~.

14. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to claim 13, the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprising:
- 5 a frontend channel estimator ~~(91)~~;
- a frontend channel pre-equalizer ~~(92)~~;
- 10 wherein the frontend channel estimator ~~(91)~~ is configured to perform a channel estimation based on a frontend evaluation signal ~~(45)~~;
- wherein the frontend channel pre-equalizer ~~(92)~~ is configured to pre-equalize the inbound signal ~~(105)~~ to reduce the distortions, which will be caused by using the extremely-high frequencies during transmission of the outbound signal ~~(110)~~, based on the channel estimation of the frontend channel estimator ~~(91)~~.
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15. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to claim 13, the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprising:
- 20 a frontend channel pre-equalizer ~~(92)~~;
- wherein the frontend channel pre-equalizer ~~(92)~~ is configured to pre-equalize the inbound signal ~~(105)~~ to reduce the distortions, which will be caused by using the extremely-high frequencies during transmission of the outbound signal ~~(110)~~, based on the configuration signal ~~(46)~~ received from a frontend channel estimator ~~(20)~~ of the user equipment ~~(10)~~.
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16. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to one of the claims 13-15, wherein the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprises an encoder ~~(93)~~ configured to encode and/or compress the inbound signal ~~(105)~~ using signal processing parameters and/or compressing parameters received from the user equipment ~~(10)~~; and/or
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- wherein the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprises a decoder ~~(94)~~ configured to decode and/or decompress the outbound
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signal using decoding parameters and/or decompressing parameters received from the user equipment ~~(10)~~.

17. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to one of the claims 13-16,

wherein the frontend transceiver ~~(90)~~ comprises a frontend frequency estimator ~~(96)~~ configured to perform a frontend frequency estimation based on frontend control portion ~~(40)~~ and a frontend frequency compensator ~~(97)~~ configured to perform a frontend frequency offset compensation based on the estimation; and/or

wherein the backend transceiver ~~(85)~~ comprises a backend frequency estimator ~~(98)~~ configured to perform a backend frequency estimation based on backend control portion ~~(50)~~ and a backend frequency compensator ~~(99)~~ configured to perform a backend frequency offset compensation based on the estimation.

18. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to claim 17, wherein the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprises a voltage controlled oscillator to obtain the frontend and/or backend frequency offset compensation, wherein an additional frontend control portion ~~(42)~~ is a continuous wave signal used by the voltage controlled oscillator to perform an inverse frequency modulation.

19. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to one of the claims 1, 13-18, wherein the frontend transceiver ~~(90)~~ is configured to receive an inbound signal ~~(150)~~ from a user equipment ~~(10)~~ using extremely-high frequencies;

wherein the backend transceiver ~~(85)~~ is configured to transmit an outbound signal ~~(165)~~ to a base station ~~(70)~~ using ultra-high frequencies.

20. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to claim 19, comprising a frontend channel estimator ~~(91)~~ and a frontend channel equalizer ~~(92a)~~;

wherein the frontend channel estimator ~~(91)~~ is configured to perform a channel estimation based on the frontend evaluation signal ~~(45)~~;

wherein the frontend channel equalizer ~~(92a)~~ is configured to equalize distortions, caused by using the extremely-high frequencies, based on the channel estimation of the frontend channel estimator ~~(91)~~.

21. The Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ 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.

22. A system ~~(700)~~ comprising:

a transceiver ~~(5)~~ according to claims 2-12; and

a Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ according to claims 1 or 13-21;

wherein the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ and the transceiver ~~(5)~~ establish a communication link using the receiving and transmitting stages ~~(15, 55)~~ of the transceiver ~~(5)~~ and the frontend transceiver ~~(90)~~ of the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~; and

wherein the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ and/or the transceiver ~~(5)~~ are configured to perform a time synchronization based on an external, common time reference or based on a signal sent by the transceiver ~~(5)~~ comprising a current time reference.

23. The system ~~(700)~~ according to claim 22, wherein the system comprises a base station ~~(70)~~.

24. The system ~~(700)~~ according to claim 22 or 23, wherein the transceiver ~~(5)~~ and/or the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ use the backend control portion ~~(50)~~ of the base station as a common time reference.

25. The system ~~(700)~~ according to one of the claims 22-24,

wherein the user equipment extracts a time reference from the backend control portion ~~(50)~~;

wherein the user equipment transmits the time reference to the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ in order to obtain a common time reference.

26. The system ~~(700)~~ according to one of the claims 22-25,

wherein the Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ is configured for simultaneously relaying two or more communication links serving one or more receiving and transmitting stages ~~(15, 55)~~ of the transceiver ~~(5)~~ of one or more user equipments ~~(10)~~.

27. A method ~~(800)~~ for signal processing in a transceiver ~~(5)~~ comprising the steps:

receiving an inbound signal ~~(25)~~ from a Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ with a receiving stage ~~(15)~~, wherein the Shared User Equipment-Side Distributed Antenna Component enables a relay communication comprising a frontend communication using extremely-high frequencies and a backend communication using ultra-high frequencies, wherein the inbound signal ~~(25)~~ comprises a data portion ~~(35)~~, a backend control portion ~~(50)~~ and a frontend control portion ~~(40)~~, the frontend control portion comprising a frontend evaluation signal ~~(45)~~ and a configuration signal ~~(46)~~; and

performing a channel estimation with a frontend channel estimator ~~(20)~~ based on the frontend evaluation signal ~~(45)~~

equalizing distortions, caused by using the extremely-high frequencies, with a frontend channel equalizer ~~(21)~~ based on the channel estimation of the frontend channel estimator ~~(20)~~;

performing a channel estimation with a backend channel estimator ~~(22)~~ based on the control portion ~~(50)~~; and

equalizing distortions, caused by using the ultra-high frequencies, with a backend channel equalizer ~~(23)~~ based on the channel estimation of the backend channel estimator ~~(22)~~.

- 5 28. A method for signal processing in a Shared User Equipment-Side Distributed Antenna Component ~~(30)~~ comprising the steps:

receiving an inbound signal ~~(105)~~ from at least one base station ~~(70)~~ with a backend transceiver using ultra-high frequencies and to output the inbound signal at intermediate frequencies;

creating a frontend control portion ~~(40)~~ with an evaluation signal generator ~~(95)~~ comprising the frontend evaluation signal ~~(45)~~;

15 generating an outbound signal ~~(110)~~ with a frontend transceiver using extremely high frequencies comprising the inbound signal ~~(105)~~ using a relay bandwidth and further comprising the frontend control portion arranged below ~~(40)~~ and another frontend control portion arranged above the relay bandwidth and to transmit the outbound signal ~~(110)~~ comprising the frontend control portions to a user equipment ~~(10)~~.

- 20 29. A method ~~(1000)~~ for signal processing in a Shared User Equipment-Side Distributed Antenna Component comprising the steps:

25 receiving an inbound signal ~~(105)~~ from a base station ~~(70)~~ with a backend transceiver ~~(85)~~ using ultra-high frequencies;

outputting the inbound signal ~~(105)~~ at intermediate frequencies with a backend transceiver ~~(85)~~;

30 reducing the inbound signal from distortions caused by using the ultra-high frequencies with a backend channel equalizer ~~(86)~~, using the configuration signal ~~(46)~~ received from a backend channel estimator of the user equipment ~~(10)~~; and/or

outputting the inbound signal with a frontend transceiver ~~(90)~~ using extremely-high frequencies in order to generate an outbound signal ~~(110)~~ and to transmit the outbound signal ~~(110)~~ to a user equipment ~~(10)~~.

- 5 30. 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 one of the claims 27-29.