DISTRIBUTED RADIO FREQUENCY COMMUNICATION SYSTEMS FOR AUTOMOTIVE

BACKGROUND

Technical Field

[0001] Embodiments of the invention relate to electronic systems, and in particular, to radio frequency (RF) electronics.

Description of Related Technology

[0002] Radio frequency (RF) communication systems transmit and receive RF signals via antennas. RF signals have a frequency in the range from about 30 kHz to 300 GHz, for instance, in the range of about 400 MHz to about 7.125 GHz for Frequency Range 1 (FR1) of the Fifth Generation (5G) communication standard or in the range of about 24.250 GHz to about 71.000 GHz for Frequency Range 2 (FR2) of the 5G communication standard.

SUMMARY

[0003] In an aspect, the present disclosure relates to a distributed radio frequency communication system for an automobile, the distributed radio frequency communication system including a digital processing circuit, cabling, a first serializer/deserializer circuit electrically connected between the digital processing circuit and the cabling, a first radio frequency module, and a second serializer/deserializer circuit electrically connected between the first radio frequency module and the cabling. The first serializer/deserializer circuit and the second serializer/deserializer circuit are configured to communicate digital data over the cabling.

[0004] In various examples, the cabling includes a twisted pair.

[0005] In a number of examples, the cabling includes an Ethernet cable.

[0006] In several examples, the digital processing circuit includes a baseband processor.

[0007] In some examples, the first radio frequency module includes at least one transceiver and at least one radio frequency front-end. According to a number of examples, the distributed radio frequency communication system further includes at least one antenna

coupled to the at least one radio frequency front-end. In accordance with several examples, the distributed radio frequency communication system further includes a second radio frequency module, the second serializer/deserializer circuit electrically connected between the second radio frequency module and the cabling.

[0008] In several examples, the distributed radio frequency communication system further includes a second radio frequency module, and a third serializer/deserializer circuit electrically connected between the second radio frequency module and the cabling. According to a number of examples, the cabling includes a common cable shared by the second serializer/deserializer circuit and the third serializer/deserializer circuit. In accordance with various examples, the cabling includes a first cable connected between the second serializer/deserializer circuit and the first serializer/deserializer circuit, and a second cable connected between the third serializer/deserializer circuit and the first serializer/deserializer circuit.

[0009] In various examples, the distributed radio frequency communication system further includes at least one automotive system configured to communicate with the digital processing circuit by way of the second serializer/deserializer circuit, the cabling, and the first serializer/deserializer circuit.

[0010] In some examples, the digital data includes in-phase and quadrature-phase data representing a radio frequency transmit signal.

[0011] In an aspect, the present disclosure relates to an automobile. The automobile includes a digital processing circuit in a first location of the automobile, cabling, a first serializer/deserializer circuit electrically connected between the digital processing circuit and the cabling and co-located with the digital processing circuit, a first radio frequency module in a second location of the automobile, and a second serializer/deserializer circuit electrically connected between the first radio frequency module and the cabling and co-located with the first radio frequency module, the first serializer/deserializer circuit and the second serializer/deserializer circuit configured to communicate digital data over the cabling.

[0012] In several examples, the cabling includes a twisted pair.

[0013] In various examples, the cabling includes an Ethernet cable.

[0014] In a number of examples, the digital processing circuit includes a baseband processor.

[0015] In some examples, the first radio frequency module includes at least one transceiver and at least one radio frequency front-end.

[0016] In several examples, the automobile further includes at least one antenna coupled to the at least one radio frequency front-end and co-located with the at least one radio frequency front-end. According to a number of examples, the at least one antenna includes an antenna positioned on a roof, a bumper, a trunk or a mirror of the car.

[0017] In various examples, the first location is of a lower temperature than the second location.

[0018] In some examples, the automobile further includes a second radio frequency module, the second serializer/deserializer circuit electrically connected between the second radio frequency module and the cabling.

[0019] In several examples, the automobile further includes a second radio frequency module, and a third serializer/deserializer circuit electrically connected between the second radio frequency module and the cabling. According to a number of examples, the cabling includes a common cable shared by the second serializer/deserializer circuit and the third serializer/deserializer circuit. In accordance with various examples, the cabling includes a first cable connected between the second serializer/deserializer circuit and the first serializer/deserializer circuit, and a second cable connected between the third serializer/deserializer circuit and the first serializer/deserializer circuit.

[0020] In some examples, the automobile further includes at least one automotive system configured to communicate with the digital processing circuit by way of the second serializer/deserializer circuit, the cabling, and the first serializer/deserializer circuit. According to a number of examples, the at least one automotive system includes a radar or a camera.

[0021] In several examples, the digital data includes in-phase and quadrature-phase data representing a radio frequency transmit signal.

[0022] In an aspect, the present disclosure relates to a method of radio frequency communication in an automobile. The method includes generating digital data using a digital processing circuit located in a first location of an automobile, serializing the digital data using a first serializer/deserializer circuit co-located with the digital processing circuit, sending the serialized digital data to a second serializer/deserializer circuit over cabling, and