

CLAIMS

1. An apparatus, comprising:
a processing element configured to:
determine that simultaneous communication of a first wireless communication technology and a second wireless communication technology causes performance degradation to a third wireless communication technology, wherein said performance degradation is a result of intermodulation products associated with the first and second wireless communication technologies; and
select two or more antennas used for the simultaneous communication of the first wireless communication technology and the second wireless communication technology based at least in part on determining that the simultaneous communication of the first wireless communication technology and the second wireless communication technology causes performance degradation to the third wireless communication technology, wherein the two or more antennas are selected to reduce the intermodulation products.
2. The apparatus of claim 1, wherein the processing element is further configured to:
determine that the third wireless communication technology is active; and
select the two or more antennas used for the simultaneous communication of the first wireless communication technology and the second wireless communication technology based at least in part on determining that the simultaneous communication of the first wireless communication technology and the second wireless communication technology causes performance degradation to the third wireless communication technology when the third wireless communication technology is active.
3. The apparatus of claim 1,
wherein the first wireless communication technology comprises a wireless local area networking (WLAN) technology,
wherein the second wireless communication technology comprises a cellular communication technology,
wherein the third wireless communication technology comprises a global navigational satellite system (GNSS) technology).

4. The apparatus of claim 1, wherein to select two or more antennas used for the simultaneous communication of the first wireless communication technology and the second wireless communication technology based at least in part on determining that the simultaneous communication of the first wireless communication technology and the second wireless communication technology causes performance degradation to the third wireless communication technology, the processing element is further configured to:

select the two or more antennas used for the simultaneous communication of the first wireless communication technology and the second wireless communication technology to reduce performance degradation with respect to the third wireless communication technology.

5. The apparatus of claim 1, wherein to select two or more antennas used for the simultaneous communication of the first wireless communication technology and the second wireless communication technology based at least in part on determining that the simultaneous communication the first wireless communication technology and the second wireless communication technology causes performance degradation to the third wireless communication technology, the processing element is further configured to:

select the two or more antennas used for the simultaneous communication of the first wireless communication technology and the second wireless communication technology to provide increased isolation for an antenna used by the third wireless communication technology.

6. The apparatus of claim 1, wherein to select two or more antennas used for the simultaneous communication of the first wireless communication technology and the second wireless communication technology based at least in part on determining that the simultaneous communication of the first wireless communication technology and the second wireless communication technology causes performance degradation to the third wireless communication technology, the processing element is further configured to:

switch at least one of the first wireless communication technology or the second wireless communication technology from a multi-antenna communication mode to a single-antenna communication mode.

7. A wireless user equipment (UE) device, comprising:
a plurality of antennas;
one or more radios coupled to the plurality of antennas; and
a processing element operably coupled to the one or more radios;
wherein the UE device is configured to:

determine whether an intermodulation product of cellular and Wi-Fi communication by the UE device is in a frequency band used by the UE device for global navigational satellite system (GNSS) communication;

select two or more antennas for cellular and Wi-Fi communication by the UE device based at least in part on determining that the intermodulation product of cellular and Wi-Fi communication by the UE device is in a frequency band used by the UE device for GNSS communication, wherein the two or more antennas are selected to reduce the intermodulation product; and

transmit Wi-Fi signals and cellular signals using the selected two or more antennas.

8. The UE device of claim 7, wherein the UE device is further configured to:

select the two or more antennas for cellular and Wi-Fi communication in a first manner if no intermodulation product of cellular and Wi-Fi communication by the UE device is in a frequency band used by the UE device for GNSS communication; and

select the two or more antennas for cellular and Wi-Fi communication in a second manner if an intermodulation product of cellular and Wi-Fi communication by the UE device is in a frequency band used by the UE device for GNSS communication.

9. The UE device of claim 7, wherein the UE device is further configured to:

determine whether a GNSS module of the UE device is active;

wherein selecting the two or more antennas for cellular and Wi-Fi communication by the UE device is further based at least in part on determining whether a GNSS module of the UE device is active.

10. The UE device of claim 9, wherein the UE device is further configured to:

select the two or more antennas for cellular and Wi-Fi communication in a first manner if no intermodulation product of cellular and Wi-Fi communication by the UE device is in a frequency band used by the UE device for GNSS communication or if no GNSS module of the UE device is active; and

select the two or more antennas for cellular and Wi-Fi communication in a second manner if an intermodulation product of cellular and Wi-Fi communication by the UE device is in a frequency band used by the UE device for GNSS communication and a GNSS module of the UE device is active.

11. The UE device of claim 10,
wherein to select the two or more antennas for cellular and Wi-Fi communication by the UE device in the second manner, the UE device is further configured to:
select a single antenna mode for Wi-Fi communication; and
select an antenna for Wi-Fi communication with greatest isolation from a GNSS antenna.

12. The UE device of claim 7, wherein to determine whether an intermodulation product of cellular and Wi-Fi communication by the UE device is in a frequency band used by the UE device for GNSS communication, the UE device is configured use one or more of:
a lookup table indicating intermodulation products of selected frequency combinations;
or
one or more formulas for calculating intermodulation products of frequency combinations.

13. The UE device of claim 7, wherein the UE device is further configured to:
select an antenna combination that causes a lowest amount of receiver desensitization to GNSS communication among possible antenna combinations if it is determined that an intermodulation product of cellular and Wi-Fi communication is in a frequency band used by the UE device for GNSS communication.

14. A non-transitory computer accessible memory medium comprising program instructions that, when executed by a wireless user equipment (UE) device, cause the UE device to:

determine a first transmission frequency for transmitting according to a first wireless communication technology;

determine a second transmission frequency for transmitting according to a second wireless communication technology;

determine one or more frequencies on which intermodulation products are generated from simultaneously transmitting on the first transmission frequency and the second transmission frequency;

determine whether any of the one or more frequencies on which intermodulation products are generated at least partially overlap a frequency band associated with a third wireless communication technology;

determine an activity status of the third wireless communication technology;

perform antenna selection for transmitting signals according to at least one of the first wireless communication technology or the second wireless communication technology to reduce interference to the third wireless communication technology if the third wireless communication technology is active and the one or more frequencies on which intermodulation products are generated at least partially overlap a frequency band associated with the third wireless communication technology, wherein the antenna selection is performed to reduce the intermodulation products.

15. The memory medium of claim 14, wherein to perform antenna selection to reduce interference to the third wireless communication technology, the program instructions further cause the UE device to:

switch from a multi-antenna transmission mode to a single-antenna transmission mode for at least one of the first wireless communication technology or the second wireless communication technology.

16. The memory medium of claim 14, wherein to perform antenna selection to reduce interference to the third wireless communication technology, the program instructions further cause the UE device to:

select a transmission antenna for at least one of the first wireless communication technology or the second wireless communication technology that provides increased isolation to an antenna used to receive signals according to the third wireless communication technology.

17. The memory medium of claim 14,
wherein the first transmission frequency is associated with a frequency channel
associated with the first wireless communication technology,
wherein the second transmission frequency is associated with a frequency channel
associated with the second wireless communication technology.

18. The memory medium of claim 14,
wherein the first wireless communication technology is Wi-Fi,
wherein to perform antenna selection to reduce interference to the third wireless
communication technology, the program instructions further cause the UE device to:
switch Wi-Fi from multiple input multiple output (MIMO) mode to single output
single input (SISO) mode; and
select a Wi-Fi antenna among a plurality of available Wi-Fi antennas that
provides greatest isolation to an antenna used to receive signals according to the third wireless
communication technology.

19. The memory medium of claim 14, wherein the program instructions further cause the
UE device to:
perform antenna selection for transmitting signals according to the first wireless
communication technology and the second wireless communication technology without regard to
reducing interference to the third wireless communication technology if none of the one or more
frequencies on which intermodulation products are generated overlap a frequency band
associated with the third wireless communication technology.

20. The memory medium of claim 14, wherein the program instructions further cause the
UE device to:
perform antenna selection for transmitting signals according to the first wireless
communication technology and the second wireless communication technology without regard to
reducing interference to the third wireless communication technology if the third wireless
communication technology is not active.